

Oracle® Real Application Clusters

Installation Guide

11g Release 1 (11.1) for Linux and UNIX

B28264-07

August 2010

Copyright © 2007, 2010, Oracle and/or its affiliates. All rights reserved.

Primary Author: Douglas Williams

Contributing Authors: Mark Bauer, Jonathan Creighton, Ram Kumar, Barb Lundhild, Venkat Maddali, Markus Michalewicz, Dipak Saggi, Sanjay Sharma, Khethavath Singh, Malai Stalin, Jason Straub, Ajesh Viswambharan, Sergiusz Wolicki

Contributors: David Austin, Namrata Bhakthavatsalam, Eric Belden, Aimee Cai, HanYool Chang, Tracy Chen, David Chu, Sudip Datta, Dave Diamond, Michael Gianatassio, Pat Huey, Luann Ho, Rajiv Jayaraman, Sana Karam, Roland Knapp, Vivekananda Kolla, George Kotsovolos, Raj Kumar, Sameer Joshi, Karen Li, Frank Liu, Gary Ling Ni, Diana Lorentz, Vijay Lunawat, Komal Mangtani, Bob McGuirk, John Patrick McHugh, Anil Nair, Randy Neville, Philip Newlan, Roy Rossebo, Michael Rubino, Sudheendra Sampath, Trivikrama Samudrala, Vishal Saxena, Viv Schupmann, Janelle Simmons, Clive Simpkins, Khethavath P. Singh, Janet Stern, Bob Thome, Lyju Vadassery, Nitin Vengurlekar, Sumana Vijayagopal, Pierre Wagner, Li Wang, Martin Widjaja, Terri Winters, Sivakumar Yarlagaadda, Bin Yan, Jun Yang, Michael Yau, Derek Yue, Ricky Zhu, Tony Zhu

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

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

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

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

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

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

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

Contents

Preface	xi
Intended Audience.....	xi
Documentation Accessibility	xi
Related Documents	xii
Conventions	xiii
 What's New in Oracle Real Application Clusters Installation?	xv
Changes in Installation Documentation.....	xv
Changes in the Install Options	xvi
New Components Available for Installation.....	xvii
Enhancements and New Features for Installation.....	xviii
Deprecated Components in Oracle Database 11g Release 1 (11.1).....	xxii
 1 Preinstallation Checklist	
Before You Start: Planning your Installation	1-1
Check Oracle <i>MetaLink</i>	1-2
Check Oracle Technical Network	1-2
Review How to Use Cluster Verification Utility	1-2
Review and Back Up Existing Oracle Installations	1-3
Review Globalization Requirements.....	1-4
Review Documentation	1-4
Server Hardware, Network and Operating System Overview	1-5
Review Server Hardware and Software Requirements.....	1-5
Server Environment Configuration Overview	1-6
Oracle Base Overview	1-6
Network Connections Overview	1-7
Secure Shell (SSH) Configuration Overview	1-8
Browser Requirement Overview	1-8
Platform-Specific Server Configuration Overview	1-9
Oracle RAC Storage Overview	1-9
Overview of Oracle Database and Recovery File Options.....	1-9
General Storage Considerations for Oracle RAC	1-10
Additional Information to Prepare for Installation	1-12
Oracle Clusterware and Vendor Clusterware	1-12
Shared Components of Oracle RAC Installations	1-12

Oracle Database 11g Real Application Clusters Release Compatibility	1-12
Confirming Cluster Readiness for Oracle RAC Installation with CVU	1-13
Stopping Existing Oracle Processes for Upgrades or Coexisting Databases	1-14

2 Installing Oracle Database 11g with Oracle Real Application Clusters

Verifying System Readiness for Installing Oracle Database with CVU	2-1
Reviewing Oracle Application Express Requirements.....	2-2
Browser Requirements for Oracle Application Express.....	2-2
Installing APEX with Existing Oracle HTML Server Installations	2-3
Oracle Text Requirement for Oracle Application Express.....	2-3
Oracle XML DB Requirement for Oracle Application Express	2-3
Selecting a Configuration Option.....	2-3
Automatic Storage Management Configuration	2-4
Preparing for a Rolling Upgrade of Automatic Storage Management	2-4
Oracle Database Vault Configuration	2-5
Oracle Database Vault Requirements	2-5
Oracle Database Vault Accounts.....	2-6
Oracle Database Vault Owner.....	2-6
Oracle Database Vault Account Manager	2-6
Multiple Oracle Database Vault Homes	2-7
Starting the Listener with Oracle Database Vault Installations	2-7
Installing Oracle Database Vault	2-7
Installing Oracle Database Vault During Oracle RAC Installation	2-7
Installing Oracle Database Vault After Oracle RAC Installation.....	2-7
Oracle Database Configuration Type Descriptions.....	2-7
General Purpose, Transaction Processing, and Data Warehouse Configuration Types	2-8
Using the Advanced Configuration Type	2-8
Oracle Configuration Manager Option.....	2-8
Database Security Options.....	2-9
Selecting Database Passwords.....	2-9
Actions of OUI, DBCA, and Other Assistants During Installation	2-10
Installing Oracle Database with Other Languages.....	2-11
Selecting a Database Name	2-11
Using Oracle Universal Installer to install Oracle RAC.....	2-11

3 Creating Oracle Real Application Clusters Databases with Database Configuration Assistant

Using Database Configuration Assistant with Oracle RAC.....	3-1
Benefits of Using Database Configuration Assistant	3-2
Automatic Listener Migration from Earlier Releases.....	3-2
Verifying Requirements for DBCA	3-3
Creating an Oracle RAC Database with DBCA	3-3
Deleting an Oracle RAC Database with DBCA	3-7

4 Oracle Real Application Clusters Postinstallation Procedures

Required Postinstallation Tasks.....	4-1
--------------------------------------	-----

Download and Install Patch Updates	4-1
Configure Oracle Products	4-2
Relocate Instance-related Memory-mapped files from OCFS2 Using Symbolic Links	4-2
Recommended Postinstallation Tasks	4-3
Recommended Database Postinstallation Tasks	4-3
Back Up the root.sh Script	4-3
Set the Oracle User Environment Variables.....	4-3
Recompile all PL/SQL modules.....	4-3
Set Up User Accounts.....	4-4
Logging in to Oracle Enterprise Manager Database Control	4-4
Oracle Configuration Manager Postinstallation Configuration for Oracle RAC	4-5
Oracle Database Vault Postinstallation with DVCA for Oracle RAC	4-5
Upgrading 10.2.0.3 Databases with Oracle Database Vault to Oracle Database 11g	4-6

5 Oracle Application Express Postinstallation Tasks

Restarting Application Express Processes After an Upgrade	5-1
Patching Oracle Application Express 3.0	5-1
Choosing an HTTP Server	5-2
Selecting an HTTP Server in an Oracle RAC Environment	5-2
About Oracle HTTP Server and mod_plsql	5-2
Copying the Images Directory	5-2
Copying the Images Directory After an Upgrade	5-2
Copying the Images Directory After a New Installation	5-3
Configuring Oracle HTTP Server in a New Installation	5-3
Security Considerations for Oracle HTTP Server.....	5-4
Configuring Oracle HTTP Server Release 9.0.3 in a New Installation	5-4
Changing the Password for the ADMIN Account	5-4
Changing the Password for the APEX_PUBLIC_USER Database User	5-4
Modifying the wdsrvr.app File in a New Installation	5-5
Modifying the Oracle9i httpd.conf File.....	5-6
Configuring Oracle HTTP Server or Oracle Application Server in a New Installation.....	5-6
Changing the Password for the ADMIN Account	5-7
Unlocking the APEX_PUBLIC_USER Database User	5-7
Changing the Password for the APEX_PUBLIC_USER Database User	5-7
Edit the dads.conf File.....	5-8
Stopping and Restarting Oracle HTTP Server	5-9
Installing Oracle Application Express in Other Languages.....	5-9
Installing a Translated Version of Oracle Application Express	5-9
Managing JOB_QUEUE_PROCESSES	5-10
Viewing the Number of JOB_QUEUE_PROCESSES	5-10
Changing the Number of JOB_QUEUE_PROCESSES.....	5-11
Obfuscating PlsqlDatabasePassword Parameter.....	5-11
Obfuscating Passwords.....	5-11
Logging In to Oracle Application Express	5-11
Oracle Application Express User Roles	5-11
Setting Up Your Local Environment.....	5-12
Enabling Network Services in Oracle Database 11g	5-12

Granting Connect Privileges.....	5-12
Troubleshooting an Invalid ACL Error	5-13

6 Configuring the Server Parameter File in Oracle Real Application Clusters Environments

Parameter Files and Oracle RAC	6-1
Using Server Parameter Files with Oracle RAC.....	6-1
Location of the Server Parameter File	6-2
Parameter File Search Order in Oracle RAC.....	6-3
Migrating to the SPFILE in Oracle RAC Environments	6-3
Server Parameter File Placement in Oracle RAC.....	6-3
Procedures for Migrating to the Server Parameter File	6-3
Server Parameter File Errors in Oracle RAC	6-4

7 Understanding the Oracle Real Application Clusters Installed Configuration

Understanding the Configured Environment in Oracle RAC.....	7-1
Oracle Cluster Registry in Oracle RAC.....	7-2
Oratab Configuration for Oracle RAC	7-2
Database Components Created Using Database Configuration Assistant.....	7-2
Tablespaces and Data files	7-2
Control Files	7-3
Redo Log Files	7-3
Managing Undo Tablespaces in Oracle RAC	7-3
Initialization Parameter Files.....	7-4
Oracle Database Vault Default Audit Policy and Initialization Parameters	7-4
Configuring Service Registration-Related Parameters.....	7-4
Configuring the Listener File (listener.ora).....	7-5
Local Listeners	7-5
Multiple Listeners	7-6
How Oracle Database Uses the Listener (listener.ora File).....	7-6
Listener Registration and PMON Discovery	7-6
Net Service Names (tnsnames.ora File).....	7-7
Net Services Profile (sqlnet.ora File)	7-14

8 Removing Oracle RAC and ASM Software

Overview of Deinstallation Procedures.....	8-1
Identifying All Instances On a Cluster	8-1
Deinstalling Oracle RAC Software.....	8-2
Deinstalling Oracle RAC and ASM Using Configuration Assistants.....	8-2
Deinstalling Oracle Clusterware.....	8-5
Removing Oracle Software.....	8-5

A Troubleshooting the Oracle Real Application Clusters Installation Process

Troubleshooting the Oracle Real Application Clusters Installation.....	A-1
General Installation Issues	A-1
Oracle RAC Installation Error Messages	A-3

Performing Cluster Diagnostics During Oracle Clusterware Installations	A-3
Reviewing the Log of an Installation Session	A-4
Configuration Assistant Errors	A-4
Configuration Assistant Failures	A-5
Fatal Errors.....	A-5
 B Using Scripts to Create Oracle Real Application Clusters Databases	
Using DBCA to generate Installation Scripts for Oracle RAC.....	B-1
Using DBCA Noninteractive (Silent) Configuration for Oracle RAC.....	B-2
 C Converting to Oracle Real Application Clusters from Single-Instance Oracle Databases	
Administrative Issues for Converting Databases to Oracle RAC.....	C-1
Converting to Oracle RAC with DBCA	C-2
Converting Oracle Database 11g Installations to Oracle RAC Using DBCA	C-2
Back Up the Original Single-Instance Database	C-3
Complete Oracle Clusterware Installation.....	C-3
Validate the Cluster	C-3
Copy the Preconfigured Database Image.....	C-3
Install Oracle Database 11g Software with Oracle RAC.....	C-3
Converting Single Instance on a Cluster to Oracle RAC using DBCA.....	C-4
Single Instance on a Cluster Running from a Cluster-Enabled Oracle Home	C-4
Single Instance on a Cluster Running from an Oracle RAC-Disabled Oracle Home	C-7
Single Instance on a Cluster Running from a Single-Instance Installed Oracle Home....	C-7
Converting Single-Instance ASM to Cluster ASM Using DBCA	C-7
Preparing to Convert with rconfig and Oracle Enterprise Manager	C-8
Prerequisites for Converting to Oracle RAC Databases.....	C-8
Configuration Changes during Oracle RAC Conversion Using RCONFIG	C-9
Converting Databases to Oracle RAC Using RCONFIG or Oracle Enterprise Manager	C-10
Converting Databases to Oracle RAC Using Oracle Enterprise Manager.....	C-10
Converting Databases to Oracle RAC Using RCONFIG.....	C-11
Example of an rconfig XML Input File for ConvertToRAC	C-13
Converting Single-Instance ASM to Oracle RAC Using RCONFIG	C-14
Example of an rconfig XML Input File for ConvertToASM.....	C-15
Post-Conversion Steps.....	C-16
 D Directory Structure for Oracle Real Application Clusters Environments	
Understanding the Oracle RAC Directory Structure	D-1
Directory Structures for Oracle RAC.....	D-1
 E How to Stop Processes in an Existing Oracle Real Application Clusters Database	
Back Up the Oracle RAC Database.....	E-1
Shut Down Oracle RAC Databases	E-1
Stop All Oracle Processes	E-1

Stopping Oracle Clusterware or Cluster Ready Services Processes	E-2
Stopping Oracle Database Processes Before Adding Products or Upgrading.....	E-2

F Managing Oracle Database Port Numbers

About Managing Ports	F-1
Viewing Port Numbers and Access URLs.....	F-2
Port Numbers and Protocols of Oracle Components	F-2
Changing the Oracle Enterprise Management Agent Port.....	F-4
Changing the Oracle Enterprise Manager Database Console Ports.....	F-4
Changing the Oracle Ultra Search Ports	F-5
Changing the Oracle XML DB Ports.....	F-5

Index

List of Tables

1-1	Overview of IP Address Requirements for Each Node with Oracle Clusterware	1-7
1-2	Supported Storage Options for Oracle Database and Recovery Files	1-11
1-3	Overview of System Preparation for Upgrades or Co-existing Databases	1-14
7-1	Tablespace Names Used with Real Application Clusters Databases	7-3
7-2	Connections for Net Service Names	7-9
D-1	Directory Structure for A Sample OFA-Compliant Environment	D-1
F-1	Ports Used in Oracle Components	F-2

Preface

Oracle Real Application Clusters Installation Guide for Linux and UNIX explains how to install and configure Oracle Real Application Clusters (Oracle RAC). Before you use this guide, you must first complete successfully an installation of Oracle Clusterware, as described in *Oracle Clusterware Installation Guide* for your platform.

This preface contains the following topics:

- [Intended Audience](#)
- [Documentation Accessibility](#)
- [Related Documents](#)
- [Conventions](#)

Intended Audience

Oracle Real Application Clusters Installation Guide for Linux and UNIX provides database installation information for database administrators (DBAs) who install and configure Oracle RAC.

Documentation Accessibility

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

Accessibility of Code Examples in Documentation

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

Accessibility of Links to External Web Sites in Documentation

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

Access to Oracle Support

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

Related Documents

For more information, refer to the following Oracle resources:

Oracle Real Application Clusters Documentation

Most Oracle error message documentation is only available in HTML format. If you only have access to the Oracle Documentation media, then browse the error messages by range. Once you find a range, use your browser's "find in page" feature to locate a specific message. When connected to the Internet, you can search for a specific error message using the error message search feature of the Oracle online documentation. However, error messages for Oracle Clusterware and Oracle RAC tools are included in *Oracle Clusterware Administration and Deployment Guide*, or in *Oracle Real Application Clusters Administration and Deployment Guide*.

Installation Guides

- *Oracle Diagnostics Pack Installation Guide*
- *Oracle Clusterware Installation Guide for AIX Based Systems*
- *Oracle Clusterware Installation Guide for HP-UX*
- *Oracle Clusterware Installation Guide for Linux*
- *Oracle Clusterware Installation Guide for Microsoft Windows*
- *Oracle Clusterware Installation Guide for Solaris Operating System*

Operating System-Specific Administrative Guides

- *Oracle Clusterware Administration and Deployment Guide*
- *Oracle Database Administrator's Reference, 11g Release 1 (11.1) for UNIX Systems*
- *Oracle Database Platform Guide for Microsoft Windows*

Oracle Database 11g Release 1 (11.1) Real Application Clusters Management

- *Oracle Real Application Clusters Administration and Deployment Guide*
- *Oracle Database 2 Day DBA*
- *Oracle Database 2 Day + Real Application Clusters Guide*
- *Getting Started with the Oracle Diagnostics Pack*

Generic Documentation

- *Oracle Database New Features Guide*
- *Oracle Database Net Services Administrator's Guide*

- *Oracle Database Concepts*
- *Oracle Database Reference*

Printed documentation is available for sale in the Oracle Store at the following Web site:

<http://oraclestore.oracle.com/>

To download free release notes, installation documentation, white papers, or other collateral, please visit the Oracle Technology Network (OTN). You must register online before using OTN; registration is free and can be done at the following Web site:

<http://otn.oracle.com/membership/>

If you already have a username and password for OTN, then you can go directly to the documentation section of the OTN Web site at the following Web site:

<http://otn.oracle.com/documentation/>

Oracle error message documentation is available only in HTML. You can browse the error messages by range in the Documentation directory of the installation media. When you find a range, use your browser's "find in page" feature to locate a specific message. When connected to the Internet, you can search for a specific error message using the error message search feature of the Oracle online documentation.

If you already have a username and password for OTN, then you can go directly to the documentation section of the OTN Web Site:

<http://otn.oracle.com/documentation/>

Conventions

The following text conventions are used in this document:

Convention	Meaning
boldface	Boldface type indicates graphical user interface elements associated with an action, or terms defined in text or the glossary.
<i>italic</i>	Italic type indicates book titles, emphasis, or placeholder variables for which you supply particular values.
monospace	Monospace type indicates commands within a paragraph, URLs, code in examples, text that appears on the screen, or text that you enter.

What's New in Oracle Real Application Clusters Installation?

This section describes Oracle Database 11g release 1 (11.1) features as they pertain to the installation and configuration of Oracle Real Application Clusters (Oracle RAC). The topics in this section are:

- [Changes in Installation Documentation](#)
- [Changes in the Install Options](#)
- [New Components Available for Installation](#)
- [Enhancements and New Features for Installation](#)
- [Deprecated Components in Oracle Database 11g Release 1 \(11.1\)](#)

Changes in Installation Documentation

With Oracle Database 11g release 1, Oracle Clusterware can be installed or configured as an independent product, and additional documentation is provided on storage administration. For installation planning, note the following documentation:

Oracle Database 2 Day + Real Application Clusters Guide

This book provides an overview and examples of the procedures to install and configure a two-node Oracle Clusterware and Oracle RAC environment.

Oracle Clusterware Installation Guide

This platform-specific book provides procedures either to install Oracle Clusterware as a standalone product, or to install Oracle Clusterware with either Oracle Database, or Oracle RAC. It contains system configuration instructions that require system administrator privileges.

Oracle Real Application Clusters Installation Guide

This book (the guide that you are reading) provides procedures to install Oracle RAC after you have completed successfully an Oracle Clusterware installation. It contains database configuration instructions for database administrators.

Oracle Database Storage Administrator's Guide

This book provides information for database and storage administrators who administer and manage storage, or who configure and administer Automatic Storage Management (ASM).

Oracle Clusterware Administration and Deployment Guide

This is the administrator's reference for Oracle Clusterware. It contains information about administrative tasks, including those that involve changes to operating system configurations, and cloning Oracle Clusterware.

Oracle Real Application Clusters Administration and Deployment Guide

This is the administrator's reference for Oracle RAC. It contains information about administrative tasks. These tasks include database cloning, node addition and deletion, Oracle Cluster Registry (OCR) administration, use of SRVCTL and other database administration utilities, and tuning changes to operating system configurations.

Changes in the Install Options

Review the following updates:

Oracle HTTP Server Update

To install Oracle HTTP Server, use the "Oracle Fusion Middleware Web Tier Utilities 11g (11.1.1.2.0)" media or download.

Installation Option Changes

The following are installation option changes for Oracle Database 11g:

- **Oracle Application Express:** This feature is installed with Oracle Database 11g. It was previously named HTML DB, and was available as a separate Companion CD component.
- **Oracle Configuration Manager:** Oracle Configuration Manager (OCM) is integrated with Oracle Universal Installer. However, it is an optional component with database and client installations. Oracle Configuration Manager, used in previous releases as Customer Configuration Repository (CCR), is a tool that gathers and stores details relating to the configuration of the software stored in the ASM and database Oracle home directories.

Refer to [Oracle Configuration Manager for Improved Support in New Components Available for Installation](#) in this chapter for further information.

- **Oracle Data Mining:** The Enterprise Edition installation type selects Oracle Database Mining option by default. In Oracle Database 11g, the Data Mining metadata is created with SYS metadata when you select the **Create Database** option.
- **Oracle Database Vault:** This feature is integrated with Oracle Universal Installer. However, it is an optional component for database installation. To install this product, you have to select Custom installation.
- **Oracle SQL Developer:** This feature is installed by default with template-based database installations, such as General Purpose, Transaction Processing, and Data Warehousing. It is also installed with database client Administrator, Runtime, and Custom installations.
- **Oracle Warehouse Builder:** This information integration tool is now installed with both Standard and Enterprise Edition versions of the Oracle Database. With Enterprise Edition, you can purchase additional extension processes. Installing the Oracle Database also installs a pre-seeded repository, OWBSYS, necessary for using Oracle Warehouse Builder.

- **Oracle Ultra Search:** Starting with Oracle Database 11g, Oracle Ultra Search is integrated with Oracle Database. In the previous releases, this product was available as a Companion CD component.
- **Oracle XML DB:** Starting with Oracle Database 11g, Oracle XML DB is no longer an optional feature. It is installed and configured using Database Configuration Assistant for all database installations.

New Components Available for Installation

The following are the new components available while installing Oracle Database 11g:

- **Oracle Application Express:** Starting Oracle Database 11g, HTML DB is no longer available as a Companion CD component. Renamed as Oracle Application Express, this component is installed with Oracle Database 11g.

With Oracle Database 11g, Oracle Application Express replaces *iSQL*Plus*.

See Also: *Oracle Database Application Express User's Guide* for more information about Oracle Application Express

- **Oracle Configuration Manager:** This feature is offered during custom installation. It was previously named Customer Configuration repository (CCR). It is an optional component for database and client installations. Oracle Configuration Manager gathers and stores details relating to the configuration of the software stored in database Oracle home directories.
- **Oracle Database Vault:** This feature is an optional component for database installation.

See Also: *Oracle Database Vault Administrator's Guide* for more information about Oracle Database Vault

- **Oracle Real Application Testing:** This feature is installed by default with the Enterprise Edition installation type of Oracle Database 11g.

See Also: *Oracle Database Performance Tuning Guide* for more information about Oracle Real Application Testing

- **Oracle SQL Developer:** This feature is installed by default with template-based database installations, such as General Purpose, Transaction Processing, and Data Warehousing. It is also installed with database client Administrator, Runtime, and Custom installations.

See Also: *Oracle Database SQL Developer User's Guide* for more information about Oracle SQL Developer

- **Oracle Warehouse Builder:** This feature is now included as an option in the Database installation.

Note: With Standard Edition and Enterprise Edition versions of Oracle Database 11g release 1 (11.1), Oracle Warehouse Builder with basic features is installed. However, with Enterprise Edition, you can purchase options that extend Oracle Warehouse Builder.

See Also: *Oracle Warehouse Builder User's Guide* for more information about Oracle Warehouse Builder

Enhancements and New Features for Installation

The following is a list of enhancements and new features for Oracle Database 11g release 1 (11.1):

Oracle HTTP Server Update

To install Oracle HTTP Server, use the "Oracle Fusion Middleware Web Tier Utilities 11g (11.1.1.2.0)" media or download.

Automatic Diagnostic Repository

The Automatic Diagnostic Repository is a feature added to Oracle Database 11g. The main objective of this feature is to reduce the time required to resolve bugs. Automatic Diagnostic Repository is the layer of the Diagnostic Framework implemented in Oracle Database 11g that stores diagnostic data and also provides service APIs to access data. The default directory that stores the diagnostic data is `$ORACLE_BASE/diag`.

The Automatic Diagnostic Repository implements the following:

- Diagnostic data for all Oracle products is written into an on-disk repository.
- Interfaces that provide easy navigation of the repository, and the capability to read and write data

For Oracle RAC installations, if you use a shared Oracle Database home, then the Automatic Data Repository must be located on a shared storage location available to all the nodes.

Oracle Clusterware continues to place diagnostic data in the directory `CRS_home/log`, where `CRS_home` is the Oracle Clusterware home.

Automatic Storage Management Fast Mirror Resync

ASM fast mirror resync quickly resynchronizes ASM disks within a disk group after transient disk path failures as long as the disk drive media is not corrupted. Any failures that render a failure group temporarily unavailable are considered transient failures. Disk path malfunctions, such as cable disconnections, host bus adapter or controller failures, or disk power supply interruptions, can cause transient failures. The duration of a fast mirror resync depends on the duration of the outage. The duration of a resynchronization is typically much shorter than the amount of time required to completely rebuild an entire ASM disk group.

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

ASM and Oracle RAC Deinstallation and Other Configuration Assistant Enhancements

Database Configuration Assistant (DBCA), Database Upgrade Assistant (DBUA), and Oracle Net Configuration Assistant (NETCA) have been improved. These improvements include the following:

DBCA

- Provides a command line feature, `deleteASM`, which removes ASM instances.

- Provides the option to switch from a database configured for Oracle Enterprise Manager Database Control to Oracle Enterprise Manager Grid Control.

DBUA

- Includes an improved pre-upgrade script to provide space estimation, initialization parameters, statistics gathering, and new warnings. DBUA also provides upgrades from Oracle Database releases 9.0, 9.2, 10.1, and 10.2.
- Supports in-place patch set upgrades
- Starts any services running prior to upgrades

New SYSASM Privilege and OSASM operating system group for ASM Administration

This feature introduces a new `SYSASM` privilege that is specifically intended for performing ASM administration tasks. Using the `SYSASM` privilege instead of the `SYSDBA` privilege provides a clearer division of responsibility between ASM administration and database administration.

OSASM is a new operating system group that is used exclusively for ASM. Members of the OSASM group can connect as `SYSASM` using operating system authentication and have full access to ASM.

ASM Preferred Read Disk Groups

In previous releases, ASM used the disk with the primary copy of a mirrored extent as the preferred disk for data reads. With this release, using the new initialization file parameter `asm_preferred_read_failure_groups`, you can specify disks located near a specific cluster node as the preferred disks from which that node obtains mirrored data. This option is presented in Database Configuration Assistant (DBCA), and can be configured after installation. This change facilitates faster processing of data with widely distributed shared storage systems or with extended clusters (clusters whose nodes are geographically dispersed), and improves disaster recovery preparedness.

Automatic Storage Management Rolling Migration

Rolling migration for ASM enables you to upgrade or patch ASM instances on clustered ASM nodes without affecting database availability. Rolling migration provides greater availability and more graceful migration of ASM software from one release to the next. This feature applies to ASM configurations that run on Oracle Database 11g release 1 (11.1) and later. In other words, you must already have Oracle Database 11g release 1 (11.1) installed before you can perform rolling migrations.

Note: You cannot change the owner of the Oracle ASM or Oracle Database home during an upgrade. You must use the same Oracle software owner that owns the existing Oracle ASM or Oracle Database home.

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

Conversion of Single-Instance ASM to clustered ASM

Using either `rconfig` or Oracle Enterprise Manager Grid Control, you can convert an existing ASM instance from a single-instance storage manager to a cluster storage manager. You can convert ASM release 11.1 instances directly, and convert releases

previous to 11.1 by upgrading the instance to 11.1, and then performing the conversion.

Data Mining Schema Creation Option

In Oracle Database 11g, the data mining schema is created when you run the SQL script `catproc.sql` as the SYS user. Therefore, the data mining option is removed from the Database Features screen of Database Configuration Assistant.

Oracle Disk Manager Network File System Management

Oracle Disk Manager (ODM) can manage network file systems (NFS) on its own, without using the operating system kernel NFS driver. This is referred to as Direct NFS. Direct NFS implements NFS version 3 protocol within the Oracle RDBMS kernel. This change enables monitoring of NFS status using the ODM interface. The Oracle RDBMS kernel driver tunes itself to obtain optimal use of available resources.

This feature provides the following:

- Ease of tuning, and diagnosability, by providing the Oracle kernel control over the input-output paths to Network File Server, and avoiding the need to tune network performance at the operating system level.
- A highly stable, highly optimized NFS client for database operations.
- Use of the Oracle network file system layer for user tasks, reserving the operating system kernel network file system layer for network communication.
- Use of the Oracle buffer cache, rather than the file system cache, for simpler tuning.
- A common, consistent NFS interface, capable for use across Linux, UNIX and Windows platforms.
- Oracle RAC-aware NFS performance. With operating system NFS drivers, even though NFS is a shared file system, NFS drives have to be mounted with the option `noac` (NO Attribute Caching) to prevent the operating system NFS driver from optimizing the filesystem cache by keeping file attributes locally. ODM NFS automatically recognizes Oracle RAC instances, and performs appropriate operations for datafiles without requiring additional reconfiguration from users, system administrators, or DBAs. If you store the Oracle Clusterware voting disks or Oracle Cluster Registry (OCR) files on NFS, then they continue to require mounting with the `noac` option.

Optimal Flexible Architecture (OFA) Simplified

With the development of Stripe and Mirror Everything architecture (SAME), and improved storage and throughput capacity for storage devices, the original OFA mission to enhance performance has shifted to its role of providing well-organized Oracle installations with separated software, configuration files and data. This separation enhances security, and simplifies upgrade, cloning, and other administrative tasks.

Oracle Database 11g release 1 (11.1) incorporates several changes to OFA to address this changed purpose.

As part of this change:

- During Oracle RAC installation, you are prompted to accept the default, or select a location for the Oracle base directory, instead of the Oracle home directory. This change facilitates installation of more than one Oracle home directory in a common location, and separates software units for simplified administration. For

this release, you are not required to use Oracle base, but this may become a requirement in a future release.

- With this release, as part of the implementation of Automatic Diagnostic Repository (ADR), the following `admin` directories are changed:
 - `bdump` (location set by the `background_dump_dest` initialization parameter; storage of Oracle background process trace files)
 - `cdump` (location set by the `core_dump_dest` initialization parameter; storage of Oracle core dump files)
 - `udump` (location set by the `user_dump_dest` initialization parameter; storage of Oracle user SQL trace files)

By default, the location of these trace and core files is in the `/diag` directory, which is in the path `$ORACLE_BASE/diag`.

- The initialization parameters `BACKGROUND_DUMP_DEST` and `USER_DUMP_DEST` are deprecated. They continue to be set, but you should not set these parameters manually.
- A new initialization parameter is introduced. `DIAGNOSTIC_DEST` contains the location of "ADR base," which is the base directory under which one or more Automatic Database Repository homes are kept. Oracle documentation commonly refers to these homes as ADR homes. Each database instance has an ADR home, which is the root directory for a number of other directories that contain trace files, the alert log, health monitor reports, and dumps for critical errors. You can also view alert and trace files with the SQL statement `select name, value from v$diag_info`.
- The default Fast Recovery area is moved from `$ORACLE_HOME/.. /fast_recovery_area` to `$ORACLE_BASE/fast_recovery_area`.
- The default data file location is moved from `$ORACLE_HOME/.. /oradata` to `$ORACLE_BASE/oradata`.
- A new utility, The ADR Command Interpreter (ADRCI), is introduced. The ADRCI facilitates reviewing alert log and trace files.

For Oracle RAC installations, Oracle requires that the Fast recovery area and the data file location are on a location shared among all the nodes. The Oracle Universal Installer confirms that this is the case during installation.

This change does not affect the location of trace files for Oracle Clusterware.

See Also: *Oracle Database Administrator's Guide* for detailed information about these changes, and *Oracle Database Utilities* for information about viewing alert log and list trace files with ADRCI

Oracle Configuration Manager for Improved Support

During installation, you are asked if you want to install Oracle Configuration Manager (OCM). OCM is an optional tool that enables you to associate your configuration information with your Oracle*MetaLink* account. This can facilitate handling of service requests by ensuring that server system information is readily available.

Configuring the OCM tool requires that you have the following information from your service agreement:

- Customer Identification Number (CSI)
- Oracle*MetaLink* user account name

- Country Code

In addition, you are prompted for server proxy information, if the host system does not have a direct connection to the Internet.

Support for Large Data Files

Large data file support is an automated feature that enables Oracle to support larger files on ASM more efficiently, and to increase the maximum file size.

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

Switching a Database from Database Control to Grid Control Configuration

In previous releases, Database Configuration Assistant contains the functionality to configure databases while creating them either with Database Control or with Grid Control, or to reconfigure databases after creation. However, if you want to change the configuration from Database to Grid control, this requires significant work. With Oracle Database 11g, Database Configuration Assistant enables you to switch configuration of a database from Database Control to Grid Control by running the Oracle Enterprise Manager Configuration Plug-in.

Deprecated Components in Oracle Database 11g Release 1 (11.1)

The following components that were part of Oracle Database 10g release 2 (10.2) are not available for installation with Oracle Database 11g:

- iSQL*Plus
- Oracle Workflow
- Data Mining Scoring Engine
- Oracle Enterprise Manager Java console

Preinstallation Checklist

Most installation errors with Oracle Real Application Clusters (Oracle RAC) are due to a failure to complete all steps required before starting Oracle Universal Installer.

This chapter is intended for database administrators to use in consultation with system administrators and storage administrators to coordinate installation plan tasks for Oracle Clusterware, in preparation for completing an installation of Oracle RAC.

This chapter contains the following topics:

- [Before You Start: Planning your Installation](#)
- [Server Hardware, Network and Operating System Overview](#)
- [Oracle RAC Storage Overview](#)
- [Additional Information to Prepare for Installation](#)
- [Confirming Cluster Readiness for Oracle RAC Installation with CVU](#)
- [Stopping Existing Oracle Processes for Upgrades or Coexisting Databases](#)

1.1 Before You Start: Planning your Installation

This section provides a list of tasks Oracle recommends you complete before starting Oracle Clusterware and Oracle RAC installation. Whether your location is a Tier IV data center with a large project team of system administrators, storage administrators, network administrators, database administrators, and third-party hardware and software vendors, or you are a project team of one, planning is important to help ensure that your installation proceeds smoothly.

It is beyond the scope of this documentation set to advise how to determine hardware sizing or capacity planning for your installation. Note that with Oracle Clusterware and Oracle RAC, you can add additional nodes and instances as needed in response to testing, or in response to increased workloads.

Review and complete the following steps as part of your installation plan:

- [Check OracleMetaLink](#)
- [Check Oracle Technical Network](#)
- [Review How to Use Cluster Verification Utility](#)
- [Review and Back Up Existing Oracle Installations](#)
- [Review Globalization Requirements](#)
- [Review Documentation](#)

1.1.1 Check Oracle*MetaLink*

Before you decide whether you want to install Oracle Database 11g release 1 (11.1) on existing hardware, or decide what server and storage hardware to purchase for an installation, log on to Oracle*MetaLink* (<https://metalink.oracle.com>), and click the **Certify** tab. Check the Certification Matrix for Oracle RAC for the operating system platform on which you intend to install, to ensure that your hardware configuration is supported for use with Oracle Clusterware, and, if you intend to install it, Oracle RAC. You can receive guidance about supported hardware options that can assist you with your purchasing decisions.

At the time of this release, you can also check the following URL for direct access to the Certification Matrix:

<http://www.oracle.com/technology/support/metalink/index.html>

In addition to specific certified hardware configurations, the Certify page provides support and patch information, and general advice about how to proceed with an Oracle Clusterware or Oracle Clusterware with Oracle RAC 11g release 1 (11.1) installation, including important information about vendor clusterware and other configuration issues.

Contact your Oracle Sales Representative if you do not have an Oracle*MetaLink* account.

Also, you may want to refer to Oracle.com (<http://www.oracle.com>) for additional resources about planning for specific implementation scenarios, best practices, and other information that can help you with your installation plan. In particular, refer to the following Web site:

<http://www.oracle.com/technology/products/database/clustering/index.html>

1.1.2 Check Oracle Technical Network

The Oracle Technical Network (OTN) contains white papers about deployment options, such as capacity planning, best practices on various NFS platforms, and extended clusters deployments, which are not addressed in this guide. You can review available papers at the following Web site:

<http://www.oracle.com/technology/products/database/clustering/index.html>

1.1.3 Review How to Use Cluster Verification Utility

All users intending to install Oracle Clusterware or Oracle RAC should use Cluster Verification Utility to ensure that the cluster is prepared for a successful installation.

Oracle provides Cluster Verification Utility to perform system checks in preparation for installation, patch updates, or other system changes. Learning how to use Cluster Verification Utility can help system administrators, storage administrators, and database administrators to ensure that each has completed required system configuration and preinstallation steps, so that installations, updates, or patches complete successfully.

If you have a vendor performing hardware or operating system configuration steps for you, then ask the vendor to complete the relevant Cluster Verification Utility check of the cluster after they complete their work to ensure that your system is configured correctly.

Database administrators should refer to the section "[Confirming Cluster Readiness for Oracle RAC Installation with CVU](#)" on page 1-13 to confirm that their system is prepared for installation before they start an Oracle RAC installation.

1.1.4 Review and Back Up Existing Oracle Installations

If you have an existing Oracle installation, then document version numbers, patches, and other configuration information, and review upgrade procedures for your existing installation. Review Oracle upgrade documentation before proceeding with installation, to decide how you want to proceed.

For late-breaking updates and best practices about preupgrade, post-upgrade, compatibility, and interoperability discussions, refer to "Oracle Upgrade Companion." "Oracle Upgrade Companion" is available through Note 466181.1 on OracleMetaLink:

<https://metalink.oracle.com/>

For upgrades, note the following:

- You can have only one version of Oracle Clusterware running on a cluster at a time. It must be the most recent release of any software (Oracle Clusterware, Oracle Database, Oracle RAC and Automatic Storage Management) running on the cluster.
- You can have multiple Oracle homes of Oracle Database 11g release 1 (11.1) or later on your cluster. However, the Oracle RAC database software in these homes must be from a version that is equal to or less than the version of Oracle Clusterware that is installed; you cannot have a version of Oracle Database on Oracle Clusterware that was released after the version of Oracle Clusterware that you are running.

For example:

If you have Oracle Clusterware 11g release 1 installed as your clusterware, then you can have an Oracle Database 10g release 1 single-instance database running on one node, and separate Oracle RAC 10g release 1, release 2, and Oracle RAC 11g release 1 databases also running on the cluster.

However, you cannot have Oracle Clusterware 10g release 2 installed on your cluster, and install Oracle RAC 11g.

- You can install earlier or later versions of Automatic Storage Management, but you can have only one ASM installation running in the cluster.

Both forward and backward compatibility is available with different versions of Automatic Storage Management (ASM). However, if you mix software versions, then be aware that ASM functionality reverts to the earliest software installation it supports.

For example, if you install Oracle Clusterware 11g with ASM, and you use it to support an existing Oracle Database release 10.2.0.3 installation, then ASM functionality is equivalent only to that available in the 10.2 release version.

- Starting with release 10.1.0.6 and 10.2.0.3, you can use Database Upgrade Assistant (DBUA) for patch set upgrades with Oracle RAC. You can also use DBUA to upgrade between major point releases of Oracle RAC (for example, from 10.1 to 10.2, or 10.2 to 11g).
- If you want to upgrade Oracle Clusterware release 10.2 to Oracle Clusterware release 11g, then you must first apply the 10.2.0.3 or later patch set.

- You cannot change the owner of the Oracle ASM or Oracle Database home during an upgrade. You must use the same Oracle software owner that owns the existing Oracle ASM or Oracle Database home.
- As with any system change, back up your existing database before attempting to install new software.

See Also: *Oracle Database Upgrade Guide*

1.1.5 Review Globalization Requirements

Before you start an installation where you want to support languages other than English, review *Oracle Database Globalization Support Guide*.

Note the following:

- Oracle recommends that you use Unicode AL32UTF8 as the database character set
Unicode is the universal character set that supports most of the currently spoken languages of the world. It also supports many historical scripts (alphabets). Unicode is the native encoding of many technologies, including Java, XML, XHTML, ECMAScript, and LDAP. Unicode is ideally suited for databases supporting the Internet and the global economy.
- The locale setting of your operating system session determines the language of the user interface, and the globalization behavior for components such as Oracle Universal Installer, Oracle Net Configuration Assistant, and Database Configuration Assistant. It also determines the globalization behavior of Oracle Database sessions created by a user application through Oracle JDBC driver, unless overridden by the application.
- The NLS_LANG environment variable determines the language of the user interface and the globalization behavior for components such as SQL*Plus, exp, and imp. It sets the language and territory used by the client application and the database. It also declares the character set for entering and displaying data by the client application.

Note: *Oracle Database Installation Guide* for your platform contains a fuller discussion of database character sets used with different languages, and provides further information about installing and configuring Oracle Database globalization support.

1.1.6 Review Documentation

Users planning to install Oracle Clusterware should review *Oracle Clusterware Installation Guide* for your operating system platform, particularly the Preinstallation, and the Storage chapters, to complete all required steps needed for a successful installation.

Oracle Clusterware Installation Guide also contains most tasks requiring root privileges or storage administrator privileges that need to be completed before starting an Oracle RAC installation.

In addition, review the Release Notes and OracleMetalink (<https://metalink.oracle.com>) to ensure that you have the most current information about system requirements and other information that can affect your installation. The small time that this review takes can save a much greater amount of time required to track down causes of installation errors later.

Oracle recommends that you install a Web browser on your cluster nodes, both to enable Oracle Enterprise Manager and Oracle Application Express, if you install Oracle RAC, and to access online documentation as needed. Online documentation is available in PDF and HTML formats.

Note: Refer to *Oracle Database Concepts* for an overview of Oracle Database, and *Oracle Real Application Clusters Administration and Deployment Guide* for additional information about Oracle Clusterware or Oracle RAC configuration and deployment. The Oracle Clusterware *Installation Guide* for your platform contains server and storage configuration information for Oracle RAC.

1.2 Server Hardware, Network and Operating System Overview

Oracle Clusterware must be installed successfully before attempting to install Oracle RAC.

To complete installations successfully, ensure that required hardware, network, and operating system preinstallation steps for Oracle software are complete. Failure to complete required preinstallation steps is the most common reason for failed installations.

Before Oracle Clusterware is installed, you should already have completed installing CPUs, memory, local disks, network cards, host bus adaptors, interconnects, and any other networking or server hardware; and you should have installed the operating system, and any vendor clusterware. Review your vendor documentation to complete these tasks, and if relevant, work with your vendor to complete such Oracle preinstallation steps that are listed here to confirm that the vendor hardware and software is correctly configured.

Server and network preparation for installation include the following:

- [Review Server Hardware and Software Requirements](#)
- [Server Environment Configuration Overview](#)
- [Oracle Base Overview](#)
- [Network Connections Overview](#)
- [Secure Shell \(SSH\) Configuration Overview](#)
- [Browser Requirement Overview](#)
- [Platform-Specific Server Configuration Overview](#)

1.2.1 Review Server Hardware and Software Requirements

The following is a summary of server hardware and software configuration.

Oracle Requires

Each node in a cluster requires the following:

- Supported server hardware, including processors and system configuration.
Review *OracleMetaLink* before starting installation on existing hardware, and before purchasing new hardware, to ensure that the hardware is supported with Oracle Clusterware with Oracle RAC 11g release 1 (11.1).

Note: You must use the same operating system on each node in the cluster. Oracle strongly recommends that you use the same software configurations on each node of the cluster.

- Operating system packages listed in system requirements.
Customized operating system package installations are not supported, because they may not include required packages. You can add additional packages as needed, but if you subtract packages from the default packages set, then you may encounter "failed dependencies" errors for required software packages.
- A supported interconnect software protocol on each node, to support Oracle Clusterware voting disk polling, and to support Cache Fusion with Oracle RAC. Your interconnect *must* be certified by Oracle for your platform.

Oracle Recommends: System Administrator Tasks

Oracle recommends the following to simplify server installation and maintenance, and prevent service issues

- Enabling the Network Time Protocol feature of most operating systems, and ensuring that all nodes use the same reference Network Time Protocol server.
- Configuring redundant switches, for all cluster sizes.
- Using identical server hardware on each node, to simplify server maintenance.

Additional Options: System Administrators and Vendors

- Though you do not need to use vendor clusterware with Oracle Clusterware, Oracle supports the use of many vendor clusterware options. However, you must install Oracle Clusterware to use Oracle RAC. Be aware that when you use vendor clusterware, Oracle Clusterware defers to the vendor clusterware for some tasks, such as node membership decisions.
- You may require third-party vendor clusterware if you use a non-ethernet interconnect.

After you have set up server hardware, review "Checking Hardware Requirements" in the preinstallation chapter to ensure that your system has enough RAM, that the TMP and TEMP_DIR locations have enough available space for the installation, and that your system meets other hardware requirements.

1.2.2 Server Environment Configuration Overview

Configuring the server environment includes at least the following

- Creating standard configuration operating system groups and users, as described in the preinstallation chapter. This includes creating specific operating system users to install and own Oracle software, and various other groups and users to enhance the security of your Oracle Clusterware, application, and data files.
- Configuring the Oracle software owner user environments, as described in the Oracle Clusterware preinstallation chapters.

1.2.3 Oracle Base Overview

With Oracle Database 11g, during installation, you are prompted for the Oracle base path, instead of the Oracle home path.

In preparation for installation, Oracle recommends that you only set the `ORACLE_BASE` environment variable. Oracle Universal Installer (OUI) creates other paths and environment variables as necessary, in accordance with the Optimal Flexible Architecture (OFA) rules for well-structured Oracle software environments.

For example, with Oracle Database 11g, Oracle recommends that you do not set an Oracle home environment variable, and instead allow OUI to create it. If the Oracle base path is `/u01/app/oracle`, then by default, OUI creates the following Oracle home path:

```
/u01/app/oracle/product/11.1.0/db_1
```

Note: If you are upgrading from an existing Oracle RAC installation, then you must use the same type of Oracle home that you have in your existing installation. For example, if you have a shared Oracle home in your existing installation, then you must upgrade to a shared Oracle home with Oracle RAC 11g release 1 (11.1). Similarly, if you have local Oracle homes on cluster nodes, then you must upgrade to local Oracle homes on cluster nodes.

1.2.4 Network Connections Overview

The following table provides an overview of network configuration requirements. Network administrators and system administrators can refer to the Preinstallation chapter in Oracle Clusterware Installation Guide for detailed configuration information.

[Table 1–1](#) and the content following provides an overview of IP address requirements for network connections:

Table 1–1 Overview of IP Address Requirements for Each Node with Oracle Clusterware

IP Address Type	Purpose	Where Registered	Pingable from Clients
Virtual IP address	Address for client requests and to be used to fail over requests to other nodes	DNS (recommended), or in the <code>/etc/hosts</code> file for each node in the cluster, and the <code>/etc/hosts</code> file for each node that is accessing the cluster database/	No, before installation; yes, after installation
Public IP address	Address for service requests	DNS, or in the <code>/etc/hosts</code> file for each node in the cluster.	Yes
Private IP address	Address for inter-node communication only	DNS, or <code>/etc/hosts</code> file for each node in the cluster. Must be resolvable only by other nodes in the cluster, and should be on dedicated network hardware.	No

The following is additional information about each address type

- **Virtual IP address:** a public internet protocol (IP) address for each node, to be used as the Virtual IP address (VIP) for client connections. If a node fails, then Oracle Clusterware fails over the VIP address to an available node. This address should be in the `/etc/hosts` file on any client system that requires access to the database.

During installation, the public VIP for each node is associated with the same interface name on every node that is part of your cluster. If you have a domain name server (DNS), then register the host names for the VIP with the DNS, so that it is resolvable from any client, as well as the cluster nodes. The VIP should not be in use at the time of the installation, because this is an IP address that Oracle Clusterware manages.

- **Public IP address:** a public host name address for each node, typically assigned by the system administrator during initial system configuration. The public IP address name must be resolvable to the hostname. Register both the public IP and the VIP address with the DNS. If you do not have a DNS, then you must make sure that both public IP addresses are in the node `/etc/hosts` file (for all cluster nodes),
- **Private IP address:** a private IP address for each node to serve as the private interconnect address for internode cluster communication only. The following must be true for each private IP address:
 - It must be separate from the public network
 - It must be accessible on the same network interface on each node
 - It must be connected to a network switch between the nodes for the private network; crossable interconnects are not supported

The private interconnect is used for internode communication by both Oracle Clusterware and Oracle RAC. The private IP address must be available in each node's `/etc/hosts` file. Oracle recommends that it is configured on a dedicated switch (or switches) that are not connected to anything other than the nodes in the same cluster.

Note: All host names must conform to the RFC 952 standard, which permits alphanumeric characters. Host names using underscores ("_") are not allowed.

1.2.5 Secure Shell (SSH) Configuration Overview

Secure Shell (SSH) configuration is required for Oracle Clusterware and Oracle RAC.

System administrators can follow the procedure described in "Configuring SSH on All Cluster Nodes" in the Preinstallation chapter of *Oracle Clusterware Installation Guide* for your operating system, to configure SSH access for each node on the cluster to all other nodes of the cluster.

1.2.6 Browser Requirement Overview

You need a web browser to access documentation, and to use Oracle Enterprise Manager and Oracle Application Express. Web browsers must support Java Script and the HTML 4.0 and CSS 1.0 standards. The following browsers meet these requirements:

- Netscape Navigator 7.2
- Netscape Navigator 8.1
- Mozilla version 1.7
- Microsoft Internet Explorer 6.0 SP2
- Microsoft Internet Explorer 7.0 or later

- Firefox 1.0.4
- Firefox 1.5
- Firefox 2.0

1.2.7 Platform-Specific Server Configuration Overview

Oracle Clusterware and Oracle RAC are tested with specific operating system kernels, and specific operating system components. Oracle requires that you use the operating system kernel and components that are certified for this release.

Oracle recommends that you or your system administrator review the system requirements carefully in *Oracle Clusterware Installation Guide* before beginning installation, to ensure that your system meets these requirements. If your system does not meet minimum operating system kernel and component requirements, then your installation may fail to complete, or other errors may develop during Oracle Clusterware or Oracle Database runtime.

In addition to the standard system requirements configuration, deployment on specific server hardware can include additional operating system configuration steps. Review the Preinstallation chapter, and check the Oracle*Metalink* Certify page to ensure that you are aware of any additional requirements or recommendations for your specific hardware platform configuration.

1.3 Oracle RAC Storage Overview

To install Oracle RAC, you need to have configured external shared disks for storing the database files.

Refer to the "Configuring Oracle Real Application Clusters Storage" chapter in *Oracle Clusterware Installation Guide* for your operating system to review storage options for installation planning. Storage and system administrators can refer to this chapter to configure storage for Oracle Database files on Oracle RAC. Note that when Database Configuration Assistant (DBCA) configures automatic disk backup, it uses a database recovery area that must be shared.

See Also : The Certify page on Oracle*Metalink* for the most current information about storage options:

<https://metalink.oracle.com>

Oracle Database Storage Administrator's Guide for an overview of storage configuration administration

1.3.1 Overview of Oracle Database and Recovery File Options

There are three ways of storing Oracle Database and recovery files:

- **Automatic Storage Management:** Automatic Storage Management (ASM) is an integrated, high-performance database file system and disk manager for Oracle Database files. It performs striping and mirroring of database files automatically.

Note: For Standard Edition Oracle Database installations using Oracle RAC, ASM is the only supported storage option.

- **A supported shared file system:** Supported file systems include the following:
 - A supported cluster file system: Note that if you intend to use a cluster file system for your data files, then you should create partitions large enough for the database files when you create partitions for Oracle Clusterware.

See Also: The Certify page on *OracleMetalink* for supported cluster file systems

- **NAS Network File System (NFS) listed on Oracle Certify:** Note that if you intend to use NFS for your data files, then you should create partitions large enough for the database files when you create partitions for Oracle Clusterware.

See Also: The Certify page on *OracleMetalink* for supported Network Attached Storage (NAS) devices, and supported cluster file systems

Note: Oracle Clusterware software can be installed on OCFS2. However, Oracle Clusterware software *cannot* be installed on Oracle Cluster File System (OCFS). Oracle Clusterware software can be installed on network-attached storage (NAS).

For OCFS2 certification status, refer to the Certify page on *OracleMetaLink*:

- **Block or Raw Devices:** A partition is required for each database file. If you do not use ASM, then for new installations on raw devices, you must use a custom installation.

Note: On Linux, Oracle recommends using block devices for new installations.

1.3.2 General Storage Considerations for Oracle RAC

For all installations, you must choose the storage option that you want to use for Oracle Database files, or for Oracle Clusterware with Oracle RAC (Oracle RAC). If you want to enable automated backups during the installation, then you must also choose the storage option that you want to use for recovery files (the Fast recovery area). You do not have to use the same storage option for each file type.

For single-instance Oracle Database installations using Oracle Clusterware for failover, you must use OCFS2, ASM, block devices (on Linux), or shared raw disks if you do not want the failover processing to include dismounting and remounting of local file systems.

The following table shows the storage options supported for storing Oracle Database files and Oracle Database recovery files. Oracle Database files include data files, control files, redo log files, the server parameter file, and the password file.

Note: For the most up-to-date information about supported storage options for Oracle RAC installations, refer to the Certify pages on the OracleMetaLink Web site:

<https://metalink.oracle.com>

Table 1–2 Supported Storage Options for Oracle Database and Recovery Files

Storage Option	File Types Supported	
	Database	Recovery
Automatic Storage Management	Yes	Yes
OCFS2	Yes	Yes
Red Hat Global File System (GFS); for Red Hat Enterprise Linux and Oracle Enterprise Linux	Yes	Yes
Local storage	No	No
NFS file system	Yes	Yes
Note: Requires a certified NAS device		
Shared raw devices	Yes	No
Shared block devices	Yes	No

Use the following guidelines when choosing the storage options that you want to use for each file type:

- You can choose any combination of the supported storage options for each file type provided that you satisfy all requirements listed for the chosen storage options.
- Oracle recommends that you choose Automatic Storage Management (ASM) as the storage option for database and recovery files.
- For Standard Edition Oracle RAC installations, ASM is the only supported storage option for database or recovery files.
- You cannot use ASM to store Oracle Clusterware files, because these files must be accessible before any ASM instance starts.
- If you intend to use ASM with Oracle RAC, and you are configuring a new ASM instance, then your system must meet the following conditions:
 - All nodes on the cluster have the 11g release 1 (11.1) version of Oracle Clusterware installed.
 - Any existing ASM instance on any node in the cluster is shut down.
- If you intend to upgrade an existing Oracle RAC database, or an Oracle RAC database with ASM instances, then you must ensure that your system meets the following conditions:
 - Oracle Universal Installer (OUI) and Database Configuration Assistant (DBCA) are run on the node where the Oracle RAC database or Oracle RAC database with ASM instance is located.
 - The Oracle RAC database or Oracle RAC database with an ASM instance is running on the *same* nodes that you intend to make members of the new

cluster installation. For example, if you have an existing Oracle RAC database running on a three-node cluster, then you must install the upgrade on all three nodes. You cannot upgrade only 2 nodes of the cluster, removing the third instance in the upgrade.

See Also: *Oracle Database Upgrade Guide* for information about how to prepare for upgrading an existing database

- If you do not have a storage option that provides external file redundancy, then you must configure at least three voting disk areas to provide voting disk redundancy.

1.4 Additional Information to Prepare for Installation

This section contains additional information about Oracle Clusterware, Oracle Automatic Storage Management, and Oracle RAC, that may be helpful for your installation plan team to read to decide how you want to configure your installation. It contains the following sections:

- [Oracle Clusterware and Vendor Clusterware](#)
- [Shared Components of Oracle RAC Installations](#)
- [Oracle Database 11g Real Application Clusters Release Compatibility](#)

1.4.1 Oracle Clusterware and Vendor Clusterware

Oracle Clusterware provides clustering services. You do not require vendor clusterware when you use Oracle Clusterware. If you intend to install Oracle RAC, then you must install Oracle Clusterware.

1.4.2 Shared Components of Oracle RAC Installations

For Oracle RAC, you and your system administrator should note that all instances in Oracle RAC environments share the control file, server parameter file, redo log files, and all data files. These files must be placed on a shared cluster file system or on shared disks, and all the cluster database instances must have access to them. Each instance also has its own set of redo log files. During failures, shared access to redo log files enables surviving instances to perform recovery.

1.4.3 Oracle Database 11g Real Application Clusters Release Compatibility

You can install and operate different releases of Oracle Database software on the same computer:

- When you have Oracle Clusterware installed with different release versions of Oracle software, the Oracle Clusterware version must be greater than or equal to the Oracle Database or Automatic Storage Management software version.
- If you have an existing Oracle home, then you can create a new Oracle home and install Oracle Database 11g into the new Oracle home. You should install Oracle Clusterware in a separate Oracle Clusterware home. Note that if you intend to install Oracle Database 11g with RAC, then you must install Oracle Clusterware 11g. Each node can have only one Oracle Clusterware home. You can install Oracle RAC into a new home, and use OUI to deinstall and reinstall it as part of a test plan.

- If you are running the Oracle9i release of Oracle RAC, and you want to continue to use that release, then you must run cluster software that is compatible with that release, such as Oracle Cluster Manager or a third party cluster software. Oracle Clusterware release 11g can be installed on the same system as Oracle9i database software, but Oracle9i software cannot be supported by Oracle Clusterware 11g.

Note: If you want to remove third party cluster software after upgrading your database to Oracle Database 10g or Oracle Database 11g, then you must first remove the third party cluster software, and then re-install Oracle Clusterware.

- If OUI detects a previous database release, then OUI asks you about your upgrade preferences. You have the option to upgrade one of the previous release databases with DBUA or to create a new database using DBCA. The information collected during this dialog is passed to DBUA or DBCA after the software is installed.

If OUI detects a previous Oracle Clusterware release, then you are asked to upgrade the existing Oracle Clusterware installation. Only one Oracle Clusterware version can exist on a server, and servers must be members of one cluster only.

Note: Do not move Oracle binaries from the Oracle home to another location. Doing so can cause dynamic link failures.

- You can run different releases of Oracle Database and Automatic Storage Management (ASM). If the Oracle Database release and the ASM release are the same release, then they can both run out of the same Oracle home. If they are different releases, then the Oracle Database release and the ASM release must be in their separate release homes. For example, you can install an ASM release 11g release 1 (11.1) instance and use it with Oracle Database 10g release 2 (10.2) database, or you can install an Oracle 11g release 1 (11.1) database and use it with an ASM 10g release 2 (10.2) instance.

Note: When using different release ASM and Oracle Database releases, the functionality of each is dependent on the functionality of the earlier software release. For example, an Oracle Database 10g release 10.2 database using an ASM 11.1.0.2 instance will not be able to use new features available for ASM in the 11.1.0.2 release, but instead only ASM 10.2 features. Conversely, an Oracle Database 11g release 11.1.0.2 installation using an ASM instance release 10.2 will function like a release 10.2 database.

1.5 Confirming Cluster Readiness for Oracle RAC Installation with CVU

Before you start your installation, use Cluster Verification Utility (CVU) to ensure that your system is prepared for Oracle RAC installation. If any checks fail, then fix the errors reported, or contact your system or storage administrator to have the cause of the errors addressed.

CVU is available in the Oracle Clusterware home, in the bin directory. For example, if the Oracle Clusterware home is `/crs`, then the path is `/crs/bin`. To start CVU, navigate to the Clusterware home bin directory, and use the following command syntax:

```
cluvfy stage -pre dbinst -n nodelist -r release -osdba OSDBA -verbose
```

For example, with a two node cluster with nodeA and nodeB, where you are testing the cluster to prepare to install Oracle Database 11g with Oracle RAC, and your osdba group is dba, the following command checks for system readiness:

```
$ ./cluvfy stage -pre dbinst -n nodea,nodeb -r 11gR1 -osdba dba -verbose
```

For more information about CVU commands, enter `./cluvfy -help`.

See Also: *Oracle Clusterware Administration and Deployment Guide* for detailed information about CVU

1.6 Stopping Existing Oracle Processes for Upgrades or Coexisting Databases

If you are planning an installation on a system where you have an existing Oracle RAC or Oracle Database installation, then you must perform additional tasks to prepare your system for installation.

[Table 1–3](#) provides an overview of what you need to do if you have an existing Oracle Database installation. Review the table, and perform tasks as required.

See Also: *Oracle Database Upgrade Guide* for additional information about preparing for and performing upgrades

Table 1–3 Overview of System Preparation for Upgrades or Co-existing Databases

Installation Scenario	What you need to do
Upgrading from Oracle Database 10g release 1 (10.1) to 11g release 1 (11.1)	No additional tasks. Refer to Installing Oracle Database 11g on a System with Oracle Database 10g on page 1-15
installing Oracle Database 11g release 1 (11.1) on a system to coexist with Oracle Database 10g release 1 (10.1)	No additional tasks. Refer to Installing Oracle Database 11g on a System with Oracle Database 10g on page 1-15
Upgrading from Oracle9i release 9.2 to Oracle Database 11g release 1 (11.1)	Shut down the Global Service Daemon, and shut down a default listener on port 1521, if present. Refer to Installing Oracle 11g Database on a System with Oracle9i Database Release 2 on page 1-15
Installing Oracle Database 11g release 1 (11.1) on a system to co-exist with Oracle9i release 9.2	Shut down a default listener on port 1521, if present, and shut down the Global Service Daemon. Refer to Installing Oracle 11g Database on a System with Oracle9i Database Release 2 on page 1-15

Installing Oracle Database 11g on a System with Oracle Database 10g

If your system has an Oracle Database 10g installation, and you install Oracle Database 11g release 1 (11.1) either to coexist with or to upgrade the Oracle Database 10g installation, then most installation types configure and start a default Oracle Net listener using TCP/IP port 1521 and the IPC key value `EXTPROC`. One of the following occurs:

- During a co-existing installation, Database Configuration Assistant (DBCA) automatically migrates the listener and related files from the Oracle Database 10g Oracle home to the Oracle Database 11g Oracle home.

- During an upgrade, Oracle Database Upgrade Assistant (DBUA) automatically locates the Oracle Database10g listener, and migrates it to Oracle Database 11g.

Installing Oracle 11g Database on a System with Oracle9i Database Release 2

Explanation of Tasks If you are installing an Oracle Database 11g release 1 (11.1) on a system with an existing Oracle9i Database release 2 (9.2), and the Oracle Net listener process is using the *same* port or key value as the default used with the Oracle Database 11g release 1 (11.1) installation, port 1521, then OUI can only configure the new listener; it cannot start it. To ensure that the new listener process starts during the installation, you must shut down any existing listeners before starting OUI. To do this, refer to ["Shutting Down the Listener"](#) on page 1-15

You must shut down the Global Services Daemon (GSD), because otherwise, during Oracle Database 11g installation, the Oracle Database 9i release 9.2 SRVM shared data is upgraded into an Oracle Cluster Registry that the 9.2 GSD will not be able to use. The 10.2 Oracle Clusterware installation starts an 11g release 1 (11.1) GSD to serve the Oracle9i 9.2 clients. To do this, refer to ["Shutting down the Global Services Daemon"](#) on page 1-16

Shutting Down the Listener To determine if an existing Oracle Database 9i listener process is running and to shut it down if necessary, follow these steps:

1. Switch user to oracle:

```
# su - oracle
```

2. Enter the following command to determine if an Oracle Database 9i listener process is running and to identify its name and the Oracle home directory in which it is installed:

```
$ ps -ef | grep tnslnsr
```

This command displays information about the Oracle Net listeners running on the system:

```
... oracle_home1/bin/tnslnsr LISTENER -inherit
```

In this example, *oracle_home1* is the Oracle home directory where the listener is installed and *LISTENER* is the listener name.

3. Set the ORACLE_HOME environment variable to specify the appropriate Oracle home directory for the listener:

- Bourne, Bash, or Korn shell:

```
$ ORACLE_HOME=oracle_home1
$ export ORACLE_HOME
```

- C or tcsh shell:

```
% setenv ORACLE_HOME oracle_home1
```

4. Enter the following command to identify the TCP/IP port number and IPC key value that the listener is using:

```
$ $ORACLE_HOME/bin/lsnrctl status listenername
```

Note: If the listener uses the default name *LISTENER*, then you do not have to specify the listener name in this command.

5. Enter a command similar to the following to stop the listener process:

```
$ $ORACLE_HOME/bin/lsnrctl stop listenername
```

6. Repeat this procedure to stop all listeners running on this system and on all other nodes in the cluster.

Shutting down the Global Services Daemon As the `oracle` user, on each node of the cluster, use the following syntax to shut down the GSD:

```
$ cd 92_Oracle_home  
$ bin/gsdctl stop
```

In the preceding syntax example, the variable *92_Oracle_home* is the Oracle Database 9i release 2 (9.2) home.

Installing Oracle Database 11g with Oracle Real Application Clusters

This chapter describes phase two of the installation procedures for installing Oracle Database 11g release 1 (11.1) with Oracle Real Application Clusters (Oracle RAC). Phase one is the completion of installing Oracle Clusterware, as described in *Oracle Database Oracle Clusterware Installation Guide* for your platform.

See Also: *Oracle Database Installation Guide* for your platform for additional information, such as how to open compressed files, and other information about setting up files for installation

Also, during installation, click **Help** to find explanations of options and prompts for each installation screen

This chapter contains the following topics:

- [Verifying System Readiness for Installing Oracle Database with CVU](#)
- [Reviewing Oracle Application Express Requirements](#)
- [Selecting a Configuration Option](#)
- [Automatic Storage Management Configuration](#)
- [Preparing for a Rolling Upgrade of Automatic Storage Management](#)
- [Oracle Database Vault Configuration](#)
- [Oracle Database Configuration Type Descriptions](#)
- [Oracle Configuration Manager Option](#)
- [Database Security Options](#)
- [Selecting Database Passwords](#)
- [Actions of OUI, DBCA, and Other Assistants During Installation](#)
- [Installing Oracle Database with Other Languages](#)
- [Selecting a Database Name](#)
- [Using Oracle Universal Installer to install Oracle RAC](#)

2.1 Verifying System Readiness for Installing Oracle Database with CVU

To help verify that your system is prepared to install Oracle Database with Oracle RAC successfully, enter a Cluster Verification Utility (CVU) command using the following command syntax:

```
/mountpoint/runcluvfy.sh stage -pre dbinst -n node_list [-r {10gR1|10gR2|11gR1}]  
[-osdba osdba_group] [-verbose]
```

In the preceding syntax example:

- The variable *mountpoint* is the mountpoint of the installation media.
- The variable *node_list* is the list of nodes in your cluster, separated by commas.
- The optional flag *-r* takes the options 10gR1 (test for an Oracle Database 10g release 1 Oracle Cluster Ready Services installation), 10gR2 (test for an Oracle Database 10g release 2 Oracle Clusterware installation), or 11gR1 (test for an Oracle Database 11g release 1 (11.1) installation). If the *-r* flag is missing, then by default, the command tests for Oracle Clusterware for Oracle Database 11g release 1 (11.1) installation.
- The variable *osdba_group* is the name of your OSDBA group, which by default is *dba*.

For example, to perform a pre-installation check for Oracle Database 11g release 1 (11.1) with Oracle RAC installation on a two-node cluster with the mountpoint */mnt/dvdrom*, and with nodes *node1* and *node2*, enter the following command:

```
$ /mnt/dvdrom/cluvfy/runcluvfy.sh stage -pre dbinst -n node1,node2 -verbose
```

Oracle recommends that you select the option *-verbose* to receive progress updates as the CVU performs its system checks. The *-verbose* option provides detailed test reporting, which you can use to identify the cause of any checks that fail.

If the cluster verification check fails, then your Oracle Clusterware installation is not functioning. Review and correct the relevant system configuration steps, and run the test again.

See Also: *Oracle Database Oracle Clusterware Installation Guide* for your platform

2.2 Reviewing Oracle Application Express Requirements

With the Oracle Database 11g release, Oracle Application Express is provided as an Oracle Database option, rather than as an Oracle Application option. If you intend to install Oracle Database after installing Oracle Clusterware, and you have an existing Oracle Database installation that you are upgrading, then review the following Oracle Application Express requirements:

- [Browser Requirements for Oracle Application Express](#)
- [Installing APEX with Existing Oracle HTML Server Installations](#)
- [Oracle Text Requirement for Oracle Application Express](#)
- [Oracle XML DB Requirement for Oracle Application Express](#)

2.2.1 Browser Requirements for Oracle Application Express

To view or develop Oracle Application Express applications, Web browsers must support Java Script, and the HTML 4.0 and CSS 1.0 standards. The following browsers meet this requirement:

- Mozilla 1.2 or a later version
- Firefox 1.0 or a later version

2.2.2 Installing APEX with Existing Oracle HTML Server Installations

Oracle Application Express must have access to Oracle HTTP Server and `mod_plsql` to run. The following products include the versions of HTTP Server and `mod_plsql` that meet this requirement:

- Oracle 9i Database release 2 (9.2) or a later version
- Oracle 9i Application Server release 1 (1.0.2.2) or a later version

2.2.3 Oracle Text Requirement for Oracle Application Express

Oracle Text must be installed so that you can use the searchable online Help in Oracle Application Express. By default, Oracle Text is installed as part of Oracle Database.

See Also: *Oracle Text Application Developer's Guide* for more information about Oracle Text

2.2.4 Oracle XML DB Requirement for Oracle Application Express

To upgrade an existing database to Oracle Database 11g release 1 (11.1), Oracle XML DB must be installed in the Oracle database that you want to upgrade. If you are using a preconfigured database created either during an installation or by Database Configuration Assistant (DBCA), then Oracle XML DB is already installed and configured.

See Also: *Oracle XML DB Developer's Guide* for more information about manually adding Oracle XML DB to an existing database

2.3 Selecting a Configuration Option

This section describes OUI features that you should understand before beginning phase two of the Oracle RAC installation process.

See Also: [Appendix C, "Converting to Oracle Real Application Clusters from Single-Instance Oracle Databases"](#) for information about how to convert single-instance databases to Oracle RAC

On the Select Configuration page, you are given the following options:

- **Create a database:** Provides you with the option to create a database using a preconfigured database template designed for particular system load demands, such as an online transaction processing (OLTP) database, or a decision support or data warehouse database.

If you select the Automatic Storage Management option for storage, then an ASM instance is installed as part of the database installation. The Oracle home is used for the ASM home when you install the database using this method. If you plan to use the ASM instance for multiple database homes, you should select the Configure Automatic Storage Management option to create a separate ASM home.
- **Configure Automatic Storage Management:** Installs an ASM instance only. You are prompted for the ASM SYS password.
- **Install database software only:** Installs Oracle Database software; you must complete database configuration later.

If you are installing Oracle Database software, then Oracle recommends that you use one of the preconfigured database options, or select the **Advanced** option on the Select Configuration page, and configure a custom starter database.

If you want to configure your environment and create your database manually, then select **Do not create a database** on the Select Configuration page, and refer to the manual database creation procedures posted at the following Web site:

<http://otn.oracle.com>

See Also: If you have an existing Oracle installation, then document version numbers, patches, and other configuration information, and review upgrade procedures for your existing installation. Review Oracle upgrade documentation before proceeding with installation, to decide how you want to proceed.

For late-breaking updates and best practices about preupgrade, post-upgrade, compatibility, and interoperability discussions, refer to "Oracle Upgrade Companion." "Oracle Upgrade Companion" is available through Note 466181.1 on Oracle*MetaLink*:

<https://metalink.oracle.com/>

2.4 Automatic Storage Management Configuration

If you want to use Automatic Storage Management, then select **Configure Automatic Storage Management (ASM)**, and provide information as prompted. Click **Help** if you need assistance.

Before you start Oracle Automatic Storage Management installation, ensure that you have the list of paths to the storage devices on which you want to configure ASM disk groups.

If you are installing ASM 11g release 1 (11.1) on a system with an existing ASM installation, you choose to upgrade the existing ASM installation, and you have running databases on that system, then you must stop ASM on those systems before you start the upgrade. To do this, enter the following command:

```
srvctl stop asm -n ASM_nodename
```

Note: You can have only one version of ASM installed and running on a cluster.

2.5 Preparing for a Rolling Upgrade of Automatic Storage Management

Starting with Oracle ASM 11g, you can perform rolling upgrades of ASM. This can be performed with 11.1 and later releases; it is not backward-compatible. To prepare for a rolling upgrade, perform a software-only installation of ASM on all nodes in the cluster.

Note the following if you intend to perform rolling upgrades of ASM:

- Either the release version of Oracle Clusterware must be equal to the ASM release to which you want to upgrade, or you must first upgrade Oracle Clusterware. For example, you can upgrade ASM release 11.1.0.6 to 11.1.0.7 if Oracle Clusterware on your system is release 11.1.0.7, but you cannot do this if Oracle Clusterware is 11.1.0.6 or an earlier release.
- On the nodes that you want to upgrade, you must shut down all applications and fail over those applications to other nodes when applicable, and you must shut

down all database instances using ASM on the nodes, or fail the instances over to other nodes when applicable.

- You must ensure that any rebalance operations on your existing ASM installation are completed.
- During the upgrade process, you alter the ASM instances to an upgrade state. Because this upgrade state limits ASM operations, you should complete the upgrades soon after you begin. The following are the operations allowed during ASM upgrade:
 - Diskgroup mounts and dismounts
 - Opening, closing, resizing, or deleting database files
 - Recovering instances
 - Queries of fixed views and packages: Users are allowed to query fixed views and run anonymous PL/SQL blocks using fixed packages, such as `dbms_diskgroup`)

See Also: *Oracle Database Upgrade Guide* and *Oracle Database Storage Administrator's Guide* for additional information about preparing an upgrade plan for ASM, and for starting, completing, and stopping ASM upgrades

2.6 Oracle Database Vault Configuration

You can install Oracle Database Vault using a Custom installation. Review the following information if you want to install Oracle Database Vault:

- [Oracle Database Vault Requirements](#)
- [Oracle Database Vault Accounts](#)
- [Multiple Oracle Database Vault Homes](#)
- [Starting the Listener with Oracle Database Vault Installations](#)
- [Installing Oracle Database Vault](#)

2.6.1 Oracle Database Vault Requirements

Oracle Database Vault requires the following:

- An Oracle Database Enterprise Edition installation (single-instance or Oracle RAC)
- Oracle Enterprise Manager Console.
- If performing a Custom installation, then the Custom template needs to be selected when configuring the database with Oracle Database Vault.
- Oracle Clusterware running (for installation in an Oracle RAC environment)

Note: You must have `root` access if you need to start up Oracle Clusterware.

The command `crsctl start crs` also starts the database. Before you start OUI to install Oracle Database Vault, shut down the database.

See Also: ["Stopping Oracle Database Processes Before Adding Products or Upgrading"](#) on page E-2

- A listener configured for the database into which you are installing Oracle Database Vault. To ensure that the new listener process starts during the installation, you must shut down existing listeners before starting Oracle Universal Installer.
- Oracle Database Vault installation owner write access to the Oratab file (`/etc/oratab`) and to the oraInst.loc file (`/etc/oraInst.loc`). This access is provided either by using the same installation owner as you use with the Oracle Database installation, or another user with `oinstall` group membership.
- An existing password file for the Oracle Database. In addition, the password file authentication parameter, `REMOTE_LOGIN_PASSWORDFILE`, must have been set to `EXCLUSIVE` or `SHARED`.

You can set the `REMOTE_LOGIN_PASSWORDFILE` parameter in the `init.ora` file. Use the `orapwd` utility to create and manage password files.

See Also: *Oracle Database Administrator's Guide* for more information on creating and maintaining a password file

2.6.2 Oracle Database Vault Accounts

Oracle Database Vault prompts for two accounts that you can create during installation. These are the Oracle Database Vault Owner and the Oracle Database Vault Account Manager accounts. You must supply an account name and password for the Oracle Database Vault Owner during installation. Creating an Oracle Database Vault Account Manager is optional.

2.6.2.1 Oracle Database Vault Owner

The Oracle Database Vault Owner account is granted the `DV_OWNER` role. This account can manage Oracle Database Vault roles and configuration.

The Oracle Database Vault Owner user name can be a minimum of 2, and a maximum of 30 characters long. The account password can be a minimum of 8, and a maximum of 30 characters.

The password that you choose for the Oracle Database Vault Owner account must be a secure one. The following password restrictions are enforced:

- The password must include at least one alphabet, one digit, and one nonalphanumeric character (symbol).
- The password cannot be the same as the account name.
- The password cannot contain any consecutive repeating characters.

2.6.2.2 Oracle Database Vault Account Manager

The Oracle Database Vault Account Manager is granted the `DV_ACCTMGR` role. This account is used to manage database user accounts. The Oracle Database Vault Account Manager is created to facilitate separation of duties. If you do not choose to create the Oracle Database Vault Account Manager account, then the `DV_ACCTMGR` role is granted to the Oracle Database Vault Owner account by default.

The Oracle Database Vault Account Manager user name can be a minimum of 2, and a maximum of 30 characters long. The account password can be a minimum of 8, and a maximum of 30 characters.

The same password restrictions that apply to Oracle Database Vault Owner are applicable to Oracle Database Vault Account Manager as well.

2.6.3 Multiple Oracle Database Vault Homes

You can install Oracle Database Vault more than once on the same system, in different Oracle homes.

2.6.4 Starting the Listener with Oracle Database Vault Installations

You need to start the listener and database on all Oracle RAC nodes other than the one on which the installation is performed. You must use the Server Control (srvctl) utility to start and stop Oracle Database Vault Oracle RAC instances. Do not use SQL*Plus to start and stop Oracle RAC instances.

For example:

```
$ORACLE_HOME/bin/lsnrctl start listener_name
$ORACLE_HOME/bin/srvctl start instance -d database_name -i instance_name
```

2.6.5 Installing Oracle Database Vault

You can install Oracle Database Vault with a Custom installation, either when you install Oracle RAC, or after you install Oracle RAC.

2.6.5.1 Installing Oracle Database Vault During Oracle RAC Installation

To install Oracle Database Vault while installing Oracle RAC:

1. Start Oracle Universal Installer, and select Custom installation.
2. In addition to the default installation components, select Oracle Label Security (OLS) and Oracle Database Vault.
3. Provide the required administrative user accounts and passwords, and proceed with installation.

2.6.5.2 Installing Oracle Database Vault After Oracle RAC Installation

To install Oracle Database Vault after installing Oracle RAC:

1. Install the Oracle RAC Enterprise Edition database.
2. Stop all database processes
3. Start Oracle Universal Installer, and select Custom installation.
4. Select Oracle Label Security (OLS) and Oracle Database Vault, and install.
5. Start the Oracle RAC database.
6. Start DBCA, and select the option Configure Database
7. In the component list, select Oracle Label Security and Oracle Database Vault
8. Provide the required administrative user accounts and passwords, and proceed with configuration.

2.7 Oracle Database Configuration Type Descriptions

When you run OUI, you can select the **General Purpose**, **Transaction Processing**, **Data Warehouse**, or **Advanced** database configuration type.

For the first three configuration types, you can complete additional procedures that are described later in this chapter. If you select Advanced configuration, then you can use Database Configuration Assistant (DBCA) to create the database as described in [Chapter 3](#). Oracle recommends that you use DBCA to create your database.

2.7.1 General Purpose, Transaction Processing, and Data Warehouse Configuration Types

The General Purpose, Transaction Processing, and Data Warehouse configuration types use preconfigured database templates.

During installation, if you select one of the preconfigured database templates, then OUI starts Oracle Network Configuration Assistant (NETCA) and DBCA, and installs the preconfigured database without further input. During database installation, OUI displays a progress indicator.

DBCA processing for these three configuration types creates a starter database, and configures the Oracle network services. If you choose raw devices on the Specify Database File Storage Option page, then DBCA verifies that you configured the raw devices for each tablespace.

If you select Advanced configuration, then you must enter specific information as described in the next section.

2.7.2 Using the Advanced Configuration Type

If you select the Advanced configuration type, then OUI runs DBCA, which displays General Purpose, Transaction Processing, Data Warehouse, and a fourth configuration type, Custom Database.

Use the Advanced Configuration type to address specific requirements, such as creating a database in a nondefault character set, or adding translation of product user interface into languages other than English. By default, the installation configures the character set of a new database based on the language of the operating system.

See Also: *Oracle Database Globalization Support Guide* for detailed information on character sets and language configuration

The first three templates are customizable versions of the preconfigured database types. The Custom Database type creates a database without using preconfigured options.

The following section provides more detail about OUI and DBCA processing when creating an Oracle RAC database.

See Also: *Oracle Database Installation Guide* for your platform for information about configuring globalization

2.8 Oracle Configuration Manager Option

During installation, you are prompted to provide information needed to enable Oracle Configuration Manager. This option enables you to associate information about your Oracle RAC configuration with your *OracleMetaLink* account. In the event that you need to place a service request with Oracle Support, that configuration information can help to provide a more rapid resolution to the service issue.

You can enable Oracle Configuration Manager during or after installation, or choose not to enable it. To enable it during installation, you must have the following information available:

- Customer Support Identification Number (CSI) that identifies your organization
- Oracle*Metalink* user account name
- Country code associated with your service agreement

Refer to Oracle*Metalink* (<https://metalink.oracle.com>) if you encounter registration failures and are uncertain that the correct country code has been specified. You can find the country associated with your Oracle*MetaLink* account in the **Profile** section under the **Licenses** link.

See Also: *Oracle Configuration Manager Installation and Administration Guide* for further information

2.9 Database Security Options

During installation, you are prompted to select database security configuration. The **Secure Configuration** option configures the database with database auditing options, and password policy and expiration settings.

For new database installations, the default configuration for Oracle Database 11g release 1 (11.1) includes the **Secure Configuration** option. If you want to disable these enhanced security controls, then you can check the **Disable security settings** box. Oracle Database is then installed with default options for Oracle Database 10g release 2. After installation, you can change security settings by starting DBCA and modifying security settings. You can enable or disable auditing or password security settings, or revert to a previous security setting.

For database upgrades, the upgraded database retains your existing database security configuration, to ensure compatibility with existing applications. After installation, you can use DBCA to enable or disable the **Secure Configuration** auditing or password security settings for testing.

Note: Oracle strongly recommends configuring your database with the **Secure Configuration** option either during installation, or after installation using DBCA.

2.10 Selecting Database Passwords

Apply the following guidelines when specifying passwords:

- Passwords must be between 8 and 30 characters long.
- Passwords must be from the ASCII character set.
- Passwords must not start with a numeral.
- Passwords must not be the same as the user name.
- Passwords must not be Oracle reserved words.
- The SYS account password must not be `change_on_install`.
- The SYSTEM account password must not be `manager`.
- The SYSMAN account password must not be `sysman`.
- The DBSNMP account password must not be `dbsnmp`.

- If you choose to use the same password for all the accounts, then that password must not be `change_on_install`, `manager`, `sysman`, or `dbstmp`.
- Passwords should have at least 1 alphabetic, 1 numeric, and 1 punctuation mark character
- Passwords should not be simple or obvious words, such as `welcome`, `account`, `database`, and `user`.

2.11 Actions of OUI, DBCA, and Other Assistants During Installation

After installation, OUI starts the Network Configuration Assistant (NETCA). After NETCA completes its processing, OUI runs DBCA to create your database, in accordance with Optimal Flexible Architecture (OFA) guidelines. An installation created following OFA guidelines means that DBCA creates your database files, including the default server parameter file (SPFILE), using standard file naming and file placement practices.

The primary phases of DBCA processing are the following:

- Create the database.
- Configure the Oracle network services, if necessary.
- Start the listeners and database instances.

You can also use DBCA in standalone mode to create or delete a database or ASM installation, or to switch database management from Oracle Enterprise Manager Database Control to Oracle Enterprise Manager Grid Control.

Note that with Oracle Database release 11.1, service management is no longer performed for Oracle RAC databases. Use Oracle Enterprise Manager DB Control or Grid Control for all administration and monitoring of services.

See Also: *Oracle Database Net Services Administrator's Guide* if you experience problems (for example, with the listener configuration), and for further information about Lightweight Directory Access Protocol (LDAP) support

In Oracle Database 10g and later releases, some database language and territory definition files have been updated to better reflect locale conventions used in associated locales.

If the resulting changes in default NLS parameter values break your existing applications, you can revert the changes by installing Oracle9i compatibility definition files. To install Oracle9i files in place of Oracle11g files, you must run OUI from a command line, as described in "[Using Oracle Universal Installer to install Oracle RAC](#)" on page 2-11, and use the following statement to set the `b_cr9idata` variable to `true`:

```
runInstaller oracle.rsfnlsrtl_rsf:b_cr9idata=true
```

See Also: *Oracle Database Globalization Support Guide* for additional information about updates to the Oracle Database language and territory definition files

2.12 Installing Oracle Database with Other Languages

If you want to use languages other than the default (English), either for the database or for applications running on the database, then you must use the Custom Installation method.

See Also: *Oracle Database Globalization Support Guide*

2.13 Selecting a Database Name

The global database name can be up to 30 characters in length, and must begin with an alphabetic character. The domain portion of the global database name can be no more than 128 characters and can contain only alphabetic and numeric characters, as well as the period (.) character.

The SID prefix must begin with an alphabetic character.

2.14 Using Oracle Universal Installer to install Oracle RAC

Perform the following procedures to install the Oracle Database software with Oracle RAC:

1. Ensure that you can access other nodes with SSH. If you are prompted for a pass phrase, then obtain it from the system administrator.

If it is required, then the pass phrase provides credentials to set up Secure Shell (SSH). OUI requires secure shell keys to be loaded for the terminal session from which OUI runs.
2. Open the terminal from which you intend to run OUI, log in as the oracle user (the user account that you want to own the Oracle Database software installation), and enter the following commands:

```
$ exec /usr/bin/ssh-agent $SHELL
$ /usr/bin/ssh-add
```

If your system has been configured to require a pass phrase, then enter the pass phrase for each key when prompted.

For example:

```
[rac@node1 .ssh]$ exec /usr/bin/ssh-agent $SHELL
[rac@node1 .ssh]$ ssh-add
Enter passphrase for /home/crs/.ssh/id_rsa
Identity added: /home/oracle/.ssh/id_rsa (/home/crs/.ssh/id_rsa)
Identity added: /home/oracle/.ssh/id_dsa (/home/crs/.ssh/id_dsa)
```

These commands start the ssh-agent on the node, and load the SSH RSA and DSA keys into memory.

3. Ensure that you have su or sudo credentials, as you will be prompted to run a script as the root user during installation.
4. Start the runInstaller command from the Disk1 directory of the Oracle Database 11g release 1 (11.1) installation media. When OUI displays the Welcome page, click **Next**.
5. Provide information or run scripts as root when prompted by OUI. If you need assistance during installation, click **Help**. If you encounter problems during installation, then examine the OUI actions recorded in the installation log file. The log file is located in the Oracle Inventory directory in the following location:

`OraInventory/logs/installActionsdate_time.log`

Note: The Oracle home name and path that you provide during database installation *must be different* from the home that you used during the Oracle Clusterware installation in phase one. You *must not* install Oracle Database 11g with Oracle RAC software into the same home in which you installed the Oracle Clusterware software.

If you are upgrading, then you must use the same type of Oracle home. For example, you should not change from local Oracle homes to a shared Oracle home.

The following is a list of additional information to note about installation:

- If you are installing on Linux systems, you are using the ASM library driver (ASMLIB), and you select Automatic Storage Management (ASM) during installation, then ASM default discovery finds all disks that ASMLIB marks as ASM disks.
- If you are installing on Linux systems, you are not using ASMLIB, and you select ASM during installation, then ASM default discovery finds all disks marked `/dev/raw/*` for which the `oracle` account has read/write permission. You can change the disk discovery string during the install if the disks you want to use for ASM are located elsewhere.

If you are installing Oracle RAC from the Standard Edition, then you must use ASM for your database storage.

On the Select Database Management Option page, if you have already completed the Grid Control Management Agent installation, then you can select either Grid or Local Database control. Otherwise, only Local Database control for database management is supported for Oracle RAC. When you use the local Database Control, you can choose the e-mail option and enter the outgoing SMTP server name and e-mail address.

If you perform an installation that does not include Oracle Enterprise Manager (for example, a custom software install without Oracle Enterprise Manager, an installation with no Oracle Enterprise Manager configuration, or a database creation with your own scripts), then you can configure Oracle Enterprise Manager later with OUI, DBCA, or the Oracle Enterprise Manager Configuration Assistant (EMCA) utility.

When you have completed the second and final phase of the installation, proceed to [Chapter 4, "Oracle Real Application Clusters Postinstallation Procedures"](#) to perform the postinstallation tasks.

Caution: After installation is completed and you have created the database, if you decide that you want to install additional Oracle Database 11g release 1 (11.1) products in the database, then you must stop *all* processes running in the Oracle home before you attempt to install the additional products. For the Oracle Universal Installer to relink certain executables and libraries, all database processes must be down. Refer to [Appendix E, "How to Stop Processes in an Existing Oracle Real Application Clusters Database"](#) for additional information.

Creating Oracle Real Application Clusters Databases with Database Configuration Assistant

This chapter describes how to use Database Configuration Assistant (DBCA) in standalone mode to create and delete Oracle Real Application Clusters (Oracle RAC) databases. The topics in this chapter include the following:

- [Using Database Configuration Assistant with Oracle RAC](#)
- [Benefits of Using Database Configuration Assistant](#)
- [Automatic Listener Migration from Earlier Releases](#)
- [Verifying Requirements for DBCA](#)
- [Creating an Oracle RAC Database with DBCA](#)
- [Deleting an Oracle RAC Database with DBCA](#)

See Also: *Oracle Real Application Clusters Administration and Deployment Guide* for procedures on using DBCA to add and delete instances

3.1 Using Database Configuration Assistant with Oracle RAC

DBCA has the following primary database functions:

- Create and delete the database
- Add and delete database instances
- Set up network configuration for the database and its instances
- Register the database in Oracle Enterprise Manager Grid Control or configure Database Control
- Start up the database and its instances

Note: Cluster Managed Services are no longer managed through DBCA. Instead, use the cluster managed services page in Oracle Enterprise Manager DB Control (accessible from the Cluster Database Availability Page). For more information, refer to *Oracle Real Application Clusters Administration and Deployment Guide*.

In addition DBCA has the following primary ASM functions:

- Configure and delete Automatic Storage Management (ASM)
- Provide an ASM instance for an Oracle Database node that is added to an existing Oracle RAC database that uses ASM, if ASM is not already configured on the node that is added to the Oracle RAC database
- Automatically extend an ASM instance on any node where you attempt to perform any ASM configuration operations (such as mount) on a node where ASM is not already configured

See Also:

- ["Creating an Oracle RAC Database with DBCA"](#) on page 3-3 for more information about using DBCA in standalone mode
- *Oracle Database Net Services Administrator's Guide* to resolve problems—for example, with the listener configuration—and for further information about Lightweight Directory Access Protocol (LDAP)-compliant directory support

3.2 Benefits of Using Database Configuration Assistant

Oracle recommends that you use DBCA to create your Oracle RAC database, because preconfigured databases optimize your environment for features such as Automatic Storage Management (ASM), the server parameter file (SPFILE), and automatic undo management. DBCA also provides pages to create new ASM disk groups if they are needed. If you use ASM or cluster file system storage, then DBCA also configures automated backup, which uses the Fast recovery area.

With DBCA, you can create site-specific tablespaces as part of database creation. If you have data file requirements that differ from those offered by DBCA templates, then create your database with DBCA and modify the data files later. You can also run user-specified scripts as part of your database creation process.

DBCA also configures your Oracle RAC environment for various Oracle high availability features, such as cluster administration tools. It also starts any database instances required to support your defined configuration.

3.3 Automatic Listener Migration from Earlier Releases

If your system has an Oracle Database 10g (10.1) installation, and you install Oracle Database 11g release 1 (11.1) either to coexist with or to upgrade the Oracle Database 10.1 or 10.2 installation, then most installation types automatically migrate the Oracle Database 10.1 listener to the 11g release 1 (11.1) Oracle home. During migration, they configure and start a default Oracle Net listener using the same TCP/IP port as the existing listener, with the IPC key value `EXTPROC`. This process occurs through one of the following scenarios:

- During a coexisting installation, DBCA automatically migrates the listener and related files from the Oracle Database 10.1 or 10.2 Oracle home to the Oracle Database 11g Oracle home.
- During an upgrade, Oracle Database Upgrade Assistant (DBUA) automatically locates the Oracle 10g release 1 (10.1) or release 2 (10.2) listener, and migrates it to Oracle 11g release 1 (11.1).

The listener migration process stops the listener in the existing Oracle home, and restarts the listener from the new Oracle home. During migration, client applications

may not be able to connect to any databases that are registered to the listener that is being migrated.

3.4 Verifying Requirements for DBCA

To help to verify that your system is prepared to create Oracle Database with Oracle RAC successfully, enter a Cluster Verification Utility (CVU) command using the following command syntax:

```
/CRS_home/bin/cluvfy.sh stage -pre dbcfg -n node_list -d Oracle_home [-verbose]
```

In the preceding syntax example, the variable *CRS_home* is the Oracle Clusterware home, the variable *node_list* is the list of nodes in your cluster, separated by commas, and the variable *Oracle_home* is the path for the Oracle home directory where OUI creates or modifies the database.

For example, to perform a check to determine if your system is prepared for an Oracle Database with Oracle RAC installation on a two-node cluster with nodes *node1* and *node2*, with the CRS home path */u01/app/crs/*, and with the Oracle home path */u01/app/oracle/product/11.1/db1*, enter the following command:

```
$ /u01/app/crs/bin/cluvfy stage -pre dbcfg -n node1,node2 -d\  
/u01/app/oracle/product/11.1/db1
```

You can select the option *-verbose* to receive progress updates as the CVU performs its system checks, and detailed reporting of the test results.

If the CVU summary indicates that the cluster verification check fails, then review and correct the relevant system configuration steps, and run the test again.

The command *cluvfy.sh stage -pre dbcfg* verifies the following:

- Node Reachability: All the specified nodes are reachable from the local node.
- User Equivalence: User equivalence exists on all the specified nodes.
- Node Connectivity: Connectivity exists between all the specified nodes through the available public and private network interfaces.
- Administrative Privileges: The *oracle* user has proper administrative privileges on the specified nodes for creating an Oracle RAC database.
- Oracle Clusterware Integrity: All the components of the Oracle Clusterware stack are fully operational.

3.5 Creating an Oracle RAC Database with DBCA

To create a database with DBCA in standalone mode without ASM or a cluster file system, you must have configured shared storage devices. In addition, you must have run the Oracle Net Configuration Assistant (NETCA) to configure your Oracle Net *listener.ora* file.

If you select DBCA templates that use preconfigured data files and if you do not use ASM or a cluster file system, then during database creation, DBCA first verifies that you created shared storage devices for each tablespace. If you have not configured the shared storage devices, then you must configure the devices and replace the default data file names that DBCA provides with the device names on the DBCA Storage page to continue database creation.

To start DBCA, connect as the `oracle` user to one of your nodes where Oracle RAC is installed, load SSH keys into memory, and enter the command `dbca` command from the `$ORACLE_HOME/bin` directory.

Note: In an Oracle RAC environment, you must load SSH keys into memory for the terminal session where you start DBCA. If you do not do this, then you receive user equivalency errors when you attempt to start DBCA. If you use a pass phrase on your system for SSH, then you must provide the pass phrase to load the SSH keys.

Use the following commands to load SSH keys:

```
$ exec /usr/bin/ssh-agent $SHELL
$ /usr/bin/ssh-add
```

Provide the pass phrase when prompted. You can then start DBCA.

When you start DBCA, the first page it displays is the Welcome page for Oracle RAC, which includes the option to select an Oracle RAC database. DBCA displays this Oracle RAC Welcome page only if the Oracle home from which it is started was installed on a cluster.

If the Oracle RAC Welcome page opens, then provide information as prompted by DBCA. Click **Help** if you need assistance.

If DBCA does not display the Welcome page for Oracle RAC, then DBCA was unable to detect if the Oracle home is installed on a cluster. In this case, check that the OUI inventory is correctly located in the directory `/etc/oraInst.loc`, and that the `oraInventory` file is not corrupted. Also, perform clusterware diagnostics by using the following CVU command syntax:

```
/CRS_home/bin/cluvfy/runcluvfy.sh stage -post crsinst -n nodelist.
```

For example, with the mountpoint `/u01/app/crs`, and nodes `node1` and `node2`, run the following command:

```
$ /u01/app/crs/bin/cluvfy.sh stage -post crsinst -n node1,node2
```

Note the following important information when using DBCA:

- If nodes that are part of your cluster installation do not appear on the Node Selection page, then run `Opatch lsinventory` to perform inventory diagnostics and `CVU` to perform clusterware diagnostics.
- The global database name can be up to 30 characters in length, and must begin with an alphabetic character. The domain portion of the global database name can be no more than 128 characters and can contain only alphabetic and numeric characters, as well as the period (.) character.
- The `SID` prefix must begin with an alphabetic character.
- The maximum number of characters you can use for the `SID` prefix is 8 characters. DBCA uses the `SID` prefix to generate a unique value for the variable `ORACLE_SID` for each instance.
- On the Management Options page, you are provided with selections for Oracle Enterprise Manager monitoring and management interfaces.

Database Control is always an option. If DBCA discovers Grid Control agents on the cluster, then it also provides you with the option **Enterprise Manager with the Grid Control**. Choose between Database Control and Grid Control interfaces.

You can set up e-mail notification and enable daily backup operations. For e-mail notifications, you provide the outgoing mail server and e-mail address. For daily backups, you enter the backup time and operating system credentials for the user that performs backup operations.

- To use a Fast recovery area, Oracle recommends that you create at least two separate ASM disk groups: one for the database area and one for the recovery area. Oracle recommends that you place the database area and the recovery area in separate failure groups.

A failure group is defined by shared hardware, such as a controller shared between two disks, or two disks that are on the same spindle. If two disks share hardware that could fail, making both disks unavailable, then these disks are said to be in the same failure group.

If you do not use ASM, then Oracle recommends that the data files and the Fast Recovery area are located outside of the Oracle home, in separate locations, as with separate ASM failure groups, so that a hardware failure does not affect availability.

See Also: *Oracle Database Concepts* for more information about using a Fast recovery area, and *Oracle Database Storage Administrator's Guide* for information about failure groups and best practices for high availability and recovery

- On the ASM Disk Groups page, if you do not see the disks that you want to add, then click **Change Disk Discovery Path** to alter the search path used by DBCA to find available disks. You can select disks with a status of `Candidate` or `Former` (never used in an ASM disk group or no longer in a group) by selecting the box. If you want to add disks that still have ASM disk headers, but the disk group is no longer in use (a case that can occur if you are selecting disks after an aborted install, you attempted deinstallation without dropping the disk group, or other configuration problems), then use the `Force` command.
- If DBCA displays the following message:

The file `oracle_home/bin/oracle` does not exist on node `node_name`.
Make sure that file exists on these nodes before proceeding.

This message means that the Oracle home from which the first ASM instance in the cluster runs is not installed on these cluster nodes. You must extend the ASM Oracle home to these nodes by performing the procedure documented in "Step 4: Adding Nodes at the Oracle RAC Database Layer" in the *Oracle Real Application Clusters Administration and Deployment Guide*. However, do not perform Step 5 in that section. OUI extends the ASM Oracle home to the selected nodes and performs any configuration required for running an ASM instance on these nodes.

- If DBCA displays the following message:

Please run the DBCA from one of the nodes that has an existing ASM instance `node_list`.

This message means that you are attempting to create an Oracle RAC database using ASM storage, but the ASM instance does not exist on the node from which you ran DBCA. However, ASM instances do exist on the remote nodes that appear in the message node list. In this case, DBCA cannot clone the existing ASM

instance from the remote node to the local node. To correct this, start DBCA from one of the nodes shown in the node list to create your Oracle RAC database using ASM storage. This copies the local node's ASM instance and modifies its parameters and attributes to create ASM instances on the nodes in your cluster that do not have ASM instances.

- On the Recovery Configuration page, if you are using ASM or cluster file system storage, then you can also select the Fast recovery area and size on the Recovery Configuration page. If you are using ASM, then the Fast recovery area defaults to the ASM Disk Group. If you are using OCFS2, then the Fast recovery area defaults to `$ORACLE_BASE/Fast_recovery_area`.
- On the Initialization Parameters page, if you are installing on a Linux system, note that **Memory Size (SGA and PGA)**, which sets the initialization parameter `MEMORY_TARGET` or `MEMORY_MAX_TARGET`, cannot be greater than the shared memory filesystem (`/dev/shm`) on your operating system.

For example, if the shared memory filesystem allocation on your system is 1 GB, but you set Memory Size (`MEMORY_TARGET`) to 2 GB, then you receive the following error during database startup:

```
ORA-00845: MEMORY_TARGET not supported on this system
ORA-01078: Failure in processing system parameters
```

This issue is not relevant for other platforms.

For all platforms, if you intend to add more nodes in your cluster than you have during the current DBCA session, then click **All Initialization Parameters**, and change the parameter `CLUSTER_DATABASE_INSTANCES` to the number of nodes that you will add to the cluster.

In addition, if you click **All Initialization Parameters**, note that if your global database name is longer than 8 characters, then the database name value (in the `DB_NAME` parameter) is truncated to the first 8 characters, and the `DB_UNIQUE_NAME` parameter value is set to the global name.

See Also: *Oracle Database Administrator's Reference* for information about initialization parameters

After you respond to DBCA prompts, review the Summary dialog information and click **OK**, DBCA does the following:

- Creates an operative Oracle RAC database and its instances
- Creates the Oracle RAC data dictionary views
- Configures the network for the cluster database
- Migrates previous release Oracle Database listeners and related files to the Oracle Database 11g Oracle home
- Starts the listeners and database instances, and then starts the high availability services
- Configures Oracle Enterprise Manager Database Control or Grid Control

Caution: After you have created the database, if you decide that you want to install additional Oracle Database products in the database you have created, then you must stop *all* processes running in the Oracle home before you attempt to install the additional products, so that Oracle Universal Installer can relink certain executables and libraries. Refer to [Appendix E, "How to Stop Processes in an Existing Oracle Real Application Clusters Database"](#) for additional information.

3.6 Deleting an Oracle RAC Database with DBCA

This section explains how to delete an Oracle RAC database with DBCA. This process deletes a database and removes a database's initialization parameter files, instances, OFA structure, and an Oracle network configuration. However, this process does not remove data files if you placed the files on raw devices or on raw partitions.

To delete a database with DBCA:

1. Start DBCA on one of the nodes:.
 - Run the DBCA command from the `$ORACLE_HOME/bin` directory.

The DBCA Welcome page appears.
2. Select **Oracle Real Application Clusters**, and click **Next**.
After you click **Next**, DBCA displays the Operations page.
3. Select **Delete a database**, and click **Next**. DBCA displays the List of Cluster Databases page.
4. If your user ID and password are not operating-system authenticated, then the List of Cluster Databases page displays the user name and password fields. If these fields appear, then enter a user ID and password for a user account that has SYSDBA privileges.
5. Select the database to delete, and click **Finish**.
After you click **Finish**, DBCA displays a dialog box to confirm the database and instances that DBCA is going to delete.
6. Click **OK** to begin the deletion of the database and its associated files, services, and environment settings, or click **Cancel** to stop the operation.

When you click **OK**, DBCA continues the operation and deletes all the associated instances for this database. DBCA also removes the parameter files, password files, and `oratab` entries.

At this point, you have accomplished the following:

- Deleted the selected database from the cluster
- Deleted high availability services that were assigned to the database
- Deleted the Oracle Net configuration for the database
- Deconfigures Database Control
- Deleted the OFA directory structure from the cluster
- Deleted the data files if the data files were not on raw devices

Oracle Real Application Clusters Postinstallation Procedures

This chapter describes how to complete the postinstallation tasks after you have installed the Oracle Database 11g release 1 (11.1) with Oracle Real Application Clusters (Oracle RAC) software.

This chapter contains the following topics:

- [Required Postinstallation Tasks](#)
- [Recommended Postinstallation Tasks](#)
- [Oracle Configuration Manager Postinstallation Configuration for Oracle RAC](#)
- [Oracle Database Vault Postinstallation with DVCA for Oracle RAC](#)
- [Upgrading 10.2.0.3 Databases with Oracle Database Vault to Oracle Database 11g](#)

Note: This chapter describes only basic configurations. Refer to *Oracle Database 11g Administrator's Guide for UNIX Systems*, and the product administration and tuning guides for more detailed configuration and tuning information. Refer also to *Oracle Database Installation Guide* for your platform, for additional postinstallation configuration information.

4.1 Required Postinstallation Tasks

You must perform the following tasks after completing your installation:

- [Download and Install Patch Updates](#)
- [Configure Oracle Products](#)
- [Relocate Instance-related Memory-mapped files from OCFS2 Using Symbolic Links](#)

4.1.1 Download and Install Patch Updates

Refer to the *OracleMetaLink* Web site for required patch updates for your installation. To download required patch updates:

1. Use a Web browser to view the *OracleMetaLink* Web site:

<https://metalink.oracle.com>

2. Log in to *OracleMetaLink*.

Note: If you are not an Oracle*MetaLink* registered user, then click **Register for MetaLink** and register.

3. On the main Oracle*MetaLink* page, click **Patches & Updates**.
4. In the Patches section, click **Simple Search**.
5. Specify the following information, then click Go:
 - In the **Search By** field, select **Product or Family**, and then specify RDBMS Server.
 - In the **Release** field, specify the current release number.
 - In the **Patch Type** field, specify Patchset/Minipack.
 - In the **Platform or Language** field, select your platform.
6. In the Results list, find the latest patch set for Oracle Database.

Patch sets for Oracle databases are identified in the Description column as Patchset *x.x.x.x* PATCH SET FOR ORACLE DATABASE SERVER.
7. In the Patch column, click the number of the patch that you want to download.
8. On the Patch Set page, click **View README** and read the page that appears. The README page contains information about the patch set and how to apply the patches to your installation.
9. Return to the Patch Set page, click **Download**, and save the file on your system.
10. Use the unzip utility provided with Oracle Database 11g release 1 (11.1) to uncompress the Oracle patch updates that you downloaded from Oracle*MetaLink*. The unzip utility is located in the \$ORACLE_HOME/bin directory.

4.1.2 Configure Oracle Products

Many Oracle products and options must be configured before you use them for the first time. Before using individual Oracle Database 11g release 1 (11.1) database products or options, refer to the manual in the product documentation library which is available in the DOC directory on the Oracle Database installation media, or on the OTN Web site.

4.1.3 Relocate Instance-related Memory-mapped files from OCFS2 Using Symbolic Links

If you install Oracle RAC on a standard local file system, then this section does not concern you.

If your Oracle Clusterware installation is created on OCFS2, then you must relocate the healthcheck files (hc_*.dat), that typically reside in \$ORACLE_HOME/dbs, to a local file system, and create symbolic links to it from the original path. This is required as OCFS2 version 1.2 for Linux does not support shared writable mmap access that the Oracle software uses to manipulate these files.

To relocate the files:

1. Stop the Oracle Database instance.
2. Move the \$ORACLE_HOME/dbs/hc_*.dat files to a directory on a local file system.

3. Create symbolic links from the `$ORACLE_HOME/dbs` directory to the `hc_*.dat` files on the local file system.
4. Restart the Oracle Database instance

4.2 Recommended Postinstallation Tasks

This section explains the tasks that Oracle recommends you perform after completing an installation.

- [Recommended Database Postinstallation Tasks](#)
- [Logging in to Oracle Enterprise Manager Database Control](#)

4.2.1 Recommended Database Postinstallation Tasks

Oracle recommends that you complete the following tasks after installing Oracle RAC:

- [Back Up the root.sh Script](#)
- [Set the Oracle User Environment Variables](#)
- [Recompile all PL/SQL modules](#)
- [Set Up User Accounts](#)

4.2.1.1 Back Up the root.sh Script

Oracle recommends that you back up the `root.sh` script after you complete an installation. If you install other products in the same Oracle home directory, then the Oracle Universal Installer (OUI) updates the contents of the existing `root.sh` script during the installation. If you require information contained in the original `root.sh` script, then you can recover it from the `root.sh` file copy.

4.2.1.2 Set the Oracle User Environment Variables

On each node, in the oracle user profile file, set the environment variables `ORACLE_BASE` and `ORACLE_HOME`, and `ORACLE_SID`; also add `ORACLE_HOME/bin` to the path file.

For example:

```
export ORACLE_BASE=/u01/app/oracle
export ORACLE_HOME=/u01/app/oracle/11.1.0/db_1
PATH=$PATH:$ORACLE_HOME/bin
export ORACLE_SID=sales1
```

If the environment variables `ORACLE_HOME` and `ORACLE_SID` are not set, and you try to use SQL*Plus or other tools, then you receive an error message requesting that you set these variables.

4.2.1.3 Recompile all PL/SQL modules

Oracle recommends that you run the `utlrp.sql` script after creating or upgrading a database. This script recompiles all PL/SQL modules that might be in an invalid state, including packages, procedures, and types. This is an optional step but Oracle recommends that you do it during installation and not at a later date.

1. Complete setting up the oracle user environment, as described in "[Set the Oracle User Environment Variables](#)" in the preceding section.
2. Start SQL*Plus, as follows:

```
$ sqlplus "/ AS SYSDBA"
```

3. Run the `utlrp.sql` script:

```
SQL> @?/rdbms/admin/utlrp.sql
```

4.2.1.4 Set Up User Accounts

For information about setting up additional optional user accounts, refer to *Oracle Database 11g Administrator's Guide for UNIX Systems*.

When you complete these procedures, you are ready to perform the initial configuration tasks described in [Chapter 6, "Configuring the Server Parameter File in Oracle Real Application Clusters Environments"](#).

4.2.2 Logging in to Oracle Enterprise Manager Database Control

If you configure Oracle Enterprise Manager Database Control during installation, then you can use it to manage your database. Alternatively, you can use Oracle Enterprise Manager Grid Control to manage your database.

To use Database Control, you must access it on the node where you installed the database. If you want to log in to Database Control from another cluster node, then you need to reconfigure Oracle Enterprise Manager to start the Database Control interface on that other node.

See Also: the `emca` command line help for instructions to perform reconfiguration

Use the following instructions to log in to Database Control:

1. On the node from which you installed the database, open a Web browser to access the Database Control URL, and use the following URL syntax:

```
https://host:port/em
```

In the preceding example:

- `host` is the name of the computer on which you installed Oracle Database
- `port` is the port number reserved for the Database Control or Grid Control during installation

If you do not know the correct port number to use, then look for the following line in the file `$ORACLE_HOME/install/portlist.ini`, which lists the assigned port:

```
Enterprise Manager Console HTTP Port (db_name) = 1158
```

The installation reserves the first available port from the range 5500 to 5519.

For example, if you install Oracle Database on host `example`, and the Database Control uses port 1158, then use the following URL:

```
https://example:1158/em
```

Oracle Enterprise Manager displays the Database Control login page.

2. Log in to the database using the user name `SYS` and connect as `SYSDBA`.

Use the password that you specified for the `SYS` account during the installation.

Note: You can also log in to the Database Control using the `SYSTEM` or `SYSMAN` accounts, or you can grant login privileges to other database users.

4.3 Oracle Configuration Manager Postinstallation Configuration for Oracle RAC

If you have installed Oracle Configuration Manager, then you must run a script to create a database account to collect database configuration collections. You must create this account in both **Connected** and **Disconnected** modes. The database account stores the PL/SQL procedures that collect the configuration information, and the account owns the database management system (DBMS) job that performs the collection. After the account has been set up, as login privileges are no longer required, the account is locked.

To configure the database for configuration collection, run the following script:

```
$ORACLE_HOME/ccr/admin/scripts/installCCRSQL.sh collectconfig -s SID -r\
SYSDBA-USER -p SYSDBA-PASSWORD
```

The script `installCCRSQL.sh` creates an Oracle Configuration Manager user and loads the PL/SQL procedure into the database defined by the `ORACLE_SID`. You can also specify the database SID by using the `-s` option in the command line, as in the following example, where the SID is `orcl`:

```
$ORACLE_HOME/ccr/admin/scripts/installCCRSQL.sh collectconfig -s orcl
```

For Oracle RAC, you must run the database script against only one instance, such as the local instance on which you performed installation. However, Oracle Configuration Manager must be installed in all instance homes.

See Also: *Oracle Configuration Manager Installation and Administration Guide* for further information

4.4 Oracle Database Vault Postinstallation with DVCA for Oracle RAC

After installing Oracle Database Vault for an Oracle RAC instance, you need to run Oracle Database Vault Configuration Assistant (DVCA) with the `-action optionrac` switch on all other Oracle RAC nodes. This sets instance parameters and disables SYSDBA operating system authentication.

You need to run this command on all Oracle RAC nodes other than the node on which the Oracle Database Vault installation is performed. This step is required to enable the enhanced security features provided by Oracle Database Vault.

Note: The listener and database instance should be running on the nodes on which you run DVCA.

Use the following syntax to run DVCA:

```
# dvca -action optionrac -racnode host_name -oh oracle_home
-jdbc_str jdbc_connection_string -sys_passwd sys_password
[-logfile ./dvca.log] [-silent] [-nodecrypt] [-lockout]
```

Where:

- *action* is the action to perform. *optionrac* performs the action of updating the instance parameters for the Oracle RAC instance. This flag also provides the option of disabling *SYSDBA* operating system access for the instance.
- *raccnode* is the host name of the Oracle RAC node on which the action is being performed. Do not include the domain name with the host name.
- *oh* is the Oracle home for the Oracle RAC instance.
- *jdbc_connection_string* is the JDBC connection string used to connect to the database. For example: *jdbc:oracle:oci:@orcl1*.
- *sys_password* is the password for the SYS user.
- *logfile* is an optional flag to specify a log file name and location. You can enter an absolute path, or enter a path that is relative to the location of the *\$ORACLE_HOME/bin* directory.
- *silent* is the option to run in command line mode. This option is required if you are not running DVCA in an *xterm* window.
- *nodecrypt* is the option to read plaintext passwords as passed on the command line.
- *lockout* is the flag to use to disable *SYSDBA* operating system authentication.

Note: You can re-enable *SYSDBA* access by recreating the password file with the *nosysdba* flag set to *n* (No). The *orapwd* utility enables you to do this.

4.5 Upgrading 10.2.0.3 Databases with Oracle Database Vault to Oracle Database 11g

If you have an existing Oracle Database 10g release 2 installation (10.2.0.3) with Oracle Database Vault, then you must disable Oracle Database Vault before you can upgrade to Oracle Database 11g release 1 (11.1).

Note: If you have Oracle Database 10g release 10.1.0.2 with Oracle Database Vault, then you must upgrade to release 10.1.0.3 before upgrading to Oracle Database 11g.

To disable Oracle Database Vault, complete the following procedure:

1. Stop all processes (Listener, Oracle Enterprise Manager, and Oracle Database), as described in [Appendix E](#).
2. Change directory to the Oracle Database *rdbms/lib* directory. For example:

```
$ cd $ORACLE_HOME/rdbms/lib
```

3. Enter the following command:

```
$ make -f ins_rdbms.mk dv_off
```

4. Change directory to the Oracle home *bin* directory, and relink Oracle Database. For example:

```
$ cd $ORACLE_HOME/bin
$ relink oracle
```


5. Restart all processes (Listener, Oracle Enterprise Manager, and Oracle Database).
6. If you are upgrading an Oracle RAC database, then repeat steps 1 through 5 on each member node of the RAC Database on the cluster.
7. On the local node, enter the following command syntax, where *Oracle_home* is the Oracle Database home, *Database_name* is the name of the database, *Sys_password* is the SYS password for the database, *DV_owner* is the user account that owns Oracle Database Vault, *DV_owner_passwd* is the Oracle Database Vault owner password, *DV_acct_manager* is the user account of the Oracle Database Vault account manager, and *DV_acct_passwd* is the password of the Oracle Database Vault account manager:

```
dvca -action disable -oh Oracle_home -service Database_name -sys_passwd Sys_password -owner_account DV_owner -owner_passwd DV_owner_passwd -acctmgr_account DV_acct_manager -acctmgr_passwd DV_acctmanager_passwd -logfile ./dvca.log -nodecrypt
```

For example:

```
$ dvca -action disable -oh /u01/app/oracle/10.2.0/db_1 -service sales
-sys_passwd mySyspw -owner_account DVowner -owner_passwd myDVownerpw
-acctmgr_account DVacctmgr -acctmgr_passwd myDVmgrpw -logfile ./dvca.log
-nodecrypt
```

8. Install Oracle Database 11g, using a custom Oracle RAC software only installation with Oracle Label Security and Oracle Database Vault. Repeat steps 2 through step 4 in the Oracle Database 11g home.

Note: You do not need to start or stop processes in a software-only installation home

9. From the Oracle Database 11g release 1 (11.1) Oracle home, start DBUA to upgrade the Oracle Database
10. On all nodes, enable Oracle Database Vault in the Oracle Database 11g release 1 (11.1) Oracle home.

```
$ cd $ORACLE_HOME/rdbms/lib
$ make -f ins_rdbms.mk dv_on
$ cd $ORACLE_HOME/bin
$ relink oracle
```

Restart all processes after relinking is completed.

Oracle Application Express Postinstallation Tasks

This section describes tasks that you need to complete Oracle Application Express configuration after you finish installing the Oracle Real Application Clusters (Oracle RAC) software.

This chapter contains the following topics:

- [Restarting Application Express Processes After an Upgrade](#)
- [Patching Oracle Application Express 3.0](#)
- [Choosing an HTTP Server](#)
- [Copying the Images Directory](#)
- [Configuring Oracle HTTP Server in a New Installation](#)
- [Enabling Network Services in Oracle Database 11g](#)
- [Troubleshooting an Invalid ACL Error](#)

5.1 Restarting Application Express Processes After an Upgrade

If you had a previous Oracle Application Express installation, then after the Oracle RAC installation completes, you need to restart the Oracle Application Express processes that you stopped before you began the installation, such as the listener. In addition, restart Oracle HTTP Server.

5.2 Patching Oracle Application Express 3.0

If you are already running Oracle Application Express 3.0, then check the Oracle Application Express page on the Oracle Technology Network (OTN) at the following URL for information about patch set releases or later versions of Oracle Application Express:

http://www.oracle.com/technology/products/database/application_express/index.html

Upgrading to Oracle Database 11g will not patch an Application Express 3.0 instance to Application Express 3.0.1.

5.3 Choosing an HTTP Server

Oracle Application Express requires access either to the embedded PL/SQL gateway, or to Oracle HTTP Server and `mod_plsql`. Review the following information to select an HTTP server.

This section contains the following topics:

- [Selecting an HTTP Server in an Oracle RAC Environment](#)
- [About Oracle HTTP Server and `mod\_plsql`](#)

5.3.1 Selecting an HTTP Server in an Oracle RAC Environment

Oracle recommends that you use Oracle HTTP Server with `mod_plsql`, as it permits you to specify a connection in the service name format, so that one HTTP Server can access all nodes. This section contains instructions for configuring that HTTP server.

Oracle recommends that you do not select the embedded PL/SQL gateway option for Oracle RAC installations. The embedded PL/SQL gateway uses an HTTP Server built into the database instance, and because of this, it does not take advantage of the Oracle RAC shared architecture.

To use an embedded PL/SQL gateway as the HTTP server with RAC, the gateway must be configured on each node, and users of Oracle Application Express would have to specify which node they would like to access in the URL. If the node fails, then the embedded PL/SQL gateway fails as well, and the service is not failed over to surviving nodes.

5.3.2 About Oracle HTTP Server and `mod_plsql`

Oracle HTTP Server uses the `mod_plsql` plug-in to communicate to the Oracle Application Express engine within Oracle Database. It functions as a communication broker between the Web server and the Oracle Application Express objects in Oracle Database. More specifically, it maps browser requests into database stored procedure calls over a SQL*Net connection.

Note that this configuration consists of three tier architecture: a Web browser, Oracle HTTP Server (ohs) with `mod_plsql`, and an Oracle database containing Oracle Application Express.

5.4 Copying the Images Directory

Whether you are loading a new installation or upgrading from a previous release, you must copy the images directory from the top level of the `$ORACLE_HOME/apex` directory to the location on the file system containing the Oracle home for Oracle HTTP Server.

This section includes the following topics:

- [Copying the Images Directory After an Upgrade](#)
- [Copying the Images Directory After a New Installation](#)

5.4.1 Copying the Images Directory After an Upgrade

During an upgrade, you must overwrite your existing images directory. Before you begin the upgrade, to ensure that you can revert to the previous version, Oracle recommends that you create a copy of your existing `images` directory for Oracle

Application Express, indicating the release number of the images (for example, `images_2_0`).

To locate the path to the `images` directory on the file system, locate the text `alias /i/` in one of the following files, depending on your existing version release:

- Oracle9i HTTP Server release 2—see the `httpd.conf` file.
- Oracle HTTP Server 11g—see the `dads.conf` file.
- Oracle Application Server 10g—see the `marvel.conf` file.

When you locate the `images` directory path, Oracle recommends that you copy the existing `images` directory to a backup location. Doing this enables you to revert to the previous release, if that becomes necessary.

After you copy the existing `images` directory, use the following command syntax to copy the `apex\images` directory from the Oracle Database 11g home to the existing `images` directory path, overwriting the existing `images`:

- Existing Oracle Application Server 10g

```
cp -rf ORACLE_BASE/ORACLE_HOME/apex/images\
ORACLE_BASE/ORACLE_HTTPSERVER_HOME/Apache
```

- Existing Oracle HTTP Server 11g:

```
cp -rf ORACLE_BASE/ORACLE_HOME/apex/images\
ORACLE_BASE/ORACLE_HTTPSERVER_HOME/ohs
```

In the preceding syntax examples:

- `ORACLE_BASE` is an Oracle software base directory, in which Oracle home directories are installed, such as `u01/app/oracle`.
- `ORACLE_HTTPSERVER_HOME` is the existing Oracle Application Server or Oracle HTTP Server Oracle home
- `ORACLE_HOME` is the Oracle Database 11g Oracle home

For example:

```
cp -rf u01/app/oracle/10_2/db_1/apex/images \
u01/app/oracle/OAS_11_0/ohs
```

5.4.2 Copying the Images Directory After a New Installation

After installation, copy the directory `apex/images`, using a command similar to the following:

```
cp -rf ORACLE_BASE/ORACLE_HOME/apex/images\
ORACLE_BASE/ORACLE_HTTPSERVER_HOME/ohs
```

5.5 Configuring Oracle HTTP Server in a New Installation

This section describes how to configure different versions of Oracle HTTP Server with `mod_plsql` in a new installation.

Topics in this section include:

- [Security Considerations for Oracle HTTP Server](#)
- [Configuring Oracle HTTP Server Release 9.0.3 in a New Installation](#)

- [Configuring Oracle HTTP Server or Oracle Application Server in a New Installation](#)
- [Stopping and Restarting Oracle HTTP Server](#)
- [Installing Oracle Application Express in Other Languages](#)
- [Managing JOB_QUEUE_PROCESSES](#)
- [Obfuscating PlsqlDatabasePassword Parameter](#)
- [Logging In to Oracle Application Express](#)

5.5.1 Security Considerations for Oracle HTTP Server

Oracle highly recommends that you configure and use a Secure Sockets Layer (SSL) to ensure that passwords and other sensitive data are not transmitted in clear text in HTTP requests. Without the use of SSL, passwords potentially could be exposed, compromising the security of your Application Express instance.

SSL is an industry standard protocol that uses RSA public key cryptography in conjunction with symmetric key cryptography to provide authentication, encryption, and data integrity.

5.5.2 Configuring Oracle HTTP Server Release 9.0.3 in a New Installation

In Oracle HTTP Server release 9.0.3, the file `wdbsvr.app` contains information about the Database Access Descriptor (DAD) to access Oracle Application Express. A DAD is a set of values that specify how the Oracle HTTP Server component `modplsql` connects to the database server to fulfill an HTTP request.

5.5.2.1 Changing the Password for the ADMIN Account

To change the password for the ADMIN account:

1. Change your working directory to `$ORACLE_HOME/apex`.
2. Start SQL*Plus and connect to the database where Oracle Application Express is installed as SYS. For example:

```
$ sqlplus sys/SYS_password as sysdba
```

3. Enter the following command followed by the new password:

```
@apxxepwd.sql password
```

For example to change the password to `apex1234`:

```
@apxxepwd.sql password apex1234
```

5.5.2.2 Changing the Password for the APEX_PUBLIC_USER Database User

To specify the password in the DAD file, use the following procedure to the password for the database user `APEX_PUBLIC_USER`:

1. Start SQL*Plus, and connect to the database where Oracle Application Express is installed as SYS. For example:

```
$ sqlplus sys/SYS_password as sysdba
```

2. Enter the following SQL statement, where `PASSWORD` is the new password:

```
ALTER USER APEX_PUBLIC_USER IDENTIFIED BY PASSWORD
```

5.5.2.3 Modifying the wdbsvr.app File in a New Installation

To create the DAD, modify the file `wdbsvr.app`, and add an entry for Oracle Application Express.

To modify the `wdbsvr.app` file:

1. Using a text editor, open the file `wdbsvr.app`, which is in the path `ORACLE_BASE/ORACLE_HTTPSERVER_HOME/modplsql/cfg/`
2. Add an entry for Oracle Application Express using the following syntax. Only change the settings indicated in italics.

```
[DAD_htmlldb]
connect_string = localhost:1521:orcl
password = apex
username = apex_public_user
default_page = apex
document_table = wwv_flow_file_objects$
document_path = docs
document_proc = wwv_flow_file_mgr.process_download
reuse = Yes
enable_lesso = No
stateful = STATELESS_RESET
nls_lang = American_America.AL32UTF8
```

Where:

- *connect_string* refers to the host ID, port number, and Oracle9i database where Oracle Application Express was installed. Use the format `host:port:sid`.

If you have an Oracle9i version of Oracle HTTP Server you want to use, and it is installed in the same Oracle home as the database you specified for use with Oracle Application Express, then leave this parameter blank.

- *password* is the password for the Oracle Application Express ADMIN account you specified in ["Changing the Password for the APEX_PUBLIC_USER Database User"](#) on page 5-7.
- *nls_lang* determines the language setting of the DAD. The character set portion of the *nls_lang* value must always be set to AL32UTF8, regardless of whether or not the database character set is AL32UTF8.

If either the territory portion or the language portion of the NLS settings contains a space, then you must wrap the value in double quotes, as shown in the following example:

```
nls_lang = "ENGLISH_UNITED KINGDOM.AL32UTF8"
```

You can find information about your database's NLS settings by querying the view `NLS_DATABASE_PARAMETERS` as shown in the following example:

```
SELECT parameter,value
FROM nls_database_parameters
WHERE PARAMETER = 'NLS_CHARACTERSET';
```

3. Leave the remaining settings, including the username setting, as they appear in the preceding example.
4. Save and exit the `wdbsvr.app` file.

5.5.2.4 Modifying the Oracle9i httpd.conf File

You need to modify the `httpd.conf` file to include an alias that points to the file system path where you copied the images directory. You may also need to modify the `httpd.conf` file to add two new MIME types to support SQL Workshop.

See Also: ["Copying the Images Directory After an Upgrade"](#) on page 5-2

To modify the `httpd.conf` file:

1. Using a text editor, open the following file:

```
ORACLE_BASE/Apache/Apache/conf/httpd.conf
```

2. Add an alias entry that points to the file system path where you copied the images directory. For example:

```
alias /i/ "/home/oracle/OraHome1/Apache/Apache/images/"
```

3. Add the following lines to the `httpd.conf` file, if they are not already in the file:

```
AddType text/xml xbl
AddType text/x-component htc
```

If you are upgrading from Oracle HTML DB 2.0, then these MIME types should be defined in the file already.

4. Save and exit the `httpd.conf` file.
5. Restart the Oracle HTTP Server with the changed DAD setting.

To stop and restart the Oracle HTTP Server, enter commands using the following syntax, where `ORACLE_BASE` is the path to the Oracle base directory:

```
ORACLE_BASE/Apache/Apache/bin/apachectl stop
ORACLE_BASE/Apache/Apache/bin/apachectl start
```

Note: If Oracle HTTP Server is set to listen on port 1024 or lower, then you must run the stop and start commands as a privileged user, such as `root`.

See Also: *Oracle HTTP Server Administrator's Guide*

5.5.3 Configuring Oracle HTTP Server or Oracle Application Server in a New Installation

Oracle Application Express must have access to Oracle HTTP Server with `mod_plsql`. Perform the postinstallation steps in this section if one of the following conditions is true:

- You are running Oracle HTTP Server 11g or Oracle Application Server 10g.
- Oracle HTTP Server is installed in an Oracle home.
- You have not previously configured Oracle HTTP Server to work with Oracle Application Express.

These instructions do not apply if you are running Oracle HTTP Server release 9.0.3. For more information on configuring Oracle HTTP Server release 9.0.3, see ["Configuring Oracle HTTP Server in a New Installation"](#) on page 5-3.

If these instructions do apply to your installation, then complete the following steps:

Note: Within the context of this section, the Apache home directory (ORACLE_HTTPSERVER_HOME) is the location where Oracle HTTP Server is installed.

5.5.3.1 Changing the Password for the ADMIN Account

You must change the password for the Oracle Application Express ADMIN account.

To change the password for the ADMIN account:

1. Change your working directory to \$ORACLE_HOME/apex.
2. Start SQL*Plus and connect to the database where Oracle Application Express is installed as SYS. For example:

```
$ sqlplus sys/SYS_password as sysdba
```

3. Using the following syntax, enter the new password:

```
> @apxxepwd.sql password
```

For example, to change the password to apex1234:

```
> @apxxepwd.sql apex1234
```

5.5.3.2 Unlocking the APEX_PUBLIC_USER Database User

When configuring Oracle HTTP Server for Oracle Application Express in a new installation, the database user APEX_PUBLIC_USER must be an unlocked account. To unlock the account for database user APEX_PUBLIC_USER, complete the following steps:

1. Start SQL*Plus and connect to the database where Oracle Application Express is installed as SYS. For example:

```
$ $ORACLE_HOME/bin/sqlplus
SQL> CONNECT SYS as SYSDBA
Enter password: SYS_password
```

2. Run the following command:

```
SQL> ALTER USER APEX_PUBLIC_USER ACCOUNT UNLOCK
```

5.5.3.3 Changing the Password for the APEX_PUBLIC_USER Database User

To specify the password in the DAD file, use the following procedure to change the password for the database user APEX_PUBLIC_USER:

1. Start SQL*Plus, and connect to the database where Oracle Application Express is installed as SYS. For example:

```
$ sqlplus sys/SYS_password as sysdba
```

2. Enter the following SQL statement, where *PASSWORD* is the new password:

```
ALTER USER APEX_PUBLIC_USER IDENTIFIED BY PASSWORD
```

5.5.3.4 Edit the dads.conf File

If this is a new installation of Oracle Application Express, then you must edit the `dads.conf` file.

To edit the `dads.conf` file:

1. Using a text editor, open the `dads.conf` file for your release:

- Oracle Application Server 10g

```
ORACLE_HTTPSERVER_HOME/Apache/modplsql/conf/dads.conf
```

For example:

```
$ vi /u01/product/oas/Apache/modplsql/conf/dads.conf
```

- Oracle HTTP Server 11g:

```
ORACLE_HTTPSERVER_HOME/ohs/modplsql/conf/dads.conf
```

For example:

```
$ vi /u01/product/oas/ohs/modplsql/conf/dads.conf
```

2. Copy the following code text into the `dads.conf` file.

In the text, replace the variables `$ORACLE_HOME`, `host`, `port`, `service_name`, and `apex_public_user_password` with values appropriate for your system. Note that `apex_public_user_password` is the password that you defined in the section ["Changing the Password for the APEX_PUBLIC_USER Database User"](#) on page 5-4.

```
Alias /i/ "ORACLE_BASE/ORACLE_HTTPSERVER_HOME/ohs/images"
AddType text/xml          xbl
AddType text/x-component  htc

<Location /pls/apex>
  Order deny,allow
  PlsqlDocumentPath docs
  AllowOverride None
  PlsqlDocumentProcedure      wwv_flow_file_mgr.process_download
  PlsqlDatabaseConnectString  host:port:service_name ServiceNameFormat
  PlsqlNLSLanguage            AMERICAN_AMERICA.AL32UTF8
  PlsqlAuthenticationMode     Basic
  SetHandler                  pls_handler
  PlsqlDocumentTablename      wwv_flow_file_objects$
  PlsqlDatabaseUsername       APEX_PUBLIC_USER
  PlsqlDefaultPage             apex
  PlsqlDatabasePassword       apex_public_user_password
  Allow from all
</Location>
```

3. Locate the line containing `PlsqlNLSLanguage`.

The `PlsqlNLSLanguage` setting determines the language setting of the DAD. The character set portion of the `PlsqlNLSLanguage` value must be set to `AL32UTF8`, regardless of whether or not the database character set is `AL32UTF8`. For example:

```
PlsqlNLSLanguage          AMERICAN_AMERICA.AL32UTF8
```

4. Save and exit the `dads.conf` file.

5.5.4 Stopping and Restarting Oracle HTTP Server

To stop and restart Oracle HTTP Server, run the following commands:

```
ORACLE_HTTPSERVER_HOME/opmn/bin/opmnctl stopproc ias-component=HTTP_Server
ORACLE_HTTPSERVER_HOME/opmn/bin/opmnctl startproc ias-component=HTTP_Server
```

5.5.5 Installing Oracle Application Express in Other Languages

The Oracle Application Express interface is translated into German, Spanish, French, Italian, Japanese, Korean, Brazilian Portuguese, Simplified Chinese, and Traditional Chinese. A single instance of Oracle Application Express can be installed with one or more of these translated versions. At runtime, each user's Web browser language settings determine the specific language version.

The translated version of Oracle Application Express should be loaded into a database that has a character set that can support the specific language. If you attempt to install a translated version of Oracle Application Express into a database that does not support the character encoding of the language, the installation may fail or the translated Oracle Application Express instance may appear corrupt when run. The database character set `AL32UTF8` supports all the translated versions of Oracle Application Express.

You can manually install translated versions of Oracle Application Express using SQL*Plus. The installation files are encoded in `AL32UTF8`.

Note: Regardless of the target database character set, to install a translated version of Oracle Application Express, you must set the character set value of the `NLS_LANG` environment variable to `AL32UTF8` prior to starting SQL*Plus.

The following examples illustrate valid `NLS_LANG` settings for loading Oracle Application Express translations:

```
American_America.AL32UTF8
Japanese_Japan.AL32UTF8
```

5.5.6 Installing a Translated Version of Oracle Application Express

Whether you are installing for the first time or upgrading from a previous release, you must run the script `load_lang.sql` to run a translated version of Oracle Application Express.

To install a translated version of Oracle Application Express:

1. Set the `NLS_LANG` environment variable, making sure that the character set is `AL32UTF8`. For example:

Bourne or Korn Shell

```
$ NLS_LANG=American_America.AL32UTF8
$ export NLS_LANG
```

C Shell

```
% setenv NLS_LANG American_America.AL32UTF8
```

2. Start SQL*Plus and connect to the target database as SYS.
3. Run the following statement:

```
> ALTER SESSION SET CURRENT_SCHEMA = FLOWS_03000;
```

4. Run the appropriate language specific script. For example:

```
> @load_de.sql
```

The installation scripts are located in subdirectories identified by a language code in the unzipped distribution \$ORACLE_HOME/apex/builder. For example, the German version is located in \$ORACLE_HOME/apex/builder/de and the Japanese version is located in \$ORACLE_HOME/apex/builder/ja. Within each of these directories, there is a language loading script identified by the language code (for example, load_de.sql or load_ja.sql).

5.5.7 Managing JOB_QUEUE_PROCESSES

JOB_QUEUE_PROCESSES determines the maximum number of concurrently running jobs. In Oracle Application Express release 3.0, transactional support and SQL scripts require jobs. If JOB_QUEUE_PROCESSES is not enabled and working properly, then you cannot successfully run a script.

This section includes the following topics:

- [Viewing the Number of JOB_QUEUE_PROCESSES](#)
- [Changing the Number of JOB_QUEUE_PROCESSES](#)

5.5.7.1 Viewing the Number of JOB_QUEUE_PROCESSES

You can view the number of number of JOB_QUEUE_PROCESSES using one of the following methods:

- [Viewing JOB_QUEUE_PROCESSES in the Installation Log File](#)
- [Viewing JOB_QUEUE_PROCESSES in Oracle Application Express](#)
- [Viewing JOB_QUEUE_PROCESSES from SQL*Plus](#)

5.5.7.1.1 Viewing JOB_QUEUE_PROCESSES in the Installation Log File After installing or upgrading Oracle Application Express to release 3.0, you can view the number of JOB_QUEUE_PROCESSES in the installation log files.

5.5.7.1.2 Viewing JOB_QUEUE_PROCESSES in Oracle Application Express You can view the number of JOB_QUEUE_PROCESSES on the **About Application Express** page.

To view the **About Application Express** page:

1. Log in to Oracle Application Express.
2. On the Administration list, click **About Application Express**.

The current number JOB_QUEUE_PROCESSES displays at the bottom of the page.

5.5.7.1.3 Viewing JOB_QUEUE_PROCESSES from SQL*Plus You can view the number of JOB_QUEUE_PROCESSES from SQL*Plus by running the following SQL statement:

```
> SELECT VALUE FROM v$parameter WHERE NAME = 'job_queue_processes'
```

5.5.7.2 Changing the Number of JOB_QUEUE_PROCESSES

You can change the number of `JOB_QUEUE_PROCESSES` by running a SQL statement in SQL*Plus, using the following procedure:

1. Log in to the database as SYSDBA using SQL*Plus.
2. In SQL*Plus run the following SQL statement, where the variable *number* represents the number of processes you want to set:

```
> ALTER SYSTEM SET JOB_QUEUE_PROCESSES = number
```

For example, running the statement `ALTER SYSTEM SET JOB_QUEUE_PROCESSES = 20` sets `JOB_QUEUE_PROCESSES` to 20.

5.5.8 Obfuscating PlsqlDatabasePassword Parameter

The parameter `PlsqlDatabasePassword` specifies the password for logging in to the database. You can use the utility `dadTool.pl` to obfuscate passwords in the `dads.conf` file.

You can find the `dadTool.pl` utility in the following directory:

```
ORACLE_HTTPSERVER_HOME/ohs/modplsql/conf
```

5.5.8.1 Obfuscating Passwords

To obfuscate passwords, run `dadTool.pl` by following the instructions in the `dadTool.README` file.

5.5.9 Logging In to Oracle Application Express

You access the Oracle Application Express home page in a Web browser. To view or develop Oracle Application Express applications, the Web browser must support JavaScript and the HTML 4.0 and CSS 1.0 standards.

This section contains the following topics

- [Oracle Application Express User Roles](#)
- [Setting Up Your Local Environment](#)

5.5.9.1 Oracle Application Express User Roles

In the Oracle Application Express development environment, users log in to a shared work area called a **workspace**. Users are divided into four primary roles:

- **Workspace administrators** are users who perform administrator tasks specific to a workspace such as managing user accounts, monitoring workspace activity, and viewing log files.
- **Developers** are users who create and edit applications. Developers can have their own workspace or share a workspace.
- **End users** have no development privileges. You define end users so that they can access applications that do not use an external authentication scheme.
- **Oracle Application Express administrators** are superusers that manage an entire hosted instance using the Application Express Administration Services application.

5.5.9.2 Setting Up Your Local Environment

How you set up Oracle Application Express depends upon your user role. If you are a **developer** accessing a hosted development environment, then an administrator must grant you access to a workspace. If you are an Oracle **Application Express administrator**, then you must perform the following steps:

1. **Log in to Oracle Application Express Administration Services.** Oracle Application Express Administration Services is a separate application for managing an entire Oracle Application Express instance. You log in using the ADMIN account and password created or reset during the installation process.
2. **Specify a provisioning mode.** In Oracle Application Express Administration Services, you need to determine how the process of creating (or provisioning) a workspace will work in your development environment.
3. **Create a Workspace.** A workspace is a virtual private database allowing multiple users to work within the same Oracle Application Express installation while keeping their objects, data and applications private. Each workspace has a unique ID and name. An Oracle Application Express administrator can create a workspace manually or have users submit requests.
4. **Log in to a Workspace.** Once you create a workspace in Oracle Application Express Administration Services, return to the Oracle Application Express Login page and log in to that workspace.

See Also: *Oracle Database 2 Day + Application Express Developer's Guide* or "Quick Start" on *Oracle Database Application Express User's Guide*

5.6 Enabling Network Services in Oracle Database 11g

By default, the ability to interact with network services is disabled in Oracle Database 11g release 1 (11.1). To use Oracle Application Express with Oracle Database 11g release 1 (11.1), you need to use the new DBMS_NETWORK_ACL_ADMIN package to grant connect privilege to any host for the FLOWS_03000 database user. Failing to grant these privileges results in issues with the following:

- Sending outbound mail in Oracle Application Express
Users can call methods from the APEX_MAIL package, but issues arise when sending outbound e-mail.
- Using Web services in Oracle Application Express.
- Using PDF/report printing
- Searching for content in online Help (that is, using the Find link).

5.6.1 Granting Connect Privileges

The following example demonstrates how to grant connect privileges to any host for the FLOWS_03000 database user:

Note: To run the examples, the compatible initialization parameter of the database must be set at least to 11.1.0.0.0. In Oracle 11g Database, the parameter is already set by default. However, you will have to set this parameter if you are upgrading to Oracle 11g Database from a prior version.

See Also: "Creating and Configuring an Oracle Database" in the *Oracle Database Administrator's Guide* for information about changing database compatible initialization parameters

```

SELECT ACL INTO ACL_PATH FROM DBA_NETWORK_ACLS
WHERE HOST = '*' AND LOWER_PORT IS NULL AND UPPER_PORT IS NULL;

-- Before checking the privilege, make sure that the ACL is valid
-- (for example, does not contain stale references to dropped users).
-- If it does, the following exception will be raised:
--
-- ORA-44416: Invalid ACL: Unresolved principal 'FLOWS_03000'
-- ORA-06512: at "XDB.DBMS_XDBZ", line ...
--
SELECT SYS_OP_R2O(extractValue(P.RES, '/Resource/XMLRef')) INTO ACL_ID
FROM XDB.XDB$ACL A, PATH_VIEW P
WHERE extractValue(P.RES, '/Resource/XMLRef') = REF(A) AND
EQUALS_PATH(P.RES, ACL_PATH) = 1;

DBMS_XDBZ.ValidateACL(ACL_ID);
IF DBMS_NETWORK_ACL_ADMIN.CHECK_PRIVILEGE(ACL_PATH, 'FLOWS_03000',
'connect') IS NULL THEN
    DBMS_NETWORK_ACL_ADMIN.ADD_PRIVILEGE(ACL_PATH,
'FLOWS_03000', TRUE, 'connect');
END IF;

EXCEPTION
-- When no ACL has been assigned to '*'.
WHEN NO_DATA_FOUND THEN
DBMS_NETWORK_ACL_ADMIN.CREATE_ACL('power_users.xml',
'ACL that lets power users to connect to everywhere',
'FLOWS_03000', TRUE, 'connect');
DBMS_NETWORK_ACL_ADMIN.ASSIGN_ACL('power_users.xml', '*');
END;
/
COMMIT;

```

5.7 Troubleshooting an Invalid ACL Error

If you receive the error ORA-44416: Invalid ACL, then use the following query to identify the invalid access control list (ACL):

```

REM Show the dangling references to dropped users in the ACL that is assigned
REM to '*'.

```

```

SELECT ACL, PRINCIPAL
FROM DBA_NETWORK_ACLS NACL, XDS_ACE ACE
WHERE HOST = '*' AND LOWER_PORT IS NULL AND UPPER_PORT IS NULL AND
NACL.ACLID = ACE.ACLID AND
NOT EXISTS (SELECT NULL FROM ALL_USERS WHERE USERNAME = PRINCIPAL);

```

After you identify the invalid ACL, run the following script to fix the ACL:

```

DECLARE
    ACL_ID    RAW(16);
    CNT       NUMBER;
BEGIN

-- Look for the object ID of the ACL currently assigned to '*'
SELECT ACLID INTO ACL_ID FROM DBA_NETWORK_ACLS

```

```

WHERE HOST = '*' AND LOWER_PORT IS NULL AND UPPER_PORT IS NULL;

-- If just some users referenced in the ACL are invalid, remove just those
-- users in the ACL. Otherwise, drop the ACL completely.
SELECT COUNT(PRINCIPAL) INTO CNT FROM XDS_ACE
WHERE ACLID = ACL_ID AND
      EXISTS (SELECT NULL FROM ALL_USERS WHERE USERNAME = PRINCIPAL);

IF (CNT > 0) THEN

  FOR R IN (SELECT PRINCIPAL FROM XDS_ACE
            WHERE ACLID = ACL_ID AND
                  NOT EXISTS (SELECT NULL FROM ALL_USERS
                              WHERE USERNAME = PRINCIPAL)) LOOP

    UPDATE XDB.XDB$ACL
      SET OBJECT_VALUE =
        DELETXML(OBJECT_VALUE,
                  '/ACL/ACE[PRINCIPAL="' || R.PRINCIPAL || '"]')
      WHERE OBJECT_ID = ACL_ID;
  END LOOP;

ELSE
  DELETE FROM XDB.XDB$ACL WHERE OBJECT_ID = ACL_ID;
END IF;

END;
/

REM commit the changes.

COMMIT;

```

When the ACL has been fixed, run the first script in this section to apply the ACL to the FLOWS_03000 user. See ["Granting Connect Privileges"](#) on page 5-12.

Configuring the Server Parameter File in Oracle Real Application Clusters Environments

This chapter describes server parameter file (SPFILE) placement and configuration in Oracle Real Application Clusters (Oracle RAC) environments.

This chapter contains the following topics:

- [Parameter Files and Oracle RAC](#)
- [Using Server Parameter Files with Oracle RAC](#)
- [Parameter File Search Order in Oracle RAC](#)
- [Migrating to the SPFILE in Oracle RAC Environments](#)
- [Server Parameter File Errors in Oracle RAC](#)

See Also: *Oracle Real Application Clusters Administration and Deployment Guide* for more information about parameters, and for a discussion of parallel execution-related parameters in Oracle RAC data warehouse environments

6.1 Parameter Files and Oracle RAC

Oracle Database uses parameter settings in parameter files to determine how to control various database resources. You can use two types of files for parameter administration: the server parameter file (SPFILE) or one or more traditional client-side parameter files.

Oracle recommends that you manage parameters using an SPFILE. If you use client-side parameter files, then Oracle does not preserve parameter changes made for self-tuning after shutdown.

See Also: Oracle Database 11g release 1 (11.1) Oracle RAC documentation for more information about using client-side parameter files

6.2 Using Server Parameter Files with Oracle RAC

By default, Oracle Database creates the `init` parameter file (PFILE) for each node based on one SPFILE. You can change parameter settings in the SPFILE file only by using Oracle Enterprise Manager or `ALTER SYSTEM SET SQL` statements, because the server parameter file is a binary file. Do not try to edit this file manually.

Note: Oracle recommends that you avoid modifying the values for self-tuning parameters; overriding these settings can affect performance adversely.

If you are upgrading from a previous Oracle Database release, then create and configure the server parameter file for Oracle RAC using the procedures described in the following section.

6.2.1 Location of the Server Parameter File

The default location of the server parameter file (SPFILE) is:

```
$ORACLE_HOME/dbs/spfile$ORACLE_sid.ora
```

The default location of the server parameter file is inappropriate for Oracle RAC databases and ASM instances if you use storage on a node, because all instances must use the same server parameter file.

Instead, Oracle recommends that you use a PFILE in this directory:

```
$ORACLE_HOME/dbs/init$ORACLE_sid.ora
```

This path is valid for each instance and it refers to a single, shared initialization parameter file. For example, if you use raw storage, then on a Linux or UNIX system, the file should contain an entry similar to the following:

```
SPFILE= '/dev/vx/rdsk/oracle_dg/dbspfile'
```

However, if you use a cluster file system, then use the following file location:

On Linux and UNIX-based systems:

```
SPFILE= '/shared_mount/dbname/spfiledbname.ora'
```

The variable *shared_mount* is the shared mount point, and the variable *dbname* is the database name.

If you use ASM, then the SPFILE value will be:

```
SPFILE= '+disk_group_name/dbunique_name/spfiledbname.ora'
```

The variable *dbunique_name* is the unique database name, and the variable *dbname* is the database name.

You must use the same value of SPFILE so that all instances use the same server parameter file at startup.

To use DBCA to create your database, and to use the server parameter file, start DBCA. When the Initialization Parameters page appears, select **Create server parameter file (SPFILE)** under the File Locations tab. This option is visible only if you are using raw storage. When you have made this selection, then enter either a shared file system filename, or enter the raw device path name in the **Server Parameters Filename** field.

Note: When you use DBCA to create the server parameter file, the default PFILE file name is `$ORACLE_HOME/dbs/init$ORACLE_sid.ora`.

6.3 Parameter File Search Order in Oracle RAC

Oracle Database searches for your parameter file in the following order:

1. \$ORACLE_HOME/dbs/spfilesid.ora
2. \$ORACLE_HOME/dbs/spfile.ora
3. \$ORACLE_HOME/dbs/initssid.ora

6.4 Migrating to the SPFILE in Oracle RAC Environments

Migrate to the SPFile by creating and editing the server parameter file using the procedures described in this section.

This section contains the following topics:

- [Server Parameter File Placement in Oracle RAC](#)
- [Procedures for Migrating to the Server Parameter File](#)

6.4.1 Server Parameter File Placement in Oracle RAC

For single-node cluster-enabled configurations, or if you are using ASM disk groups or a cluster file system, place the server parameter file in an ASM disk group or on a file system. Otherwise, place the server parameter file on a shared raw device that is at least 5 MB in size.

6.4.2 Procedures for Migrating to the Server Parameter File

Migrate to the SPFILE file by completing the following procedures:

1. Combine the initialization parameter files for all instances into one `initdbname.ora` file by copying all shared `IFILE` contents *as is*. All parameters defined in your `IFILE` parameter files are global. Therefore, create them in the format `parameter=value`, without `SID` prefixes.
2. Copy all instance-specific parameter definitions from `initssid.ora` files using the following syntax, where the variable `sid` is the `SID` of the instance:

```
sid.parameter=value
```

3. If you are using a cluster file system, then create the server parameter file using the `CREATE SPFILE` statement as in the following example:

```
CREATE SPFILE='?/dbs/spfile_dbname.ora'
FROM PFILE='?/dbs/initdbname.ora'
```

If you use ASM, then use the following syntax to create the server parameter file:

```
CREATE SPFILE='+disk_group_name/db_uniquename/spfiledbname.ora'
FROM PFILE='?/dbs/initdbname.ora'
```

If you use raw storage, then use the following syntax to create the server parameter file on a raw device:

```
CREATE SPFILE='/dev/vx/rdsk/oracle_dg/dbspfile'
FROM PFILE='?/dbs/initdbname.ora'
```

These statements read your combined `initdbname.ora` file that you created by merging your `IFILES`, and then transfer the settings for the parameters from the merged file into your server parameter file.

4. Oracle recommends that you use the SPFILE by using the PFILE as a pointer to the SPFILE. Do this by running the STARTUP command as in the following example, where the SID variable *sid* in the file *init*sid*.ora* is the SID that you use in the SPFILE entry from Step 3. For example:

```
STARTUP PFILE=$ORACLE_HOME/dbs/initsid.ora
```

If you use this STARTUP command syntax, then Oracle Database uses the server parameter file entry specified in the file *init*sid*.ora*.

Note: The SPFILE for the ASM instance cannot be stored in ASM, as it is used to start the ASM instance. You can place an ASM instance SPFILE on a shared raw device, or in a cluster file system for ASM; or you can use a traditional client-side parameter file for each ASM instance.

6.5 Server Parameter File Errors in Oracle RAC

Oracle Database reports errors that occur during server parameter file creation, or while reading the file during startup. If an error occurs during a parameter update, then Oracle records the error in your ALERT .LOG file, and ignores subsequent parameter updates to the file. If this happens, then do either of the following:

- Shut down the instance, recover the server parameter file, and restart the instance.
- Enable the instance to continue running without regard for subsequent parameter updates.

Oracle Database displays errors for parameter changes that you attempt when you incorrectly use the ALTER SYSTEM SET statement. Oracle Database does this when an error occurs while reading from or writing to the server parameter file.

See Also: *Oracle Real Application Clusters Administration and Deployment Guide* for more information about backing up the SPFILE

Understanding the Oracle Real Application Clusters Installed Configuration

This chapter describes the Oracle Real Application Clusters (Oracle RAC) installed configuration.

This chapter contains the following topics:

- [Understanding the Configured Environment in Oracle RAC](#)
- [Oracle Cluster Registry in Oracle RAC](#)
- [Oratab Configuration for Oracle RAC](#)
- [Database Components Created Using Database Configuration Assistant](#)
- [Managing Undo Tablespaces in Oracle RAC](#)
- [Initialization Parameter Files](#)
- [Oracle Database Vault Default Audit Policy and Initialization Parameters](#)
- [Configuring Service Registration-Related Parameters](#)
- [Configuring the Listener File \(listener.ora\)](#)
- [Net Service Names \(tnsnames.ora File\)](#)
- [Net Services Profile \(sqlnet.ora File\)](#)

7.1 Understanding the Configured Environment in Oracle RAC

Oracle Net Configuration Assistant (NETCA) and Database Configuration Assistant (DBCA) configure your environment to meet the requirements for database creation and Oracle Enterprise Manager discovery of Oracle RAC databases.

Note: Configuration files are created on each node in your cluster database.

Avoid changing host names after you complete the Oracle RAC installation, including adding or deleting domain qualifications. Hostnames are created with Oracle Clusterware installation, and are used extensively with database processes. Nodes with changed host names must be deleted from the cluster and added back with the new name.

7.2 Oracle Cluster Registry in Oracle RAC

DBCA uses Oracle Cluster Registry (OCR) for storing the configurations for the cluster databases that it creates. The OCR is a shared file in a cluster file system environment. If you do not use a cluster file system, then you must make this file a shared disk device file. Oracle Universal Installer (OUI) automatically initializes the OCR during the Oracle Clusterware installation.

7.3 Oratab Configuration for Oracle RAC

Oracle creates an entry for each Oracle RAC database in the `oratab` configuration file. The `oratab` file is created by the `root.sh` script during installation, and it is updated by the Database Configuration Assistant when creating or deleting a database. Oracle Enterprise Manager uses this file during service discovery to determine the name of the Oracle RAC database, and to determine if the database should be started automatically when the system is restarted.

The database entry has the following syntax:

```
$DB_UNIQUE_NAME:$ORACLE_HOME:N
```

A colon, ':', is used as the field terminator. A new line terminates the entry. Lines beginning with a pound sign, '#', are comments. The `$DB_UNIQUE_NAME` environment variable is the Oracle system identifier, or `SID`, for your Oracle RAC database. The `$DB_UNIQUE_NAME` identifier for your RAC database must be unique across your enterprise. `$ORACLE_HOME` is the directory path to the database, and `N` indicates that the database should not be started at restart time. The following is an example entry for a database named `sales`:

```
sales:u01/app/oracle/sales:N
```

7.4 Database Components Created Using Database Configuration Assistant

This section describes the database components that DBCA creates, which include:

- [Tablespaces and Data files](#)
- [Control Files](#)
- [Redo Log Files](#)

7.4.1 Tablespaces and Data files

For both single-instance and cluster database environments, an Oracle Database is divided into smaller logical areas of space known as tablespaces. Each tablespace corresponds to one or more data files stored on a disk. [Table 7-1](#) shows the tablespace names used by an Oracle RAC database and the types of data they contain.

Table 7–1 Tablespace Names Used with Real Application Clusters Databases

Tablespace Name	Contents
SYSTEM	Consists of the data dictionary, including definitions of tables, views, and stored procedures needed by the database. Oracle Database automatically maintains information in this tablespace.
SYSAUX	An auxiliary system tablespace that contains the DRSYS (contains data for Oracle Text), CWM Lite (contains the OLAP schemas), XDB (for XML features), ODM (for Oracle Data Mining), TOOLS (contains Oracle Enterprise Manager tables), INDEX, EXAMPLE, and OEM-REPO tablespaces.
USERS	Consists of application data. As you create and enter data into tables, Oracle Database fills this space with your data.
TEMP	Contains temporary tables and indexes created during SQL statement processing. You may need to expand this tablespace if you are running a SQL statement that involves significant sorting, such as <code>ANALYZE COMPUTE STATISTICS</code> on a very large table, or the constructs <code>GROUP BY</code> , <code>ORDER BY</code> , or <code>DISTINCT</code> .
UNDOTBS <i>n</i>	These are the undo tablespaces for each instance that DBCA creates for automatic undo management.
RBS	If you do not use automatic undo management, then Oracle Database uses the RBS tablespace for the rollback segments.

You cannot alter these tablespace names when using the preconfigured database configuration options from OUI. However, you can change the names of the tablespaces if you use the advanced database creation method.

As mentioned, each tablespace has one or more data files. The data file names created by the preconfigured database configuration options vary by storage type such as ASM, OFS, block or raw devices, and so on.

7.4.2 Control Files

The database is configured with two control files that are stored on shared storage.

7.4.3 Redo Log Files

Each instance is configured with at least two redo log files that are stored in the shared storage. If you use a cluster file system, then these files are shared file system files. If you do not have a cluster file system, then these files are block or raw devices. If you use ASM, then these files are stored on the ASM disk group.

The file names of the redo log files that are created with the preconfigured database configuration options vary by storage type. Unless you are using a cluster file system, you must enter the block or raw device names.

When using block or raw devices, to use the advanced database creation method, locate the redo log files in the Database Storage page and replace their default filenames with the correct block or raw device names, or symbolic link names.

7.5 Managing Undo Tablespaces in Oracle RAC

Oracle Database stores rollback or undo information in undo tablespaces. To manage undo tablespaces, Oracle recommends that you use automatic undo management. Automatic undo management is an automated undo tablespace management mode that is easier to administer than manual undo management.

See Also: *Oracle Real Application Clusters Administration and Deployment Guide* for more information about managing undo tablespaces

7.6 Initialization Parameter Files

Oracle recommends using the server parameter file (SPFILE). This file resides on the server on the shared disk; all instances in a cluster database can access this parameter file.

See Also: [Chapter 6, "Configuring the Server Parameter File in Oracle Real Application Clusters Environments"](#) for more information about the creation and use of parameter files

7.7 Oracle Database Vault Default Audit Policy and Initialization Parameters

Oracle Database Vault installs a baseline database auditing policy. This policy covers the access control configuration information stored in Oracle Database Vault database tables, information stored in Oracle Catalog (rollback segments, tablespaces, and so on), the use of system privileges, and Oracle Label Security configuration.

See Also: *Oracle Database Vault Administrator's Guide* for more information about the database audit policy

7.8 Configuring Service Registration-Related Parameters

Two key benefits of Oracle RAC are connection load balancing and failover.

Oracle RAC extends the ability of single-instance Oracle Database load balancing, where connections are distributed among local dispatchers, to the balancing of connections among all instances in a cluster database.

Oracle RAC provides failover by configuring multiple listeners on multiple nodes to manage client connection requests for the same database service. With Oracle RAC, if a node or interconnect fails, then the associated virtual IP address (VIP) is relocated to a surviving node, enabling fast notification of the failure to the clients connecting through that VIP. If the application and client are configured with transparent application failover options, then the client is reconnected to the surviving node.

Connection load balancing and failover increase availability by taking advantage of the redundant resources within a cluster database. These features, however, require cross-instance registration.

Cross-instance registration in Oracle RAC occurs when an instance's process monitor (PMON) registers with the local listener, and with all other listeners. Thus, all instances in the cluster database register with all listeners that run on nodes that run instances of the cluster database. This enables all listeners to manage connections across all instances for both load balancing and failover.

Cross-instance registration requires configuring the `LOCAL_LISTENER` and `REMOTE_LISTENER` initialization parameters. The `LOCAL_LISTENER` parameter identifies the local listener, and the `REMOTE_LISTENER` parameter identifies the global list of listeners. The `REMOTE_LISTENER` parameter is dynamic. Oracle Database changes the setting for `REMOTE_LISTENER` dynamically when you reconfigure your cluster database; for example, when you add or delete instances.

By default, DBCA configures your environment with dedicated servers. However, if you select the Shared server option when using DBCA, then Oracle configures the shared server. In this case, Oracle Database uses both dedicated and shared server processing. When shared servers are configured, the `DISPATCHERS` parameter is specified as in the following example:

```
DISPATCHERS=" (protocol=tcp) "
```

If the `DISPATCHERS` initialization parameter does not specify the `LISTENER` attribute as in the previous example, then the PMON process registers information for all dispatchers with the listeners specified by the `LOCAL_LISTENER` and `REMOTE_LISTENER` parameters.

However, when the `LISTENER` attribute is specified, the PMON process registers dispatcher information with the listeners specified by the `LISTENER` attribute. In this case, setting the `LISTENER` attribute overrides `REMOTE_LISTENER` settings for the specified dispatchers as in the following example:

```
DISPATCHERS=" (protocol=tcp) (listener=listeners_db_name) "
```

Note: Where the notation *db_name* appears in the previous example and throughout this chapter, it refers to the database name (or Oracle SID) that you entered when prompted by DBCA, or it refers to the entry you made for the `DATABASE` keyword of the `CREATE DATABASE` statement.

See Also: *Oracle Database Net Services Administrator's Guide* for further information about cross-instance registration, shared and dedicated server configurations, and connection load balancing

7.9 Configuring the Listener File (listener.ora)

You can configure two types of listeners in the `listener.ora` file as described in the following sections:

- [Local Listeners](#)
- [Multiple Listeners](#)
- [How Oracle Database Uses the Listener \(listener.ora File\)](#)

7.9.1 Local Listeners

If you configured the dedicated server mode using the DBCA Connection Mode tab on the Initialization Parameters page, then DBCA automatically configures the `LOCAL_LISTENER` parameter when the listener uses a nondefault address port.

If you configured the dedicated server mode by setting the `REMOTE_LISTENER` initialization parameter, then you must also configure the instance-specific `LOCAL_LISTENER` initialization parameter.

For example, to configure the `LOCAL_LISTENER` parameter, add the following entry to the initialization parameter file, where `listener_sid` is resolved to a listener address through either a `tnsnames.ora` file or through the Oracle Names Server:

```
sid.local_listener=listener_sid
```

The following entry should be in your `tnsnames.ora` file:

```
listener_sid=(address=(protocol=tcp)(host=node1-vip)(port=1522))
```

7.9.2 Multiple Listeners

If DBCA detects more than one listener on the node, it displays a list of the listeners. You can select one or all of these listeners with which to register your database.

7.9.3 How Oracle Database Uses the Listener (listener.ora File)

Services coordinate their sessions using listener file entries by running a process on the server that receives connection requests on behalf of a client application. This process is either a dedicated process, or a shared server process, depending on your selection during database configuration. Listeners are configured to respond to connection requests sent to protocol addresses for a database service or non-database service.

Protocol addresses are configured in the listener configuration file, `listener.ora`, for a database service or a non-database service. Clients configured with the same addresses can connect to a service through the listener.

During a preconfigured database configuration installation, Oracle Net Configuration Assistant creates and starts a default listener called `LISTENER_NODENAME`. The listener is configured with default protocol listening addresses for the database. The advanced installation process prompts you to create at least one listener with Oracle Net Configuration Assistant. The listener is configured to respond to connection requests that are directed to one protocol address you specify.

Both installation modes configure service information about the Oracle RAC database. An Oracle Database 11g release 1 (11.1) database service automatically registers its information with the listener, such as its service name, instance names, and load information.

This feature, called service registration, does not require configuration in the `listener.ora` file. After listener creation, Oracle Net Configuration Assistant starts the listener. The following is an example `listener.ora` file with an entry for a node named `node1`:

```
LISTENER_NODE1=
  (DESCRIPTION_LIST =
    (DESCRIPTION=
      (ADDRESS = (PROTOCOL = TCP) (HOST = node1-vip) (PORT = 1521) (IP = FIRST))
      (ADDRESS = (PROTOCOL = TCP) (HOST = 140.87.25.116) (PORT = 1521) (IP = FIRST))
    )
  )
SID_LIST_LISTENER_NODE1=
  (SID_LIST=
    (SID_DESC=
      (SID_NAME=)
      (ORACLE_HOME=/u01/app/oracle/11/db_1)
```

7.9.3.1 Listener Registration and PMON Discovery

When a listener starts after the Oracle instance starts, and the listener is listed for service registration, registration does not occur until the next time the Oracle Database process monitor (PMON) discovery routine starts. By default, PMON discovery occurs every 60 seconds.

To override the 60-second delay, use the `SQL ALTER SYSTEM REGISTER` statement. This statement forces the PMON process to register the service immediately.

Oracle recommends that you create a script to run this statement immediately after starting the listener. If you run this statement while the listener is up and the instance is already registered, or while the listener is down, then the statement has no effect.

See Also: *Oracle Database Net Services Administrator's Guide* for further information about the listener and the `listener.ora` file

7.10 Net Service Names (tnsnames.ora File)

A `tnsnames.ora` file is created on each node with net service names. A connect identifier is an identifier that maps to a connect descriptor. A connect descriptor contains the following information:

- The network route to the service, including the location of the listener through a protocol address
- The `SERVICE_NAME` for an Oracle release 8.1 or later, or `sid` for releases previous to Oracle8

Note: The `SERVICE_NAME` parameter you use in the `tnsnames.ora` file is singular, because you can specify only one service name.

DBCA creates net service names for connections as shown in [Table 7-2](#).

Table 7–2 Connections for Net Service Names

Net Service Name Type	Description
Database connections	Clients that connect to any instance of the database use the net service name entry for the database. This entry also enables Oracle Enterprise Manager to discover an Oracle RAC database. A listener address is configured for each node that runs an instance of the database. The <code>LOAD_BALANCE</code> option causes Oracle to choose the address randomly. If the chosen address fails, then the <code>FAILOVER</code> option causes the connection request to fail over to the next address. Thus, if an instance fails, then clients can still connect using another instance. In the following example, <code>db.example.com</code> is used by the client to connect to the target database, <code>db.example.com</code>. <pre>db.example.com= (description= (load_balance=on) (address=(protocol=tcp)(host=node1-vip)(port=1521) (address=(protocol=tcp)(host=node2-vip)(port=1521) (connect_data= (service_name=db.example.com)))</pre> Note: <code>FAILOVER=ON</code> is set by default for a list of addresses. Thus, you do not need to explicitly specify the <code>FAILOVER=ON</code> parameter. When you set <code>DB_UNIQUE_NAME</code> by entering a global database name that is longer than 8 characters, excluding <code>DB_DOMAIN</code>, then a net service entry similar to the following is created: <pre>mydatabase.example.com= (description = (address = (protocol = tcp)(host = node1-vip)(port = 1521)) (address = (protocol = tcp)(host = node2-vip)(port = 1521)) (load_balance = yes) (connect_data = (server = dedicated) (service_name = mydatabase.example.com)))</pre>
Instance connections	Clients that connect to a particular instance of the database use the net service name entry for the instance. This entry, for example, enables Oracle Enterprise Manager to discover the instances in the cluster. These entries are also used to start and stop instances. In the following example, Oracle Enterprise Manager uses <code>db1.example.com</code> to connect to an instance named <code>db1</code> on node1: <pre>db1.example.com= (description= (address=(protocol=tcp)(host=node1-vip)(port=1521)) (connect_data= (service_name=db.example.com) (instance_name=db1)))</pre>

Table 7–2 (Cont.) Connections for Net Service Names

Net Service Name Type	Description
Remote listeners	As discussed in "Configuring Service Registration-Related Parameters" on page 7-4, the REMOTE_LISTENER parameter identifies the global list of listeners and it is dynamic. Oracle Database changes the setting for REMOTE_LISTENER when you reconfigure your cluster database. Whether using shared servers or dedicated servers, the list of remote listeners is supplied using the REMOTE_LISTENER parameter. For example: <pre>REMOTE_LISTENER=listeners_db_unique_name</pre> This enables the instance to register with remote listeners on the other nodes; <code>listeners_db_unique_name</code> is resolved through a naming method such as a <code>tnsnames.ora</code> file. In the following example, <code>listeners_db.example.com</code> is resolved to a list of listeners available on the nodes on which the cluster database has instances: <pre>listeners_db.example.com= (address_list= (address=(protocol=tcp) (host=node1-vip) (port=1521)) (address=(protocol=tcp) (host=node2-vip) (port=1521)))</pre> The instance uses this list to determine the addresses of the remote listeners with which to register its information.

Table 7–2 (Cont.) Connections for Net Service Names

Net Service Name Type	Description
Nondefault listeners	As discussed in "Local Listeners" on page 7-5 and "Multiple Listeners" on page 7-6, if a nondefault listener is configured, then the <code>LOCAL_LISTENER</code> parameter is set in the <code>init<i>sid</i>.ora</code> file or SPFILE. For example: <pre><i>sid</i>.local_listener=listener_<i>sid</i></pre> The variable <code>listener_<i>sid</i></code> is resolved to a listener address through a naming method such as a <code>tnsnames.ora</code> file. In the following example, <code>listener_db1.example.com</code> is resolved to the nondefault listener address: <pre>listener_db1.example.com= (address=(protocol=tcp) (host=node1-vip) (port=1522))</pre>

Table 7–2 (Cont.) Connections for Net Service Names

Net Service Name Type	Description
Services Entries	When you configure high availability services using the DBCA Services page, then DBCA creates net service entries similar to the following. The three services in the following examples, db_svc1, db_svc2, and db_svc3, have TAF policies of NONE, BASIC and PRECONNECT respectively. <pre> db_svc1.example.com= (description = (address=(protocol=tcp) (host=node1-vip) (port=1521)) (address=(protocol=tcp) (host=node2-vip) (port=1521)) (load_balance=yes) (connect_data= (server = dedicated) (service_name = db_svc1.example.com))) db_svc2.example.com= (description= (address=(protocol=tcp) (host=node1-vip) (port=1521)) (address=(protocol=tcp) (host=node2-vip) (port=1521)) (load_balance=yes) (connect_data = (server = dedicated) (service_name=db_svc2.example.com) (failover_mode = (type=select) (method=basic) (retries=180) (delay=5)))) db_svc3.example.com= (description= (address=(protocol=tcp) (host=node1-vip) (port=1521)) (address=(protocol=tcp) (host=node2-vip) (port=1521)) (load_balance=yes) (connect_data= (server=dedicated) (service_name=db_svc3.example.com) (failover_mode= (backup=db_svc3_preconnect.example.com) (type=select) (method=preconnect) (retries=180) (delay=5)))) </pre>

Table 7–2 (Cont.) Connections for Net Service Names

Net Service Name Type	Description
Services Entries (continued)	When a service has a TAF policy of PRECONNECT, then a <i>service_name_preconnect</i> net service entry is also created as in the following example: <pre> db_svc3_preconnect.example.com = (description = (address = (protocol = tcp) (host = node1-vip) (port = 1521)) (address = (protocol = tcp) (host = node2-vip) (port = 1521)) (load_balance = yes) (connect_data = (server = dedicated) (service_name = db_svc3_preconnect.example.com) (failover_mode = (backup = db_svc3.example.com) (type = select) (method = basic) (retries = 180) (delay = 5)))) </pre>

Example 7–1 Example tnsnames.ora File

This example is a sample `tnsnames.ora` file that is created during a preconfigured database configuration installation.

```

db.example.com=
  (description=
    (load_balance=on)
    (address=(protocol=tcp) (host=node1-vip) (port=1521))
    (address=(protocol=tcp) (host=node2-vip) (port=1521))
    (connect_data=
      (service_name=db.example.com)))

db1.example.com=
  (description=
    (address=(protocol=tcp) (host=node1-vip) (port=1521))
    (connect_data=
      (service_name=db.example.com)
      (instance_name=db1)))

db2.example.com=
  (description=
    (address=(protocol=tcp) (host=node2-vip) (port=1521))
    (connect_data=
      (service_name=db.example.com)
      (instance_name=db2)))

listeners_db.example.com=
  (address_list=
    (address=(protocol=tcp) (host=node1-vip) (port=1521))
    (address=(protocol=tcp) (host=node2-vip) (port=1521)))

```

See Also: *Oracle Database Net Services Administrator's Guide* for further information about the `tnsnames.ora` file

7.11 Net Services Profile (sqlnet.ora File)

Oracle Universal Installer starts Oracle Net Configuration Assistant after the database is installed, and creates the Net Services profile, or `sqlnet.ora` file.

By default, the `sqlnet.ora` file is located in the following directory:

```
$ORACLE_HOME/network/admin
```

In this directory, in addition to the default `sqlnet.ora` file generated during installation, you also can find a sample `sqlnet.ora` file in the directory `sample`.

During installation, Oracle Net Configuration Assistant creates the following entries in the `sqlnet.ora` file:

```
NAMES.DIRECTORY_PATH= (TNSNAMES, EZCONNECT)
```

The parameter `NAMES.DIRECTORY_PATH` specifies the priority order of the naming methods to use to resolve connect identifiers to connect descriptors.

The order of naming methods is as follows: directory naming (for Custom Install or Advanced database configuration options only), `tnsnames.ora` file, Easy Connect, and host naming.

The Easy Connect naming method eliminates the need for service name lookup in the `tnsnames.ora` files for TCP/IP environments. With Easy Connect, clients use a connect string for a simple TCP/IP address, consisting of a host name and optional port and service name. If you use this method, then no naming or directory system is required.

See Also: *Oracle Database Net Services Administrator's Guide* for further information about the `sqlnet.ora` file

Removing Oracle RAC and ASM Software

This chapter describes how to completely remove all Oracle databases, instances, and software from an Oracle Real Application Clusters (Oracle RAC) Oracle home directory.

This chapter contains the following topics:

- [Overview of Deinstallation Procedures](#)
- [Identifying All Instances On a Cluster](#)
- [Deinstalling Oracle RAC Software](#)
- [Removing Oracle Software](#)

See Also: If you want to remove an individual product, refer to the product-specific documentation for requirements and restrictions

8.1 Overview of Deinstallation Procedures

To completely remove all Oracle databases, instances, and software from an Oracle home directory:

- Identify all instances associated with the Oracle home
- Shut down processes
- Remove database instances
- Remove Automatic Storage Management
- Remove Oracle Clusterware

Note: You cannot remove or uninstall the Oracle Database Vault option. However, you can disable it. Refer to *Oracle Database Vault Administrator's Guide* for more details.

You can remove Oracle Configuration Manager. Refer to *Oracle Configuration Manager Installation and Administration Guide* for more details.

8.2 Identifying All Instances On a Cluster

To identify all instances associated with the Oracle home that you want to remove, enter the following command:

AIX, HP-UX, or Linux:

```
$ more /etc/oratab
```

Solaris

```
$ more /var/opt/oracle/oratab
```

The output of this command contains entries similar to the following:

```
+ASM1:/u01/app/oracle/product/11.1.0/db_1:N  
CUST:/u01/app/oracle/product/11.1.0/db_1:N
```

These entries show that the +ASM Automatic Storage Management instance and the CUST Oracle database instance are associated with the Oracle home directory /u01/app/oracle/product/11.1.0/db_1.

8.3 Deinstalling Oracle RAC Software

Perform the following procedures to de-install Oracle RAC:

- [Deinstalling Oracle RAC and ASM Using Configuration Assistants](#)
- [Deinstalling Oracle Clusterware](#)

See Also: *Oracle Real Application Clusters Administration and Deployment Guide* for more information about using Oracle RAC scalability features of adding and deleting nodes and instances from Oracle RAC databases, and for information about viewing OCR content

8.3.1 Deinstalling Oracle RAC and ASM Using Configuration Assistants

This section describes the procedure to deinstall the Oracle RAC software and Automatic Storage Management (ASM) software using configuration assistant command lines.

Caution: Before you perform these steps, Oracle recommends that you make a backup of any databases that run from the Oracle home you are about to delete. You should then stop any instances and processes on all nodes, including services, that depend on the software that you are de-installing.

1. Examine the `oratab` file to identify the instance dependencies on this Oracle home.
2. Start DBCA, select **Oracle Real Application Clusters Database**, select **Delete a database**, and select the database that you want to delete. Repeat this step to delete all databases.
3. If you do not use ASM, then proceed to step 4.

If the database is in the Oracle home from which the ASM database runs, then ensure that there are no other database dependencies on this group of ASM instances.

If Oracle RAC and ASM are owned by the same Oracle user account, then log in as that user (typically `oracle`).

If Oracle RAC and Oracle ASM are owned by different software owners, then remove the Oracle RAC installation by logging in as the Oracle RAC software owner, and remove ASM by logging in as the ASM software owner.

To remove the software, complete the following steps

- a. Connect to the ASM instance and run the following command to determine database instances using this ASM instance:

```
SQL> select INSTANCE_NAME from GV$ASM_CLIENT;
```

Note: This command lists only database instances that are running. It is possible that other instances are associated with the ASM instance, but they are not currently running. If you removed a database from this Oracle home but the output from the command shows that this ASM instance is supporting a database instance in another Oracle home, then do not remove the ASM instance or the Oracle home.

If your Oracle RAC database uses a different Oracle home from the Oracle home that your ASM environment uses, and you want to delete the Oracle RAC database, then perform step 5 in the Oracle RAC database home.

- b. For each instance listed in the output of the statement you run in step a, stop the respective databases.
 - c. Oracle recommends that you back up the database files for all the databases that are currently using this ASM instance.
 - d. Using your connection to the ASM instance, run the following command:
- ```
SQL> select * from V$ASM_DISKGROUP;
```
- e. For each disk group listed in the output of the statement you run in step d, run the following command, where the variable *diskgroup\_name* is the name of the disk group that you want to delete:
- ```
SQL> drop diskgroup diskgroup_name including contents;
```
- f. Shut down ASM on all Oracle RAC nodes, and verify that all ASM instances are stopped.
 - g. If you are de-installing from a system with ASMLIB, then run the following procedure. First, run this command to list the disks that you need to delete:

```
oracleasm listdisks
```

Second, run the following command to delete every disk listed by the previous command:

```
oracleasm deletedisks
```

Third, re-run the `oracleasm listdisks` command to confirm that the disks are all deleted. Repeat this command on each of the Oracle RAC cluster nodes to confirm that the disks have been deleted from all the nodes.

Fourth, as `root`, run the following commands on all nodes of your Oracle RAC cluster:

```
/etc/init.d/oracleasm stop  
/etc/init.d/oracleasm disable
```

- h. Deconfigure ASM, using either DBCA in silent mode, or performing deconfiguration manually.

To deconfigure ASM manually, complete steps i through l.

To deconfigure ASM using DBCA, run DBCA in silent mode to deconfigure ASM. To run DBCA in silent mode, navigate to the directory `$ORACLE_HOME/bin` and use the following command syntax:

```
dbca -silent -deleteASM -nodelist node1,node2,...
```

for the variables `node1`, `node2`, and so on, provide a list of all the nodes where ASM is configured. When DBCA completes de-installation, proceed to step 4.

- i. To remove the ASM entry from the OCR, run the following command for all nodes on which this Oracle home exists:

```
srvctl remove asm -n nodename
```

where `nodename` is the name of a node from which you want to remove the ASM instance. Repeat this command for each node on which you want to remove ASM.

- j. If you are using a shared cluster file system for your Oracle home, then run the following commands on the local node:

```
rm -Rf $ORACLE_HOME/dbs/*ASM*  
rm -Rf $ORACLE_BASE/admin/+ASM
```

You may need to remove subordinate files or directories before these commands complete successfully.

- k. If you are not using a shared cluster file system for your Oracle home, then run the commands from the previous step, step j, on *each* node on which the Oracle home exists.
 - l. Remove `oratab` entries for the deleted Oracle home databases.
4. If there are no outstanding dependencies, then change directory to the `$ORACLE_HOME/bin` directory, and use the following NETCA command syntax to remove the listener and its Oracle Clusterware resources.

```
$ ./netca /deinst /nodeinfo node1,node2,...
```

In the preceding syntax example, replace the variables `node1`, `node2`, and so on, with all the member nodes of the Oracle RAC database.

Note: You cannot perform an Oracle RAC installation from the same Oracle Universal Installer session in which you perform an Oracle RAC deinstallation. If you deinstall Oracle RAC with OUI and want to perform another Oracle RAC installation, then you must start a new OUI session.

5. Start OUI, and remove any existing Oracle Database with Oracle RAC software by selecting **Deinstall Products**, and selecting the Oracle home that you want to remove. If any of these databases is an ASM database, then de-install the Oracle

home with ASM where you want to de-install the Oracle Database software, and then de-install the Oracle Database. Removing ASM does not remove the ASM data or disk groups.

8.3.2 Deinstalling Oracle Clusterware

Deinstall each Oracle RAC home by running the procedure in the previous section, ["Deinstalling Oracle RAC and ASM Using Configuration Assistants"](#). Then complete the deinstallation by removing the Oracle Clusterware software. Refer to *Oracle Clusterware Installation Guide* for your platform for Oracle Clusterware deinstallation procedures.

8.4 Removing Oracle Software

The following steps describe how to use Oracle Universal Installer (OUI) to remove Oracle software from an Oracle home:

Note: Always use OUI to remove Oracle software. Do not delete any Oracle home directories without first using OUI to remove the software.

1. If necessary, log in as the `oracle` user:

```
$ su - oracle
```

2. Set the `ORACLE_HOME` environment variable to specify the path of the Oracle home directory that you want to remove:

- Bourne, Bash, or Korn shell:

```
$ ORACLE_HOME=/u01/app/oracle/product/11.1.0/db_1
$ export ORACLE_HOME
```

- C shell:

```
$ setenv ORACLE_HOME /u01/app/oracle/product/11.1.0/db_1
```

3. Remove any databases or Automatic Storage Management instances associated with this Oracle home and delete the Oracle CSS daemon.

Refer to the preceding sections for information about how to complete these tasks.

4. Stop any processes running in this Oracle home:

Process Name	Command
Database Control	<code>\$ORACLE_HOME/bin/emctl stop dbconsole</code>
Oracle Net listener	<code>\$srvctl stop listener -n nodename</code>
Oracle Ultra Search	<code>\$ORACLE_HOME/bin/searchctl stop</code>

5. Start OUI as follows:

```
$ $ORACLE_HOME/oui/bin/runInstaller
```

6. In the Welcome window, click **Deinstall Products**.

The Inventory screen appears, listing all of the Oracle homes on the system.

7. In the Inventory screen, select the Oracle home and the products that you want to remove, then click **Remove**.

Note: If you choose to remove Oracle JVM, then OUI removes all installed products that depend on Oracle JVM, including Oracle Database 10g.

OUI displays a confirmation window asking you to confirm that you want to deinstall the products and their dependent components.

8. Click **Yes**.

OUI displays a progress indicator as it removes the software.

9. Click **Close** on the Inventory screen.

10. When the products have been deleted, click **Cancel** to exit from OUI, and then click **Yes**.

Troubleshooting the Oracle Real Application Clusters Installation Process

This appendix provides troubleshooting information for Oracle Real Application Clusters (Oracle RAC).

See Also: The Oracle Database 11g release 1 (11.1) Oracle Real Application Clusters documentation set included with the installation media in the Documentation directory:

- *Oracle Real Application Clusters Administration and Deployment Guide*

A.1 Troubleshooting the Oracle Real Application Clusters Installation

This section contains these topics:

- [General Installation Issues](#)
- [Oracle RAC Installation Error Messages](#)
- [Performing Cluster Diagnostics During Oracle Clusterware Installations](#)
- [Reviewing the Log of an Installation Session](#)
- [Configuration Assistant Errors](#)

A.1.1 General Installation Issues

The following is a list of examples of types of errors that can occur during installation. It contains the following issues:

- [An error occurred while trying to get the disks](#)
- [Failed to connect to server, Connection refused by server, or Can't open display](#)
- [Nodes unavailable for selection from the OUI Node Selection screen](#)
- [Node nodename is unreachable](#)
- [PROT-8: Failed to import data from specified file to the cluster registry](#)
- [PRKP-1001: Error starting instance](#)
- [Time stamp is in the future](#)
- [YPBINDPROC_DOMAIN: Domain not bound](#)

An error occurred while trying to get the disks

Cause: There is an entry in `/etc/oratab` pointing to a non-existent Oracle home. The OUI error file should show the following error:

```
"java.io.IOException: /home/oracle/OraHome//bin/kfod: not found"
```

Action: Remove the entry in `/etc/oratab` pointing to a non-existing Oracle home.

Failed to connect to server, Connection refused by server, or Can't open display

Cause: These are typical of X Window display errors on Windows or UNIX systems, where `xhost` is not properly configured.

Action: In a local terminal window, log in as the user that started the X Window session, and enter the following command:

```
$ xhost fully_qualified_remote_host_name
```

For example:

```
$ xhost somehost.example.com
```

Then, enter the following commands, where *workstation_name* is the host name or IP address of your workstation.

Bourne, Bash, or Korn shell:

```
$ DISPLAY=workstation_name:0.0
$ export DISPLAY
```

To determine if X Window applications display correctly on the local system, enter the following command:

```
$ xclock
```

The X clock should appear on your monitor.

If the X clock appears, then close the X clock and start Oracle Universal Installer again.

Nodes unavailable for selection from the OUI Node Selection screen

Cause: Oracle Clusterware is either not installed, or the Oracle Clusterware services are not up and running.

Action: Install Oracle Clusterware, or review the status of your Oracle Clusterware. Consider restarting the nodes, as doing so may resolve the problem.

Node *nodename* is unreachable

Cause: Unavailable IP host

Action: Attempt the following:

1. Run the command `ifconfig -a`. Compare the output of this command with the contents of the `/etc/hosts` file to ensure that the node IP is listed.
2. Run the command `nslookup` to see if the host is reachable.
3. As the `oracle` user, attempt to connect to the node with `ssh` or `rsh`. If you are prompted for a password, then user equivalence is not set up properly. Contact your system administrator, or consult *Oracle Clusterware Installation Guide* for your platform to complete SSH configuration.

PROT-8: Failed to import data from specified file to the cluster registry

Cause: Insufficient space in an existing Oracle Cluster Registry raw device partition, which causes a migration failure while running `rootupgrade.sh`. To confirm, look for the error "utopen:12:Not enough space in the backing store" in the log file `$ORA_CRS_HOME/log/hostname/client/ocrconfig_pid.log`.

Action: Identify a raw device that has 280 MB or more available space. Locate the existing raw device name from `/var/opt/oracle/srvConfig.loc`, and copy the contents of this raw device to the new device using the command `dd`.

PRKP-1001: Error starting instance

Cause: Missing ODBC Driver Manager. Associated message is **CRS-0215: Could not start resource**.

Action: Clean up installation, download and install the ODBC driver from <http://www.unixodbc.org>, and restart the installation. This is a requirement for Oracle RAC databases, documented in system requirements in the Oracle Clusterware installation guide for your platform.

Time stamp is in the future

Cause: One or more nodes has a different clock time than the local node. If this is the case, then you may see output similar to the following:

```
time stamp 2005-04-04 14:49:49 is 106 s in the future
```

Action: Ensure that all member nodes of the cluster have the same clock time.

YPBINDPROC_DOMAIN: Domain not bound

Cause: This error can occur during postinstallation testing when a node public network interconnect is pulled out, and the VIP does not fail over. Instead, the node hangs, and users are unable to log in to the system. This error occurs when the Oracle home, listener.ora, Oracle log files, or any action scripts are located on an NAS device or NFS mount, and the name service cache daemon `nscd` has not been activated.

Action: Enter the following command on all nodes in the cluster to start the `nscd` service:

```
/sbin/service nscd start
```

A.1.2 Oracle RAC Installation Error Messages

Oracle Real Application Clusters Management Tools Error Messages are in *Oracle Real Application Clusters Administration and Deployment Guide*.

Note that the user performing the Oracle RAC installation must have membership both in the `oinstall` group and the `OSDBA` group (typically `oinstall` and `dba`). If this is not the case, then the installation will fail

A.1.3 Performing Cluster Diagnostics During Oracle Clusterware Installations

If Oracle Universal Installer (OUI) does not display the Node Selection page, then perform clusterware diagnostics by running the `olsnodes -v` command from the binary directory in your Oracle Clusterware home (`CRS_home`) and analyzing its output. Refer to your clusterware documentation if the detailed output indicates that your clusterware is not running.

In addition, use the following command syntax to check the integrity of the Cluster Manager:

```
cluvfy comp clumgr -n node_list -verbose
```

In the preceding syntax example, the variable *node_list* is the list of nodes in your cluster, separated by commas.

A.1.4 Reviewing the Log of an Installation Session

During an installation, Oracle Universal Installer records all of the actions that it performs in a log file. If you encounter problems during the installation, then review the log file for information about possible causes of the problem.

To view the log file, follow these steps:

1. If necessary, enter the following command to determine the location of the oraInventory directory:

```
$ cat /opt/oracle/oraInst.loc
```

2. Enter the following command to determine the name of the log file:

```
$ ls -ltr
```

This command lists the files in the order of creation, with the most recent file shown last. Installer log files have names similar to the following, where *date_time* indicates the date and time that the installation started:

```
installActionsdate_time.log
```

To view the most recent entries in the log file, where information about a problem is most likely to appear, enter a command similar to the following:

```
$ tail -50 installActions2007-07-20_09-53-22AM.log | more
```

This command displays the last 50 lines in the log file, and enables you to page through them.

If the error displayed by Oracle Universal Installer or listed in the log file indicates a relinking problem, then refer to the following file for more information:

```
$ORACLE_HOME/install/make.log
```

A.1.5 Configuration Assistant Errors

To troubleshoot an installation error that occurs when a configuration assistant is running:

Review the installation log files listed in the section ["Reviewing the Log of an Installation Session"](#) on page A-4.

Review the specific configuration assistant log file located in the \$ORACLE_HOME/cfgtoollogs directory. Try to fix the issue that caused the error.

If you see the "Fatal Error. Reinstall" message, then look for the cause of the problem by reviewing the log files. Refer to the section ["Fatal Errors"](#) on page A-5 for further instructions.

This section contains the following topics:

- [Configuration Assistant Failures](#)
- [Fatal Errors](#)

A.1.5.1 Configuration Assistant Failures

Oracle configuration assistant failures are noted at the bottom of the installation screen. The configuration assistant interface displays additional information, if available. The configuration assistant execution status is stored in the following file:

```
oraInventory_location/logs/installActionsdate_time.log
```

More details on errors related to the configuration assistant can be found under the following directory:

```
$ORACLE_HOME/cfgtoollogs
```

The completion status codes are listed in the following table:

Status	Result	Code
Configuration assistant	succeeded	0
Configuration assistant	failed	1
Configuration assistant	cancelled	-1

A.1.5.2 Fatal Errors

If you receive a fatal error while a configuration assistant is running, you must complete the following tasks:

1. Deinstall Oracle software.
2. Correct the cause of the fatal error.
3. Reinstall the Oracle software.

Using Scripts to Create Oracle Real Application Clusters Databases

This appendix describes the steps required to create an Oracle Real Application Clusters (Oracle RAC) database using scripts to perform noninteractive installations.

Note: The scripts generated by DBCA are for reference purposes only. Oracle strongly recommends that you use DBCA to create a database.

See Also: *Oracle Universal Installer and OPatch User's Guide for Windows and UNIX* for detailed information about generating scripts

This appendix contains the following topics:

- [Using DBCA to generate Installation Scripts for Oracle RAC](#)
- [Using DBCA Noninteractive \(Silent\) Configuration for Oracle RAC](#)

B.1 Using DBCA to generate Installation Scripts for Oracle RAC

To generate scripts to create an Oracle RAC database, create a database using the scripts, and prepare the database for use, complete the following steps:

1. Start Database Configuration Assistant (DBCA) and select your preferred options to build the Oracle RAC database. Note: you must select the **Custom Database** template on the Database Templates page for DBCA to provide the script generation option.

On the Creation Options page of your DBCA session, deselect Create Database and select **Generate Database Creation Scripts** before you click **Finish**. You can accept the default destination directory for the scripts, or browse for a different location. In either case, you should note the path name for use in the next step.

See Also: [Chapter 3, "Creating Oracle Real Application Clusters Databases with Database Configuration Assistant"](#) for additional information about running a DBCA session

2. Navigate to the directory, which you noted in step 1, where DBCA created the scripts, and review the SQL scripts to ensure that they contain the statements to build a database with the characteristics you require. If they do not, then Oracle recommends that you rerun DBCA to create scripts with the desired configuration rather than editing the scripts yourself.

3. On each cluster node you identified during your DBCA session, run the script *sid.sh*, where *sid* is the SID prefix that you entered on the DBCA Database Name page.
4. Set the initialization parameter, *cluster_database*, to the value `TRUE` in your SPFILE by issuing an `ALTER SYSTEM` command, or by uncommenting it in your PFILE for each instance.
5. Configure Oracle Net Services to support your new database and instances as described in [Chapter 7, "Understanding the Oracle Real Application Clusters Installed Configuration"](#).
6. Set the *local_listener* and *remote_listener* parameters in your SPFILE by issuing an `ALTER SYSTEM` command, or by uncommenting it in your PFILE for each instance.
7. Run `SRVCTL` to configure and start database and instance applications as described in *Oracle Real Application Clusters Administration and Deployment Guide*.

See Also: *Oracle Universal Installer and OPatch User's Guide for Windows and UNIX* for additional information about creating and using scripts to install Oracle software with OUI

B.2 Using DBCA Noninteractive (Silent) Configuration for Oracle RAC

You can perform a noninteractive, or "silent" configuration of Oracle RAC using DBCA. To perform a silent configuration, you must have completed an Oracle Clusterware installation, run the `root.sh` script from the Oracle Database or Oracle ASM homes, and defined the Oracle home and ASM home directory environment variables.

The following command syntax creates an ASM instance and one disk group:

```
# su oracle -c "$ORA_ASM_HOME/bin/dbca -silent -configureASM -gdbName NO
-sid NO -emConfiguration NONE -diskList ASM_Disks -diskGroupName ASM_
Group_Name -datafileJarLocation $ORACLE_HOME/assistants/dbca/templates
-nodeinfo $NODE1,$NODE2 -obfuscatedPasswords false -asmSysPassword My_ASM_
password -redundancy ASM_redundancy"
```

In the preceding syntax example:

- *ASM_Disks* represent disk addresses, such as `/dev/sda1`, `/dev/sdb1`
- *ASM_Group_Name* represents the name of an ASM disk group
- *ASM_Redundancy* represents an ASM disk redundancy setting, such as 'NORMAL'.
- *My_ASM_password* represents the ASM SYS user password.

The following command syntax creates an Oracle RAC database on an existing ASM disk group, where the cluster nodes are `node1` and `node2`, and where the disk group name is `ASMgrp1`, the passwords are *my_password*, and the ASM SYS password is *My_ASM_Password*:

```
# su oracle -c "$ORACLE_HOME/bin/dbca -silent -createDatabase -templateName
General_Purpose.dbc -gdbName $DBNAME -sid $SID -sysPassword my_password
-systemPassword my_password -sysmanPassword my_password -dbsnmpPassword my_
password -emConfiguration LOCAL -storageType ASM -diskGroupName ASMgrp1
-datafileJarLocation $ORACLE_HOME/assistants/dbca/templates -nodeinfo
node1,node2 -characterSet WE8ISO8859P1 -obfuscatedPasswords false -sampleSchema
false -asmSysPassword My_ASM_password"
```

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

This chapter describes the procedures for converting from Oracle Database 11g release 1 (11.1) single-instance databases to Oracle Real Application Clusters (Oracle RAC) databases.

This appendix contains the following topics:

- [Administrative Issues for Converting Databases to Oracle RAC](#)
- [Converting to Oracle RAC with DBCA](#)
- [Preparing to Convert with rconfig and Oracle Enterprise Manager](#)
- [Converting Databases to Oracle RAC Using RCONFIG](#)
- [Example of an rconfig XML Input File for ConvertToRAC](#)
- [Converting Single-Instance ASM to Oracle RAC Using RCONFIG](#)
- [Example of an rconfig XML Input File for ConvertToASM](#)
- [Post-Conversion Steps](#)

If you are upgrading from Oracle Parallel Server to Oracle RAC, or from an earlier version of Oracle RAC, then use Oracle Database Upgrade Assistant (DBUA).

The procedures in this chapter assume that your original single-instance database and the target Oracle RAC database are using the same release, and running on the same platform.

Note: You must use clustered ASM instances for Oracle RAC databases.

See Also: You must comply with the restrictions of the license you have purchased. To understand the restrictions of your license, refer to *Oracle Database Licensing Information*

C.1 Administrative Issues for Converting Databases to Oracle RAC

Note the following administrative considerations before converting single-instance databases to Oracle RAC:

- Backup procedures should be available before converting from a single-instance Oracle Database to Oracle RAC.
- For archiving with Oracle RAC environments, the archive file format requires a thread number.
- The archived logs from all instances of an Oracle RAC database are required for media recovery. Because of this, if you archive to a file and you do not use a cluster file system, or some other means to provide shared file systems, then you require a method of accessing the archive logs from all nodes on which the cluster database has instances.
- By default, all database files are migrated to Oracle-Managed Files (OMF). This feature simplifies tablespace creation, ensures datafile location consistency and compliance with OFA rules, and reduces human error with data file management.

C.2 Converting to Oracle RAC with DBCA

You can use Database Configuration Assistant to convert from single-instance Oracle databases to Oracle RAC. DBCA automates the configuration of the control file attributes, creates the undo tablespaces and the redo logs, and makes the initialization parameter file entries for cluster-enabled environments. It also configures Oracle Net Services, Oracle Clusterware resources, and the configuration for Oracle RAC database management for use by Oracle Enterprise Manager or the SRVCTL utility.

Before you use DBCA to convert a single-instance database to an Oracle RAC database, ensure that your system meets the following conditions:

- It is a supported hardware and operating system software configuration.
- It has shared storage: either Oracle Cluster File System or ASM is available and accessible from all nodes. On Linux on POWER systems, ensure that GPFS is available and accessible from all nodes.
- Your applications have no design characteristics that preclude their use with cluster database processing.

If your platform supports a cluster file system, then you can use it for Oracle RAC. You can also convert to Oracle RAC and use a non-shared file system. In either case, Oracle strongly recommends that you use Oracle Universal Installer (OUI) to perform an Oracle Database 11g release 1 (11.1) installation that sets up the Oracle home and inventory in an identical location on each of the selected nodes in your cluster.

This section describes the following scenarios:

- [Converting Oracle Database 11g Installations to Oracle RAC Using DBCA](#)
- [Converting Single Instance on a Cluster to Oracle RAC using DBCA](#)
- [Converting Single-Instance ASM to Cluster ASM Using DBCA](#)

C.2.1 Converting Oracle Database 11g Installations to Oracle RAC Using DBCA

To convert from a single-instance Oracle Database that is on a non-cluster computer to Oracle RAC, perform the procedures described in the following sections, and in the order shown:

- [Back Up the Original Single-Instance Database](#)
- [Complete Oracle Clusterware Installation](#)
- [Validate the Cluster](#)

- [Copy the Preconfigured Database Image](#)
- [Install Oracle Database 11g Software with Oracle RAC](#)

C.2.1.1 Back Up the Original Single-Instance Database

Use DBCA to create a preconfigured image of your single-instance database by using the following procedure:

1. Navigate to the `bin` directory in `$ORACLE_HOME`, and start DBCA.
2. At the Welcome page, click **Next**.
3. On the Operations page, select **Manage Templates**, and click **Next**.
4. On the Template Management page, select **Create a database template** and **From an existing database (structure as well as data)**, and click **Next**.
5. On the Source Database page, select the database name in the **Database instance** list, and click **Next**.
6. On the Template Properties page, enter a name for your template in the **Name** field. Oracle recommends that you use the database name.

By default, the template files are generated in the directory `ORACLE_HOME/assistants/dbca/templates`. If you choose to do so, you can enter a description of the file in the **Description** field, and change the template file location in the **Template data file** field.

When you have completed entries, click **Next**.

7. On the Location of Database Related Files page, select **Maintain the file locations**, so that you can restore the database to the current directory structure, and click **Finish**.

DBCA generates two files: a database structure file (`template_name.dbc`), and a database preconfigured image file (`template_name.dfb`).

C.2.1.2 Complete Oracle Clusterware Installation

Complete Oracle Clusterware installation, as described in *Oracle Database Oracle Clusterware Installation Guide* for your platform.

C.2.1.3 Validate the Cluster

Validate the cluster configuration using the Cluster Verification Utility.

C.2.1.4 Copy the Preconfigured Database Image

Copy the preconfigured database image. This includes copying the database structure `*.dbc` file and the database preconfigured image `*.dfb` file that DBCA created in the previous procedure "[Back Up the Original Single-Instance Database](#)" on page C-3 to a temporary location on the node in the cluster from which you plan to run DBCA.

C.2.1.5 Install Oracle Database 11g Software with Oracle RAC

1. Run OUI to perform an Oracle Database installation with Oracle RAC.
2. Select **Cluster Installation Mode** on the Specify Hardware Cluster Installation page of OUI, and select the nodes to include in your Oracle RAC database.
3. On the OUI Database Configuration Types page, select the **Advanced** install type.

After installing the Oracle Database software, OUI runs postinstallation configuration tools, such as Network Configuration Assistant (NETCA), DBCA, and so on.

4. On the DBCA Template Selection page, use the template that you copied to a temporary location in the ["Copy the Preconfigured Database Image"](#) procedure. Use the browse option to select the template location.
5. If you selected raw storage on the OUI Storage Options page, then on the DBCA File Locations Tab on the Initialization Parameters page, replace the data files, control files, and log files, and so on, with the corresponding raw device files if you have not set up the `DBCA_RAW_CONFIG` environment variable. You must also replace default database files with raw devices on the Storage page.

See Also: [Chapter 3, "Creating Oracle Real Application Clusters Databases with Database Configuration Assistant"](#) for more details about DBCA

6. After creating the Oracle RAC database, DBCA displays the Password Management page on which you must change the passwords for database privileged users who have `SYSDBA` and `SYSOPER` roles. When DBCA exits, the conversion process is complete.

C.2.2 Converting Single Instance on a Cluster to Oracle RAC using DBCA

There are three scenarios in which a single-instance database can exist on a cluster computer:

- Scenario 1: The Oracle home from which the single-instance database is running is cluster-installed. The steps to perform a conversion to Oracle RAC in this scenario are described in ["Single Instance on a Cluster Running from a Cluster-Enabled Oracle Home"](#) on page C-4.
- Scenario 2: The Oracle home from which the single-instance database is running is cluster-installed, but the Oracle RAC feature is disabled. Refer to ["Single Instance on a Cluster Running from an Oracle RAC-Disabled Oracle Home"](#) on page C-7 for instructions on how to convert the database to Oracle RAC in this environment.
- Scenario 3: The Oracle home from which the single-instance database is running is not cluster-installed. The procedure to convert the single-instance database to Oracle RAC in this scenario is described in ["Single Instance on a Cluster Running from a Single-Instance Installed Oracle Home"](#) on page C-7.

C.2.2.1 Single Instance on a Cluster Running from a Cluster-Enabled Oracle Home

Perform the following procedures to convert a single-instance database on a cluster running from a cluster-installed (Oracle Database 11g with RAC) Oracle home.

1. Use DBCA to create a preconfigured image of your single-instance database as described in the section ["Back Up the Original Single-Instance Database"](#) on page C-3. To perform the conversion manually, shut down the single-instance database.
2. To add nodes to your cluster, add and connect these nodes to the cluster as described in *Oracle Database Oracle Clusterware Installation Guide* for your platform. Ensure that all of these nodes can access the shared storage. Also, extend the Oracle Clusterware home to the new nodes using the procedures for "Extending Clusterware and Oracle Software to New Nodes" as described in *Oracle Clusterware Administration and Deployment Guide*.

3. From the existing Oracle home, extend this home to the new nodes using the procedure "Adding Nodes at the Oracle RAC Database Layer" as described in *Oracle Clusterware Administration and Deployment Guide*.
4. From one of the newly added nodes, configure the listeners on the additional nodes using NETCA. Choose the same port number and protocol that you used on the existing node. If NETCA displays the existing node in the node list page, then do not select this node, because the listener is already configured on it.
5. Convert the database using one of the following procedures:
 - [Automated Conversion Procedure Using DBCA](#)
 - [Manual Conversion Procedure Using DBCA](#)

C.2.2.1.1 Automated Conversion Procedure Using DBCA 1.If you created the preconfigured image of the single instance database as described in the section "[Back Up the Original Single-Instance Database](#)" on page C-3, then use DBCA to complete the conversion to an Oracle RAC database.

2. Start DBCA from the initial node. Select the names of the nodes that you want to include as part of your cluster database. On the Template Selection page, select the preconfigured template that you created in Step 1 on page C-4. Enter the database name and respond to the remaining DBCA prompts.
3. To use raw devices for the cluster database files: When the Initialization Parameters page appears, enter the raw device name for the SPFILE on the File Locations tab. On the Storage page, replace the default database file names with the raw devices for the control files, redo logs, and data files to create the cluster database. Click **Finish**, and create the database.

After creating the Oracle RAC database, DBCA displays the Password Management page on which you must change the passwords for the database privileged users who have SYSDBA and SYSOPER roles. When DBCA exits, the conversion process is complete.

C.2.2.1.2 Manual Conversion Procedure Using DBCA Because you did not use DBCA to create a preconfigured image of your single-instance database in step 1 on page C-4, perform the following steps to complete the conversion:

1. Create the Optimal Flexible Architecture (OFA) directory structure on each of the nodes that you have added.

See Also: "[Directory Structures for Oracle RAC](#)" on page D-1 for more information about OFA

2. If you are converting single-instance database files on a file system to raw devices, then copy the database data files, control files, redo logs, and server parameter file to their corresponding raw devices using the `dd` command. Otherwise, continue to the next step.
3. Re-create the control files by running the `CREATE CONTROLFILE SQL` statement with the `REUSE` keyword and specify `MAXINSTANCES` and `MAXLOGFILES`, and so on, as needed for your Oracle RAC configuration. The `MAXINSTANCES` recommended default is 32.
4. Shut down the database instance.
5. If your single-instance database was using an SPFILE, then create a temporary PFILE from the SPFILE using the following SQL statement:

```
CREATE PFILE='pfile_name' from spfile='spfile_name'
```

6. Set the `CLUSTER_DATABASE` parameter to `TRUE`, set the `INSTANCE_NUMBER` parameter to a unique value for each instance, using a `sid.parameter=value` syntax.

If you optimized memory usage on your single-instance database, then adjust the size of the system global area (SGA) to avoid swapping and paging when you convert to Oracle RAC. you should make this adjustment because Oracle RAC requires about 350 bytes for each buffer to accommodate the Global Cache Service (GCS). For example, if you have 10,000 buffers, then Oracle RAC requires about 350 multiplied by 10,000 bytes more memory. Therefore, adjust the size of the SGA by changing the `DB_CACHE_SIZE` and `DB_nK_CACHE_SIZE` parameters accordingly.

7. Start up the database instance using the PFILE created in step 5.
8. If your single-instance database was using automatic undo management, then create an undo tablespace for each additional instance using the `CREATE UNDO TABLESPACE` SQL statement. If you are using raw devices, then ensure that the data file for the undo tablespace is on the raw device.
9. Create redo threads that have at least two redo logs for each additional instance. If you are using raw devices, then ensure that the redo log files are on raw devices. Enable the new redo threads by using an `ALTER DATABASE` SQL statement. Then, shut down the database instance.
10. Copy the Oracle password file from the initial node, or from the node from which you are working, to the corresponding location on the additional nodes on which the cluster database will have an instance. Replace the `ORACLE_SID` name in each password file appropriately for each additional instance.
11. Add `REMOTE_LISTENER=LISTENER_DB_NAME` and `sid.LOCAL_LISTENER=LISTENER_SID` parameters to the PFILE.
12. Configure the net service entries for the database and instances, and address entries for the `LOCAL_LISTENER` for each instance and for the `REMOTE_LISTENER` in the `tnsnames.ora` file. When you have done this, copy these to all nodes.
13. Create the SPFILE from the PFILE using the procedures in the section "[Procedures for Migrating to the Server Parameter File](#)" on page 6-3. If you are not using a cluster file system, then ensure that the SPFILE is on a raw device.
14. Create the `$ORACLE_HOME/dbs/initsid.ora` file that contains the following entry:

```
spfile='spfile_path_name'
```

The variable `spfile_path_name` is the complete path name of the SPFILE.

15. On the local node, run `catclust.sql`. This command creates the dictionary views needed for Oracle RAC databases. For example:

```
SQL> start ?/rdbms/admin/catclust.sql
```

16. Add the configuration for the Oracle RAC database and its instance-to-node mapping using `SRVCTL`.
17. Start the Oracle RAC database using `SRVCTL`.

After starting the database with SRVCTL, your conversion process is complete and, for example, you can run the following SQL statement to see the status of all the instances in your Oracle RAC database:

```
select * from v$active_instances
```

C.2.2.2 Single Instance on a Cluster Running from an Oracle RAC-Disabled Oracle Home

You can install a single instance on a cluster running from an Oracle RAC-disabled Oracle home if you performed a one-node cluster (with Oracle RAC) installation, but later disabled the Oracle RAC feature by unlinking it from the `oracle` binary before creating the single instance database. (However, you can also select the **local** and **non-cluster** selection on the Node Selection Page to create a single-instance home on a cluster with Oracle RAC disabled.) Perform the following procedures to convert this type of single-instance database to an Oracle RAC database:

1. Use DBCA to create a preconfigured image of your single-instance database as described in the section ["Back Up the Original Single-Instance Database"](#) on page C-3. To perform the conversion manually, shut down the single-instance database.
2. Change the directory to the `lib` subdirectory in the `rdbms` directory under the Oracle home.

3. Relink the `oracle` binary by running the following commands:

```
make -f ins_rdbms.mk rac_on
make -f ins_rdbms.mk ioracle
```

4. Continue with step 2 on page C-4.

C.2.2.3 Single Instance on a Cluster Running from a Single-Instance Installed Oracle Home

You can only install a single instance on a cluster running from a single-instance installed Oracle home if you selected the local installation option on the OUI Specify Hardware Cluster Installation page during the single-instance Oracle Database 11g release 1 (11.1) installation.

To convert this type of database to an Oracle RAC database, perform the procedures described in the following sections:

1. ["Back Up the Original Single-Instance Database"](#) on page C-3.
2. ["Complete Oracle Clusterware Installation"](#) on page C-3.
3. ["Validate the Cluster"](#) on page C-3.
4. ["Install Oracle Database 11g Software with Oracle RAC"](#) on page C-3. In this step, make sure that you select a new Oracle home other than the one from which the single-instance database was running.

C.2.3 Converting Single-Instance ASM to Cluster ASM Using DBCA

To use Database Configuration Assistant (DBCA) to convert a single-instance node using ASM to an Oracle RAC node using ASM, complete the following procedure:

1. Shut down the database instance, the ASM instance, and the listener.

To enable you to shut down and uninstall CSS, run the following command:


```
$ORACLE_HOME/bin/localconfig delete
```

This command removes the CSS auto-start line from the `/etc/inittab` file.

2. Follow the instructions *Oracle Clusterware Installation Guide* for your platform to configure each node that you want to have as a cluster member.
3. If any cluster member node has had previous versions of Oracle Clusterware (Cluster Ready Services or Oracle Clusterware) installed, then ensure that you remove the file `ocr.loc` on any node that has been labeled previously as a cluster node. The file `ocr.loc` is in `/etc/oracle` on Linux and UNIX, and `/var/opt/oracle` on Solaris.
4. log in as the `oracle` user, and run DBCA in silent mode to deconfigure ASM. To run DBCA in silent mode, navigate to the directory `$ORACLE_HOME/bin` and use the following command syntax on the local node:

```
dbca -silent -deleteASM
```

You can de-install the single-instance ASM without losing data.

5. Install Oracle Clusterware on all nodes you intend to have as cluster members, as described in *Oracle Clusterware Installation Guide* for your platform.
6. Install Cluster ASM using DBCA. At the Node Selection page, select all the cluster member nodes for which you intend to use ASM to manage storage. When the ASM Disk Groups page prompts you to select disk groups, select the existing disk groups you used with the single-instance ASM instance that you deleted in step 4.
7. Start up the single-instance Oracle Database.

C.3 Preparing to Convert with rconfig and Oracle Enterprise Manager

You can use `rconfig`, or Oracle Enterprise Manager to assist you with the task of converting a single-instance database installation to an Oracle RAC database. The first of these, `rconfig`, is a command line utility. Oracle Enterprise Manager Grid Control database administration option, Convert to Cluster Database, provides a GUI conversion tool. The following sections describe how to use these conversion tools:

- [Prerequisites for Converting to Oracle RAC Databases](#)
- [Configuration Changes during Oracle RAC Conversion Using RCONFIG](#)
- [Converting Databases to Oracle RAC Using RCONFIG or Oracle Enterprise Manager](#)
- [Converting Databases to Oracle RAC Using Oracle Enterprise Manager](#)

Note: Before you start the conversion, as is always true before you start any major change to your database, always back up your existing database.

C.3.1 Prerequisites for Converting to Oracle RAC Databases

Before you convert a single-instance database to an Oracle RAC database, ensure that the following conditions are met for each cluster node that you intend to make an Oracle RAC database node:

- Oracle Clusterware 11g release 1 (11.1) is installed, configured, and running.
- Oracle RAC 11g release 1 (11.1) software is installed.

- The Oracle binary is enabled for Oracle RAC.
- Shared storage, either Oracle Cluster File System or ASM, is available and accessible from all nodes.
- User equivalence exists for the `oracle` account.
- If you intend to use Oracle Enterprise Manager, then all Oracle Enterprise Manager agents are configured and running, and are configured with cluster and host information.
- You have backed up your existing database.

Note: You must use clustered ASM instances for Oracle RAC databases. The `rconfig` utility can migrate single instance ASM storage to clustered ASM storage. If you want to use this option, then you can use the file `ConverttoClusteredASM.xml`, which is located in the path `$ORACLE_HOME/assistants/rconfig/SampleXMLs`.

Provide the SID for the ASM instance on the local node in the `rconfig` XML file. For example:

```
<!--ASMInfo element is required only if the current non-rac
database uses ASM Storage -->
<n:ASMInfo SID="+ASM">
```

The ASM instance name you specify in the XML file is only the local ASM instance. Ensure that ASM instances on all the nodes you want to have as cluster members are running, and that the required diskgroups are mounted on each of them.

You can identify the ASM disk groups by issuing the following statement when connected to an ASM instance:

```
> select name, state, total_mb, free_mb from v$asm_diskgroup
```

C.3.2 Configuration Changes during Oracle RAC Conversion Using RCONFIG

Note the following changes that occur when you convert a single-instance database to Oracle RAC using `rconfig`:

- During the conversion, `rconfig` places the target Oracle RAC database into archive log mode, and enables archiving for the database. If you do not plan to use archivelog space, then you can disable archive logging after the conversion has completed.
- For the **Shared Storage Type** value, if you enter **CFS**, and you use a cluster file system for your single-instance database storage, then `rconfig` converts the environment to use Oracle Managed Files (OMF) for database storage, and places the datafiles in a subdirectory located under the shared storage location.
- During the conversion, `rconfig` moves database files to a specified shared location, and configures them using OMF.

If you want to avoid using OMF with your converted database, then the single-instance database files must already be located in a shared file system, and you must indicate that `rconfig` should not move the files.

C.3.3 Converting Databases to Oracle RAC Using RCONFIG or Oracle Enterprise Manager

The following is a list of scenarios for converting a single-instance Oracle database to an Oracle RAC database:

- Converting a single-instance Oracle Database 11g release 1 (11.1) to an Oracle 11g release 1 (11.1) Oracle RAC database, running out of the *same* Oracle home and using the same data files as the single-instance database.

In this scenario, either use the `rconfig` utility, or use the **Convert to RAC** option on the single-instance database target of Oracle Enterprise Manager Grid Control.

- Converting a single-instance Oracle Database version previous to Oracle Database 11g release 1 (11.1), running out of the same Oracle home and using the same data files as the single-instance database

In this scenario, use OUI and Database Upgrade Assistant (DBUA) to update the single-instance database to Oracle Database 11g release 1 (11.1). Then use `rconfig` or the Oracle Enterprise Manager **Convert to RAC** option, as described in the preceding scenario.

- Converting a single-instance Oracle Database 11g release 1 (11.1) to an Oracle 11g release 1 (11.1) Oracle RAC database, running out of a *different* Oracle home and using the same data files as the single-instance database.

In this scenario, either use the `rconfig` utility in the target database home, or use the **Convert to RAC** option in the single-instance database target of Oracle Enterprise Manager Grid Control. Provide the file storage location when prompted.

- Converting a single-instance Oracle Database 11g release 1 (11.1) to an 11g release 1 (11.1) Oracle RAC database, running out of a *different* Oracle home, and where the host where the single-instance database is running is *not* one of the nodes of the Oracle RAC database.

In this scenario, create a clone image of the single-instance database, and move the clone image to a host that is one of the nodes of the cluster. Then use `rconfig` or the Oracle Enterprise Manager **Convert to RAC** option, as described in the preceding scenario.

C.3.4 Converting Databases to Oracle RAC Using Oracle Enterprise Manager

You can use Oracle Enterprise Manager Grid Control to convert a single-instance database to Oracle RAC. To use this feature, complete the following steps:

See Also: *Oracle Database Upgrade Guide* for information about upgrading existing Oracle Database installations

1. Log in to Grid Control. From the Grid Control Home page, click the **Targets** tab.
2. On the Targets page, click the **Databases** secondary tab, and click the link in the Names column of the database that you want to convert to Oracle RAC.
3. On the Database Instance Home page, click the **Change Database** secondary tab.
4. On the Administration page, in the Database Administration Change Database section, click **Convert to Cluster Database**.
5. Log in as the database user `SYS` with `SYSDBA` privileges to the database you want to convert, and click **Next**.

6. On the Convert to Cluster Database: Cluster Credentials page, provide a user name and password for the `oracle` user and password of the target database that you want to convert. If the target database is using ASM, then also provide the ASM `SYS` user and password, and click **Next**.
7. On the Hosts screen, select the host nodes in the cluster that you want to be cluster members in the Oracle RAC database installed. When you have completed your selection, click **Next**.
8. On the Convert to Database: Options page, select whether you want to use the existing listener and port number, or specify a new listener and port number for the cluster. Also provide a prefix for cluster database instances on the cluster.

When you have finished entering information, click **Next**, or click **Help** if you need assistance in deciding how to enter information.
9. On the Convert to Cluster Database: Shared Storage page, either select the option to use your existing shared storage area, or select the option to have your database files copied to a new shared storage location. Also, decide if you want to use your existing Fast Recovery area, or if you want to copy your Fast Recovery files to a new Fast Recovery area using files managed by Oracle Database.

If you use ASM, then Oracle recommends that you place the database area and the recovery area in separate failure groups. A failure group is defined by shared hardware, such as a controller shared between two disks, or two disks that are on the same spindle. If two disks share hardware that could fail, making both disks unavailable, then these disks are said to be in the same failure group. If you do not use ASM, then Oracle recommends that the data files and the Fast Recovery area are located on separate locations, as with separate ASM failure groups, so that a hardware failure does not affect availability.

When you have finished entering information, click **Next**, or click **Help** if you need assistance in deciding how to enter information.
10. On the Convert to Cluster Database: Review page, review the options you have selected. Click **Submit Job** if you want to proceed to conversion. If you want to change options you have selected, click **Back**. To cancel the conversion, click **Cancel**.
11. On the Confirmation page, click **View Job** to check the status of the conversion.

C.4 Converting Databases to Oracle RAC Using RCONFIG

You can use the command line utility `rconfig` to convert a single-instance database to Oracle RAC. To use this feature, complete the following steps:

Note: If the single-instance database is using ASM storage, then use `rconfig` to convert the database in the following order:

1. Convert the single-instance ASM configuration to clustered ASM, substituting the file `ConverttoClusteredASM.xml` as the input XML file for `rconfig`. The `ConverttoClusteredASM.xml` file is located in the path `$ORACLE_HOME/assistants/rconfig/SampleXMLs`.
2. Convert the single-instance database using the following procedure.

If the single-instance database is already using clustered ASM, then proceed directly to conversion of the single-instance database.

See Also: *Oracle Database Upgrade Guide* for information about upgrading existing Oracle Database installations

1. As the `oracle` user, navigate to the directory `$ORACLE_HOME/assistants/rconfig/sampleXMLs`, and open the file `ConvertToRAC.xml` using a text editor, such as `vi`.
2. Review the `ConvertToRAC.xml` file, and modify the parameters as required for your system. The XML sample file contains comment lines that provide instructions for how to configure the file.

Caution: Set the convert option `Convert verify="ONLY"` to perform a test conversion to ensure that a conversion can be completed successfully.

When you have completed making changes, save the file with the syntax `filename.xml`. Make a note of the name you select.

3. Navigate to the directory `$ORACLE_HOME/bin`, and use the following syntax to run the command `rconfig`:

```
rconfig input.xml
```

where `input.xml` is the name of the XML input file you configured in step 2.

For example, if you create an input XML file called `convert.xml`, then enter the following command

```
$ ./rconfig convert.xml
```

Note: The `Convert verify` option in the `ConvertToRAC.xml` file has three options:

- `Convert verify="YES"`: `rconfig` performs checks to ensure that the prerequisites for single-instance to Oracle RAC conversion have been met before it starts conversion
 - `Convert verify="NO"`: `rconfig` does not perform prerequisite checks, and starts conversion
 - `Convert verify="ONLY"`: `rconfig` only performs prerequisite checks; it does not start conversion after completing prerequisite checks
-

If performing the conversion fails, then use the following procedure to recover and reattempt the conversion.:

1. Attempt to delete the database using the DBCA delete database option.
2. Restore the source database.
3. Review the conversion log, and fix any problems it reports that may have caused the conversion failure. The `rconfig` log files are under the `rconfig` directory in `$ORACLE_BASE/cfgtoollogs`.
4. Reattempt the conversion.

C.5 Example of an rconfig XML Input File for ConvertToRAC

The following is an example of an XML ConvertToRAC input file for the rconfig utility. In the example, the XML input file is for converting a single-instance database with ASM to an Oracle RAC database with ASM in the same Oracle home.

```
<?xml version="1.0" encoding="UTF-8"?>
<n:RConfig xmlns:n="http://www.oracle.com/rconfig"
          xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
          xsi:schemaLocation="http://www.oracle.com/rconfig">
  <n:ConvertToRAC>
    <!-- Verify does a precheck to ensure all pre-requisites are met, before the
    conversion is attempted. Allowable values are: YES|NO|ONLY -->
    <n:Convert verify="YES">
      <!--Specify current OracleHome of non-rac database for SourceDBHome -->
      <n:SourceDBHome>C:/oracle/rac11home</n:SourceDBHome>
      <!--Specify OracleHome where the rac database should be configured. It can be same
      as SourceDBHome -->
      <n:TargetDBHome>C:/oracle/rac11home</n:TargetDBHome>
      <!--Specify SID of non-rac database and credential. User with sysdba role is
      required to perform conversion -->
      <n:SourceDBInfo SID="sidb">
        <n:Credentials>
          <n:User>sys</n:User>
          <n>Password>oracle</n>Password>
          <n:Role>sysdba</n:Role>
        </n:Credentials>
      </n:SourceDBInfo>
      <!--ASMInfo element is required only if the current non-rac database uses ASM
      Storage -->
      <n:ASMInfo SID="+ASM1">
        <n:Credentials>
          <n:User>sys</n:User>
          <n>Password>welcome</n>Password>
          <n:Role>sysdba</n:Role>
        </n:Credentials>
      </n:ASMInfo>
      <!--Specify the list of nodes that should have rac instances running. LocalNode
      should be the first node in this nodelist. -->
      <n:NodeList>
        <n:Node name="node1"/>
        <n:Node name="node2"/>
      </n:NodeList>
      <!--Specify prefix for rac instances. It can be same as the instance name for
      non-rac database or different. The instance number will be attached to this
      prefix. -->
      <n:InstancePrefix>sales</n:InstancePrefix>
      <!--Specify port for the listener to be configured for rac database.If port="",
      alistener existing on localhost will be used for rac database.The listener will be
      extended to all nodes in the nodelist -->
      <n:Listener port="1521"/>
      <!--Specify the type of storage to be used by rac database. Allowable values are
      CFS|ASM. The non-rac database should have same storage type. -->
      <n:SharedStorage type="CFS">
        <!--Specify Database Area Location to be configured for rac database.If this field
        is left empty, current storage will be used for rac database. For CFS, this field
        will have directory path. -->
        <n:TargetDatabaseArea>M:\oradata</n:TargetDatabaseArea>
        <!--Specify Fast Recovery Area to be configured for rac database. If this field is
        left empty, current recovery area of non-rac database will be configured for rac
        database. If current database is not using recovery Area, the resulting rac
```

```

database will not have a recovery area. -->
  <n:TargetFastRecoveryArea>M:\Fast_sidb</n:TargetFastRecoveryArea>
</n:SharedStorage>
  </n:Convert>
</n:ConvertToRAC>
</n:RConfig>

```

C.6 Converting Single-Instance ASM to Oracle RAC Using RCONFIG

You can use the command line utility `rconfig` to convert Automatic Storage Management (ASM) configured for a single-instance database to ASM configured for Oracle RAC. To use this feature, complete the following steps:

See Also: *Oracle Database Upgrade Guide* for information about upgrading existing ASM installations

1. As the `oracle` user, navigate to the directory `$ORACLE_HOME/assistants/rconfig/sampleXMLs`, and open the file `ConvertToASM.xml` using a text editor, such as `vi`.
2. Review the `ConvertToASM.xml` file, and modify the parameters as required for your system. The XML sample file contains comment lines that provide instructions for how to configure the file.

Caution: Set the convert option `Convert verify="ONLY"` to perform a test conversion to ensure that a conversion can be completed successfully.

When you have completed making changes, save the file with the syntax `filename.xml`. Make a note of the name you select.

3. Navigate to the directory `$ORACLE_HOME/bin`, and use the following syntax to run the command `rconfig`:

```
rconfig input.xml
```

where `input.xml` is the name of the XML input file you configured in step 2.

For example, if you create an input XML file called `convert.xml`, then enter the following command

```
$ ./rconfig convert.xml
```

Note: The `Convert verify` option in the `ConvertToRAC.xml` file has three options:

- `Convert verify="YES"`: `rconfig` performs checks to ensure that the prerequisites for single-instance to Oracle RAC conversion have been met before it starts conversion
 - `Convert verify="NO"`: `rconfig` does not perform prerequisite checks, and starts conversion
 - `Convert verify="ONLY"`: `rconfig` only performs prerequisite checks; it does not start conversion after completing prerequisite checks
-

If performing the conversion fails, then use the following procedure to recover and reattempt the conversion.:

1. Attempt to delete the ASM instance using the DBCA delete ASM option.
2. Restore the source ASM instance.
3. Review the conversion log, and fix any problems it reports that may have caused the conversion failure. The `rconfig` log files are under the `rconfig` directory in `$ORACLE_BASE/cfgtoollogs`.
4. Reattempt the conversion.

C.7 Example of an rconfig XML Input File for ConvertToASM

The following is an example of an XML `ConvertToRAC` input file for the `rconfig` utility. This file is available for use in the following path:

`$ORACLE_HOME/assistants/rconfig/sampleXMLs`

In this example, the XML input file is for converting a single-instance database with ASM to an Oracle RAC database with ASM in the same Oracle home.

```
<?xml version="1.0" encoding="UTF-8"?>
<n:RConfig xmlns:n="http://www.oracle.com/rconfig"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="http://www.oracle.com/rconfig/rconfig.xsd">

  <n:ConvertToClusteredASM>
    <!-- Verify does a precheck to ensure all pre-requisites are met, before the
    conversion is attempted. Allowable values are: YES|NO|ONLY -->
    <n:ConvertASM verify="YES">
      <!--Specify current OracleHome of single instance ASM for SourceASMHome -->
      <n:SourceASMHome>/oracle/product/11.1.0/db_1</n:SourceASMHome>
      <!--Specify OracleHome where the clustered ASM should be configured. It can be
      same as SourceASMHome -->
      <n:TargetASMHome>/oracle/product/11.1.0/db_1</n:TargetASMHome>
      <!--Specify single instance ASM credentials -->
      <n:ASMInfo SID="+ASM">
        <n:Credentials>
          <n:User>sys</n:User>
          <n>Password>welcome</n>Password>
          <n:Role>sysdba</n:Role>
        </n:Credentials>
      </n:ASMInfo>
      <!--Specify the list of nodes that should have clustered ASM instances running.
      LocalNode should be the first node in this nodelist. -->
      <n:NodeList>
        <n:Node name="node1"/>
        <n:Node name="node2"/>
      </n:NodeList>
      <!--Specify port for the listener to be configured for clustered ASM. If port="",
      listener existing on localhost will be used for clustered ASM. The listener will
      be extended to all nodes in the nodelist -->
      <n:Listener port=""/>
      <!--Specify comma-separated path of ASM diskstring to discover diskgroups that
      will be mounted on clustered ASM instances. If this path is not accessible from a
      node in the nodelist, the diskgroup will not be mounted on that node. -->
      <n:ASMDiskString>/dev/raw1/*,/dev/raw2/*</n:ASMDiskString>
    </n:ConvertASM>
  </n:ConvertToClusteredASM>
```

</n:RConfig>

C.8 Post-Conversion Steps

After completing the conversion, note the following recommendations for Oracle RAC environments, as described in the Oracle RAC documentation:

- Follow the recommendations for using load balancing and transparent application failover, as described in *Oracle Real Application Clusters Administration and Deployment Guide*
- Use locally managed tablespaces instead of dictionary managed tablespaces to reduce contention and manage sequences in Oracle RAC as described in *Oracle Real Application Clusters Administration and Deployment Guide*
- Follow the guidelines for using automatic segment space management as described in *Oracle Real Application Clusters Administration and Deployment Guide*

The buffer cache and shared pool capacity requirements in Oracle RAC are slightly greater than the requirements for single-instance Oracle databases. Therefore, you should increase the size of the buffer cache by about 10%, and the size of the shared pool by about 15%.

Directory Structure for Oracle Real Application Clusters Environments

This appendix describes the directory structures for Oracle Real Application Clusters (Oracle RAC) software environments.

This appendix contains the following topics:

- [Understanding the Oracle RAC Directory Structure](#)
- [Directory Structures for Oracle RAC](#)

D.1 Understanding the Oracle RAC Directory Structure

When you install Oracle Database 11g release 1 (11.1) with Oracle RAC, all subdirectories except for `oraInventory`, the Automatic Storage Management home (if applicable), and the Oracle Clusterware home, are under a top-level `ORACLE_BASE` directory. The `ORACLE_HOME` and `ADMIN` directories are also located under `ORACLE_BASE`.

See Also: *Oracle Real Application Clusters Administration and Deployment Guide* for further information about the `$ORACLE_HOME` and `/ADMIN` directories

D.2 Directory Structures for Oracle RAC

[Table D–1](#) shows the hierarchical directory tree of a sample optimal flexible architecture (OFA)-compliant database for Oracle RAC:

Table D–1 Directory Structure for A Sample OFA-Compliant Environment

Root	Second-Level	Third-Level	Fourth-Level	Description
<code>\$ORACLE_BASE</code>				<code>/u01/app/oracle</code> The default <code>ORACLE_BASE</code> directory where the software owner is the <code>oracle</code> user.
	<code>ORACLE_HOME</code>			<code>/u01/app/oracle/11.1.0/</code> The default name of the Oracle home. Note that the Oracle database home is under the Oracle base directory path. An Oracle Clusterware directory must <i>not</i> be under the Oracle base directory path where the database binaries are located.

Table D–1 (Cont.) Directory Structure for A Sample OFA-Compliant Environment

Root	Second-Level	Third-Level	Fourth-Level	Description
		installation_ type		Type of installation under the Oracle base directory. You can also choose to add a counter, if you intend to have more than one installation of the software. For example, with an Oracle database installation, where the database is the second database, the path is as follows: /u01/app/oracle/11.1.0/db_2
	/ADMIN			The administrative directory. Note that with Oracle Database 11g, bdump, cdump, and udump files are relocated to the directory \$ADR_BASE.
		/db_unique_ name		The database unique name; this is the same as dbname when the database name is 8 or fewer characters in length.
			/hdump /pfile	The dump destinations for database server.
\$ADR_BASE			/bdump /cdump /udump	Automatic Diagnostic Repository dump destination trace files. Note that this directory path is set by the initialization parameter DIAGNOSTIC_DEST, and that the path for the Automatic Data Repository must be located on a shared storage location available to all the nodes. By default, this path is a subset of the Oracle base directory, in the following path: \$ORACLE_BASE/diag/
Oracle_ Clusterware_ home				/u01/app/crs/ An OFA-compliant path for the Oracle Clusterware home. When the Oracle Clusterware software is installed, the root.sh script changes permissions of all of the parent directories of the Oracle Clusterware home directory to grant write access only to the root user. Because of this, the Oracle Clusterware home directory must not be a subdirectory of the Oracle base directory.
		/bin		The subtree for Oracle binaries.
		/network		The subtree for Oracle Net.

See Also: *Oracle Database Administrator's Reference for Linux and UNIX* for further information about the \$ORACLE_HOME and /admin directories

How to Stop Processes in an Existing Oracle Real Application Clusters Database

This appendix describes how to stop all processes in an Oracle Real Application Clusters (Oracle RAC) database, in preparation for adding additional products to an existing database, or in preparation for patch updates.

This appendix contains the following topics:

- [Back Up the Oracle RAC Database](#)
- [Shut Down Oracle RAC Databases](#)
- [Stop All Oracle Processes](#)

E.1 Back Up the Oracle RAC Database

Before you make any changes to the Oracle software, Oracle recommends that you create a backup of the Oracle Database installation.

E.2 Shut Down Oracle RAC Databases

Shut down any existing Oracle Database instances on each node, with normal or immediate priority.

If Automatic Storage Management (ASM) is running, then shut down all databases that use ASM, and then shut down the ASM instance on each node of the cluster.

Note: If you are using Oracle Clusterware or Cluster Ready Services, then you must shut down all Oracle Database instances on all cluster nodes before modifying the Oracle software. If you are performing a patch update, then review the instructions in the Patch Set Notes for detailed instructions.

E.3 Stop All Oracle Processes

Stop all listener and other processes running in the Oracle home directories where you want to modify the database software.

Note: If you shut down ASM instances, then you must first shut down all database instances that use ASM, even if these databases run from different Oracle homes.

This section contains the following topics:

- [Stopping Oracle Clusterware or Cluster Ready Services Processes](#)
- [Stopping Oracle Database Processes Before Adding Products or Upgrading](#)

E.3.1 Stopping Oracle Clusterware or Cluster Ready Services Processes

If you are modifying an Oracle Clusterware or Oracle Cluster Ready Services (CRS) installation, then shut down the following Oracle Database services.

Note: You must perform these steps in the order listed.

1. Shut down any processes in the Oracle home on each node that might be accessing a database; for example, Oracle Enterprise Manager Database Control.

Note: Before you shut down any processes that are monitored by Oracle Enterprise Manager Grid Control, set a blackout in Grid Control for the processes that you intend to shut down. This is necessary so that the availability records for these processes indicate that the shutdown was planned downtime, rather than an unplanned system outage.

2. Shut down all Oracle RAC instances on all nodes. To shut down all Oracle RAC instances for a database, enter the following command, where *db_name* is the name of the database:

```
$ oracle_home/bin/srvctl stop database -d db_name
```

3. Shut down all ASM instances on all nodes. To shut down an ASM instance, enter the following command, where *node* is the name of the node where the ASM instance is running:

```
$ oracle_home/bin/srvctl stop asm -n node
```

4. Stop all node applications on all nodes. To stop node applications running on a node, enter the following command, where *node* is the name of the node where the applications are running

```
$ oracle_home/bin/srvctl stop nodeapps -n node
```

5. Shut down the Oracle Clusterware or CRS process by entering the following command on all nodes as the root user

```
# /etc/init.d/init.crs stop
```

E.3.2 Stopping Oracle Database Processes Before Adding Products or Upgrading

This section provides an overview of what needs to be done before adding additional products to Oracle Database 11g release 1 (11.1). If you are performing a patch upgrade, then refer to the Database Patch Set Notes for the patch for additional instructions.

If node applications are running in the Oracle RAC Oracle home, then shut down the following Oracle Database services before modifying the Oracle Database software:

Note: You must perform these steps in the order listed.

1. Shut down any processes in the Oracle home on each node that can access a database.

Note: Before you shut down any processes that are monitored by Enterprise Manager Grid Control, set a blackout in Grid Control for the processes that you intend to shut down. This is necessary so that the availability records for these processes indicate that the shutdown was planned downtime, rather than an unplanned system outage.

For example:

```
$ORACLE_HOME/bin/emctl stop dbconsole
$ORACLE_HOME/bin/searchctl stop
```

2. Shut down all Oracle RAC instances on all nodes. To shut down all Oracle RAC instances for a database, enter the following command, where *db_name* is the name of the database:

```
$ oracle_home/bin/srvctl stop database -d db_name
```

3. Shut down all ASM instances on all nodes. To shut down an ASM instance, enter the following command, where *node* is the name of the node where the ASM instance is running:

```
$ oracle_home/bin/srvctl stop asm -n node
```

4. Stop all node applications on all nodes. To stop node applications running on a node, enter the following command, where *node* is the name of the node where the applications are running:

```
$ oracle_home/bin/srvctl stop nodeapps -n node
```

Managing Oracle Database Port Numbers

This appendix lists the default port numbers and describes how to change the assigned port after installation.

This appendix contains the following topics:

- [About Managing Ports](#)
- [Viewing Port Numbers and Access URLs](#)
- [Port Numbers and Protocols of Oracle Components](#)
- [Changing the Oracle Enterprise Management Agent Port](#)
- [Changing the Oracle Enterprise Manager Database Console Ports](#)
- [Changing the Oracle Ultra Search Ports](#)
- [Changing the Oracle XML DB Ports](#)

F.1 About Managing Ports

During installation, Oracle Universal Installer (OUI) assigns port numbers to components from a set of default port numbers. Many Oracle Database components and services use ports. As an administrator, it is important to know the port numbers used by these services, and to make sure that the same port number is not used by two services on your host.

Most port numbers are assigned during installation. Every component and service has an allotted port range, which is the set of port numbers Oracle Database attempts to use when assigning a port. Oracle Database starts with the lowest number in the range and performs the following checks:

- Is the port used by another Oracle Database installation on the host?
The installation may be up or down at the time; Oracle Database can still detect if the port is used.
- Is the port used by a process that is currently running?
This could be any process on the host, including processes other than Oracle Database processes.

If the answer to any of the preceding questions is yes, then Oracle Database moves to the next highest port in the allotted port range and continues checking until it finds a free port.

F.2 Viewing Port Numbers and Access URLs

In most cases, the Oracle Database component's port number is listed in the tool used to configure the port. In addition, ports for some Oracle Database applications are listed in the `portlist.ini` file. This file is located in the directory `$ORACLE_HOME/install`.

If you change a port number, it is not updated in the `portlist.ini` file, so you can only rely on this file immediately after installation. To find or change a port number, use the methods described in this appendix.

F.3 Port Numbers and Protocols of Oracle Components

The following table lists the port numbers and protocols used by components that are configured during the installation. By default, the first port in the range is assigned to the component, if it is available.

Table F–1 Ports Used in Oracle Components

Component and Description	Default Port Number	Port Range	Protocol
Oracle SQL*Net Listener Allows Oracle client connections to the database over Oracle's SQL*Net protocol. You can configure it during installation. To reconfigure this port, use Net Configuration Assistant.	1521	1521	TCP
Oracle Data Guard Shares the SQL*Net port and is configured during installation. To reconfigure this port, use Net Configuration Assistant to reconfigure the Oracle SQL*Net listener.	1521 (same value as the listener)	1521	TCP
Oracle Connection Manager Listening port for Oracle client connections to Oracle Connection Manager. You can configure Oracle Connection Manager either through a Custom installation, or configure it after installation using Net Configuration Assistant.	1630	1630	TCP
Oracle Management Agent HTTP port for Oracle Management Agent, which is part of Oracle Enterprise Manager. It is configured during installation. "Changing the Oracle Enterprise Management Agent Port" on page F-4 explains how to modify its port number	3938	1830–1849	HTTP
Oracle Enterprise Manager Database Console HTTP port for Oracle Enterprise Manager Database Control. It is configured during installation. "Changing the Oracle Enterprise Manager Database Console Ports" on page F-4 explains how to modify its port number.	1158	5500–5519	TCP/HTTP
Oracle Enterprise Manager Database Console RMI port for Oracle Enterprise Manager Database Control. It is configured during installation. "Changing the Oracle Enterprise Manager Database Console Ports" on page F-4 explains how to modify its port number.	5520	5520–5539	TCP

Table F-1 (Cont.) Ports Used in Oracle Components

Component and Description	Default Port Number	Port Range	Protocol
Oracle Enterprise Manager Database Console JMS port for Oracle Enterprise Manager Database Control. It is configured during installation. "Changing the Oracle Enterprise Manager Database Console Ports" on page F-4 explains how to modify its port number.	5540	5540–5559	TCP
Oracle Ultra Search HTTP port for Oracle Ultra Search. Its port number is assigned automatically when you install Oracle Ultra Search, by using the Custom installation type. "Changing the Oracle Ultra Search Ports" explains how to change its port number.	5620	5620–5639	TCP/HTTP
Oracle Ultra Search RMI port for Oracle Ultra Search. Its port number is assigned automatically when you install Oracle Ultra Search, by using the Custom installation type. "Changing the Oracle Ultra Search Ports" explains how to change its port number.	5640	5640–5659	TCP
Oracle Ultra Search JMS port for Oracle Ultra Search. Its port number is assigned automatically when you install Oracle Ultra Search, by using the Custom installation type. "Changing the Oracle Ultra Search Ports" explains how to change its port number.	5660	5660–5679	TCP
Oracle XML DB The Oracle XML DB HTTP port is used if Web-based applications need to access an Oracle database from an HTTP listener. It is configured during installation, but you cannot view it afterward. "Changing the Oracle XML DB Ports" explains how to change its port number.	Dynamic	Dynamic	HTTP
Oracle XML DB The Oracle XML DB FTP is used when applications need to access an Oracle database from an FTP listener. It is configured during installation, but you cannot view it afterward. "Changing the Oracle XML DB Ports" explains how to change its port number.	Dynamic	Dynamic	FTP
Oracle Real Application Clusters The port number is assigned automatically during installation. You cannot view or modify it afterward.	Dynamic	Dynamic	UDP
Oracle Clusterware CRS daemon (Oracle Cluster Ready Services Daemon) internode connection. The port number is assigned automatically during installation. You cannot view or modify it afterward.	49896	49896	TCP
Cluster Synchronization Service (CSS) CSS daemon internode connection for the GM layer. The port number is assigned automatically during installation. You cannot view or modify it afterward.	49895	49895	TCP

Table F–1 (Cont.) Ports Used in Oracle Components

Component and Description	Default Port Number	Port Range	Protocol
Oracle Cluster Registry The port number is assigned automatically during installation. You cannot view or modify it afterward.	Dynamic	Dynamic	TCP
Oracle Event Manager The port number is assigned automatically during installation. You cannot view or modify it afterward.	49897	49897–49898	TCP
Cluster Manager The port number is assigned automatically during installation. You cannot view or modify it afterward.	Dynamic	Dynamic	TCP

F.4 Changing the Oracle Enterprise Management Agent Port

To find the current setting for the Oracle Management agent port, search for `EMD_URL` in the `ORACLE_BASE/ORACLE_HOME/host_sid/sysman/config/emd.properties` file.

To change the Oracle Management Agent HTTP port, use the `emca -reconfig ports` command:

```
emca -reconfig ports -AGENT_PORT 1831
```

F.5 Changing the Oracle Enterprise Manager Database Console Ports

To find the current HTTP, RMI, and JMS port settings, search in the following files:

- **HTTP port:** Search for `REPOSITORY_URL` in the `ORACLE_BASE/ORACLE_HOME/host_sid/sysman/config/emd.properties` file.
- **RMI port:** Search for the port attribute in the `rmi-server` tag in the `ORACLE_BASE/ORACLE_HOME/oc4j/j2ee/OC4J_DBConsole_host_sid/config/rmi.xml` file.
- **JMS port:** Search for the port attribute in the `jms-server` tag in the `ORACLE_BASE/ORACLE_HOME/oc4j/j2ee/OC4J_DBConsole_host_sid/config/jms.xml` file.

To change the Oracle Enterprise Manager Database Console ports, use the `emca -reconfig ports` command:

```
ORACLE_BASE/ORACLE_HOME/bin> emca -reconfig ports option setting
```

where *option* can be:

- **DBCONTROL_HTTP_PORT:** Sets the HTTP port, for example:

```
emca -reconfig ports -DBCONTROL_HTTP_PORT 1820
```
- **RMI_PORT:** Sets the RMI port, for example:

```
emca -reconfig ports -RMI_PORT 5520
```
- **JMS_PORT:** Sets the JMS port, for example:

```
emca -reconfig ports -JMS_PORT 5521
```

You can enter multiple `-reconfig port` settings in one line, for example:

```
emca -reconfig ports -DBCONTROL_HTTP_PORT 1820 -AGENT_PORT 1821 -RMI_PORT 5520
```

F.6 Changing the Oracle Ultra Search Ports

The following sections describe how to change the Oracle Ultra Search Ports.

Changing the HTTP Port

To change the HTTP port, modify the `port` attribute of the `web-site` element in the `$ORACLE_HOME/oc4j/j2ee/OC4J_SEARCH/config/http-web-site.xml` file:

```
<web-site port="5620"...>
```

Changing the RMI Port

To change the RMI port, modify the `port` attribute of the `rmi-server` element in the `$ORACLE_HOME/oc4j/j2ee/OC4J_SEARCH/config/rmi.xml` file:

```
<rmi-server port="5640"...>
```

Changing the JMS Port

To change the JMS port, modify the `port` attribute of the `jms-server` element in the `$ORACLE_HOME/oc4j/j2ee/OC4J_SEARCH/config/jms.xml` file:

```
<jms-server port="5660"...>
```

F.7 Changing the Oracle XML DB Ports

To change the Oracle XML FTP and HTTP ports, you need to run the `catxdbdbca.sql` script, which in a default installation is located in `$ORACLE_HOME/rdbms/admin`.

To change the Oracle XML DB ports:

1. Check that the Oracle listener is running.
If you cannot start the listener, then refer to *Oracle Database Net Services Administrator's Guide*.
2. log in to SQL*Plus or iSQL*Plus as SYS or XDB using the SYSDBA role.
For example, to log in to SQL*Plus as SYS using the password `welcome`:

```
SQL> sqlplus sys/welcome as sysdba
```
3. Run the `catxdbdbca.sql` script.
For example, to use 2200 for the FTP port and 8200 for the HTTP port, and assuming your Oracle home is in the following location, enter the following command:

```
SQL> /oracle/product/10.20.0/db_1/rdbms/admin/catxdbdbca.sql 2200 8200
```
4. Exit SQL*Plus or iSQL*Plus.

Index

A

- access control list
 - for Oracle Application Express, 5-12
- ACL, 5-12
- Advanced
 - configuration type, 2-7, 2-8
- APEX_PUBLIC_USER, 5-4
 - password for, 5-7
 - unlocking, 5-7
- architecture
 - Optimal Flexible Architecture (OFA), 2-10
- archive logs
 - destinations, converting to cluster database, C-2
- ASM. *See* Automatic Storage Management
- ASMLIB, 2-12
- Automatic Diagnostic Repository, xviii
 - default directory for diagnostic data, xviii
- Automatic Storage Management
 - and rolling upgrade, 2-4
 - ASM library driver (ASMLIB), 2-12
 - disk group, xviii
 - Fast Mirror Resync, xviii
 - installation, 2-4
 - OSASM group, xix
 - preferred read disk groups, xix
 - rolling upgrade of, xix
 - storage option for data files, 1-10
 - SYS password for, 2-3
 - SYSASM privilege, xix
- Automatic Storage Management disks
 - marking, 2-12
- automatic undo management, 7-3

B

- backups
 - and converting to cluster database, C-2
- block devices, 1-11
 - storage option for data files, 1-10

C

- changing host names, 7-1
- cluster database
 - installed configuration, 7-2

- cluster file system
 - storage option for data files, 1-10
- Cluster Manager
 - ports, ranges and protocol, F-4
- Cluster Synchronization Services (CSS)
 - ports, ranges and protocol, F-3
- Cluster Verification Utility
 - DBCA database creation stage readiness
 - check, 3-3
 - verifying readiness for database installation, 1-13, 2-1
- CLUSTER_DATABASE_INSTANCES, 3-6
- clusterware diagnostics, A-3
- commands
 - crsctl start crs, 2-5
 - emca, 4-4
 - emctl stop dbconsole, 8-5
 - lsnrctl start instance, 2-7
 - oracleasm disable, 8-3
 - oracleasm stop, 8-3
 - ps, 1-15
 - searchctl stop, 8-5
 - srvctl remove asm, 8-4
 - srvctl stop asm, 2-4
 - srvctl stop listener, 8-5
 - su, B-2
- components
 - created when using DBCA, 7-2
- configuration assistants
 - troubleshooting, A-4
- configuration types
 - Advanced, 2-7
 - Data Warehouse, 2-7
 - Do not create a starter database, 2-4
 - General Purpose, 2-7
 - Transaction Processing, 2-7
- connection load balancing, 7-4
- Connection Manager. *See* Oracle Connection Manager
- control file
 - installed configuration, 7-3
- control files, 1-12
 - described, 7-3
- convert to cluster database
 - administrative considerations, C-1
 - from non-cluster system, C-2
 - from single-instance, C-4

- from single-instance to Oracle Real Application Clusters, C-1
- post-conversion, C-16
- reasons not to convert, C-2
- to Real Application Clusters from single-instance Oracle databases, C-1
- converting
 - from single instance to Oracle Real Application Clusters, C-8
 - from single-instance to Real Application Clusters, C-10
 - to Oracle Real Application Clusters from single-instance Oracle databases, B-1
 - with rconfig, C-8
- create database
 - using scripts, B-1
- creating
 - Oracle Real Application Clusters database with Database Configuration Assistant, 2-10, 3-1, 3-4
- cross-node registration, 7-4
- Customer Configuration Repository. *See* Oracle Configuration Manager

D

- data files
 - storage options, 1-10
- Data Warehouse
 - configuration type, 2-7
- database
 - components, created when using DBCA, 7-2
- Database Configuration Assistant
 - and deleteASM command, xviii
 - ASM Disk Groups page, 3-5
 - components created by, 7-2
 - control files, 7-3
 - creating Oracle Real Application Clusters database
 - after installation, 3-4
 - during installation, 2-10, 3-1
 - datafiles, 7-2
 - deleting databases with, 3-7
 - deleting Oracle Real Application Clusters databases, 3-7
 - initialization parameter files, 7-4
 - Initialization Parameters page, 3-6
 - List of Cluster Databases page, 3-7
 - Operations page, 3-7
 - Recovery Configuration page, 3-6
 - redo log files, 7-3
 - rollback segments, 7-3
 - Summary dialog, 3-7
 - tablespaces, 7-2
 - using, 3-1
 - Welcome page, 3-4
- database configuration type
 - selecting, 2-7
- database creation using scripts, B-1
- database files
 - supported storage options, 1-11

- datafiles, 1-12
 - and DBCA, 7-2
 - described, 7-2
- DB_NAME, 3-6
- DB_UNIQUE_NAME, 3-6
 - initialization parameters, 3-6
- DBCA
 - delete database, 3-7
 - loading SSH keys into memory to start, 3-4
- DBMS_NETWORK_ACL_ADMIN
 - package to enable Oracle Application Express, 5-12
- DBSNMP
 - password requirements for, 2-9
- dedicated servers, 7-5
- deinstall Oracle Clusterware software, 8-5
- deinstall Oracle RAC and Oracle ASM software, 8-2
- delete database with DBCA, 3-7
- deprecated features
 - service management, 2-10
- /dev/shm
 - and initialization parameters, 3-6
- diagnostics, A-3
- directory structure, D-1
- disk groups
 - and preferred read disk groups, xix
- DNS
 - registering server addresses in, 1-7
- Do not create a database
 - configuration type, 2-4
- DV_ACCTMGR, 2-6
- DV_OWNER, 2-6
- DVCA. *See* Oracle Database Vault Configuration Assistant

E

- Easy Connect, 7-14
- embedded PL/SQL gateway
 - not recommended for Oracle RAC, 5-2
- environment variables
 - ORACLE_HOME, 1-15
- error messages
 - during installation, A-1
 - ORA-00845, 3-6
 - ORA-01078, 3-6
 - ORA-06512, 5-12
 - ORA-44416, 5-12, 5-13
 - Oracle Real Application Clusters management tools, A-3
- /etc/hosts
 - server addresses in, 1-7

F

- failover
 - and service registration, 7-4
- Fast Mirror Resynch, xviii
- Fast Recovery
 - and files managed by Oracle, C-11

features, new, xv
file system
 storage option for data files, 1-10

G

General Purpose
 configuration type, 2-7
gid
 selecting, 2-11
global database name
 selecting, 2-11
globalization
 support for, 1-4, 2-8

H

host names
 changing, 7-1
HTTP Server
 and Oracle Application Express, 5-2

I

initialization parameter files, 7-4
 for instances, 6-1
 listener parameters, 7-5
initialization parameters
 CLUSTER_DATABASE_INSTANCES, 3-6
 DB_NAME, 3-6
 DISPATCHERS, 7-5
 LOCAL_LISTENER, 7-4
 MEMORY_TARGET, 3-6
 REMOTE_LISTENER, 7-4, 7-10
installation
 and globalization, 1-4, 2-8
 Automatic Storage Management, 2-4
 directory structure, D-1
 listener.ora file, 7-6
 non-interactive, B-1
 of additional products after installation is
 completed, 3-7
 Oracle Configuration Manager, 2-8
 Oracle Database Vault, 2-5
 tnsnames.ora file, 7-7
 verifying shared storage devices, 3-3
instances
 initialization parameter files, 6-1

J

JOB_QUEUE_PROCESSES, 5-10

L

language
 choosing different languages, 2-8
 See globalization., 1-4
language support and installation, 2-8
List of Cluster Databases page, 3-7
listener

 automatic migration from 10.1 to 10.2, 3-2
 identifying Oracle home for, 1-15
 local, 7-4
 lsnrctl command, 1-16
 registration, 7-6
 stopping, 1-15, 1-16
 stopping existing listener process, 1-14
listener.ora file, 7-6
 configuring, 7-5
 default configuration, 7-6
listeners
 listener.ora file, 7-6
load balancing
 and service registration, 7-4
local listener, 7-4
localization
 and installation, 2-8
log file
 troubleshooting with, A-4
lsnrctl command, 1-16

M

Memory Size (SGA and PGA), 3-6
MEMORY_TARGET, 3-6
 and /dev/shm, 3-6
Metalink. *See* OracleMetaLink
migration
 from single-instance, C-2
modplssql
 recommended for Oracle RAC, 5-2
multiple Oracle homes
 and Oracle Clusterware, 1-3
multiple Oracle RAC databases
 clusterware requirements for, 1-3

N

Net naming methods, 7-14
net service names, 7-7
network
 server addresses, 1-7
network configuration files
 listener.ora, 7-6
 sqlnet.ora, 7-14
 tnsnames.ora, 7-7
network directory, D-2
network services
 enabling for Oracle Application Express, 5-12
new features, xv

O

OCR. *See* Oracle Cluster Registry
olsnodes command, A-3
operating system
 preinstallation requirements for Oracle RAC, 1-9
Optimal Flexible Architecture (OFA), 2-10
Oracle Application Express
 ACL, 5-12
 and HTTP Server for Oracle RAC, 5-2

- APEX_PUBLIC_USER, 5-4
- enabling network service access, 5-12
- JOB_QUEUE_PROCESSES, 5-10
- logging in, 5-11
- obfuscating database login passwords, 5-11
- online help, 2-3
- Oracle Text and, 2-3
- password for APEX_PUBLIC_USER, 5-7
- patching, 5-1
- postinstallation, 5-1
- requirements for installation, 2-2
- unlocking APEX_PUBLIC_USER, 5-7
- using secure sockets layer, 5-4
- web browsers supported for, 1-8
- Oracle Cluster Registry
 - contents, 7-2
 - installed configuration, 7-2
- Oracle Cluster Registry port, F-4
- Oracle Clusterware
 - and multiple database versions, 1-3
 - ports, ranges and protocol, F-3
- Oracle Configuration Manager
 - information needed to enable, 2-8
 - information to provide for configuration of, xxi
 - postinstallation, 4-5
- Oracle Connection Manager
 - ports, ranges and protocol, F-2
- Oracle Data Guard
 - ports, ranges and protocol, F-2
- Oracle Data Mining, xvi
- Oracle Database
 - data file storage options, 1-10
 - supported storage options for, 1-9
 - upgrades of, 1-3, 2-4
- Oracle Database Upgrade Assistant, 3-2, C-1
- Oracle Database Vault, xvi, xvii
 - configuration, 2-5
 - Oracle Database Vault Account Manager (DV_
 - ACCTMGR), 2-6
 - Oracle Database Vault Owner (DV_OWNER), 2-6
 - postinstallation, 4-5
 - starting and stopping Oracle RAC instances
 - with, 2-7
- Oracle Database Vault Configuration Assistant, 4-5
- Oracle Enterprise Management Agent
 - ports
 - changing, F-4
 - ranges and protocol, F-2
- Oracle Enterprise Manager
 - Database Control, 4-4
 - logging in to Database Control, 4-4
 - stopping Database Control, 8-5
 - using to convert single-instance databases to Real
 - Application Clusters, C-10
- Oracle Enterprise Manager Database Console
 - ports
 - changing, F-4
 - ranges and protocol, F-2
- Oracle Event Manager
 - ports, ranges and protocol, F-4
- Oracle home directory
 - identifying for listener, 1-15
- Oracle Net
 - identifying Oracle home for listener, 1-15
 - lsnrctl command, 1-16
 - stopping existing listener, 1-14
 - stopping listener, 1-15, 8-5
 - stopping the listener, 1-16
- Oracle Real Application Clusters
 - databases, deleting, 3-7
 - installed components of, 1-12
 - management tools error messages, A-3
 - operating system requirements for, 1-9
 - overview, 3-1, 7-1
 - ports
 - ranges and protocol, F-3
 - storage requirements for, 1-9
 - using Oracle Application Express with, 5-2
- Oracle Real Application Testing, xvii
- Oracle software
 - removing, 8-5
- Oracle SQL Developer, xvi, xvii
- Oracle SQL*Net Listener
 - ports
 - ranges and protocol, F-2
- Oracle Text
 - Oracle Application Express requirement for, 2-3
- Oracle Ultra Search, xvii
 - ports
 - changing, F-5
 - ranges and protocol, F-3
 - stopping, 8-5
- Oracle Universal Installer
 - Welcome page, 2-11
- Oracle Upgrade Companion, 1-3, 2-4
- Oracle Warehouse Builder, xvi, xvii
- Oracle XML DB, xvii
 - ports
 - changing, F-5
 - ranges and protocol, F-3
- ORACLE_BASE environment variable
 - setting, 4-3
- ORACLE_HOME environment variable
 - setting, 1-15, 4-3
- ORACLE_SID environment variable
 - setting, 4-3
- Oracle9i
 - checking for listener, 1-15
- OracleMetaLink, 4-1
 - and storage, 1-9
 - check before installation, 1-2
- oratab file, 7-2
- OSASM
 - and SYSASM, xix
- OWBSYS repository, xvi

P

- parameter file search order, 6-3
- parameters

- initialization, 6-1
- pass phrase, 3-4
 - for SSH, 3-4
- password
 - Oracle Database Vault Account Manager, 2-7
 - Oracle Database Vault Owner, 2-6
- passwords, 2-9
- patch updates
 - download, 4-1
 - install, 4-1
 - OracleMetaLink, 4-1
- patch upgrades, E-2
- patches
 - operating system patches for Oracle RAC, 1-9
- portlist.ini file, F-2
- ports
 - access URLs, F-2
 - Cluster Manager, ranges and protocol, F-4
 - Cluster Synchronization Services, ranges and protocol, F-3
 - configured for applications, F-2
 - default ranges, F-1
 - Oracle Cluster Registry, F-4
 - Oracle Clusterware, ranges and protocol, F-3
 - Oracle Connection Manager, ranges and protocol, F-2
 - Oracle Data Guard, ranges and protocol, F-2
 - Oracle Enterprise Management Agent
 - changing, F-4
 - ranges and protocol, F-2
 - Oracle Enterprise Manager Database Console
 - changing, F-4
 - ranges and protocol, F-2
 - Oracle Event Manager, ranges and protocol, F-4
 - Oracle Real Application Clusters
 - ranges and protocol, F-3
 - Oracle SQL*Net Listener
 - ranges and protocol, F-2
 - Oracle Ultra Search
 - changing, F-5
 - ranges and protocol, F-3
 - Oracle XML DB
 - changing, F-5
 - ranges and protocol, F-3
- postinstallation
 - patch download and install, 4-1
 - product configuration, 4-2
 - root.sh back up, 4-3
 - user accounts setup, 4-4
- preconfigured database installation types, 2-8
- preinstallation requirements
 - operating system, 1-9
- private IP address, 1-7
- process
 - stopping existing, 1-14
 - stopping existing listener process, 1-14
 - stopping listener process, 1-15
- ps command, 1-15
- public IP address, 1-7

R

- RAC. *See* Oracle Real Application Clusters.
- raw devices
 - storage option for data files, 1-10
- raw storage
 - example of SPFILE on, 6-2
- RBS tablespace
 - description, 7-3
- rconfig, C-8
- readme.txt file, F-2
- recovery files
 - supported storage options, 1-11
- redo log file
 - installed configuration, 7-3
- redo log files, 1-12
 - described, 7-3
- registration
 - cross-node, 7-4
- rollback segments
 - described, 7-3
- rolling upgrade
 - of Automatic Storage Management, 2-4
- root.sh
 - back up, 4-3

S

- scripts to create an Oracle Real Application Clusters
 - database, B-1
- Secure Configuration database installation
 - option, 2-9
- secure shell configuration, 1-8
- secure sockets layer
 - and Oracle Application Express, 5-4
- security
 - for Oracle Database Vault Account Manager
 - password, 2-7
 - for Oracle Database Vault owner password, 2-6
 - Oracle Application Express recommendation
 - for, 5-4
 - Secure Configuration option, 2-9
 - selecting passwords, 2-9
- server parameter files, 1-12, 6-1, 7-4
 - errors, 6-4
- service registration
 - configuring, 7-4
- shared configuration file, 7-2
- shared server, 7-5
- shared storage devices
 - verification, 3-3
- sid, 2-11
- single-instance databases
 - converting, C-10
- SPFILE
 - default creation, 6-1
 - default location, 6-2
 - managing on raw device, 6-2
 - migrating to, 6-3
 - on raw storage, 6-2
- sqlnet.ora file, 7-14

- SSH, 3-4
- ssh configuration, 1-8
- Standard Edition Oracle Database
 - supported storage options for, 1-9
- storage
 - for Oracle RAC, 1-9
 - marking Automatic Storage Management disks, 2-12
- storage options
 - Fast Mirror Resynch, xviii
 - for Enterprise Edition installations, 1-9
 - for Standard Edition installations, 1-9
- Summary dialog, 3-7
- supported storage options, 1-11
 - and block devices, 1-11
- SYS
 - password requirements for, 2-9
- SYSASM, xix
 - and OSASM, xix
- SYSMAN
 - password requirements for, 2-9
- SYSTEM
 - password requirements for, 2-9
- system identifier, 2-11
- SYSTEM tablespace
 - description, 7-3

T

- tablespaces
 - and DBCA, 7-2
 - expanding for large sorts, 7-3
 - RBS, 7-3
 - SYSTEM, 7-3
 - TEMP, 7-3
 - undo tablespaces for automatic undo management, 7-3
 - USERS, 7-3
- TEMP tablespace
 - described, 7-3
- tnsnames.ora file, 7-7
 - default configuration, 7-7
- Transaction Processing
 - configuration type, 2-7
- troubleshooting
 - Nodes unavailable for selection, A-2
- troubleshooting
 - An error occurred while trying to get the disks, A-1
 - Can't open display, A-2
 - configuration assistant errors, A-4
 - Connection refused by server, A-2
 - error starting instance, A-3
 - Failed to connect to server, A-2
 - log file, A-4
 - node is unreachable, A-2
 - online help for Oracle Application Express, 2-3
 - ora-44416, 5-13
 - Oracle Application Express, 5-12
 - PRKP-1001

- Error starting instance, A-3
- PROT-8
 - Failed to import data from specified file to the cluster registry, A-2
 - reviewing a log file, A-4
 - time stamp in the future, A-3
- X server, A-2
- YPBINDPROC_DOMAIN
 - Domain not bound, A-3

U

- undo management, 7-3
- upgrade
 - of existing Oracle Databases, 3-2
 - of listener, 3-2
 - of Oracle Database with patch, E-2
- upgrades, 1-3, 2-4
 - stopping processes, 1-14
- upgrading, 1-3, 2-4
 - and using same Oracle home, 1-7, 2-12
- user accounts
 - postinstallation setup, 4-4
- USERS tablespace
 - described, 7-3

V

- VIP, 1-8
- vip address, 1-7
- virtual IP address, 1-7
- virtual IP. *See* VIP

W

- web browsers
 - supported with Oracle Application Express, 1-8
 - supported with Oracle Enterprise Manager, 1-8
- Welcome page
 - Oracle Universal Installer, 2-11