
Oracle Database 10g: 2 Day DBA

Student Guide

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Appendix A - Practices

Appendix B - Practice Solutions

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1

Overview of Oracle Database Administration

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Objectives

After completing this lesson, you should be able to do the following:

- **Describe the structure of a relational database and use of SQL**
- **Identify the components of an Oracle instance and database**
- **Describe the basic tasks that an Oracle DBA performs**
- **Define the tools used to administer an Oracle database**
- **Use Oracle MetaLink to research issues and log Service Requests (SRs)**

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Objectives

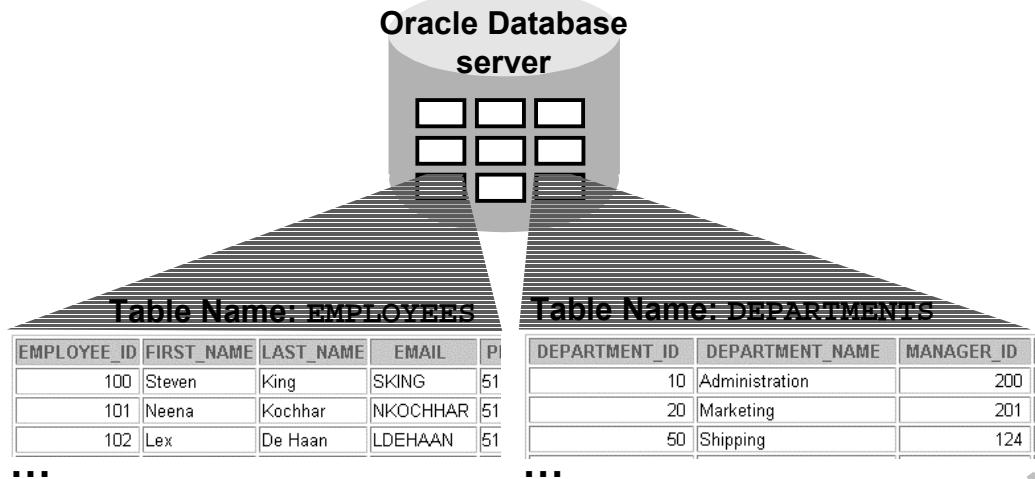
The *Oracle Database 10g: 2 Day DBA* course is designed to teach you how to perform common day-to-day administrative tasks that are required of an Oracle database administrator (DBA). Prior knowledge or experience with managing databases is not required. The only requirement is a basic knowledge of computers.

This course is specifically targeted towards the following groups of Oracle Database users:

- Developers who want to acquire part-time DBA skills
- Anyone who manages departmental servers
- Database administrators who manage Oracle databases for small or medium businesses (SMB)

Relational Database: Introduction

A relational database is a collection of relations or two-dimensional tables.



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Relational Database: Introduction

Oracle Database is a relational database management system (RDBMS). The database you create when you use Oracle Database is a relational database. A relational database uses relations or two-dimensional tables to store information. The relational database model consists of three components: a collection of objects or relations (tables), a set of operators to manage the tables, and data integrity rules.

For example, you may want to store information about all the employees in your company. In a relational database, you create several tables, such as an employee table, a department table, and a salary table, to store different pieces of information about your employees.

Relational Database Terminology

EMPLOYEE_ID							LAST_NAME	FIRST_NAME	SALARY	COMMISSION_PCT	DEPARTMENT_ID
100	King	Steven		24000							90
101	Kochhar	Neena		17000							90
102	De Haan	Lex		17000							60
103	Hunold	Alexander		9000							60
104	Ernst	Bruce		6000							60
107	Lorentz	Diana		4200							60
124	Mourgos	Kevin		5800							50
141	Rajs	Trenna		3500							50
142	Davies	Curtis		3100							50
143	Matos	Randall		2600							50
144	Vargas	Peter		2500							50
149	Zlotkey	Eleni		10500		.2					80
174	Abel	Ellen		11000		.3					80
176	Taylor	Jonathon		8600		.2					80
178	Grant	Kimberely		7000		.15					
200	Whalen	Jennifer		4400							10
201	Hartstein	Michael		13000							20
202	Fay	Pat		6000							20
205	Higgins	Shelley		12000							110
206	Gietz	William		8300							110

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Terminology Used in a Relational Database

A relational database can contain one or many tables. A *table* is the basic storage structure in an RDBMS. A table holds all the data necessary about something in the real world, such as employees, invoices, or customers.

The slide shows the contents of the EMPLOYEES *table* or *relation*. The following terms are illustrated in the slide:

1. A single *row* or table representing all data required for a particular employee. Each row in a table must be identified by a primary key, which allows no duplicate rows. The order of rows is insignificant; specify the row order when the data is retrieved.
2. A *column* or attribute containing the employee number. The employee number identifies a *unique* employee in the EMPLOYEES table. In this example, the EMPLOYEE_ID column containing the employee number is designated as the *primary key*. A primary key must contain a value, and the value must be unique.
3. A column that is not a key value. A column represents one kind of data in a table; in the example, the salary of all the employees. Column order is insignificant when storing data; specify the column order when the data is retrieved.

Terminology Used in a Relational Database (continued)

4. A column containing the department number, which is also a *foreign key*. A foreign key is a column that defines how tables relate to each other. A foreign key refers to a primary key or a unique key in the same table or in another table. In the example, DEPARTMENT_ID *uniquely* identifies a department in the DEPARTMENTS table.
5. A *field* found at the intersection of a row and a column. There can be only one value in it.
6. A field may have no value in it. This is called a null value. In the EMPLOYEES table, only employees who have the role of Sales Representative have a value in the COMMISSION_PCT (commission) field.

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Relating Multiple Tables

- Each row of data in a table is uniquely identified by a primary key (PK).
- You can logically relate data from multiple tables using foreign keys (FK).

Table Name: DEPARTMENTS

Table Name: EMPLOYEES

EMPLOYEE_ID	FIRST_NAME	LAST_NAME	DEPARTMENT_ID
174	Ellen	Abel	80
142	Curtis	Davies	50
102	Lex	De Haan	90
104	Bruce	Ernst	60
202	Pat	Fay	20
206	William	Gietz	110

DEPARTMENT_ID	DEPARTMENT_NAME	MANAGER_ID	LOCATION_ID
10	Administration	200	1700
20	Marketing	201	1800
50	Shipping	124	1500
60	IT	103	1400
80	Sales	149	2500
90	Executive	100	1700
110	Accounting	205	1700
190	Contracting		1700

...
Primary key

Foreign key Primary key

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Relating Multiple Tables

Each table contains data that describes exactly one entity. For example, the EMPLOYEES table contains information about employees. Because data about different entities is stored in different tables, you may need to combine two or more tables to answer a particular question. For example, you may want to know the location of the department where an employee works. In this scenario, you need information from the EMPLOYEES table (which contains data about employees) and the DEPARTMENTS table (which contains information about departments). With an RDBMS, you can relate the data in one table to the data in another by using the foreign keys. A foreign key is a column or a set of columns that refer to a primary key in the same table or another table.

You can use the ability to relate data in one table to data in another to organize information in separate, manageable units. Employee data can be kept logically distinct from department data by storing it in a separate table.

What Is SQL?

- **Structured Query Language (SQL): Statements used to access data in the Oracle database**
- **SQL provides statements for a variety of tasks, including:**
 - **Querying data**
 - **Inserting, updating, and deleting rows in a table**
 - **Creating, replacing, altering, and dropping objects**
 - **Controlling access to the database and its objects**
 - **Guaranteeing database consistency and integrity**

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What Is SQL?

Structured Query Language (SQL) is the set of statements with which all programs and users access data in an Oracle database. Application programs and Oracle tools often enable users access to the database without using SQL directly; however, these applications use SQL when executing the user's request.

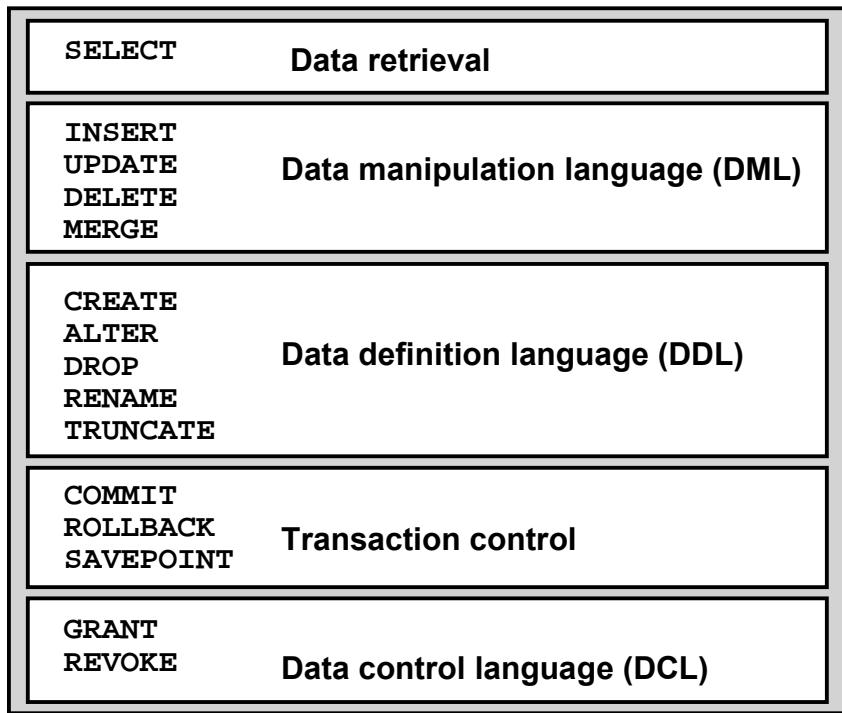
SQL enables you to work with data at the logical level. For example, to retrieve a set of rows from a table, you define a condition used to filter the rows. All rows satisfying the condition are retrieved in a single step and can be passed as a unit to an application or to another SQL statement. You do not need to know how the rows are physically stored or retrieved. All SQL statements use the optimizer component of Oracle Database to determine the most efficient means of accessing the specified data.

SQL provides statements for a variety of tasks, including:

- Querying data
- Inserting, updating, and deleting rows in a table
- Creating, replacing, altering, and dropping objects
- Controlling access to the database and its objects
- Guaranteeing database consistency and integrity

For more information about SQL, refer to the *Oracle Database SQL Reference*.

SQL Statements



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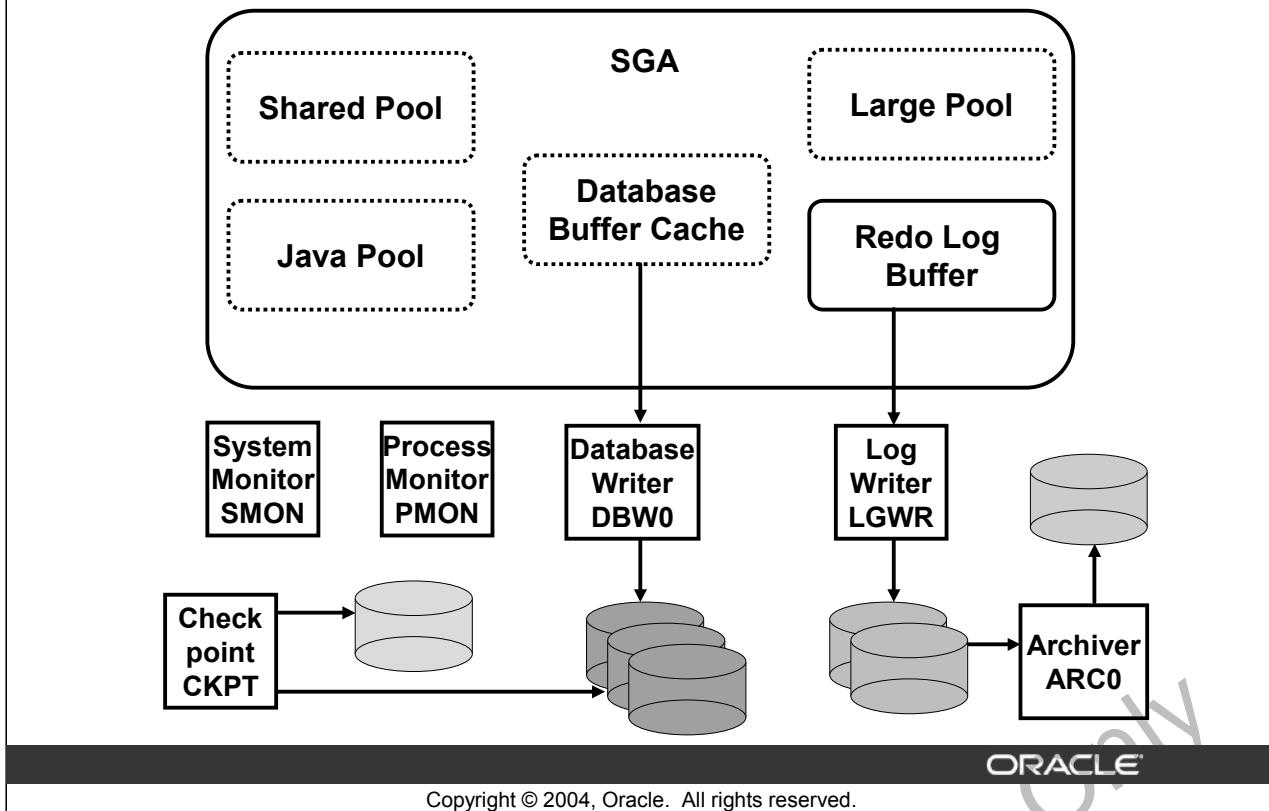
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SQL Statements

Oracle SQL complies with industry-accepted standards. Oracle Corporation ensures future compliance with evolving standards by actively involving key personnel in SQL standards committees such as the American National Standards Institute (ANSI) and the International Organization for Standardization (ISO).

Statement	Description
SELECT	Retrieves data from the database
INSERT UPDATE DELETE	Enters new rows, changes existing rows, and removes unwanted rows from tables in the database, respectively; collectively known as <i>data manipulation language (DML)</i>
CREATE ALTER DROP RENAME TRUNCATE	Sets up, changes, and removes data structures from tables; collectively known as <i>data definition language (DDL)</i>
COMMIT ROLLBACK SAVEPOINT	Manages the changes made by DML statements. Changes to the data can be grouped together into logical transactions.
GRANT REVOKE	Gives or removes access rights to both the Oracle database and the structures within it; collectively known as <i>data control language (DCL)</i>

Oracle Instance and Database: Overview



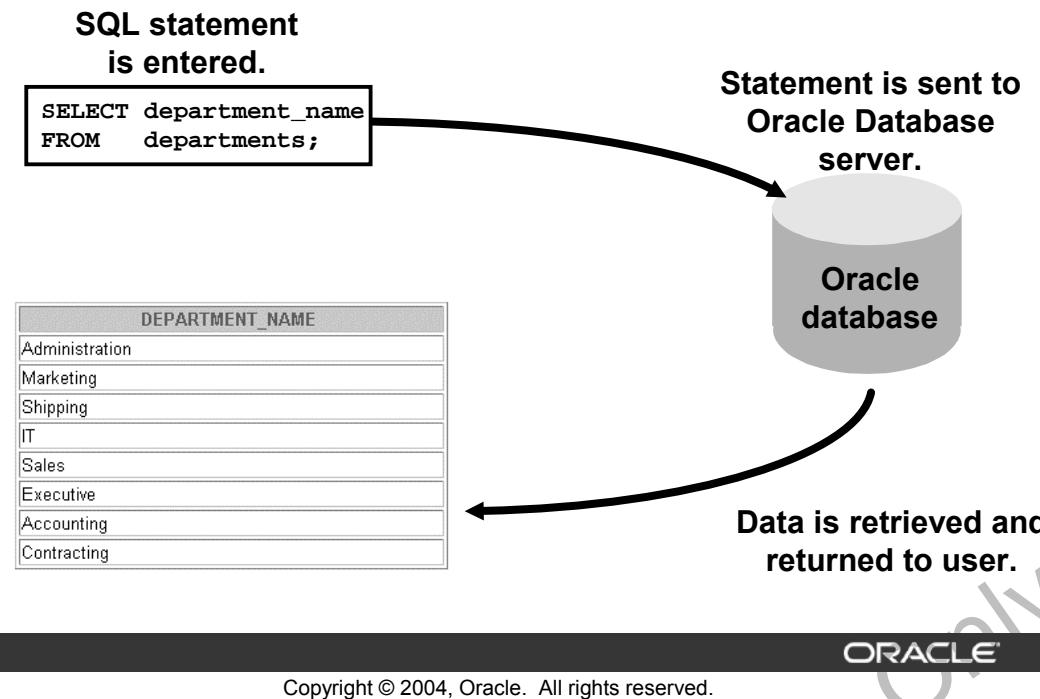
Oracle Instance and Database: Overview

The Oracle instance comprises memory structures known as the System Global Area (SGA) and Oracle background processes.

An Oracle database comprises datafiles, redo log files, and control files.

The Oracle instance and Oracle database will be discussed in greater detail in later lessons.

Using SQL to Access the Database



Using SQL to Access the Database

You can communicate with the Oracle Database server by using SQL. The SQL statement is entered by the user or executed in a program. The statement is processed and the data is returned to the user.

Common Tasks of an Oracle Database Administrator

- **Installing and updating Oracle software**
- **Creating databases**
- **Performing upgrades of the database and software**
- **Starting up and shutting down the instance**
- **Managing the database's storage structures**
- **Managing users and security**
- **Managing schema objects**
- **Taking backups and effecting recovery when necessary**
- **Proactively monitoring the database and taking preventive or corrective action as required**
- **Monitoring and tuning performance**

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Common Tasks of an Oracle Database Administrator

In a small to midsize database environment, you might be the sole person performing these tasks. In large, enterprise environments, the job is often divided among several DBAs, each with his or her own area of specialty such as the database security administrator or database tuning expert.

Tools Used to Administer an Oracle Database

- **Oracle Universal Installer**
- **Database Configuration Assistant**
- **Database Upgrade Assistant**
- **Oracle Net Manager**
- **Oracle Enterprise Manager**
- **SQL*Plus and iSQL*Plus**
- **Recovery Manager**
- **Data Pump**
- **SQL*Loader**

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Tools Used to Administer an Oracle Database

You can use the following tools for installation and upgrade:

- **Oracle Universal Installer (OUI):** The Oracle Universal Installer installs your Oracle software and options. It can automatically launch the Database Configuration Assistant to create a database.
- **Database Configuration Assistant (DBCA):** The Database Configuration Assistant creates a database from Oracle-supplied templates. Alternatively, you can create your own database. It enables you to copy a preconfigured seed database.
- **Database Upgrade Assistant:** This tool guides you through the upgrade of your existing database to a new Oracle release.

You can use **Oracle Net Manager** to configure your Oracle Net network.

Tools Used to Administer an Oracle Database (continued)

The following tools are used to manage your Oracle instance and database:

- **Oracle Enterprise Manager:** Oracle Enterprise Manager combines a graphical console, agents, common services, and tools to provide an integrated and comprehensive systems management platform for managing Oracle products. After you have installed the Oracle software, created or upgraded a database, and configured the network, you can use Oracle Enterprise Manager as the single interface for managing your database. In addition to providing a Web-based user interface for executing SQL commands, it seamlessly interfaces with other Oracle components used to administer your database, for example, Recovery Manager and Scheduler. Enterprise Manager must be used for all your management tasks.
- **SQL*Plus:** SQL*Plus is the standard command-line interface for managing your database.
- **iSQL*Plus:** iSQL*Plus is a browser-based interface to an Oracle database.
- **Recovery Manager (RMAN):** RMAN is an Oracle tool that provides a complete solution for the backup, restoration, and recovery needs of the database as a whole, or of database files.
- **Data Pump:** Data Pump enables high-speed transfer of data from one database to another. For example, you might want to export a table and import it into another database.
- **SQL*Loader:** The SQL*Loader utility enables the loading of data from an external file into an Oracle database. It is one of the several Oracle utilities that you can use to load data into database tables.

Working with Oracle Support

- **Oracle Support Services (OSS) provides 24 × 7 solution support.**
- **Support is delivered in the following ways:**
 - MetaLink Web site
 - Telephone
 - Oracle Direct Connect (ODC) remote diagnostic tool
- **The Customer Support Identifier (CSI) number is used to track the software and support licensed by each customer.**

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Working with Oracle Support

Oracle Support Services (OSS) provides 24 × 7 solution support to Oracle customers throughout the world. OSS has support centers around the globe to provide this coverage whenever it is required, 365 days a year.

Support is delivered to Oracle customers through the MetaLink Web site, telephone, and by using the Oracle Direct Connect (ODC) remote diagnostic tool.

After purchasing Oracle software, customers are provided with a Customer Support Identifier (CSI) number. This number is used to track the software and support licensed to each customer. The CSI number provides access to all the available patches, documentation, and troubleshooting information on MetaLink. The CSI number enables customers to log a Service Request (SR) with Oracle Support Services.

Note: Service Requests were formerly called Technical Assistance Requests (TARs).

Using MetaLink

The screenshot shows the Oracle MetaLink homepage. At the top left is the ORACLE logo. To its right is the MetaLink logo. A navigation bar on the left includes links for My Headlines, Top Tech Docs, Forums, User Profile, Certify & Availability, Patches, TARs, Bugs, My Configs & Projects, News & Events, and E-Business 11i. Below this is a feedback and site map link. On the right side, there's a search bar with 'Search' and 'Advanced' buttons. A banner titled 'My Headlines for Donna Keesling (Oracle Employee)' with a note to 'Click the red triangle to view the full article' is displayed. Below it are 'Bookmarks' and 'Preferences' buttons. A 'News & Notes' section lists several items, including 'Product Name Change for Oracle 9i Application Server Enterprise Edition', 'Oracle Support Services Announces Advanced MetaLink Seminar, Webcast', and 'Oracle Product Security Management Issues Security Alerts #61'. At the bottom of the page is a copyright notice: 'Copyright (c) 1995,2000 Oracle Corporation. All Rights Reserved. Legal Notice'.

Using MetaLink

To register for MetaLink, go to <http://MetaLink.oracle.com/> and select First Time User. At the prompt, enter your CSI number and answer a few basic questions. After registering, you are ready to use MetaLink. Note that each CSI number has an administrator designated by the customer who controls new-user access to MetaLink. Customers must designate this individual and then new users must work with this individual to create new accounts and grant appropriate MetaLink access.

MetaLink has a variety of tools and methods available for researching problems.

Searching for answers on MetaLink through the standard and advanced search engines is relatively straightforward. The following are some simple steps that can improve the quality and relevancy of search results:

- Use full and exact error text when performing your search. For example, “ORA-1400: mandatory (NOT NULL) column” will return more relevant answers than “ORA-1400”.
- When researching errors in the E-Business Suite, enter the name of the code as part of the search criteria. For example, “APXINWKB ORA-1400: mandatory (NOT NULL) column” will return fewer results than if you supply only the error message.

Using MetaLink (continued)

You can use Top Tech Docs if you prefer a drill-down method of searching for information versus keyword searching. Top Tech Docs provides easy to use drill-down access to Oracle Support Services' most frequently used technical content.

The following information is available in the Top Tech Docs pages:

- User documentation
- Electronic Technical Reference Manuals (eTRMs)
- Frequently Asked Questions (FAQs)
- Listing of educational offerings
- Self-Service Toolkits (SSTK)
- Business flows
- Resolution flows

MetaLink Forums enable you to interact with other Oracle customers to share ideas and discuss Oracle products. You can use MetaLink Forums to find out how other customers perform complex tasks or meet various business requirements with Oracle products. You should not use Forums as a substitute for logging a Service Request.

Customers can use the patch engine to search for patches by using a variety of methods. The following are the most common patch searches:

- **Patch Number:** If you know the patch number, then you can simply enter the patch number.
- **Latest Consolidated Patch:** You can use this when upgrading to determine the latest patches for the products you are using.
- **Includes File:** Often when a problem is encountered in a specific piece of code, a patch is available to fix the issue. For this reason, support representatives often recommend that customers apply a patch to update their code to the most current version available for their release. You can find and apply the latest versions of Oracle software by identifying the name and version of the code and then by using the patch search utility to find out whether a more current version of the code is available.

Note: For detailed information on performing these searches, refer to MetaLink Technical Note 166650.1.

You can use the BUGs link to search the BUG database when researching issues. A variety of methods are available for searching the BUG database.

Researching an Issue

Perform the following steps to research an issue by using MetaLink:

- 1. Perform a keyword search.**
- 2. Review the documentation.**
- 3. Use the Self-Service Toolkits.**
- 4. Use the automated Diagnostic Tests and Business Flows.**
- 5. Search for applicable patches.**
- 6. Log a Service Request (SR).**

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Researching an Issue

MetaLink provides several resources that can be used to research an issue. The following steps outline the basic troubleshooting techniques using the MetaLink resources:

- 1. Keyword Search:** Most issues can be resolved quickly and easily by using the keyword search utility on MetaLink. Effective searches can provide a wealth of information about a specific problem and how to solve it.
- 2. Documentation:** If keyword searching fails to yield a solution, then you should review the documentation to ensure that setup problems are not the root cause. Setup issues account for more than one-third of all Service Requests and, therefore, it is always good to review setups early in the troubleshooting process. Searching via the basic and advanced search options can reveal some common setup issues. However, more unusual issues may be missed when performing searches and thus a review of documentation is suggested. Documentation consists of user guides and implementation manuals published in PDF format as well as product readme files and installation notes published in HTML. Both of these document types are available on MetaLink, and can be accessed through the Self-Service Toolkits for each product.

Researching an Issue (continued)

3. **Self-Service Toolkits:** Self-Service Toolkits (SSTKs) provide a wealth of information about each product. In most cases, they contain FAQs, patch listings and other helpful information that can assist you in researching and troubleshooting the issues that you are facing. SSTKs contain the most frequently used content about each product and you should reference them periodically to identify known issues before they cause problems within your environment.
4. **Diagnostics and Flows:** Much of the recent innovations in Oracle Support Services has been in the area of automated Diagnostic Tests and Business Flows. Several Business Flows and Diagnostic Tests have been created that you can use to check the setup of your system or gather information about a problem. In the case of Diagnostic Tests, this can be done by running a java or sql script. The output of these tests can aid you in resolving issues and can also help Oracle Support Services identify the cause of your problem if it become necessary to log a Service Request.
5. **Patches and BUGs:** There are times when BUGs are found in Oracle products and patches are required to correct the problem. When troubleshooting a problem, you should review your system to see if patches are available to provide you with a more recent release of the product. With the patch search tool, you can search for patches that contain specific files. Searching for the latest code and patching your environment to the most recent version improves the troubleshooting process by eliminating existing BUGs as possible candidates for the problem that you encounter. You should also leverage the BUG search engine to see if a BUG has been logged for your issue, but not yet fixed.
6. **Logging a Service Request (SR):** When all self-service options fail, it may become necessary to engage a support representative to assist in resolving your issue.

Logging Service Requests

- Log an SR by clicking the TARs link located on the left side of the MetaLink home page.
- MetaLink performs searches based on CSI number and SR profile.
- Provide the following information when logging an SR:
 - Explanation of the issue including error messages
 - Steps taken to troubleshoot the issue
 - Software version
 - Steps required to reproduce the problem
 - Business impact of the issue

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Logging Service Requests

You may research an issue on MetaLink but may be unable to locate a solution. In this case, you should log a Service Request (SR) through MetaLink. You can log an SR by clicking the TARs link located on the left side of the MetaLink home page.

The first step in creating an SR is the selection of a CSI number and SR profile. After the required profile information has been selected, MetaLink will gather some specifics about the problem, including the problem type, error message, brief summary of the issue, and the language preference. MetaLink performs a search using this information and attempts to find a solution.

The search conducted during this phase may provide different results than the searches you have performed earlier. Both searches retrieve notes and BUGs from the same database; however, the search engines and weighting are slightly different. Because the search results can differ, it is important that the search results are reviewed during the SR creation process, even if previous searches have been conducted using the MetaLink search engine.

Logging Service Requests (SRs) (continued)

If the search results fail to resolve the issue, then the SR creation process continues with a series of questions and requests for information. After the questions are answered, the SR is submitted electronically and routed to a support representative who analyzes the issue further. Any files, screenshots or other additional information, must be uploaded immediately after the SR is logged by using the upload utility provided in the SR section of MetaLink.

You must ensure that the items listed below are clearly documented in the SR. By providing the information listed below, the support representative is equipped to effectively prioritize and work on the issue.

- Clear explanation of the problem including exact error messages
- Explanation of the steps taken to troubleshoot the problem and the findings
- Exact versions of the software
- Steps required to reproduce the problem
- Business impact of this issue, including milestones, dates, and costs

Each SR is assigned a unique identifier called the SR number. When you log an SR, MetaLink will provide you with the SR number or your support representative will advise you of the SR number if you logged the SR via the telephone. The support representative subsequently receives the SR in his or her queue through an automated allocation process that Oracle Support Services uses to distribute all phone and Web-sourced Service Requests. This automated process ensures that all SRs are assigned to the support representative, who is best able to work on the specific issue that is being reported.

Note: For more information, refer to MetaLink Technical Note 166650.1.

Summary

In this lesson, you should have learned how to:

- **Describe the structure of a relational database and use of SQL**
- **Identify the components of an Oracle instance and database**
- **Describe the basic tasks that an Oracle DBA performs**
- **Define the tools used to administer an Oracle database**
- **Use MetaLink to research issues and log Service Requests (SRs)**

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Installing Oracle Software and Creating the Database

2

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Objectives

After completing this lesson, you should be able to do the following:

- Install the Oracle software**
- Create an Oracle database**

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Using the Oracle Universal Installer

- **Oracle Universal Installer (OUI) enables you to:**
 - View the Oracle software that is installed on your machine
 - Install new Oracle software
 - Uninstall the Oracle software that you no longer intend to use
- **OUI provides online help.**

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Using the Oracle Universal Installer

You use the Oracle Universal Installer (OUI) to install the Oracle software. The Oracle Universal Installer is a GUI tool that enables you to view the Oracle software that is already installed on your machine, install new Oracle software, and uninstall Oracle software that you no longer intend to use. Online help is available to guide you through the installation process.

The installer automatically sets any operating system environment variables that the Oracle database server requires for its operation.

Note: Refer to the *Oracle Installation Guide* for your platform for detailed information on any operating-system configuration tasks that you must perform prior to installing Oracle Database.

Installation Prerequisites

Before installation, OUI checks:

- Availability of a minimum of 512 MB of memory
- Availability of sufficient paging space (swap space)
- Whether appropriate operating system service packs or patches are installed
- Whether appropriate file system format is being used

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Installation Prerequisites

Before the installation process begins, OUI performs several automated prerequisite checks to ensure that your machine meets the basic hardware and software requirements. If your machine does not meet any of the requirements, then an error message is displayed. The requirements may vary depending on your machine and operation system. The following is a list of common prerequisite checks:

- A minimum of 512 MB of memory is available.
- Sufficient paging (swap) space is available.
- Appropriate operating system service packs or patches are installed.
- Appropriate file system format is being used.

The following are the minimum hardware requirements:

- 512 MB of physical random access memory (RAM)
- 1 GB of swap space (or twice the size of RAM)
- 400 MB of disk space in the /tmp directory
- 1 GB of disk space for the Oracle software
- 1.0 GB of disk space for the pre-configured database

Note: On systems with 2 GB or more of RAM, the swap space can be between one and two times the size of RAM.

Setting Environment Variables

- **ORACLE_BASE:** Specifies the base of the Oracle directory structure for Optimal Flexible Architecture (OFA)
- **ORACLE_HOME:** Specifies the directory containing the Oracle software
- **ORACLE_SID:** The initial instance name (ORCL by default)
- **LD_LIBRARY_PATH:** Location of shared object libraries (UNIX)

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Setting Environment Variables

The following environment variables are very important to a successful installation of your Oracle software and use of an Oracle database:

- ORACLE_BASE: Specifies the base of the Oracle directory structure for Optimal Flexible Architecture (OFA). OFA is a method for configuring the Oracle database and other databases. Use of ORACLE_BASE is optional, although it can ease future installations and upgrades. It is a directory path as shown in the following example:
/u01/app/oracle
- ORACLE_HOME: Specifies the directory containing the Oracle software. It is a directory path as shown in the following example:
\$ORACLE_BASE/product/10.1.0
- ORACLE_SID: Is the initial instance name and is set to ORCL by default. It is a string of numbers and letters, and it must begin with a letter. Oracle Corporation recommends a maximum of eight characters for system identifiers.
- LD_LIBRARY_PATH: Specifies the list of directories that the shared library loader searches to locate shared object libraries at run time. This is used only in UNIX and Linux environments. It is a colon-separated list of directories as shown in the following example:
/usr/lib:\$ORACLE_HOME/lib

Installing the Oracle Software



Installing the Oracle Software

You can install the Oracle software by using OUI:

1. Log on to your computer as a member of the administrative group that is authorized to install Oracle software and create and manage the database.
2. Insert the distribution CD for the database into your CD drive. The Autorun window appears. Select Install/Deinstall Products.
Note: If you are downloading from Oracle's Web site, follow the instructions given on the Web site.
3. The Oracle Universal Installer Welcome screen appears. Click Next to begin the installation of your software.
4. On Linux and UNIX operating systems only: The Specify Inventory Directory screen appears. You must specify a directory for installation files. The inventory directory is an area that is used during the installation of the software. The files in this directory should not be deleted. The Oracle Universal Installer inventory is the location for the Oracle Universal Installer's bookkeeping. The inventory stores information about:
 - All Oracle software products that are installed in all Oracle homes on a machine
 - Other non-Oracle products included with Oracle software, such as Java Runtime Environment (JRE)

Installing the Oracle Software (continued)

The Installer will also prompt you to provide the name of the group which should own the base directory. You must choose a UNIX group name which will have permissions to update, install, and remove Oracle software. Members of this group must have write permissions to the base directory chosen. Only users who belong to this group are able to install or remove software on this machine.

5. The Specify File Locations screen appears. Enter the Oracle home name and directory path in which to install the Oracle software or accept the default. Select Next.
Note: If there is a previously defined Oracle home on your machine, then OUI suggests that name and directory path for the installation. If that Oracle home is for a different release of Oracle, then you should specify a new Oracle home name and path.
6. Select the following installation options on the following pages:
 - Database installation
 - Enterprise Edition or Standard Edition
7. Select one of the three preconfigured database types to be installed: General Purpose, Transaction Processing, or Data Warehouse.
8. Additional information is required for the database that is to be created. You are presented with a series of pages in which you enter the following:
 - The database identification: Enter a global database name and system identifier (SID).
 - The database character set: Accept the default, unless you are aware of another character set that you should be using.
 - Passwords for administrative users such as SYS and SYSTEM.
 - Your selection of database storage.
 - Your database management option. You can deploy your database and Enterprise Manager in central or local mode. Use local mode to manage your database individually. This is the common choice for a first-time installation. You can use central mode if you plan to manage more than one database from Enterprise Manager.

A summary page displays the components that are about to be installed. Click Install to start the installation. A progress bar displays the progress of the installation.

9. At the end of the installation of the software and creation of the database, the Configuration Tools screen appears. Allow the tools to install and start. They configure your network, and start an Oracle Net Services listener process for connecting to the database. Click Next.
10. After the tools are executed, a page appears providing information about your database. Review this list. Click Password Management at the bottom of the screen.
11. The Password Management page appears. Clear the Lock Account column for any additional administrative accounts you want to use and assign new passwords for them. These accounts are initially locked with their passwords expired to protect these accounts from being used by unauthorized users familiar with their Oracle-supplied passwords. As the database administrator, you are responsible for the unlocking and resetting of these accounts.

You have completed the installation of Oracle software and creation of your first database.

Using the Database Configuration Assistant (DBCA)

- **DBCA can be used to:**
 - Create a database
 - Delete a database
 - Add options to a database
 - Manage templates
- **You can use the online Help.**

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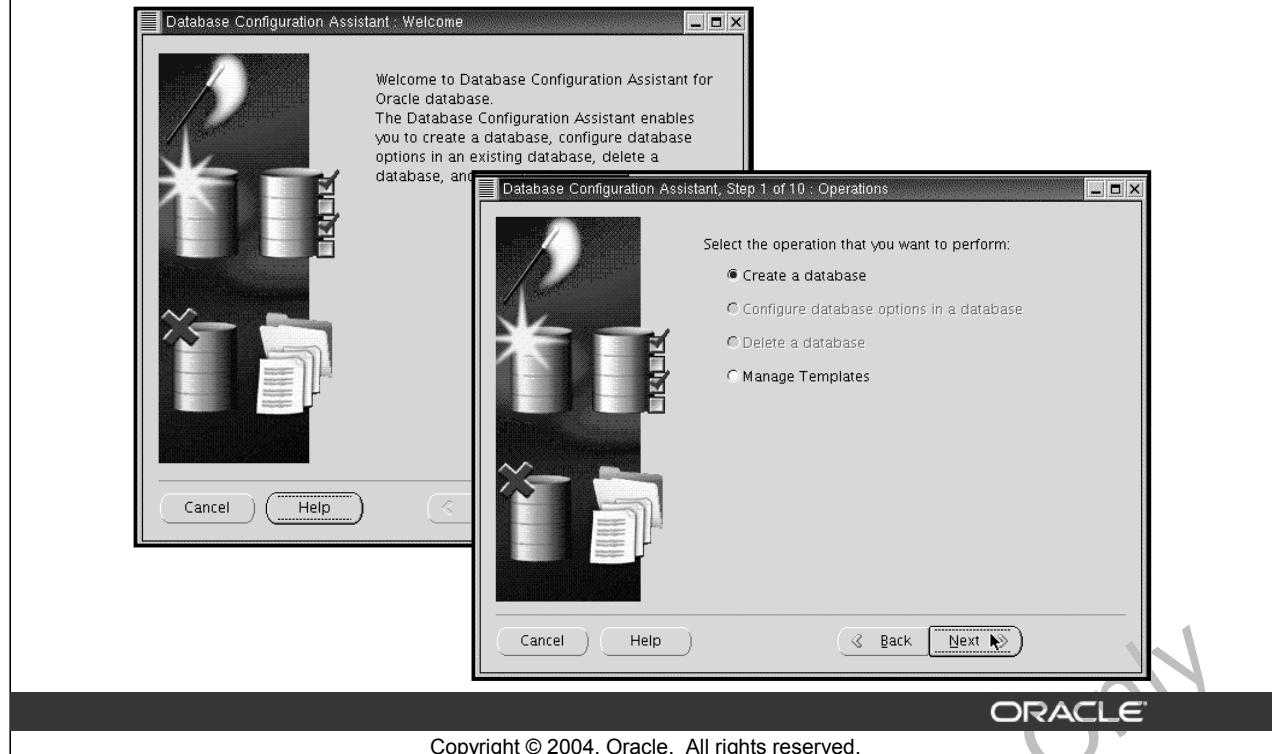
Using the Database Configuration Assistant (DBCA)

When you install the Oracle software, you can choose to install the software only and create your database at a later time. You can then use the Database Configuration Assistant (DBCA) to create your database. You can also use DBCA to create an additional database, delete a database, add options to a database, or to manage templates. You can access online Help in DBCA by clicking Help. The online Help provides additional information that guide you in selecting configuration options.

You can invoke DBCA as follows:

1. Log on to your computer as a member of the administrative group that is authorized to install Oracle software.
2. To invoke DBCA on a Windows operating system, select the following:
Start > Programs > Oracle - home_name > Configuration and Migration Tools >
Database Configuration Assistant
To invoke DBCA on a UNIX or Linux operating system, enter the following at the command prompt: `dbca`
The Welcome screen is displayed.
3. Click Next to continue.

Using DBCA to Create a Database



Using DBCA to Create a Database

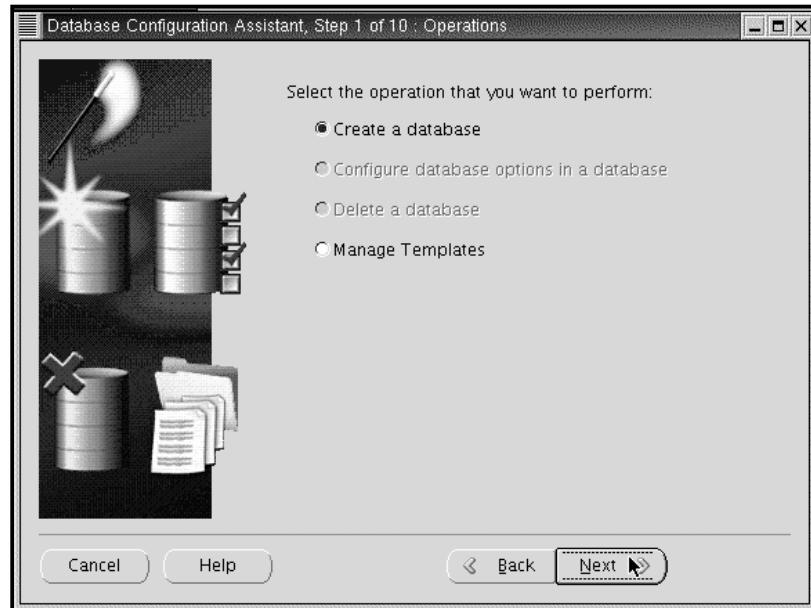
You can use DBCA to create a database as follows:

1. Select Create a database on the DBCA Operations page to invoke a wizard that enables you to configure and create a database.
2. The wizard prompts you to provide configuration information as outlined in the steps that follow. On most pages, the wizard provides a default setting that you can accept. You can click Finish at any step to accept all the default parameters.
3. Database Templates: Select the type of database template to be used in creating the database. There are templates for Data Warehouse, General Purpose, and Transaction Processing databases that copy a preconfigured database including datafiles. These datafiles include control files, redo log files, and datafiles for various included tablespaces. Click Show Details to see the configuration for each type of database. For more complex environments, you may want to select the Custom Database option.
4. Database Identification: Enter the Global Database Name, in the form database_name.domain_name and system identifier (SID). The SID defaults to the database name and uniquely identifies the instance associated with the database.

Using DBCA to Create a Database (continued)

5. Management Options: Use this page to set up your database, so that it can be managed with Oracle Enterprise Manager. Select Configure the Database with Enterprise Manager.
Select Use Database Control for Database Management to manage your database individually. Select Enable Email Notifications and Enable Daily Backup.
6. Database Credentials: Use this page to specify the passwords for the administrative accounts such as SYS and SYSTEM. To use the same password for all accounts, specify Use the Same Password for All Accounts and enter the password. Otherwise, specify Use Different Passwords and specify passwords individually.
7. Storage Options: Specify the type of storage mechanism that you would like your database to use. Select from the following options: File system, Automatic Storage Management (ASM), and Raw devices.
8. Database File Locations: Specify the Oracle home and directory path for the location of the database files. Choose one of the following: Use Database File Locations from Template, Use Common Location for All Database Files, or Use Oracle-Managed Files.
9. Recovery Configuration: Use this page to specify a flash recovery area and to enable archiving. Select Specify Flash Recovery Area and specify its directory location and size. Select Enable Archiving.
10. Database Content: Check Sample Schemas to include the Sample Schemas tablespace named EXAMPLE in your database.
11. Initialization Parameters: The tabs on this page provide access to pages that enable you change default initialization parameter settings. These parameters fall into the following categories:
 - Memory: Use this page to set the initialization parameters that control memory usage. Select Typical and enter a percentage value. You can click Show Memory Distribution to see how much memory the Assistant assigns to the System Global Area (SGA) and the Program Global Area (PGA).
 - Sizing: To specify block size, enter the size in bytes or accept the default. To specify maximum number of processes that can simultaneously connect to the database, enter the number or accept the default.
 - Character Sets: Use this page to define the character sets used by your database. Select Use the Default if you need to support only the language currently used by the operating system for all your database users and your database applications.
 - Connection Mode: Select Dedicated Server Mode so that there is a dedicated server process for each user process.
12. Database Storage: If you selected one of the preconfigured templates for a database, then you cannot add or remove control files, datafiles, or rollback segments.
13. Creation Options: You have the option of creating your database at this time, or saving the database definition as a template to use at another time, or both.

Performing Other Actions with DBCA



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Performing Other Actions with DBCA

You can also use DBCA to perform the following actions:

- **Configure database options in a database:** You can add database options that have not been previously configured for use with your database.
- **Delete a database:** You can permanently remove a database from your system.
- **Manage templates:** You can create and delete templates.

Using DBCA to Manage Templates

- **DBCA templates are:**
 - XML files that store database configuration information such as:
 - Database options**
 - Initialization parameters**
 - Storage attributes for database files**
 - Used to create new databases and make clones
- **DBCA templates can be used like scripts**
- **There are two types of DBCA templates:**
 - Seed
 - Non-seed

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Using DBCA to Manage Templates

You can use DBCA to create templates. Templates are XML files that contain information required to create a database. Templates are used to create new databases and make clones of existing databases. The information in templates includes database options, initialization parameters, and storage attributes (for datafiles, tablespaces, control files, and redo logs).

Templates can be used just like scripts. However, they are more powerful than scripts, because you have the option of cloning an existing database. This saves time in database creation, because it typically takes less time to copy the seed database's files than to create new files.

Templates are stored in \$ORACLE_HOME/assistants/dbca/templates.

There are two types of templates:

- **Seed templates:** Contain both the structure and the physical datafiles of an existing (seed) database. When you select a seed template, database creation is faster because the physical files and schema of the database have already been created.
- **Non-seed templates:** Used to create a new database. It contains the characteristics of the database to be created. Non-seed templates are more flexible than their seed counterparts, because all datafiles and redo logs are created to your specification (not copied), and names, sizes, and other attributes can be changed as required.

Oracle-Provided Templates

- **Data Warehouse**
- **Transaction Processing**
- **General Purpose**
- **Custom Database**

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Oracle-Provided Templates

Oracle provides the following templates:

- **Data Warehouse:** Appropriate in an environment where users perform numerous, complex queries that process large volumes of data. Response time, accuracy, and availability are key issues.
- **Transaction Processing:** Appropriate in an environment where there are many concurrent users performing numerous transactions that require rapid access to data. Availability, speed, concurrence, and recoverability are key issues.
- **General Purpose:** Creates a database designed for general purpose usage. It combines features of both the Data Warehouse and Transaction Processing database templates.
- **Custom Database:** Provides maximum flexibility in defining a database.

Using DBUA to Upgrade the Database

- Automates the upgrade process
- Makes configuration recommendations
- Performs preupgrade steps
- Supports silent mode

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Using DBUA to Upgrade the Database

The Database Upgrade Assistant (DBUA) interactively steps you through the upgrade process and configures the database for the Oracle Database 10g release. The Database Upgrade Assistant automates the upgrade process by performing all the tasks that are usually performed manually. The Database Upgrade Assistant makes appropriate recommendations for configuration options such as tablespaces and redo logs. You can then act on these recommendations. For example, the Database Upgrade Assistant recommends sizing information for the new SYSAUX tablespace required in Oracle Database 10g.

The Database Upgrade Assistant performs the following preupgrade steps:

- Checks for any invalid user accounts or roles
- Checks for any invalid datatypes
- Checks for any unsupported character sets
- Checks for adequate resources, including undo segments, tablespaces, and free disk space
- Optionally backs up all necessary files

Using DBUA to Upgrade the Database (continued)

The Database Upgrade Assistant automatically modifies or creates new required tablespaces, invokes the appropriate upgrade scripts, archives the redo logs, and disables archiving during the upgrade phase. While the upgrade is running, the Database Upgrade Assistant shows the upgrade progress for each component. The Database Upgrade Assistant writes detailed trace and log files and produces a complete HTML report for later reference. To enhance security, the Database Upgrade Assistant automatically locks new user accounts in the upgraded database. The Database Upgrade Assistant then proceeds to create new configuration files (parameter and listener files) in the new Oracle home.

You can invoke the Database Upgrade Assistant as follows:

- On UNIX platforms, enter the following command at the system prompt: dbua
- On Windows operating systems, select the following:

Start > Programs > Oracle – Oracle home name >
Configuration and Migration Tools > Database Upgrade Assistant

The Database Upgrade Assistant also supports a silent mode of operation where no user interface is presented to the user. Silent mode allows you to use a single command for the upgrade.

Summary

In this lesson, you should have learned how to:

- Use the Oracle Universal Installer to install the Oracle software**
- Use the Database Configuration Assistant to create an Oracle database**

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Practice Overview

This practice covers the following topics:

- Installing the Oracle software by using OUI**
- Creating a database**

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Using Oracle Enterprise Manager Database Control and SQL*Plus

3

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Objectives

After completing this lesson, you should be able to do the following:

- **Start the Enterprise Manager dbconsole process**
- **Access Enterprise Manager Database Control**
- **Navigate in Enterprise Manager Database Control**
- **Grant Enterprise Manager administrative privileges**
- **Use SQL*Plus and iSQL*Plus to access your database**

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Overview of Administering the Database Using Enterprise Manager

Oracle Enterprise Manager Database Control provides a wide array of management capabilities, including:

- **Database monitoring**
- **Administration**
- **Maintenance features**



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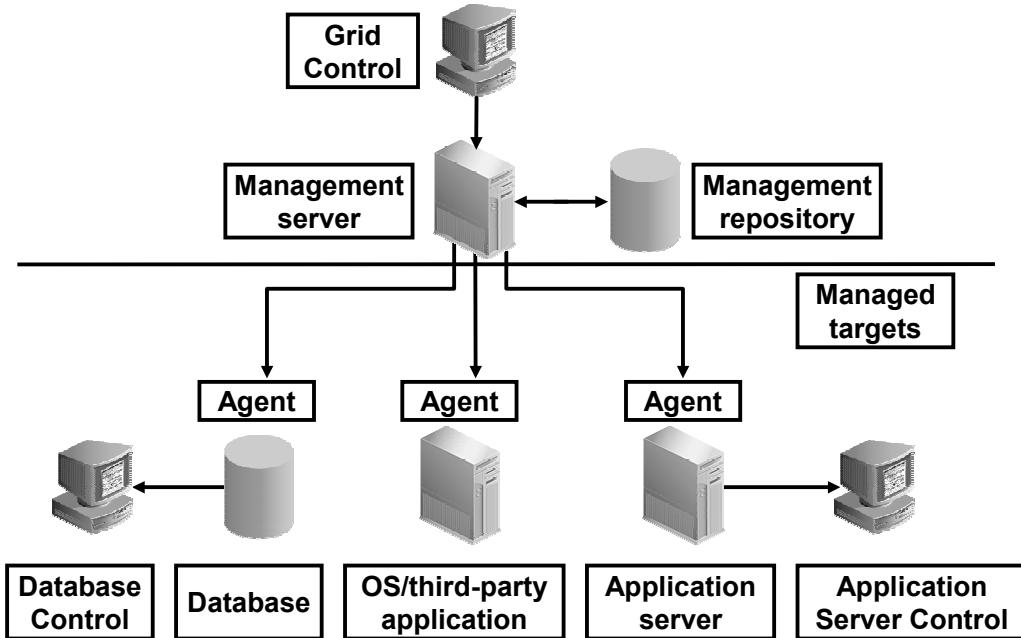
Overview of Administering the Database Using Enterprise Manager

The Oracle Universal Installer installs Oracle Enterprise Manager Database Control when you install the Oracle software. Oracle Enterprise Manager Database Control provides a Web-based interface that you can use to manage your Oracle instance and database.

From Oracle Enterprise Manager Database Control, you can perform the following tasks:

- View performance and status information about your database instance.
- Create database storage structures such as tablespaces.
- Create schema objects such as tables and indexes.
- Manage user security.
- Back up your database.
- Recover your database.
- Import and export data.

Management Framework



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Management Framework

The architecture of the Oracle Enterprise Manager framework provides a high level of flexibility and functionality. You can easily customize Oracle Enterprise Manager to suit the monitoring and administrative needs of your environment.

The typical Oracle Enterprise Manager framework configuration consists of the following functional areas:

- Managed targets
- Management services
- Grid Control
- Database Control
- Application Server Control

In this course, you will be using Oracle Enterprise Manager Database Control to manage your database.

Starting the Enterprise Manager dbconsole Process



```
$ emctl start dbconsole
```

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Starting the Enterprise Manager dbconsole Process

You must start the dbconsole process to access Oracle Enterprise Manager Database Control from a client browser. The dbconsole process is automatically started after installation.

If the process is not started, you can manually start it at the command line as follows:

1. Navigate to your \$ORACLE_HOME/bin directory.
2. Execute the following command: emctl start dbconsole.

You can view the status of the dbconsole process as follows:

```
[oracle@EDCDR32P1 oracle]$ emctl status dbconsole
Oracle Enterprise Manager 10g Database Control Release 10.1.0.2.0
Copyright (c) 1996, 2003 Oracle Corporation. All rights reserved.
http://edcdr32p1.us.oracle.com:5500/em/console/aboutApplication
Oracle Enterprise Manager 10g is running.
```

Logs are generated in directory
/u01/app/oracle/product/10.1.0/edcdr32p1.us.ora

Starting the Enterprise Manager dbconsole Process (continued)

You can stop the process by executing the following command:

```
emctl stop dbconsole.
```

You can enter the emctl command without any options to obtain a list of available options.

In Windows, you can start the dbconsole process as a service as follows:

1. Click Start > Control Panel > Administrative Tools > Services. The Services page appears.
2. Oracle services begin with Oracle. The dbconsole service is listed as Oracle<oracle_SID>DBConsole. The status of this process is listed in the Status column, either Started or Stopped. Double click the service. The property page appears.
3. In the properties page, ensure that the Startup Type is either Manual or Automatic and not Disabled. Click Start, if the process is not already started. Click OK.

You can also use the Services page to stop the process.

Accessing Enterprise Manager Database Control



`http://hostname:5500/em`

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Accessing Enterprise Manager Database Control

You can access Oracle Enterprise Manager Database Control by opening your Web browser and entering the following URL:

`http://hostname:portnumber/em`

hostname is the name or address of your computer. portnumber is the Oracle Enterprise Manager Database Control HTTP port number. The default is 5500. You can find the value for your system in the `$ORACLE_HOME/install/portlist.ini` file. You can also execute the `emctl status dbconsole` command as shown on the previous page to view the port number.

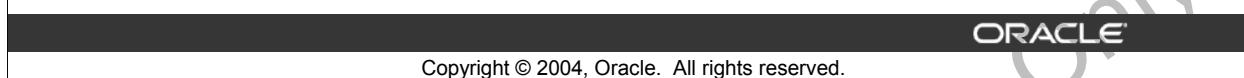
If the instance is started and the database is opened, then Oracle Enterprise Manager displays the Database Control Login Page as shown on the next page.

If the instance is shut down and needs to be started or if the database is mounted, Oracle Enterprise Manager displays the Startup/Shutdown and Perform Recovery page. Starting the instance is covered in detail in the “Managing the Oracle Instance” lesson.

Note: You cannot access the Enterprise Manager Database Control Login page if the listener is down. Starting the listener is covered in detail in the “Configuring the Oracle Network Environment” lesson.

Enterprise Manager Login

The screenshot shows the Oracle Enterprise Manager login interface. At the top, the title 'Enterprise Manager' is displayed above a 'Login' button. Below this, a header bar says 'Login to Database:orcl.us.oracle.com'. The main form contains fields for 'User Name' (set to 'sys'), 'Password' (showing five asterisks), and 'Connect As' (set to 'SYSDBA'). A 'Login' button is located to the right of the connect-as dropdown. At the bottom of the form, a copyright notice reads 'Copyright ©1996, 2003, Oracle. All rights reserved.'



Enterprise Manager: Database Control Login

You must log in to the database using a username that is authorized to access Database Control. Initially, the SYS, SYSTEM, and SYSMAN users are authorized.

You can log in to Enterprise Manager Database Control as follows:

1. Open your Web browser and enter the following URL:
`http://hostname:portnumber/em`
2. Enter SYS in the User Name field. Enter the password you specified for the SYS user during database creation in the Password field. Select SYSDBA from the "Connect As" drop-down list.
Note: SYSDBA is an administrative privilege that allows you to perform certain types of database operations. Privileges will be discussed in more detail in the Administering Users and Security lesson.
3. Click Login. The Database Home page is displayed.

Enterprise Manager: Database Home Page

The screenshot shows the Oracle Enterprise Manager Database Home Page for the database `orcl.us.oracle.com`. The page is titled "Property pages". It displays several key metrics and charts:

- General:** Status is Up, Up Since Oct 2, 2003 10:02:41 AM. Availability is 100% (Last 24 hours). Instance Name is `orcl`, Version is 10.1.0.1.0, Host is EDCDR32P1, Listener is LISTENER_EDCDR32P1, Oracle Home is /oracle/ora10g, and Alert Log shows No ORA- errors.
- Host CPU:** A bar chart showing CPU usage. The x-axis ranges from 0 to 100%, and the y-axis ranges from 0 to 100%. The chart shows "orcl" at approximately 10% and "Other" at approximately 90%.
- Active Sessions:** A pie chart showing session activity. The legend indicates: Using CPU (0.2%), Waiting: I/O (0%), and Waiting: Other (99.7%).
- Space Usage:** Shows 0 problem tablespaces, 0 fragmentation issues, and 0 dump area used.
- Advice:** ADDM Findings: 1, Policy Violations: 23.
- High Availability:** Instance Recovery Time: 8 seconds, Last Backup: n/a, Archiving: Disabled, Archive Area Used (%): n/a, Flashback Logging: Disabled.
- Job Activity:** Scheduled Executions: 0, Running Executions: 0, Suspended Executions: 0, Problem Executions: 0.

At the bottom, it says "Copyright © 2004, Oracle. All rights reserved." and features the Oracle logo.

Enterprise Manager: Database Home Page

The Database Home page displays the current state of the database by displaying a series of metrics that portray the overall health of the database. With the property pages, you can access performance, administration, and maintenance pages for managing your database. The pages will be discussed in detail in later lessons.

You can view the following performance and status information about your database instance on the Database Home page:

- Instance name, database version, Oracle home location, media recovery options, and other pertinent instance data
- Current instance availability
- Outstanding alerts
- Session and SQL-related performance information
- Key space usage metrics

Enterprise Manager Navigation

- **Property pages: Organize management tasks**

Database: orcl.us.oracle.com

Home Performance Administration Maintenance

- **Drill-down links: Provide increasing levels of detail**

General

Status Up

Up Since Oct 2, 2003 10:02:41 AM

Time Zone PDT

Availability (%) 100
(Last 24 hours)

Shutdown

- **Suggested related links: Provide more information**

Related Links

Advisor Central	Alert History
All Metrics	Blackouts
Manage Metrics	Metric Collection Errors
iSQL*Plus	

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Enterprise Manager Navigation

Navigational features of Oracle Enterprise Manager include:

- Property pages on each home page that help you organize management tasks into distinct categories
- Drill-down links that provide additional detailed information and functionality
- Related links that provide additional information

Context-sensitive online Help is available on each page.

Granting EM Administrative Privileges

Select Setup > Administrators from the Database Home page.

The screenshot shows two windows side-by-side. On the left is the 'Create Administrator: Properties' dialog, which includes fields for Name, Password, Confirm Password, Email Address, and a Super User checkbox. On the right is a 'Select Database User' dialog, which lists various database users with radio buttons next to them. The 'ANONYMOUS' user is selected. Both dialogs have 'Cancel' and 'Finish' buttons at the bottom.

Select an existing database user to assign management privileges to.

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Granting Enterprise Manager Administrative Privileges

Administrators are database users defined in the Management Repository who can log in to Enterprise Manager to perform management tasks. The breadth of management tasks available in Enterprise Manager depends on the privileges and roles assigned to the administrators.

Note: Database users are discussed in detail in the “Administering Users and Security” lesson.

You can grant management privileges to other database users as follows:

1. Log in to Database Control as the SYS user.
2. Click Setup at the top of the Database Home page.
3. Click Administrators in the left navigation bar.
4. Click Create to create a new Enterprise Manager user by assigning the management privileges to an existing database user.
5. Click the flashlight icon next to the Name field, and select an existing database user from the pop-up window.
6. Enter the password for the selected user and click Finish.

Configuring Enterprise Manager Settings and Preferences

You can configure the following settings and preferences in Enterprise Manager to manage the database:

- **Notifications**
 - **Notification methods**
- **Blackouts**
- **Preferred credentials**

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Configuring Enterprise Manager Settings and Preferences

Enterprise Manager enables you to configure settings and preferences to manage the database. These include the following:

- Notifications: You can configure notification methods, rules, and schedules. You can configure notifications so that you can receive alert notifications via e-mail. By default, the Enterprise Manager Database home page lists all alerts. Detailed information about alerts and setting up notifications is presented in the lesson titled “Monitoring and Tuning the Database.”
- Blackouts: You can configure blackout time periods to suspend monitoring. You can define blackout periods so that false alerts will not be sent to you.
- Preferred Credentials: Enterprise Manager can automatically execute many routine administrative tasks, such as backups on your behalf. This is done using sophisticated job scheduling system built into the Enterprise. To keep your environment secure, setting up tasks for automatic execution in Enterprise Manager requires you to provide login information for the machine and database. To avoid having to enter this information every time you create a job or task, Enterprise Manager enables you to save this information as preferred credentials. Preferred credentials are stored in the database in encrypted mode to protect it from unauthorized use.

Defining Blackout Time Periods

- **Blackouts enable you to suspend monitoring on one or more targets to perform maintenance operations.**
- **Define blackout time periods to prevent alert notifications from being sent when you are shutting down your database for maintenance.**

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Defining Blackout Time Periods

When you plan to bring your database down for maintenance, you can indicate that you do not want alert notifications to be sent to you by defining a blackout period. Blackouts also enable you to suspend monitoring to perform other maintenance operations.

You can define a blackout time period in Enterprise Manager Database Control by performing the following steps:

1. Click Setup at the top of the Database Home page. The Setup page appears.
2. Click Blackouts in the left frame. The Blackouts page appears.
3. Click Create to start the Create Blackout Wizard.
4. Enter a name for your blackout in the Name field. Select “Enter a new reason” and enter a reason for your blackout. Select Database in the Type drop-down menu in the Available Targets region. Select your database and click Move. Click Next. The Create Blackout: Schedule page appears.
5. Enter the start time of your planned blackout, or choose Immediately if you are shutting down the database now. Select the duration of the blackout, either as indefinite, a length or time, or until a time in the future. Accept the default of “Do Not Repeat” or select a repeat frequency in the drop-down menu. Click Next.
6. The Create Blackout: Review page appears. Review what you have entered and click Finish. You can click Back if you need to change a setting. You will receive a confirmation message.

Setting Preferred Credentials

Configure host and database login information so that it is automatically supplied for jobs

The screenshot shows the Oracle Enterprise Manager 10g Database Control interface. The title bar reads "ORACLE Enterprise Manager 10g Database Control". The menu bar includes "Setup", "Preferences", "Help", "Logout", and "Database". The main navigation bar on the left says "Preferences" and "Preferred Credentials > Database Preferred Credentials". The central content area is titled "Database Preferred Credentials". It contains a note: "To set preferred credentials for Database targets, update the appropriate fields in one of the tables below. To delete credentials, clear the appropriate fields. Press Apply after making any changes." A tip follows: "Normal database credentials are used by Enterprise Manager functions that do not require database administrator privileges. SYSDBA database credentials are used by privileged functions that access non-open databases or perform database startup/shutdown operations. Host credentials are used by remote operations and jobs to run applications that access a database (e.g., SQLPLUS)". Below this is a section titled "Target Credentials" with a note: "Target credentials can be specified for each Database target." A table lists credentials for a target named "orcl.oracle.com":

Name	Host	Normal Username	Normal Password	SYSDBA Username	SYSDBA Password	Host Username	Host Password	Test
orcl.oracle.com	edop4p1.us.oracle.com	system	*****	sys	*****	oracle	*****	Test

Buttons for "Revert" and "Apply" are at the top right of the table. At the bottom of the page are links for "Database", "Setup", "Preferences", "Help", and "Logout". Copyright information at the bottom states "Copyright © 1996, 2003, Oracle. All rights reserved." and "About Oracle Enterprise Manager 10g Database Control".

Setting Preferred Credentials

You can set Preferred Credentials so that Enterprise Manager will automatically supply host and database login credentials for you when you schedule jobs and tasks to perform administrative operations such as backup and recovery. For security, Oracle stores preferred credentials in the encrypted mode.

You can set preferred credentials in Enterprise Manager Database Control by performing the following steps:

1. Click Preferences at the top of the Database Home page. The Preferences page appears.
2. Click Preferred Credentials in the left frame. The Preferred Credentials page appears.
3. Click the icon under Set Credentials for the Target Type database. The Database Preferred Credentials page appears.
4. Enter the credentials in the form of username and password for normal, SYSDBA, and host connections. Click Test.
5. You receive a confirmation message that your credentials have been verified. Click Apply to save your preferred credentials.

Using SQL*Plus and iSQL*Plus to Access Your Database

SQL*Plus and iSQL*Plus provide a command-line interface to your database, thereby enabling you to:

- Perform database management operations**
- Execute SQL commands to query, insert, update, and delete data in your database**

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Using SQL*Plus and iSQL*Plus to Access Your Database

In addition to Enterprise Manager, you can use other Oracle tools to issue SQL statements such as SQL*Plus and iSQL*Plus. These tools enable you to perform many of the same database management operations, as well as to query, insert, update or delete data in the database.

Using SQL*Plus

- **SQL*Plus provides a command line interface to your database.**
- **SQL*Plus can be used interactively or in the batch mode.**

```
SQL> connect / as sysdba
Connected.
SQL> SELECT * FROM hr.regions;

REGION_ID REGION_NAME
-----
1 Europe
2 Americas
3 Asia
4 Middle East and Africa

SQL>
```

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Using SQL*Plus

You can use SQL*Plus to enter SQL commands to:

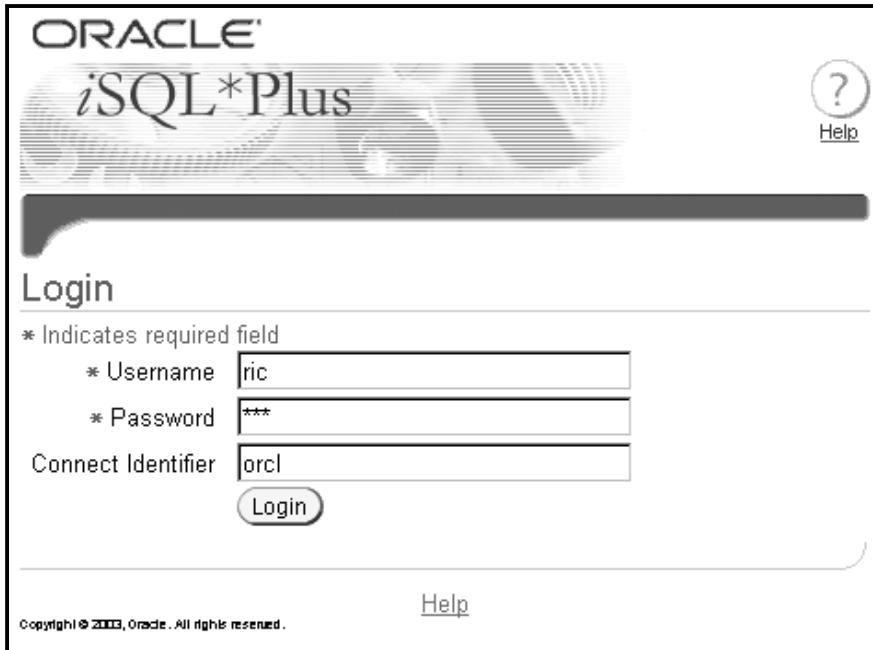
- Query tables in your database
- Insert, update, and delete rows in your database
- Perform database administration operations

In addition, you can enter PL/SQL commands and use SQL*Plus commands for formatting and reporting. For more information on SQL*Plus, refer to the *SQL*Plus User's Guide and Reference*.

You can invoke SQL*Plus by performing the following steps:

1. Open a terminal window.
2. Enter the following at the command-line prompt:
 \$ sqlplus /nolog
3. Enter connect and the username/password as shown in the following example:
 SQL> connect hr/hr

Using *iSQL*Plus*



Using *iSQL*Plus*

*iSQL*Plus* is a browser-based interface to an Oracle database. It is a component of the SQL*Plus product. *iSQL*Plus* has a server-side listener process that must be started before you can connect with a browser. To start this listener process execute the following command:

```
isqlplusctl start
```

You can invoke *iSQL*Plus* from Enterprise Manager by clicking the *iSQL*Plus* link in the Related Links region on the Database home page.

You can also access *iSQL*Plus* from a browser as follows:

1. Connect to the Internet or your intranet, and start your Web browser.
2. Enter your *iSQL*Plus* URL. The *iSQL*Plus* URL looks like the following:

```
http://hostname:port/isqlplus
```

The port number used by *iSQL*Plus* is normally 5560 unless the Oracle Universal Installer (OUI) detects something already using that port. You can review the \$ORACLE_HOME/install/portlist.ini file to find the port used by *iSQL*Plus*.

Using *iSQL*Plus* (continued)

3. The *iSQL*Plus* Login screen is displayed in your Web browser.
4. Enter your Oracle username and password in the Username and Password fields.
5. Leave the Connection Identifier field null to connect to the default database. Enter the Oracle Net database alias to connect to a database other than the default.
Note: Oracle Net is discussed in detail in the “Configuring the Oracle Network Environment” lesson.
6. Click Login to connect to the database. The *iSQL*Plus* Work screen is displayed in your Web browser.

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MetaLink Integration

- **Enterprise Manager automatically alerts users to new critical patches.**
- **The Enterprise Manager patch wizard can be used to select an interim patch.**
- **Review the README patch directly from within Enterprise Manager.**
- **Download the selected patches from MetaLink into the Enterprise Manager patch cache.**

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MetaLink Integration

Oracle Enterprise Manager 10g significantly facilitates software patching with its built-in MetaLink integration. Enterprise Manager automatically alerts users to new critical patches and flags all systems that require a specific patch. You can invoke the Enterprise Manager patch wizard to determine what interim patches are available for installation. Alternatively, you can use the patch wizard to select an interim patch and determine if any of your systems require that patch. You can review the patch details and README patch notes directly from within Enterprise Manager.

You can use the Enterprise Manager patch wizard to download interim patches from MetaLink into the Enterprise Manager patch cache, eliminating the need for repeated downloads. You can stage appropriate patches on the destination system or systems for manual application at a later time. To further automate the patching process, you can also provide a customizable patch application script that is executed on the destination system at a user-defined time by the resident Enterprise Manager agents. As patches are applied to a system, the corresponding OUI inventory is automatically updated to keep track of the systems' correct patch level.

Click Patch in the Deployments region of the Maintenance page to access the patch wizard.

Summary

In this lesson, you should have learned how to:

- **Start the Enterprise Manager dbconsole process**
- **Access Enterprise Manager Database Control**
- **Navigate in Enterprise Manager Database Control**
- **Grant Enterprise Manager administrative privileges**
- **Use SQL*Plus and iSQL*Plus to access your database**

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Practice Overview

This practice covers the following topics:

- Using the `emctl` utility to check the status of the `dbconsole` process
- Navigating in Enterprise Manager Database Control

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Configuring the Oracle Network Environment

4

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Objectives

After completing this lesson, you should be able to do the following:

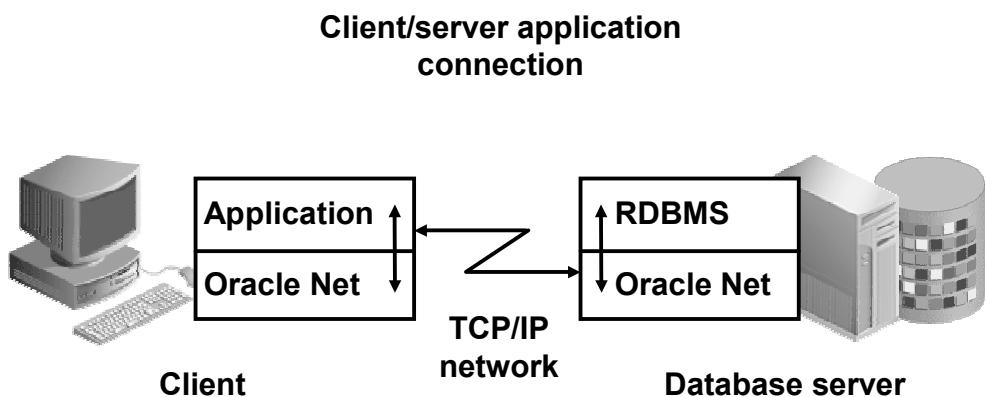
- **Describe the Oracle Network configuration**
- **Use the Enterprise Manager Net Services Administration page for Oracle Network configuration**
- **Use the listener control utility**
- **Configure a client to access an Oracle database**

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Network Configuration: Overview



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Network Configuration: Overview

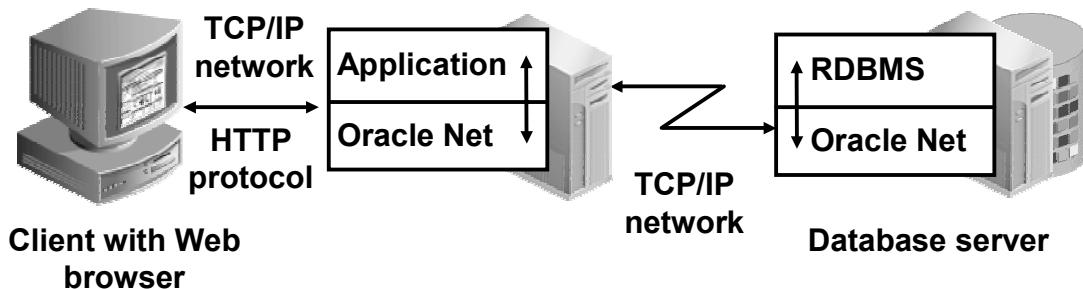
Oracle Net is a component of Oracle Net Services. It resides on both the client computer and the Oracle database server. Oracle Net is responsible for establishing and maintaining the connection between the client application and the server, as well as exchanging messages between them by using industry-standard protocols.

Oracle Net supports the traditional client/server application connections as shown in the illustration in the slide. In addition, Oracle Net supports Web client connections through an application Web server as shown on the next page.

For more information about Oracle Net configurations, refer to the *Oracle Net Services Administration Guide*.

Network Configuration: Overview

Web client connections through an application Web server



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Network Configuration: Overview (continued)

Internet connections from client Web browsers to an Oracle Database server are similar to client/server applications. The browser on the client uses HTTP to communicate to a Web server to make a connection request. The Web server sends the request to an application where it is processed. The application uses Oracle Net to communicate with an Oracle Database server configured with Oracle Net.

Tools for Configuring and Managing the Oracle Network

- **Oracle Enterprise Manager Net Services Administration page**
- **Oracle Net Manager**
- **Oracle Net Configuration Assistant: Launched by Oracle Universal Installer**

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Tools for Configuring and Managing the Oracle Network

You can use any of the following tools or applications to manage your Oracle Network configuration:

- **Oracle Enterprise Manager:** Provides an integrated environment for configuring and managing Oracle Net Services. You can use Enterprise Manager to configure Oracle Net Services for any Oracle home across multiple file systems. You can also administer listeners through Oracle Enterprise Manager. Oracle Enterprise Manager now includes functionality that was previously available only through Oracle Net Manager.
- **Oracle Net Manager:** Provides a GUI interface through which you can configure Oracle Net Services for an Oracle home on a local client or a server host.
- **Oracle Net Configuration Assistant:** Launched by the Oracle Universal Installer when you install Oracle software. Oracle Net Configuration Assistant enables you to configure the listening protocol address and service information for an Oracle database.

Enterprise Manager Net Services Administration Page

You can use the Enterprise Manager Net Services Administration page to perform the following tasks:

- Configuring local naming and directory naming**
- Searching directory naming entries**
- Configuring and administering the listener**
- Sorting listener names, local naming entries, and directory naming entries**
- Exporting directory naming entries to the `tnsnames.ora` file**

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Enterprise Manager Net Services Administration Page

The Net Services Administration page provides a means of administering listeners, directory naming, and local naming, and changing network configuration files for the Oracle home.

Note: Naming methods are explained later in the lesson.

Accessing the Net Services Administration Page

The screenshot shows the Oracle Database home page. In the top left, there's a 'General' section with various status metrics. A callout box points to the 'Listener' link under the 'Host' section. In the bottom right, there's a 'Related Links' section with several links, one of which is 'Net Services Administration'. Another callout box points to this link.

General

Status **Up**
Up Since **Nov 25, 2003 2:03:23 PM**
Time Zone **PST**
Availability (%) **100**
(Last 24 hours)
Instance Name **orcl**
Version **10.1.0.2.0**
Oracle Home **/u01/app/oracle/product/10.1.0**
Listener **LISTENER_EDCDR32P1**
Host **EDCDR32P1**

Click listener link.

Home [Serviced Databases](#)

Related Links

[All Metrics](#)
[Blackouts](#)
[**Net Services Administration**](#)

Click Net Services Administration.

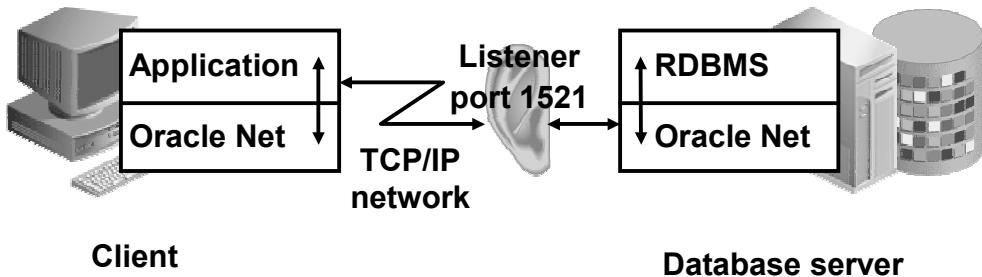
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Accessing the Net Services Administration Page

You can access the Net Services Administration page as follows:

1. Click the Listener link in the General region on the Database home page.
2. Click the Net Services Administration link in the Related Links region.
The Net Services Administration page appears.

Oracle Net Listener Configuration and Management



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Oracle Net Listener Configuration and Management

The listener is a separate process that runs on the database server computer. It receives incoming client connection requests and forwards these requests to the database server.

A listener is configured with one or more listening protocol addresses, information about supported services, and parameters that control its run-time behavior. The listener configuration is stored in a configuration file named `listener.ora`.

When you install the Enterprise Edition or the Standard Edition of Oracle, Oracle Net Configuration Assistant automatically configures a default listener named `LISTENER` with a TCP/IP listening protocol address. During a custom installation, Oracle Net Configuration Assistant prompts you to provide a listener name and protocol address. For all installations, a listening interprocess communication (IPC) protocol address for external procedure calls is automatically configured.

Note: An external procedure is written in a third-generation language (3GL), such as C, and is called from PL/SQL code.

Managing the Oracle Net Listener with Enterprise Manager

Listener: LISTENER_EDCDR32P1

Home Serviced Databases

General

	Status Up	Edit Stop
Availability (%)	100 (Last 24 Hours)	
Alias	LISTENER	
Version	10.1.0.1.0	
Oracle Home	/u01/app/oracle/product/10.1.0	
Net Address	(ADDRESS=(PROTOCOL=TCP)(HOST=EDCDR32P1)(PORT=1521))	
LISTENER.ORA Location	/u01/app/oracle/product/10.1.0/network/admin	
Start Time	Nov 25, 2003 1:55:18 PM	
Host	EDCDR32P1	

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Managing the Oracle Net Listener with Enterprise Manager

You can administer the listener with Oracle Enterprise Manager or the listener control utility.

To stop a listener by using Oracle Enterprise Manager, perform the following steps:

1. From the Database home page, click the Listener link in the General region.
The Listener home page appears.
2. Click Stop to stop the listener. The Net Services Administration: Host Login page is displayed.
3. Enter the username and password. Click Login. The Start/Stop: LISTENER page is displayed.
4. Click OK. The Processing: Stop Listener page is displayed.
5. The Listener home page is displayed after the listener is stopped.

Managing the Oracle Net Listener with Enterprise Manager (continued)

To start a listener by using Oracle Enterprise Manager, perform the following steps:

1. From the Database home page, click the Listener link in the General region.
The Listener home page appears.
2. Click Start to start the listener. The Net Services Administration: Host Login page is displayed.
3. Enter the username and password. Click Login. The Start/Stop: LISTENER page is displayed.
4. Click OK. The Processing: Start Listener page is displayed.
5. The Listener home page is displayed after the listener is started.

Note: You cannot access Oracle Enterprise Manager Database Control if the listener is not started. In this case, you must start the listener with the listener control utility as described later in the lesson.

Using the Listener Control Utility

Use the following commands to control the listener:

- **Starting the listener:**

```
$lsnrctl START listener_name
```

- **Stopping the listener:**

```
$lsnrctl STOP listener_name
```

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Using the Listener Control Utility

You may need to use the listener control utility to start the listener in situations such as a restart of your machine.

Starting the Listener

You can use the START command to start the listener from the Listener Control utility. The argument for the START command is the name of the listener, and if no argument is specified, the default listener named LISTENER is started. Execute the following command to start the listener:

```
$lsnrctl start listener_name
```

Verifying the Status of the Listener

You can execute the following command to verify whether the listener is started:

```
$lsnrctl status listener_name
```

You can also execute the following command to list the supported services:

```
$lsnrctl services listener_name
```

For more information about the Listener Control Utility, refer to the *Oracle Net Services Administration Guide*.

Connecting to an Oracle Database



Database server

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Connecting to an Oracle Database

An Oracle database is represented to a client as a service. A database can have one or more services associated with it. Databases are identified by a *service name* that is specified by the SERVICE_NAMES parameter in the initialization parameter file. The service name defaults to the global database name, which is a name that comprises the database name (DB_NAME parameter value) and domain name (DB_DOMAIN parameter value).

To connect to a database service, clients use a *connect descriptor* that provides the location of the database and the name of the database service. Clients can use the connect descriptor or a name that resolves to the connect descriptor as discussed later in the lesson.

The following example shows a connect descriptor that enables clients to connect to a database service called finance.us.flowers.com.

```
(DESCRIPTION=
  (ADDRESS=(PROTOCOL=tcp)(HOST=flowers-
server)(PORT=1521))
  (CONNECT_DATA=
    (SERVICE_NAME=finance.us.flowers.com)))
```

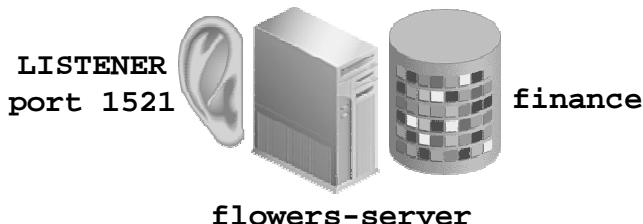
Name Resolution



```
CONNECT jsmith/jspass@finflowers
```

Name resolution

```
(DESCRIPTION=
  (ADDRESS=(PROTOCOL=tcp)(HOST=flowers-server)(PORT=1521))
  (CONNECT_DATA=
    (SERVICE_NAME=finance.us.flowers.com)))
```



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Name Resolution

Users initiate a connection request to the Oracle database by sending a *connect string*. A connect string includes a username and password, along with a *connect identifier*. A connect identifier can be the connect descriptor itself or a *name* that resolves to a connect descriptor. One of the most common connect identifiers is a *net service name*, a simple name for a service.

When a net service name is used, connection processing takes place by mapping the net service name to a connect descriptor. The mapping information can be stored in one or more repositories of information and is resolved using a *naming method*.

Oracle Net Naming Methods

Oracle Net provides support for the following methods:

- **Local naming:** Uses a local configuration file
- **Directory naming:** Uses a centralized LDAP-compliant directory server
- **Easy connect naming:** Uses a TCP/IP connect string
- **External naming:** Uses a supported non-Oracle naming service

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Oracle Net Naming Methods

Oracle Net provides support for the following naming methods:

- **Local naming:** The local naming method stores connect descriptors, identified by their net service name, in a local configuration file named `tnsnames.ora` on the client.
- **Directory naming:** The directory naming method stores connect identifiers in a centralized LDAP-compliant directory server to access a database service.
- **Easy connect naming:** The easy connect naming method enables clients to connect to an Oracle database server by using a TCP/IP connect string consisting of a host name and optional port and service name as follows:

CONNECT `username/password@host[:port][/service_name]`

The easy connect naming method requires no configuration.

- **External naming:** The external naming method stores net service names in a supported non-Oracle naming service. Supported third-party services include:
 - Network Information Service (NIS) External Naming
 - Distributed Computing Environment (DCE) Cell Directory Services (CDS)

Using Enterprise Manager to Configure Local Naming

Create Net Service Name

General [Advanced](#)

* Net Service Name

Database Information

To identify the database or service, you must provide either its service name, global database name, a name comprising the database name and domain, or a SID.

Use Service Name
Service Name

Use SID
SID

Choose if you want a shared or dedicated server database connection.

Database Default
Requests will be served by whatever database default is.

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Using Enterprise Manager to Configure Local Naming

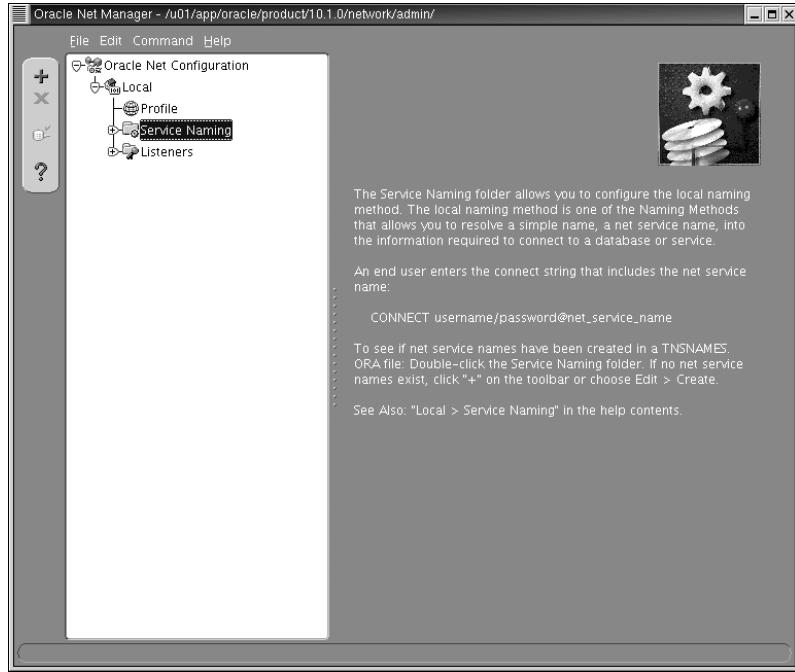
You can use Enterprise Manager to configure a net service name using the local naming method as follows:

1. From the Database home page, click the Listener link in the General region. The Listener home page appears.
2. Click Net Services Administration in the Related Links region. The Net Services Administration page appears.
3. Select the appropriate Configuration File Location for an Oracle home. Select Local Naming from the Administer drop-down menu. Click Go. The Net Services Administration: Host Login page appears.
4. Enter the username and password for the host computer, and click Login. The Local Naming page appears.
5. Click the Create button, or select an existing Net Service Name and click Create Like. The Create Net Service Name General page appears.
6. Enter a name in the Net Service Name field.

Using Enterprise Manager to Configure Local Naming (continued)

7. In the Database Information region, configure service support as follows:
 - a. Enter a destination service. Select Use Service Name and enter a service name in the Service Name field.
 - b. Select the Database Default database connection type.
8. In the Addresses region, configure protocol support as follows:
 - a. Click Add. The Add Address page appears.
 - b. Select the protocol upon which the listener is configured to listen from the Protocol list.
Note: This protocol must also be installed on the client. In most cases, the protocol will be TCP/IP.
 - c. Enter the Port and Host fields of the listening address.
9. Click OK. You are returned to the Create Net Service Name page.
10. Click OK. A message confirming successful creation is displayed on the Local Naming page.
11. Select the net service name you just created. Click Test Connection.
12. Provide a valid database username and password to test the connection. Click Test. The Test Result page is displayed.

Using Net Manager to Configure Local Naming



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Using Net Manager to Configure Local Naming

You must configure a client machine so that it can connect to an Oracle database. You must first install Oracle Database client software, which includes Oracle Net software. After you have installed Oracle Net, you can use Net Manager to configure a net service name by using the local naming method:

1. On Windows, start Oracle Net Manager by clicking Start > Programs > Oracle > Configuration and Migration Tools > Net Manager.
On Unix or Linux, invoke Oracle Net Manager by entering `netmgr` at the command line.
2. Highlight Service Naming and click the plus sign (+) on the left of the page. The Net Service Name Wizard appears.
3. Enter a net service name to identify it. The name you choose will appear under the Service Naming folder. Click Next.
4. Select the protocol to use to connect to your database. For example, you can accept the TCP/IP (the default protocol). The database listener must be configured to use the same network protocol. Click Next.
5. Enter the host name of the database machine.

Using Net Manager to Configure Local Naming (continued)

6. Enter the database service name. In addition, select a Connection Type, either Shared or Dedicated. If you are unsure or would like to use the default database connection type, select Database Default. Click Next.
7. The last page of the wizard enables you to test the connection by using the information you entered. You can change the default login by clicking Change login and entering a username and password. Click Test. The wizard informs you whether the connection test succeeded or not.
8. Click Finish. The new service appears under the Service Naming folder. You can view or modify the configuration for the highlighted service under Service Identification and Address Configuration.

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Summary

In this lesson, you should have learned how to:

- **Use the Enterprise Manager Net Services Administration page for Oracle Network configuration**
- **Use the listener control utility to manage the listener**
- **Configure local naming so that a client can access an Oracle database**

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Practice Overview

This practice covers the following topics:

- **Using the Enterprise Manager Net Services Administration page**
- **Starting and stopping the listener**
- **Configuring local naming**

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Managing the Oracle Instance

5

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Objectives

After completing this lesson, you should be able to do the following:

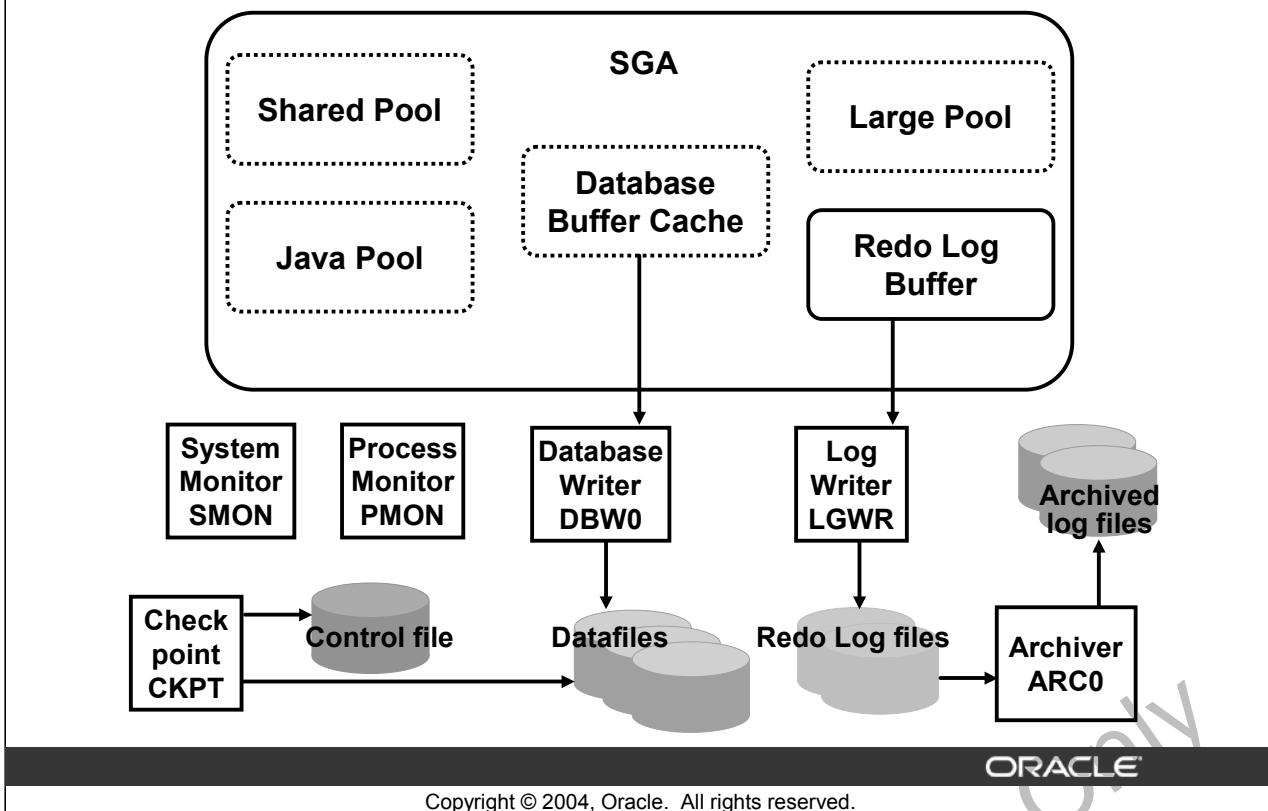
- Start up and shut down the Oracle instance
- View the parameters that are used to configure the Oracle instance
- Manage Oracle instance memory components

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Oracle Instance Management



Oracle Instance Management

An Oracle Database server consists of an Oracle instance and an Oracle database. An Oracle instance comprises memory areas and processes.

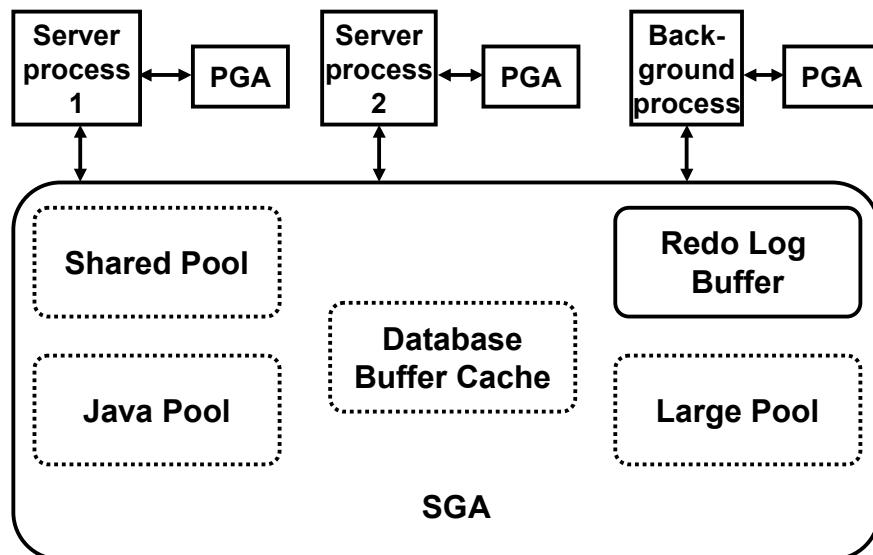
An Oracle database comprises datafiles, the control file and redo log files. The files and their contents are discussed in detail in the lesson titled “Managing Database Storage Structures.”

You must start the instance for users to access the database. When you start the instance, an initialization parameter file is read to configure the instance, the memory areas are allocated and the processes are started.

After the instance is started and the database is opened, users can access the database.

Note: Starting an instance and opening the database are covered in more detail later in the lesson.

Oracle Memory Structures



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Oracle Memory Structures

The basic memory structures associated with an Oracle instance include:

- **System Global Area (SGA):** Shared by all server and background processes
- **Program Global Area (PGA):** Private to each server and background process; there is one PGA for each process

System Global Area (SGA)

The System Global Area (SGA) is a shared memory area that contains data and control information for the instance.

The SGA comprises the following data structures:

- **Database buffer cache:** Contains copies of blocks of data retrieved from the database. Data stored in the database must be read from disk and brought into memory before it can be viewed or modified.
- **Redo log buffer:** Buffers redo information (used for instance recovery) until it can be written to the physical redo log files stored on disk. Redo log files are covered in detail in a later lesson.
- **Shared pool:** Caches SQL statements that can be shared among users

Oracle Memory Structures (continued)

- **Large pool:** Optional area used for buffering I/O requests and Recovery Manager (RMAN) backup buffers
- **Java pool:** Used for all session-specific Java code and data within the Java Virtual Machine (JVM)

When you start the instance by using Oracle Enterprise Manager (Enterprise Manager) or SQL*Plus, the memory allocated for the SGA is displayed.

With the dynamic SGA infrastructure, the size of the database buffer cache, the shared pool, the large pool, and the Java pool can be changed without shutting down the instance.

Oracle Database 10g includes the Automatic Shared Memory Management feature, which simplifies the SGA memory management significantly. You can specify the total amount of SGA memory available to an instance by using the `SGA_TARGET` initialization parameter, and the Oracle server will automatically distribute this memory among various subcomponents to ensure most effective memory utilization. The shared pool, java pool, database buffer cache, and large pool can participate in Automatic Shared Memory Management and are shown with dashed lines in the slide. Enabling Automatic Shared Memory Management is discussed in more detail later in the lesson.

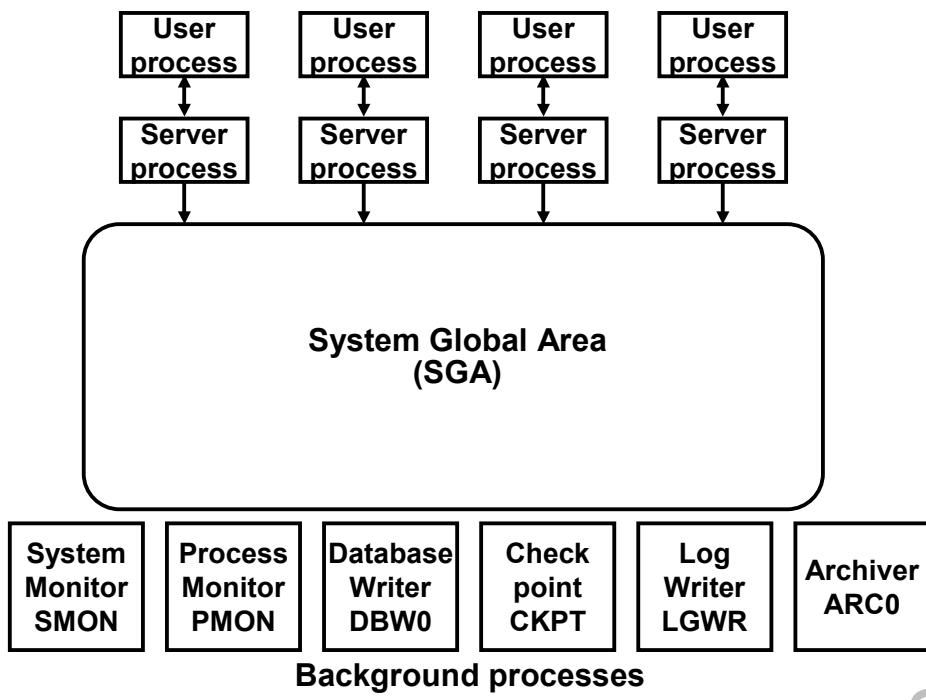
The preconfigured database has been pretuned with adequate settings for the memory parameters. However, as your database usage expands, you may find it necessary to alter the settings of the memory parameters.

Oracle provides alerts and advisors to identify memory sizing problems and to help you determine appropriate values for memory parameters.

Program Global Area (PGA)

Program Global Area (PGA) is a memory region that contains data and control information for each server process. A server process is an operating system process or thread that services a client's requests. Each server process has its own private PGA that is created when the server process is started. Access to the PGA is exclusive to that server process and is read and written only by the Oracle code acting on behalf of it.

Oracle Processes



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Oracle Processes

When you invoke an application program or an Oracle tool, such as Enterprise Manager, the Oracle server creates a user process to execute your application. The Oracle server creates server processes to handle the requests of user processes that are connected to the instance.

The Oracle server also creates a set of background processes for an instance that interact with each other and with the operating system to manage the memory structures, perform I/O to write data to disk, and do general housekeeping.

There are many background processes and not all may be present depending on the features that are being used in the database. The most common background processes are:

- **System monitor (SMON):** Performs instance recovery when the instance is started following a failure
- **Process monitor (PMON):** Performs process recovery when a user process fails by cleaning up the cache and freeing resources that the process was using
- **Database Writer (DBW n):** Writes modified blocks from the database buffer cache to the files on disk
- **Checkpoint (CKPT):** Signals DBW n at checkpoints and updates all of the datafiles and control files of the database to indicate the most recent checkpoint. When a checkpoint occurs, all changes made by committed transactions are written to datafiles on disk.

Oracle Processes (continued)

- **Log writer (LGWR):** Writes redo log entries to disk
- **Archiver (ARC n):** Copies the redo log files to archival storage when the log files are full or a log switch occurs. The Archiver process is present only when the database is in ARCHIVELOG mode and automatic archiving is enabled. This is discussed in detail in the “Performing Backup and Recovery” lesson.

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Starting the Instance and Opening the Database

- **Perform the following steps to make the database available for use:**
 1. Start the instance: SGA is allocated and background processes are started
 2. Mount the database: Control file is read
 3. Open the database: Database is available for access
- **All three steps can be performed by clicking Startup in Enterprise Manager.**

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Starting the Instance and Opening the Database

You can perform the following three steps to start an Oracle instance and make the database available for systemwide use:

1. Start the instance.
2. Mount the database.
3. Open the database.

You can perform these steps by using Enterprise Manager or the SQL*Plus STARTUP command. When you start the instance, the server parameter file (SPFILE) or the initialization parameter file is read to determine the values of initialization parameters. Then, SGA is allocated and background processes are started.

When the database is mounted, the control file is read and the datafiles are checked for consistency. In the mounting stage, you can perform certain administrative functions and recovery operations.

When the database is opened, the redo log files and datafiles are read and opened. In this state, the database is available for users to access.

Note: Database files are discussed in detail in the “Managing Database Storage Structures” lesson.

Using Enterprise Manager to Start the Instance



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Using Enterprise Manager to Start the Instance

You can use Enterprise Manager to start the instance and open the database by performing the following steps:

1. Invoke Enterprise Manager from your browser.
2. Click Startup/Shutdown on the Database home page to start the instance.
3. Specify the operating system username and password, and the database username and password on the Startup/Shutdown:Specify Host and Target Database Credentials page. Click OK.
4. Click Yes on the Startup/Shutdown:Confirmation page.
5. The Startup/Shutdown:Activity Information page is displayed. After the instance has started the Login to Database page is displayed.
6. Enter the username and password to log in to the database.

Starting the Instance by Using Windows Services

- **Start the following services:**
 - OracleService<SID>
 - Oracle<oracle_home><SID>TNSListener
 - Oracle<oracle_home><SID>DBConsole
- **Access Services from Administrative Tools in the Control Panel.**

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Starting the Instance by Using Windows Services

You can start up and shut down your Oracle instance with the Windows Services program. To access your Oracle database, you must start the following three services:

- OracleService<SID>: Your Oracle Database instance
- Oracle<oracle_home><SID>TNSListener: Your listener that enables clients to connect to your database
- Oracle<oracle_home><SID>DBConsole: Enterprise Manager dbconsole process which enables clients to connect to Enterprise Manager

Perform the following steps to start the Oracle services:

1. Select Administrative Tools > Services in the Control Panel. A list of all available services on your system appears.
2. Locate the three Oracle services as described earlier.
3. Start each service by right-clicking the service name and selecting Start. You can also choose Start from the Actions menu. You can double-click the service to view the Service Properties page where you can Start or Stop the service and select the Startup Type.

Viewing and Modifying Initialization Parameters

The screenshot shows the Oracle Enterprise Manager interface for viewing and modifying initialization parameters. The top navigation bar includes links for Setup, Preferences, Help, and Logout, with 'Database' selected. The main title is 'Initialization Parameters'. Below the title, there are tabs for 'Current' and 'SPFile', with 'SPFile' selected. A message states: 'The parameter values listed here are currently used by the running instance(s). You can change static parameters in SPFILE mode.' There is a 'Filter' input field and a 'Go' button. To the right are 'Save to File' and 'Show All' buttons. A table lists various initialization parameters with their current values, types, and categories. The table has columns for Name, Help, Revisions, Value, Type, Basic, Default, Dynamic, and Category. The 'Category' column includes entries like 'Cluster Database', 'Miscellaneous', 'File Configuration', 'Cache and I/O', 'File Configuration', 'Database Identification', 'Database Identification', 'Miscellaneous', and 'Miscellaneous'. The table shows parameters such as cluster_database (Value: FALSE), compatible (Value: 10.1.0.1.0), control_files (Value: '/oracle/oradata/orcl/control01.ctl', '/oracle/oradata/orcl/control02.ctl', '/oracle/oradata/orcl/control03.ctl'), db_block_size (Value: 8192), db_create_file_dest (Value: empty), db_domain (Value: us.oracle.com), db_name (Value: orcl), db_recovery_file_dest (Value: '/oracle/flash_recovery_area'), and db_recovery_file_dest_size (Value: 2147483648).

Name	Help	Revisions	Type	Basic	Default	Dynamic	Category
cluster_database	[x] Help		Boolean	✓	✓		Cluster Database
compatible	[x] Help		String	✓			Miscellaneous
control_files	[x] Help		String	✓			File Configuration
db_block_size	[x] Help		Integer	✓			Cache and I/O
db_create_file_dest	[x] Help		String	✓	✓	✓	File Configuration
db_domain	[x] Help		String	✓			Database Identification
db_name	[x] Help		String	✓			Database Identification
db_recovery_file_dest	[x] Help		String	✓		✓	Miscellaneous
db_recovery_file_dest_size	[x] Help		Big Integer	✓		✓	Miscellaneous

Viewing and Modifying Initialization Parameters

When you start the instance, an initialization parameter file is read. There are two types of parameter files:

- **Server parameter file:** This is the preferred type of initialization parameter file. It is a binary file that can be written to and read by the database server and must not be edited manually. It resides in the server that Oracle is executing on, and is persistent across shutdown and startup. This is often referred to as an SPFILE.
- **Text initialization parameter file:** This type of initialization parameter file can be read by the database server, but it is not written to by the server. The initialization parameter settings must be set and changed manually by using a text editor so that they are persistent across shutdown and startup.

Managing Memory Components

You can manage memory components in the following ways:

- Use Automatic Shared Memory Management (recommended).
 - Oracle server manages the amount of memory allocated to shared pool, Java pool, database buffer cache, and large pool.
 - Specify total memory to be allocated to SGA through initialization parameter.
- Manage component sizes through individual initialization parameters and use the Memory Advisor.

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Managing Memory Components

The SGA comprises several components. The size of these components can be managed by the Oracle server through the use of the Automatic Shared Memory Management feature. Alternatively, you can manage the size of the components manually by setting initialization parameters that determine the size of each component.

Enabling Automatic Shared Memory Management

Database: orcl.us.oracle.com > Memory Parameters

Memory Parameters

SGA PGA

The System Global Area (SGA) is a group of shared memory structures that in memory when an Oracle database instance is started.

Automatic Shared Memory Management **Disabled**

Shared Pool 80
Buffer Cache 24
Large Pool 8 MB
Java Pool 48 MB
Other (MB) 1
Total SGA (MB) 161

Click Enable to enable Automatic Shared Memory Management.

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Enabling Automatic Shared Memory Management

You can enable Automatic Shared Memory Management so that the Oracle server will automatically size the SGA components including the shared pool and buffer cache.

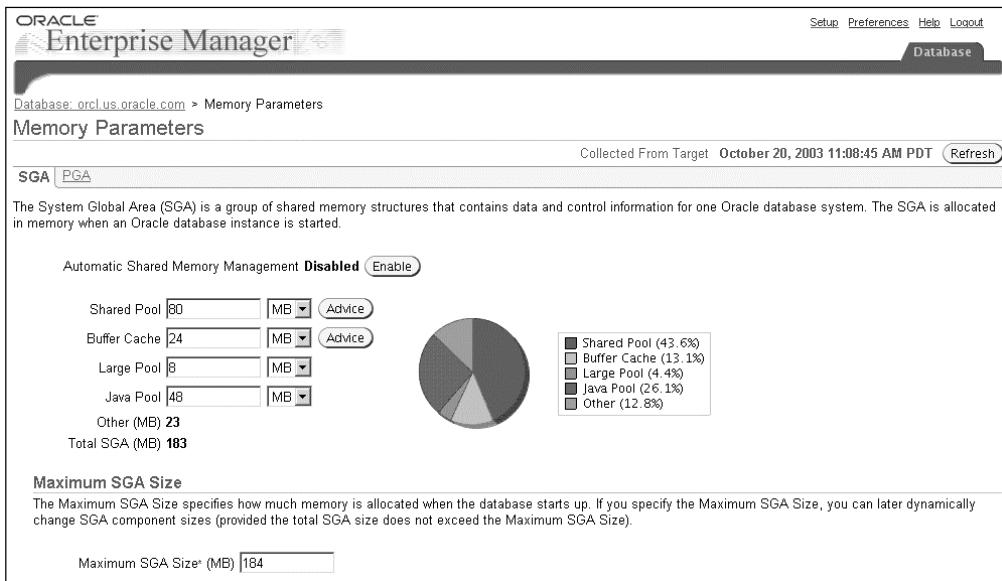
Note: It is recommended that you enable Automatic Shared Memory Management.

If you did not enable this feature when you configured your database, then you can enable it by performing the following steps:

1. Click Memory Parameters in the Instance region of the Administration page.
2. Click Enable.
3. The Enable Automatic Shared Memory Management page appears. You can specify the total SGA size or accept the current SGA size. Click OK.

You can increase the total SGA size at a later time by increasing the value of the SGA_TARGET initialization parameter. For more information, refer to the *Oracle Database Administrator's Guide*.

Using Manual Shared Memory Management



Using Manual Shared Memory Management

If you decide not to use Automatic Shared Memory Management, you must manually configure each component of the SGA. When you install your Oracle Database software and create your database, you provide values for the configuration of the SGA components.

If the Oracle server notifies you of a performance problem that is related to the size of the SGA or PGA at a later time, you can use the memory advisor to determine appropriate new settings. The memory advisor can model the effect of parameter changes. Using the memory advisor, you can also specify that you want the Oracle server to automatically tune all the memory parameters for you as conditions change. It is recommended that you use automatic tuning.

You can access the Memory Parameters page by selecting the Memory Parameters link in the Instance region of the Administration page. You can invoke any of the memory advisors by clicking Advice. You can click Help to view the online Help for additional information on how the memory advisor works.

Viewing the Alert Log

The screenshot shows the Oracle Enterprise Manager Database home page. In the top navigation bar, there are links for Home, Performance, Administration, and Maintenance. Below this, the Related Links section contains links for Advisor Central, All Metrics, Manage Metrics, and iSQL*Plus. To the right of these, under the Monitoring category, are links for Alert History, Blackouts, Metric Collection Errors, Jobs, and Monitoring Configuration. An arrow points from a callout box labeled "Click Alert Log Content to view the alert log." to the "Jobs" link.

Click Alert Log Content to view the alert log.

The screenshot shows the "Most Recent Alert Log Entries" page. The URL is Database: orcl.us.oracle.com > Most Recent Alert Log Entries. The page title is "Most Recent Alert Log Entries". It displays the last 100,000 bytes of the alert log, which is constantly growing. A message says "This shows the last 100,000 bytes of the alert log. The log is constantly growing, so select the browser's Refresh button to see the most recent log entries." The number of lines displayed is 2,880. The log entries show timestamps and system messages:

```
Fri Oct 17 11:46:39 2003
MTTR advisory is disabled because FAST_START_MTTR_TARGET is not set
Fri Oct 17 11:46:39 2003
SMON: enabling cache recovery
Fri Oct 17 11:46:40 2003
Undo Segment 1 Onlined
```

At the bottom, there is a copyright notice: Copyright © 2004, Oracle. All rights reserved.

Viewing the Alert Log

The alert log is a file that contains a chronological log of messages and errors. The alert log files includes the following:

- A record of all internal errors (ORA-600), block corruption errors (ORA-1578), and deadlock errors (ORA-60) that occur
- A record of administrative operations, such as CREATE, ALTER, and DROP statements and STARTUP, SHUTDOWN, and ARCHIVELOG statements
- Messages and errors relating to the functions of shared server and dispatcher processes
- The value of all initialization parameters that had nondefault values at instance start time

The Oracle server record these operations in the alert log as an alternative to displaying the information on an operator's console. If an operation is successful, a "completed" message is written in the alert log, along with a timestamp.

Using Enterprise Manager, you can view the contents of the alert log by clicking Alert Log Content in the Related Links region on the Database home page. The Most Recent Alert Log Entries page is displayed.

Summary

In this lesson, you should have learned how to:

- Start the instance and open the database so that it is available for users**
- View initialization parameter values**
- Manage Oracle instance memory components**

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Practice Overview

This practice covers the following topics:

- **Using Enterprise Manager to start up and shut down the instance**
- **Viewing initialization parameters**
- **Viewing the alert log**

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Managing Database Storage Structures

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Objectives

After completing this lesson, you should be able to do the following:

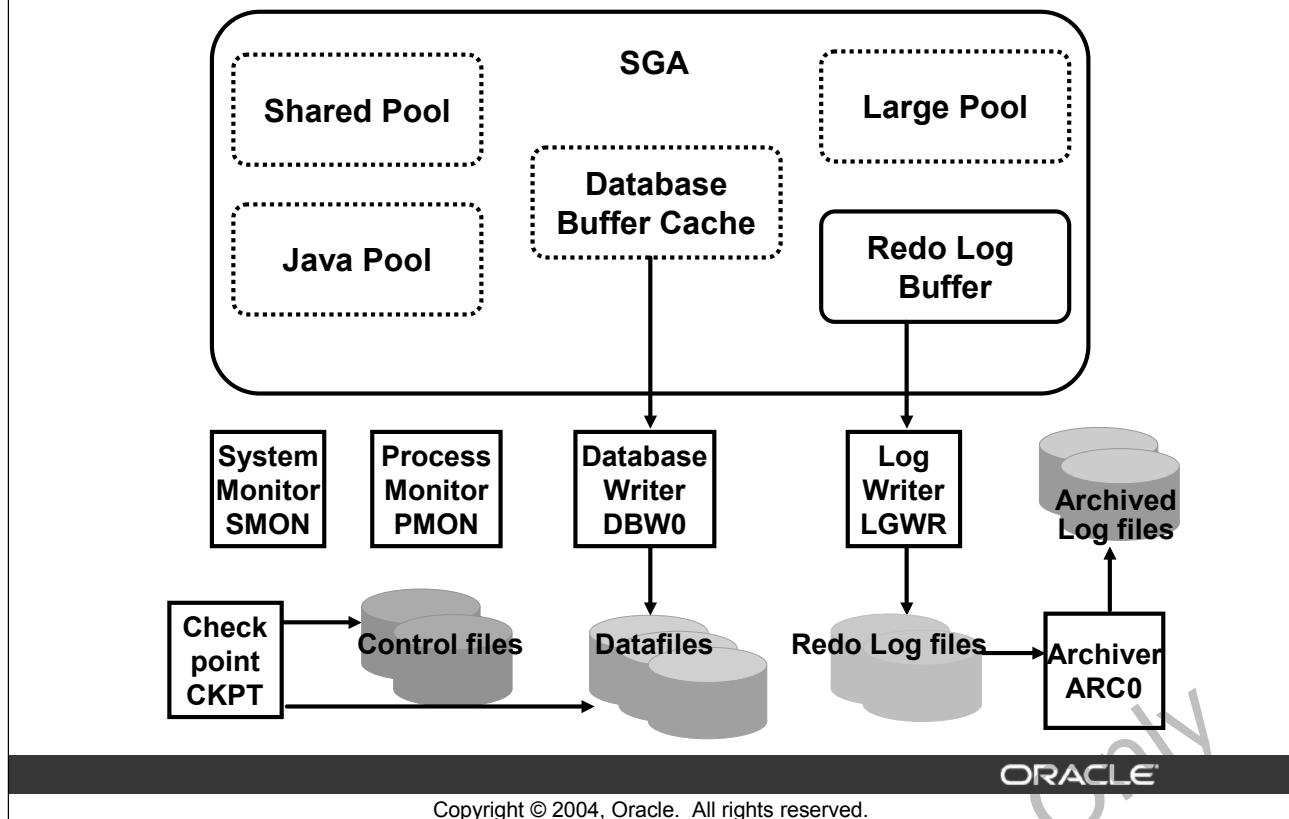
- **Use Oracle Enterprise Manager to view database storage structures**
- **Create new storage structures in your database**
- **Reclaim unused space in your database**
- **Manage structures used to undo the changes that are made to the database and maintain consistency**

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Oracle Database Structures



Oracle Database Structures

The Oracle database comprises the following physical database structures:

- **Control file:** Contains entries that specify the physical structure of the database
- **Datafiles:** Contain all the database data. The content of logical database structures, such as tables and indexes, is physically stored in the datafiles.
- **Redo log files:** Record all changes made to data

Exploring the Storage Structure of the Oracle Database

The screenshot shows the Oracle Enterprise Manager interface for the database `orcl.us.oracle.com`. The navigation bar at the top includes Home, Performance, Administration (which is selected), and Maintenance. The main content area is divided into two columns: Instance and Storage. Under Instance, there are links for Memory Parameters, Undo Management, and All Initialization Parameters. Under Storage, there are links for Controlfiles, Tablespaces, Datafiles, Rollback Segments, Redo Log Groups, Archive Logs, and Temporary Tablespace Groups. A callout box with an arrow points from the text "Click the links to view detailed information." to the Storage column.

Database: orcl.us.oracle.com

Home Performance **Administration** Maintenance

Instance

Memory Parameters
Undo Management
All Initialization Parameters

Storage

Controlfiles
Tablespaces
Datafiles
Rollback Segments
Redo Log Groups
Archive Logs
Temporary Tablespace Groups

Click the links to view detailed information.

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Exploring the Storage Structure of the Oracle Database

Logical data structures are stored in the physical files of the database. You can easily view the logical and physical structures of your database by using Oracle Enterprise Manager (Enterprise Manager). For detailed information on each structure, click the links in the Storage region of the Administration page.

Control File

- Contains physical database structure information
- Multiplexed to protect against loss
- Read at mount stage



Controlfiles

General Advanced Record Section

Controlfile Mirror Images

Oracle strongly recommends that your database has a minimum of two control files and that they disk failure, it could be restored using the intact copy of the control file from the other disk. You c: file.

Valid	File Name	File Directory
VALID	control01.ctl	/u01/app/oracle/oradata/orcl/
VALID	control02.ctl	/u01/app/oracle/oradata/orcl/
VALID	control03.ctl	/u01/app/oracle/oradata/orcl/

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Control File

When you start the instance and mount the database, the control file is read. The entries in the control file specify the physical files that comprise the database.

When you add additional files to your database, the control file is automatically updated.

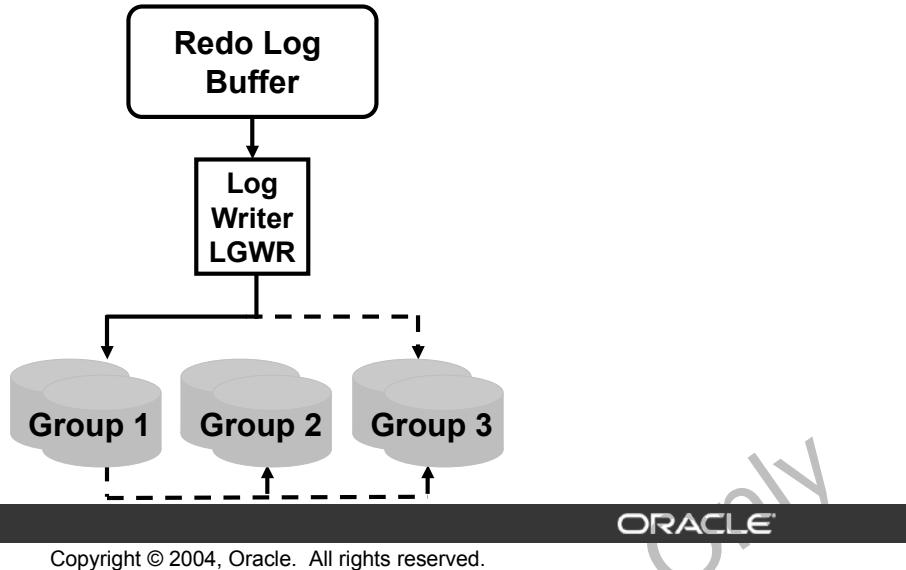
The location of the control files is specified in the `CONTROL_FILES` initialization parameter.

To protect against failure of the database because of the loss of the control file, you should multiplex the control file. By specifying multiple files through the initialization parameter, you enable the Oracle database server to maintain multiple copies of the control file.

You can access information about the control files in your database by clicking the Controlfiles link in the Storage region of the Administration page in Enterprise Manager. The Controlfiles General page displays the name and location of the control files in your database. The Advanced page provides information about the creation of the control file and database identification. The Record Section page displays information about the entries in the control file.

Redo Log Files

- Record changes to the database
- Should be multiplexed to protect against loss



Redo Log Files

Redo log files are used to record changes to the database as a result of transactions and internal Oracle database server actions.

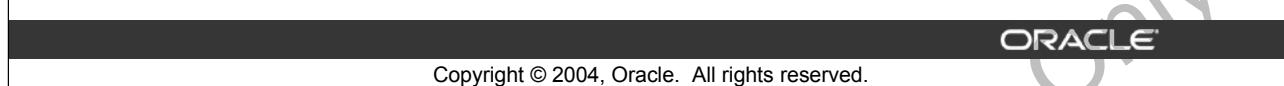
Note: A transaction is a logical unit of work that comprises one or more SQL statements run by a single user. Redo log files protect the database from loss of integrity because of system failures caused by power outages, disk failures, and so on. Redo log files should be multiplexed to ensure that the information stored in them is not lost in the event of a disk failure.

The redo log consists of groups of redo log files. A group consists of a redo log file and its multiplexed copies. Each identical copy is said to be a member of that group and each group is identified by a number. The log writer process (LGWR) writes redo records from the redo log buffer to a redo log group until the files in the group are filled or a log switch operation is requested. Then it switches and writes to the files in the next group. Redo log groups are used in a circular fashion.

You can access information about the redo log files in your database by clicking the Redo Log Groups link in the Storage region of the Administration page. You can view detailed information, including the names of the redo log files, by selecting a group and clicking View.

Multiplexing the Redo Log

The screenshot shows the Oracle Enterprise Manager interface. The title bar says 'ORACLE Enterprise Manager'. The main menu bar includes 'Database', 'Setup', 'Preferences', 'Help', and 'Logout'. The top navigation bar shows the path: 'Database: orcl.us.oracle.com > Redo Log Groups > Edit Redo Log Group: 1: Add Redo Log Member'. The main content area is titled 'Edit Redo Log Group: 1: Add Redo Log Member'. It contains fields for 'File Name' (set to 'redo01b.log') and 'File Directory' (set to '/oracle/oradata/orcl/'). There is also a 'Reuse File' checkbox. At the bottom of the page, there is copyright information: 'Copyright © 1996, 2003, Oracle. All rights reserved.' and 'About Oracle Enterprise Manager Database Console'.



Multiplexing the Redo Log

You can multiplex your redo log by adding a member to an existing log group. Perform the following steps to add a member to a redo log group:

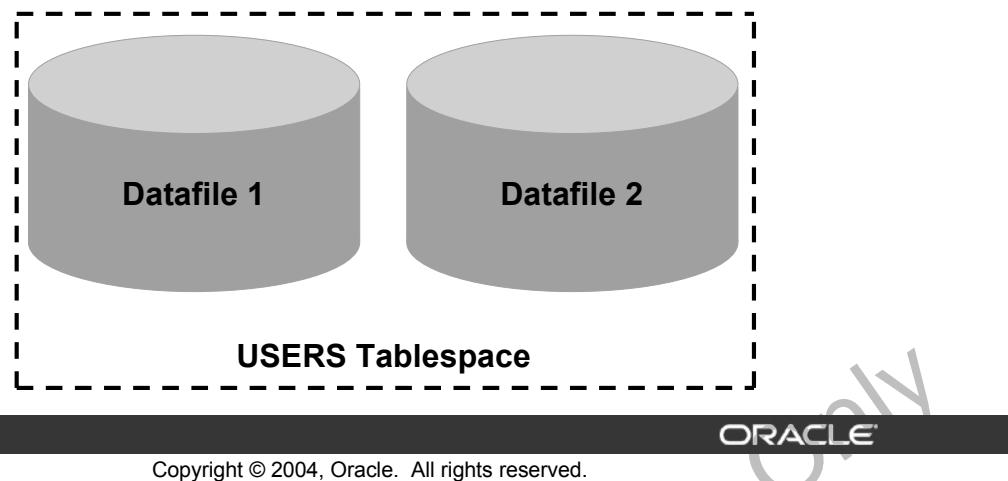
1. Click Redo Log Groups in the Storage Region of the Administration page. The Redo Log Groups page appears.
2. Select a group and click Edit, or click the group number link. The Edit Redo Log Group page appears.
3. In the Redo Log Members region, click Add. The Add Redo Log Member page appears.
4. Enter the file name and the file directory. Click OK.
5. Repeat these steps for every existing group.

Note: It is recommended that you store members on separate drives to protect against total loss of the redo log entries in event of a disk failure.

When you add a redo log member to a group, the group's status is marked **INVALID**. This is the expected state because a member of the group has not yet been written to. When a log switch occurs and the invalid group becomes the current group, the status changes to **CURRENT**.

Tablespaces and Datafiles

- **Tablespaces comprise one or more datafiles**
- **Datafiles belong to only one tablespace**
- **Segments can span datafiles within a tablespace**



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Tablespaces and Datafiles

A database is divided into logical storage units called tablespaces, which can be used to group related logical structures together. Each database is logically divided into two or more tablespaces. One or more datafiles are explicitly created for each tablespace to physically store the data of all logical structures in a tablespace.

Database objects, such as tables and indexes, are stored in tablespaces as segments. Each segment contains one or more extents. An extent consists of contiguous data blocks. Data blocks are the smallest unit of I/O in the database.

You can access information about the tablespaces in your database by clicking the Tablespaces link in the Storage region of the Administration page. Select the tablespace of interest and click View to display more detailed information about the tablespace.

Tablespaces in the Preconfigured Database

- **SYSTEM:** Contains data dictionary tables and other administrative data
- **SYSAUX:** Auxiliary tablespace to the **SYSTEM** tablespace
- **TEMP:** Contains transient data that persists only for the duration of the session
- **UNDOTBS1:** Contains undo segments
- **USERS:** Default tablespace for all objects created by nonsystem users
- **EXAMPLE:** Contains the sample schemas

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Tablespaces in the Preconfigured Database

The following tablespaces are created for you in the preconfigured database:

- **SYSTEM:** The SYSTEM tablespace is used by the Oracle database server to manage the database. It contains the data dictionary tables that contain administrative information about the database. These are all contained in the SYS schema, and can only be accessed by the user SYS, or other administrative users with the required privilege.
- **SYSAUX:** This is an auxiliary tablespace to the SYSTEM tablespace. Some components and products that used the SYSTEM tablespace or their own tablespaces in earlier releases of Oracle, now use the SYSAUX tablespace. Every Oracle Database10g database must have a SYSAUX tablespace.
- **TEMP:** This tablespace contains transient data that persists only for the duration of the session. As an example, it can be used for sort work space. Every database should have a temporary tablespace that is assigned to users as their temporary tablespace. In the preconfigured database, the TEMP tablespace is specified as the default temporary tablespace. This means that if no temporary tablespace is specified when the user account is created, then Oracle assigns this tablespace to the user.

Tablespaces in the Preconfigured Database (continued)

- **UNDOTBS1:** This is the undo tablespace used by the database server to store undo information. Every database must have an undo tablespace that is created during database creation.
- **USERS:** This tablespace is used to store permanent user objects and data. In the pre-configured database, USERS is the default tablespace for all objects that are created by nonsystem users.
- **EXAMPLE:** This tablespace contains the sample schemas that can be installed when you create the database. Your Oracle documentation and courseware materials contain examples based upon the objects defined in the Sample Schemas.

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Enlarging the Database

You can enlarge the database in the following ways:

- Create a new tablespace.**
- Add a datafile to an existing tablespace.**
- Increase the size of a datafile.**
- Provide for dynamic growth of a datafile.**

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Enlarging the Database

You can add space to an existing tablespace by adding a datafile as follows:

1. Click the Tablespaces link in the Storage region of the Administration page.
2. Select the tablespace and click Add Datafile. The Add Datafile page appears.
3. Enter the file name, directory, and file size. Click OK.
4. A confirmation message is displayed on the Tablespaces page.

Creating a New Tablespace

The screenshot shows the 'Create Tablespace' page in Oracle Enterprise Manager. The 'General' tab is selected. The 'Name' field contains 'INVENTORY'. Under 'Extent Management', 'Locally Managed' is selected. Under 'Type', 'Permanent' is selected. Under 'Status', 'Read Write' is selected. In the 'Datafiles' section, there is a note about using bigfile tablespaces. A table lists one datafile entry: 'Select Name' is 'INVENTORY', 'Directory' is 'DATA', and 'Size (MB)' is '100'. There is an 'Add' button to add more datafiles.

Creating a New Tablespace

To create a permanent tablespace, perform the following steps:

1. Navigate to the Tablespaces page.
2. Click Create.

Note: If you want to create a tablespace that is like an existing tablespace, select an existing tablespace and select Create Like from the Actions menu. Click Go.

The Create Tablespace page appears.

3. Enter a name for the tablespace.
4. Select Locally Managed under the Extent Management heading. The extents of a locally managed tablespace are managed efficiently within the tablespace by the Oracle database server. Dictionary managed-tablespaces are being deprecated. Oracle Corporation does not recommend their use.
5. Select Permanent under the Type heading. Permanent tablespaces store permanent database objects created by the system or users.
6. Select Read Write under the Status heading. Read-write status means users can read and write to the tablespace after it is created. This is the default.

Creating a New Tablespace

Database: orcl.oracle.com > Tablespaces > Create Tablespace: Add Datafile

Create Tablespace: Add Datafile

* File Name

* File Directory

Tablespace **INVENTORY**

File Size MB

Reuse Existing File

Storage

Automatically extend datafile when full (AUTOEXTEND)

Increment KB

Maximum File Size Unlimited

Value MB

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Creating a New Tablespace (continued)

7. Click Add in the Datafiles region of the page.
8. Enter a file name in the File Name field on the Add Datafiles page. Accept the defaults for the File Directory and File Size.
9. Under the Storage heading, select Automatically extend datafile when full (AUTOEXTEND) and specify an amount in the Increment field by which you want to extend the datafile each time it fills. You can leave the Maximum File Size set to Unlimited or enter a specific limit. Click Continue. You are returned to the Create Tablespace General page.
10. Click the Storage tab. The Create Tablespace Storage page appears.
11. Accept all the defaults on the Storage page.
12. Click the Thresholds tab. The Thresholds page appears. This page enables you to set monitored thresholds for space usage. You receive advice and an option for action when the threshold is reached.
13. After specifying thresholds, click OK to add the tablespace. You are returned to the Tablespaces page where you receive a confirmation of the creation of the tablespace. You can view your new tablespace in the Results region.

Modifying a Tablespace

You can modify a tablespace by:

- **Adding a datafile**
- **Setting it to automatically extend**
- **Manually extending it by increasing the size of a datafile**
- **Changing its space thresholds**
- **Changing its status to offline**

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Modifying a Tablespace

You can increase the size of a tablespace by manually extending or enlarging a datafile that belongs to it. You can configure the tablespace so that the datafile will automatically extend when space is needed. If you need to perform a recovery operation on a specific tablespace, you may need to take it offline.

You can also add space to an existing tablespace by adding a datafile as follows:

1. Click the Tablespaces link in the Storage region of the Administration page.
2. Select the tablespace and click Add Datafile. The Add Datafile page appears.
3. Enter the file name, directory, and file size. Click OK.
4. A confirmation message is displayed on the Tablespaces page.

You can set a tablespace to automatically extend when it reaches its limit as follows:

1. Click the Tablespaces link in the Storage region of the Administration page.
2. Select the tablespace you want to configure to automatically extend and click Edit. The *Edit Tablespace:tablespace name* General property page appears.
3. Select the datafile associated with the tablespace and click Edit. The Edit Datafile page appears.
4. Select “Automatically extend datafile when full (AUTOEXTEND).” Enter a suitable increment. You can optionally set a maximum file size or set the file size to unlimited.

Modifying a Tablespace (continued)

5. Click Continue. You return to the Edit Tablespace page.
6. Click Apply. A confirmation message appears.

You can use a SQL statement to manually resize a datafile. This enables you to add space to your database without adding datafiles which is advantageous if you are concerned about reaching the maximum number of datafiles allowed in your database. Manually reducing the sizes of datafiles enables you to reclaim unused space in the database. This is helpful when you need to correct errors in estimates of space requirements. For more information on managing datafiles, see the *Oracle Database Administrator's Guide*.

You can change tablespace thresholds by selecting a tablespace on the Tablespaces page and navigating to the Threshold property page. On this page, you can alter the space thresholds that generate the warning and critical alerts. For more information on thresholds and alerts, see the lesson titled "Monitoring and Tuning the Database."

You can take a tablespace offline on the Edit Tablespace page. Select Offline under Status and click Apply.

Dropping a Tablespace

When you drop a tablespace the following actions take place:

- **Objects that were stored in the tablespace are removed.**
- **Datafiles are deleted from the operating system.**

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Dropping a Tablespace

After you drop a tablespace, the objects stored in the tablespace and data in them will no longer be available. In addition, the definitions of the objects are removed from the data dictionary. The datafiles associated with the tablespace are also deleted from the operating system.

You can use Enterprise Manager to drop a tablespace as follows:

1. Click Tablespaces in the Storage region on the Administration page. The Tablespaces page appears.
2. Select the tablespace that you want to drop and click Delete. Enterprise Manager will prompt you to confirm whether you want to delete the tablespace and the associated datafiles from the operating system.

Reclaiming Space in Your Tablespace

You can reclaim available space in your tablespace as follows:

- **Use the Segment Advisor to determine whether there are objects that can be shrunk to free space.**
- **Perform the shrink operation to compact segments and return the space to the tablespace.**

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Reclaiming Space in Your Tablespace

Over time, DML operations against objects in a tablespace can create pockets of unused space. Many times, these individual pieces are not large enough to be reused. There can be a large amount of total free space within your tablespace when all of this unused space is added together.

You can reclaim this unused space by using the Segment Advisor and performing a shrink operation. In a shrink operation, data is compacted to the front of the table. Free space can either be given back to the tablespace or kept in the table for future inserts. A shrink operation on a table does not affect DML operations on the table.

Using the Segment Advisor

You can use the Segment Advisor to analyze a specific tablespace as follows:

1. Click Tablespaces in the Storage region of the Administration page. The Tablespaces page appears.
2. Select your tablespace and select Run Segment Advisor in the Actions pull-down menu. Note the used space before the operation for later comparison. Click Go.
Note: The Segment Advisor can also be launched from the Advisor Central page.
3. The Segment Advisor: Advisor Mode page appears. Accept the default “Complete Analysis of All Segments (Comprehensive)” mode. Click Continue.

Reclaiming Space in Your Tablespace (continued)

4. The Segment Advisor:Options page appears. Accept Unlimited as the time limit for Analysis. Click Next.
5. The Segment Advisor:Schedule page appears. Accept Immediately as the Start. Otherwise, you can schedule the task to run later. Click Next.
6. The Segment Advisor:Review page appears summarizing the task and selected objects. Verify whether the task will execute as you require and click Submit.
7. The Advisor Central page appears listing the advisor-related tasks that have run. Select the Segment Advisor task that you submitted, and click View Result.
8. The Segment Advisor Task page appears showing the recommendations for your selected tablespace. To implement one or more recommendations, select the recommendations to implement. This will launch the Shrink Wizard as described in the following section.

Shrinking Database Objects

The Segment Advisor provides advice on whether an object has space available for reclamation based on the level of space fragmentation within an object. After executing the Segment Advisor, you can shrink database objects as follows:

1. Select Shrink Options at the bottom of the page. You can choose to Compact Segments and Release Space, which releases freed space to the tablespace, or you can Compact Segments only. Click Schedule Implementation to run the shrink operation.
2. The Schedule Implementation page appears. Accept a start time of Immediately, and click Submit.
3. The Scheduler Jobs page appears showing the status of the job. Click Refresh to update the page until the status of the job is Completed. After the job has been completed, you can navigate back to the Tablespace page and compare the current used space with the previous amount of used space.

Managing Undo

- **Undo records contain a copy of data as it looks before a change is made.**
- **Undo is used to undo or roll back uncommitted changes due to an explicit rollback request or recovery.**
- **Undo provides read consistency.**
- **Undo enables flashback features.**
- **Undo retention period affects reuse of undo segments.**

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Managing Undo

Undo is the collective term for records that the Oracle Database server writes before a change is made to data. Undo is used to undo any uncommitted changes made to the database in the event that a rollback operation is necessary. A rollback operation can be the result of a user specifically issuing a rollback statement to undo the changes of a transaction, be part of a recovery operation for session failure, or part of a recovery operation for instance or media failure.

Undo is also used to provide read consistency. Each user obtains a consistent view of data, even while other changes may be occurring against the data.

Undo information is the basis for several of the Oracle Database flashback features, where data can be viewed or recovered to a previous point in time. These features include flashback query, flashback row history, flashback transaction history, and flashback table.

Undo records are stored in an undo tablespace. Because space within the undo tablespace is reused in a cyclical fashion, undo records are subject to being overwritten. It is important for the success of flashback functionality, and for read consistency for long-running transactions, that records are not overwritten too soon.

Managing Undo (continued)

To control the retention of undo records, you can specify an undo retention period, which in turn affects the size of the undo tablespace. Autotuning of the undo retention period is enabled by default at installation.

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Managing Undo Retention

- **Automatic Tuning of Undo Retention:** Oracle Database server automatically tunes the undo retention period based on its ongoing monitoring of undo generation.
- **UNDO_RETENTION:** This determines the low threshold value of undo retention.

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Managing Undo Retention

Committed undo information is normally lost when its undo space is overwritten by a newer transaction. However, for consistent read purposes, long-running queries sometimes require old undo information for undoing changes and producing older images of data blocks. The success of several Flashback features can also depend on older undo information.

Oracle Database server automatically tunes undo retention by collecting database use statistics and estimating the undo capacity needs for the successful completion of the queries. You can set a low threshold value for the UNDO_RETENTION parameter so that the system retains the undo for at least the time specified in the parameter, provided that the current undo tablespace has enough space. Under space constraint conditions, the system may retain undo for a shorter duration than that specified by the low threshold value so that DML operations succeed.

The default value for the UNDO_RETENTION parameter is 900. Retention is specified in units of seconds. This parameter determines the low threshold value of undo retention. The system retains undo for at least the time specified in this parameter.

Note: Autotuning of undo retention cannot be disabled.

Sizing the Undo Tablespace

- **Auto-extensible:** Automatic extension of the undo tablespace datafile is possible.
- **Fixed-size:** Undo tablespace datafile is of a fixed size.

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Sizing the Undo Tablespace

You can size the undo tablespace by using automatic extension of the undo tablespace or by manually estimating the space that you will need for undo.

Oracle Database supports automatic extension of the undo tablespace. When you create your database, you may be unsure of the space requirements of the undo tablespace. In this case, you can enable automatic extension for datafiles of the undo tablespace so that they automatically increase in size when more space is needed. By combining automatic extension of the undo tablespace with automatically tuned undo retention, you can ensure that long-running queries will succeed by guaranteeing the undo required for such queries.

After your system has stabilized and you are more familiar with undo space requirements, it is recommended that you set the maximum size of the tablespace to be slightly more (10%) than the current size of the undo tablespace.

If you have decided on a fixed-size undo tablespace, the Undo Advisor enables you to estimate the needed capacity, and you can then calculate the amount of retention your system will need. The Undo Advisor is described later in this lesson. For more information about manually estimating space requirements, refer to the *Oracle Database Administrator's Guide*.

Using Enterprise Manager to Manage Undo

The screenshot shows the Oracle Enterprise Manager 10g Database Control interface. The title bar reads "ORACLE Enterprise Manager 10g Database Control". The main menu bar includes "Setup", "Preferences", "Help", "Logout", and "Database". The "Database" menu is currently selected. The left navigation pane shows "Database: orcl.oracle.com > Undo Management". The main content area is titled "Undo Management". It contains several sections: "Configuration" (Auto-tuned Undo Retention: 15 minutes, Low Threshold Undo Retention: 15 minutes, Undo Retention Guarantee: No; Undo Tablespace: UNDOTBS1, Size (MB): 30, Auto-Extensible: Yes), "Recommendations" (Analysis Time Period: Last Seven Days, Selected Analysis Time Period: 1/16/04 12:00 PM - 1/23/04 12:00 PM, Potential Problems: No Problem Found, Recommendations: No Recommendation), and "System Activity and Tablespace Usage" (Longest Running Query (seconds): 0, Average Undo Generation Rate (KB/minute): 79.0, Maximum Undo Generation Rate (KB/minute): 612.0). There are "Undo Advisor" buttons throughout the page. At the bottom right is the "ORACLE" logo and the copyright notice "Copyright © 2004, Oracle. All rights reserved."

Using Enterprise Manager to Manage Undo

You can use the Undo Management page in Enterprise Manager to view undo configuration, including the Auto-tuned Undo Retention period, its low threshold retention period, and the name and size of the undo tablespace. You can also use this page to set the low threshold retention or to extend your tablespace.

You can access the Undo Management page by selecting Undo Management in the Instance region on the Administration page.

You can invoke the following features on the Undo Management page to size the undo tablespace:

- **Using Oracle Recommendations for Managing Undo:** In the Recommendations region of the Undo Management page, you can specify a past time period for which you want the Oracle server to analyze undo generation and produce a recommendation for a new setting accordingly. You can choose to accept the recommendation by clicking Apply Recommendation.
- **Using the Undo Advisor:** The undo advisor can be used both to advise you about an appropriate undo retention setting and to analyze the impact of new undo retention settings.

Using the Undo Advisor

Undo Advisor

Auto-tuned Undo Retention (minutes) **15** Undo Tab

Undo retention is automatically tuned by the system for successful completion of long running queries specified in the undo_retention parameter by the user. Use this page to assess the undo tablespaces value for undo retention. You can change the Analysis Time Period to see different analytical results.

Advisor

* New Undo Retention **15** minutes

Analysis Time Period **Last Seven Days**

Choose the time period that best represents system activity

Update Analysis and Graph

Selected Analysis Time Period **12/11/03 2:00 PM - 12/18/03 2:00 PM**

Analysis

Required Tablespace Size for New Undo Retention (MB) **36**

Low Threshold Undo Retention (minutes) **15**

Best Possible Undo Retention (minutes) **178047**

Maximum Extensible Undo Tablespace Size (MB) **32688**

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Using the Undo Advisor

You can invoke the Undo Advisor by clicking Undo Advisor on the Undo Management page. Using the Analysis region of the Undo Advisor, you can answer the following questions about your undo configuration:

- What is the maximum undo retention time required to guarantee successful query? This time period corresponds to the duration of your longest running query.
- Does my database have enough space to accommodate the maximum undo retention given the current tablespace configuration? Note the Best Possible Undo Retention in the Analysis region on the Undo Advisor page. If this time period is longer than your longest running query, your undo tablespace is adequately configured.
- What if the best possible retention time is less than my longest running query? If this is the case, your undo tablespace is too small. You must enable automatic extension for your tablespace or manually extend it. You can determine the required size of your tablespace by entering the time for your longest running query in the New Undo Retention field. Enter an appropriate Analysis Time Period and click Update Analysis and Graph. Under Analysis, note the Required Tablespace size for New Undo Retention.

Using the Undo Advisor (continued)

- How do I configure undo to accommodate Flashback operations? If you are using flashback features, such as Flashback Query or Flashback Table, you can use the Undo Advisor to determine how to configure your tablespace and undo retention. You must ensure that undo data is not overwritten for flashback operations to succeed. To build a flashback recovery strategy, you can set the low threshold parameter, which determines the lowest value for automatic undo tuning. If your flashback recovery strategy requires you to go back eight hours to recover from human errors, set the low threshold to 8 hours.

The Required Tablespace Size by Undo Retention Length graph shows the relationship between retention period and undo tablespace size, highlighting the data points that answer the above questions.

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Summary

In this lesson, you should have learned how to:

- **Use Enterprise Manager to view database storage structures**
- **Create new storage structures in your database**
 - Multiplex the redo log file
 - Create and modify tablespaces
- **Use the Segment Advisor and reclaim unused space in your database**
- **Manage undo**

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Practice Overview

This practice covers the following topics:

- **Using Enterprise Manager to view the storage structure of the database**
- **Multiplexing the redo log**
- **Creating a new tablespace**
- **Managing undo in the database**

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Administering Users and Security

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Objectives

After completing this lesson, you should be able to do the following:

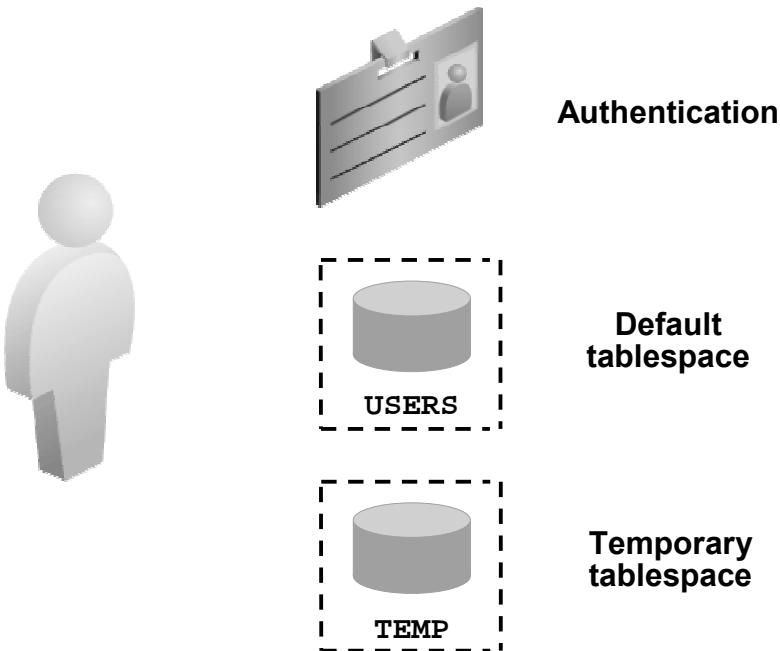
- **Create and administer users**
- **Grant privileges to users to perform database operations**
- **Create and manage roles**

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Overview of Users and Security



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Overview of Users and Security

Users connect to the database by using a user account that you create in the database. A user account is identified by a username and defines the user's attributes such as the following:

- Method of authentication
- Password for database authentication
- Temporary tablespace: Used for sort operations
- Default tablespace: Used for object creation when a tablespace is not explicitly specified
- Tablespace quota: Amount of space that can be consumed by user's objects within a tablespace
- Account locking

Users are granted privileges so that they can connect to the database and perform operations in the database such as viewing data and creating objects. Privileges are discussed later in this lesson.

Overview of Users and Security (continued)

Several user accounts are automatically created when you create your database. All databases created by Database Configuration Assistant (DBCA) include the SYS, SYSTEM, SYSMAN, and DBSNMP user accounts. Additional administrative users are created depending on the features or options that you install. Many of the administrative user accounts are initially locked with expired passwords. These accounts are locked to prevent unauthorized access by people who are familiar with their Oracle supplied passwords. You are responsible for unlocking and resetting these accounts.

You can create additional users to serve as owners of objects in your database. You can also create user accounts so that users can log on to the database.

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Oracle-Defined Users

The following user accounts are created, when the database is created:

- **SYS: Database administrative user**
- **SYSTEM: Database administrative user**
- **SYSMAN: Oracle Enterprise Manager user**
- **DBSNMP: Used by Oracle Enterprise Manager**
- **Sample schema users: HR, OE, SH, and others**

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Oracle-Defined Users

A number of users are created when you create the database and install certain options. Some of the users created are:

- **DBSNMP:** Used by the Management Agent component of Oracle Enterprise Manager (Enterprise Manager) to manage and monitor the database
- **SYS:** Is the database administrator account. All the base tables and views for the database's data dictionary are stored in the sys schema.
- **SYSMAN:** Can be used to perform database operations by using Enterprise Manager
- **SYSTEM:** Is the database administrator account. Owns tables and views that display administrative information, and internal tables and views used by various Oracle options and tools.
- **Sample schema users (HR, OE, SH):** The Human Resources (HR) schema is a basic relational database schema. The Order Entry (OE) schema builds on the purely relational HR schema with some object-relational and object-oriented features. The Sales History (SH) schema is an example of a relational star schema.

Creating Users

The screenshot shows the Oracle Enterprise Manager interface for creating a new user. The title bar reads "ORACLE Enterprise Manager". The URL in the address bar is "Database: orcl.us.oracle.com > Users > Create User". The main title is "Create User". A tab bar at the top includes "General", "Roles", "System Privileges", "Object Privileges", "Quotas", "Consumer Groups", and "Proxy Users". The "General" tab is selected. The form fields are as follows:

- * Name: shopowner
- Profile: DEFAULT
- Authentication: Password
- * Enter Password: *****
- * Confirm Password: *****
- Expire Password now
- * Default Tablespace: INVENTORY
- Temporary Tablespace: TEMP
- Status: Locked Unlocked

Below the form is another tab bar with "General", "Roles", "System Privileges", "Object Privileges", "Quotas", "Consumer Groups", and "Proxy Users". At the bottom right is the "ORACLE" logo, and at the bottom center is the copyright notice "Copyright © 2004, Oracle. All rights reserved."

Creating Users

You can use Enterprise Manager to define a new user as follows:

1. Click Users in the Security region of the Administration page.
2. Click Create on the Users page.

Note: You can create a user with the same attributes as an existing user by selecting that user, selecting Create Like from the Actions menu, and clicking Go.

The General Page in the Create User property sheet is displayed. The General page is one of a series of pages that comprise the Create User property sheet. The other pages of the property sheet are accessed by clicking the tabs adjacent to the General page tab.

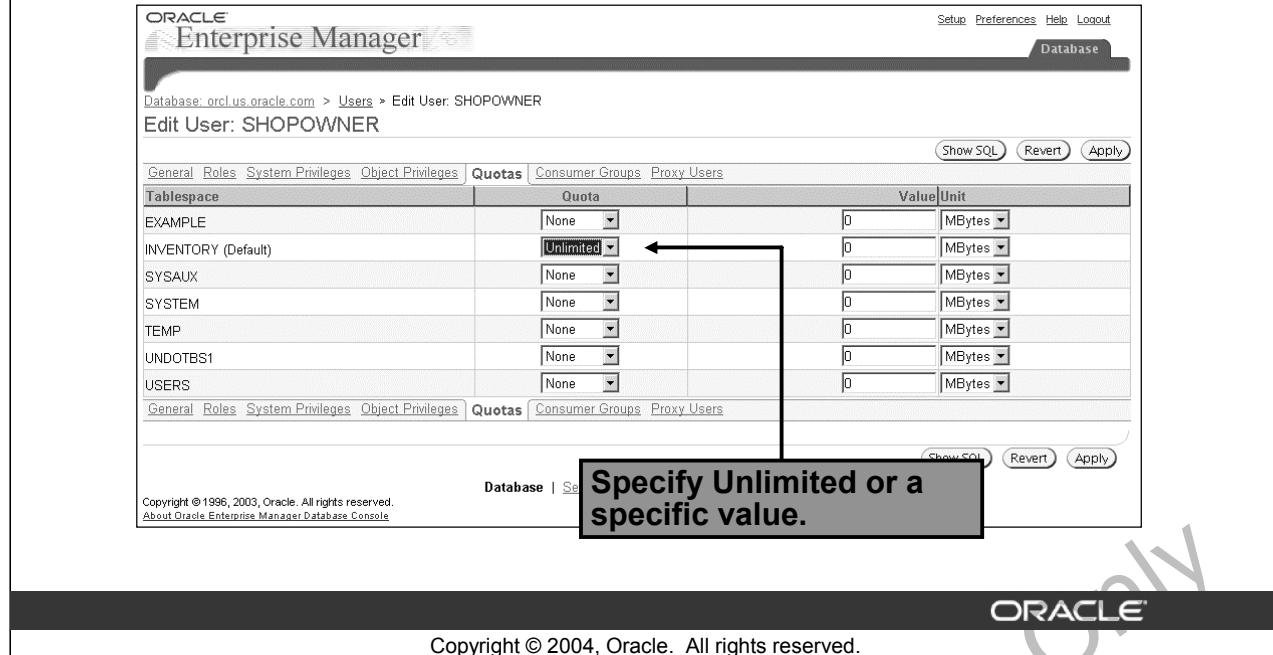
3. Enter a user name in the Name field.
4. Select DEFAULT from the Profile drop-down list.
5. Select the default of Password as the authentication method.
6. Enter the password of your choice in the Enter Password and Confirm Password fields.
7. Click the flashlight icon next to the Default Tablespace field and select the tablespace to serve as the user's default tablespace.

Creating Users (continued)

8. Click the flashlight icon next to the Temporary Tablespace field and select TEMP tablespace.
9. Select Unlocked for the Status.
10. Click the Quotas link to access the Quotas page. Enter the quota amount for any tablespace in which the user creates objects. You can select Unlimited from the Quota menu or select Value and enter a specify value.
11. Click OK. The creation confirmation message is displayed on the Users page and the new user is visible in the User list.

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Modifying Users



Modifying Users

You can use Enterprise Manager to modify or edit the attributes of a user.

You must grant quota to users who create tables, clusters, materialized views, indexes, and other objects in your database. Quota is a limit on how much space the user can consume in a tablespace. You can grant the user a specific amount of space or an unlimited quota on the tables.

To change the tablespace quota for a user, perform the following steps:

1. Click Users in the Security region of the Administration page.
2. Select the user and click Edit.
3. You can change the authentication method, default tablespace, and temporary tablespace on the General page of the Edit User property sheet. Click the Quotas tab to change the tablespace quota for the user.
4. Click Apply.

Dropping Users

When you drop a user, the following takes place:

- **The user's definition is deleted.**
- **The user loses ability connect to the database.**
- **All objects that belong to the user are dropped.**

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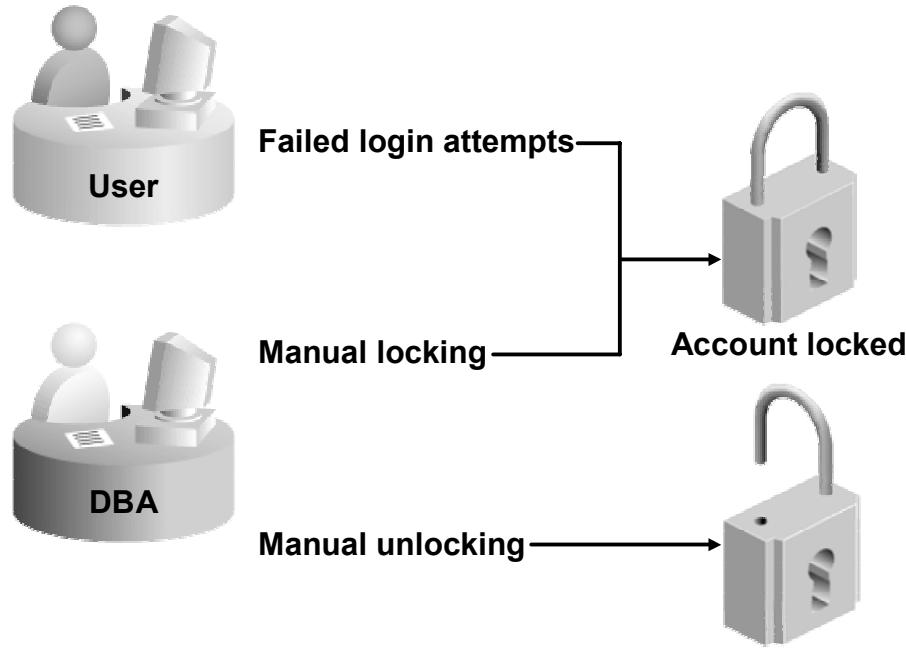
Dropping Users

When you drop a user, all schema objects owned by the user including tables and indexes are deleted from the database. If you need to maintain a user's objects and want to deny that user access to the database, then you can lock the user's account or make the user's password expire as an alternative to dropping the user.

Using Enterprise Manager, you can drop a user by performing the following steps:

1. Click Users in the Security region of the Administration page.
2. Select the user and click Delete.
3. A confirmation page appears. Click Yes to confirm the deletion of the user.

Locking and Unlocking Accounts



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Locking and Unlocking Accounts

You can configure a user account, so that after a specified number of consecutive failed login attempts the account is locked. You can also configure the account to unlock automatically after a specified time interval or to require database administrator intervention to unlock the account.

You can also lock accounts manually, so that they must be unlocked explicitly by a database administrator.

Note: Many of the Oracle-supplied database user accounts are locked following database creation. You learn how to unlock accounts later in this lesson.

Setting Password Expiration

Password management includes the following:

- **Specifying a maximum lifetime for a password**
- **Specifying a grace period for changing a password**

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Setting Password Expiration

You can specify a lifetime for passwords, after which they expire and must be changed before the user can log on to the database. You can establish a grace period so that the user receives a warning message to change the password when logging on to the database. If the user does not change the password by the end of that period, then the account is locked. The user will be unable to log on to the database until the user account is unlocked.

You can also set the password state to “expired.” In this case, the password must be reset before the user can log on to the database.

Note: Password management is enabled through the use of profiles. For more information about the administration of profiles, refer to the *Oracle Database Security Guide*.

Unlocking a User Account and Resetting the Password

Results

Select	UserName	Account Status	Expiration Date	Default Tablespace	Temporary Tablespac
<input type="radio"/>	ANONYMOUS	EXPIRED & LOCKED	2003-10-02 10:01:32.0	SYSAUX	TEMP
<input type="radio"/>	BI	EXPIRED & LOCKED	2003-10-02 10:01:32.0	USERS	TEMP
<input type="radio"/>	CTXSYS	EXPIRED & LOCKED	2003-10-02 10:01:32.0	SYSAUX	TEMP
<input type="radio"/>	DBSNMP	OPEN		SYSAUX	TEMP
<input type="radio"/>	DIP	EXPIRED & LOCKED		USERS	TEMP
<input type="radio"/>	DMSYS	EXPIRED & LOCKED	2003-10-02 10:01:32.0	SYSAUX	TEMP
<input type="radio"/>	EXFSYS	EXPIRED & LOCKED	2003-10-02 10:01:32.0	SYSAUX	TEMP
<input checked="" type="radio"/>	HR	EXPIRED & LOCKED	2003-10-02 10:01:32.0	USERS	TEMP
<input type="radio"/>	IX	EXPIRED & LOCKED	2003-10-02 10:01:32.0	USERS	TEMP

Select the user and click Edit.

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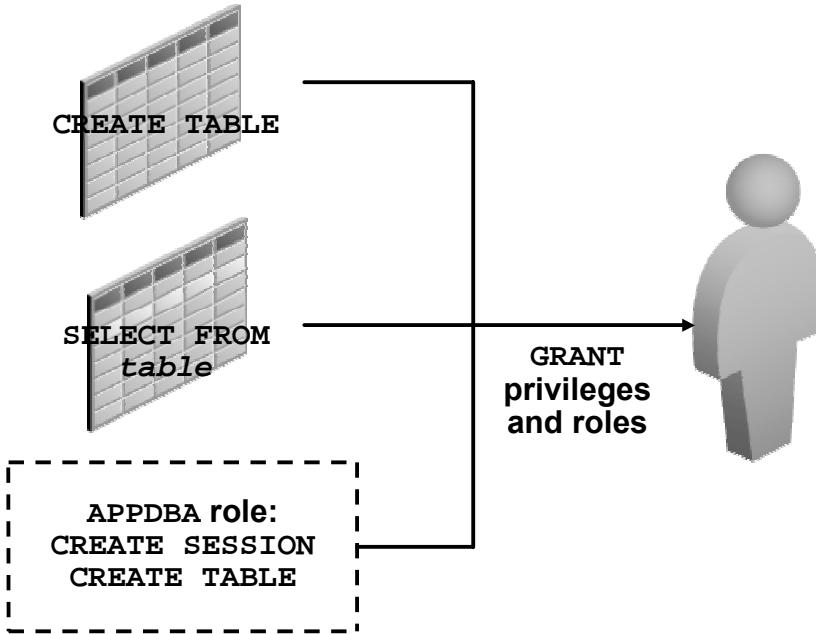
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Unlocking a User Account and Resetting the Password

During installation and database creation, you can unlock and reset many of the Oracle supplied database user accounts. If you did not choose to unlock the user accounts at that time, then you can unlock the users and reset the passwords as follows:

1. Select the user on the Users page and click Edit. The Edit User page is displayed.
2. Enter the new password in the Enter Password and Confirm Password fields.
3. Select Unlocked for the Status to unlock the user account.
4. Click Apply to reset the password and unlock the user account. The Update Confirmation message is displayed.

Administering Privileges and Roles



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Administering Privileges and Roles

Privileges and roles are used to control user access to data and the types of SQL statements that can be executed. There are two types of privileges as follows:

- **System privilege:** Allow users to perform specific database operations. CREATE TABLE is a system privilege that enables a user to create tables in the database.
- **Object privilege:** Controls access to a specific database object. SELECT TABLE is an object privilege that enables a user to retrieve rows from a specified table in the database.

Roles are used to group privileges and other roles to facilitate the granting of multiple privileges and roles to users. There are a number of predefined roles. In addition, you can create roles that are applicable for the operations and objects that exist in your database.

Administrative Privileges

- **SYSDBA and SYSOPER privileges**
- **Methods of authentication:**
 - Operating system
 - Password file

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Administrative Privileges

Administrative privileges that are required to perform basic database operations, such as creating the database, and instance startup and shutdown, are granted through two special system privileges, SYSDBA and SYSOPER.

The SYSDBA and SYSOPER privileges can also be thought of as types of connections that enable you to perform certain database operations for which privileges cannot be granted in any other fashion. The SYSDBA and SYSOPER system privileges allow access to a database instance even when the database is not open.

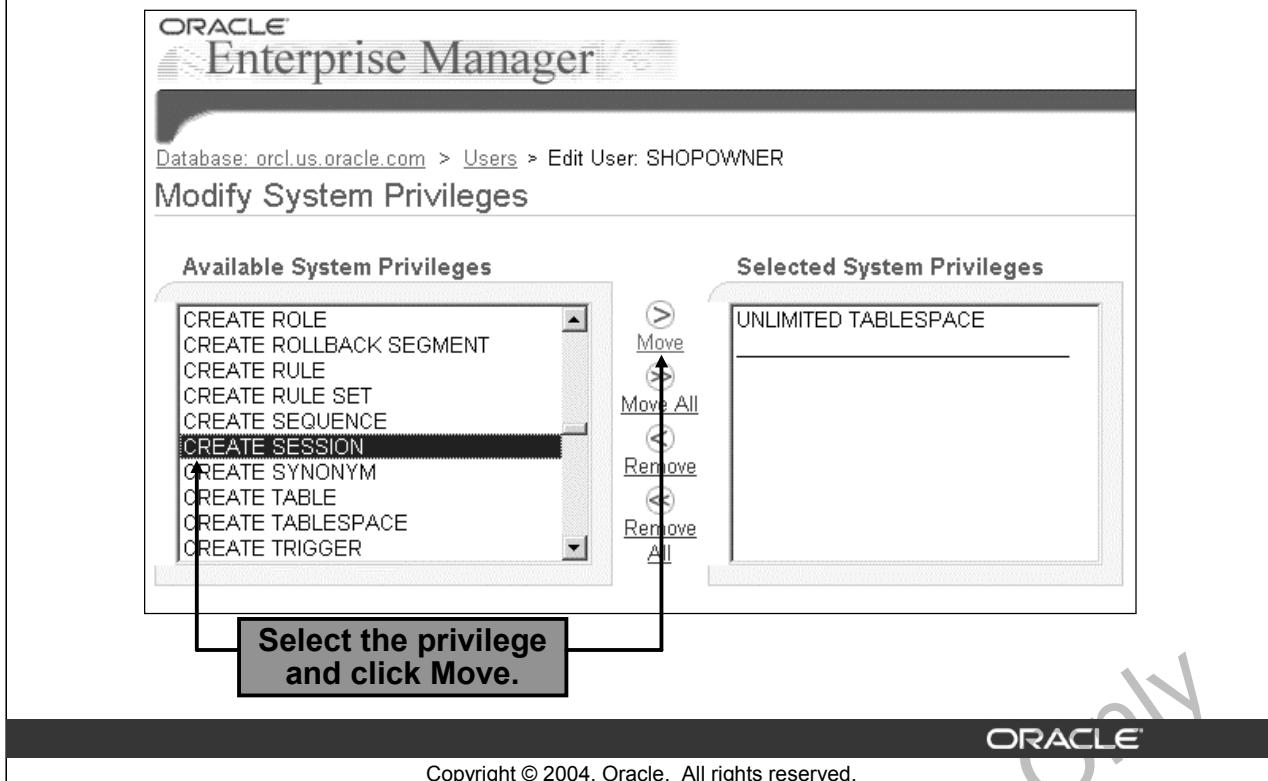
Control of these privileges is totally outside of the database itself. The following methods are available for authenticating database administrators:

- Operating system (OS) authentication
- A password file

Your choice will be influenced by whether you intend to administer your database locally on the same machine where the database resides, or whether you intend to administer many different databases from a single remote client. You must use a password file to administer a remote database when you do not have a secure connection.

For detailed information about creating a password file and configuring operating system authentication, refer to the *Oracle Database Administrator's Guide*.

Granting Privileges



Granting Privileges

To grant privileges by using Enterprise Manager, perform the following steps:

1. Click the Users link in the Security region of the Administration page.
2. Select the user and click the Edit button. The Edit User page appears.
3. Click the System Privileges tab. A list of system privileges that are currently assigned to the user is displayed.
4. Click Modify. The Modify System Privileges page appears.
5. Select the desired privilege and click Move to add it to the Selected System Privileges list.
6. Click OK. The Edit User page appears.
7. Click Apply to grant the system privilege to the user. An update confirmation message is displayed.

Note: Object privileges are granted in a similar manner.

Viewing Roles

The screenshot shows the Oracle Enterprise Manager interface. At the top, it says "Database: orcl.us.oracle.com > Roles > View Role: CONNECT". Below this, the title "View Role: CONNECT" is displayed. Under "General", it shows "Name CONNECT" and "Authentication None". Under "Roles", there is a table with one row: "Role Admin Option" and "No items found". Under "System Privileges", there is a table listing various system privileges and their admin options:

System Privilege	Admin Option
ALTER SESSION	N
CREATE CLUSTER	N
CREATE DATABASE LINK	N
CREATE SEQUENCE	N
CREATE SESSION	N
CREATE SYNONYM	N
CREATE TABLE	N
CREATE VIEW	N

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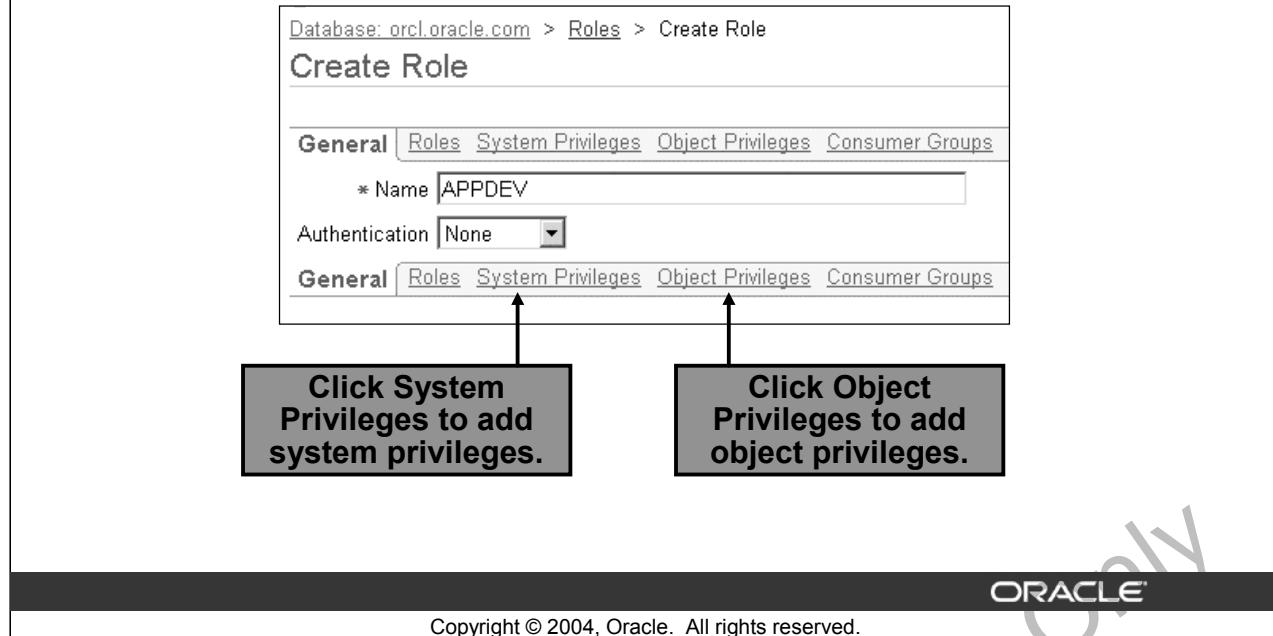
Viewing Roles

You can use roles to group privileges and other roles to facilitate the granting of multiple privileges and roles to users.

You can use Enterprise Manager to view existing roles as follows:

1. Click the Roles link in the Security region of the Administration page.
2. The Roles page is displayed. You can view a role by selecting it and clicking View.

Creating and Modifying Roles



Creating and Modifying Roles

You can use Enterprise Manager to define a new role by performing the following steps:

1. Click Roles in the Security region on the Administration Page.
2. Click Create.
3. On the Create Role page, enter the name of your new role. Click OK.
4. Click Roles, System Privileges, and/or Object Privileges to add the required privileges to your new role.

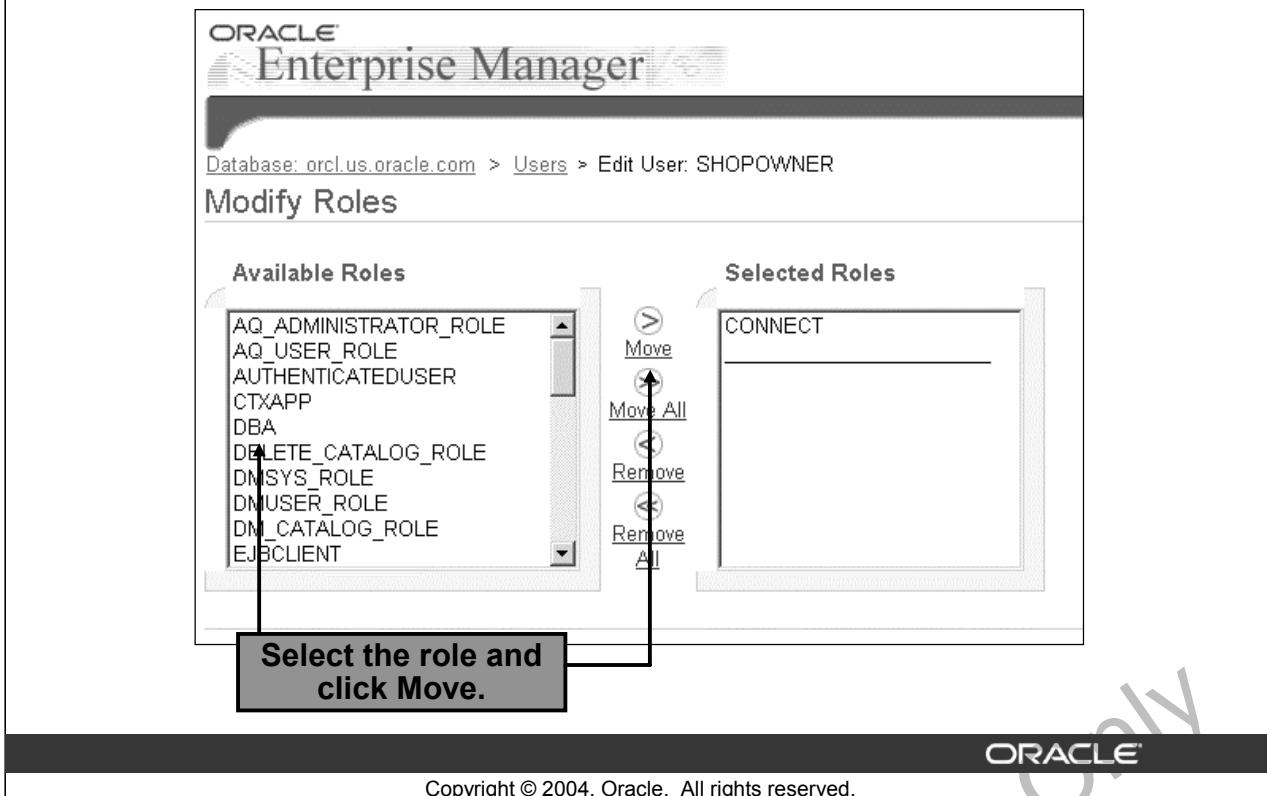
You can modify an existing role by performing the following steps:

1. Click Roles in the Security region on the Administration Page.
2. Select the role you want to modify and click Edit. The Edit Role:*role name* page appears. This page has links to the following property pages: Roles, System Privileges, Object Privileges, and Consumer Groups. Click the appropriate page for the type of privilege you want to add to the role.
3. Click Modify and choose the role or privilege.

Note: You can also delete privileges and roles from a role.

You can also delete roles on the Roles property page.

Granting and Revoking Roles



Granting and Revoking Roles

You can use Enterprise Manager to grant roles as follows:

1. Click the Users link in the Security region of the Administration page.
2. Select the user and click the Edit button. The Edit User page appears.
3. Click the Roles tab. A list of the roles currently assigned to the user appears.
4. Click Modify. The Modify Roles page appears.
5. Select the desired role and click Move to add it to the Selected Roles list.
6. Click OK. The Edit User page appears.
7. Click Apply to grant the role to the user. An update confirmation message is displayed.

You can revoke or remove roles from a user by accessing the Roles page from the Edit User page. Click Remove to revoke a role from the user.

Summary

In this lesson, you should have learned how to:

- Create and modify users**
- Grant privileges and roles to users so that they can perform database operations and create objects in the database**

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Practice Overview

This practice covers the following topics:

- **Creating a new user**
- **Granting privileges and roles**
- **Locking and unlocking user accounts**

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Managing Schema Objects

8

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Objectives

After completing this lesson, you should be able to do the following:

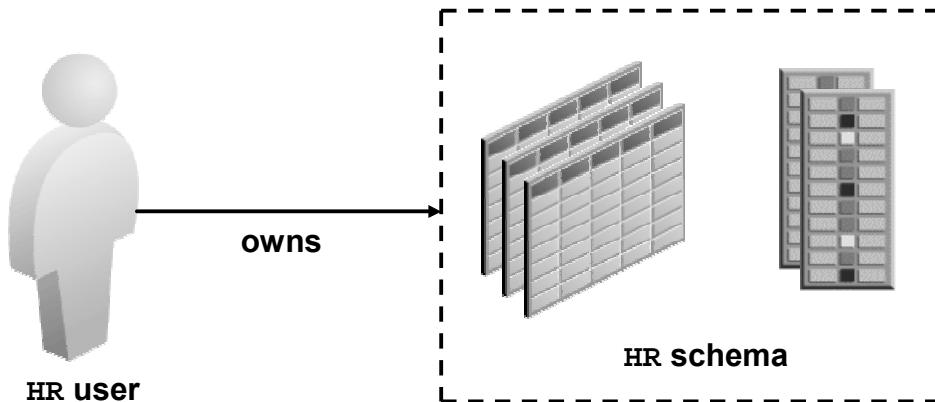
- **Create and modify database tables**
- **View data in the database**
- **Create additional database objects**
- **Load data into tables**

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What Is a Schema?



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What Is a Schema?

A schema is a collection of database objects. A schema is owned by a database user and has the same name as that user. Schema objects are the logical structures that directly refer to the database's data. Schema objects include structures such as tables, views, and indexes.

Note: There is no relationship between a tablespace and a schema. Objects in the same schema can be in different tablespaces, and a tablespace can hold objects from different schemas.

You can create and manipulate schema objects by using SQL or Oracle Enterprise Manager (Enterprise Manager). When you use Enterprise Manager, the underlying SQL is generated for you.

Schemas

Schemas created as part of the database creation process include:

- **SYS**
- **SYSTEM**
- **Sample schemas**

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Schemas

When you create a database, a number of schemas are created for you. The following two schemas are of particular importance:

- **SYS Schema:** All the base tables and views that comprise the database's data dictionary are created in the SYS schema. The data dictionary is a collection of tables that describe the Oracle database. The data dictionary is created in the SYSTEM tablespace when the database is created and is updated by the Oracle database server when a data definition language (DDL) statement is executed. The data dictionary contains information about users, schema objects, and storage structures. You can use the data dictionary as a read-only reference for information about the database. When you use Enterprise Manager, you can access the data dictionary tables through views.
Objects in the SYS schema should never be modified by any user or database administrator, and no one should create any tables in the schema of user SYS.
- **SYSTEM schema:** Contains additional tables and views that store administrative information, and internal tables and views used by various Oracle options and tools. You should not create any additional objects in the SYSTEM schema.

Schemas (continued)

During a complete installation of Oracle database, the Sample Schemas are installed automatically with the seed database. The Sample Schemas serve the purpose of providing a common platform for examples in Oracle documentation and curriculum. They are a set of interlinked schemas aimed at providing a layered approach to complexity and include the following:

- **HR:** The Human Resources schema is a simple schema for introducing basic topics. An extension to this schema supports Oracle Internet Directory demonstrations.
- **OE:** The Order Entry schema is for dealing with matters of intermediate complexity. A multitude of datatypes is available in the OE schema. The OC (Online Catalog) subschema is a collection of object-relational database objects built inside the OE schema.
- **PM:** The Product Media schema is dedicated to multimedia datatypes.
- **QS:** The Queued Shipping schema contains a set of schemas used to demonstrate Oracle Advanced Queueing capabilities.
- **SH:** The Sales History schema is designed to allow demonstrations with larger amounts of data. An extension to this schema provides support for advanced analytic processing.

Accessing Schema Objects

Database: orcl.us.oracle.com

Home Performance Administration Maintenance

Instance

Memory Parameters
Undo Management
All Initialization Parameters

Storage

Controlfiles
Tablespaces
Datafiles
Rollback Segments
Redo Log Groups
Archive Logs
Temporary Tablespace Groups

Click a link to access the schema objects.

Schema

Tables
Indexes
Views
Synonyms
Sequences
Database Links

Source Types

Packages
Package Bodies
Procedures
Functions
Triggers
Java Sources
Java Classes

User Types

Array Types
Object Types
Table Types

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Accessing Schema Objects

You can quickly access many types of schema objects from the Schema region of the Database Administration page.

After clicking on one of the links, the Results page is displayed. In the Search region of the page, you can enter a schema name and object name to search for a specific object. In addition, you can search for other types of objects from the Search region by selecting the object type from the drop-down menu. The drop-down menu includes additional object types that are not shown as links on the Database Administration page.

Specifying Datatypes in Tables

Common datatypes:

- **CHAR:** Fixed-length character data of length size bytes
- **DATE:** Valid date range from January 1, 4712 BC to December 31, 9999 AD
- **NUMBER:** Number having precision p and scale s
- **VARCHAR2:** Variable-length character string having maximum length size bytes or characters

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Specifying Datatypes in Tables

When you create a table, you must specify a datatype for each of its columns. When you create a procedure or stored function, you must specify a datatype for each of its arguments. These datatypes define the domain of values that each column can contain.

Oracle database built-in datatypes include the following:

- **CHAR:** Fixed-length character data of length size bytes. Maximum size is 2000 bytes. Default and minimum size is 1 byte.
- **DATE:** Valid date range from January 1, 4712 B.C. to December 31, 9999 A.D. The DATE datatype stores date and time information.
- **NUMBER:** Number having precision p and scale s . Precision is the total number of digits. Scale is the number of digits to the right of the decimal point.
- **VARCHAR2:** Variable-length character string having maximum length size bytes or characters. Maximum size is 4000 bytes, and minimum is 1 byte or 1 character. You must specify size for VARCHAR2.

For a complete list of built-in datatypes and user-defined types, refer to the *Oracle Database SQL Reference*.

Creating and Modifying Tables

Database: orcl.us.oracle.com > Tables > Create Table

Create Table

General Constraints Storage Options Partitions

Specify the table name and schema.

* Name: jobs
Schema: shopowner
Tablespace: <Default>
Organization: Standard, Heap Organized

Specify the column names, datatypes, and lengths.

Select	Name	Data Type	Size
<input checked="" type="radio"/>	job_id	NUMBER	5
<input type="radio"/>	job_title	VARCHAR2	30
<input type="radio"/>	min_salary	NUMBER	6
<input type="radio"/>	max_salary	NUMBER	6
<input type="radio"/>		VARCHAR2	

Add 5 Table Columns

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Creating and Modifying Tables

Tables are the basic unit of data storage in an Oracle database. They hold all user-accessible data. Each table has columns and rows.

Creating a Table

You can create a table by using Enterprise Manager as follows:

1. Click Tables in the Schema region of the Administration page. The Tables page appears.
2. If you know the schema name, then enter all or part of it in the Schema field in the Search region. If you do not know the schema name, then click the flashlight icon next to the Schema field. The Search and Select:Schema window appears. You can enter page through the schema names and select the correct one.
3. Click Create. The Create Table: Table Organization page appears.
4. Select the default of Standard, Heap Organized by clicking Continue.
5. The Create Table page appears.
6. Enter the table name in the Name field.
7. Enter the schema name in the Schema field or click the flashlight icon to invoke the search function.

Creating and Modifying Tables (continued)

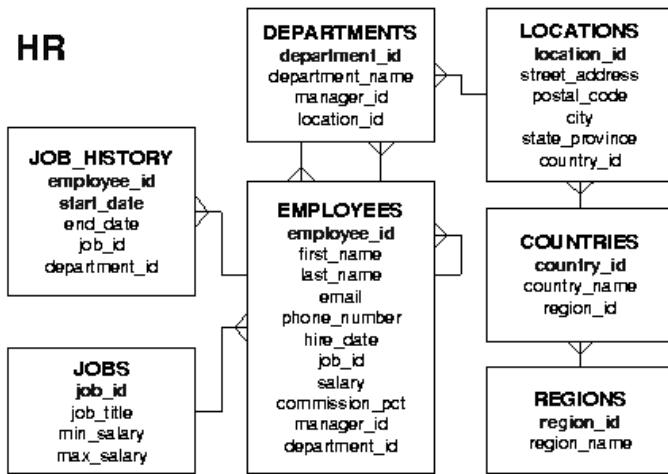
8. Enter the tablespace name in the Tablespace field or click the flashlight icon to invoke the search function.
9. In the Columns region, enter the column name and datatypes.
10. Click OK. An update message appears indicating the table has been successfully created.

Modifying a Table

You can modify a table by using Enterprise Manager, as described in the following steps. In this example, an additional column is added to a table.

1. In the Tables page, select the table in the results list and click Edit.
2. In the Edit Table page, click the “Add 5 Table Columns” button. An editable columns list appears.
3. Enter the new column name, datatype, and size. Click Apply.
4. An Update Message appears indicating that the table has been modified successfully.

Understanding Data Integrity



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Understanding Data Integrity

The Entity Relationship diagram documents the data integrity constraints defined in the HR sample schema.

You can use the following integrity constraints to impose restrictions on the input of column values:

- **NOT NULL:** By default, all columns in a table allow null values. Null means the absence of a value. A NOT NULL constraint requires that a column of a table contain no null values. For example, you can define a NOT NULL constraint to require that a value be input in the LAST_NAME column for every row of the EMPLOYEES table.
- **UNIQUE Key:** A UNIQUE key integrity constraint requires that every value in a column or set of columns (key) be unique—that is, no two rows of a table have duplicate values in a specified column or set of columns. For example, a UNIQUE key constraint is defined on the DEPARTMENT_NAME column of the DEPARTMENTS table to disallow rows with duplicate department names.
- **PRIMARY Key:** Each table in the database can have at most one PRIMARY KEY constraint. The values in the group of one or more columns subject to this constraint constitute the unique identifier of the row. In effect, each row is named by its primary key values.

Understanding Data Integrity (continued)

The Oracle implementation of the PRIMARY KEY integrity constraint guarantee that both of the following are true:

- No two rows of a table have duplicate values in the specified column or set of columns.
- The primary key columns do not allow nulls. That is, a value must exist for the primary key columns in each row.

Oracle enforces all PRIMARY KEY constraints by using indexes. The primary key constraint created for the DEPARTMENT_ID column in the DEPARTMENTS table is enforced by the implicit creation of:

- A unique index on that column
- A NOT NULL constraint for that column

- **FOREIGN KEY constraints** (also referred to as referential integrity constraints): Different tables in a relational database can be related by common columns, and the rules that govern the relationship of the columns must be maintained. Referential integrity rules guarantee that these relationships are preserved.

A referential integrity constraint requires that for each row of a table, the value in the foreign key matches a value in a parent key.

As an example, a foreign key defined is defined on the DEPARTMENT_ID column of the EMPLOYEES table. It guarantees that every value in this column must match a value in the primary key of the DEPARTMENTS table (also the DEPARTMENT_ID column). Therefore, no erroneous department numbers can exist in the DEPARTMENT_ID column of the EMPLOYEES table.

Another type of referential integrity constraint is called a self-referential integrity constraint. This type of foreign key references a parent key in the same table.

- **Check constraints:** A CHECK integrity constraint on a column or set of columns requires that a specified condition be true or unknown for every row of the table. If a DML statement results in the condition of the CHECK constraint evaluating to false, then the statement is rolled back. As an example, you can create a check constraint on the EMPLOYEES table to ensure that salary * commission_pct <= 5000.

Defining Constraints

Database: orcl.us.oracle.com > Tables > Edit Table: HR.COUNTRIES

Add UNIQUE Constraint

Up to 32 columns can make up a UNIQUE key constraint. The unique key columns constitute a unique key for the table.

Definition

Name: <System Assigned 3>

Table Columns

Available Columns	Selected Columns
COUNTRY_ID REGION_ID	COUNTRY_NAME

Available Columns: COUNTRY_ID, REGION_ID

Selected Columns: COUNTRY_NAME

Buttons: Move, Move All, Remove, Remove All

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Defining Constraints

You can add a constraint to a table as follows:

1. Select the table on the Tables page and click Edit.
2. Click Constraints. The Constraints page is displayed showing all constraints that have been defined on the table.
3. Select the type of constraint that you want to add from the drop-down menu, and click Add.
4. Enter the appropriate information for the type of constraint that you are defining. Click OK.

Viewing the Attributes of a Table

Database: orcl.us.oracle.com > Tables > Edit Table: HR.DEPARTMENTS

Edit Table: HR.DEPARTMENTS

General Constraints Segments Storage Options

* Name DEPARTMENTS

Schema HR

Tablespace EXAMPLE

Organization Standard, Heap Organized

Columns

Select	Name	Data Type	Size
<input checked="" type="radio"/>	DEPARTMENT_ID	NUMBER	4
<input type="radio"/>	DEPARTMENT_NAME	VARCHAR2	30
<input type="radio"/>	MANAGER_ID	NUMBER	6
<input type="radio"/>	LOCATION_ID	NUMBER	4

Add 5 Table Columns

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Viewing the Attributes of a Table

You can use Enterprise Manager to view the attributes of a table as follows:

1. Click the Tables link in the Schema region of the Database Administration page.
2. Select a table from the Results list and click the View button to see the attributes of the table.

Viewing the Contents of a Table

The screenshot shows the Oracle Enterprise Manager interface. The title bar reads "ORACLE Enterprise Manager". Below it, the URL "Database: orcl.us.oracle.com > Tables > View Data for Table: HR.REGIONS" is displayed. The main content area is titled "View Data for Table: HR.REGIONS". On the left, there is a "Query" box containing the SQL statement: "SELECT \"REGION_ID\", \"REGION_NAME\" FROM \"HR\".\"REGIONS\"". To the right of the query box is a "Result" table with two columns: "REGION_ID" and "REGION_NAME". The data rows are: 1 Europe, 2 Americas, 3 Asia, and 4 Middle East and Africa.

REGION_ID	REGION_NAME
1	Europe
2	Americas
3	Asia
4	Middle East and Africa

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Viewing the Contents of a Table

You can view the rows in a table by using Enterprise Manager as follows:

1. Select the table on the Tables page. Select View Data from the Actions menu, and click Go.
2. The View Data For Table page appears. The row data for the table is shown in the Results region. The Query box displays the SQL query that was executed to produce the results.

On this page, you can click any column name and sort the data in the column in either ascending or descending order. If you want to change the query, click the Refine Query button. On the Refine Query for Table page, you can select the columns that you want to display and specify a WHERE clause for the SQL statement to limit the results.

For more information on WHERE clauses in SQL statements, refer to the *Oracle Database SQL Reference*.

Dropping a Table

When you drop a table:

- **The table definition is removed from the data dictionary**
- **All rows of the table are removed**
- **All indexes defined on the table are removed**

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Dropping a Table

If you no longer need a table in your database, you can drop the table. When you drop a table, the following occur:

- The table definition is removed from the data dictionary.
- All rows of the table are removed.
- All indexes defined on the table are removed.

You can drop (delete) a table by using Enterprise Manager as follows:

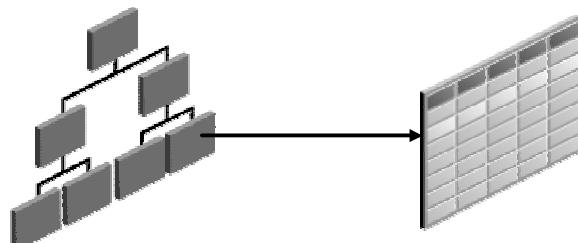
1. Select Tables in the Schema region of the Administration page.
2. Enter the schema name and table name or use the search facility to select the table. Select Delete.
3. The Confirmation page enables you to choose whether to continue the operation. Click Yes if you have identified the correct table to delete.
4. A confirmation message appears if the table has been successfully deleted.

If you find later that you dropped a table in error, you may be able to recover it using the Flashback Drop feature. The Flashback Drop is discussed in the lesson titled “Performing Backup and Recovery.” For more information about Flashback Drop, refer to the *Oracle Database Administrator’s Guide*.

Managing Indexes

An index:

- Provides faster access to the rows in a table
- Is automatically used for data access
- Is physically independent of the table
- Is automatically maintained when the table is updated



Index entry points to row in table

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Managing Indexes

Indexes are optional structures that are associated with tables. They can be created to increase the performance of data retrieval. An Oracle index provides a direct access path to table data.

Indexes can be created on one or more columns of a table. After an index is created, it is automatically maintained and used by the Oracle server. When a table is updated, changes to the relevant indexes are automatically made with complete transparency to the user.

You can click the Indexes link under the Schema heading of the Administration page to view the Indexes page. You can view index attributes, or use the Actions menu to View Dependencies for an index.

Indexes can be created explicitly, or implicitly through constraints that are placed on a table.

Creating and Dropping Indexes

The screenshot shows the 'Create Index' dialog box. In the 'General' tab, the index name is set to 'EMP_EMAIL_UK', schema is 'HR', and tablespace is 'Default'. The index type is selected as 'Standard - B-tree'. In the 'Indexed Table Object' section, the table name is 'HR.EMPLOYEES'. A note says 'TIP The indexed columns and their orders are indicated by the Order field'. Below is a table of columns:

Column Name	Data Type	Sorting Order	Order
EMPLOYEE_ID	NUMBER	ASC	
FIRST_NAME	VARCHAR2	ASC	
LAST_NAME	VARCHAR2	ASC	
EMAIL	VARCHAR2	ASC	1

At the bottom, there is an 'ORACLE' logo and a copyright notice: 'Copyright © 2004, Oracle. All rights reserved.'

Creating and Dropping Indexes

You can create a standard (B-tree) index on one column as follows:

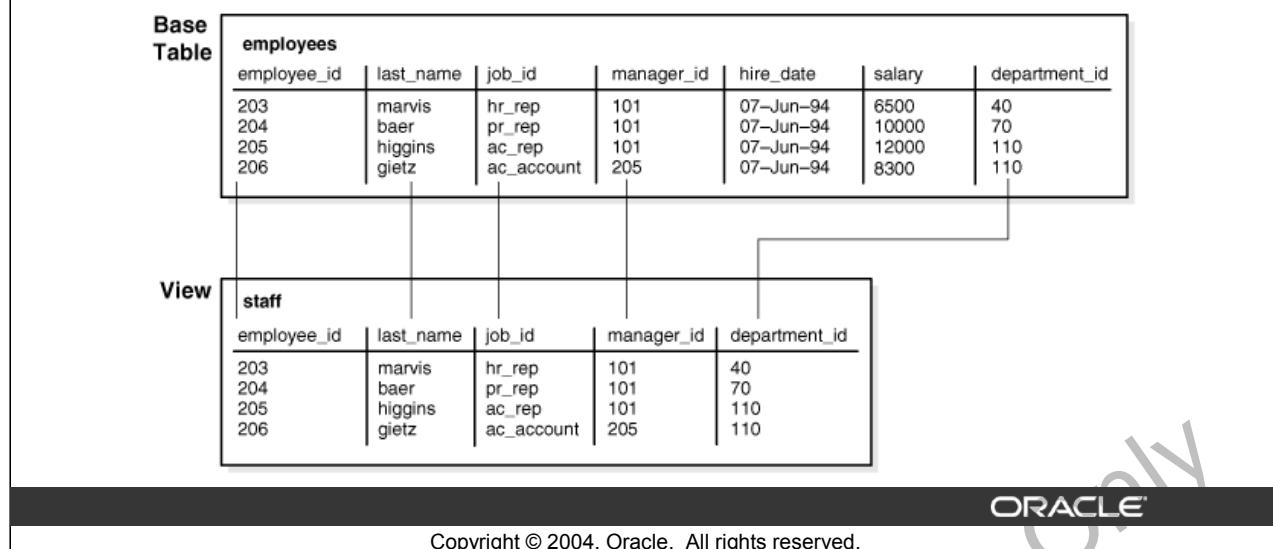
1. Click table in the Schema region of the Administration page. The Tables page appears.
2. Enter the table name or use the search facility to select the table. Select Create Index from the Actions drop-down menu. Click Go.
3. The Create Index page appears. Enter a name for the new index. Enter the tablespace name and select Standard B-tree as the index type.
4. Select the column in the list of table columns by entering 1 in the Order column. Accept ASC as the Sorting Order. Click OK to create the index.
5. After the index is created, the Indexes page appears with a confirmation message. The new index is listed under Results.

Perform the following steps to drop an index:

1. Select Indexes in the Schema region of the Administration page. The Indexes page appears.
2. Enter the index name or use the search facility to locate the index. Click Delete.
3. If you are certain you have identified the correct index, then click Yes on the Confirmation page.
4. A confirmation message appears if the index has been successfully deleted.

Managing Views

- Customized presentation of data in a table or view
- Views do not contain data



Managing Views

Views are customized presentations of data in one or more tables or other views. They can be thought of as stored queries. Views do not actually contain data, but instead they derive their data from the tables upon which they are based. These tables are referred to as the base tables of the view.

Like tables, views can be queried, updated, inserted into, and deleted from with some restrictions. All operations that are performed on a view actually affect the base tables of the view. Views provide an additional level of security by restricting access to a predetermined set of rows and columns of a table. They also hide data complexity and store complex queries.

You can click the Views link under the Schema heading on the Administration page to see the views defined in the database. You can create views by using Enterprise Manager.

Managing Database Resident Program Units

Use Enterprise Manager to manage the following types of database resident program units:

- **Packages**
- **Package bodies**
- **Stand-alone subprograms**
 - **Procedures**
 - **Functions**
- **Database triggers**

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Managing Database Resident Program Units

Database resident program units are programs written in PL/SQL or Java that are stored in the Oracle database. With database resident program units, you can write commonly used code once, test it, and invoke it from any application program. This ensures consistent application of business rules and makes the development of applications easier.

You can use Enterprise Manager to manage the source types such as PL/SQL packages, procedures, triggers, and functions, and Java sources and classes. The actions include creating, compiling, creating synonyms for, granting privileges on, and showing dependencies for these source types.

The following types of database resident program units can be created:

- Package: This is a structure that contains definitions, blocks of PL/SQL code, or both in a single unit
- Package bodies: These contain the PL/SQL code for the procedures and functions defined in the definitions of the packages to which they belong.
- Stand-alone subprograms: Procedures and functions are standalone subprograms. Functions must return a value to the invoking program.
- Database triggers: These are stored subprograms associated with a database table, view, or event.

Using Enterprise Manager to Manage Database Resident Program Units

The screenshot shows the Oracle Enterprise Manager Administration interface for a database named 'orcl.us.oracle.com'. The top navigation bar includes links for Home, Performance, Administration (which is selected), and Maintenance. The main content area is divided into several sections:

- Instance:** Memory Parameters, Undo Management, All Initialization Parameters.
- Storage:** Controlfiles, Tablespaces, Datafiles, Rollback Segments, Redo Log Groups, Archive Logs, Transactional Log Groups.
- Schema:** Tables, Indexes, Views, Synonyms, Sequences, Database Links.
- Source Types:** Packages, Package Bodies, Procedures, Functions, Triggers, Java Sources, Java Classes.
- User Types:** Array Types, Object Types, Table Types.

A callout box with a black border and white text is overlaid on the 'Source Types' section, containing the instruction: "Click a link to access the program units." An arrow points from the bottom-left of this box to the 'Packages' link in the 'Source Types' list.

At the bottom of the page, there is a dark footer bar with the ORACLE logo and the copyright notice: Copyright © 2004, Oracle. All rights reserved.

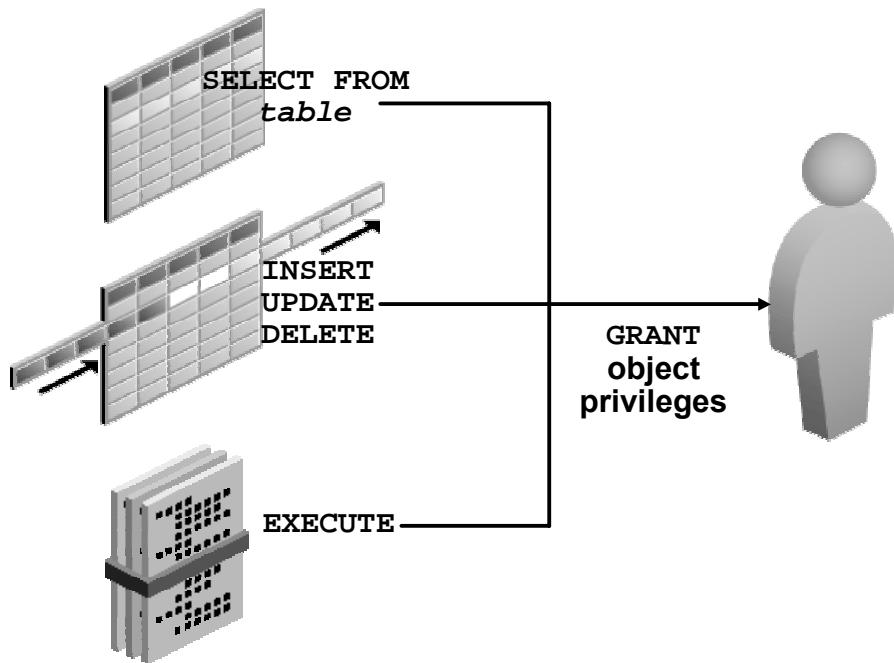
Using Enterprise Manager to Manage Database Resident Program Units

You can examine packages that already exist in the database by clicking the Packages link on the Enterprise Manager Administration property page to open the Packages property page. You can then search for packages by schema, name, both schema and object name, or neither. (The latter option will include every package in the result set.) To see a package definition, click its name in the Results list or select the package in the Results list and click Edit. The Edit Package property page contains the package name, schema, status, and source. From the Edit Package property page, you can modify the package and package body definition and compile the package. New packages can be created by clicking Create on the Packages property page. You can also delete packages from this page.

The other types of database resident program units are managed in a similar fashion using Enterprise Manager.

For detailed information about creating and managing database resident program units, refer to the *Oracle Database Application Developer's Guide – Fundamentals*.

Managing Access to Schema Objects



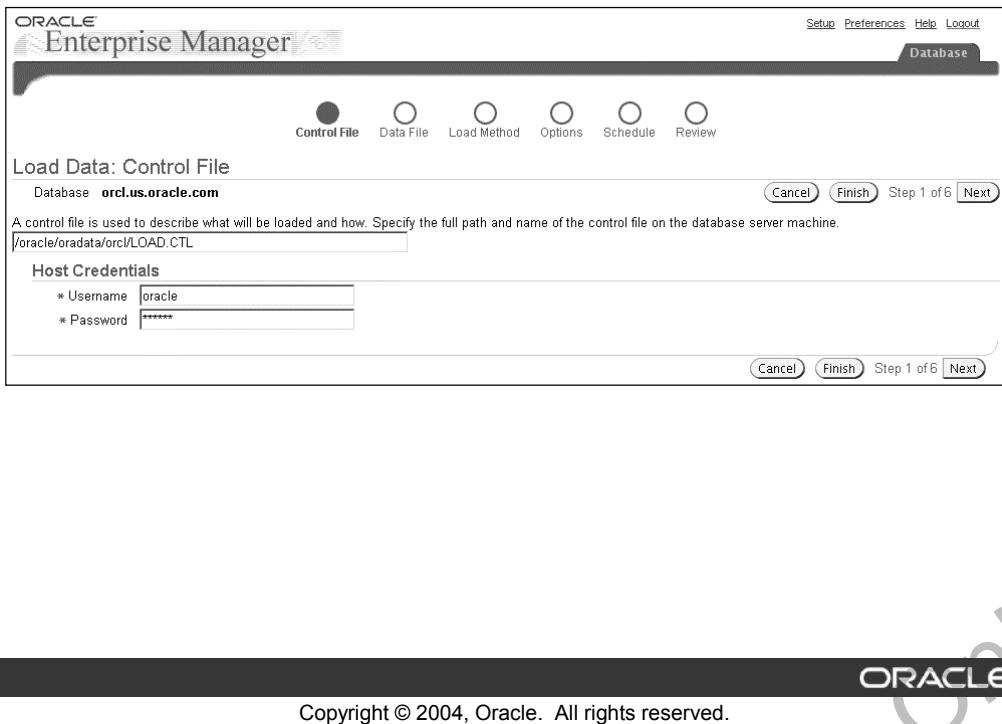
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Managing Access to Schema Objects

By default, only the owner of an object or users with advanced system privileges can access the object. For each object you want to make available to other users, you must grant privileges to that object. You can grant the privileges directly to a user or to a role. For more information on granting privileges and roles, see the lesson titled “Administering Users and Security.”

Loading Data



Loading Data

You can use Enterprise Manager to load data into tables in batch. Batch loading is useful when you have a lot of data. You can load data from operating system files or from other databases. You can also export data into files.

For loading data with Enterprise Manager, one method is to use control (.ctl) and data (.dat) files. These files are formatted as standard SQL*Loader files.

Note: Do not confuse the SQL*Loader control file with your database control file. The SQL*Loader control is used to describe the data file used in the batch load.

You can load data as follows:

1. Log on to Enterprise Manager as SYS or another user with administrator privileges.
2. Click Load Data from File under Utilities on the Maintenance Page to invoke a six step loading wizard.
3. Enter the full path of your control file on the database server machine on the Load Data: Control File page. Also, enter the username and password for the host machine. Click Next.
4. Select Provide the full path and name on the database server machine on the Load Data: Data File screen and enter the path. Click Next.

Loading Data (continued)

5. Select the default Conventional Path as the loading method on the Load Data: Load Method screen.
6. Select Generate log file where logging information is to be stored under Optional Files on the Load Data: Options screen. You can select the default file name and path or enter a different one. Note that this screen gives you the option of limiting the number of rows loaded. Click Next.
7. Enter a Job Name and Description on the Load Data: Schedule screen. Select Immediately to run the job now. Click Next.
8. You can use the Load Data: Review screen to review your file names and loading methods. If you want to change something, click Back. Otherwise, click Submit Job to start the loading.
9. The Status screen appears with the Load Data Submit Successful message. Click View Job to view the job summary. The summary screen should indicate that the job has succeeded. You can view the log file by clicking on your job under the Logs heading or by viewing the log file directly.
10. You can confirm the loaded data by navigating to the Tables screen, selecting the table, and choosing View Data.

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Summary

In this lesson, you should have learned how to:

- **Create and modify tables**
- **Define constraints**
- **View the attributes of a table**
- **View the contents of a table**
- **Create indexes and views**
- **Load data into tables**

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Practice Overview

This practice covers the following topics:

- **Creating a table**
- **Defining constraints**
- **Creating an index**
- **Granting object privileges to a role**
- **Loading data**

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Performing Backup and Recovery

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Objectives

After completing this lesson, you should be able to do the following:

- **Configure the database for backup and recovery operations**
- **Create and manage database backups**
- **Restore and recover the database**
- **Use flashback features**

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Oracle Recovery Features

- **Automatic recovery after instance failure (crash recovery)**
- **Datafile media recovery**
- **Flashback:**
 - **Flashback Query**
 - **Flashback Versions Query**
 - **Flashback Transaction Query**
 - **Flashback Table**
 - **Flashback Drop**
 - **Flashback Database**

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Oracle Recovery Features

Oracle provides several features that enable you to recover from failures in your database, including hardware failures and user errors. In this lesson, you learn how to protect your database from hardware failure through the implementation of a backup and recovery strategy. In addition, you learn how to recover from user errors by using the flashback features.

Instance or crash recovery is a special form of recovery, which happens the first time an Oracle database instance is started after a crash. In crash recovery, the datafiles are returned to a transaction-consistent state, preserving all committed changes up to the point when the instance failed.

Datafile media recovery is the most basic form of user-initiated data recovery. It can be used to recover data from a lost or damaged datafile, server parameter file (SPFILE), or control file.

Oracle Recovery Features (continued)

Oracle Flashback features support viewing and rewinding data back and forth in time as follows:

- Flashback Query feature enables you to specify a target time and then execute queries against your database, viewing results as they would have appeared at that time.
- Flashback Versions Query feature enables you to view all the versions of all the rows that ever existed in one or more tables in a specified time interval.
- Flashback Transaction Query feature enables you to view changes made by a single transaction, or by all transactions during a specified period of time.
- Flashback Table feature returns a table to its state at a previous point in time.
- Flashback Drop feature reverses the effects of a `DROP TABLE` statement.
- Flashback Database feature provides a more efficient alternative to database point-in-time recovery.

In this course you learn how to use the Flashback Drop and Flashback Table features. For more information about the other Flashback features, refer to the *Oracle Database Backup and Recovery Advanced User's Guide*.

Backup, Restore, and Recovery Concepts

Types of backups:

- **Consistent**
 - Taken when the instance is shutdown
 - All changes in the redo logs have been applied to the datafiles
 - Enables you to open the database immediately after a restore operation
- **Inconsistent**
 - Taken when the database is open
 - Online and archived redo logs can contain changes that have not yet been applied to the datafiles
 - Must perform media recovery after restoring

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Backup, Restore, and Recovery Concepts

When you back up your database, you make copies of your datafiles, control file, and archived redo logs if any. Restoring a database from backup is simply copying the physical files that make up the database from some backup medium (disk or tape) to their locations during normal database operation.

You can make consistent or inconsistent backups. A consistent backup is one in which the database can be opened immediately after a restore operation. Creating a consistent backup requires that all changes in the redo logs have been applied to the datafiles. You must close your database and shut down the instance to perform this type of backup.

In an inconsistent backup, the online and archived redo logs can contain changes that have not yet been applied to the datafiles. You can create an inconsistent backup while the database is open. However, to use an inconsistent backup to recover your database, you must perform media recovery after restoring the database files from backup.

Backup, Restore, and Recovery Concepts

Media recovery options:

- **Complete:**
 - All changes from the logs are applied.
 - Database is returned to its state at the time of failure.
- **Point-in-time (incomplete):**
 - Choose any time between the time of the datafile backup and the last change in the redo logs.
 - Apply only changes up through the specified time.

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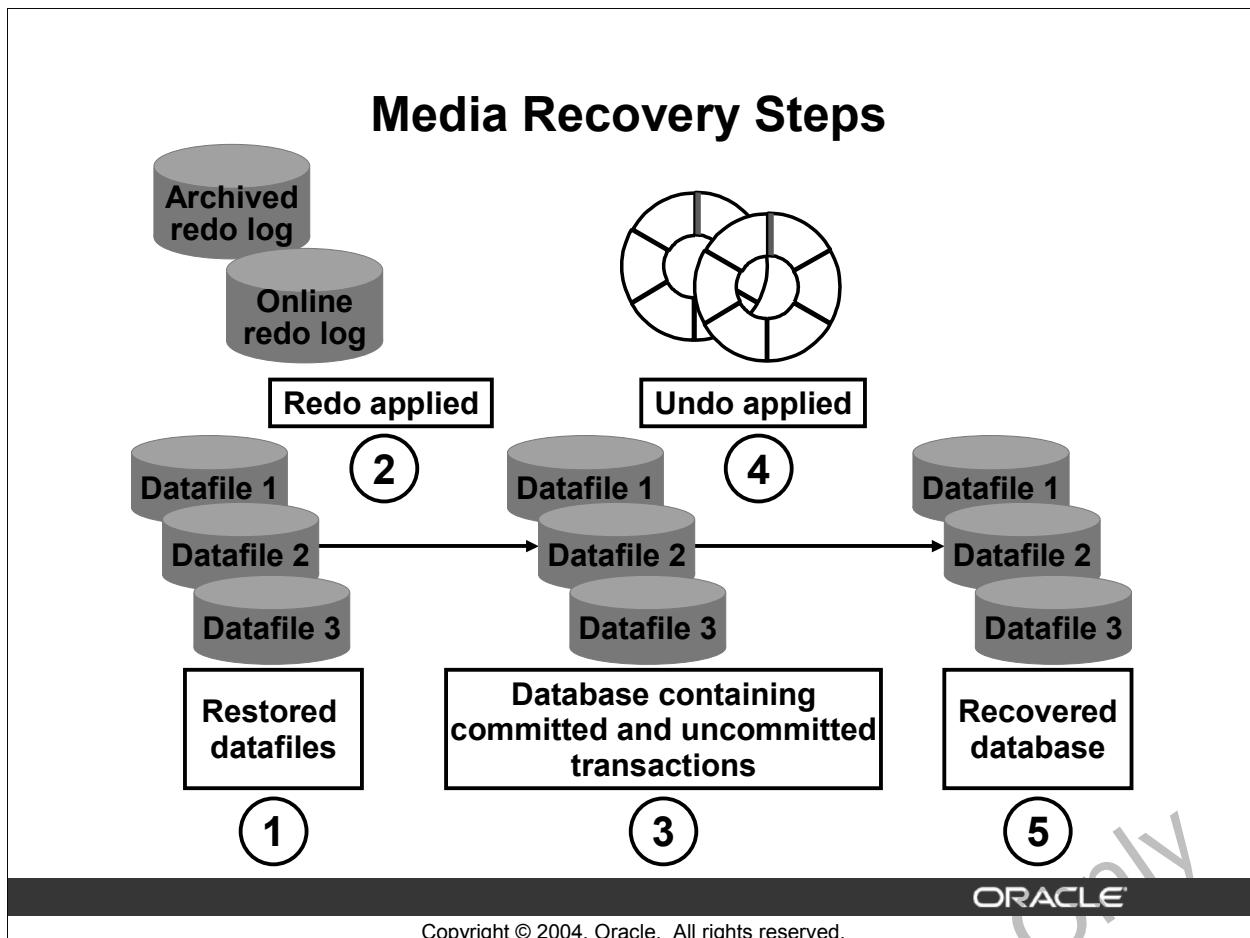
Backup, Restore, and Recovery Concepts (continued)

When you restore the archived redo logs and the datafiles from a backup, the Oracle server performs media recovery when you try to open the database. The database transactions in the online and archived redo logs that are not already reflected in the datafiles are applied to the datafiles. Any uncommitted transactions are rolled back. This brings them to a transactionally consistent state before the database is opened.

Media recovery can be either complete recovery or point-in-time recovery. In complete recovery, all changes from the logs are applied and the database returns to its state at the time of failure. You can then reopen the database with no loss of data.

In point-in-time recovery, you return your database to its state at a target time of your choice in the past. Starting with a set of datafile backups created before the target time and a complete set of archived redo log files from the time of the backup through the target time, changes are applied to the datafiles. When all changes as of the target time have been reapplied, the datafiles are returned to their contents as of the target time. Point-in-time recovery is sometimes referred to as incomplete recovery, because not all changes are applied.

Media recovery requires a control file, datafiles typically restored from backup, and all online and archived redo logs from the time the datafiles were backed up. It is typically used only in the case of database failure caused by a media failure, such as the loss of a file or disk.



Media Recovery Steps

Media recovery of the database involves the following steps:

1. Damaged or missing files are restored from a backup.
2. Changes from the archived redo log files and online redo log files are applied as necessary. Undo blocks are generated at this time. This is referred to as rolling forward or cache recovery.
3. The database may now contain committed and uncommitted changes.
4. The undo blocks are used to roll back any uncommitted changes. This is known as rolling back or transaction recovery.
5. The database is now in a recovered state.

Configuring the Database for Backup and Recovery

- **Configure the flash recovery area**
 - Sized to contain two complete backups of datafiles
 - Separate disk
- **Configure ARCHIVELOG mode**
- **Use flash recovery area for archive redo logs**

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Configuring the Database for Backup and Recovery

To use Oracle's features for automatic management of backup and recovery operations, configure your database as follows:

- Use a flash recovery area to automate storage management for most backup-related files.
- Operate your database in ARCHIVELOG mode so that you can perform online backups.
- Use the flash recovery area as an archive log destination.

You can set policies to govern which files are backed up, what format is used to store backups on disk, and when files become eligible for deletion from the flash recovery area.

Sizing the Flash Recovery Area

Ideally, the flash recovery area should be large enough to hold two complete backup copies of your datafiles, plus any incremental backups and archive logs required to restore your database to any point in time during your recovery window.

For more information about configuring the flash recovery area, refer to *Oracle Database Backup and Recovery Basics*.

Configuring the Flash Recovery Area

Flash Recovery Area

It is highly recommended to use flash recovery area to automate your disk backup management.

Flash Recovery Area Location

Flash Recovery Area Size Flash Recovery Area Size must be set when the location is set

Used Flash Recovery Area Size (B) **0**

Enable flashback logging for fast database point-in-time recovery*
The flash recovery area must be set to enable flashback logging. Using flashback logs, you may recover your entire database point-in-time recovery method in the recovery wizard when appropriate.

Specify how far back you wish to flash the database in the future

Flashback Retention Time Current size of the flashback logs **n/a**
Lowest SCN in the flashback data **n/a**
Time of the lowest SCN in the flashback data **n/a**

Apply changes to SPFILE only. Otherwise the changes will be made to both SPFILE and the running static parameters.

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Configuring the Flash Recovery Area

You can configure ARCHIVELOG mode and the flash recovery area as follows:

1. Create a directory to hold the flash recovery area in your operating system. Make sure that the permissions on this directory allow the Oracle server to create files in it.
2. Select the Maintenance property page from the Database home page. Select Configure Recovery Settings in the Backup/Recovery region. The Recovery Settings page appears.
3. Select the ARCHIVELOG Mode check box in the Media Recovery region if it is not checked. Below the ARCHIVELOG Mode check box is a list of up to ten possible log archiving locations. Destination number 10 specifies USE_DB_RECOVERY_FILE_DEST as the destination indicating the flash recovery area is to be used.
4. Specify the directory name and size for the flash recovery area in the Flash Recovery Area region.

Note: The location can be a directory in the host operating system or the name of an ASM disk group. Ensure that the “Apply Changes to SPFILE Only” check box is not selected. Click Apply.

Configuring the Flash Recovery Area (continued)

5. The Confirmation page appears. Click Yes to restart your instance. This is required to place the database in ARCHIVELOG mode.
6. The Restart Database:Specify Host and Target Database Credentials page appears. Provide the host and databases credentials, and click OK.
7. The Restart Database:Confirmation page appears. Click Yes.
8. The Restart Database:Activity Information page appears. If you receive a browser error, then click the refresh button until the Login page is displayed.
9. Specify the username and password on the Database Login page.
10. The Startup/Shutdown:Specify Host and Target Database Credentials page appears. Provide the host and databases credentials and click OK.
11. The Database home page appears.
12. Click the Maintenance tab and click Configure Recovery Settings. Verify your changes on the Configure Recovery Settings page.

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Types of Backups

- **Full backups of datafiles**
- **Incremental backups of datafiles**
- **Incrementally updated backups: Rolling forward image copies of datafiles**
- **Whole backups**

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Types of Backups

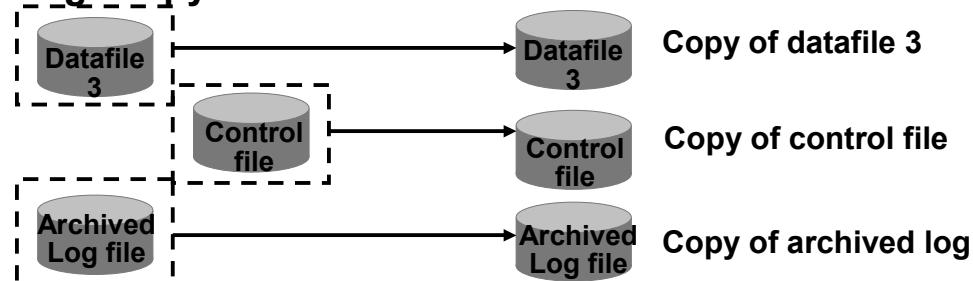
Oracle Enterprise Manager (Enterprise Manager) supports the following types of backups:

- **Full backups of datafiles:** Includes all used blocks of the datafile. This can be an image copy backup or a backup set. Regardless of the form in which the backup is stored, the entire datafile is backed up, even if only a few blocks have changed.
- **Incremental backups of datafiles:** Includes only those blocks that change between backups in each datafile of your database. In a typical incremental backup strategy, a level 0 incremental backup, which captures all blocks in the datafile, is taken as a starting point. Subsequent level 1 incremental backups, typically taken at regular intervals, capture images of each block in a datafile that changed. Level 1 backups can be cumulative, in which case all blocks changed since the most recent level 0 backup are included, or differential, in which case only those blocks changed since the most recent level 0 or level 1 incremental backup are included.
- **Whole backups:** Backing up the entire contents of the database at the time of backup. Full backups of all datafiles are created. The results may be stored as image copies or as backup sets, but in either case the complete contents of all datafiles of the database are represented in the backup, as well as the control file, archived redo log and server parameter file. With this set of files, the database can be recovered completely.

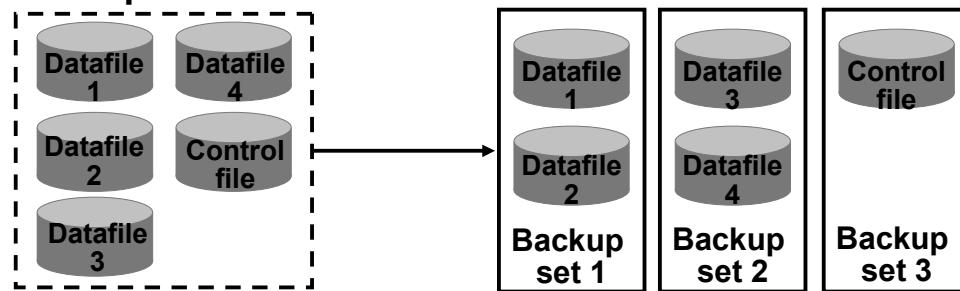
Whole database backups are required in some circumstances, such as when you switch your database between ARCHIVELOG and NOARCHIVELOG modes.

Backup File Types

Image copy



Backup set



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Backup File Types

You can make the following types of backups:

- Image copies are copies of a datafile, control file, or archived redo log file. A copy can be made by using Enterprise Manager or an operating system utility. The image copy of a datafile consists of all the blocks of the datafile, including the unused blocks. The image copy can include only one file and a single operation of copy cannot be multiplexed.
- Backup sets can include one or more datafiles, the control file, or archived redo log files. You can make a backup set in two distinct ways:
 - **Full backup:** In a full backup, you back up one or more files. In a full backup, all blocks containing data for the files specified are backed up.
 - **Incremental backup:** An incremental backup is a backup of datafiles that include only the blocks that have changed since the last incremental backup. Incremental backups require a base-level (or incremental level 0) backup, which backs up all blocks containing data for the files specified. Incremental level 0 and full backups copy all blocks in datafiles, but full backups cannot be used in an incremental backup strategy.

Note: You can configure automatic control file backup so that the control file and the current server parameter file are backed up when you issue a BACKUP or COPY command.

Backup File Types (continued)

The incrementally updated backup feature enables you to use one or more level 1 incremental backups with an older image copy backup of your datafiles, to roll the copy forward to the SCN at which the last level 1 incremental backup was taken. All blocks changed since the image copy was created are overwritten with their new contents as of the time of the last level 1 incremental backup. The effect is to roll the file forward in time, so that its contents are equivalent to an image copy full datafile backup taken at the time of the last incremental level 1 backup. This feature lets you implement strategies with shorter recovery times, because you must only perform recovery starting at the SCN of the last level 1 incremental applied to your datafiles.

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Configuring Backup Settings: Disk Settings

- **Parallelism: Default value of 1**
- **Disk Backup Location: Null to use the flash recovery area**
- **Disk Backup Type: Default of disk**

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Configuring Backup Settings: Disk Settings

You can configure settings that are applicable for all backup jobs on the Configure Backup Settings page. You can override these settings if required.

You can use Enterprise Manager to configure disk settings as follows:

1. Click Configure Backup Settings in the Backup/Recovery region of the Maintenance page. The Device tab of the Configure Backup Settings page is displayed.
2. Select the default value of 1 for Parallelism.
3. The Disk Backup Location should be set to null indicating that the backups will be placed in the flash recovery area.
4. Select the default of Backup Set for Disk Backup Type.
5. Specify the host credentials for the backup in the Host Credentials region.
6. Click the Test Disk Backup button to verify that the credentials and backup location are correct.
7. The Disk Backup Test Successful confirmation message is displayed.

Configuring Backup Settings: Policy Settings

- **Backup Policy:**
 - Back up the server parameter file (SPFILE)
 - Back up the control file
 - Skip unchanged files
 - Enable block change tracking
- **Retention Policy**
 - Retain all backups
 - Recovery window
 - Redundancy

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Configuring Backup Settings: Policy Settings

On Policy Settings page, you can set the backup policies governing control file and server parameter file (SPFILE) backups, specify tablespaces that are to be excluded from whole database backup, and set the backup retention policy.

You can use Enterprise Manager to configure backup policies as follows:

1. Click Configure Backup Settings in the Backup/Recovery region of the Maintenance page.
2. Click the Policy tab.
3. Select the “Automatically backup the control file and server parameter file (SPFILE) with every backup and database structural change” check box. Do not specify a location for the “Autobackup Disk Location” so that the backups are made in the flash recovery area.
4. Select the “Optimize the whole database backup by skipping unchanged files such as read-only and offline datafiles that have been backed up” check box.
5. Select the “Enable block change tracking for faster incremental backups” check box. If you have not configured a database area to use Oracle Managed Files, then provide a file location and name for the block change tracking file.

Configuring Backup Settings: Policy Settings (continued)

6. Select “Retain backups that are necessary for a recovery to any time within the specified number of days (point-in-time recovery)” and select the default of 31 days.
7. Specify the host credentials for the backup in the Host Credentials region. Click OK.
8. You are returned to your Database home page.

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Whole Database Backups

- **Full backups of all datafiles**
- **Control file**
- **Archived redo log files**
- **Server parameter file (SPFILE)**

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Whole Database Backups

When you create a whole backup of your database, you are backing up the entire database. Full backups of all datafiles are created. The results may be stored as image copies or as backup sets, but in either case the complete contents of all datafiles of the database are represented in the backup, as well as the control file, archived redo log and server parameter file. With this set of files, the database can be recovered completely.

Whole database backups are required in some circumstances, such as when you switch your database between ARCHIVELOG and NOARCHIVELOG modes.

Backing Up the Database

The screenshot shows the Oracle Enterprise Manager interface for scheduling a backup. The title bar reads "ORACLE Enterprise Manager". Below it, the database URL is "Database: orcl.us.oracle.com". The main section is titled "Schedule Backup: Strategy". A note states: "Based on your disk and/or tape configuration, Oracle provides an automated backup strategy, or you can develop your own backup strategy with customized options." A dropdown menu for "Backup Strategy" is set to "Customized". Under "Object Type", the "Whole Database" option is selected, while "Tablespaces", "Datafiles", and "Archivelogs" are unselected. A sub-note below says: "These files include all archivelogs and disk backups that are not already backed up to tape". The "Host Credentials" section asks for operating system login credentials, showing fields for "Username" (oracle) and "Password" (*****). The bottom right corner features the "ORACLE" logo.

Backing Up the Database

You can perform a whole backup by using Enterprise Manager as follows:

1. Click Schedule Backup in the Backup/Recovery region of the Maintenance page.
The Schedule Backup: Strategy page appears.
2. Select Customized from the Backup Strategy drop-down menu. The page is refreshed and the Object Types are displayed.
3. Select Whole Database.
4. Enter your host operating system credentials and click Continue. The Schedule Backup: Options page appears.
5. Choose Full Backup in the Backup Type region.
6. Select Online Backup in the Backup Mode region. Typically, you perform online backups to maximize database availability.
7. If you are performing an online backup, then select the “Back up all archived logs on disk” check box in the Advanced region.

Note: You do not need to back up archived logs when performing an offline backup, as the database will be in a consistent state at the time of backup and does not require media recovery if you restore from this backup.

Click Next. The Schedule Backup: Settings page is displayed.

Backing Up the Database (continued)

8. Select Disk as the backup destination. Click Next. The Schedule Backup: Schedule page is displayed.
9. Select the default job name. Edit the Job Description field as needed. Select the default start time of Immediately to execute the backup immediately. Alternatively, you can schedule the job for some time in the future and set the Repeat and Repeat Until parameters as needed. Click Next. The Schedule Backup: Review page is displayed.
10. You can make any final changes on the Schedule Backup: Review page. Click Submit Job to execute the backup job with the specified options.
11. You can click the View Job to monitor the progress of the backup job. A page that shows a summary of the job submitted is displayed. In the Logs region you can follow the progress of the various steps of the backup job and drill down to see logs of the RMAN output from the jobs.

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Oracle-Suggested Backup Strategy

- **Creates an image copy of your database which is rolled forward using incrementally updated backups**
- **Day 1: An incremental level 0 datafile backup is created.**
- **Day 2: An incremental level 1 backup is created.**
- **Day 3 and later:**
 - **The level 1 backup from the beginning of day n-1 is applied to the level 0 backup.**
 - **A new level 1 is created.**

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Oracle-Suggested Backup Strategy

Enterprise Manager makes it easy to set up an Oracle-suggested backup strategy, that protects your data and provides efficient recoverability. The Oracle-suggested strategy leverages Oracle's incremental backup and incrementally-updated backup features to provide faster recoverability than is possible applying database changes from the archived log to your datafiles. The backup strategy depends on the backup devices the user plans to use.

The Oracle-suggested backup strategy is based on creating an image copy of your database which is rolled forward using incrementally updated backups. Oracle Enterprise Manager schedules RMAN backups jobs for you to run during the overnight hours.

For each datafile, the strategy calls for backups to be made as follows:

- At the beginning of day 1 of the strategy (the time the first scheduled job actually runs), an incremental level 0 datafile copy backup. It contains the datafile contents at the beginning of day 1. In a restore-and-recovery scenario, the redo logs from day 1 can be used to recover to any point during day 1.
- At the beginning of day 2, an incremental level 1 backup is created, containing the blocks changed during day 1. In a restore-and-recovery scenario, this incremental level 1 can be applied to quickly recover the rolled-forward level 0 backup to the beginning of day 2, and redo logs can be used to recover to any point during day 2.

Oracle-Suggested Backup Strategy (continued)

- At the beginning of each day n for days 3 and later, the level 1 backup from the beginning of day n-1 is applied to the level 0 backup. This brings the datafile copy to its state at the beginning of day n-1. Then, a new level 1 is created, containing the blocks changed during day n-1. In a restore-and-recovery scenario, this incremental level 1 can be applied to quickly recover a restored backup to the beginning of day n, and redo logs can be used to recover the database to any point during day n.

The datafile copies used in the Oracle-suggested backup strategy are tagged with the tag ORA\$OEM_LEVEL_0. The level 1 incremental backups for use in this strategy are created for use with datafile copies that are so labeled. You can safely implement other backup strategies without concern for interference from the backups for the Oracle suggested strategy.

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Using the Oracle-Suggested Strategy

Schedule Backup: Strategy

Current Database Information

1. ARCHIVELOG Mode - ARCHIVELOG
2. Current Status - OPEN

Based on your disk and/or tape configuration, Oracle provides an automated backup strategy, or you can develop your own backup strategy with customized options.

Backup Strategy **Oracle-suggested**

Select your backup destination

Disk
Use disk as the only storage for backups

Tape
Use tape as the only storage for backups

Both Disk and Tape
Use disk to store the most recent database backup and archivelogs for fast complete recovery. Use tape to store older backups for extended recovery window.

Host Credentials

To perform a backup, supply operating system login credentials.

* Username

* Password

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Using the Oracle-Suggested Strategy

You can perform a whole backup by using Enterprise Manager as follows:

1. Click Schedule Backup in the Backup/Recovery region of the Maintenance page.
The Schedule Backup: Strategy page appears.
2. Select Oracle-suggested from the Backup Strategy drop-down menu.
3. Select Disk for your backup destination.
4. Enter your host operating system credentials and click Continue. The Schedule Backup: Setup page appears.
5. Click Next to continue. The Schedule Backup: Schedule page appears.
6. Specify the backup date and time. Click Next. The Schedule Backup: Review page appears.
7. Review your settings. Click Submit Job to schedule the Oracle-suggested backup strategy. The Status page appears confirming the job submission.
8. Click View Job to view the submitted job.

Managing Your Backups

- **Managing your backups involves:**
 - Managing the backup files on disk or tape
 - Managing the backup records
- **Backups can be in one of the three states:**
 - **Available:** Backup is still present on disk or tape, as recorded in the repository.
 - **Expired:** Backup has been deleted from disk or tape but is still listed in the repository.
 - **Unavailable:** Backup is temporarily unavailable for data recovery operations.

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Managing Your Backups

Managing backups consists of managing the backups themselves as they exist on disk or tape and managing the record of backups. The backup records are stored in the Recovery Manager (RMAN) repository.

You can manage your backup records through Enterprise Manager. Backup maintenance functions provided in Enterprise Manager include the following:

- Viewing lists of backups (backup sets and image copies) recorded in the RMAN repository
- Crosschecking your repository:
 - Verifying whether the backups listed in the repository exist and are accessible
 - Marking as expired any backups that are not accessible at the time of the crosscheck
- Deleting the record of expired backups from your RMAN repository
- Deleting obsolete backups from the repository and from disk

Note: If you use a flash recovery area for your backup storage, then many maintenance activities are reduced or eliminated because of the flash recovery area's automatic management of disk space and file retention based on the retention policy.

Using the Manage Current Backups Page

Database: orcl.oracle.com > Manage Current Backups

Logged in As SYS

Manage Current Backups

This backup data was retrieved from the database control file.

Catalog Additional Files Crosscheck All Delete All Obsolete Delete All Expired

Backup Sets Image Copies

Search

Status Available

Contents Datafile Archived Redo Log SPFILE Control File

Completion Time Within a month GO

Results

Select	Key Tag	Completion Time	Contents	Device Type	Status	Obsolete	Keep	Pieces
No items found.								

Host Credentials

To perform backup management operations, supply operating system login credentials.

* Username oracle

* Password *****

Save as Preferred Credential

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Using the Manage Current Backups Page

You can access the Manage Current Backups page in Enterprise Manager by clicking Manage Current Backups in the Backup/Recovery region of the Maintenance page. The Manage Current Backups page has two property pages: Backup Set (the initial view) and Image Copy. Each serves a similar purpose, listing the backups as recorded in the Recovery Manager repository.

Backup sets are identified by their tags and completion times. To view information about which files are backed up in a backup set, drill down by clicking the value in the Contents column. For information about the individual backup pieces in a backup set, click the number of pieces in the Pieces column. Individual pieces will be listed by file name.

The Image Copy property page presents similar information to the Backup Sets property page.

Performing Backup Maintenance Tasks

- **Crosschecking:** Verifying whether the actual physical status of the backup matches the record of the backup in the RMAN repository
- **Deleting EXPIRED backups:** Deleting backups that RMAN found to be inaccessible during a crosscheck operation
- **Deleting obsolete backups:** Deleting backups that are no longer needed based on your retention policy

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Performing Backup Maintenance Tasks

Crosschecking

Crosschecking a backup causes RMAN to verify whether the actual physical status of the backup matches the record of the backup in the RMAN repository. During the crosscheck operation, the repository is updated to reflect the current status of the backup. Backups to disk are marked AVAILABLE if they are still present on disk in the location listed in the RMAN repository, and if they have no corruption in the file header. Backups on tape are listed as AVAILABLE if they are still found on tape. (The file headers are not checked for corruption.) Backups that are missing or corrupt are marked EXPIRED.

Click Crosscheck All at the top of the Manage Current Backups page to crosscheck all files in the RMAN repository. When you click Crosscheck All, a job is scheduled to perform the crosscheck.

You can also crosscheck individual files by selecting the file in the Results list and clicking Crosscheck at the top of the Results list. Unlike Crosscheck All, the crosscheck of individual files is performed immediately.

Performing Backup Maintenance Tasks (continued)

Deleting Expired Backups

When you delete an expired backup from the RMAN repository, the records of those backups which are marked EXPIRED are deleted.

You can delete expired backups with Enterprise Manager by clicking Delete All Expired at the top of the Manage Current Backups page. Note that this will delete both expired backup sets and expired image copies from the RMAN repository, regardless of whether you are viewing the Backup Sets or Image Copies property page when you click Delete All Expired.

When you select Delete All Expired, the Delete All Expired: Specify Job Parameters page is displayed. To ensure that RMAN has the most current information, select “Perform the operation Crosscheck All before Delete All Expired.”

Deleting Obsolete Backups

Obsolete backups are backups that are no longer needed based on your retention policy. You can delete obsolete backups by clicking Delete All Obsolete at the top of the Manage Current Backups page. All obsolete backups (both backup sets and image copies) will be deleted, regardless of whether you clicked Delete All Obsolete while viewing the Backup Set or Image Copy property page on the Manage Current Backups page.

When you click Delete All Obsolete, the Delete All Obsolete: Specify Job Parameters page appears. You can run the deletion job immediately or schedule it as you would a backup job.

Note: If you use a flash recovery area as your sole disk-based backup destination, you will never need to delete obsolete backups from disk. The files will be managed as specified by the backup retention policy, and only deleted when space is needed.

Performing Backup Maintenance Tasks

- **Marking backups UNAVAILABLE:** Marking the backup as temporarily unavailable so that RMAN will not attempt to use it in a recovery operation
- **Cataloging additional backups:** Cataloging backups taken with operating system commands

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Performing Backup Maintenance Tasks (continued)

Marking Backups Unavailable

If you know that an individual backup is unavailable because of a temporary condition, such as a disk drive that is temporarily offline or a tape stored off-site, then you can mark the backups as UNAVAILABLE. RMAN will keep the backup information in the RMAN repository (and not delete it when you delete expired backups) but will not try to use the backup in recovery operations. When the backup becomes available again, you can change its state back to AVAILABLE.

You can mark a backup as UNAVAILABLE by selecting the Select check box next to each backup in the Results list of backups and selecting Change to Unavailable.

Note: You cannot mark backups stored in the flash recovery area as UNAVAILABLE.

Cataloging Additional Backups

If you have backups in the flash recovery area or have taken backups using operating system commands, then you can catalog them in the RMAN repository so that RMAN can use them in a recovery operation.

Performing Backup Maintenance Tasks (continued)

You can add backups to the catalog by selecting Catalog Additional Files at the top of the Manage Current Backups page. On the Catalog Additional Files page, you can either select “Catalog all files in the recovery area into the Recovery Manager repository” or “Catalog files in the specified disk location into the Recovery Manager repository.”

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Restoring and Recovering the Whole Database

Perform Recovery: Type

Warning

The database will be shut down to perform this operation.

Operation - You cannot restore or recover the whole database at the OPEN state. It must be in the MOUNTED state.

Type

Object Type **Whole Database**

Operation Recover to the current time or a previous point-in-time
Type Datafiles will be restored from the latest usable backup as required.
 Restore all datafiles
Need to specify Time, SCN or log sequence. The backup taken at or prior to that time will be used.
 Recover from previously restored datafiles

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Restoring and Recovering the Whole Database

1. Select the Maintenance property page from the Database home page. Select Perform Recovery under the Backup/Recovery heading to invoke the Recovery Wizard.
2. Select Whole Database from the Object Type drop-down menu.
3. Select Restore and Recover as the Operation Type.
4. Specify the Username and Password for Host Credentials. Click Continue.
5. The instance is shut down. Click the Refresh button in your browser.
6. The Database home page is displayed. Click Perform Recovery.
7. Specify the host and database credentials. Click Continue. The Perform Recovery: Type page is displayed again.
8. Select Whole Database from the Object Type drop-down menu. Select Restore and Recover as the Operation Type. Confirm the Username and Password for Host Credentials. Click Continue.
9. Select “Recover to the current time”. Click Next.
10. Select “No. Restore the files to the default location.” Click Next.
11. Review your selections on the Perform Recovery: Review page. Click Submit to begin the recovery operation.
12. An informational message is displayed indicating the recovery was successful. Click OK to return to the Login page.

Flashback Table

- **Flashback table enables you to recover a table or tables to a specific point in time without restoring a backup.**
- **Data is retrieved from the undo tablespace to perform a flashback table operation.**
- **The FLASHBACK TABLE privilege is required to perform flashback of a table.**
- **Row movement must be enabled on the table that you are performing the flashback operation on.**

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Flashback Table

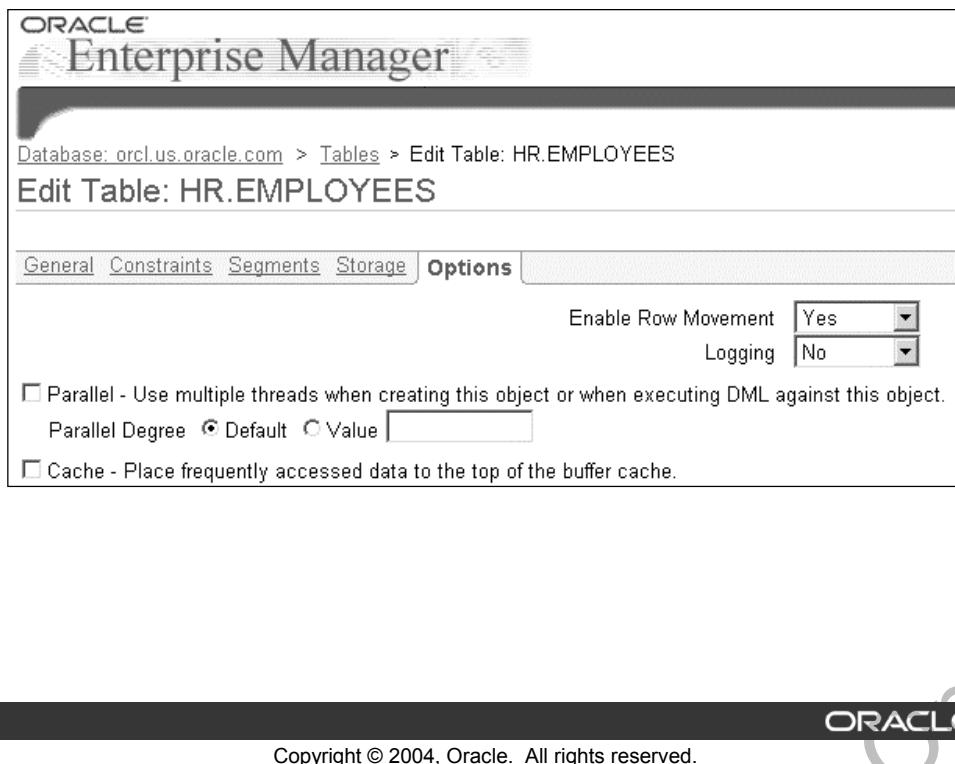
Flashback Table enables you to recover a table or tables to a specific point in time without restoring a backup. When you use this feature, the data in the tables and all associated objects (indexes, constraints, triggers, and so on) is restored. Data used to satisfy Flashback Table is retrieved from the undo tablespace.

You can use Flashback Versions Query and Flashback Transaction Query to help determine the appropriate flashback time. For more information about using these features, refer to *Oracle Database Concepts*.

Flashback Table provides a way for users to easily and quickly recover from accidental modifications without DBA involvement. You must grant the FLASHBACK TABLE or FLASHBACK ANY TABLE system privilege to any user that will use the Flashback Table feature. In addition, you must grant the SELECT, INSERT, DELETE, and ALTER object privileges to the user.

You can use Enterprise Manager to flashback a table. The wizard guides you through the process.

Enabling Row Movement on a Table



Enabling Row Movement on a Table

You must enable row movement on the table to be able to flashback the table. When you enable row movement, the Oracle server can move a row in the table. You can use Enterprise Manager to enable row movement.

Using Enterprise Manager, you can enable row movement on a table by performing the following steps:

1. Select Tables in the Schema region on the Administration property page. Enter the schema name to search for the table, and click OK.
2. Select the table by selecting Table from the Object Type drop-down menu, select the schema, and specifying the table name in the Object Name box. You can click the flashlight icon to search for the schema and table.
3. Click the table name in the Results region. The Edit Table page appears.
4. Select the Options tab.
5. Select Enable Row Movement from the drop-down menu and click Apply to update the options for the table.
6. The update confirmation message is displayed.

Performing Flashback Table

The screenshot shows the Oracle Enterprise Manager interface with the title "Enterprise Manager" at the top. Below the title, there is a navigation bar with four items: "SCN/timestamp Options" (which is selected, indicated by a filled circle), "Row History Filter", "Choose SCN", and "Flashback Tables". A horizontal dotted line separates the navigation from the main content area. The main content area has a header "Recovery:SCN/timestamp Options". Below the header, it says "Object Type **Tables**" and "Operation Type **Flashback existing tables**". A question follows: "Would you like to evaluate row changes/transactions on a table to decide on a SCN/timestamp ?". There are two radio button options: " Yes." and " No, I would like to flashback tables to a known SCN/timestamp.". If "Yes" is selected, there is a text input field for "Table" containing "SCOTT.EMP" with a "Browse" icon next to it. If "No" is selected, there are two input fields: "SCN" and "Timestamp". The "Timestamp" field contains "Nov 11, 2003" with dropdown menus for "08" and "02" and radio buttons for "AM" and "PM". At the bottom right of the content area, there is an "OK" button.

Performing Flashback Table

You can flash back a table using Enterprise Manager by performing the following steps:

1. Select Perform Recovery in the Backup/Recovery region on the Maintenance property page. The Perform Recovery: Type page appears.
2. Select Tables from the Object Type drop-down menu. The page is refreshed.
3. Select “Flashback existing tables” as the Operation Type. Click Continue. The Recovery:SCN/timestamp Options page is displayed.
4. You can select Yes to evaluate changes to a table. You can select “No, I would like to flashback tables to a known SCN/Timestamp.” Specify the SCN or Timestamp as appropriate. Click Next to continue. The Recovery: Flashback Tables page appears.
5. Specify the table or click Add Tables to search for the table. Click OK. Click Next to continue with the flashback table process.
6. The Dependent tables page may appear if there are dependent tables.
7. The Perform Recovery:Review page appears. The Impact Analysis box shows which tables and other objects will be flashed back. When you are satisfied with the results, click Submit to execute the flashback table operation.

Recovering Tables Using Flashback Drop

- **Flashback drop enables you to recover a dropped table.**
- **The dropped tables are placed in the recycle bin.**
- **Flashback drop recovers tables from the recycle bin.**

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Recovering Tables Using Flashback Drop

Flashback drop enables you to reverse the effects of dropping a table, returning the dropped table and its dependent objects to the database. When you drop a table in the database, it is stored in the recycle bin. You can retrieve your dropped table from the recycle bin until it is purged.

The extents allocated to the segment are not deallocated until you purge the object.

Performing Flashback Drop

Recovery:Dropped Objects Selection

Object Type: Tables
Operation Type: Flashback dropped tables

Search

Schema Name: HR

Table: [Search] Go

Results

Select All | Select None | Expand All | Collapse All

Select	Owner	Object Name	Object Type	Tablespace	Drop Time	Create Time	Size	Operation
<input type="checkbox"/>	▼ Recycle Bin							View Content
<input checked="" type="checkbox"/>	▼ HR	JOB_HISTORY	TABLE	EXAMPLE	2003-11-11:10:59:05	2003-09-19:07:05:02	8	View Content
<input type="checkbox"/>	▼ HR	RB\$\$48927\$INDEX\$1	INDEX	EXAMPLE	2003-11-11:10:59:05	2003-09-19:07:05:02	8	View Content
<input type="checkbox"/>	▼ HR	RB\$\$48928\$INDEX\$1	INDEX	EXAMPLE	2003-11-11:10:59:05	2003-09-19:07:05:02	8	View Content
<input type="checkbox"/>	▼ HR	RB\$\$48929\$INDEX\$1	INDEX	EXAMPLE	2003-11-11:10:59:05	2003-09-19:07:05:03	8	View Content
<input type="checkbox"/>	▼ HR	RB\$\$48926\$INDEX\$1	INDEX	EXAMPLE	2003-11-11:10:59:05	2003-09-19:07:05:02	8	View Content

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Performing Flashback Drop

Using Enterprise Manager, you can perform flashback drop by performing the following steps:

1. Select Perform Recovery in the Backup/Recovery region on the Maintenance property page. The Perform Recovery: Type page appears.
2. Select Tables from the Object Type drop-down menu. The page is refreshed.
3. Select “Flashback dropped tables” as the Operation Type. Click Continue. The Recovery:Dropped Objects Selection page is displayed.
4. Specify the schema name and table name. You can click the flashlight icon to search for the schema. Click Go. The page is refreshed and the dropped table and its dependent objects is displayed in the Results region.
5. Select the table and click Next. The Recovery: Rename page is displayed.
6. You can give the table a new name or select the default for the table name. Click Next. The Perform Recovery: Review page is displayed.
7. Verify your request and click Submit to perform the flashback drop operation. The Confirmation page is displayed.
8. Click OK.

Summary

In this lesson, you should have learned how to:

- **Configure the database for backup and recovery operations**
- **Perform a whole database backup**
- **Restore and recover the whole database**
- **Perform flashback table and flashback drop operations**

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Practice Overview

This practice covers the following topics:

- **Configuring the database for backup and recovery operations**
- **Configuring backup settings and policies**
- **Performing a whole database backup**
- **Restoring and recovering the whole database**
- **Using Flashback Table to recover a table**
- **Using Flashback Drop to recover a table**

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Monitoring the Database and Using the Advisors

10

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Objectives

After completing this lesson, you should be able to do the following:

- Describe the Oracle Self-Monitoring architecture**
- Use the performance advisors to optimize database performance**

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Proactive Database Monitoring

- You can use Oracle Enterprise Manager to proactively monitor the state and performance of your database.
- Proactive monitoring comprises the following tasks:
 - Monitoring general database state and workload
 - Monitoring performance
 - Using alerts

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Proactive Database Monitoring

You can use Oracle Enterprise Manager (Enterprise Manager) to proactively monitor the state and performance of your database. By proactively monitoring such metrics, such as where the database is spending CPU time or how disk space is being used from hour to hour or day to day, you can take necessary corrective steps to avoid future performance problems.

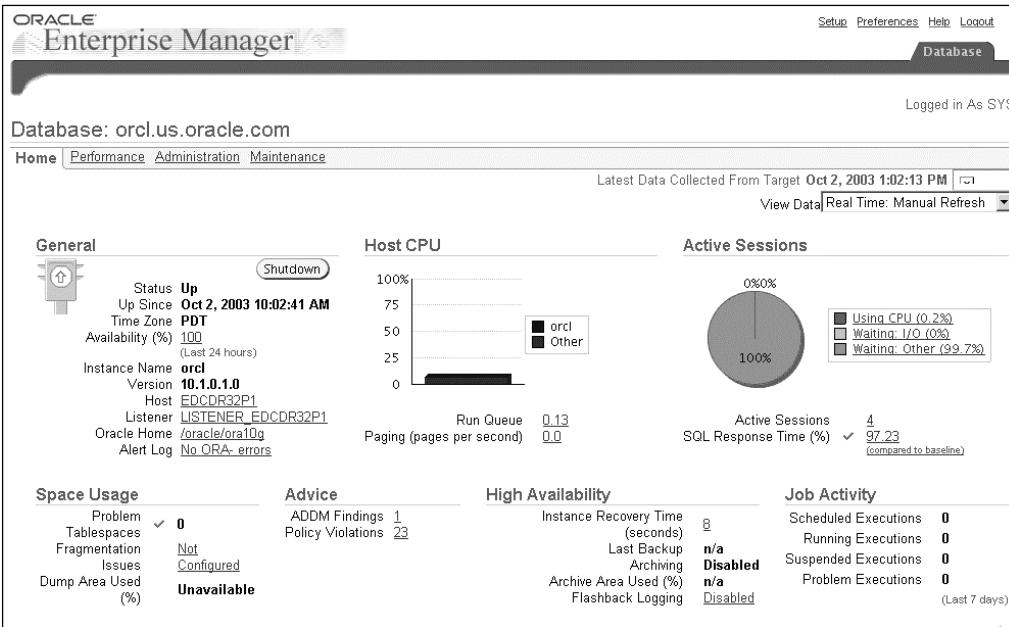
Proactive monitoring comprises the following tasks:

- Monitoring general database state and workload
- Monitoring performance
- Using alerts

Each of these tasks is discussed in detail in this lesson.

Oracle database includes a self-diagnostic engine called the Automatic Database Diagnostic Monitor (ADDM). ADDM makes it possible for the Oracle database to diagnose its performance and determine how any identified problems can be resolved.

Monitoring General Database State and Workload



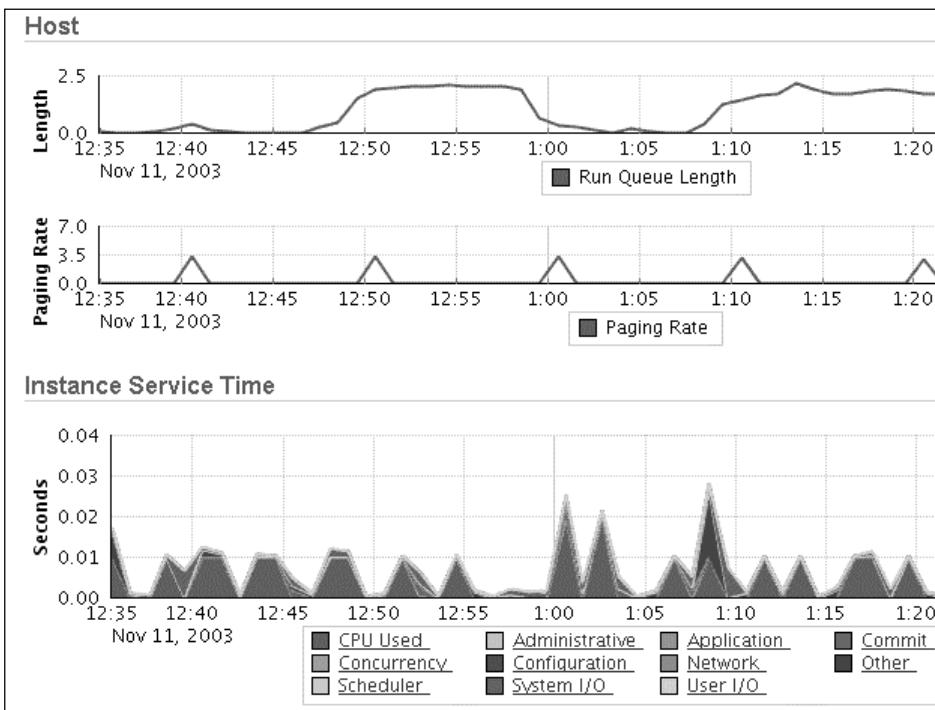
Monitoring General Database State and Workload

You can monitor the health of your database by using the Enterprise Manager Database home page. This page provides general database state information and reports information that is helpful for monitoring database state and workload. It is updated periodically.

The Database home page includes the following regions:

- **General:** Provides a quick view of the database, including the status of the database, the time the database was last started, instance name, and host name
- **Host CPU:** Shows the percentage of CPU time used in the overall system. This chart breaks down CPU percentage into time used by the database and time used by other processes. If your database is taking up most of the CPU time, then you can explore the cause further by looking at the Active Sessions summary.
- **Alerts table:** Provides information about any alerts that have been issued along with the severity rating of each. An alert is a notification that a metric threshold has been exceeded.

Monitoring Performance



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Monitoring Performance

You can use the Performance page to view the overall status of your system over time. Information is plotted graphically over time that helps you to identify time periods of increased activity. This page covers three main performance areas: host, sessions, and instance throughput. You can click the graphs to obtain detailed information.

The Performance page provides information about CPU utilization, memory utilization, and disk utilization over time in a graphical format. On this page you can also view the top ten processes in the CPU.

Using Alerts

- **Alerts are notifications when particular metrics thresholds are exceeded.**
- **You can set critical and warning threshold values for each alert.**
- **The following alerts are enabled by default:**
 - Table space usage (warning at 85% full, critical at 97% full)
 - Snapshot too old
 - Recovery area low on free space
 - Resumable session suspended

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Using Alerts

Alerts help you monitor your database proactively. Most alerts are notifications when particular metrics thresholds are exceeded. You can set critical and warning threshold values for each alert. These threshold values are meant to be boundary values that when exceeded indicate that the system is in an undesirable state. In addition to notification, you can set alerts to perform some action such as running a script.

The following alerts are enabled by default:

- Table space usage (warning at 85% full, critical at 97% full)
- Snapshot too old
- Recovery area low on free space
- Resumable session suspended

You can modify these or set your own on other metrics.

When you receive an alert, follow any recommendation it provides, or consider running ADDM or another advisor, as appropriate to get more detailed diagnostics of system or object behavior.

Viewing Metrics and Thresholds

- **Metrics:**
 - Are a set of statistics for certain system attributes
 - Are computed and stored by the Automatic Workload Repository
- You can define warning and critical threshold values for each metric.
- Metrics serve as input for self-tuning and recommendations made by Oracle advisors.

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Viewing Metrics and Thresholds

Metrics are a set of statistics for certain system attributes as defined by Oracle. They are computed and stored by the Automatic Workload Repository, and are displayed on the All Metrics page. You can access the All Metrics page by clicking the All Metrics link under the Related Links heading on the Database Home page.

When you click a specific metric link, a detail page appears, with more information about the metric. Online help for this page gives you a description of the metric.

You can define warning and critical threshold values for each of these metrics. Whenever the threshold is exceeded, the Oracle server issues an alert. Alerts are displayed on the Database Home page under the Alerts heading or Related Alerts for non-database alerts.

Metrics are important for measuring the health of the database and serve as input for self-tuning and recommendations made by Oracle advisors.

Setting Metric Thresholds

The screenshot shows the Oracle Enterprise Manager interface for setting metric thresholds. The page title is "Edit Thresholds". It displays a table of metrics with columns for Select Metric, Comparison Operator, Warning Threshold, Critical Threshold, and Response Actions. An annotation box with an upward arrow points to the table, containing the text: "Specify thresholds and optional response action."

Select Metric	Comparison Operator	Warning Threshold	Critical Threshold	Response Actions
Archive Area Used (%)	>	80		
Archiver Hung Alert Log Error	Contains		ORA-	
Archiver Hung Alert Log Error Status	>	0		
Audited User	=	SYS		
Average File Read Time (centi-seconds)	>			
Average File Write Time (centi-seconds)	>			
BG Checkpoints (per second)	>			
Blocking Session Count	>	0		

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Setting Metric Thresholds

The Oracle server provides a set of predefined metrics, some of which initially have thresholds defined for them. You can alter the existing threshold settings and set thresholds for other metrics in the Edit Thresholds page.

You can set metric thresholds by performing the following steps:

1. Click the Manage Metrics link under the Related Links heading on the Database Home page. The Manage Metrics page is displayed. It displays the existing thresholds for metrics and any response actions that have been specified. You cannot edit any thresholds on this page.
2. Click Edit Thresholds. The Edit Thresholds page is displayed. You can enter new Warning Threshold and Critical Threshold values, or you can modify existing values on this page.
3. You can optionally specify a fully qualified path to a SQL script that you want executed when an alert is issued, because a threshold has been exceeded in the Response Actions field. You can also create new alerts. Click OK.
4. Select the option button in the Select column for that metric and click Manage Metric Indexes. The Manage Metric Indexes: metric_name page is displayed that enables you to add or delete specific metric threshold and response action settings.

Setting Up Notification Rules

- **Set up notification methods:**
 - Outgoing mail server
 - Sender's name
 - Sender's e-mail address
- **Specifying receiving e-mail address**
- **Select notification rules**

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Setting Up Notification Rules

You can optionally direct the Oracle Enterprise Manager Database Control to provide notification when events that require your intervention arise.

You set up an e-mail notification by performing the following steps:

1. Click the Setup link in the header or footer area of any Database Control page.
 2. Select Notification Methods on the Setup page.
 3. Enter the required information in the Mail Server region of the Notifications Methods page.
- You have set up a method of notification and now must establish rules for notification and an e-mail address to receive the notification.
4. Click the Preferences link in the header or footer region of any Database Control page.
 5. Select General on the Preferences page. Click Add Another Row in the Email Addresses region to add your e-mail address.
 6. Specify your e-mail address. Click Apply.
 7. Select Rules in the Notification region.
 8. Select the conditions for which you want to be notified. Click Apply.

Diagnosing Performance Problems

- **Performance problems are flagged by the Automatic Database Diagnostics Monitor (ADDM).**
- **ADDM performs a top-down system analysis every half hour.**
- **The findings are reported on the Enterprise Manager Database Home page.**
- **ADDM concentrates on those components and operations that are consuming the maximum database time.**
- **ADDM uses active session history and snapshot statistics captured by the Automatic Workload Repository (AWR).**

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Diagnosing Performance Problems

Database performance problems are flagged by the Automatic Database Diagnostics Monitor (ADDM). To facilitate automatic performance diagnosis using ADDM, the Oracle server periodically collects information about the database state and workload it is running. This information is gathered in the form of snapshots that are a statistical summary of the state of the system at any given point in time. These snapshots are stored in the Automatic Workload Repository (AWR) residing in the SYSAUX tablespace. The snapshots are stored in the AWR for a given amount of time and then are purged to make room for new snapshots. ADDM examines data stored in the AWR and performs analysis on a proactive basis to determine the major issues in the database.

ADDM can greatly reduce the amount of effort that is required to diagnose and tune the performance of Oracle-based systems. ADDM is the advisor for the database as a whole. It concentrates on those components and operations that are consuming the maximum database time.

Diagnosing Performance Problems (continued)

In most systems, the bulk of performance problems relate to bottlenecks that cause vast under or over utilization of resources. The ADDM can identify these bottlenecks within the Oracle server using active session history and snapshot statistics captured in the AWR. Working with other server manageability components and advisors, the ADDM can either fix a problem or make recommendations on the options available for fixing the problem.

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Viewing Performance Analysis and Responding to Findings

ADDM Analysis

Period Start Time **Nov 12, 2003 1:41:21 PM** Duration (minutes) **19.45**

Finding
PL/SQL execution consumed significant database time.

Click the link to access the Details page.

Database: orcl.us.oracle.com > Advisor Central > ADDM Task > ADDM Finding Details

ADDM Finding Details

Period Start Time **Nov 12, 2003 1:41:21 PM**
Duration (minutes) **19.45**

Finding
PL/SQL execution consumed significant database time.

Recommendations

Benefit (minutes) **18.83**
Action **Tune the PL/SQL block with SQL_ID fjxa1vp3yhtmr. Refer to the 'Tuning PL/SQL' section of the Oracle Database Performance Tuning Guide.**

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Viewing Performance Analysis and Responding to Findings

ADDM runs automatically every 60 minutes to coincide with the snapshots taken by AWR. Its output consists of a description of each problem it has identified that could not be automatically fixed, and a recommended action.

The findings are displayed in two regions on the Database Home page:

- In the ADDM Analysis region: Click the finding to access detailed information. The ADDM Finding Details page describes the finding in more detail and provides a recommended action.
- Below the Diagnostic Summary heading next to Performance Findings: Shows the number of findings if any. Clicking this link takes you to the ADDM page.

You can respond to a performance finding by clicking Finding and following the recommended actions, if any. The recommendation may include invoking an advisor.

Modifying Default ADDM Behavior

Database: orcl.us.oracle.com > Automatic Workload Repository > Edit Settings

Edit Settings

Snapshot Retention Use Time-Based Retention
Retention Period (Days)

Retain Forever

Snapshot Collection System Snapshot Interval
Interval

Turn off Snapshot Collection

Collection Level TYPICAL

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Modifying Default ADDM Behavior

ADDM behavior and analysis is based on the Automatic Workload Repository (AWR), which collects system performance statistics and stores the data in the database. After default installation, the AWR captures data every 60 minutes and purges data over seven days old. You can configure both the snapshot frequency and the data retention period. For example, you might make the snapshot interval shorter when debugging an ADDM finding.

You can view and alter the following settings on the Workload Repository page:

- The retention period for snapshots. This is initially set to 7 days.
- The interval for snapshots. The default and recommended value is 60 minutes.

You can alter the settings by performing the following steps:

1. Select Automatic Workload Repository in the Workload region on the Database Administration page.
2. Click Edit on the Automatic Workload Repository page. The Edit Settings page appears.
3. Enter a new Snapshot Retention period or new System Snapshot Interval. Click OK.

Using Advisors

- **Advisors designate a specific object for analysis**
- **Provide information and recommended action**
- **Invoked implicitly by the Oracle server or by the DBA**

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Using Advisors

Advisors are procedures that you can invoke, or the Oracle server can invoke internally, that designate a specific object for analysis. An advisor can report on a variety of aspects of the object and describe a recommended action for each condition worthy of user intervention. The advisor might report that the condition can be corrected by an automated task that it provides. It is common for ADDM, or an alert, to recommend running a specific advisor to analyze a problem in more detail.

Available Advisors

- **Performance advisors:**
 - ADDM
 - SQL Tuning Advisor
 - SQL Access Advisor
 - Memory Advisor
- **Other advisors**
 - Mean Time to Recovery (MTTR) Advisor
 - Segment Advisor
 - Undo Advisor

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Available Advisors

The following performance advisors are available:

- **Automatic Database Diagnostic Monitor (ADDM):** Advisor for the database as a whole. Its job is to perform a top down analysis of the system, identify problems and their potential causes, and to make recommendations for fixing problems. The overall goal is to reduce any bottlenecks in the system and consequently improve performance. It can potentially call other advisors.
- **SQL Tuning Advisor:** Analyzes SQL statements and makes recommendations for improving performance
- **SQL Access Advisor:** Used to tune a schema to a given SQL workload. For example, the access advisor can provide recommendations for creating indexes and materialized views for a given workload.
- **Memory Advisor:** Main advisor for system memory and is responsible for optimizing memory on the instance as a whole. You have the option of having Oracle auto-tune memory. If you choose not to have Oracle auto-tune memory, then you can invoke the SGA Advisors or the PGA Advisor to obtain optimal settings for the components and total size of the SGA or PGA.

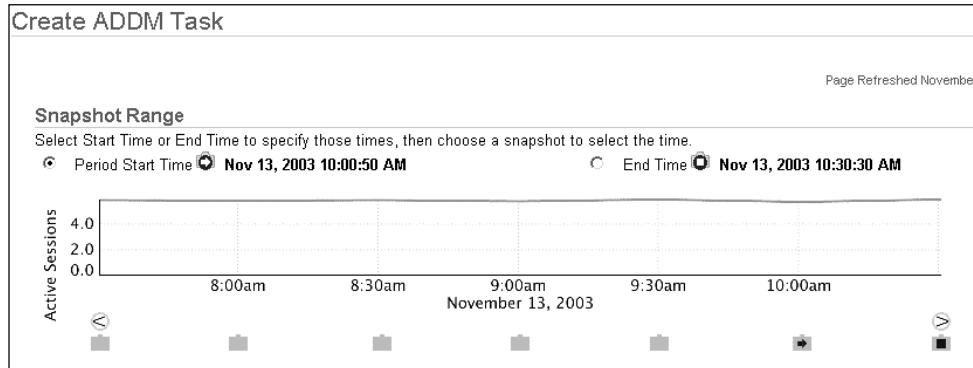
Available Advisors (continued)

Other advisors include:

- **Mean Time to Recovery (MTTR) Advisor:** Enables you to tune the mean time to recovery (MTTR) after instance failure
- **Segment Advisor:** Provides advice on whether an object is a good candidate for a shrink operation based on the level of space fragmentation within an object. The advisor also reports on the historical growth trend of segments. You can use this information for capacity planning and for arriving at an informed decision about which segments to shrink.
- **Undo Advisor:** Assists in sizing the undo tablespace by considering the statistics for system activity, the longest running query, and the low threshold value for undo retention specified in the UNDO_RETENTION initialization parameter.

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Manually Invoking ADDM



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Manually Invoking ADDM

ADDM runs every 60 minutes by default. Performance findings from the last snapshot are listed on the Database home page.

You can also invoke ADDM manually. You may need to do so for the following reasons:

- It is a recommended action associated with an alert.
- You must run it in the middle of a snapshot period .
- You must run it across multiple snapshots.

You can invoke ADDM manually by performing the following steps:

1. Click Advisor Central in the Related Links region of the Database home page.
2. Click ADDM. The Create ADDM Task page appears.
3. Increased session activity shows up as peaks in the graph. Select a start time and click OK, then choose an end time and click OK to analyze a period across multiple snapshots. The ADDM Task page appears detailing any findings.

Using the SQL Tuning Advisor

- You can use the SQL Tuning Advisor to analyze SQL statements and obtain performance recommendations
- To analyze, you can run SQL Tuning Advisor on the following sources:
 - Top SQL: Analyzes the top SQL statements currently active
 - SQL Tuning Sets: Analyzes a set of SQL statements you provide
 - Snapshots: Analyzes a snapshot
 - Baselines: Analyzes a baseline

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Using the SQL Tuning Advisor

You can use the SQL Tuning Advisor to analyze SQL statements and obtain performance recommendations. Typically, you run this advisor as an ADDM performance finding action.

Additionally, you can run the SQL tuning advisor when you want to analyze the top SQL statements consuming the most CPU time, I/O, and memory.

You can invoke the SQL Tuning Advisor by performing the following steps:

1. Click Advisor Central in the Related Links region on the Database home page.
2. Click SQL Tuning Advisor. The SQL Tuning Advisor Links page appears.
3. The advisor can be run on one of the following sources:
 - Top SQL: Analyzes the top SQL statements currently active
 - SQL Tuning Sets: Analyzes a set of SQL statements you provide
 - Snapshots: Analyzes a snapshot
 - Baselines: Analyzes a baseline
4. An example, select Top SQL. The Top SQL page appears. Select a five minute interval to analyze by dragging the shaded box over the period. Select one or more SQL statements to analyze during the selected period.

Using the SQL Tuning Advisor (continued)

5. Click Run SQL Tuning Advisor. The SQL Tuning Options page appears showing the SQL statements in the interval. Give your task a name and description, select Comprehensive as the scope, and select Immediately for start time. Click OK.
6. Navigate back to the Advisor Central page. The status of Advisor Tasks are listed under this heading in the results region. You must wait until your task status is COMPLETED. You can check the status by clicking Refresh in your browser. Select your task and click View Result. The SQL Tuning Result page appears.
7. Select the SQL statement and click View Recommendations to view recommendations.

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Using the SQL Access Advisor

- You can use the SQL Access advisor to tune your schema and improve your query performance.
- Identify a SQL workload, a representative set of SQL statements that access the schema.
- You can select your workload from the following resources:
 - Current and recent SQL activity
 - A SQL repository
 - User-defined workload such as from a development environment

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Using the SQL Access Advisor

You can use the SQL Access Advisor to tune your schema and improve your query performance. This advisor requires you to identify a SQL workload, which is a representative set of SQL statements that access the schema. You can select your workload from different sources including current and recent SQL activity, a SQL repository, or a user-defined workload such as from a development environment.

The SQL Access Advisor may make recommendations such as creating indexes or materialized views to improve your query performance for the given workload.

You can invoke the SQL Access Advisor by performing the following steps:

1. Click Advisor Central in the Related Links region on the Database home page.
2. Click SQL Access to open a wizard. The SQL Access Advisor: Workload Source page appears.
3. Specify your workload source and click Next. The SQL Access Advisor: Recommendation Options page appears.
4. Specify if you want the advisor to recommend indexes, materialized views or both.
5. Specify limited or comprehensive mode. Limited mode runs faster by concentrating on highest cost statements. Click Next. The SQL Access Advisor: Schedule page appears.

Using the SQL Access Advisor (continued)

6. Select the default of immediate execution or schedule execution for a later time. Click Next. The SQL Access Advisor: Review page appears.
7. Review the options you have selected and click Submit to submit your job.
8. Results are posted on the Advisor Central page. The SQL Access Advisor recommendations are ordered by cost benefit. For example, a recommendation might consist of a SQL script with one or more CREATE INDEX statements, which you can implement by clicking Schedule Implementation.

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Using the Memory Advisor

The Memory Advisor:

- **Helps you tune the size of your memory structures**
- **Comprises three advisors that give you recommendations on the following memory structures:**
 - **Shared pool in the System Global Area (SGA)**
 - **Buffer cache in the SGA**
 - **Program Global Area (PGA)**

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Using the Memory Advisor

The Memory Advisor helps you tune the size of your memory structures. You can use this advisor only when automatic memory tuning is disabled.

The Memory Advisor comprises three advisors that give you recommendations on the following memory structures:

- Shared pool in the System Global Area (SGA)
- Buffer cache in the SGA
- Program Global Area (PGA)

You can invoke the Memory Advisors by performing the following steps:

1. Click Advisor Central in the Related Links region on the Database home page.
2. Click Memory Advisor on the Advisor Central page. The Memory Parameters page appears. This page provides a breakdown of memory usage for the SGA.
Note: The Automatic Shared Memory Management setting should be disabled in order to run the advisor.
3. Click Advice next to the Shared Pool value or Buffer Cache value to invoke the respective advisors.
4. Click PGA to access the PGA property page. Click Advice to invoke the PGA Advisor.

Summary

In this lesson, you should have learned how to:

- **Describe the Oracle Self-Monitoring architecture**
- **Invoke ADDM**
- **Use the following performance advisors to optimize database performance:**
 - **SQL Tuning**
 - **SQL Access**
 - **Memory**

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Practice Overview

This practice covers the following topics:

- **Setting up notification rules**
- **Setting metric thresholds**
- **Responding to alerts**
- **Using the advisors**

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Practices

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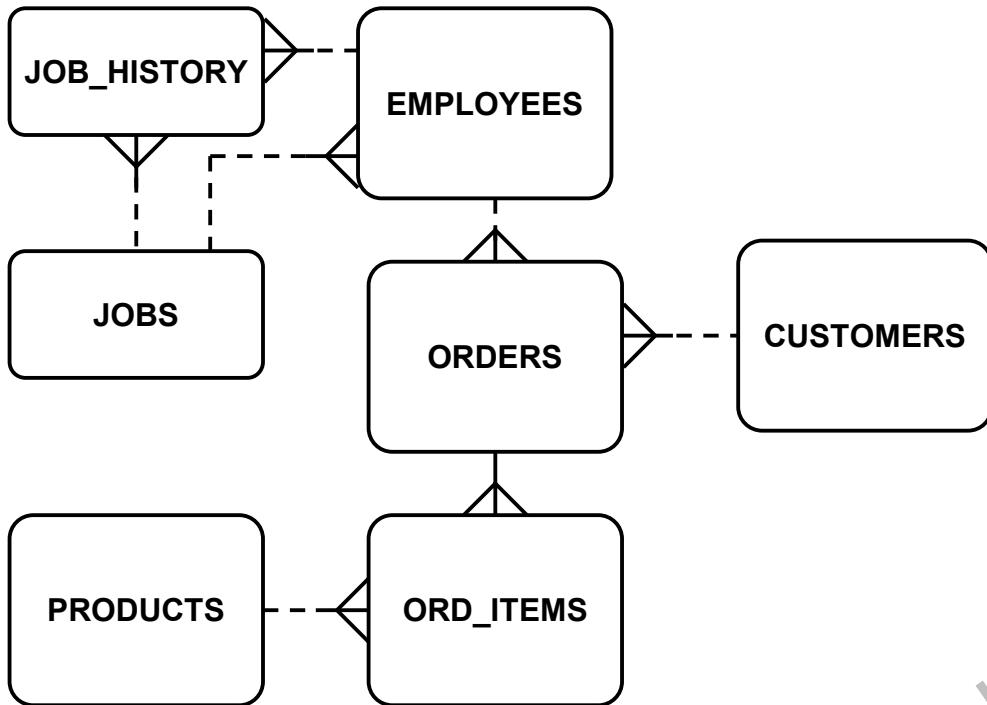
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Overview of Course Practices

As you work through the practices in this course, keep the following scenario in mind:

- You are a consultant responsible for installing the Oracle software and creating a database to manage the business of a flower shop.
- **Note:** This part of the database does not include all the financial information that is necessary to run a business. The financial applications are part of a package. The practices focus only on the flower shop business part of the database.
- The flower shop currently has five employees: the owner, a sales person, two flower arrangers, and one delivery person. The database must keep track of the employees and what job each holds.
- The owner hopes to expand and open additional shops in the future.
- Flowers, flower arrangements, and containers (pots, vases, and so on) are sold from the shop. Orders can be placed in person or over the telephone. In addition, orders are received from other flower services such as FTD. In the future, the flower shop intends to support online ordering.
- Flowers are sold separately or as part of an arrangement. Mixed bunches are available for someone to pick up from the store. A few flower arrangements are made in advance and available on a walk-in basis. Most flower arrangements are ordered in advance.
- Flowers are picked up at the shop or delivered by the delivery person. The database needs to track how the flowers are delivered.
- The shop will advertise in the newspaper and phone books, and send mailings, which may include a coupon in a bulk coupon mailing packet.
- The owner would like to track the reason why a customer purchases flowers (special occasion, hospital stay, funeral, and so on). This would help in future advertising.

Flower Shop Entity Relationship Diagram



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Flower Shop Database Entity Relationship Diagram

The diagram in the slide provides the names of the tables that comprise the Flower Shop database, and describes the relationships that exist between the tables. The table descriptions are provided on the following page. You will create some of these tables during the course practices.

Flower Shop Database Table Descriptions

CUSTOMERS

CUSTOMER_ID	NUMBER(6)
CUST_FIRST_NAME	VARCHAR2(20)
CUST_LAST_NAME	VARCHAR2(20)
STREET_ADDRESS	VARCHAR2(40)
CITY	VARCHAR2(30)
STATE	VARCHAR2(10)
POSTAL_CODE	VARCHAR2(10)
PHONE_NUMBER	VARCHAR2(20)

EMPLOYEES

EMPLOYEE_ID	NUMBER(6)
FIRST_NAME	VARCHAR2(20)
LAST_NAME	VARCHAR2(25)
EMAIL_ADDRESS	VARCHAR2(25)
PHONE_NUMBER	VARCHAR2(20)
HIRE_DATE	DATE
JOB_ID	VARCHAR2(10)
SALARY	NUMBER(8)
MANAGER_ID	NUMBER(6)

JOBS

JOB_ID	VARCHAR2(10)
JOB_TITLE	VARCHAR2(35)
MIN_SALARY	NUMBER(6)
MAX_SALARY	NUMBER(6)

JOB_HISTORY

EMPLOYEE_ID	NUMBER(6)
START_DATE	DATE
END_DATE	DATE
JOB_ID	VARCHAR2(10)

Flower Shop Database Table Descriptions (continued)

ORDERS

ORDER_ID	NUMBER(12)
ORDER_DATE	DATE
ORDER_MODE	VARCHAR2(8)
CUSTOMER_ID	NUMBER(6)
DELIVERY_MODE	VARCHAR2(8)
ORDER_STATUS	NUMBER(2)
SALES_CLERK_ID	NUMBER(6)
ORDER_TOTAL	NUMBER(8,2)

ORD_ITEMS

ORDER_ID	NUMBER(12)
PRODUCT_ID	NUMBER(6)
UNIT_PRICE	NUMBER(8)
QUANTITY	NUMBER(8)

PRODUCTS

PRODUCT_ID	NUMBER(6)
PRODUCT_NAME	VARCHAR2(50)
PRODUCT_DESC	VARCHAR2(200)
CATEGORY	NUMBER(2)
SUPPLIER_ID	NUMBER(6)
LIST_PRICE	NUMBER(8,2)
MIN_PRICE	NUMBER(8,2)
QTY_ON_HAND	NUMBER(8)

Practice 2: Installing Oracle Software and Creating the Database

In this practice, you will install the Oracle software and create a database for your flower shop application. The installation software has been staged in a directory on your student PC. Your instructor will provide the directory location.

1. Open a terminal window and log on to your PC as the `oracle` user, specifying the password of `oracle`.
2. Navigate to the installation software directory and invoke the Oracle Universal Installer (OUI).
3. Install the Oracle software and create a General Purpose database to support your flower shop database and application.
 - a. Name the ORACLE_HOME `ora10g`. Accept the default path.
 - b. Name the database `orcl`. Use the Western European WE8ISO8859P1characterset.
 - c. Do not enable Email notifications.
 - d. Make the SYS, DBSNMP, SYSMAN, and SYSTEM passwords `oracle`.
 - e. Make a note of the URLs for Enterprise Manager and *i*SQL*Plus.

Question: What determined the default path that the OUI selected as the location to install the software?

Question: How can you see what environment variables have been set for your user?

Practice 3: Using Oracle Enterprise Manager Database Control

In the flower shop, Enterprise Manager will be used to manage the database. In this practice, you will verify that the dbconsole process is started and log in to Enterprise Manager Database Control.

1. Open a terminal window and log on to your PC as the oracle user.
2. Verify that the Enterprise Manager dbconsole process is started.
3. If the dbconsole process is not started, start the process.
4. Invoke Enterprise Manager Database Control and log in as user SYS with a SYSDBA connection.
5. Set preferred credentials for your host and database.
6. Explore your database by viewing the Performance, Administration, and Maintenance property pages.

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Practice 4: Configuring the Oracle Network Environment

In this practice, you will verify that the listener is started. You will also configure local naming to access another database.

1. Log in to Enterprise Manager Database Control as the SYS user with a SYSDBA connection.
2. Verify that the listener is started.
3. In the flower shop, there will be multiple computers that use the application and access the database. Work with another group in your classroom to simulate this requirement. Configure local naming so that you can access the other group's database.
4. Test your new network service name.

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Practice 5: Managing the Oracle Instance

In this practice, you will use Enterprise Manager to shut down and restart your instance. In addition, you will explore the initialization parameters in your database and become familiar with the alert log and trace files.

1. Log in to Database Control as the SYS user with a SYSDBA connection.
2. Shut down your instance.

Question: What are the advanced shutdown options used for?

3. Restart your instance.
4. View the alert log to see what information was recorded when you restarted your instance.
5. Access the Memory Parameters page to view the values for the memory parameters.
6. View the initialization parameters that have been set for your database.
7. Change the OPEN_CURSORS initialization parameter to 310.

Question: What is the significance of a check in the Dynamic column for the OPEN_CURSORS parameter?

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Practice 6: Managing Database Storage Structures

In this practice, you will use Enterprise Manager to manage the storage structures of your database. You will verify whether the control file has been multiplexed and multiplex the redo log groups. Finally, you will create new tablespaces for tables and other objects in your flower shop database.

1. Log in to Database Control as the SYS user with a SYSDBA connection.
2. Access the Administration page and click the Controlfiles link in the Storage section.
Verify whether the control files in your database have been multiplexed.

Question: Control files are multiplexed to decrease the chance of losing all control files from a single failure. What would you do in a production system to improve the control file multiplexing shown above?

3. Return to the Administration page and click the Redo Log Groups link.

Question: How could you improve the current configuration to make your system more reliable?

4. Multiplex the redo log files in your database to protect against loss.
5. Click Redo Log Groups. Verify that group 1 now has two members.
6. Repeat step 4 for the remaining two log groups. For group 2, use a file name of `redo02_02.log`. For group 3, use a file name of `redo03_02.log`.
7. Your flower shop database requires two tablespaces. One tablespace will be used to store tables and the other tablespace will be used for indexes. Create a locally managed tablespace named `FSDATA`. The datafile for this tablespace should be named `flowers_data.dbf` and should be stored in the `/u01/app/oracle/oradata` directory. Enable Autoextend in 100 MB increments with a maximum size of 1 GB.
8. Repeat step 7 to create a locally managed tablespace named `FSIDX`. The datafile for this tablespace should be named `flowers_indx.dbf`. All other settings should be the same as the `FSDATA` tablespace.

Question: Why did you select “Automatically extend datafile when full?”

Practice 7: Administering Users and Security

In this practice, you will use Enterprise Manager to create a role and two users.

1. Log in to the Database Control as the SYS user with a SYSDBA connection.
2. Create the flower shop owner user with the following characteristics:

 Username: FSOWNER

 Password: FSOWNER

 Temporary tablespace: TEMP

 Default tablespace: FSDATA

 Status: Unlocked

3. Grant the CREATE SESSION and CREATE TABLE system privileges to the flower shop owner.
4. Grant unlimited quota on the FSDATA and FSINDEX tablespaces to the flower shop owner.
5. Grant Enterprise Manager administrative privileges to the FSOWNER user.

Hint: For more information about this task, refer to the lesson titled “Using Oracle Enterprise Manager Database Control.”

6. Create a role for the flower shop retail clerk named FSCLERK with the CREATE SESSION privilege:

Note: After you create tables and other objects in the next lesson, you will grant object privileges to this role.

7. Create the first flower shop retail clerk with the following characteristics:

 Username: FSCLERK1

 Password: FSCLERK1

 Default tablespace: FSDATA

 Temporary tablespace: TEMP

 Status: Unlocked

8. Grant the FSCLERK role to the FSCLERK1 user.

Question: Why does FSCLERK1 already have the CONNECT role?

Practice 8: Managing Schema Objects

In this practice, you will use Enterprise Manager to define tables and indexes that are part of the flower shop database. You will also grant privileges to the FSCLERK role to access the newly created tables.

1. Log in to Database Control as the FSOWNER user with a Normal connection.
2. Click Tables in the Schema section of the Administration properties page.
3. Create the EMPLOYEES table in the FSDATA tablespace. Enter column specifications as shown below. Define a PRIMARY KEY constraint on the EMPLOYEE_ID column.

EMPLOYEE_ID	NUMBER(6)	HIRE_DATE	DATE
FIRST_NAME	VARCHAR2(20)	JOB_ID	VARCHAR2(10)
LAST_NAME	VARCHAR2(25)	SALARY	NUMBER(8)
EMAIL_ADDRESS	VARCHAR2(25)	MANAGER_ID	NUMBER(6)
PHONE_NUMBER	VARCHAR2(20)		

4. Create the CUSTOMERS table in the FSDATA tablespace with column definitions as shown below. Define a PRIMARY KEY constraint on the CUSTOMER_ID column.

CUSTOMER_ID	NUMBER(6)	CITY	VARCHAR2(30)
CUST_FIRST_NAME	VARCHAR2(20)	STATE	VARCHAR2(10)
CUST_LAST_NAME	VARCHAR2(20)	POSTAL_CODE	VARCHAR2(10)
STREET_ADDRESS	VARCHAR2(40)	PHONE_NUMBER	VARCHAR2(20)

5. Create the ORDERS table in the FSDATA tablespace with column definitions as shown below. Define a PRIMARY KEY constraint on the ORDER_ID column.

ORDER_ID	NUMBER(12)	DELIVERY_MODE	VARCHAR2(8)
ORDER_DATE	DATE	ORDER_STATUS	NUMBER(2)
ORDER_MODE	VARCHAR2(8)	SALES_CLERK_ID	NUMBER(6)
CUSTOMER_ID	NUMBER(6)	ORDER_TOTAL	NUMBER(8 , 2)

6. Define referential constraints between the SALES_CLERK_ID column of the ORDERS table and the EMPLOYEE_ID column of the EMPLOYEES table.
7. Define referential constraints between the CUSTOMER_ID column of the ORDERS table and the CUSTOMER_ID column of the CUSTOMERS table.
8. Create a standard index on the CUSTOMER_ID column in the ORDERS table so that you can quickly access all orders for a specified customer. The index should be stored in the FSINDEX tablespace.

Practice 8: Managing Schema Objects (continued)

9. Grant object privileges to SELECT from the CUSTOMERS and ORDERS table to the FSCLERK role.
10. Using Enterprise Manager, load data into the CUSTOMERS table using the /home/oracle/labs/load_cust.ctl file as your control file.
11. Using Enterprise Manager, load data into the EMPLOYEES table using the /home/oracle/labs/load_emp.ctl file as your control file.
12. Using Enterprise Manager, load data into the ORDERS table using the /home/oracle/labs/load_ord.ctl file as your control file.

Question: The order in which the tables were loaded was important. Why did the ORDERS table have to be loaded last?

13. View the data in the ORDERS table to ensure that the loading has completed successfully.

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Practice 9-1: Performing Backup and Recovery

In this practice, you will use Enterprise Manager to back up your database and perform recovery of the whole database.

1. Log in to Database Control as the SYS user with a SYSDBA connection.
2. Place your database in ARCHIVELOG mode. Place archived logs in the flash recovery area.
3. Configure backup settings so that:
 - a. Parallelism is 1
 - b. Backups are placed in the flash recovery area
 - c. The controlfile and SPFILE are automatically backed up to the flash recovery area
4. Create an online, full back up of the whole database.
5. Verify whether your backup has completed successfully.
6. Shut down your instance and cause a failure in your database by deleting a datafile belonging to the FSDATA tablespace.
7. Attempt to restart your database.

Question: Why did the preferred credentials not appear when you tried to restart your instance?

8. Recover your database.
9. Start your database.

Practice 9-2: Performing Flashback Table and Flashback Drop

In this practice, you will enable row movement on tables in your database. You will then use Flashback Table and Flashback Drop.

1. Log in to Database Control as the FSOWNER user with a Normal connection.
2. Enable row movement for the FSOWNER.CUSTOMERS table.
3. Enable row movement for the FSOWNER.EMPLOYEES table.
4. Enable row movement for the FSOWNER.ORDERS table.
5. View the system time and contents of the FSOWNER.ORDERS table by using iSQL*Plus.

```
SQL> SELECT * FROM fsowner.orders;
...
16 rows selected.
SQL> SELECT systimestamp FROM dual;
SYSTIMESTAMP
-----
19-DEC-03 01.32.32.037700 AM -07:00
```

Record your system time: _____

6. Simulate user error by deleting all of the rows in FSOWNER.ORDERS table. View the contents to verify your change.

```
SQL> DELETE FROM fsowner.orders;
16 rows deleted.
SQL> COMMIT;
Commit complete.
SQL> SELECT * FROM fsowner.orders;
no rows select
```

7. Use the Flashback Table feature to restore the contents of your ORDERS table.
8. Verify whether the deleted data was restored to the FSOWNER.ORDERS table. Note the system time.

```
SQL> SELECT * FROM fsowner.orders;
...
16 rows selected.
SQL> SELECT systimestamp FROM dual;
SYSTIMESTAMP
-----
19-DEC-03 01.32.32.037700 AM -07:00
```

Record your system time: _____

9. Delete the FSOWNER.ORDERS table and verify your change.
10. Use the Flashback Drop feature to recover your ORDERS table.
11. Verify whether the dropped table was restored.

Practice 10: Monitoring the Database and Using the Advisors

In this practice, you will use Enterprise Manager to define notification rules and metric thresholds. You want to ensure that you are notified when your FSDATA tablespace is 80% full.

1. Log in to Database Control as the SYS user with a SYSDBA connection.
2. Modify the Tablespace Space Used (%) metric for the FSDATA tablespace to give a warning alert at 80% full, a critical alert at 90% full.
3. Set the notification rules so that you will be notified by e-mail when your tablespace usage exceeds the threshold you have specified.
4. Configure an address to receive e-mail notifications.
5. Simulate a table that has grown excessively by manually extending the FSOWNER.EMPLOYEES table.
 - a. Open a terminal window.
 - b. Connect to the database as FSOWNER using *iSQL*Plus*.
sqlplus fsowner/fsowner
 - c. Manually extend the EMPLOYEES table thrice.
SQL> ALTER TABLE fsowner.employees ALLOCATE EXTENT;
Table altered.
SQL> /
Table altered.
SQL> /
Table altered.

Note: Each time this SQL command was executed the table grew by an additional 64K. In a production database, segments can possess unnecessary space naturally when a table has grown and rows have been deleted.

6. Use the Segment Advisor to determine if you need to make any modifications to objects in the FSDATA and FSINDEX tablespaces.

B

Practice Solutions

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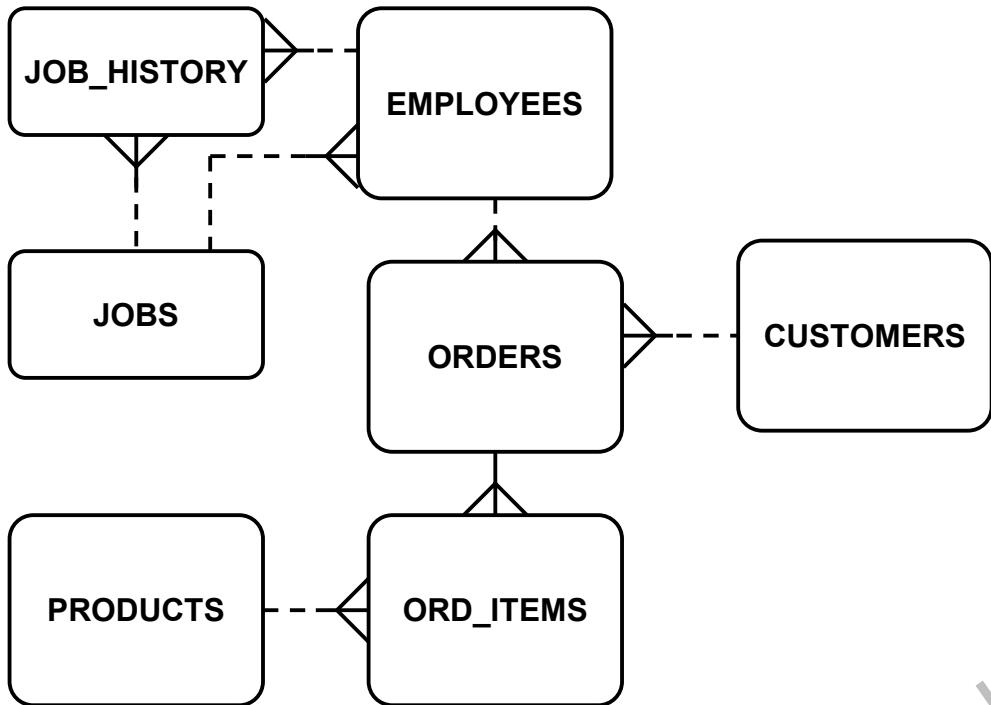
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As you work through the practices in this course, keep the following scenario in mind:

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- **Note:** This part of the database does not include all the financial information that is necessary to run a business. The financial applications are part of a package. The practices focus only on the flower shop business part of the database.
- The flower shop currently has five employees: the owner, a sales person, two flower arrangers, and one delivery person. The database must keep track of the employees and what job each holds.
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Flower Shop Entity Relationship Diagram



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Flower Shop Database Entity Relationship Diagram

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Flower Shop Database Table Descriptions

CUSTOMERS

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CUST_FIRST_NAME	VARCHAR2(20)
CUST_LAST_NAME	VARCHAR2(20)
STREET_ADDRESS	VARCHAR2(40)
CITY	VARCHAR2(30)
STATE	VARCHAR2(10)
POSTAL_CODE	VARCHAR2(10)
PHONE_NUMBER	VARCHAR2(20)

EMPLOYEES

EMPLOYEE_ID	NUMBER(6)
FIRST_NAME	VARCHAR2(20)
LAST_NAME	VARCHAR2(25)
EMAIL_ADDRESS	VARCHAR2(25)
PHONE_NUMBER	VARCHAR2(20)
HIRE_DATE	DATE
JOB_ID	VARCHAR2(10)
SALARY	NUMBER(8)
MANAGER_ID	NUMBER(6)

JOBS

JOB_ID	VARCHAR2(10)
JOB_TITLE	VARCHAR2(35)
MIN_SALARY	NUMBER(6)
MAX_SALARY	NUMBER(6)

JOB_HISTORY

EMPLOYEE_ID	NUMBER(6)
START_DATE	DATE
END_DATE	DATE
JOB_ID	VARCHAR2(10)

Flower Shop Database Table Descriptions (continued)

ORDERS

ORDER_ID	NUMBER(12)
ORDER_DATE	DATE
ORDER_MODE	VARCHAR2(8)
CUSTOMER_ID	NUMBER(6)
DELIVERY_MODE	VARCHAR2(8)
ORDER_STATUS	NUMBER(2)
SALES_CLERK_ID	NUMBER(6)
ORDER_TOTAL	NUMBER(8,2)

ORD_ITEMS

ORDER_ID	NUMBER(12)
PRODUCT_ID	NUMBER(6)
UNIT_PRICE	NUMBER(8)
QUANTITY	NUMBER(8)

PRODUCTS

PRODUCT_ID	NUMBER(6)
PRODUCT_NAME	VARCHAR2(50)
PRODUCT_DESC	VARCHAR2(200)
CATEGORY	NUMBER(2)
SUPPLIER_ID	NUMBER(6)
LIST_PRICE	NUMBER(8,2)
MIN_PRICE	NUMBER(8,2)
QTY_ON_HAND	NUMBER(8)

Practice 2: Installing Oracle Software and Creating the Database

In this practice, you will install the Oracle software and create a database for your flower shop application. The installation software has been staged in a directory on your student PC. Your instructor will provide the directory location.

1. Open a terminal window and log on to your PC as the `oracle` user, specifying the password of `oracle`.
2. Navigate to the installation software directory and invoke the Oracle Universal Installer (OUI) by executing the `./runInstaller` command.
Note: When installing Oracle software from a removable media, such as a CD or a DVD, you should not run the OUI from a directory on the removable media or you may be unable to change disks without aborting the installation process.
3. Install the Oracle software and create a General Purpose database to support your flower shop database and application.
 - a. Click Next on the Welcome page.
 - b. Specify inventory directory and credentials. Accept the default inventory directory. When prompted to specify the operating system group name that will have permission to install the software, accept the default group of `oinstall`. Click Next.
 - c. When prompted, open a separate terminal window as the `root` user, and run the `orainstRoot.sh` script.

```
home/oracle> su -  
Password:  
/root> /u01/app/oracle/orainventory/orainstRoot.sh  
Creating the Oracle inventory pointer file  
(/etc/oraInst.loc)  
Changing the groupname of /u01/app/oracle/orainventory to  
oinstall.  
/root>
```

- d. Leave the `root` user's terminal window open for later use and return to the window that directed you to run the `orainstRoot.sh` script. Click continue.
- e. Specify file locations. Enter the `ORACLE_HOME` location where the Oracle Database 10g software will be installed. Accept the default destination name of `OraDb10g_home1` and the default path. Click Next.

Question: What determined the default path that the OUI selected as the location to install the software?

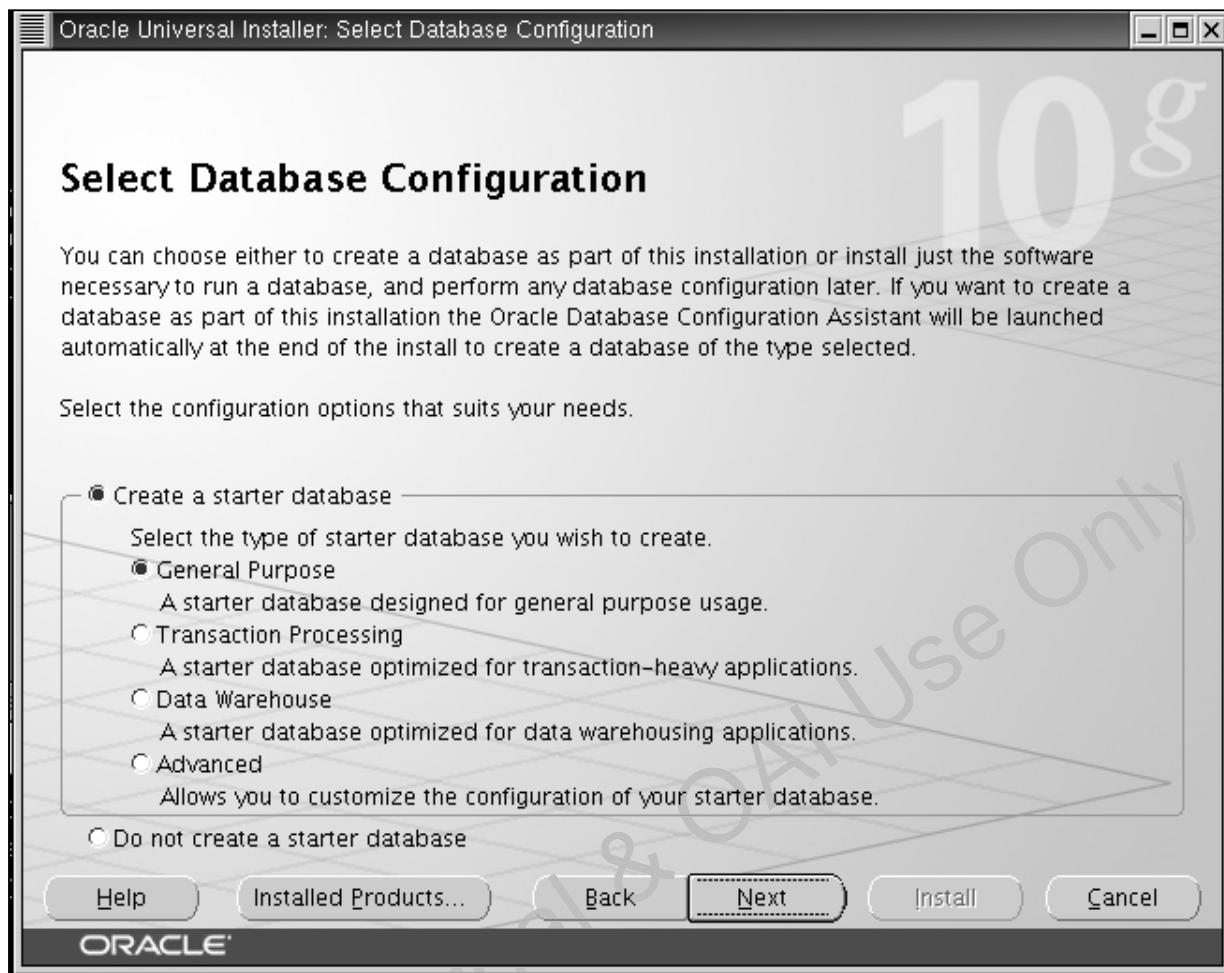
Answer: The `ORACLE_HOME` environment variable, which was set to that path during the setting up of the operating system.

Question: How can you see what environment variables have been set for your user?

Answer: In a UNIX or Linux environment, the `env` command with no arguments returns a list of all environment variables and their values. In a Windows environment, use the `set` command.

Practice 2: Installing Oracle Software and Creating the Database (continued)

- f. Select an installation type. Choose Enterprise Edition and click Next.
- g. The installer will now verify that your system meets all the minimum requirements for installing and configuring the chosen products. Correct any reported problems before continuing. Click Next.
- h. Select a database configuration by choosing the General Purpose database, and click Next.

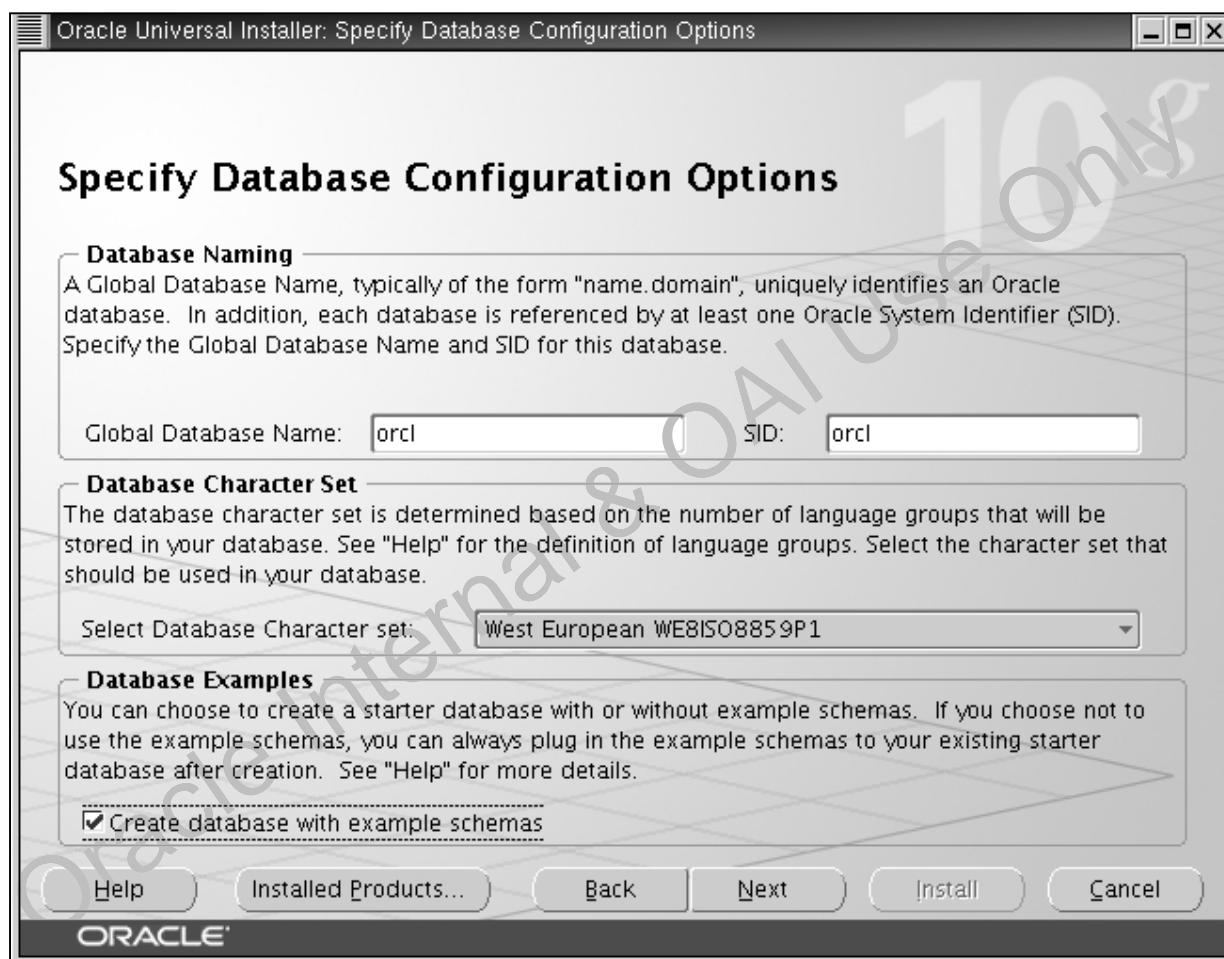


- i. Specify database configuration options as follows:
Global Database Name: orcl
SID: orcl
Database Character Set: Western European WE8ISO8859P1

Select "Create database with sample schemas"
Click next.

Practice 2: Installing Oracle Software and Creating the Database (continued)

- j. Select the database management option. Choose Use Database Control for Database Management. Do not select "Enable Email notifications." Click Next.
- k. Specify your database's file storage option. Choose File System. Accept the default database file location /u01/app/oracle/oradata/. Click Next.
- l. Specify backup and recovery options. Select "Do not enable automated backups." Click Next.
- m. Specify database schema passwords. Use the same password for all the accounts. Enter the password (for this training environment choose *oracle* as the password), and then confirm the password by reentering it. Click Next.
Note: This is the password for the database administrative users. In a production environment, this should be a more secure password with at least eight characters and containing at least one number.
- n. Summary. The Summary window presents an overview of the choices that you have made so far in the installation process. After you have reviewed the information, click Install to proceed with the installation. This step takes some time. (The actual speed depends on the server on which you are installing the software.)



Practice 2: Installing Oracle Software and Creating the Database (continued)

- o. The Configuration Assistants will now execute. The Oracle Net Configuration Assistant does not require any user input. The Database Configuration Assistant (DBCA) will begin automatically after the Oracle Net Configuration Assistant finishes.
- p. After the DBCA has completed, a Summary window is displayed that contains the URL for Enterprise Manager Database Control. Note this URL because you will be using Database Control throughout the rest of this course. Click OK to continue the installation process.



- q. A window appears prompting you to run a script as root. Return to the terminal window where you ran the `orainstRoot.sh` script and run `/u01/app/oracle/product/10.1.0/db_1/root.sh`. The script will prompt you for the full path name of the local bin directory. Enter `/usr/local/bin`. When this script executes, it is normal to see error messages as the script checks several file storage options including the Oracle Cluster File System. These error messages can be safely ignored. Return to the window that prompted you to run `root.sh` and click OK to complete the installation.
- r. When the End of Installation window appears, note the port number for iSQL*Plus. You will need this port number later in the course. Click Exit. Click Yes.

Note: The port information is also available in the `portlist.ini` file:

```
/home/oracle> cat $ORACLE_HOME/install/portlist.ini
Ultra Search HTTP port number =5620
iSQL*Plus HTTP port number =5560
Enterprise Manager Agent Port =
Enterprise Manager Console HTTP Port (orcl) = 5500
Enterprise Manager Agent Port (orcl) = 1830
```

Practice 3: Using Oracle Enterprise Manager Database Control

In the flower shop, Enterprise Manager will be used to manage the database. In this practice, you will verify that the dbconsole process is started and log in to Enterprise Manager Database Control.

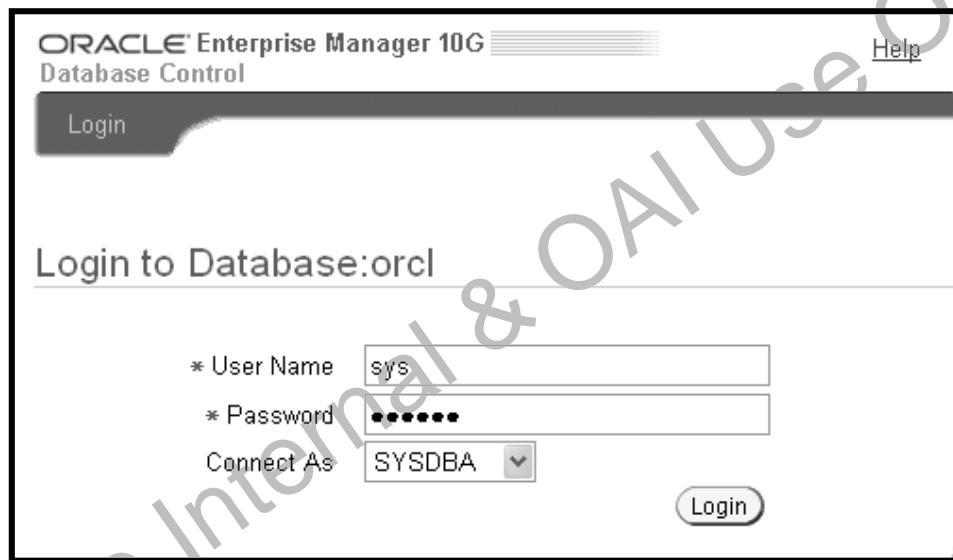
1. Open a terminal window and log on to your PC as the oracle user.
2. Verify that the Enterprise Manager dbconsole process is started by using the emctl utility to check the status.

```
/home/oracle> emctl status dbconsole
TZ set to US/Mountain
Oracle Enterprise Manager 10g Database Control Release
10.1.0.2.0
Copyright (c) 1996, 2003 Oracle Corporation. All rights
reserved.
http://localhost:5500/em/console/aboutApplication
Oracle Enterprise Manager 10g is running.

-----
Logs are generated in directory
/u01/app/oracle/product/10.1.0/orcl/sysman/log
```

3. If the dbconsole process is not started, use the emctl utility to start the process.

```
/home/oracle> emctl start dbconsole
```
4. Invoke Enterprise Manager Database Control by opening your browser and entering the following URL: <http://hostname:portnumber/em>
Log in to the database as the SYS user and specify SYSDBA.



5. When Database Control needs to call a host operating system command, it must authenticate to the operating system. It is possible to save the host username and password, so that they do not have to be entered for each command by setting preferred credentials.

Practice 3: Using Oracle Enterprise Manager Database Control (continued)

Set preferred credentials for your host as follows:

- a. Click Preferences in the links at the top right of the Database Control page.
- b. Click Preferred Credentials in the menu on the right side of the Preferences property page.

The screenshot shows the 'Preferences' window with the 'Preferred Credentials' tab selected. On the left, there's a sidebar with 'General', 'Preferred Credentials' (which is bolded), 'Notification Rules', and 'Schedule'. The main area is titled 'Preferred Credentials' with the sub-instruction: 'You can use preferred credentials to simplify access to targets that you manage. If a target has preferred credentials set, applications that login to that target will automatically use the preferred credentials.' Below this is a table with three rows: Database (1 total, 0 set), Host (1 total, 0 set), and Listener (1 total, 0 set). Each row has a 'Set Credentials' icon (a person icon inside a square).

Target Type	Total Targets	Targets with Credentials Set	Set Credentials
Database	1	0	[Icon]
Host	1	0	[Icon]
Listener	1	0	[Icon]

- c. Click the Set Credentials icon for the host target.

The screenshot shows the 'Host Preferred Credentials' page under 'Preferred Credentials > Host Preferred Credentials'. It includes a 'TIP' note: 'To set preferred credentials for Host targets, update the appropriate fields in one of the tables below. To delete credentials, clear the appropriate fields. Press Apply after making any changes.' A 'TIP' note says: 'Normal credentials are used by Enterprise Manager functions that need operating system access but do not require administrator privileges. Privileged credentials are used by functions that do need administrator privileges. Database functions and jobs that require host credentials do not use the credentials set on this page; they instead use database-specific host credentials set on the Database Preferred Credentials page.' Below is a 'Target Credentials' table for a host target named 'c640.lowenthal.com'. The table has columns: Name, Normal Username, Normal Password, Privileged Username, Privileged Password, and Test. The 'Normal Username' and 'Normal Password' fields contain 'oracle' and '*****' respectively. The 'Privileged Username' and 'Privileged Password' fields also contain 'oracle' and '*****'. The 'Test' button is labeled 'Test'.

Name ▲	Normal Username	Normal Password	Privileged Username	Privileged Password	Test
c640.lowenthal.com	oracle	*****	oracle	*****	Test

- d. Enter the operating system username **oracle** and password **oracle** for normal and privileged operations. Validate the entries by clicking **Test**.
- e. When the test completes successfully, store the credentials by clicking **Apply**.

Practice 4: Configuring the Oracle Network Environment

In this practice, you will verify that the listener is started. You will also configure local naming to access another database.

1. Invoke Enterprise Manager Database Control by opening your browser and entering the following URL: `http://hostname:portnumber/em`
Log in to the database as the SYS user.
2. Click the Listener from the Database home page to verify that the listener is started.

The screenshot shows the 'Listener: LISTENER' page in Oracle Enterprise Manager. At the top, there are tabs for 'Home' and 'Serviced Databases'. The 'Home' tab is selected. To the right, it says 'Page Refreshed Dec 14, 2003 2:06:51 AM' with a refresh icon. Below the tabs, there are two main sections: 'General' and 'State'. The 'General' section contains the following details:

- Status: Up
- Availability (%): 100 (Last 24 Hours)
- Alias: LISTENER
- Version: 10.1.0.2.0
- Oracle Home: /u01/app/oracle/product/10.1.0
- Net Address: (ADDRESS=(PROTOCOL=TCP)(HOST=c640)(PORT=1521))
- LISTENER.ORA Location: /u01/app/oracle/product/10.1.0/network/admin
- Start Time: Dec 13, 2003 1:56:37 AM
- Host: c640

Below the 'General' section are two buttons: 'Edit' and 'Stop'. The 'State' section displays the following metrics:

Metric	Value
TNS Ping (ms)	0
Established	4
Connections per minute	4
Refused	0
Connections per minute	0

3. In the flower shop, there will be multiple computers that use the application and access the database. Work with another group in your classroom to simulate this requirement. Configure local naming so that you can access the other group's database.
 - a. Click Net Services Administration from the related links at the bottom of the Listener status page.
 - b. Select Local Naming from the Administer drop-down list and click Go.
 - c. Notice that the preferred credentials you entered in practice 3 are automatically retrieved for the host login page. Click Login.
 - d. Click Create to enter a new network service name.
 - Enter `testorcl` for the Net Service Name.
 - Select User Service Name and enter `orcl` for the service name.
 - Select Database Default.

Practice 4: Configuring the Oracle Network Environment (continued)

- e. Click Add in the Addresses region.

Create Net Service Name

General Advanced

* Net Service Name testorcl

Database Information

To identify the database or service, you must provide either its service name (recommended) or the Oracle System Identifier (SID). The service name is normally its global database name, a name comprising the database name and domain name.

Use Service Name
Service Name orcl

Use SID
SID

Choose if you want a shared or dedicated server database connection.

Database Default
Requests will be served by whatever database default is.

Cancel OK

Add Address

Protocol TCP/IP

* Port 1521

* Host <hostname of your partners server>
The host name or IP address of the computer.

Cancel OK

- Select the TCP/IP protocol.
 - Enter 1521 for the listener port.
 - Enter the host name or IP address for your partner's computer.
 - Click OK to return to the Create Net Service Name property page. Click OK.
4. Test the new network service name.
 - a. Select the testorcl service.
 - b. Click Test Connection.
 - c. Enter the password of oracle for dbsnmp and click Test.

Test Result

The test was successful. See log for details.

- d. Click OK.

Practice 5: Managing the Oracle Instance

In this practice, you will use Enterprise Manager to shut down and restart your instance. In addition, you will explore the initialization parameters in your database and become familiar with the alert log and trace files.

1. Log in to Database Control as the SYS user with a SYSDBA connection.

Login to Database:orcl

* User Name	sys
* Password	*****
Connect As	SYSDBA

2. Shut down your instance.
 - a. Click Shutdown.
 - b. Enter host operating system credentials: username: oracle, password: oracle.
 - c. Enter database credentials: username: sys, password: <the password you gave SYS when you created the database>.

Startup/Shutdown:Specify Host and Target Database Credentials

Specify the following credentials in order to change the status of the database.

Host Credentials

Specify the OS user name and password to login to target database machine.

* Username	oracle
* Password	*****

Database Credentials

Specify the credentials for the target database.

To use OS authentication, leave the user name and password fields blank.

* Username	sys
* Password	*****
Database	orcl
* Connect As	SYSDBA

Save as Preferred Credential

Note that you need to login to the database as SYSDBA or SYSOPER in order to change the status of the database.

Practice 5: Managing the Oracle Instance (continued)

- d. Click OK, and then click Yes.

Question: What are the advanced options used for?

Answer: Using any shutdown options other than the immediate option.



3. Restart your instance.
 - a. Exit Database Control, wait about two minutes, and then reopen Database Control.
 - b. Click Startup.
4. View the alert log to see what information was recorded when you restarted your instance.
 - a. Log in to Database Control.
 - b. Click Alert Log Content in the Related Links region at the bottom of the home page.
 - c. Move to the end of the log. Find:
 - The time the database was opened
 - The location where background trace files will be written
(BACKGROUND_DUMP_DEST)
 - d. - The version of the database
5. Access the Memory Parameters page to view the values for the memory parameters.
 - a. Navigate to the Administration property page.
 - b. Click Memory Parameters.

Practice 5: Managing the Oracle Instance (continued)

Question: How could you change the maximum SGA size?

Answer: Enter a new maximum, click “Apply changes to SPFILE only,” and apply. The change will take effect the next time you restart the instance.

6. View the initialization parameters that have been set for your database.
 - a. Navigate to the Administration property page.
 - b. Click All Initialization Parameters.
7. Change the OPEN_CURSORS initialization parameter to 310.
 - a. Enter OPEN_CURSORS in the filter field and click Go.
 - b. Enter 310 in the value field and click Apply.

Name	Help	Revisions	Value	Type	Basic	Default	Dynamic	Category
open_cursor	(i)		310	Integer	✓		✓	Cursors and Library Cache

Question: What is the significance of a check in the Dynamic column for the OPEN_CURSORS parameter?

Answer: Parameters that have a check in the Dynamic column can be altered without shutting down the instance. Parameters without a check in that column can be changed with the instance open, but the change will not take effect until the instance is restarted.

Practice 6: Managing Database Storage Structures

In this practice, you will use Enterprise Manager to manage the storage structures of your database. You will verify whether the control file has been multiplexed and multiplex the redo log groups. Finally, you will create new tablespaces for tables and other objects in your flower shop database.

1. Log in to Database Control as the SYS user with a SYSDBA connection.
2. Access the Administration page, and click the Controlfiles link in the Storage region.
Verify whether the control files in your database have been multiplexed.

Controlfile Mirror Images

Oracle strongly recommends that your database has a minimum of two control files and that they are located on separate disks. If a control file is damaged due to a disk failure, it could be restored using the intact copy of the control file from the other disk. You can specify their location in the database's initialization parameter file.

Valid	File Name	File Directory
VALID	control01.ctl	/u01/app/oracle/oradata/orcl/
VALID	control02.ctl	/u01/app/oracle/oradata/orcl/
VALID	control03.ctl	/u01/app/oracle/oradata/orcl/

Question: Control files are multiplexed to decrease the chance of losing all control files from a single failure. What would you do in a production system to improve the control file multiplexing shown above?

Answer: Place the control files on different disks, preferably with different controllers. The current configuration has all three control files on the same disk; that is, a disk failure would destroy all three files.

3. Return to the Administration property page. Click Redo Log Groups.

Question: How could you improve the current configuration to make your system more reliable?

Answer: Ensure that each redo log group is multiplexed with at least two members.

4. Multiplex the redo log files in your database to protect against loss.
 - a. Select group 1. Click Edit and then click Add.
 - b. Enter redo01_02.log in the File Name field.
 - c. Accept the default file directory, and click Continue.

Edit Redo Log Group: 1: Add Redo Log Member

* File Name	redo01_02.log
* File Directory	/u01/app/oracle/oradata/orcl/
<input type="checkbox"/> Reuse File	

Practice 6: Managing Database Storage Structures (continued)

- d. Click Apply to save your changes.
5. Click Redo Log Groups. Verify that group 1 now has two members.
6. Repeat step 4 for the remaining two log groups. For group 2 use a file name of `redo02_02.log`. For group 3, use a file name of `redo03_02.log`.

Results							
Select	Group	Status	# of Members	Archived	Size (KB)	Sequence	First Change#
<input checked="" type="radio"/>	1	Inactive		2 No	10240	95	1669338
<input type="radio"/>	2	Current		2 No	10240	96	1685345
<input type="radio"/>	3	Inactive		2 No	10240	94	1657997

7. Your flower shop database requires two tablespaces. One tablespace will be used to store tables and the other tablespace will be used for indexes. Create a locally managed tablespace named FSDATA. The datafile for this tablespace should be named `flowers_data.dbf` and should be stored in the `/u01/app/oracle/oradata` directory.
 - a. From the Administration property page, click Tablespaces.
 - b. Click Create.
 - c. Enter FSDATA in the Name field.
 - d. Select Locally Managed, Permanent, and Read Write.

Create Tablespace

Show SQL Cancel

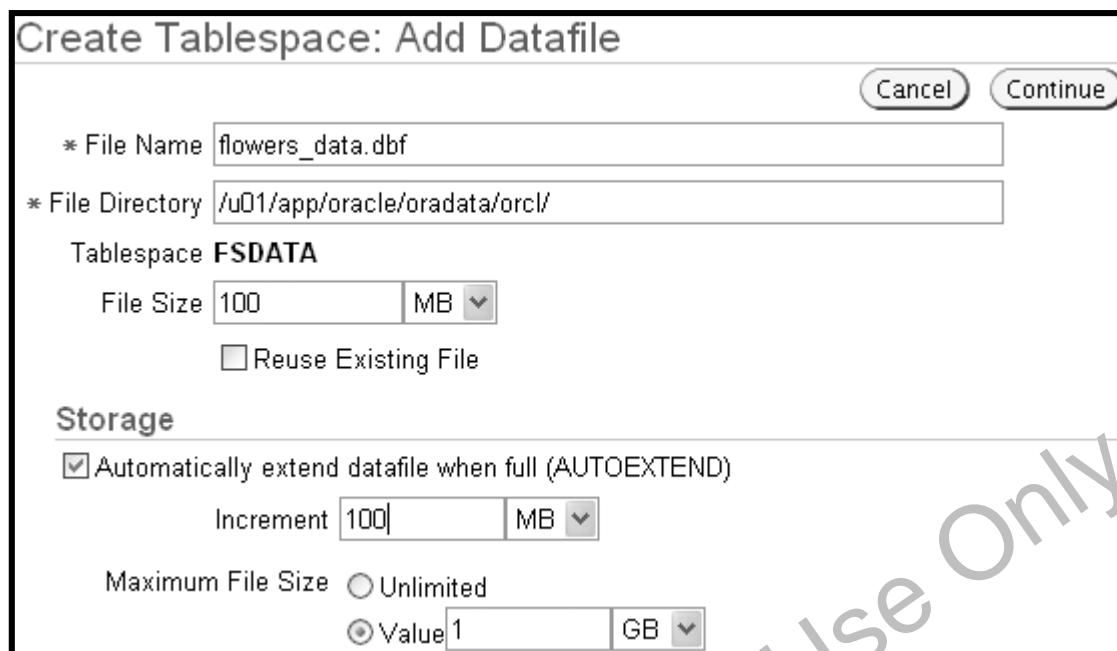
General Storage Thresholds

* Name

Extent Management	Type	Status
<input checked="" type="radio"/> Locally Managed	<input checked="" type="radio"/> Permanent <input type="checkbox"/> Set as default permanent tablespace	<input checked="" type="radio"/> Read Write
<input type="radio"/> Dictionary Managed	<input type="radio"/> Temporary <input type="checkbox"/> Set as default temporary tablespace	<input type="radio"/> Read Only
	<input type="radio"/> Undo	<input type="radio"/> Offline

Practice 6: Managing Database Storage Structures (continued)

- e. Click Add to enter the information about the tablespace's data file
 - Enter flowers_data.dbf in the File Name field.
 - Select the default file directory.
 - Enter 100 MB as the file size.
 - Check "Automatically extend datafile when full."
 - Enter 100 MB in the Increment field.
 - Select Value and enter 1 GB as the maximum file size.
 - Click Continue and then OK to create the tablespace.



8. Repeat step 7 to create a locally managed tablespace named FSINDEX. The datafile for this tablespace should be named flowers_indx.dbf. All other settings should be the same as the FSDATA tablespace.

Question: Why did you select "Automatically extend datafile when full"?

Answer: If the tablespace uses its assigned 100 MB of space, this allows it to automatically allocate more space within the 1 GB limit, which is specified as the maximum file size. Enabling this option can prevent future application errors due to lack of space.

Practice 7: Administering Users and Security

In this practice, you will use Enterprise Manager to create a role and two users.

1. Log in to Database Control as the SYS user with a SYSDBA connection.
2. Create the flower shop owner user with the following characteristics:

Username: FSOWNER

Password: FSOWNER

Temporary tablespace: TEMP

Default tablespace: FSDATA

Status: Unlocked

a. Click Users in the Security region on the Administration property page.

b. Click Create.

c. Enter FSOWNER in the Name field.

d. Select the default profile and password authentication.

e. Enter FSOWNER in the Enter Password and Confirm Password fields.

f. Enter FSDATA in the Default Tablespace field.

Hint: Click the flashlight icon for a list of available tablespaces.

g. Enter TEMP in the Temporary Tablespace field.

Create User

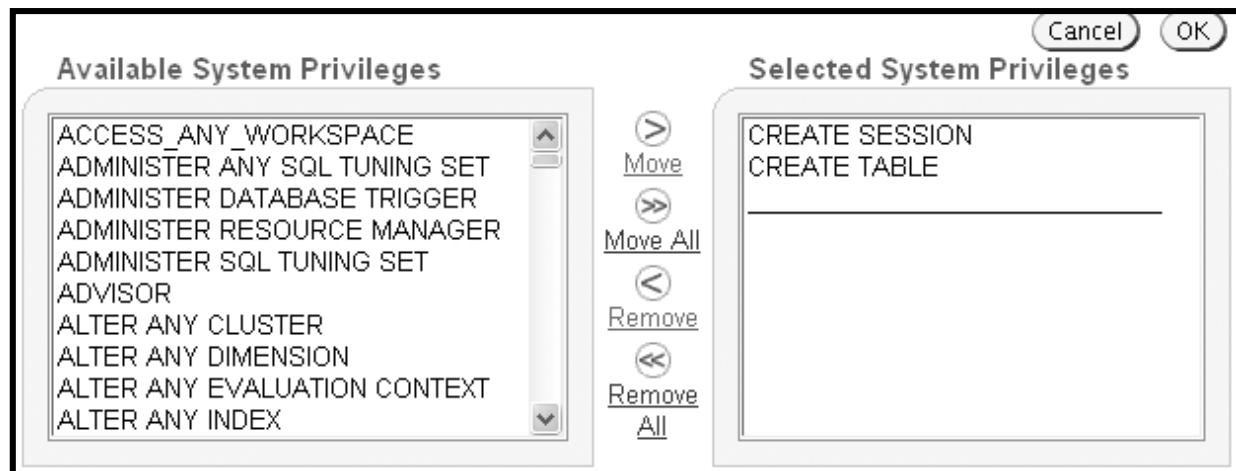
Show SQL Cancel OK

General Roles System Privileges Object Privileges Quotas Consumer Groups Proxy Users

* Name	FSOWNER
Profile	DEFAULT
Authentication	Password
* Enter Password	*****
* Confirm Password	*****
<input type="checkbox"/> Expire Password now	
Default Tablespace	FSDATA
Temporary Tablespace	TEMP
Status	<input type="radio"/> Locked <input checked="" type="radio"/> Unlocked

3. Grant the CREATE SESSION and CREATE TABLE system privileges to the flower shop owner:
 - a. Click System Privileges and then click Modify.
 - b. Scroll down the list of available system privileges until you find CREATE SESSION and CREATE TABLE. Use the arrow button to move them to the Selected System Privileges.
 - c. Click OK.

Practice 7: Administering Users and Security (continued)



4. Grant quota on the FSDATA and FSINDEX tablespaces to the flower shop owner.
 - a. Click Quotas.
 - b. Select Unlimited from the Quota drop-down list or enter -1 in the Value field for the FSDATA tablespace.
 - c. Select Unlimited from the Quota drop-down list or enter -1 in the Value field for the FSINDEX tablespace.
 - d. Click OK to create the FSOWNER user.

The screenshot shows the 'Quotas' tab of the User Properties dialog box. It lists tablespaces and their current quota settings. The 'Quotas' tab also includes 'Show SQL', 'Revert', and 'Apply' buttons.

Tablespace	Quota	Value	Unit
EXAMPLE	None	0	MBytes
FSDATA (Default)	Unlimited	0	MBytes
FSINDEX	Unlimited	0	MBytes
SYSAUX	None	0	MBytes
SYSTEM	None	0	MBytes
TEMP	None	0	MBytes
UNDOTBS1	None	0	MBytes
USERS	None	0	MBytes

Practice 7: Administering Users and Security (continued)

5. Grant Enterprise Manager administrative privileges to the FSOWNER user.

Hint: For more information about this task, refer to the lesson titled “Using Oracle Enterprise Manager Database Control.”

- a. Click Setup from the links at the top of the Database Control page.
- b. Click Create to create a new administrator.
- c. Enter FSOWNER in the Name, Password, and Confirm Password fields.
- d. Leave Email Address blank.
- e. Click Finish, and then click Finish again to grant administrative privileges to FSOWNER.

Create Administrator: Properties

		<input type="button" value="Cancel"/> <input type="button" value="Finish"/>
* Name	FSOWNER 	
* Password	*****	
* Confirm Password	*****	
Email Address	<optional>	
Specify one or more e-mail addresses separated by a comma or space.		
<input checked="" type="checkbox"/> Super Administrator		

Practice 7: Administering Users and Security (continued)

6. Create a role for the flower shop retail clerk named FSCLERK with the CREATE SESSION privilege:

Note: After you create tables and other objects in the next lesson, you will grant object privileges to this role.

- a. Click Roles in the Security region of the Administration property page.
b. Click Create and enter FSCLERK in the Name field, select None from the Authentication drop-down list.
c. Click System Privileges and then click Modify.
d. Scroll down the list of available system privileges until you find CREATE SESSION. Use the arrow button to move it to the Selected System Privileges.
e. Click OK, and then click OK again to create the role.
7. Create the first flower shop retail clerk with the following characteristics:

Username:	FSCLERK1
Password:	FSCLERK1
Default tablespace:	FSDATA
Temporary tablespace:	TEMP
Status:	Unlocked

 - a. On the Administration property page, click Users.
 - b. Click Create.
 - c. Enter FSCLERK1 in the Name field.
 - d. Select the default profile and password authentication.
 - e. Enter FSCLERK1 in the password and confirm password fields.
 - f. Enter FSDATA in the Default Tablespace field.
 - g. Enter TEMP in the Temporary Tablespace field.
8. Grant the FSCLERK role to the FSCLERK1 user.
 - a. Click Roles and then click Modify.
 - b. Scroll down the list of available roles until you find the FSCLERK role. Use the arrow button to move it to the list of selected roles.

Question: Why does FSCLERK1 already have the CONNECT role?

Answer: Users created with Database Control are automatically given the connect role.

- c. Click OK, and then click OK again to create the FSCLERK1 user.

Practice 8: Managing Schema Objects

In this practice, you will use Enterprise Manager to define tables and indexes that are part of the flower shop database. You will also grant privileges to the FSCLERK role to access the newly created tables.

1. Log in to Database Control as the FSOWNER user with a normal connection (password is fsowner).
2. Click Tables in the Schema region of the Administration property page.
3. Create the EMPLOYEES table in the FSDATA tablespace. Click Create.
 - a. Select “Standard, Heap Organized” and do not check Temporary. Click Continue.
 - b. Enter EMPLOYEES in the Name field, FSOWNER in the Schema field, and FSDATA in the tablespace field.
 - c. Enter column specifications as shown below (you will have to add five table columns):

EMPLOYEE_ID	NUMBER (6)	HIRE_DATE	DATE
FIRST_NAME	VARCHAR2 (20)	JOB_ID	VARCHAR2 (10)
LAST_NAME	VARCHAR2 (25)	SALARY	NUMBER (8)
EMAIL_ADDRESS	VARCHAR2 (25)	MANAGER_ID	NUMBER (6)
PHONE_NUMBER	VARCHAR2 (20)		

The screenshot shows the Oracle Database Control interface for creating a new table named 'EMPLOYEES'. The 'General' tab is active, displaying basic table properties: Name (EMPLOYEES), Schema (FSOWNER), Tablespace (FSDATA), Organization (Standard, Heap Organized), and a 'Estimate Table Size' button. The 'Columns' tab is selected, showing a list of 11 columns with their definitions:

Select	Name	Data Type	Size	Scale	Not NULL	Default Value
<input checked="" type="radio"/>	EMPLOYEE_ID	NUMBER	6		<input type="checkbox"/>	
<input type="radio"/>	FIRST_NAME	VARCHAR2	20		<input type="checkbox"/>	
<input type="radio"/>	LAST_NAME	VARCHAR2	25		<input type="checkbox"/>	
<input type="radio"/>	EMAIL_ADDRESS	VARCHAR2	25		<input type="checkbox"/>	
<input type="radio"/>	PHONE_NUMBER	VARCHAR2	20		<input type="checkbox"/>	
<input type="radio"/>	HIRE_DATE	DATE			<input type="checkbox"/>	
<input type="radio"/>	JOB_ID	VARCHAR2	10		<input type="checkbox"/>	
<input type="radio"/>	SALARY	NUMBER	8		<input type="checkbox"/>	
<input type="radio"/>	MANAGER_ID	NUMBER	6		<input type="checkbox"/>	

Practice 8: Managing Schema Objects (continued)

Define a PRIMARY KEY constraint on the EMPLOYEE_ID column.

- a. Click Constraints.
- b. Select Primary and click Add.
- c. Enter EMPLOYEES_ID_PK in the Name field.
- d. Use the arrow button to move EMPLOYEE_ID from the Available Columns list to the Selected Columns list.
- e. Select the Validate attribute.
- f. Click OK to create the constraint.
- g. Click OK to create the table.

Add PRIMARY Constraint

Cancel OK

Each Table in the database can have only one PRIMARY key constraint. One or more columns can comprise the constraint. The primary key columns constitute a unique identifier for each row in the table. The primary key columns do not allow nulls and the combination of the values of the primary key columns must be unique.

Definition

Name

Table Columns

Available Columns	Selected Columns
FIRST_NAME LAST_NAME EMAIL_ADDRESS PHONE_NUMBER HIRE_DATE JOB_ID SALARY MANAGER_ID	EMPLOYEE_ID

Attributes

Disabled

Deferrable - In subsequent transactions this allows constraint checking to be deferred until the end of the transaction.
 Initially Deferred - Set the default deferred behavior to check constraints at the end of a transaction.

Validate - Check to ensure all existing data meets the constraint criteria.

Do not enforce the constraint (RELY) - Constraint is not used to enforce data integrity. It is used to express the relationship between tables and views.

Practice 8: Managing Schema Objects (continued)

4. Create the CUSTOMERS table in the FSDATA tablespace with column definitions as shown below. Define a PRIMARY KEY constraint on the CUSTOMER_ID column

CUSTOMER_ID	NUMBER (6)	CITY	VARCHAR2 (30)
CUST_FIRST_NAME	VARCHAR2 (20)	STATE	VARCHAR2 (10)
CUST_LAST_NAME	VARCHAR2 (20)	POSTAL_CODE	VARCHAR2 (10)
STREET_ADDRESS	VARCHAR2 (40)	PHONE_NUMBER	VARCHAR2 (20)

5. Create the ORDERS table in the FSDATA tablespace with column definitions as shown below. Define a PRIMARY KEY constraint on the ORDER_ID column.

Note: For a number column that is defined as NUMBER (8 , 2), the first digit is the size and the second is the scale (number of decimal places).

ORDER_ID	NUMBER (12)	DELIVERY_MODE	VARCHAR2 (8)
ORDER_DATE	DATE	ORDER_STATUS	NUMBER (2)
ORDER_MODE	VARCHAR2 (8)	SALES_CLERK_ID	NUMBER (6)
CUSTOMER_ID	NUMBER (6)	ORDER_TOTAL	NUMBER (8 , 2)

6. Define referential constraints between the SALES_CLERK_ID column of the ORDERS table and the EMPLOYEE_ID column of the EMPLOYEES table.
- Click Tables in the Schema region of the Administration property page.
 - Enter FSOWNER in the Schema field and click Go.
 - Select the ORDERS table and click Edit.
 - Click Constraints, select FOREIGN from the drop-down list, and click Add.
 - Enter ORDERS_EMPLOYEES_FK in the Name field.
 - Use the arrow button to transfer SALES_CLERK_ID from the list of available columns to the list of selected columns.
 - Enter FSOWNER.EMPLOYEES in the referenced table field and click Go, or click the flashlight icon and select the EMPLOYEES table.
 - Use the arrow button to transfer EMPLOYEE_ID from the list of available columns to the list of selected columns.
 - Check the Validate attribute.
 - Click OK.
 - Click Apply.

Add FOREIGN Constraint

Different tables in a database can be related by common columns. FOREIGN key constraints are used to preserve relationships between these columns. For each row of a table, the values in the foreign key columns match the values in the referenced primary or unique key columns.

Definition

Name	ORDERS_EMPLOYEES_FK	Cancel	OK																	
Table Columns																				
Available Columns		Selected Columns																		
<table border="1"><tr><td>ORDER_ID</td><td>Move</td></tr><tr><td>ORDER_DATE</td><td>Move</td></tr><tr><td>ORDER_MODE</td><td>Move</td></tr><tr><td>CUSTOMER_ID</td><td>Move All</td></tr><tr><td>DELIVERY_MODE</td><td>Move</td></tr><tr><td>ORDER_STATUS</td><td>Move</td></tr><tr><td>ORDER_TOTAL</td><td>Move</td></tr></table>		ORDER_ID	Move	ORDER_DATE	Move	ORDER_MODE	Move	CUSTOMER_ID	Move All	DELIVERY_MODE	Move	ORDER_STATUS	Move	ORDER_TOTAL	Move	<table border="1"><tr><td>SALES_CLERK_ID</td></tr></table>		SALES_CLERK_ID		
ORDER_ID	Move																			
ORDER_DATE	Move																			
ORDER_MODE	Move																			
CUSTOMER_ID	Move All																			
DELIVERY_MODE	Move																			
ORDER_STATUS	Move																			
ORDER_TOTAL	Move																			
SALES_CLERK_ID																				
<input type="button" value="Remove"/> <input type="button" value="All"/>		<input type="button" value="Remove"/> <input type="button" value="All"/>																		
Referenced Table Columns																				
Available Columns		Selected Columns																		
<table border="1"><tr><td>FIRST_NAME</td><td>Move</td></tr><tr><td>LAST_NAME</td><td>Move</td></tr><tr><td>EMAIL_ADDRESS</td><td>Move</td></tr><tr><td>PHONE_NUMBER</td><td>Move</td></tr><tr><td>HIRE_DATE</td><td>Move All</td></tr><tr><td>JOB_ID</td><td>Move All</td></tr><tr><td>SALARY</td><td>Move All</td></tr><tr><td>MANAGER_ID</td><td>Move All</td></tr></table>		FIRST_NAME	Move	LAST_NAME	Move	EMAIL_ADDRESS	Move	PHONE_NUMBER	Move	HIRE_DATE	Move All	JOB_ID	Move All	SALARY	Move All	MANAGER_ID	Move All	<table border="1"><tr><td>EMPLOYEE_ID</td></tr></table>		EMPLOYEE_ID
FIRST_NAME	Move																			
LAST_NAME	Move																			
EMAIL_ADDRESS	Move																			
PHONE_NUMBER	Move																			
HIRE_DATE	Move All																			
JOB_ID	Move All																			
SALARY	Move All																			
MANAGER_ID	Move All																			
EMPLOYEE_ID																				
<input type="button" value="Remove"/> <input type="button" value="All"/>		<input type="button" value="Remove"/> <input type="button" value="All"/>																		
Attributes																				
<input type="checkbox"/> Disabled																				
<input type="checkbox"/> Deferrable - In subsequent transactions this allows constraint checking to be deferred until the end of the transaction.																				
<input type="checkbox"/> Initially Deferred - Set the default deferred behavior to check constraints at the end of a transaction.																				
<input checked="" type="checkbox"/> Validate - Check to ensure all existing data meets the constraint criteria.																				
<input type="checkbox"/> Do not enforce the constraint (RELY) - Constraint is not used to enforce data integrity. It is used to express the relationship between tables and views.																				

Practice 8: Managing Schema Objects (continued)

7. Define referential constraints between the CUSTOMER_ID column of the ORDERS table and the CUSTOMER_ID column of the CUSTOMERS table.
 - a. Click Tables in the Schema region of the Administration property page.
 - b. Enter FSOWNER in the Schema field and click Go.
 - c. Select the ORDERS table and click Edit.
 - d. Click Constraints, select FOREIGN from the drop-down list, and click Add.
 - e. Enter ORDERS_CUSTOMERS_FK in the Name field.
 - f. Use the arrow button to transfer CUSTOMER_ID from the list of available columns to the list of selected columns.
 - g. Enter FSOWNER.CUSTOMERS in the referenced table field and click Go, or click the flashlight icon and select the CUSTOMERS table.
 - h. Use the arrow button to transfer CUSTOMER_ID from the list of available columns to the list of selected columns.
 - i. Check the Validate attribute.
 - j. Click OK.
 - k. Click Apply.

Oracle Internal & OAI Use Only

Practice 8: Managing Schema Objects (continued)

8. Create an index on the CUSTOMER_ID column in the ORDERS table so that you can quickly access all orders for a specified customer. The index should be stored in the FSINDEX tablespace.
 - a. Click Indexes in the Schema region of the Administration property page.
 - b. Click Create.
 - c. Enter ORDERS_CUSTID_IDX in the Name field.
 - d. Enter FSOWNER in the schema field.
 - e. Enter FSINDEX in the tablespace field.
 - f. Select a Standard – B-tree index type.
 - g. Enter ORDERS in the Table Name field and click Go, or click the flashlight icon and select the ORDERS table.
 - h. Click Populate Columns. Enter the number 1 in the CUSTOMER_ID column and click OK.

Create Index

General Storage Options Partitions

* Name: ORDERS_CUSTID_IDX
Schema: FSOWNER
Tablespace: FSINDEX
Index Type: Standard - B-tree Bitmap

Estimate Index Size

* Table Name: FSOWNER.ORDERS
Populate Columns

TIP The indexed columns and their orders are indicated by the Order field

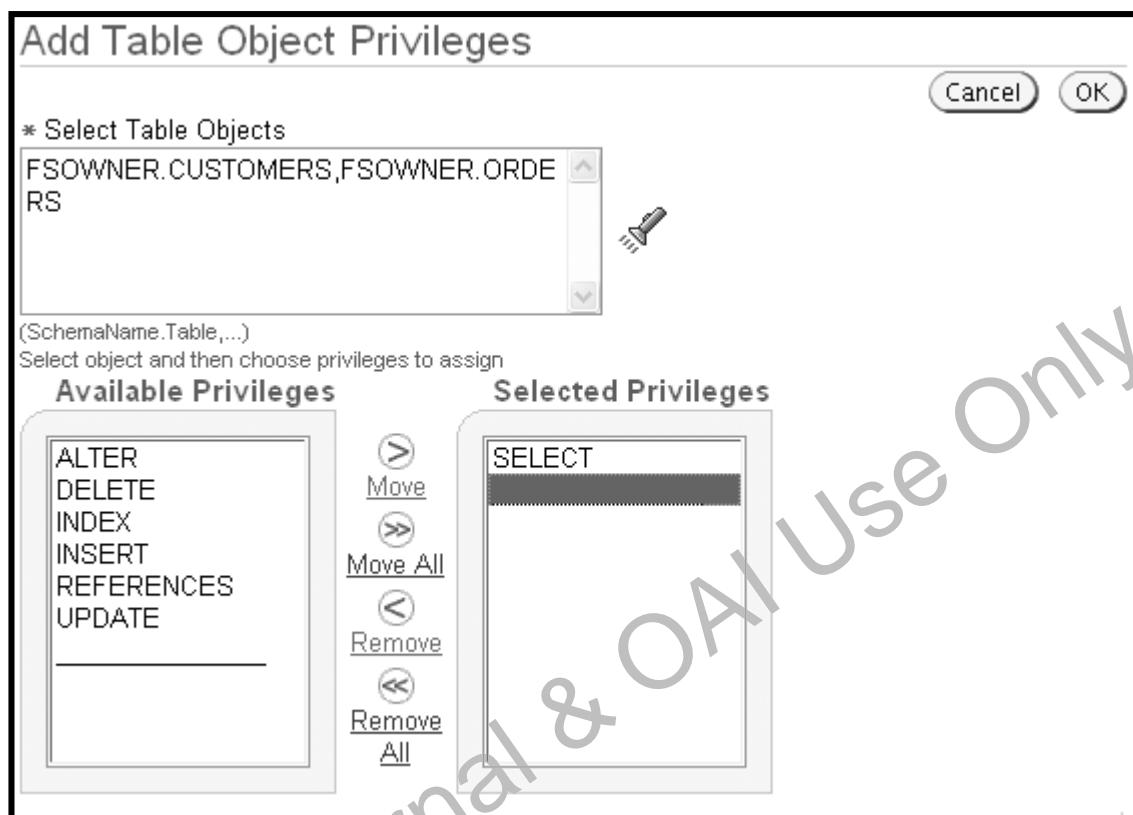
Table Columns

Column Name	Data Type	Sorting Order	Order
ORDER_ID	NUMBER	ASC	
ORDER_DATE	DATE	ASC	
ORDER_MODE	VARCHAR2	ASC	
CUSTOMER_ID	NUMBER	ASC	1
DELIVERY_MODE	VARCHAR2	ASC	
ORDER_STATUS	NUMBER	ASC	
SALES_CLERK_ID	NUMBER	ASC	
ORDER_TOTAL	NUMBER	ASC	

Add Column Expression

Practice 8: Managing Schema Objects (continued)

9. Grant object privileges to SELECT from the CUSTOMERS and ORDERS table to the FSCLERK role.
 - a. Click Roles in the Security region of the Administrative property page.
 - b. Enter FSCLERK in the Name field, click Go, and then click Edit.
 - c. Click Object Privileges.
 - d. Select Table from the Object Type drop-down list and click Add.
 - e. Enter FSOWNER.CUSTOMERS, FSOWNER.ORDERS in the Select Table Objects field or use the flashlight icon to select these two tables.
 - f. Use the arrow button to transfer the Select privilege from the list of available privileges to the list of selected privileges.
 - g. Click OK and then click Apply to save your changes.



Oracle Internal & OAI Use Only

Practice 8: Managing Schema Objects (continued)

10. Using Enterprise Manager, load data into the CUSTOMERS table using the /home/oracle/labs/load_cust.ctl file as your control file.
- Click Load Data from File in the Utilities region of the Maintenance property page.
 - Enter /home/oracle/labs/load_cust.ctl in the Control File field.
 - Click Finish and then click Submit Job.
 - Click OK to return to the Maintenance property page.

Load Data: Control File

Database **orcl** Cancel Finish Step 1 of 6 Next

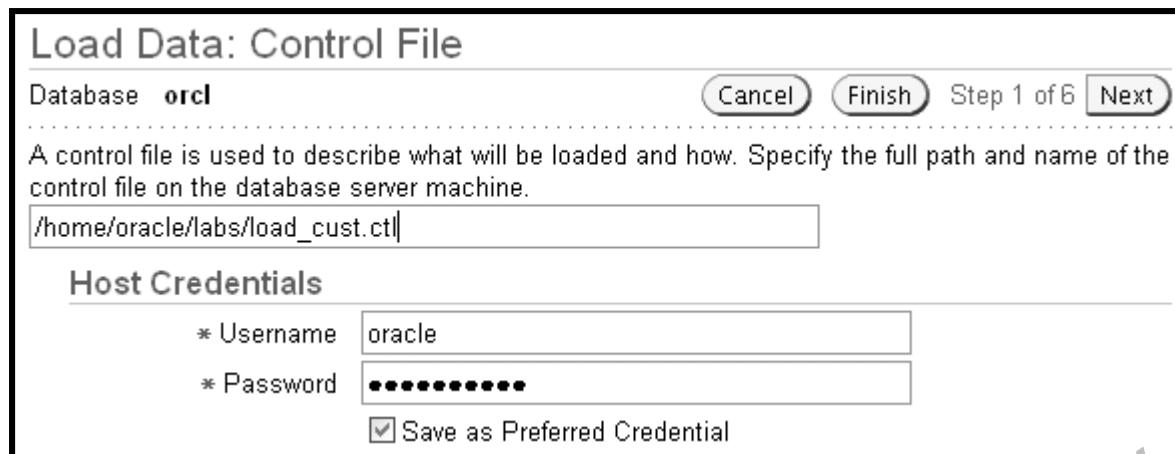
A control file is used to describe what will be loaded and how. Specify the full path and name of the control file on the database server machine.

/home/oracle/labs/load_cust.ctl

Host Credentials

* Username * Password

Save as Preferred Credential



Oracle Internal & OAI Use Only

Practice 8: Managing Schema Objects (continued)

11. Using Enterprise Manager, load data into the EMPLOYEES table using the /home/oracle/labs/load_emp.ctl file as your control file.
 - a. Click Load Data from File in the Utilities region of the Maintenance property page.
 - b. Enter /home/oracle/labs/load_emp.ctl in the Control File field.
 - c. Click Finish and then click Submit Job.
 - d. Click OK to return to the Maintenance property page.
12. Using Enterprise Manager, load data into the ORDERS table using the /home/oracle/labs/load_ord.ctl file as your control file.
 - a. Click Load Data from File in the Utilities region of the Maintenance property page.
 - b. Enter /home/oracle/labs/load_ord.ctl in the Control File field.
 - c. Click Finish and then click Submit Job.
 - d. Click OK to return to the Maintenance property page.

Question: The order in which the tables were loaded was important. Why did the ORDERS table have to be loaded last?

Answer: Because the ORDERS table has foreign key constraints to the CUSTOMERS and EMPLOYEES tables. If those tables had not already had data in them, loading data into the ORDERS table would have failed.

13. View the data in the ORDERS table to ensure that the loading has completed successfully.
 - Click Tables in the Schema region of the Administration property page.
 - Enter FSOWNER in the schema field and ORDERS in the object name field. Click Go.
 - Select View Data from the Actions drop-down list and click Go.

View Data for Table: FSOWNER.ORDERS								
Result	ORDER_ID	ORDER_DATE	ORDER_MODE	CUSTOMER_ID	DELIVERY_MODE	ORDER_STATUS	SALES_CLERK_ID	ORDER_TOTAL
	501	2004-01-06 00:00:00.0	PHONE		101 DONE		1	1003 52.35
	502	2004-01-06 00:00:00.0	WEB		102 DONE		1	1003 49.76
	503	2004-01-06 00:00:00.0	PHONE		103 DONE		1	1004 79.13
	504	2004-01-07 00:00:00.0	WEB		104 DONE		1	1005 13.45
	505	2004-01-07 00:00:00.0	WALKIN		105 PICKUP		1	1006 113.24

Practice 9-1: Performing Backup and Recovery

In this practice, you will use Enterprise Manager to back up your database and perform recovery of the whole database.

1. Log in to Database Control as the SYS user with a SYSDBA connection.
2. Place your database in ARCHIVELOG mode:
 - a. Click Configure Recovery Settings in the Backup/Recovery region of the Maintenance property page.
 - b. In the Media Recovery region, select the ARCHIVELOG Mode check box.
 - c. Verify whether the Log Archive Filename Format contains %t, %s, and %r.
 - d. Notice that the database is preconfigured to save archived logs to the Flash Recovery Area by default (Archive Log Destination 10).
 - e. Click Apply. When asked if you want to restart the database now, click Yes.
 - f. Enter the credentials to restart the database and click OK.
 - g. When asked to confirm, click Yes.
 - h. The instance will now be shut down and restarted. Wait a few minutes and then click Refresh to continue.

Configure Recovery Settings

[Show SQL](#) [Revert](#) [Apply](#)

Instance Recovery

The FAST_START_MTTR_TARGET initialization parameter specifies the number of seconds estimated for crash recovery. Oracle converts this number into a set of internal parameters and sets the recovery time as close as possible to these parameters. Setting FAST_START_MTTR_TARGET to 0 will disable this functionality.

Current Estimated Mean Time To Recover (seconds) **15**

Desired Mean Time To Recover Minutes

Media Recovery

The database is currently in NOARCHIVELOG mode. In ARCHIVELOG mode, hot backups and recovery to the latest time is possible, but you must provide space for logs. If you change the database to ARCHIVELOG mode, you should make a backup immediately. In NOARCHIVELOG mode, you can make only cold backups and data may be lost in the event of database corruption.

ARCHIVELOG Mode*

Log Archive Filename Format*

The naming convention for the archived log files. %s: log sequence number; %t: thread number; %S and %T: padding the filename to the left with zeroes.

3. Configure backup settings.
 - a. Click Configure Backup Settings in the Backup/Recovery region of the Maintenance property page.
 - b. Verify whether parallelism is 1, disk backup location is null (so that backups will be sent to the flash recovery area), and that disk backup type is set to backup set.
 - c. Click Policy. Select “Automatically backup the control file and server parameter file (SPFILE) with every backup and database structural change.”

Practice 9-1: Performing Backup and Recovery (continued)

- d. Leave Autobackup Disk Location null so that backups will be sent to the flash recovery area.
 - e. Click OK.
4. Create an online, full back up of the whole database.
- a. Click Schedule Backup in the Backup/Recovery region of the Maintenance property page.
 - b. Select Customized from the drop-down list for Backup Strategy.
 - c. Select Whole Database as the object type to be backed up and click Next.
 - d. Select a backup type of Full Backup, backup mode of Online Backup, and the advanced option Back up all archived logs on disk. Click Next.
 - e. Note that the backup settings you configured in step 3 have been automatically applied. Click Next.
 - f. Click Immediately in the Start region. Verify that One Time Only is selected in the Repeat region. Click Next and then Submit Job. Allow about five minutes for it to complete.

Schedule Backup: Review

(Cancel) (Edit RMAN Script) (Back) Step 4 of 4 (Submit Job)

Database **orcl**
 Backup Strategy **Customized**
 Object Type **Whole Database**
 Backup Type **Full Backup**
 Backup Mode **Online Backup**

Settings

Flash Recovery Area /u01/app/oracle/flash_recovery_area/

5. Verify whether your backup has completed successfully.
- a. Click Manage Current Backups in the Backup/Recovery region of the Maintenance property page.
 - b. Check the Results region of the page. If no backups are listed, then wait several minutes and click Go to search for available backups of any contents completed within a month.

Results

(Crosscheck) (Change to Unavailable) (Delete)

Select All | Select None

Select	Key	Tag	Completion Time ▾	Contents	Device Type	Status	Obsolete	Keep	Pieces
<input type="checkbox"/>	4	TAG20031218T224010	Dec 18, 2003 10:40:13 PM	SPFILE, CONTROLFILE	DISK	AVAILABLE	NO	NO	1
<input type="checkbox"/>	3	BACKUP_ORCL_000024_121803102501	Dec 18, 2003 10:40:04 PM	ARCHIVED LOG	DISK	AVAILABLE	NO	NO	1
<input type="checkbox"/>	2	TAG20031218T223934	Dec 18, 2003 10:39:38 PM	SPFILE, CONTROLFILE	DISK	AVAILABLE	YES	NO	1
<input type="checkbox"/>	1	BACKUP_ORCL_000024_121803102501	Dec 18, 2003 10:39:26 PM	DATAFILE	DISK	AVAILABLE	NO	NO	1

Practice 9-1: Performing Backup and Recovery (continued)

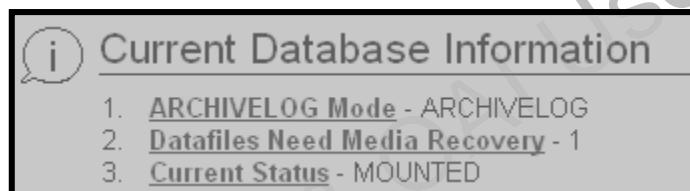
6. Cause a failure in your database by deleting a data file.
 - a. Shut down your instance using Enterprise Manager to prepare for the simulated failure.
 - Click Shutdown on the Database Home page.
 - Click Ok and then Yes to confirm the shutdown of your database.
 - b. Wait about two minutes and click Refresh to verify your database as completed shutting down.
 - c. Open a terminal session and delete the datafile belonging to the FSDATA tablespace.

```
# rm /u01/app/oracle/oradata/orcl/flowers_data.dbf
```
7. Attempt to restart your database.
 - a. Return to Database Control. Click Startup (as if you did not know the database needs recovery).
 - b. Enter credentials for the host and database. Click OK and then Yes.

Question: Why did the preferred credentials not appear when you tried to restart your instance??

Answer: Database Control stores the preferred credentials in the database. With the database down you must enter host and database credentials for each operation that requires them.

8. The database could not be started because of the missing datafile. Recover your database.
 - a. Click Perform Recovery.
 - b. Enter credentials for the host and database. Click OK and then Yes.
 - c. View the current database information. Note that there is one datafile that needs media recovery.



- d. Select Datafiles from the Object Type drop-down list. Verify that the selected operation is “Recover to Current time...” and click Next.
- e. Select the flowers_data.dbf file and click Next.
- f. Because only the file was damaged and not the disk itself, there is no need to rename the file. Verify that “No, Restore the files to the default location” is selected, and click Next.
- g. Click Submit to begin recovery. This step takes several minutes to complete.
- h. When the Operation Succeeded page appears, click OK.
9. Start your database.
 - Click Startup.
 - Click OK, Continue, and then Yes.
 - Log in to Database Control as the SYS user with a SYSDBA connection.
 - Verify whether the database status is Up.

Practice 9-2: Performing Flashback Table and Flashback Drop

In this practice, you will enable row movement on tables in your database. You will then use Flashback Table and Flashback Drop.

1. Log in to the Database Control as the FSOWNER user with a normal connection (password is fsowner).
2. Enable row movement for the FSOWNER.CUSTOMERS table.
 - a. Click Tables in the Schema region of the Administration property page.
 - b. Enter FSOWNER in the schema field and click Go.
 - c. Select the CUSTOMERS table and click Edit.
 - d. Click Options and select Yes from the Enable Row Movement drop-down list.
 - e. Click Apply.



3. Enable row movement for the FSOWNER.EMPLOYEES table.
 - Click Tables in the Schema region of the Administration property page.
 - Enter FSOWNER in the schema field and click Go.
 - Select the EMPLOYEES table and click Edit.
 - Click Options and select Yes from the Enable Row Movement drop-down list.
 - Click Apply.
4. Enable row movement for the FSOWNER.ORDERS table.
 - Click Tables in the Schema region of the Administration property page.
 - Enter FSOWNER in the schema field and click Go.
 - Select the ORDERS table and click Edit.
 - Click Options and select Yes from the Enable Row Movement drop-down list.
 - Click Apply.
5. View the system time and contents of the FSOWNER.ORDERS table using SQL*Plus.
 - a. Open a terminal window.
 - b. Connect to the database as FSOWNER using SQL*Plus.

```
# sqlplus fsowner/fsowner
SQL*Plus: Release 10.1.0.2.0 - Production on Fri Dec 19
00:51:48 2003
Copyright (c) 1982, 2003, Oracle. All rights reserved.
Connected to:
Oracle Database 10g Enterprise Edition Release 10.1.0.2.0
- Production
With the Partitioning, OLAP and Data Mining options
```

Practice 9-2: Performing Flashback Table and Flashback Drop (continued)

- c. View the current system time.

```
SQL> SELECT systimestamp FROM dual;
SYSTIMESTAMP
-----
19-DEC-03 12.57.46.522742 PM -07:00
```

Record your system time: _____

- d. View the contents of the orders table.

```
SQL> SELECT * FROM fsowner.orders;
...
16 rows selected.
```

6. Simulate user error by deleting all the rows in FSOWNER.ORDERS table. View the contents to verify your change.

```
SQL> DELETE FROM fsowner.orders;
16 rows deleted.
SQL> COMMIT;
Commit complete.
SQL> SELECT * FROM fsowner.orders;
no rows select
```

7. Use the Flashback Table feature to restore the contents of your ORDERS table.

- Log in to the Database Control as the FSOWNER user with a normal connection (password is fsowner).
- Click Tables in the Schema region of the Administration property page.
- Enter FSOWNER in the schema field, enter ORDERS in the object name field, and click Go.
- Select Flashback Table from the actions drop-down list and click Go.
- Select "Flashback to a Timestamp." Enter the date and time you found when you selected the system time in step 5. You know that as of that time the data in the ORDERS table had not yet been deleted.
- Click Next.

Perform Recovery: Point-in-time

Object Type **Tables**
Operation Type **Flashback Existing Tables**

Specify the point in time to which to recover.

Evaluate row changes and transactions to decide on a point in time
 Flashback to a timestamp

* Table 
Example: SCOTT.EMP

Date  Time AM PM
Example: Mar 19, 2003

Step 1 of 7

Practice 9-2: Performing Flashback Table and Flashback Drop (continued)

- g. Verify whether FSOWNER.ORDERS is in the “Tables to Flashback” box, and click Next.
- h. Select the Cascade dependency option. Click Next.

Perform Recovery: Review

(Cancel) (Show Row Changes) (Show SQL) (Back) Step 7 of 7 (Submit)

Object Type **Tables**
Operation Type **Flashback Existing Tables**

The following tables will be flashed back. All these tables will be locked while the flashback operation is in progress.

SCN	2372238
Timestamp	Dec 19, 2003 00:57 AM
Tables	FSOWNER.ORDERS
Dependent Tables	FSOWNER.CUSTOMERS, FSOWNER.EMPLOYEES

- i. Review your selections and click Submit.
 - j. Click OK to confirm that the tables have been flashed back
8. Verify that the deleted data was restored to the FSOWNER.ORDERS table. Note the system time.

```
SQL> SELECT * FROM fsowner.orders;
...
16 rows selected.
SQL> SELECT systimestamp FROM dual;
SYSTIMESTAMP
-----
19-DEC-03 01.32.32.037700 AM -07:00
```

Record your system time: _____

9. Delete the FSOWNER.ORDERS table and verify your change.
- a. Log in to Database Control as the FSOWNER user with a normal connection (password is fsowner).
 - b. Click Tables in the Schema region of the Administration property page.
 - c. Enter FSOWNER in the schema field, ORDERS in the object name field, and click Go.
 - d. Click Delete and then Yes to confirm the deletion of the FSOWNER.ORDERS table.
 - e. Verify that the FSOWNER.ORDERS table is no longer there.

```
SQL> SELECT * FROM fsowner.orders;
SELECT * FROM fsowner.orders
*
ERROR at line 1:
ORA-00942: table or view does not exist
```

Practice 9-2: Performing Flashback Table and Flashback Drop (continued)

10. Use the Flashback Drop feature to recover your ORDERS table.
 - a. Log in to the Database Control as the FSOWNER user with a normal connection (password is fsowner).
 - b. Click Tables in the Schema region of the Administration property page.
 - c. Click Recycle Bin.
 - d. Select the Orders table and click Flashback Drop.

Results							
Select All Select None Expand All Collapse All							
Select	Object Name	Schema	Object Type	Tablespace	Drop Time	Create Time	Size
<input type="checkbox"/>	▼ Recycle Bin						View Content
<input checked="" type="checkbox"/>	► ORDERS	FSOWNER	TABLE	FSDATA	2003-12-19:01:34:31	2003-12-17:07:30:45	8

- e. Leave the new name for the restored table as ORDERS, and click Next. Click Submit.
- f. Click OK to confirm that the tables have been flashed back

11. Verify whether the dropped table was restored

```
SQL> SELECT * FROM fsowner.orders;
...
16 rows selected.
```

Practice 10: Monitoring the Database and Using the Advisors

In this practice, you will use Enterprise Manager to define notification rules and metric thresholds. You want to ensure that you are notified when your FSDATA tablespace is 80% full.

1. Log in to Database Control as the SYS user with a SYSDBA connection.
2. Modify the Tablespace Space Used (%) metric for the FSDATA tablespace.
 - a. Click Manage Metrics in the Related Links region at the bottom of Database Control.
 - b. Click Edit Thresholds and scroll down to select Tablespace Space Used (%).
 - c. Click Specify Multiple Thresholds.
 - d. Enter FSDATA in the Tablespace Name field.
 - e. Enter 80 in the Warning Threshold field, enter 90 in the Critical Threshold field.
 - f. Leave response action blank and click OK.

Specify Multiple Thresholds: Tablespace Space Used (%)

This metric monitors all Tablespace Name objects on orcl. You can specify different

Select Tablespace Name	Comparison Operator	Warning Threshold	Critical Threshold
<input checked="" type="radio"/> FSDATA	>	80	90

3. Set the notification rules so that you will be notified by e-mail when your tablespace usage exceeds the threshold that you have specified.
 - a. Click Setup from the links at the top of Database Control.
 - b. Click Notification Methods.
 - c. Enter e-mail notification information:
 - Enter smtp.mailhost.ou.com in the outgoing mail server field.
 - Enter Database Control in the Identify Sender field
 - Enter dbcontrol@ou.com in the Sender's E-Mail field

Note: This is a fictitious mail server. Testing it will fail.

- d. Click Apply.

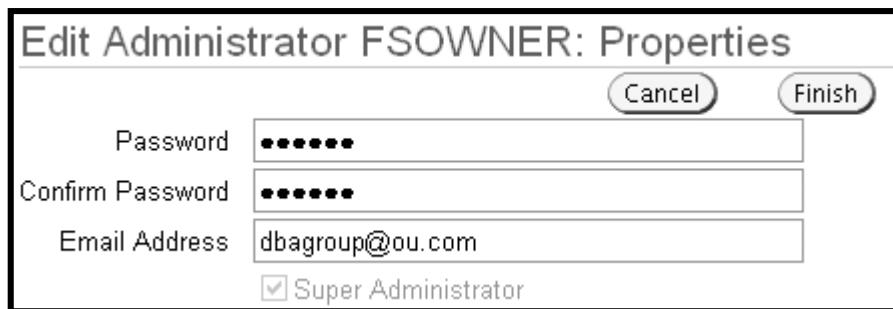
Mail Server

The information below is needed before Enterprise Manager can send e-mail notifications by means of Notification Rules.

Outgoing Mail (SMTP) Server	smtp.mailhost.ou.com
Specify one or more server names separated by a comma or space.	
Identify Sender As	Database Control
Sender's E-mail Address	dbcontrol@ou.com

Practice 10: Monitoring the Database and Using the Advisors (continued)

4. Configure an address to receive e-mail notifications.
 - a. Click Setup from the links at the top of Database Control.
 - b. Click Administrators.
 - c. Select FSOWNER and click Edit.
 - d. Enter an e-mail address to receive database alerts. Click Finish and click Finish again.



5. Simulate a table that has grown excessively by manually extending the FSOWNER.EMPLOYEES table.
 - a. Open a terminal window.
 - b. Connect to the database as FSOWNER using SQL*Plus.

```
# sqlplus fsowner/fsowner
```
 - c. Manually extend the EMPLOYEES table thrice.

```
SQL> ALTER TABLE fsowner.employees ALLOCATE EXTENT;
Table altered.
SQL> /
Table altered.
SQL> /
Table altered.
```
- Note:** Each time this SQL command was executed, the table grew by an additional 64KB. In a production database segments can possess unnecessary space naturally when a table has grown and then had rows deleted.
6. Use the Segment Advisor to determine if you need to make any modifications to objects in the FSDATA and FSIDX tablespaces.
 - a. Click Advisor Central from the Related Links region of Database Control.
 - b. Click Segment Advisor.
 - c. Select Tablespaces and Complete Analysis of All Segments. Click Continue.
 - d. Click Add and select the FSDATA and FSIDX tablespaces. Click OK and then Next.
 - e. Select Unlimited and click Next.
 - f. Select Standard from the Schedule Type drop-down list.
 - g. Click Immediately in the Start region, and click Next.

Practice 10: Monitoring the Database and Using the Advisors (continued)

- h. Click Submit.
- i. Wait about two minutes and then click View Result.
- j. Click Schedule Implementation and Submit to correct the space problem found by the Segment Advisor.

Segment Advisor: Schedule

Database **orcl** Cancel Back Step 3 of 4 Next

TIP This operation may be resource-intensive and should be scheduled during off-peak hours.

Task Information

* Task Name **SHRINK_7556010**
Task Description **Get shrink advice based on object growth trend**

Schedule

Schedule Type **Standard**

Time Zone **Database Time Zone GMT -7:00**

Repeating

Repeat **Do Not Repeat**

Start

Immediately

Recommendations

Show SQL Schedule Implementation

View Segments Recommended to Shrink
 View other Segments
Select All | Select None

Select	Tablespace	Schema	Segment	Partition	Segment Type	Allocated Space (MB)	Used Space (MB)	Reclaimable Space (MB)	Recommendation
<input checked="" type="checkbox"/>	FSDATA	FSOWNER	EMPLOYEES		TABLE	0.25	0.008	0.241	Perform shrink, estimated savings is 253158 bytes.