

Chapter 1

Installing and Upgrading to Oracle 10g

ORACLE DATABASE 10g NEW FEATURES FOR ADMINISTRATORS EXAM OBJECTIVES COVERED IN THIS CHAPTER:

✓ Installation

- Describe installation new features support
- Describe installation performance enhancements

✓ Server Configuration

- Simplify instance configuration using a subset of initialization parameters
- Use policy-based database configuration framework
- Use DBCA to clone database
- View database usage statistics through EM

✓ Maintain Software

- Understand the supported upgrade paths to Oracle Database 10g
- Use new utility to perform pre-upgrade validation checks
- Use simplified upgrade process that automatically determines components to be upgraded
- Start up the database using a new mode when upgrading



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With the release of Oracle Database 10g (Oracle 10g), DBAs have a database that is simple to set up, more robust, and self-managing. Oracle 10g is full of new features, most of which the DBAs long awaited and many of which are designed with the DBA in mind. Though this book is not intended to review and explain all the new features of Oracle 10g, we will explain all the features relevant to the OCP New Features for Administrators exam.

According to the International Oracle Users Group (IOUG), DBAs spend more than 50 percent of their time managing the database, which includes tuning, managing space, managing storage, and performing backup and recovery. Oracle 10g has put a lot of focus on the managing database area so that you can spend your time on proactive and strategic planning. Oracle 10g is a self-managing database. Automatic management of the database includes storage management, SQL management and tuning, resource management, space management, and backup recovery management.

The *g* in Oracle 10g stands for *grid*. Grid computing is designed to reduce costs, make the most efficient use of all resources, and easily adapt to the ever-growing needs of the business. Oracle's grid architecture combines all the available resources (network, servers, and disk) into a large pool of resources (the grid); users can subscribe to these resources based on their requirements. Grid computing uses sophisticated workload management that makes it possible for applications to share resources across many servers. Data processing capacity can be added or removed on demand, and resources within a location can be dynamically provisioned. According to Larry Ellison, grid computing for end users is like subscribing to the electric (utility) company. You consume what you need. When you consume more, more resources are made available. The subscriber does not know where the generator is or how the electric grid is wired.

In Oracle 10g, you can clone a database and the Oracle software installation (the Oracle installation home directory) to a location on the same server or to a remote server. The Enterprise Manager comes with several out-of-the-box policy verifications that can alert you to the database security and configuration issues. In this chapter, we will discuss the installation features, configuration enhancements, and upgrade options available for Oracle 10g.

Installing Oracle 10g

With Oracle 10g, the emphasis is on self-managing and keeping things simple. Oracle has removed many redundant and obvious choices from the installation. As a DBA, you need to enter only minimal (that is, absolutely required) information to install an Oracle database.

For a clean and trouble-free install, you must install the software to an empty directory. Do not install in the same directory where you have a previous version of Oracle software installed. For

all platforms, read the platform-specific installation document to make sure you have minimum required hardware and OS versions. On Unix platforms, you need to adjust the kernel parameters.



You can find the installation documentation—Oracle Database Quick Installation Guide—at <http://www.oracle.com/technology/documentation/database10g.html>.

In the following sections, we will discuss using the Oracle Universal Installer (OUI) to install Oracle 10g software, what new features of Oracle 10g the OUI supports, what installation checks the OUI performs, and enhancements made to the installation process.

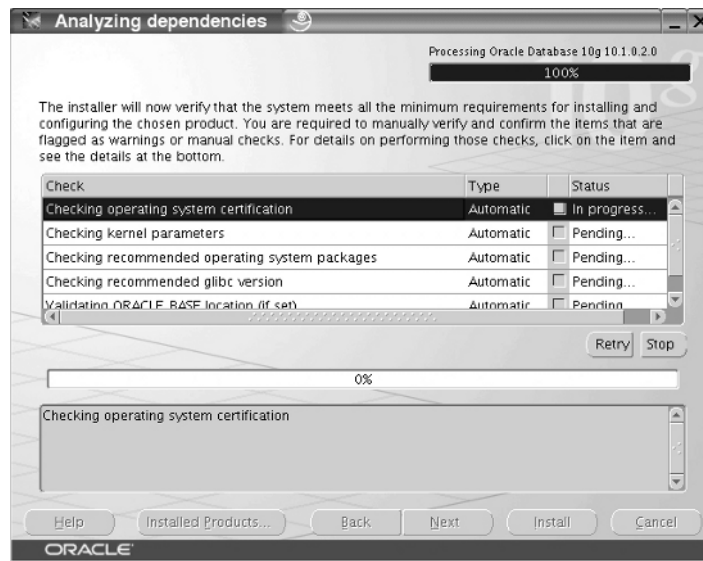
Using the Oracle Universal Installer

As in the previous releases of Oracle, Oracle 10g uses the OUI to install the software. With the OUI, the Oracle 10g installation process is simple. The most common Oracle 10g installation can be performed with just one CD. The OUI performs the necessary preinstall checks to make sure the operating system is certified and properly configured, the necessary patches are applied, and enough resources are available. If any problems are detected, it even recommends corrective action.

On the Windows platform, the OUI is invoked automatically when you insert the CD. To manually invoke the OUI, simply double-click the `setup.exe` icon from the root directory of the CD. On Unix platforms, you invoke the OUI by executing the `runInstaller` script. In the Oracle 10g database CD, `runInstaller` is in the root directory. If you're using the DVD, this script is under the `db` folder.

The OUI in Oracle 10g does a lot more checking for necessary resources before the installation begins. Figure 1.1 shows the OUI checking the necessary system requirements.

FIGURE 1.1 The OUI verifying install requirements



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On Linux (and Unix) platforms, you invoke the OUI by using the script `runInstaller`; you may use the `-ignoreSysPrereqs` option to continue with Oracle 10g install, even if the flavor of Linux is not certified by Oracle. If you do not use this flag, `runInstaller` will fail. You do not have to use this flag on Red Hat 2.1, Red Hat 3, and United Linux 1.0.

In the next section, we will discuss the preinstall checks performed by the OUI before installing the Oracle 10g software, the software components you can install, and the options for creating a database along with the software install.

Checking Preinstall Requirements

The OUI automatically performs the following verifications (some steps are specific to the Linux/Unix platform):

- Checks for certified version of operating system software. For example, only the SuSE SLES-7, Red Hat Advanced Server 2.1, and United Linux 1.0 platforms are supported under Linux, and only Solaris 2.8 or higher is supported for Sun platforms. (Always verify current certifications at <http://technet.oracle.com>.)
- Checks to make sure 32-bit Oracle 10g software components are not installed to an Oracle home directory with 64-bit Oracle 10g software and vice versa.
- Verifies that all the required operating system patches are installed.
- Checks for all the required kernel parameters.
- Checks if the `DISPLAY` variable and X Server permissions are set.
- Verifies sufficient swap space and temporary space are available.
- Verifies that the Oracle home directory where the software being installed is either empty or has the supported version of software components. Previous versions of Oracle were allowed to install software to an Oracle home directory with a different software version, but Oracle 10g does not allow this. It warns you if the software directory is not empty.

Choosing the Components to Install

The Select Installation Type screen lets you choose the components of the database to install. The components are preconfigured into two major categories: Enterprise Edition and Standard Edition. You should choose the right component based on the requirement and license agreement.

Enterprise Edition includes all the database components, which may be essential for mission-critical applications. Standard Edition does not have certain features enabled, such as the data compression, materialized view query rewrite, transportable tablespaces, and so on.

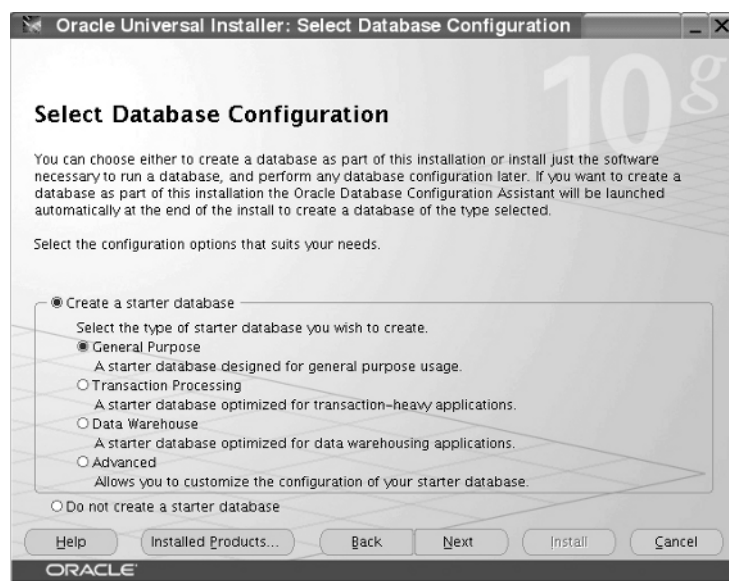
Windows platforms have an additional installation option: Personal Edition. This is similar to the Enterprise Edition and meant for single-user applications. Real Application Clusters (RAC) is not included in the Personal Edition.

You can also choose a custom installation type, where you can pick and choose the components to install.

Introducing Starter Database Options

The OUI, along with the software installation, can create an Oracle 10g database for you. If you're not creating a database along with the software install, you can specify that by choosing the Do Not Create a Starter Database option in the Select Database Configuration screen (see Figure 1.2).

FIGURE 1.2 The OUI: Select Database Configuration screen



The next screen you see will depend on which option you select in the Select Database Configuration screen. If you choose Do Not Create a Starter Database, the OUI shows the installation summary and proceeds with the software installation. If you choose General Purpose, Transaction Processing, or Data Warehouse as the type of the database, the OUI will get minimal information such as database management, file storage, backup location, and password for default accounts. After the software is installed, OUI will invoke the *Database Configuration Assistant (DBCA)* tool in noninteractive mode to create the database. The DBCA is a GUI tool to create a new database, configure an existing database, delete a database or clone a database.



The DBCA is discussed in detail later in the section "DBCA Enhancements."

If you choose Advanced as the database type, the OUI will install the software and at the end of installation invoke the DBCA utility interactively to get more information on the database options.

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You can install sample *schemas* using the DBCA when creating the database. Sample schemas are schema objects with sample data in them. The following are the five schemas in the sample schema installation:

- HR
- IX
- OE
- PM
- SH

Most of the examples and sample code provided in the Oracle documentation are based on these sample schemas. Oracle will install the EXAMPLE tablespace using the following transportable tablespace method:

```
imp transport_tablespace=y
file=/orahome/product/10.1.0/assistants/dbca/
    ↳templates/example.dmp
log=/ora1/admin/ORA10GP/create/tts_example_imp.log
datafiles=/ora5/oradata/ORA10GP/example01.dbf
tablespaces=EXAMPLE
tts_owners=hr,oe,pm,ix,sh
```



You can install Oracle 8, Oracle 8*i*, Oracle 9*i*, and Oracle 10*g* databases in multiple (separate) Oracle home directories on the same computer and have Oracle 8 (8.0.6), Oracle 8*i* (8.1.7), Oracle 9*i* (9.2), and Oracle 10*g* clients connecting to any or all the databases. When using a client version older than the database release, all features specific to the release of the database may not be available to the client.

Examining the OUI Support for New Features

Oracle 10g is feature rich with Automatic Storage Management (ASM), Flashback database, Enterprise Manager Database Control, RAC control, and so on. The OUI includes screens to set up these options if you decide to create a starter database.



These screens will display only if you install a preconfigured database. For a custom install, or for using advanced database options, you obtain this information through the DBCA interface.

We will look at these options and how to install them in the following sections.

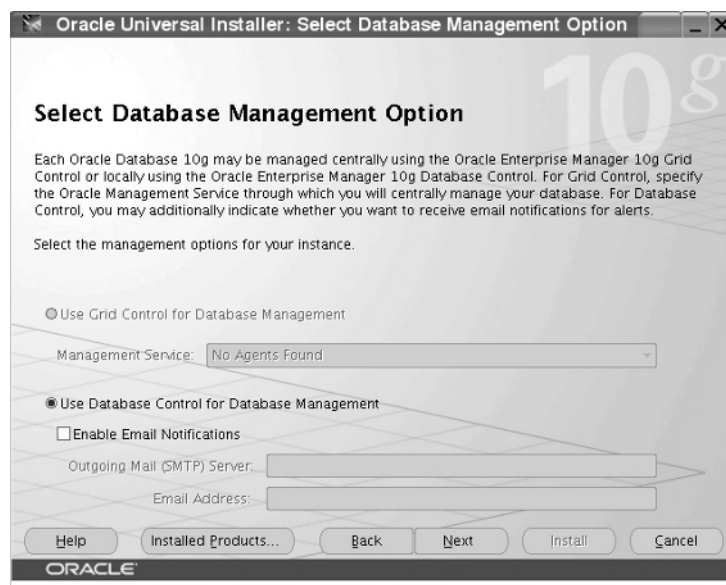


The specifics of these features will be discussed throughout the book.

Introducing Database Management Options

You can manage Oracle databases using the web-based tool *Oracle Enterprise Manager (EM)*. EM is a GUI tool to manage the Oracle environment, which includes database, host server, listener, HTTP server, and web applications. In the Select Database Management Option screen (see Figure 1.3), you can choose to manage all databases at a centralized location or manage a single database using the EM.

FIGURE 1.3 The Select Database Management Option screen



EM is installed by default if you install a preconfigured database (if you choose a custom install, you have the option not to install it). The options available are as follows:

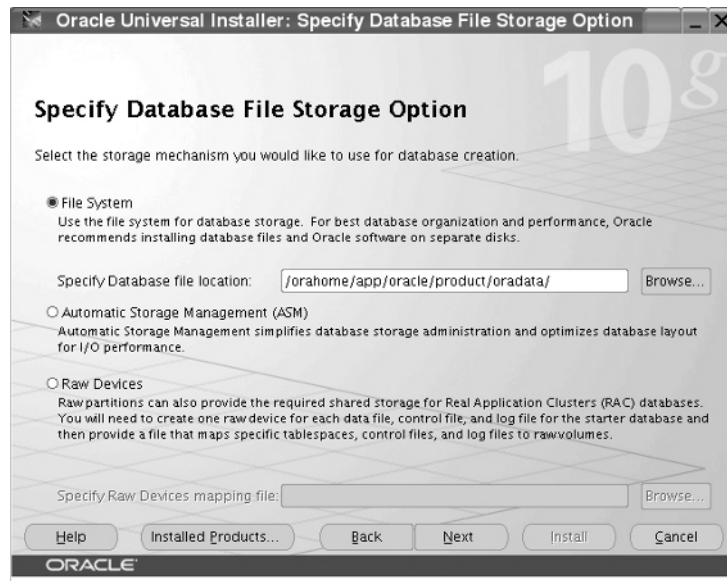
Use the Grid Control for database management Choose this option if you want to manage more than one database using a single EM interface. To deploy EM centrally, at least one Oracle Management Repository, at least one Oracle Management Service, and Oracle Management Agent must be installed on every server that you want to manage. EM 10g Grid Control is installed from a separate CD.

Use the Database Control for database management This option is selected by default if an *Oracle Management Agent* is not installed on the computer. Oracle Management Agent is responsible for monitoring all targets on the host, for communicating that information to the middle-tier Management Service, and for managing and maintaining the host and its targets. However, even if a Oracle Management Agent is installed, you can still choose to configure the Database Control to manage the database. Using this option, you can also specify an e-mail address where you want to receive the database alerts.

Introducing Database File Storage Options

The OUI gives the option to specify the type of storage you want for the database using the Specify Database File Storage Option screen, as shown in Figure 1.4.

FIGURE 1.4 The Specify Database File Storage Option screen



Oracle 10g supports the following three types of storage for its data:

File system Oracle database files are created under the directory you specify in this option. This method is the most commonly used and the easiest to set up. Oracle recommends creating the database files in a different file system that stores the Oracle software or operating system files. The file system could be a disk physically attached to the computer, a RAID/Logical Volume Manager configuration, or an NFS-mounted file system. Once File System is chosen, the next screen will accept the location of the data files.

Automatic Storage Management (ASM) Choose this option if you would like the data files to be stored in ASM disks. *Automatic Storage Management (ASM)* is a new feature in Oracle 10g. ASM manages the disk for database use and tunes I/O automatically. To use ASM, one or more ASM disk groups must exist. A disk group is a set of disk devices that ASM manages as a single unit. ASM spreads data evenly across all the devices in the disk group to optimize performance and utilization. When you choose ASM, Oracle checks if an ASM instance is running on the machine; if not, it will create one for you.

Raw devices If you choose this option, Oracle data files will be stored on disk directly, bypassing the operating system layer. Raw devices are disk partitions or logical volumes that have not been formatted with a file system. When using raw devices for database file storage, Oracle writes data directly to the partition or volume, bypassing the operating system's file system layer.

Introducing Backup and Recovery Options

You may enable automated database backup using the Specify Backup and Recovery Options screen (see Figure 1.5). Oracle uses Recovery Manager (RMAN) to back up the files and can set up a job to perform the backups.

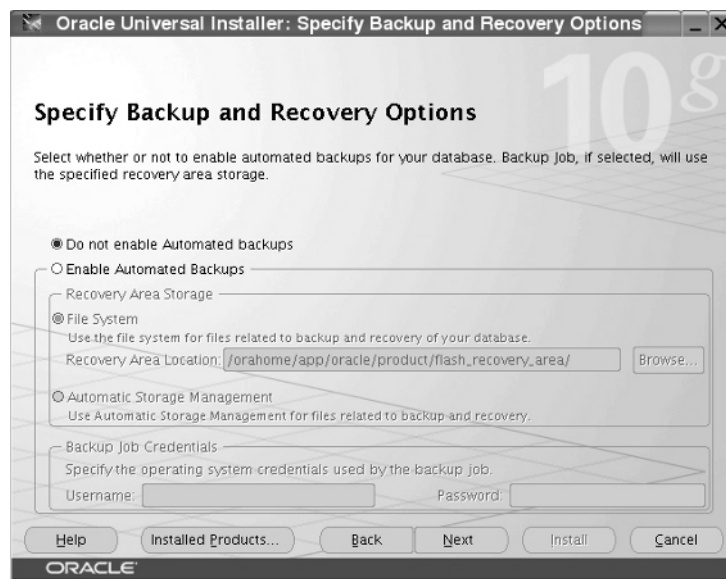
You can choose the following options from this screen:

Do Not Enable Automated Backups Choose this option if you do not want the OUI to set up backups. All databases should be backed up, so if you choose this option, make sure you define other methods to back up the database for data protection.

Enable Automated Backups Choose this option to set up backup job to run automatically every day. The backups can be written to a file system area or to ASM storage. The default disk quota configured for the flash recovery area is 2GB. The default job execution time is 2 a.m.

For ASM disk groups, the required disk space depends on the redundancy level of the disk group you choose. Normal redundancy is two-way mirroring, and high redundancy is three-way mirroring.

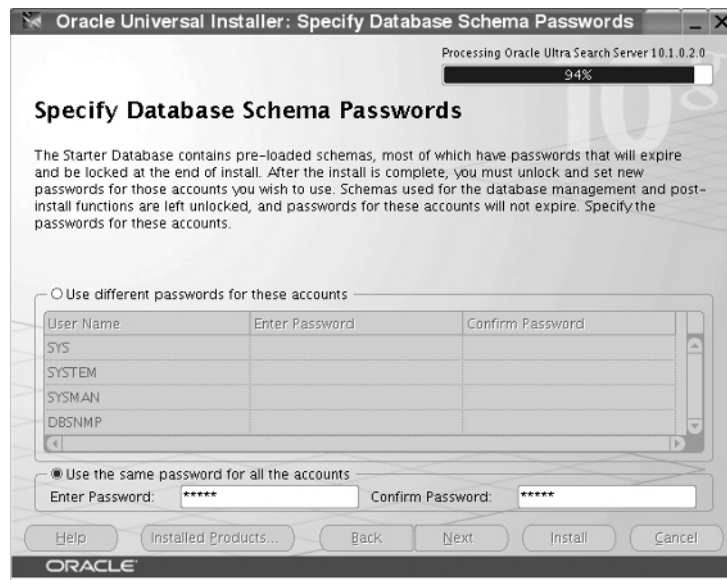
FIGURE 1.5 The Specify Backup and Recovery Options screen



Introducing Database Schema Password Options

Using the Specify Database Schema Passwords screen (see Figure 1.6), you can provide separate passwords for each administrative user, such as SYS, SYSTEM, SYSMAN, and DBSNMP, or provide one password for all.

FIGURE 1.6 The Specify Database Schema Passwords screen



Introducing Installation Enhancements

In addition to the new installation features, the Oracle 10g installer includes many performance and management enhancements over 9i. Oracle 10g groups the products into separate CDs so that you need to use only one CD at a time. The following are some of the CDs that ship with Oracle 10g; all these are included in one DVD:

- Oracle Database 10g
- Oracle Database 10g Companion CD
- Oracle Database 10g Client
- Oracle Cluster Ready Services
- Oracle Database Documentation Library



Oracle Enterprise Manager 10g Grid Control is shipped separately in one DVD or three CDs.

The installation completes in about 20 minutes and requires only one CD. The EM Webstage and Apache, which were installed with Oracle 9i, are no longer installed with the Oracle 10g database.

Oracle 10g has a simplified software install and database creation; the disk requirement for software is now less. The following are some of the install enhancements:

Simplified install The Oracle 10g installer can install the software and create a database with default settings from one screen. This simplifies the install actions required and is really useful for a new user. Figure 1.7 shows the install screen from a Windows platform. The Advanced Installation option lets you choose location, type of software installation, and other options.

FIGURE 1.7 The Welcome to the Oracle Database 10g Installation screen



Memory and disk Oracle 10g requires a minimum of 512MB for an instance with the Database Control and a minimum of 256MB for an instance without the Database Control. The OUI automatically checks the disk space requirements. The minimum is 1GB swap space (or twice the RAM), between 500MB and 2.5GB of disk space depending on the options, and about 1200MB for the preconfigured database.

Administrative passwords In Oracle 9i Release 2, you were required to enter the passwords for SYS and SYSTEM twice—once during installation and once after the database creation. In Oracle 10g, this information is required only once during installation.

Clean removal The Oracle 10g OUI removes the Oracle software cleanly, meaning no files are left in the Oracle home directory; files outside the Oracle home directory related to the install are also removed. Software removal also shuts down any databases that are currently using the Oracle home directory.



The silent install of Oracle using a response file in Unix is truly silent; you have no need to set up a `DISPLAY` variable. The response file records only the values used in dialog boxes needing user inputs.

Though most of the features used by the Oracle database can be installed from one CD, you may want to install a few products from the Oracle Database 10g Companion CD. The Oracle 10g Companion CD includes the following two main product options:

Oracle 10g products These products must be installed to an existing Oracle 10g home directory:

Oracle database examples Database examples are product demonstrations to learn the product features. These mostly use the sample schema data to demonstrate features.

JPublisher JPublisher is a Java utility that generates Java classes to represent the user-defined database entities in a Java program. JPublisher enables you to specify and customize the mapping of SQL object types, object reference types, and collection types (VARRAYs or nested tables) to Java classes in a strongly typed paradigm.

Legato Single Server Version Legato Single Server Version (LSSV) is a backup and recovery application that is developed by Legato Systems Inc. LSSV software includes a media management layer. Oracle RMAN requires this layer when using tape storage for database backups and restoration. LSSV manages the backup schedule and communicates with Oracle Recovery Manager (RMAN) to copy the Oracle data to tape.

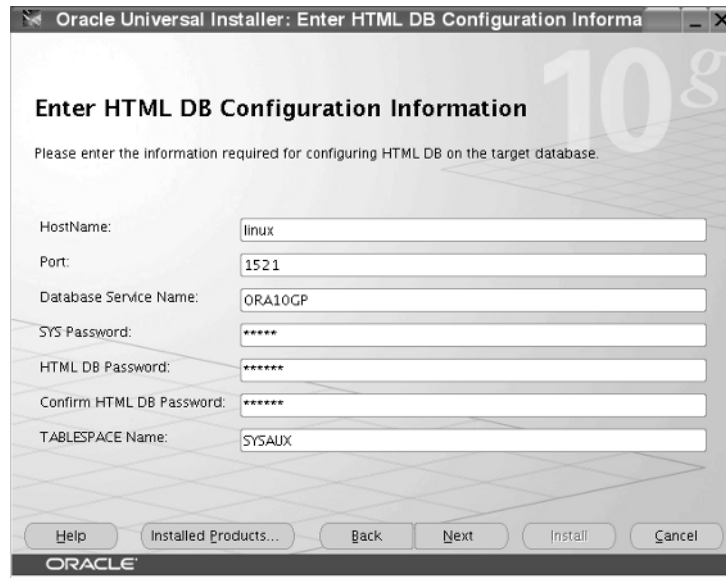
Natively compiled Java libraries The CD includes JAccelerator and Oracle interMedia Image Accelerator, which contain the natively compiled Java libraries (NCOMPs) for Oracle JVM and Oracle interMedia. These libraries improve the performance of the Oracle JVM and Oracle interMedia.

Oracle text-supplied Knowledge Bases An Oracle Text Knowledge Base is a hierarchical tree of concepts used for indexing themes, performing ABOUT queries, and deriving themes for document services.

Oracle 10g companion products These products must not be installed to the Oracle 10g database Oracle home directory; they must be installed to a separate Oracle home directory.

Oracle HTTP server *Oracle 10g HTTP Server (OHS)* is based on the Apache web server 1.3.28 and is designed to take advantage of the latest optimizations and security features. OHS includes SSL session renegotiation and death detection and the restart of failed processes.

Oracle HTML DB *HTML DB* is new in Oracle 10g. HTML DB is a Rapid Application Development (RAD) tool for the Oracle database, and it has many built-in themes and features. Using only a web browser, developers can build web applications faster. Before installing HTML DB, an Oracle 10g database must be configured and should be able to connect using SQLNet. Also, OHS and HTML DB must be installed in the same Oracle home directory. Figure 1.8 shows the HTML configuration screen of the OUI.

FIGURE 1.8 HTML DB configuration options

In earlier releases of Oracle, the client software was part of the database install CD. In Oracle 10g, the client is installed from the Oracle Database 10g CD when installing the database software. To install the Oracle client software alone, you need to use the Oracle Database 10g Client CD.

Configuring Oracle 10g

Oracle 10g provides several configuration enhancements over 9i. Most of the tasks are completed automatically, thus reducing manual intervention and errors. The architectural enhancements include a new SYSAUX tablespace to store all auxiliary metadata (discussed in Chapter 4, “General Storage Enhancements”), store workload information, and collect statistics to optimize performance. In addition, the DBCA is enhanced in Oracle 10g to include all these architectural changes.

You invoke the DBCA on Unix platforms using the `dbca` executable. On Windows, choose Database Configuration Assistant from the Configuration and Migration Tools folder.

In the following sections, we will discuss the enhancements to DBCA, how you can set up the database using simplified initialization parameters, and how to verify the database feature and high-watermark usage.

Examining DBCA Enhancements

The DBCA is a GUI tool for database creation and configuration changes. The DBCA can create a stand-alone database, a Real Application Cluster (RAC) database, or a standby database. A database created using the DBCA is fully set up and ready to use.

When creating a database, the DBCA can configure the following new features of Oracle 10g:

- Automatically create the `SYSAUX` tablespace to store auxiliary metadata information.
- Implement backup and recovery procedures and set up flash recovery area.
- Create management repository and services. The Enterprise Manager repository, jobs, and event subsystems are configured automatically.
- Automatically register LDAP (if available), which eliminates the need for manual `LDAP.ORA` configuration.
- Simplify the creation of a seed database, which is powerful and makes use of all the Oracle 10g features.
- Make the database ready for management using Enterprise Manager. The database can be centrally managed using EM Grid control. DBCA can set this up.
- Configure ASM storage options, and if an ASM instance is not already installed, create an ASM instance.
- Specify initialization parameters as typical, where you need to provide only minimal information. Choosing Custom enables you to configure parameters.
- Create sample schemas.
- Create a database as a clone of an existing database. The DBCA can clone the database entirely or just the structure.

In addition, when a database is deleted using the DBCA, the DBCA deletes all the files associated with the database and, on Windows, also removes the services.

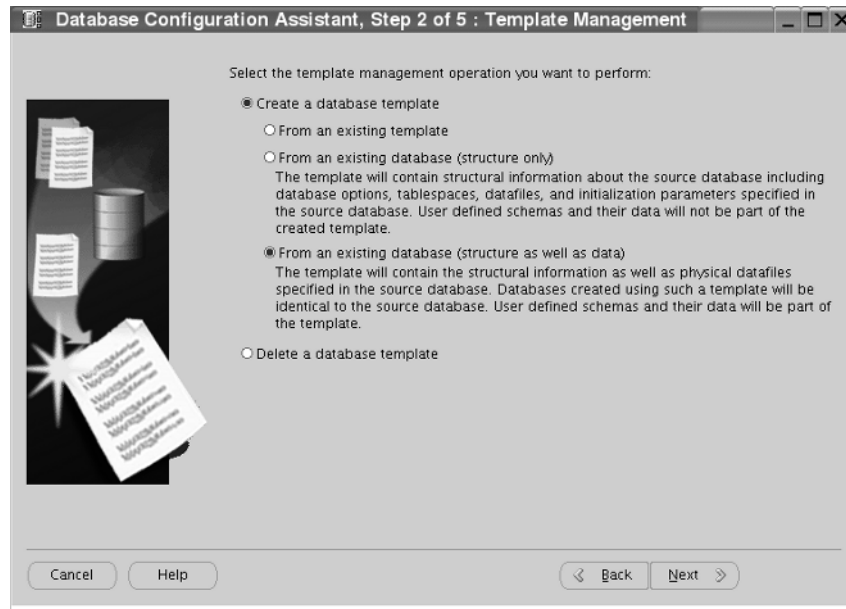


You can also change many options using the DBCA utility at a later time, if you decide to do so. Choose the Configure Database option from the main screen of the DBCA.

Using the DBCA to Clone a Database

The DBCA can create a database, configure database options, delete a database, or manage templates. These are the four options you see when you start the DBCA. Managing the templates clones the database. Figure 1.9 shows the Template Management screen of the DBCA.

DBCA templates are XML files that contain information required to create a database—new databases or clones of existing databases. The information in the templates includes database options, initialization parameters, and storage attributes (for data files, tablespaces, control files, and redo logs).

FIGURE 1.9 The DBCA: Template Management screen

Cloning a database using templates saves time in database creation, because copying an already created seed database's files to the correct locations takes less time than creating them as new. Templates are stored in the `$ORACLE_HOME/assistants/dbca/templates` directory. Templates are easy to share and can be copied from one machine to another.

Two types of templates exist: seed and nonseed. *Seed templates* have the extension `.dbc` and include the data files of an existing database. When creating a database using DBCA, if you choose seed template, the database creation is faster because the physical files and schema of the database have already been created. Your database starts as a copy of the seed database, rather than having to be built. DBCA copies the data files to the location you specify and creates a control file and opens the database with `RESETLOGS` option.

A nonseed template has the extension `.dbt` and does not include data files. If you choose a nonseed template while creating the database, the database creation assistant builds a fresh database and runs all the scripts on the database. Nonseed database templates have more flexibility in customizing database creation.

For seed database templates, you can change only the following:

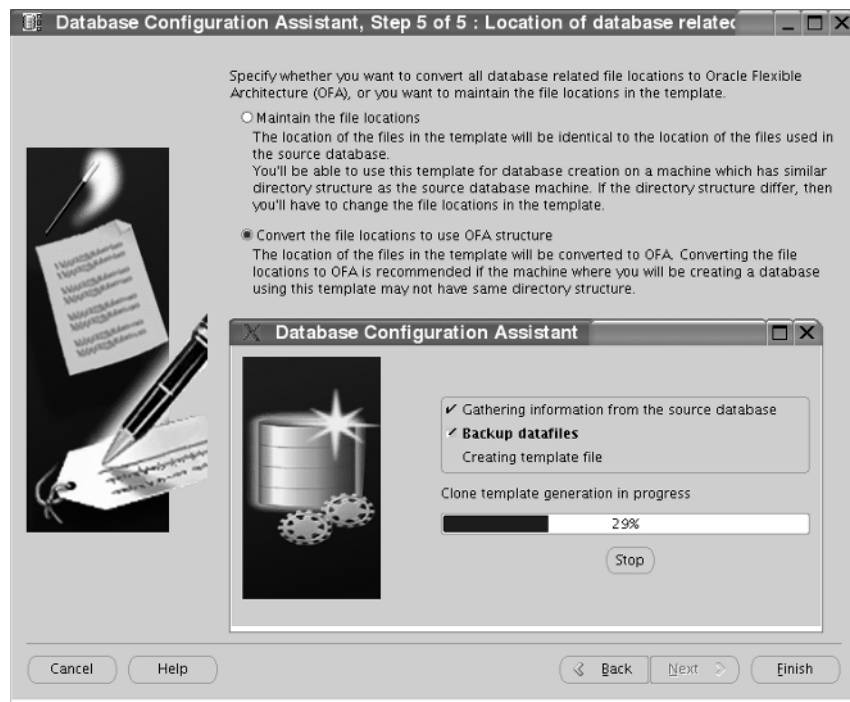
- Name of the database
- Destination of the data files
- Number of control files
- Number of redo log groups
- Initialization parameters

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Templates can be created from an existing template or an existing database. Cloning of database is performed when you create a template using the From an Existing Database (Structure As Well As Data) option, as shown in Figure 1.9.

Choose the database you want to clone. The database file locations can be maintained or the files can be converted to an OFA structure. See Figure 1.10, which shows this option. When you click Finish, the confirmation window pops up and the template creation is started.

FIGURE 1.10 Location of database related files



DBCA will shut down the database and start in the mount state to create the template. If the database is already shut down, the DBCA will start it in mount state. At mount state, the data files are copied to the XML file template. When the template creation is completed, two files will exist for seed database templates: the template with a .dbc extension and another file with a .dfb extension that contains all the database files. The template files are by default stored under the \$ORACLE_HOME/assistants/dbca/templates directory.

Copy these two files to another host or to a different Oracle home directory if you want to clone the database at a different host or location. To clone the database, start the DBCA, and choose the Create Database option. You will see that the new template you just created is listed along with other Oracle supplied templates. To summarize, the following are the steps needed in cloning a database using DBCA.

1. Start DBCA and choose Manage Templates.

2. Choose the From an Existing Database (Structure As Well As Data) option.
3. Choose the database to be cloned.
4. If the database is cloned on a different server, copy the .dbc and .dfb file to the remote server.
5. Start DBCA on the destination server and choose the Create Database option.
6. Choose the template you just copied.



Oracle supplies four templates: General Purpose, Transaction Processing, Data Warehouse, and Custom Database. Except for Custom Database, the other three are seed templates (they include data files).

Once you have created the template to clone the database, you can remove it from the templates using the Manage Template screen of the DBCA.

Simplifying Instance Configuration

In Oracle 10g, the instance parameters (also known as *initialization parameters*) are categorized into two groups: basic and advanced. You can achieve most of the database setup and simple tuning with the basic parameters. The following are the basic parameters:

CLUSTER_DATABASE	NLS_LANGUAGE
COMPATIBLE	NLS_TERRITORY
CONTROL_FILES	OPEN_CURSORS
DB_BLOCK_SIZE	PGA_AGGREGATE_TARGET
DB_CREATE_FILE_DEST	PROCESSES
DB_CREATE_ONLINE_LOG_DEST_n	REMOTE_LISTENER
DB_DOMAIN	REMOTE_LOGIN_PASSWORDFILE
DB_NAME	ROLLBACK_SEGMENTS
DB_RECOVERY_FILE_DEST	SESSIONS
DB_RECOVERY_FILE_DEST_SIZE	SGA_TARGET
DB_UNIQUE_NAME	SHARED_SERVERS
INSTANCE_NUMBER	STAR_TRANSFORMATION_ENABLED
JOB_QUEUE_PROCESSES	UNDO_MANAGEMENT
LOG_ARCHIVE_DEST_n	UNDO_TABLESPACE
LOG_ARCHIVE_DEST_STATE_n	



Oracle recommends you set up the database using these basic parameters and use the advanced parameters on an as-needed basis.

You can view/modify the initialization parameters used for the database through the EM Database Control page. A check mark in the Basic column indicates the parameter is basic. A blank in the Dynamic column indicates the parameter is static, meaning you are required to restart a database for the changes to take effect.



The COMPATIBLE parameter in Oracle 10g is irreversible; once you set it, you cannot change its value to one that is less than a previous value. To lower the value, you need to perform a point-in-time recovery of the database.

Using the Enterprise Manager

Oracle Enterprise Manager (EM) in Oracle 10g is completely revamped, includes many new features, and is very DBA friendly. Unlike the Java-based Oracle 9i EM, the HTML-based 10g EM can be accessed from any computer on the network using a web browser and can be used to manage all databases in your enterprise. EM can have two types of installations: Database Control and Grid Control.

The Oracle Management Repository stores host configurations and database configurations that are collected by the Oracle Management Agent on the hosts. The set of all host configurations and database configurations stored in a Management Repository is known as the *enterprise configuration*.

When you are using Enterprise Manager Database Control, the enterprise configuration includes the host configuration for a single host and the database configuration for the databases installed on that host. When you are using Enterprise Manager Grid Control, the enterprise configuration includes all the host configurations collected and all the database configurations collected by the Oracle management agent on each host.

Every 12 hours, the Oracle Management Agent on the host communicates the database configuration information over HTTPS to the Oracle Management Service, which loads the information to the Oracle Management Repository. The database configuration information you see on the EM is the information from the Oracle Management Repository. The database configuration information collected by the EM includes the following:

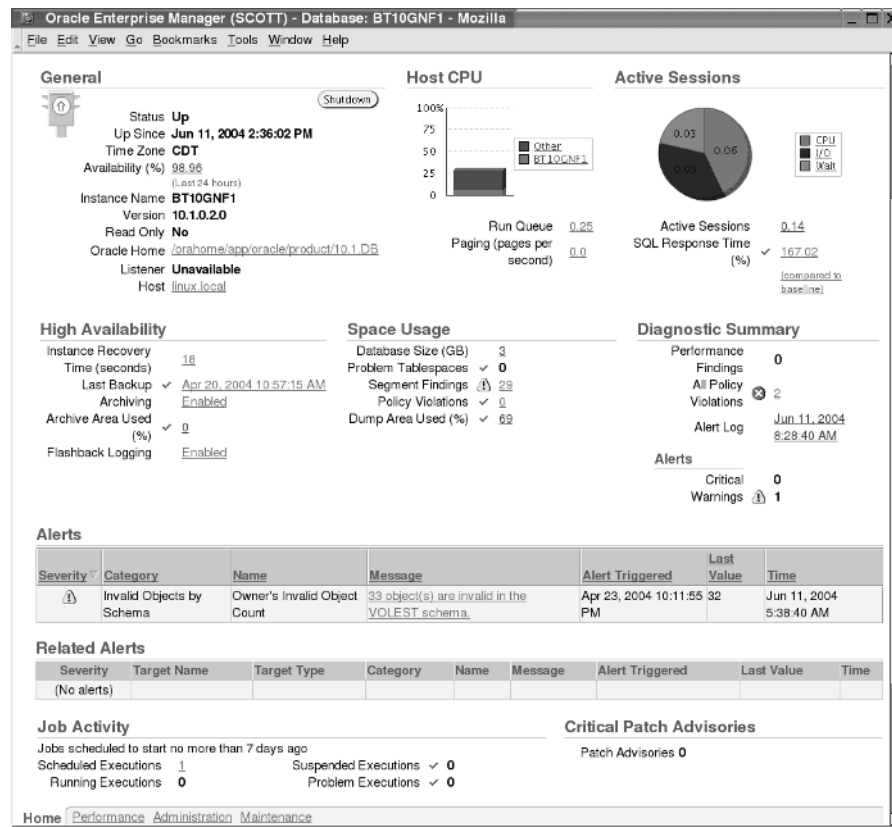
- Database and instance names
- Whether the database is running in ARCHIVELOG mode
- Initialization parameter and System Global Area values
- Information on tablespaces and rollback segments
- Attributes of data files, control files, and redo logs
- License and high-availability information

The Oracle Management Agent sends the host configuration information to the Management Repository every 24 hours. The host configuration information collected by the EM includes the following:

- Hardware information
- Operating system information, including patches
- Installed Oracle software, its patch level, and all product information
- Oracle patches installed by the OPatch utility
- Operating system-registered software

The EM Database Control is installed by default when you create a database using the DBCA utility (refer to Figure 1.3). By default, the Database control can be accessed from any web browser using port 5500 of your host. Figure 1.11 shows Enterprise Manager Database Control main page.

FIGURE 1.11 Enterprise Manager Database Control



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Many organizations have rules to manage the IT infrastructure, which translate into policies for the database administrator. In the next section, we will discuss the policies defined and monitored by EM. We will also discuss how you can use Enterprise Manager to clone Oracle home directories.

Configuring a Database Policy

Oracle 10g Enterprise Manager includes several out-of-the-box policies that are based on the best practices followed in the industry. The policies are categorized into configuration, security, and storage. The policy rules are given different priorities, such as High, Medium, and Informational. Enterprise Manager compares each host and database in the enterprise with the policy rules and identifies the policy violations for each host and database. The main page of the Database Control shows the number of policy violations for the database. When you click the Policy Violations count, all policy violations display, as shown in Figure 1.12.

FIGURE 1.12 Policy violations

Priority	Policy Rule	Category	Recommendation	Violation Count	Details	Last Evaluation	Non-Compliant Since
High	Well-known accounts	Security	Oracle recommends that you to expire and lock well-known accounts	1	Account HR(open)	Jun 10, 2004 5:38:54 AM	Apr 20, 2004 10:31:29 AM
High	Unlimited login attempts	Security	Oracle recommends changing the parameter FAILED_LOGIN_ATTEMPTS in user profiles to no more than 10	1	Account DBSNMP	Jun 10, 2004 5:38:54 AM	Apr 20, 2004 10:31:29 AM

Related Links

[Manage Policy Library](#)
[Manage Policy Violations](#)

Click the Manage Policy Library link, and you will see all the policies defined for the enterprise. On this page, you can view the priority, category, and description of each policy rule. The Target Type column tells you which infrastructure component the policy is evaluated against; examples are Host, Database, Listener, HTTP Server, and so on. You can disable certain policies if they are not applicable to you or if the policy violation is to be ignored. The Disabled By

column shows the user who disabled the policy rule. Figure 1.13 shows the Manage Policy Library screen.

FIGURE 1.13 Manage Policy Library



Priority	Policy Rule	Category	Target Type	Description	Disable	Disabled By
✖	Critical Patch Advisories for Oracle Homes	Configuration	Host	Checks Oracle Homes for missing critical patches	<input type="checkbox"/>	
✖	EXECUTE UTL_FILE privileges to PUBLIC	Security	Database	Test for PUBLIC having EXECUTE privilege on the UTL_FILE package	<input type="checkbox"/>	
✖	HTTP Server Access Logging	Security	HTTP Server	Check that HTTP Server access logging is enabled	<input type="checkbox"/>	
✖	HTTP Server Directory Indexing	Security	HTTP Server	Check that Directory Indexing is disabled on this HTTP Server	<input type="checkbox"/>	
✖	HTTP Server Dummy wallet	Security	HTTP Server	Check that dummy wallet is not used for production SSL load.	<input type="checkbox"/>	
✖	HTTP Server Owner and setuid bit	Security	HTTP Server	Check the httpd binary is not owned by root and setuid bit is not set.	<input type="checkbox"/>	
✖	Insufficient Number of Control Files	Configuration	Database	Checks for use of a single control file	<input type="checkbox"/>	
✖	Insufficient Redo Log Size	Storage	Database	Checks for redo log files less than 1 Mb	<input type="checkbox"/>	
✖	Listener direct administration	Security	Listener	Ensure that listeners cannot be administered directly	<input type="checkbox"/>	
✖	Listener password	Security	Listener	Test for password-protected listeners	<input type="checkbox"/>	
✖	Open ports	Security	Host	Check for open ports	<input type="checkbox"/>	
✖	Remote OS authentication	Security	Database	Check for insecure authentication of remote users (remote OS authentication)	<input type="checkbox"/>	
✖	Remote OS role	Security	Database	Check for insecure authentication of remote users (remote OS role)	<input type="checkbox"/>	
✖	Web Cache Access Logging	Security	Web Cache	Check that Web Cache access logging is enabled	<input type="checkbox"/>	
✖	Web Cache Dummy wallet	Security	Web Cache	Check that dummy wallet is not used for production SSL load.	<input type="checkbox"/>	
✖	Web Cache owner and setuid bit	Security	Web Cache	Check that webcached binary is not owned by root and setuid is not set	<input type="checkbox"/>	
⚠	DBSNMP privileges	Security	Database	Check that DBSNMP account has sufficient	<input type="checkbox"/>	



When you disable a particular rule, you also delete any violations from the Management Repository that were previously detected for the rule.

Enterprise Manager considers Oracle-critical patches that are not applied to appropriate Oracle software installations (ORACLE_HOME) as policy violations. From the main page of the Database Control, you can see if any such critical patches are to be applied. Enterprise Manager logs into Oracle's support site (Metalink) with the credentials provided by you to check for the critical patch availability. By default this patch search job is set to run once daily.



The jobs Enterprise Manager uses to verify the policy violations and to check for critical patches are maintained by the job system inside Enterprise Manager. You can create, edit, and manage jobs by clicking the Jobs link on the Database Control main page. For more information about Enterprise Manager jobs, click the Help link found on the top-right corner of the page.

Cloning the Oracle Home and Database

You can use the EM to clone Oracle software installations on the same server or different servers. This ensures that all patches and settings in the source and destination are the same. Cloning is faster than installing new software and applying the patches; also it is less error prone.

EM cloning uses the Enterprise Manager job system, which allows you to clone an Oracle home directory to multiple hosts and multiple Oracle home directories in a single cloning job. Enterprise Manager clones only the Oracle home directories that are clonable. An Oracle home directory is clonable when it was installed from an OUI that has built-in cloning support (for example, the Oracle 10g OUI).

From the Database Control main page, navigate to the Maintenance tab. Under Deployments, click the Clone Oracle Home link. Choose the Oracle home directory that you need to clone. In the six steps to set up a cloning job, you specify the source, destination, and when to clone.

Enterprise Manager can also clone a database. The Clone Database link is available under the Deployments. The Clone Database tool clones a database instance to an existing Oracle home directory. If you want to create a new Oracle home directory to clone the instance to, use the Clone Oracle Home tool to create a new Oracle home directory and then use the Clone Database tool to clone the instance to that home directory.

Figure 1.14 shows the Review screen of the Clone Database operation. You must follow five steps to set up the clone job. In step 3, you can specify destination file locations. The clone job can be executed immediately or can be set for a future time.

Cloning a database has several advantages. It saves time compared to creating a new database and populating it. The database can be cloned while it is up; the clone tool uses the RMAN to perform the cloning and then applies the archive logs to make it consistent. Note that DBCA cloning does not use RMAN, it copies the template and data files to XML files. EM Clone Database uses RMAN and performs the following operations:

- Backs up each database file and stores it in a working directory
- Transfers each backup file from source to the destination host
- Restores each backup file to the existing destination Oracle home directory
- Recovers the cloned database with saved archived logs
- Opens the cloned database with RESETLOGS



If the source database is in ARCHIVELOG mode, the source database is kept up and running while the cloning operation is performed.

FIGURE 1.14 Clone Database: Review

Oracle Enterprise Manager 10g
Database Control

Source Working Directory Select Destination Destination Options Schedule **Review**

Clone Database: Review

The database **BT10GNF1** on host **linux.local** will be cloned to database **BT10GNF2_linux.local** on host **linux.local** in Oracle Home **/orahome/app/oracle/product/10.1.DB**. Cancel Back Step 5 of 5 Submit Job

Job Name **DBCclone_BT10GNF1_93**
Scheduled **Jun 12, 2004 11:30 AM**

Details

Source Database		Destination Database	
Global Database Name	BT10GNF1	Global Database Name	BT10GNF2
Instance Name	BT10GNF1	Instance Name	BT10GNF2
Database Version	10.1.0.2.0	Oracle Server Version	10.1.0.2.0
Oracle Home	/orahome/app/oracle/product/10.1.DB	Oracle Base	/orahome/app/oracle
Host	linux.local	Oracle Home	/orahome/app/oracle/product/10.1.DB
Operating System	oracle	Host	linux.local
Host Username	oracle	Operating System	oracle
Working Directory Location	/orahome/app/oracle/product/10.1.DB/dbs	Host Username	oracle
Database Username	SCOTT	Working Directory Location	/orahome/app/oracle/product/10.1.DB/dbs
Target Database Name	BT10GNF1	Share Source Working Directory	Yes
Retain Working Directory	No	Configuration File Location	/orahome/app/oracle/product/10.1.DB/network/admin
Archiving Mode	ARCHIVELOG	Database Username	SCOTT

▼ Destination Database File Locations

Name	Status	Size (KB)
/orahome/app/oracle/oradata/BT10GNF2/system01.dbf	SYSTEM	481280
/orahome/app/oracle/oradata/BT10GNF2/undotbs01.dbf	ONLINE	92160
/orahome/app/oracle/oradata/BT10GNF2/sysaux01.dbf	ONLINE	337920
/orahome/app/oracle/oradata/BT10GNF2/users01.dbf	ONLINE	5120
/orahome/app/oracle/oradata/BT10GNF2/example01.dbf	ONLINE	153600
/orahome/app/oracle/oradata/BT10GNF2/appdata1.dbf	ONLINE	102400
/orahome/app/oracle/oradata/BT10GNF2/ves_data01.dbf	ONLINE	972800
/orahome/app/oracle/oradata/BT10GNF2/ves_index01.dbf	ONLINE	921600

Control Files

Viewing Database Usage

Oracle 10g keeps track of how the database is being used. The information is collected by the MMON process and is recorded in the Automatic Workload Repository (AWR). AWR is a new feature of Oracle 10g database and is discussed in Chapter 3, “Automating Management.” AWR collects the following two types of database usage metrics:

- Database feature usage
- High watermark (HWM) of database attributes

Introducing Database Feature Usage

Database Feature usage of EM shows the usage statistics of various database features such as audit options, data mining, flashback database, MTTR advisor, and so on. You can determine what feature of the database is used how often. You can query the usage information using the `DBA_FEATURE_USAGE_STATISTICS` view. The `NAME` column identifies the feature, and the `DESCRIPTION` column provides a description on what/how the feature is monitored.

Here is a sample query from the `DBA_FEATURE_USAGE_STATISTICS` view:

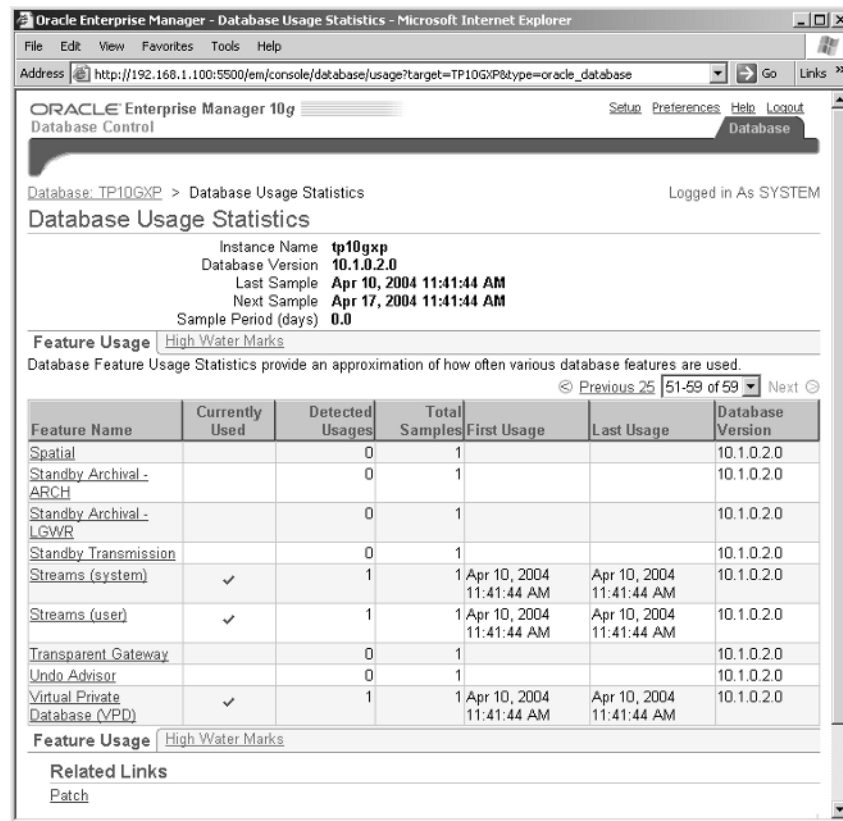
```
SQL> SELECT name, detected_usages DU, last_usage_date
       2 FROM dba_feature_usage_statistics
       3 WHERE currently_used = 'TRUE'
SQL> /
```

NAME	DU	LAST_USAG
Automatic Segment Space Management (system)	7	06-JUN-04
Automatic Segment Space Management (user)	7	06-JUN-04
Automatic SQL Execution Memory	7	06-JUN-04
Automatic Undo Management	7	06-JUN-04
Locally Managed Tablespaces (system)	7	06-JUN-04
Locally Managed Tablespaces (user)	7	06-JUN-04
MTTR Advisor	6	06-JUN-04
Partitioning (system)	7	06-JUN-04
Protection Mode - Maximum Performance	7	06-JUN-04
Recovery Area	7	06-JUN-04
Recovery Manager (RMAN)	6	06-JUN-04
RMAN - Disk Backup	6	06-JUN-04
SQL Access Advisor	3	06-JUN-04
Streams (system)	7	06-JUN-04
Streams (user)	7	06-JUN-04
Virtual Private Database (VPD)	7	06-JUN-04

16 rows selected.

SQL>

You may use EM to get the database feature usage. From the EM Database Control page, navigate to the Administration tab, then navigate to Configuration Management, and next click Database Usage Statistics. Click the Feature Usage tab. Figure 1.15 shows the EM screen on the Database Usage Statistics.

FIGURE 1.15 The Database Usage Statistics screen

Introducing the HWM of Database Attributes

The Oracle 10g database keeps the usage statistics of various database attributes at its highest usage point. Information includes the size of the largest segment, the number of tables, the number of indexes, the maximum number of partitions per table/index, and the maximum concurrent sessions. You can query the information using the `DBA_HIGH_WATER_MARK_STATISTICS` view. The `NAME` column shows the name of the statistic, and the `DESCRIPTION` column provides a short explanation.



If the high-water statistics and database feature usage statistics are not populated, you can perform `execute dbms_stats.gather_database_stats` to collect the statistics.

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Here is a sample query from the DBA_HIGH_WATER_MARK_STATISTICS view:

```
SQL> SELECT name, highwater, last_value  
2 FROM dba_high_water_mark_statistics;
```

NAME	HIGHWATER	LAST_VALUE
-----	-----	-----
USER_TABLES	764	764
SEGMENT_SIZE	158334976	158334976
PART_TABLES	0	0
PART_INDEXES	0	0
USER_INDEXES	1400	1400
SESSIONS	3	3
DB_SIZE	1553203200	1553203200
DATAFILES	10	10
TABLESPACES	11	11
CPU_COUNT	1	1
QUERY_LENGTH	87	87
SERVICES	4	4

You may use the EM to get the high-watermark information. In the Database Usage Statistics page, click the High Water Marks link.

Upgrading the Database

You can upgrade your database from one release to a higher release to use the new features and to be in a supported database version. Oracle typically announces the “de-support” date for a database version several months ahead so that you can plan and test the database migration.

Follow the database upgrade process when you’re ready to transform your pre-Oracle 10g database to Oracle 10g. Before upgrading the production database, make sure you upgrade the test database and thoroughly check all the application features.

Oracle 10g has several upgrade options.

- Direct upgrade to Oracle 10g using *Database Upgrade Utility (DBUA)*. The DBUA is a GUI tool to upgrade an existing database to Oracle 10g. Using the DBUA is Oracle’s preferred method.
- Direct upgrade to Oracle 10g by running scripts (this is a manual upgrade).
- Export/import utilities to copy data to a new Oracle 10g database.
- Copy data to a new Oracle 10g database using SQL tools.

Upgrading a database to Oracle 10g typically involves these tasks:

- Identify the supported upgrade options for the database.
- Decide on the method to be used to upgrade the database.
- Verify if the database is ready for direct upgrade.
- Upgrade the database.

In the following sections, we will discuss the supported releases for direct upgrade to Oracle 10g, the preupgrade checks provided by Oracle for a smooth trouble-free upgrade, and how to upgrade an Oracle database to Oracle 10g using the DBUA (GUI and command line) and using scripts.



Before upgrading the database to Oracle 10g, check with the application vendor to verify that the application is certified on Oracle 10g database and/or if the vendor has an upgraded application that works with Oracle 10g.

Introducing Upgrade-Supported Releases

Oracle 10g supports the direct upgrade of database from the following releases:

- Oracle 8 Release 8.0.6
- Oracle 8i Release 8.1.7
- Oracle 9i Release 1 – 9.0.1
- Oracle 9i Release 2 – 9.2.0

For all other database releases, you must upgrade the database to an upgrade-supported release using the methods suggested in that release before using the direct upgrade method. You have some restrictions, though. To upgrade any database prior to release 8.0.6, you must upgrade the database to 8.0.6 first and then use the DBUA utility (or manual upgrade) to upgrade to Oracle 10g. To upgrade an 8.1.5 or 8.1.6 database to Oracle 10g, you must first upgrade the database to Oracle 8i 8.1.7. To upgrade a 7.3.4 database, first upgrade to 9.2.0 and then to Oracle 10g.

The upgrade path you choose and the steps involved depend on the release of the database you are upgrading. For smaller databases in non-upgrade-supported releases (older than 8.0.6, or 8.1.5, or 8.1.6), it may be faster to perform an export/import rather than going through two upgrade processes.

Upgrading a database using the export/import method has the following advantages and disadvantages:

- How long the upgrade process takes depends on the size of the database.
- A new database for Oracle 10g needs to be created, which makes the current database a backup archive. Therefore, you need to double the amount of disk space required.
- The import process can defragment data that would improve performance. It also gives you an opportunity to create tablespaces using the new features of Oracle 10g database.



When installing Oracle 10g software, the OUI provides an option to invoke the DBUA if it finds any existing Oracle database in `/var/opt/oracle/oratab`, in `/etc/oratab`, or in the Windows Registry. The DBUA also can be invoked as a stand-alone tool.



After upgrading a database, its Oracle home directory changes to the new Oracle 10g home directory. DBUA automatically updates the `oratab` file with the right Oracle home directory. You must use the new Oracle home directory to start and stop the database.

Validating the Database Before Upgrade

Oracle 10g provides a utility script—`utlu101i.sql`—to perform preupgrade validation on the database to be upgraded. The DBUA automatically runs this tool (and takes corrective action) as part of the upgrade process. You can find the SQL script in the administration scripts directory (`$ORACLE_HOME/rdbms/admin`).

The `utlu101i.sql` script needs to be run as SYSDBA before you plan on performing a manual upgrade. It is preferred to copy this script to a temporary folder and run it after spooling the output to a file. You must run this script on the database to be upgraded. The script performs the following tasks:

- Checks database compatibility (the `COMPATIBLE` parameter must be set to 9.2.0 before upgrade)
- Verifies the redo log file size is at least 4MB
- Estimates time for upgrade
- Looks for obsolete, renamed, and special parameters
- Applies new values for certain upgrade parameters
- Finds all the components installed
- Finds the default tablespace for each database component schema
- Finds tablespace size estimates
- If the SYSAUX tablespace already exists, warns the user the properties may not be right and displays the required properties of the SYSAUX tablespace SYSAUX tablespace is covered in depth in Chapter 4.
- Checks the installed database options
- Checks the database character set and national character set are supported in Oracle 10g.

If the database version is not one that supports a direct upgrade, an error displays and the script terminates.

The following output shows the result of executing the `utlu101i.sql` script on an Oracle 9i Release 2 database under Linux; the installation home for ora0109 database is `/orahome/app/oracle/product/9.2.0:`

```
linux:oracle>pwd
/home/oracle/temp
linux:oracle>echo $ORACLE_HOME
/orahome/app/oracle/product/9.2.0
linux:oracle>echo $ORACLE_SID
ora0109
linux:oracle>sqlplus '/ as sysdba'
```

```
SQL*Plus: Release 9.2.0.1.0 - Production on Fri Mar 19Copyright (c) 1982, 2002,
Oracle Corporation.
```

```
All rights reserved.
```

```
Connected to:
```

```
Oracle9i Enterprise Edition Release 9.2.0.1.0 - Production
```

```
With the Partitioning and Oracle Data Mining options
```

```
JServer Release 9.2.0.1.0 - Production
```

```
sys@ORA0109> spool ora0109upgcheck.lst
```

```
sys@ORA0109> @utlu101i.sql
```

```
Oracle Database 10.1 Upgrade Information Tool.
```

```
*****
```

```
Database:
```

```
-----
```

```
--> name: ORA0109
```

```
--> version: 9.2.0.1.0
```

```
--> compatibility: 9.2.0.0.0
```

```
.
```

```
*****
```

```
Logfiles: [make adjustments in the current environment]
```

```
-----
```

```
-- The existing log files are adequate.
```

```
    No changes are required.
```

```
.
```

```
*****
```

```
Tablespaces: [make adjustments in the current environment]
```

```
-----
```

```
--> SYSTEM tablespace is adequate for the upgrade.
```

```
.... owner: SYS
```

```
.... minimum required size: 501 MB
```

```
--> DRSYS tablespace is adequate for the upgrade.
```

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```
.... owner: CTXSYS
.... minimum required size: 10 MB
--> ODM tablespace is adequate for the upgrade.
.... owner: ODM
.... minimum required size: 9 MB
--> XDB tablespace is adequate for the upgrade.
.... owner: XDB
.... minimum required size: 48 MB
.
*****Options: [present in
existing database]
-----
--> Partitioning
--> Spatial
--> Oracle Data Mining
WARNING: Listed option(s) must be installed with
        Oracle Database 10.1
.
*****Update Parameters:
[Update Oracle Database 10.1 init.ora or spfile]
-----WARNING: --> "shared_
pool_size" needs to be increased to
        at least "150944944"
WARNING: --> "pga_aggregate_target" needs to be increased
        to at least "25165824"
--> "large_pool_size" is already at "16777216" calculated
        new value is "16777216"
--> "java_pool_size" is already at "83886080" calculated
        new value is "83886080"
.
*****Deprecated Parameters:
[Update Oracle Database 10.1 init.ora or spfile]
----- No deprecated
parameters found. No changes required.
.
*****Obsolete Parameters:
[Update Oracle Database 10.1 init.ora or spfile]
-----> "hash_join_enabled"
.
*****Components: [The
following database components will be
upgraded or installed]
```

-----> Oracle Catalog

Views [upgrade] VALID
--> Oracle Packages and Types [upgrade] VALID
--> JServer JAVA Virtual Machine [upgrade] VALID
...The 'JServer JAVA Virtual Machine' JAccelerator(NCOMP)
...is required to be installed from the 10g Companion CD.

...
--> Oracle XDK for Java [upgrade] VALID
--> Oracle Java Packages [upgrade] VALID
--> Oracle XML Database [upgrade] VALID
--> Oracle Workspace Manager [upgrade] VALID
--> Oracle Data Mining [upgrade]
--> Oracle interMedia [upgrade]
...The 'Oracle interMedia Image Accelerator' is
...required to be installed from the 10g Companion CD.

...
--> Spatial [upgrade]
--> Oracle Text [upgrade] VALID
--> Oracle Ultra Search [upgrade] VALID
--> Oracle Label Security [upgrade] VALID
.

*****SYSAUX Tablespace:

[Create tablespace in Oracle
Database 10.1 environment]

-----> New "SYSAUX"
tablespace

.... minimum required size for database upgrade: 500 MB
Please create the new SYSAUX Tablespace AFTER the Oracle
Database 10.1 server is started and BEFORE you invoke
the upgrade script.

*****Oracle Database 10g:
Changes in Default Behavior

This page describes some of the changes in the behavior
of Oracle Database 10g from that of previous releases.
In some cases the default values of some parameters have
changed. In other cases new behaviors/requirements have
been introduced that may affect current scripts or
applications. More detailed information is in the
documentation.

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SQL OPTIMIZER

The Cost Based Optimizer (CBO) is now enabled by default.

- * Rule-based optimization is not supported in 10g (setting `OPTIMIZER_MODE` to `RULE` or `CHOOSE` is not supported). See Chapter 12, "Introduction to the Optimizer," in Oracle Database Performance Tuning Guide.

- * Collection of optimizer statistics is now performed by default, automatically for all schemas (including `SYS`), for pre-existing databases upgraded to 10g, and for newly created 10g databases.

Gathering optimizer statistics on stale objects is scheduled by default to occur daily during the maintenance window. See Chapter 15, "Managing Optimizer Statistics" in Oracle Performance Tuning Guide.

- * See the Oracle Database Upgrade Guide for changes in behavior for the `COMPUTE STATISTICS` clause of `CREATE INDEX`, and for behavior changes in `SKIP_UNUSABLE_INDEXES`.

UPGRADE/DOWNGRADE

- * After upgrading to 10g, the minimum supported release to downgrade to is Oracle 9i R2 release 9.2.0.3 (or later) and the minimum value for `COMPATIBLE` is 9.2.0. The only supported downgrade path is for those users who have kept `COMPATIBLE=9.2.0` and have an installed 9i R2 (release 9.2.0.3 or later) executable. Users upgrading to 10g from prior releases (such as Oracle 8, Oracle 8i or 9iR1) cannot downgrade to 9i R2 unless they first install 9i R2. When upgrading to 10g, by default the database will remain at 9i R2 file format compatibility, so the on disk structures that 10g writes are compatible with 9i R2 structures; this makes it possible to downgrade to 9i R2. Once file format compatibility has been explicitly advanced to 10g (using `COMPATIBLE=10.x.x`), it is no longer possible to downgrade.

See the Oracle Database Upgrade Guide.

- * A `SYSAUX` tablespace is created upon upgrade to 10g. The `SYSAUX` tablespace serves as an auxiliary tablespace to the `SYSTEM` tablespace. Because it is the default

tablespace for many Oracle features and products that previously required their own tablespaces, it reduces the number of tablespaces required by Oracle that you, as a DBA, must maintain.

MANAGEABILITY

* Database performance statistics are now collected by the Automatic Workload Repository (AWR) database component, automatically upon upgrade to 10g and also for newly created 10g databases. This data is stored in the SYSAUX tablespace, and is used by the database for automatic generation of performance recommendations. See Chapter 5, "Automatic Performance Statistics" in the Oracle Database Performance Tuning Guide.

* If you currently use Statspack for performance data gathering, see section 1. of the Statspack readme (spdoc.txt in the RDBMS ADMIN directory) for directions on using Statspack in 10g to avoid conflict with the AWR.

MEMORY

* Automatic PGA Memory Management is now enabled by default (unless PGA_AGGREGATE_TARGET is explicitly set to 0 or WORKAREA_SIZE_POLICY is explicitly set to MANUAL). PGA_AGGREGATE_TARGET is defaulted to 20% of the SGA size, Unless explicitly set. Oracle recommends tuning the value of PGA_AGGREGATE_TARGET after upgrading. See Chapter 14 of the Oracle Database Performance Tuning Guide.

* Previously, the number of SQL cursors cached by PL/SQL was determined by OPEN_CURSORS. In 10g, the number of cursors cached is determined by SESSION_CACHED_CURSORS. See the Oracle Database Reference manual.

* SHARED_POOL_SIZE must increase to include the space needed for shared pool overhead.

* The default value of DB_BLOCK_SIZE is operating system specific, but is typically 8KB (was typically 2KB in previous releases).

TRANSACTION/SPACE

* Dropped objects are now moved to the recycle bin, where

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the space is only reused when it is needed. This allows 'undropping' a table using the FLASHBACK DROP feature. See Chapter 14 of the Oracle Database Administrator's Guide.

* Auto tuning undo retention is on by default. For more information, see Chapter 10, "Managing the Undo Tablespace," in the Oracle Database Administrator's Guide.

CREATE DATABASE

* In addition to the SYSTEM tablespace, a SYSAUX tablespace is always created at database creation, and upon upgrade to 10g. The SYSAUX tablespace serves as an auxiliary tablespace to the SYSTEM tablespace. Because it is the default tablespace for many Oracle features and products that previously required their own tablespaces, it reduces the number of tablespaces required by Oracle that you, as a DBA, must maintain. See Chapter 2, "Creating a Database," in the Oracle Database Administrator's Guide.

* In 10g, by default all new databases are created with 10g file format compatibility. This means you can immediately use all the 10g features. Once a database uses 10g compatible file formats, it is not possible to downgrade this database to prior releases. Minimum and default logfile sizes are larger. Minimum is now 4 MB, default is 50MB, unless you are using Oracle Managed Files (OMF) when it is 100 MB.

PL/SQL procedure successfully completed.

```
sys@ORA0109> spool off
```

We showed the result in its entirety because of the useful tips that follow the checks and warnings. Please read them. We copied the `utlu101i.sql` script from the Oracle 10g `$ORACLE_HOME/rdbms/admin` directory to the `/home/oracle/temp` directory.



Before upgrading the database, make sure you have a good backup. You have the option to back up the database while using the DBUA.

Performing the Upgrade

You can perform a direct upgrade of an Oracle database to Oracle 10g by using Oracle's GUI interface, the DBUA, or by running scripts using the command-line SQL*Plus. Oracle 10g has a simplified upgrade procedure. In the earlier releases, you were supposed to run different scripts based on the database options. In Oracle 10g, the components to be upgraded are determined automatically and are executed in the correct dependency order. Oracle 10g has one script upgrade, which upgrades all the database components.

Oracle uses the DBMS_REGISTRY package to determine the objects to be upgraded. In Oracle 10g, the database and all the components have been integrated into the `cmpdbmig.sql` script. The `cmpdbmig.sql` script determines which components are in the database by performing specific callouts to the component REGISTRY.

The versions of Oracle prior to Oracle 9i Release 2 do not have a component REGISTRY. When upgrading from the older versions of Oracle, the upgrade automatically creates and populates the component REGISTRY. You can query the components using the DBA_REGISTRY view.

The following components are identified automatically by the upgrade process and are upgraded or installed (if a required component):

- Oracle Database Catalog Views
- Oracle Database Packages and Types
- JServer Java Virtual Machine
- Oracle Database Java Packages
- Oracle XDK
- Oracle Real Application Clusters
- Oracle Workspace Manager
- Oracle interMedia
- Oracle XML Database
- OLAP Analytic Workspace
- Oracle OLAP API
- OLAP Catalog
- Oracle Text
- Spatial
- Oracle Data Mining
- Oracle Label Security
- Messaging Gateway

The next section describes the direct database upgrade performed by using the DBUA.

Using the DBUA

The DBUA will be invoked by the OUI if you choose the Upgrade Database option when first installing the Oracle 10g software. On Unix platforms, you can invoke the DBUA by using the command `dbua`. On Windows platforms, you can invoke the DBUA by choosing Start ► Program Files ► Oracle Configuration and Migration Tools ► Database Upgrade Assistant.

The upgrade process is automated by DBUA, including the preupgrade steps. The following are some of the DBUA features and their advantages:

- Proceeds with upgrade only if the selected database release is supported for direct upgrade.
- Runs the preupgrade validation and identifies the options to be upgraded. It performs the necessary adjustments.
- Checks for disk space and tablespace requirements.
- Updates obsolete initialization parameters.
- Includes an option to back up the database prior to upgrade.
- Shows upgrade progress and writes detailed traces and log files.
- Disables archiving of the database during upgrade.
- Includes an option to configure the database with the EM.
- Includes an option to recompile invalid objects after upgrade; on multiCPU systems, the recompilation happens in parallel.
- Shows summary page prior to upgrade and after the upgrade.
- Includes an HTML report of upgrade summary.
- Able to upgrade all nodes of a database in RAC.
- Supports silent mode upgrade with a single command line.

To upgrade the database with the DBUA, follow these steps:

1. Choose the database to be upgraded from the list. You can choose only one database for upgrade at one time, and the database must be running.
2. The SYSAUX tablespace will be created in the database. Specify the file location and size of this tablespace. The minimum recommended size is 500MB. You cannot change other properties of the SYSAUX tablespace.
3. Choose if you would like to recompile all the invalid objects at the end of upgrade. During the upgrade, it is common that many of the objects will become invalid. By selecting this option, the DBUA runs the `utlrp.sql` script. If there are multiple CPUs on the server, an additional screen displays to change the degree of parallelism during recompile. This can speed up the recompilation time.
4. Choose the option to back up the database. If the backup is performed by the DBUA, it writes the backup files to a directory on the server, uncompressed. The DBUA also creates

- a script to restore the database. The script is named `<dbname>BACK.BAT` on Windows and `<dbname>back.sh` on Unix.
5. Chose the option to configure the database with the EM and schedule daily backups.
 6. Specify a location and size of the flash recovery area. This screen displays only if you choose to back up the database using the EM in the previous screen.
 7. Specify passwords for the EM administrative accounts: SYSMAN and DBSNMP.
 8. The summary of the upgrade displays (see Figure 1.16). Verify all the information, especially the database name, Oracle home directories (source and target), and version. The summary page also shows the components to be upgraded, the parameter changes, and the estimated upgrade time (excluding recompiling objects). The upgrade starts as soon as you click the Finish button. No one should connect to the database until the upgrade is completed.

Figure 1.17 shows the DBUA Progress screen. You can stop the upgrade at any time, but you may have to restore the database from the backup.

FIGURE 1.16 The DBUA: Summary screen

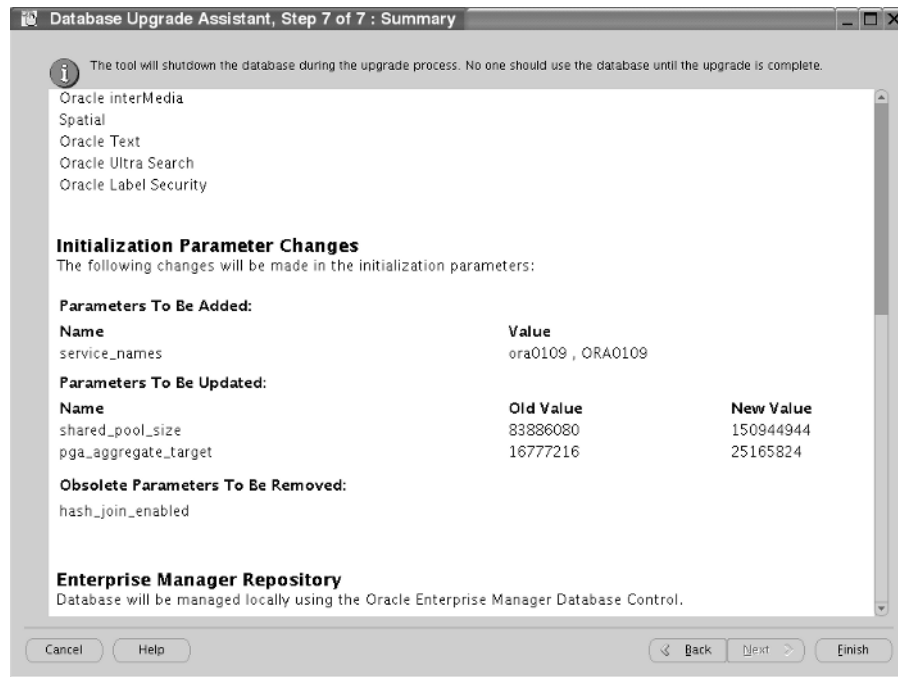


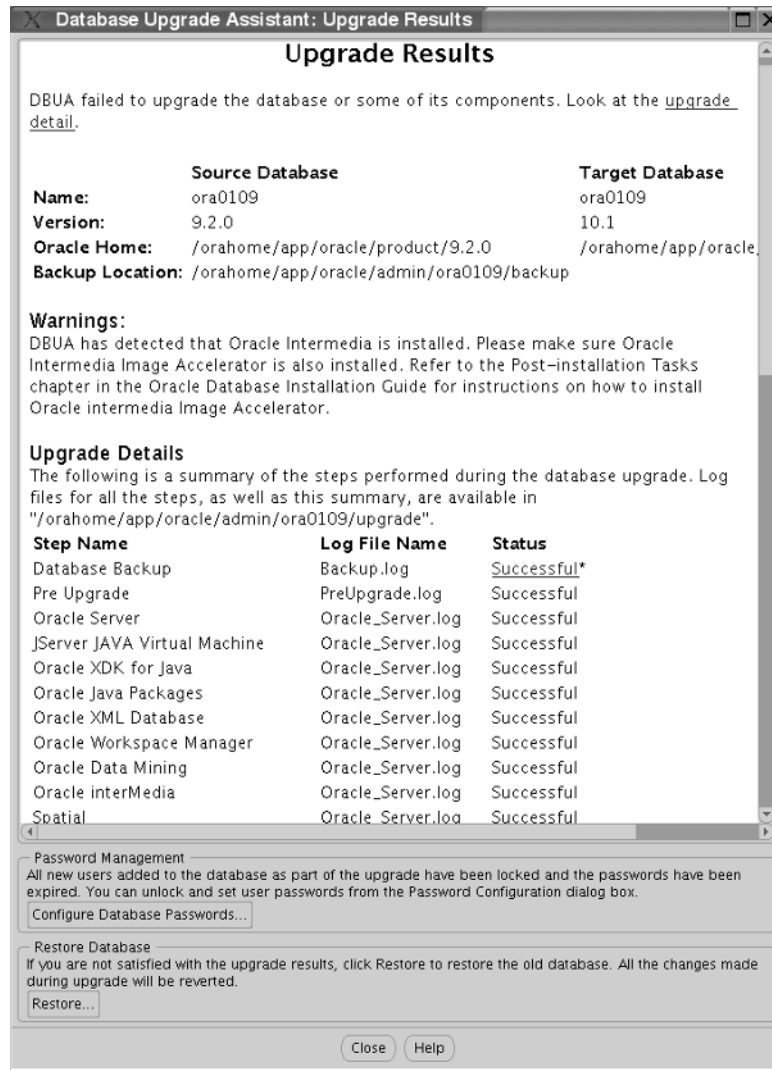
FIGURE 1.17 The DBUA: Progress screen

After the upgrade is completed, the upgrade results display on the DBUA Upgrade Results screen (see Figure 1.18). You are also given the option to change passwords and to restore the database. All the user accounts created by the upgrade process are locked for security reasons. Click the Configure Database Parameters button to assign new password and to unlock the accounts. If the DBUA is used to back up the database, restoring will put back the original database and the parameters. If you used other tools to back up the database, the DBUA restores only the original database settings (parameters) without the data files.

DBUA removes the database entry from the `listener.ora` file of the old database and adds it to the `listener.ora` file of the new database. Both listeners are reloaded automatically. If you have only the Oracle 10g listener, the Oracle home value is adjusted to reflect the upgrade.



Oracle 10g collects optimizer statistics for all the dictionary tables that lack statistics during upgrade. You can minimize the database upgrade downtime if you collect statistics on tables owned by SYS, SYSTEM, DBSNMP, and OUTLN and all other system schema using `exec dbms_stats.gather_schema_stats('<schema>', method_opt => 'FOR ALL COLUMNS SIZE AUTO', cascade => TRUE)` prior to the upgrade.

FIGURE 1.18 The DBUA: Upgrade Results screen

Using the DBUA Command Line

You can invoke the DBUA in command-line mode. You can specify several parameters with the command line dbua. The command line is invoked if you specify any parameter with the command dbua. dbua -h shows the help information.

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Table 1.1 lists the command-line dbua parameters and their purpose.

TABLE 1.1 DBUA Command-Line Parameters

Parameter	Purpose
-dbName	Name of the database to be upgraded. This is the only mandatory argument.
-silent	Performs the upgrade in silent mode.
-disableUpgradeScriptLogging	Use this parameter to disable logging during upgrading.
-backupLocation	Name of the directory where the database should be backed up before upgrading.
-postUpgradeScripts	Comma-separated names of files that need to run after the upgrade. Specify full path along with file names.
-initParam	Specify comma-separated values of parameters to start up the database for upgrade.
-emConfiguration	Specify how you want the database to be managed: database configuration or grid configuration. Use dbua -h to see the other -emConfiguration arguments such as passwords.

For example,

```
dbua -silent -dbName ORA9
```

will upgrade the ORA9 database to Oracle 10g, detailed logging information will be written to log files, the database will not be backed up by DBUA, and the database will be configured to use the Enterprise Manager locally.

Upgrading the Database Manually

You can manually upgrade the database by running scripts using the SQL*Plus utility. Though manual upgrade provides you with more control, the process is error prone, involves more work, and could take more time.

To manually upgrade the database, follow these steps:

1. Connect to the database to be upgraded and run `utlu101i.sql` to determine the preupgrade tasks to be completed.

2. Resize the redo log files if they are smaller than 4 MB.
3. Adjust the size of the tablespaces where the dictionary objects are stored.
4. Perform a cold backup of the database.
5. Shut down the database (do not perform a SHUTDOWN ABORT; perform only SHUTDOWN IMMEDIATE or SHUTDOWN NORMAL). On Windows you will have to do NET STOP, ORADIM -DELETE from the old Oracle home directory and ORADIM -NEW from the new Oracle 10g home directory.
6. Copy the parameter file (initDB.ora or spfileDB.ora) and password file from the old Oracle home directory to the Oracle 10g Oracle home directory. The default location for parameter file is \$ORACLE_HOME/dbs on Unix platforms and ORACLE_HOME\database on Windows. Adjust the following parameters:
 - Adjust the COMPATIBLE parameter; the minimum value required is 9.2.0 for the upgrade. If you set this to 10.0, you will never be able to downgrade the database to 9i.
 - Update the initialization parameters. You must remove obsolete parameters.
 - Set the DB_DOMAIN parameter properly.
 - Make sure memory parameters have at least the minimum size required for upgrade: SHARED_POOL_SIZE (96MB for 32-bit platforms, 144MB for 64-bit), PGA_AGGREGATE_TARGET (24MB), JAVA_POOL_SIZE (48MB), and LARGE_POOL_SIZE (8MB). Use the sizes recommended by the preinstall verification utility.
7. Make sure all the environment variables are set to correctly reference the Oracle 10g Oracle home. On Unix, verify ORACLE_HOME, PATH, ORA_NLS33, and LD_LIBRARY_PATH.
8. Use SQL*Plus, and connect to the database using the SYSDBA privilege. Start the instance by using the STARTUP UPGRADE mode.
9. Create the SYSAUX tablespace with the following attributes:
 - online
 - permanent
 - read write
 - extent management local
 - segment space management auto

The syntax could be as follows:

```
CREATE TABLESPACE sysaux
DATAFILE '/ora01/oradata/OR0109/sysaux.dbf' SIZE 500M
EXTENT MANAGEMENT LOCAL
SEGMENT SPACE MANAGEMENT AUTO;
```

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10. Run the upgrade script from the \$ORACLE_HOME/rdbms/admin directory. Based on the version of the old database, the name of the upgrade script varies. The following lists the old release and the upgrade script name:

Database Version	Script to Run
8.0.6	u0800060.sql
8.1.7	u0801070.sql
9.0.1	u0900010.sql
9.2.0	u0902000.sql

For example, to upgrade an Oracle 8.1.7 database to Oracle 10g, you must run u0801070.sql.

```
SQL> spool ora8i7upg.log
SQL> @?/rdbms/admin/u0801070.sql
SQL> spool off
```

If you get any errors during the upgrade script execution, reexecute the script after fixing the error. The postupgrade status utility—utlu101s.sql—gives the name of specific script to run to fix the failed component.

11. Run the utlu101s.sql utility with the TEXT option. It queries the DBA_SERVER_REGISTRY to determine upgrade status and provides information about invalid or incorrect component upgrades. It also provides names of scripts to rerun to fix the errors.

Here is an example (output truncated to fit in single line):

```
sys@ORA0109> @?/rdbms/admin/utlu101s.sql TEXT
```

PL/SQL procedure successfully completed.

```
Oracle Database 10.1 Upgrade Status Tool 19-MAR-2004
--> Oracle Database Catalog Views      Normal successful
--> Oracle Database Packages and Types Normal successful
--> JServer JAVA Virtual Machine       Normal successful
--> Oracle XDK                         Normal successful
--> Oracle Database Java Packages      Normal successful
--> Oracle XML Database               Normal successful
--> Oracle Workspace Manager          Normal successful
--> Oracle Data Mining                 Normal successful
--> Oracle interMedia                 Normal successful
--> Spatial                           Normal successful
```

```
--> Oracle Text                Normal successful
--> Oracle Ultra Search         Normal successful
--> Oracle Label Security       Problem detected
WARNING:----> required option not installed
----> component not upgraded
```

PL/SQL procedure successfully completed.

sys@ORA0109>

12. Shut down and restart the instance to reinitialize the system parameters for normal operation. The restart also performs Oracle 10g database initialization for JServer Java Virtual Machine and other components. Perform a clean shutdown (SHUTDOWN IMMEDIATE); starting the instance flushes all caches, clears buffers, and performs other housekeeping activities. This is an important step to ensure the integrity and consistency of the upgraded database.
13. Run the `utlrp.sql` script to recompile all invalid objects.
14. Update the `listener.ora` file with the new database information.
15. Back up the database.



On Unix environments, to connect to the database as SYSDBA, the single quotes are no longer required in Oracle 10g. In the prior releases you had to specify `sqlplus '/ as sysdba'` whereas in Oracle 10g `sqlplus / as sysdba` will work.

Using the **STARTUP UPGRADE** Option

To upgrade the database to Oracle 10g, you must start the instance with the **STARTUP UPGRADE** option (introduced in Oracle 9i Release 2). If you try to start the database in any other mode, you will get an error. This mode automatically handles certain system parameter values for the upgrade. Also, this option suppresses the ORA-00942 error for the DROP TABLE statements in the upgrade script. So when reviewing for errors, you will see only genuine errors in the log file. For successful upgrade, you should not see any ORA- or PLS- errors in the log file. Here is an example of logging into the database using SQL*Plus with the SYSDBA privilege and starting up using the **STARTUP UPGRADE** method:

```
linux:oracle>sqlplus / as sysdba
SQL*Plus: Release 10.1.0.2.0 - Production on Fri Jun 11 Copyright (c) 1982,
2004, Oracle. All rights reserved.
Connected to an idle instance.
```

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```
SQL> startup upgrade
ORACLE instance started.
```

```
Total System Global Area 197132288 bytes
Fixed Size                  778076 bytes
Variable Size              162537636 bytes
Database Buffers           33554432 bytes
Redo Buffers                262144 bytes
Database mounted.
Database opened.
SQL>
```

Downgrading Your Database

Sometimes it may be necessary to downgrade a database to its previous release because of issues with an application in the new database. Though the safe method is to restore from the backup taken prior to the upgrade, Oracle provides an option to downgrade the database to Oracle *9i* Release 2. After upgrading the database to Oracle 10g release 1, the only supported downgrade option is downgrading to Oracle *9i* Release 2. If you have set the `COMPATIBLE` parameter to 10.0 or higher, you will not be able to downgrade the database.

To downgrade the database, follow these steps:

1. Run `d0902000.sql` script from the Oracle 10g Oracle home directory after starting the instance using the `STARTUP DOWNGRADE` option.
2. Shut down the database, and start it from the Oracle *9i* Release 2 home directory after adjusting the system parameters.
3. Connect to the database as `SYSDBA`, and start using the `STARTUP MIGRATE` option. Run `catrelod.sql` to reinstall the Oracle *9i* Release 2 dictionary objects.
4. Perform a `SHUTDOWN IMMEDIATE`, and start the database in normal mode.



Real World Scenario

Upgrading Oracle *8i* Database to Oracle 10g

We have an Oracle 8.1.7 database that is couple of terabytes big. Since the database is still in 8.1.7 and its support ends by the end of 2004, we have to upgrade the database to a higher release. We chose to upgrade to 10g, skipping *9i* to avoid another major upgrade and the time spent on testing. Since the application is homegrown, we have to perform thorough testing.

The only practical upgrade option for this database to upgrade to Oracle 10g is to use the direct method. The other option—export/import—would require several days and is prone to errors when dealing with a database of this size.

Since we have decided on the upgrade path, the first step is to run the `ut1u101i.sql` script to see what items should be fixed in the database for a successful upgrade. The following is the advice from the preupgrade check utility where changes need to be made:

```
Database:
-----
--> name: DBNAME
--> version: 8.1.7.4.0
--> compatibility: 8.1.7
WARNING: Database compatibility must be set to 9.2.0 prior to
       upgrade.
.
*****
Options: [present in existing database]
-----
--> Partitioning
WARNING: Listed option(s) must be installed with Oracle
       Database 10.1
.
*****
Update Parameters: [Update Oracle Database 10.1 init.ora or
       spfile]
-----WARNING: -->
"shared_pool_size" needs to be increased to at
       least "440688496"
WARNING: --> "pga_aggregate_target" is not currently defined
       and needs a value of at least "25165824"
--> "large_pool_size" is already at "104857600" calculated
       new value is "104857600"
WARNING: --> "java_pool_size" needs to be increased to at
       least "50331648"
*****
Obsolete Parameters: [Update Oracle Database 10.1 init.ora or
       spfile]
----->
"db_block_lru_latches"
--> "max_rollback_segments"
--> "job_queue_interval"
--> "optimizer_max_permutations"
--> "fast_start_io_target"
--> "max_enabled_roles"
```

```

--> "log_archive_start"
.
*****Components: [The fol-
lowing database components will be
upgraded or installed]
-----> Oracle Catalog
Views          [upgrade]
--> Oracle Packages and Types    [upgrade]
--> JServer JAVA Virtual Machine [upgrade]
...The 'JServer JAVA Virtual Machine' JAccelerator (NCOMP)
...is required to be installed from the 10g Companion CD.
...
--> Oracle XDK for Java          [upgrade]
--> Oracle Java Packages        [install]
.
*****

```

The first warning is the compatibility, which we can fix only during the upgrade. In fact, we let the DBUA fix all the parameter changes required in the upgraded Oracle 10g database. Since the tablespace sizes are adequate, the item we need to be working on is to install the JServer Java Virtual Machine from the companion CD.

We performed a backup and initiated the DBUA utility to upgrade the database after installing the JServer JVM component. This upgrade was tested successfully in the test database. Now the developers and users are testing the application. Our testing typically takes three months, so we hope we will be upgrading the production database to Oracle 10g soon.

Summary

The Oracle Universal Installer (OUI) is enhanced to include the entire new Oracle 10g database feature install. You perform the installation of the Oracle database software and the most common components from one CD. The companion CD includes HTTP Server and HTML DB along with other database products. The Oracle client is shipped in a separate CD.

For creating preconfigured database during software install, the OUI invokes the DBCA in a noninteractive mode. For custom databases, the DBCA is invoked interactively. The OUI and the DBCA include several options to capture user input for all the new features of the Oracle 10g database. You can also configure the database management using the Database Control (local) or Grid Control (centralized management).

The OUI and the DBCA have screens to capture the installation options for the new Oracle 10g features. The database data files can be using file system, raw devices, or ASM storage. Also, you can set up database management locally or using central management.

You can use the DBCA to clone a database. You do this by creating a template with structure and data. Enterprise Manager has several new features and has a new look in Oracle 10g. EM comes with several out-of-the-box policy rules for monitoring the enterprise. You can see the policy violations from the Database Control main page.

Oracle 10g keeps track of the database feature usage and database high-watermark usage. You can query the information from the data dictionary or using EM. The COMPATIBLE database parameter is irreversible in Oracle 10g; it cannot be set to a value less than a previous value. The minimum value is 9.2.0.

Upgrading a database to Oracle 10g is simplified by using the DBUA. DBUA does the pre-install tasks, backs up the database, adjusts parameters, upgrades the database, does the postupgrade status, and recompiles all the invalid objects. Directly upgrading the database is possible from the 9.2.0, 9.0.1, 8.1.7, and 8.0.6 databases. For other releases, you must first upgrade to an intermediate release and then upgrade to Oracle 10g or use other methods of the upgrade such as export/import.

Manually upgrading the database is made simple by using the one-script upgrade method. The database identifies all the components to be upgraded and performs the upgrade. The postupgrade status utility gives the status of all the components of the database and, if any component is invalid, provides the name of the script to run to fix the component.

The SYSAUX tablespace is mandatory in all Oracle 10g databases. The DBUA creates this as part of the upgrade. If you are performing a manual upgrade, you must create this tablespace. You must start the database in the STARTUP UPGRADE mode to begin the database upgrade.

Once the database is upgraded to Oracle 10g, it can be downgraded only to Oracle 9i Release 2. If the COMPATIBLE parameter was set to 10.0 or higher, a database downgrade is not possible.

Exam Essentials

Understand the new features of Oracle 10g database supported by the Oracle Universal Installer. Be familiar with the performance enhancements and preinstallation checks.

Understand the features of the Database Configuration Assistant. Learn to install the sample schema, when and how the DBCA is invoked by the OUI, and how to invoke the DBCA in stand-alone mode.

Familiarize with the Database Control main pages Know where to get the database feature usage and high-watermark usage.

Understand the policy violations pages Know the major links and their purpose on the Database Control Administration, Maintenance and Performance pages.

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Learn which versions of Oracle can be upgraded directly to Oracle 10g, and learn the upgrade path for other versions. Oracle supports direct upgrade of the database to the Oracle 10g from 8.0.6, 8.1.7, 9.0.1, and 9.2.0 versions. For other database versions, you need to first upgrade to one of these releases before upgrading to Oracle 10g.

Remember the scripts to perform preupgrade check and postupgrade validation. Know the script to run on pre-Oracle 10g databases to check what needs be done before upgrade. Understand the results of the postupgrade utility script. Remember the script names.

Understand the advantages of using the Database Upgrade Assistant to upgrade a database rather than performing a manual upgrade. Using the DBUA automates the upgrade process. The DBUA can back up the database, perform the preupgrade checks and make changes, and upgrade the database with detailed log files.

Familiarize yourself with the steps involved in upgrading a database to Oracle 10g manually. Learn the scripts to perform the database checks (preupgrade and postupgrade), and learn the script to perform the upgrade based on the version of the database.

Understand cloning a database using DBCA Know the steps involved in cloning a database using DBCA and how to create templates.

Review Questions

1. On most platforms, to install Oracle 9i software, you needed three installation CDs. How many CDs are required for Oracle 10g installation?
 - A. 4
 - B. 3
 - C. 2
 - D. 1
2. Of the following options, which is not true when installing Oracle 10g?
 - A. The operating system must be certified.
 - B. A product key must be entered and activated.
 - C. 512MB RAM is required for each database instance with Database Control
 - D. Enough swap space available
3. Which component can be installed from the Oracle 10g database installation CD?
 - A. Legato Single Server Version
 - B. Database examples
 - C. Oracle Enterprise Manager Database Control
 - D. Oracle Database Client
4. When using the DBCA GUI tool to create a database, which feature is supported?
 - A. Databases that use ASM storage
 - B. Databases that need to be controlled using the Enterprise Manager Central Management Control
 - C. Real Application Cluster database
 - D. All of the above
5. Identify the statement that is true regarding cloning a database using DBCA.
 - A. When cloning a database, the source database must not be started.
 - B. When cloning a database, the source database must be started.
 - C. Cloning using the DBCA creates a copy of the database data files under templates and can be used for creating any number of cloned databases at any time.
 - D. When cloning a database to more than one destination, the source database must remain in the mount state until all cloning operations are completed.

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6. When upgrading a database to Oracle 10g, which of the following options are true?
 - A. Any version of Oracle 8, Oracle 8i, or Oracle 9i database can be upgraded to Oracle 10g using the DBUA.
 - B. Only the versions 8.0.6, 8.1.7, 9.0.1, and 9.2.0 can be upgraded to Oracle 10g.
 - C. Once upgraded to Oracle 10g, the database can be downgraded only to Oracle 9i 9.2.0.
 - D. The upgraded database can be downgraded to its original version by using the DBUA if no Oracle 10g-related feature is implemented in the database.
7. Which option in the database is used to monitor the database feature usage?
 - A. Automatic Workload Repository
 - B. Enterprise Manager Database Control
 - C. Database monitoring feature
 - D. The SYSAUX tablespace
8. Which is the best option to upgrade an Oracle 8i, 8.1.7 database to Oracle 10g?
 - A. Use the export utility from Oracle 8i and import utility from Oracle 10g.
 - B. Perform a direct upgrade using DBUA.
 - C. Upgrade to Oracle 9i 9.2.0 using the Oracle 9i DBUA and then upgrade the database to Oracle 10g using the Oracle 10g DBUA.
 - D. Run `u0801070.sql` script on an Oracle 8i instance and then start the instance in Oracle 10g.
9. When upgrading a database using the DBUA to Oracle 10g, which activity is not performed by the DBUA?
 - A. Perform preupgrade steps.
 - B. Create the SYSAUX tablespace.
 - C. Change the `listener.ora` file to enter new Oracle home directory information.
 - D. Back up the database after upgradDisable archiving during upgrade.
 - E. Lock new user accounts created.
 - F. Adjust initialization parameter values.
 - G. Remove deprecated initialization parameters.
 - H. Recompile invalid objects.
10. When performing a manual upgrade to Oracle 10g, in what order are the following steps performed? (Note: Some steps may be missing.)
 - 1 Run `utlu101s.sql`.
 - 2 Run `utlu101i.sql`.
 - 3 Run `utl1rp.sql`.
 - 4 Create the SYSAUX tablespace.

- 5 Start the database using the STARTUP UPGRADE option.
- A. 1, 2, 3, 4, 5.
 - B. 2, 5, 4, 1, 3.
 - C. 5, 4, 2, 1, 3.
 - D. 5, 2, 4, 1, 3.
11. When using the DBCA to create a database, which types of file storage cannot be chosen for the database?
- A. Raw device
 - B. ASM storage
 - C. File system
 - D. Oracle Managed Files (OMF)
 - E. None of the above
12. Which of the following actions are performed by the preupgrade utility `utlu101i.sql`?
- A. Resize redo log files to 4MB if they are smaller.
 - B. Create the SYSAUX tablespace.
 - C. Resize the SYSTEM tablespace.
 - D. Suggest the size for the PGA_AGGREGATE_TARGET parameter.
13. Which two options are not true with the STARTUP UPGRADE mode instance startup?
- A. Prepares the database for upgrade; no need to run any special script.
 - B. Suppresses spurious and unnecessary error messages, especially the ORA-00942.
 - C. Handles certain system startup parameters that could interfere with the upgrade.
 - D. This option is more of a documentation purpose when the database is started for upgrade; its functionality is no different from the default STARTUP option.
14. When you click the Restore button on the Upgrade Results page, which options must be true to perform a complete restore?
- A. The database upgraded from 9.2.0 to Oracle 10g.
 - B. The database must be backed up using the DBUA.
 - C. The COMPATIBLE parameter value must be 9.2.0.
 - D. You must have backed up the database prior to upgrading.
15. Which product option installed from the Oracle 10g Companion CD must be installed in an Oracle home directory with database software installation?
- A. JPublisher
 - B. HTML DB
 - C. HTTP Server
 - D. None

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- 16.** Which of the following database options must be upgraded after upgrading the database to Oracle 10g?
- A.** JServer Java Virtual Machine
 - B.** Oracle Real Application Clusters
 - C.** Oracle XML Database
 - D.** All of the above
 - E.** None of the above
- 17.** When creating a database to Oracle 10g, what is the minimum size for the redo log files?
- A.** 40KB
 - B.** 4MB
 - C.** 50MB
 - D.** 100MB
- 18.** Which component is used by Oracle to identify the options that need to be upgraded while upgrading a database to Oracle 10g?
- A.** V\$OPTION
 - B.** V\$LICENSE
 - C.** DBMS_REGISTRY
 - D.** DBMS_OPTIONS
- 19.** When you choose to create a Transaction Processing database while installing Oracle software, which of the following statements is most appropriate?
- A.** The OUI will invoke the DBCA in an interactive mode, where you enter more information about the database and data files.
 - B.** The OUI will not invoke the DBCA; the OUI collects all the information to create the database and creates the database.
 - C.** The OUI will invoke DBCA in a noninteractive mode to create the database.
 - D.** Irrespective of the type of database, the OUI always invokes DBCA in noninteractive mode.
- 20.** Before manually upgrading an Oracle 8i 8.1.7 database, which of the following would be the appropriate value of COMPATIBLE parameter? (Choose two.)
- A.** 8.1.7.
 - B.** 9.2.0.
 - C.** Any value between 8.1.7 and 10.1.0.
 - D.** Leave the COMPATIBLE parameter's default value.

Answers to Review Questions

1. D. Oracle has made several enhancements to Oracle 10g installation. Oracle 10g can be installed with just one CD. You can also install a preconfigured database or a custom database with the software install. Oracle achieved this by removing all duplicate files and having only one database template. The Oracle database examples are installed from the companion CD.
2. B. You do not need to provide or activate any product key to install the Oracle1Oracle 10g software.
3. C. The EM Database Control is installed by default for Enterprise Edition or Standard Edition; for custom install you can optionally not install this. Legato and database examples are installed from the companion CD. (Remember, database examples are not the same as sample schema; sample schema can be installed along with the database creation.) Beginning with Oracle 10g, the client software can be installed only from database client installation media.
4. D. The DBCA supports RAC, ASM, backup and recovery options, administrative passwords, and so on. The DBCA supports all the new features of Oracle 10g database including database management control using Enterprise Manager. You can also use the DBCA to clone an existing database.
5. C. Database cloning using DBCA is accomplished by creating a template with structure and data option. Once the template is created, it can be used to create any number of similar (cloned) databases. The source database will be in the mount state when creating the template. The state of the source database does not matter when creating the clones using the template.
6. C. The Oracle 10g database provides the provision to downgrade the database to Oracle 9i Release 2, provided the COMPATIBLE parameter is still set to 9.2.0. Not all versions of the database can be upgraded to Oracle 10g using the DBUA; only 8.0.6, 8.1.7, 9.0.1, and 9.2.0 databases can be directly upgraded to Oracle 10g. The DBUA supports only direct upgrade. Any version of Oracle database can be upgraded to Oracle 10g either using the direct upgrade method, first upgrading to a version supported by direct upgrade, or by using export/import method.
7. A. The AWR is used to monitor the database feature usage. The MMON process collects information on database feature usage (can be queried from DBA_FEATURE_USAGE_STATISTICS view) and database high-watermark statistics (can be queried from DBA_HIGH_WATER_MARK_STATISTICS view).
8. B. Oracle 10g supports direct upgrade from 8.0.6, 8.1.7, 9.0.1, and 9.2.0 databases.
9. D. The DBUA has an option to back up the database prior to upgrade. It's up to you to back up the database after the upgrade is completed.
10. B. The first step is to run the preupgrade information utility `ut1u101i.sql`. Fix all the discrepancies listed in this result, and shut down the database. Start the Oracle 10g instance after adjusting any initialization parameters using `STARTUP UPGRADE`. Create the SYSAUX tablespace and then run the upgrade script based on the release of the database from which you're upgrading. After the upgrade, verify the status of upgrade using `ut1u101s.sql`. Shut down and start up the database, and recompile any invalid objects using `ut1rp.sql` script.

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11. E. DBCA in Oracle 10g provides provisions to create the database with any of the storage options. OMF is a subcategory of file system storage.
12. D. The preupgrade information utility—`utlu101i.sql`—does not make any database changes; it advises you on what parameters need to be changed and tablespaces that need more space for a successful database upgrade. This utility is run on the database environment that needs the upgrade. When upgrading the database manually, you must perform all the suggestion by the `utlu101i.sql` before performing the upgrade. If you're using DBUA to upgrade, it will take care of all these changes.
13. A, D. `STARTUP UPGRADE` is the only way you can bring up an instance of Oracle 10g database prior to upgrading a database. You still need to upgrade the database using the upgrade scripts after creating the `SYSAUX` tablespace. Though the `STARTUP UPGRADE` option prepares the database for upgrade, you still need to run the database upgrade script based on the release of the database. This option suppresses `ORA-00942` error messages and disables certain startup parameters.
14. B. DBUA performs a restore from the backup it created prior to upgrade, and it restores the database files and configuration files from the backup location. If the backup is performed by you, the DBUA only restores the database settings—data files are not restored.
15. A. JPublisher, as well as Legato Single Server Version, Java libraries, and other products, must be installed in the same Oracle home directory as the database software. HTTP Server must be installed in a separate Oracle home directory, and HTML DB must be installed in the same Oracle home directory as HTTP Server.
16. E. Oracle 10g has a very simplified upgrade process, which determines all the components of the database to be upgraded and automatically upgrades them. Oracle uses `DBMS_REGISTRY` to identify the components to be upgraded.
17. B. The minimum size of redo log file in Oracle 10g is 4MB. When creating a new database, the default is 50MB. If you're using OMF, the default is 100MB.
18. C. Oracle uses `DBMS_REGISTRY` to keep the status of components loaded to the database. You can query `DBA_REGISTRY` to see all the components and their status. It also provides the schema owner of the component and the script to run if a component is invalid.
19. C. When installing database software, you are given choice to create four types of databases: General Purpose, Data Warehouse, Transaction Processing, and Advanced. If you choose Advanced, the OUI invokes the DBCA in an interactive mode, where more information about the database is obtained by the DBCA. For the other three choices, OUI invokes DBCA in noninteractive mode to create the database; OUI gets the necessary information for database creation.
20. B, D. The minimum `COMPATIBLE` value for Oracle 10g database is 9.2.0. You can set this value to 9.2.0 or 10.0.0 prior to upgrading the database (that is, prior to starting the instance in Oracle 10g). The default value of `COMPATIBLE` parameter in 10g is 10.0.0.