
Oracle Database 11g: Administration Workshop I

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ORACLE®

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I

Introduction

Course Objectives

After completing this course, you should be able to:

- Install, create, and administer Oracle Database 11g Release 2
- Configure the database for an application
- Employ basic monitoring procedures
- Implement a backup and recovery strategy
- Move data between databases and files



Suggested Schedule

| Day | Lessons | Day | Lessons |
|-----|---|-----|---|
| 1 | <ol style="list-style-type: none">1. Exploring the Oracle Database Architecture2. Preparing the Database Environment3. Creating an Oracle Database4. Managing Database Instances | 3 | <ol style="list-style-type: none">9. Managing Data Concurrency10. Managing Undo Data11. Implementing Oracle Database Auditing |
| 2 | <ol style="list-style-type: none">5. Managing ASM Instances6. Configuring the Oracle Network Environment7. Managing Database Storage Structures8. Administering User Security | 4 | <ol style="list-style-type: none">12. Database Maintenance13. Performance Management14. Backup and Recovery Concepts |
| | | 5 | <ol style="list-style-type: none">15. Performing Database Backups16. Performing Database Recovery17. Moving Data18. Working with Support |

Oracle Products and Services

- Oracle Database
- Oracle WebLogic Application Server
- Oracle Applications
- Oracle Collaboration Suite
- Oracle Developer Suite
- Oracle Services

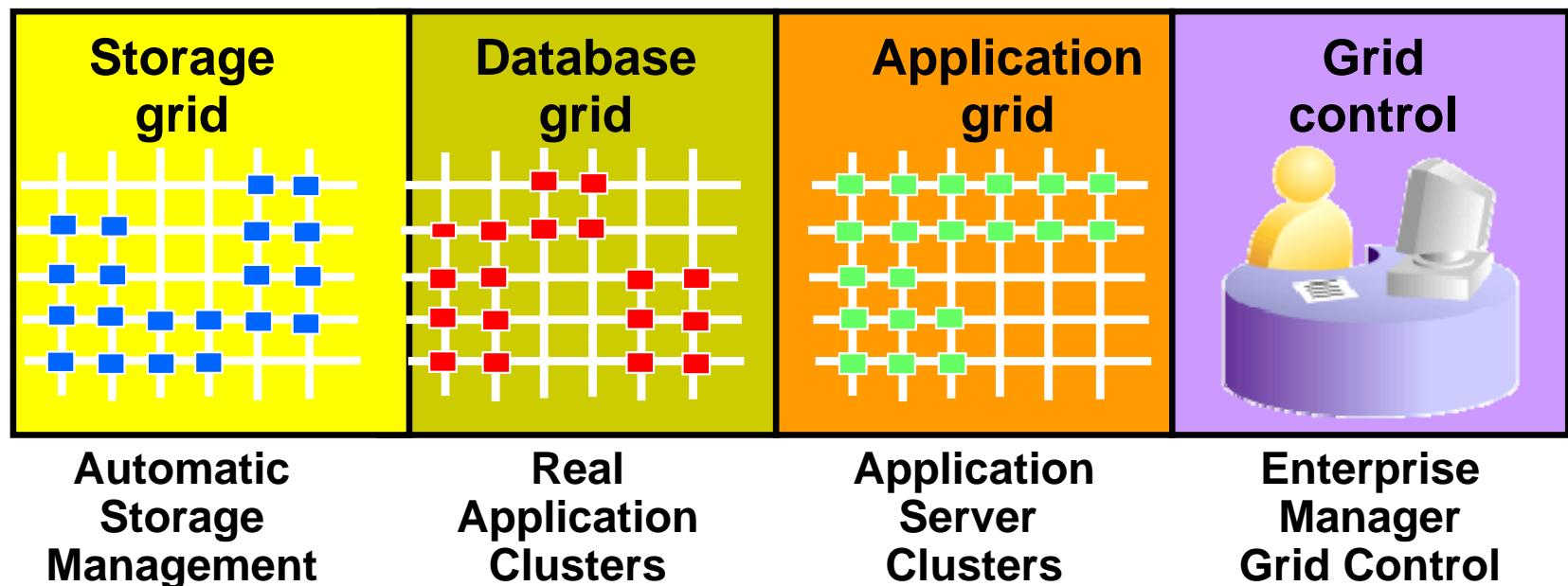


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Oracle Database 11g: “g” Stands for Grid

- Open Grid Forum (OGF)
- Oracle's grid infrastructure:
 - Low cost
 - High quality of service
 - Easy to manage



Grid Infrastructure for Single-Instance

Grid Infrastructure for Single-Instance is introduced with Oracle Database 11g Release 2.

- Is installed from the clusterware media, separate from Oracle database software
- Contains Oracle Automatic Storage Management (ASM)
- Contains Oracle Restart – a high availability solution for non-clustered databases
 - Can monitor and restart the following components:
 - Database Instances
 - Oracle Net Listener
 - Database Services
 - Automatic Storage Management (ASM) Instance
 - ASM Disk Groups
 - Oracle Notification Services (ONS/eONS) for Data Guard



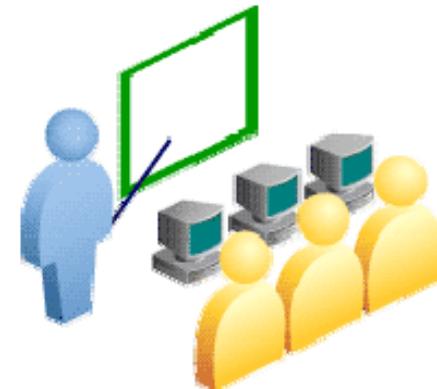
1

Exploring the Oracle Database Architecture

Objectives

After completing this lesson, you should be able to:

- List the major architectural components of Oracle Database
- Explain the memory structures
- Describe the background processes
- Correlate the logical and physical storage structures
- Describe ASM storage components

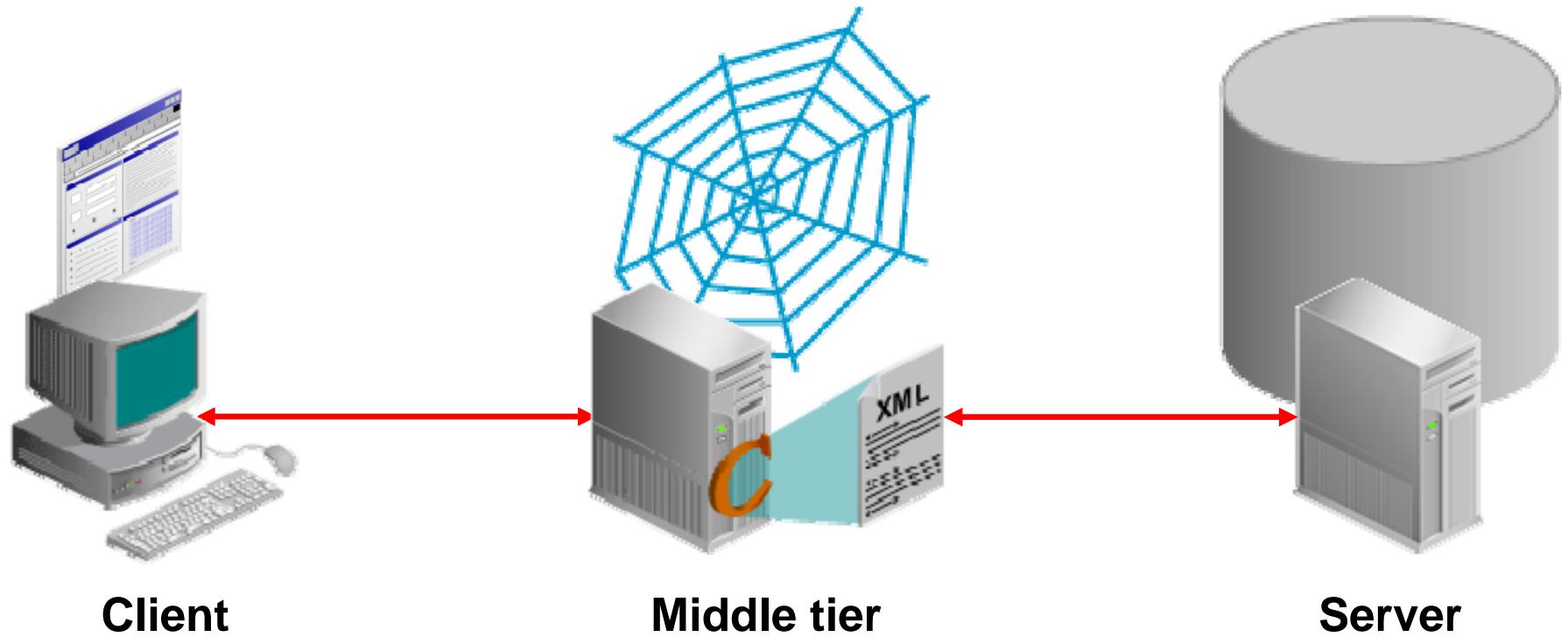


Oracle Database

The Oracle relational database management system (RDBMS) provides an open, comprehensive, integrated approach to information management

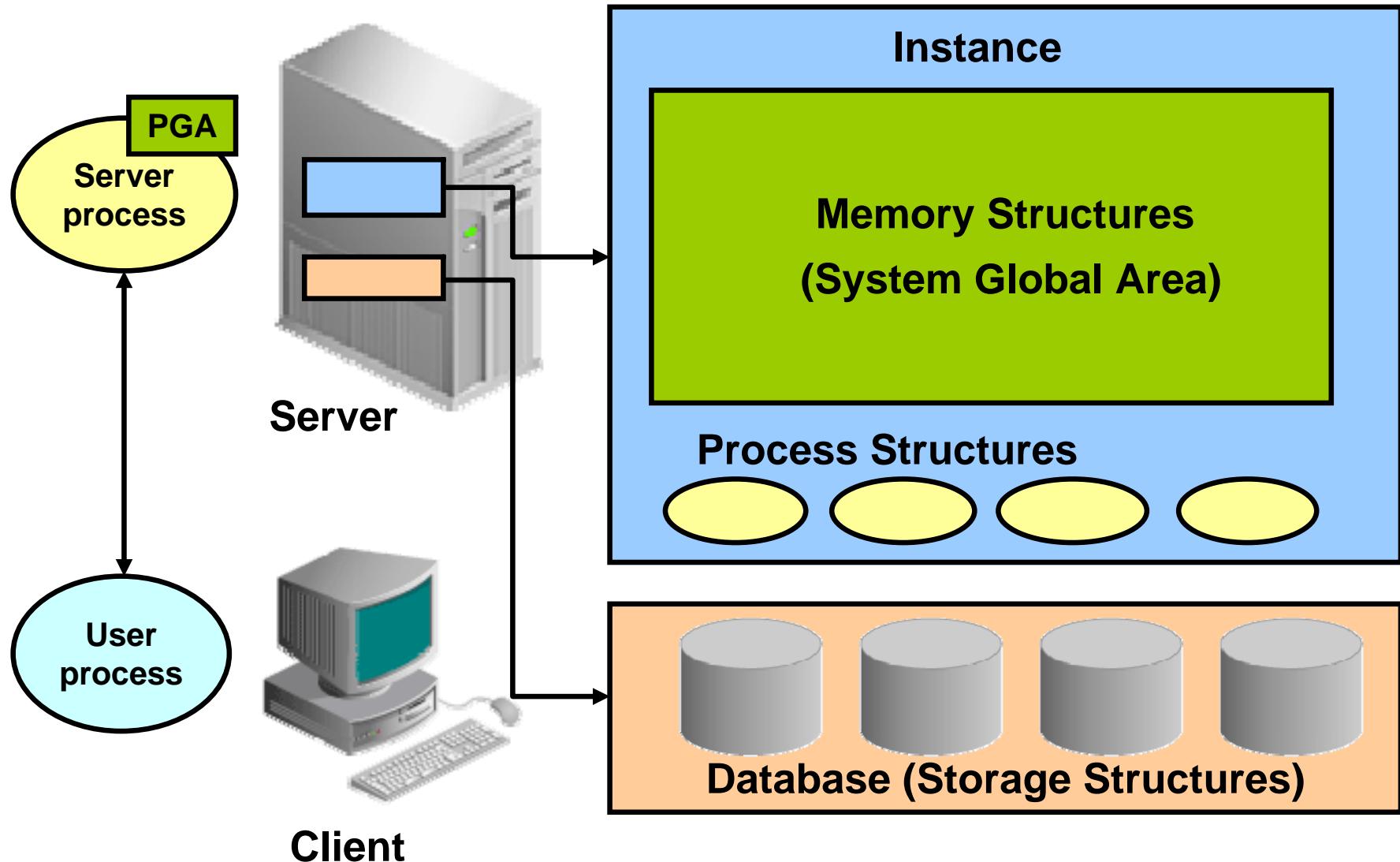


Connecting to a Server



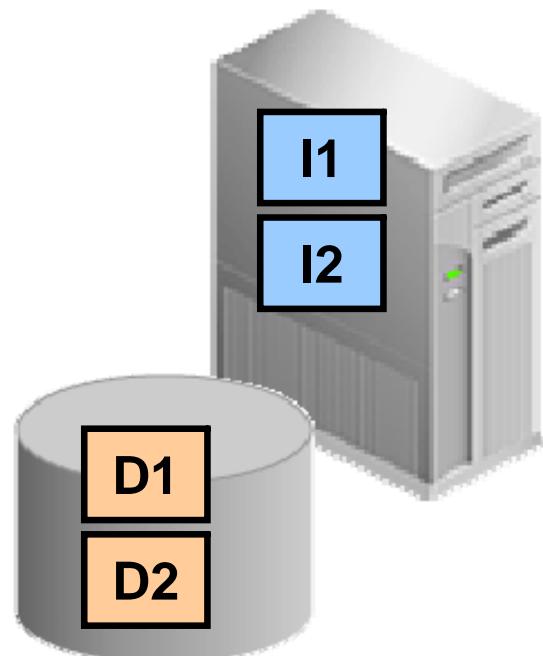
Multitier architecture shown

Oracle Database Server Architecture: Overview



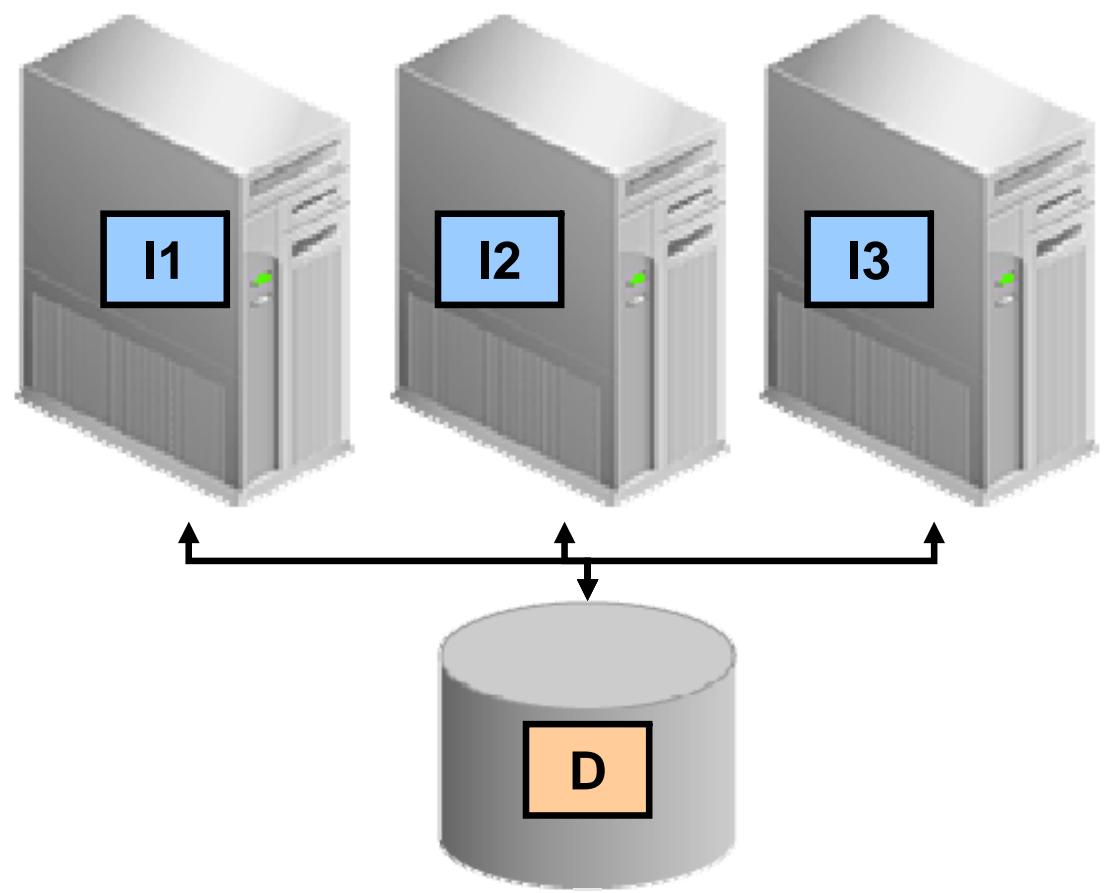
Instance: Database Configurations

Nonclustered System



Local Storage

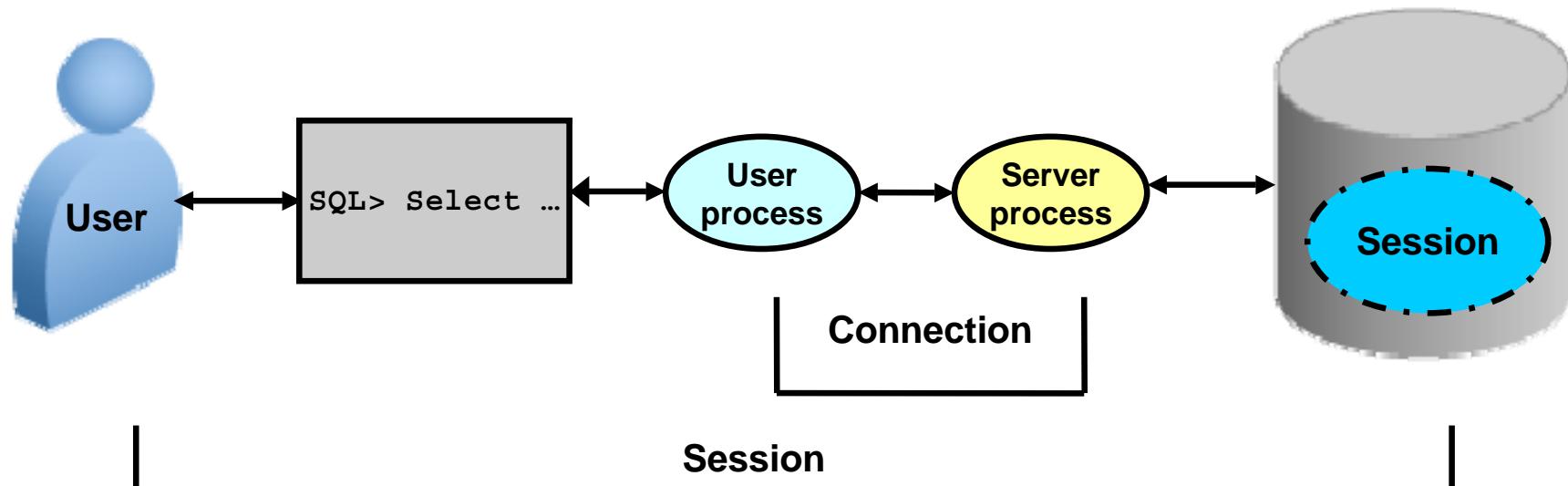
Clustered System



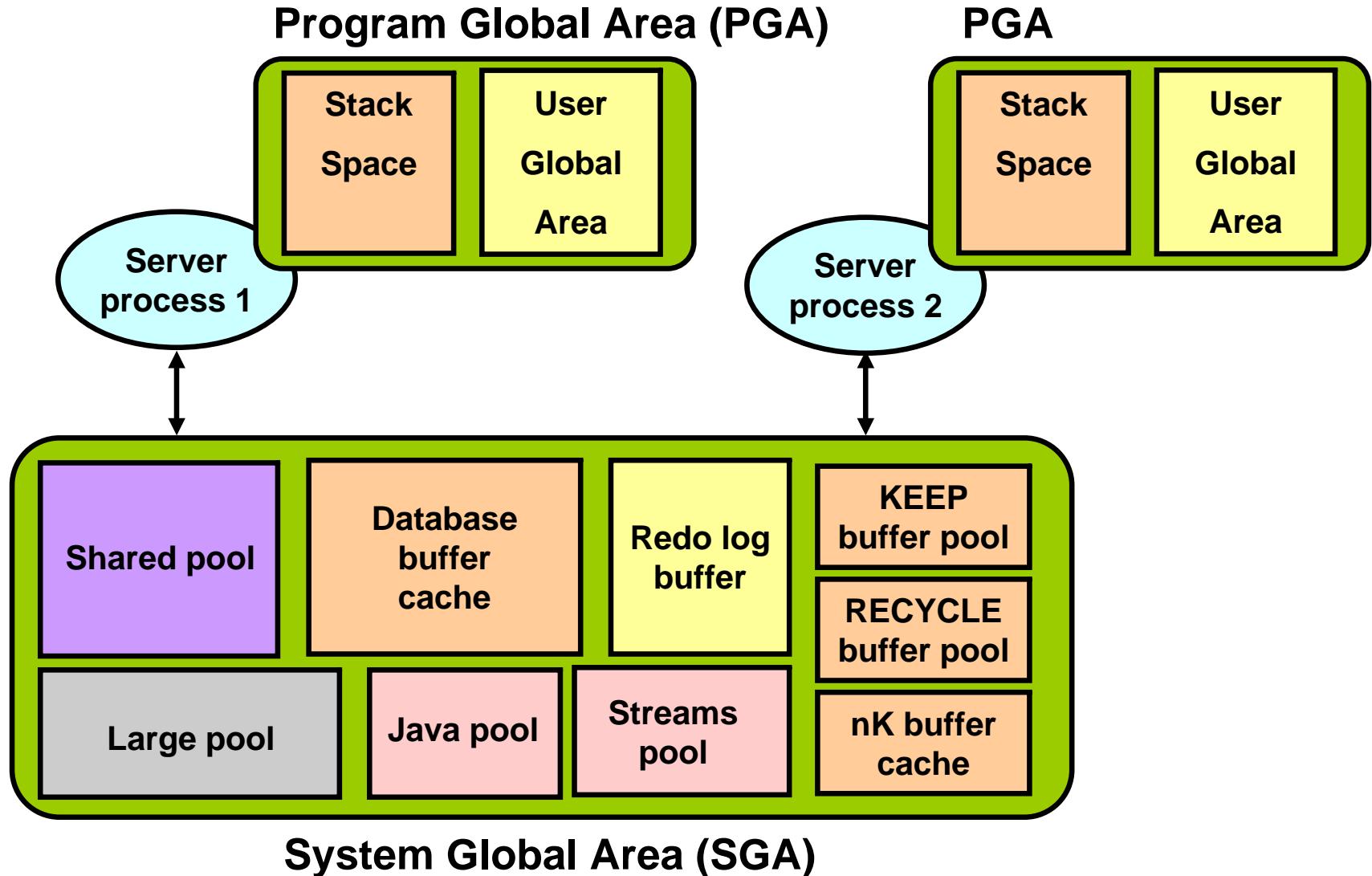
Shared Storage

Connecting to the Database Instance

- Connection: Communication between a user process and an instance
- Session: Specific connection of a user to an instance through a user process

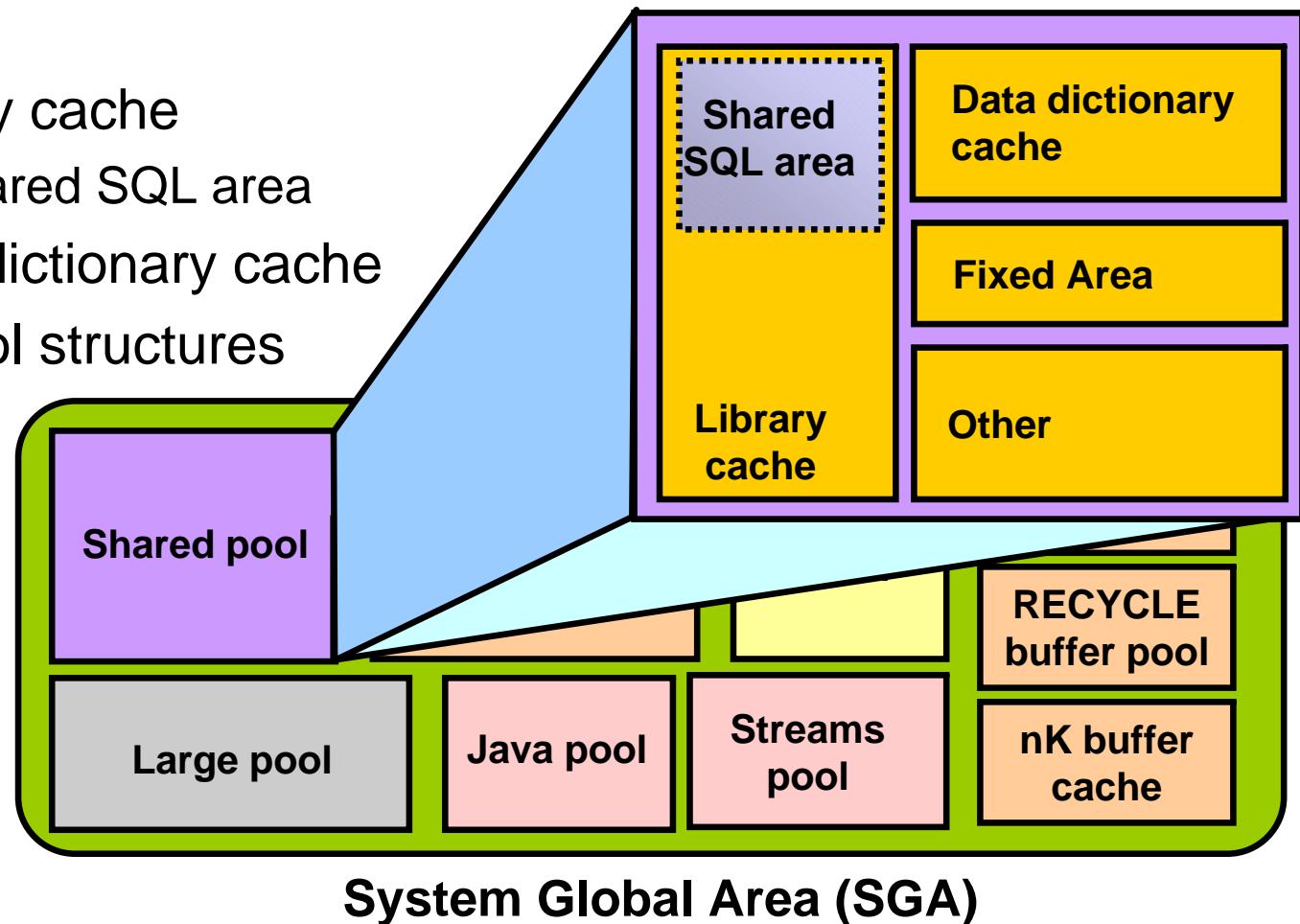


Oracle Database Memory Structures



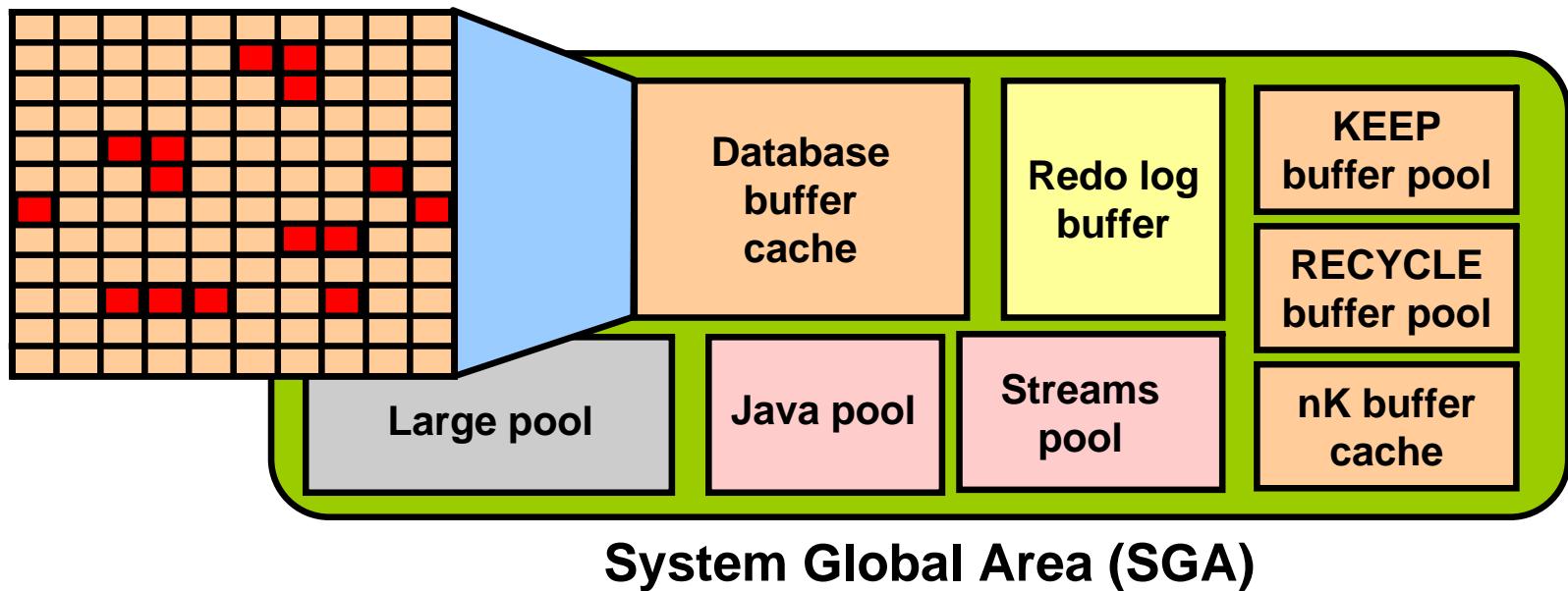
Shared Pool

- Is a portion of the SGA
- Contains:
 - Library cache
 - Shared SQL area
 - Data dictionary cache
 - Control structures



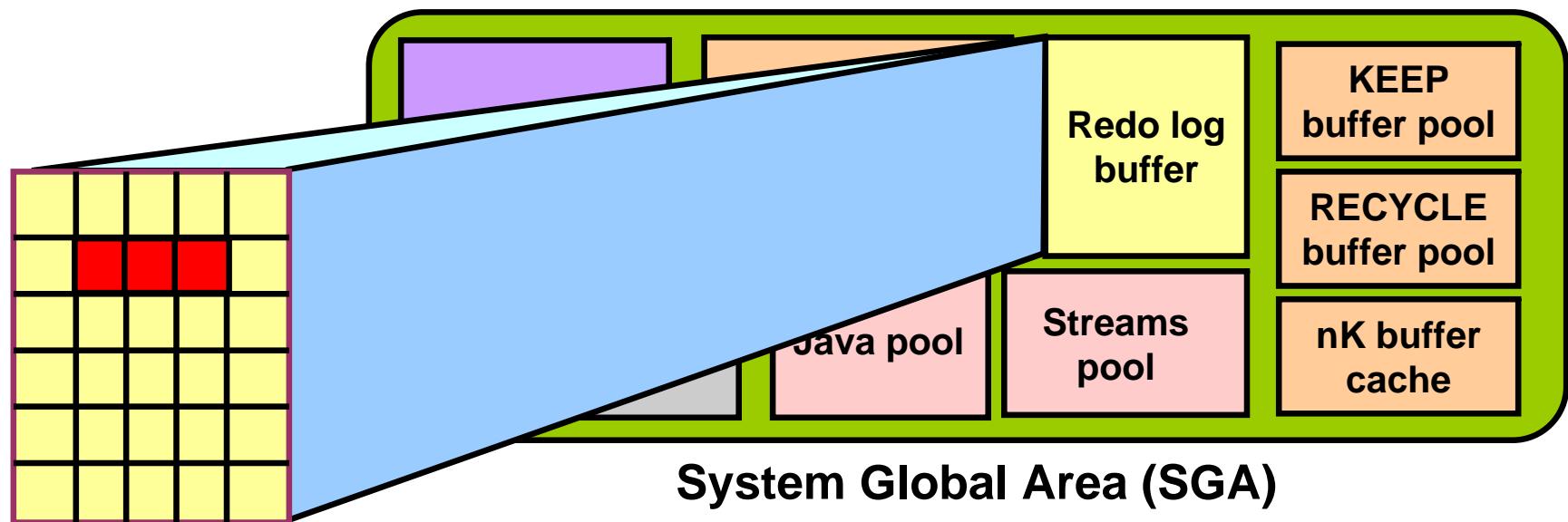
Database Buffer Cache

- Is part of the SGA
- Holds copies of data blocks that are read from data files
- Is shared by all concurrent users



Redo Log Buffer

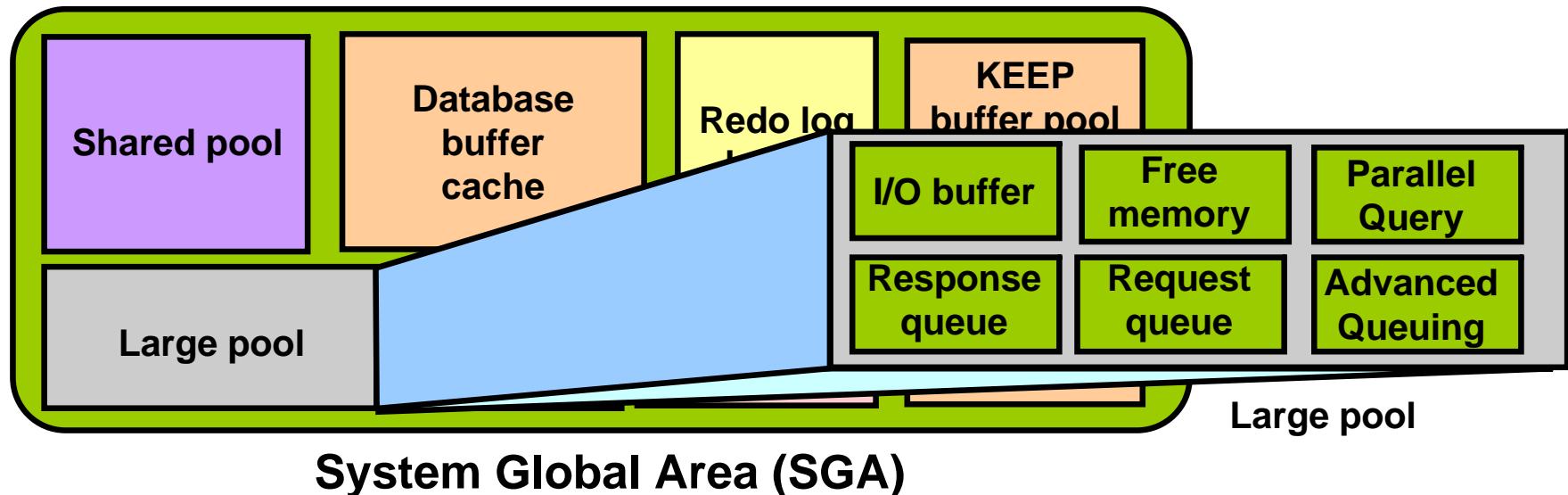
- Is a circular buffer in the SGA
- Holds information about changes made to the database
- Contains redo entries that have the information to redo changes made by operations such as DML and DDL



Large Pool

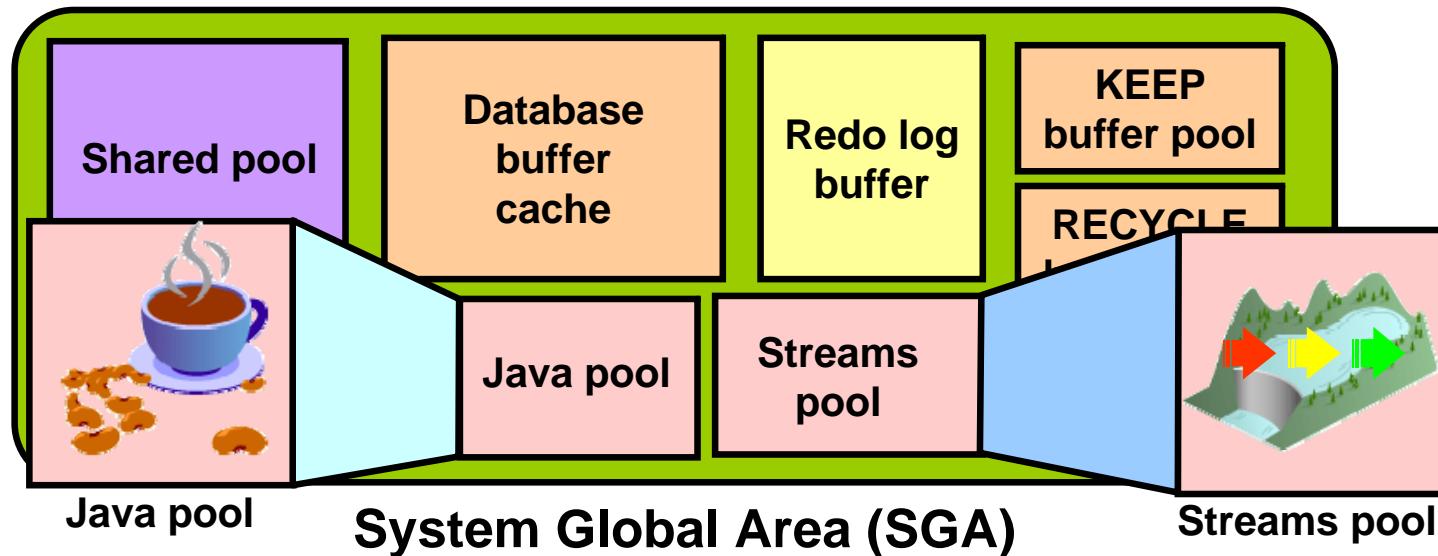
Provides large memory allocations for:

- Session memory for the shared server and the Oracle XA interface
- I/O server processes
- Oracle Database backup and restore operations

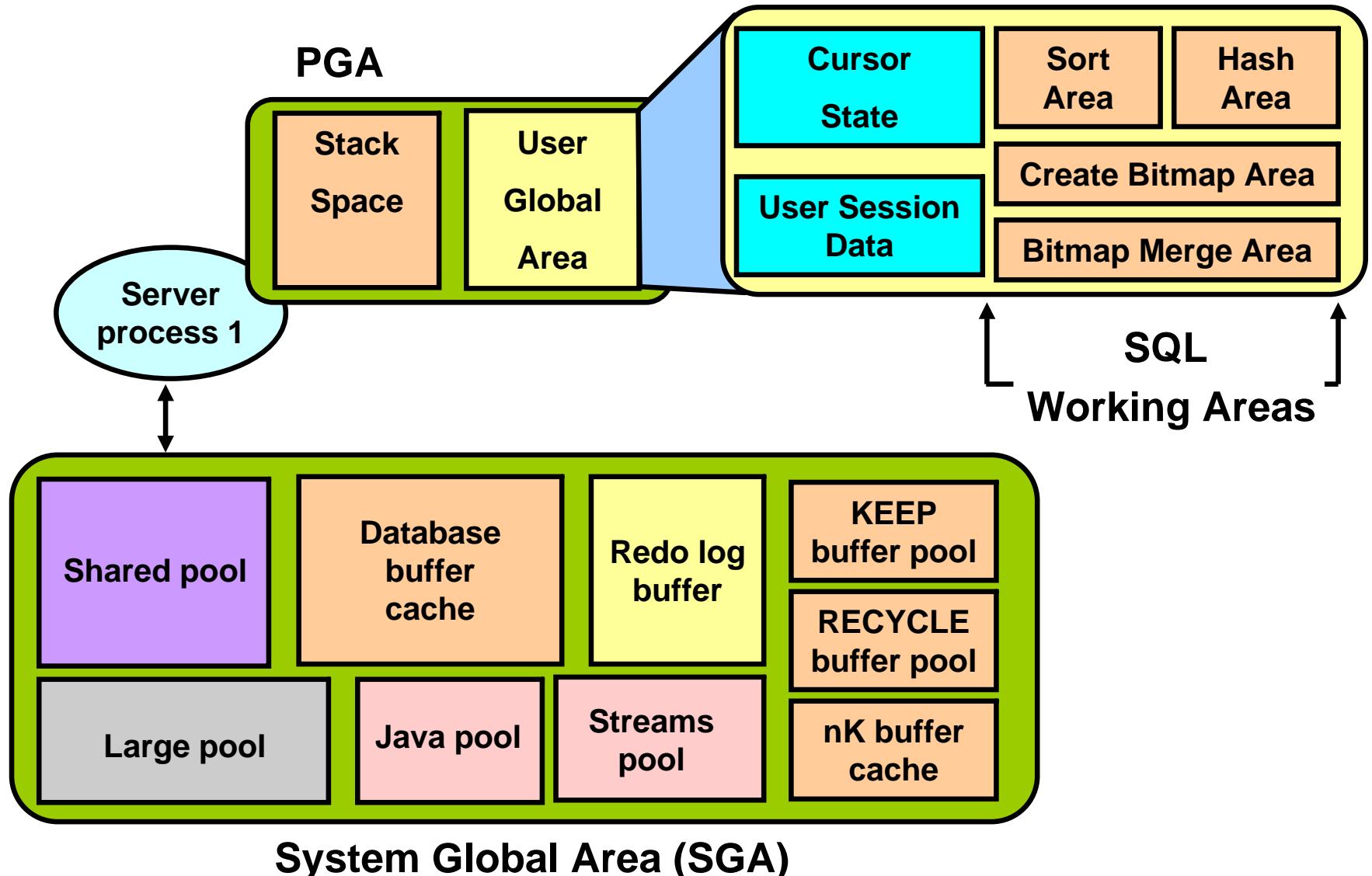


Java Pool and Streams Pool

- Java pool memory is used to store all session-specific Java code and data in the JVM.
- Streams pool memory is used exclusively by Oracle Streams to:
 - Store buffered queue messages
 - Provide memory for Oracle Streams processes



Program Global Area (PGA)



Quiz

Memory region that contains data and control information for a server or background process is called:

1. Shared Pool
2. PGA
3. Buffer Cache
4. User session data

Quiz

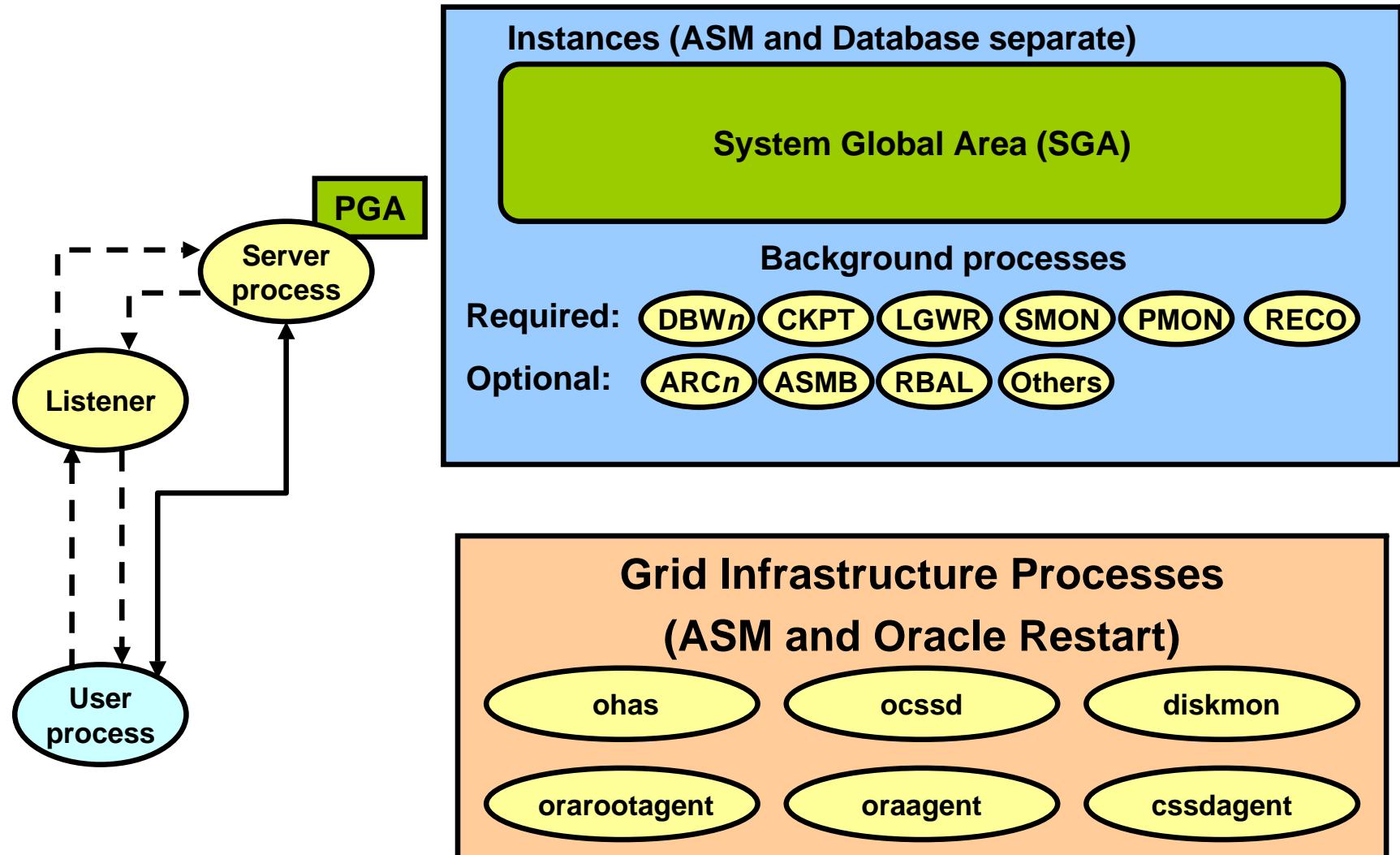
What is read into the Database Buffer Cache from the data files?

1. Rows
2. Changes
3. Blocks
4. SQL

Process Architecture

- User process
 - Is the application or tool that connects to the Oracle database
- Database processes
 - Server process: Connects to the Oracle instance and is started when a user establishes a session
 - Background processes: Are started when an Oracle instance is started
- Daemon / Application processes
 - Networking listeners
 - Grid infrastructure daemons

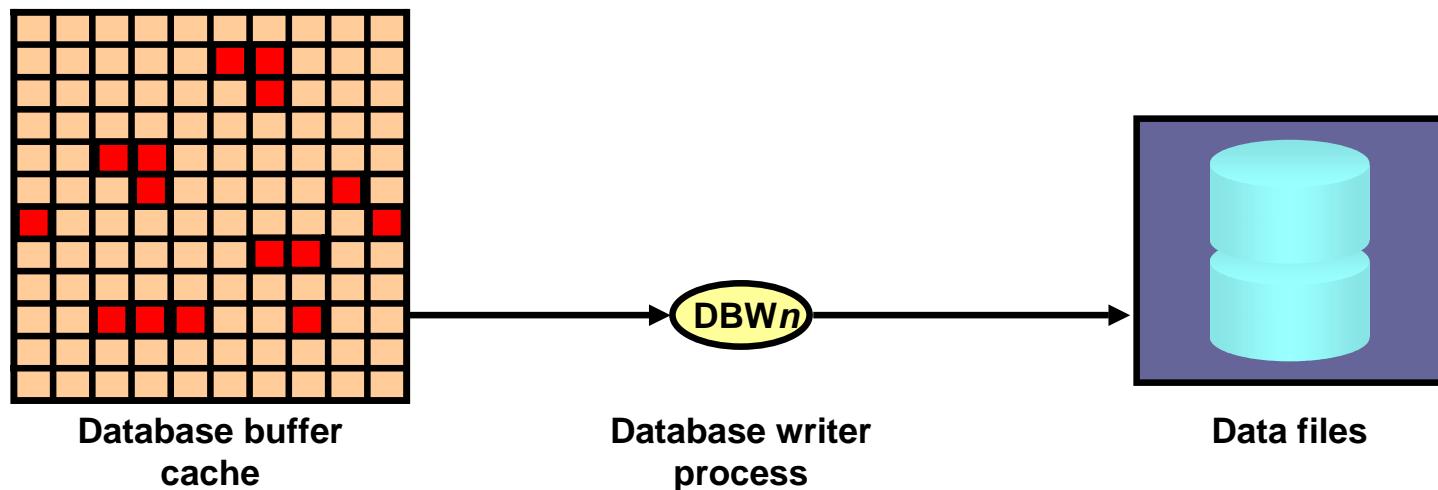
Process Structures



Database Writer Process (DBWn)

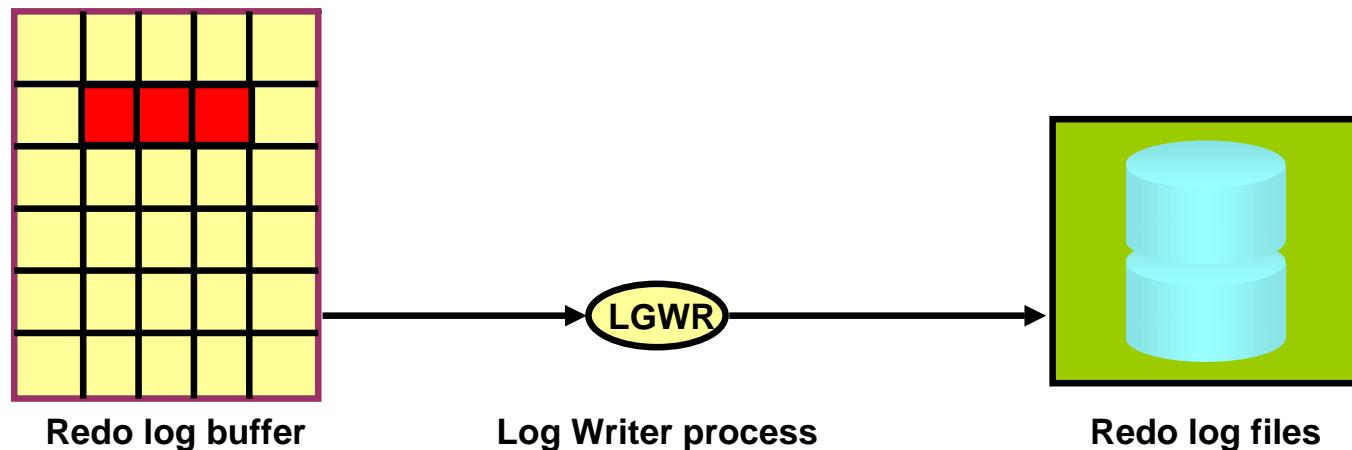
Writes modified (dirty) buffers in the database buffer cache to disk:

- Asynchronously while performing other processing
- To advance the checkpoint



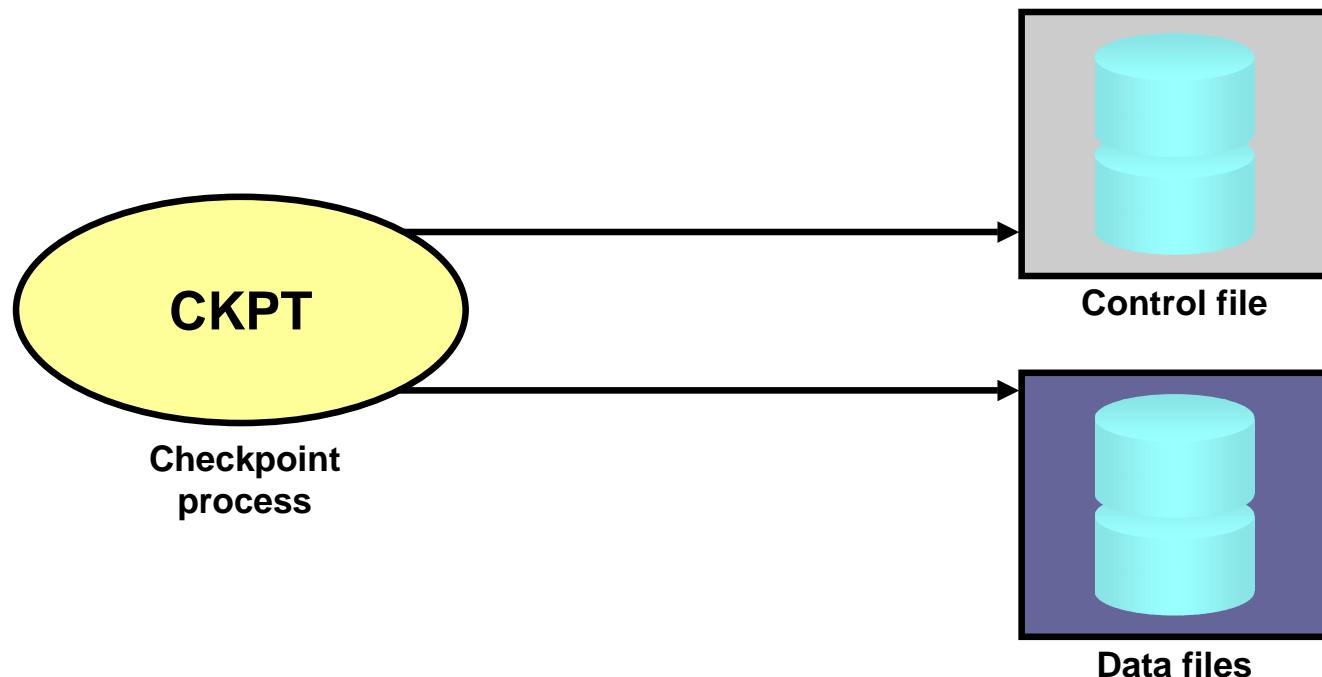
Log Writer Process (LGWR)

- Writes the redo log buffer to a redo log file on disk
- Writes:
 - When a user process commits a transaction
 - When the redo log buffer is one-third full
 - Before a DBWn process writes modified buffers to disk
 - Every 3 seconds



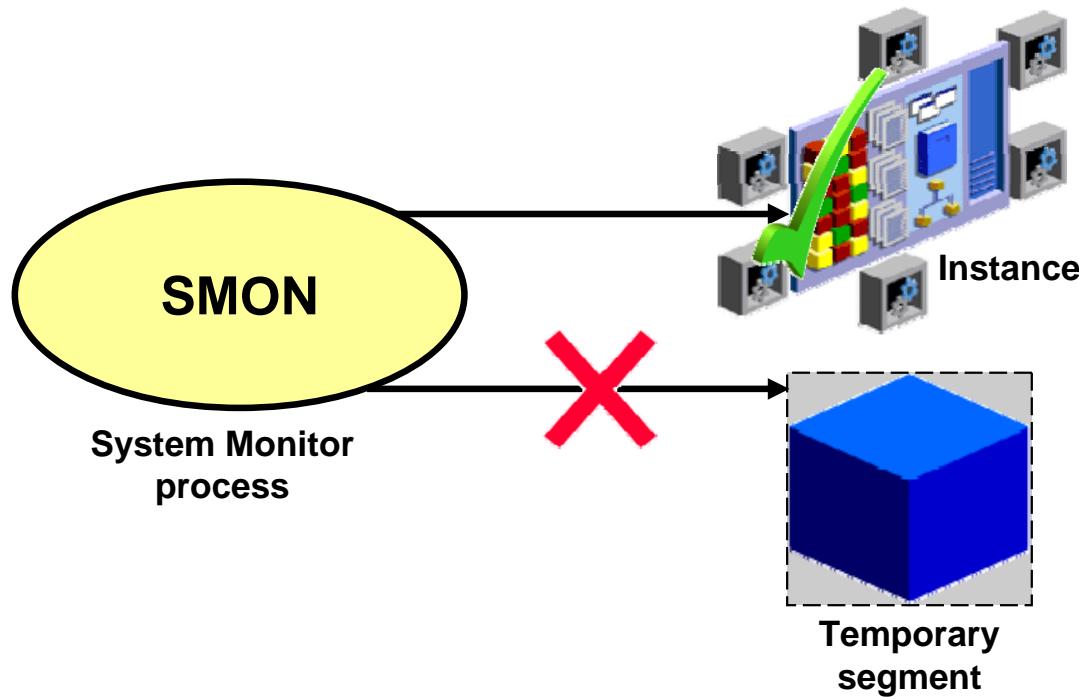
Checkpoint Process (CKPT)

- Records checkpoint information in
 - Control file
 - Each data file header



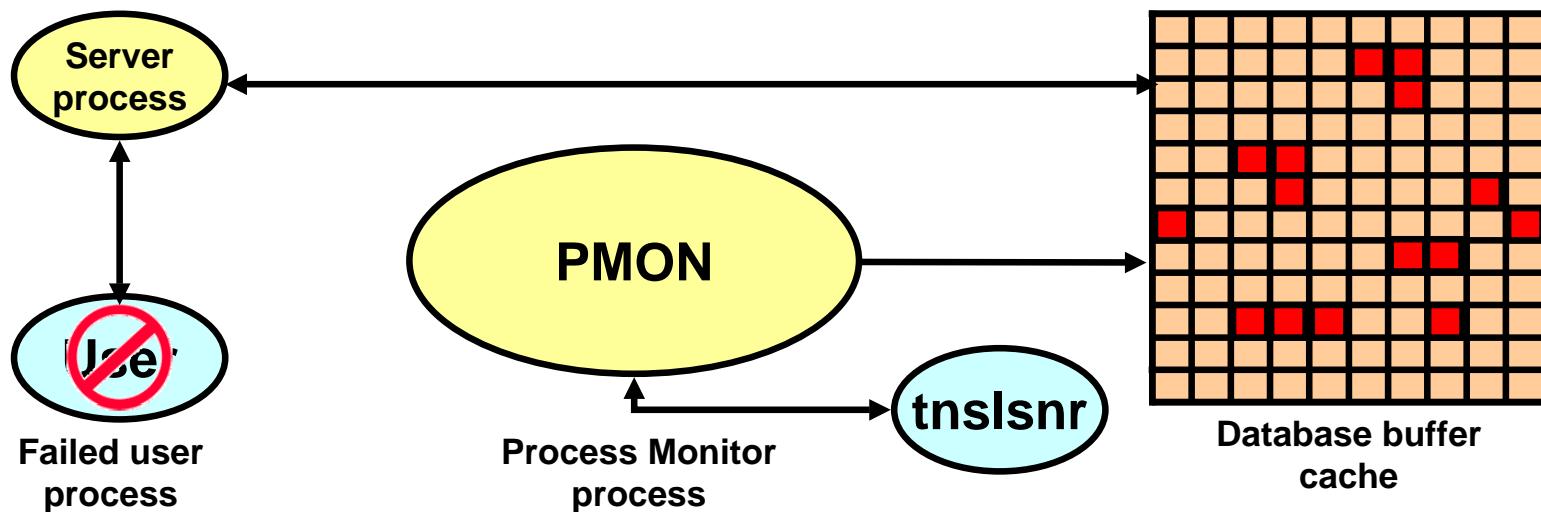
System Monitor Process (SMON)

- Performs recovery at instance startup
- Cleans up unused temporary segments



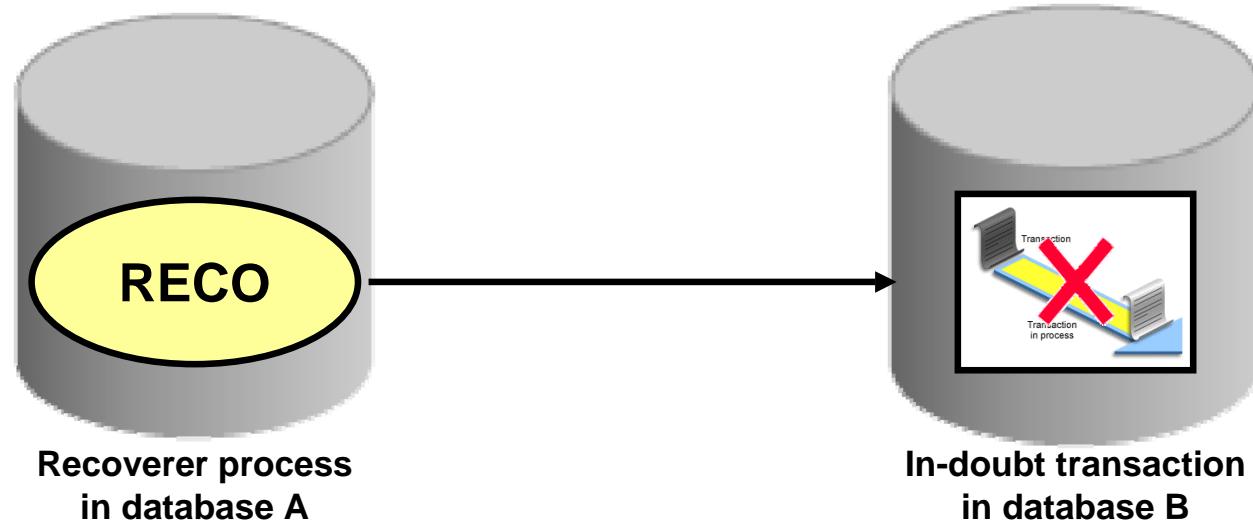
Process Monitor Process (PMON)

- Performs process recovery when a user process fails
 - Cleans up the database buffer cache
 - Frees resources that are used by the user process
- Monitors sessions for idle session timeout
- Dynamically registers database services with listeners



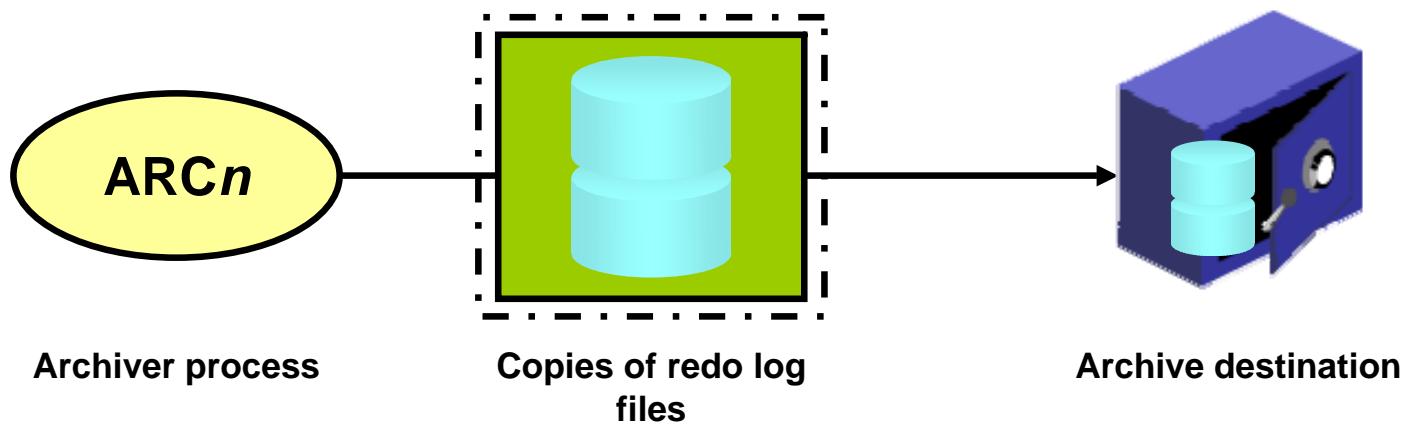
Recoverer Process

- Used with the distributed database configuration
- Automatically connects to other databases involved in in-doubt distributed transactions
- Automatically resolves all in-doubt transactions
- Removes any rows that correspond to in-doubt transactions



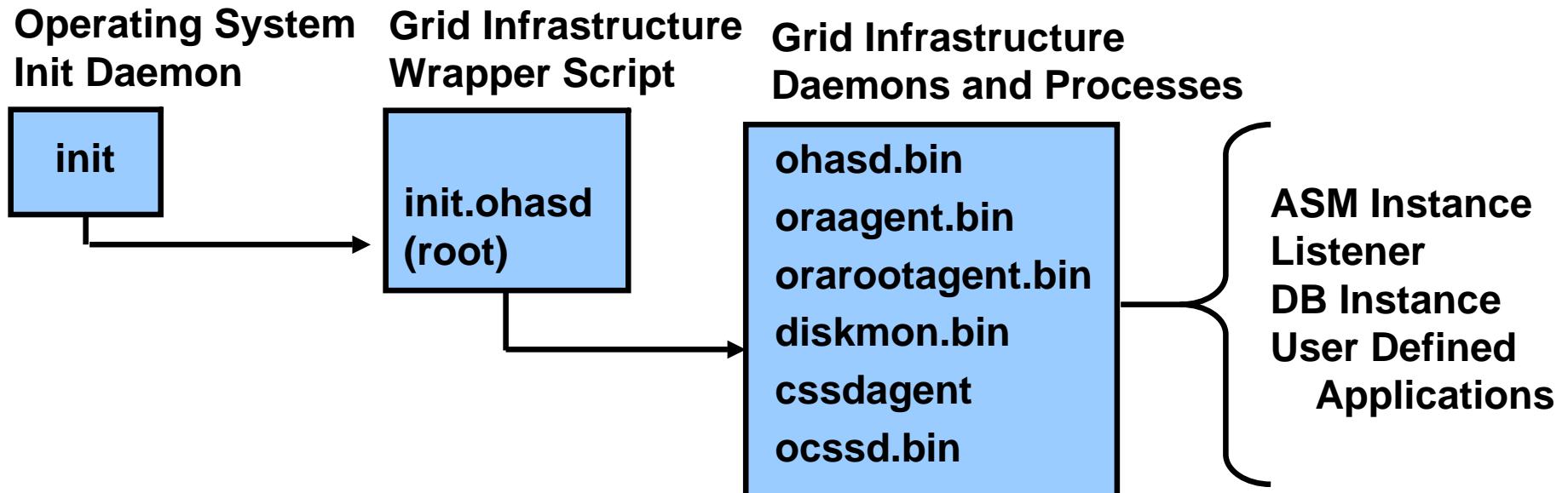
Archiver Processes (ARCn)

- Copy redo log files to a designated storage device after a log switch has occurred
- Can collect transaction redo data and transmit that data to standby destinations



Process Startup Sequence

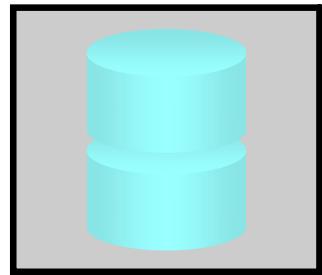
- Oracle Grid Infrastructure is started by the OS init daemon.



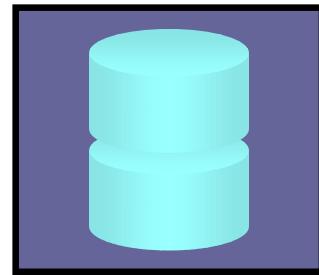
- Oracle Grid Infrastructure installation modifies the `/etc/inittab` file to ensure startup every time machine is started in corresponding run level.

```
# cat /etc/inittab
...
h1:35:respawn:/etc/init.d/init.ohasd run >/dev/null 2>&1 </dev/null
```

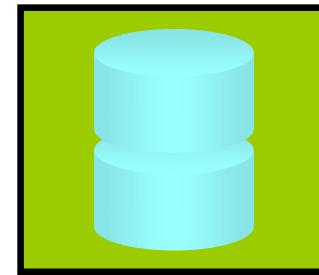
Database Storage Architecture



Control files



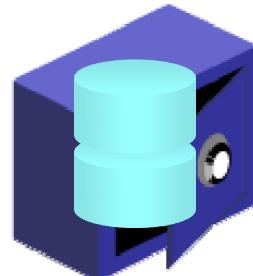
Data files



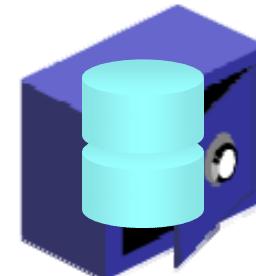
Online redo log files



Parameter file



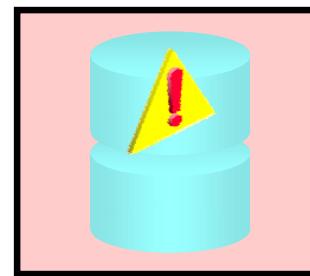
Backup files



**Archived redo log
files**

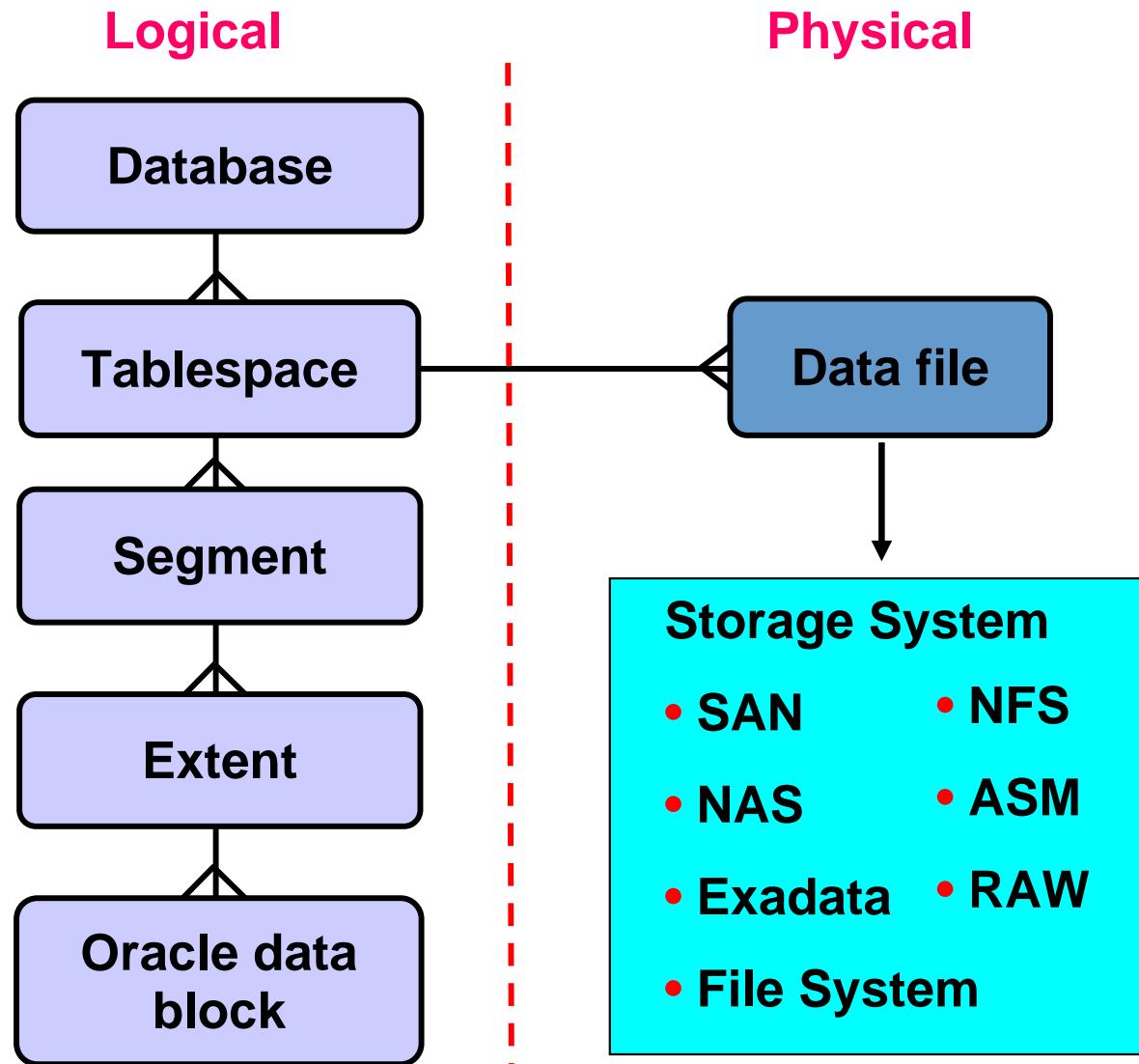


Password file



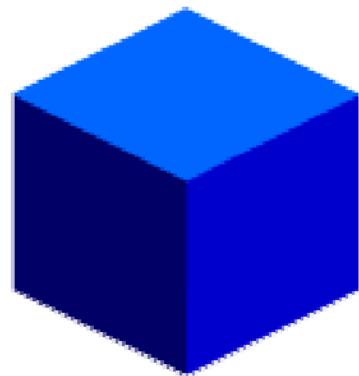
Alert log and trace files

Logical and Physical Database Structures



Segments, Extents, and Blocks

- Segments exist in a tablespace.
- Segments are collections of extents.
- Extents are collections of data blocks.
- Data blocks are mapped to disk blocks.



Segment



Extents

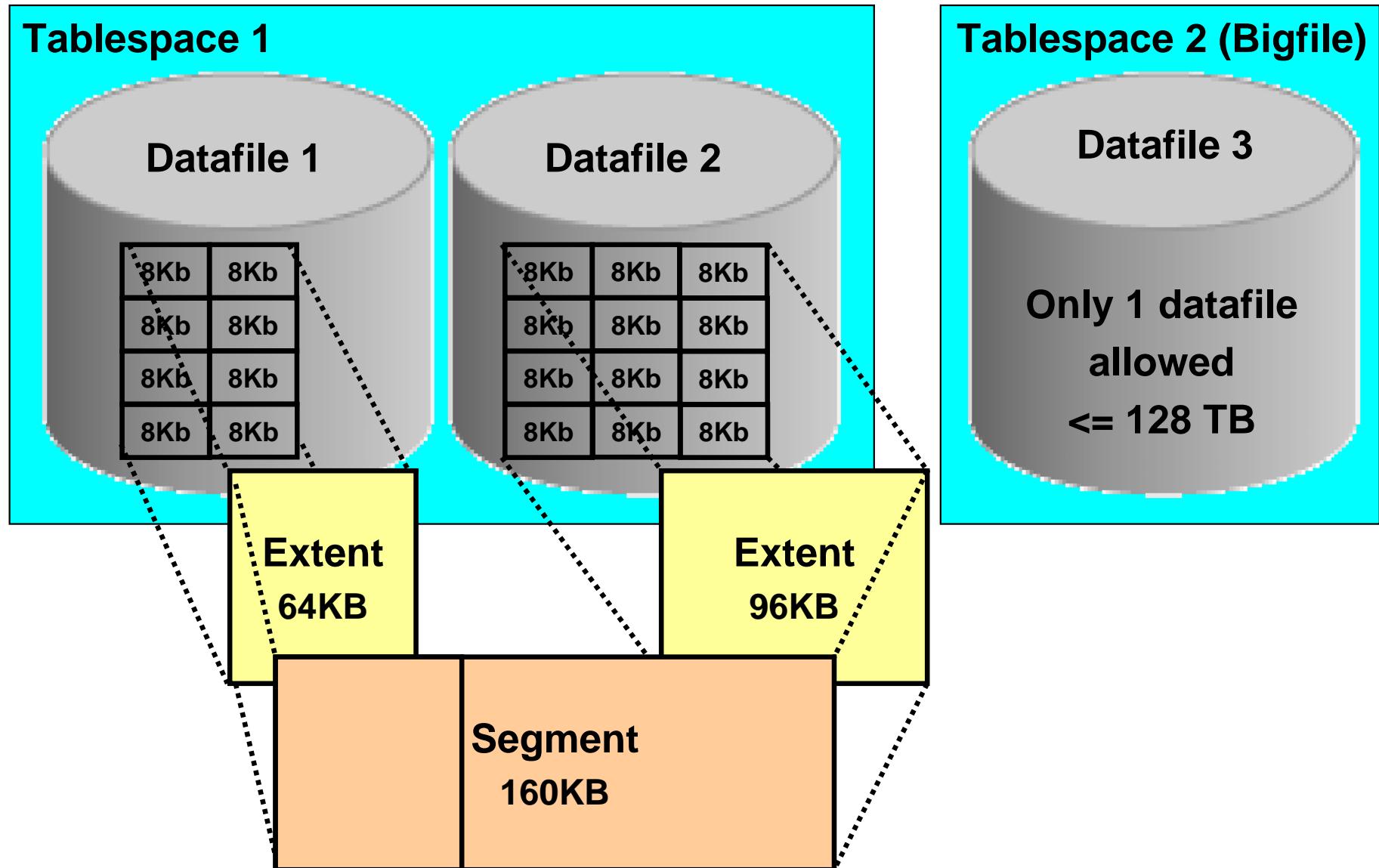


**Data
blocks**



**Disk blocks
(File System
Storage)**

Tablespaces and Data Files

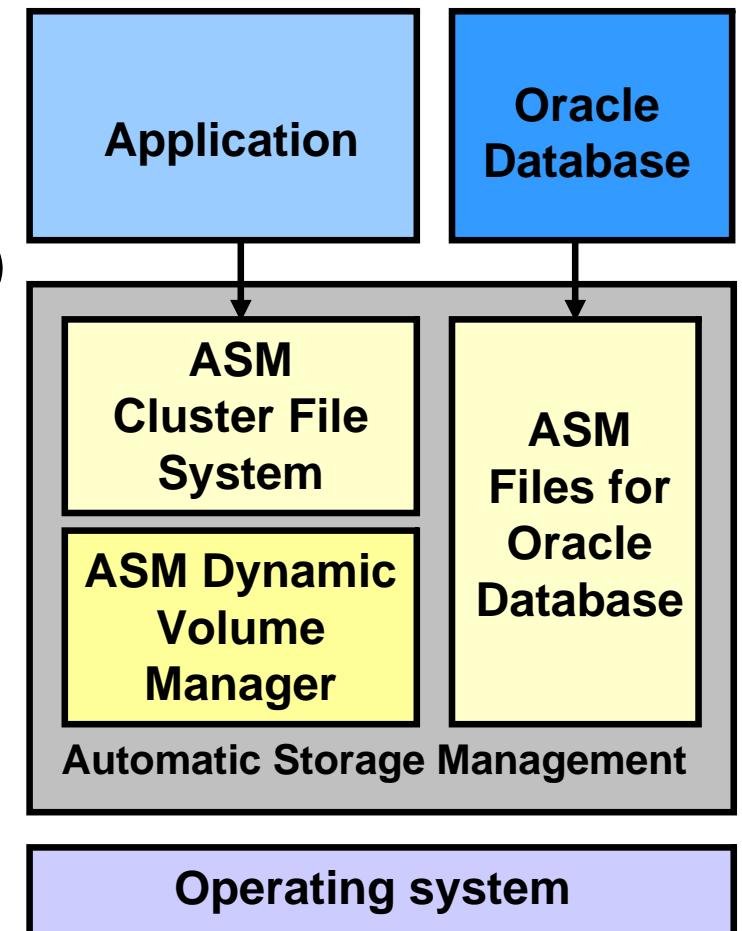


SYSTEM and SYSAUX Tablespaces

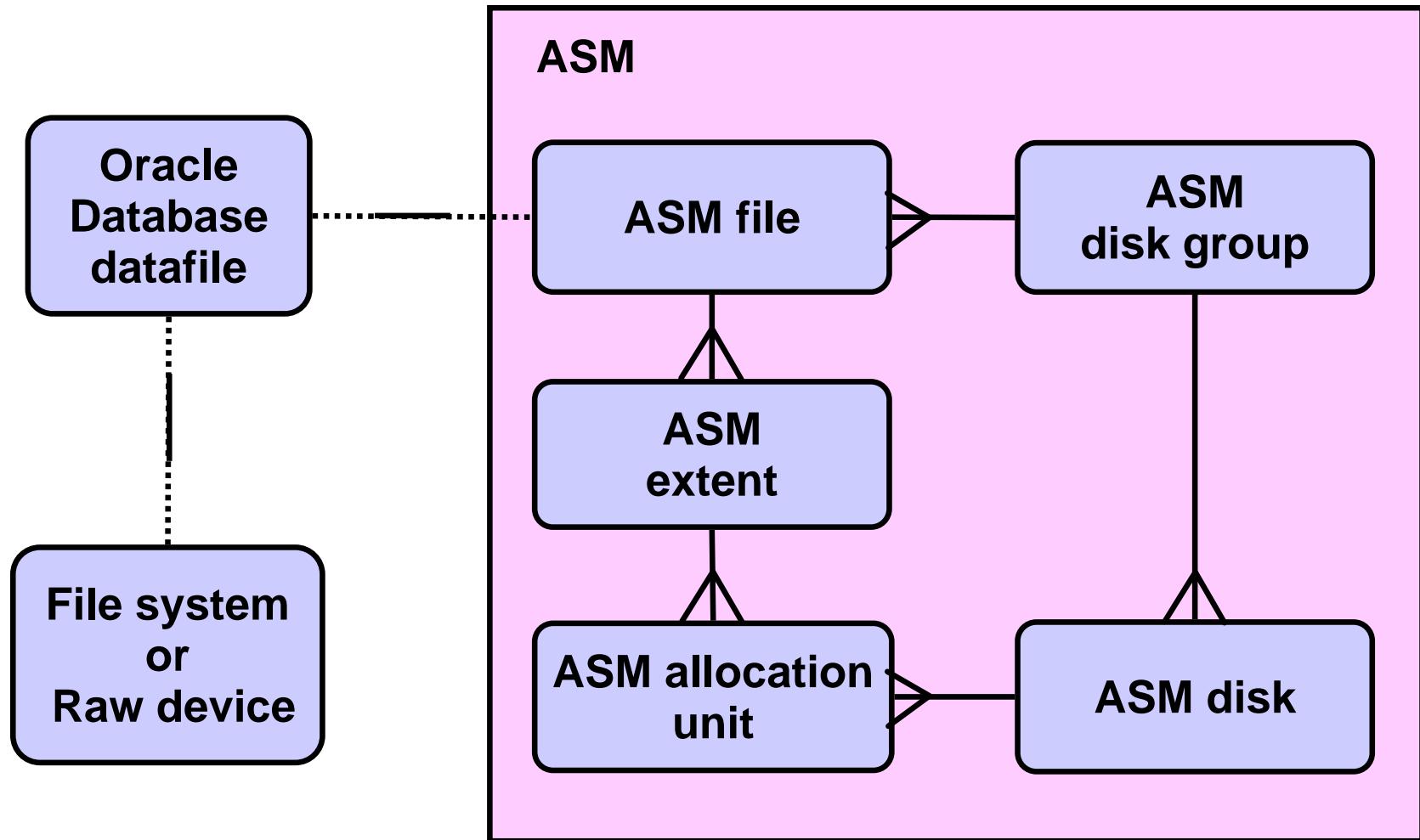
- The SYSTEM and SYSAUX tablespaces are mandatory tablespaces that are created at the time of database creation. They must be online.
- The SYSTEM tablespace is used for core functionality (for example, data dictionary tables).
- The auxiliary SYSAUX tablespace is used for additional database components (such as the Enterprise Manager Repository).
- The SYSTEM and SYSAUX tablespaces are not recommended to be used to store application's data.

Automatic Storage Management

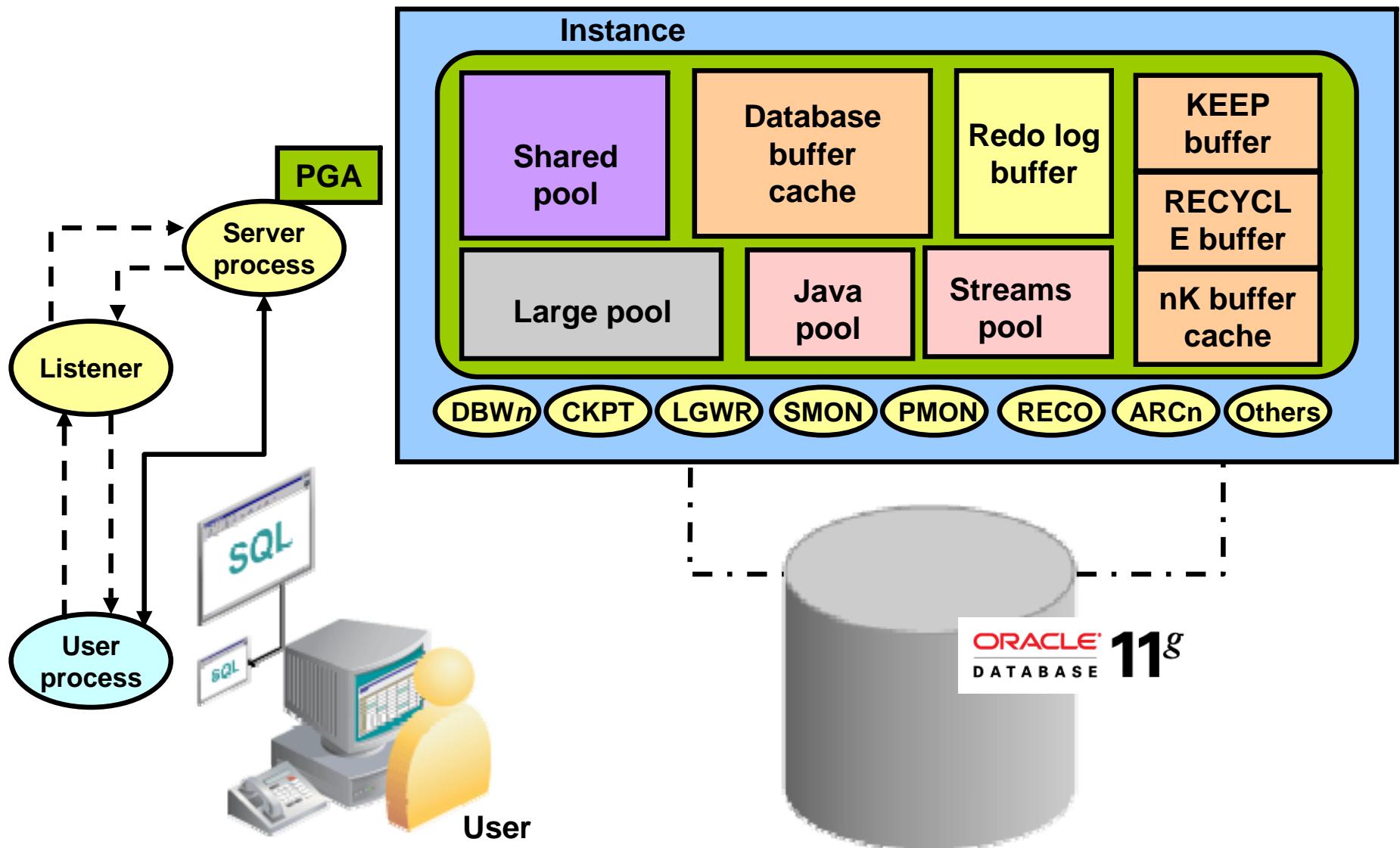
- Is a portable and high-performance cluster file system
- Manages Oracle database files
- Manages application files with ASM Cluster File System (ACFS)
- Spreads data across disks to balance load
- Mirrors data in case of failures
- Solves storage-management challenges



ASM Storage Components



Interacting with an Oracle Database: Memory, Processes and Storage



Quiz

The Process Monitor process (PMON):

1. Performs recovery at instance startup
2. Performs process recovery when a user process fails
3. Automatically resolves all in-doubt transactions
4. Writes the redo log buffer to a redo log file

Quiz

ASM Files are accessed by which types of instances?

1. RDBMS Instances only
2. ASM Instances only
3. Both RDBMS and ASM Instances

Summary

In this lesson, you should have learned how to:

- List the major architectural components of Oracle Database
- Explain the memory structures
- Describe the background processes
- Correlate the logical and physical storage structures
- Describe the ASM storage components

Practice 1: Overview

This is a paper practice with questions about:

- Database architecture
- Memory
- Processes
- File structures



Installing your Oracle Software

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Objectives

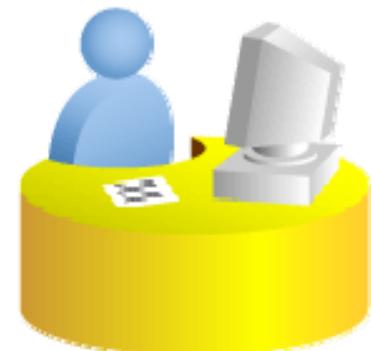
After completing this lesson, you should be able to:

- Describe your role as a database administrator (DBA) and explain typical tasks and tools
- Plan an Oracle software installation
- Install Oracle Grid Infrastructure for a standalone server
- Install the Oracle database software

Tasks of an Oracle Database Administrator

The approach for designing, implementing, and maintaining an Oracle database involves the following tasks:

1. Evaluating the database server hardware
2. Installing the Oracle software
3. Planning the database and security strategy
4. Creating, migrating, and opening the database
5. Backing up the database
6. Enrolling system users and planning for their Oracle Network access
7. Implementing the database design
8. Recovering from database failure
9. Monitoring database performance



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Tools for Administering an Oracle Database

- Oracle Universal Installer
- Database Configuration Assistant
- Database Upgrade Assistant
- Oracle Net Manager
- Oracle Net Configuration Assistant
- Oracle Enterprise Manager
- Server Control Utility
- SQL*Plus
- Recovery Manager
- Data Pump
- SQL*Loader



Planning Your Installation

- What Oracle software are you installing?
- Does the hardware involved meet the minimum required specifications?
- Is there a recommended order of installation when multiple products are involved?
- Are there prerequisite steps that must be performed by someone other than the DBA?



Oracle Grid Infrastructure and Oracle Database Installation: System Requirements

- Memory requirements:
 - 1 GB for the database instance with Oracle Enterprise Manager Database Control
 - 1.5 GB for the ASM instance and Oracle Restart
- Disk space requirements:
 - 3 GB of swap space (based on 2 GB RAM)
 - 1 GB of disk space in the /tmp directory
 - 3.8 GB for the Oracle Database software
 - 4.5 GB for the Grid Infrastructure software
 - 1.7 GB for the preconfigured database (optional)
 - 3.4 GB for the fast recovery area (optional)
- Operating system (see documentation)



Preparing the Operating System

Create the required operating system users and groups:

- Groups:
 - oinstall
 - dba
 - Optional groups (if doing separation of duty across multiple users):
 - oper
 - asmdba
 - asmoper
 - asmadmin
- Users:
 - Software owner, usually oracle
 - Can create multiple users for multiple product installations



Setting Environment Variables

Oracle environment variables:

- ORACLE_BASE: Base of the Oracle directory structure.
Recommended to set this before installation.
- ORACLE_HOME: The environment in which Oracle products run. Not required before installation if ORACLE_BASE is set.
- ORACLE_SID: Not required before installation, but useful afterwards for ease of interaction with a particular instance
- NLS_LANG: Optional environment variable that controls language, territory, and client character set settings



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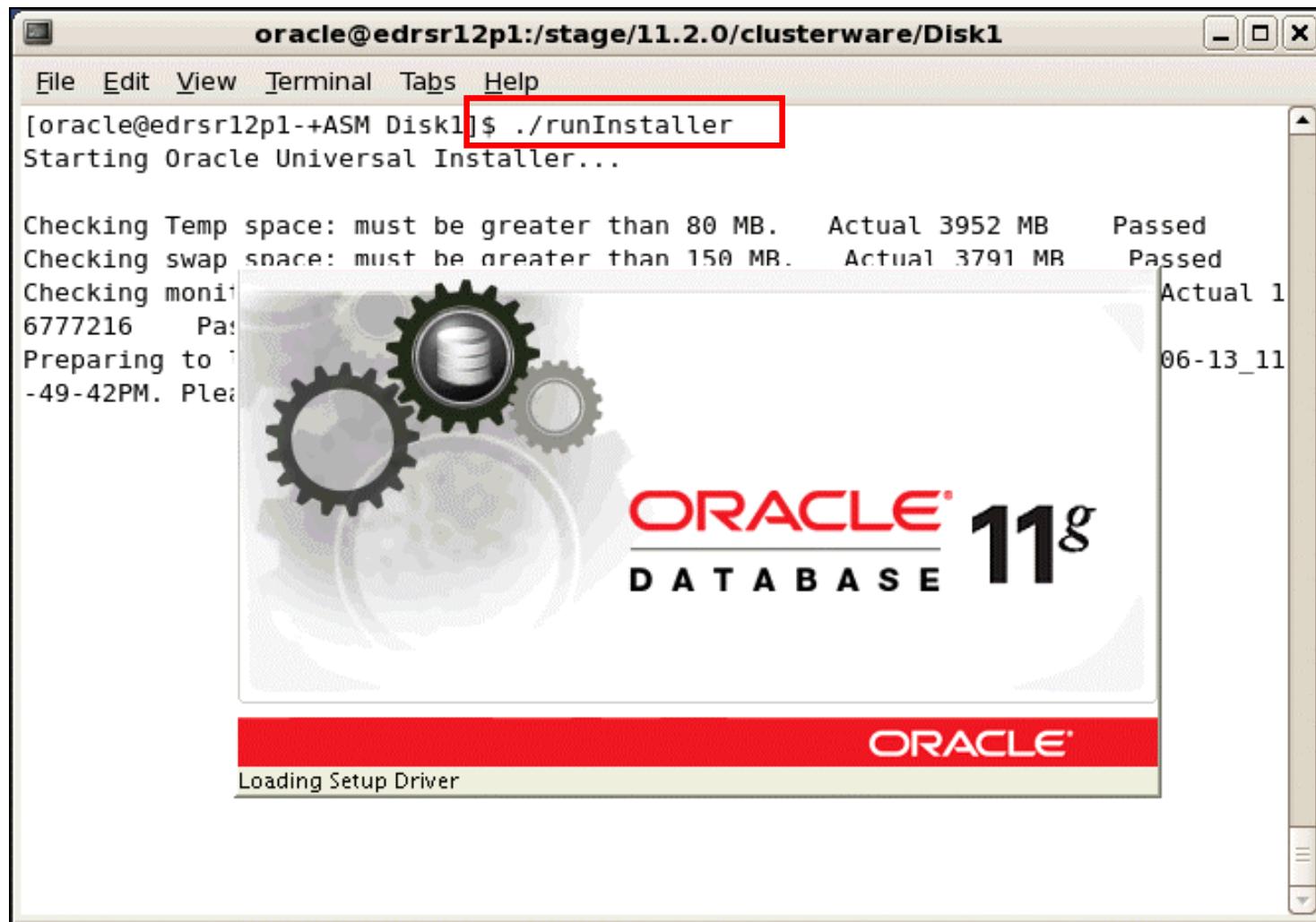
Checking the System Requirements

- Adequate temporary space
- 64-bit versus
- 32-bit issues
- Correct operating system (OS)
- OS patch level
- System packages
- System and kernel parameters
- X Server permissions
- Sufficient swapping
- ORACLE_HOME status

```
[oracle@edrsrl2p1-+ASM Disk1]$ ./runInstaller
Starting Oracle Universal Installer...

Checking Temp space: must be greater than 80 MB.    Actual 15067 MB    Passed
Checking swap space: must be greater than 150 MB.    Actual 4000 MB    Passed
Checking monitor: must be configured to display at least 256 colors.    Actual 6
5536    Passed
Preparing to launch Oracle Universal Installer from /tmp/OraInstall2009-05-15_12
-04-10AM. Please wait ...
```

Oracle Universal Installer (OUI)

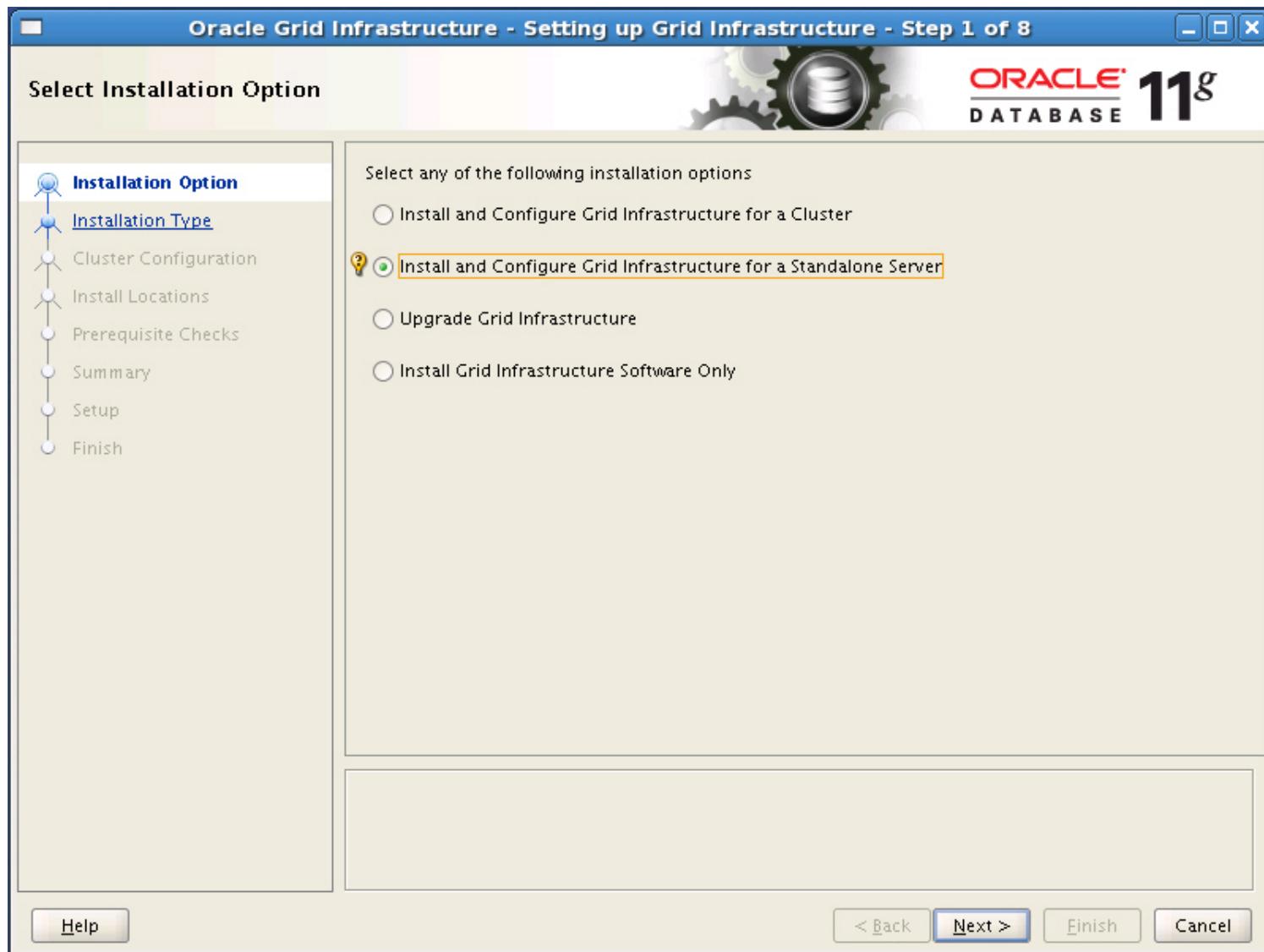


Example: Installation Scenario

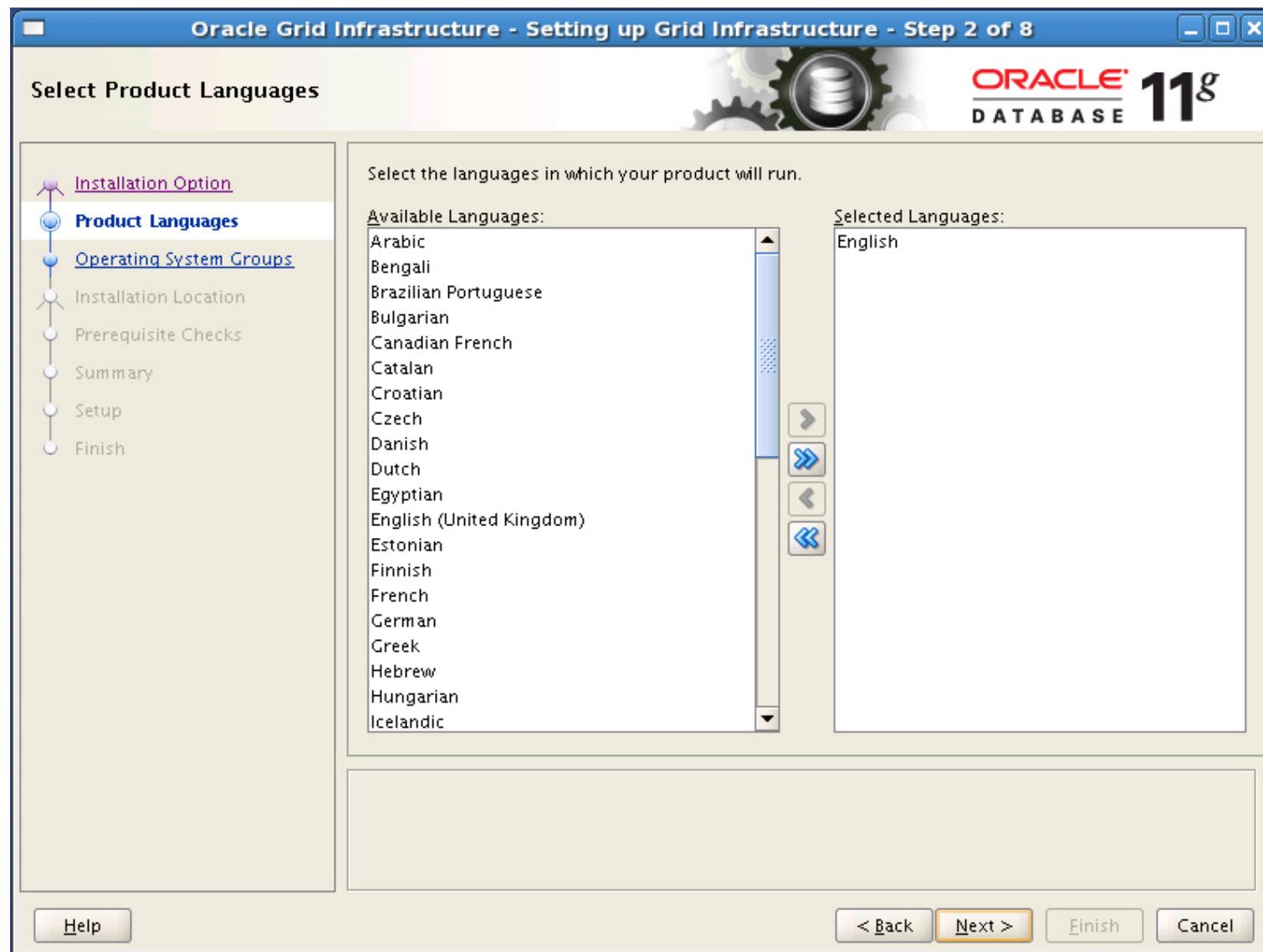
The installation scenario being presented in this lesson is divided into two parts:

- Part One: Install Oracle Grid Infrastructure for standalone server
- Part Two: Install Oracle Database software

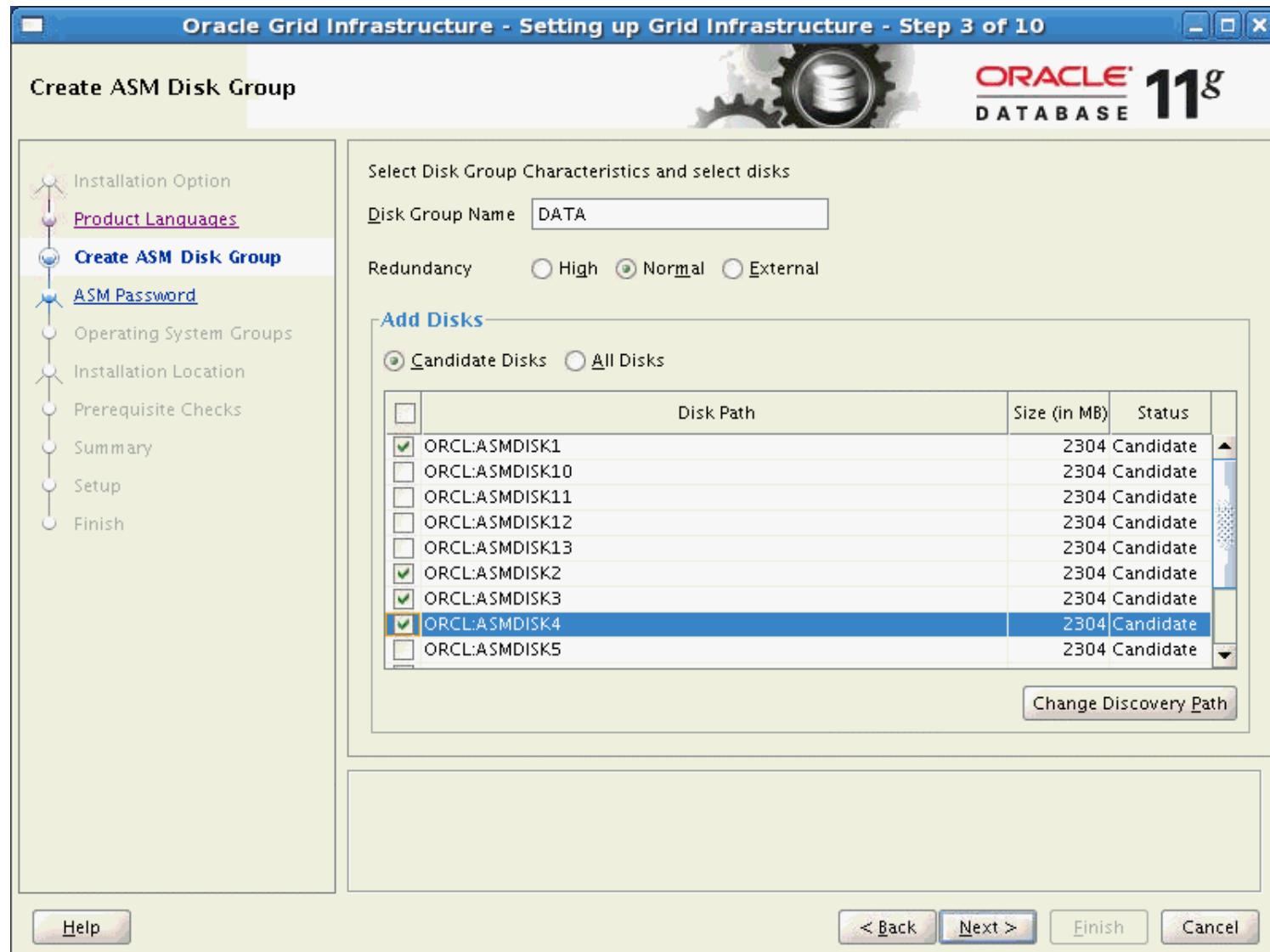
Part One: Installing the Oracle Grid Infrastructure for Standalone Server



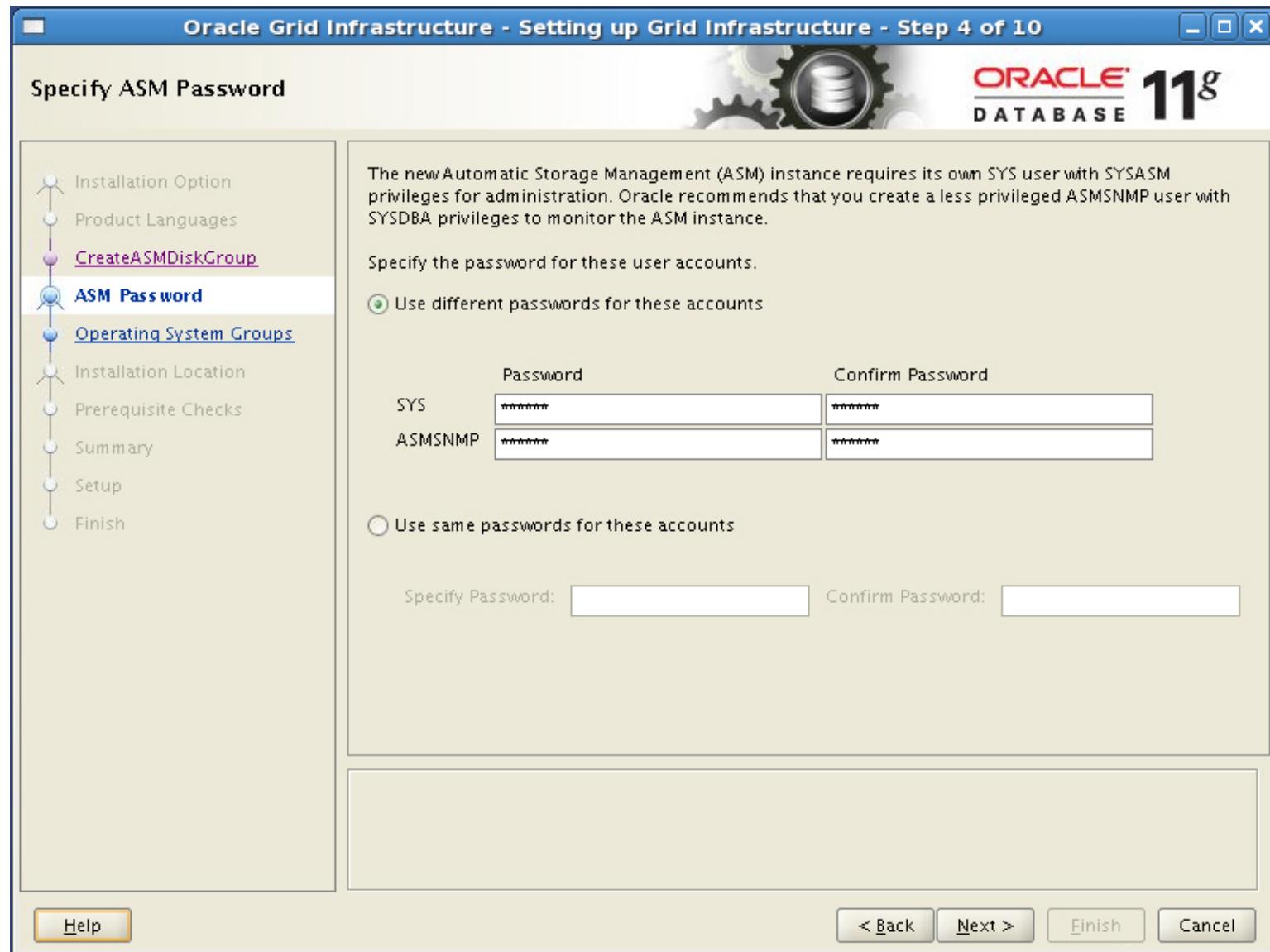
Selecting Product Languages



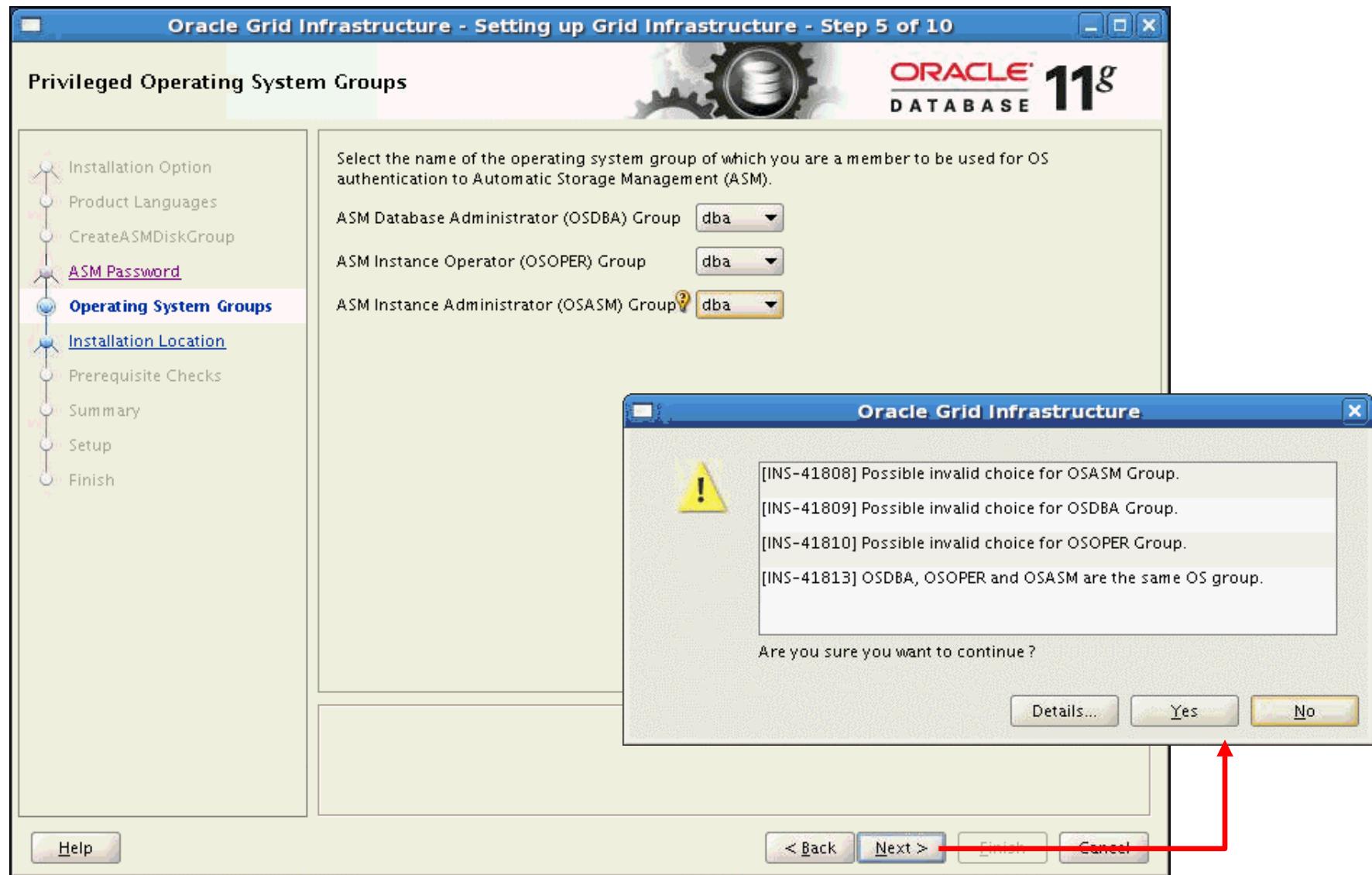
Creating an ASM Disk Group



Defining ASM Passwords



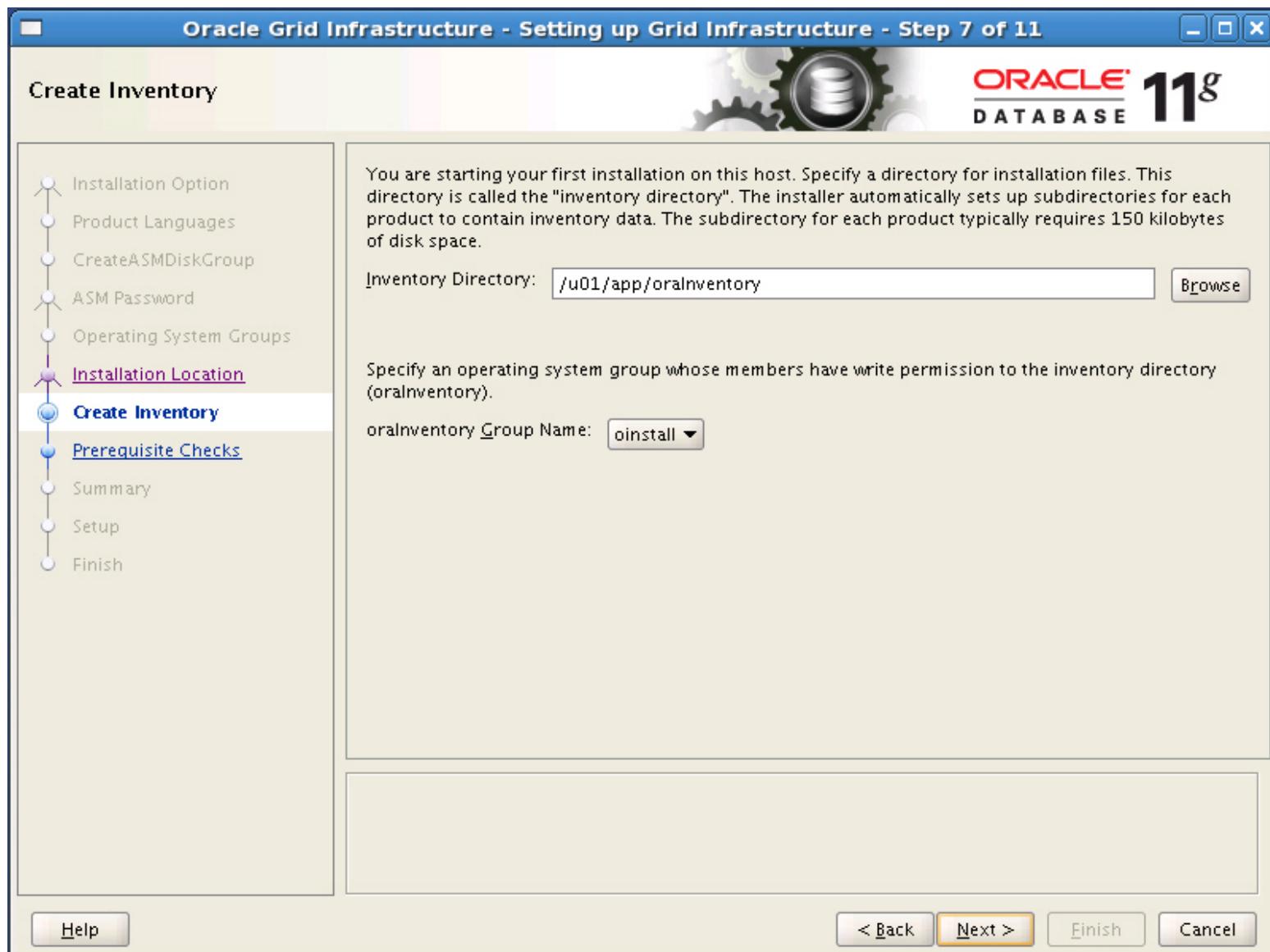
Defining Privileged Operating System Groups



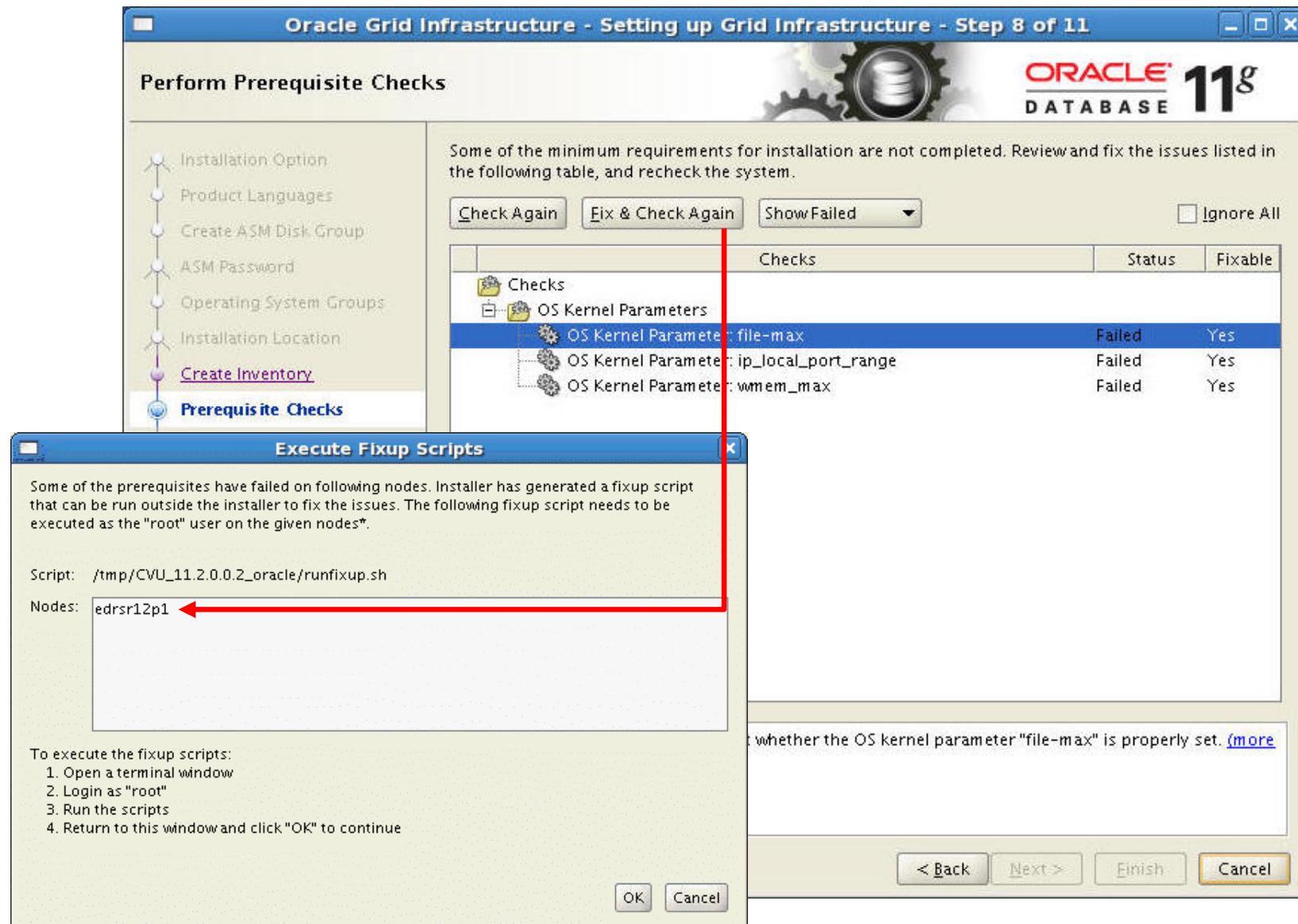
Specifying Installation Location



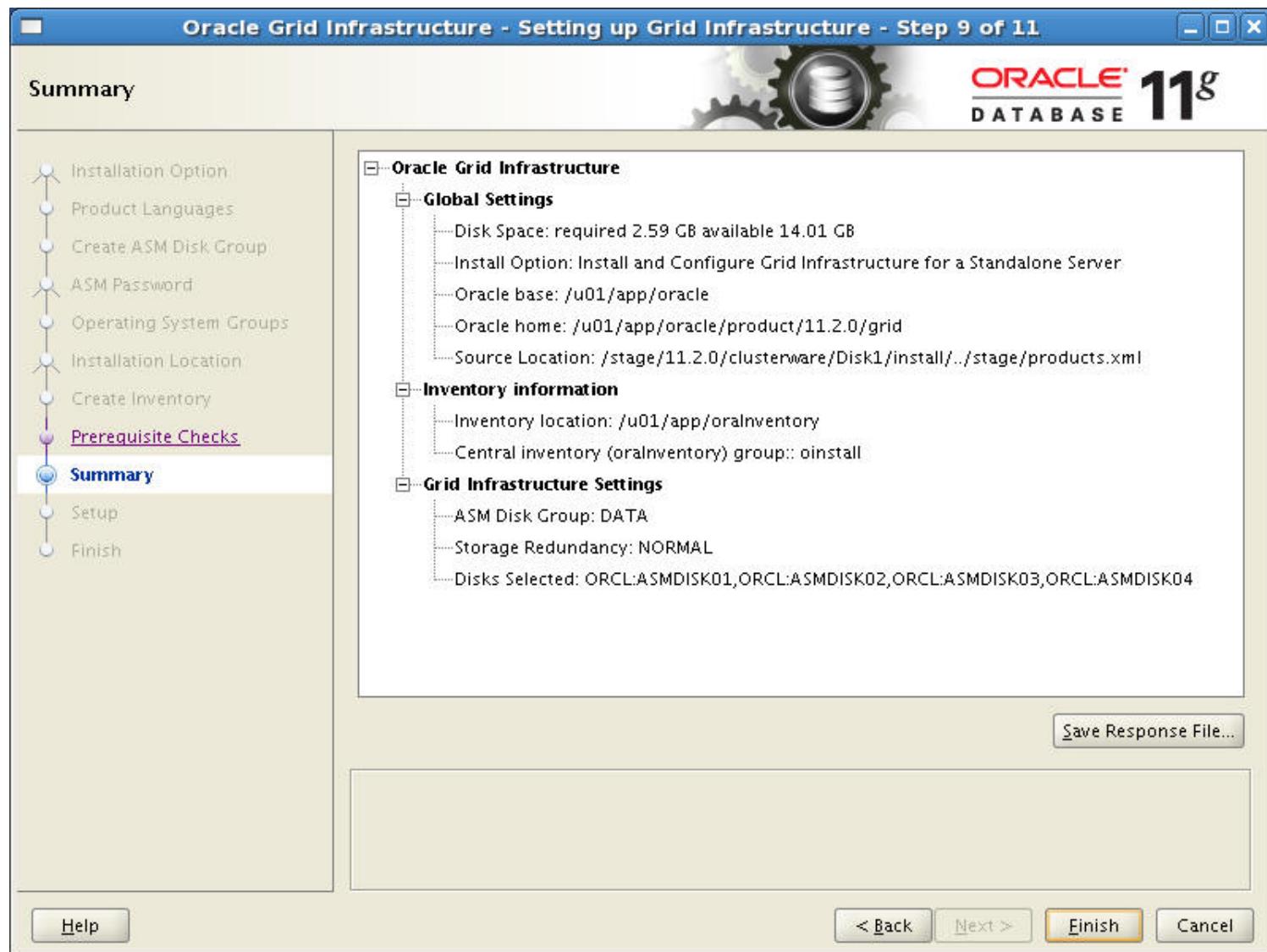
Creating Inventory



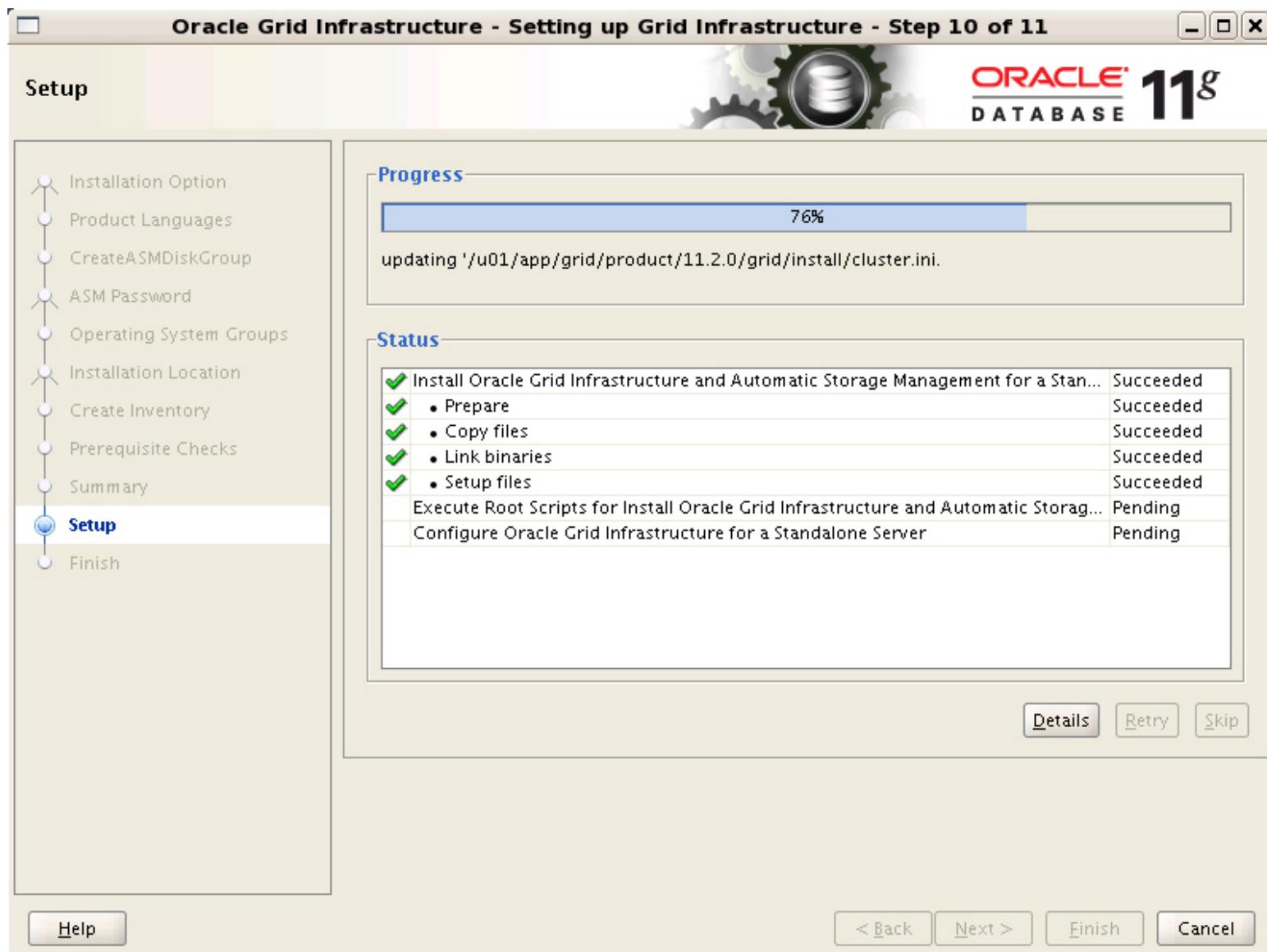
Performing Prerequisite Checks



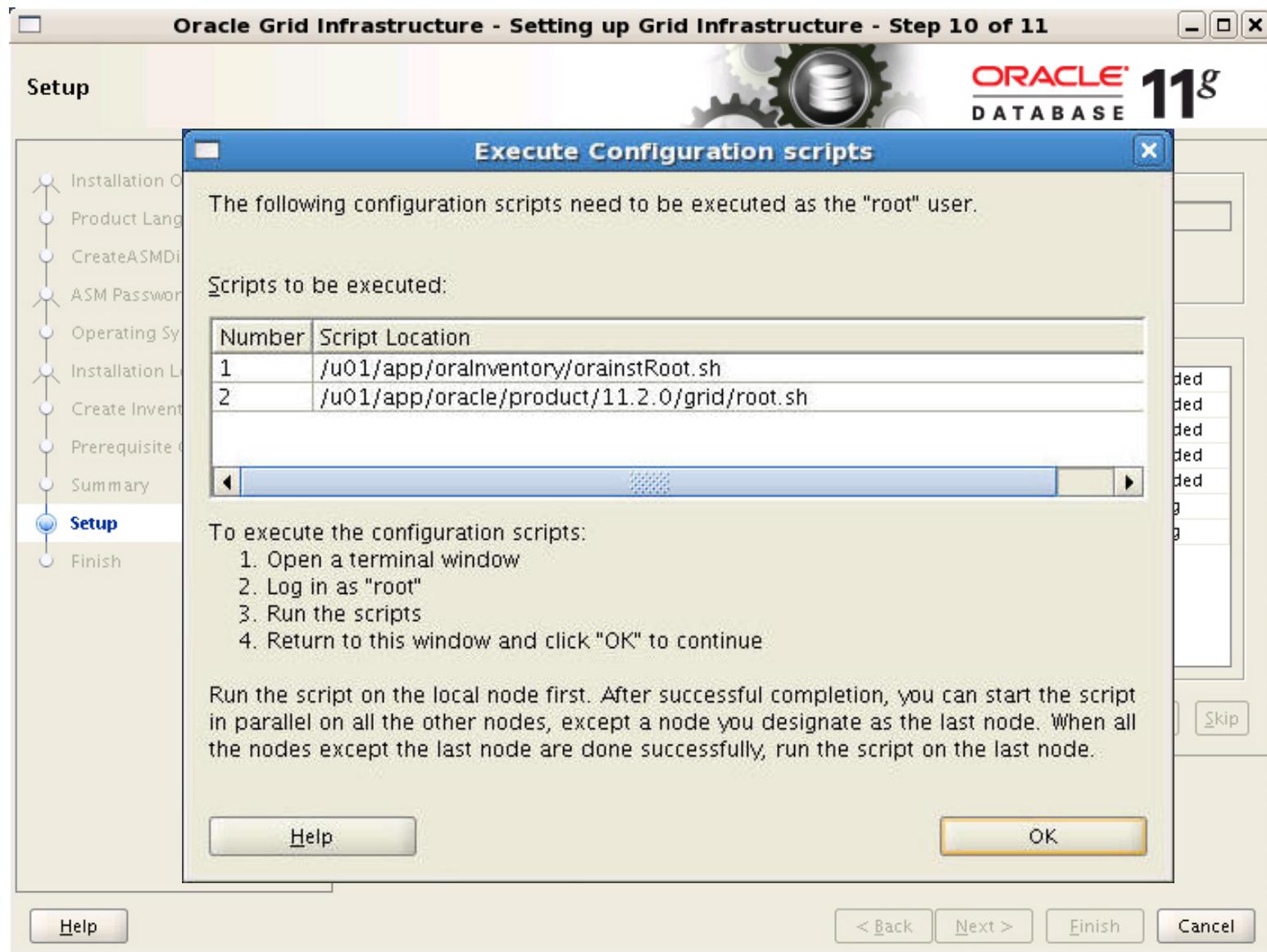
Verifying Installation Summary Data



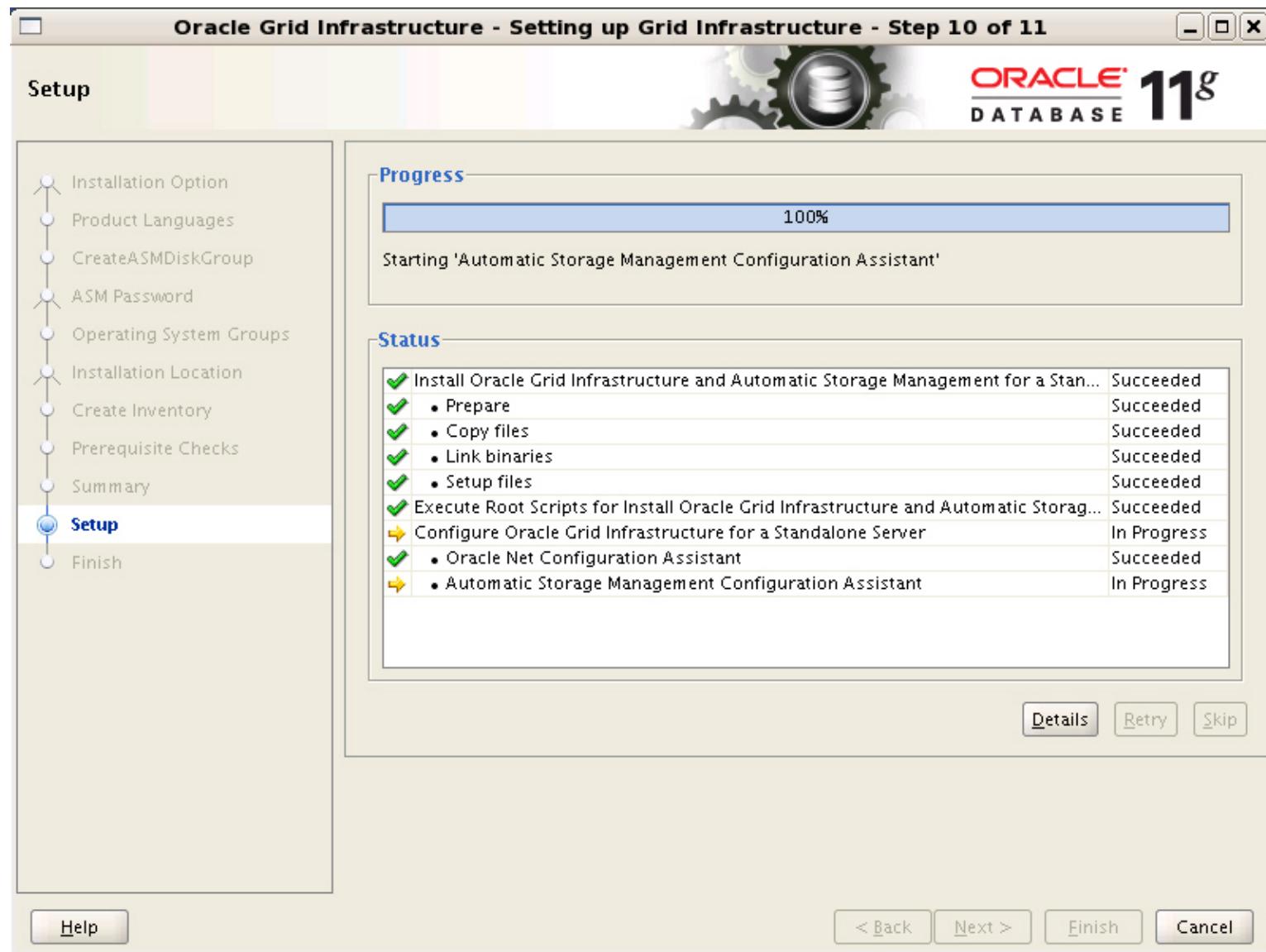
Monitoring Installation Progress



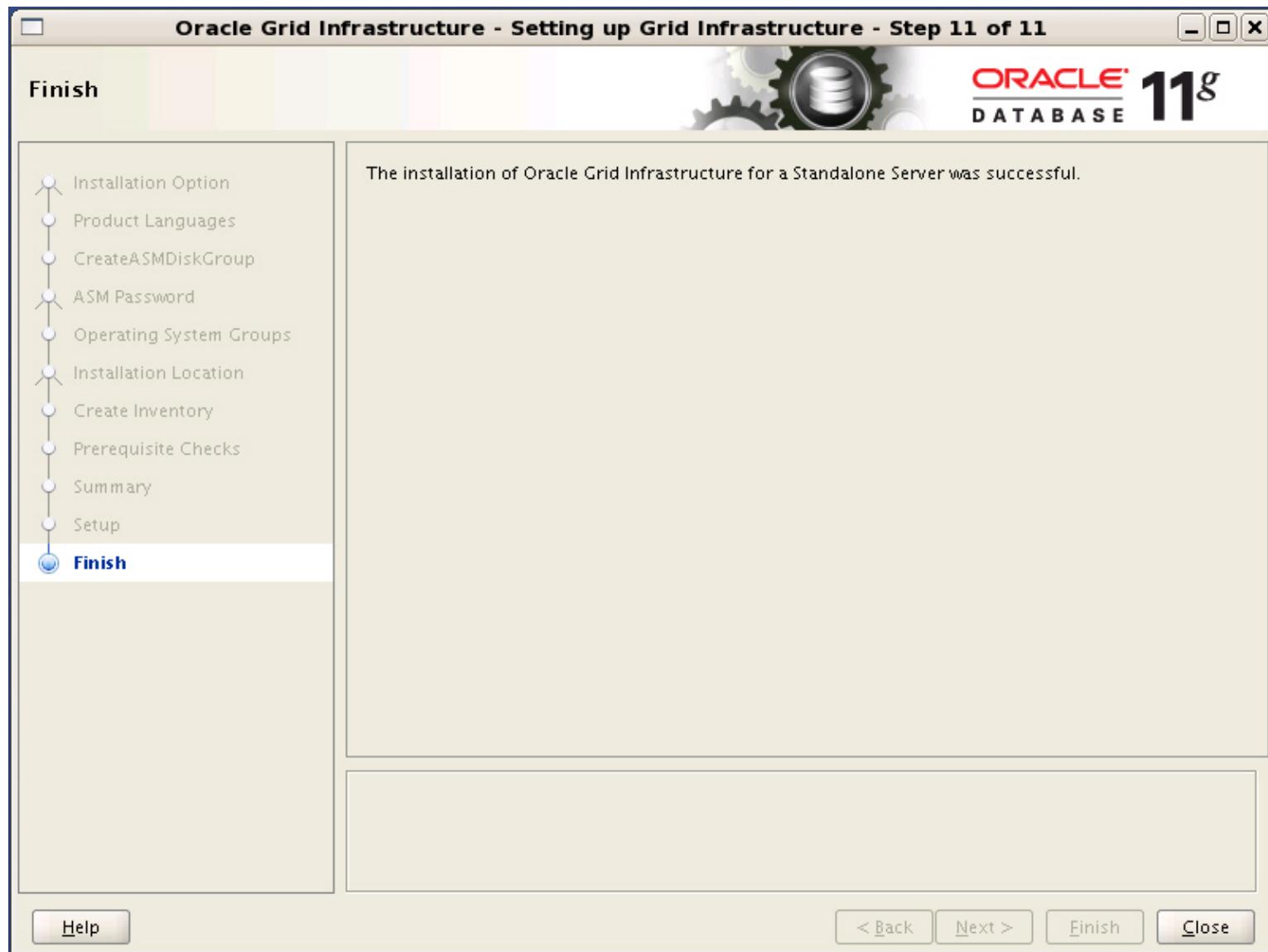
Executing root Configuration Scripts



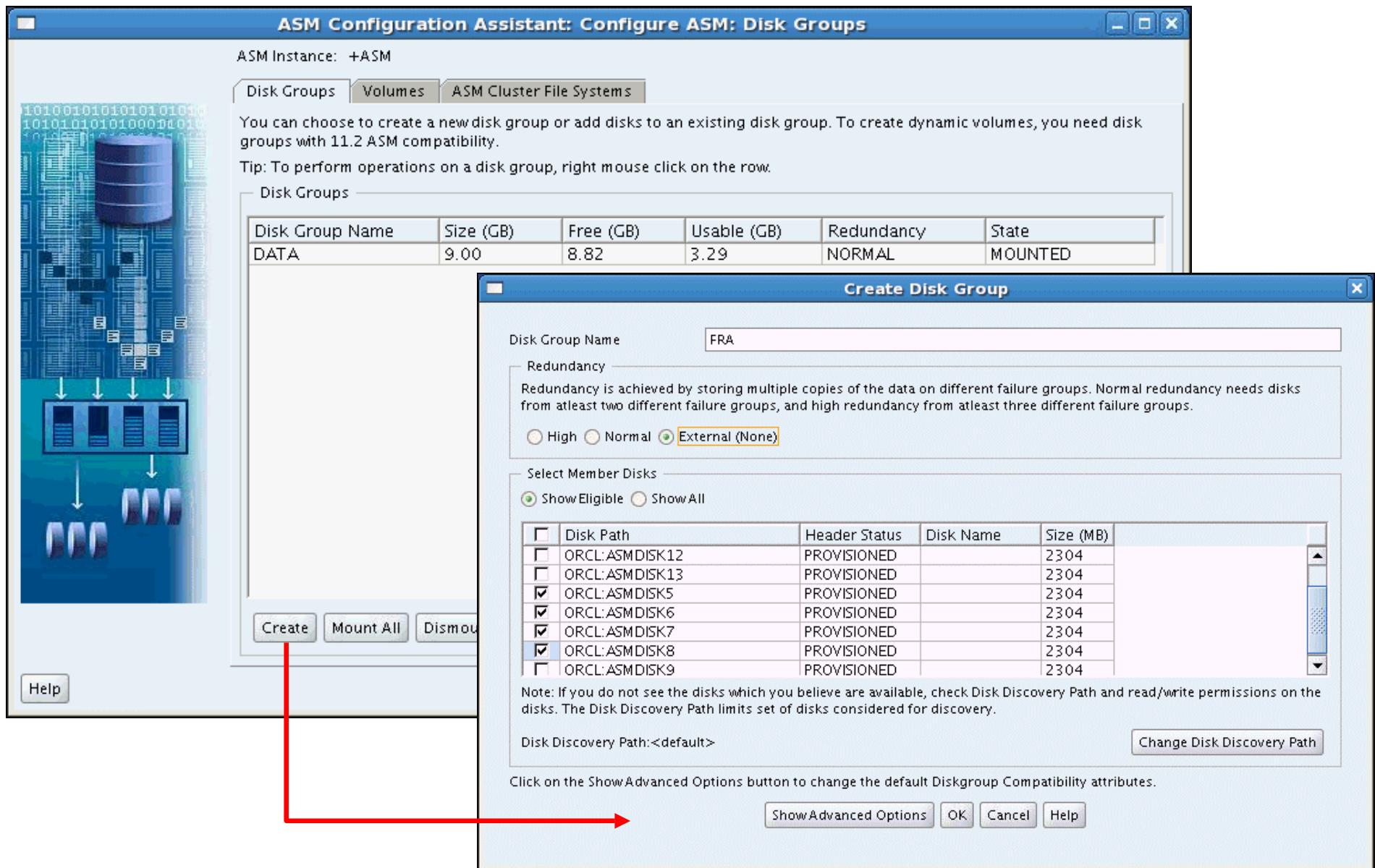
Executing Configuration Assistants



Finishing Installation



Configuring the FRA Disk Group



Quiz

The universal installer performs all required configuration for installing Oracle software.

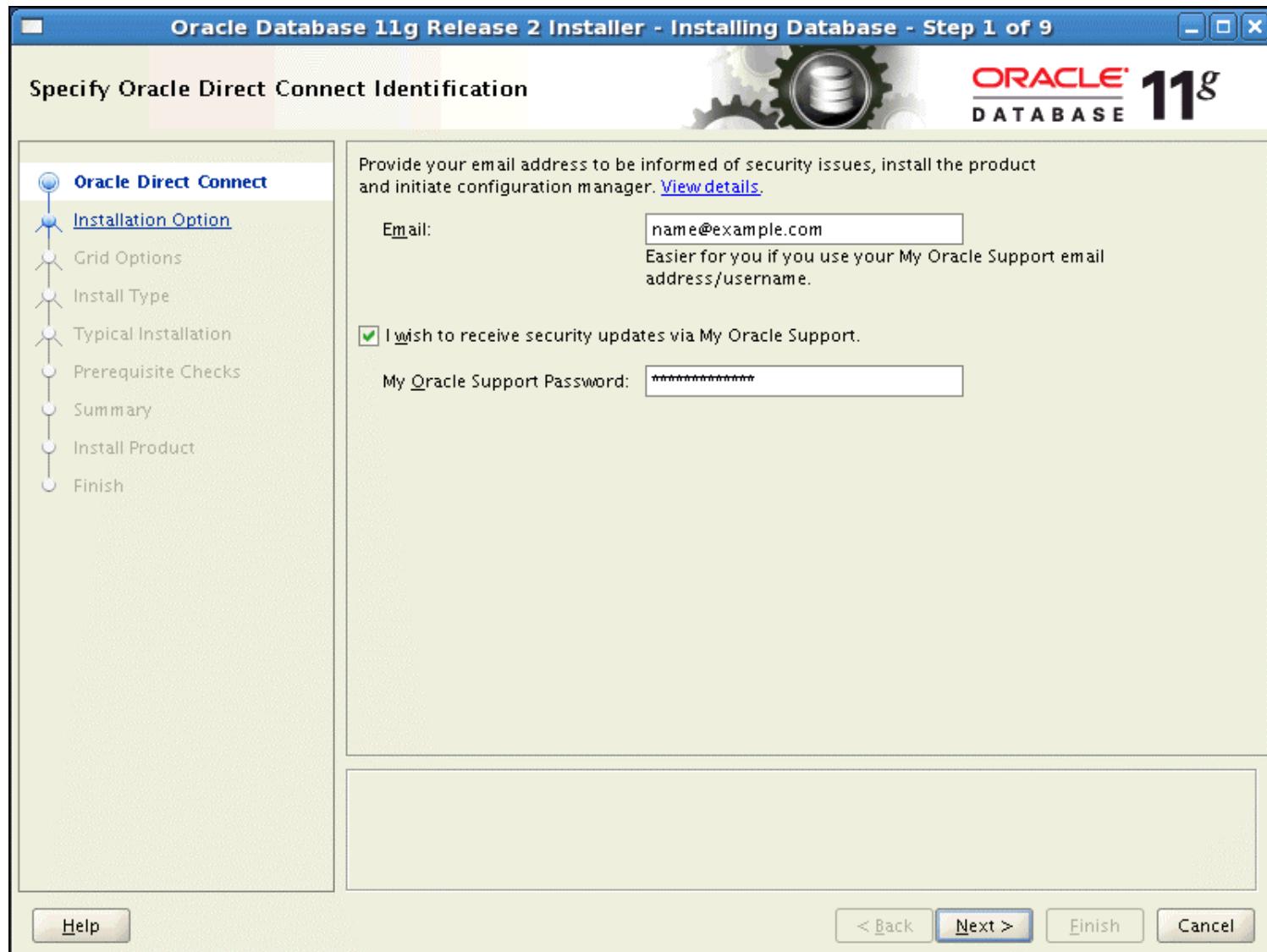
1. True
2. False

Quiz

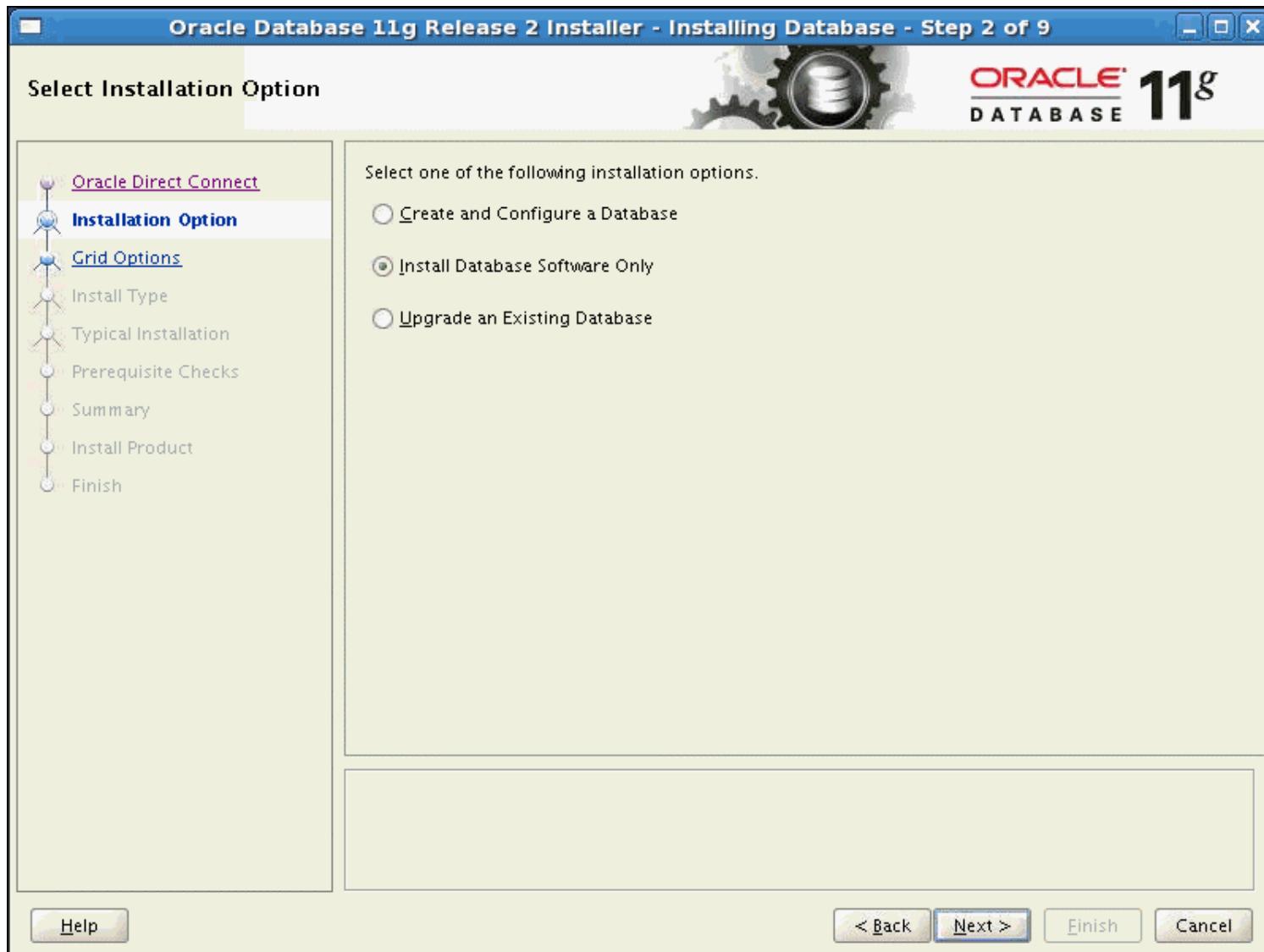
During Grid infrastructure setup it is a possible to:

1. Specify exact location of datafiles for ASM instance
2. Create only one DISKGROUP
3. Specify size of SGA for ASM instance
4. Create several DISKGROUPS

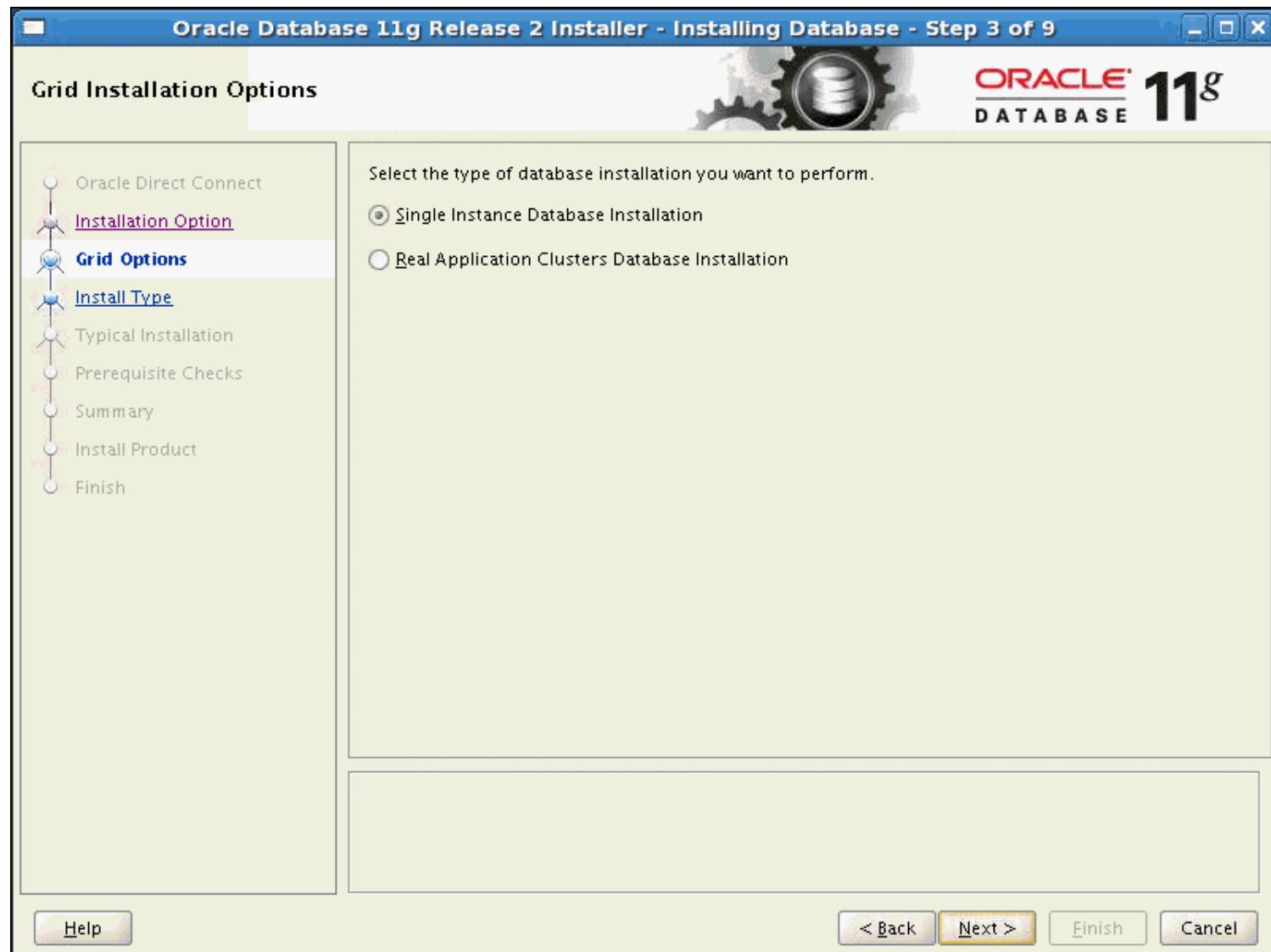
Part Two: Installing the Oracle Database Software



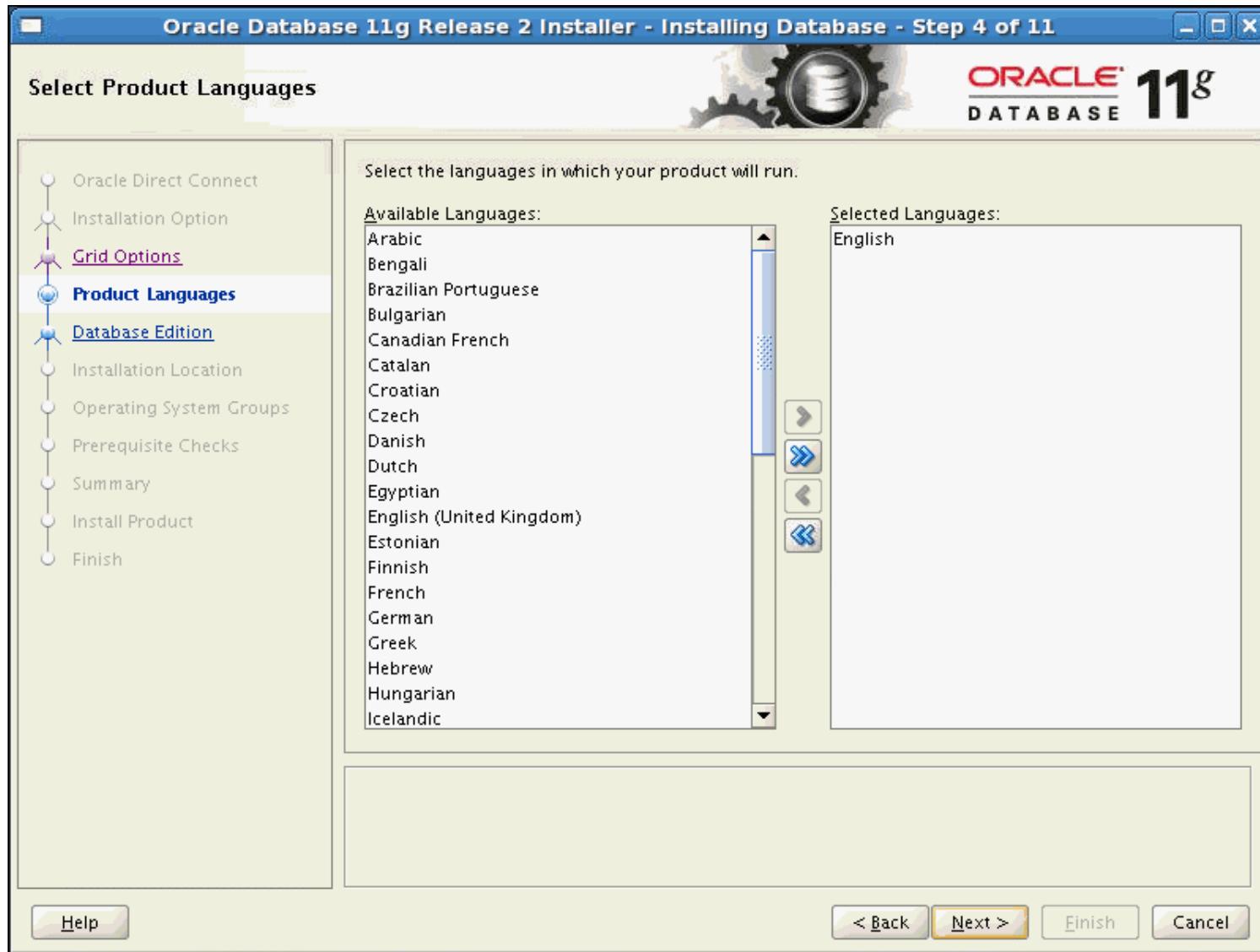
Choosing the Type of Installation



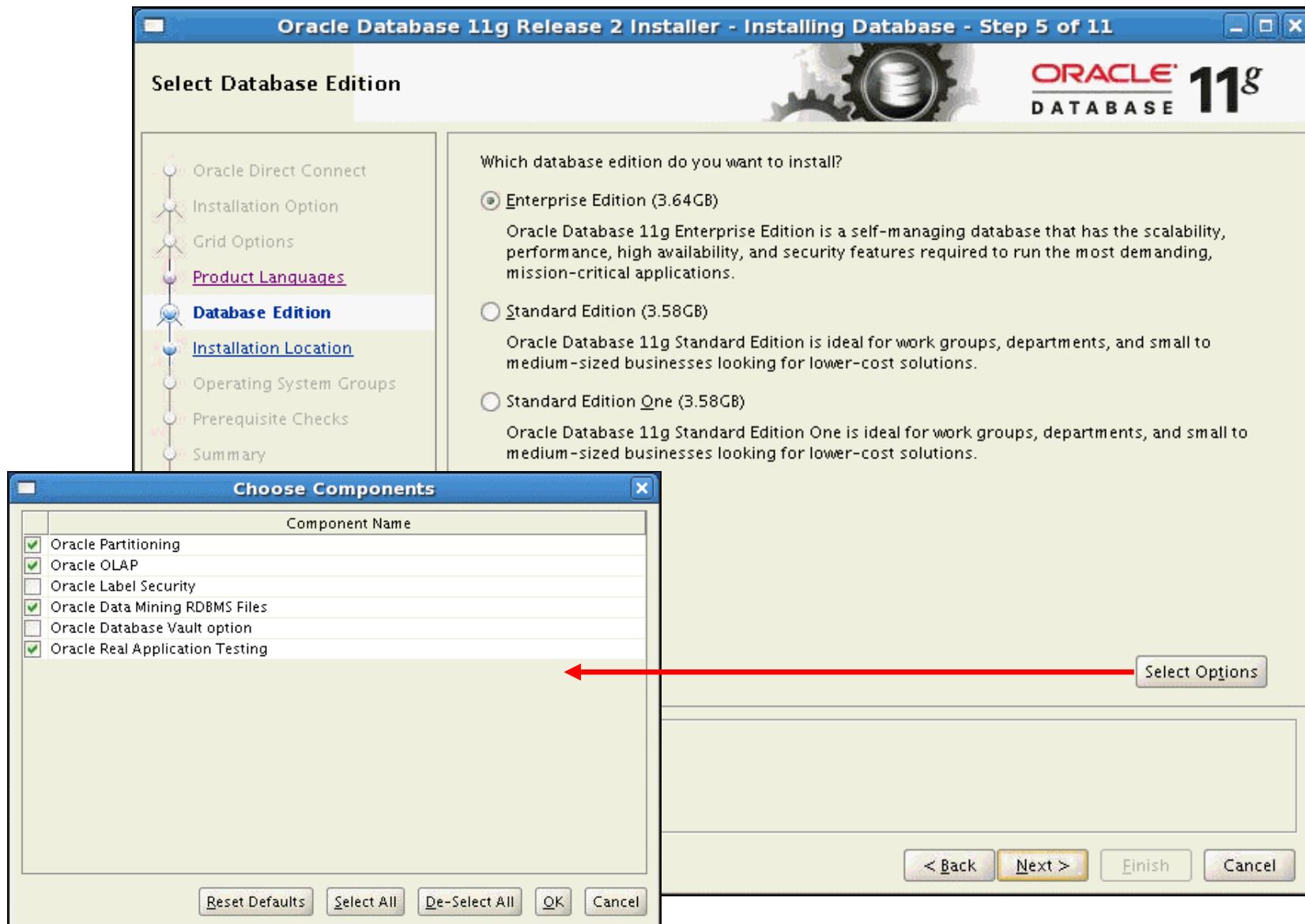
Choosing Grid Installation Options



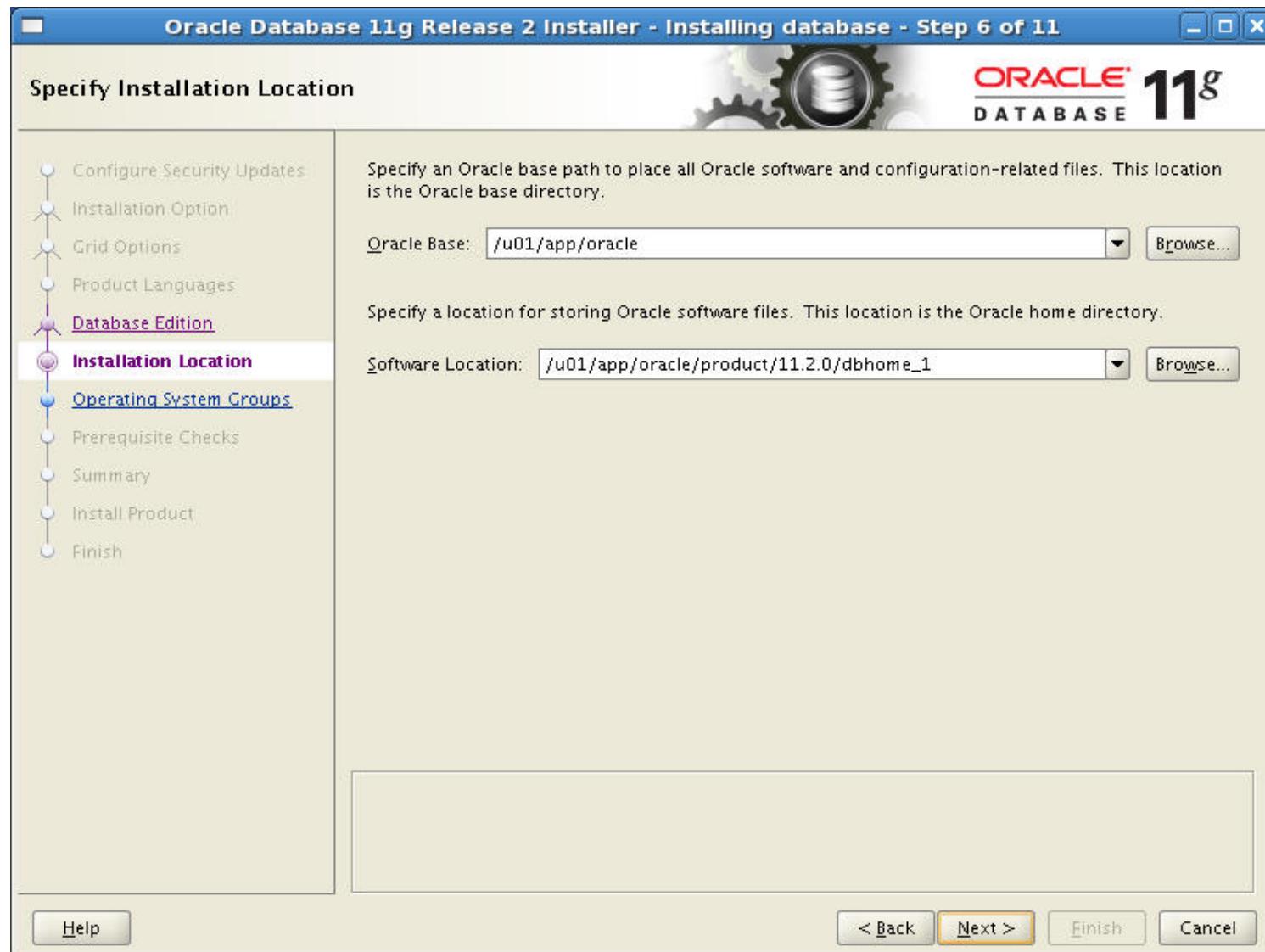
Choosing Language Settings



Choosing the Database Edition



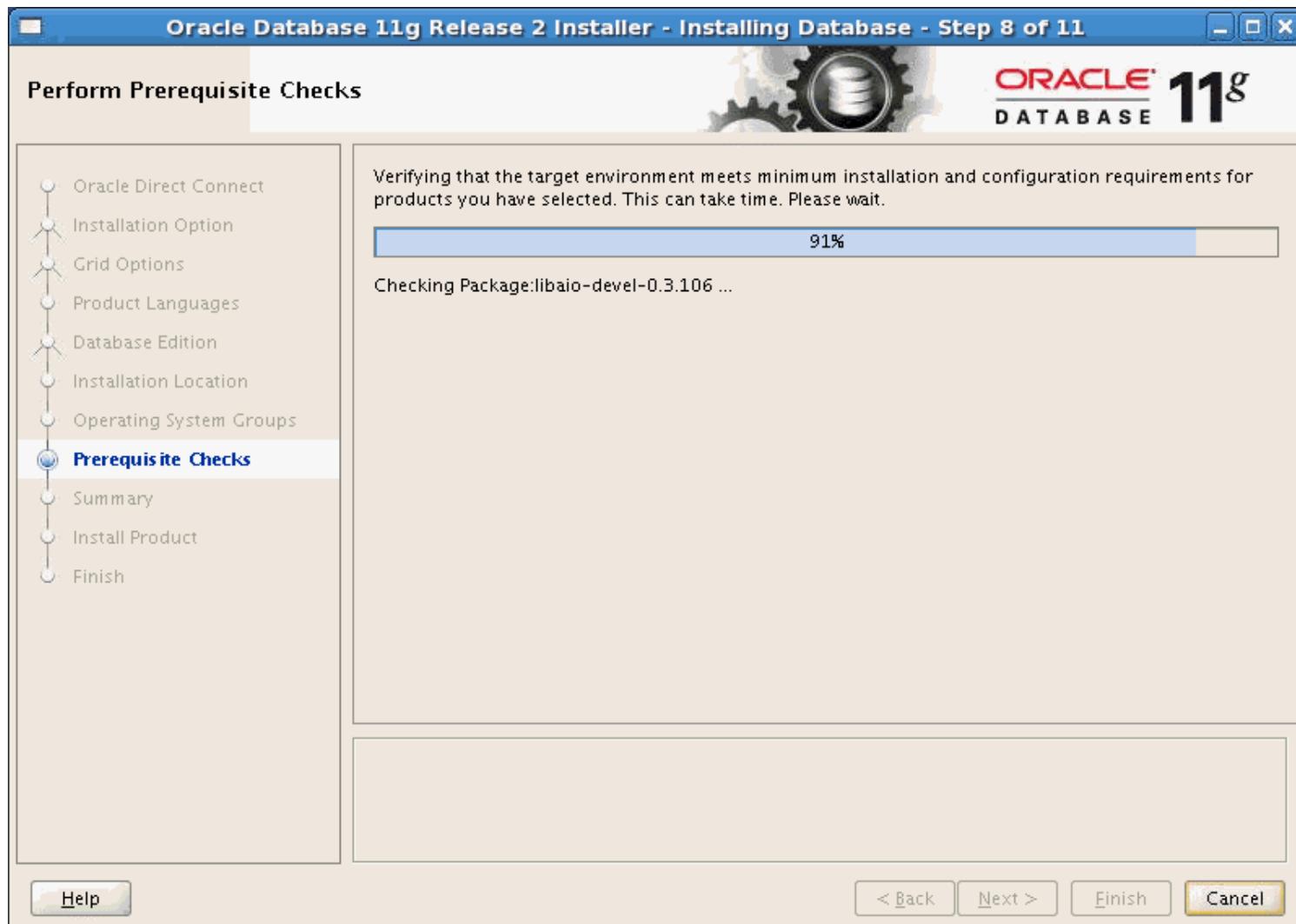
Specifying Installation Location



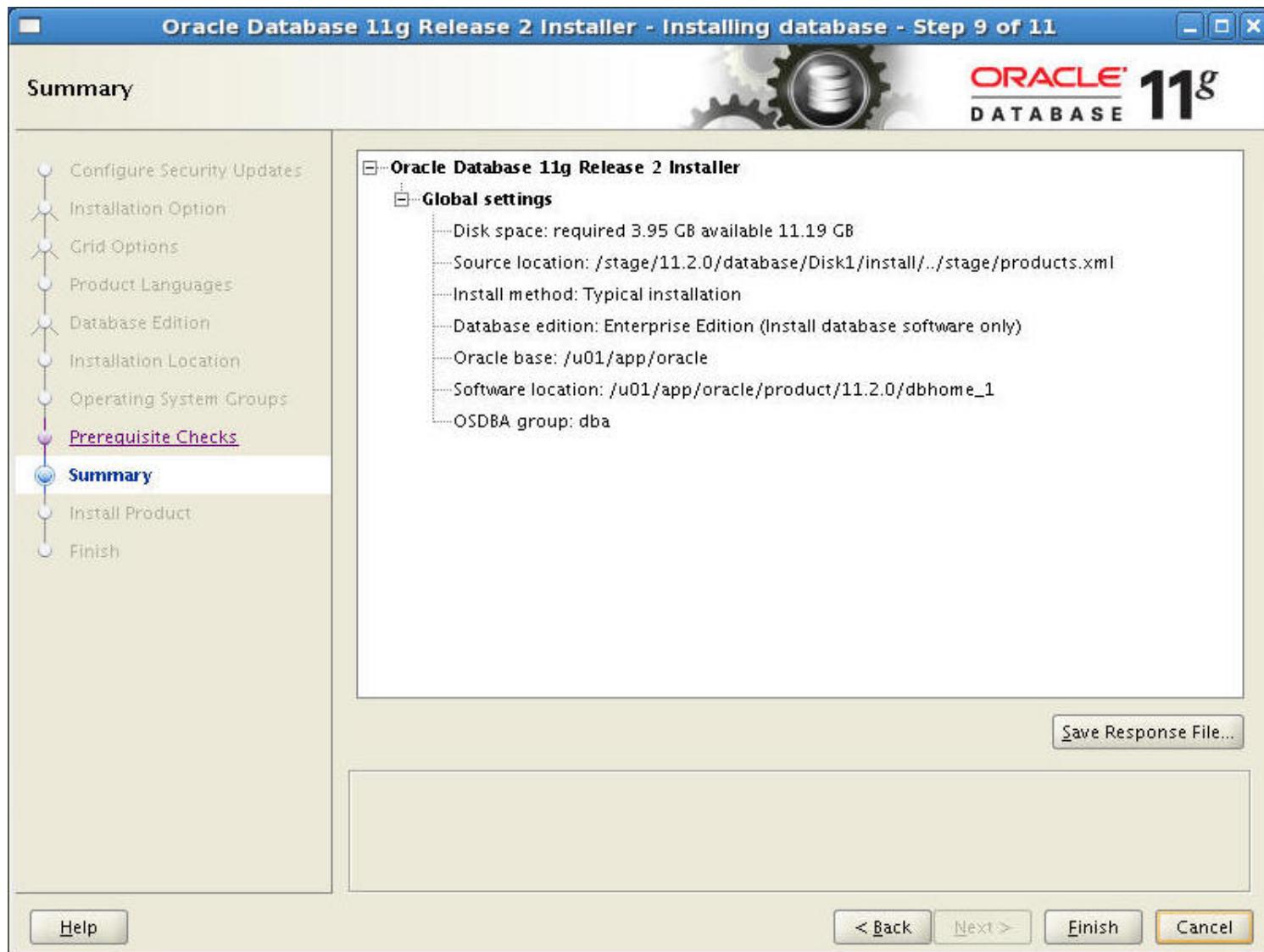
Choosing Operating System Groups



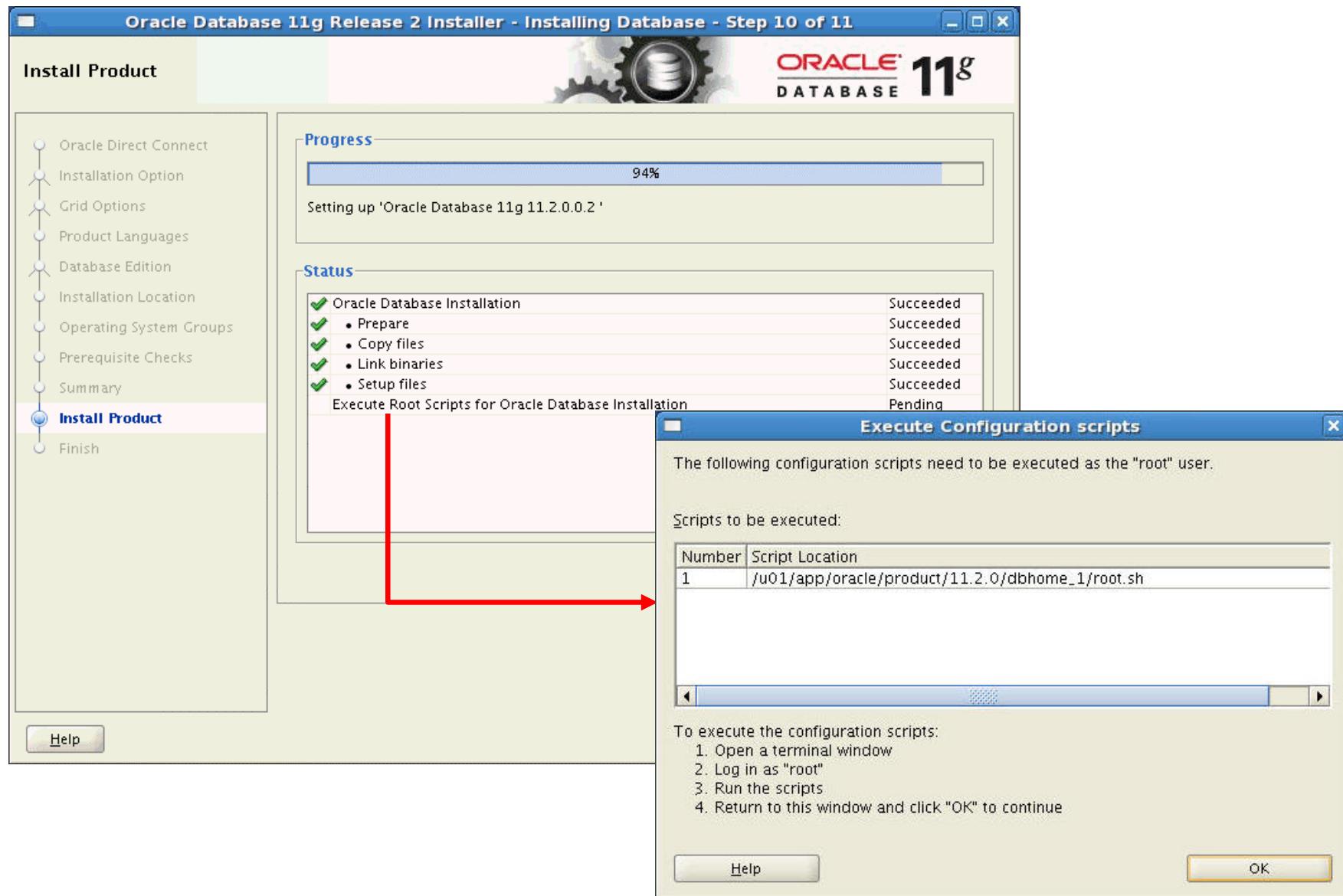
Performing Prerequisite Checks



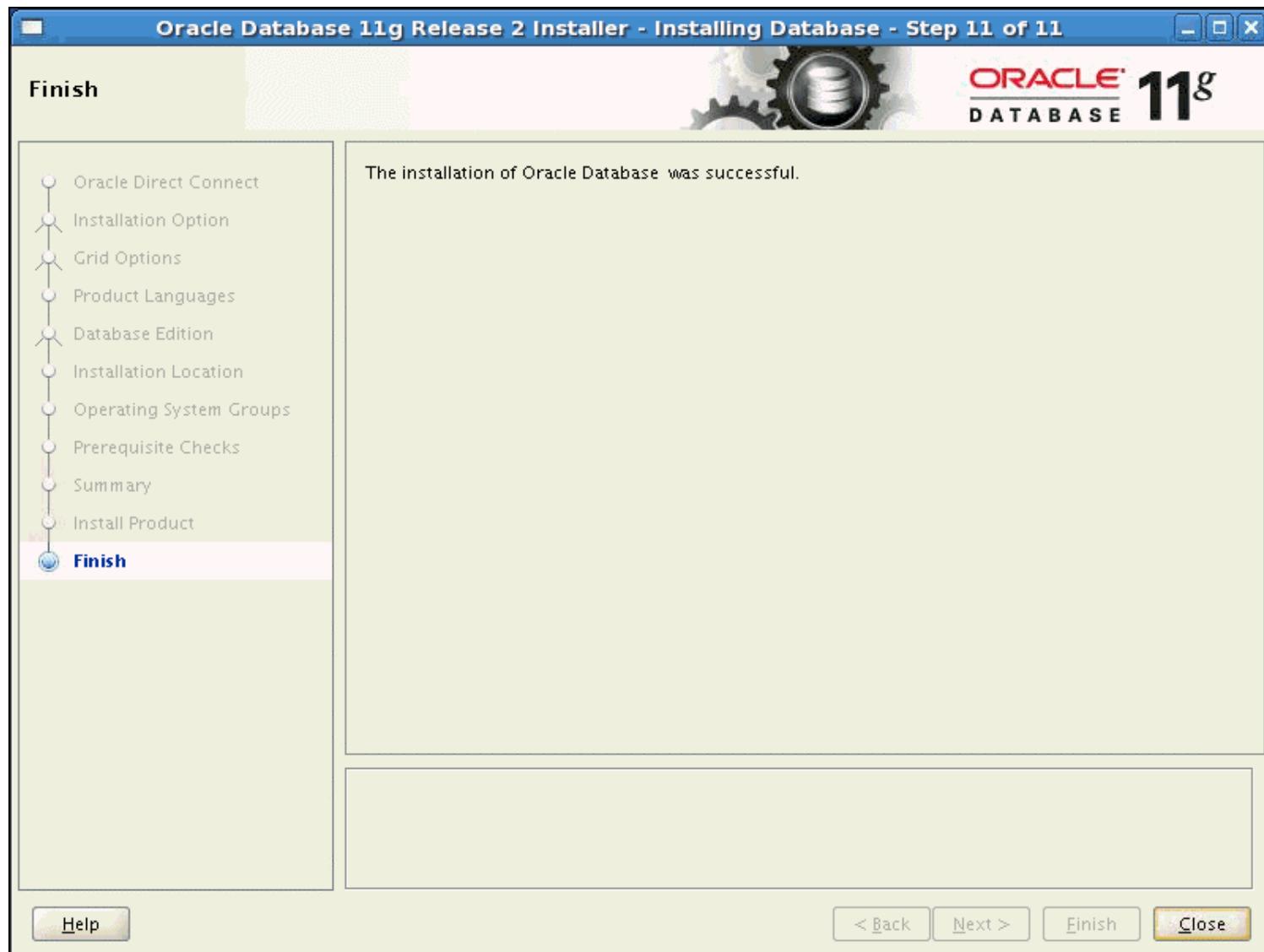
Installation Summary Page



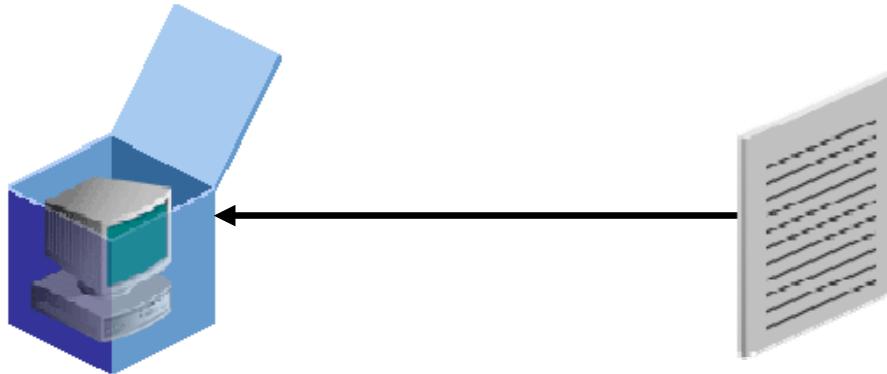
The Install Product Page



Installation Finished



Installation Option: Silent Mode



To install and configure Oracle products with OUI in silent mode, perform the following steps:

1. Prepare a response file:

- Using one of the file templates that are delivered with the Oracle software
- By recording a response file during an installation process using the OUI by clicking Save Response File on the summary page

2. Run OUI in silent or suppressed mode.

```
./runInstaller -silent -responsefile <filename>
```

If required, run NetCA and the DBCA in silent mode.

ORACLE

Quiz

A response file is:

1. A binary file that can be edited using a binary editing program
2. A binary file that can be created by the installer program
3. A text file that cannot be edited, but can be created by the installer program
4. A text file that can be edited with a text editor

Quiz

During Database software installation you can specify groups for:

1. the osoper group
2. the osasm group
3. the osdba group
4. the osadmin group

Summary

In this lesson, you should have learned how to:

- Describe your role as a database administrator (DBA) and explain typical tasks and tools
- Plan an Oracle software installation
- Install Oracle Grid Infrastructure for a standalone server
- Install the Oracle database software

Practice 2 Overview: Preparing the Database Environment

This practice covers installing the Oracle software by using Oracle Universal Installer.

Note: Completing this practice is critical for all subsequent practices.

Creating an Oracle Database Using DBCA



ORACLE®

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Objectives

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

- Create a database by using the Database Configuration Assistant (DBCA)
- Generate database creation scripts with the DBCA
- Manage database design templates with the DBCA
- Perform additional tasks with the DBCA

Planning the Database

As a DBA, you must plan:

- The logical storage structure of the database and its physical implementation:
 - How many disk drives do you have? What type of storage is being used?
 - How many data files will you need? (Plan for growth.)
 - How many tablespaces will you use?
 - What types of information will be stored?
 - Are there any special storage requirements due to type or size?
- Overall database design
- Database backup strategy



Databases: Examples

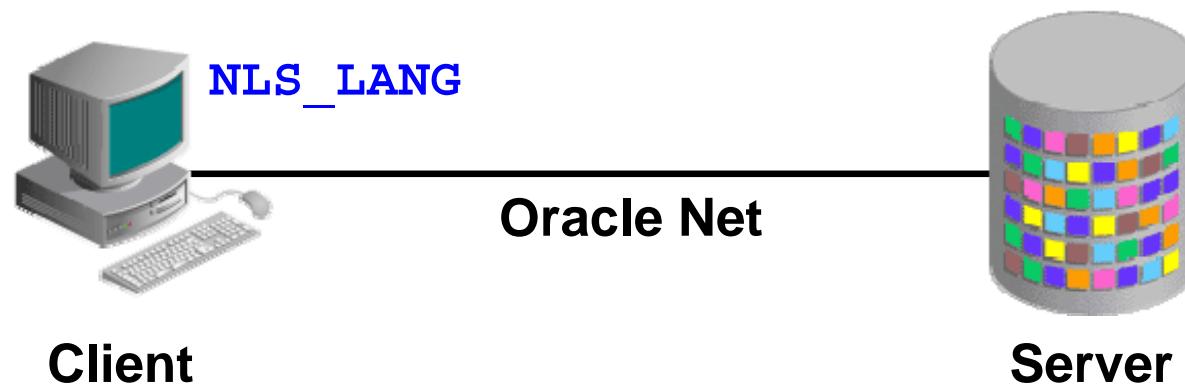
- General purpose or transaction processing:
 - Online transaction processing (OLTP) system, for example a retail billing system for a software house or a nursery
- Custom:
 - Multipurpose database (perhaps combined OLTP and data warehouse functionality)
- Data warehouse:
 - Research and marketing data
 - State or federal tax payments
 - Professional licensing (doctors, nurses, and so on)

Choosing the Appropriate Character Set

- The Oracle database supports different classes of character-encoding schemes:
 - Single-byte character sets
 - 7-bit
 - 8-bit
 - Multibyte character sets, including Unicode
- The character set is chosen at the time of database creation. Choose the character set that best meets your business requirements now and in the future because it can be difficult to change character sets later on.
- In general Unicode is recommended because it is the most flexible character set.

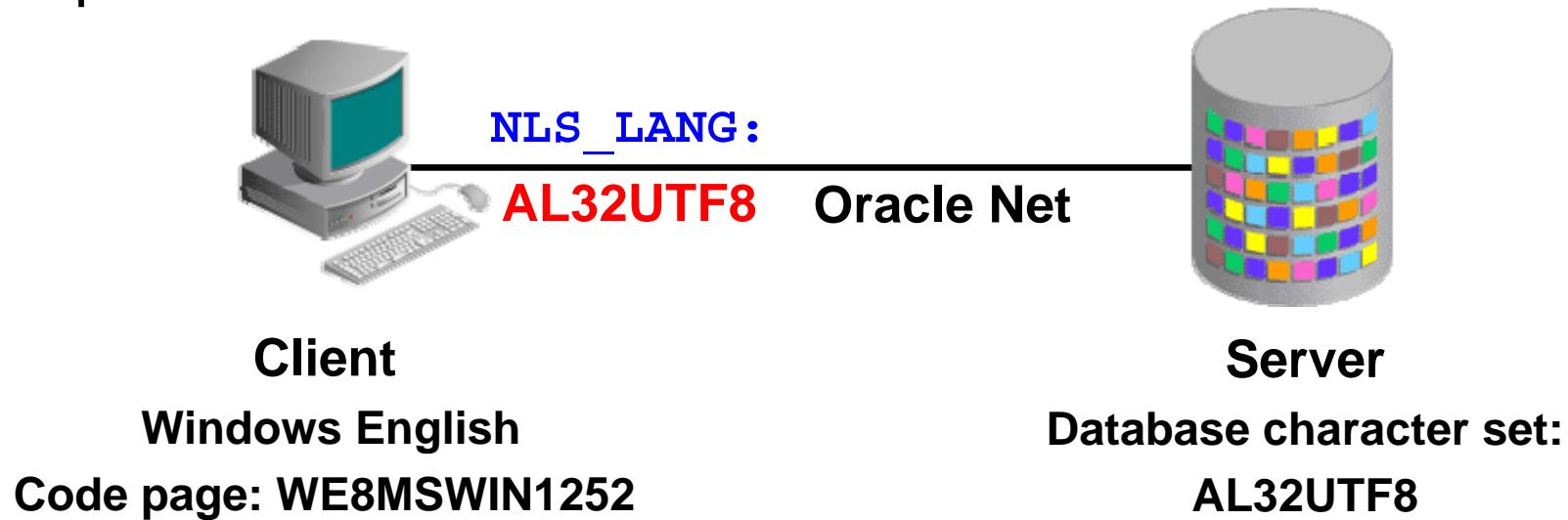
How Are Character Sets Used?

- Oracle Net compares the client `NLS_LANG` setting to the character set on the server.
- If needed, conversion occurs automatically and transparently.



Problems to Avoid

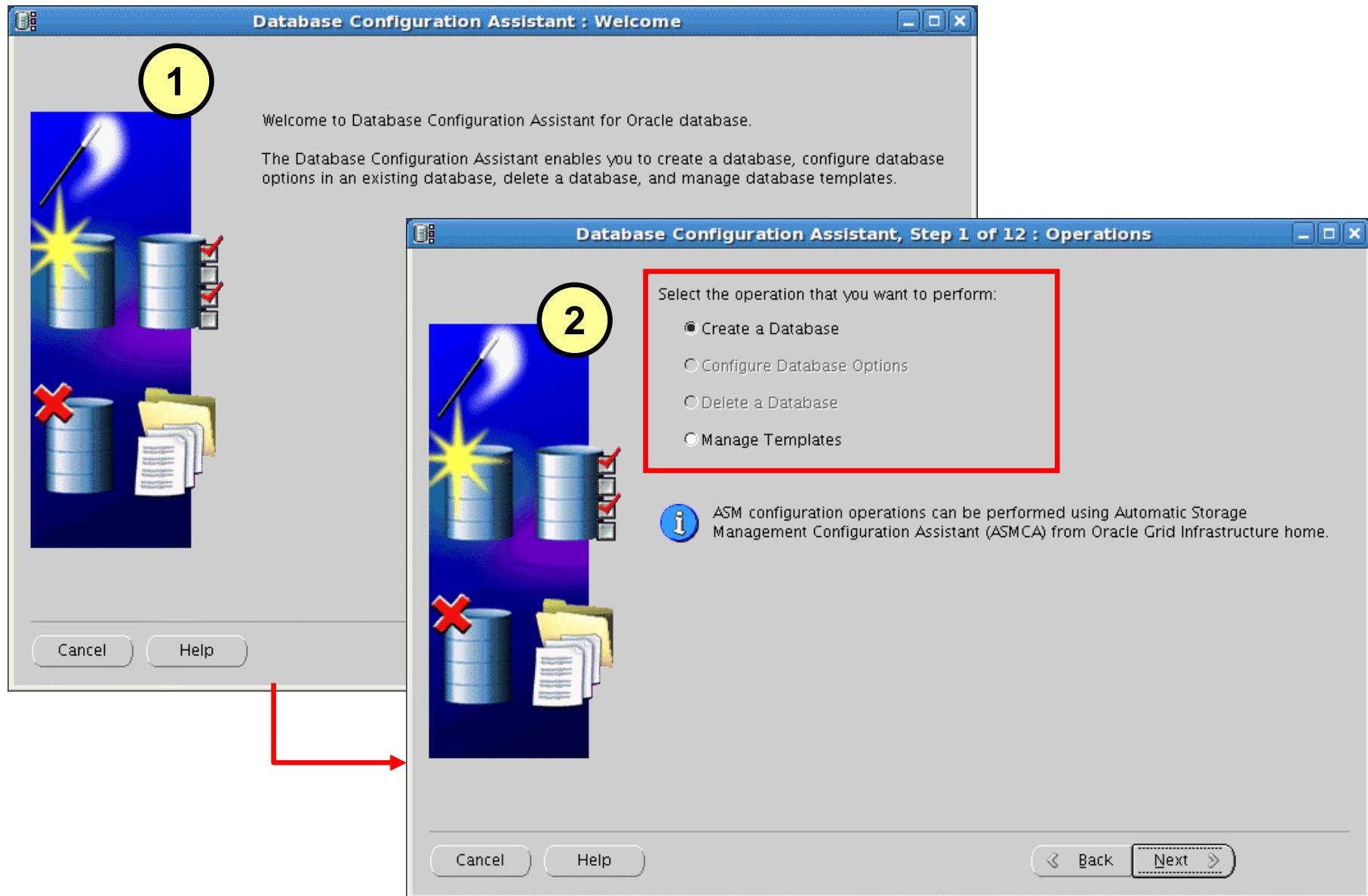
Example:



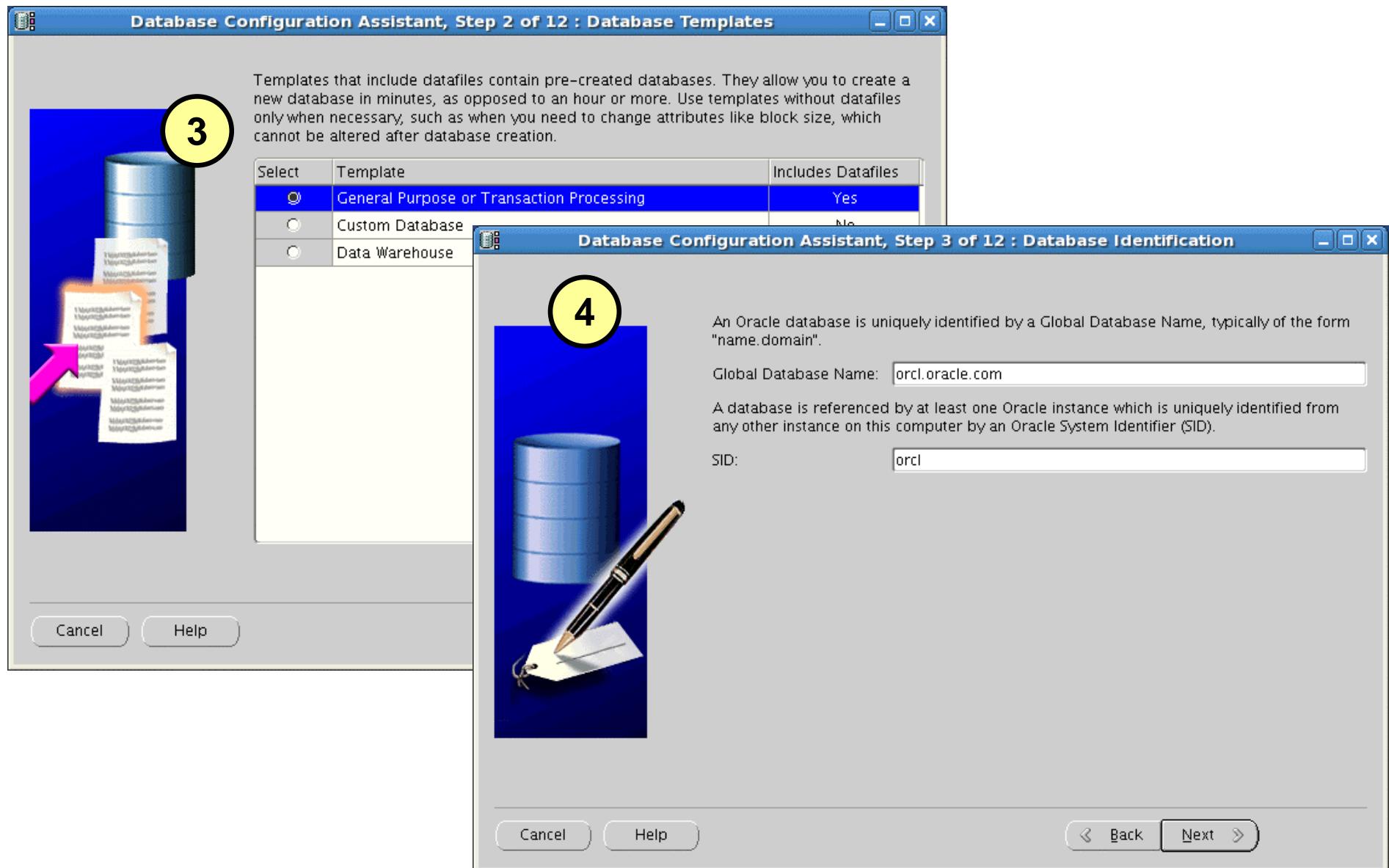
No conversion occurs, because it does not seem to be required.

Issue: Invalid data are entered into the database.

Database Configuration Assistant (DBCA)



Using the DBCA to Create a Database



Using the DBCA to Create a Database

Database Configuration Assistant, Step 4 of 12 : Management Options

Enterprise Manager Automatic Maintenance Tasks

Configure Enterprise Manager
 Register with Grid Control for centralized management

Management Service No Agents Found

Configure Database Control for local management

Enable Alert Notifications
Outgoing Mail (SMTP) Server:
Recipient Email Address:

Enable Daily Disk Backup to:
Backup Start Time:

OS Username:
OS Password:

5

For security reasons, you must specify passwords for the following user accounts in the new database.

Use Different Administrative Passwords

| User Name | Password | Confirm Password |
|-----------|----------|------------------|
| SYS | | |
| SYSTEM | | |
| DBSNMP | | |
| SYSMAN | | |

Use the Same Administrative Password for All Accounts

Password: Confirm Password:

6

Cancel Help Back Next

Configuring Enterprise Manager for your database requires a listener to be configured as well.

Enable automatic maintenance tasks such as optimizer statistic collection and proactive advisor reports.

Using the DBCA to Create a Database

Choose between the file system or ASM (if ASM is available)

Create multiple copies of your redo logs and control files if desired.



Database Configuration Assistant, Step 6 of 12 : Database File Locations

7

Specify storage type and locations for database files.

Storage Type:

Automatic Storage Management (ASM)

Storage Locations:

- Use Database File Locations from Template
- Use Common Location for All Database Files
- Use Oracle-Managed Files

Database Files Location:

Browse...

Database Area: +DATA

Browse...

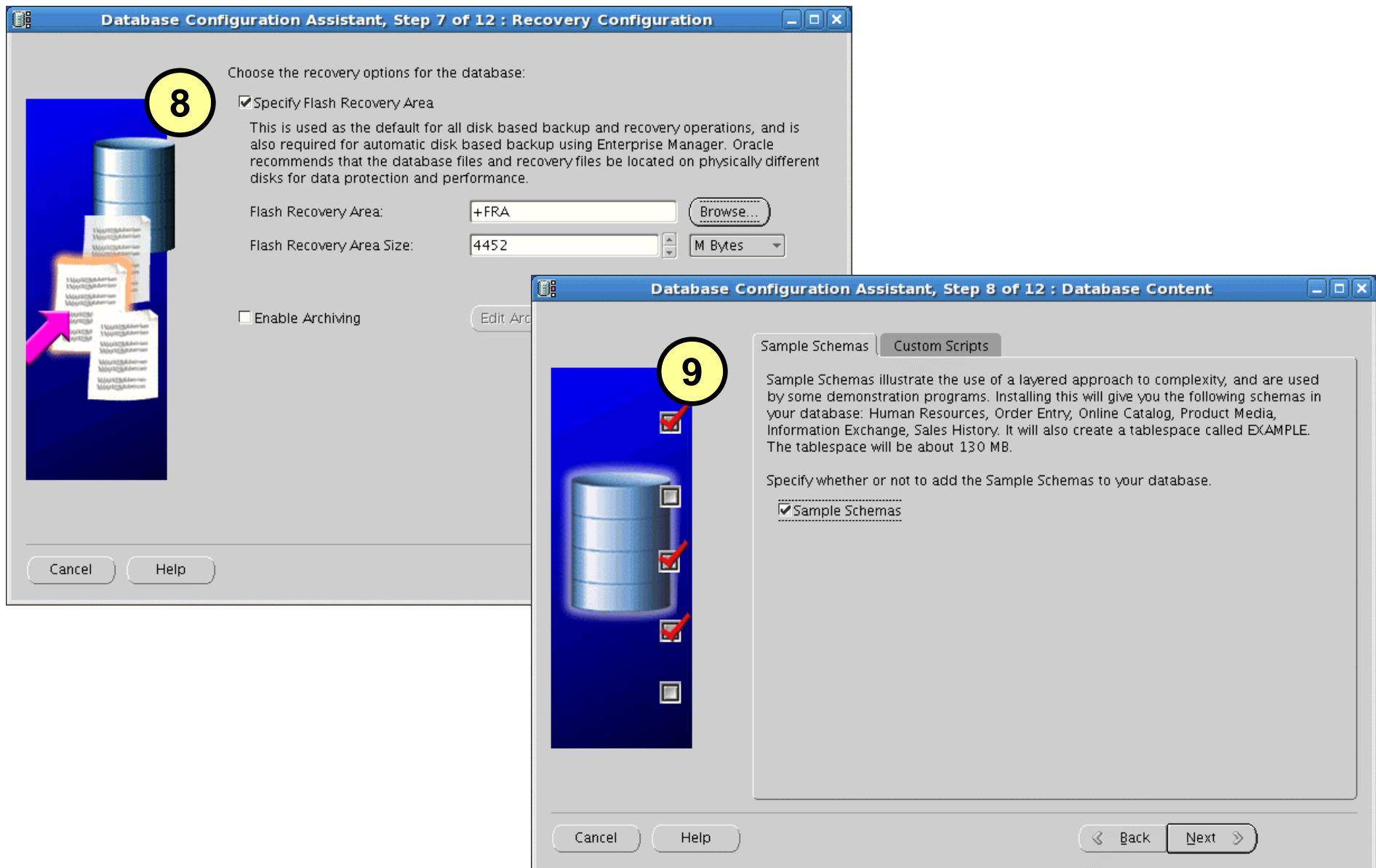
Multiplex Redo Logs and Control Files...



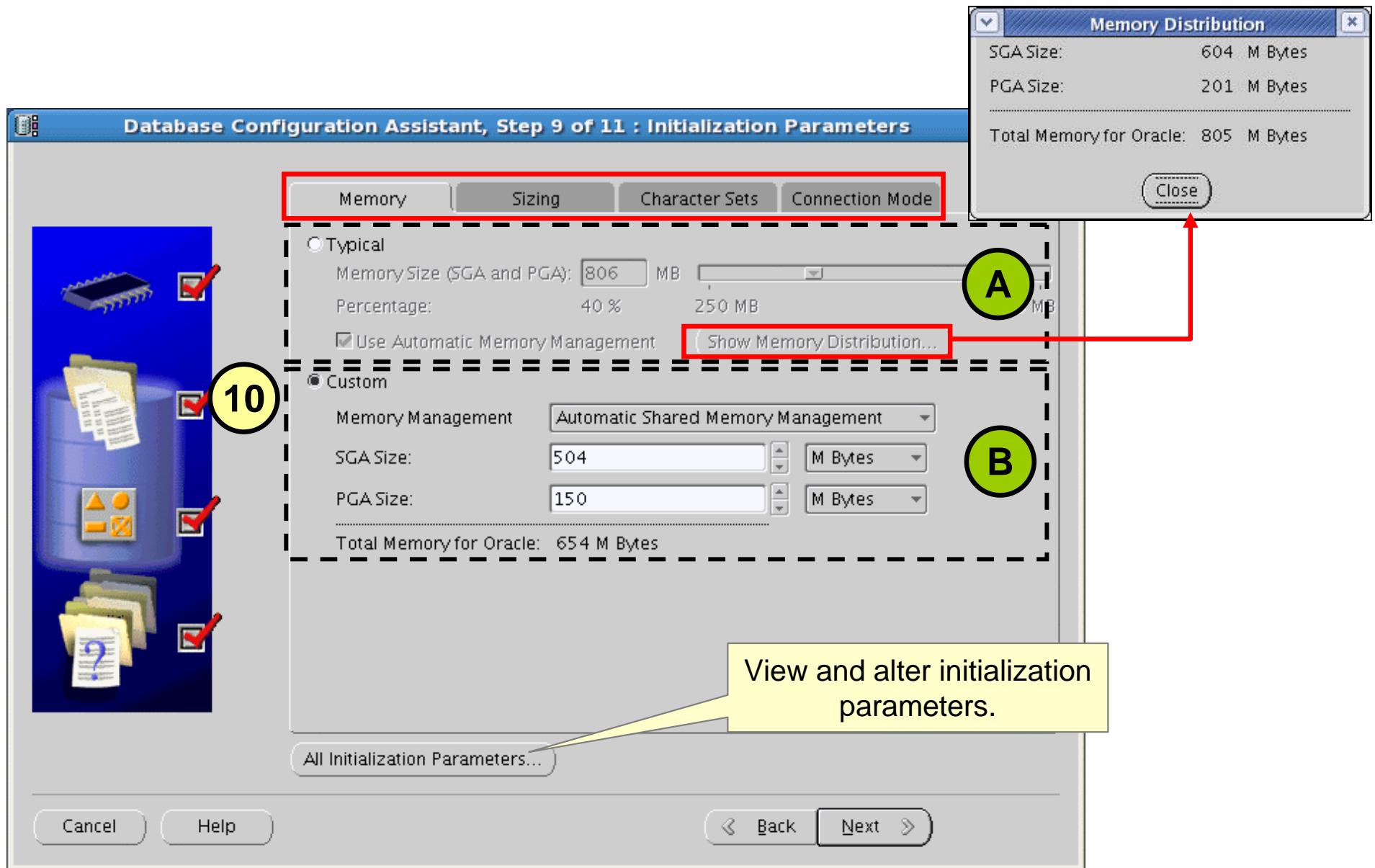
If you want to specify different locations for any database files, pick any of the above options except Oracle-Managed Files and use the Storage page later to customize each file location. If you use Oracle-Managed Files, Oracle automatically generates the names for database files, which can not be changed on the Storage page.

Adjust file location variables
(ORACLE_BASE,
ORACLE_HOME, DB_NAME,
DB_UNIQUE_NAME, SID) if
needed.

Using the DBCA to Create a Database



Using the DBCA to Create a Database



Using the DBCA to Create a Database

11

Database Storage

From the **Database Storage** page, you can specify storage parameters for database creation. This page displays a tree listing and summary view (multi-column lists) to enable you to change and view the following objects:

- Control files
- Tablespaces
- Datafiles
- Rollback Segments
- Redo Log Groups

From any object type folder select the specific object from the tree.

Important: If you select a database object type folder, it is able to add or remove data of template enables you to:

- Destination of the data
- Control files or log groups

For more information, refer to the Oracle Database Administrator's Guide.

12

Database Configuration Assistant, Step 11 of 11 : Creation Options

Select the database creation options:

Create Database

Save as a Database Template

Name:

Description:

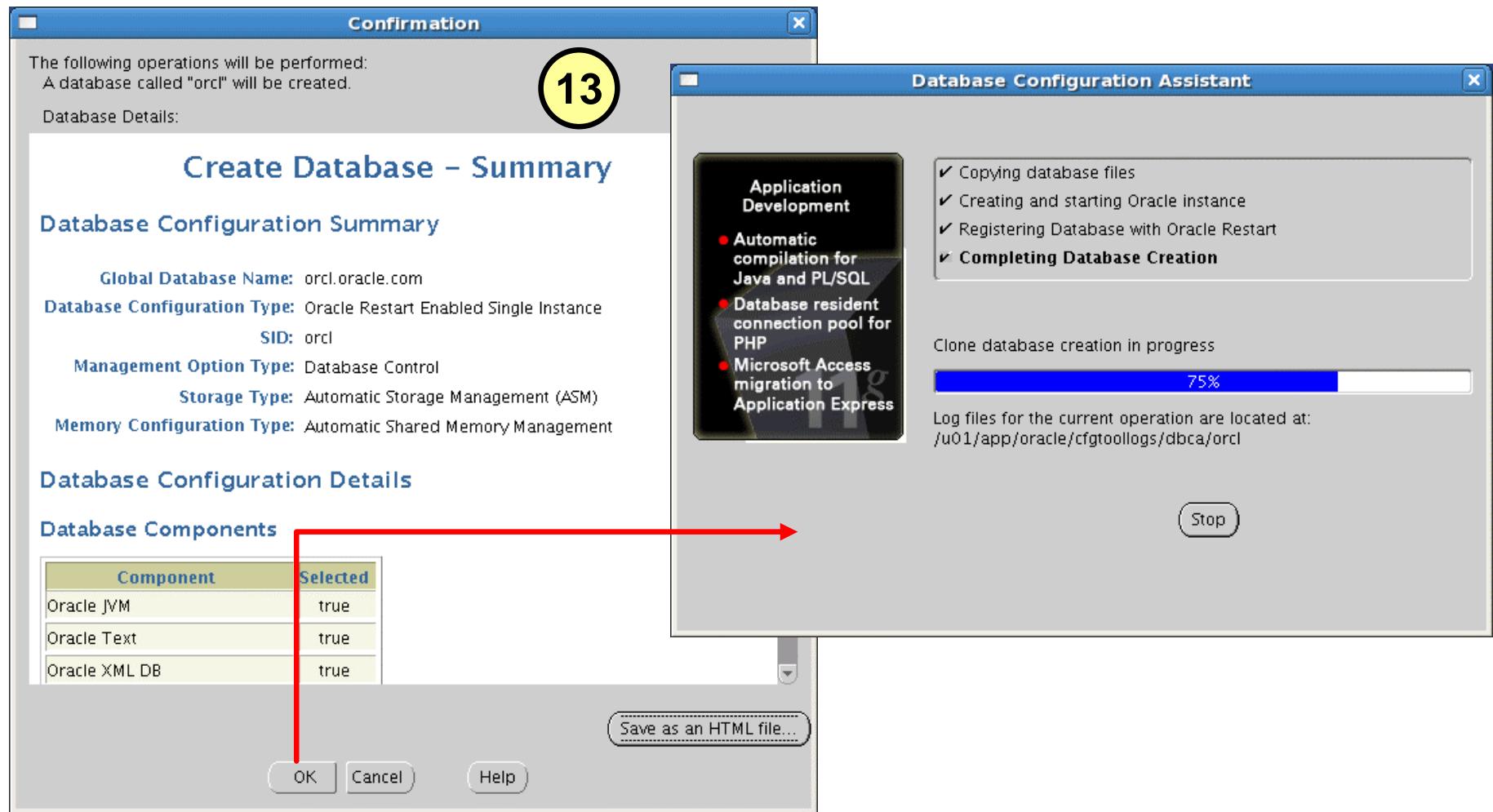
Generate Database Creation Scripts

Destination Directory:

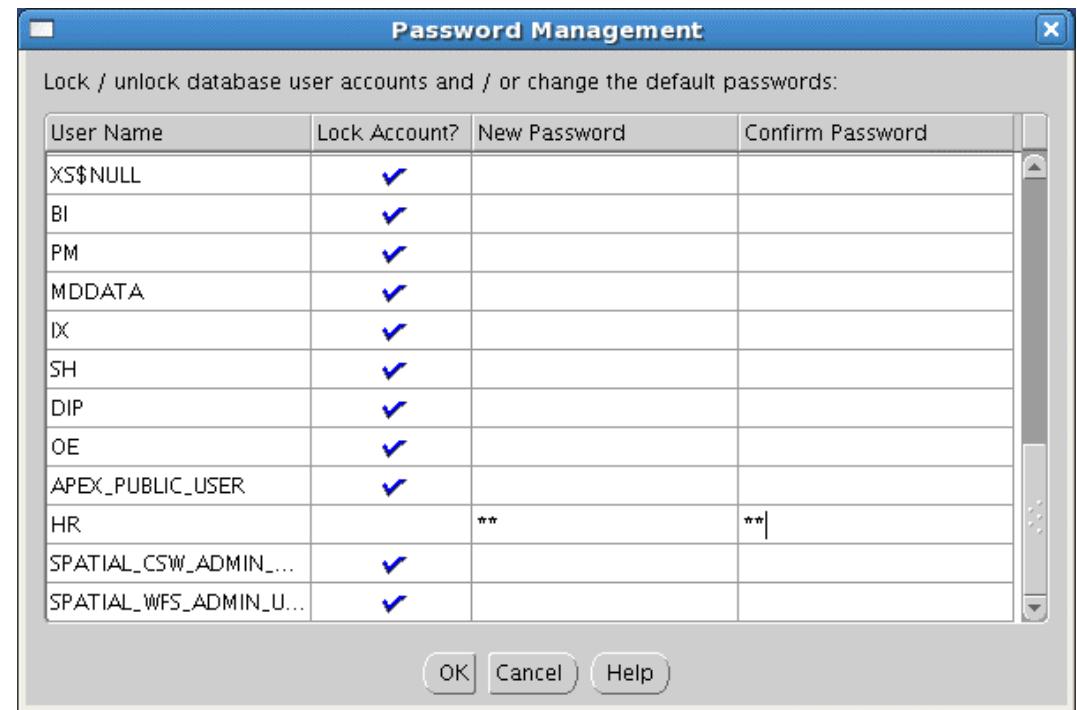
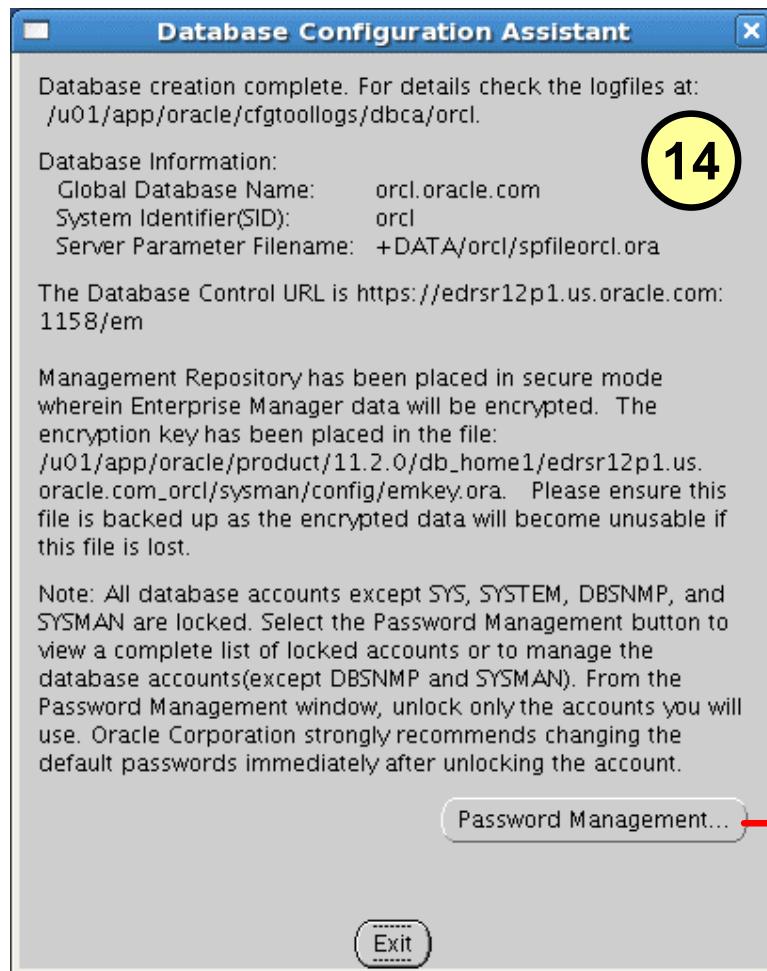


Cancel Help Back Next Finish

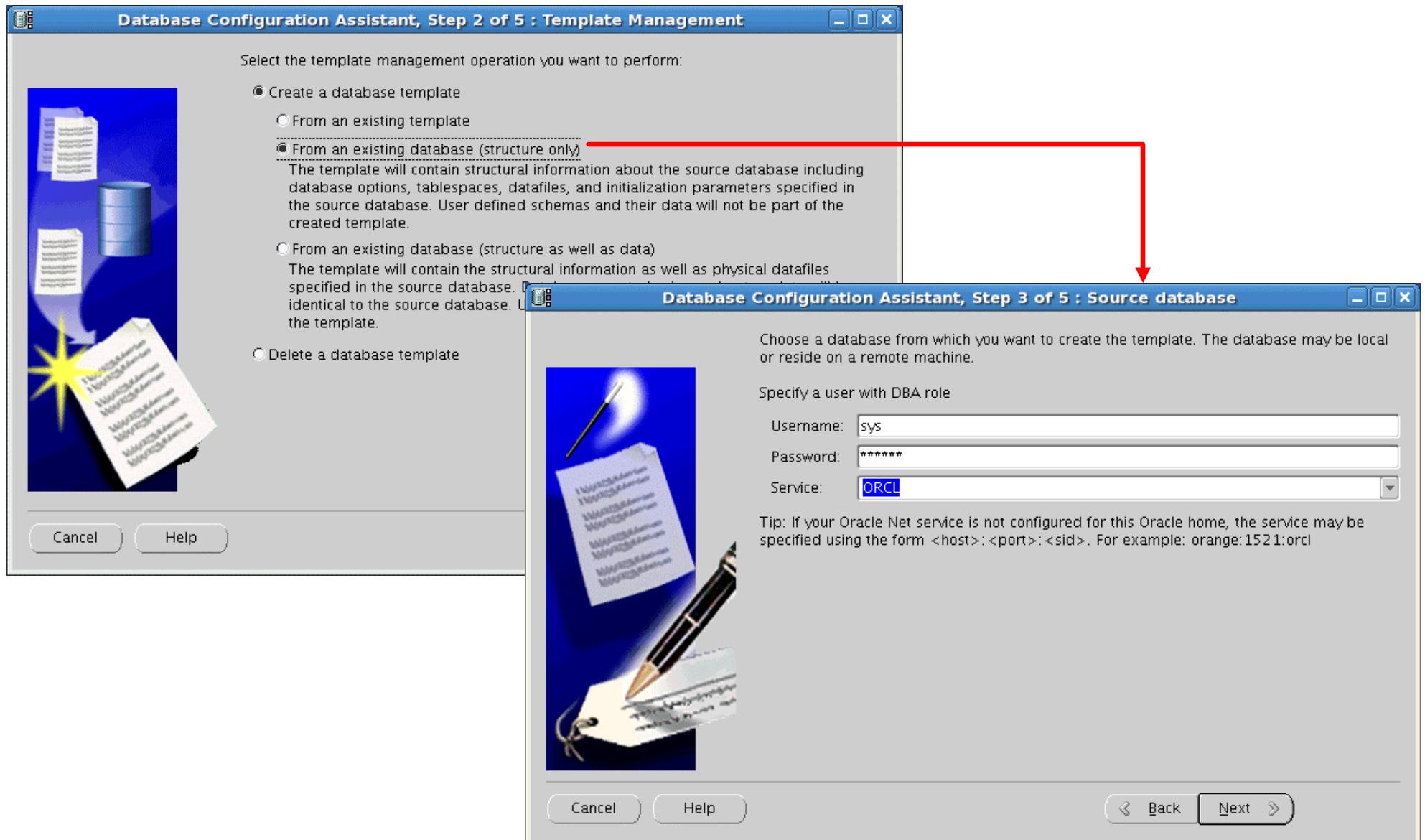
Create Database Summary



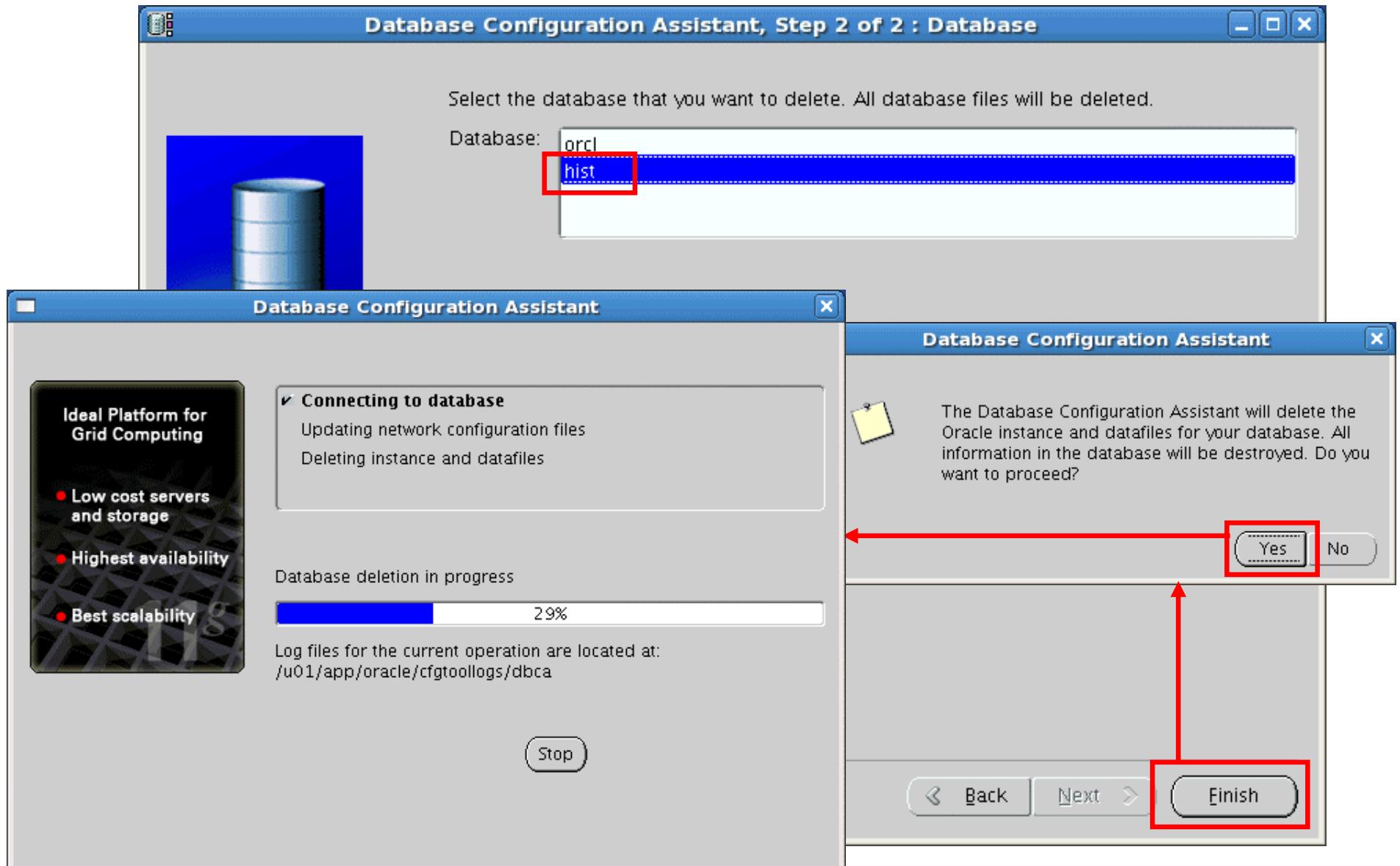
Password Management



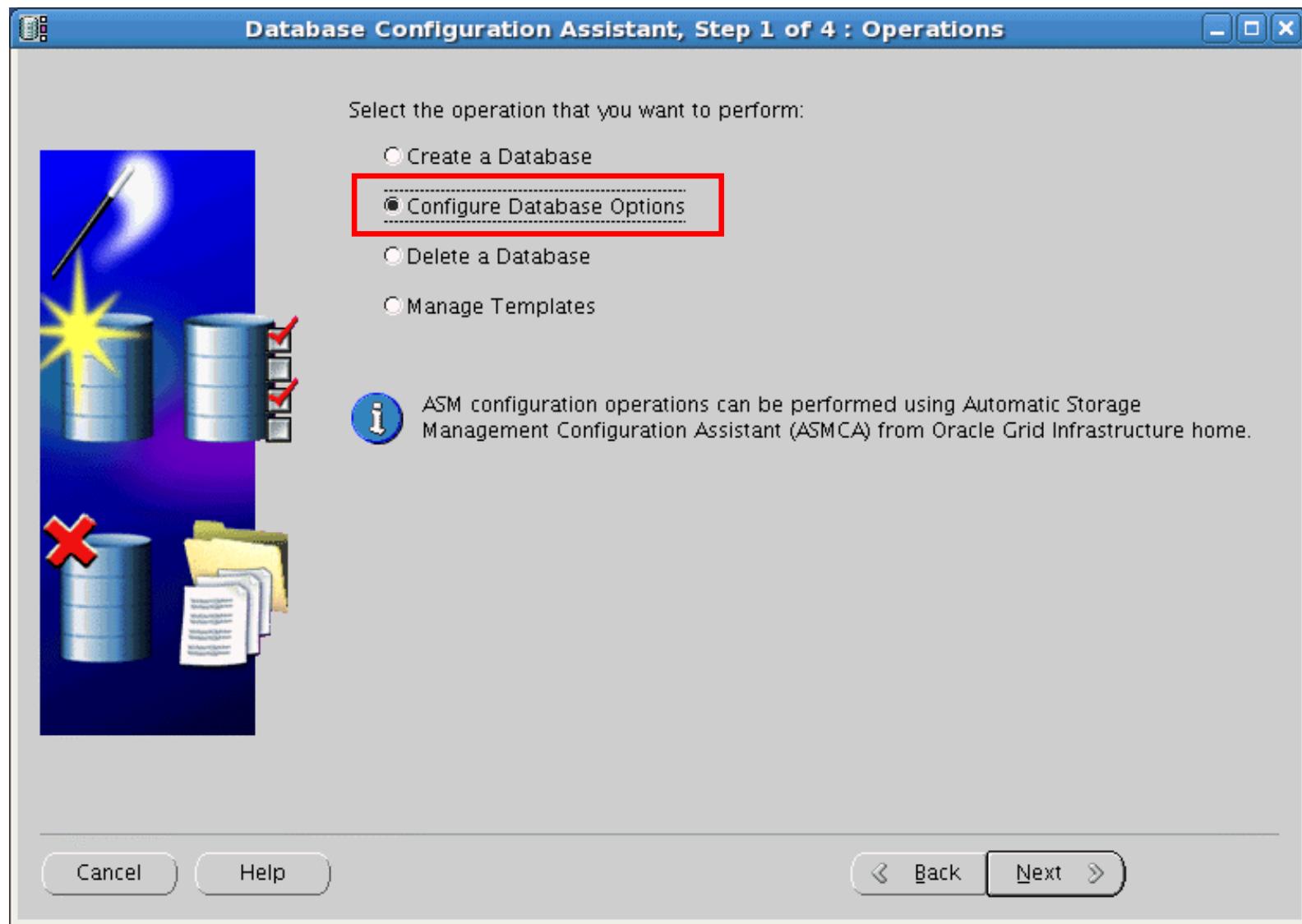
Creating a Database Design Template



Using the DBCA to Delete a Database



Using the DBCA for Additional Tasks



Quiz

The parameter `DB_BLOCK_SIZE` is set for the lifetime of a database and cannot be changed.

1. True
2. False

Quiz

In order to drop a database using the `DROP DATABASE` command, the database must be:

1. Open and in `RESTRICT` mode
2. Mounted exclusively in `RESTRICT` mode
3. Shut down with the immediate option

Summary

In this lesson, you should have learned how to:

- Create a database by using the Database Configuration Assistant (DBCA)
- Generate database creation scripts with the DBCA
- Manage database design templates with the DBCA
- Perform additional tasks with the DBCA

Practice 3 Overview: Using the DBCA

This practice covers the following topics:

- Creating the ORCL database by using the DBCA
- Unlocking the HR schema

Note: Completing database creation and unlocking the HR schema are critical for all following practices.

- Creating the ORCL database design template by using the DBCA
- Creating database creation scripts by using the DBCA



Managing the Database Instance

4

Objectives

After completing this lesson, you should be able to:

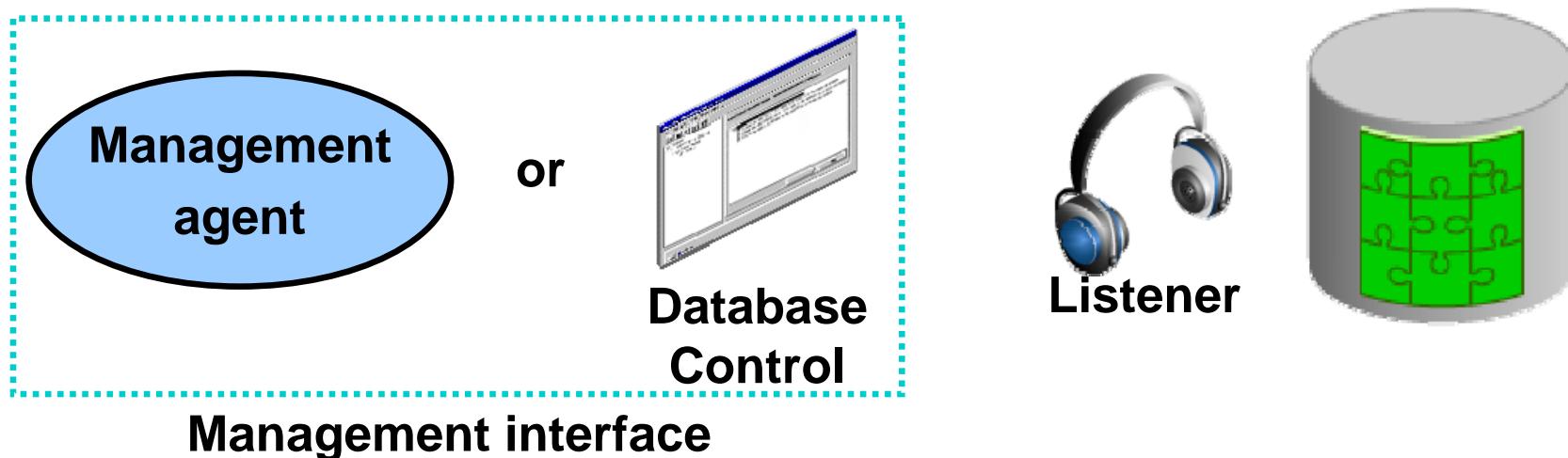
- Start and stop the Oracle database and components
- Use Oracle Enterprise Manager
- Access a database with SQL*Plus
- Modify database initialization parameters
- Describe the stages of database startup
- Describe database shutdown options
- View the alert log
- Access dynamic performance views



Management Framework

Oracle Database 11g Release 2 management framework components:

- Database instance
- Listener
- Management interface:
 - Database Control
 - Management agent (when using Grid Control)



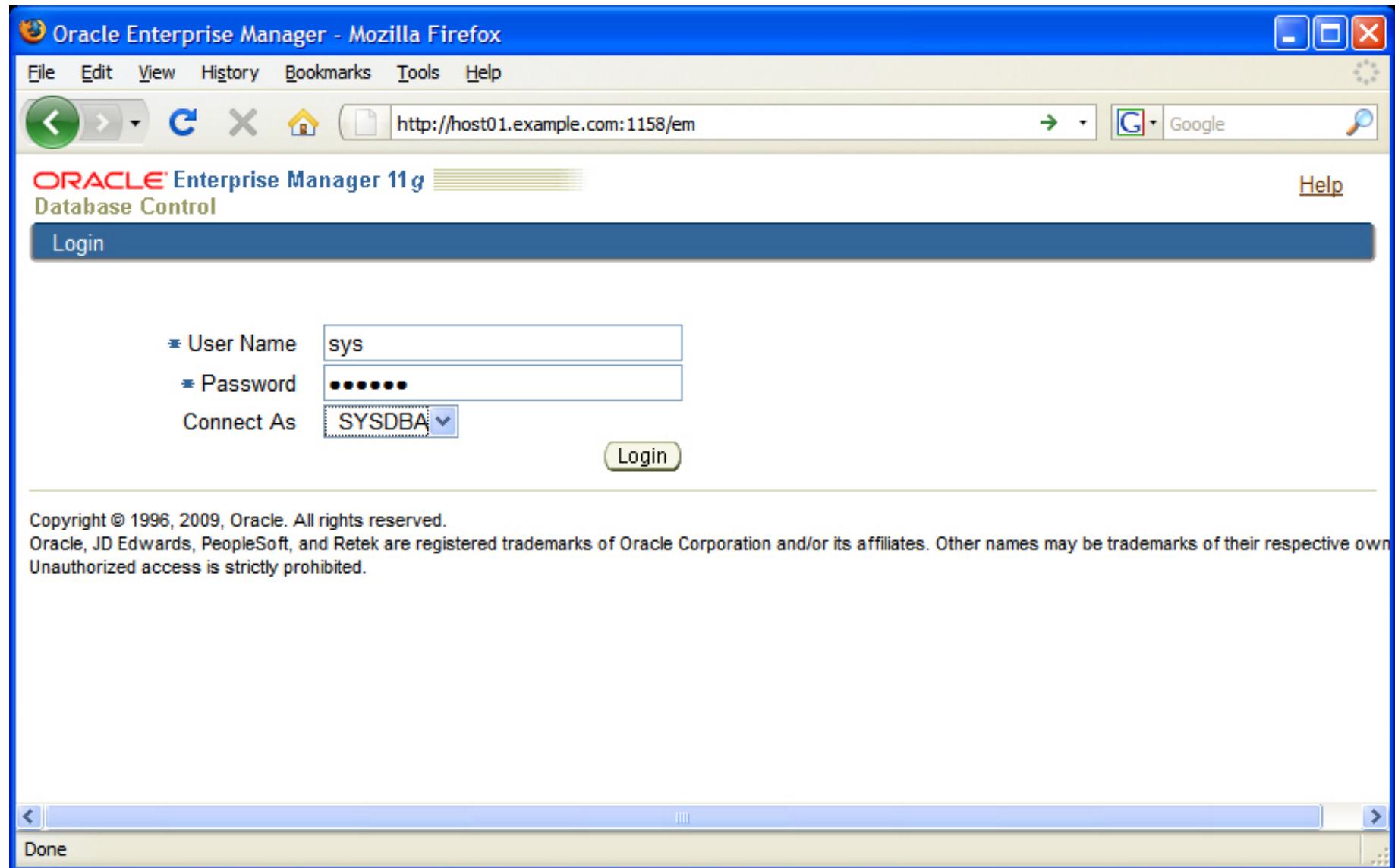
Starting and Stopping Database Control

```
$ . oraenv
ORACLE_SID = [orcl] ? orcl
The Oracle base for ORACLE_HOME=/u01/app/oracle/product/11.2.0/db_home1
is /u01/app/oracle
$ emctl start dbconsole
Oracle Enterprise Manager 11g Database Control Release 11.2.0.1.0
Copyright (c) 1996, 2009 Oracle Corporation. All rights reserved.
http://host01.example.com:1158/em/console/aboutApplication
Starting Oracle Enterprise Manager 11g Database Control .....started.
-----
Logs are generated in directory
/u01/app/oracle/product/11.2.0/db_home1/host01.example.com_orcl/sysman/
log
```

```
$ emctl stop dbconsole
Oracle Enterprise Manager 11g Database Control Release 11.2.0.1.0
Copyright (c) 1996, 2009 Oracle Corporation. All rights reserved.
https://host01.example.com:1158/em/console/aboutApplication
Stopping Oracle Enterprise Manager 11g Database Control ...
... Stopped.
```



Oracle Enterprise Manager



Database Home Page

ORACLE Enterprise Manager 11g Database Control

Setup Preferences Help Logout Database Logged in As SYS

Database Instance: orcl.example.com

Home Performance Availability Server Schema Data Movement Software and Support **Property pages**

Page Refreshed Jun 18, 2009 11:46:00 PM GMT+07:00 Refresh View Data Automatically (60 sec) ▾

General

Status Up
Up Since Jun 18, 2009 5:31:03 AM GMT+07:00
Instance Name orcl
Version 11.2.0.1.0
Host edrsr25p1.us.oracle.com
Listener LISTENER_edrsr25p1.us.oracle.com
ASM +ASM_edrsr25p1.us.oracle.com

[View All Properties](#)

Host CPU

Host CPU chart showing usage for 'Other' and 'orcl'. The Y-axis ranges from 0 to 100%. The X-axis shows time intervals. The 'orcl' series is represented by a green bar, and the 'Other' series by a light green bar.

Active Sessions

Active Sessions chart showing Wait, User, I/O, and CPU. The Y-axis ranges from 0.0 to 1.0. The X-axis shows time intervals. The legend indicates: Wait (orange), User (blue), I/O (green), and CPU (dark blue).

SQL Response Time

SQL Response Time chart showing latest collection. The Y-axis ranges from 0.0 to 1.0. The X-axis shows time intervals. The legend indicates: Latest Collection (seconds) (orange), Reference Collection (seconds) (blue).

Load 0.31 Paging 0.05 Core Count 1 SQL Response Time (%) 102.90 [Edit Reference Collection](#)

Diagnostic Summary

| ADDM Findings | 2 |
|----------------------------|------------------------------------|
| Period Start Time | Jun 18, 2009 10:00:40 PM GMT+07:00 |
| Alert Log Active Incidents | No ORA- errors 0 |

Space Summary

| Database Size (GB) | 1.448 |
|---------------------------------|-------|
| Problem Tablespaces | 0 |
| Segment Advisor Recommendations | 0 |
| Policy Violations | ✓ 0 |
| Dump Area Used (%) | 85 |

High Availability

| Console Oracle Restart | Enabled |
|--------------------------------|----------|
| Instance Recovery Time (sec) | 14 |
| Last Backup | n/a |
| Usable Flash Recovery Area (%) | 95.96 |
| Flashback Database Logging | Disabled |

Other Oracle Tools

- SQL*Plus provides an additional interface to your database so that you can:
 - Perform database management operations
 - Execute SQL commands to query, insert, update, and delete data in your database
- SQL Developer:
 - Is a graphical user interface for accessing your instance of Oracle Database
 - Supports development in both SQL and PL/SQL
 - Is available in the default installation of Oracle Database

Components
> **SQL*Plus**
Init Params
DB Startup
DB Shutdown
Alert Log
Perf Views

Using SQL*Plus

SQL*Plus is:

- A command-line tool
- Used interactively or in batch mode

```
$ sqlplus hr

SQL*Plus: Release 11.2.0.1.0 - Production on Thu Jun 18 05:04:49 2009
Copyright (c) 1982, 2009, Oracle. All rights reserved.
Enter Password: *****

Connected to:
Oracle Database 11g Enterprise Edition Release 11.2.0.1.0 - Production
With the Partitioning, Automatic Storage Management, OLAP, Data Mining
and Real Application Testing options

SQL> select last_name from employees;
LAST_NAME
-----
Abel
Ande
...
...
```

Calling SQL*Plus from a Shell Script

```
$ ./batch_sqlplus.sh
```

```
SQL*Plus: Release 11.2.0.1.0 - Production on Thu Jun 18 05:10:19 2009  
Copyright (c) 1982, 2009, Oracle. All rights reserved.
```

```
Connected to:
```

```
Oracle Database 11g Enterprise Edition Release 11.2.0.1.0 - Production  
With the Partitioning, Automatic Storage Management, OLAP, Data Mining  
and Real Application Testing options
```

```
SQL>  
  COUNT(*)  
-----  
      107  
SQL>  
107 rows updated.  
SQL>
```

```
# Name of this file: batch_sqlplus.sh  
# Count employees and give raise.  
sqlplus hr/hr <<EOF  
select count(*) from employees;  
update employees set salary = salary*1.10;  
commit;  
quit  
EOF
```

```
Commit complete.
```

```
SQL> Disconnected from Oracle Database 11g Enterprise Edition Release  
11.2.0.1.0 - Production  
With the Partitioning, Automatic Storage Management, OLAP, Data Mining  
and Real Application Testing options
```

```
$
```

Output

Calling a SQL Script from SQL*Plus

script.sql

```
select * from departments where location_id = 1400;  
quit
```

Output

```
$ sqlplus hr/hr @script.sql
```

```
SQL*Plus: Release 11.2.0.1.0 - Production on Thu Jun 18 05:13:42 2009  
Copyright (c) 1982, 2009, Oracle. All rights reserved.
```

Connected to:

```
Oracle Database 11g Enterprise Edition Release 11.2.0.1.0 - Production  
With the Partitioning, Automatic Storage Management, OLAP, Data Mining  
and Real Application Testing options
```

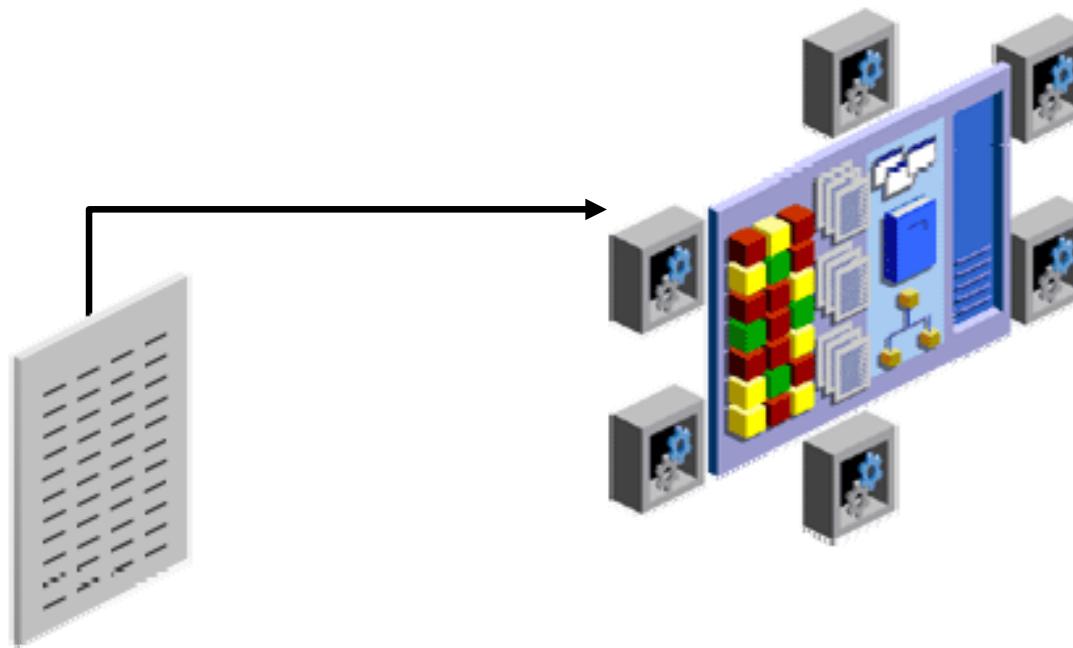
| DEPARTMENT_ID | DEPARTMENT_NAME | MANAGER_ID | LOCATION_ID |
|---------------|-----------------|------------|-------------|
| 60 | IT | 103 | 1400 |

```
Disconnected from Oracle Database 11g Enterprise Edition Release  
11.2.0.1.0 - Production  
With the Partitioning, Automatic Storage Management, OLAP, Data Mining  
and Real Application Testing options
```

ORACLE

Initialization Parameter Files

Components
SQL*Plus
> **Init Params**
DB Startup
DB Shutdown
Alert Log
Perf Views



spfileorcl.ora

or

initorcl.ora

Simplified Initialization Parameters

Basic



CONTROL_FILES
DB_BLOCK_SIZE
PROCESSES
UNDO_TABLESPACE
...

Advanced

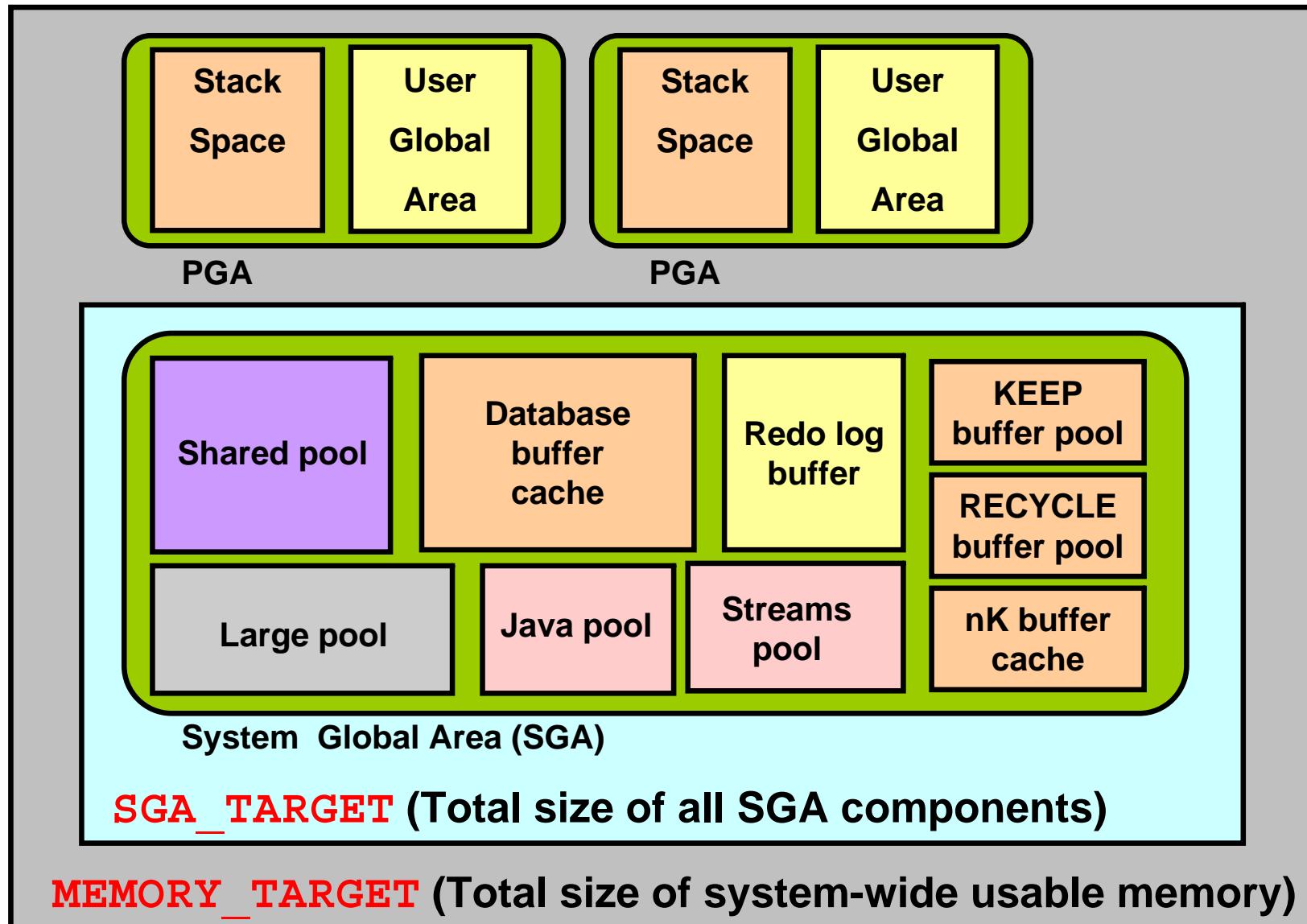


DB_CACHE_SIZE
DB_FILE_MULTIBLOCK_READ_COUNT
SHARED_POOL_SIZE
...

Initialization Parameters: Examples

| Parameter | Specifies |
|---------------|---|
| CONTROL_FILES | One or more control file names |
| DB_FILES | Maximum number of database files |
| PROCESSES | Maximum number of OS user processes that can simultaneously connect |
| DB_BLOCK_SIZE | Standard database block size used by all tablespaces |
| DB_CACHE_SIZE | Size of the standard block buffer cache |

Initialization Parameters: Examples



Initialization Parameters: Examples

| Parameter | Specifies |
|----------------------|--|
| PGA_AGGREGATE_TARGET | Amount of PGA memory allocated to all server processes |
| SHARED_POOL_SIZE | Size of shared pool (in bytes) |
| UNDO_MANAGEMENT | Undo space management mode to be used |

Using SQL*Plus to View Parameters

```
SQL> SELECT name , value FROM V$PARAMETER;  
NAME          VALUE  
-----  
lock_name_space      2  
processes           150  
sessions            247  
timed_statistics    TRUE  
timed_os_statistics 0  
...
```

```
SQL>SHOW PARAMETER SHARED_POOL_SIZE
```

| NAME | TYPE | VALUE |
|------------------|-------------|-------|
| shared_pool_size | big integer | 0 |

```
SQL> show parameter para
```

| NAME | TYPE | VALUE |
|---------------------------------|---------|-------|
| fast_start_parallel_rollback | string | LOW |
| parallel_adaptive_multi_user | boolean | TRUE |
| parallel_automatic_tuning | boolean | FALSE |
| parallel_execution_message_size | integer | 16384 |
| parallel_instance_group | string | |
| ... | | |



Changing Initialization Parameter Values

- Static parameters:
 - Can be changed only in the parameter file
 - Require restarting the instance before taking effect
 - Account for about 110 parameters
- Dynamic parameters:
 - Can be changed while database is online
 - Can be altered at:
 - Session level
 - System level
 - Are valid for duration of session or based on SCOPE setting
 - Are changed by using ALTER SESSION and ALTER SYSTEM commands
 - Account for about 234 parameters

Changing Parameter Values: Examples

```
SQL> ALTER SESSION  
      SET NLS_DATE_FORMAT = 'mon dd yyyy';
```

Session altered.

```
SQL> SELECT SYSDATE FROM dual;
```

SYSDATE

jun 18 2009

```
SQL> ALTER SYSTEM SET  
SEC_MAX_FAILED_LOGIN_ATTEMPTS=2 COMMENT='Reduce  
from 10 for tighter security.' SCOPE=SPFILE;
```

System altered.



Quiz

Enterprise Manager Database Control can be used to manage many databases concurrently.

1. True
2. False

Quiz

The majority of the database parameters are dynamic and can be changed without having to shut down the database instance.

1. True
2. False

Database Startup and Shutdown: Credentials

Components
SQL*Plus
Init Params
> DB Startup
DB Shutdown
Alert Log
Perf Views

ORACLE Enterprise Manager 11g Database Control

Setup Preferences Help Logout Database

Database Instance: orcl.example.com > Logged in As SYS Cancel OK

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.example.com
* Connect As SYSDBA ▾
 Save as Preferred Credential

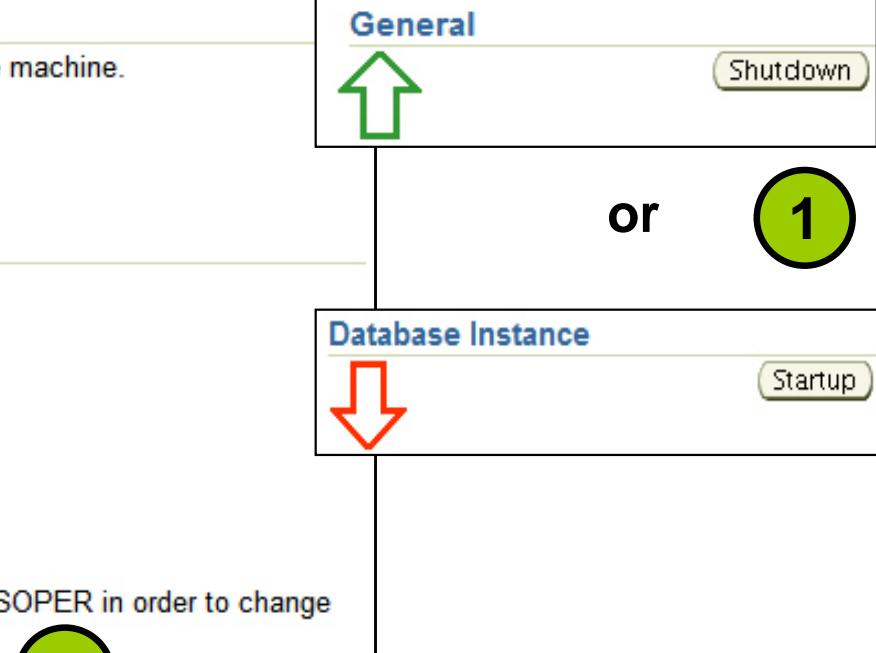
Note that you need to login to the database as SYSDBA or SYSOPER in order to change the status of the database.

General  Shutdown

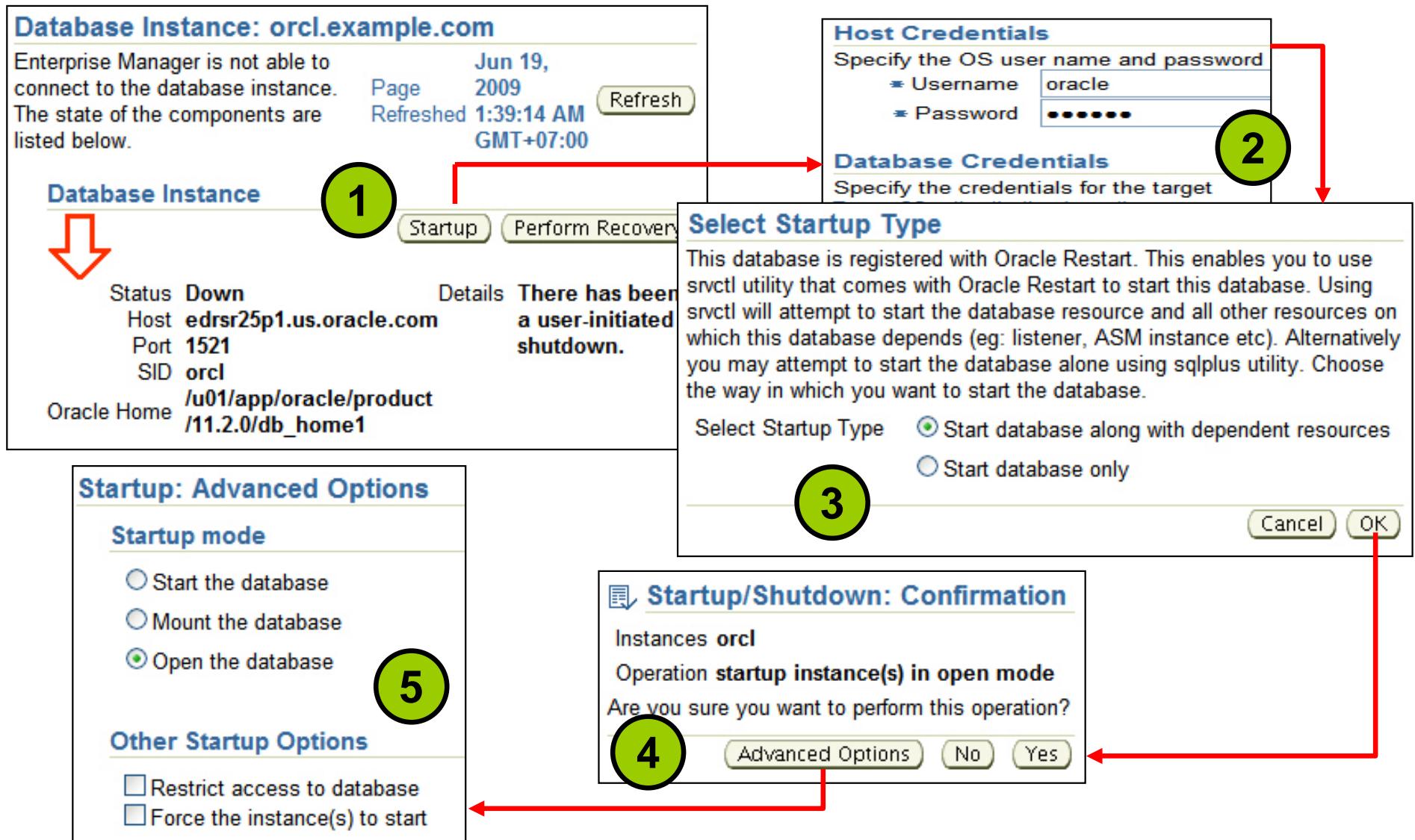
or

Database Instance  Startup

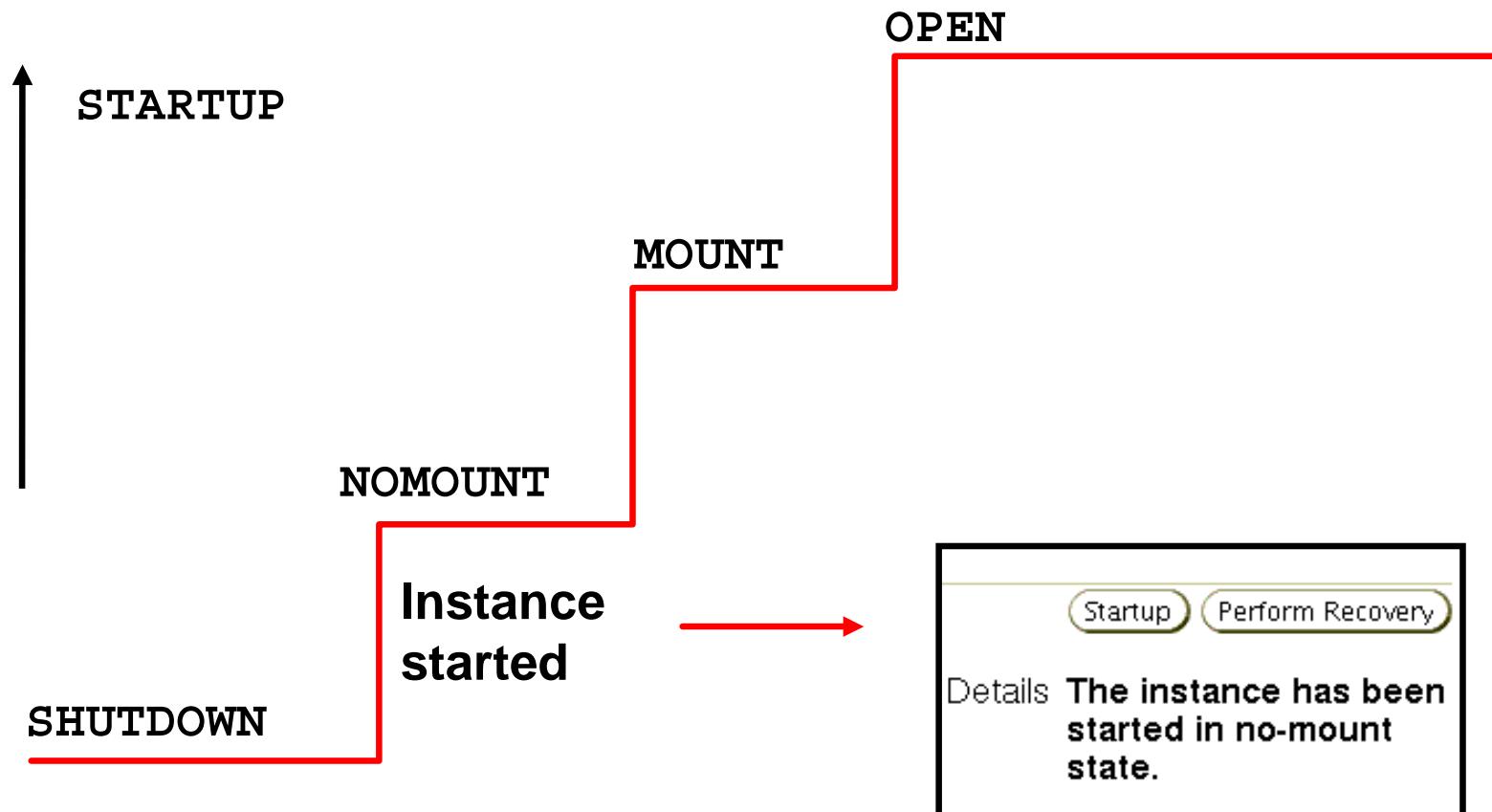
Cancel OK



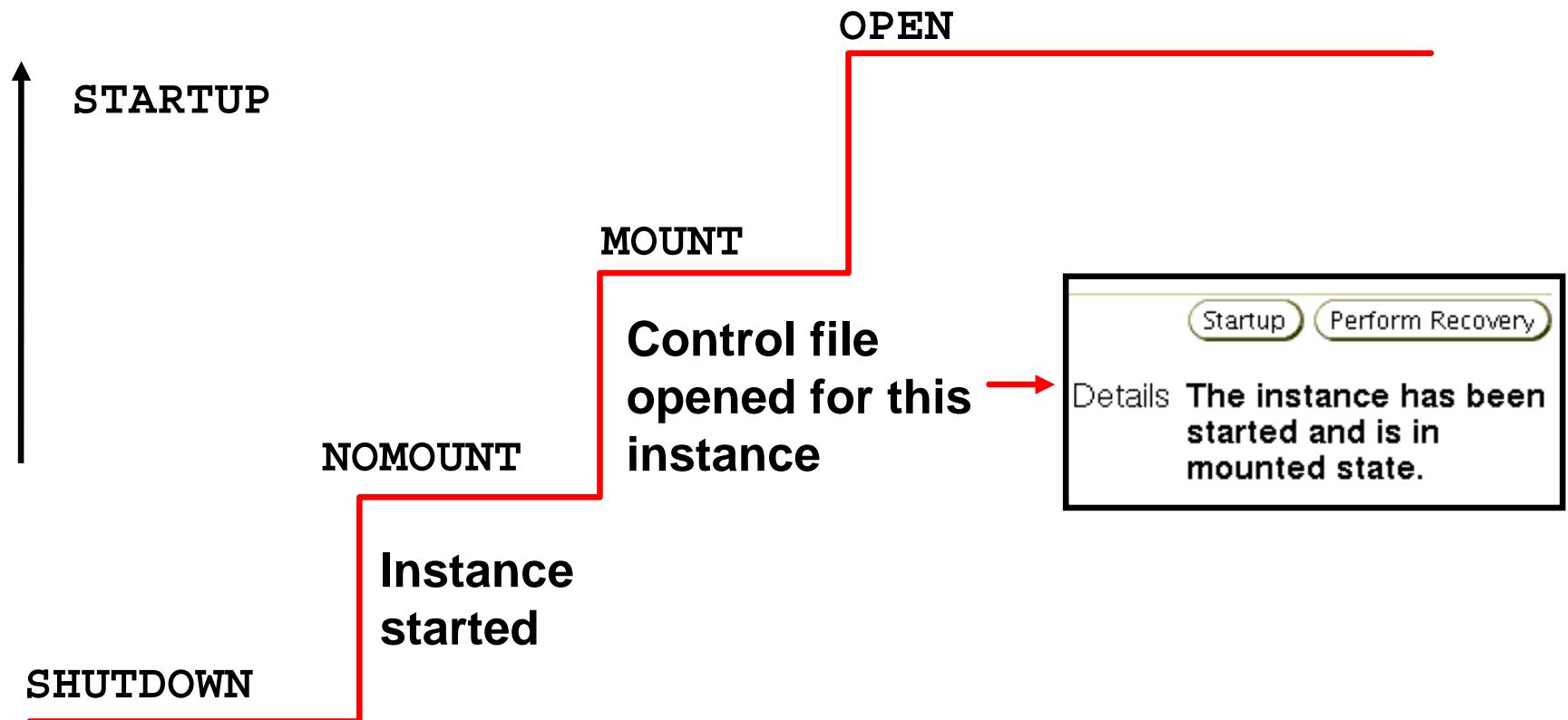
Starting Up an Oracle Database Instance



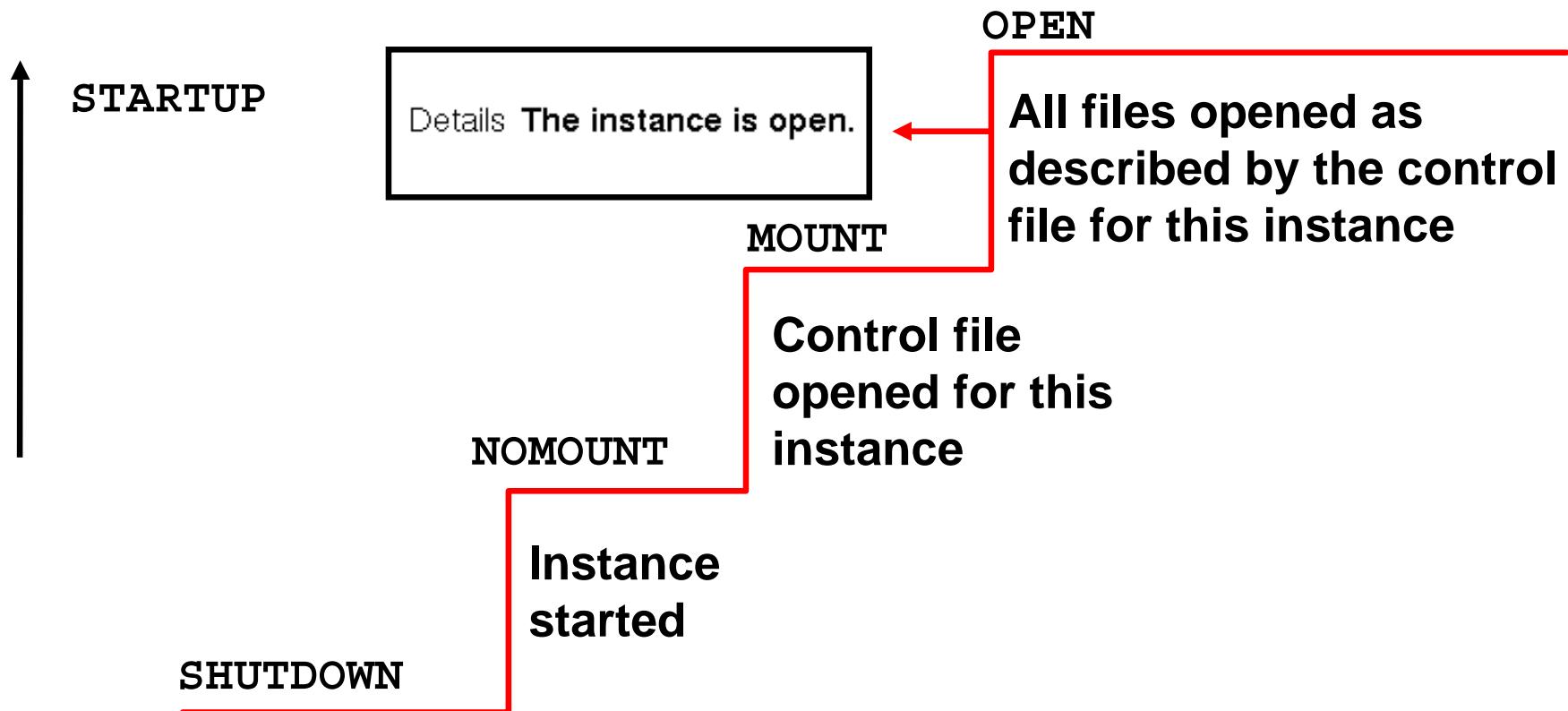
Starting Up an Oracle Database Instance: NOMOUNT



Starting Up an Oracle Database Instance: MOUNT



Starting Up an Oracle Database Instance: OPEN



Startup Options: Examples

- Using the sqlplus utility:

```
SQL> startup
```

1

```
SQL> startup nomount
```

2

```
SQL> alter database mount;
```

3

```
SQL> alter database open;
```

4

- Using the srvctl utility with Oracle Restart

```
$ srvctl start database -d orcl -o mount
```

Shutting Down an Oracle Database Instance

General

1

Status Up
Up Since Jun 19, 2009 2:02:00 AM GMT+07:00
Instance Name orcl
Version 11.2.0.1.0
Host edrsr25p1.us.oracle.com
Listener LISTENER_edrsr25p1.us.orac...
ASM +ASM_edrsr25p1.us.oracle.com

[View All Properties](#)

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.example.com
* Connect As SYSDBA

Startup/Shutdown:Advanced Shutdown Option

Specify the shutdown mode

Normal [Browse Sessions](#)
⚠ Wait for all currently connected users to disconnect from the database

Transactional
Disconnect all connected users after transactions have completed

Immediate
Rollback active transactions and disconnect all connected users

Abort
Instantaneous shutdown by aborting the database instance

Startup/Shutdown:Confirmation

Current Status open
Operation shutdown immediate

Are you sure you want to perform this operation?

Show SQL Advanced Options No Yes

Cancel OK

4

3

Shutdown Modes

| Shutdown Modes | A | I | T | N |
|--------------------------------------|----|-----|-----|-----|
| Allows new connections | No | No | No | No |
| Waits until current sessions end | No | No | No | Yes |
| Waits until current transactions end | No | No | Yes | Yes |
| Forces a checkpoint and closes files | No | Yes | Yes | Yes |

Shutdown modes:

- A = ABORT
- I = IMMEDIATE
- T = TRANSACTIONAL
- N = NORMAL

Shutdown Options

On the way down:

- Uncommitted changes rolled back, for IMMEDIATE
- Database buffer cache written to data files
- Resources released

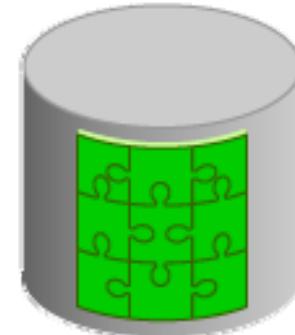
During:

SHUTDOWN
NORMAL
or
SHUTDOWN
TRANSACTIONAL
or
SHUTDOWN
IMMEDIATE

On the way up:

- No instance recovery

Consistent database

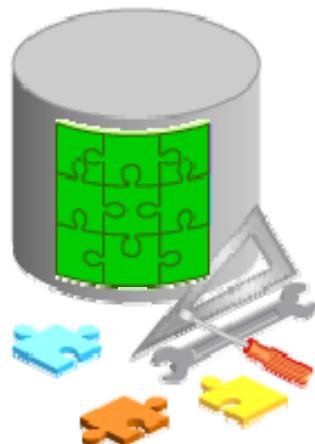


ORACLE

Shutdown Options

On the way down:

- Modified buffers not written to data files
- Uncommitted changes not rolled back



During:

**SHUTDOWN ABORT
or
Instance failure
or
STARTUP FORCE**

On the way up:

- Online redo log files used to reapply changes
- Undo segments used to roll back uncommitted changes
- Resources released

Inconsistent database

Shutdown Options: Examples

- Using SQL*Plus:

```
SQL> shutdown
```

1

```
SQL> shutdown transactional
```

2

```
SQL> shutdown immediate
```

3

```
SQL> shutdown abort
```

4

- Using the SRVCTL utility with Oracle Restart

```
$ srvctl stop database -d orcl -o abort
```

Viewing the Alert Log

Database Home page > Related Links region >
Alert Log Content

Components
SQL*Plus
Init Params
DB Startup
DB Shutdown
> **Alert Log**
Perf Views

| View Entries Last 50 | | | | | | |
|------------------------------------|--------------|-------|-------------|---------------|---------------------------------|---|
| Timestamp | Type | Level | Incident ID | Group | Message ID | Message Text |
| Jun 19, 2009 10:00:16 PM GMT+07:00 | NOTIFICATION | 16 | | sqltune | kesaiTuneSqlDrv:5067:3456118459 | End automatic SQL Tuning Advisor run for special tuning task "SYS_AUTO_SQL_TUNING_TASK" |
| Jun 19, 2009 10:00:03 PM GMT+07:00 | NOTIFICATION | 16 | | sqltune | kesaiTuneSqlDrv:4555:2579917519 | Begin automatic SQL Tuning Advisor run for special tuning task "SYS_AUTO_SQL_TUNING_TASK" |
| Jun 19, 2009 10:00:00 PM GMT+07:00 | NOTIFICATION | 16 | | process start | ksbrdp:3833:3697353022 | VKRM started with pid=24, OS id=7929 |
| Jun 19, 2009 10:00:00 PM GMT+07:00 | NOTIFICATION | 16 | | process start | ksbs1p_real:2253:2371767696 | Starting background process VKRM |
| Jun 19, 2009 2:07:22 AM GMT+07:00 | NOTIFICATION | 16 | | process start | ksbrdp:3833:3697353022 | SMCO started with pid=23, OS id=30582 |
| Jun 19, 2009 2:07:22 AM GMT+07:00 | NOTIFICATION | 16 | | process start | ksbs1p_real:2253:2371767696 | Starting background process SMCO |
| Jun 19, 2009 2:02:26 AM GMT+07:00 | NOTIFICATION | 16 | | process start | ksbrdp:3833:3697353022 | CJQ0 started with pid=33, OS id=29846 |

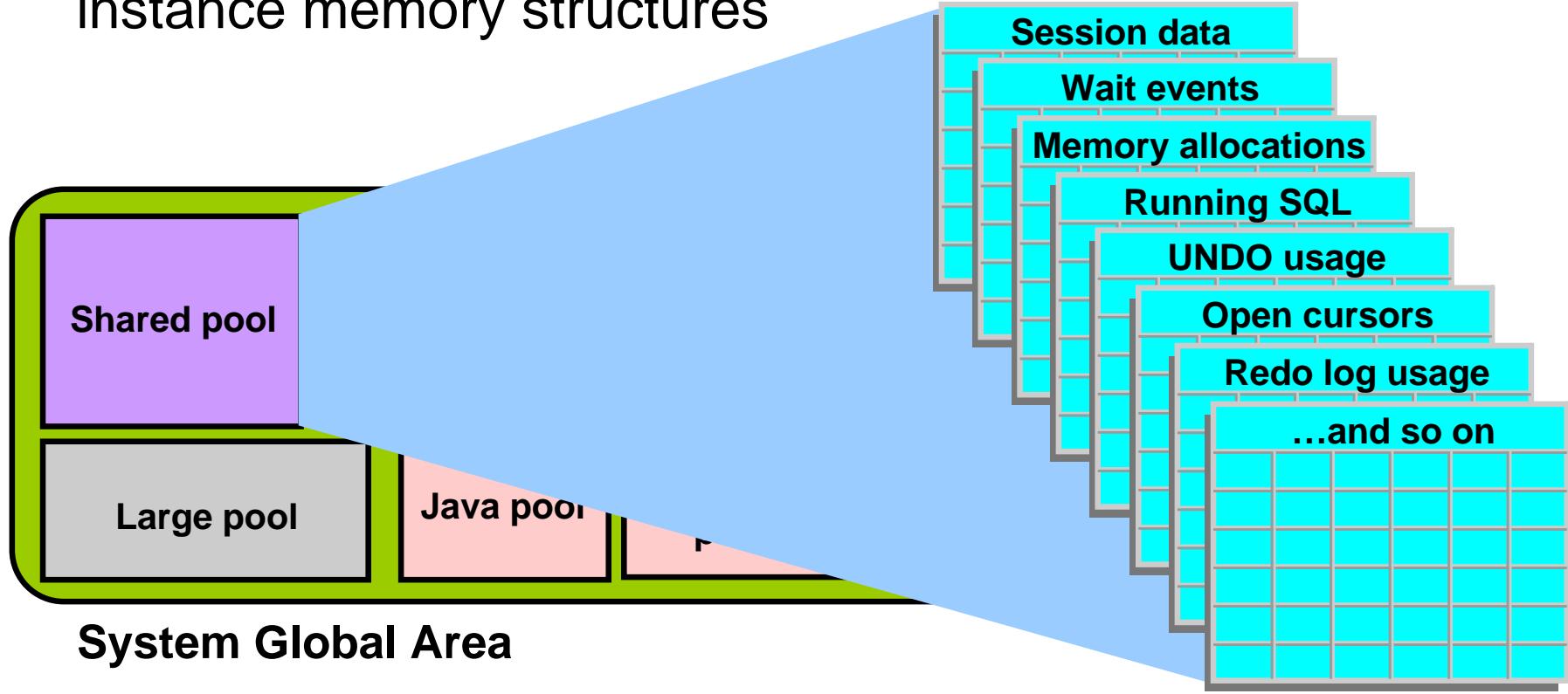
Using Trace Files

- Each server and background process can write to an associated trace file.
- Error information is written to the corresponding trace file.
- Automatic diagnostic repository (ADR)
 - Is a systemwide central tracing and logging repository
 - Stores database diagnostic data such as:
 - Traces
 - Alert log
 - Health monitor reports

Dynamic Performance Views

Provide access to information about changing states of the instance memory structures

Components
SQL*Plus
Init Params
DB Startup
DB Shutdown
Alert Log
> **Perf Views**



Dynamic Performance Views: Usage Examples

1 SQL> SELECT sql_text, executions FROM v\$sql
WHERE cpu_time > 200000;

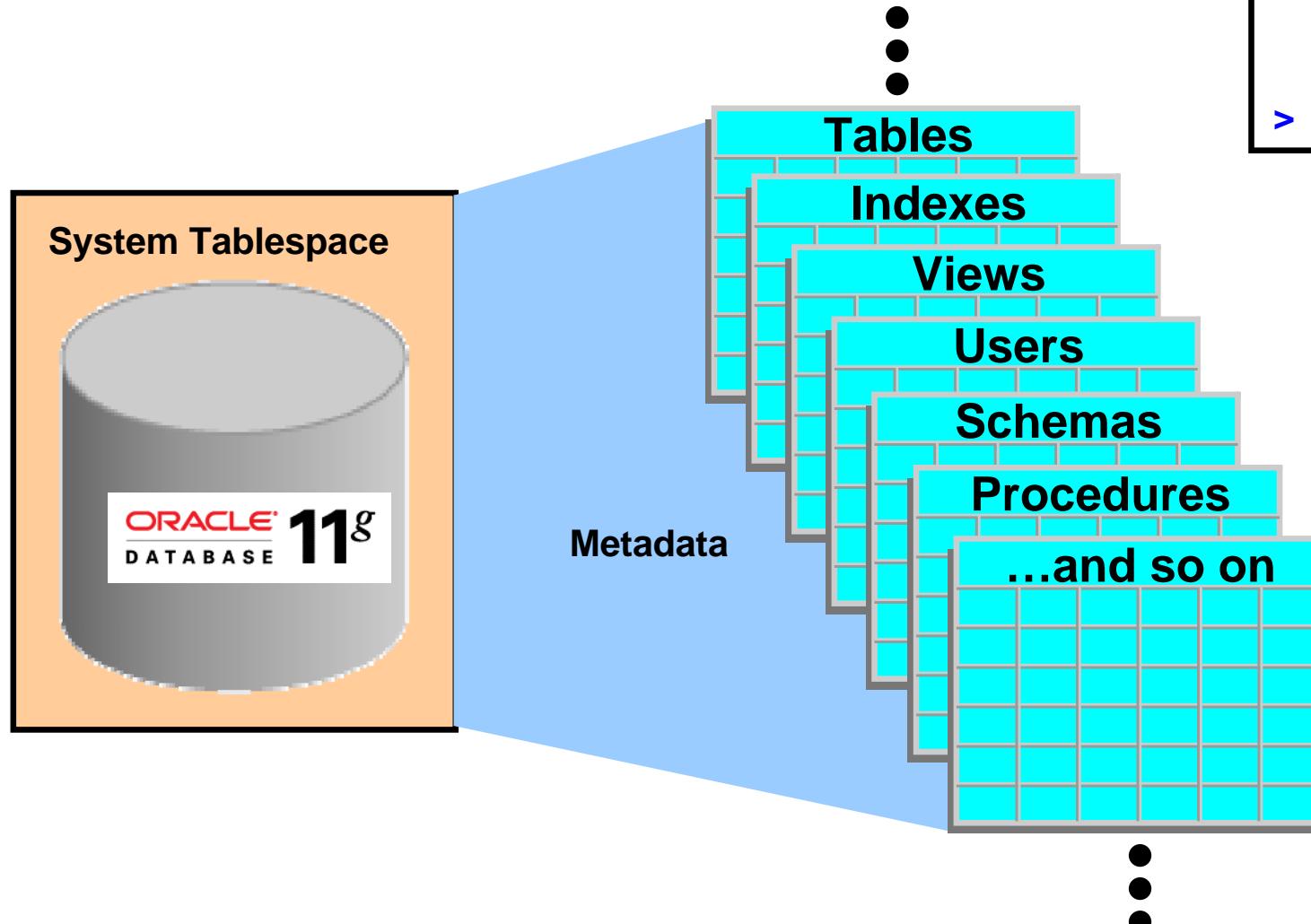
2 SQL> SELECT * FROM v\$session WHERE machine =
'EDRSR9P1' and logon_time > SYSDATE - 1;

3 SQL> SELECT sid, ctime FROM v\$lock
WHERE block > 0;

Dynamic Performance Views: Considerations

- These views are owned by the SYS user.
- Different views are available at different times:
 - The instance has been started.
 - The database is mounted.
 - The database is open.
- You can query V\$FIXED_TABLE to see all the view names.
- These views are often referred to as “v-dollar views.”
- Read consistency is not guaranteed on these views because the data is dynamic.

Data Dictionary: Overview



Schema
Constraints
Indexes
Views
Sequences
Temp Tables
> Data Dict

```
SELECT * FROM dictionary;
```

Data Dictionary Views

| | Who Can Query | Contents | Subset of | Notes |
|-------|---------------|--|------------|---|
| DBA_ | DBA | Everything | N/A | May have additional columns meant for DBA use only |
| ALL_ | Everyone | Everything that the user has privileges to see | DBA_ views | Includes user's own objects and other objects the user has been granted privileges to see |
| USER_ | Everyone | Everything that the user owns | ALL_ views | Is usually the same as ALL_ except for the missing OWNER column (Some views have abbreviated names as PUBLIC synonyms.) |

Data Dictionary: Usage Examples

1

```
SELECT table_name, tablespace_name  
FROM user_tables;
```

2

```
SELECT sequence_name, min_value, max_value,  
increment_by  
FROM all_sequences  
WHERE sequence_owner IN ('MDSYS', 'XDB');
```

3

```
SELECT USERNAME, ACCOUNT_STATUS  
FROM dba_users  
WHERE ACCOUNT_STATUS = 'OPEN';
```

4

```
DESCRIBE dba_indexes
```

Quiz

When using Oracle Restart, the server control utility (`srvctl`) must be used instead of SQL*Plus to start and stop a database instance.

- 1. True**
- 2. False**

Quiz

Which data dictionary view can be used to find the names of all tables in the database?

1. USER_TABLES
2. ALL_TABLES
3. DBA_TABLES
4. ANY_TABLES



Summary

In this lesson, you should have learned how to:

- Start and stop the Oracle database and components
- Use Oracle Enterprise Manager
- Access a database with SQL*Plus
- Modify database initialization parameters
- Describe the stages of database startup
- Describe database shutdown options
- View the alert log
- Access dynamic performance views

Practice 4 Overview: Managing the Oracle Instance

This practice covers the following topics:

- Navigating in Enterprise Manager
- Viewing and modifying initialization parameters
- Stopping and starting the database instance
- Viewing the alert log
- Connecting to the database by using SQL*Plus





Managing the ASM Instance

Objectives

After completing this lesson, you should be able to:

- Describe the benefits of using ASM
- Manage the ASM instance
- Create and drop ASM disk groups
- Extend ASM disk groups
- Retrieve ASM metadata by using various utilities



ASM Benefits for Administrators

ASM eliminates:

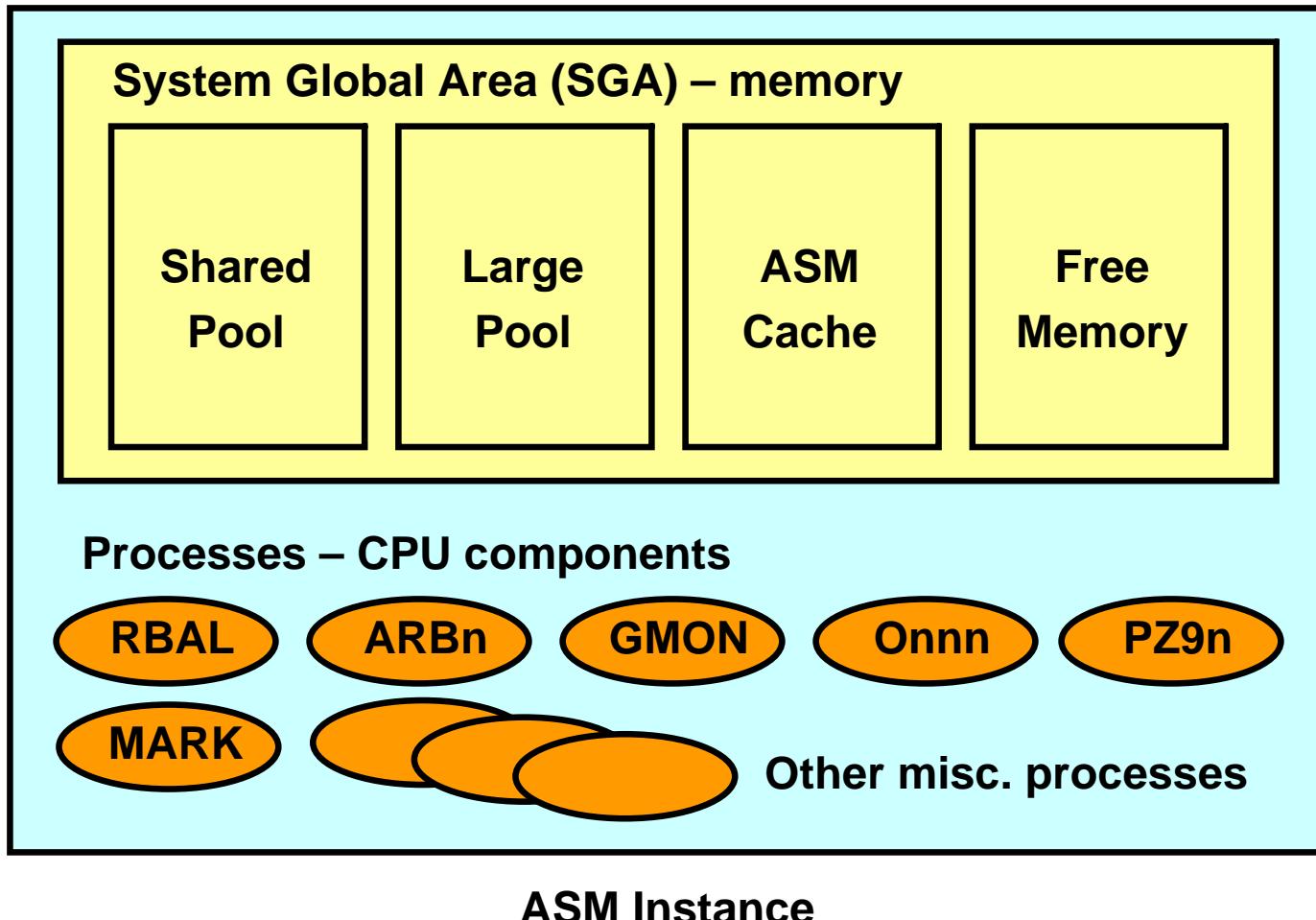
- I/O performance tuning
- Data file movements and reorganizations
- File name management
- Logical volume management
- File system management
- Cluster file system management
- Raw device management

ASM significantly reduces:

- Logical Unit Number (LUN) management
 - Fewer, larger LUNs
- Database administrator dependence on system administrator
- Likelihood of errors associated with manual maintenance tasks

ASM Instance

The ASM Instance is a combination of the process and memory components for ASM.



ASM Components:

ASM Instance—Primary Processes

The ASM instance primary processes are responsible for ASM-related activities.

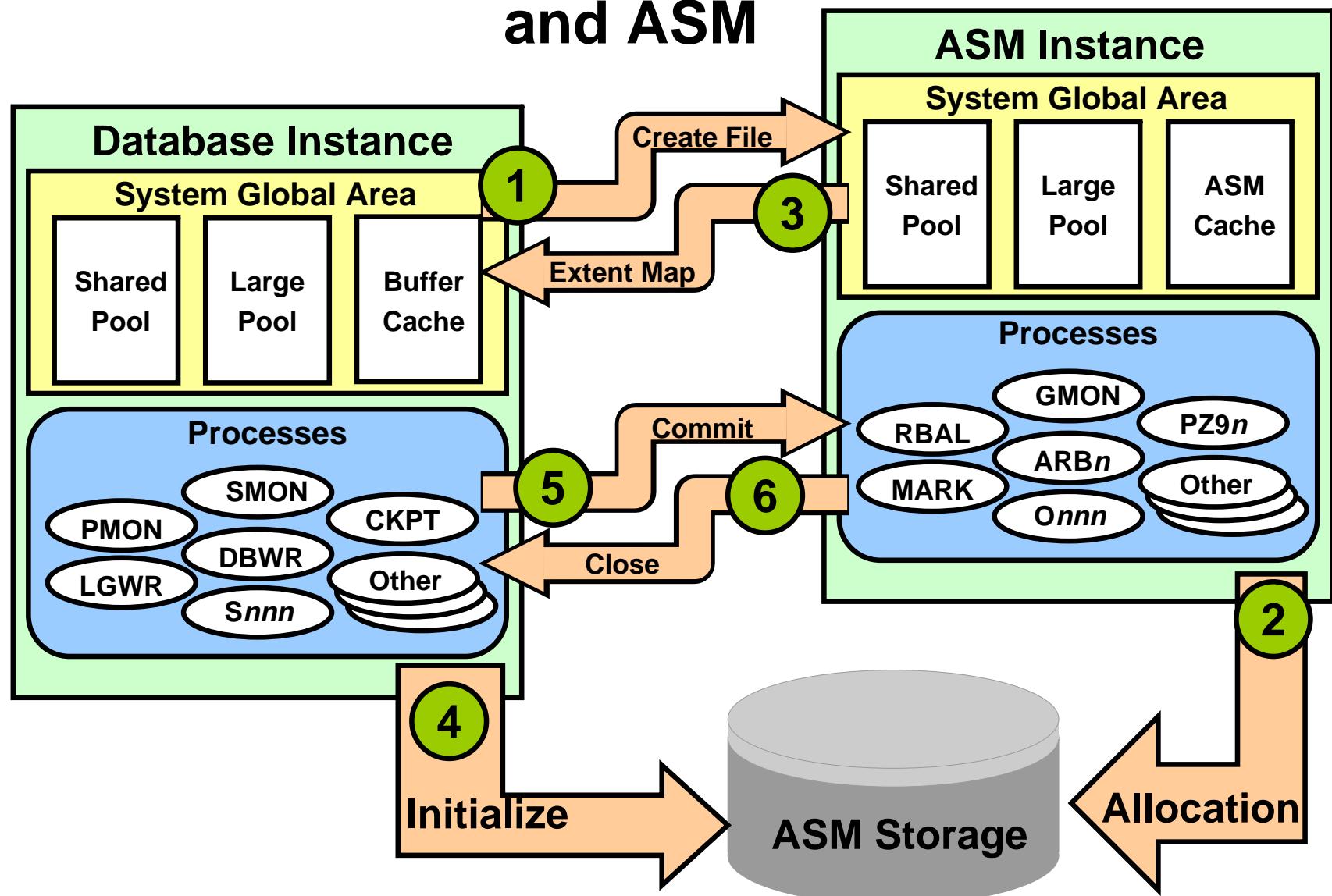
| Process | Description |
|---------|---|
| RBAL | Opens all device files as part of discovery and coordinates the rebalance activity |
| ARBn | One or more slave processes that do the rebalance activity |
| GMON | Responsible for managing the disk-level activities such as drop or offline and advancing the ASM disk group compatibility |
| MARK | Marks ASM allocation units as stale when needed |
| Onnn | One or more ASM slave processes forming a pool of connections to the ASM instance for exchanging messages |
| PZ9n | One or more parallel slave processes used in fetching data on clustered ASM installation from GV\$ views |

ASM Instance Initialization Parameters

The ASM instance uses a small subset of the parameters that an Oracle Database instance uses.

```
INSTANCE_TYPE = ASM
ASM_POWER_LIMIT = 1
ASM_DISKSTRING = '/dev/sda1','/dev/sdb*'
ASM_DISKGROUPS = DATA2, FRA
ASM_PREFERRED_READ_FAILURE_GROUPS = DATA.FailGroup2
DIAGNOSTIC_DEST = /u01/app/oracle
LARGE_POOL_SIZE = 12M
REMOTE_LOGIN_PASSWORDFILE = EXCLUSIVE
```

Interaction Between Database Instances and ASM



ASM Instance: Dynamic Performance Views

The ASM instance hosts memory-based metadata tables presented as dynamic performance views.

- Accessed by ASM utilities to retrieve metadata-only information using the SQL language
- Contains many dedicated ASM-related views such as:

| | | |
|-------------------------|------------------------------|-------------------------|
| V\$ASM_ALIAS | V\$ASM_ATTRIBUTE | V\$ASM_CLIENT |
| V\$ASM_DISK | V\$ASM_DISK_IOSTAT | V\$ASM_DISK_STAT |
| V\$ASM_DISKGROUP | V\$ASM_DISKGROUP_STAT | V\$ASM_FILE |
| V\$ASM_OPERATION | V\$ASM_TEMPLATE | |

ASM System Privileges

- An ASM instance does not have a data dictionary, so the only way to connect to ASM is by using these system privileges.

| ASM Privilege | Privilege Group (Suggested) | Privilege |
|---------------|--------------------------------|---|
| SYSASM | OSASM (asmadmin) | Full administrative privilege |
| SYSDBA | OSDBA (asmdba) | Access to data stored on ASM, and SYSASM in the current release |
| SYSOPER | OSOPER (asmoper) | Limited privileges to start and stop the ASM instance along with a set of nondestructive ALTER DISKGROUP commands |

- The SYS user is automatically created with the SYSASM privilege.



Using Enterprise Manager to Manage ASM Users

The screenshot illustrates the Oracle Enterprise Manager 11g interface for Automatic Storage Management (ASM) on the host +ASM_edrsr25p1.us.oracle.com. The top navigation bar includes links for Setup, Preferences, Help, Logout, Database Control, Home, Performance, Disk Groups, Configuration, Users, and ASM Cluster File System. The current view is under the Users tab.

Create User Dialog: A modal window titled "Create User" is open, with a red arrow pointing from the "Create" button back to the main "Users" page. The dialog contains instructions for creating a user through password file authentication and lists the REMOTE_LOGIN_PASSWORDFILE initialization parameter requirement. It also includes "Show SQL", "Cancel", and "OK" buttons.

Edit User: SYS Dialog: Another modal window titled "Edit User: SYS" is open, with a red arrow pointing from the "Edit" button on the main page. This dialog shows the current login credentials for the SYS user: User Name SYS, Password (redacted), and Confirm Password (redacted). It also includes "Show SQL", "Revert", and "Apply" buttons. The text area describes the need for a password file and the REMOTE_LOGIN_PASSWORDFILE parameter.

Main Users Page: The main page displays a table of users with their privileges. The "Edit" button for the SYS user is highlighted with a red box. The table includes columns for User Name and Privileges. The SYS user is granted SYSDBA, SYSOPER, and SYSASM.

Starting and Stopping ASM Instances Using SQL*Plus

Using SQL*Plus to start and stop ASM instances is similar to the way in which you start and stop database instances.

```
$ . oraenv
ORACLE_SID = [orcl] ? +ASM
The Oracle base for ORACLE_HOME=/u01/app/oracle/product/11.2.0/grid is
/u01/app/oracle
$ sqlplus / AS SYSASM
SQL*Plus: Release 11.2.0.1.0 - Production on Wed Jul 8 20:46:46 2009
Copyright (c) 1982, 2009, Oracle. All rights reserved.
Connected to an idle instance.
SQL> startup
ASM instance started

Total System Global Area  284565504 bytes
Fixed Size                  1336028 bytes
Variable Size                258063652 bytes
ASM Cache                   25165824 bytes
ASM diskgroups mounted
ASM diskgroups volume enabled
SQL> shutdown abort
```



Starting and Stopping ASM Instances Using `srvctl`

The Server Control utility (`srvctl`) can be used to start and stop ASM instances.

```
$ . oraenv
ORACLE_SID = [orcl] ? +ASM
The Oracle base for
    ORACLE_HOME=/u01/app/oracle/product/11.2.0/grid is
    /u01/app/oracle
$ srvctl start asm -o mount
$ srvctl stop asm -f
```

The Sever Control utility (`srvctl`) can be used to check the status of ASM instances.

```
$ srvctl status asm
ASM is running on edrsr25p1
```

Starting and Stopping ASM Instances Using asmcmd

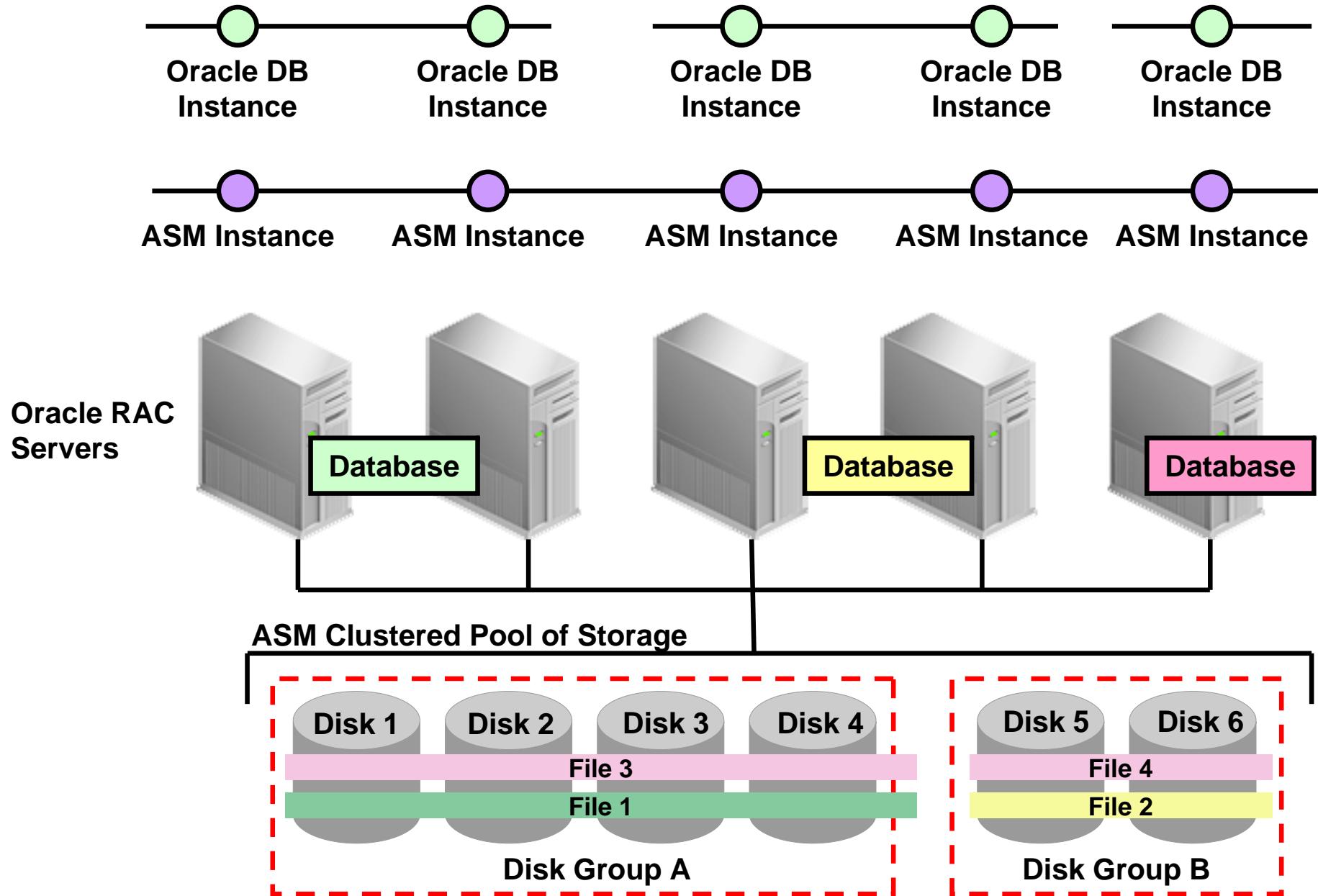
The asmcmd utility provides a command-line interface to ASM without using the SQL language.

```
$ . oraenv
ORACLE_SID = [orcl] ? +ASM
The Oracle base for ORACLE_HOME=/u01/app/oracle/product/11.2.0/grid is
/u01/app/oracle
$ asmcmd
Connected to an idle instance.
ASMCMD> startup
ASM instance started

Total System Global Area  284565504 bytes
Fixed Size                  1336028 bytes
Variable Size                258063652 bytes
ASM Cache                   25165824 bytes

ASM diskgroups mounted
ASM diskgroups volume enabled
ASMCMD> shutdown --abort
ASM instance shut down
Connected to an idle instance.
```

Disk Group Overview



ASM Disks

ASM disks:

- Are the storage devices provisioned to ASM disk groups
- Are accessed through normal O/S interfaces
- Must be read and write accessible by the ASM owner
- Must be accessible by all nodes in a cluster
- May have different O/S names or paths on different nodes
- May be:
 - An entire physical disk or partition of a physical disk
 - A disk or partition from a storage array
 - Logical volumes (LV) or logical units (LUN)
 - Network-attached files (NFS)

Allocation Units

ASM disks are divided into allocation units (AU):

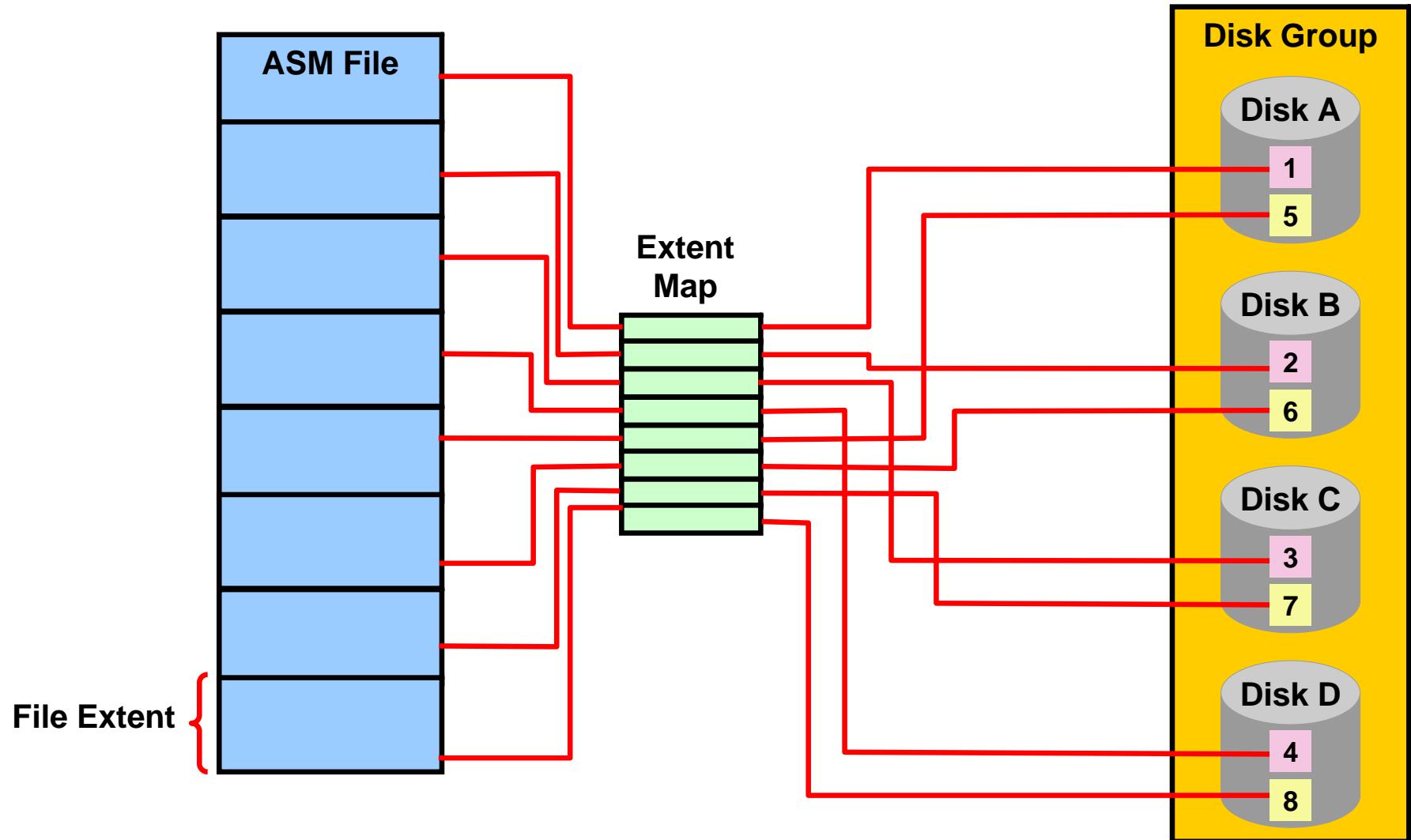
- AU size is configurable at disk group creation.
- Default AU size is 1 MB:
 - Small enough to be cached by database and large enough for efficient sequential access
- Allowable AU sizes:
 - 1, 2, 4, 8, 16, 32, or 64 MB
 - Large AUs may be useful in very large database (VLDB) scenarios or when using specialized storage hardware

ASM Files

ASM files:

- Are a collection of ASM extents composed of AUs
 - Variable sized extents support large files
- Appear as normal files to the database kernel
- Have file names that start with '+'
 - For example,
+DATA/orcl/datafile/system.256.689832921
- May be associated with an optional alias file name
 - For example, +DATA/dbfiles/mydb/system01.dbf
- Are evenly distributed across disks in a disk group
- Are mirrored according to the policies defined in the disk group

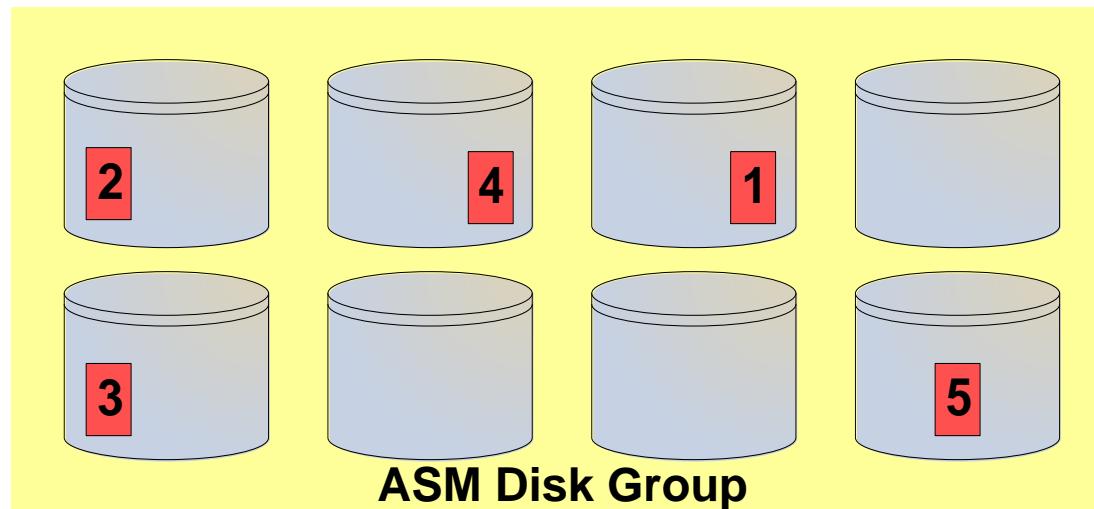
Extent Maps



Striping Granularity

ASM separates striping for load balance and striping for latency:

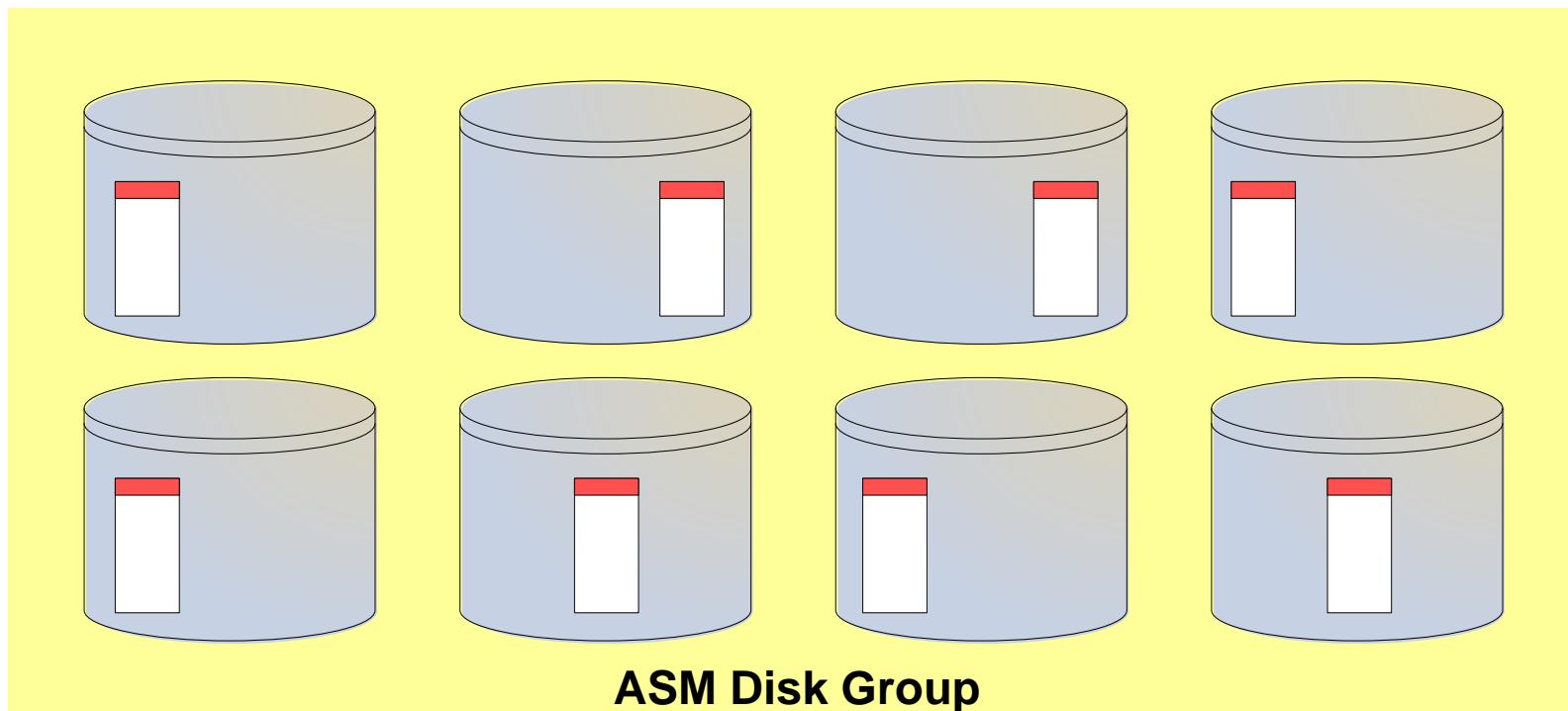
- Coarse-grain striping concatenates allocation units for load balancing.
 - For example:



Fine-Grained Striping

Fine-grain striping puts 128 KB stripe units across groups of allocation units to improve latency.

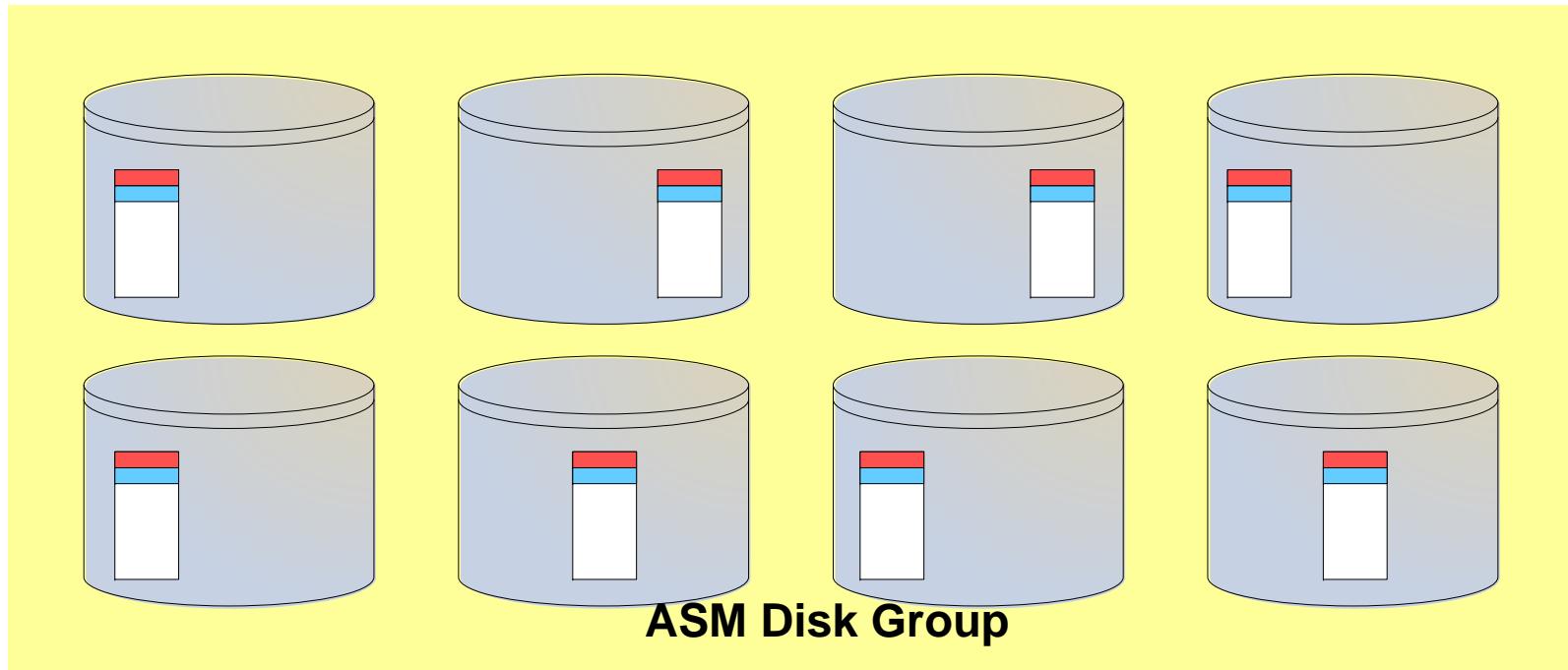
- Disk group with 8 disks and external redundancy
- Default AU size of 1 MB in use
- First 1 MB extent written as 128 KB stripes across 8 AUs



Fine-Grained Striping

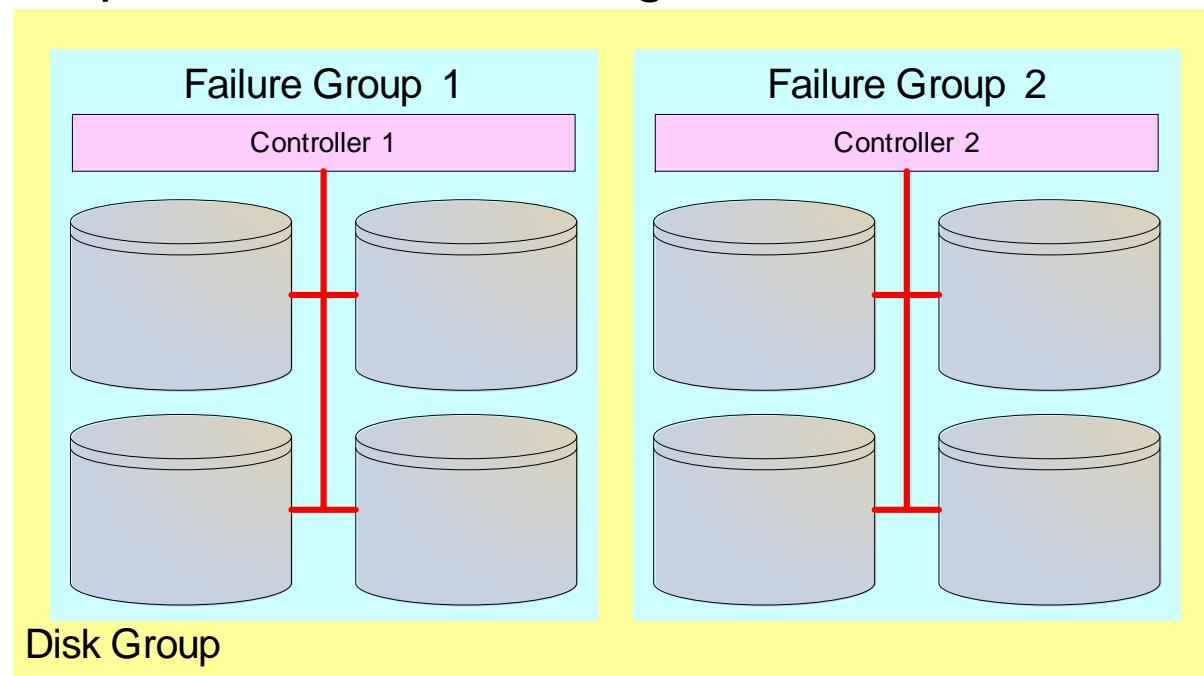
Example:

- Disk group with 8 disks and external redundancy
- Default AU size of 1 MB in use
- Next 1 MB extent written as 128 KB stripes across the same 8 allocation units until they are full



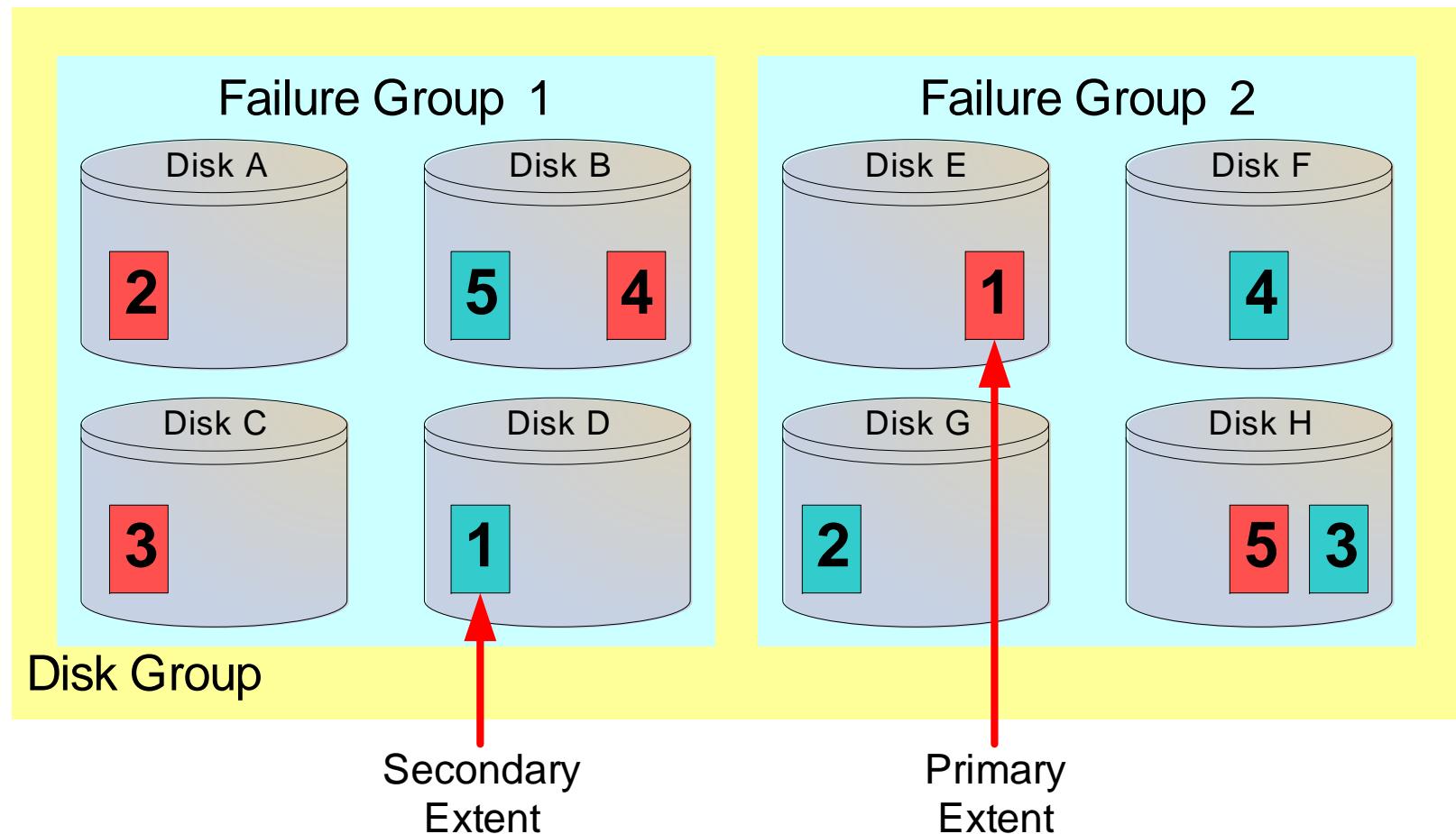
ASM Failure Groups

- A set of disks sharing a common resource whose failure needs to be tolerated
- Mirrored extent copies stored in separate failure groups
- Storage hardware dictates failure group boundaries
 - Example based on isolating disk controllers:



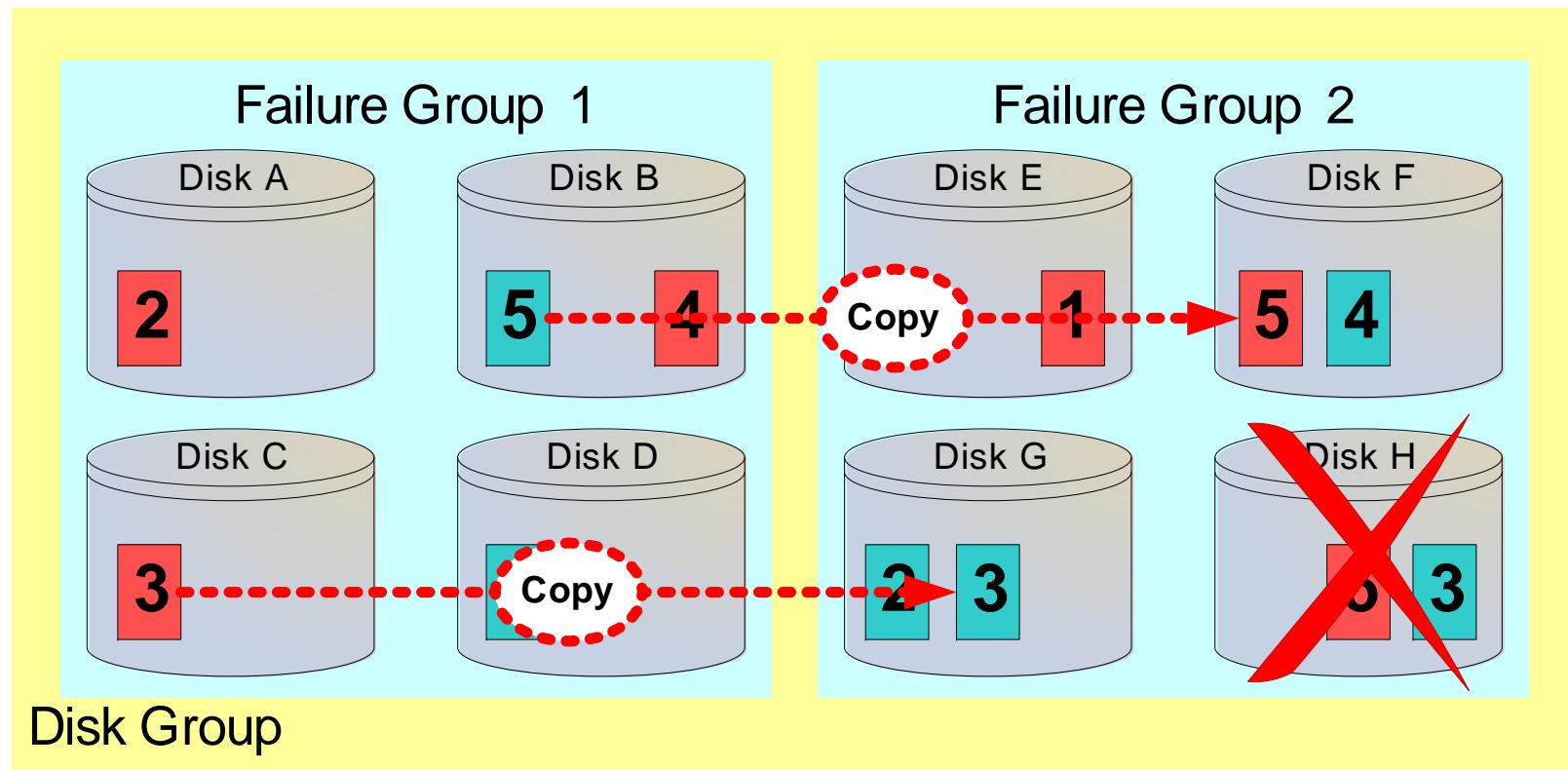
Stripe and Mirror Example

Normal redundancy disk group with eight disks in total, spread across two failure groups.

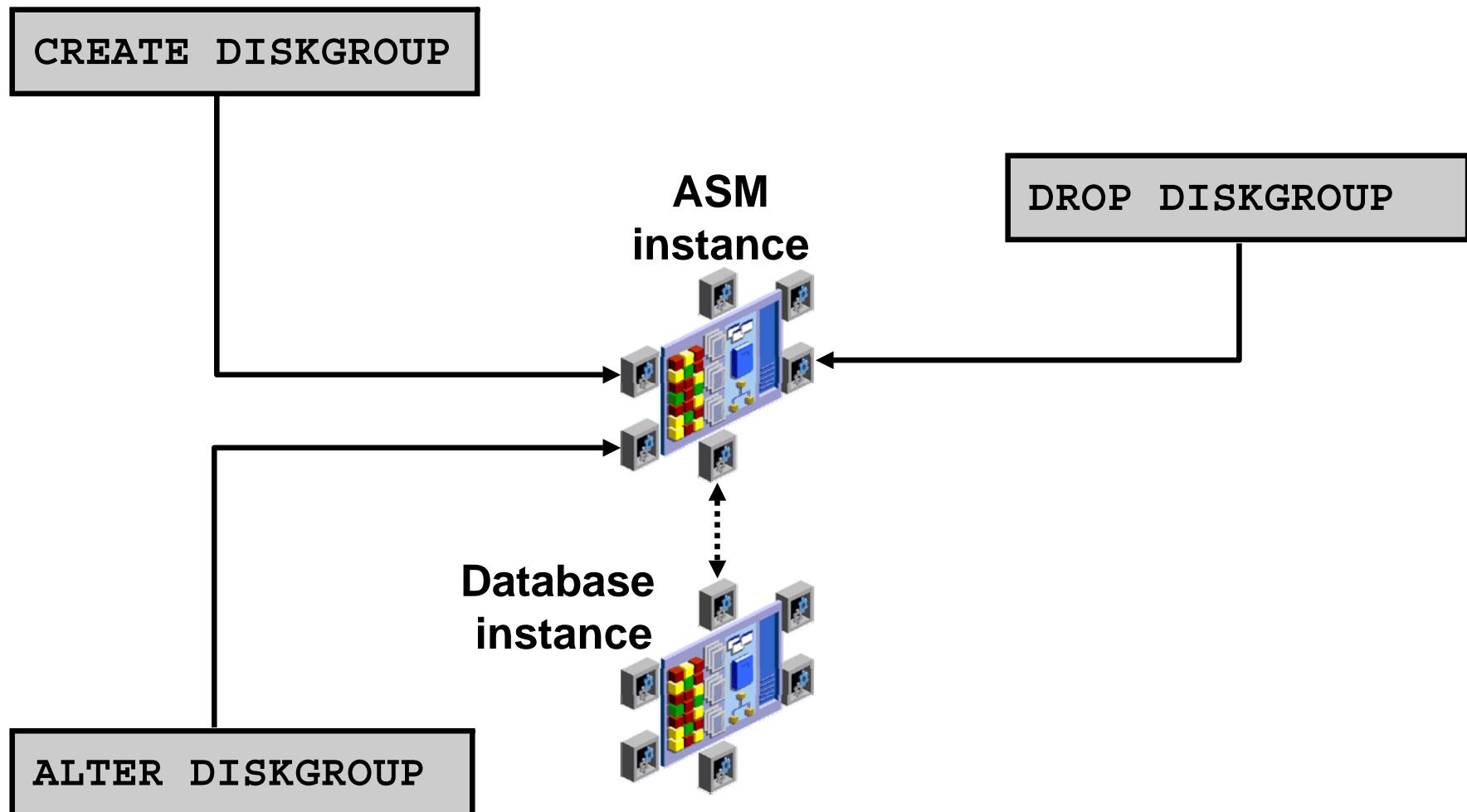


Failure Example

If disk H fails, then the extents it contained are re-created on surviving disks from surviving mirrors.



Managing Disk Groups



Creating and Dropping Disk Groups Using SQL*Plus

```
$ . oraenv
ORACLE_SID = [orcl] ? +ASM
The Oracle base for ORACLE_HOME=/u01/app/oracle/product/11.2.0/grid is
/u01/app/oracle
$ sqlplus / AS SYSASM
SQL*Plus: Release 11.2.0.1.0 - Production on Wed Jul 8 20:46:46 2009
Copyright (c) 1982, 2009, Oracle. All rights reserved.

..
SQL> CREATE DISKGROUP dgroupA NORMAL REDUNDANCY
FAILGROUP controller1 DISK
  '/devices/A1' NAME diskA1 SIZE 120G FORCE,
  '/devices/A2',
FAILGROUP controller2 DISK
  '/devices/B1',
  '/devices/B2';
```

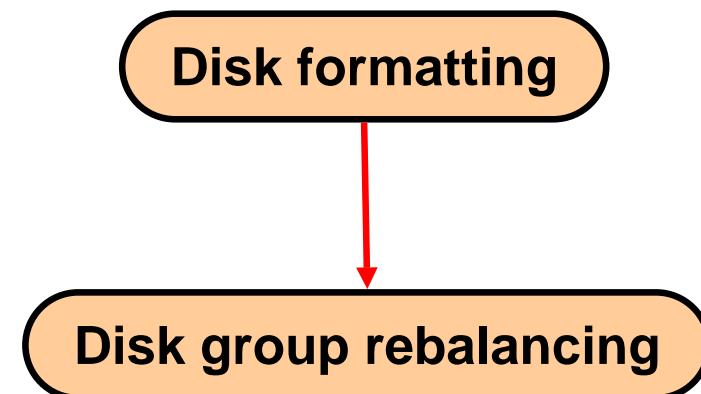
```
SQL> DROP DISKGROUP dgroupA INCLUDING CONTENTS;
```



Adding Disks to Disk Groups

```
ALTER DISKGROUP dgroupA ADD DISK  
  '/dev/sde1' NAME A5,  
  '/dev/sdf1' NAME A6,  
  '/dev/sdg1' NAME A7,  
  '/dev/sdh1' NAME A8;
```

```
ALTER DISKGROUP dgroupA ADD DISK '/devices/A*';
```



Miscellaneous ALTER Commands

Remove a disk from dgroupA:

```
ALTER DISKGROUP dgroupA DROP DISK A5;
```

Add and drop a disk in a single command:

```
ALTER DISKGROUP dgroupA  
  DROP DISK A6  
  ADD FAILGROUP controller3  
    DISK '/dev/sdi1' NAME A9;
```

Cancel a disk drop operation:

```
ALTER DISKGROUP dgroupA UNDROP DISKS;
```



ASM Management Using Enterprise Manager

ORACLE Enterprise Manager 11g Database Control

Setup Preferences Help Logout Database

Logged in As SYS / SYSASM

Automatic Storage Management: +ASM_edrsr25p1.us.oracle.com

Home Performance Disk Groups Configuration Users ASM Cluster File System

Data Retrieved Jul 9, 2009 3:24:16 AM GMT+07:00 Refresh

General

Current Status: Up
Up Since: Jul 8, 2009 10:18:28 AM GMT+07:00
Availability (%): 76.38 (Last 24 hours)
Instance Name: +ASM
Version: 11.2.0.1.0
Host: edrsr25p1.us.oracle.com
Oracle Home: /u01/app/oracle/product/11.2.0/grid

Disk Group Usage (GB)

| Disk Group | Size (GB) |
|------------|-----------|
| FRA | 9.00 |
| DATA | 6.00 |

Legend: Unallocated (Blue), Internal (Light Blue), orcl.example.com (Green), CLUSTER_UNKNOWN (Dark Blue)

Diagnostic Summary

Alert Log: No ORA- errors
Active Incidents: 0

Serviced Databases

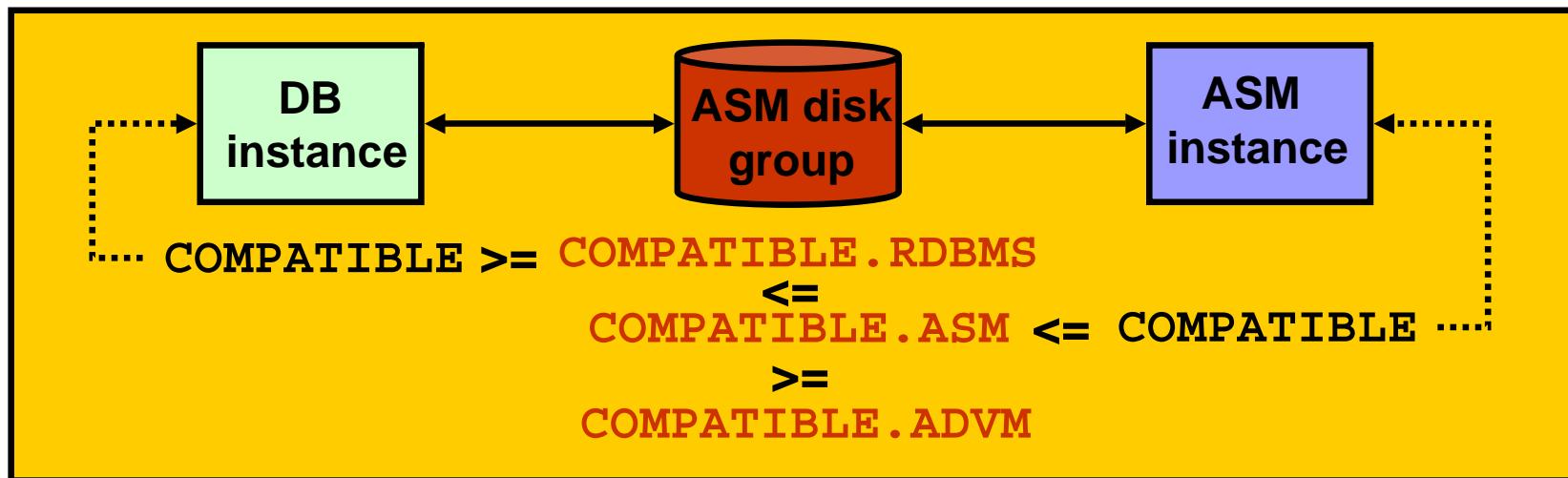
| Name | Disk Groups | Failure Groups | Allocated Space (GB) | Availability | Alerts |
|------------------|-------------|----------------|----------------------|---------------------------------------|---------------|
| orcl.example.com | FRA, DATA | 4 (0 down) | 3.97 | UP | 1 0 |
| CLUSTER_UNKNOWN | DATA | 4 (0 down) | 0 | | Not Monitored |

Serviced ASM Cluster File Systems

| Mount Point | Availability | State | Used (%) | Used (GB) | Size (GB) | Allocated Space (GB) | Volume | Disk Group |
|-------------------------------|--------------|-------|----------|-----------|-----------|----------------------|--------|------------|
| (No ASM Cluster File Systems) | | | | | | | | |

ASM Disk Group Compatibility

- Compatibility of each disk group is separately controllable:
 - ASM compatibility controls ASM metadata on-disk structure.
 - RDBMS compatibility controls minimum consumer client level.
 - ADVM compatibility determines whether a disk group can contain Oracle ASM volumes.
- Setting disk group compatibility is irreversible.



ASM Disk Group Attributes

| Name | Property | Values | Description |
|------------------------------------|------------------|----------------------------|--|
| au_size | Create, Alter | 1 2 4 8 16 32 64MB | Size of allocation units in the disk group |
| compatible.rdbms | Create, Alter | Valid database version | Format of messages exchanged between DB and ASM |
| compatible.asm | Create, Alter | Valid ASM instance version | Format of ASM metadata structures on disk |
| compatible.advm | Create, Alter | Valid ASM instance version | Allows Oracle ASM volumes in disk group |
| disk_repair_time | Create, Alter | 0 M to 2^{32} D | Length of time before removing a disk once OFFLINE |
| template. <i>tname</i> .redundancy | Alter | UNPROTECT MIRROR HIGH | Redundancy of specified template |
| template. <i>tname</i> .stripe | Alter | COARSE FINE | Striping attribute of specified template |

```
CREATE DISKGROUP DATA2 NORMAL REDUNDANCY
DISK '/dev/sda1','/dev/sdb1'
ATTRIBUTE 'compatible.asm'='11.2';
```



Using Enterprise Manager to Edit Disk Group Attributes

The screenshot shows the Oracle Enterprise Manager 11g interface for managing disk groups. On the left, under 'Disk Group: DATA', the 'General' tab is selected. It displays the following information:

| | |
|----------------------|---------|
| Name | DATA |
| State | MOUNTED |
| Redundancy | NORMAL |
| Total Size (GB) | 9 |
| Pending Operations | 0 |
| Allocation Unit (MB) | 1 |

Under 'Advanced Attributes', there is a list of settings:

| | |
|--------------------------|------------|
| Database Compatibility | 10.1.0.0.0 |
| ASM Compatibility | 11.2.0.0.0 |
| ASM Volume Compatibility | |
| Disk Repair Time (Hours) | 3.6 |
| Smart Scan Capability | Disabled |
| File Access Control | Disabled |

An 'Edit' button is highlighted with a red box and a red arrow points from it to the 'Edit Advanced Attributes' dialog box on the right.

Edit Advanced Attributes for Disk Group: DATA

Disk Group Compatibility

Advancing the disk group compatibility enables the user to use new features available in the newer version. This operation can not be reversed.

Database Compatibility: 10.1.0.0.0
The minimum software version required for a database instance to use files in this disk group (10.1 and above).

ASM Compatibility: 11.2.0.0.0
The minimum software version required for an ASM instance to mount this disk group (10.1 and above).

ASM Volume Compatibility: (empty)
The minimum software version required for an ASM Volume to use this disk group (11.2 and above).

TIP The database compatibility has to be less than or equal to the ASM compatibility. The ASM Volume compatibility can only be set when ASM compatibility is 11.2 and above.

Retrieving ASM Metadata

- Using SQL*Plus:

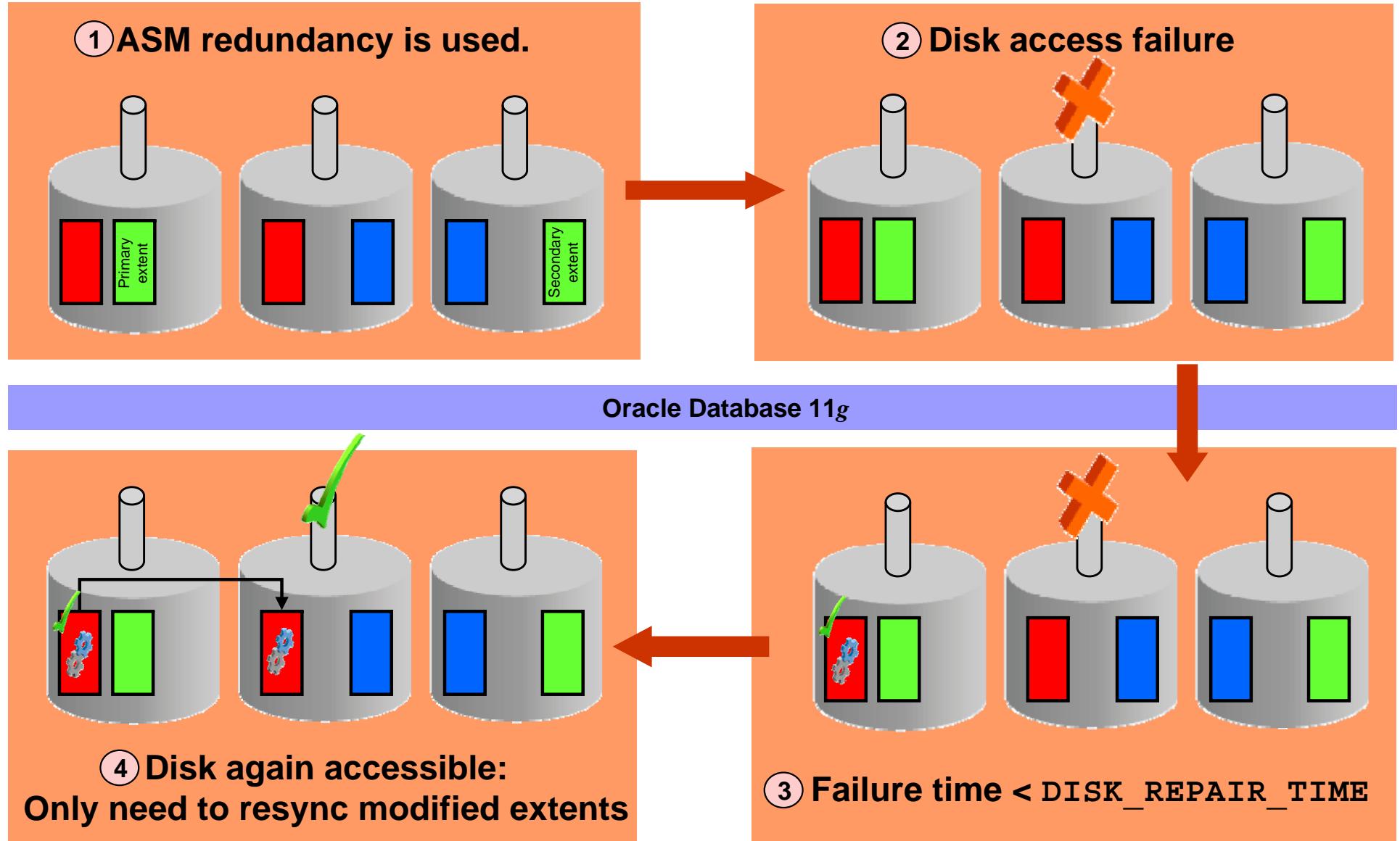
```
SQL> SELECT f.type, f.redundancy, f.striped, f.modification_date,
  a.system_created, a.name FROM v$asm_alias a, v$asm_file f WHERE
  a.file_number = f.file_number and a.group_number = f.group_number
  and type='DATAFILE';

TYPE      REDUND    STRIPE    MODIFICAT   S   NAME
-----  -----  -----  -----  -  -----
DATAFILE    MIRROR    COARSE    08-JUL-09    Y  SYSTEM.256.689832921
DATAFILE    MIRROR    COARSE    08-JUL-09    Y  SYSAUX.257.689832923
..
```

- Using asmcmd:

```
ASMCMD> ls -l +DATA/orcl/datafile
Type      Redund    Striped    Time                  Sys   Name
DATAFILE    MIRROR    COARSE    JUL 08 21:00:00    Y  SYSTEM.256.689832921
DATAFILE    MIRROR    COARSE    JUL 08 21:00:00    Y  SYSAUX.257.689832923
..
```

ASM Fast Mirror Resync Overview



Quiz

Which parameter is required for an ASM instance?

1. INSTANCE_TYPE
2. ASM_DISKGROUPS
3. LARGE_POOL_SIZE
4. None of the above

Quiz

Fine-grain striping, by default, is used for _____ and _____.

1. Data files
2. Control files
3. Temp files
4. Online redo logs
5. SPFILE

Summary

In this lesson, you should have learned how to:

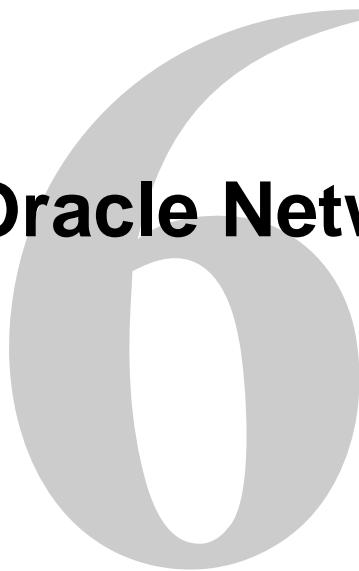
- Manage the ASM instance by using SQL*plus, asmcmd, and Enterprise Manager
- Create and drop ASM disk groups
- Specify ASM compatibility attributes
- Extend ASM disk groups
- Compare methods of retrieving ASM metadata

Practice 5 Overview: Managing the ASM Instance

This practice covers the following topics:

- Creating an ASM disk group with asmcmd
- Dropping an ASM disk group with EM
- Viewing ASM metadata

Configuring the Oracle Network Environment



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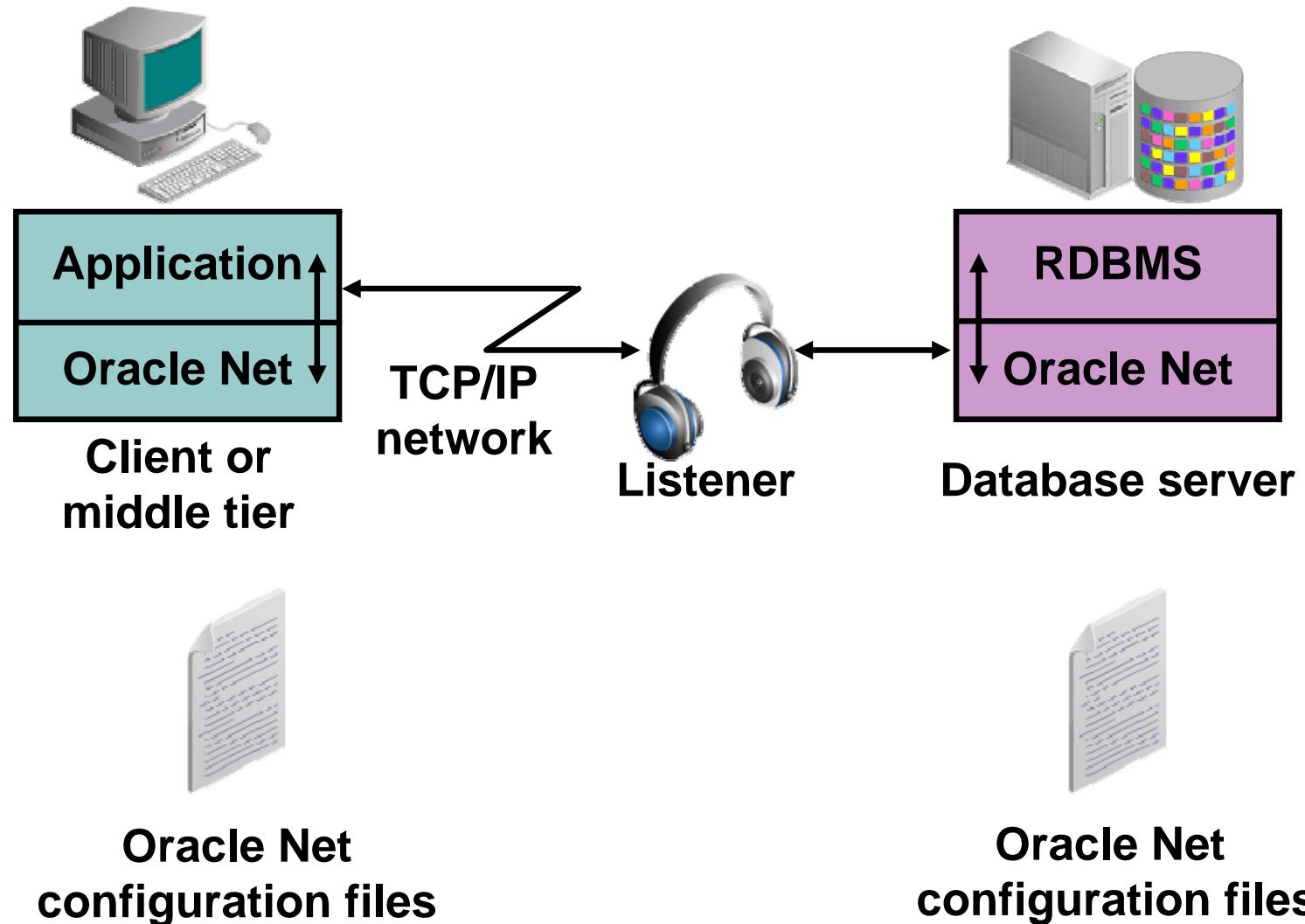
Copyright © 2009, Oracle. All rights reserved.

Objectives

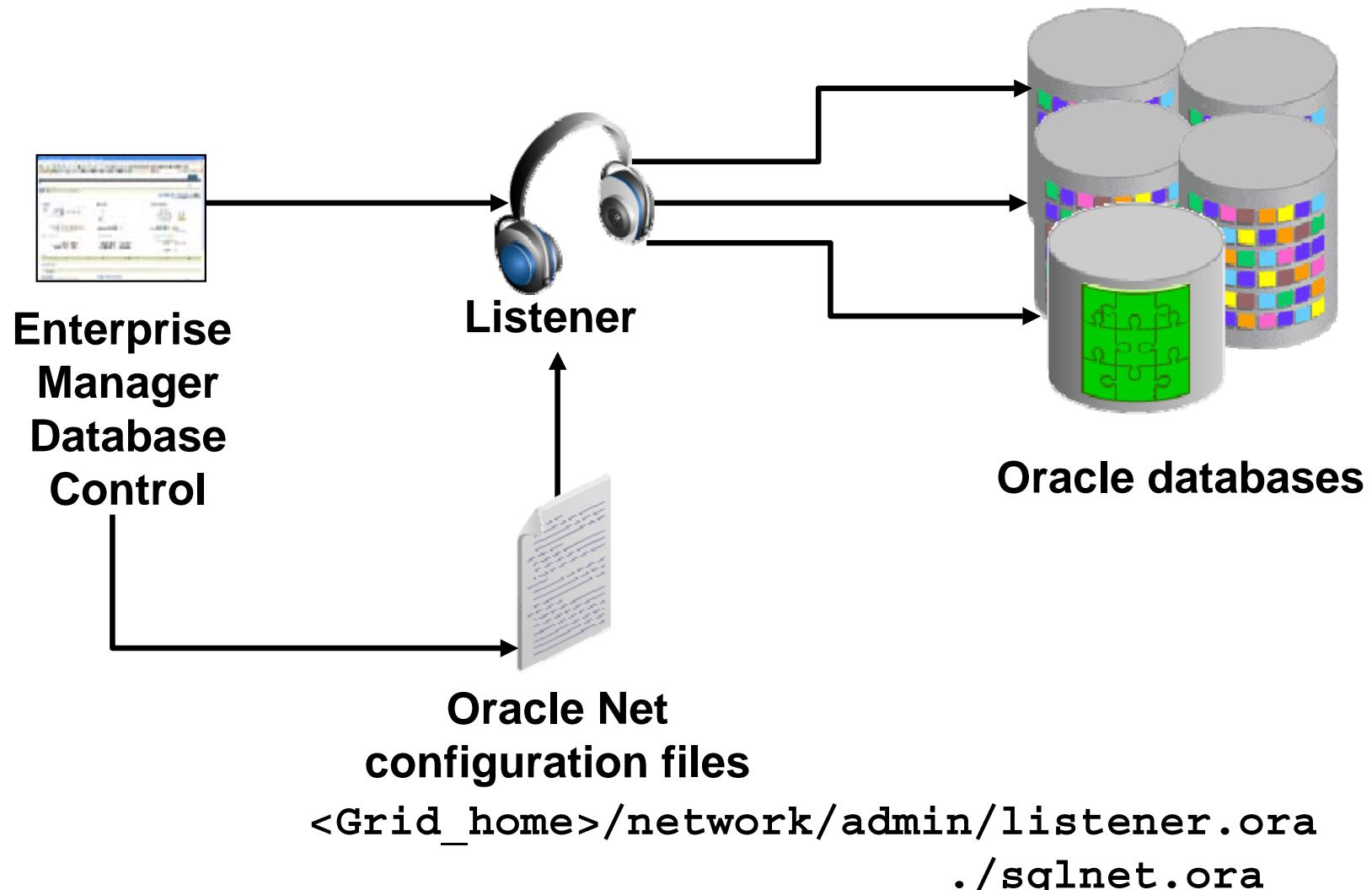
After completing this lesson, you should be able to:

- Use Enterprise Manager to:
 - Create additional listeners
 - Create Oracle Net Service aliases
 - Configure connect-time failover
 - Control the Oracle Net Listener
- Use `tnsping` to test Oracle Net connectivity
- Identify when to use shared servers and when to use dedicated servers

Oracle Net Services



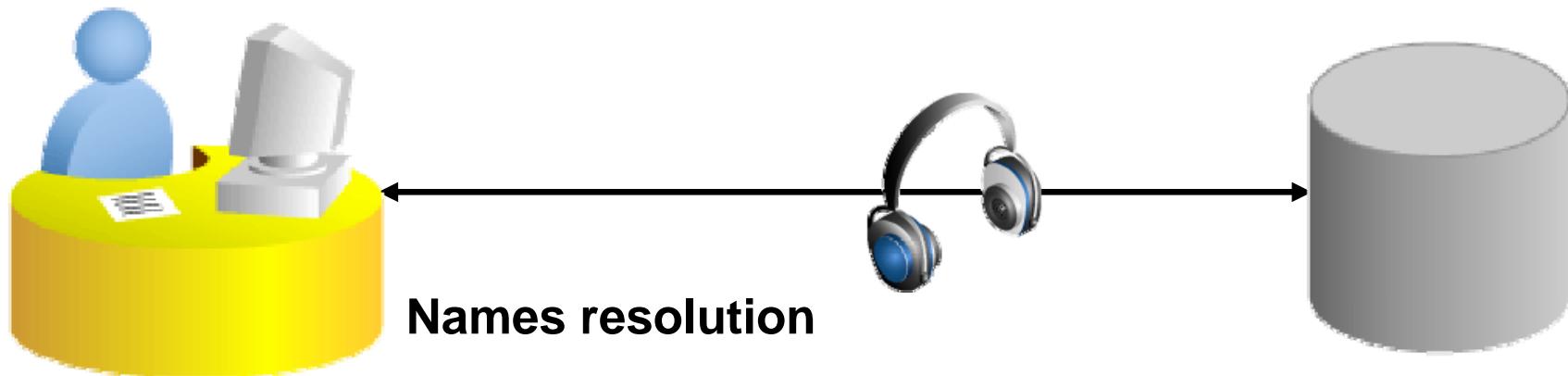
Oracle Net Listener



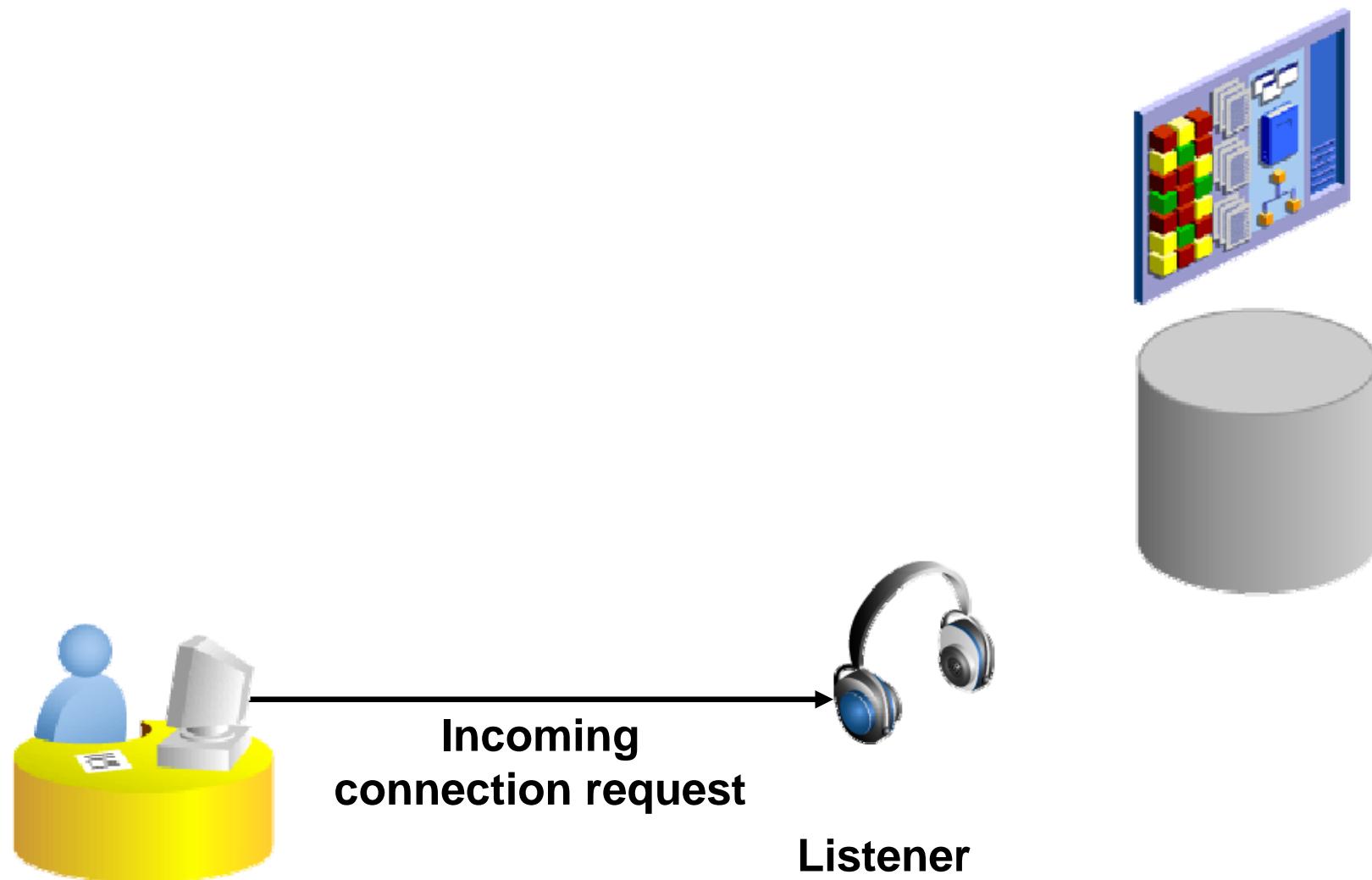
Establishing Net Connections

To make a client or middle-tier connection, Oracle Net requires the client to know the:

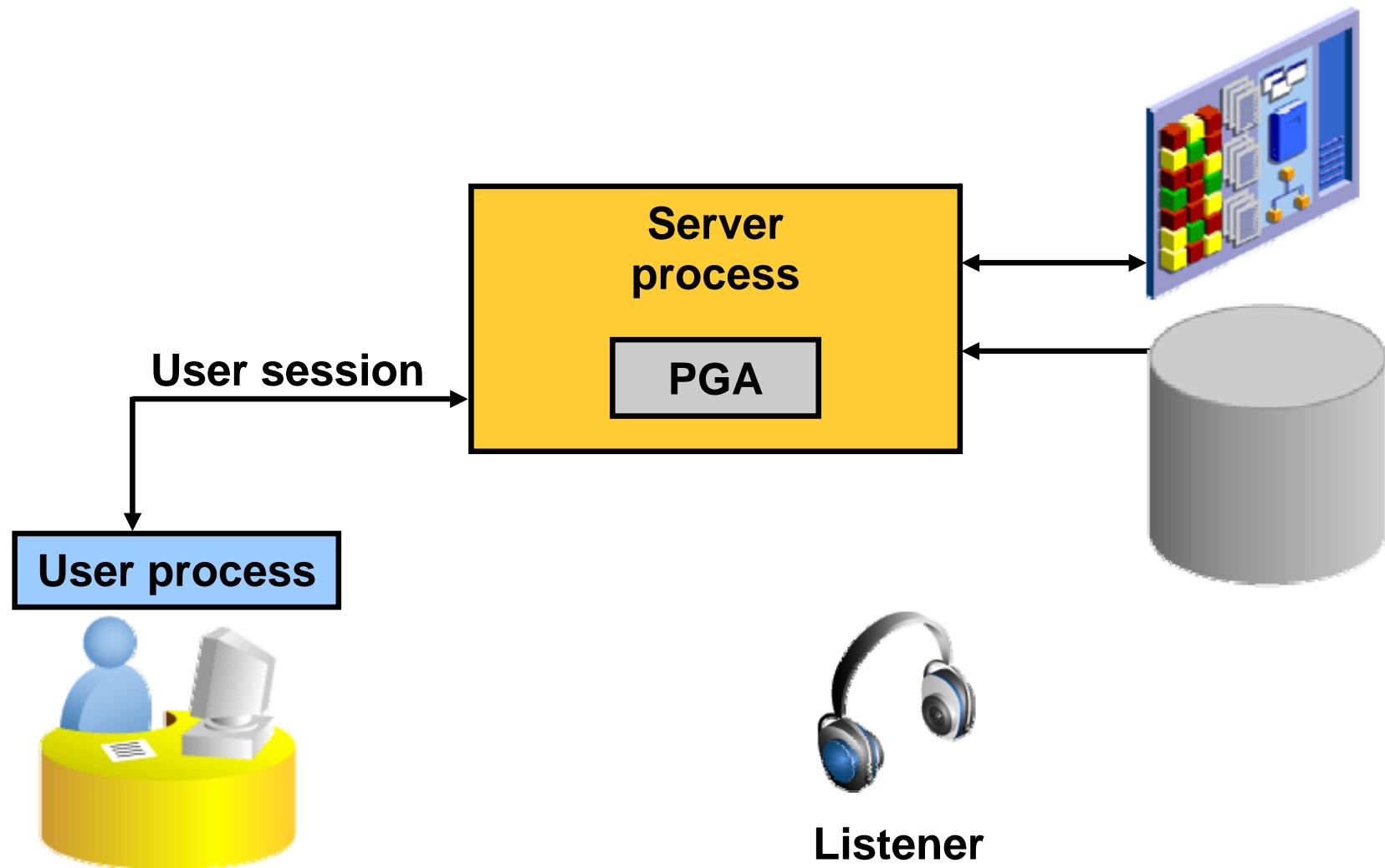
- Host where the listener is running
- Port that the listener is monitoring
- Protocol that the listener is using
- Name of the service that the listener is handling



Establishing a Connection



User Sessions



Tools for Configuring and Managing the Oracle Network

- Enterprise Manager Net Services Administration page
- Oracle Net Manager
- Oracle Net Configuration Assistant
- Command line



ORACLE

Listener Control Utility

Oracle Net listeners can be controlled with the lsnrctl command-line utility (or from EM).

```
$ . oraenv
ORACLE_SID = [orcl] ? +ASM
$ lsnrctl
LSNRCTL for Linux: Version 11.2.0.1.0 - Production on 30-JUN-2009 00:47:01
Copyright (c) 1991, 2009, Oracle. All rights reserved.
Welcome to LSNRCTL, type "help" for information.

LSNRCTL> help
The following operations are available
An asterisk (*) denotes a modifier or extended command:
start                      stop                      status
services                   version                   reload
save_config                trace                     spawn
change_password            quit                     exit
set*                       show*
```

Listener Control Utility Syntax

Commands from the listener control utility can be issued from the command line or from the LSNRCTL prompt.

- Command-line syntax:

```
$ lsnrctl <command name>
$ lsnrctl start
$ lsnrctl status
```

- Prompt syntax:

```
LSNRCTL> <command name>
LSNRCTL> start
LSNRCTL> status
```

Using SRVCTL to Start and Stop the Listener

If Oracle Restart is configured to monitor your listener, you should use SRVCTL to manage that listener.

- Example syntax:

```
$ srvctl -h  
$ srvctl start listener  
$ srvctl stop listener  
$ srvctl start listener -l mylistener  
$ srvctl status listener
```

Listener Home Page

General

Status **Up**
Up Since Jun 19, 2009 2:02:00 AM GMT+07:00
Instance Name **orcl**
Version **11.2.0.1.0**
Host [edrsr25p1.us.oracle.com](#)
Listener [LISTENER edrsr25p1.us.oracle...](#)
ASM [+ASM edrsr25p1.us.oracle.com](#)

[View All Properties](#)



General

Status **Up**
Availability (%) **100**
(Last 24 Hours)
Alias **LISTENER**
Version **11.2.0.1.0**
Oracle Home [/u01/app/oracle/product/11.2.0/grid](#)
Net Address [\(ADDRESS=\(PROTOCOL=TCP\)\(HOST=edrsr25p1.us.oracle.com\)\(PORT=1521\)\)](#)
LISTENER.ORA Location [/u01/app/oracle/product/11.2.0/grid/network/admin](#)
Start Time **Jun 18, 2009 3:20:31 AM**
Host [edrsr25p1.us.oracle.com](#)
Oracle Restart **Enabled**

State

TNS Ping (ms) **10** ✓
Established Connections per minute **2.2**
Refused Connections per minute **0**

Net Services Administration Page

ORACLE Enterprise Manager 11g Database Control

Host: edrsr25p1.us.oracle.com >

Net Services Administration

Net Services Administration allows you to configure or administer the following network components:

- Listener: Allows configuration and administration functions on listeners.
- Directory Naming: Allows configuration and administration of Net service names on a Directory server.
- Local Naming: Allows configuration and administration of Net service names on a client's tnsnames.ora file.
- Network Profile: Allows configuration of preferences for Oracle Net Services features on the client or server.
- File Location: Allows specification of the configuration file location for the Oracle Home.

Choose a configuration file location, then select the feature that you want to administer and click 'Go'.

| | | |
|---|---|-------------|
| Administrator | Listeners | Go |
| Select Configuration | Listeners | Oracle Home |
| /u01/app/oracle/product/11.2.0/db_home1/network/admin | /u01/app/oracle/product/11.2.0/db_home1 | |
| Directory Naming | | |
| Local Naming | | |
| Network Profile | | |
| File Location | | |

[Database](#) | [Setup](#) | [Preferences](#) | [Help](#) | [Logout](#)



Creating a Listener

Net Services Administration

Net Services Administration allows you to

- Listener: Allows configuration and a
- Directory Naming: Allows configura
- Local Naming: Allows configura
- Network Profile: Allows configura
- File Location: Allows specification

Choose a configuration file location, then s

1 Administer Listeners Go

Net Services Administration: Host Login

Host edrsr25p1.us.oracle.com
Oracle Home /u01/app/oracle/product/11.2.0/db_home1
* Username oracle
* Password Save as Preferred Credential

Cancel Login

2

Select Configuration File Location Oracle Home

/u01/app/oracle/product/11.2.0/db_home1/network/admin /u01/app/oracle/product/11.2.0/db_home1

Listeners: /u01/app/oracle/product/11.2.0/db_home1/network/admin

A listener process is identified by the listening end-points ('Host' and 'Port'), along with the other parameters like, logging and tracing levels, log/trace directories etc. All these parameters are defined in the "Listener Parameter File" (listener.ora). This page shows the status of a listener as "Started" only when the listener is running, and has been started using the "Listener Parameter File" at the same location as shown above.

Create Listener

General Authentication Logging & Tracing Static Database Registration Other Services

3 Create

* Listener Name LISTENER0

4

Addresses

Listener must have at least one address. If address is changed, listener will be stopped before applying changes.

Add

Select Protocol (No items found.) Protocol Details

The screenshot illustrates the process of creating a new listener in Oracle's Net Services Administration. It is divided into four numbered sections:

- Step 1:** Shows the main "Net Services Administration" page with a list of services. A red box highlights the "Administer Listeners" button, which is circled in green.
- Step 2:** Shows the "Net Services Administration: Host Login" dialog. It displays connection details: Host (edrsr25p1.us.oracle.com), Oracle Home (/u01/app/oracle/product/11.2.0/db_home1), Username (oracle), and Password. A red box highlights the "Go" button, which is circled in green.
- Step 3:** Shows the "Create Listener" dialog. It includes tabs for General, Authentication, Logging & Tracing, Static Database Registration, and Other Services. A red box highlights the "Create" button, which is circled in green.
- Step 4:** Shows the "Create Listener" dialog with the "General" tab selected. A red box highlights the "Listener Name" field, which contains "LISTENER0". A red box also highlights the "Add" button in the "Protocol Details" section, which is circled in green.

Adding Listener Addresses

Add Address

Protocol: TCP/IP (5)

* Port: 1522 (6)

* Host: edrsr25p1.us.oracle.com (7)

Advanced Parameters

The following parameters are introduced in this screen:

- Total Send
- Buffer Size (Bytes): Cumulative size for all send operations.
- Total Receive

Creation Message

Listener "LISTENER0" created successfully.

Listeners: /u01/app/oracle/product

A listener process is identified by the listener name, levels, log/trace directories etc. All these parameters are defined in the "Listener Parameter File" (listener.ora). This page shows the status of a listener as "Started" only when the listener is running, and has been started using the "Listener Parameter File" at the same location as shown above.

Listener Name: Go (10)

Actions: Start/Stop (highlighted with a red box)

Select | **Name** | Protocol Details | Status | Enterprise Manager Target

| | | | |
|--|---|-----------------|---|
| <input checked="" type="radio"/> LISTENER0 | Protocol: TCP/IP Host: edrsr25p1.us.oracle.com Port: 1522 | Status: Stopped | Enterprise Manager Target: Not a target |
|--|---|-----------------|---|

Database Service Registration

Edit Listener: LISTENER0

| | | | | | |
|---------------------------|----------------|-------------------|-------------------------------------|--------|----|
| General | Authentication | Logging & Tracing | Static Database Registration | Cancel | OK |
| * Listener Name LISTENER0 | | | | | |

Edit Listener: LISTENER0

| | | | | | | |
|---|-----------------------|--------------------------------|-------------------------------------|----------------|--------|----|
| General | Authentication | Logging & Tracing | Static Database Registration | Other Services | Cancel | OK |
| Configure the static registration of databases for the listener. Database information for Oracle8i or later releases is dynamically registered with the listener during instance startup. Therefore, static registration is not required for these releases, unless you require remote database startup from other than Oracle Enterprise Manager. Click Help for more details. | | | | | | |
| Select Service Name | Oracle Home Directory | Oracle System Identifier (SID) | Add | | | |
| (No items found.) | | | | | | |

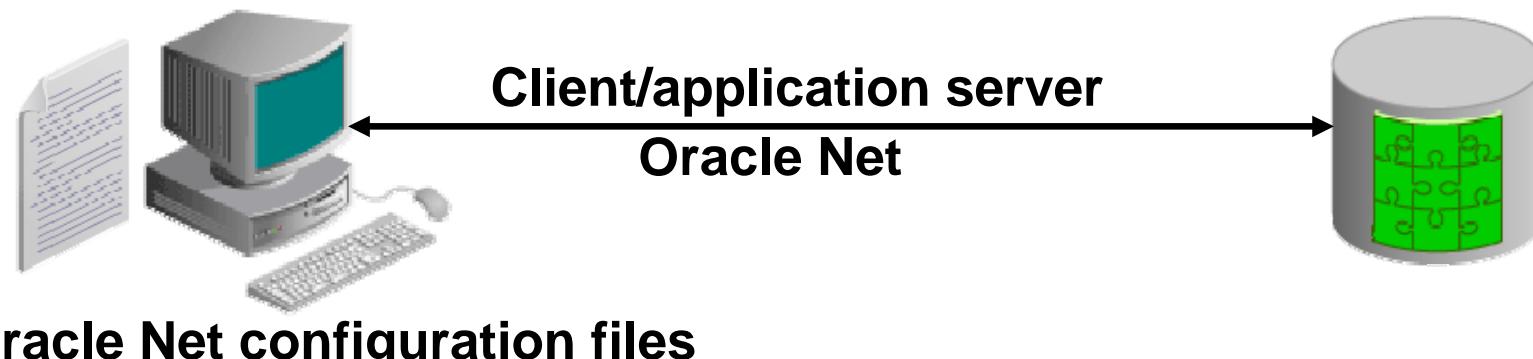
Add Database Service

| | | | |
|--------------------------------|-----------------------------------|--------|----|
| Service Name | orcl.example.com | Cancel | OK |
| Oracle Home Directory | ip/oracle/product/11.2.0/db_home1 | | |
| Oracle System Identifier (SID) | orcl | | |

Naming Methods

Oracle Net supports several methods of resolving connection information:

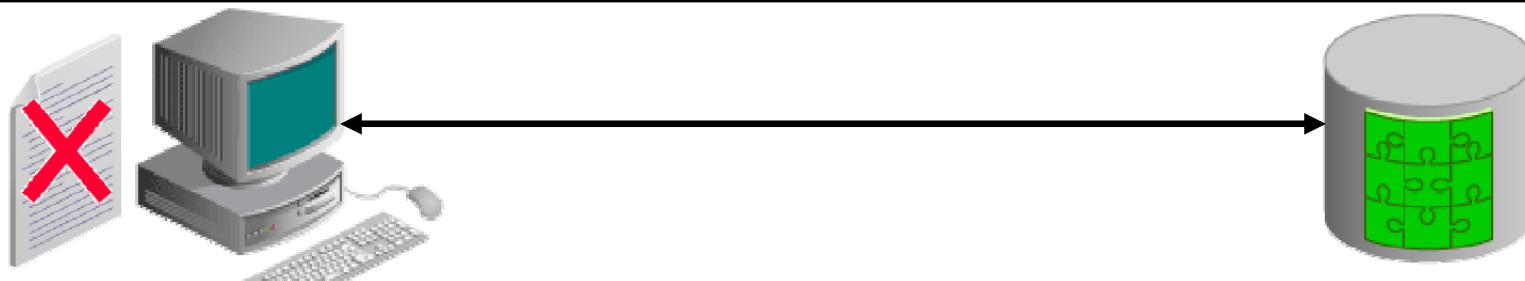
- Easy connect naming: Uses a TCP/IP connect string
- Local naming: Uses a local configuration file
- Directory naming: Uses a centralized LDAP-compliant directory server
- External naming: Uses a supported non-Oracle naming service



Easy Connect

- Is enabled by default
- Requires no client-side configuration
- Supports only TCP/IP (no SSL)
- Offers no support for advanced connection options such as:
 - Connect-time failover
 - Source routing
 - Load balancing

```
SQL> CONNECT hr/hr@db.us.oracle.com:1521/dba11g
```

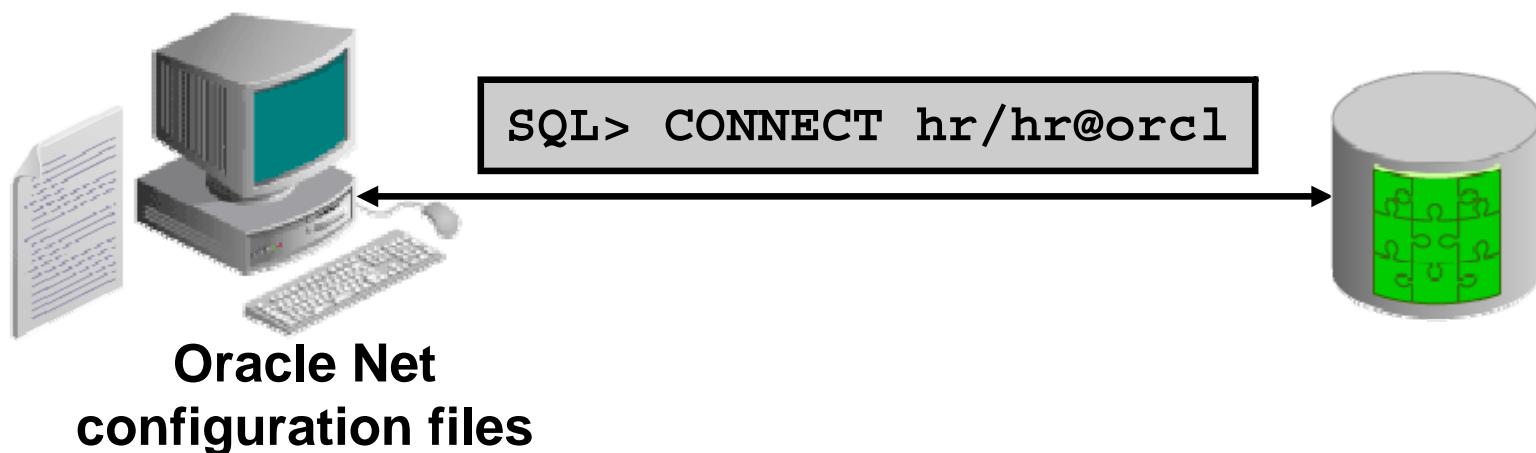


No Oracle Net configuration files

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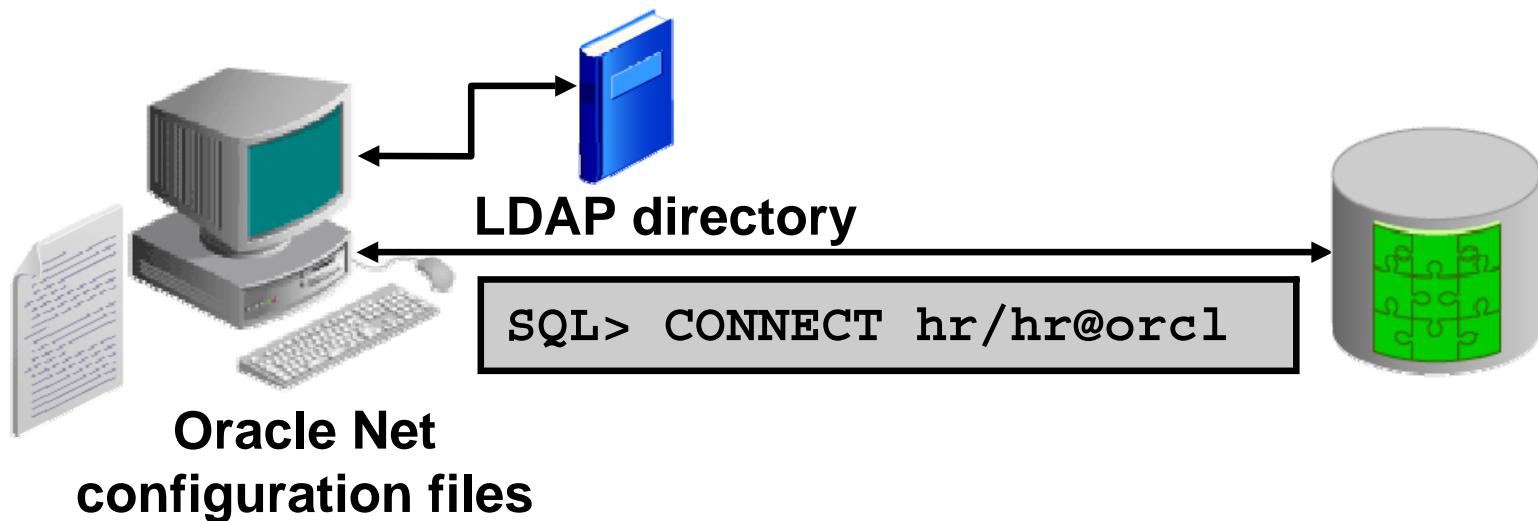
Local Naming

- Requires a client-side Names Resolution file
- Supports all Oracle Net protocols
- Supports advanced connection options such:
 - Connect-time failover
 - Source routing
 - Load balancing



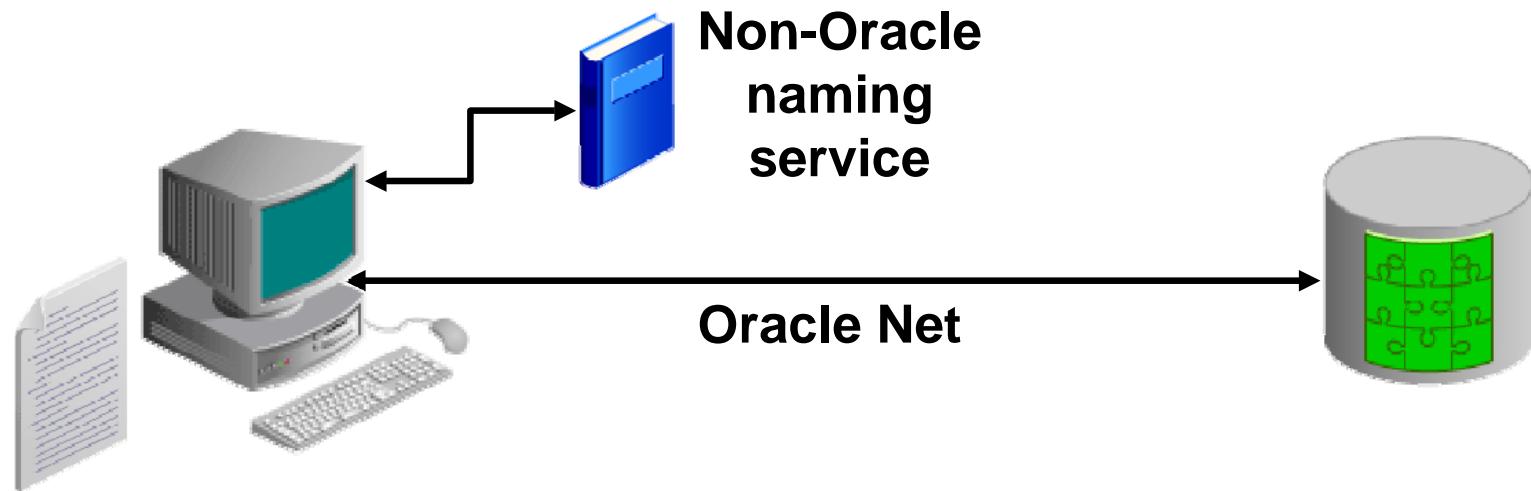
Directory Naming

- Requires LDAP with Oracle Net Names Resolution information loaded:
 - Oracle Internet Directory
 - Microsoft Active Directory Services
- Supports all Oracle Net protocols
- Supports advanced connection options



External Naming Method

- Uses a supported non-Oracle naming service
- Includes:
 - Network Information Service (NIS) External Naming
 - Distributed Computing Environment (DCE) Cell Directory Services (CDS)



Configuring Service Aliases

Local Naming: /u01/app/oracle/product/11.2.0/db_home1/network/admin

These are the local Net Service Names in tnsnames.ora file at /u01/app/oracle/product/11.2.0/db_home1/network/admin. You can test, edit, create and delete a Net Service Name.

Search

Net Service Name Go

Create Net Service Name

Cancel OK

General Advanced

* Net Service Name

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

Use SID
SID

⋮

Add Address

Cancel OK

Protocol TCP/IP

* Port 1522

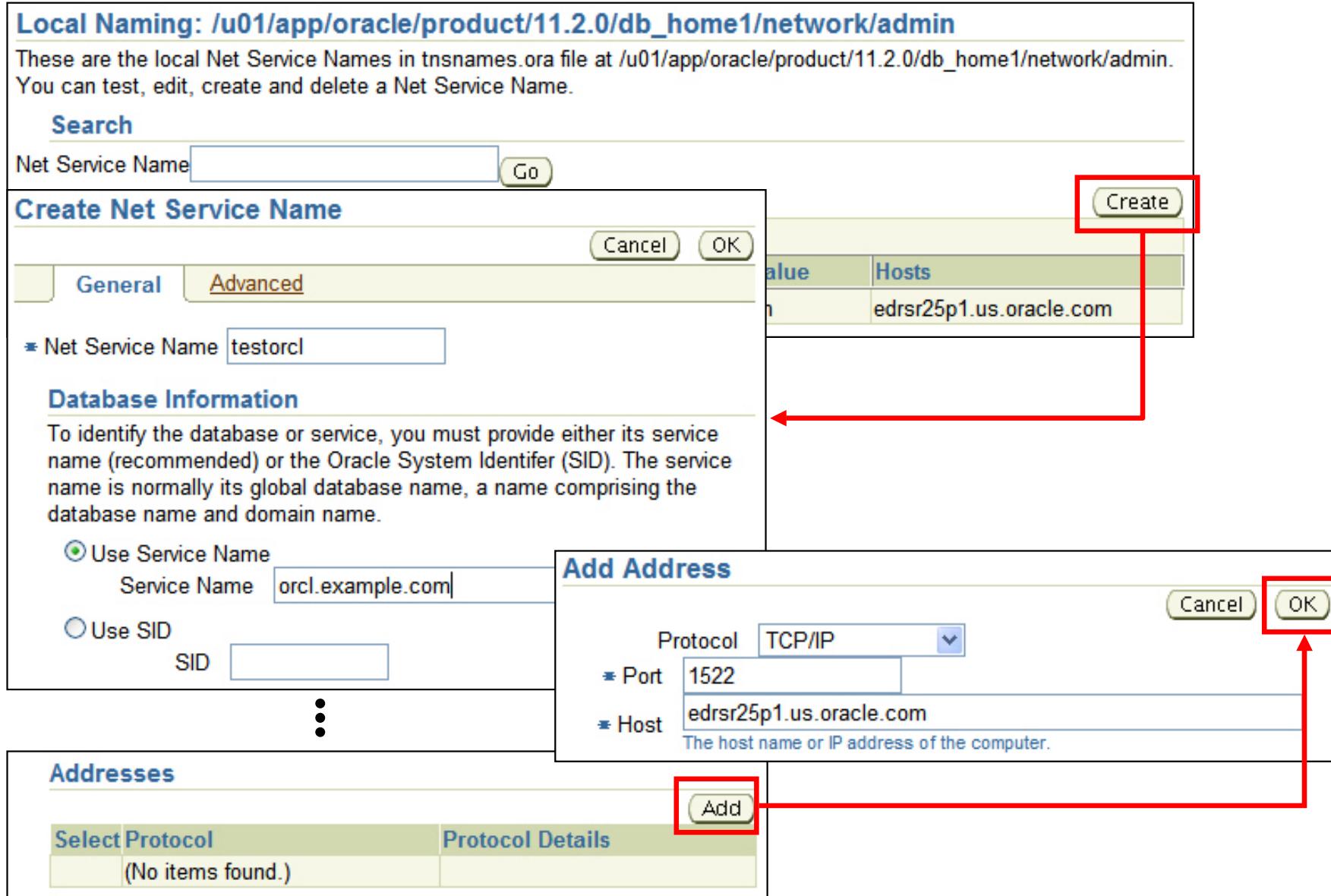
* Host edrsr25p1.us.oracle.com
The host name or IP address of the computer.

Addresses

Select Protocol Protocol Details

(No items found.)

Add



Advanced Connection Options

Oracle Net supports the following advanced connection options with local and directory naming:

- Connect-time failover
- Load balancing
- Source routing

Addresses

| Select | Protocol | Protocol Details |
|----------------------------------|----------|---|
| <input checked="" type="radio"/> | TCP/IP | Host edrsr25p1.us.oracle.com Port 1522 |
| <input type="radio"/> | TCP/IP | Host edrsr25p1.us.oracle.com Port 1521 |

Connect-time Failover and Client Load Balancing

Configure whether addresses are tried randomly or sequentially during connections to the service. This setting is applicable only if there are more than one addresses configured.

Try each address, in order, until one succeeds
 Try each address randomly, until one succeeds
 Try one address, selected at random
 Use each address in order until destination is reached
 Use only the first address

Testing Oracle Net Connectivity

The tnsping utility that tests Oracle Net service aliases:

- Ensures connectivity between the client and the Oracle Net Listener
- Does not verify that the requested service is available
- Supports Easy Connect Names Resolution:

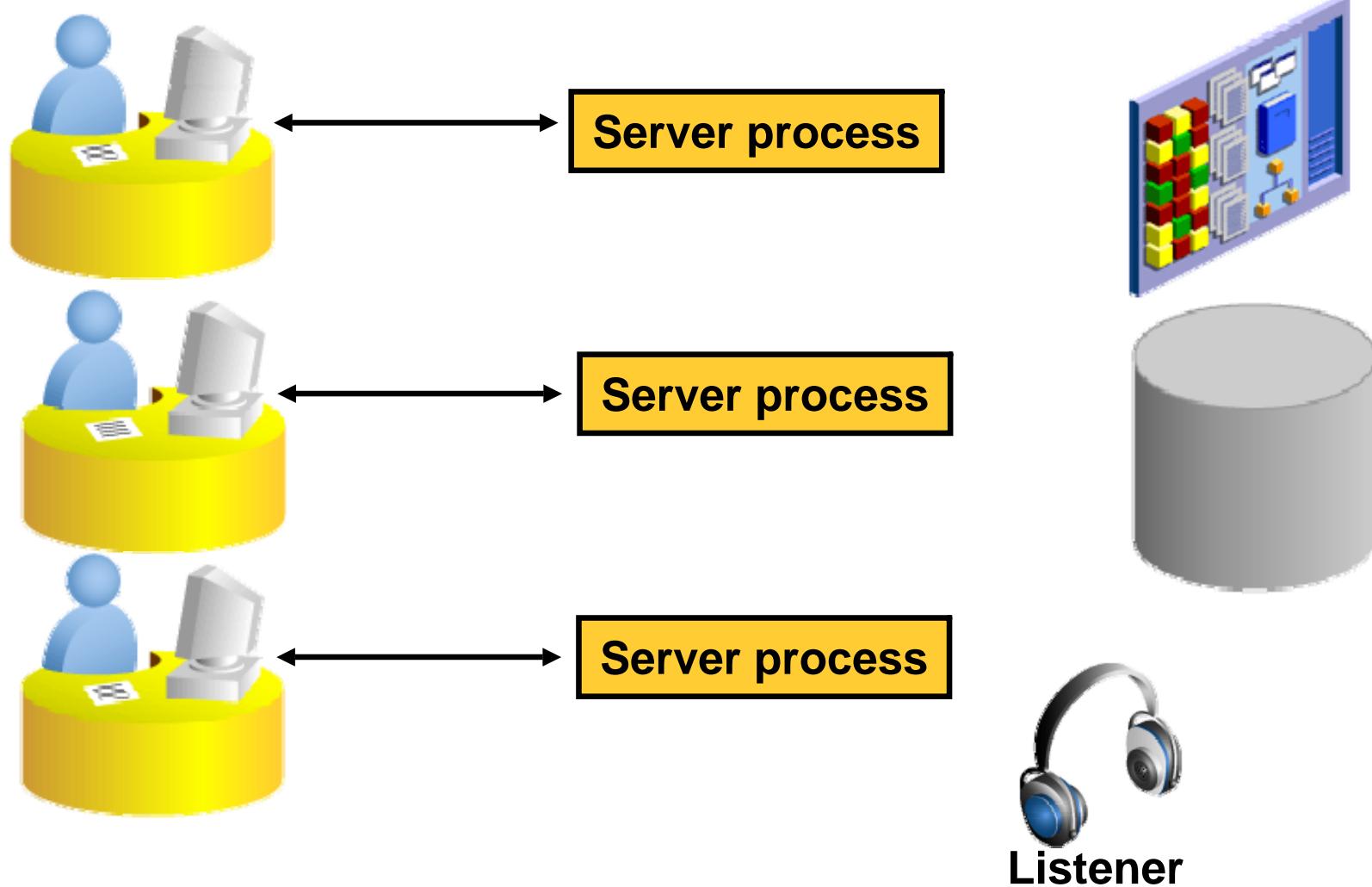
```
tnsping host01.example.com:1521/orcl
```

- Supports local and directory naming:

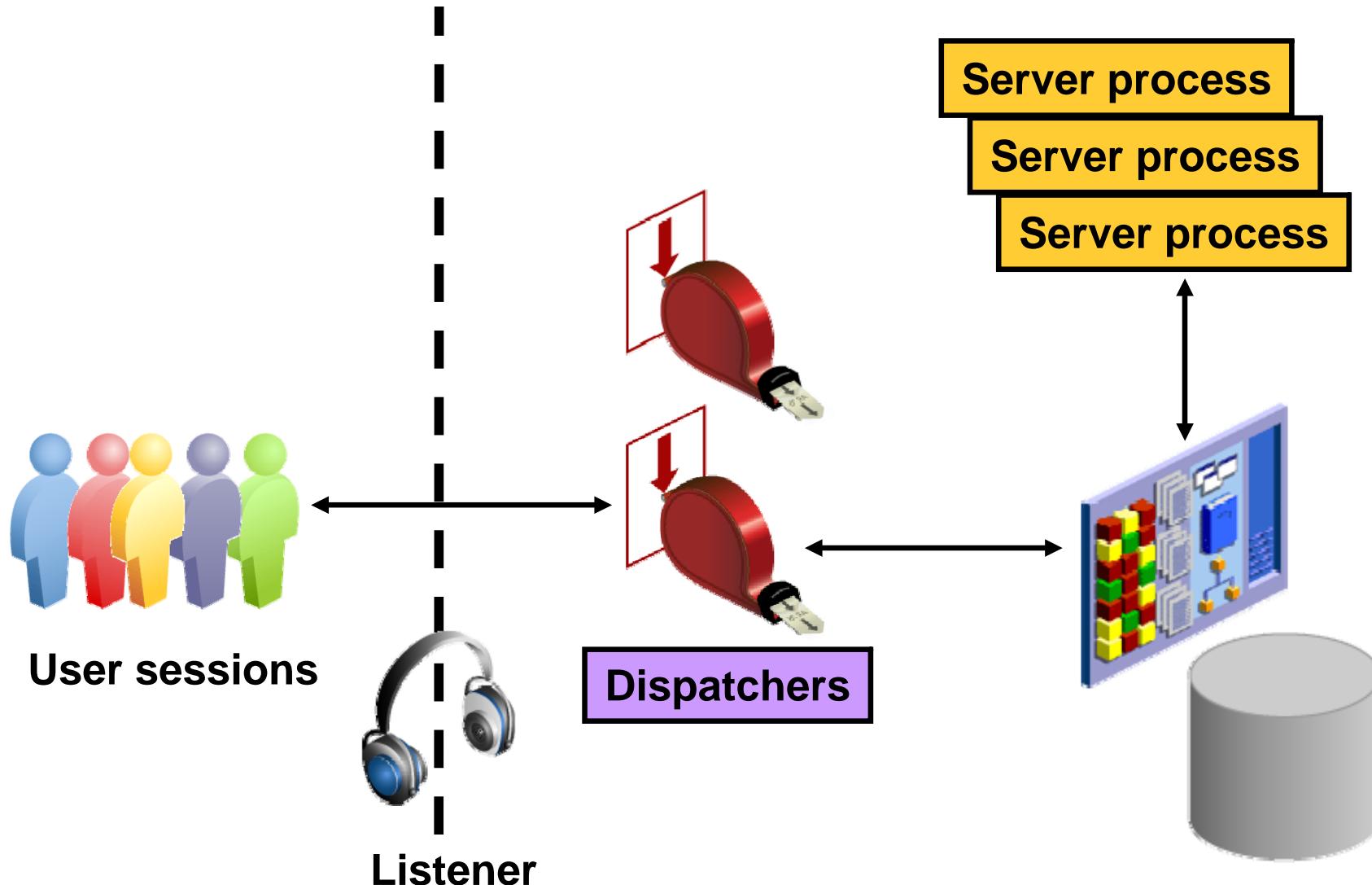
```
tnsping orcl
```

User Sessions: Dedicated Server Process

User sessions

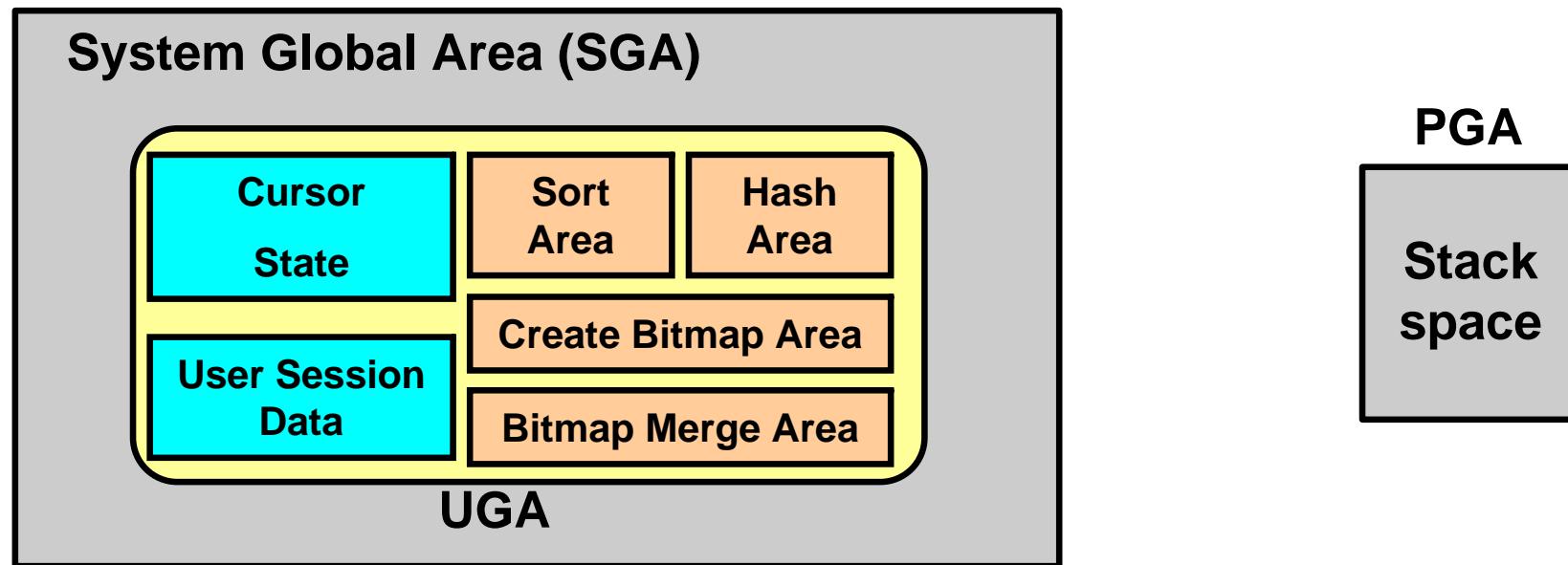


User Sessions: Shared Server Processes



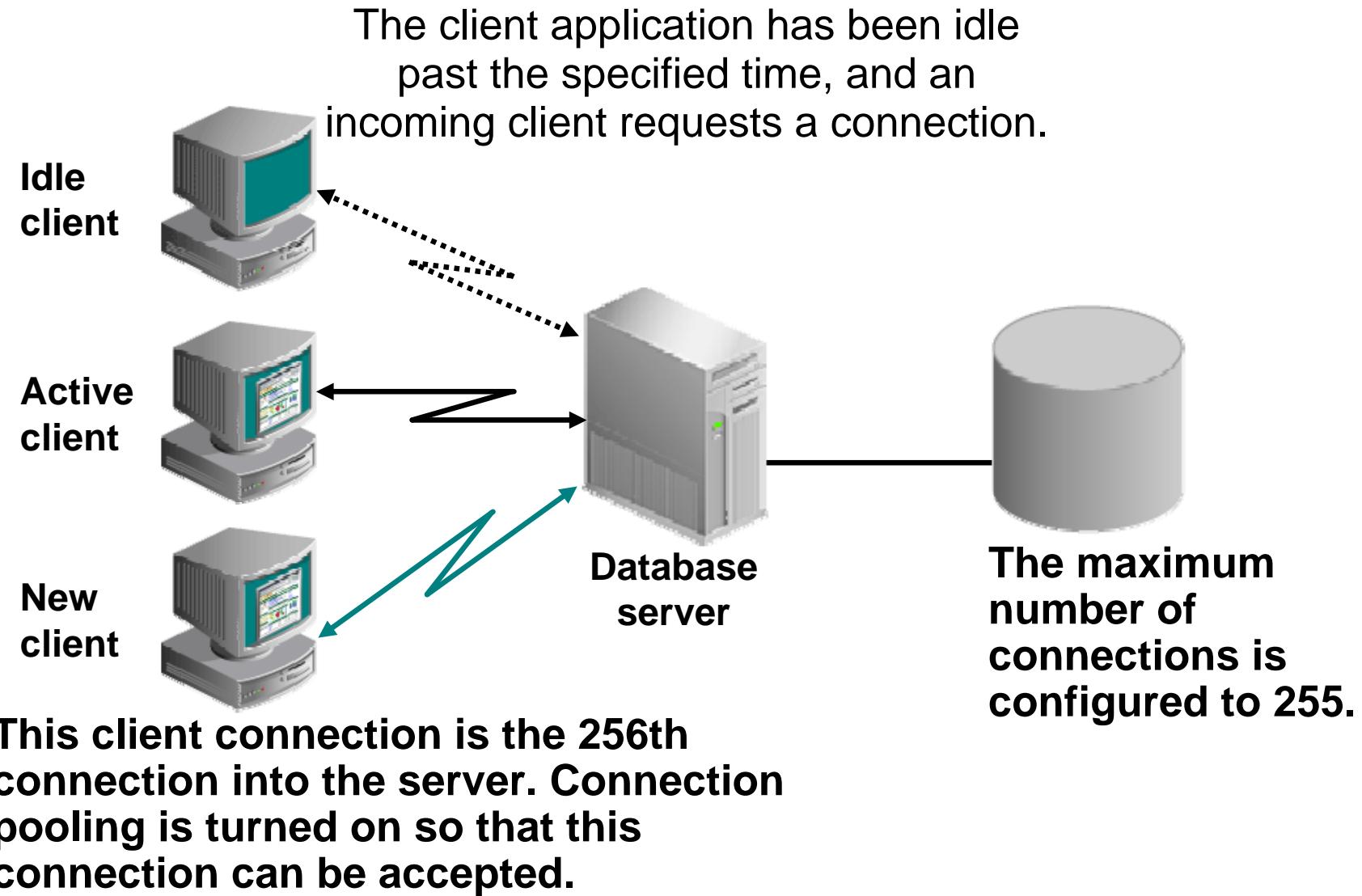
SGA and PGA

Oracle Shared Server: User session data is held in the SGA.



Remember to consider shared server memory requirements when sizing the SGA.

Shared Server: Connection Pooling



When Not to Use a Shared Server

Certain types of database work must not be performed using shared servers:

- Database administration
- Backup and recovery operations
- Batch processing and bulk load operations
- Data warehouse operations



Dispatcher



**Dedicated
server process**

Configuring Communication Between Databases

- Sending data or messages between sites requires network configuration on both sites.
- You must configure the following:
 - Network connectivity (for example, TNSNAMES.ora)
 - Database links

```
CREATE DATABASE LINK <remote_global_name>
CONNECT TO <user> IDENTIFIED BY <pwd>
USING '<connect_string_for_remote_db>';
```

Connecting to Another Database

```
REMOTE_ORCL =  
  (DESCRIPTION =  
    (ADDRESS = (PROTOCOL = TCP)  
     (HOST = host02.example.com)  
     (PORT = 1521))  
    (CONNECT_DATA =  
      (SERVER = DEDICATED)  
      (SERVICE_NAME = orcl.example.com)  
    )  
)
```

tnsnames.ora

```
CONNECT hr/hr@orcl;
```

SQL*Plus

```
CREATE DATABASE LINK remote  
CONNECT TO HR IDENTIFIED BY HR  
USING 'REMOTE_ORCL';
```

```
SELECT * FROM employees@remote
```

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Quiz

Which configuration files are used to configure the listener?

1. listener.ora
2. listener.conf
3. tnsnames.ora
4. tnsnames.conf
5. sqlnet.ora
6. sqlnet.conf

Quiz

When using the shared server process architecture, the PGA is relocated into the SGA.

1. True
2. False

Summary

In this lesson, you should have learned how to:

- Use Enterprise Manager to:
 - Create additional listeners
 - Create Oracle Net Service aliases
 - Configure connect-time failover
 - Control the Oracle Net Listener
- Use `tnsping` to test Oracle Net connectivity
- Identify when to use shared servers and when to use dedicated servers

Practice 6 Overview: Working with Oracle Network Components

This practice covers the following topics:

- Configuring local Names Resolution to connect to another database
- Creating a second listener for connect-time failover





Managing Database Storage Structures

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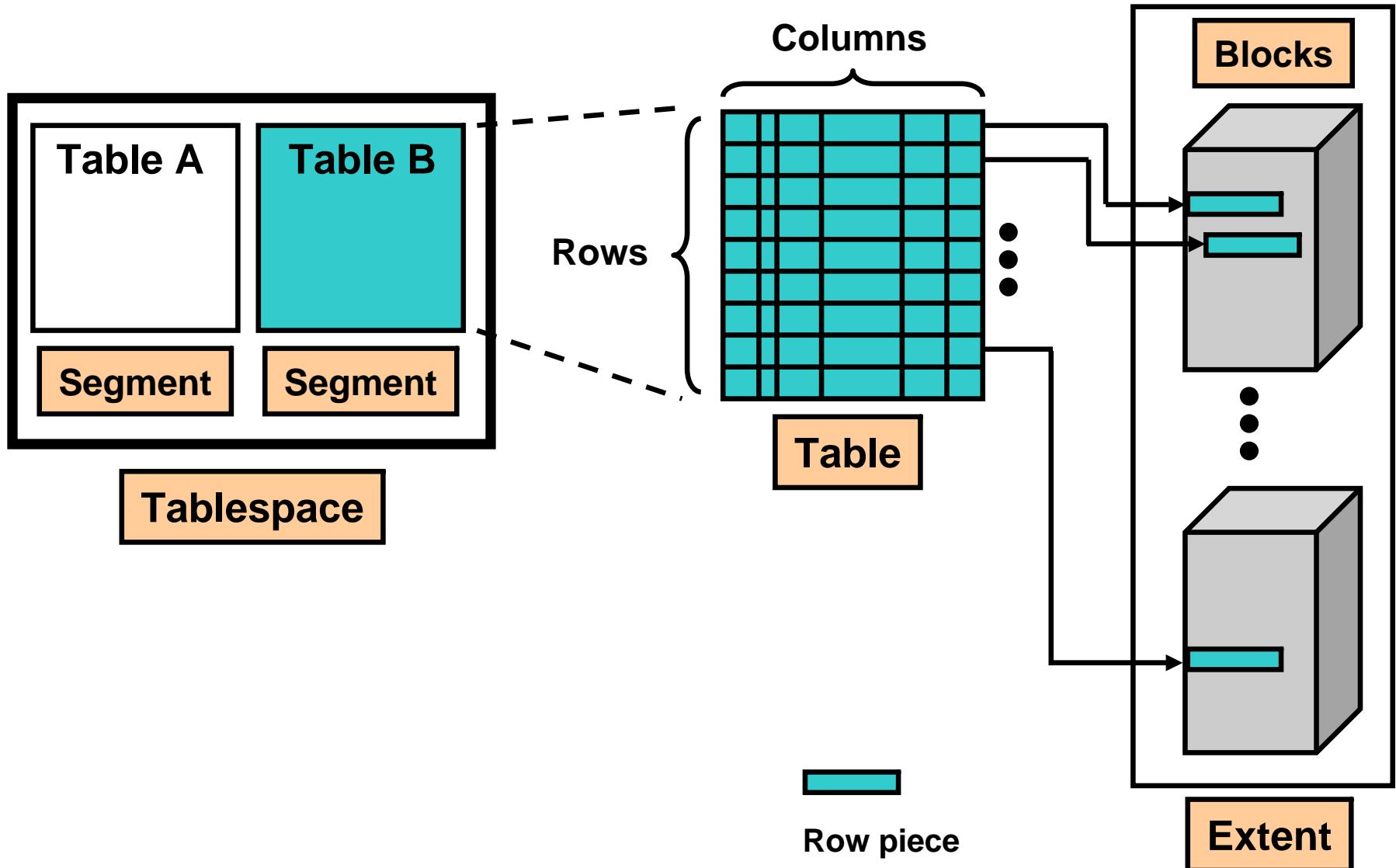
Copyright © 2009, Oracle. All rights reserved.

Objectives

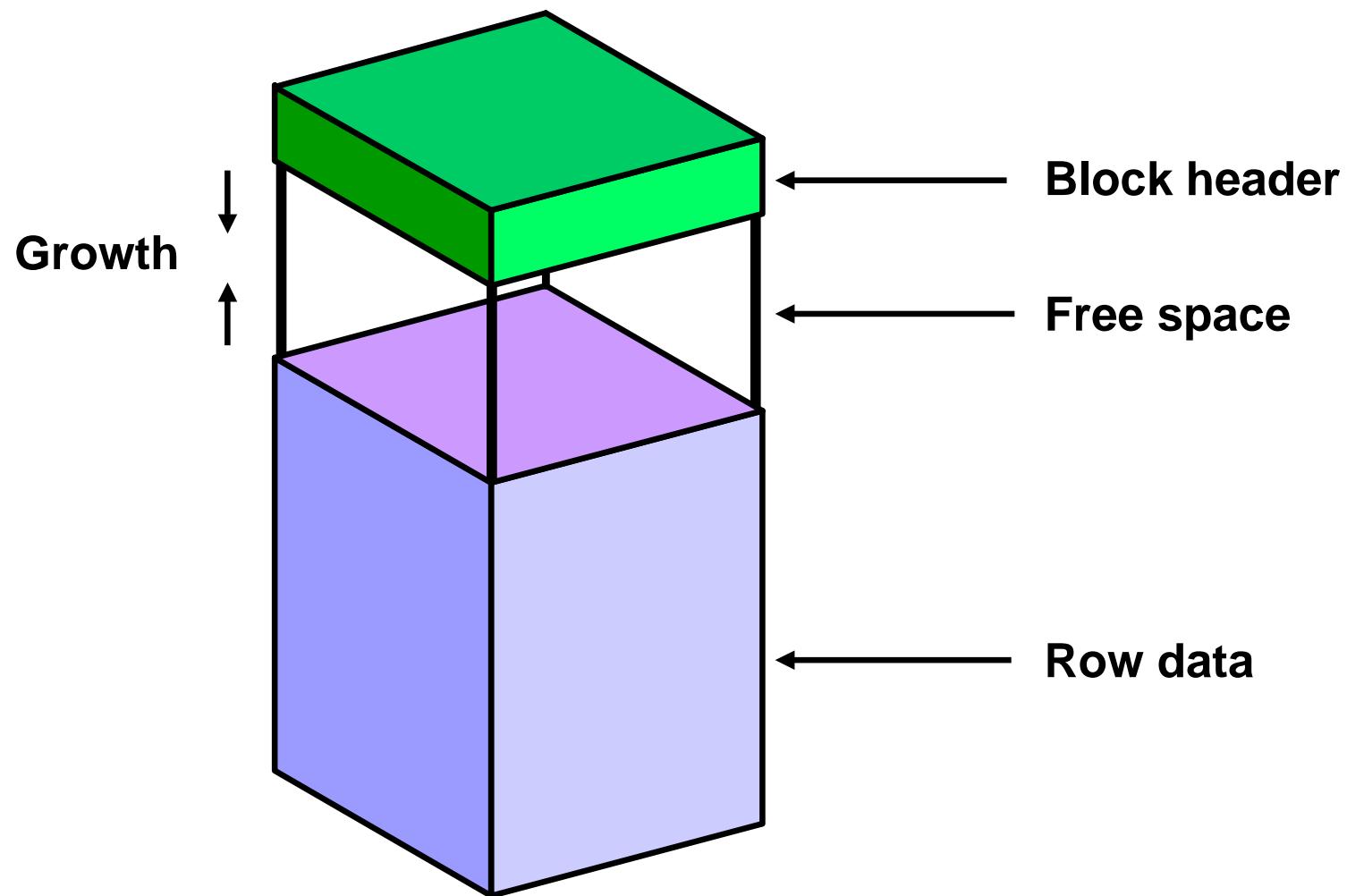
After completing this lesson, you should be able to:

- Describe the storage of table row data in blocks
- Create and manage tablespaces
- Obtain tablespace information

How Table Data Is Stored



Database Block: Contents



Exploring the Storage Structure

The screenshot shows the Oracle Enterprise Manager 11g Database Control interface. The top navigation bar includes links for Home, Performance, Availability, Server, Schema, and Data Movement. The 'Server' tab is selected. Below the navigation bar, the main content area is titled 'Database Instance: orcl.oracle.com'. On the left, under the 'Storage' heading, there is a list of links: Control Files, Tablespaces, Temporary Tablespace Groups, Datafiles, Rollback Segments, Redo Log Groups, Archive Logs, Disk Groups, Migrate to ASM, and Make Tablespace Locally Managed. An arrow points from a callout box at the bottom to the 'Make Tablespace Locally Managed' link. The callout box contains the text: 'Click the links to view detailed information.'

ORACLE Enterprise Manager 11g

Database Control

Database Instance: orcl.oracle.com

Home Performance Availability **Server** Schema Data Movement

Storage

[Control Files](#)
[Tablespaces](#)
[Temporary Tablespace Groups](#)
[Datafiles](#)
[Rollback Segments](#)
[Redo Log Groups](#)
[Archive Logs](#)
[Disk Groups](#)
[Migrate to ASM](#)
[Make Tablespace Locally Managed](#)

Database Configuration

[Memory Advisors](#)
[Automatic Undo Management](#)
[Initialization Parameters](#)
[View Database Feature Usage](#)

Click the links to view detailed information.

Creating a New Tablespace

Create Tablespace

General Storage

* Name

Extent Management

Locally Managed
 Dictionary Managed

Type

Permanent
 Set as default permanent tablespace
 Encryption [Encryption Options](#)

Temporary
 Set as default temporary tablespace

Undo
Undo Retention Guarantee Yes No

Status

Read Write
 Read Only
 Offline

Datafiles

Use bigfile tablespace
Tablespace can have only one datafile with no practical size limit.

[Add](#)

| Select | Name | Directory | Size (MB) |
|--------|----------------|-----------|-----------|
| | No items found | | |

Creating a New Tablespace

Add Datafile

Storage Type Automatic Storage Management ↗

* DiskGroup DATA ↗

Template <Default> ↗

Alias Directory

Alias Name

Tablespace INVENTORY

File Size 100 MB ↗

Reuse Existing File

Storage

Automatically extend datafile when full (AUTOEXTEND)

Increment 10 MB ↗

Maximum File Size Unlimited
 Value ↗

TIP Changes made on this page will NOT take effect until you click Continue.

Add Datafile

Storage Type File System ↗

* File Name

* File Directory ↗

Tablespace INVENTORY

File Size 100 MB ↗

Reuse Existing File

Choose the appropriate Storage Type

Storage for Tablespaces

| | |
|--|--|
| General | Storage |
| Extent Allocation | |
| <input checked="" type="radio"/> Automatic | |
| <input type="radio"/> Uniform | |
| Size | <input type="text"/> KB <input type="button" value="▼"/> |
| Segment Space Management | |
| <input checked="" type="radio"/> Automatic | |
| Objects in the tablespace automatically manage their free space. It offers high performance for free space management. | |
| <input type="radio"/> Manual | |
| Objects in the tablespace will manage their free space using free lists. It is provided for backward compatibility. | |
| Compression Options | |
| Enabling data segment compression can reduce disk usage. | |
| Compression | <input checked="" type="radio"/> Disabled |
| <input type="radio"/> Enabled on direct-path INSERT operations only | |
| <input type="radio"/> Enabled on all operations | |
| Enable logging | |
| <input checked="" type="radio"/> Yes | |
| Generate redo logs for creation of tables, indexes and partitions, and for subsequent inserts. Recoverable | |
| <input type="radio"/> No | |
| Redo log entries are smaller, the above operations are not logged and not recoverable. | |
| Block information | |
| Block Size (B) 8192 | |

Tablespaces in the Preconfigured Database

- SYSTEM
- SYSAUX
- TEMP
- UNDOTBS1
- USERS
- EXAMPLE (optional)

Tablespaces

Object Type Tablespace

Search
Enter an object name to filter the data that is displayed in your results set.
Object Name Go
By default, the search returns all uppercase matches beginning with the string you entered. To run an exact or case-sensitive match, double quote the search string. You can use the wildcard symbol (%) in a double quoted string.

Selection Mode Single Create

Edit View Delete Actions Add Datafile Go

| Select | Name | Allocated Size(MB) | Space Used(MB) | Allocated Space Used(%) | Auto Extend | Allocated Free Space(MB) | Status | Datafiles | Type | Extent Management | Segment Management |
|----------------------------------|----------|--------------------|----------------|-------------------------|-------------|--------------------------|--------|-----------|-----------|-------------------|--------------------|
| <input checked="" type="radio"/> | EXAMPLE | 100.0 | 78.8 | 78.8 | YES | 21.2 | ✓ | 1 | PERMANENT | LOCAL | AUTO |
| <input type="radio"/> | SYSAUX | 697.2 | 663.9 | 95.2 | YES | 33.3 | ✓ | 1 | PERMANENT | LOCAL | AUTO |
| <input type="radio"/> | SYSTEM | 750.0 | 744.2 | 99.2 | YES | 5.8 | ✓ | 1 | PERMANENT | LOCAL | MANUAL |
| <input type="radio"/> | TEMP | 27.0 | 0.0 | 0.0 | YES | 27.0 | ✓ | 1 | TEMPORARY | LOCAL | MANUAL |
| <input type="radio"/> | UNDOTBS1 | 100.0 | 16.1 | 16.1 | YES | 83.9 | ✓ | 1 | UNDO | LOCAL | MANUAL |
| <input type="radio"/> | USERS | 5.0 | 4.1 | 82.5 | YES | 0.9 | ✓ | 1 | PERMANENT | LOCAL | AUTO |

Total Allocated Size (GB) 1.64 ✓ Online ✘ Offline 📁 Read Only
Total Used (GB) 1.47
Total Allocated Free Space (GB) 0.17

Altering a Tablespace

The screenshot shows the Oracle Database Control interface for managing tablespaces. At the top, there's a navigation bar with 'Edit', 'View', 'Delete', 'Actions', 'Add Datafile', and a 'Go' button. Below this is a table listing tablespaces:

| Select | Name | Allocated Size(MB) | Space Used(MB) | Allocated Space Used(%) | Auto Extend | Allocated Free Space(MB) | Status | Datafiles | Type | Extent Management | Segment Management |
|----------------------------------|----------|--------------------|----------------|-------------------------|-------------|--------------------------|-------------|-----------|------|-------------------|--------------------|
| <input checked="" type="radio"/> | EXAMPLE | 1000.0 | 78.8 | 78.8 YES | 21.2 | ✓ | 1 PERMANENT | LOCAL | AUTO | | |
| <input type="radio"/> | SYSAUDIT | | | | | | | | | | |

The 'EXAMPLE' row is selected. A modal dialog titled 'Edit Tablespace: EXAMPLE' is open over the main interface. This dialog has its own set of buttons at the top right: 'Actions', 'Add Datafile', 'Go', 'Show SQL', 'Revert', and 'Apply'. The dialog is divided into sections:

- General**: Contains the 'Name' field set to 'EXAMPLE'.
- Storage**: Shows 'Bigfile tablespace No'.
- Extent Management**: Contains radio buttons for 'Locally Managed' (selected) and 'Dictionary Managed'. It also includes sections for 'Type' (with 'Permanent' selected), 'Status' (with 'Read Write' selected), and 'Datafiles' management.
- Type**: Includes options for 'Set as default permanent tablespace' and 'Encryption' (with a 'Encryption Options' link).
- Status**: Includes options for 'Read Only' and 'Offline'.
- Datafiles**: A table showing existing datafiles:

| Select | Name | Directory | Size (MB) | Used (MB) |
|----------------------------------|-----------------------|----------------------|-----------|-----------|
| <input checked="" type="radio"/> | example.265.688820635 | +DATA/orcl/datafile/ | 100.00 | 78.81 |

Actions with Tablespaces

Selection Mode Single ▾

Create

Actions Add Datafile Go

| Select | Name ▾ | Allocated Size(MB) | Used(%) | Auto Extend | Allocated Free Space(MB) | Status | Datafiles | Type | Extent Management | Segment Management |
|----------------------------------|-----------------|--------------------|---------|-------------|--------------------------|--------|-----------|-----------|-------------------|--------------------|
| <input checked="" type="radio"/> | <u>EXAMPLE</u> | 100.0 | 78.8 | YES | 21.2 | ✓ | 1 | PERMANENT | LOCAL | AUTO |
| <input type="radio"/> | <u>SYSAUX</u> | 697.2 | 95.2 | YES | 33.3 | ✓ | 1 | PERMANENT | LOCAL | AUTO |
| <input type="radio"/> | <u>SYSTEM</u> | 750.0 | 99.2 | YES | 5.8 | ✓ | 1 | PERMANENT | LOCAL | MANUAL |
| <input type="radio"/> | <u>TEMP</u> | 27.0 | 0.0 | YES | 27.0 | ✓ | 1 | TEMPORARY | LOCAL | MANUAL |
| <input type="radio"/> | <u>UNDOTBS1</u> | 100.0 | 17.1 | YES | 82.9 | ✓ | 1 | UNDO | LOCAL | MANUAL |
| <input type="radio"/> | <u>USERS</u> | 5.0 | 4.1 | YES | 82.5 | ✓ | 1 | PERMANENT | LOCAL | AUTO |

Total Allocated Size (GB) **1.64** ✓ Online ✘ Offline ⚡ Read Only
Total Used (GB) **1.47**
Total Allocated Free Space (GB) **0.17**



Show DDL

Return

```
CREATE SMALLFILE TABLESPACE "EXAMPLE" DATAFILE '+DATA/orcl/datafile/example.265.688820635'
SIZE 100M REUSE AUTOEXTEND ON NEXT 640K MAXSIZE 32767M NOLOGGING EXTENT MANAGEMENT LOCAL
SEGMENT SPACE MANAGEMENT AUTO
```

Dropping Tablespaces

Warning

Once a tablespace has been dropped, the objects and data in it will no longer be available. To recover them can be a time consuming process. Oracle recommends a backup before and after dropping a tablespace.

Are you sure you want to delete Tablespace EXAMPLE?

Delete associated datafiles from storage

No Yes



| Tablespace Management | | | | | | | | | | | |
|----------------------------------|--------------|--------------------|----------------|--|-------------|--------------------------|--------|-----------|-----------|-------------------|--------------------|
| Actions | Add Datafile | Tablespace Details | | | | | | | | | |
| Select | Name | Allocated Size(MB) | Space Used(MB) | Allocated Space Used(%) | Auto Extend | Allocated Free Space(MB) | Status | Datafiles | Type | Extent Management | Segment Management |
| <input checked="" type="radio"/> | EXAMPLE | 100.0 | 78.8 | <div style="width: 78.8%; background-color: #0070C0;"></div> | 78.8 YES | 21.2 | ✓ | 1 | PERMANENT | LOCAL | AUTO |
| <input type="radio"/> | SYSAUX | 697.2 | 663.9 | <div style="width: 95.2%; background-color: #0070C0;"></div> | 95.2 YES | 33.3 | ✓ | 1 | PERMANENT | LOCAL | AUTO |
| <input type="radio"/> | SYSTEM | 750.0 | 744.2 | <div style="width: 99.2%; background-color: #0070C0;"></div> | 99.2 YES | 5.8 | ✓ | 1 | PERMANENT | LOCAL | MANUAL |
| <input type="radio"/> | TEMP | 27.0 | 0.0 | <div style="width: 0.0%; background-color: #0070C0;"></div> | 0.0 YES | 27.0 | ✓ | 1 | TEMPORARY | LOCAL | MANUAL |
| <input type="radio"/> | UNDOTBS1 | 100.0 | 17.1 | <div style="width: 17.1%; background-color: #0070C0;"></div> | 17.1 YES | 82.9 | ✓ | 1 | UNDO | LOCAL | MANUAL |
| <input type="radio"/> | USERS | 5.0 | 4.1 | <div style="width: 82.5%; background-color: #0070C0;"></div> | 82.5 YES | 0.9 | ✓ | 1 | PERMANENT | LOCAL | AUTO |

Viewing Tablespace Information

```
SELECT tablespace_name, status, contents, logging, extent_management,  
allocation_type, segment_space_management  
FROM dba_tablespaces
```

| TABLESPACE_NAME | STATUS | CONTENTS | LOGGING | EXTENT_MANAGEMENT | ALLOCATION_TYPE | SEGMENT_SPACE_MANAGEMENT |
|-----------------|--------|-----------|-----------|-------------------|-----------------|--------------------------|
| SYSTEM | ONLINE | PERMANENT | LOGGING | LOCAL | SYSTEM | MANUAL |
| SYSAUX | ONLINE | PERMANENT | LOGGING | LOCAL | SYSTEM | AUTO |
| UNDOTBS1 | ONLINE | UNDO | LOGGING | LOCAL | SYSTEM | MANUAL |
| TEMP | ONLINE | TEMPORARY | NOLOGGING | LOCAL | UNIFORM | MANUAL |
| USERS | ONLINE | PERMANENT | LOGGING | LOCAL | SYSTEM | AUTO |
| EXAMPLE | ONLINE | PERMANENT | NOLOGGING | LOCAL | SYSTEM | AUTO |

```
SELECT ts#, name FROM v$tablespace
```

| TS# | NAME |
|-----|----------|
| 0 | SYSTEM |
| 1 | SYSAUX |
| 2 | UNDOTBS1 |
| 4 | USERS |
| 3 | TEMP |
| 6 | EXAMPLE |

Viewing Tablespace Contents

Show Tablespace Contents

| | | | | |
|--------------------------|-----------------------|--------------------------|------------------------|------------------------|
| Size (MB) 100.0 | Used (MB) 78.8 | Extent Mgmt LOCAL | Auto Extend Yes | Return |
| Block Size (KB) 8 | Used (%) 78.8 | Segment Mgmt AUTO | Extents 882 | |

Segments

Search

| | | | |
|----------------------|-----------|--------------|---|
| Segment Name | Type | Minimum Size | Minimum Extents |
| <input type="text"/> | All Types | (KB) | <input type="text"/> Go |

By default, the search returns all uppercase matches beginning with the string you entered. To run an exact or case-sensitive match, double quote the search string. You can use the wildcard symbol (%) in a double quoted string.

▼ Extent Map

Clicking the Highlight Extents button for a segment in the table will cause all extents that belong to that segment to be highlighted in the Extent Map. Clicking on a used extent in the Extent Map will select the segment to which that extent belongs in the segment table.

| Segment Name |
|-----------------|
| SH.CUSTOMERS |
| PM.SYS_LOB0000 |
| PM.SYS_LOB0000 |
| SH.SUPPLEMENTA |
| OE.PRODUCT_DES |
| SH.SALES.SALES_ |
| SH.SALES.SALES_ |
| SH.SALES.SALES_ |
| SH.CUSTOMERS_F |
| SH.SALES.SALES_ |

Header
Used
Free
Selected
Unmapped

Zoom

[Extent Map](#)

Oracle-Managed Files (OMF)

Specify file operations in terms of database objects rather than file names.

| Parameter | Description |
|-----------------------------|--|
| DB_CREATE_FILE_DEST | Defines the location of the default file system directory for data files and temporary files |
| DB_CREATE_ONLINE_LOG_DEST_n | Defines the location for redo log files and control file creation |
| DB_RECOVERY_FILE_DEST | Default location for the fast recovery area |

Example:

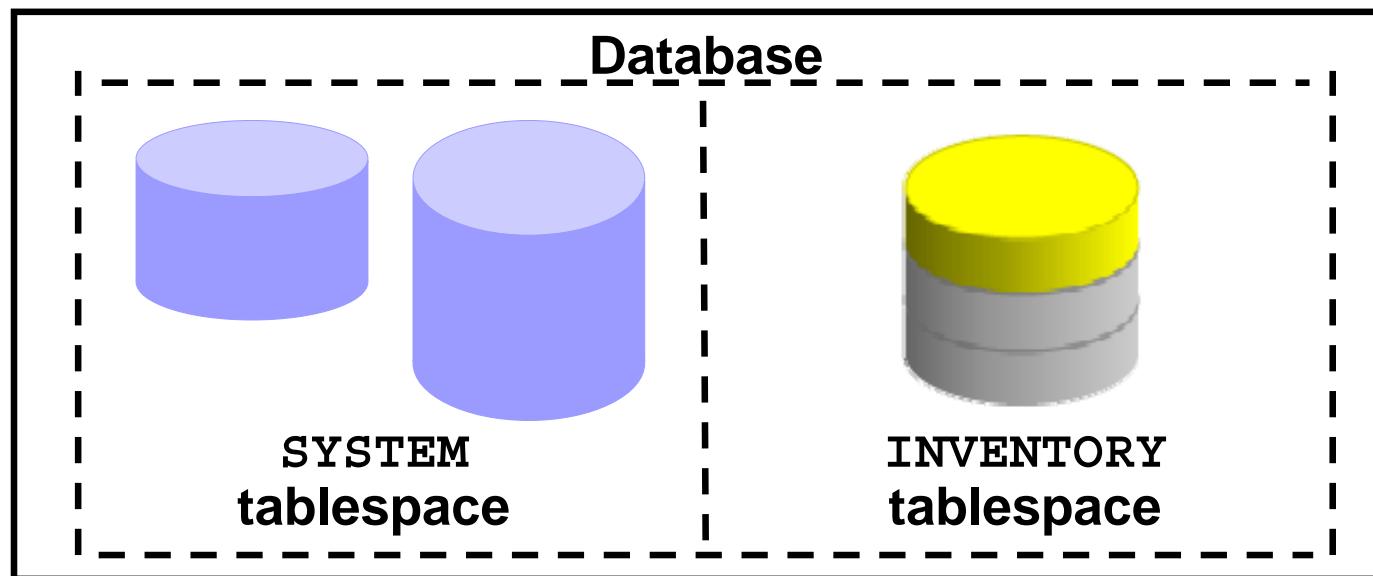
```
SQL> ALTER SYSTEM SET DB_CREATE_FILE_DEST = '+DATA';
SQL> CREATE TABLESPACE tbs_1;
```



Enlarging the Database

You can enlarge the database in the following ways:

- Creating a new tablespace
- Adding a data file to an existing smallfile tablespace
- Increasing the size of a data file
- Providing for the dynamic growth of a data file



Quiz

A database can have a mixture of Oracle-managed and unmanaged files.

1. True
2. False

Quiz

Bigfile Tablespaces must have 1 file of at least 100 MB.

1. True
2. False

Summary

In this lesson, you should have learned how to:

- Describe the storage of table row data in blocks
- Create and manage tablespaces
- Obtain tablespace information

Practice 7 Overview: Managing Database Storage Structures

This practice covers the following topics:

- Creating tablespaces
- Gathering information about tablespaces

Administering User Security

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Objectives

After completing this lesson, you should be able to:

- Create and manage database user accounts:
 - Authenticate users
 - Assign default storage areas (tablespaces)
- Grant and revoke privileges
- Create and manage roles
- Create and manage profiles:
 - Implement standard password security features
 - Control resource usage by users

Database User Accounts

Each database user account has:

- A unique username
- An authentication method
- A default tablespace
- A temporary tablespace
- A user profile
- An initial consumer group
- An account status



A schema:

- Is a collection of database objects that are owned by a database user
- Has the same name as the user account

Predefined Administrative Accounts

- **SYS account:**
 - Is granted the DBA role, as well as several other roles.
 - Has all privileges with ADMIN OPTION
 - Is required for startup, shutdown, and some maintenance commands
 - Owns the data dictionary and the Automatic Workload Repository (AWR)
- **SYSTEM account** is granted the DBA, MGMT_USER, and AQ_ADMINISTRATOR_ROLE roles.
- **DBSNMP account** is granted the OEM_MONITOR role.
- **SYSMAN account** is granted the MGMT_USER, RESOURCE and SELECT_CATALOG_ROLE roles.
- These accounts are not used for routine operations.



Creating a User

Database Instance: orcl.oracle.com > Users >

Logged in As SYS

Create User

Show SQL Cancel OK

General Roles System Privileges Object Privileges Quotas Consumer Group Privileges Proxy Users

* Name mydba
Profile DEFAULT
Authentication Password
* Enter Password
* Confirm Password
For Password choice, the role is authorized via password.
 Expire Password now
Default Tablespace USERS 
Temporary Tablespace TEMP 
Status Locked Unlocked

Show SQL Return

```
CREATE USER "MYDBA" PROFILE "DEFAULT" IDENTIFIED BY "*****" DEFAULT
TABLESPACE "USERS" TEMPORARY TABLESPACE "TEMP" ACCOUNT UNLOCK
GRANT "CONNECT" TO "MYDBA"
```

Select Server > Users, and then click the Create button.

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Authenticating Users

- Password
- External
- Global

Edit User: HR

Actions Create Like ▾ Go Show SQL Revert Apply

General Roles System Privileges Object Privileges Quotas Consumer Group Privileges Proxy Users

Name **HR**

Profile **DEFAULT**

Authentication **Password** ▾

* Enter Password

* Confirm Password

For Password choice, the role is authorized via password.

Expire Password now

Default Tablespace **USERS**  

Temporary Tablespace **TEMP**  

Status Locked Unlocked



Administrator Authentication

Operating system security:

- DBAs must have the OS privileges to create and delete files.
- Typical database users should not have the OS privileges to create or delete database files.

Administrator security:

- For SYSDBA, SYSOPER, and SYSASM connections:
 - DBA user by name is audited for password file and strong authentication methods
 - OS account name is audited for OS authentication
 - OS authentication takes precedence over password file authentication for privileged users
 - Password file uses case-sensitive passwords



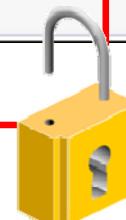
Unlocking a User Account and Resetting the Password

Screenshot of the Oracle Database User Management interface showing the 'Users' list page.

The 'Actions' column for the user 'APEX_PUBLIC_USER' has a dropdown menu open, with the 'Unlock User' option highlighted by a red arrow and a yellow callout box containing the instruction: "Select the user, select Unlock User, and click Go." A red bracket on the left also points to this callout box.

| Select | UserName | Account Status | Actions | Create | Default Tablespace | Temporary Tablespace | Profile | Created |
|-------------------------------------|------------------|---------------------|---|----------------------------|--------------------|----------------------|---------|----------------------------|
| <input checked="" type="checkbox"/> | ANONYMOUS | EXPIRE LOCKED | <input type="button" value="Edit"/> <input type="button" value="View"/> <input type="button" value="Delete"/> Lock User <input type="button" value="Go"/> | 10:51 | SYSAUX | TEMP | DEFAULT | Aug 3, 2007 1:34:38 AM MDT |
| <input checked="" type="checkbox"/> | APEX_PUBLIC_USER | EXPIRED & LOCKED | Generate DDL Lock User Unlock User | Aug 4, 2008 7:10:51 PM MDT | USERS | TEMP | DEFAULT | Aug 3, 2007 2:04:08 AM MDT |
| <input checked="" type="checkbox"/> | BI | EXPIRED & LOCKED | | Aug 4, 2008 7:10:51 PM MDT | USERS | TEMP | DEFAULT | Aug 4, 2008 7:04:49 PM MDT |

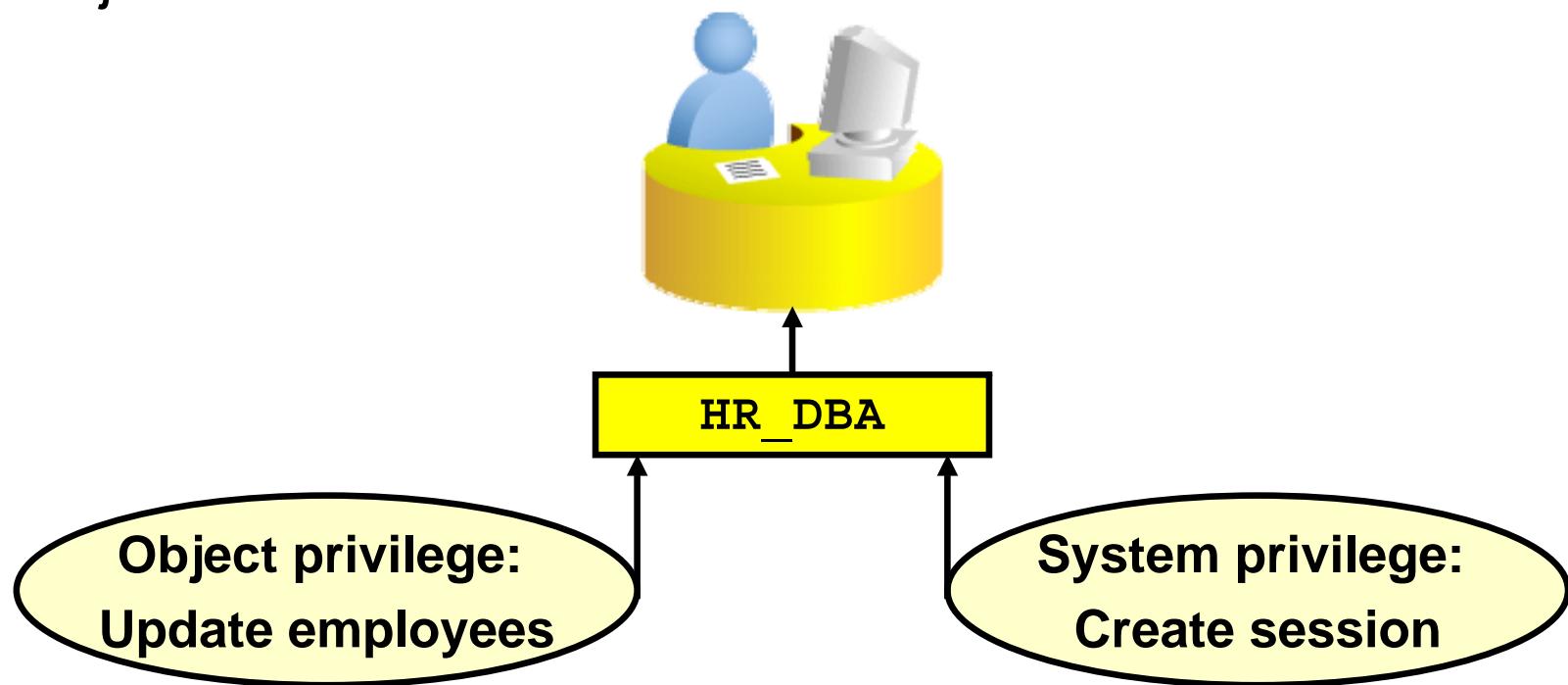
Select the user, select Unlock User, and click Go.



Privileges

There are two types of user privileges:

- System: Enables users to perform particular actions in the database
- Object: Enables users to access and manipulate a specific object



System Privileges

Edit User: HR

Actions Create Like ▾ Go Show SQL Revert Apply

General Roles System Privileges Object Privileges Quotas Consumer Group Privileges Proxy Users

Edit List

| System Privilege | Admin Option |
|----------------------|--------------------------|
| ALTER SESSION | <input type="checkbox"/> |
| CREATE DATABASE LINK | <input type="checkbox"/> |
| CREATE SEQUENCE | <input type="checkbox"/> |
| CREATE SESSION | <input type="checkbox"/> |
| CREATE SYNONYM | <input type="checkbox"/> |
| CREATE VIEW | <input type="checkbox"/> |
| UNLIMITED TABLESPACE | <input type="checkbox"/> |

Modify System Privileges

Available System Privileges

- ACCESS_ANY_WORKSPACE
- ADMINISTER ANY SQL TUNING SET
- ADMINISTER DATABASE TRIGGER
- ADMINISTER RESOURCE MANAGER
- ADMINISTER SQL MANAGEMENT OBJECT
- ADMINISTER SQL TUNING SET
- ADVISOR
- ALTER ANY ASSEMBLY
- ALTER ANY CLUSTER
- ALTER ANY CUBE

Selected System Privileges

- ALTER SESSION
- CREATE DATABASE LINK
- CREATE SEQUENCE
- CREATE SESSION
- CREATE SYNONYM
- CREATE VIEW
- UNLIMITED TABLESPACE

Cancel OK

Move Move All Remove Remove All

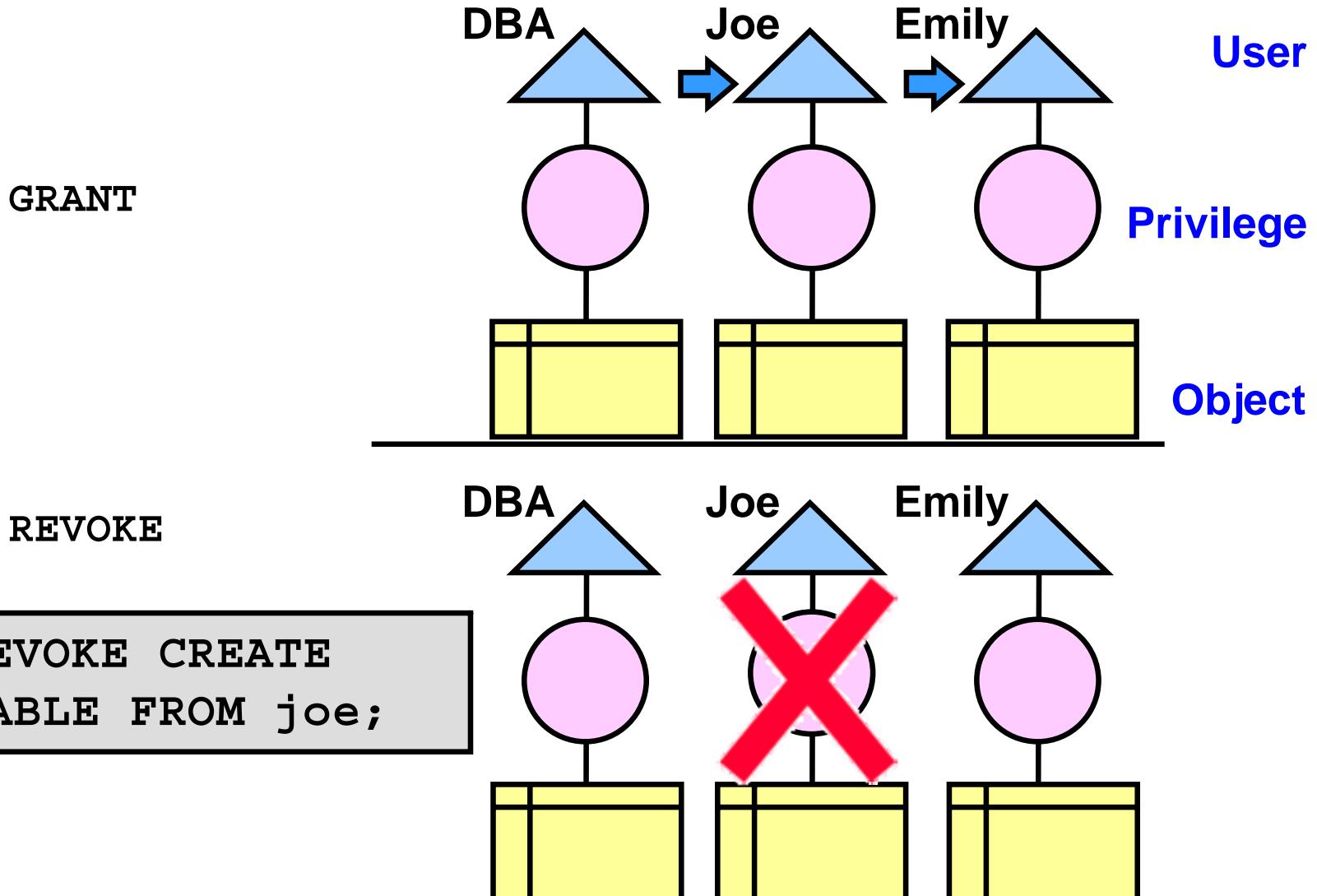
Object Privileges

The screenshot shows the 'Edit User: HR' page in Oracle Database. The 'Object Privileges' tab is selected. A red box highlights the 'Select Object Type' dropdown set to 'Table'. A green circle labeled '1' points to this area. A red arrow points from this box to the 'Add' button in the 'Add Table Object Privileges' dialog. The dialog has three tabs: 'Grant Option' (selected), 'Add Table Object Privileges', and 'Quotas'. The 'Add Table Object Privileges' tab shows 'OE.CUSTOMERS,OE.INVENTORIES,OE.ORDERS,OE.ORDER_ITEMS' listed under 'Selected Objects'. A green circle labeled '2' points to this list. A yellow callout box with a blue arrow points to the list and contains the text 'Search and select objects.' Below the list are buttons for 'Cancel' and 'OK'. The 'Available Privileges' list on the left includes: ALTER, DELETE, INDEX, INSERT, REFERENCES, UPDATE. The 'Selected Privileges' list on the right includes: SELECT. Buttons for moving privileges between lists are: Move (right arrow), Move All (double right arrow), Remove (left arrow), and Remove All (double left arrow). A green circle labeled '3' points to the 'Selected Privileges' list.

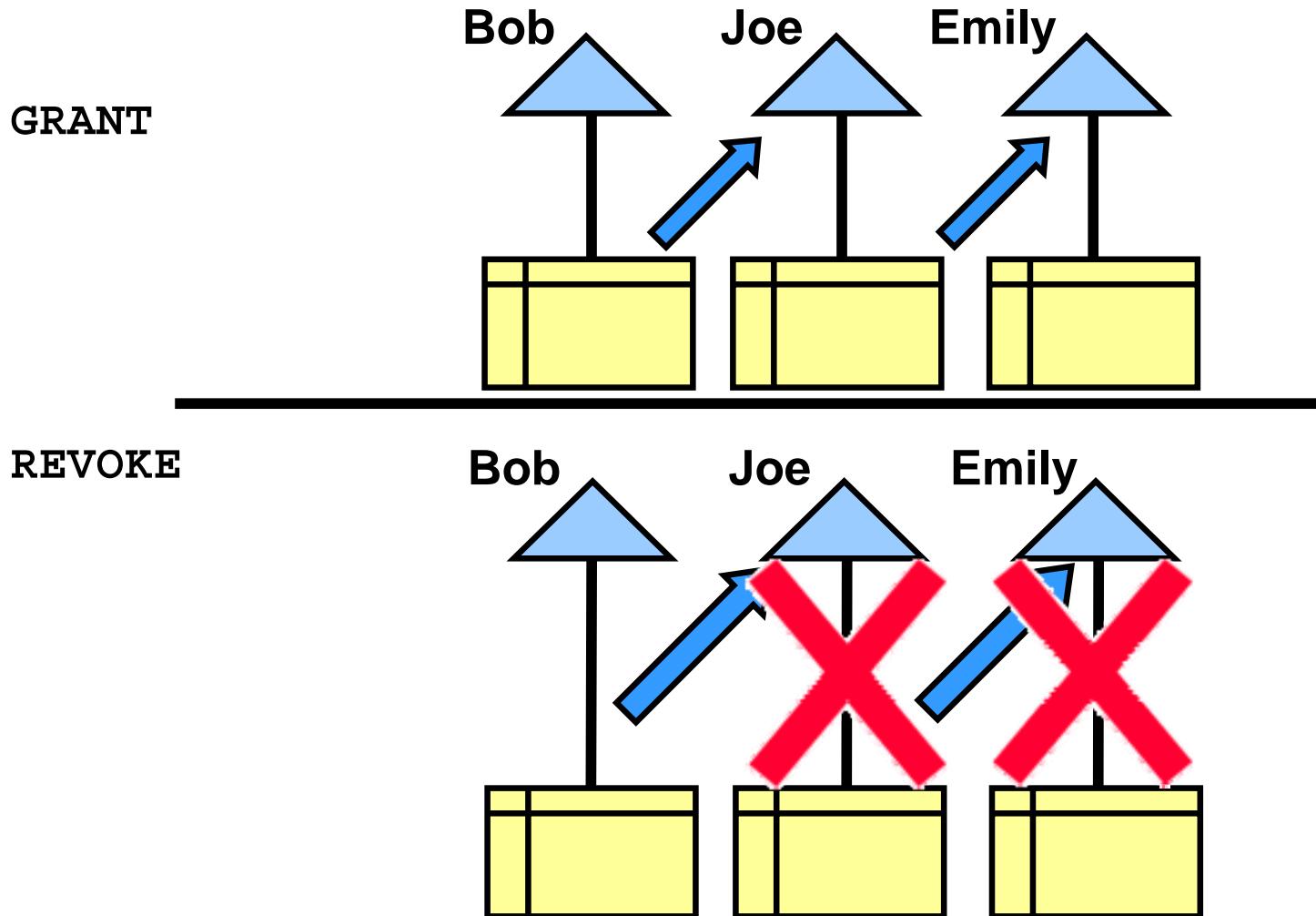
To grant object privileges:

- Choose the object type.
- Select objects.
- Select privileges.

Revoking System Privileges with ADMIN OPTION



Revoking Object Privileges with GRANT OPTION



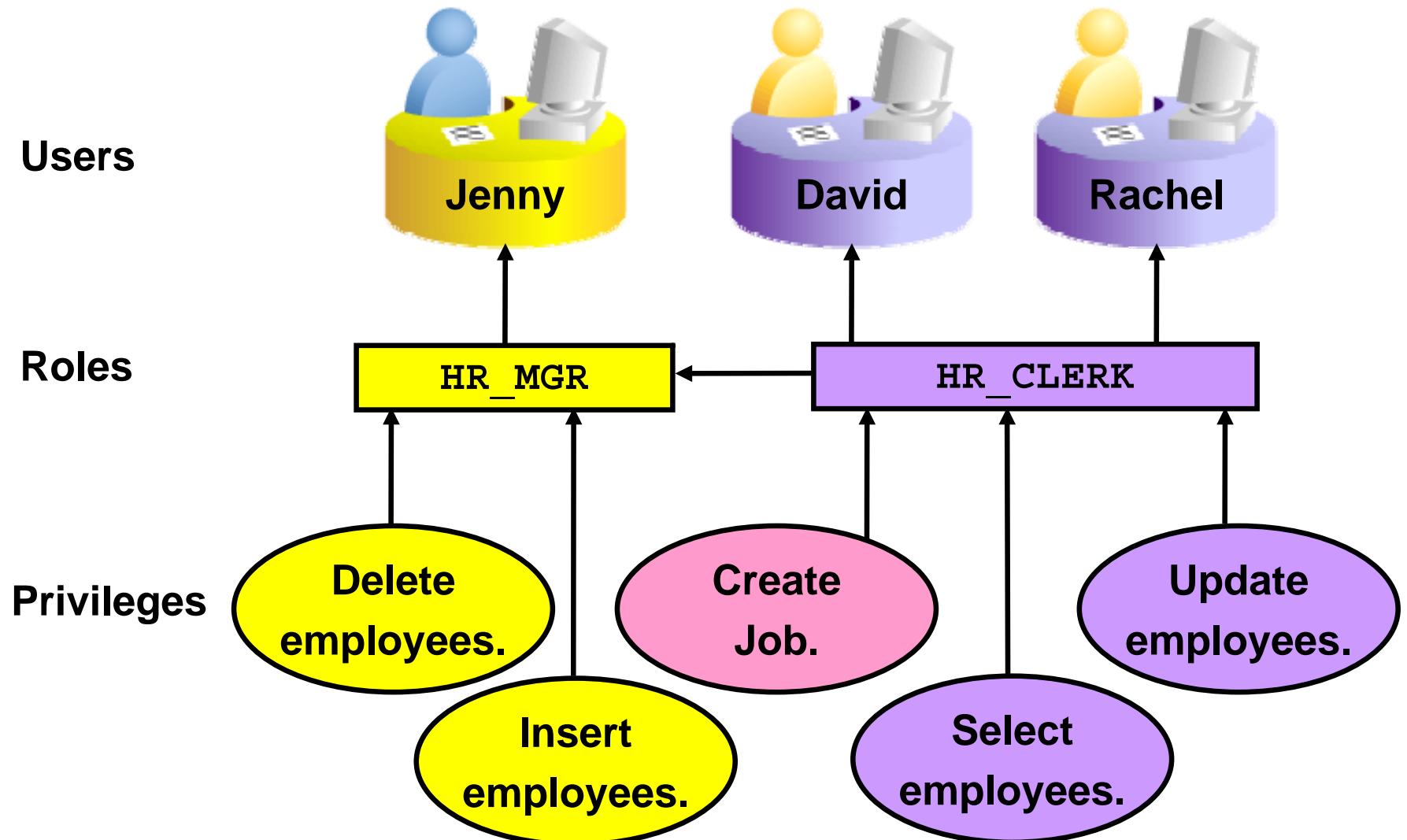
Benefits of Roles

- Easier privilege management
- Dynamic privilege management
- Selective availability of privileges



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Assigning Privileges to Roles and Assigning Roles to Users



Predefined Roles

| Role | Privileges Included |
|-----------------------|---|
| CONNECT | CREATE SESSION |
| RESOURCE | CREATE CLUSTER, CREATE INDEXTYPE, CREATE OPERATOR, CREATE PROCEDURE, CREATE SEQUENCE, CREATE TABLE, CREATE TRIGGER, CREATE TYPE |
| SCHEDULER_ ADMIN | CREATE ANY JOB, CREATE EXTERNAL JOB, CREATE JOB, EXECUTE ANY CLASS, EXECUTE ANY PROGRAM, MANAGE SCHEDULER |
| DBA | Most system privileges; several other roles. Do not grant to nonadministrators. |
| SELECT_ CATALOG_ ROLE | No system privileges; HS_ADMIN_ROLE and over 1,700 object privileges on the data dictionary |

Creating a Role

Select Server > Roles.

Add privileges and roles from the appropriate tab.

The screenshot shows the Oracle Database 'Create Role' dialog box. At the top, there are tabs for General, Roles, System Privileges, Object Privileges, Consumer Group Privileges, and Dependencies. The General tab is selected, showing a field for 'Name' (OE_READER) which is highlighted with a red box. Below it is an 'Authentication' dropdown set to 'None'. A note says 'There is no authentication.' To the right, there are 'Show SQL', 'Cancel', and 'OK' buttons. A yellow callout points to the 'OK' button with the text 'Click OK when finished.' In the middle section, the 'Object Privileges' tab is selected. It has a 'Select Object Type' dropdown set to 'Table' with an 'Add' button next to it, both highlighted with red boxes. Below is a table with four rows:

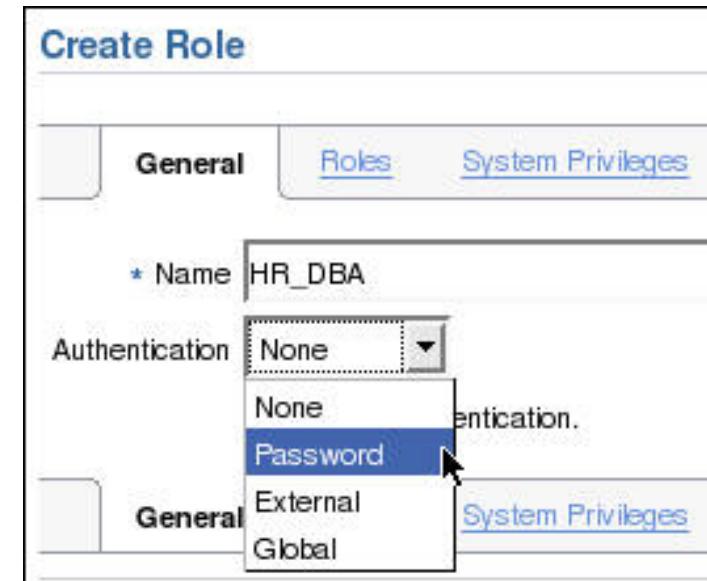
| Select Object Privilege | Schema | Object |
|---|--------|-------------|
| <input checked="" type="radio"/> SELECT | OE | CUSTOMERS |
| <input type="radio"/> SELECT | OE | INVENTORIES |
| <input type="radio"/> SELECT | OE | ORDERS |
| <input type="radio"/> SELECT | OE | ORDER_ITEMS |

Secure Roles

- Roles can be nondefault and enabled when required.

```
SET ROLE vacationdba;
```

- Roles can be protected through authentication.



- Roles can also be secured programmatically.

```
CREATE ROLE secure_application_role  
IDENTIFIED USING <security_procedure_name>;
```

Assigning Roles to Users

Edit User: BERNST

Actions Create Like ▾ Go Show SQL Revert Apply

General Roles System Privileges Object Privileges Quotas Consumer Group Privileges Proxy Users

Role Admin Option Default

CONNECT

Edit List

Modify Roles

Available Roles

- JAVA_DEPLOY
- JMXSERVER
- LOGSTDBY_ADMINISTRATOR
- MGMT_USER
- OEM_AdVISOR
- OEM_MONITOR
- OE_READER
- OLAPI_TRACE_USER
- OLAP_DBA
- OLAP_USER

Selected Roles

- CONNECT

Move

Move All

Remove

Remove All

Quiz

All passwords created in Oracle Database 11g are not case-sensitive by default.

1. True
2. False

Quiz

A database role:

1. Can be enabled or disabled
2. Can consist of system and object privileges
3. Is owned by its creator
4. Cannot be protected by a password

Profiles and Users

Users are assigned only one profile at a time.

Profiles:

- Control resource consumption
- Manage account status and password expiration

Create Profile

Show SQL Cancel OK

General Password

* Name

Details

| | | |
|------------------------|-----------|---|
| CPU/Session (Sec./100) | 1000 | ⬆ |
| CPU/Call (Sec./100) | UNLIMITED | ⬆ |
| Connect Time (Minutes) | DEFAULT | ⬆ |
| Idle Time (Minutes) | 60 | ⬆ |

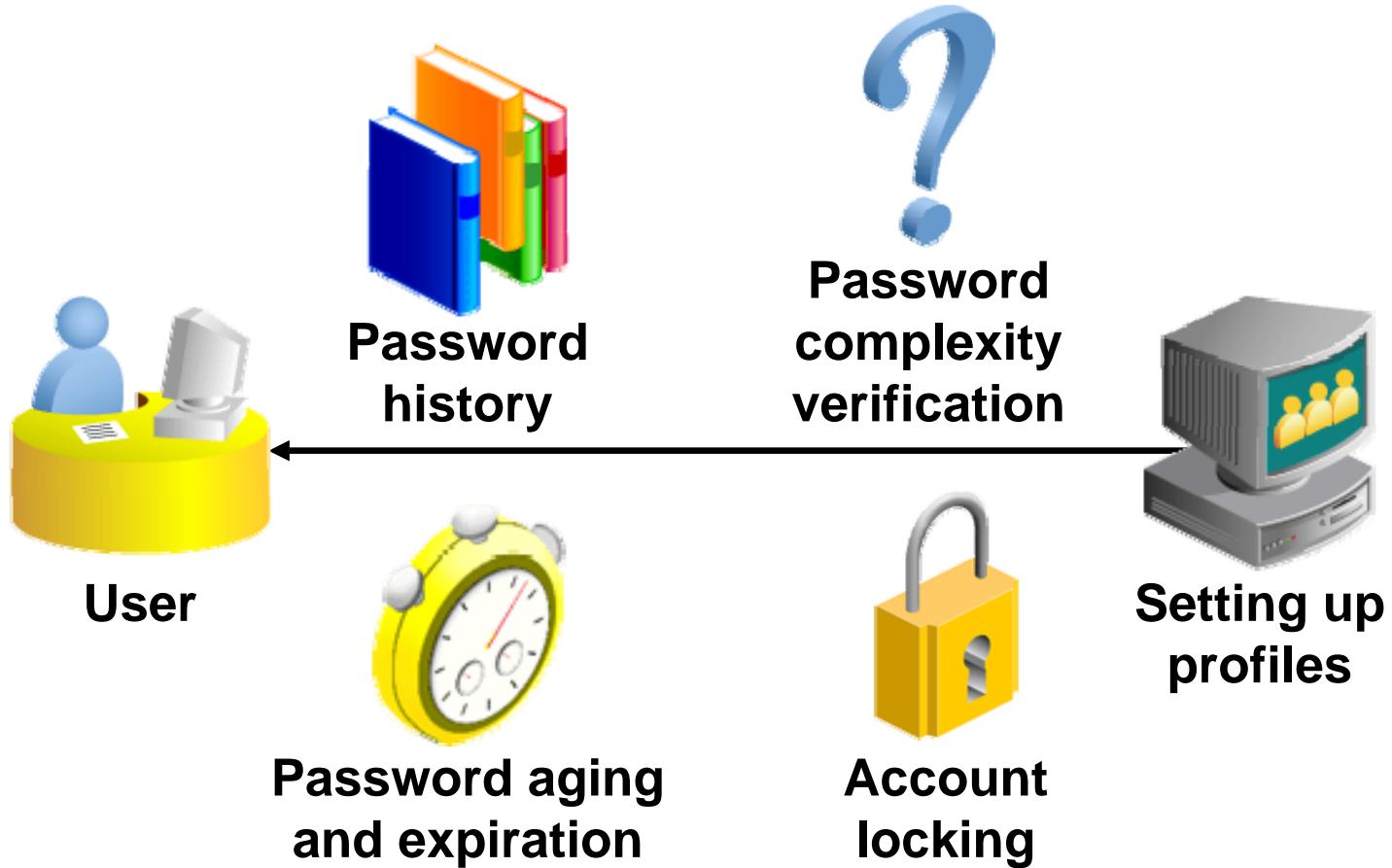
Database Services

| | | |
|---------------------------------|---------|---|
| Concurrent Sessions (Per User) | DEFAULT | ⬆ |
| Reads/Session (Blocks) | DEFAULT | ⬆ |
| Reads/Call (Blocks) | DEFAULT | ⬆ |
| Private SGA (KBytes) | DEFAULT | ⬆ |
| Composite Limit (Service Units) | DEFAULT | ⬆ |

Note: RESOURCE_LIMIT must be set to TRUE before profiles can impose resource limitations.

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Implementing Password Security Features



Note: Do not use profiles that cause the SYS, SYSMAN, and DBSNMP passwords to expire and the accounts to be locked.

Creating a Password Profile

Create Profile

General Password

Password

Expire in (days)  

Lock (days past expiration)  

History

Number of passwords to keep  

Number of days to keep for  

Complexity

Complexity function 

Failed Login

Number of failed login attempts to lock after  

Number of days to lock for  

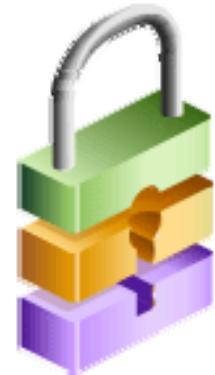
Supplied Password Verification Function:

VERIFY_FUNCTION_11G

The VERIFY_FUNCTION_11G function insures that the password is:

- At least eight characters
- Different from the username, username with a number, or username reversed
- Different from the database name or the database name with a number
- A string with at least one alphabetic and one numeric character
- Different from the previous password by at least three letters

Tip: Use this function as a template to create your own customized password verification.



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Assigning Quotas to Users

Users who do not have the UNLIMITED TABLESPACE system privilege must be given a quota before they can create objects in a tablespace.

Quotas can be:

- A specific value in megabytes or kilobytes
- Unlimited

Edit User: BERNST

Actions Create Like Go Show SQL Revert Apply

General Roles System Privileges Object Privileges Quotas Consumer Group Privileges

| Tablespace | Quota | Value | Unit |
|-----------------|-------------|-------|----------|
| EXAMPLE | Value ▾ | 20 | MBytes ▾ |
| INVENTORY | None ▾ | 0 | MBytes ▾ |
| SYSAUX | None ▾ | 0 | MBytes ▾ |
| SYSTEM | None ▾ | 0 | MBytes ▾ |
| TEMP | None ▾ | 0 | MBytes ▾ |
| UNDOTBS1 | None ▾ | 0 | MBytes ▾ |
| USERS (Default) | Unlimited ▾ | 0 | MBytes ▾ |

Applying the Principle of Least Privilege

- Protect the data dictionary:

```
07_DICTIONARY_ACCESSIBILITY=FALSE
```

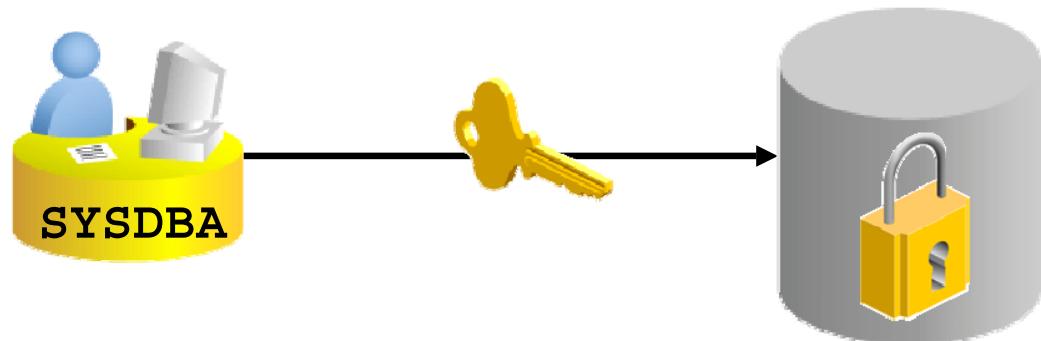
- Revoke unnecessary privileges from PUBLIC.
- Use access control lists (ACL) to control network access.
- Restrict the directories accessible by users.
- Limit users with administrative privileges.
- Restrict remote database authentication:

```
REMOTE_OS_AUTHENT=FALSE
```

Protect Privileged Accounts

Privileged accounts can be protected by:

- Using password file with case-sensitive passwords
- Enabling strong authentication for administrator roles



Quiz

Applying the principle of least privilege is not enough to harden the Oracle database.

1. True
2. False

Quiz

With RESOURCE_LIMIT set at its default value of FALSE, profile password limitations are ignored.

1. True
2. False

Summary

In this lesson, you should have learned how to:

- Create and manage database user accounts:
 - Authenticate users
 - Assign default storage areas (tablespaces)
- Grant and revoke privileges
- Create and manage roles
- Create and manage profiles:
 - Implement standard password security features
 - Control resource usage by users

Practice 8 Overview: Administering Users

This practice covers the following topics:

- Creating a profile to limit resource consumption
- Creating two roles:
 - HRCLERK
 - HRMANAGER
- Creating four new users:
 - One manager and two clerks
 - One schema user for the next practice session



Managing Data Concurrency

9

Objectives

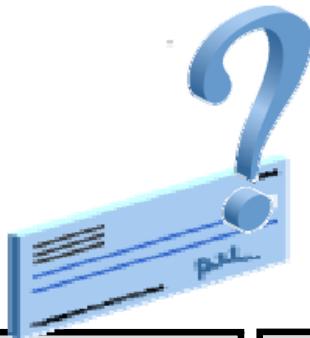
After completing this lesson, you should be able to:

- Describe the locking mechanism and how Oracle manages data concurrency
- Monitor and resolve locking conflicts

Locks

- Prevent multiple sessions from changing the same data at the same time
- Are automatically obtained at the lowest possible level for a given statement
- Do not escalate

Transaction 1



Transaction 2



```
SQL> UPDATE employees  
  2  SET salary=salary+100  
  3  WHERE employee_id=100;
```

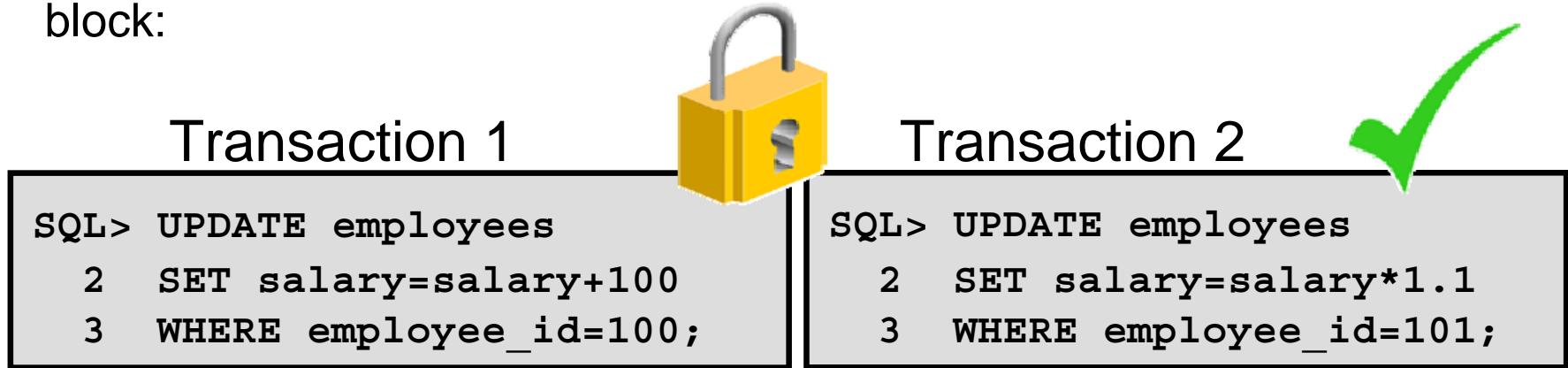
```
SQL> UPDATE employees  
  2  SET salary=salary*1.1  
  3  WHERE employee_id=100;
```

Locking Mechanism

- High level of data concurrency:
 - Row-level locks for inserts, updates, and deletes
 - No locks required for queries
- Automatic queue management
- Locks held until the transaction ends (with the COMMIT or ROLLBACK operation)

Example

Assume that the rows for employee_id 100 and 101 reside in the same block:



Data Concurrency

| | | |
|-----------------------|---------------|--|
| Time: 09:00:00 | Transaction 1 | UPDATE hr.employees SET salary=salary+100 WHERE employee_id=100; |
| | Transaction 2 | UPDATE hr.employees SET salary=salary+100 WHERE employee_id=101; |
| | Transaction 3 | UPDATE hr.employees SET salary=salary+100 WHERE employee_id=102; |
| | ... | ... |
| | Transaction x | UPDATE hr.employees SET salary=salary+100 WHERE employee_id=xxx; |

DML Locks

Transaction 1

```
SQL> UPDATE employees  
  2  SET salary=salary*1.1  
  3  WHERE employee_id= 107;  
1 row updated.
```

Transaction 2

```
SQL> UPDATE employees  
  2  SET salary=salary*1.1  
  3  WHERE employee_id= 106;  
1 row updated.
```

Each DML transaction must acquire *two locks*:

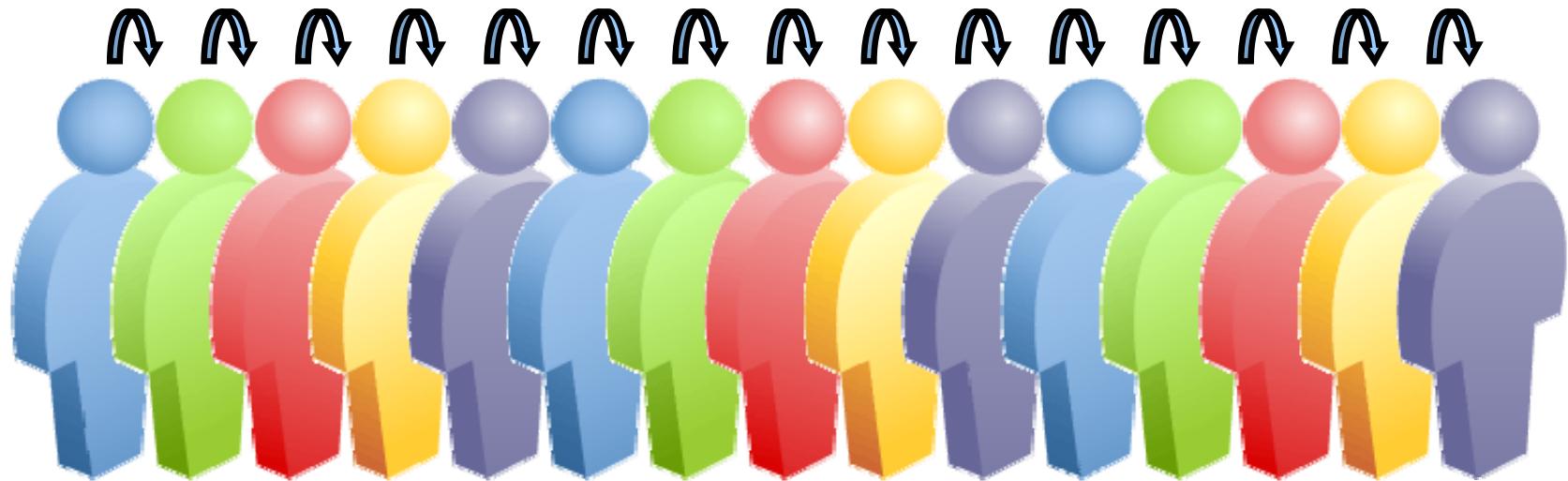
- EXCLUSIVE row lock on the row or rows being updated
- Table lock (TM) in ROW EXCLUSIVE (RX) mode on the table containing the rows



Enqueue Mechanism

The enqueue mechanism keeps track of:

- Sessions waiting for locks
- Requested lock mode
- Order in which sessions requested the lock



Lock Conflicts

Transaction 1

Time

Transaction 2

| | | |
|--|--|---|
| UPDATE employees SET salary=salary+100 WHERE employee_id=100; 1 row updated. | 9:00:00 | UPDATE employees SET salary=salary+100 WHERE employee_id=101; 1 row updated. |
| UPDATE employees SET COMMISION_PCT=2 WHERE employee_id=101; Session waits enqueue due to lock conflict. | 9:00:05  | SELECT sum(salary) FROM employees; SUM (SALARY) ----- 692634 |
| Session still waiting! | 16:30:00 | Many selects, inserts, updates, and deletes during the last 7.5 hours, but no commits or rollbacks! |
| 1 row updated. Session continues. | 16:30:01 | commit; |

Possible Causes of Lock Conflicts

- Uncommitted changes
- Long-running transactions
- Unnecessarily high locking levels



Detecting Lock Conflicts

Select Blocking Sessions on the Performance page.

| Blocking Sessions | | | | | | | | | | | |
|---|---------------------|------------------|---------------------|---------------|-------------------------------|-------------|---|------------|----------|----------|-----------------|
| Page Refreshed Aug 18, 2008 11:04:23 PM MDT Refresh | | | | | | | | | | | |
| View Session Kill Session | | | | | | | | | | | |
| Expand All Collapse All | | | | | | | | | | | |
| Select | Username | Sessions Blocked | Session ID | Serial Number | SQL ID | Wait Class | Wait Event | P1 Value | P2 Value | P3 Value | Seconds In Wait |
| <input type="radio"/> | ▶ Blocking Sessions | | | | | | | | | | |
| <input checked="" type="radio"/> | ▶ BERNST | 1 | 114 | 33091 | | Idle | SQL*Net message from client | 1650815232 | 1 | 0 | 89 |
| <input type="radio"/> | SMAVRIS | 0 | 124 | 46897 | 0tqktcvhr5fcf | Application | enq: TX - row lock contention | 1415053318 | 65545 | 3085 | 69 |

Click the Session ID link to view information about the locking session, including the actual SQL statement.

Resolving Lock Conflicts

To resolve a lock conflict:

- Have the session holding the lock commit or roll back
- Terminate the session holding the lock (in an emergency)



Resolving Lock Conflicts with SQL

SQL statements can be used to determine the blocking session and kill it.

1

```
SQL> select SID, SERIAL#, USERNAME  
      from V$SESSION where SID in  
      (select BLOCKING_SESSION from V$SESSION)
```

Result:

| SID | SERIAL# | USERNAME |
|-----|---------|----------|
| 144 | 8982 | HR |

2

```
SQL> alter system kill session '144,8982' immediate;
```

Deadlocks

| Transaction 1 | | Transaction 2 |
|---|------|--|
| <pre>UPDATE employees SET salary = salary * 1.1 WHERE employee_id = 1000;</pre> | 9:00 | <pre>UPDATE employees SET manager = 1342 WHERE employee_id = 2000;</pre> |
| <pre>UPDATE employees SET salary = salary * 1.1 WHERE employee_id = 2000;</pre> | 9:15 | <pre>UPDATE employees SET manager = 1342 WHERE employee_id = 1000;</pre> |
| <pre>ORA-00060: Deadlock detected while waiting for resource</pre> | 9:16 | |

Quiz

The lock mechanism defaults to a fine-grained, row-level locking mode.

1. True
2. False

Quiz

When the deadlock occurs, Oracle database automatically:

1. Waits 300 seconds before terminating both sessions
2. Terminates one statement with an error in one session
3. Terminates the statements with an error in both sessions
4. Takes no action by default and leaves it to DBA

Summary

In this lesson, you should have learned how to:

- Describe the locking mechanism and how Oracle manages data concurrency
- Monitor and resolve locking conflicts

Practice 9 Overview: Managing Data and Concurrency

This practice covers the following topics:

- Identifying locking conflicts
- Resolving locking conflicts



10

Managing Undo Data

Objectives

After completing this lesson, you should be able to:

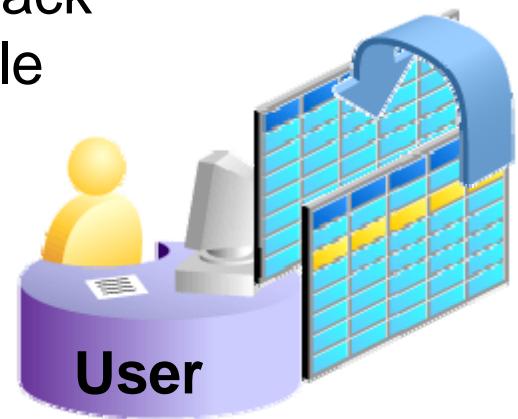
- Explain DML and undo data generation
- Monitor and administer undo data
- Describe the difference between undo data and redo data
- Configure undo retention
- Guarantee undo retention
- Use the Undo Advisor



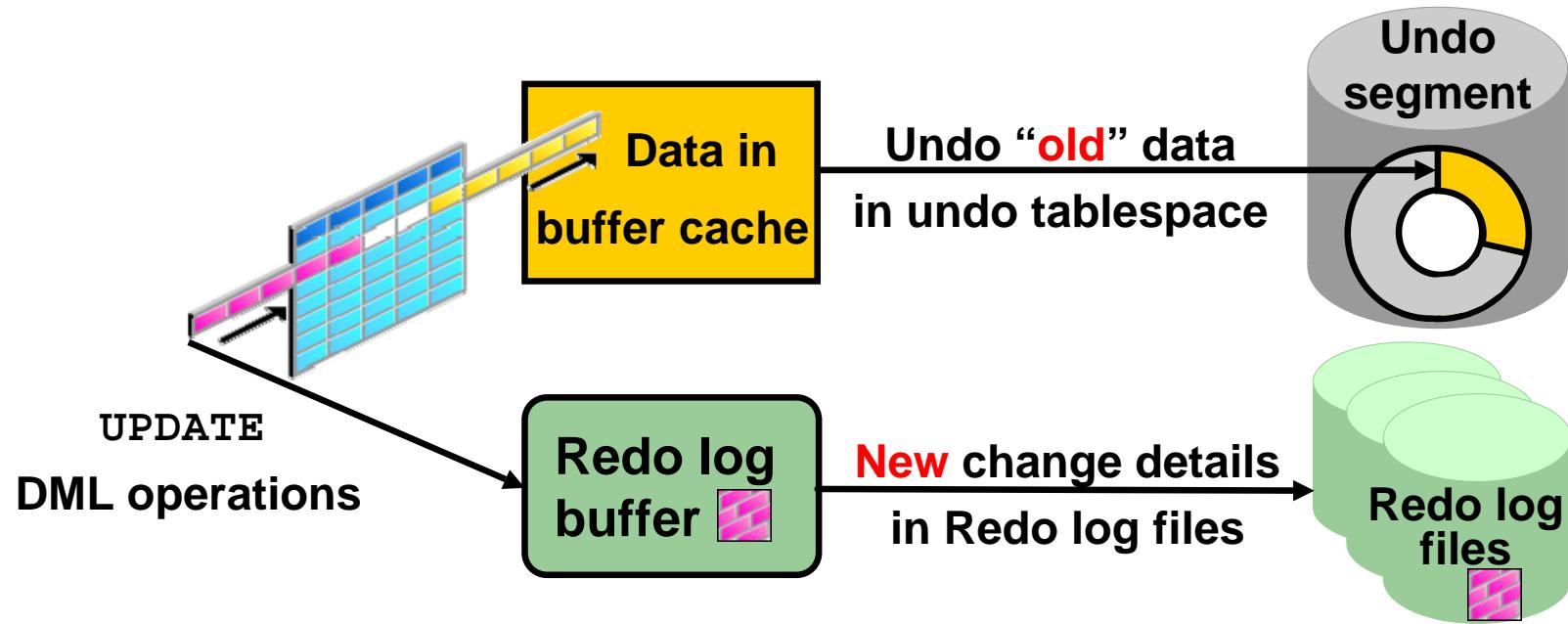
Undo Data

Undo data is:

- A copy of original, premodified data
- Captured for *every* transaction that changes data
- Retained at least until the transaction is ended
- Used to support:
 - Rollback operations
 - Read-consistent queries
 - Oracle Flashback Query, Oracle Flashback Transaction, and Oracle Flashback Table
 - Recovery from failed transactions



Transactions and Undo Data



- Each transaction is assigned to only one undo segment.
- An undo segment can service more than one transaction at a time.

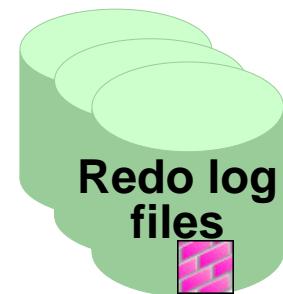
Storing Undo Information

Undo information is stored in undo segments, which are stored in an undo tablespace. Undo tablespaces:

- Are used only for undo segments
- Have special recovery considerations
- May be associated with only a single instance
- Require that only one of them be the current writable undo tablespace for a given instance at any given time

Undo Data Versus Redo Data

| | Undo | Redo |
|------------------|---|----------------------------------|
| Record of | How to undo a change | How to reproduce a change |
| Used for | Rollback, read consistency, flashback | Rolling forward database changes |
| Stored in | Undo segments | Redo log files |
| Protects against | Inconsistent reads in multiuser systems | Data loss |



Managing Undo

Automatic undo management:

- Fully automated management of undo data and space in a dedicated undo tablespace
- For all sessions
- Self-tuning in AUTOEXTEND tablespaces to satisfy long-running queries
- Self-tuning in fixed-size tablespaces for best retention

DBA tasks in support of Flashback operations:

- Configuring undo retention
- Changing undo tablespace to a fixed size
- Avoiding space and “snapshot too old” errors



Configuring Undo Retention

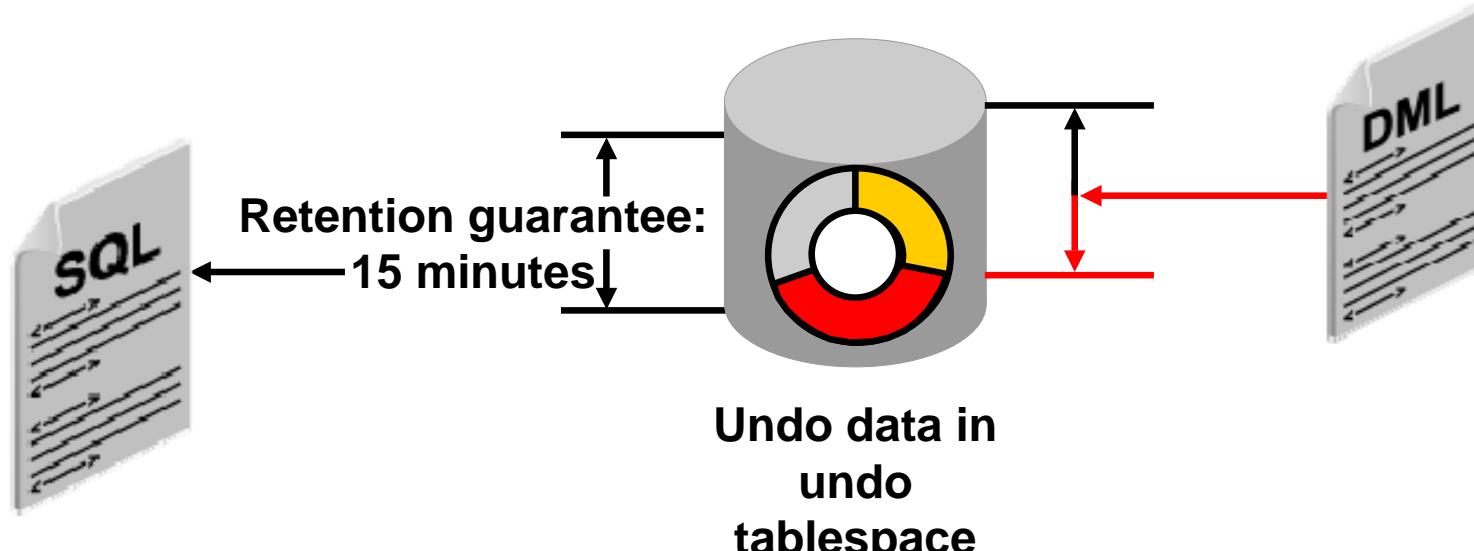
`UNDO_RETENTION` specifies (in seconds) how long already committed undo information is to be retained. The only time you must set this parameter is when:

- The undo tablespace has the `AUTOEXTEND` option enabled
- You want to set undo retention for LOBs
- You want to guarantee retention



Guaranteeing Undo Retention

```
SQL> ALTER TABLESPACE undotbs1 RETENTION GUARANTEE;
```



**SELECT statements
running 15 minutes or less
are always satisfied.**

**A transaction will fail
if it generates more undo
than there is space.**

Note: This example is based on an UNDO_RETENTION setting of 900 seconds (15 minutes).

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Changing an Undo Tablespace to a Fixed Size

Reasons:

- Supporting Flashback operations
- Limiting tablespace growth

Workflow:

1. Run regular workload.
2. Self-tuning mechanism establishes minimum required size.
3. (Optional) Use Undo Advisor, which calculates required size for future growth.
4. (Optional) Change undo tablespace to a fixed size.



General Undo Information

Database Instance: orcl.oracle.com >

Automatic Undo Management

In the General tab, you can view the current undo settings for your instance and use the Undo Advisor to analyze the undo tablespace requirements. This analysis can be performed based on the specified analysis period or the desired undo retention. The system activity for the specified time period can be viewed in the System Activity tab.

| | |
|--|------------------------|
| General | System Activity |
| Undo Retention Settings | |
| Undo Retention (minutes) | 15 |
| Retention Guarantee | No |
| Undo Tablespace for this Instance | |
| Tablespace | UNDOTBS1 |
| Size (MB) | 100 |
| Auto-Extensible | Yes |

Current
tablespace size

Using the Undo Advisor

Undo Advisor: Undo Retention and Undo Tablespace Sizing Advice

Undo retention is the length of time that undo data is retained in the undo tablespaces. Undo data must be retained for the length of the longest running query, the longest running transaction, and the longest flashback duration (except for Flashback Database). The undo tablespace should be sized large enough to hold the undo generated by the database during the undo retention period. Note that the undo retention parameter is also used as the retention value for LOB columns.

Analysis Period

Analysis Time Period

Last One Hour

Desired Undo Retention

Automatically chosen based on longest query in analysis period

Specified manually to allow for longer duration queries or flashback

Duration

minutes

Analysis Results

Selected Analysis Time Period Jun 17, 2009 11:04:47 AM GMT+07:00 To J
PM GMT+07:00

Minimum Required Undo Tablespace Size

(MB)

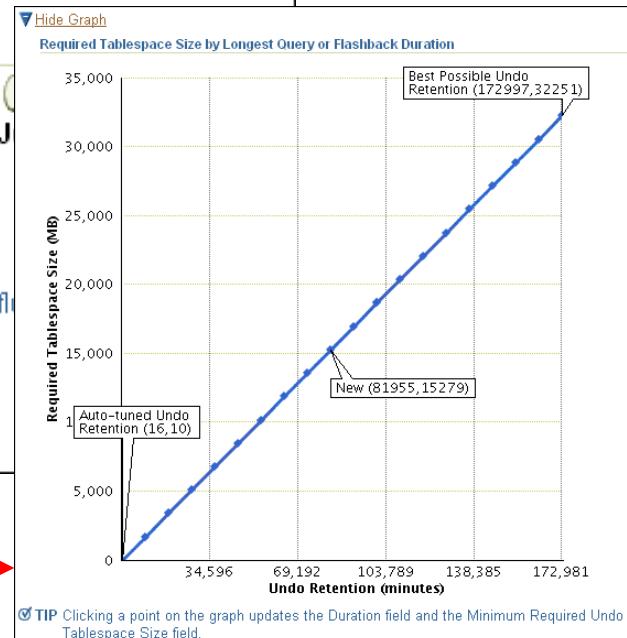
10

Recommended Undo Tablespace Size (MB)

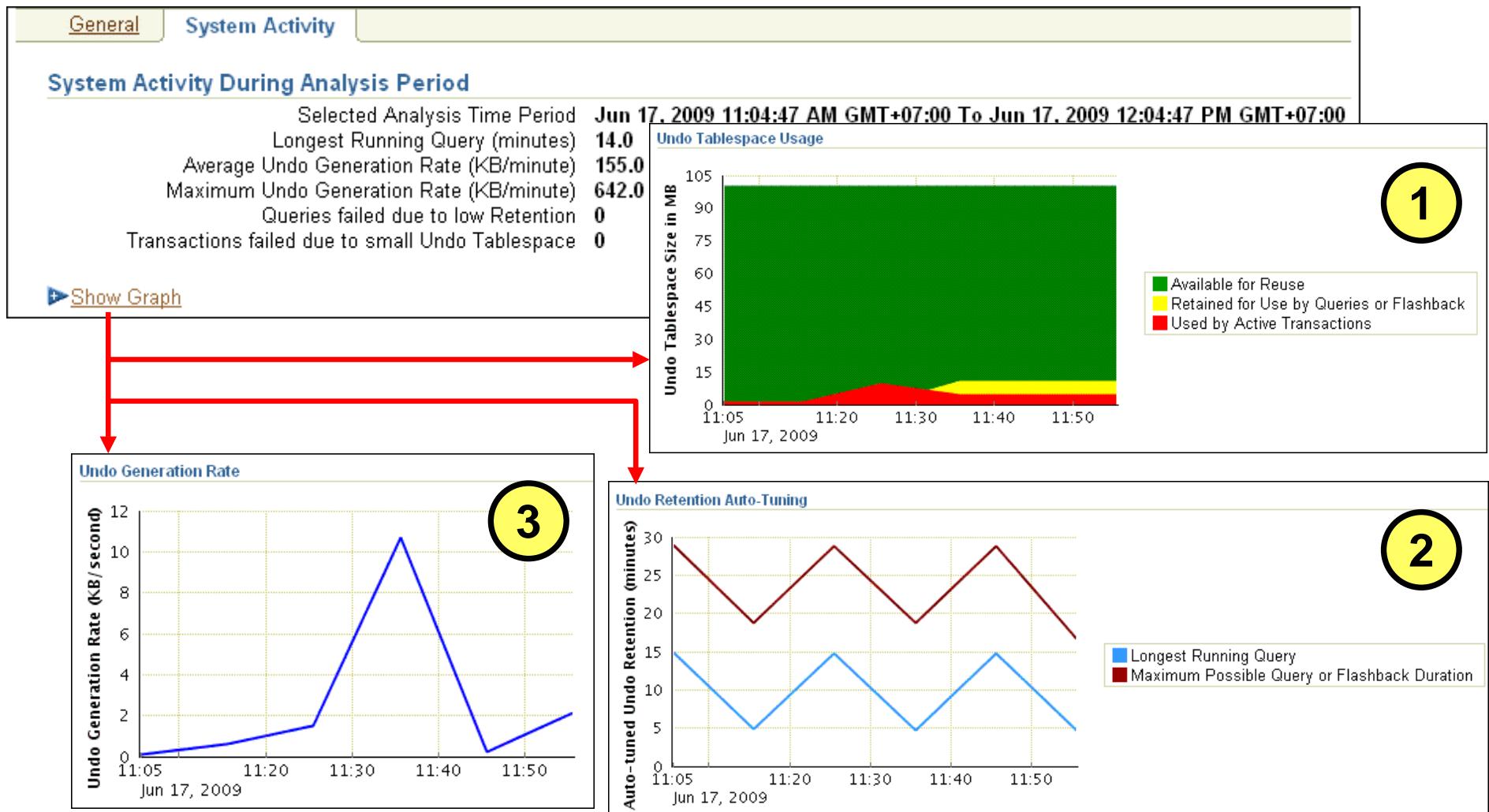
15

TIP Recommended size is three times the minimum size to allow for workload fl

Potential Problems **No Problem Found**
Recommendations **No Recommendation**



Viewing System Activity



Quiz

All you need to do to guarantee that all queries under 15 minutes will find the undo data needed for read consistency, is set the `UNDO_RETENTION` parameter to 15 minutes.

1. True
2. False

Quiz

Which statement does not relate to undo data?

1. Provides a record of how to undo a change
2. Is used for rollback, read consistency, and flashback
3. Is stored in memory only, not written to disk
4. Protects against inconsistent reads in a multiuser system

Summary

In this lesson, you should have learned how to:

- Explain DML and undo data generation
- Monitor and administer undo data
- Describe the difference between undo data and redo data
- Configure undo retention
- Guarantee undo retention
- Use the Undo Advisor



Practice 10 Overview: Managing Undo Segments

This practice covers the following topics:

- Viewing system activity
- Calculating undo tablespace sizing to support a 48-hour retention interval
- Modifying an undo tablespace to support a 48-hour retention interval



11

Implementing Oracle Database Auditing

Objectives

After completing this lesson, you should be able to:

- Describe DBA responsibilities for security and auditing
- Enable standard database auditing
- Specify audit options
- Review audit information
- Maintain the audit trail



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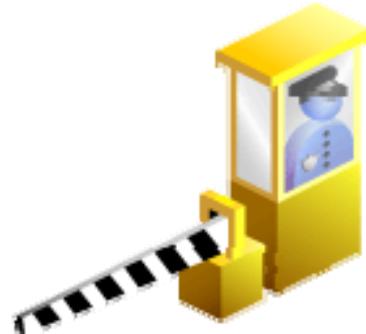
Separation of Responsibilities

- Users with DBA privileges must be trusted.
 - Abuse of trust
 - Audit trails protecting the trusted position
- DBA responsibilities must be shared.
- Accounts must never be shared.
- The DBA and the system administrator must be different people.
- Separate operator and DBA responsibilities.

Database Security

A secure system ensures the confidentiality of the data that it contains. There are several aspects of security:

- Restricting access to data and services
- Authenticating users
- Monitoring for suspicious activity



Monitoring for Compliance

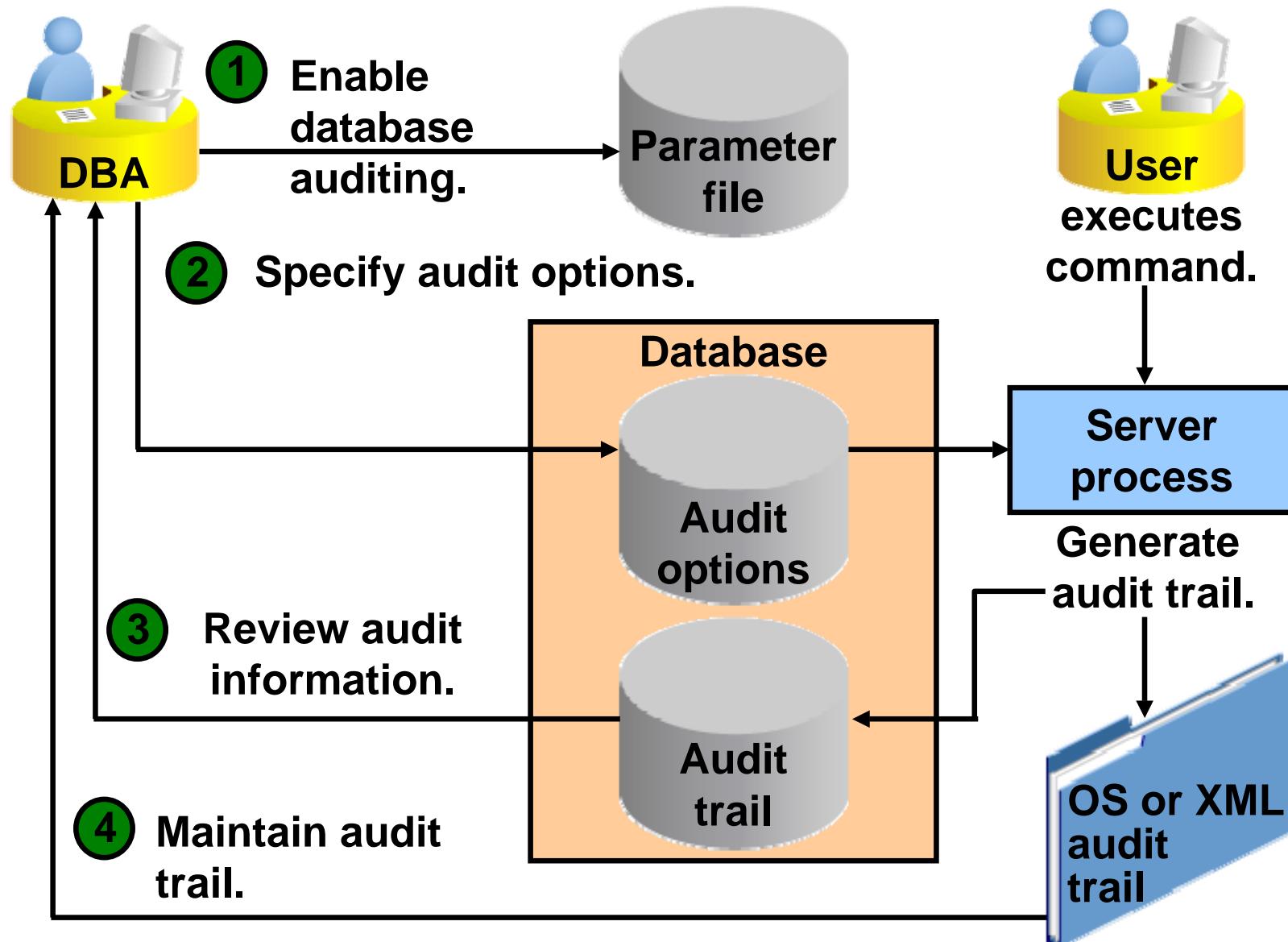
Monitoring or auditing must be an integral part of your security procedures.

Review the following:

- Mandatory auditing
- Standard database auditing
- Value-based auditing
- Fine-grained auditing (FGA)
- SYSDBA (and SYSOPER) auditing



Standard Database Auditing



Configuring the Audit Trail

Use `AUDIT_TRAIL` to enable database auditing.

Database Instance: orcl.oracle.com > Logged in As SYS

Initialization Parameters

SPFile

The parameter values listed here are from the SPFILE +DATA/orcl/spfileorcl.ora

Name Basic Dynamic Category
audit All All All Go

Filter on a name or partial name

Apply changes in SPFile mode to the current running instance(s). For static parameters, you must restart the database.

Reset

| Select | Name ▲ | Help | Revisions | Value | Comments | Type | Basic | Dynamic | Category |
|----------------------------------|----------------------|-------------------|-----------|--------------------------------|----------|---------|-------------------------------------|---------|-----------------------|
| <input checked="" type="radio"/> | audit_file_dest | ? | | /1/app/oracle/admin/orcl/audit | | String | <input checked="" type="checkbox"/> | | Security and Auditing |
| <input type="radio"/> | audit_sys_operations | ? | | Unspecified | | Boolean | | | Security and Auditing |
| <input type="radio"/> | audit_syslog_level | | | | | String | | | Miscellaneous |
| <input type="radio"/> | audit_trail | ? | | XML | | String | | | Security and Auditing |

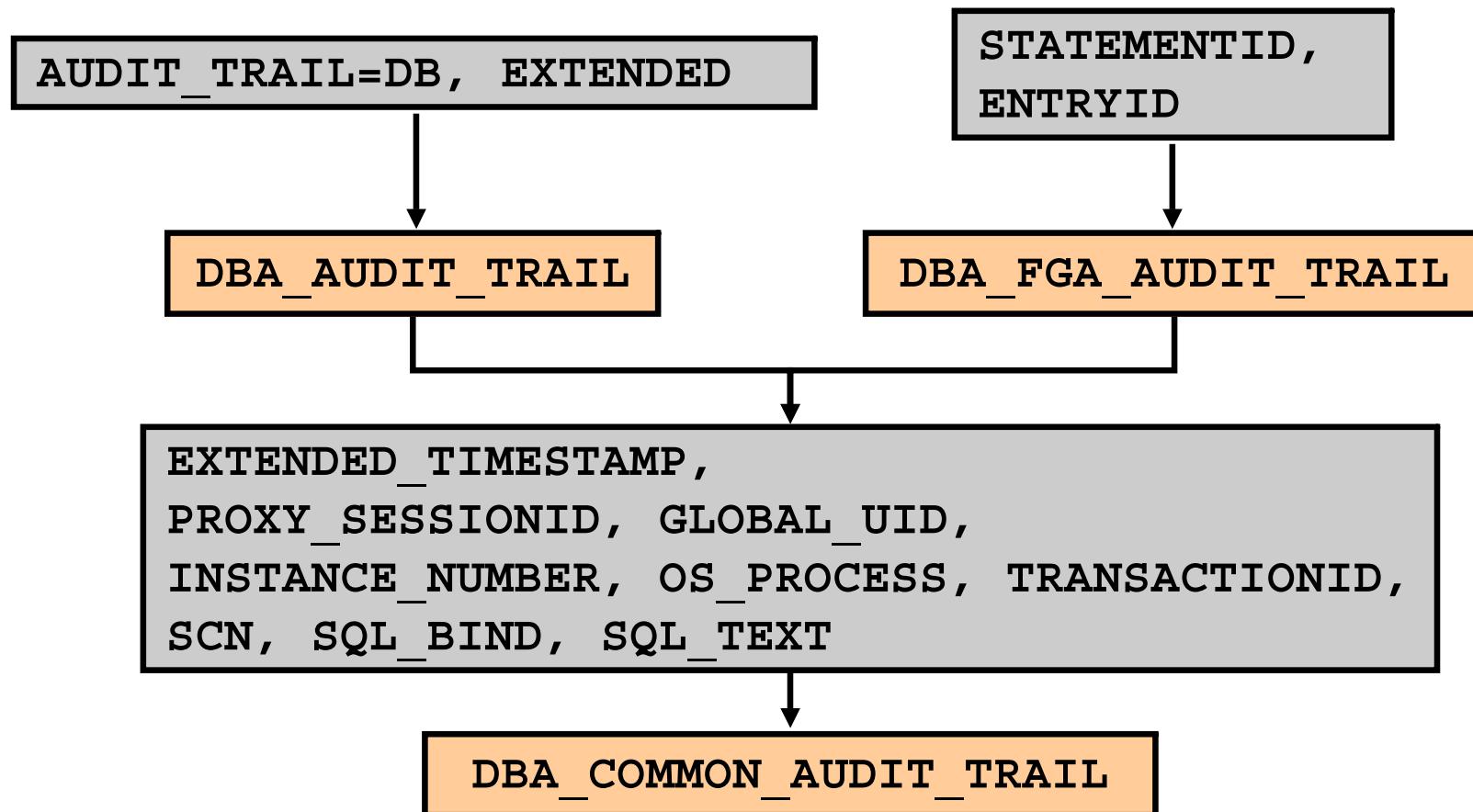
Audit trail can be set to:
• NONE
• OS
• DB
• DB, EXTENDED
• XML
• XML, EXTENDED

```
ALTER SYSTEM SET AUDIT_TRAIL='XML' SCOPE=SPFILE;
```

Restart database after modifying this static initialization parameter.



Uniform Audit Trails



Specifying Audit Options

- SQL statement auditing:

```
AUDIT table;
```

- System-privilege auditing (nonfocused and focused):

```
AUDIT select any table, create any trigger;
```

```
AUDIT select any table BY hr BY SESSION;
```

- Object-privilege auditing (nonfocused and focused):

```
AUDIT ALL on hr.employees;
```

```
AUDIT UPDATE,DELETE on hr.employees BY ACCESS;
```



Default Auditing

| Privileges Audited by Default | | |
|-------------------------------|-----------------------------|----------------------|
| ALTER ANY PROCEDURE | CREATE ANY LIBRARY | GRANT ANY PRIVILEGE |
| ALTER ANY TABLE | CREATE ANY PROCEDURE | GRANT ANY ROLE |
| ALTER DATABASE | CREATE ANY TABLE | DROP ANY PROCEDURE |
| ALTER PROFILE | CREATE EXTERNAL JOB | DROP ANY TABLE |
| ALTER SYSTEM | CREATE PUBLIC DATABASE LINK | DROP PROFILE |
| ALTER USER | CREATE SESSION | DROP USER |
| AUDIT SYSTEM | CREATE USER | EXEMPT ACCESS POLICY |
| CREATE ANY JOB | GRANT ANY OBJECT PRIVILEGE | |
| Statements Audited by Default | | |
| SYSTEM AUDIT BY ACCESS | | |
| ROLE BY ACCESS | | |

Enterprise Manager Audit Page

Security

[Users](#)
[Roles](#)
[Profiles](#)
Audit Settings
[Transparent Data Encryption](#)

Audit Settings

i Audit information can be located in the database or in an OS file. Some information is always written to the OS audit file. Other information can optionally be written to either the OS audit file or to the database.

Configuration

| | |
|---------------------------|--|
| Audit Trail | DB |
| Audit SYS User Operations | FALSE |
| Audit File Directory | /u01/app/oracle/admin/orcl/adump |
| | Audit File Directory value is effective only when Audit Trail is set to "OS" or "XML". |

Audit Trails

| | |
|------------------------------|---------------------------------------|
| Database Audit Trail | Audited Failed Logins |
| | Audited Privileges |
| | Audited Objects |
| Operating System Audit Trail | View OS Audit Trails |

Default Options For Future Audited Objects [0](#)

 [Audited Privileges \(23\)](#) [Audited Objects \(0\)](#) [Audited Statements \(2\)](#)

| Privilege | Select | Privilege | User | Proxy | Success | Failure |
|-----------|--------------------------|-----------------|------|-------|-----------|-----------|
| | <input type="checkbox"/> | DROP PROFILE | | | BY ACCESS | BY ACCESS |
| | <input type="checkbox"/> | ALTER ANY TABLE | | | BY ACCESS | BY ACCESS |
| | <input type="checkbox"/> | ALTER SYSTEM | | | BY ACCESS | BY ACCESS |
| | <input type="checkbox"/> | ALTER DATABASE | | | BY ACCESS | BY ACCESS |
| | <input type="checkbox"/> | DROP USER | | | BY ACCESS | BY ACCESS |

Using and Maintaining Audit Information

The screenshot shows two panels. The left panel, titled 'Audit Trails', lists 'Database Audit Trail' with links to 'Audited Failed Logins', 'Audited Privileges', and 'Audited Objects'. It also lists 'Operating System Audit Trail' with a link to 'View OS Audit Trails'. A red box highlights the 'Audited Objects' link, and a red arrow points from it to the right panel. The right panel, titled 'Audited Objects', contains a SQL query: 'SELECT 'OWNER', 'OBJ_NAME', 'USERNAME', 'ACTION_NAME', 'TIMESTAMP' FROM 'SYS'.'DBA_AUDIT_OBJECT''. Below the query is a table with the following data:

| Schema | Object Name | User Name | Action | Time |
|-----------|-----------------|-----------|--------------|-----------------------|
| INVENTORY | PRODUCT_MASTER | DBA1 | ALTER TABLE | 2008-08-13 22:47:56.0 |
| INVENTORY | PRODUCT_ON_HAND | DBA1 | CREATE TABLE | 2008-08-13 16:45:49.0 |

Buttons at the top right of the right panel include 'Filter Result' and 'Return'. At the bottom are navigation links 'Previous 25', '26-34 of 34', and 'Next'.

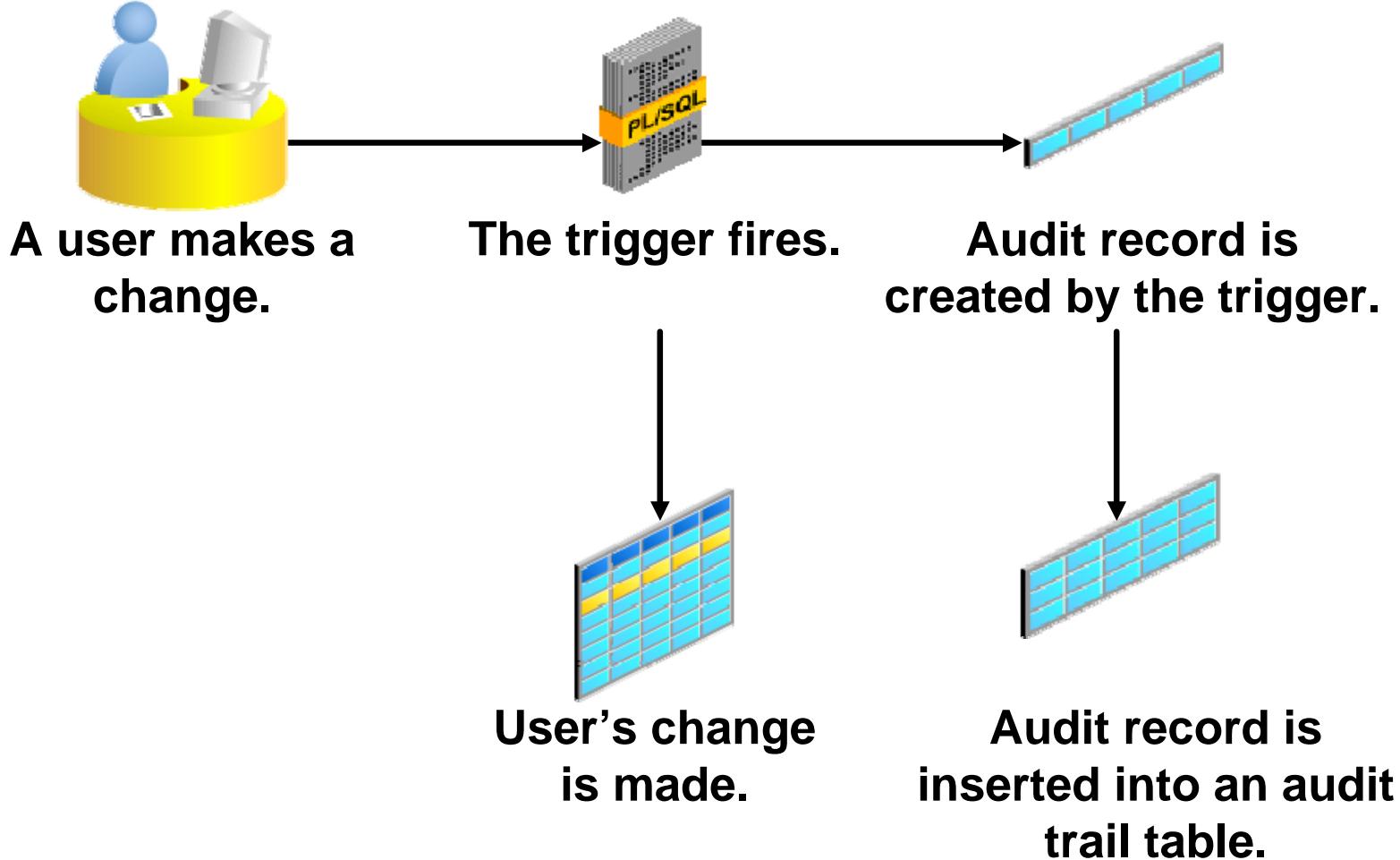
Disable audit options if you are not using them.

A confirmation dialog box titled 'Confirmation' asks: 'Are you sure you want to remove the 4 selected audited objects?'. It states: 'The audited statements you remove will no longer be audited on the objects.' Below is a 'Hide SQL' link and a list of four NOAUDIT statements:

```
NOAUDIT COMMENT ON HR.EMPLOYEES
NOAUDIT INDEX ON HR.EMPLOYEES
NOAUDIT LOCK ON HR.EMPLOYEES
NOAUDIT RENAME ON HR.EMPLOYEES
```

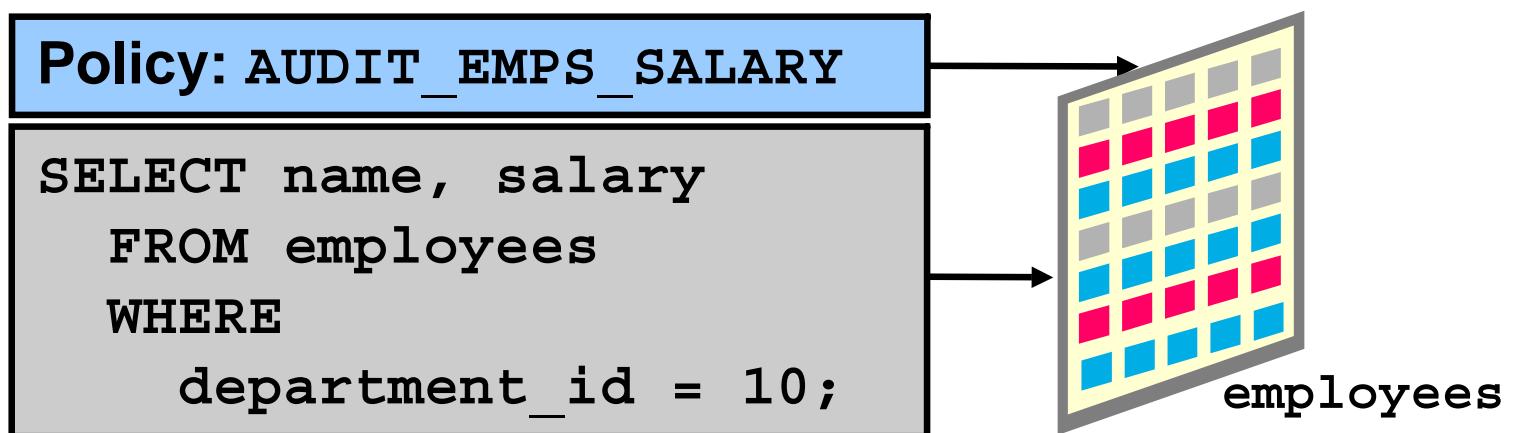
At the bottom are 'No' and 'Yes' buttons.

Value-Based Auditing



Fine-Grained Auditing

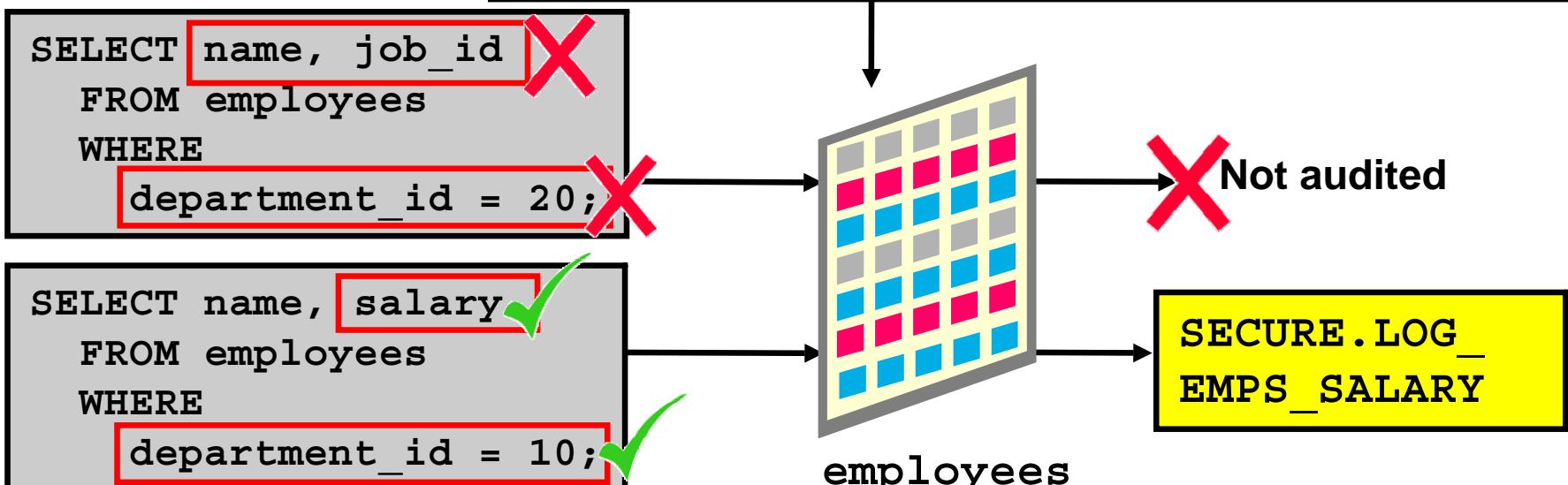
- Monitors data access on the basis of content
- Audits SELECT, INSERT, UPDATE, DELETE, and MERGE
- Can be linked to one or more columns in a table or view
- May execute a procedure
- Is administered with the DBMS_FGA package



FGA Policy

- Defines:
 - Audit criteria
 - Audit action
- Is created with DBMS_FGA .ADD_POLICY

```
dbms_fga.add_policy (
    object_schema  => 'HR',
    object_name     => 'EMPLOYEES',
    policy_name   => 'audit_emps_salary',
    audit_condition=> 'department_id=10',
    audit_column     => 'SALARY,COMMISSION_PCT',
    handler_schema  => 'secure',
    handler_module   => 'log_emps_salary',
    enable           => TRUE,
    statement_types => 'SELECT,UPDATE');
```



Audited DML Statement: Considerations

- Records are audited if the FGA predicate is satisfied and the relevant columns are referenced.
- DELETE statements are audited regardless of columns specified.
- MERGE statements are audited with the underlying INSERT, UPDATE, and DELETE generated statements.

Not audited because none of the records involved are for department 10.

```
UPDATE hr.employees  
SET salary = 1000  
WHERE commission_pct = .2;
```



```
UPDATE hr.employees  
SET salary = 1000  
WHERE employee_id = 200;
```

FGA Guidelines

- To audit all rows, use a null audit condition.
- To audit all columns, use a null audit column.
- Policy names must be unique.
- The audited table or view must already exist when you create the policy.
- If the audit condition syntax is invalid, an ORA-28112 error is raised when the audited object is accessed.
- If the audited column does not exist in the table, no rows are audited.
- If the event handler does not exist, no error is returned and the audit record is still created.

SYSDBA Auditing

Users with SYSDBA or SYSOPER privileges can connect when the database is closed.

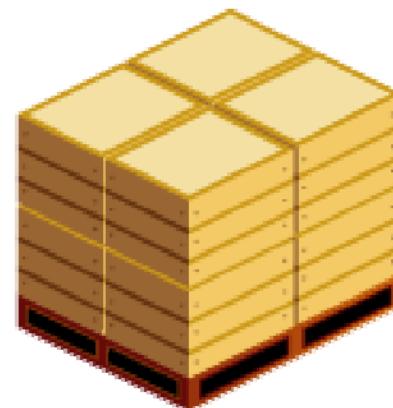
- Audit trail must be stored outside the database.
- Connections as SYSDBA or SYSOPER are always audited.
- You can enable additional auditing of SYSDBA or SYSOPER actions with AUDIT_SYS_OPERATIONS.
- You can control the audit trail with AUDIT_FILE_DEST.



Maintaining the Audit Trail

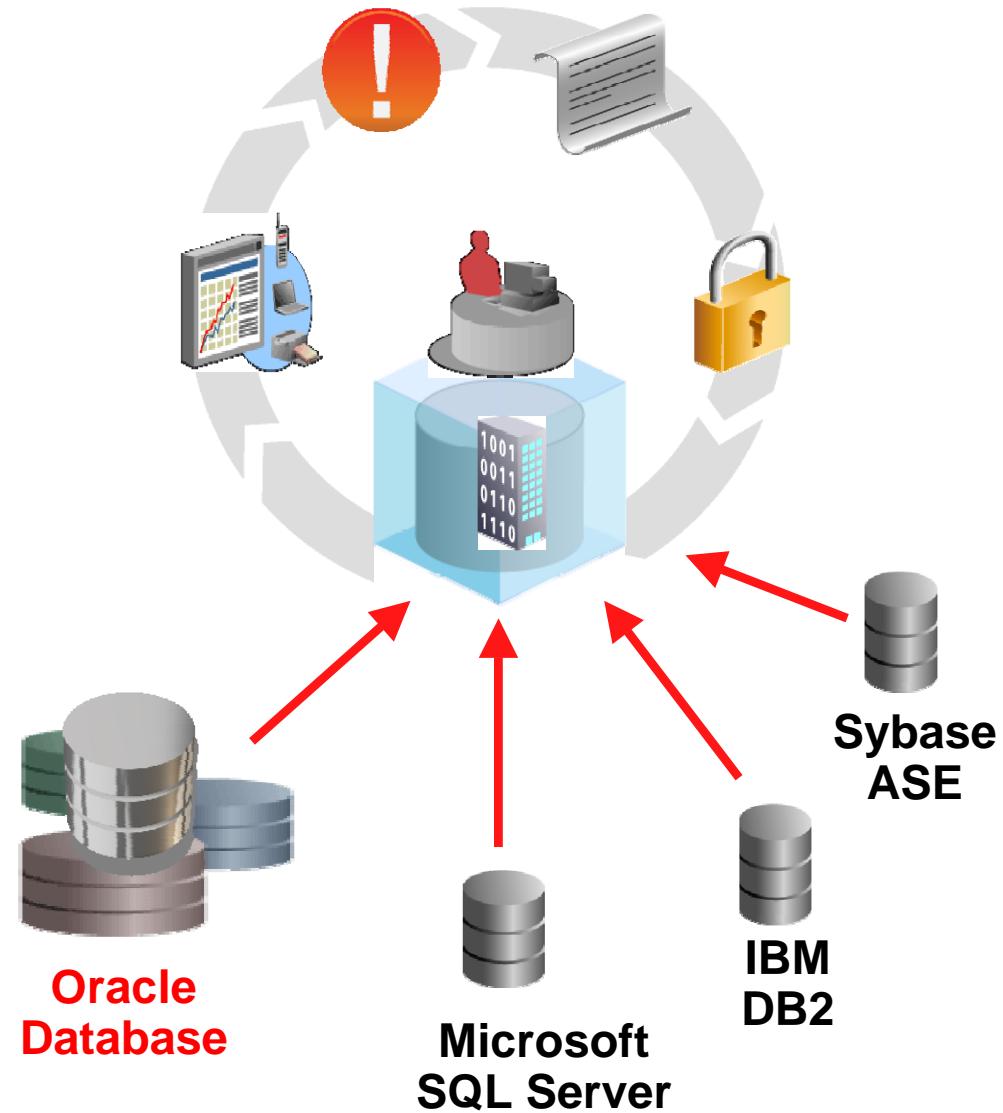
The audit trail should be maintained with the following best-practice guidelines:

- Review and store old records.
- Prevent storage problems.
- Avoid loss of records.



Oracle Audit Vault

- Consolidate and secure audit data
 - Oracle 9*i* Release 2 and higher
 - SQL Server 2000, 2005
 - IBM DB2 UDB 8.5 & 9.2
 - Sybase ASE 12.5 - 15.0
 - Secure and scalable
 - Cleanup of source Oracle audit data
- Centralized reporting
 - Updated reports interface using widely popular Oracle Application Express
 - Standard reports for compliance
 - New custom reports
- Alert on security threats
 - Detect and alert on security relevant events



Quiz

Standard database auditing captures the before and after changes of a DML transaction.

1. True
2. False

Quiz

Auditing of SYSDBA and SYSOPER actions is enabled by default.

1. True
2. False

Summary

In this lesson, you should have learned how to:

- Describe DBA responsibilities for security and auditing
- Enable standard database auditing
- Specify audit options
- Review audit information
- Maintain the audit trail



Practice 11 Overview: Implementing Oracle Database Security

This practice covers the following topics:

- Enabling standard database auditing
- Specifying audit options for the HR.JOBS table
- Updating the table
- Reviewing audit information
- Maintaining the audit trail



12

Database Maintenance

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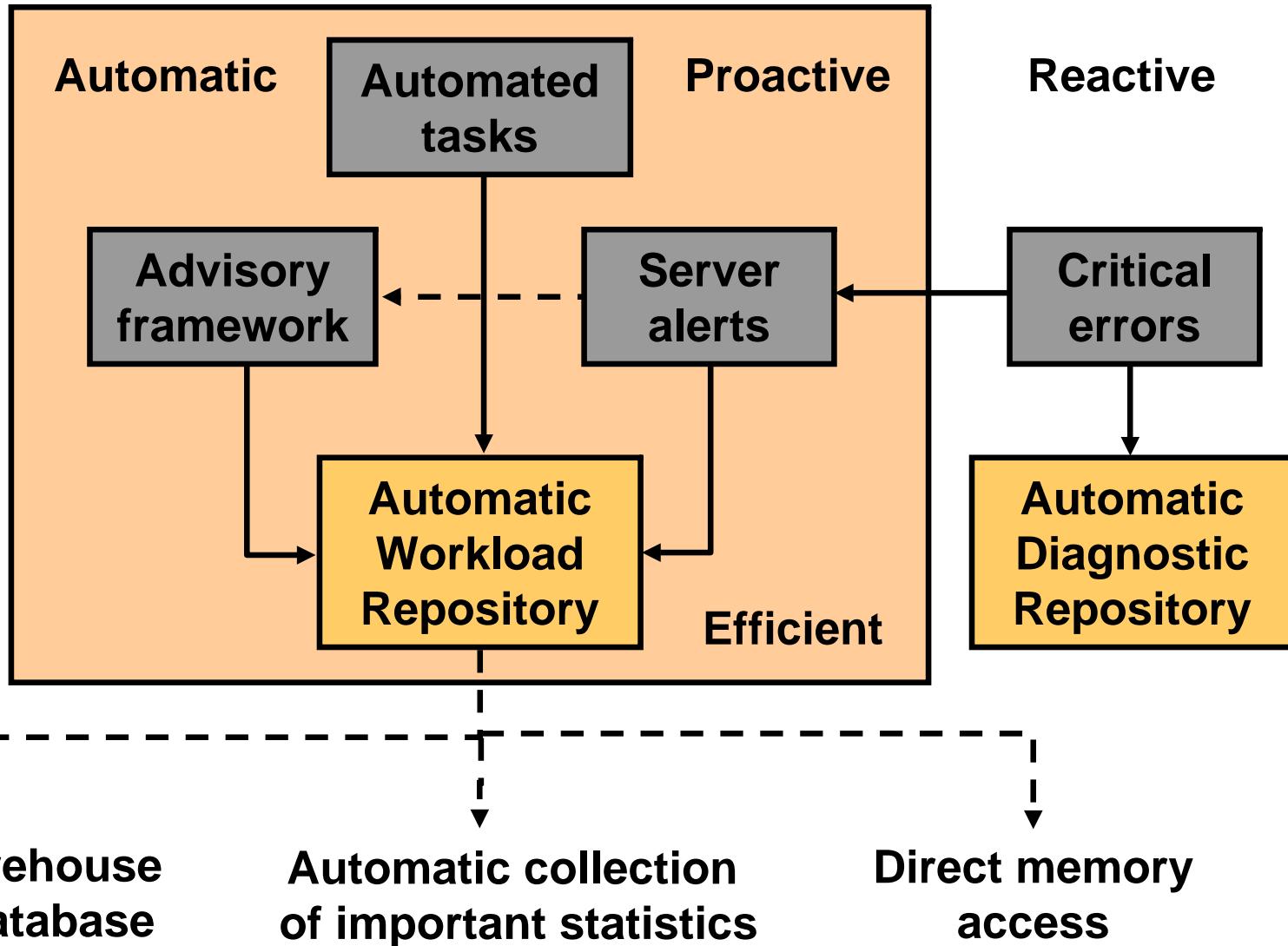
Copyright © 2009, Oracle. All rights reserved.

Objectives

After completing this lesson, you should be able to:

- Manage optimizer statistics
- Manage the Automatic Workload Repository (AWR)
- Use the Automatic Database Diagnostic Monitor (ADDM)
- Describe and use the advisory framework
- Set alert thresholds
- Use server-generated alerts
- Use automated tasks

Database Maintenance



Viewing the Alert History

Related Links

| | | |
|-------------------------------|-------------------------------|--------------------------|
| Access | Add Exadata Cell Targets | Advisor Central |
| Alert History | Alert Log Contents | All Metrics |
| Baseline Metric Thresholds | Blackouts | EM SQL History |
| Jobs | Metric and Policy Settings | Metric Collection Errors |
| Monitoring Configuration | Monitor in Memory Access Mode | Policy Groups |
| Scheduler Central | SQL Worksheet | Target Properties |
| User-Defined Metrics | | |

Alert History

Page Refreshed Jun 19, 2009 11:40:17 PM GMT+07:00
View Data Last 24 hours

| Metric | History |
|-----------------|--|
| Audited User |  |
| Instance Status |  |
| Mounted |  |

Key

- Critical
- Warning
- Clear
- No Data

11:40 3 6 9 12 PM 3 6 9
18 June 2009

Severity **Timestamp ▾** **Message** **Last Comment** **Details**

| | | | | |
|---|-------------------------|---|---|---|
| ✓ | Jun 19, 2009 2:02:12 AM | The instance is down, and health check reported: . | - | - |
| ✗ | Jun 19, 2009 1:32:12 AM | The instance is down, and health check reported: Instance Shutdown. | - | - |
| ✓ | Jun 18, 2009 5:31:15 AM | The instance is down, and health check reported: . | - | - |

Terminology

- Automatic Workload Repository (AWR): Infrastructure for data gathering, analysis, and solutions recommendations
- AWR Baseline: A set of AWR snapshots for performance comparison
- Metric: Rate of change in a cumulative statistic
- Statistics: Data collections providing database and object detail
 - Optimizer statistics: Used by query optimizer
 - Database statistics: Used for performance
- Threshold: A boundary value against which metric values are compared



ORACLE

Oracle Optimizer: Overview

The Oracle optimizer determines the most efficient execution plan and is the most important step in the processing of any SQL statement.

The optimizer:

- Evaluates expressions and conditions
- Uses object and system statistics
- Decides how to access the data
- Decides how to join tables
- Determines the most efficient path

Optimizer Statistics

Optimizer statistics are:

- A snapshot at a point in time
- Persistent across instance restarts
- Collected automatically

```
SQL> SELECT COUNT(*) FROM hr.employees;
      COUNT(*)
-----
      214

SQL> SELECT num_rows FROM dba_tables
  2 WHERE owner='HR' AND table_name = 'EMPLOYEES';
      NUM_ROWS
-----
      107
```

Using the Manage Optimizer Statistics Page

Database Instance: orcl.oracle.com

[Home](#) [Performance](#) [Availability](#) [Server](#) [Schema](#) [Data Movement](#) [Software and Support](#)

Query Optimizer

[Manage Optimizer Statistics](#)

[SQL Plan Control](#)

Manage Optimizer Statistics

Database **orcl.oracle.com**

Optimizer Statistics are used by the query optimizer to choose the best execution plan for each SQL statement. Up-to-date optimizer statistics can greatly improve the performance of SQL statements.

Operations

[Gather Optimizer Statistics](#)

[Restore Optimizer Statistics](#)

[Lock Optimizer Statistics](#)

[Unlock Optimizer Statistics](#)

[Delete Optimizer Statistics](#)

Related Links

[Object Statistics](#)

[Global Statistics Gathering Options](#)

[Object Level Statistics Gathering Preferences](#)

[Job Scheduler](#)

[Automated Maintenance Tasks](#)

Gathering Optimizer Statistics Manually

Manage Optimizer Statistics

Database orcl.oracle.com

Optimizer Statistics are used by the query statistics can greatly improve the performance.

Operations

[Gather Optimizer Statistics](#) (highlighted with a red box)

[Restore Optimizer Statistics](#)

[Lock Optimizer Statistics](#)

[Unlock Optimizer Statistics](#)

[Delete Optimizer Statistics](#)

Scope Objects Customize Options Schedule Review

i Information

For 11, Oracle recommends you enable automated maintenance task (Optimizer Statistics Gathering) to generate optimizer statistics regularly within maintenance windows. This wizard should only be used for cases where the task is inappropriate or disabled. For example, you may want to gather optimizer statistics immediately, or the task failed to execute within a maintenance window, or you want to customize options to gather optimizer statistics.

Gather Optimizer Statistics: Scope

Database orcl.oracle.com Logged In As SYS Cancel Step 1 of 5 Next

Task Status Enabled Scope Database

Select the type of object for which you want to gather optimizer statistics.

Object Type Database
 Schema
 Tables
 Indexes
 Fixed Objects
In-memory structures/variables of the RDBMS that are exposed in the form of dynamic performance tables.
 Dictionary Objects
Objects in 'SYS', 'SYSTEM' and all non-user defined schemas.

TIP The Objects step will be skipped when Database, Fixed Objects or Dictionary Objects is selected.

Preferences for Gathering Statistics



Optimizer
statistics
gathering
task

SCOPE

STATEMENT LEVEL
TABLE LEVEL
SCHEMA LEVEL
DATABASE LEVEL
GLOBAL LEVEL



DBMS_STATS
set | get | delete | export | import

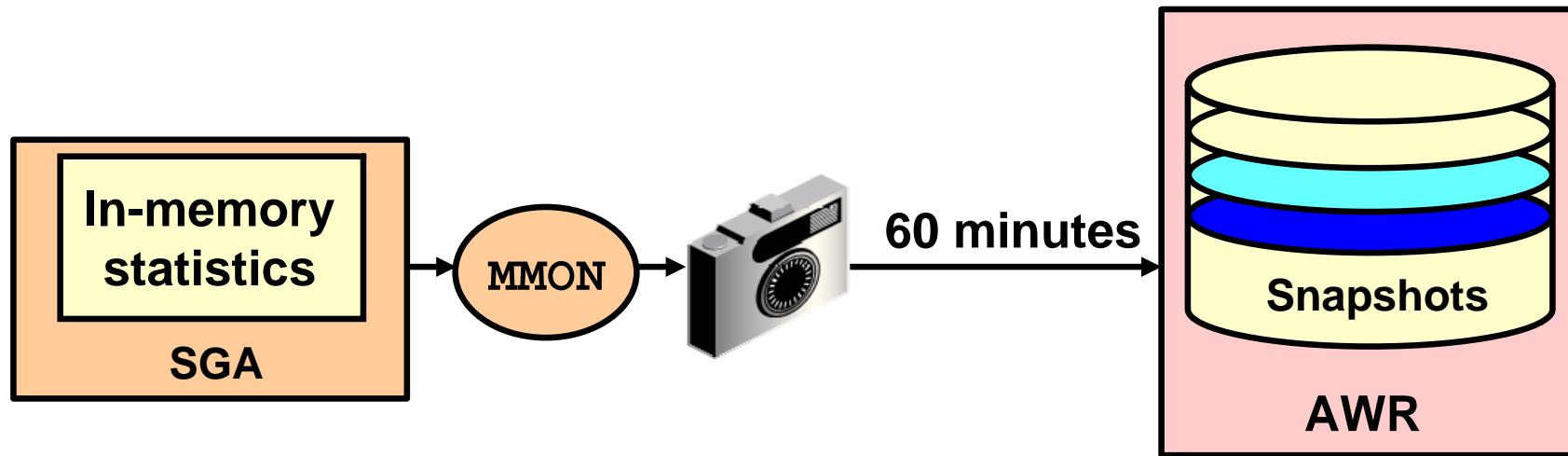
PREFERENCES

CASCADE
DEGREE
ESTIMATE_PERCENT
NO_INVALIDATE
METHOD_OPT
GRANULARITY
INCREMENTAL
PUBLISH
STALE_PERCENT

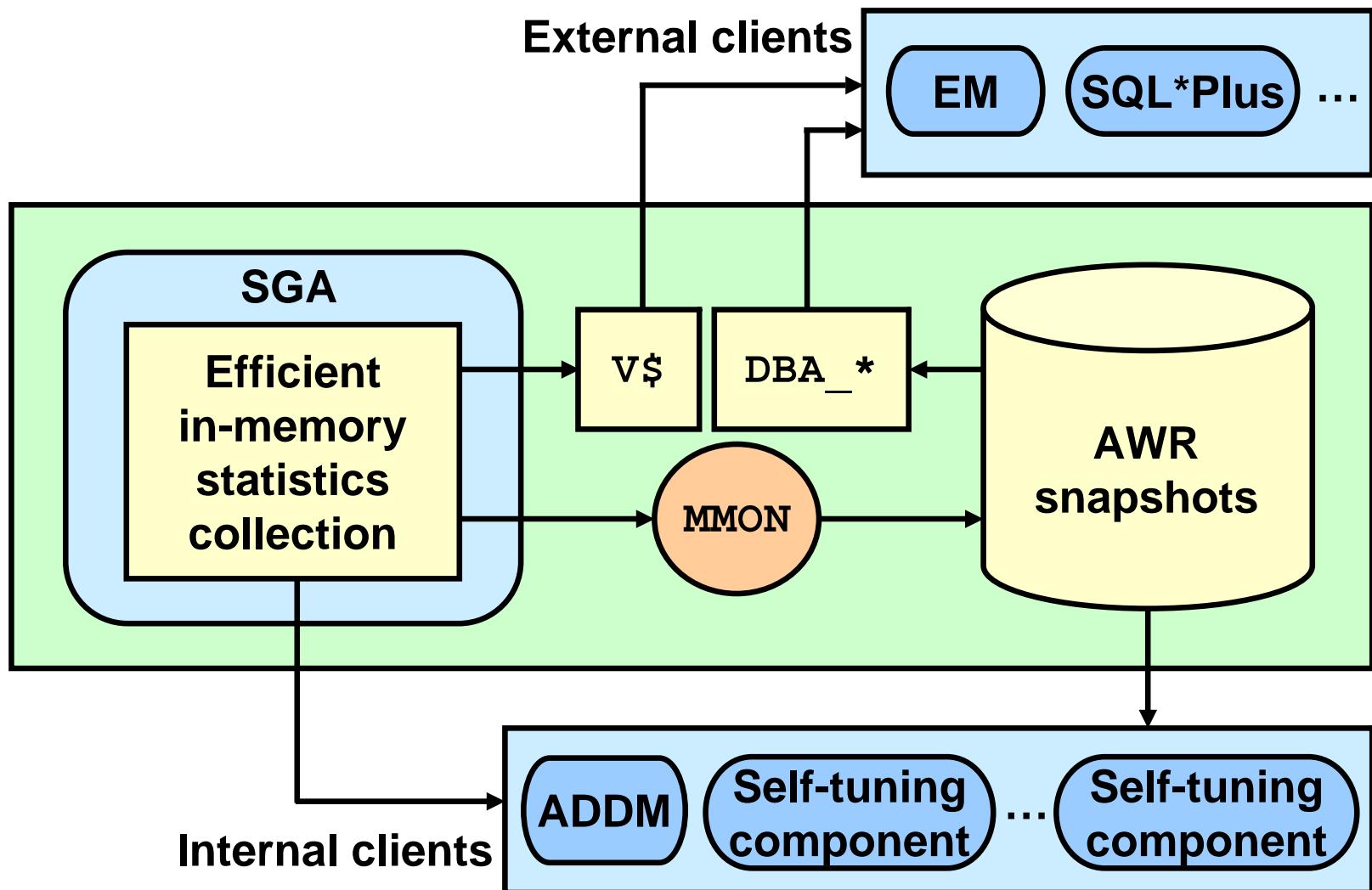
```
exec dbms_stats.set_table_prefs('SH','SALES','STALE_PERCENT','13');
```

Automatic Workload Repository (AWR)

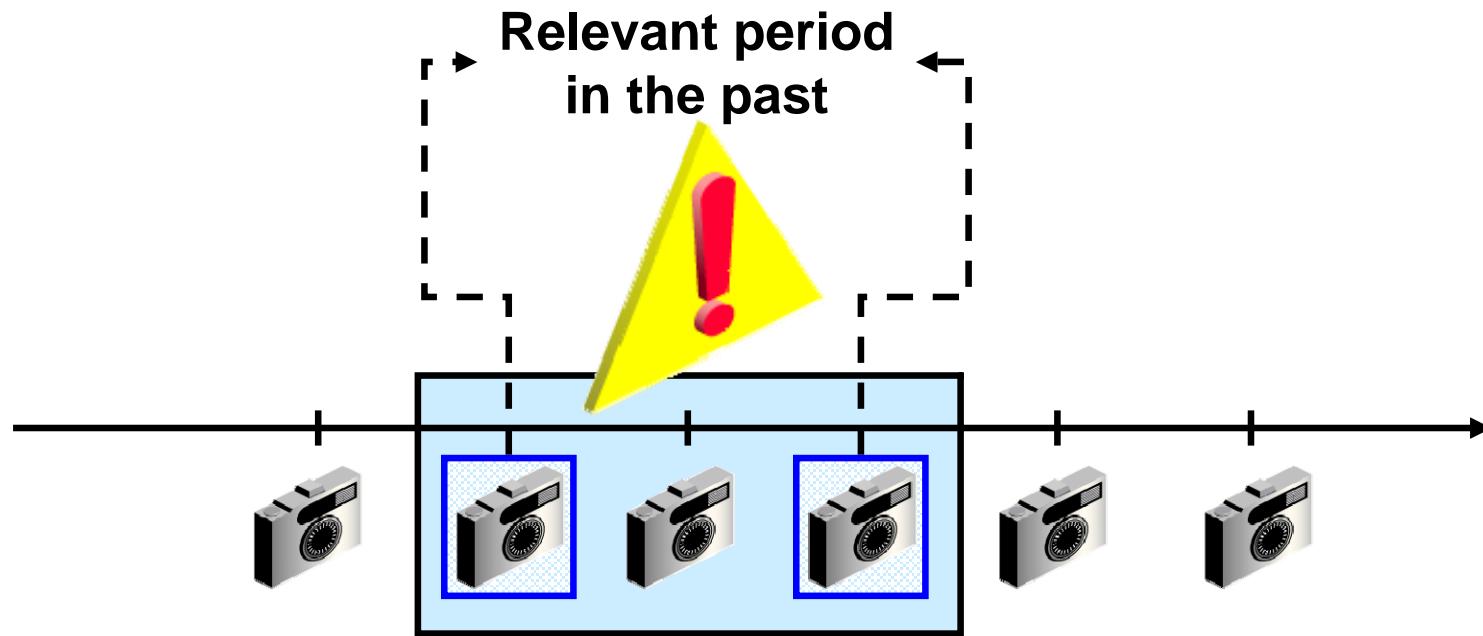
- Built-in repository of performance information
- Snapshots of database metrics taken every 60 minutes and retained for eight days
- Foundation for all self-management functions



AWR Infrastructure



AWR Baselines



```
DBMS_WORKLOAD_REPOSITORY.CREATE_BASELINE ( -  
    start_snap_id IN NUMBER,  
    end_snap_id   IN NUMBER,  
    baseline_name IN VARCHAR2);
```

Enterprise Manager and the AWR

The screenshot shows the Oracle Enterprise Manager interface with the 'Server' tab selected. On the left, there's a sidebar under 'Storage' and 'Statistics Management'. The 'Automatic Workload Repository' link in 'Statistics Management' is highlighted with a red box and a red arrow pointing to it from below.

Automatic Workload Repository

Page Refreshed Aug 21, 2008 9:47:11 PM MDT [Refresh](#)

The Automatic Workload Repository is used for storing database statistics that are used for performance tuning.

General

[Edit](#)

Snapshot Retention (days) 8
Snapshot Interval (minutes) 60
Collection Level **TYPICAL**

Next Snapshot Capture Time **Aug 21, 2008 10:00:49 PM**

Manage Snapshots and Baselines

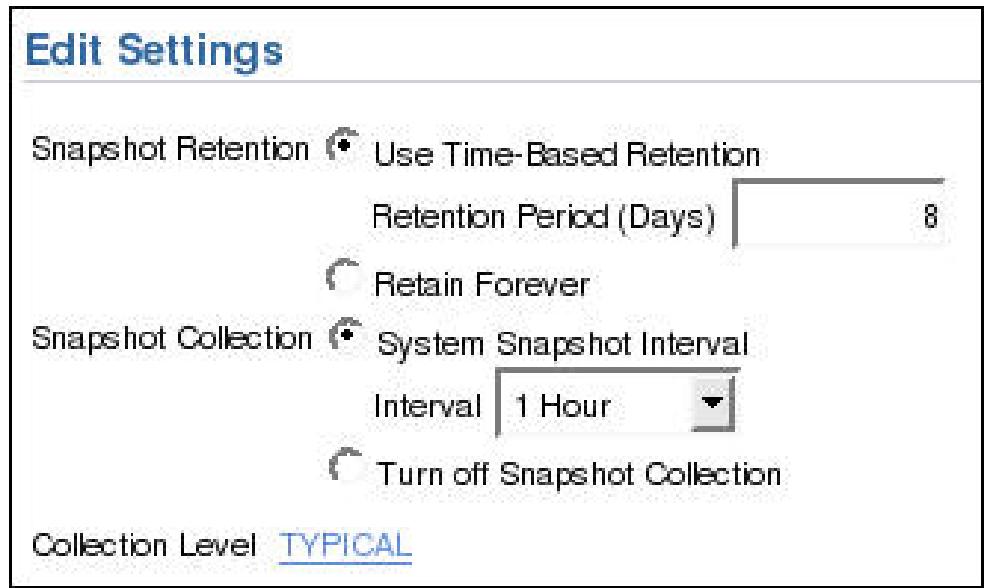
[Run AWR Report](#)

Snapshots [195](#)
Baselines [1](#)

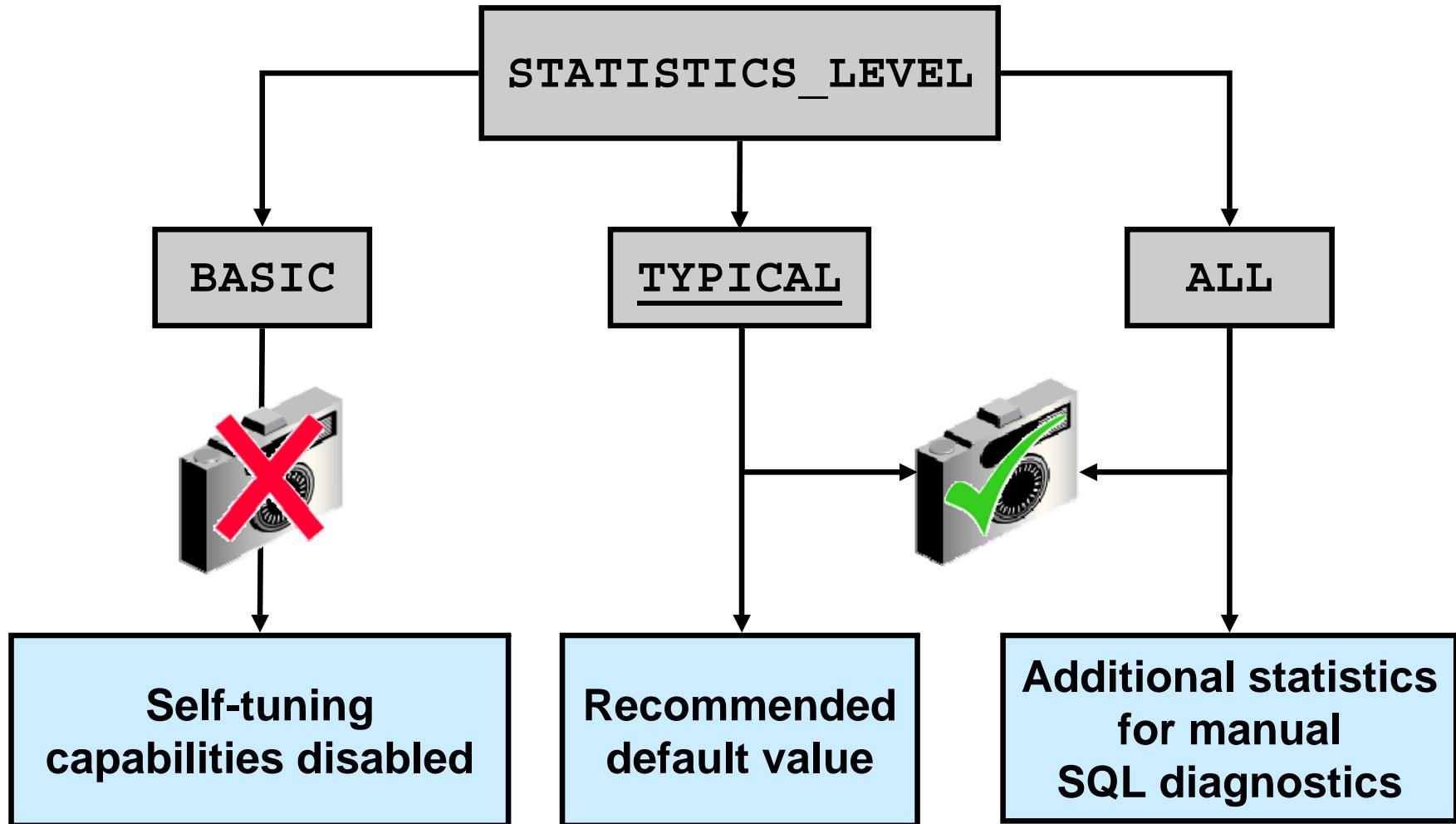
Latest Snapshot Time **Aug 21, 2008 9:00:49 PM**
Earliest Snapshot Time **Aug 13, 2008 7:00:26 PM**

Managing the AWR

- Retention period
 - Default: Eight days
 - Consider storage needs
- Collection interval
 - Default: 60 minutes
 - Consider storage needs and performance impact
- Collection level
 - Basic (disables most ADDM functionality)
 - Typical (recommended)
 - All (adds additional SQL tuning information to snapshots)

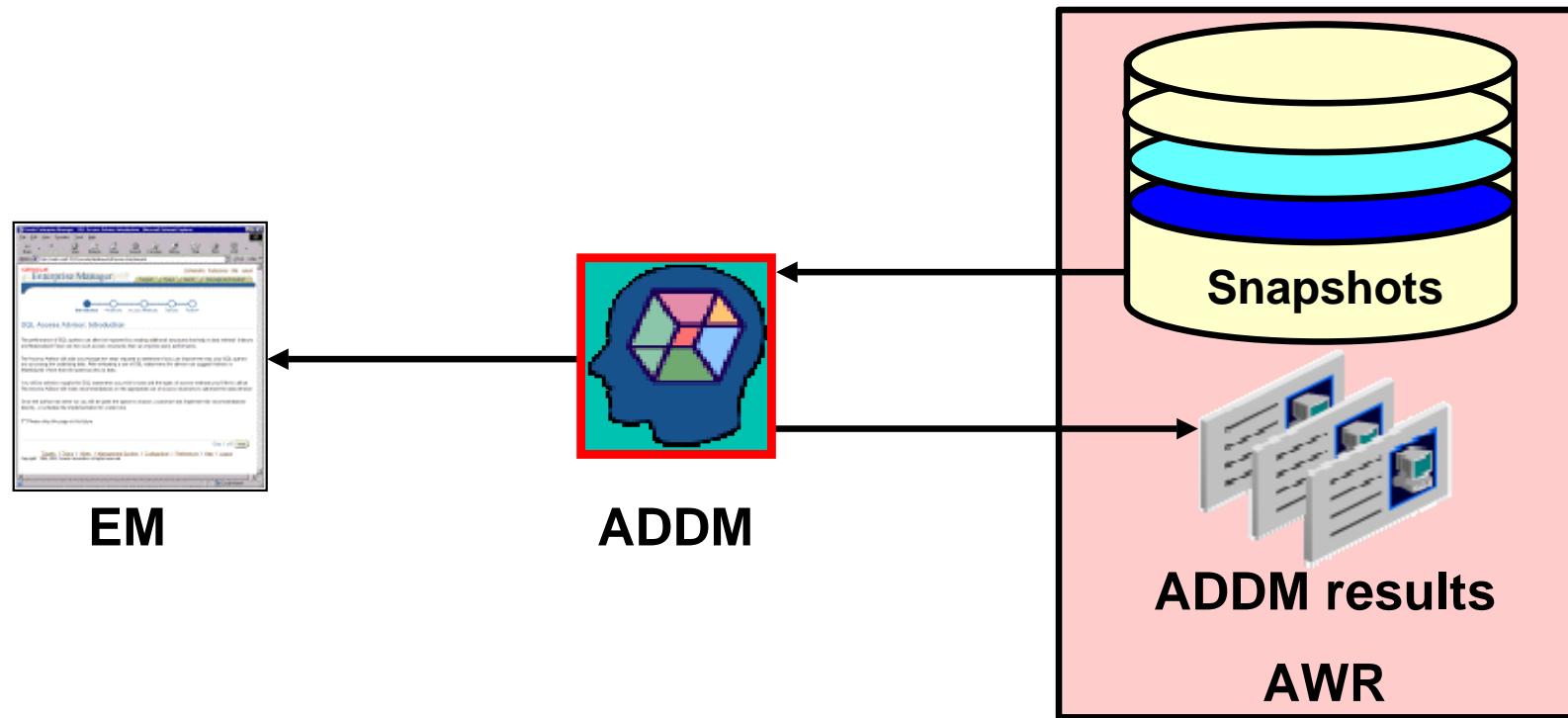


Statistic Levels



Automatic Database Diagnostic Monitor (ADDM)

- Runs after each AWR snapshot
- Monitors the instance; detects bottlenecks
- Stores results in the AWR



ADDM Findings

Icon Key
This is the legend for the various ADDM Task and Snapshot icons

Database Activity
The icon selected below indicates the analysis period.

Active Sessions
Jul 6, 2007

ADDM Task Legend

- Task(s) with findings
- Selected task with findings
- Task(s) with no findings
- Selected task with no findings
- Task(s) with errors
- Selected task with errors

Snapshot Legend

- Snapshot
- Start snapshot
- End snapshot

Run ADDM Finding History

Click on a different icon to select a different analysis period.

6 8 10 12 AM 2 7

Wait User I/O CPU

Zoom

see the [Icon Key](#)

Filters View Snapshots View Report

Period Duration 3.1 (minutes)

Task Owner SYS Average Active Sessions 0.8 Period Start Time Jul 7, 2007 3:50:05 AM GMT+07:00

| Impact (%) | Finding | Occurrences (last 24 hrs) |
|------------|----------------------------|---------------------------|
| 100 | Top SQL by DB Time | 7 of 27 |
| 23.5 | Unusual "Other" Wait Event | 2 of 27 |
| 16.8 | Buffer Busy | 6 of 27 |
| 12.7 | CPU Usage | 6 of 27 |

3

1

2

ADDM Recommendations

Performance Finding Details: Buffer Busy

| | | |
|---------------------------|--|---------------------------------|
| Finding | Read and write contention on database blocks was consuming significant database time. | Finding History |
| Impact (Active Sessions) | .14 | |
| Impact (%) |  16.8 | |
| Period Start Time | Jul 7, 2007 3:50:05 AM GMT+07:00 | |
| Period Duration (minutes) | 3.1 | |
| Filtered | No | Filters |

Recommendations

[Show All Details](#) | [Hide All Details](#)

| Details | Category | Benefit (%) |
|--|--|--|
| ▼ Hide | Schema |  16.8 |
| Action Consider using ORACLE's recommended solution of automatic segment space management in a locally managed tablespace for the tablespace "TBSSPC" containing the TABLE "SPC.SPCT" with object ID 82664. Alternatively, you can move this object to a different tablespace that is locally managed with automatic segment space management. | | |
| | Database Object SPC.SPCT | |

Rationale There was significant read and write contention on TABLE "SPC.SPCT" with object ID 82664.

Database Object [SPC.SPCT](#)

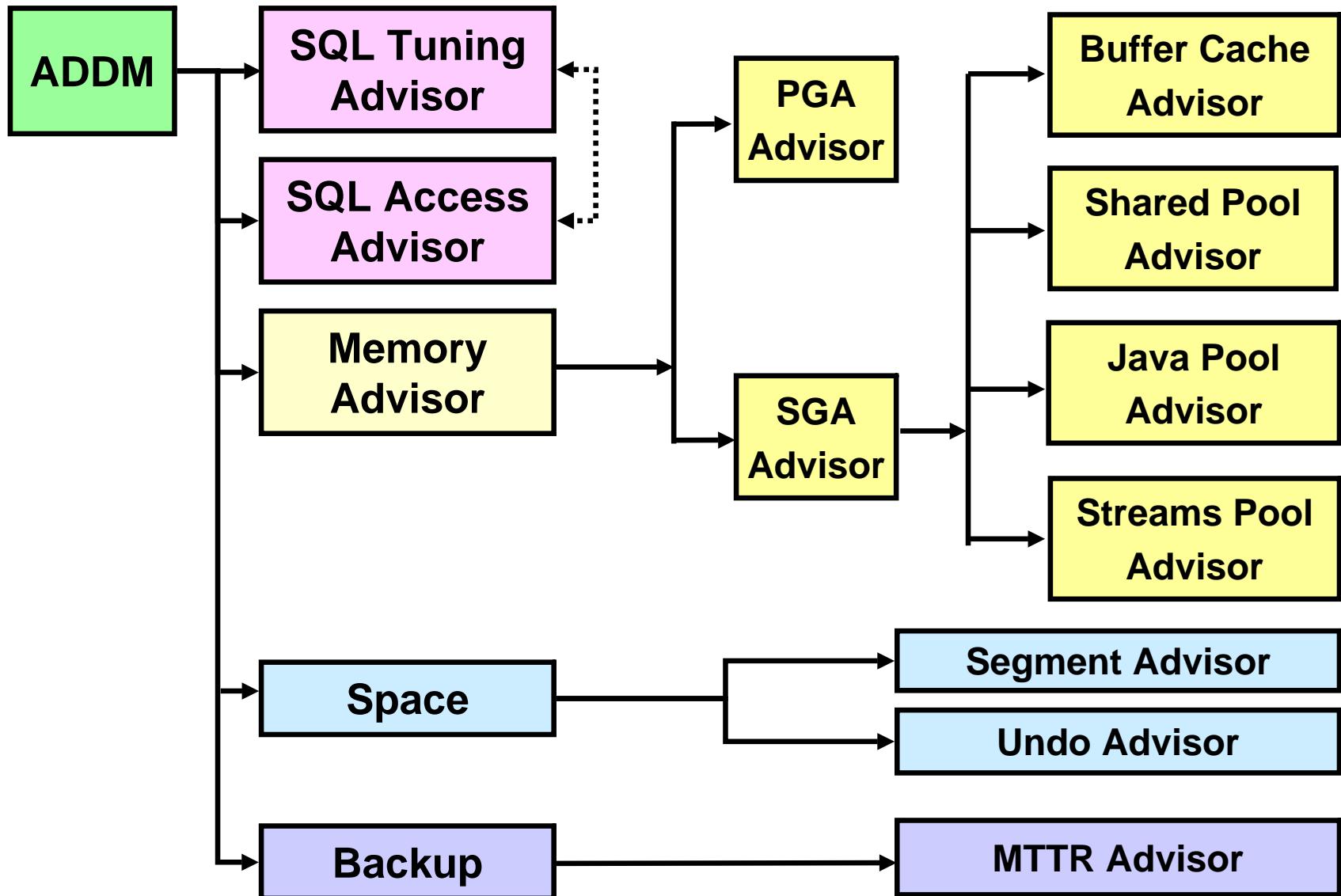
| | | |
|------------------------|--------|--|
| ► Show | Schema |  16.8 |
| ► Show | Schema |  16.8 |

Findings Path

[Expand All](#) | [Collapse All](#)

| Findings | Impact (%) | Additional Information |
|---|--|------------------------|
| ▼ Read and write contention on database blocks was consuming significant database time. |  16.8 | |
| Wait class "Concurrency" was consuming significant database time. |  17.4 | |

Advisory Framework



Enterprise Manager and Advisors

Advisor Central

Advisors [Checkers](#)

Page Refreshed Jun 7, 2007 2:26:15 PM CDT [Refresh](#)

Advisors

| | | |
|---------------------------------|---|---------------------------------------|
| ADDM | Automatic Undo Management | Data Recovery Advisor |
| Memory Advisors | MTTR Advisor | Segment Advisor |
| SQL Advisors | SQL Performance Analyzer | |

Advisor Tasks [Change Default Parameters](#)

Search
Select an advisory type and optionally enter a task name to filter the data that is displayed in your results set.

| | | | |
|---|--|--|--------|
| Advisory Type | Task Name | Advisor Runs | Status |
| <input type="button" value="All Types"/> <input type="text"/> | <input type="button" value="Last Run"/> <input type="text"/> | <input type="button" value="All"/> <input type="button" value="Go"/> | |

By default, the search returns all uppercase matches beginning with the string you entered. To run an exact or case-sensitive match, double quote the search string. You can use the wildcard symbol (%) in a double quoted string.

Results

| <input type="button" value="View Result"/> <input type="button" value="Delete"/> <input type="button" value="Actions"/> <input type="button" value="Re-schedule"/> <input type="button" value="Go"/> | <input type="button" value="Advisors"/> <input type="button" value="Checkers"/> | | | | | | | | |
|--|---|-----------------------------|------|----------------------------------|----------------------|-----------------------------|--|----------|--|
| <table border="1"><thead><tr><th>Select</th><th>Advisory Type</th><th>Name</th></tr></thead><tbody><tr><td><input checked="" type="radio"/></td><td>ADDM</td><td>ADDM:115240</td></tr></tbody></table> | Select | Advisory Type | Name | <input checked="" type="radio"/> | ADDM | ADDM:115240 | <table border="1"><thead><tr><th>Checkers</th></tr></thead><tbody><tr><td>DB Structure Integrity Check</td></tr></tbody></table> | Checkers | DB Structure Integrity Check |
| Select | Advisory Type | Name | | | | | | | |
| <input checked="" type="radio"/> | ADDM | ADDM:115240 | | | | | | | |
| Checkers | | | | | | | | | |
| DB Structure Integrity Check | | | | | | | | | |

Page Refreshed June 7, 2007 2:33:54 PM CDT [Refresh](#)

Checkers

| | | |
|--|--|--|
| DB Structure Integrity Check | Data Block Integrity Check | Redo Integrity Check |
| Transaction Integrity Check | Undo Segment Integrity Check | Dictionary Integrity Check |

DBMS ADVISED Package

| Procedure | Description |
|------------------------|---|
| CREATE_TASK | Creates a new task in the repository |
| DELETE_TASK | Deletes a task from the repository |
| EXECUTE_TASK | Initiates execution of the task |
| INTERRUPT_TASK | Suspends a task that is currently executing |
| GET_TASK_REPORT | Creates and returns a text report for the specified task |
| RESUME_TASK | Causes a suspended task to resume |
| UPDATE_TASK_ATTRIBUTES | Updates task attributes |
| SET_TASK_PARAMETER | Modifies a task parameter |
| MARK_RECOMMENDATION | Marks one or more recommendations as accepted, rejected, or ignored |
| GET_TASK_SCRIPT | Creates a script of all the recommendations that are accepted |

Quiz

The optimizer statistic `num_rows` will always reflect the true row count for a table.

1. True
2. False

Automated Maintenance Tasks

Autotask maintenance process:

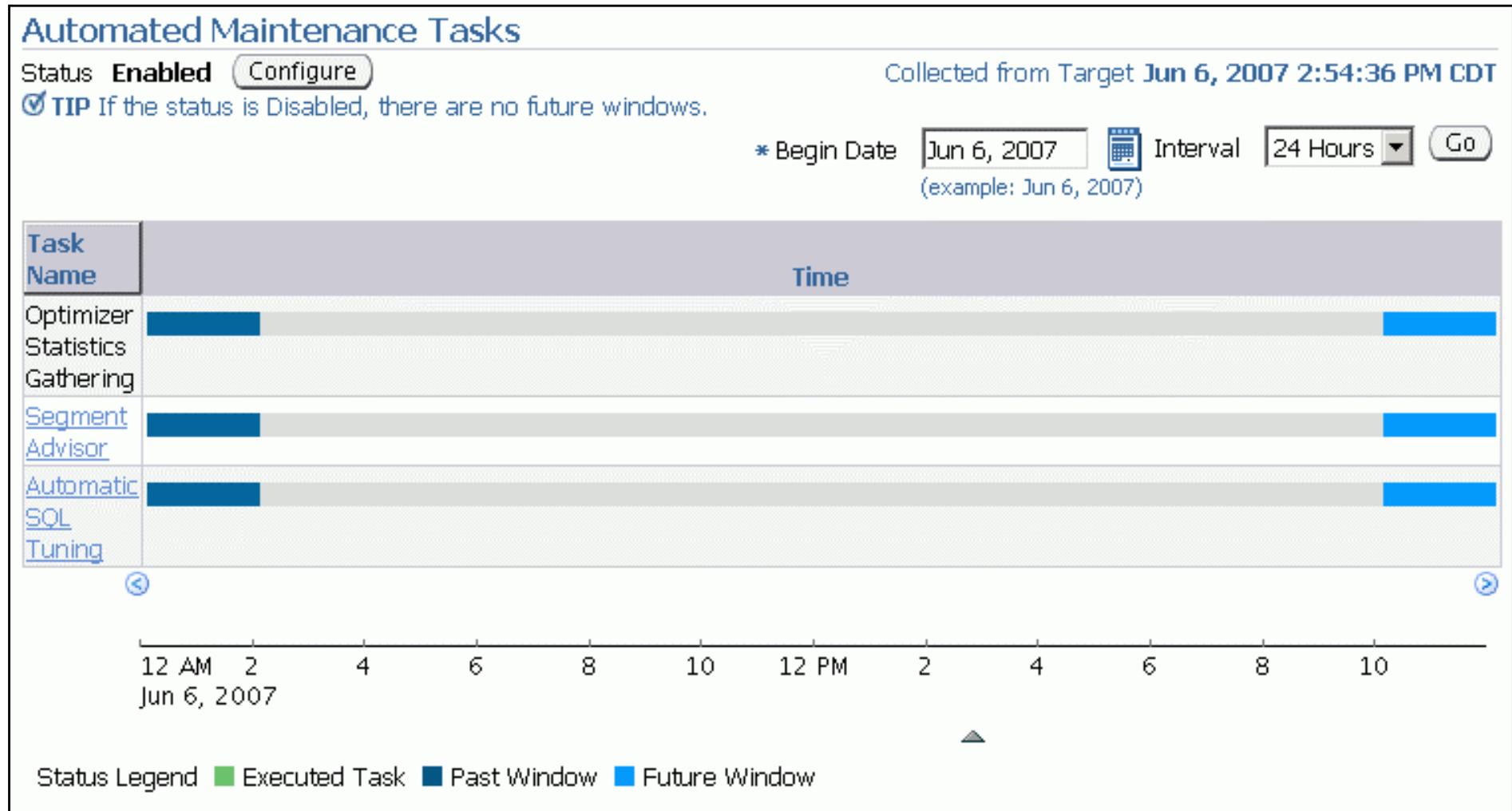
1. Maintenance Window opens.
2. Autotask background process schedules jobs.
3. Scheduler initiates jobs.
4. Resource Manager limits impact of Autotask jobs.

Default Autotask maintenance jobs:

- Gathering optimizer statistics
- Automatic Segment Advisor
- Automatic SQL Advisor



Automated Maintenance Tasks



Automated Maintenance Tasks Configuration

Automated Maintenance Tasks Configuration

Global Status Enabled Disabled

Task Settings

Optimizer Statistics Gathering Enabled Disabled

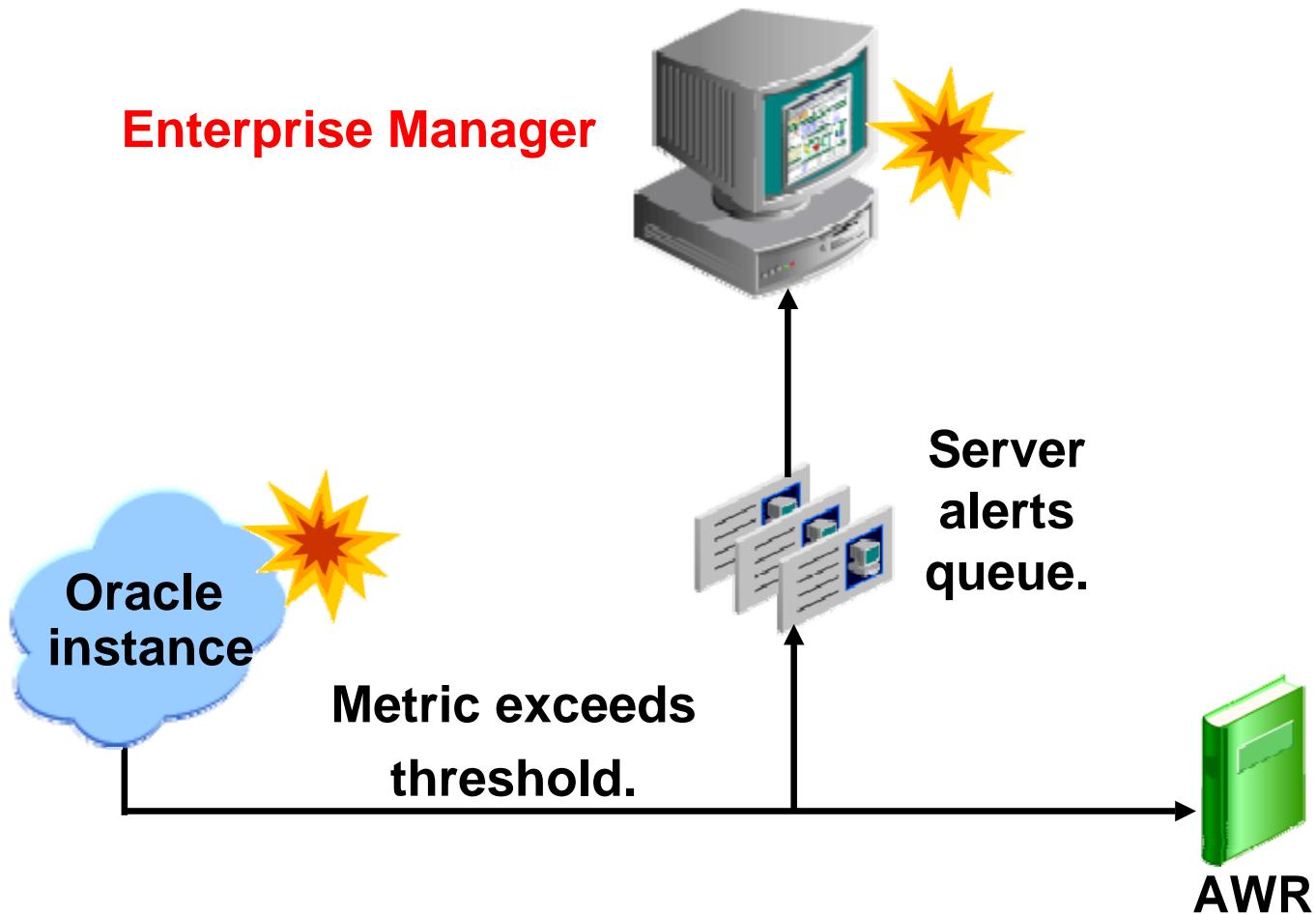
Segment Advisor Enabled Disabled

Automatic SQL Tuning Enabled Disabled

Maintenance Window Group Assignment

| Window | Optimizer Statistics Gathering | Segment Advisor | Automatic SQL Tuning |
|----------------------------------|--|--|--|
| | Select All Select None | Select All Select None | Select All Select None |
| WEDNESDAY WINDOW | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| THURSDAY WINDOW | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| FRIDAY WINDOW | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| SATURDAY WINDOW | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| SUNDAY WINDOW | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| MONDAY WINDOW | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| TUESDAY WINDOW | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |

Server-Generated Alerts



Setting Thresholds

Metric and Policy Settings

(Cancel) (OK)

Metric Thresholds Policies

View Metrics with thresholds ▾

| Metric | Comparison Operator | Warning Threshold | Critical Threshold | Corrective Actions | Collection Schedule | Edit |
|-----------------------------|---------------------|-------------------|--------------------|--------------------|---------------------|------|
| Access Violation | Matches | | * | None | Every 5 Minutes | |
| Access Violation Status | > | | 0 | None | Every 5 Minutes | |
| Archive Area Used (%) | > | 80 | | None | Every 15 Minutes | |
| Archiver Hung | Matches | | * | None | Every 5 Minutes | |
| Archiver Hung Status | > | | 0 | None | Every 5 Minutes | |
| Audited User | = | SYS | | None | Every 15 Minutes | |
| Average Users Waiting Count | | | | | | |
| Administrative | > | 10 | | None | | |
| Application | > | 10 | | None | | |
| Cluster | > | 30 | | None | | |
| Commit | > | 30 | | None | | |
| Concurrency | > | 10 | | None | | |
| Configuration | > | 10 | | None | | |
| Network | > | 10 | | None | | |

Creating and Testing an Alert

1. Specify a threshold.
2. Create a test case.
3. Check for an alert.

Edit Advanced Settings: Tablespace Space Used (%)

Cancel Continue

Monitored Objects

The table lists all Tablespace Name objects monitored for this metric. You can specify different threshold settings for each Tablespace Name object.

Add Reorder

| Select | Tablespace Name | Comparison Operator | Warning Threshold | Critical Threshold | Corrective Action |
|----------------------------------|-----------------|---------------------|-------------------|--------------------|-------------------|
| <input checked="" type="radio"/> | All others | >= | 70 | 75 | None |

1

Show SQL

Return

```
CREATE TABLE "HR"."FILLER" TABLESPACE "INVENTORY"
STORAGE ( INITIAL 8M) AS SELECT * FROM HR.EMPLOYEES
```

2

▼Alerts

Category All Go Critical × 3 Warning ! 1

| Severity | Category | Name | Impact | Message | Alert Triggered |
|----------|------------------|---------------------------|--------|---|---------------------------|
| × | Tablespaces Full | Tablespace Space Used (%) | | Tablespace INVENTORY is 80 percent full | Jun 7, 2007 3:24:05 PM |

3

Alerts Notification

ORACLE Enterprise Manager 11g Database Control

Setup Preferences Help Logout **Database**

Preferences

Edit Notification Rule: Database Availability and Critical States

(Cancel) (OK)

General Availability Metrics Policies Jobs Methods

Remove | Add Previous 10 21-24 of 24 Next

Select All | Select None

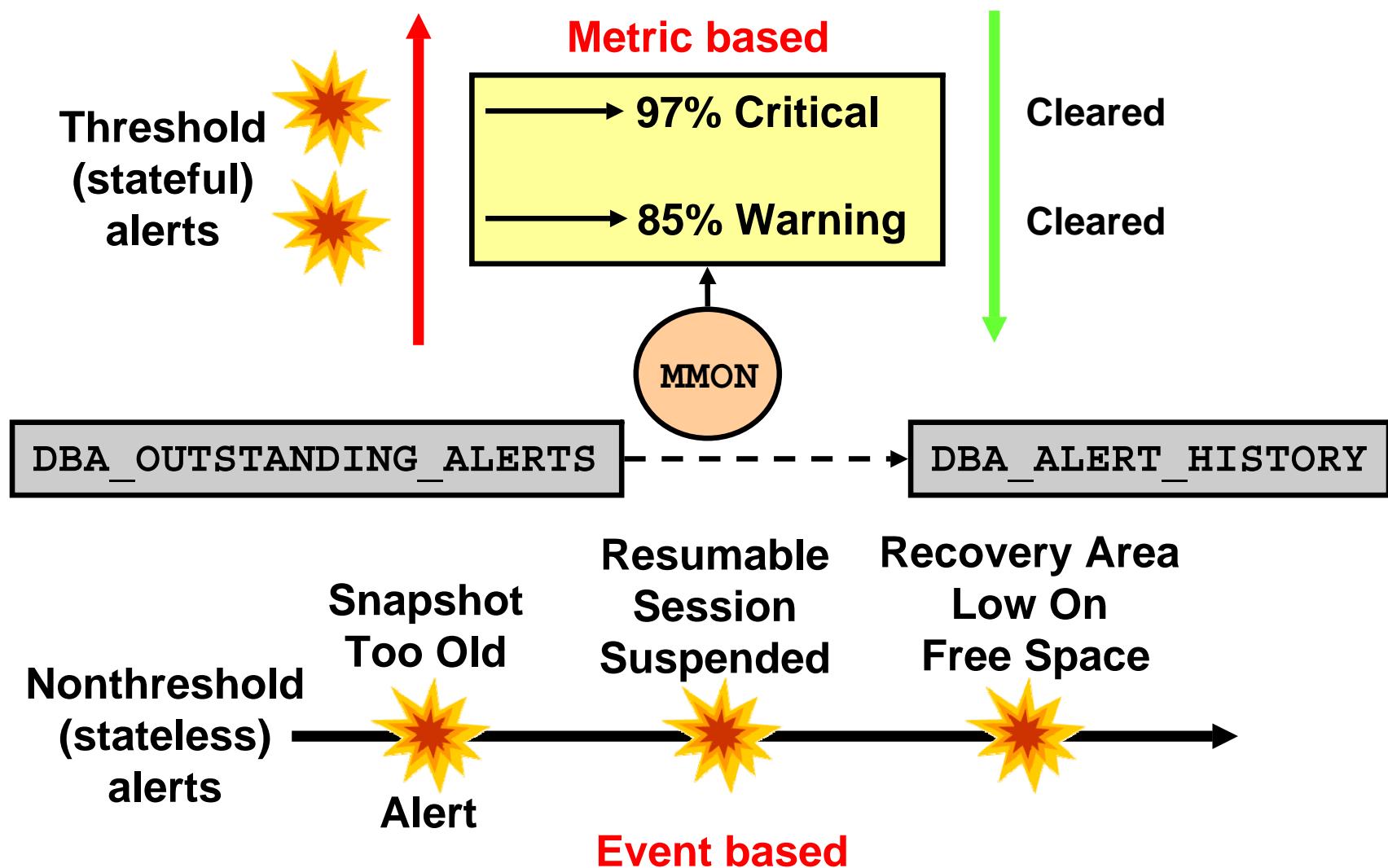
| Select | Metric ▲ | Objects | Severity States | Corrective Action States | | Edit |
|--------------------------|---------------------------|-------------------------------|-----------------|--------------------------|------------|------|
| | | | | On Critical | On Warning | |
| <input type="checkbox"/> | Session Limit Usage (%) | n/a | Critical | | | |
| <input type="checkbox"/> | Session Terminated Status | n/a | Critical | | | |
| <input type="checkbox"/> | Tablespace Space Used (%) | All Objects (Tablespace Name) | Critical | | | |
| <input type="checkbox"/> | Wait Time (%) | n/a | Critical | | | |

Reacting to Alerts

- If necessary, you should gather more input (for example, by running ADDM or another advisor).
- Investigate critical errors.
- Take corrective measures.
- Acknowledge alerts that are not automatically cleared.



Alert Types and Clearing Alerts



Quiz

Stateless alerts such as SNAPSHOT TOO OLD can be found in the dictionary view DBA_OUTSTANDING_ALERTS.

1. True
2. False

Summary

In this lesson, you should have learned how to:

- Manage optimizer statistics
- Manage the Automatic Workload Repository (AWR)
- Use the Automatic Database Diagnostic Monitor (ADDM)
- Describe and use the advisory framework
- Set alert thresholds
- Use server-generated alerts
- Use automated tasks

Practice 12 Overview: Proactive Maintenance

This practice covers proactively managing your database with ADDM, including:

- Setting up an issue for analysis
- Reviewing your database performance
- Implementing a solution



13

Performance Management

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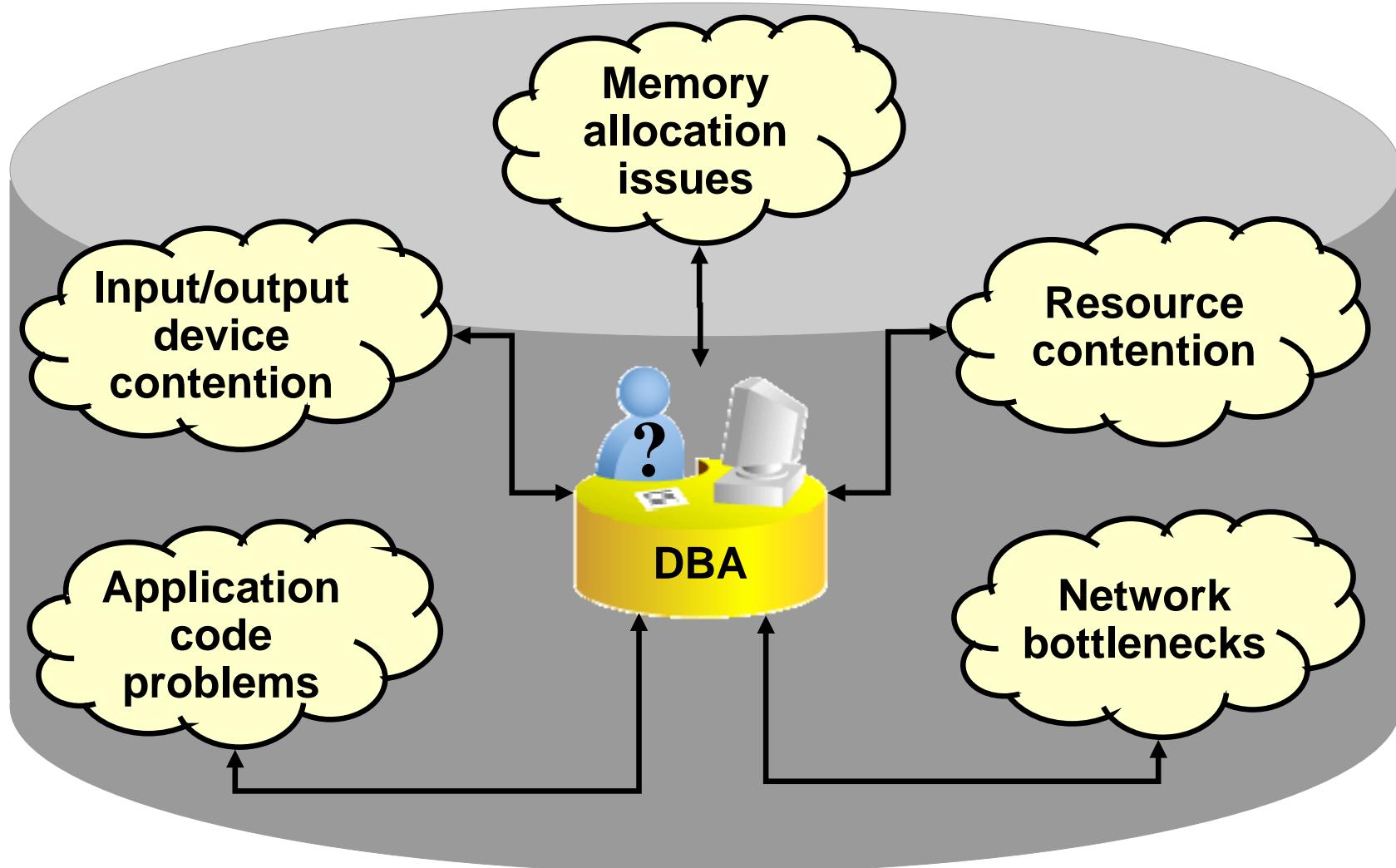
Copyright © 2009, Oracle. All rights reserved.

Objectives

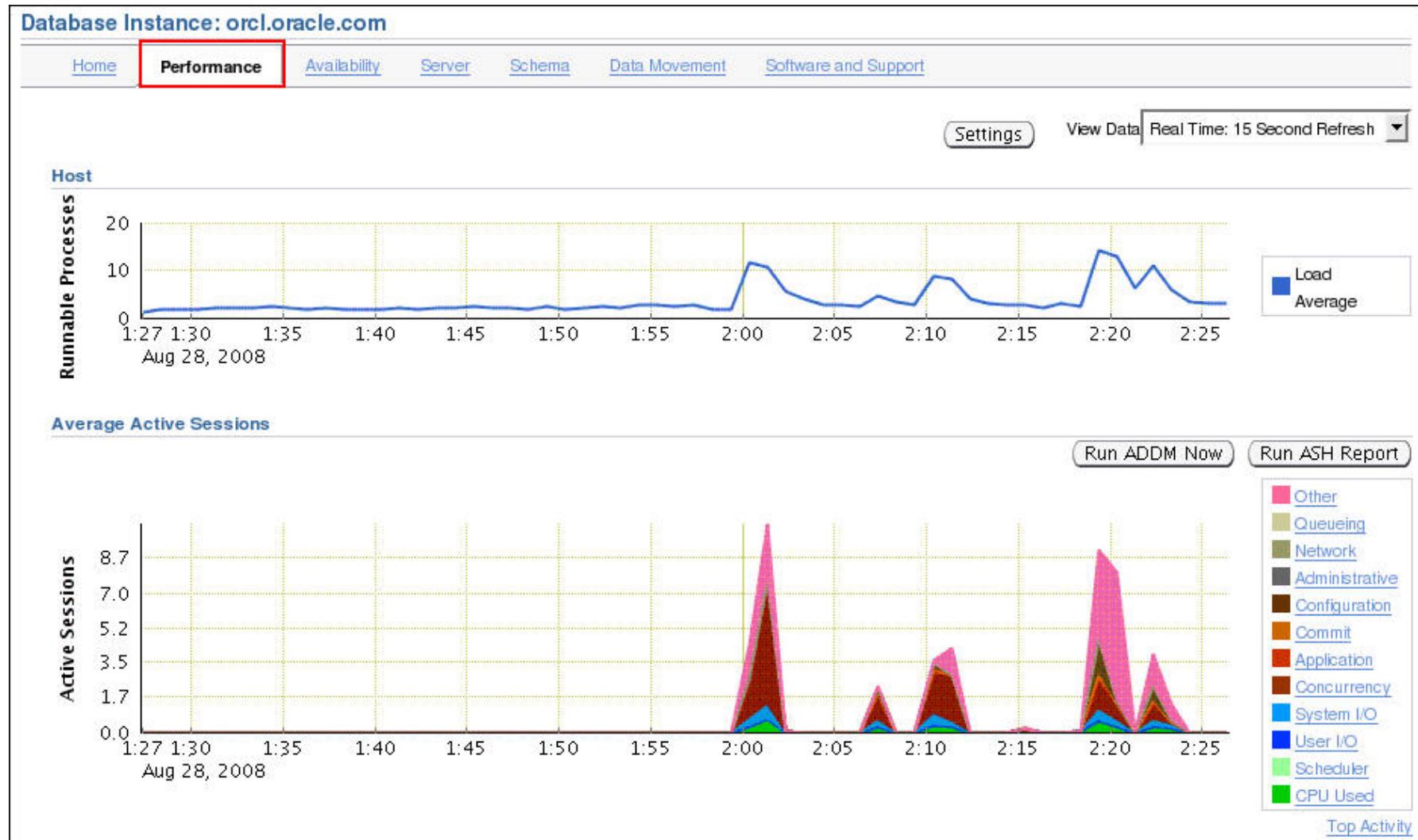
After completing this lesson, you should be able to:

- Use Enterprise Manager to monitor performance
- Use Automatic Memory Management (AMM)
- Use the Memory Advisor to size memory buffers
- View performance-related dynamic views
- Troubleshoot invalid and unusable objects

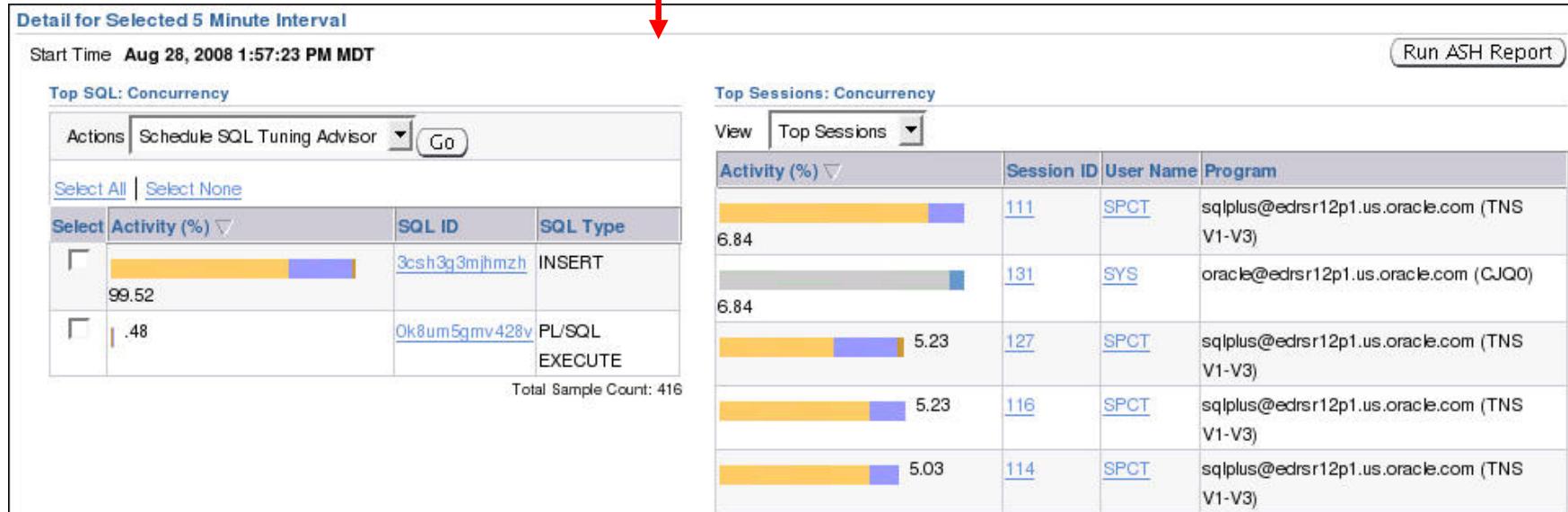
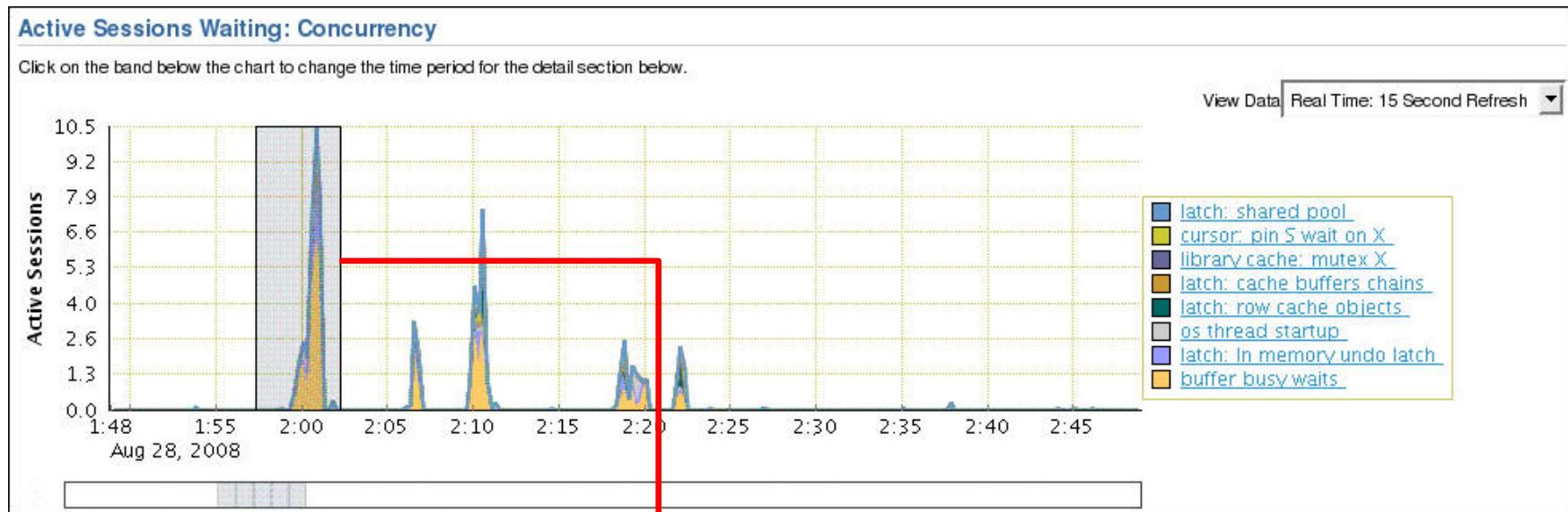
Performance Monitoring



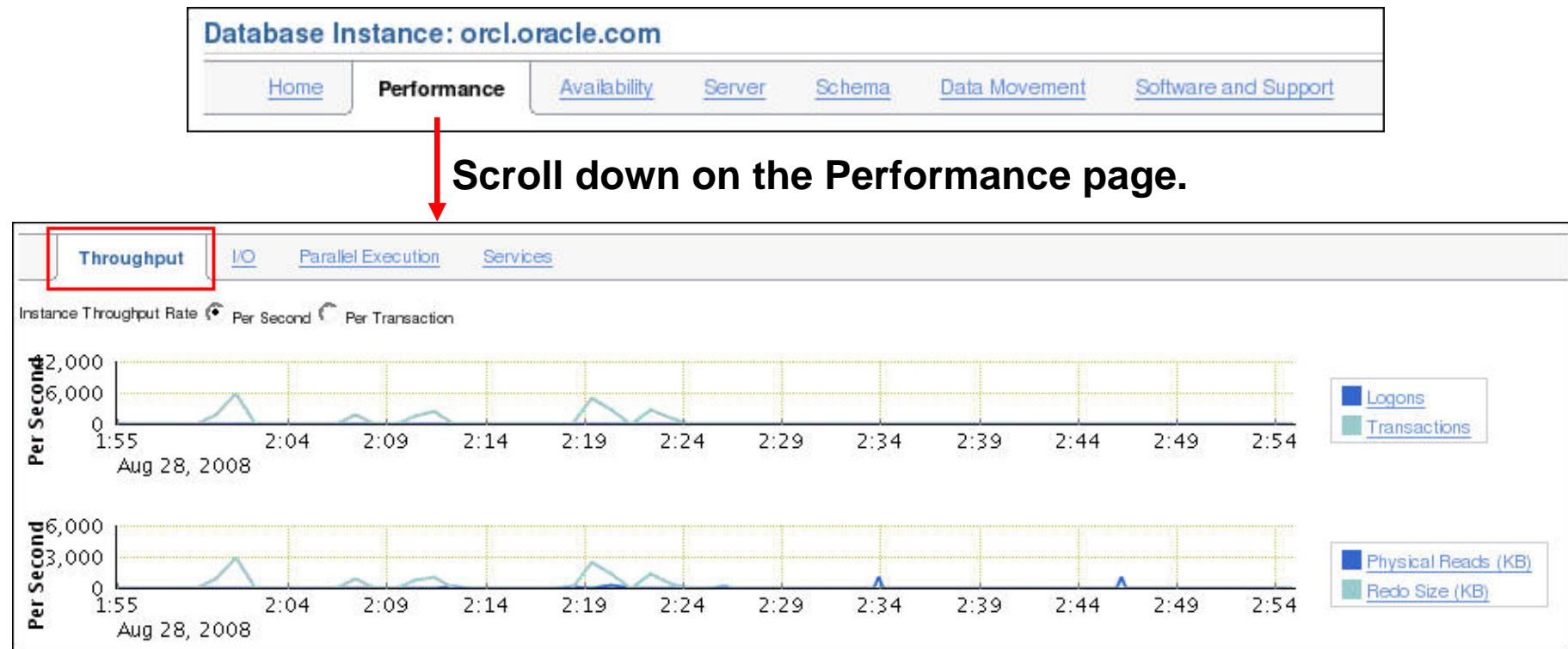
Enterprise Manager Performance Page



Drilling Down to a Particular Wait Category



Performance Page: Throughput



Performance Monitoring: Top Sessions

Top Consumers

Collected From Jul 31, 2009 8:40:17 AM GMT+07:00 To Jul 31, 2009 8:40:32 AM GMT+07:00 

[Overview](#) [Top Services](#) [Top Modules](#) [Top Actions](#) [Top Clients](#) **Top Sessions** [Show Active SQL](#) [Customize](#)

[Kill Session](#) [View](#) [Disable SQL Trace](#) [Enable SQL Trace](#)

| Select | SID | DB User | CPU (1/100 sec) | PGA Memory (bytes) | Physical Reads | Logical Reads | Hard Parses | Total Parses | Disk Sorts | Status | Program | Module | OS PID | Machine | OS User | SQL Trace |
|----------------------------------|-----|-----------|-----------------|--------------------|----------------|---------------|-------------|--------------|------------|--------|---|----------------------|--------|-------------------------|---------|-----------|
| <input checked="" type="radio"/> | 36 | INVENTORY | 1 | 1540712 | 20 | 228 | 0 | 0 | 0 | ACTIVE | sqlplus@edrsr12p1.us.oracle.com (TNS V1-V3) | SQL*Plus | 18269 | edrsr12p1.us.oracle.com | oracle | DISABLED |
| <input type="radio"/> | 59 | DBSNMP | 12 | 7168500 | 0 | 56 | 0 | 10 | 0 | ACTIVE | emagent@edrsr12p1.us.oracle.com | emagent_SQL_database | 9753 | edrsr12p1.us.oracle.com | oracle | DISABLED |
| <input type="radio"/> | 42 | CJQO | 0 | 1794548 | 0 | 6 | 0 | 0 | 0 | ACTIVE | oracle@edrsr12p1.us.oracle.com (CJQO) | | 13001 | edrsr12p1.us.oracle.com | oracle | DISABLED |
| <input type="radio"/> | 41 | DBSNMP | 0 | 2384372 | 0 | 3 | 0 | 2 | 0 | ACTIVE | emagent@edrsr12p1.us.oracle.com | emagent_AQMetrics | 13286 | edrsr12p1.us.oracle.com | oracle | DISABLED |
| <input type="radio"/> | 29 | SYSMAN | 0 | 2843124 | 0 | 1 | 0 | 5 | 0 | ACTIVE | OMS | OEM.DefaultPool | 12965 | edrsr12p1.us.oracle.com | oracle | DISABLED |
| <input type="radio"/> | 49 | DBSNMP | 14 | 1532404 | 0 | 0 | 0 | 2 | 0 | ACTIVE | OMS | Realtime Connection | 18390 | edrsr12p1.us.oracle.com | oracle | DISABLED |
| <input type="radio"/> | 34 | SYSMAN | 0 | 2384372 | 0 | 0 | 0 | 0 | 0 | ACTIVE | OMS | OEM.SystemPool | 13061 | edrsr12p1.us.oracle.com | oracle | DISABLED |
| <input type="radio"/> | 30 | SYSMAN | 0 | 3105268 | 0 | 0 | 0 | 3 | 0 | ACTIVE | OMS | OEM.DefaultPool | 12967 | edrsr12p1.us.oracle.com | oracle | DISABLED |
| <input type="radio"/> | 18 | MMNL | 0 | 1270260 | 0 | 0 | 0 | 0 | 0 | ACTIVE | oracle@edrsr12p1.us.oracle.com (MMNL) | | 12861 | edrsr12p1.us.oracle.com | oracle | DISABLED |
| <input type="radio"/> | 25 | QMNC | 0 | 745972 | 0 | 0 | 0 | 0 | 0 | ACTIVE | oracle@edrsr12p1.us.oracle.com (QMNC) | STREAMS | 12963 | edrsr12p1.us.oracle.com | oracle | DISABLED |
| <input type="radio"/> | 57 | J001 | 0 | 418292 | 0 | 0 | 0 | 0 | 0 | ACTIVE | oracle@edrsr12p1.us.oracle.com (J001) | | 18451 | edrsr12p1.us.oracle.com | oracle | DISABLED |
| <input type="radio"/> | 43 | SMCO | 0 | 418292 | 0 | 0 | 0 | 0 | 0 | ACTIVE | oracle@edrsr12p1.us.oracle.com | KTSJ | 13544 | edrsr12p1.us.oracle.com | oracle | DISABLED |

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Performance Monitoring: Top Services

Overview **Top Services** Top Modules Top Actions Top Clients Top Sessions

View Active Services

Enable SQL Trace Disable SQL Trace View SQL Trace File

Select All | Select None

| Select | Service | Activity (% for the last 5 minutes) | SQL Trace Enabled | Delta Elapsed Time (seconds) | Cumulative Elapsed Time (seconds) |
|--------------------------|-----------------|-------------------------------------|-------------------|------------------------------|-----------------------------------|
| <input type="checkbox"/> | SYS\$USERS | 42.9 | FALSE | 0 | 227 |
| <input type="checkbox"/> | SYS\$BACKGROUND | 35.7 | FALSE | 0 | 0 |
| <input type="checkbox"/> | SH | 14.3 | FALSE | 0 | 2 |
| <input type="checkbox"/> | SERV1 | 7.1 | FALSE | 0 | 2 |

→

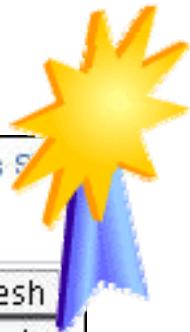
| Delta CPU Time (seconds) | Cumulative CPU Time (seconds) | Delta Physical I/O (blocks) | Cumulative Physical I/O (blocks) |
|--------------------------|-------------------------------|-----------------------------|----------------------------------|
| 0 | 0 | 0 | 16031 |
| 0 | 137 | 0 | 14414 |
| 0 | 1 | 15 | 637 |
| 0 | 2 | 0 | 12 |

Managing Memory Components

- Automatic Memory Management (AMM)
 - Enables you to specify total memory allocated to instance (including both SGA and PGA)
- Automatic Shared Memory Management (ASMM):
 - Enables you to specify total SGA memory through one initialization parameter
 - Enables the Oracle server to manage the amount of memory allocated to the shared pool, Java pool, buffer cache, streams pool, and large pool
- Manually setting shared memory management:
 - Sizes the components through multiple individual initialization parameters
 - Uses the appropriate Memory Advisor to make recommendations



Enabling Automatic Memory Management (AMM)



Database Instance: orcl.oracle.com > Advisor Central >

Logged in As S

Memory Advisors

Click Enable to enable Automatic Memory Management.

When Automatic Memory Management is enabled, the database will automatically set the optimum distribution of memory. The distribution of memory will change from time to time to accommodate changes in the workload.

Automatic Memory Management **Disabled** **Enable**

Page Refreshed August 28, 2008 3:08:57 PM MDT Refresh Show SQL Revert Apply

Memory Advisors

When Automatic Memory Management is enabled, the database will automatically set the optimum distribution of memory will change from time to time to accomodate changes in the workload.

Automatic Memory Management **Enabled** **Disable**

Total Memory Size 556 MB **Advice**

Maximum Memory Size 1000 MB

The database must be restarted for any changes to this value to take effect.

Use the Memory Size Advisor.

Memory Size Advice

| Total Memory Size (MB) | Improvement in DB Time (%) |
|------------------------|----------------------------|
| 250 | 0.12 |
| 300 | 0.12 |
| 350 | 0.05 |
| 400 | -0.45 |
| 450 | -0.45 |
| 500 | -0.25 |
| 556 | 0.00 |
| 600 | 0.05 |
| 650 | 0.12 |
| 700 | 0.15 |
| 750 | 0.18 |
| 800 | 0.20 |
| 850 | 0.20 |
| 900 | 0.20 |
| 950 | 0.20 |
| 1000 | 0.12 |
| 1050 | 0.12 |

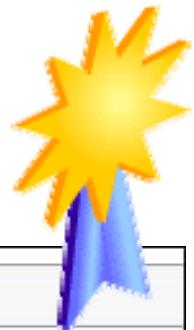
■ Percentage improvement in DB Time for various sizes of Total Memory
✖ Total Memory Size
▪ Maximum Memory Size

Total Memory Size (MB) 556

You can click on the curve in the graph to set a new value. Total Memory Size cannot be greater than the Maximum Memory Size. First modify the Maximum Memory size (from the parent page) and then select a value of Total Memory up to the Maximum Memory size.

Cancel OK

Enabling Automatic Shared Memory Management (ASMM)



The System Global Area (SGA) is a group of shared memory structures that contains data and control information for one Oracle database. The SGA is allocated in memory when an Oracle database instance is started.

Automatic Shared Memory Management **Disabled** [Enable](#)

Shared Pool 248 MB [Advice](#)

Buffer Cache 136 MB [Advice](#)

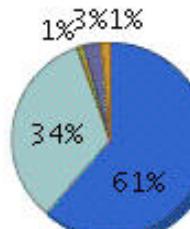
Large Pool 4 MB

Java Pool 12 MB

Other (MB) 5

Total SGA (MB) 405 [Calculate](#)

Click Enable to enable Automatic Shared Memory Management.



| SGA Component | Size (MB) | Percentage |
|---------------|-----------|------------|
| Shared Pool | 248 | 61.1% |
| Buffer Cache | 136 | 33.5% |
| Large Pool | 4 | 1% |
| Java Pool | 12 | 3% |
| Other | 5 | 1.4% |

Maximum SGA Size

The Maximum SGA Size specifies the maximum memory that the database may allocate. If you specify the Maximum SGA Size, you can later dynamically change SGA component sizes (provided the total SGA size does not exceed the Maximum SGA Size).

Maximum SGA Size (MB) 1000

The database must be restarted before any changes to this value take effect.

Automatic Shared Memory Advisor

Current Allocation

Automatic Shared Memory Management **Enabled** **Disable**

Total SGA Size (MB) **408** **Advice**

| SGA Component | Current Allocation (MB) |
|---------------|-------------------------|
| Shared Pool | 248 |
| Buffer Cache | 136 |
| Large Pool | 4 |
| Java Pool | 12 |
| Other | 8 |

A red arrow points from the "Advice" button on the left to the graph on the right.

SGA Size Advice

Improvement in DB Time (%)

Total SGA Size (MB)

- Percentage improvement in DB Time for various sizes of SGA
- Total SGA Size
- Maximum SGA Size

Total SGA Size (MB) **408**

You can click on the curve in the graph to set a new value. Total SGA Size cannot be greater than the SGA Max Size. First modify the Max SGA size (from the parent page) and then select a value of SGA up to the Max SGA size.

Cancel **OK**

Dynamic Performance Statistics

Systemwide

V\$SYSSTAT

- statistic#
- name
- class
- value
- stat_id

V\$SYSTEM_EVENT

- event
- total_waits
- total_timeouts
- time_waited
- average_wait
- time_waited_micro

 Cumulative stats

 Wait events

Session specific

V\$SESSTAT

- sid
- statistic#
- value

V\$SESSION_EVENT

- sid
- event
- total_waits
- total_timeouts
- time_waited
- average_wait
- max_wait
- time_waited_micro
- event_id

Service specific

V\$SERVICE_STATS

- service_name_hash
- service_name
- stat_id
- stat_name
- value

V\$SERVICE_EVENT

- service_name
- service_name_hash
- event
- event_id
- total_waits
- total_timeouts
- time_waited
- average_wait
- time_waited_micro

Troubleshooting and Tuning Views

Instance/Database

V\$DATABASE
V\$INSTANCE
V\$PARAMETER
V\$SPPARAMETER
V\$SYSTEM_PARAMETER
V\$PROCESS
V\$BGPROCESS
V\$PX_PROCESS_SYSSTAT
V\$SYSTEM_EVENT

Disk

V\$DATAFILE
V\$FILESTAT
V\$LOG
V\$LOG_HISTORY
V\$DBFILE
V\$TEMPFILE
V\$TEMPSEG_USAGE
V\$SEGMENT_STATISTICS

Memory

V\$BUFFER_POOL_STATISTICS
V\$LIBRARYCACHE
V\$SGAINFO
V\$PGASTAT

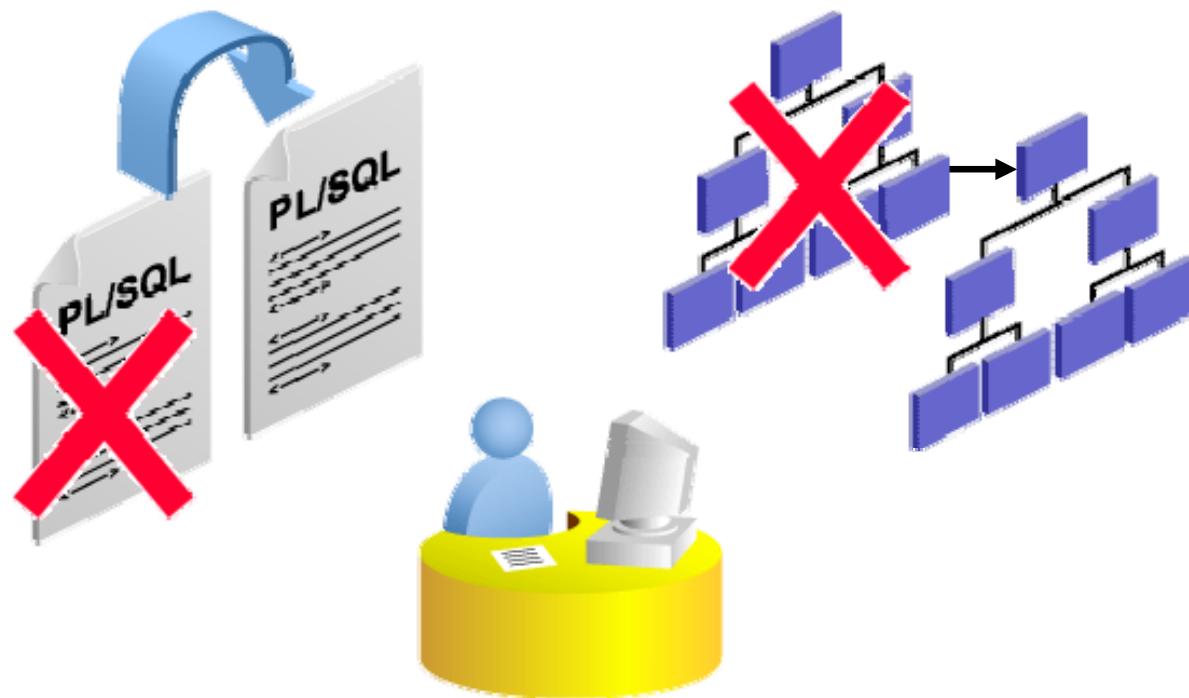
Contention

V\$LOCK
V\$UNDOSTAT
V\$WAITSTAT
V\$LATCH

Invalid and Unusable Objects

Effect on performance:

- PL/SQL code objects are recompiled.
- Indexes are rebuilt.



Quiz

Automatic Memory Management allows the Oracle instance to reallocate memory from the _____ to the SGA .

1. Large Pool
2. Log Buffer
3. PGA
4. Streams Pool

Quiz

SGA_TARGET may not be sized greater than _____.

1. LOG_BUFFER
2. SGA_MAX_SIZE
3. STREAMS_POOL_SIZE
4. PGA_AGGREGATE_TARGET

Summary

In this lesson, you should have learned how to:

- Use Enterprise Manager to monitor performance
- Use Automatic Memory Management (AMM)
- Use the Memory Advisor to size memory buffers
- View performance-related dynamic views
- Troubleshoot invalid and unusable objects

Practice 13 Overview: Monitoring and Improving Performance

This practice covers the following topics:

- Detecting and repairing unusable indexes
- Using the Performance page in Enterprise Manager



14

Backup and Recovery Concepts

Objectives

After completing this lesson, you should be able to:

- Identify the types of failure that can occur in an Oracle database
- Describe ways to tune instance recovery
- Identify the importance of checkpoints, redo log files, and archive log files
- Configure the fast recovery area
- Configure ARCHIVELOG mode

Part of Your Job

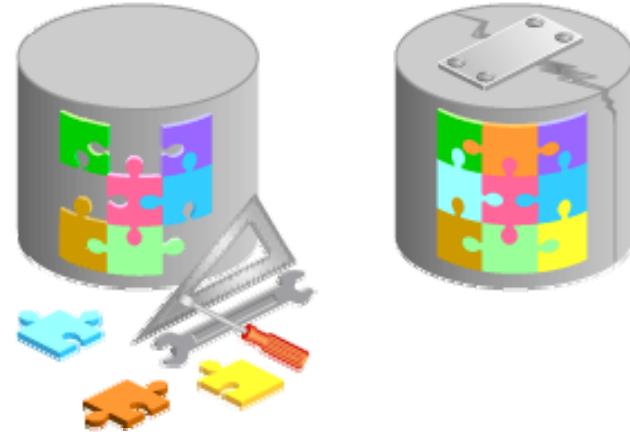
The database administrator's duties are to:

- Protect the database from failure wherever possible
- Increase the mean time between failures (MTBF)
- Protect critical components by redundancy
- Decrease the mean time to recover (MTTR)
- Minimize the loss of data

Categories of Failure

Failures can generally be divided into the following categories:

- Statement failure
- User process failure
- Network failure
- User error
- Instance failure
- Media failure



Statement Failure

| Typical Problems | Possible Solutions |
|---|---|
| Attempts to enter invalid data into a table | Work with users to validate and correct data. |
| Attempts to perform operations with insufficient privileges | Provide appropriate object or system privileges. |
| Attempts to allocate space that fail | <ul style="list-style-type: none">• Enable resumable space allocation.• Increase owner quota.• Add space to tablespace. |
| Logic errors in applications | Work with developers to correct program errors. |

User Process Failure

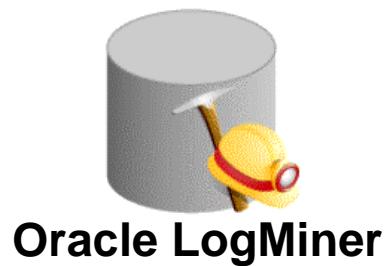
| Typical Problems | Possible Solutions |
|---|---|
| A user performs an abnormal disconnect. | A DBA's action is not usually needed to resolve user process failures. |
| A user's session is abnormally terminated. | Instance background processes roll back uncommitted changes and release locks. |
| A user experiences a program error that terminates the session. | Watch for trends.  |

Network Failure

| Typical Problems | Possible Solutions |
|-------------------------------------|--|
| Listener fails. | Configure a backup listener and connect-time failover. |
| Network Interface Card (NIC) fails. | Configure multiple network cards. |
| Network connection fails. | Configure a backup network connection. |

User Error

| Typical Causes | Possible Solutions |
|--|---|
| User inadvertently deletes or modifies data. | Roll back transaction and dependent transactions or rewind table. |
| User drops a table. | Recover table from recycle bin. |



Flashback Technology

Using Flashback technology:

- Viewing past states of data
- Winding data back and forth in time
- Assisting users in error analysis and recovery



For error analysis:

Oracle Flashback Query

Oracle Flashback Versions Query

Oracle Flashback Transaction Query

For error recovery:

Oracle Flashback Transaction Backout

Oracle Flashback Table

Oracle Flashback Drop

Oracle Flashback Database

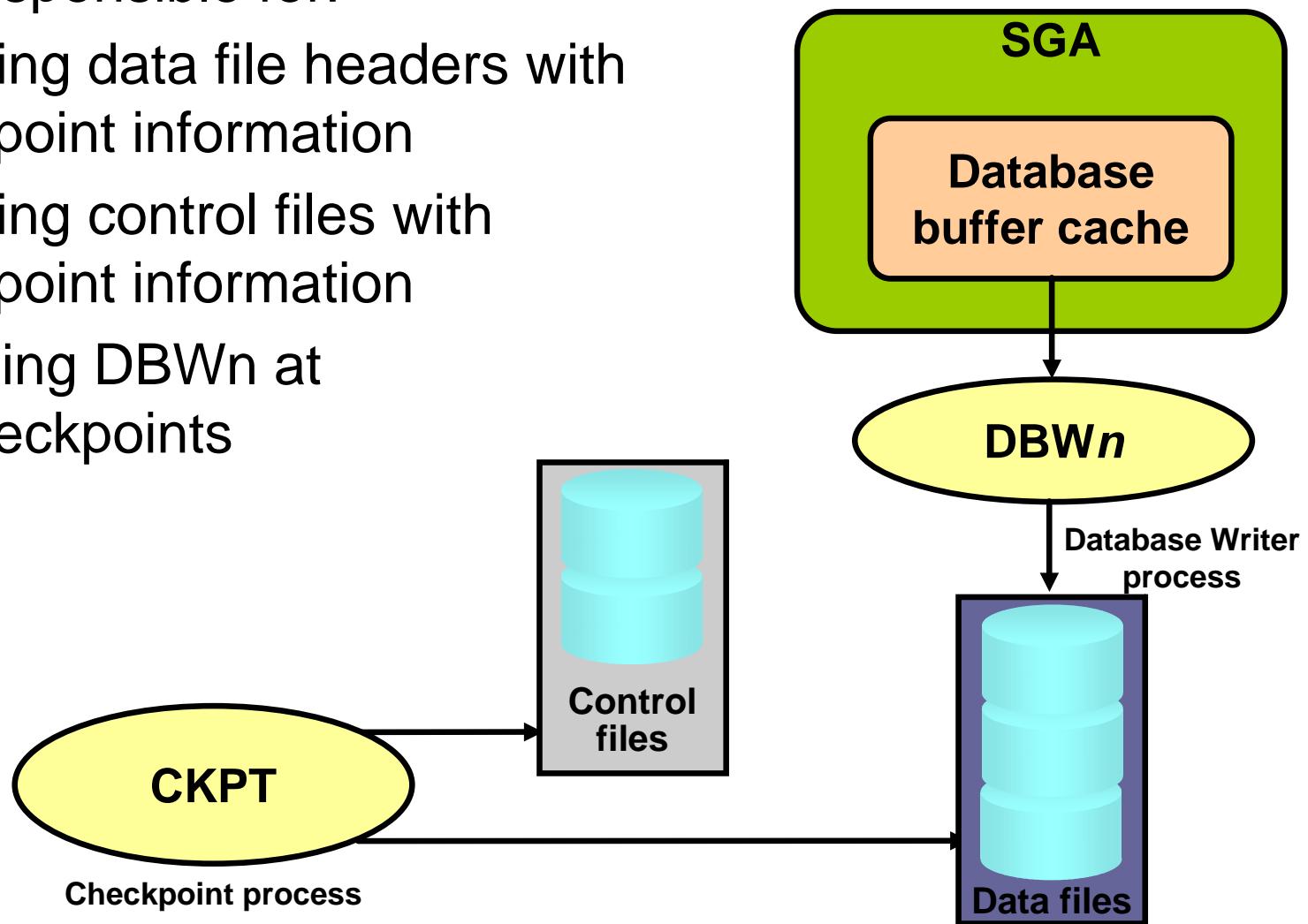
Instance Failure

| Typical Causes | Possible Solutions |
|---|--|
| Power outage | Restart the instance by using the STARTUP command. Recovering from instance failure is automatic, including rolling forward changes in the redo logs and then rolling back any uncommitted transactions. |
| Hardware failure | |
| Failure of one of the critical background processes | |
| Emergency shutdown procedures | Investigate the causes of failure by using the alert log, trace files, and Enterprise Manager. |

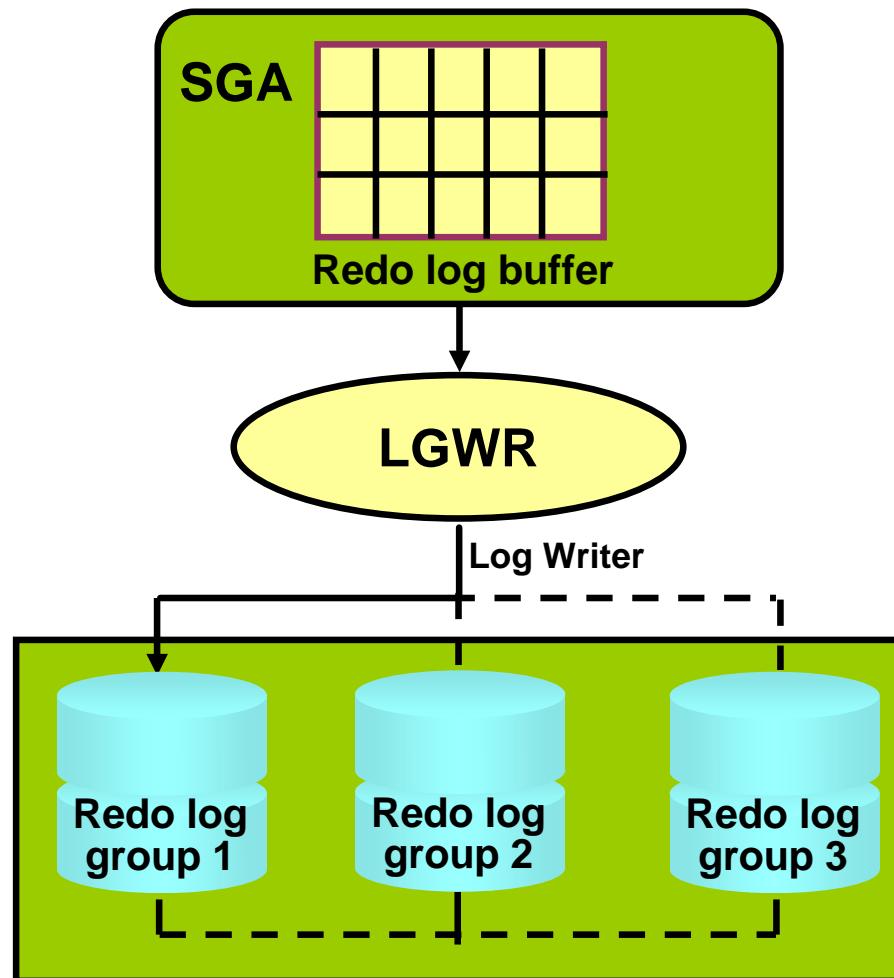
Understanding Instance Recovery: Checkpoint (CKPT) Process

CKPT is responsible for:

- Updating data file headers with checkpoint information
- Updating control files with checkpoint information
- Signaling DBWn at full checkpoints



Understanding Instance Recovery: Redo Log Files and Log Writer



Redo log files:

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

Log Writer writes:

- At commit
- When one-third full
- Every three seconds
- Before DBW n writes
- Before clean shutdowns

Understanding Instance Recovery

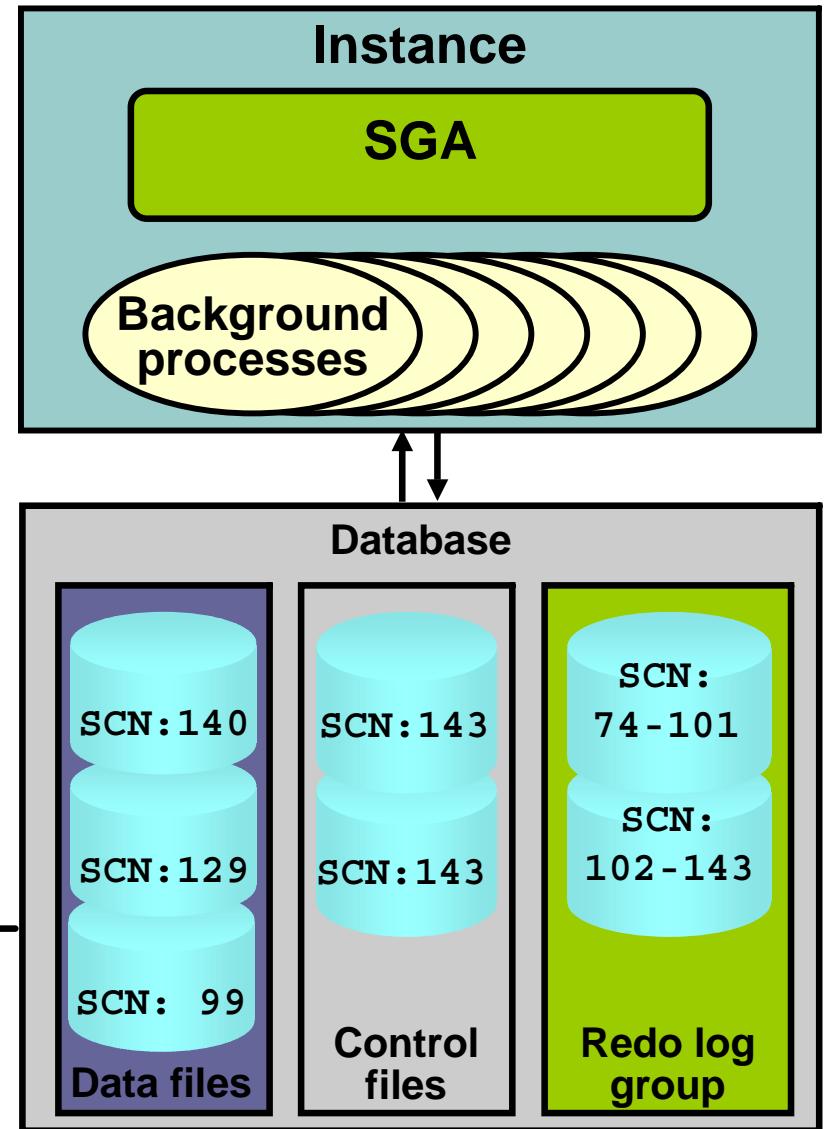
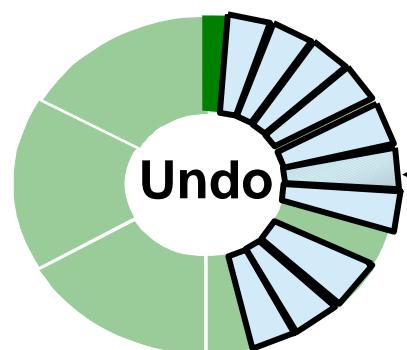
Automatic instance or crash recovery:

- Is caused by attempts to open a database whose files are not synchronized on shutdown
- Uses information stored in redo log groups to synchronize files
- Involves two distinct operations:
 - Rolling forward: Redo log changes (both committed and uncommitted) are applied to data files.
 - Rolling back: Changes that are made but not committed are returned to their original state.



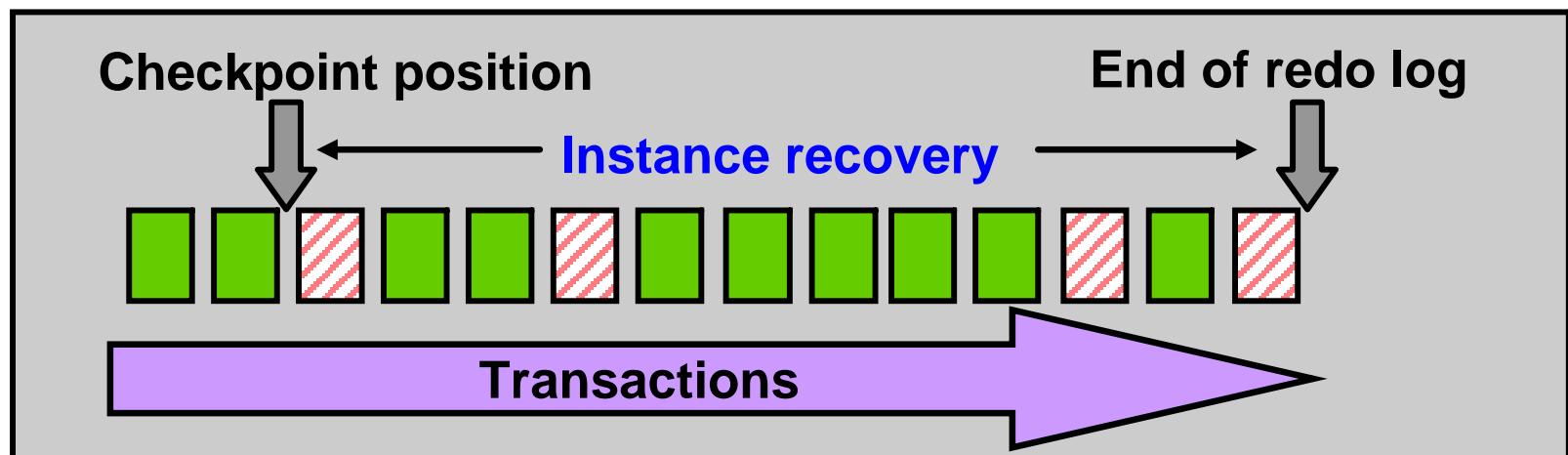
Phases of Instance Recovery

1. Startup instance (data files are out of sync)
2. Roll forward (redo)
3. Committed and uncommitted data in files
4. Database opened
5. Roll back (undo)
6. Committed data in files



Tuning Instance Recovery

- During instance recovery, the transactions between the checkpoint position and the end of redo log must be applied to data files.
- You tune instance recovery by controlling the difference between the checkpoint position and the end of redo log.



Using the MTTR Advisor

- Specify the desired time in seconds or minutes.
- The default value is 0 (disabled).
- The maximum value is 3,600 seconds (one hour).

Database Instance: orcl.oracle.com

Home Performance Availability Server Schema Data Mo

High Availability Console

Backup/Recovery

Setup Manage

[Backup Settings](#) [Schedule Backup](#)

[Recovery Settings](#) [Manage Current Backups](#)

[Recovery Catalog Settings](#) [Backup Reports](#)



Recovery Settings

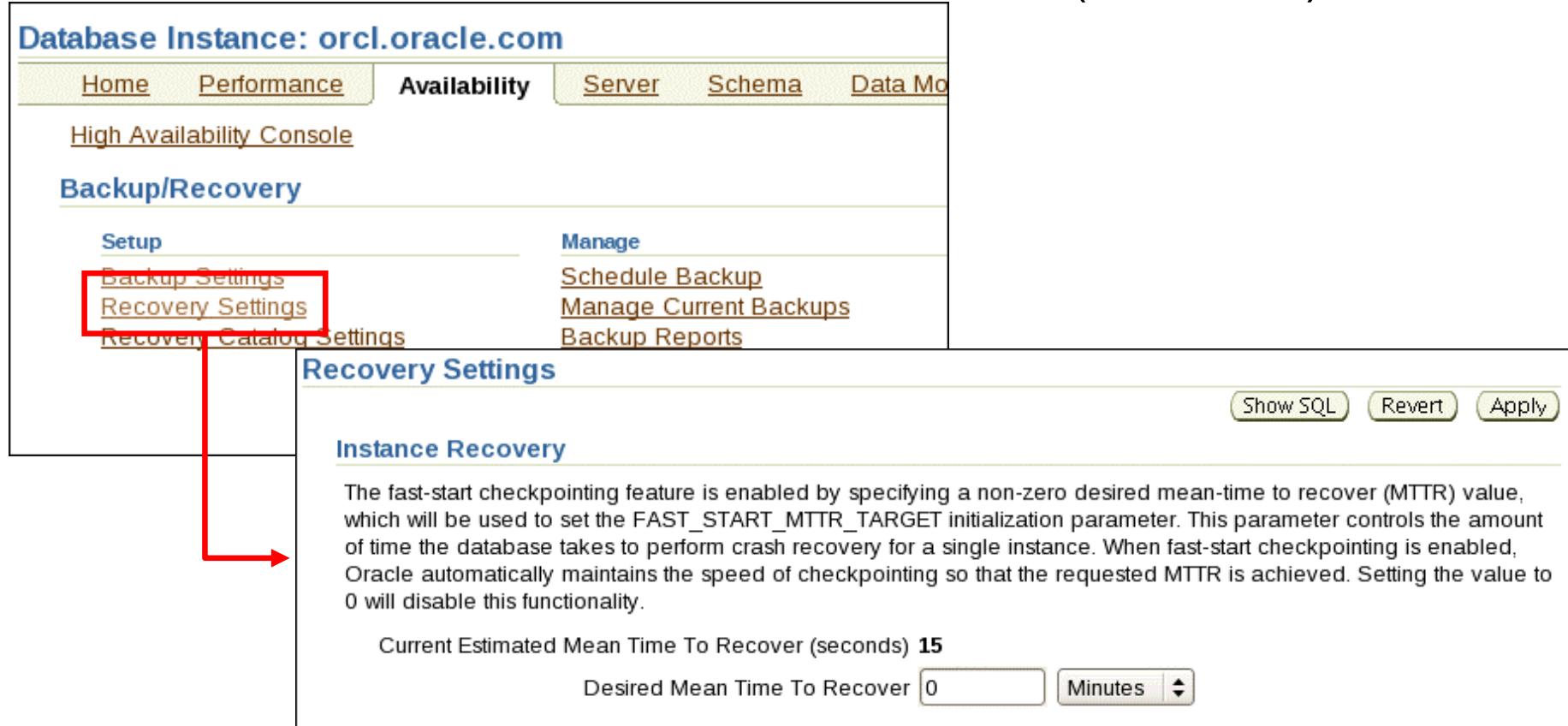
Show SQL Revert Apply

Instance Recovery

The fast-start checkpointing feature is enabled by specifying a non-zero desired mean-time to recover (MTTR) value, which will be used to set the FAST_START_MTTR_TARGET initialization parameter. This parameter controls the amount of time the database takes to perform crash recovery for a single instance. When fast-start checkpointing is enabled, Oracle automatically maintains the speed of checkpointing so that the requested MTTR is achieved. Setting the value to 0 will disable this functionality.

Current Estimated Mean Time To Recover (seconds) 15

Desired Mean Time To Recover Minutes



Media Failure

| Typical Causes | Possible Solutions |
|--|--|
| Failure of disk drive | <ol style="list-style-type: none"><li data-bbox="1079 540 1934 654">1. Restore the affected file from backup. |
| Failure of disk controller | <ol style="list-style-type: none"><li data-bbox="1079 683 1934 798">2. Inform the database about a new file location (if necessary). |
| Deletion or corruption of a file needed for database operation | <ol style="list-style-type: none"><li data-bbox="1079 822 1934 936">3. Recover the file by applying redo information (if necessary). |

Configuring for Recoverability

To configure your database for maximum recoverability, you must:

- Schedule regular backups
- Multiplex control files
- Multiplex redo log groups
- Retain archived copies of redo logs

The screenshot shows the Oracle Database Control interface with the 'Availability' tab selected. The main menu bar includes Home, Performance, Availability (selected), Server, Schema, Data Movement, and Software and Support. Below the menu, there are two columns: 'Backup/Recovery' and 'Oracle Secure Backup'. The 'Backup/Recovery' column contains links for Setup (Backup Settings, Recovery Settings, Recovery Catalog Settings) and Manage (Schedule Backup, Manage Current Backups, Backup Reports, Manage Restore Points, Perform Recovery, View and Manage Transactions). The 'Recovery Settings' link in the 'Setup' section is highlighted with a red box. The 'Oracle Secure Backup' column contains links for Oracle Secure Backup Device and Media and File System Backup and Restore.

| | | | | | | |
|---|-----------------------------|--|------------------------|---|-------------------------------|--------------------------------------|
| Home | Performance | Availability | Server | Schema | Data Movement | Software and Support |
| Backup/Recovery | | | | Oracle Secure Backup | | |
| Setup | | Manage | | Oracle Secure Backup Device and Media | | |
| Backup Settings | | Schedule Backup | | File System Backup and Restore | | |
| Recovery Settings | | Manage Current Backups | | | | |
| Recovery Catalog Settings | | Backup Reports | | | | |
| | | Manage Restore Points | | | | |
| | | Perform Recovery | | | | |
| | | View and Manage Transactions | | | | |

Configuring the Fast Recovery Area

Fast recovery area:

- Strongly recommended for simplified backup storage management
- Storage space (separate from working database files)
- Location specified by the `DB_RECOVERY_FILE_DEST` parameter
- Size specified by the `DB_RECOVERY_FILE_DEST_SIZE` parameter
- Large enough for backups, archived logs, flashback logs, multiplexed control files, and multiplexed redo logs
- Automatically managed according to your retention policy

Configuring the fast recovery area means determining location, size, and retention policy.



Multiplexing Control Files

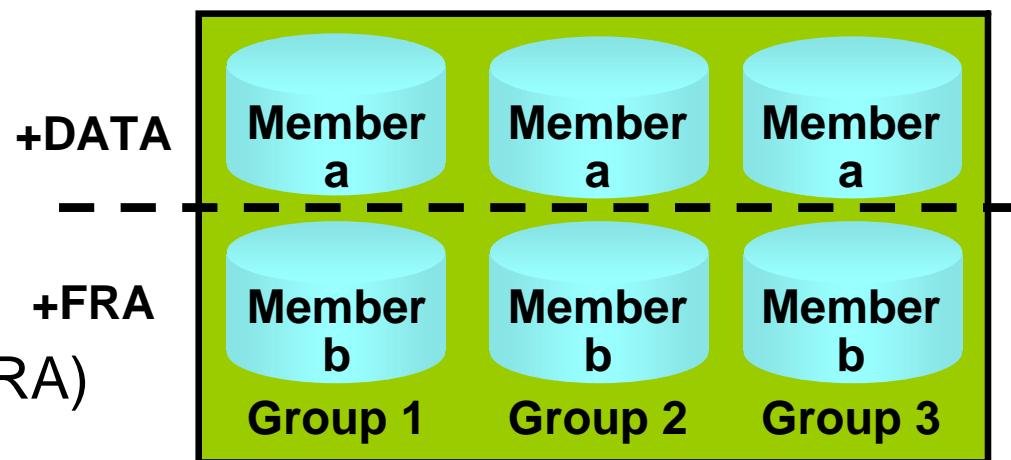
To protect against database failure, your database should have multiple copies of the control file.

| | ASM Storage | File System Storage |
|--|--|---|
| Best Practice | One copy on each disk group (such as +DATA and +FRA) | At least two copies, each on separate disk (at least one on separate disk controller) |
| Steps to create additional control files | No additional control file copies required. | <ol style="list-style-type: none">1. Alter the SPFILE with the ALTER SYSTEM SET control_files command.2. Shut down the database.3. Copy control file to a new location.4. Open the database and verify the addition of the new control file. |

Redo Log Files

Multiplex redo log groups to protect against media failure and loss of data. This increases database I/O. It is suggested that redo log groups have:

- At least two members (files) per group
- Each member:
 - On a separate disk or controller if using file system storage
 - In a separate disk group (such as +DATA and +FRA) if using ASM



Note: Multiplexing redo logs may impact overall database performance.

Multiplexing the Redo Log

If Storage Type is File System, then you are prompted to enter a File Name and File Directory.

Redo Log Groups

Search

Enter an object name to filter the results

Object Name

By default, the search returns all uppercase-sensitive match, double quote the search term to do a case-insensitive search

Selection Mode

Actions

| Select | Group | Status | # of Members | Archived | Size (KB) | Sequence | First Change# |
|----------------------------------|----------|---------|--------------|----------|-----------|----------|---------------|
| <input checked="" type="radio"/> | <u>1</u> | Active | 2 | No | 51200 | 7 | 834285 |
| <input type="radio"/> | <u>2</u> | Active | 2 | No | 51200 | 8 | 849739 |
| <input type="radio"/> | <u>3</u> | Current | 2 | No | 51200 | 9 | 849745 |

Edit Redo Log Group: 1: Add Redo Log Member

Storage Type

* DiskGroup

Template

Alias Directory

Alias Name

Reuse File

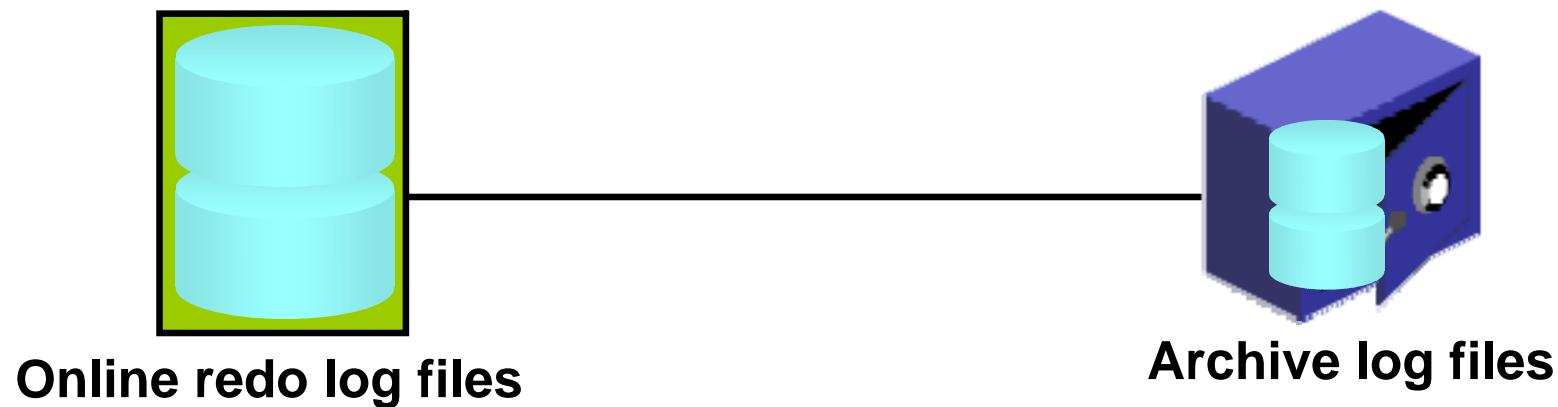
Add



Archive Log Files

To preserve redo information, create archived copies of redo log files by performing the following steps.

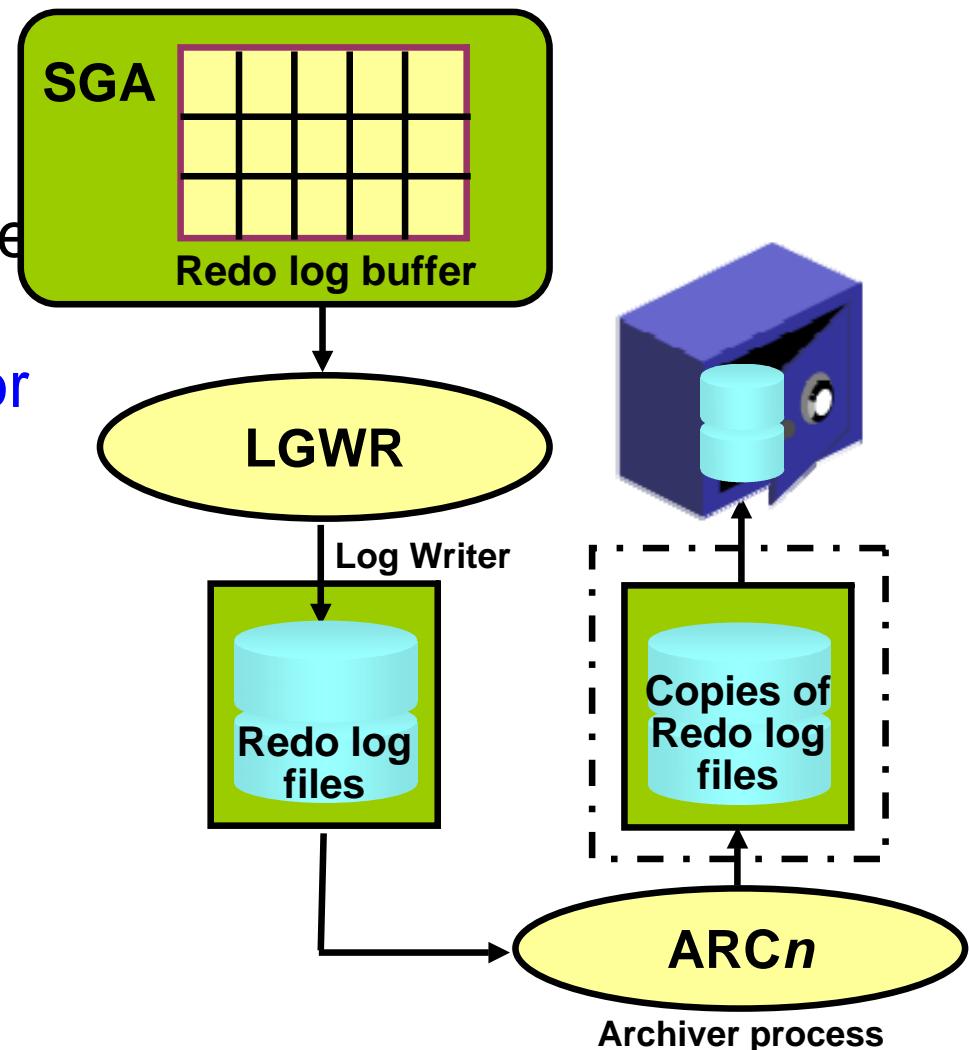
1. Specify archive log file-naming convention.
2. Specify one or more archive log file locations.
3. **Switch the database to ARCHIVELOG mode.**



Archiver (ARC n) Process

Archiver (ARC n):

- Is an optional background process
- Automatically archives online redo log files **when ARCHIVELOG mode is set for the database**
- Preserves the record of all changes made to the database



Archive Log File: Naming and Destinations

Specify naming and archive destination information on the Recovery Settings page. If using file system storage then it is recommended that you add multiple locations across different disks.

Media Recovery

The database is currently in ARCHIVELOG mode. In ARCHIVELOG mode, hot backups and recovery to the latest time are possible, but you must provide space for archived redo log files. If you change the database to ARCHIVELOG mode, you should perform a backup immediately. In NOARCHIVELOG mode, only cold backups are possible and data may be lost in the event of database corruption.

ARCHIVELOG Mode*

Log Archive Filename Format*

| Number | Archived Redo Log Destination | Status | Type |
|--------|--|--------|-------|
| 1 | <input type="text" value="USE_DB_RECOVERY_FILE_DEST"/> | VALID | Local |

TIP It is recommended that archived redo log files be written to multiple locations spread across the different disks.
 TIP You can specify up to 10 archived redo log destinations.

Enabling ARCHIVELOG Mode

To place the database in ARCHIVELOG mode, perform the following steps in Enterprise Manager:

1. Select the ARCHIVELOG Mode check box and click Apply.
The database can be set to ARCHIVELOG mode only from the MOUNT state.
2. Restart the database (with SYSDBA privileges).
3. (Optional) View the archive status.
4. Back up your database.

Note: Databases in ARCHIVELOG mode have access to the full range of backup and recovery options.

```
sqlplus / as sysdba
shutdown immediate
startup mount
alter database archivelog;
alter database open;
archive log list
```

Quiz

Statement failure is never by design and always requires the DBA to address the issue.

1. True
2. False

Quiz

Which parameters configure the fast recovery area?

1. FLASH_RECOVERY_AREA_SIZE
2. DB_RECOVERY_FILE_DEST
3. FLASH_RECOVERY_AREA_LOC
4. DB_RECOVERY_FILE_DEST_SIZE

Summary

In this lesson, you should have learned how to:

- Identify the types of failure that can occur in an Oracle database
- Describe ways to tune instance recovery
- Identify the importance of checkpoints, redo log files, and archive log files
- Configure the fast recovery area
- Configure ARCHIVELOG mode



Practice 14 Overview: Configuring for Recoverability

This practice covers the following topics:

- Verifying control files
- Configuring a default fast recovery area
- Multiplexing redo log groups
- Placing your database in ARCHIVELOG mode
- Ensuring that redundant archive logs are created



15

Performing Database Backups

Objectives

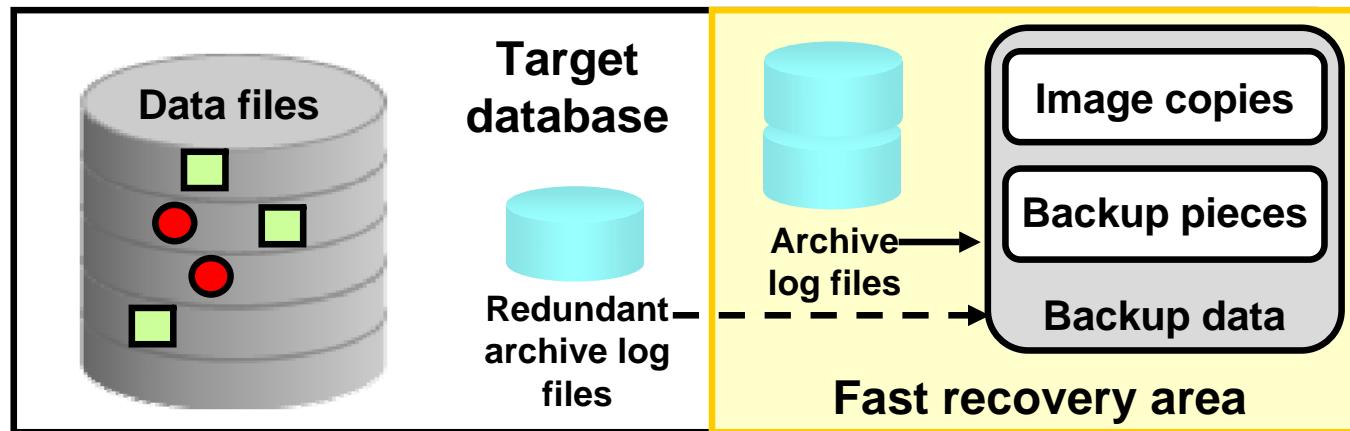
After completing this lesson, you should be able to:

- Create consistent database backups
- Back up your database without shutting it down
- Create incremental backups
- Automate database backups
- Manage backups and view backup reports
- Monitor the fast recovery area

Backup Solutions: Overview

Backups can be performed by using:

- Recovery Manager
- Oracle Secure Backup
- User-managed backup



Oracle Secure Backup

- Oracle Secure Backup and RMAN provide an end-to-end backup solution for Oracle environments:
 - Centralized tape backup management for file system data and the Oracle database
 - Most well-integrated media management layer for RMAN backups
 - Backup of any data anywhere on the network
- A single technical support resource for the entire backup solution expedites problem resolution.
- This ensures reliable data protection at lower cost and complexity.



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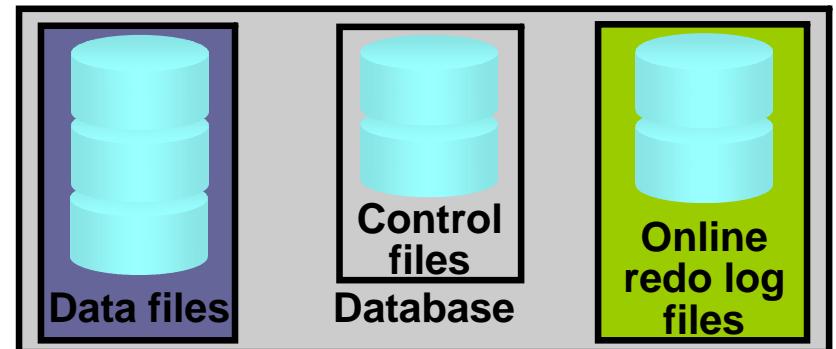
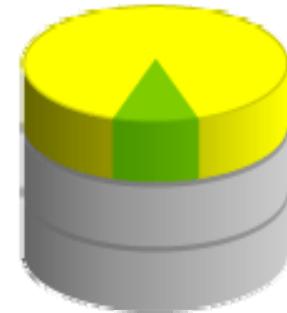
User-Managed Backup

A user-managed scenario:

- Is a manual process of tracking backup needs and status
- Typically uses your own written scripts
- Requires that database files be put in the correct mode for backup
- Relies on operating system commands to make backups of files

Terminology

- Backup strategy may include:
 - Entire database (whole)
 - Portion of the database (partial)
- Backup type may indicate inclusion of:
 - All data blocks within your chosen files (full)
 - Only information that has changed since a previous backup (incremental)
 - Cumulative (changes since last level 0)
 - Differential (changes since last incremental)
- Backup mode may be:
 - Offline (consistent, cold)
 - Online (inconsistent, hot)



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Terminology

Backups may be stored as:

- Image copies
- Backup sets

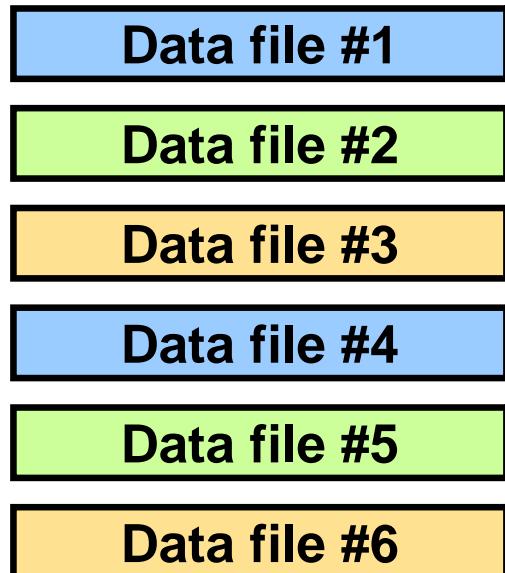
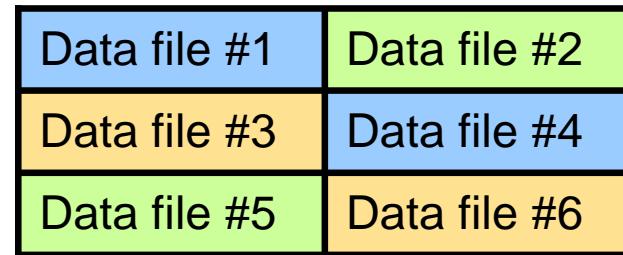


Image copies
(Duplicate data and log files in OS format)



Backup set
(Binary, compressed files in
Oracle proprietary format)

Recovery Manager (RMAN)

- Powerful control and scripting language
- Integrated with Enterprise Manager
- Published API that enables interface with most popular backup software
- Backing up data, control, archived log, and server parameter files
- Backing up files to the disk or tape

The screenshot shows a navigation bar with tabs: Home, Performance, Availability (which is selected), Server, Schema, Data Movement, and Software and Support. Below the tabs, the 'High Availability Console' is displayed. Under 'Backup/Recovery', there are three main sections: 'Setup' (with links to Backup Settings, Recovery Settings, and Recovery Catalog Settings), 'Manage' (with links to Schedule Backup, Manage Current Backups, Backup Reports, Manage Restore Points, Perform Recovery, and View and Manage Transactions), and 'Oracle Secure Backup' (with links to Assign and Manage).

| Setup | Manage | Oracle Secure Backup |
|---|--|-----------------------------------|
| Backup Settings | Schedule Backup | Assign and Manage |
| Recovery Settings | Manage Current Backups | |
| Recovery Catalog Settings | Backup Reports | |
| | Manage Restore Points | |
| | Perform Recovery | |
| | View and Manage Transactions | |

Configuring Backup Settings

Backup Settings

Device **Backup Set** **Policy**

Disk Settings

Parallelism Concurrent streams to disk drives

Disk Backup Location

The flash recovery area is the current disk backup location. If you would like to override the disk backup location, specify an existing directory or diskgroup.

Disk Backup Type **Backup Set**
An Oracle backup file format that allows for more efficient backups by interleaving multiple backup files into one output file.

Compressed Backup Set
An Oracle backup set in which the data is compressed to reduce its size.

Image Copy
A bit-by-bit copy of database files that can be used as-is to perform recovery.

Device **Backup Set** **Policy**

Maximum Backup Piece (File) Size MB

Specify a value to restrict the size of each backup piece.

Compression Algorithm

Specify the compression algorithm that will be used for both disk and tape compressed backup sets.

BZIP2
Optimized for maximum compression. Consumes more CPU resources, but will usually produce more compact backups.

ZLIB
Optimized for CPU efficiency. Requires the Oracle Advanced Compression option.

Tape Settings

The following parameters require additional configuration on different media pools.

Copies of Datafile Backups
Specify the number of identical copies for datafile backups.

Copies of Archivelog Backups
Specify the number of identical copies for archivelog backups.

Host Credentials

To save the backup settings, supply operating system login credentials to access the target database.

* Username

* Password

Save as Preferred Credential

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Configuring Backup Settings

Backup Settings

Device **Backup Set** **Policy**

Backup Policy

Automatically backup the control file and server parameter file (SPFILE) with every backup and database structural change

Autobackup Disk Location An existing directory or diskgroup name where the control file and server parameter file will be backed up. If you do not specify a location, the files will be backed up to the flash recovery area location.

Optimize the whole database backup by skipping unchanged files such as read-only and offline datafiles that have been backed up

Enable block change tracking for faster incremental backups →

Block Change Tracking File Specify a location and file, otherwise an Oracle managed file will be created in the database area.

Tablespaces Excluded From Whole Database Backup

Populate this table with the tablespaces you want to exclude from a whole database backup. Use the Add button to add tablespace names.

Select Tablespace Name **Tablespace Number** **Status** **Contents**

No Items Selected

TIP These tablespaces can be backed up separately using tablespace backup.

Retention Policy

Retain All Backups
You must manually delete any backups

Retain backups that are necessary for a recovery to any time within the specified number of days (point-in-time recovery)
Days: 31
Recovery Window

Retain at least the specified number of full backups for each datafile
Backups: 1
Redundancy

Archived Redo Log Deletion Policy

Specify the deletion policy for archived redo log files. The archived redo log files will be eligible for deletion if the flash recovery area becomes full.

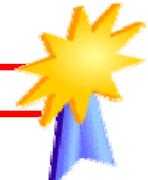
None
If a flash recovery area is set, archived redo log files that have been backed up to a tertiary device and are obsolete based on the retention policy will be deleted.

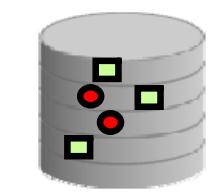
Delete archived redo log files after they have been backed up the specified number of times
Backups: 1

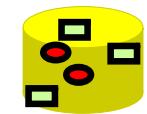
Host Credentials

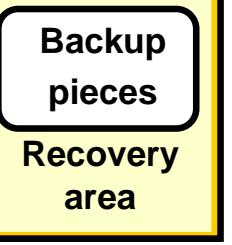
To save the backup settings, supply operating system login credentials to access the target database.

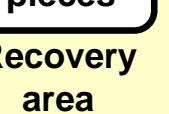
* Username
* Password
 Save as Preferred Credential

Best practice 

Data files 

Change tracking file 

Backup pieces 

Recovery area 

Scheduling Backups: Strategy

Schedule Backup

Oracle provides an automated backup strategy based on your disk and/or tape configuration. Alternatively, you can implement your own customized backup strategy.

Oracle-Suggested Backup

Schedule a backup using Oracle's automated backup strategy.

[Schedule Oracle-Suggested Backup](#)

This option will back up the entire database. The database will be backed up on daily and weekly intervals.

Customized Backup

Select the object(s) you want to back up.

[Schedule Customized Backup](#)

- Whole Database
- Tablespaces
- Datafiles
- Archived Logs
- All Recovery Files on Disk

Includes all archived logs and disk backups that are not already backed up to tape.

Backup Strategies

Oracle-suggested:

- Provides an out-of-the-box backup strategy based on the backup destination
- Sets up recovery window for backup management
- Schedules recurring and immediate backups
- Automates backup management

Customized:

- Specify the objects to be backed up
- Choose disk or tape backup destination
- Override the default backup settings
- Schedule the backup

Host Credentials

To perform a backup, supply operating system login credentials to access the target database.

* Username

* Password

Save as Preferred Credential



Scheduling Backups: Options

 Options Settings Schedule Review

Schedule Customized Backup: Options

Database **orcl.oracle.com** [Cancel](#) [Step 1 of 4](#) [Next](#)

Backup Strategy **Customized Backup**
Object Type **Whole Database**

Backup Type

Full Backup
 Use as the base of an incremental backup strategy

Incremental Backup
A level 1 cumulative incremental backup includes all blocks changed since the most recent level 0 backup.
 Refresh the latest datafile copy on disk to the current time using the incremental backup

Backup Mode

Online Backup
Can be performed when the database is open.

Offline Backup
If the database is open at the time of backup, it will be shut down and mounted before the backup, then re-opened after the backup.

Advanced

Also back up all archived logs on disk
 Delete all archived logs from disk after they are successfully backed up

Delete obsolete backups
Delete backups that are no longer required to satisfy the retention policy.

Use proxy copy supported by media management software to perform a backup
If proxy copy of the selected files is not supported, a conventional backup will be performed.

Maximum Files per Backup Set

Section Size KB

Backs up large files in parallel, using sections of the specified size. (This parameter overrides Maximum Backup Piece Size in Backup Settings.)

[►Encryption](#)

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Scheduling Backups: Settings

Options **Settings** Schedule Review

Schedule Customized Backup: Settings

Database **orcl.oracle.com** [Cancel](#) [Back](#) Step 2 of 4 [Next](#)

Backup Strategy **Customized Backup**

Object Type **Whole Database**

Select the destination media for this backup. You can also override the default backup settings.

Disk
Disk Backup Location **+FRA**

Tape

Media Management Vendor (MMV) Library Parameters **Not specified**

[View Default Settings](#) [Override Default Settings](#)

Changed settings will only apply to the current backup.

Scheduling Backups: Schedule

Options Settings **Schedule** Review

Schedule Customized Backup: Schedule

Database **orcl.oracle.com** [Cancel](#) [Back](#) [Step 3 of 4](#) [Next](#)

Backup Strategy **Customized Backup**

Object Type **Whole Database**

Job

* Job Name **BACKUP_ORCL.ORACLE.COM_001**
Job Description **Whole Database Backup**

Schedule

Type One Time (Immediately) One Time (Later) Repeating

Frequency Type **By Minutes**

Repeat Every Minutes

Time Zone **(UTC-08:00) US Pacific Time (PST)**

Start Date **Jun 18, 2009**

Start Time **1 : 00 AM**

Repeat Until Indefinite
 Specified Date

Date
(example: Jun 18, 2009)

Time : AM PM

Scheduling Backups: Review

 Options → Settings → Schedule → Review

Schedule Customized Backup: Review

Database **orcl.oracle.com** [Cancel](#) [Edit RMAN Script](#) [Back](#) **Step 4 of 4** [Submit Job](#)

Backup Strategy **Customized Backup**
Object Type **Whole Database**

Settings

Destination **Disk**
Backup Type **Full Backup**
Backup Mode **Online Backup**
Flash Recovery Area **+FRA**

RMAN Script

The RMAN script below is generated based on previous input.

```
backup device type disk tag '%TAG' database;
backup device type disk tag '%TAG' archivelog all not backed up;
```

Backing Up the Control File to a Trace File

Control files have an additional backup option.

Control Files

General Advanced Record Section

Control File 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 | current.260.689752023 | +DATA/orcl/controlfile/ |
| VALID | current.256.689752023 | +FRA/orcl/controlfile/ |

Backup To Trace

Control Files

General Advanced Record Section

Control File Information

Control files store the status of the database physical structure. It is crucial to database operation.

Database ID 1217532758
Control File Type CURRENT
Control File Creation Date June 17, 2009 5:47:05 AM
Control File Sequence Number 1557
Last Change Number 1025918
Date Last Modified June 18, 2009 12:13:30 PM
Control File AutoBackup Enabled [Click here to disable](#)

Control file trace backups
may be used to recover
from loss of all control files.

Managing Backups

Manage Current Backups

Catalog Additional Files Crosscheck All Delete All Obsolete Delete All Expired

This backup data was retrieved from the database control file.

Backup Sets **Image Copies**

Search

Status Available ▾

Contents Datafile Archived Redo Log SPFILE Control File

Completion Time Within a month ▾ **Go**

Results

Crosscheck Change to Unavailable Delete Validate

Select All | Select None

| Select | Key Tag | Completion Time ▾ | Contents | Device Type | Status | Keep | Pieces |
|--------------------------|-----------------------------------|--------------------------|---------------------|-------------|-----------|------|--------|
| <input type="checkbox"/> | 4 TAG20090618T121325 | Jun 18, 2009 12:13:27 PM | CONTROLFILE, SPFILE | DISK | AVAILABLE | NO | 1 |
| <input type="checkbox"/> | 3 BACKUP_ORCL.ORACLE_061809120854 | Jun 18, 2009 12:13:21 PM | ARCHIVED LOG | DISK | AVAILABLE | NO | 1 |
| <input type="checkbox"/> | 2 TAG20090618T121228 | Jun 18, 2009 12:12:56 PM | CONTROLFILE, SPFILE | DISK | AVAILABLE | NO | 1 |
| <input type="checkbox"/> | 1 BACKUP_ORCL.ORACLE_061809120854 | Jun 18, 2009 12:12:20 PM | DATAFILE | DISK | AVAILABLE | NO | 1 |

Viewing Backup Reports

View Backup Report

The following backup jobs are known to the database. The data is retrieved from the database control file.

Search

Status All Start Time Within 1 month Type All Go

Results

Total 1 (Completed ✓ 1)

| Backup Name | Status | Start Time | Time Taken | Type | Output Devices | Input Size | Output Size | Output Rate (Per Sec) |
|---------------------------------|-----------|-----------------------|------------|---------|----------------|------------|-------------|-----------------------|
| BACKUP_ORCL.ORACLE_061809120854 | COMPLETED | Jun 18, 2009 12:09:16 | 00:04:14 | DB FULL | DISK | 1.64G | 1.34G | 5.42M |

Related Links
Manage Current

Inputs

Datafiles

| Datafile Number | Output Type | Output Key | File Size | Tablespace | Checkpoint Time | Incremental Level | Compression Ratio | Corrupted Blocks | File Creation Time | Checkpoint SCN | Resetlogs SCN |
|-----------------|-------------|------------|-----------|------------|------------------------------------|-------------------|-------------------|------------------|------------------------------------|----------------|---------------|
| 1 | BACKUPSET | 1 | 750.01M | SYSTEM | Jun 18, 2009 12:09:18 PM GMT+07:00 | | 1.158 | 0 | Apr 24, 2009 10:31:11 AM GMT+07:00 | 1025302 | 740137 |
| 2 | BACKUPSET | 1 | 651.26M | SYSAUX | Jun 18, 2009 12:09:18 PM GMT+07:00 | | 1.43 | 0 | Apr 24, 2009 10:31:17 AM GMT+07:00 | 1025302 | 740137 |
| 3 | BACKUPSET | 1 | 100.01M | UNDOTBS1 | Jun 18, 2009 12:09:18 PM GMT+07:00 | | 11.595 | 0 | Apr 24, 2009 11:29:42 AM GMT+07:00 | 1025302 | 740137 |
| 4 | BACKUPSET | 1 | 148.20M | USERS | Jun 18, 2009 12:09:18 PM GMT+07:00 | | 1.102 | 0 | Apr 24, 2009 10:31:30 AM GMT+07:00 | 1025302 | 740137 |
| 5 | BACKUPSET | 1 | 100.01M | EXAMPLE | Jun 18, 2009 12:09:18 PM GMT+07:00 | | 1.442 | 0 | Jun 17, 2009 5:49:29 AM GMT+07:00 | 1025302 | 740137 |

Control Files

| Output Type | Output Key | Checkpoint Time | File Size | File Checkpoint SCN | Resetlogs SCN |
|-------------|------------|--------------------------------------|-----------|---------------------|---------------|
| BACKUPSET | | 2 Jun 18, 2009 12:12:28 PM GMT+07:00 | 9.30M | 1025706 | 740137 |
| BACKUPSET | | 4 Jun 18, 2009 12:13:25 PM GMT+07:00 | 9.30M | 1025894 | 740137 |

SPFile

| Backup Set | Modificaton Time | File Size |
|------------|--------------------------------------|-----------|
| | 4 Jun 18, 2009 11:21:10 AM GMT+07:00 | 0.00K |
| | 2 Jun 18, 2009 11:21:10 AM GMT+07:00 | 0.00K |

Archived Logs

| Output Type | Output Key | Thread Number | Sequence Number | File Size | Low Time | High Time | Compression Ratio | Resetlogs SCN |
|-------------|------------|---------------|-----------------|-----------|-----------------------------------|------------------------------------|-------------------|---------------|
| BACKUPSET | 3 | 1 | 14 | 42.14M | Jun 18, 2009 6:41:27 AM GMT+07:00 | Jun 18, 2009 12:13:04 PM GMT+07:00 | 1 | 740137 |

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Monitoring the Fast Recovery Area

Flash Recovery

This database is using a flash recovery area. The chart shows space used by each file type that is not reclaimable by Oracle. Performing backups to tertiary storage is one way to make space reclaimable. Usable Flash Recovery Area includes free and reclaimable space.

Flash Recovery Area Location 

Flash Recovery Area Size MB 

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

Non-reclaimable Flash Recovery Area (GB) **1.5**

Reclaimable Flash Recovery Area (MB) **53**

Free Flash Recovery Area (GB) **2.8**

Enable Flashback Database

Flashback database can be used for fast database point-in-time recovery, as it returns the database to a prior point-in-time without restoring files. Flashback is the preferred point-in-time recovery method in the recovery wizard when appropriate. The flash recovery area must be set to enable flashback database.

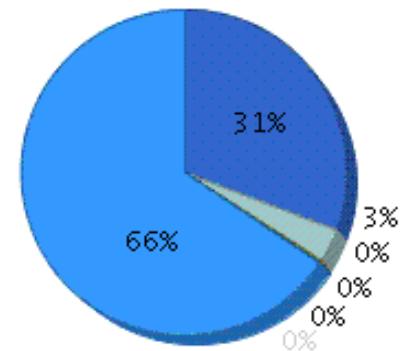
Flashback Retention Time Hours 

Current size of the flashback logs(GB) **n/a**

Lowest SCN in the flashback data **n/a**

Flashback Time **n/a**

Flash Recovery Area Usage



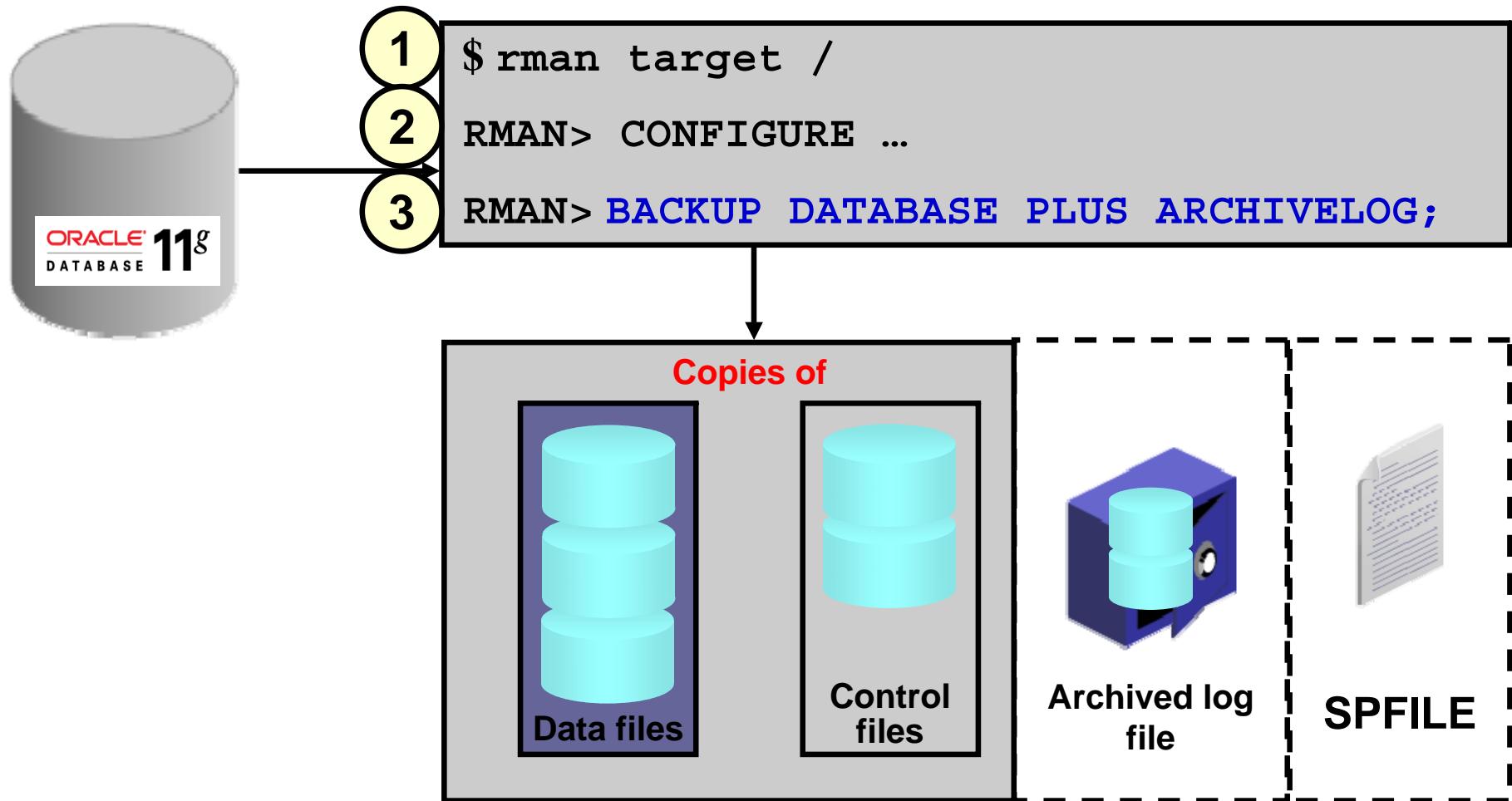
- Backup Piece - 1.34GB (30.8%)
- Online Log - 0.15 GB (3.4%)
- Control File - 0.01GB (0.2%)
- Archived Redo Log - 0GB (0%)
- Image Copy - 0GB (0%)
- Flashback Log - 0GB (0%)
- **Usable - 2.85 GB (65.6%)**

Apply initialization parameter changes to SPFILE only. If not checked, parameter changes will be made to both the SPFILE and the running instance.

* Changes to this setting or parameter require a database restart.

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Using the RMAN Command Line



Quiz

Using the change-tracking feature, an image copy backup performed by RMAN can skip blocks that have not changed since the last backup.

- 1. True**
- 2. False**

Summary

In this lesson, you should have learned how to:

- Create consistent database backups
- Back up your database without shutting it down
- Create incremental backups
- Automate database backups
- Manage backups and view backup reports
- Monitor the fast recovery area



Practice 15 Overview:

Creating Database Backups

This practice covers the following topics:

- Backing up your database while the database is open for user activity
- Scheduling automatic nightly incremental backups for your database



16

Performing Database Recovery

Objectives

After completing this lesson, you should be able to:

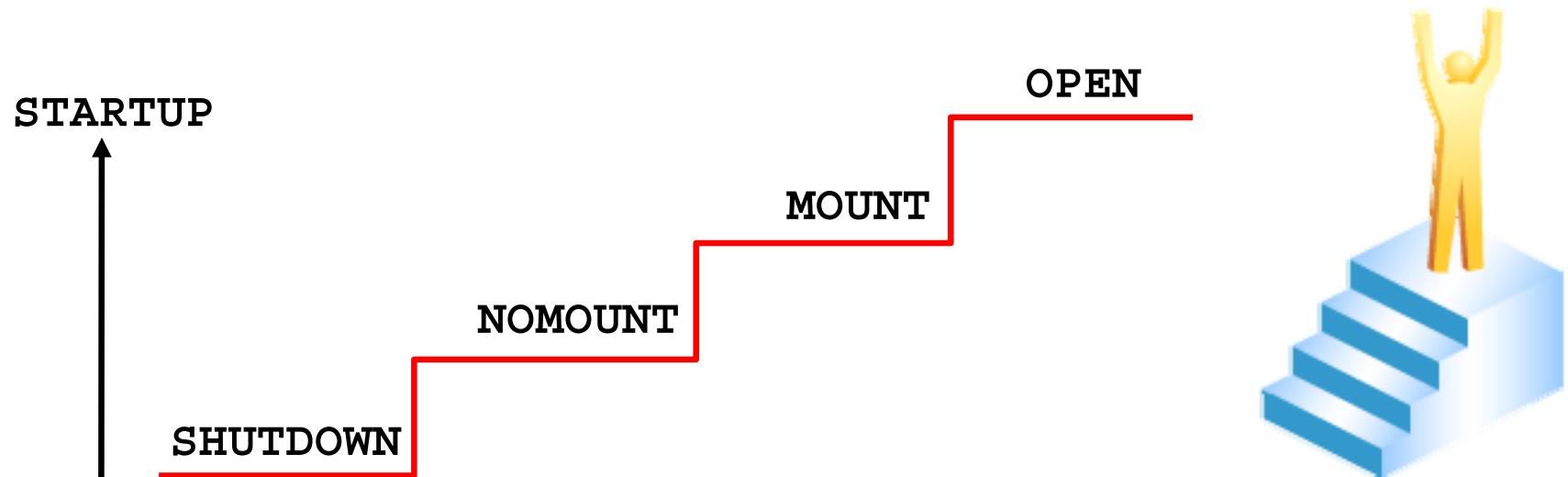
- Determine the need for performing recovery
- Access different interfaces (such as Enterprise Manager and command line)
- Describe and use available options, such as Recovery Manager (RMAN) and the Data Recovery Advisor
- Perform recovery:
 - Control file
 - Redo log file
 - Data file



Opening a Database

To open a database:

- All control files must be present and synchronized
- All online data files must be present and synchronized
- At least one member of each redo log group must be present



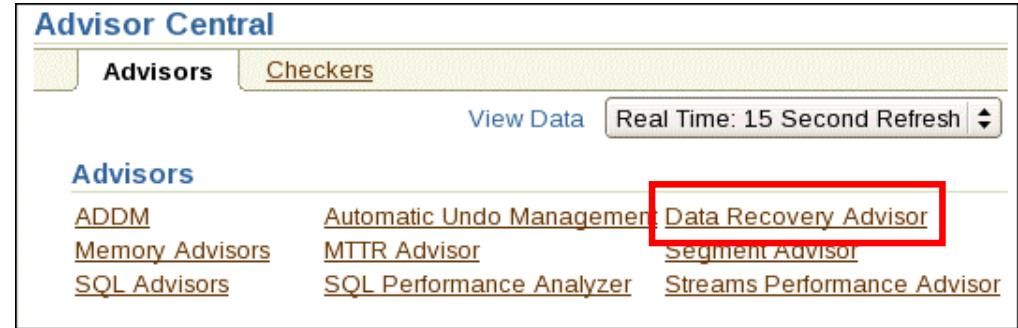
Keeping a Database Open

After the database is open, it fails in the case of the loss of:

- Any control file
- A data file belonging to the system or undo tablespaces
- An entire redo log group
(As long as at least one member of the group is available, the instance remains open.)

Data Recovery Advisor

- Fast detection, analysis, and repair of failures
- Down-time and run-time failures
- Minimizing disruptions for users
- User interfaces:
 - Enterprise Manager GUI (several paths)
 - RMAN command line
- Supported database configurations:
 - Single instance
 - Not RAC
 - Supporting failover to standby, but not analysis and repair of standby databases



Loss of a Control File

If a control file is lost or corrupted, the instance normally aborts.

- If control files are stored in ASM disk groups, recovery options are as follows:
 - Perform guided recovery using Enterprise Manager.
 - Put database in NOMOUNT mode and use an RMAN command to restore control file from existing control file.

```
RMAN> restore controlfile from
  '+DATA/orcl/controlfile/current.260.695209463' ;
```

- If control files are stored as regular file system files then:
 - Shut down the database
 - Copy existing control file to replace lost control file

After control file is successfully restored, open the database.



Loss of a Redo Log File

If a member of a redo log file group is lost and if the group still has at least one member, note the following results:

- Normal operation of the instance is not affected.
- You receive a message in the alert log notifying you that a member cannot be found.
- You can restore the missing log file by dropping the lost redo log member and adding a new member.
- If the group with the missing log file has been archived you can clear the log group to re-create the missing file.

Loss of a Data File in NOARCHIVELOG Mode

If the database is in NOARCHIVELOG mode and if any data file is lost, perform the following tasks:

1. Shut down the instance if it is not already down.
2. Restore the entire database—including all data and control files—from the backup.
3. Open the database.
4. Have users reenter all changes that were made since the last backup.



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Loss of a Noncritical Data File in ARCHIVELOG Mode

If a data file is lost or corrupted, and if that file does not belong to the SYSTEM or UNDO tablespace, you restore and recover the missing data file.

Object Level Recovery

Object Type

Operation Type Recover to current time
Datafile will be restored as required.
 Restore datafiles
Specify Time, SCN or log sequence. The backup taken at or prior to that time will be used. No recovery will be performed in this operation.
 Recover from previously restored datafiles
 Block Recovery



Users

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Loss of a System-Critical Data File in ARCHIVELOG Mode

If a data file is lost or corrupted, and if that file belongs to the SYSTEM or UNDO tablespace, perform the following tasks:

1. The instance may or may not shut down automatically. If it does not, use SHUTDOWN ABORT to bring the instance down.
2. Mount the database.
3. Restore and recover the missing data file.
4. Open the database.



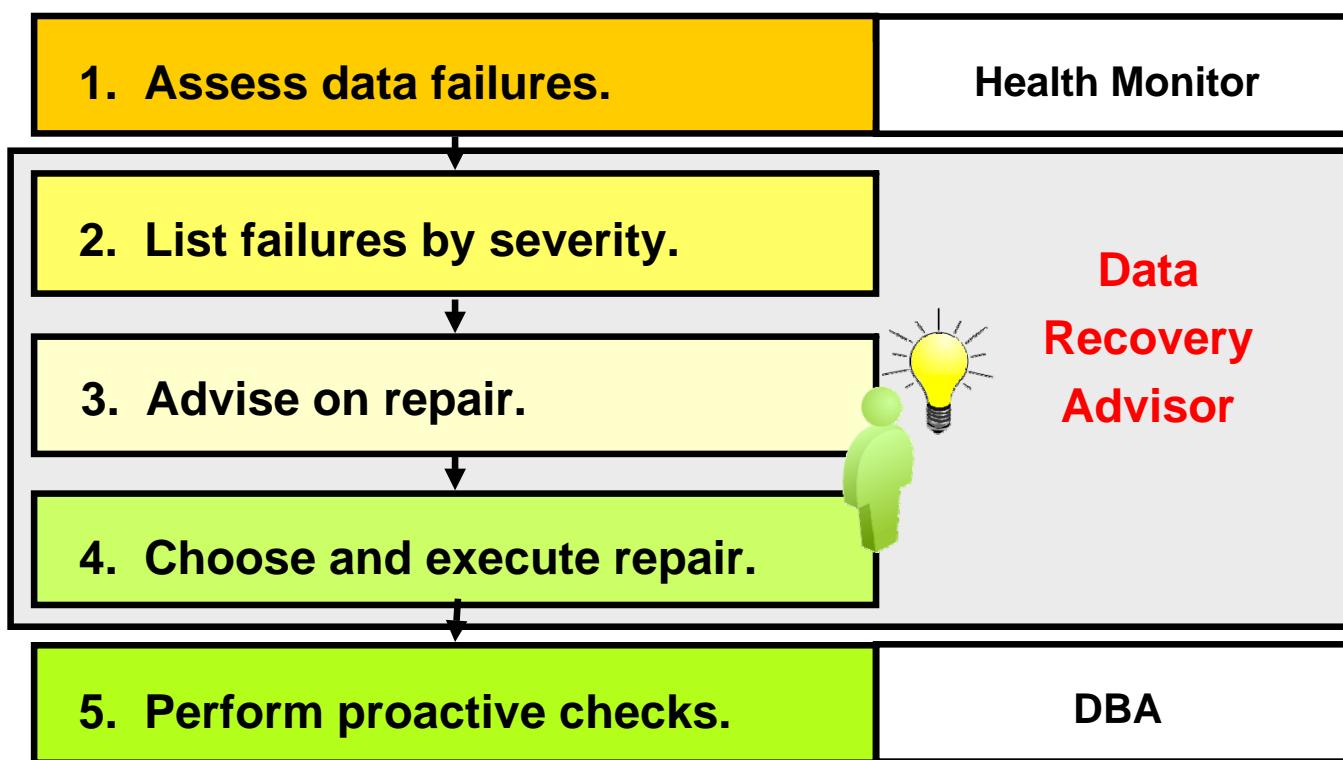
ORACLE

Data Failure: Examples



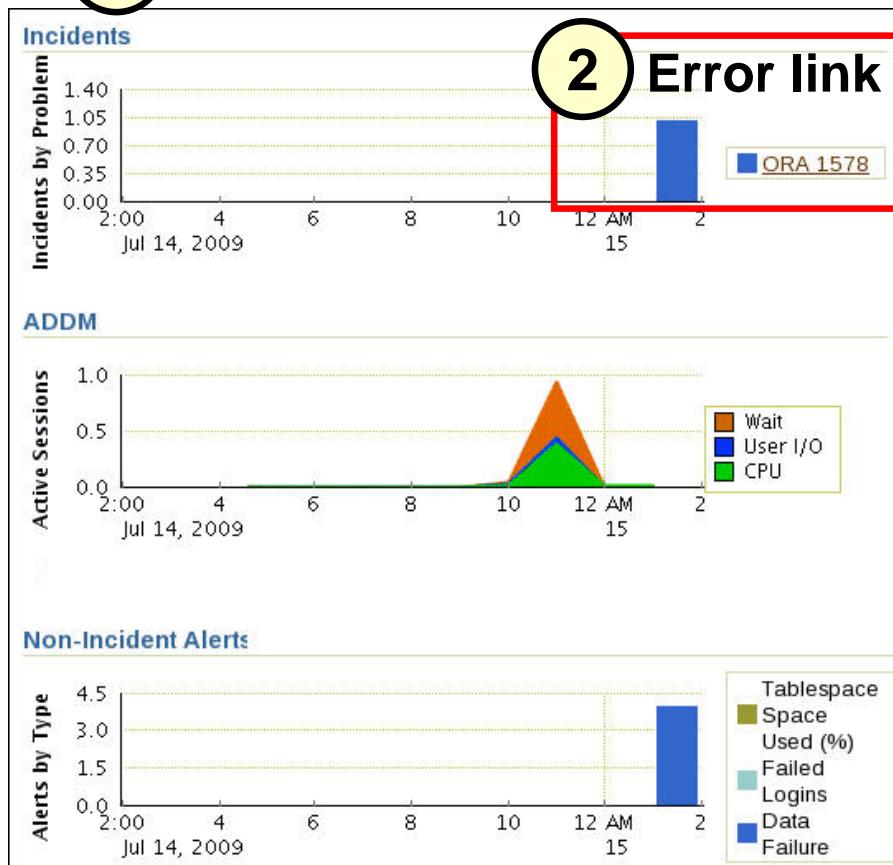
- Inaccessible components: Missing data files at the OS level, incorrect access permissions, offline tablespace
- Physical corruptions: Block checksum failures, invalid block header field values
- Logical corruptions: Inconsistent dictionary; corrupt row piece, index entry, or transaction
- Inconsistencies: Control file older or newer than the data files and online redo logs
- I/O failures: Limit on the number of open files exceeded, inaccessible channels, network or I/O error

Data Recovery Advisor



Assessing Data Failures

1 Database instance health



3 Problem details

The "Problem Details: ORA 1578" page includes the following sections:

- Summary**: Provides basic information like SR#, Bug#, Active status (Yes), and Number of Incidents (1).
- Last Dumped Incident**: Details the incident timestamp (July 15, 2009, 1:30:50 AM GMT+07:00), source (System Generated), impact, checkers run (1), and checker findings (1).
- Investigate and Resolve**: Links to Oracle Support and Self Service.
- Assess Damage**: Links to Checker Findings, Run Checkers, and Database Instance Health.
- Diagnose**: Links to Alert Log, Related Problems Across Topology, Diagnostics for Last Dumped Incident, and Go to My Oracle Support and Research.
- Resolve**: Links to SQL Repair Advisor and Data Recovery Advisor.

At the bottom, there's an "Incidents" tab and a table showing the details of the dumped incident:

| Select Details | ID | Description | Data Dumped | Active | Status | Timestamp |
|--------------------------|------------|--------------------|-------------|--------|--------|------------------------------------|
| <input type="checkbox"/> | Show 18345 | ORA-1578 [9] [129] | Yes | Yes | Ready | July 15, 2009 1:30:50 AM GMT+07:00 |

Data Failures

ORACLE Enterprise Manager 11g Database Control Help Database

Database Instance: orcl.oracle.com >

i Information

1. [Database Failures](#) - 1
2. [Current Status](#) - MOUNTED

Perform Recovery

Oracle Advised Recovery

The Data Recovery Advisor has detected failures.
Click on "Advise and Recover" to have Oracle analyze and produce recovery advice.

Advise and Recover

Failures Detected Critical: 1 High: 0 Low: 0
Failure System datafile 1: '+DATA/orcl/datafile
Description /system.256.692202091' is missing

User Directed Recovery

Recovery Scope Whole Database ▾ Recover

Operation Type Recover to the current time or a previous point-in-time
Datafiles will be restored from the latest usable backup as required.
 Restore all datafiles
Specify Time, SCN or log sequence. The backup taken at or prior to that time will be used. No recovery will be performed in this operation.
 Recover from previously restored datafiles

► Decrypt Backups

i Overview

- Recover database failures as advised by Oracle
- Restore and/or recover the entire database or selected objects
- Restore files to a new location
- Recover tablespaces to a point-in-time based on a timestamp, system change number (SCN), or log sequence number
- Recover datafile data blocks that are marked as corrupted, or based on datafile block IDs or tablespace block addresses
- Flashback database or tables to a specific system change number (SCN) or timestamp

Listing Data Failures

ORACLE Enterprise Manager 11g Database Control [Help](#) [Database](#)

Database Instance: orcl.oracle.com >

View and Manage Failures

Last Refresh July 15, 2009 2:38:38 AM GMT+07:00

Select dropdown values and optionally enter failure description and impact strings to filter the data that is displayed in your results set.

| Failure Description | Impact | Priority | Status | Time Detected | |
|--|---|---------------------------|----------|---------------|-----------------------|
| <input type="text"/> | <input type="text"/> | CRITICAL or HIGH | OPEN | All | |
| Select failures and ... | | | | | |
| Select All Select None Expand All Collapse All | | | | | |
| Select | Failure Description | Impact | Priority | Status | Time Detected |
| <input type="checkbox"/> | Data Failures | | | | |
| <input checked="" type="checkbox"/> | System datafile 1: '+DATA/orcl /datafile/system.256.692202091' is missing | Database cannot be opened | CRITICAL | OPEN | 2009-07-15 02:36:06.0 |

TIP All CRITICAL failures must be selected before "Advise". All CRITICAL failures must be unselected before "Set Priority High" or "Set Priority Low".

Use a Recovery Catalog

Recovery Catalog Database **Not specified**

Advising on Repair

The screenshot illustrates the Oracle Enterprise Manager 11g Database Control interface for managing database failures. It shows two main paths for recovery:

- (1) After manual repair:** This path starts with the "Manual Actions" step. A yellow circle labeled "1" points to the "Re-assess Failures" button. A blue box highlights the "Continue with Advise" button. A blue arrow points from the "Manual Action Details" section to the "Recovery Advice" section.
- (2) Automatic repair:** This path starts with the "Review" step. A yellow circle labeled "2a" points to the "Execute Recovery" button. A blue arrow points from the "Recovery Advice" section to the "Review" step. The "Review" step also contains a "Failures That Will Be Resolved" table and an "RMAN Script" section.

Manual Actions

1 Re-assess Failures Continue with Advise

The following user actions may provide a faster recovery path for certain simple failures. Click "Re-assess Failures" if user actions are performed. Otherwise, click "Continue with Advise" to use the recovery advice generated for the failures selected.

Manual Action Details

If file '+DATA/orcl/datafile/system.256.692202091' was unintentionally renamed or moved, restore it

Recovery Advice

Cancel Continue

The repair includes complete media recovery with no data loss

RMAN Script

```
# restore and recover datafile
restore datafile 1;
recover datafile 1;
```

Review

Cancel Execute Recovery

The repair includes complete media recovery with no data loss

Failures That Will Be Resolved

Expand All Collapse All

| Failure Description | Impact | Priority |
|--|---------------------------|----------|
| ▼ Failures That Will Be Resolved System datafile 1: '+DATA/orcl/datafile/system.256.692202091' is missing | Database cannot be opened | CRITICAL |

RMAN Script

```
# restore and recover datafile
restore datafile 1;
recover datafile 1;
```

Executing Repairs

Database Instance: orcl.oracle.com >

Recovery Succeeded

Recovery succeeded. See Recovery Results below.

Recovery Results

[Recovery Results](#) [Open Database](#) [OK](#)

Recovery Manager: Release 11.2.0.1.0 - Production on Wed Jul 15 02:47:57 2009

Copyright (c) 1982, 2009, Oracle and/or its affiliates. All rights reserved.

RMAN>
connected to target database: ORCL (DBID=1219972082, not open)
using target database control file instead of recovery catalog

RMAN> echo set on

media recovery complete, elapsed time **00:00:40**
Finished recover at 15-JUL-09
repair failure complete

RMAN> exit;

Recovery Manager complete.

[Open Database](#) [OK](#)

The database has been opened successfully.

Data Recovery Advisor Views

Querying dynamic data dictionary views

- V\$IR_FAILURE: Listing of all failures, including closed ones (result of the LIST FAILURE command)
- V\$IR_MANUAL_CHECKLIST: Listing of manual advice (result of the ADVISE FAILURE command)
- V\$IR_REPAIR: Listing of repairs (result of the ADVISE FAILURE command)
- V\$IR_FAILURE_SET: Cross-reference of failure and advise identifiers



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Quiz

An Instance will not fail if the following event occurs:

1. Loss of a control file if there is a remaining multiplexed control file
2. Loss of the SYSTEM tablespace
3. Loss of one redo log member if there is a remaining multiplexed redo log member from the same group of the lost member
4. Loss of the active undo tablespace

Quiz

The information used by the Data Recovery Advisor is only available via the Enterprise Manager interface.

1. True
2. False

Summary

In this lesson, you should have learned how to:

- Determine the need for performing recovery
- Access different interfaces (such as Enterprise Manager and command line)
- Describe and use available options, such as Recovery Manager (RMAN) and the Data Recovery Advisor
- Perform recovery:
 - Control file
 - Redo log file
 - Data file

Practice 16 Overview: Performing Database Recovery

This practice covers recovering from the loss of a:

- Control file
- Noncritical data file
- System-critical data file



11 Moving Data 17

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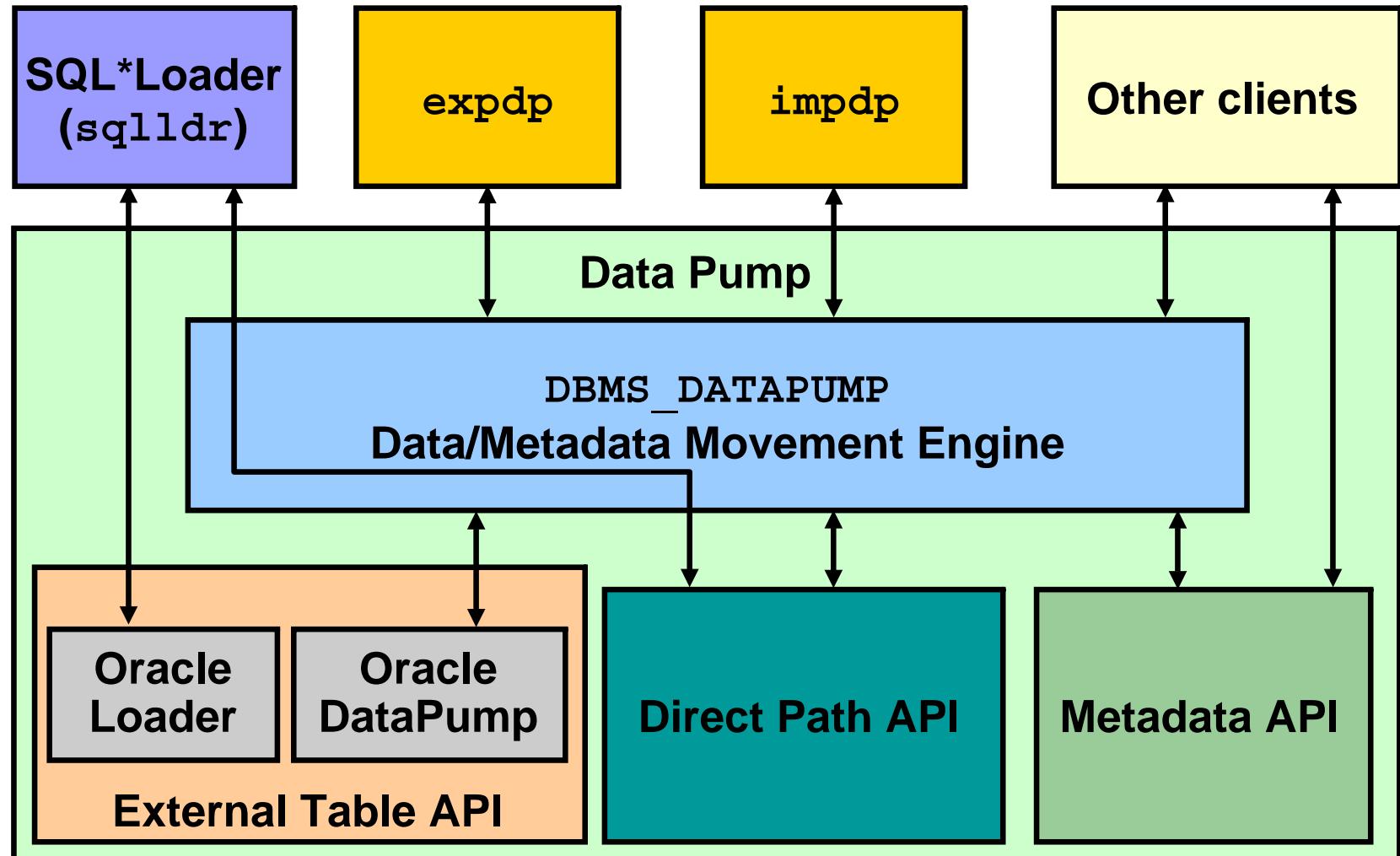
Copyright © 2009, Oracle. All rights reserved.

Objectives

After completing this lesson, you should be able to:

- Describe ways to move data
- Create and use directory objects
- Use SQL*Loader to load data from a non-Oracle database (or user files)
- Use external tables to move data via platform-independent files
- Explain the general architecture of Oracle Data Pump
- Use Data Pump Export and Import to move data between Oracle databases

Moving Data: General Architecture



Oracle Data Pump: Overview

As a server-based facility for high-speed data and metadata movement, Oracle Data Pump:

- Is callable via DBMS_DATAPUMP
- Provides the following tools:
 - expdp
 - impdp
 - Web-based interface
- Provides four data movement methods:
 - Data file copying
 - Direct path
 - External tables
 - Network link support
- Detaches from and reattaches to long-running jobs
- Restarts Data Pump jobs



Oracle Data Pump: Benefits

Data Pump offers many benefits and some new features over earlier data movement tools, such as:

- Fine-grained object and data selection
- Explicit specification of database version
- Parallel execution
- Estimation of export job space consumption
- Network mode in a distributed environment
- Remapping capabilities
- Data sampling and metadata compression
- Compression of data during a Data Pump export
- Security through encryption
- Ability to export XMLType data as CLOBs
- Legacy mode to support old import and export files



Directory Objects for Data Pump

ORACLE Enterprise Manager 11g Database Control

Database Instance: orcl.oracle.com > Logged in As SYS

Directory Objects

Search

Object Name Go

By default, the search returns all uppercase matches beginning with the string you entered. To run an exact or case-sensitive match, double quote the search string. You can use the wildcard symbol (%) in a double quoted string.

Selection Mode Single

Edit View Delete Actions Create Like Go

| Select | Name | Path |
|----------------------------------|-----------------------|---|
| <input checked="" type="radio"/> | DATA_FILE_DIR | /u01/app/oracle/product/11.2.0/dbhome_1/demo/schema/sales_history/ |
| <input type="radio"/> | DATA_PUMP_DIR | /u01/app/oracle/admin/orcl/dpdump/ |
| <input type="radio"/> | LOG_FILE_DIR | /u01/app/oracle/product/11.2.0/dbhome_1/demo/schema/log/ |
| <input type="radio"/> | MEDIA_DIR | /u01/app/oracle/product/11.2.0/dbhome_1/demo/schema/product_media/ |
| <input type="radio"/> | ORACLE_OCM_CONFIG_DIR | /u01/app/oracle/product/11.2.0/dbhome_1/ccr/state |
| <input type="radio"/> | SS_OE_XMLDIR | /u01/app/oracle/product/11.2.0/dbhome_1/demo/schema/order_entry/ |
| <input type="radio"/> | SUBDIR | /u01/app/oracle/product/11.2.0/dbhome_1/demo/schema/order_entry//2002/Sep |
| <input type="radio"/> | XMLDIR | /ade/b/1191423112/oracle/rdbms/xml |

[Database](#) | [Setup](#) | [Preferences](#) | [Help](#) | [Logout](#)

Creating Directory Objects

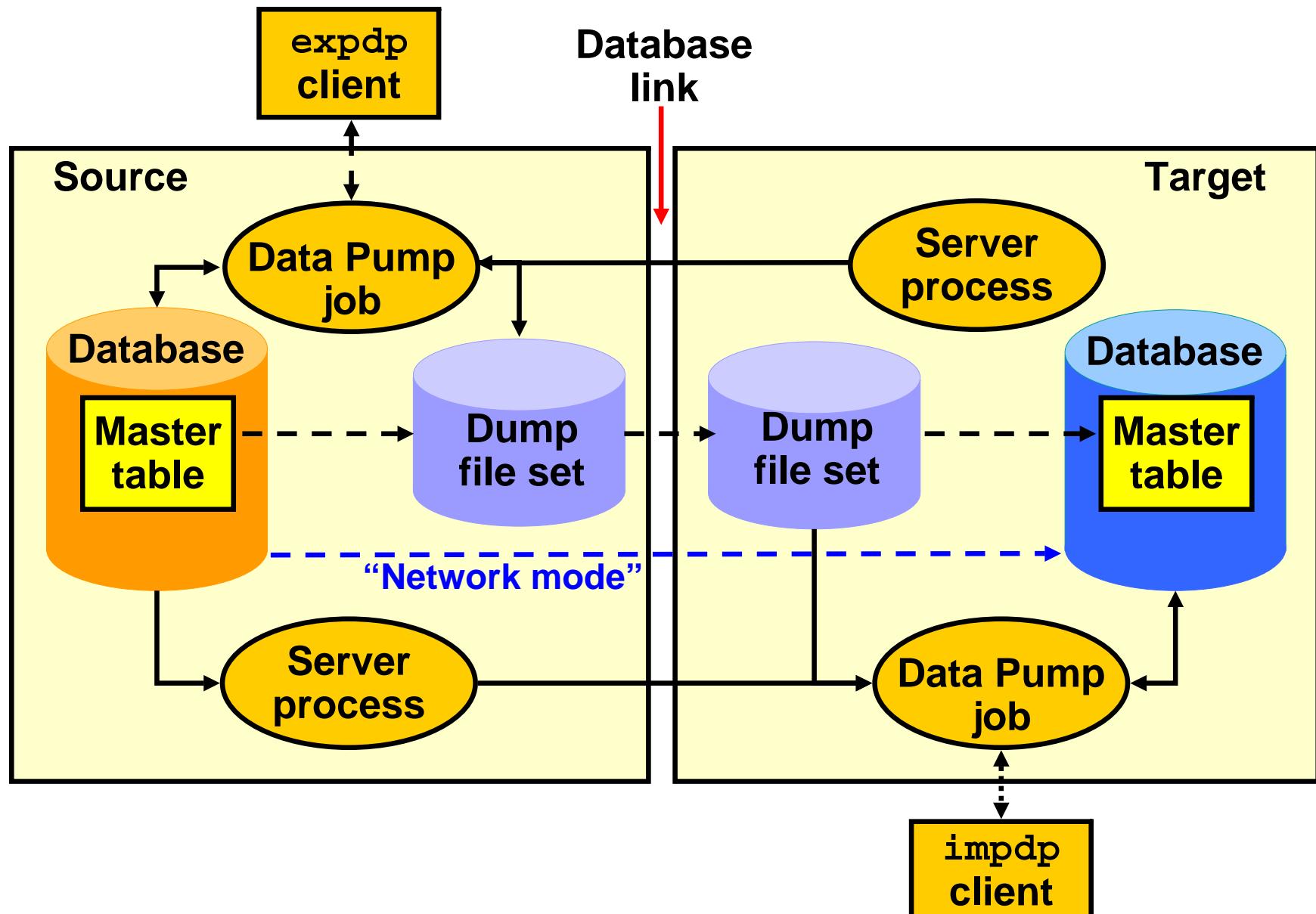
The screenshot illustrates the process of creating a directory object in Oracle Database. It consists of five numbered steps:

- Step 1:** A screenshot of the Oracle Database interface showing a list of existing directory objects. One object, "DATA_FILE_DIR", is selected. A green circle labeled "1" is positioned above the "Create" button.
- Step 2:** The "Create Directory Object" dialog box is open. It shows two tabs: "General" (selected) and "Privileges". Under "General", the "Name" field contains "ext_tab_logdir" and the "Path" field contains "/home/oracle/labs/extab1". A green circle labeled "2" is positioned next to the "Path" field.
- Step 3:** A screenshot of the "Privileges" page, which lists users with privileges for the selected directory ("DATA_FILE_DIR"). It shows a table with columns "User", "Read Access", and "Write Access". A user named "HR" has both "Read Access" and "Write Access" checked. A green circle labeled "3" is positioned above the "Privileges" tab.
- Step 4:** The "Show SQL" window displays the generated SQL commands for creating the directory and granting privileges:

```
CREATE DIRECTORY "ext_tab_logdir" AS '/home/oracle/labs/extab1'
GRANT READ ON DIRECTORY "ext_tab_logdir" TO "HR"
GRANT WRITE ON DIRECTORY "ext_tab_logdir" TO "HR"
```

A green circle labeled "4" is positioned above the "Return" button.
- Step 5:** The "Create Directory Object" dialog box again, with the "OK" button highlighted. A green circle labeled "5" is positioned above the "OK" button.

Data Pump Export and Import Clients: Overview



Data Pump Utility: Interfaces and Modes

- Data Pump Export and Import interfaces:
 - Command line
 - Parameter file
 - Interactive command line
 - Enterprise Manager
- Data Pump Export and Import modes:
 - Full
 - Schema
 - Table
 - Tablespace
 - Transportable tablespace



Data Pump Export using Database Control

Database Instance: orcl.oracle.com

Home Performance Availability Server Schema Data Movement Software and Support

Move Row Data

[Export to Export Files](#) (highlighted with a red box)

[Import from Export Files](#)

[Import from Database](#)

[Load Data from User Files](#)

[Monitor Export and Import](#)

[Jobs](#)

Move Database Files

[Clone Database](#)

[Transport Tablespaces](#)

Streams

[Setup](#)

[Manage Replication](#)

[Manage Advanced Queues](#)

Advanced Replication

[Setup](#)

[Manage](#)

Database Instance: orcl.oracle.com >

Export: Export Type

Database orcl.oracle.com

Schemas
Allows you to export the objects in your schema.

Tables
Allows you to choose one or more tables in your schema to export.

Host Credentials

* Username: oracle

* Password: (redacted)

Save as Preferred Credential

Cancel Continue

Cancel Continue

Data Pump Export Example: Basic Options

Options Files Schedule Review

Export: Options

Database **orcl.oracle.com**

Maximum Number of Threads in Export Job This option allows you to make tradeoffs between resource consumption and elapsed time. Parallelism is only available in Enterprise Edition.

Estimate Disk Space

Calculates an estimate of how much disk space the export job will consume (in bytes). The estimate is for table row data only and does not include metadata.

Blocks
Estimate will be calculated by multiplying the number of database blocks used by the target objects times the appropriate block sizes. This method will provide the quickest rough estimate.

Statistics
Estimate will be calculated using per-table statistics. This method will provide the most accuracy if all target tables have been recently analyzed.

Estimate Disk Space Now
Calculate the estimate of space that will be consumed without actually performing the export operation. This may take a few minutes.

Optional File

Generate Log File
Directory Object Create Directory Object
Log File

[Show Advanced Options](#)

Cancel Finish Step 1 of 4 Next

Data Pump Export Example: Advanced Options

Content

What to Export from the Source Database All
Export both metadata and data

Data Only
Export only table row data

Metadata Only
Export only database object definitions

Export Content Include All Objects
 Include Only Objects Specified Below
 Exclude Only Objects Specified Below

Objects to Include or Exclude

| Select Object Type | Object Name Expression |
|---------------------------------|------------------------|
| | No items found |
| Add Another Row | |

Object Name Expression example: "IN('EMP','DEPT')" or, to include every object except those of a particular type not beginning with PRO, select EXCLUDE with an expression of "NOT LIKE 'PRO%'"

Flashback

Export read-consistent view of data
 As the specified System Change Number (SCN)
SCN

As the SCN which most closely matches the specified time
Date 
Time AM PM

Query

Specify SELECT statement predicate clauses to be applied to tables being exported. If a Table Name is not supplied for a particular Predicate Clause, the Predicate Clause is applied to (and must make sense for) all tables being exported.

| Select Predicate Clause | Table Name |
|-------------------------|------------|
| No items found | |
| Add | |

Data Pump Export Example: Files

Options **Files** Schedule Review

Export: Files

Database **orcl.oracle.com** [Cancel](#) [Finish](#) [Back](#) [Step 2 of 4](#) [Next](#)

Specify the directory object and file name, and maximum size for the export files on the database server machine. [Create Directory Object](#)

[Remove](#)

| Select Directory Object | File Name | Maximum File Size (MB) |
|--|---------------|------------------------|
| <input checked="" type="radio"/> DATA_PUMP_DIR | HR_SCHEMA.DMP | |

[Add Another Row](#)

You can wildcard a set of dump files using "%U" in the filename. A "%D" wildcard will be replaced with the date the job is run using a YYMMDD format.

[Cancel](#) [Finish](#) [Back](#) [Step 2 of 4](#) [Next](#)

[Database](#) | [Help](#) | [Logout](#)

Data Pump Export Example: Schedule

Options Files **Schedule** Review

Export: Schedule

Database **orcl.oracle.com**

Specify a name and description for the export job. Specify a date to start the job.

Job Parameters

Job Name **Export_HR_Schema**
Description **Full export of HR schema**

Job Schedule

Time Zone **(UTC+00:00) Universal Time**

Start

Immediately
 Later

Date **Jul 11, 2009** 
(example: Jul 11, 2009)

Time **5**  **20**  AM PM

Repeat

One Time Only
 Interval

Frequency **1** Minutes 

Monthly
 Yearly

Repeat Until

Indefinite
 Custom

Date **Jul 11, 2009** 
(example: Jul 11, 2009)

Time **5**  **30**  AM PM
(Ignored except when repeating by minutes or hours.)

Cancel **Back** Step 3 of 4 **Next**

Data Pump Export Example: Review

Options Files Schedule **Review**

Export: Review

Database **orcl.oracle.com**

Cancel Back Step 4 of 4 **Submit Job**

| | |
|-----------------|---|
| Export Type | Schemas |
| Statistics type | Estimate optimizer statistics when data is imported |
| Parallelism | 1 |
| Files to Export | DATA_PUMP_DIR HR_SCHEMA.DMP |
| Log File | DATA_PUMP_DIR EXPDAT.LOG |
| Job Schedule | Immediately |

Hide PL/SQL

```
declare
  h1 NUMBER;
begin
  h1 := dbms_datapump.open(operation => 'EXPORT', job_mode => 'SCHEMA', job_name =>
'EXPORT_HR_SCHEMA', version => 'COMPATIBLE');
  dbms_datapump.set_parallel(handle => h1, degree => 1);
  dbms_datapump.add_file(handle => h1, filename => 'EXPDAT.LOG', directory => 'DATA_PUMP_DIR',
filetype => 3);
  dbms_datapump.set_parameter(handle => h1, name => 'KEEP_MASTER', value => 0);
  dbms_datapump.metadata_filter(handle => h1, name => 'SCHEMA_EXPR', value => 'IN("HR")');
```

Processing

Submit job is progressing. This may take some time.

This may take several minutes. This page will automatically forward to the next page when done.

 Process is in progress.

 **TIP** This operation cannot be cancelled. It will continue even if the browser window is closed.

Data Pump Import Example: impdp

Data Pump can be invoked on the command line to allow further command line options to be specified.

```
$ impdp hr DIRECTORY=DATA_PUMP_DIR \
DUMPFILE=HR_SCHEMA.DMP \
PARALLEL=1 \
CONTENT=ALL \
TABLES="EMPLOYEES" \
LOGFILE=DATA_PUMP_DIR:import_hr_employees.log \
JOB_NAME=importHR \
TRANSFORM=STORAGE:n
```

Data Pump Import: Transformations

You can remap:

- Data files by using REMAP_DATAFILE
- Tablespaces by using REMAP_TABLESPACE
- Schemas by using REMAP_SCHEMA
- Tables by using REMAP_TABLE
- Data by using REMAP_DATA

```
REMAP_TABLE = 'EMPLOYEES' : 'EMP'
```



Using Enterprise Manager to Monitor Data Pump Jobs

Database Instance: orcl.oracle.com

| | | | | | | |
|--|---------------------------------------|------------------------------|-----------------------------|------------------------|----------------------|--------------------------------------|
| Home | Performance | Availability | Server | Schema | Data Movement | Software and Support |
| Move Row Data | Move Database Files | Streams | Advanced Replication | | | |
| Export to Export Files | Clone Database | Setup | Setup | | | |
| Import from Export Files | Transport Tablespaces | Manage | Manage | | | |
| Import from Database | | | | | | |
| Load Data from User Files | | | | | | |
| Monitor Export and Import Jobs | | | | | | |

Export and Import Jobs

Page Refreshed Sep 1, 2008 12:23:20 AM MDT

In database versions 10g and greater, Enterprise Manager uses data pump jobs to do the actual export and import operations. Although Enterprise Manager exports and imports can also be monitored from their corresponding Job Summary pages, data pump jobs defined outside of Enterprise Manager can only be monitored from here.

| Select Data Pump Job | EM Job | Owner | Job Status |
|----------------------------------|--------|-------|------------|
| INVENTORY_EXPORT | Yes | DBA1 | EXECUTING |

Migration with Data Pump Legacy Mode

- Assistance in transitioning from `imp` and `exp` utilities to `impdp` and `expdp` utilities
- Data Pump in legacy mode:
 1. Encounters unique `imp` or `exp` parameter and enters legacy mode
 2. Attempts to map the old syntax to the new syntax
 3. Displays new syntax
 4. Exits legacy mode

Best practice tip: Oracle strongly recommends that you view the new syntax and make script changes as time permits.



ORACLE

Data Pump Legacy Mode

The Data Pump export and import utilities:

- Read and write files only in Data Pump format
- Accept `exp` and `imp` utility commands in legacy mode
- Include legacy mode parameters that:

- Can be identical to the new syntax:

FILESIZE=integer [B | K | M | G]

- Can be similar:

QUERY= query_clause

- Are ignored, when the command is superceded by Data Pump defaults

BUFFER=integer

COMPRESS={y|n}

DIRECT={y|n}

- Cause an error when old and new syntax is mixed



Data Pump Legacy Mode

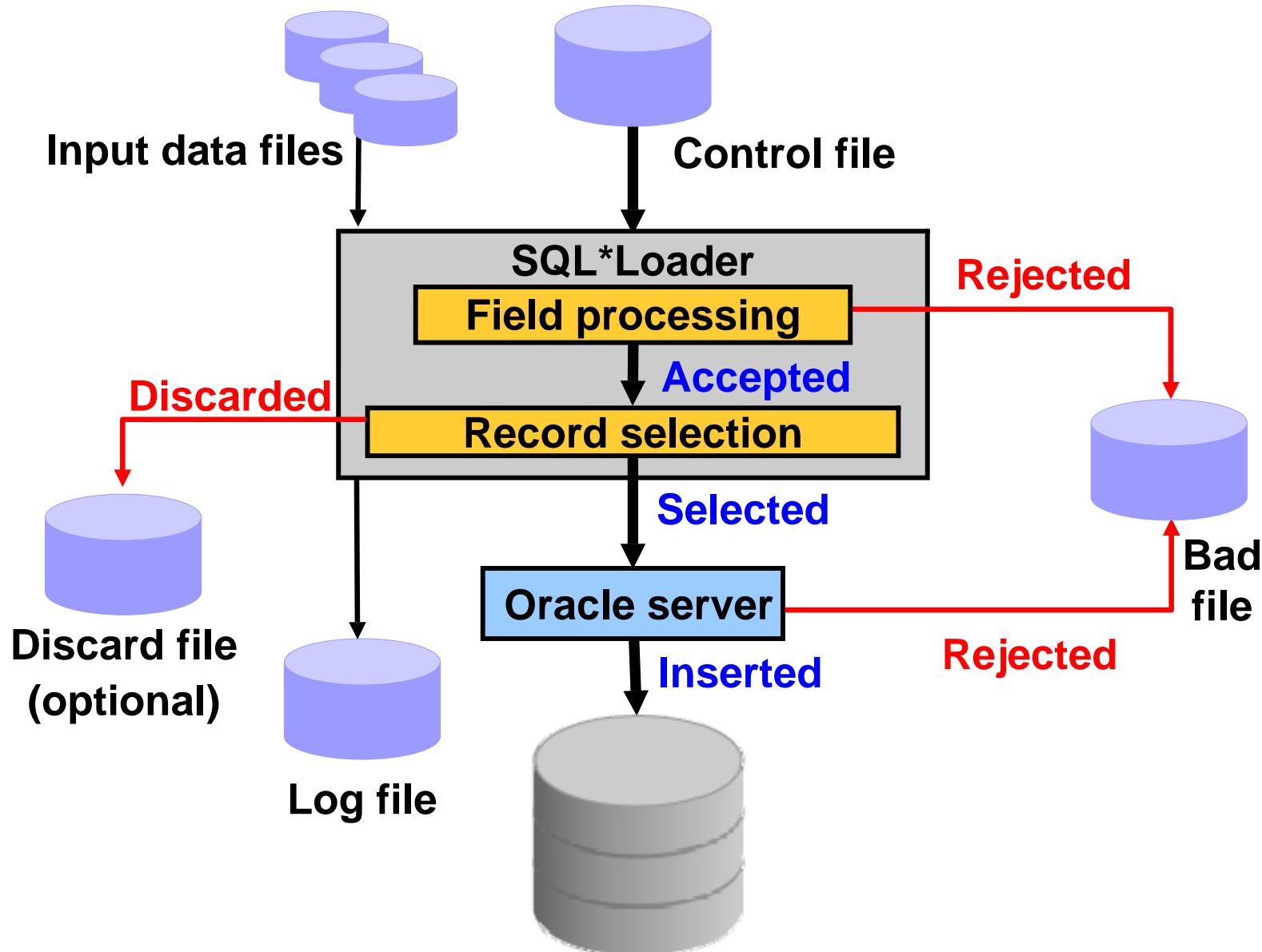
- Legacy mode parameters:
 - Are mapped to Data Pump parameters, if possible:
 - consistent={y|n} -> FLASHBACK_TIME
 - GRANTS=n -> EXCLUDE=CONSTRAINTS
 - INDEXES=n -> EXCLUDE=INDEX
 - LOG=[filename](#) -> LOGFILE=[filename](#)
 - FILE=[filename](#) -> dumpfile=directory-object:[filename](#)
 - Can be similar, but not identical:
 - FEEDBACK=integer -> STATUS
 - Cause an error when incompatible with new Data Pump:
 - VOLSIZE=integer

Managing File Locations

- Original `exp` and `imp` utilities: Fully qualified file names
- Data Pump directory object for file locations
 - Default (in prior versions): `DATA_PUMP_DIR` parameter
 - New optional `DATA_PUMP_DIR_schema-name` directory object
 - Managed with the `CREATE DIRECTORY` and `GRANT` SQL commands
 - Default location (independent of legacy mode), when:
 - Command line without `DIRECTORY` parameter
 - User without `EXP_FULL_DATABASE` privilege



SQL*Loader: Overview



Loading Data with SQL*Loader

Load Data: Generate Or Use Existing Control File

Database **orcl.oracle.com**

Automatically Generate Control File
A control file will be generated after you define the structure of the data file.

Use Existing Control File
Allows you to use an existing control file that defines the structure of the data file.

Host Credentials

* Username
* Password
 Save as Preferred Credential


Control File Data File Load Method Options Schedule Review

Load Data: Control File

Database **orcl.oracle.com** Step 1 of 6

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.



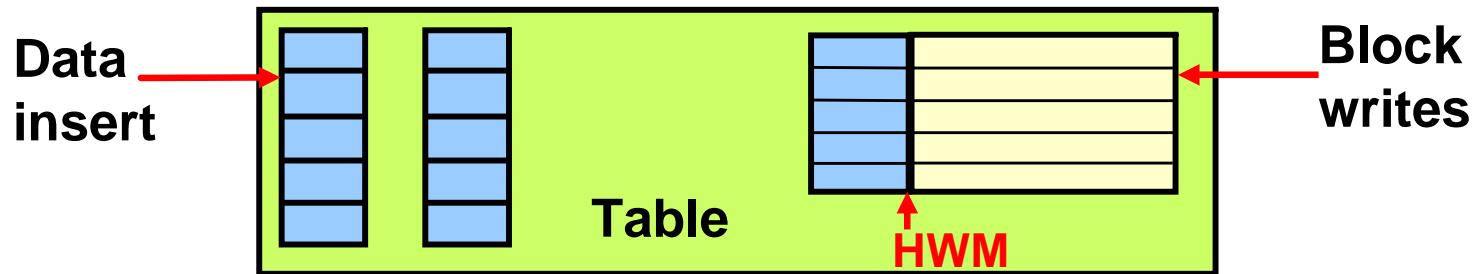
SQL*Loader Control File

The SQL*Loader control file instructs SQL*Loader about:

- Location of the data to be loaded
- Data format
- Configuration details:
 - Memory management
 - Record rejection
 - Interrupted load handling details
- Data manipulation details



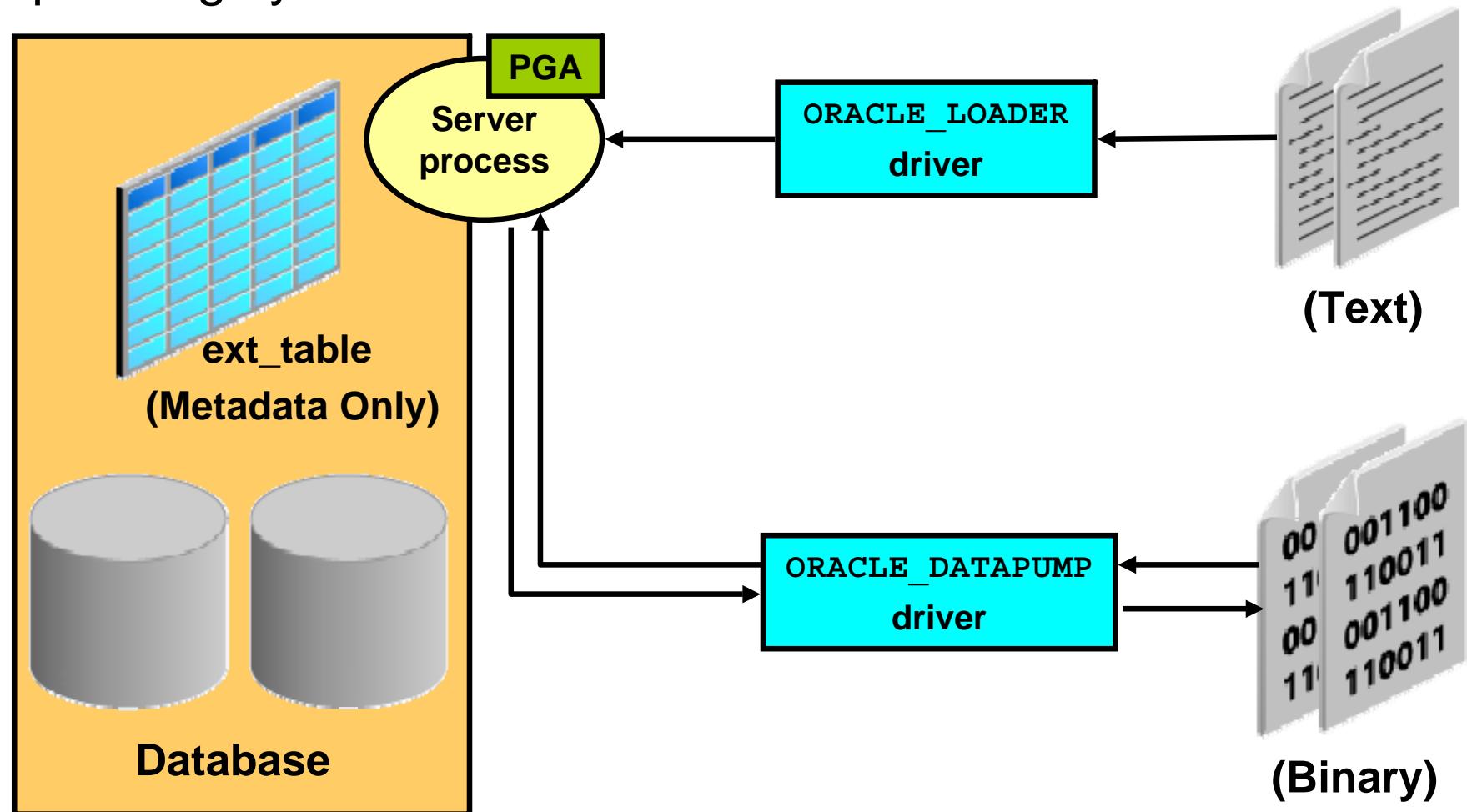
Loading Methods



| Conventional Load | Direct Path Load |
|---|--|
| Uses COMMIT | Uses data saves (faster operation) |
| Always generates redo entries | Generates redo only under specific conditions |
| Enforces all constraints | Enforces only PRIMARY KEY, UNIQUE, and NOT NULL |
| Fires INSERT triggers | Does not fire INSERT triggers |
| Can load into clustered tables | Does not load into clusters |
| Allows other users to modify tables during load operation | Prevents other users from making changes to tables during load operation |
| Maintains index entries on each insert | Merges new index entries at the end of the load |

External Tables

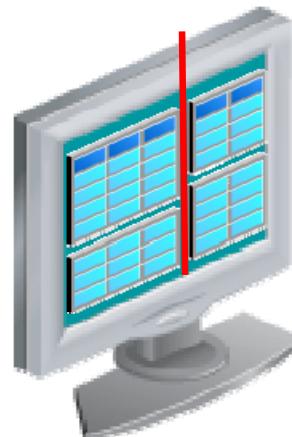
External tables are read-only tables stored as files on the operating system outside of the Oracle database.



External Table Benefits

- Data can be used directly from the external file or loaded into another database.
- External data can be queried and joined directly in parallel with tables residing in the database, without requiring it to be loaded first.
- The results of a complex query can be unloaded to an external file.
- You can combine generated files from different sources for loading purposes.

From Oracle Database



From external file

Defining an External Tables with ORACLE_LOADER

```
CREATE TABLE extab_employees
  (employee_id          NUMBER(4),
   first_name           VARCHAR2(20),
   last_name            VARCHAR2(25),
   hire_date             DATE)
ORGANIZATION EXTERNAL
  ( TYPE ORACLE_LOADER DEFAULT DIRECTORY extab_dat_dir
    ACCESS PARAMETERS
      ( records delimited by newline
        badfile extab_bad_dir:'empxt%a_%p.bad'
        logfile extab_log_dir:'empxt%a_%p.log'
        fields terminated by ','
        missing field values are null
        ( employee_id, first_name, last_name,
          hire_date char date_format date mask "dd-mon-yyyy"))
    LOCATION ('empxt1.dat', 'empxt2.dat') )
PARALLEL REJECT LIMIT UNLIMITED;
```



External Table Population with ORACLE_DATAPUMP

```
CREATE TABLE ext_emp_query_results
(first_name, last_name, department_name)
ORGANIZATION EXTERNAL
(
  TYPE ORACLE_DATAPUMP
  DEFAULT DIRECTORY ext_dir
  LOCATION ('emp1.exp', 'emp2.exp', 'emp3.exp')
)
PARALLEL
AS
SELECT e.first_name, e.last_name, d.department_name
FROM employees e, departments d
WHERE e.department_id = d.department_id AND
      d.department_name in
        ('Marketing', 'Purchasing');
```



Using External Tables

- Querying and external table:

```
SQL> SELECT * FROM extab_employees;
```

- Querying and joining an external table with an internal table

```
SQL> SELECT e.employee_id, e.first_name, e.last_name,  
d.department_name FROM departments d, extab_employees e  
WHERE d.department_id = e.department_id;
```

- Appending data to an internal table from an external table

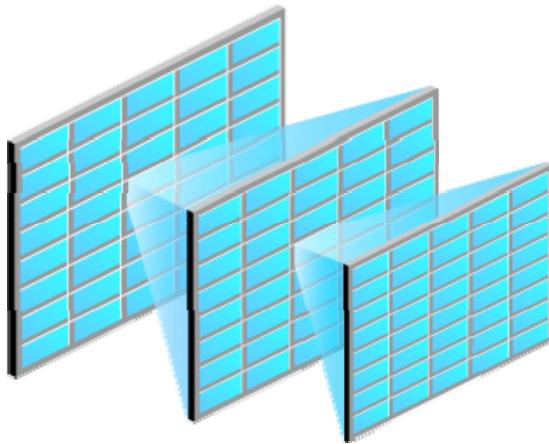
```
SQL> INSERT /*+ APPEND */ INTO hr.employees SELECT * FROM  
extab_employees;
```



Data Dictionary

View information about external tables in:

- [DBA | ALL | USER] _EXTERNAL_TABLES
- [DBA | ALL | USER] _EXTERNAL_LOCATIONS
- [DBA | ALL | USER] _TABLES
- [DBA | ALL | USER] _TAB_COLUMNS
- [DBA | ALL] _DIRECTORIES



Quiz

Like other database objects, Directory objects are owned by the user that creates them unless another schema is specified during creation.

- 1. True**
- 2. False**

Quiz

An index can be created on an external table.

1. True
2. False

Summary

In this lesson, you should have learned how to:

- Describe ways to move data
- Create and use directory objects
- Use SQL*Loader to load data from a non-Oracle database (or user files)
- Use external tables to move data via platform-independent files
- Explain the general architecture of Oracle Data Pump
- Use Data Pump Export and Import to move data between Oracle databases

Practice 17 Overview:

Moving Data

This practice covers the following topics:

- Using the Data Pump Export Wizard to select database objects to be exported
- Monitoring a Data Pump Export job
- Using the Data Pump Import Wizard to import tables to your database
- Using the Load Data Wizard to load data into your database
- Loading data by using the command line



18

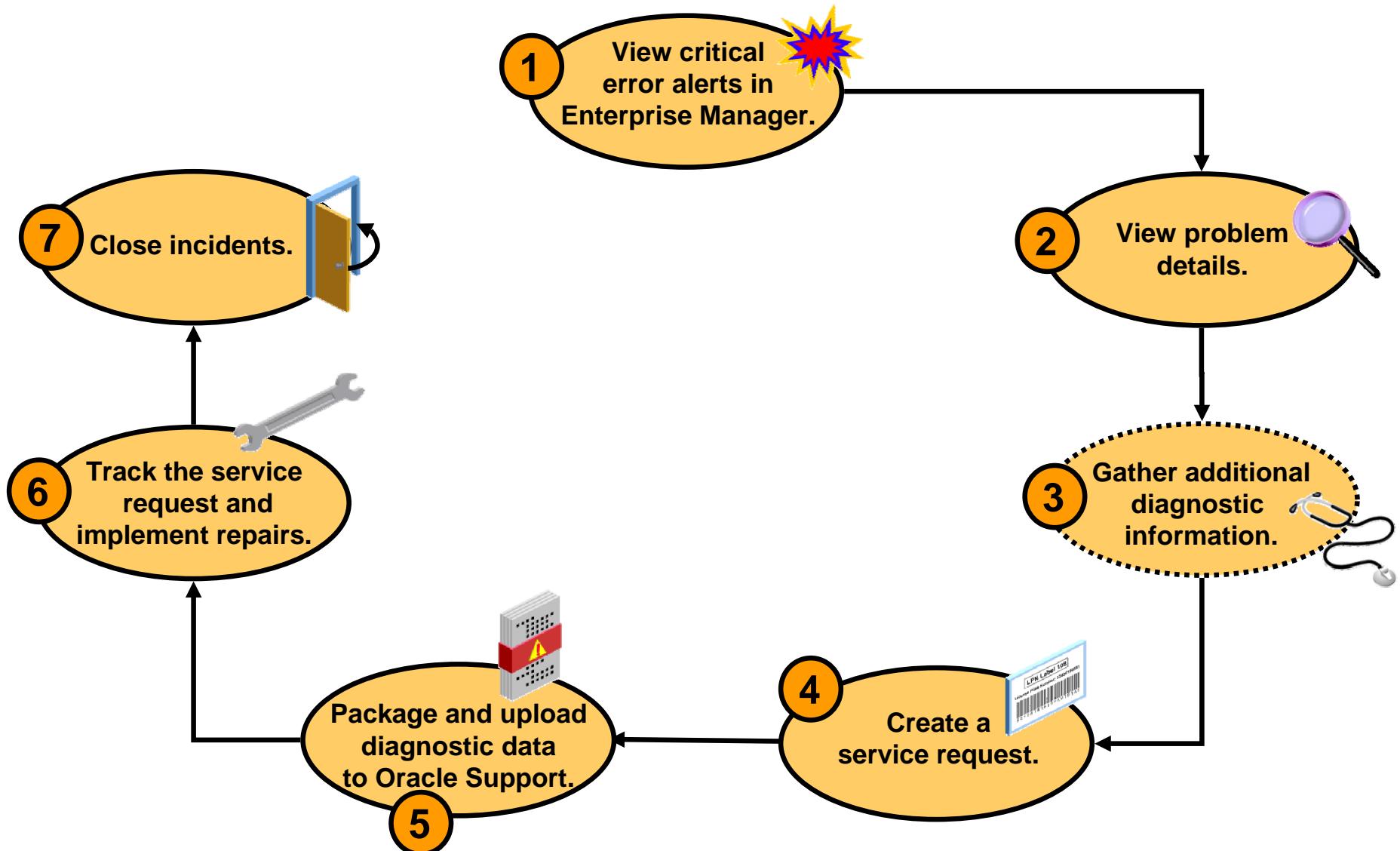
Working with Support

Objectives

After completing this lesson, you should be able to:

- Use the Enterprise Manager Support Workbench
- Work with My Oracle Support
- Search My Oracle Support
- Log service requests (SR)
- Manage patches
 - Apply a patch
 - Stage a patch

Using the Support Workbench



Viewing Critical Error Alerts in Enterprise Manager

The screenshot shows the Oracle Enterprise Manager 11g Database Control interface. The top navigation bar includes links for Setup, Preferences, Help, and Logout, with 'Database' selected. The user is logged in as SYSMAN.

The main content area is titled 'Database Instance: database'. On the left, there's a 'General' section with status information: Status Up, Up Since Apr 2, 2007 12:28:32, Instance Name b, Version 11.1.0.4.0, Host stacq17.us.oracle.com, and Listener LISTENER_stacq17.us.oracle.com. A green arrow points up from this section. Below it is a 'Diagnostic Summary' section with ADDM Findings (No ADDM run available) and Alert Log (No ORA-errors). A red box highlights the 'Active Incidents' link, which has a value of 2. A red arrow points from this link to the 'Incidents (36)' table below.

The central part of the screen is the 'Support Workbench' section. It displays 'Problems (5)', 'Checker Findings (36)', and 'Packages (4)'. Under 'Problems (5)', it shows New Problems in Last 24 Hours (0), All Active Problems (1), All Problems (5), New Incidents in Last 24 Hours (2), All Active Incidents (2), and All Incidents (43). The 'Last 24 Hours' view is selected. A search bar and an 'Advanced Search' link are also present.

The 'Incidents (36)' table lists incidents with columns for ID, Description, Number Of Incidents, Last Incident, and Last Comment. One incident is shown in detail: ORA 1578, 36 incidents, last seen April 9, 2007 10:00:24 PM PDT, with the comment 'Created package : Id = 5 Name = Pkg_database_ORA_1578_040607125612 Yes Yes 1234'.

At the bottom, there's a 'Performance and Critical Error' section with tabs for 'Problems (5)', 'Checker Findings (36)', and 'Packages (4)'. A 'Related Links' section includes Advisor Central, Create User-Reported Problem, Alert Log Contents, and Incident Packaging Configuration.

Viewing Problem Details

Support Workbench

Problem Details: ORA 1578

Page Refreshed April 10, 2007 8:02:14 AM PDT Refresh

Summary

| | | |
|----------------------|-------------------------------|------|
| SR# | 1234 | Edit |
| Bug# | -- | Edit |
| Active | Yes | |
| Packaged | Yes | |
| Number of Incidents | 36 | |
| First Incident | April 2, 2007 12:27:37 PM PDT | |
| Last Incident | | |
| Timestamp | April 9, 2007 10:00:24 PM PDT | |
| Incident Source | System Generated | |
| Impact | | |
| Checkers Run | 0 | |
| Checker Findings | 0 | |

Investigate and Resolve

Self Service Oracle Support Go to Metalink Quick Package

Assess Damage

Checker Findings Run Checkers Database Instance Health

Diagnose

Alert Log Related Problems Across Topology Diagnostic Dumps for Last Incident Go to Metalink and Research

Resolve

SQL Repair Advisor Data Recovery Advisor

Incidents

Activity Log

Comment: SYSMAN Comment Deleted package : Id = 6 Name = Pkg_database_ORA_1578_041007083836

Comment: SYSMAN Comment Created package : Id = 6 Name = Pkg_database_ORA_1578_041007083836

Package: SYSMAN Package Created physical file : packageId = 5 file = /ade/laine/medbsa/b/oracle/stacg17.us.oracle.com.b/sysman/med/state/Pkg_database_ORA_1578_040607125612.COM.1.zip

Timestamp: April 10, 2007 8:42:14 AM PDT April 10, 2007 8:39:54 AM PDT April 6, 2007 1:17:59 PM PDT

View All Incidents Previous 1-25 of 36 Next 11

Select All Select None Show All Details Hide All Details

| Select Details | ID | Description | Data Dumped | Active | Status | Timestamp |
|--------------------------|------|--|-------------|--------|--------|-------------------------------|
| <input type="checkbox"/> | 3953 | ORA 1578 [1] [63671] [] [] [] [] [] | No | No | Ready | April 2, 2007 12:27:37 PM PDT |

Viewing Incident Details: Dump Files

Incident Details: 3953

| Summary | |
|------------------|--|
| Problem Key | ORA-1578 [1] [63671] |
| Status | Ready |
| Active | No |
| Timestamp | April 2, 2007 12:27:3 |
| Impact | Unknown |
| ECID | Unknown |
| Data Dumped | No |
| Source | System Generated |
| Correlation Keys | SID = 129.232, ProcId = 16777216, Client ProcId = oracle@stacg17 (TNS V1-V3).15201_3083220672 |
| Purge Date | April 22, 2007 5:30:24 AM PDT (Purging Enabled) Disable Purging |

Dump Files [Checker Findings](#) [Additional Diagnostics](#)

| File Name | Size (MB) | Timestamp | Path | View Contents |
|---------------------------|-----------|-------------------------------|---|----------------------|
| b_ora_15201_i3953.trc | 3.28 | April 2, 2007 12:27:40 PM PDT | /ade/aime_emdbsa_b/oracle/log/diag/rdbms/b/b/incident/incdir_3953 | View |
| b_m000_15218_i3953_87.trc | 0.15 | April 2, 2007 12:27:42 PM PDT | /ade/aime_emdbsa_b/oracle/log/diag/rdbms/b/b/incident/incdir_3953 | View |

Contents: b_ora_15201_i3953.trc

File /ade/aime_emdbsa_b/oracle/log/diag/rdbms/b/b/incident/incdir_3953/b_ora_15201_i3953.trc
Modified April 2, 2007 12:27:40 PM PDT
Size 3.28 MB

Trace files are for Oracle internal use only.

Trace Map
A Trace Map provides a table of contents for a dump file.
 TIP Select a section to see its detailed trace records below.

Details

[Expand All](#) | [Collapse All](#)

/ade/aime_emdbsa_b/oracle/log/diag/rdbms/b/b/incident/incdir_3953/b_ora_15201_i3953.trc
 Error Stack:
 incident_dump:===== Dump for incident 3953 (ORA 1578) =====
ORA-01578: ORACLE data block corrupted (file # 1, block # 63671)
ORA-01110: data file 1: '/ade/aime_emdbsa_b/oracle/dbs/t_db1.f'



Viewing Incident Details: Checker Findings

Incident Details: 3953

Page Refreshed April 10, 2007 8:08:22 AM PDT [Refresh](#)

Summary

| | |
|------------------|--|
| Problem Key | ORA-1578 |
| | [1] |
| | [63671] |
| Status | Ready |
| Active | No |
| Timestamp | April 2, 2007 12:27:37 PM PDT |
| Impact | Unknown |
| ECID | Unknown |
| Data Dumped | No |
| Source | System Generated |
| Correlation Keys | SID = 129.232, ProcId = 39.24 PQ = (16777216, 1175542056), Client ProcId = oracle@stacg17 (TNS V1-V3).15201_3083220672 |
| Purge Date | April 22, 2007 5:30:24 AM PDT (Purging Enabled) Disable Purging |

[Dump Files](#) **Checker Findings** [Additional Diagnostics](#)

File Name

| |
|-------------------|
| b ora 15201 i3953 |
| b m000 15218 i39 |

[Dump Files](#) **Checker Findings** [Additional Diagnostics](#)

Search

Description Damage Translation Status Time Detected

Data Corruption

Select findings and click on the "Launch Recovery Advisor" button to repair those findings.

[Launch Recovery Advisor](#)

[Select All](#) | [Select None](#) | [Expand All](#) | [Collapse All](#)

| Select | Description | Priority | Damage Translation | Incident ID | Status | Time Detected |
|--------------------------|---|----------|--|----------------------|--------|-------------------------------|
| <input type="checkbox"/> | All Findings | | | | | |
| <input type="checkbox"/> | ► Datafile 1: '/ade/aime_emdbsa_b/oracle/dbs/t_db1.F' contains one or more corrupt blocks | High | Some objects in tablespace SYSTEM might be unavailable | 3953 | Open | April 2, 2007 12:27:41 PM PDT |

Creating a Service Request

Problem Details: ORA 603

Page Refreshed April 16, 2007 7:25:42 AM PDT Refresh

Investigate and Resolve

Self Service Oracle Support Go to Metalink Quick Package

Assess Damage Run Checker Database Ins

Diagnose Alert Log Related Prob Diagnostic Di Go to Metalink

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WELCOME TO METALINK

Explorer User Prompt

Script Prompt:
Please enter a Service Request Number (SR)

OK Cancel

Incidents Activity Log

Problem Details: ORA 603

Summary

SR# 1234 Edit

Bug# -- Edit

Active No

Packaged No

Number of Incidents 4

First Incident April 13, 2007 5:34:24 PM PDT

1234

Packaging and Uploading Diagnostic Data to Oracle Support

Problem Details: ORA 603

Page Refreshed April 16, 2007 8:05:16 AM PDT Refresh

Summary

| | | |
|--------|------|----------------------|
| SR# | 1234 | Edit |
| Bug# | -- | Edit |
| Active | No | |

Investigate and Resolve

[Go to Metalink](#) [Quick Package](#)

[Self Service](#) [Oracle Support](#)

Quick Packaging: Create New Package

Target: database
Problems Selected: ORA 603

Use quick packaging to generate an upload file for a single problem. The upload file will still be created but it will not be sent to Oracle Support.

* Package Name: Pkg_database_ORA_603

Package Description:

Send to Oracle Support

Service Request Number (SR#): 1234

A service request must be open to send diagnostic data to Oracle Support.

Step 1 of 4 Next

Progress: Create New Package → View Contents → View Manifest → Schedule

Quick Packaging: View Contents

Target: database
Problems Selected: ORA 603
Package Name: Pkg_database_ORA_603_041607080712

Incidents to be Packaged

| ID | Type | Problem ID | Description |
|------|------------|------------|---------------------------------------|
| 6213 | Main | 4 ORA-603 | [] [] [] [] [] [] [] |
| 3942 | Main | 4 ORA-603 | [] [] [] [] [] [] [] |
| 3944 | Main | 4 ORA-603 | [] [] [] [] [] [] [] |
| 6215 | Main | 4 ORA-603 | [] [] [] [] [] [] [] |
| 3938 | Correlated | 1 ORA-1578 | [1] [63729] [] [] [] [] [] |
| 6160 | Correlated | 2 ORA-600 | [4136] [2] [10.31.75] [] [] [] [] |

Tracking the Service Request and Implementing Repairs

Problem Details: ORA 603

Page Refreshed April 16, 2007 8:39:07 AM PDT [Refresh](#)

Summary

| | | |
|---------------------|---|----------------------|
| SR# | 1234 | Edit |
| Bug# | -- | Edit |
| Active | No | |
| Packaged | Yes | |
| Number of Incidents | 4 | |
| First Incident | April 13, 2007 5:34:24 PM PDT | |

Last Incident

| | |
|------------------|---|
| Timestamp | April 13, 2007 6:40:24 PM PDT |
| Incident Source | System Generated |
| Impact | |
| Checkers Run | 0 |
| Checker Findings | 0 |

[Incidents](#) [Activity Log](#)

Comment [Add Comment](#)

| User | Action | Description | Timestamp |
|------|---------|--|-------------------------------------|
| SYS | Comment | Set SR : 1234 | April 16, 2007 8:34:45 AM PDT |
| SYS | Comment | Set SR : null | April 16, 2007 8:34:30 AM PDT |
| SYS | Package | Failed to send upload file to Oracle: packageId = 1 file = /ade/aime_emdbsa_b/oracle/stacg17.us.oracle.com_b/sysman/emd/state/Pkg_database_ORA_603_041607080712_COM_1.zip | April 16, 2007 8:14:12 AM PDT |
| SYS | Package | Created physical file : packageId = 1 file = /ade/aime_emdbsa_b/oracle/stacg17.us.oracle.com_b/sysman/emd/state/Pkg_database_ORA_603_041607080712_COM_1.zip | April 16, 2007 8:14:10 AM PDT |
| SYS | Comment | Created package : Id = 1 Name = Pkg_database_ORA_603_041607080712 | April 16, 2007 8:09:30 AM PDT |

Investigate and Resolve

[Go to Metalink](#) [Quick Package](#)

[Self Service](#) [Oracle Support](#)

Collect and Send Diagnostic Data

[Create a Service Request with Metalink](#)
[Record Service Request Number to Problem](#)
[Generate Additional Dumps and Test Cases](#)
[Package the Problem](#)
[View/Send Upload Files](#)

Track and Close

[Check the Service Request Status with Metalink](#)
[Close the problem](#)

Tracking the Service Request and Implementing Repairs

Incident Details: 3953

Page Refreshed April 10, 2007 8:08:22 AM PDT [Refresh](#)

Summary

Problem Key [ORA-1578](#)
[1]
[63671]

Status Ready
Active No
Timestamp April 2, 2007 12:27:37 PM PDT
Impact Unknown
ECID Unknown
Data Dumped No
Source System Generated
Correlation Keys SID = 129.232, ProcId = 39.24
PQ = (16777216, 1175542056), Client ProcId = oracle@stacg17
(TNS V1-V3).15201_3083220672
Purge Date April 22, 2007 5:30:24 AM PDT (Purging Enabled)
[Disable Purging](#)

[Dump Files](#) [Checker Findings](#) [Additional Diagnostics](#)

Search

| Description | Damage Translation | Status | Time Detected |
|----------------------|----------------------|--|---------------|
| <input type="text"/> | <input type="text"/> | <input type="button" value="Open"/> <input type="button" value="All"/> <input type="button" value="Go"/> | |

Data Corruption

Select findings and click on the "Launch Recovery Advisor" button to repair those findings.

[Launch Recovery Advisor](#)

[Select All](#) | [Select None](#) | [Expand All](#) | [Collapse All](#)

| Select | Description | Priority | Damage Translation | Incident ID | Status | Time Detected |
|--------------------------|---|----------|--|----------------------|--------|-------------------------------|
| <input type="checkbox"/> | All Findings | | | | | |
| <input type="checkbox"/> | ▶ Datafile 1: '/ade/aimc_emdbsa_b/oracle/dbs/t_db1.f' contains one or more corrupt blocks | High | Some objects in tablespace SYSTEM might be unavailable | 3953 | Open | April 2, 2007 12:27:41 PM PDT |

Closing Incidents and Problems

Problem Details: ORA 1578

Page Refreshed July 9, 2007 12:53:11 AM GMT +07:00 Refresh

Summary

| | | |
|---------------------|-----|----------------------|
| SR# | -- | Edit |
| Bug# | -- | Edit |
| Active | Yes | |
| Packaged | No | |
| Number of Incidents | 1 | |

Last Incident

| | |
|------------------|--|
| Timestamp | July 9, 2007 12:43:48 AM GMT+07:00 |
| Incident Source | System Generated |
| Impact | |
| Checkers Run | 1 |
| Checker Findings | 1 |

Investigate and Resolve

[Go to Metalink](#) [Quick Package](#)

[Self Service](#) [Oracle Support](#)

Collect and Send Diagnostic Data

[Create a Service Request with Metalink](#)
[Record Service Request Number in](#)

Confirmation

Are you sure you want to close the problem: ORA 1578?
Once the problem is closed, the associated data will be purged after 30 days.

[No](#) [Yes](#)

Track and Close

[Check the Service Request Status with Metalink](#)
[Close the problem](#)

Incidents [Activity Log](#)

Status: Open Incidents [Data Dumped](#) Yes [Close](#)

[Select All](#) [Select None](#) [Show All Details](#) [Hide All Details](#)

| Select Details | ID | Description | Data Dumped | Active | Status | Timestamp |
|-------------------------------------|----------------------------|----------------------------------|-------------|--------|--------|------------------------------------|
| <input checked="" type="checkbox"/> | Show 30177 | ORA 1578 [9] [44] [] [] [] [] [] | Yes | Yes | Ready | July 9, 2007 12:43:48 AM GMT+07:00 |

Confirmation

Are you sure you want to close the incident: 30177?
Once the incident is closed, the associated data will be purged after 30 days.

[No](#) [Yes](#)

Incident Packaging Configuration

Edit Incident Packaging Configuration

(Restore Defaults) (Cancel) (OK)

Incident Data Retention

Incident Metadata Retention Period (day)

Incident Files Retention Period (day)

Packaging Settings

These settings are used in selecting incidents and files from a problem when the problem is added to a package.

Cutoff Age for Incident Inclusion (day)

Leading Incidents Count

Trailing Incidents Count

Correlation Time Proximity (min)

Time Window for Package Content (min)

06 AM PDT (Refresh)

(Edit) (OK)

Support Workbench

Problems (4) [Check](#)

New Problems in Last 24 Hour
New Incidents in Last 24 Hour

View All

[View](#) [Package](#)

[Select All](#) [Select None](#) [Show All Details](#) [Hide All Details](#)

| Select | Details | ID | Description | Number Of Incidents |
|--------------------------|-----------------------|----|----------------|---------------------|
| <input type="checkbox"/> | ►Show | 4 | ORA 603 | 4 |
| <input type="checkbox"/> | ►Show | 3 | ORA 600 [4137] | 2 |
| <input type="checkbox"/> | ►Show | 2 | ORA 600 [4136] | 6 |
| <input type="checkbox"/> | ►Show | 1 | ORA 1578 | 8 |

►Performance and Critical Error

Problems (4) [Checker Findings \(8\)](#) [Packages \(1\)](#)

Related Links

[Advisor Central](#) [Create User-Reported Problem](#)

Incident Data Retention

Incident Metadata Retention Period (day) **365**

Incident Files Retention Period (day) **30**

Packaging Settings

These settings are used in selecting incidents and files from a problem when the problem is added to a package.

Cutoff Age for Incident Inclusion (day) **90**

Leading Incidents Count **3**

Trailing Incidents Count **3**

Correlation Time Proximity (min) **90**

Time Window for Package Content (min) **24**

(Edit) (OK)

[Alert Log Contents](#)
[Incident Packaging Configuration](#)

[Alert Log Errors](#)

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Enterprise Manager Support Workbench for ASM

ORACLE Enterprise Manager 11g Database Control

Automatic Storage Management: +ASM_edrsr22p1.us.oracle.com >

Support Workbench

Page Refreshed June 25, 2009 8:5

[Problems \(0\)](#) [Checker Findings \(0\)](#) [Packages \(0\)](#)

New Problems in Last 24 Hours 0 All Active Problems 0 All Problems 0
New Incidents in Last 24 Hours 0 All Active Incidents 0 All Incidents 0

View [Last 24 Hours](#) [Search](#)

| Select | Details | ID | Description | Number Of Incidents | Last Incident | Last Comment |
|--------------------|---------|----|-------------|---------------------|---------------|--------------|
| No problems found. | | | | | | |

[Problems \(0\)](#) [Checker Findings \(0\)](#) [Packages \(0\)](#)

Related Links

| | | |
|--|----------------------------------|--|
| Alert Log Contents | Alert Log Errors | Create User-Reported Problem |
| Incident Packaging Configuration | Checker Central | Support Workbench (orcl) |

Working with Oracle Support

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



My Oracle Support Integration

- Enterprise Manager automatically alerts users to new critical patches.
- The Enterprise Manager patch wizard can be used to select an interim patch.
- You can review the patch's README file from within Enterprise Manager.
- You can download the selected patches from My Oracle Support into the Enterprise Manager patch cache.



Using My Oracle Support

ORACLE® MY ORACLE SUPPORT PowerView is OFF

Welcome, Mark | Settings | Feedback | Sign Out | ? Help

Dashboard Knowledge Service Requests Patches & Updates Community Certify Reports Collector

Last refreshed 3 minutes ago Customize Page...

Get the most out of My Oracle Support Watch a video tutorial

Help prevent potential outages and security issues before they impact your operations

Regions with this symbol require the configuration manager

Select Platform Learn More | Linux x86 | Download | No, Thanks

Read the Quick Install Guide

System Health

Getting Started

New Customers Start Here Support Policies
News, Events & Training Blog
Getting Started Guide Training: Pre-recorded
Collector Quick Install Guide Training: Upcoming Schedule
Frequently Asked Questions Browse Collector Articles

Inventory (See Report)

Service Requests

No information returned

Systems

Targets

News

01 SEPTEMBER 2009

- Classic MetaLink to be Retired, What You Can Do to Prepare
- Advisor Webcasts: Support Tools and Processes - Register for Free Web Seminars
- New Customers Start Here - Information Now Available for Anyone New to My Oracle Support (MetaLink)
- Attend the Advanced My Oracle Support (MetaLink) Seminar: July 15, 2009
- Welcome Virtual Iron Customers - Start Here

Knowledge Articles

Alerts (30) Recently Updated (30)

Older Than 3 Weeks

- About Oracle Customer Support Minipack 11i.CSZ.A
- OCFS2 1.2.7-1 Filesystem May Become Unavailable after Node Panic or Eviction
- 'Column precision and scale of numeric referencing columns don't match' Message When Upgrading A ...
- ALERT: Oracle 10g Release 2 (10.2) Support Status and Alerts
- Core dump - Access Violation in Client Applications After Upgrade to 9.2.0.8, 10.1.0.5, 10.2.0.x...

Researching an Issue

To research an issue on My Oracle Support, perform the following steps:

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).

Logging Service Requests

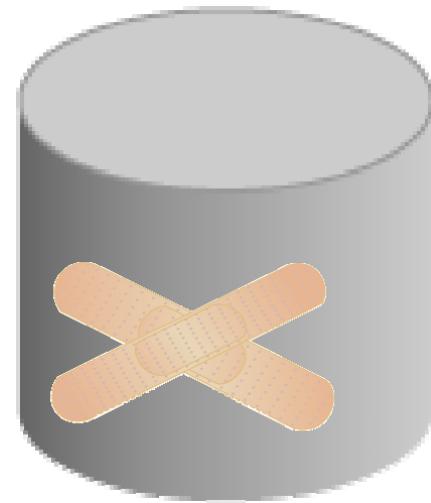
- Log an SR by clicking the Service Request tab on the My Oracle Support home page.
- My Oracle Support performs searches based on the CSI number and SR profile.
- Provide the following information when logging an SR:
 - Explanation of the issue, including error messages
 - Steps taken to troubleshoot the issue
 - Software version
 - Steps required to reproduce the problem
 - Business impact of the issue



Managing Patches

Kinds of patches

- Interim patches
 - For specific issues
 - No regression testing
- CPUs (Critical Patch Updates)
 - Critical security issues
 - Regression testing
 - Does not advance version number
- Patch releases



Applying a Patch Release

- Patch releases are fully tested product fixes that:
 - Do not include new functionality
 - Affect only the software residing in your Oracle home on installation
 - Contain individual bug fixes
 - Carry version numbers
- To apply a patch:
 1. Determine your Oracle software environment.
 2. Set your My Oracle Support login credentials.
 3. Stage the patch release.



Using the Patch Advisor

Logged In As S...

Patch Advisor

Critical Security Patches

| Select Advisory | Impact | Abstract | Affected Hosts | Affected Hosts |
|---|--------|----------|----------------|----------------|
| No patch advisories are currently applicable to your installation at this point in time | | | | |

Patch Recommendations by Feature

View Based on Usage Go

Schedule Patching

Select All | Select None

| Select Patch Number | Created On | Description | Impacted Feature | README |
|----------------------------------|------------|--------------------------|-----------------------|----------------------|
| <input type="checkbox"/> 4751921 | 2007-02-14 | A useful Patch | Services | View |
| <input type="checkbox"/> 4751923 | 2007-02-15 | Another useful patch | Services, Data Mining | View |
| <input type="checkbox"/> 4751925 | 2007-02-15 | Yet Another useful patch | Audit Options | View |

 TIP It is recommended to check patch prerequisites before applying patches.

Related Links

[Patch Prerequisites](#)
[Database Feature Usage](#)
[Interim Patches Applied](#)
[Stage Patch](#)
[Patching Setup](#)

Using the Patch Wizard

Select Patches Target List Library Step Properties Credentials and Schedule Review

Select Patches [Cancel](#) [Step 1 of 5](#) [Next](#)

Select the Patches to apply. Click on "Add Patches" to search and select patches from Metalink or Software Library.

Target List

Instance Name: database
Target Type: Database Instance
Release: 11.1.0.4.0
Host: [stapl29.us.oracle.com](#)
Staging Location: %oracle_home%/EMStagedPatches
This is the directory on the host where the updates will be staged.

Patches

[Add Patches](#)

| Software Update Name | Patch Number | Created On | Type | Product | Platform | Release | Interim Patch Applicable On | Description | Action |
|-----------------------------|--------------|-----------------------|-------|-----------------|-----------|---------|-----------------------------|----------------|--------|
| p4751921_11.1.0.4.0_46_9480 | 4751921 | 2007-02-14 00:00:00.0 | Patch | Oracle Database | Linux x86 | | 11.1.0.4.0 | A useful Patch | |

Post Patch SQL to apply

Default (for Critical Patch Updates and Patchsets)
 Custom SQL File Path Specify the file location on the host (e.g., %oracle_home%/files/patch.sql).
 None

[Cancel](#) [Step 1 of 5](#) [Next](#)

Applying a Patch

Search And Select Patches

Search Metalink Search Software Library

Select Select

Search

| | |
|----------------|----------------------|
| Patch Number | <input type="text"/> |
| Product Family | Oracle Database |
| Product | Oracle Database |
| Release | 11.1.0.5.0 |
| Patch Type | All Patches |
| Platform | Any |
| Language | Any |

Go

[Select All](#) | [Select None](#)

| Select | Software Update Name ▲ | Patch Number | Created On | Type | Product | Platform | Release | Interim Patch Applicable On | Description | README |
|--------------------------|-----------------------------|--------------|------------|-------|-----------------|-----------|---------|-----------------------------|-------------|----------------------|
| <input type="checkbox"/> | p6037441_11.1.0.5.0_46_9480 | 6037441 | | Patch | Oracle Database | Linux x86 | | 11.1.0.5.0 | | View |

Staging a Patch

To look up patches at OracleMetaLink, enter search criteria and click Search. This may take a few moments depending on the number of matches found. From Search Results, select the patch to be applied and click Next.

For advanced features like multiple patch application, patch flow customization, sudo and PAM support please use the " [Deployment Procedures](#) " functionality. For details on Deployment Procedures, consult the relevant [documentation](#)

Search by Number

* Patch Number: 6037441

Platform: Linux x86

(If you run a 32-bit Oracle product on a 64-bit operating system, choose a 32-bit platform.)

Language: Any

Search Clear Search by Criteria

Search Results

[View Details](#) [View ReadMe](#)

| Select | Patch Number | Created On | Type | Product | Platform | Release | Interim Patch Applicable On | Description | Status |
|----------------------------------|--------------|--------------|-------|-----------------|-----------|---------|-----------------------------|--|-----------|
| <input checked="" type="radio"/> | 6037441 | May 11, 2007 | Patch | Oracle Database | Linux x86 | | 11.1.0.5.0 | DUMMY BUG FOR DUMMY PATCH UPLOAD TO ARU FOR BETA TESTING | available |

Online Patching: Overview

For a bug fix or diagnostic patch on a running Oracle instance, online patching provides the ability to do the following:

- Install
- Enable
- Disable



Installing an Online Patch

- Applying an online patch does not require instance shutdown, relinking of the Oracle binary, or instance restart.
- OPatch can be used to install or uninstall an online patch.
- OPatch detects conflicts between two online patches, as well as between an online patch and a conventional patch.
- To determine if a patch is an online patch:

```
opatch query -is_online_patch <patch location>
OR
opatch query <patch location> -all
```

Benefits of Online Patching

- No down time and no interruption of business
- Extremely fast installation and uninstallation times
- Integrated with OPatch:
 - Conflict detection
 - Listed in patch inventory
 - Works in RAC environment
- Persist across instance shutdown and startup

Conventional Patching and Online Patching

| Conventional Patches | Online Patches |
|--|---|
| Require down time to apply or remove | Do not require down time to apply or remove |
| Installed and uninstalled via OPatch | Installed and uninstalled via OPatch |
| Persist across instance startup and shutdown | Persist across instance startup and shutdown |
| Take several minutes to install or uninstall | Take only a few seconds to install or uninstall |

Online Patching Considerations

- Online patches are supported on the following platforms:
 - Linux x86 32/64
 - HP Itanium
 - Sun Sparc Solaris 64
 - AIX
 - Windows x86 32/64
- Some extra memory is consumed.
 - Exact amount depends on:
 - Size of patch
 - Number of concurrently running Oracle processes
 - Minimum amount of memory: Approximately one OS page per running Oracle process

Online Patching Considerations

- There may be a small delay (a few seconds) before every Oracle process installs or uninstalls an online patch.
- Not all bug fixes and diagnostic patches are available as an online patch.
- Use online patches in situations when down time is not feasible.
- When down time is possible, you should install all relevant bug fixes as conventional patches.

Quiz

Which of the following statements are true about online patches?

1. Can be installed using OPatch
2. Require down time to apply
3. Persist across instance startup and shutdown
4. Do not require down time to remove

Summary

In this lesson, you should have learned how to:

- Use the Support Workbench
- Work with Oracle Support
- Search My Oracle Support
- Log service requests
- Manage patches
 - Apply a patch release
 - Stage a patch release

Practice 18 Overview: Using EM Tools for Alerts and Patches

This practice covers using the Support Workbench to investigate a critical error.



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Objectives

After completing this lesson, you should be able to use Oracle Restart to manage components.

Oracle Restart

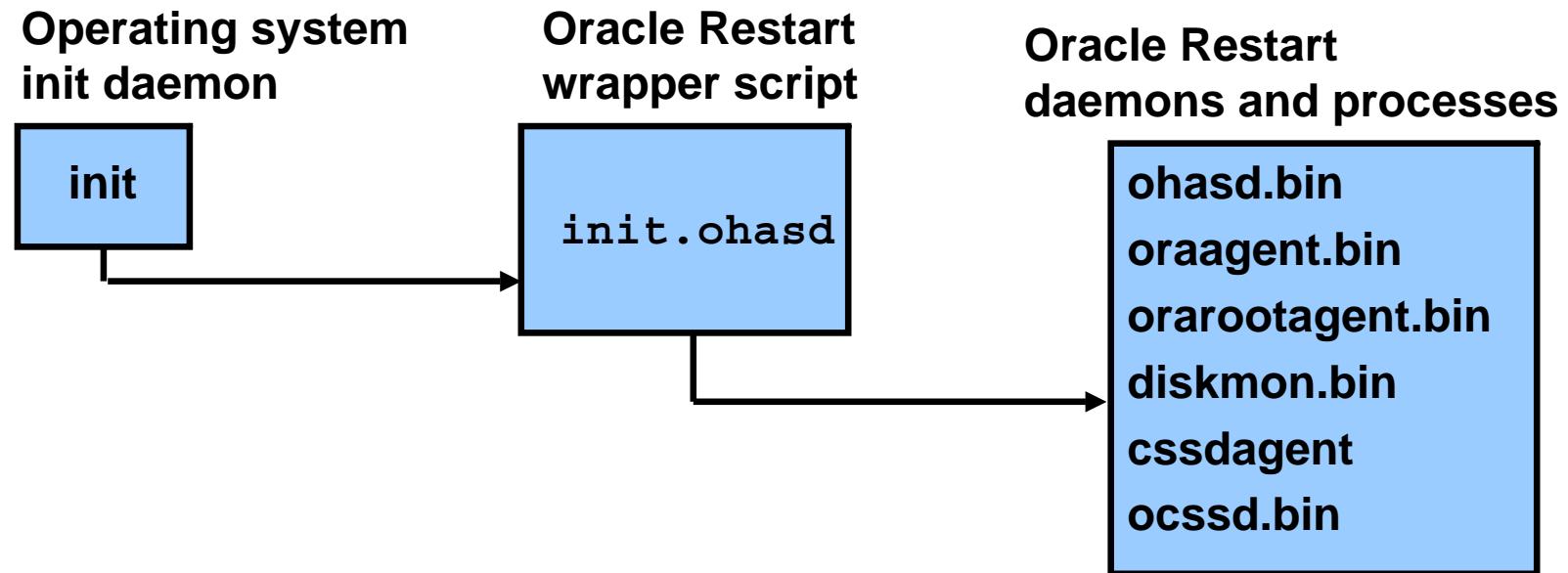
Oracle Restart implements a high availability solution for stand-alone Oracle databases.

- Can monitor and restart the following components:
 - Database instances
 - Oracle Net listener
 - Database services
 - Automatic Storage Management (ASM) instance
 - ASM disk groups
 - Oracle Notification Services (ONS/eONS)
- Runs periodic check operations to monitor the health of the components
- Runs out of the Oracle Grid Infrastructure home, which you install separately from Oracle Database homes



Oracle Restart Process Startup

- Oracle Restart is started by the OS init daemon.



- The Oracle Restart installation modifies the `/etc/inittab` file to ensure start up every time the machine starts.

```
# cat /etc/inittab
...
h1:35:respawn:/etc/init.d/init.ohasd run >/dev/null 2>&1 </dev/null
```



Controlling Oracle Restart

The CRSCTL utility can be used to control the state of Oracle Restart.

- To display the Oracle Restart configuration:

```
$ crsctl config has
```

- To enable or disable the automatic restart of Oracle Restart:

```
$ crsctl [ enable | disable ] has
```

- To start or stop Oracle Restart:

```
$ crsctl [ start | stop ] has
```



Choosing the Correct SRVCTL Utility

- Invoke the Server Control (SRVCTL) utility from the Oracle Grid Infrastructure home when working with ASM instances, disk groups, listeners, and ONS.

```
$ export ORACLE_HOME=/u01/app/oracle/product/11.2.0/grid  
$ $ORACLE_HOME/bin/srvctl command component options
```

- Invoke the SRVCTL utility from the Oracle Database home when working with the database or database instance.

```
$ export  
ORACLE_HOME=/u01/app/oracle/product/11.2.0/dbhome_1  
$ $ORACLE_HOME/bin/srvctl command component options
```

Oracle Restart Configuration

Oracle utilities will automatically update the Oracle Restart configuration.

| Create operations and the Oracle Restart configuration | Automatically added to configuration? |
|---|---------------------------------------|
| Create a database with OUI or DBCA | YES |
| Create a database with SQL statement | NO |
| Create an ASM instance with OUI, DBCA, or ASMCA | YES |
| Create a disk group (any method) | YES |
| Add a listener with NETCA | YES |
| Create a database service with SRVCTL | YES |
| Create a database service by modifying SERVICE_NAMES initialization parameter | NO |
| Create a database service with DBMS_SERVICE.CREATE_SERVICE | NO |

Using the SRVCTL Utility

- The SRVCTL utility is used to start, stop, and manage Oracle Restart components with the following syntax:

```
$ srvctl command component options
```

- The following command and components are supported:

| | |
|-------------------|---|
| Commands | add config disable enable getenv modify remove setenv start status stop unsetenv |
| Components | asm db dg filesystem home lsnr serv ons eons |

Obtaining Help for the SRVCTL Utility

The SRVCTL utility provides online help for its commands, components, and options.

- For help with general usage:

```
$ srvctl -h
```

- For help on a particular command:

```
$ srvctl command -h
```

- For help on a particular command and component:

```
$ srvctl command component -h
```



Starting Components by Using the SRVCTL Utility

Oracle recommends that the SRVCTL utility be used to start all components.

- Examples of starting individual components:

```
$ srvctl start database -d PROD -o mount  
$ srvctl start listener -l crmlistener  
$ srvctl start service -d PROD -s "service1,service2"  
$ srvctl start diskgroup -g "DATA,FRA"  
$ srvctl start asm  
$ srvctl start eons -v  
$ srvctl start ons
```

- Example of starting all Oracle Restart components in a specified Oracle home:

```
$ srvctl start home -o oracle_home -s state_file
```



Stopping Components by Using the SRVCTL Utility

Oracle recommends that the SRVCTL utility be used to stop all components.

- Examples of stopping individual components:

```
$ srvctl stop database -d PROD -o transactional  
$ srvctl stop listener -l crmlistener -f  
$ srvctl stop service -d PROD -s "service1,service2"  
$ srvctl stop diskgroup -g "DATA,FRA" -f  
$ srvctl stop asm -o immediate -f  
$ srvctl stop eons -v  
$ srvctl stop ons
```

- Example of stopping all Oracle Restart components in a specified Oracle home:

```
$ srvctl stop home -o oracle_home -s state_file -f
```



Viewing Component Status

- You can use the status command to view the running status for any component managed by Oracle Restart.
- Display the running status for a database:

```
$ srvctl status database -d orcl
Database is running.
```

- Display the listener status:

```
$ srvctl status lsnr
Listener LISTENER is enabled
Listener LISTENER is running on node(s) : host01
```

Displaying the Oracle Restart Configuration for a Component

- You can use the config command to display the Oracle Restart configuration of a component.
- Display the Oracle Restart configuration for a database:

```
$ srvctl config database -d orcl
Database unique name: orcl
Database name: orcl
Oracle home: /u01/app/oracle/product/11.2.0/dbhome_1
Oracle user: oracle
Spfile: +DATA/orcl/spfileorcl.ora
Domain: example.com
Start options: open
Stop options: immediate
Database role:
Management policy: automatic
Disk Groups: DATA,FRA
Services: east,sales
```

Manually Adding Components to the Oracle Restart Configuration

Components can be manually added to the Oracle Restart configuration with the add command.

- To define a new listener that was not created with NETCA, use the following syntax:

```
$ srvctl add listener -l MYLISTENER -p TCP:1525 -o  
/u01/app/oracle/product/11.2.0/grid
```

- To specify a nondefault location for the new listener's networking files, use the following syntax:

```
$ srvctl setenv listener -l MYLISTENER -t  
TNS_ADMIN=/usr/local/oracle
```

Quiz

You invoke the SRVCTL utility from the Oracle Grid Infrastructure home when working with:

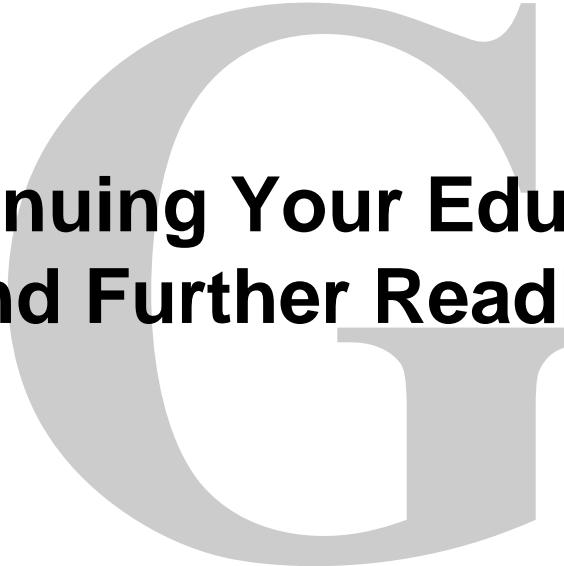
1. Listeners
2. ASM instances
3. Database instances
4. ASM disk groups

Summary

In this lesson, you should have learned how to use Oracle Restart to manage components.

Practice 3-1: Overview

In this practice, you use Oracle Restart to manage components.



Continuing Your Education and Further Reading

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Where Do You Go from Here?

“To stay competitive in the tech industry, never stop learning. Always be on the lookout for better ways of doing things and new technologies. Our industry does not reward people who let themselves stagnate.”

—John Hall, Senior Vice President, Oracle University

This appendix provides a few resources to help you with continuing your education.

Continuing Education Resources

Resources to learn more about working with Oracle Database 11g include:

- Oracle University Web site
- Oracle University Knowledge Center
- Oracle Technology Network:
 - Oracle by Example
 - *Oracle Magazine*
 - Oracle Database product page
- Technical support: My Oracle Support
- Oracle Database product page



Oracle University

The screenshot shows the Oracle University website for the United States. The header features the "ORACLE UNIVERSITY" logo and "UNITED STATES". Below the header, there are two main sections: "ORACLE UNIVERSITY" and "PRODUCT COURSES". The "ORACLE UNIVERSITY" section includes links for "100% Student Satisfaction", "Course Schedule", "Knowledge Center", "Self-Study CD-ROM", and "User Adoption Services". The "PRODUCT COURSES" section lists various Oracle products and industries, such as Database and Grids, Fusion Middleware, Development Tools, Collaboration, Data Warehouse, Linux | Java, E-Business Suite, PeopleSoft Enterprise, JD Edwards EnterpriseOne, JD Edwards World, Siebel, Retail Industry, Telecom Industry, and Utilities Industry.

ORACLE UNIVERSITY

100% Student Satisfaction
Course Schedule
Knowledge Center
Self-Study CD-ROM
User Adoption Services

PRODUCT COURSES

Database and Grids
Fusion Middleware
Development Tools
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JD Edwards World
Siebel
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Telecom Industry
Utilities Industry

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 - Instructor-Led Inclass Training
 - Live Web Class
 - Self-Study CD-ROMs
- Certification

Oracle University

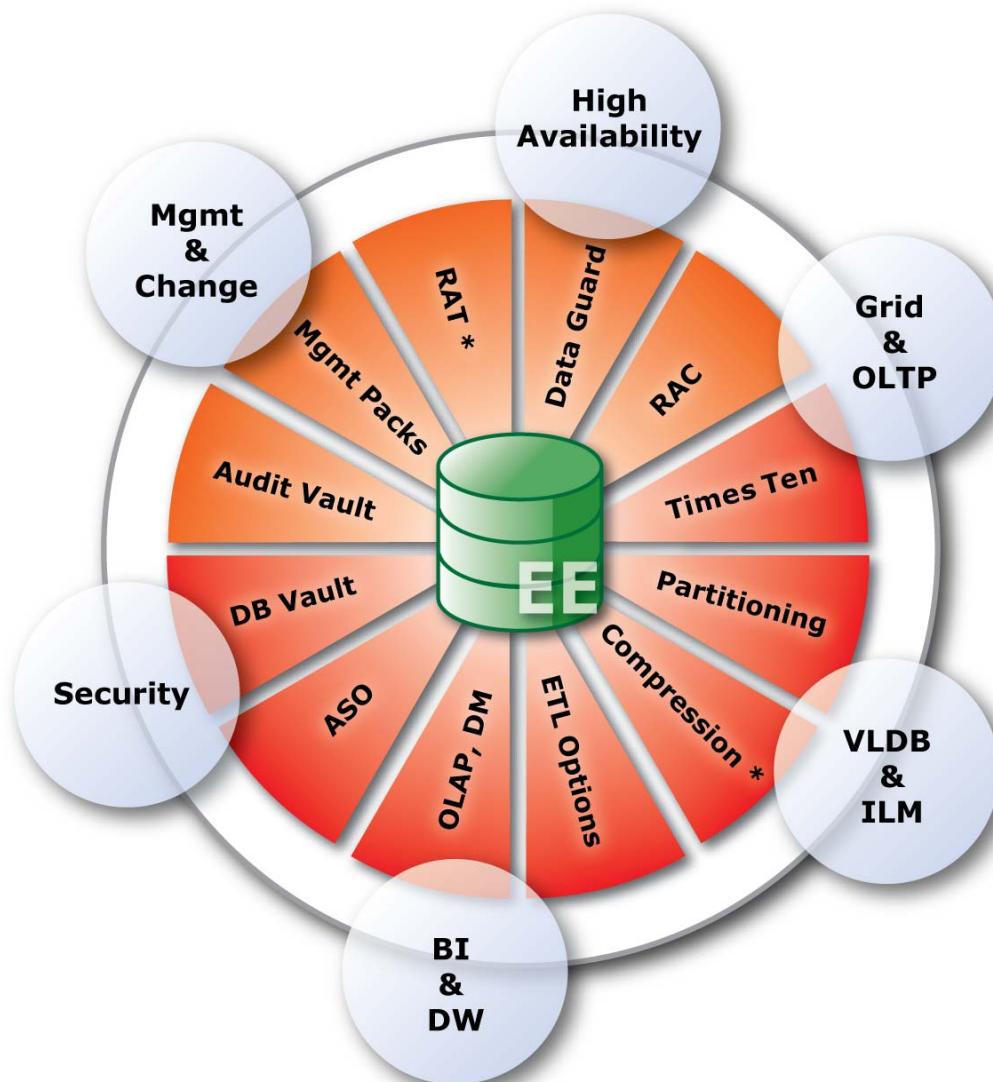
<http://www.oracle.com/education>

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Continuing Your Education

- Database specialty classes:
 - *Oracle Database 10g: Administration Workshop II*
 - *Oracle Database 11g: Performance Tuning*
 - *Oracle Database 11g: Security*
- Other specialty classes:
 - *Oracle 11g: RAC and Grid Foundation Administration*
 - *Oracle Database 11g: RAC Administration*

Database Specialty Areas



Modern Enterprise Grids

- Real Application Clusters
- Management packs
- TimesTen In-Memory Database

Information Lifecycle Management

- Partitioning
- Advanced Compression

Data Warehousing

- Oracle Information Appliances
- OLAP, Mining, Warehouse Builder

Governance, Risk & Compliance

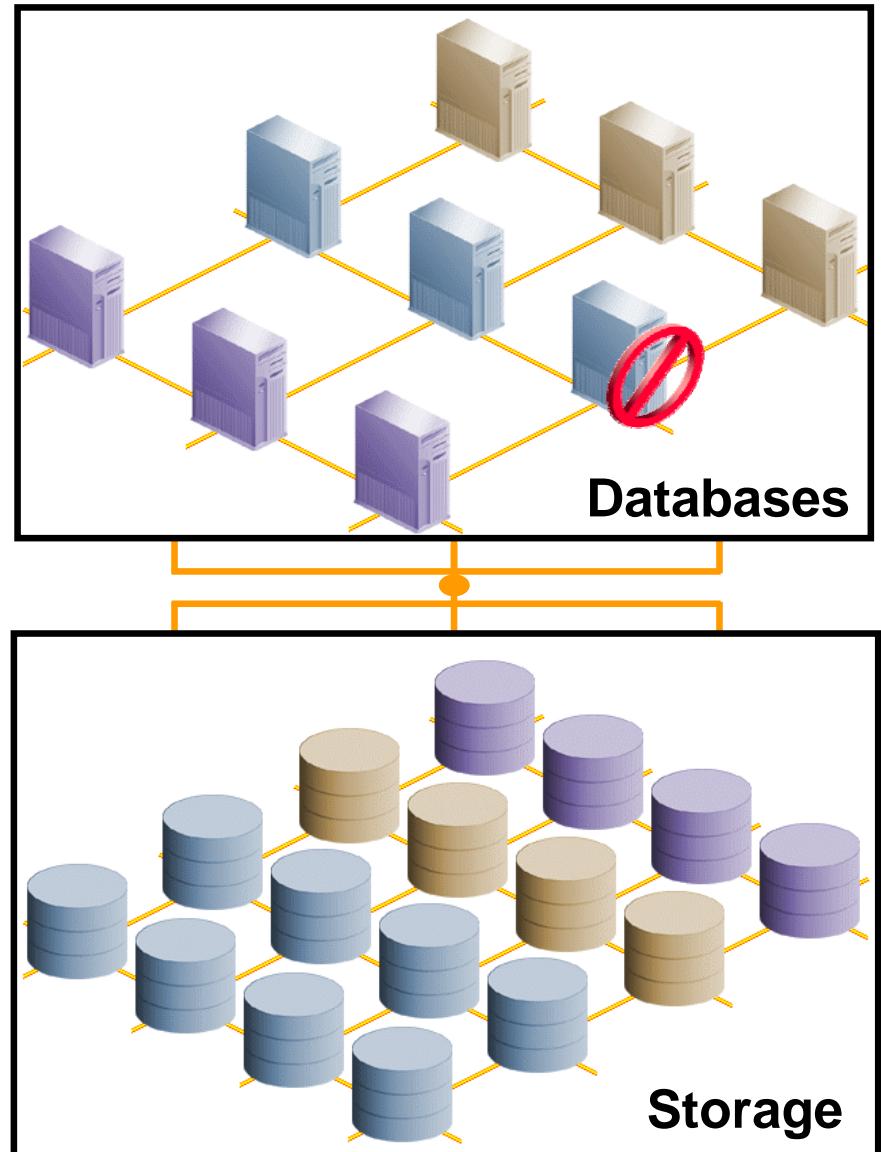
- Security Options
- Total Recall

Change management

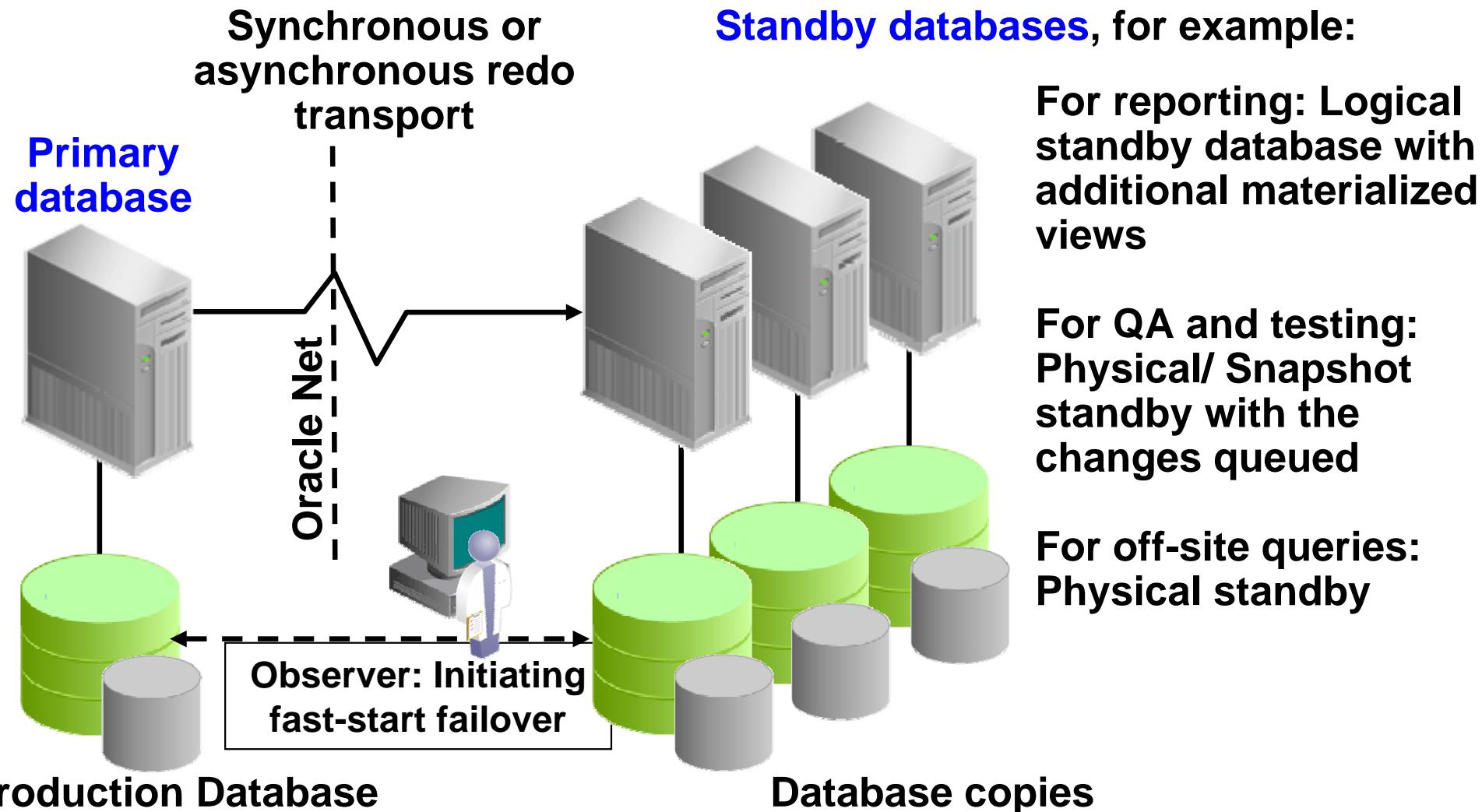
- Real Application Testing

Oracle Real Application Clusters

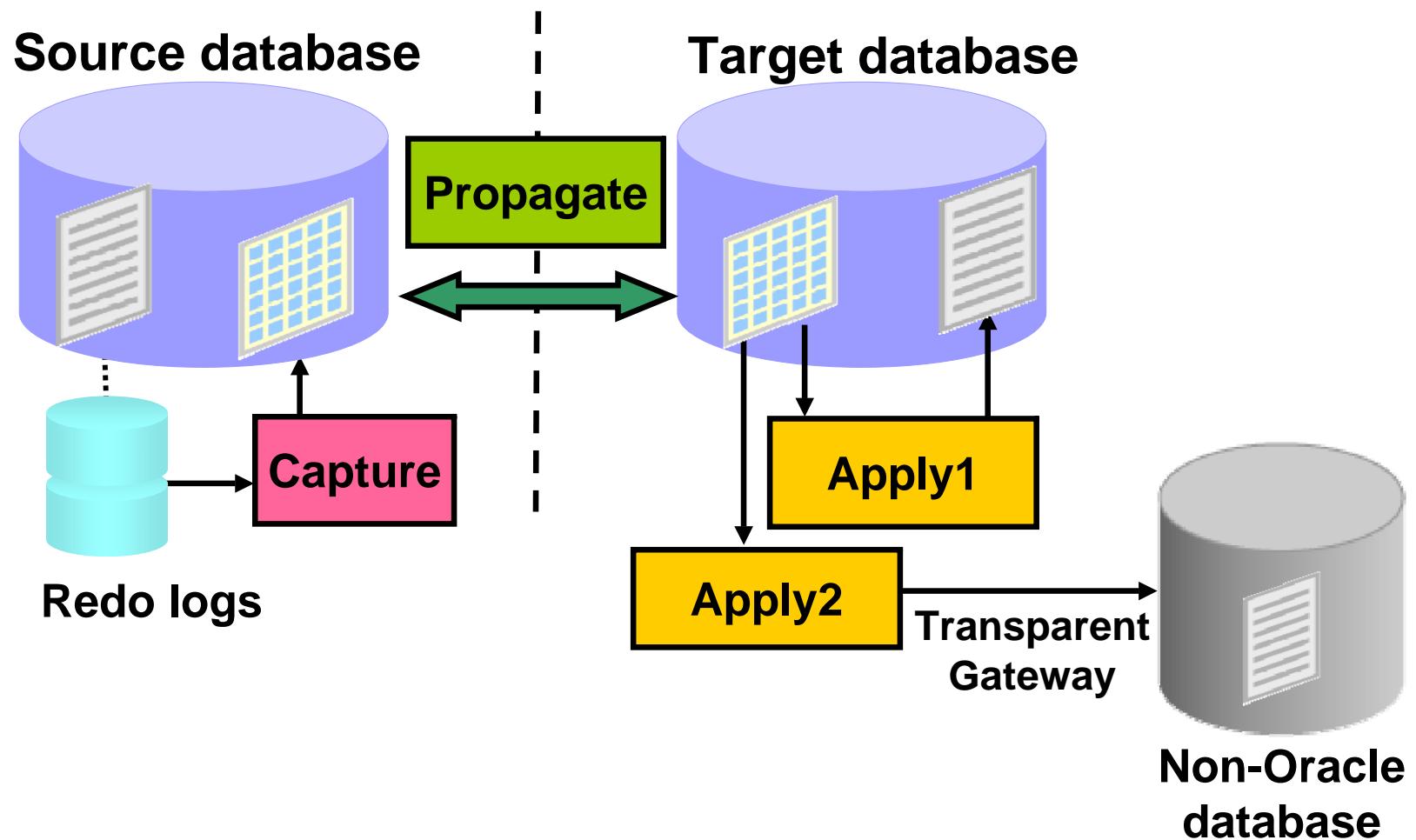
- Consolidating different workloads to a single grid
- Virtualizing the information platform
- Flexible physical infrastructure (including dedicated servers)



Oracle Data Guard



Streams Overview



Oracle Technology Network

Oracle Technology Network is a *free* resource with information about the core Oracle software products, including database, Application Server, Collaboration Suite, and development tools. You can have access to:

- Technology centers
 - Discussion forums
 - Software downloads
 - Online documentation
 - Oracle by Example
 - Code samples
- ... and much more!



<http://www.oracle.com/technology>



Security

ORACLE TECHNOLOGY NETWORK

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secure search Technology Network ▾ 

PRODUCTS
Database
Middleware
Developer Tools
Enterprise Management
Applications Technology
Products A-Z

TECHNOLOGIES
BI & Data Warehousing
Embedded
Java
Linux
.NET
PHP
Security
Technologies A-Z

ARCHITECTURE
Enterprise Architecture
Enterprise 2.0
Grid
Service-Oriented Architecture
Virtualization

COMMUNITY
Join OTN
Oracle ACEs
Oracle Mix

shortcuts GETTING STARTED DOWNLOADS DOCUMENTATION FORUMS ARTICLES SAMPLE CODE TUTORIALS

 **Security Technology Center**

Oracle delivers secure infrastructure through a wide range of products, processes, and technologies to help prevent unauthorized access to confidential information, reduce the cost of managing users, and facilitate privacy management.

View the most recent [Critical Patch Update Advisory \(July 2009\)](#)

What's New

Oracle Innovation Showcase: Mark Wilcox on Oracle Virtual Directory
Product Manager Mark Wilcox explains what he thinks is innovative about Oracle Virtual Directory.
posted Tue, 25 Aug 2009 22:31:56 +0000

Article: Keeping Current with Standards (from Oracle Magazine)
Oracle CTO Mary Ann Davidson offers a backstage tour of Oracle's own Secure Coding Standards document.
posted Fri, 14 Aug 2009 22:29:06 +0000

Technical Article: Securing Database Access at the Operating System Level (PDF)
Frits Hoogland recently published this article about how OS level security can enhance overall database security.
posted Tue, 04 Aug 2009 16:15:25 +0000

Security Technology

- [Database Platform Security](#)
- [Identity Management Infrastructure](#)
- [Security Developer Tools](#)

Security Downloads

- [Oracle Identity Management](#)
- [Oracle Database Vault](#)
- [Oracle Audit Vault](#)
- [Oracle Secure Backup](#)
- [Oracle Secure Enterprise Search](#)

Security Response

- [Critical Patch Updates](#)
- [BEA Security Advisories Archive](#)
- [Security Vulnerability Fixes - Policy and Process](#)
- [Critical Patch Update Implementation Best Practices \(PDF\)](#)

<http://www.oracle.com/technology/deploy/security/index.html>

Oracle by Example

- What is an OBE?
 - A set of hands-on, step-by-step instructions
- Where can I find them?
 - <http://www.oracle.com//technology/obe>
- What is available?
 - Hundreds of OBE tutorials on many of the Oracle product areas

Oracle Magazine

- Free subscription
- Oracle Magazine Archives
<http://www.oracle.com/technology/oramag/index.html>



Oracle Applications Community

Oracle Technology Network is a resource for Oracle Applications users and implementers. You can have access to:

- Discussion forums
- User groups
- Online chat
- Documentation
- Training
- Upgrade information
 - ... and much more!



<http://www.oracle.com/technology/community/apps/index.html>



Technical Support: My Oracle Support

Access to My Oracle Support is included as part of your annual support maintenance fees. In addition to the most up-to-date technical information available, My Oracle Support gives you access to:

- Service requests (SRs)
- Certification matrices
- Technical forums monitored by Oracle experts
- Software patches
- Bug reports



<http://metalink.oracle.com>



Oracle Database Product Page

From the Oracle Database product page on OTN, there are links to:

- Database Focus Areas
- White Papers
- Option Data Sheets
- Related technologies
- Discussions
- Other useful resources



Thank You!

We hope your experience with Oracle University has been enjoyable. We welcome your feedback on how we can improve to better meet your needs:

- End-of-course evaluations
- Oracle University Office of Customer Satisfaction
- Oracle Education Services

We hope to see you in class again soon.

