# Oracle® Grid Infrastructure

Installation Guide

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

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Oracle Grid Infrastructure Installation Guide, 11*g* Release 2 (11.2) for Microsoft Windows

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# Preface

*Oracle Grid Infrastructure Installation Guide for Microsoft Windows* explains how to configure a server in preparation for installing and configuring an Oracle Grid Infrastructure installation (Oracle Clusterware and Oracle Automatic Storage Management). It also explains how to configure a server and storage in preparation for an Oracle Real Application Clusters (Oracle RAC) installation.

## Intended Audience

*Oracle Grid Infrastructure Installation Guide for Microsoft Windows* provides configuration information for network and system administrators, and database installation information for database administrators (DBAs) who install and configure Oracle Clusterware and Oracle Automatic Storage Management in a grid infrastructure for a cluster installation.

For customers with specialized system roles who intend to install Oracle RAC, this book is intended to be used by system administrators, network administrators, or storage administrators to configure a system in preparation for an Oracle Grid Infrastructure for a cluster installation, and complete all configuration tasks that require Administrative user privileges. When grid infrastructure installation and configuration is completed successfully, a system administrator should only provide configuration information and grant access to the database administrator to run scripts that require Administrative user privileges during an Oracle RAC installation.

This guide assumes that you are familiar with Oracle Database concepts. For additional information, refer to books in the Related Documents list.

## Documentation Accessibility

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## Related Documents

For more information, refer to the following Oracle resources:

### Oracle Clusterware and Oracle Real Application Clusters Documentation

This installation guide reviews steps required to complete an Oracle Clusterware and Oracle Automatic Storage Management installation, and to perform preinstallation steps for Oracle RAC.

If you intend to install Oracle Database or Oracle RAC, then complete the preinstallation tasks as described in this installation guide, complete grid infrastructure installation, and review those installation guides for additional information. You can install either Oracle databases for a standalone server on a grid infrastructure installation, or install an Oracle RAC database. To install an Oracle Restart deployment of Oracle Clusterware, refer to *Oracle Database Installation Guide for Microsoft Windows*.

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. When you find the correct range or error messages, use your browser's Find 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.

### Installation Guides

- *Oracle Diagnostics Pack Installation Guide*
- *Oracle Database Installation Guide for Microsoft Windows*
- *Oracle Real Application Clusters Installation Guide for Linux and UNIX*

### Operating System-Specific Administrative Guides

- *Oracle Database Administrator's Reference, 11g* Release 2 (11.2) *for UNIX Systems*
- *Oracle Database Platform Guide for Microsoft Windows*

### Oracle Clusterware and Oracle Automatic Storage Management Administrative Guides

- *Oracle Clusterware Administration and Deployment Guide*
- *Oracle Database Storage Administrator's Guide*

### Oracle Real Application Clusters Administrative Guides

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

### Generic Documentation

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

To download free release notes, installation documentation, white papers, or other collateral, 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://www.oracle.com/technology/membership/`

If you 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://www.oracle.com/technology/documentation/index.html`

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 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.

## 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. |
| *italic* | Italic type indicates book titles, emphasis, or placeholder variables for which you supply particular values. |
| `monospace` | Monospace type indicates commands within a paragraph, URLs, code in examples, text that appears on the screen, or text that you enter. |

# What's New in Oracle Grid Infrastructure Installation and Configuration?

This section describes new features as they pertain to the installation and configuration of Oracle Grid Infrastructure (Oracle Clusterware and Oracle Automatic Storage Management), and Oracle Real Application Clusters (Oracle RAC). The topics in this section are:

- New Features for Release 2 (11.2)
- New Features for Release 1 (11.1)

## Desupported Options for Oracle Clusterware and Oracle ASM 11*g* Release 2

The following is a list of options desupported with this release:

### Raw Devices Not Supported with OUI

With this release, Oracle Universal Installer (OUI) no longer supports installation of Oracle Clusterware files on raw devices. Install Oracle Clusterware files either on Oracle Automatic Storage Management (Oracle ASM) diskgroups, or in a supported shared file system.

Raw devices are still supported for systems upgrading to Oracle Clusterware 11*g* release 2.

## New Features for Release 2 (11.2)

The following is a list of new features for Oracle Database 11*g* release 2 (11.2):

- Oracle Automatic Storage Management and Oracle Clusterware Installation
- Oracle Automatic Storage Management and Oracle Clusterware Files
- Oracle Automatic Storage Management Cluster File System
- Cluster Time Synchronization Service
- Daylight Savings Time Upgrade of Timestamp with Timezone Data Type
- Enterprise Manager Database Control Provisioning
- Oracle Clusterware Out-of-place Upgrade
- Grid Plug and Play
- Oracle Clusterware Administration with Oracle Enterprise Manager

- Redundant Interconnects for Oracle Clusterware
- SCAN for Simplified Client Access
- SRVCTL Command Enhancements for Patching
- Typical Installation Option
- Deinstallation Tool
- Voting Disk Backup Procedure Change

### Oracle Automatic Storage Management and Oracle Clusterware Installation

With Oracle Grid Infrastructure 11*g* release 2 (11.2), Oracle ASM and Oracle Clusterware are installed into a single home directory, which is referred to as the Grid Infrastructure home. Configuration assistants start after the installer interview process that configure Oracle ASM and Oracle Clusterware.

The installation of the combined products is called Oracle Grid Infrastructure. However, Oracle Clusterware and Oracle ASM remain separate products.

### Oracle Automatic Storage Management and Oracle Clusterware Files

With this release, Oracle Cluster Registry (OCR) and voting disks can be placed on Oracle ASM.

This feature enables Oracle ASM to provide a unified storage solution, storing all the data for the clusterware and the database, without the need for third-party volume managers or cluster filesystems.

For new installations, OCR and voting disk files can be placed either on Oracle ASM, or on a cluster file system. Installing Oracle Clusterware files on raw devices is no longer supported, unless an existing Oracle Clusterware 10*g* release 1 or higher system is being upgraded.

### Oracle Automatic Storage Management Cluster File System

Oracle Automatic Storage Management Cluster File System (Oracle ACFS) is a new multi-platform, scalable file system and storage management design that extends Oracle ASM technology to support all application data. Oracle ACFS provides dynamic file system resizing, and improved performance using the distribution, balancing and striping technology across all available disks, and provides storage reliability through Oracle ASM's mirroring and parity protection.

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**Note:** Oracle ACFS is only supported on Windows Server 2003 64-bit and Windows Server 2003 R2 64-bit.

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The Oracle ASM Dynamic Volume Manager (Oracle ADVM) extends Oracle ASM by providing a disk driver interface to Oracle ASM storage allocated as Oracle ASM volume files. You can use Oracle ADVM to create virtual disks that contain file systems. File systems and other disk-based applications issue I/O requests to Oracle ADVM volume devices as they would to other storage devices on a vendor operating system. The file systems contained on Oracle ASM volumes can support files beyond Oracle database files, such as executable files, report files, trace files, alert logs, and other application data files.

### Cluster Time Synchronization Service

Cluster node times should be synchronized, particularly if the cluster is to be used for Oracle RAC. With this release, Oracle Clusterware provides Cluster Time Synchronization Service (CTSS), which ensures that there is a synchronization service in the cluster. If Network Time Protocol (NTP) is not found during cluster configuration, then CTSS is configured to ensure time synchronization.

### Daylight Savings Time Upgrade of Timestamp with Timezone Data Type

When time zone version files are updated, TIMESTAMP WITH TIMEZONE data could become stale. With timestamp automation, the system and user data is updated transparently with minimal downtime. In addition, clients can continue to work with the server without having to update the client-side files.

### Enterprise Manager Database Control Provisioning

Enterprise Manager Database Control 11*g* provides the capability to automatically provision Oracle Grid Infrastructure and Oracle RAC installations on new nodes, and then extend the existing Oracle Grid Infrastructure and Oracle RAC database to these provisioned nodes. This provisioning procedure requires a successful Oracle RAC installation before you can use this feature.

> **See Also:** *Oracle Real Application Clusters Administration and Deployment Guide* for information about this feature

### Oracle Clusterware Out-of-place Upgrade

With this release, you can install a new version of Oracle Clusterware into a separate home from an existing Oracle Clusterware installation. This feature reduces the downtime required to upgrade a node in the cluster. When performing an out-of-place upgrade, the old and new version of the software are present on the nodes at the same time, each in a different home location, but only one version of the software is active.

### Grid Plug and Play

In the past, adding or removing servers in a cluster required extensive manual preparation. With this release, you can continue to configure server nodes manually, or use Grid Plug and Play to configure them dynamically as nodes are added or removed from the cluster.

Grid Plug and Play reduces the costs of installing, configuring, and managing server nodes by starting a grid naming service within the cluster to allow each node to perform the following tasks dynamically:

- Negotiating appropriate network identities for itself
- Acquiring additional information it requires to operate from a configuration profile
- Configuring or reconfiguring itself using profile data, making host names and addresses resolvable on the network

Because servers perform these tasks dynamically, adding and removing nodes simply requires an administrator to connect the server to the cluster and allow the cluster to configure the node. Using Grid Plug and Play, and using best practices recommendations, adding a node to the database cluster is part of the normal server restart, and removing a node from the cluster occurs automatically when a server is turned off.

### Oracle Clusterware Administration with Oracle Enterprise Manager

With this release, you can use Enterprise Manager Cluster Home page to perform full administrative and monitoring support for both standalone database and Oracle RAC environments, using High Availability Application and Oracle Cluster Resource Management.

When Oracle Enterprise Manager is installed with Oracle Clusterware, it can provide a set of users that have the Oracle Clusterware Administrator role in Enterprise Manager, and provide full administrative and monitoring support for High Availability application and Clusterware resource management.

After you have completed installation and have Enterprise Manager deployed, you can provision additional nodes added to the cluster using Enterprise Manager.

### Redundant Interconnects for Oracle Clusterware

With this release, Oracle Clusterware can use redundant network interfaces for the Clusterware interconnect, without requiring external or operating system-based bonding solutions. This provides the following advantages:

- High availability for the cluster by removing the network interface as a single point of failure
- Dynamic load-balancing across all available network interface cards (NICs)
- Ability to add or replace private interfaces during run time; Oracle Clusterware automatically recognizes and aggregates new or replaced interfaces to private interconnect addresses
- Support for UDP, TCP and raw interfaces

### SCAN for Simplified Client Access

With this release, the single client access name (SCAN) is the address to provide for all clients connecting to the cluster. The SCAN is a domain name registered to at least one and up to three IP addresses, either in the domain name service (DNS) or the Grid Naming Service (GNS). The SCAN eliminates the need to change clients when nodes are added to or removed from the cluster. Clients using SCAN can also access the cluster using Easy Connect Naming.

### SRVCTL Command Enhancements for Patching

With this release, you can use `srvctl` to shut down all Oracle software running within an Oracle home, in preparation for patching. Oracle Grid Infrastructure patching is automated across all nodes, and patches can be applied in a multi-node, multi-patch fashion.

### Typical Installation Option

To streamline cluster installations, especially for those customers who are new to clustering, Oracle introduces the Typical Installation path. Typical installation provides defaults for as many options as possible to those recommended as best practices.

### Deinstallation Tool

OUI no longer removes Oracle software. Use the new Deinstallation Tool (`deinstall.bat`) available on the installation media before installation and in the Oracle home directory after installation. This tool can also be downloaded from Oracle TechNet.

**See Also:** Chapter 6, "How to Modify or Deinstall Oracle Grid Infrastructure" for more information

### Voting Disk Backup Procedure Change

In prior releases, backing up the voting disks was a required postinstallation task. With Oracle Clusterware release 11.2 and later, backing up voting disks manually is no longer required, as voting disks are backed up automatically in the OCR as part of any configuration change and voting disk data is automatically restored to any added voting disks.

**See Also:** *Oracle Clusterware Administration and Deployment Guide*

## New Features for Release 1 (11.1)

The following is a list of new features for release 1 (11.1)

### Changes in Installation Documentation

With Oracle Database 11*g* 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 book (the guide that you are reading) 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 platform-specific book provides procedures to install Oracle RAC after you have successfully completed 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 Oracle 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, OCR administration, use of SRVCTL and other database administration utilities, and tuning changes to operating system configurations.

## Release 1 (11.1) Enhancements and New Features for Installation

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

### New SYSASM Privilege for Oracle ASM Administration

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

# 1

# Typical Installation for Oracle Grid Infrastructure for a Cluster

This chapter describes the differences between a Typical and Advanced installation for Oracle Grid Infrastructure for a cluster, and describes the steps required to complete a Typical installation.

This chapter contains the following sections:

- Typical and Advanced Installation
- Preinstallation Steps Requiring Manual Tasks
- Install Oracle Grid Infrastructure Software

## 1.1 Typical and Advanced Installation

You are given two installation options for Oracle Grid Infrastructure installations:

- **Typical Installation**: The Typical installation option is a simplified installation with a minimal number of manual configuration choices. Oracle recommends that you select this installation type for most cluster implementations.
- **Advanced Installation**: The Advanced Installation option is an advanced procedure that requires a higher level of system knowledge. It enables you to select particular configuration choices, including additional storage and network choices, integration with Intelligent Platform Management Interface (IPMI), or more granularity in specifying Oracle Automatic Storage Management (Oracle ASM) roles.

## 1.2 Preinstallation Steps Requiring Manual Tasks

Complete the following manual configuration tasks

- Verify System Requirements
- Check Network Requirements
- Install Operating System Patches and other required software
- Configure Operating System Users
- Configure the Directories Used During Installation
- Check and Prepare Storage

**See Also:** Chapter 2, "Advanced Installation Oracle Grid Infrastructure for a Cluster Preinstallation Tasks" and Chapter 3, "Configuring Storage for Grid Infrastructure for a Cluster and Oracle RAC" for information about how to complete these tasks

## 1.2.1 Verify System Requirements

This section provides a summary of the following pre-installation tasks:

- Memory Requirements
- Hardware Requirements
- Disk Requirements
- TEMP Space Requirements

For more information about these tasks, review "Checking the Hardware Requirements" on page 2-4.

### 1.2.1.1 Memory Requirements

In the Windows Task Manager window, select the **Performance** tab to view the available memory for your system.

To view the Virtual memory settings, from the Control panel, select **System**. In the System Properties window, select the **Advanced** tab, then, under Performance, click **Performance Options**, or **Settings**. In the Performance Options window, the virtual memory, or page file, select the Advanced tab and the settings are displayed at the bottom of the window.

The minimum required RAM is 1.5 gigabyte (GB) for Oracle grid infrastructure, and the minimum required virtual memory space is 2 GB. Oracle recommends that you set the paging file size to twice the amount of RAM.

If you also plan to install Oracle Real Application Clusters (Oracle RAC), then 2.5 GB of memory is the minimum required RAM.

### 1.2.1.2 Hardware Requirements

The minimum processor speed is 1 gigahertz (GHz) for Windows Server 2003, Windows Server 2003 R2, and Windows Server 2008. The minimum processor speed is 1.4 GHz for Windows Server 2008 R2.

### 1.2.1.3 Disk Requirements

From the Start menu, select **Run...** In the Run window, type in Diskmgmt.msc to open the Disk Management graphical user interface (GUI).

The Disk Management window displays the available space on file systems. If you use standard redundancy for Oracle Clusterware files, which is 3 Oracle Cluster Registry (OCR) files and 3 voting disk files, then you should have at least 2 GB of disk space available on three separate physical disks reserved for Oracle Clusterware files.

Ensure you have at least 3 GB of space for the grid infrastructure for a cluster home (Grid home). This includes Oracle Clusterware and Oracle ASM files and log files.

### 1.2.1.4 TEMP Space Requirements

Ensure that you have at least 1 GB of disk space in the Windows TEMP directory. If this space is not available, then increase the partition size, or delete unnecessary files

in the TEMP directory. Make sure the environment variables `TEMP` and `TMP` both point to the location of the TEMP directory, for example:

```
TEMP=C:\WINDOWS\TEMP
TMP=C:\WINDOWS\TEMP
```

## 1.2.2 Check Network Requirements

Ensure that you have the following available:

- Single Client Access Name for the Cluster
- IP Address Requirements
- Disable the Media Sensing feature for TCP/IP
- Network Adapter Binding Order and Protocol Priorities
- Verify Privileges for Copying Files in the Cluster

### 1.2.2.1 Single Client Access Name for the Cluster

During Typical installation, you are prompted to confirm the default single client access name (SCAN) for the cluster, which is used to connect to databases within the cluster irrespective of which nodes the database instances run on. The default value for the SCAN is based on the local node name. If you change the SCAN from the default, then the name that you use must be globally unique throughout your enterprise.

In a Typical installation, the SCAN is also the name of the cluster. The SCAN and cluster name must be at least one character long and no more than 15 characters in length, must be alphanumeric, and can contain hyphens (-). For example:

```
sales-dev
```

If you require a SCAN that is longer than 15 characters, then select the Advanced installation option. See "IP Address Requirements" for information about the SCAN address requirements.

### 1.2.2.2 IP Address Requirements

Before starting the installation, you must have at least two network interface cards configured on each node: One for the private internet protocol (IP) addresses and one for the public IP addresses.

#### 1.2.2.2.1 IP Address Requirements for Manual Configuration

The public and virtual IP addresses must be static addresses, configured before installation, and the virtual IP addresses for each node must not currently be in use. Oracle Clusterware manages private IP addresses in the private subnet on network adapters you identify as private during the installation interview.

Configures and updates the Grid plug and play (GPnP) profile with the following addresses:

- A public IP address for each node
- A virtual IP (VIP) address for each node
- A SCAN configured on the domain name system (DNS) for round-robin resolution to three addresses (recommended) or at least one address.

The SCAN is a host name used to provide access for clients to the cluster. Because the SCAN is associated with the cluster as a whole, rather than to a particular node, the SCAN makes it possible to add or remove nodes from the cluster without needing to reconfigure clients. It also adds location independence for the databases, so that client configuration does not have to depend on which nodes are running a particular database instance. Client can continue to access the cluster in the same way as with previous releases, but Oracle recommends that clients accessing the cluster use the SCAN.

---

**Note:** If you manually configure addresses, the Oracle strongly recommends that you use DNS resolution for SCAN VIPs. If you use the hosts file to resolve SCANs, then you must provide a hosts file entry for each SCAN address.

---

**See Also:** "Understanding Network Addresses" on page C-2 for more information about network addresses.

#### 1.2.2.3 Intended Use of Network Adapters

During installation, you are asked to identify the planned use for each network adapter that Oracle Universal Installer (OUI) detects on your cluster node. You must identify each adapter as a public or private adapter, and you must use the same private adapters for both Oracle Clusterware and Oracle RAC. For adapters that you plan to use for other purposes–for example, an adapter dedicated to a network file system–you must identify those adapters as "do not use" so that Oracle Clusterware ignores them.

#### 1.2.2.4 Disable the Media Sensing feature for TCP/IP

Media Sense allows Windows to uncouple an IP address from a network interface card when the link to the local switch is lost. To disable Windows Media Sensing for TCP/IP on Windows Server 2003 with SP1 or higher, you must set the value of the `DisableDHCPMediaSense` parameter to 1 on each node. Because you must modify the Windows registry to disable Media Sensing, you should first backup the registry and confirm that you can restore it, using the methods described in your Windows documentation.

Disable Media Sensing by completing the following steps on each node of your cluster:

1. Backup the Windows registry.
2. Use Registry Editor (`Regedit.exe`) to view the following key in the registry:

   ```
   HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\Tcpip\Parameters
   ```

3. Add a new DWORD value to the Parameters subkey:

   ```
   Value Name: DisableDHCPMediaSense
   Value: 0
   ```

4. Exit the Registry Editor and then restart the computer.

#### 1.2.2.5 Network Adapter Binding Order and Protocol Priorities

Check the network adapter binding order on each node. Ensure that your public network adapter is first in the bind order, and the private network adapter is second. Follow these steps to configure the network adapter bind order:

1. Right-click **My Network Places** and choose **Properties**.
2. In the Advanced menu, click **Advanced Settings.**
3. If the public adapter name is not the first name listed under the Adapters and Bindings tab, then select it and click the arrow to move it to the top of list.
4. Increase the priority of IPv4 over IPv6.
5. Click **OK** to save the setting and then exit the network setup dialog.

The names used for each class of network adapter (such as public) must be consistent across all nodes. You can use nondefault names for the network adapter, for example, `PublicLAN`, if the same names are used for the same class of network adapters on each node in the network.

#### 1.2.2.6 Verify Privileges for Copying Files in the Cluster

During installation, OUI copies the software from the local node to the remote nodes in the cluster. Verify that you have administrative privileges on the other nodes in the cluster by running the following command on each node, where *`nodename`* is the node name:

```
net use \\nodename\C$
```

### 1.2.3 Install Operating System Patches and other required software

Refer to the tables listed in "Identifying Software Requirements" on page 2-13 for details.

You must configure sufficient space in the Windows paging file. Paging files are used to store pages of memory used by the process that are not contained in other files. Paging files are shared by all processes, and the lack of space in paging files can prevent other processes from allocating memory.

If possible, split the paging file into multiple files on multiple physical devices. This encourages parallel access to virtual memory, and improves the software performance. See "Memory Requirements" on page 1-2 for information on configure the Windows paging file.

### 1.2.4 Configure Operating System Users

To install the Oracle software, you must use an account with administrative privileges. For more information, refer to the section "Configuring User Accounts" on page 2-22.

---

**Note:** If you are performing the installation remotely, refer to "Windows Telnet and Terminal Services Support" on page 2-4

---

### 1.2.5 Configure the Directories Used During Installation

To install properly across all nodes, OUI uses the temporary folders defined within Microsoft Windows. The TEMP and TMP environment variables should point to the same local directory on all nodes in the cluster. By default, these settings are defined as `%USERPROFILE%\Local Settings\Temp` and `%USERPROFILE%\Local Settings\Tmp` in the Environment Settings of My Computer. It is recommended to explicitly redefine these as `WIN_DRIVE:\temp` and `WIN_DRIVE:\tmp`, for example, `C:\temp` or `C:\tmp` for all nodes, if Windows is installed on the C drive.

The directory that Oracle software is installed in is referred to as its home directory. When installing Oracle Grid Infrastructure, you must determine the location of the

Oracle Grid Infrastructure home. Oracle ASM is also installed in this home directory. When you install Oracle RAC, you must choose a different directory to install the software. The location of the Oracle RAC installation is referred to as the Oracle home.

The Oracle Inventory directory is the central inventory location for all Oracle software installed on a server. By default, the location of the Oracle Inventory directory is `C:\Program Files\Oracle\Inventory`.

For installations with Oracle Grid Infrastructure only, Oracle recommends that you let OUI create the Oracle Grid Infrastructure home and Oracle Inventory directories for you.

## 1.2.6 Check and Prepare Storage

You must have space available on Oracle ASM for Oracle Clusterware files (voting disks and OCRs), and for Oracle Database files, if you install standalone or Oracle RAC databases. Creating Oracle Clusterware files on raw devices is no longer supported for new installations.

The following sections outline the procedure for creating OCR and voting disk partitions for Oracle Cluster File System for Windows (OCFS for Windows), and preparing disk partitions for use with Oracle ASM.

- Create Disk Partitions
- Stamp Disks for Oracle ASM

For additional information, review the following sections:

- "Configuring Storage for Oracle Database Files on OCFS for Windows" on page 3-20
- "Configuring Direct NFS Storage for Oracle RAC Data Files" on page 3-22

---

**Note:** When using Oracle ASM for either the Oracle Clusterware files or Oracle Database files, Oracle creates one Oracle ASM instance on each node in the cluster, regardless of the number of databases.

---

### 1.2.6.1 Create Disk Partitions

The following steps outline the procedure for creating disk partitions for use with either OCFS for Windows or Oracle ASM:

1. Use Microsoft Computer Management utility or the command line tool `diskpart` to create an extended partition. Use a basic disk: dynamic disks are not supported.
2. Create at least one logical partition for the Oracle Clusterware files. You do not have to create separate partitions for the OCR and voting disk if you plan to use OCFS for Windows. Oracle Clusterware creates individual files for the OCR and voting disk.
3. If your file system does not use a redundant array of inexpensive disks (RAID), then create an additional extended partition and logical partition for each partition that will be used by Oracle Clusterware files, to provide redundancy.

To create the required partitions, use the Disk Management utilities available with Microsoft Windows. Use a basic disk with a Master Boot Record (MBR) partition style as an extended partition for creating partitions.

1. From an existing node in the cluster, run the Windows disk administration tool as follows:

a. For Windows Server 2003 and Windows 2003 R2 systems:

   Click **Start**, then select **Settings**, **Control Panel**, **Administrative Tools**, and then **Computer Management**

   Expand the Storage folder to Disk Management. Use a basic disk with a MBR partition style as an extended partition for creating partitions. Right click inside an unallocated part of an extended partition and choose **Create Logical Drive**.

   Specify a size for the partition that is at least 520 megabyte (MB) to store both the OCR and voting disk, or 500 MB (the minimum size) to store just the voting disk or OCR.

   When specifying options for the logical drive, choose the option **"Do not assign a drive letter or path"** and **"Do not format this partition"**. Repeat these steps to create enough partitions to store all the required files.

b. For Windows Server 2008 and Windows Server 2008 R2 systems:

   See "Configuring Storage for Oracle Database Files on OCFS for Windows" on page 3-20 for instructions on creating disk partitions using the DISKPART utility.

2. Repeat Step 1 to create all the required partitions.

3. Check all nodes in the cluster to ensure that the partitions are visible on all the nodes and to ensure that none of the Oracle partitions have drive letters assigned. If any partitions have drive letters assigned, then remove them by performing these steps:

   - Right-click the partition in the Windows disk administration tool
   - Select **"Change Drive Letters and Paths..."** from the menu
   - Click **Remove** in the "Change Drive Letter and Paths" window

#### 1.2.6.2 Stamp Disks for Oracle ASM

If you plan to use Oracle ASM to store the Oracle Clusterware files, then you must perform one additional step. After you have created the disk partitions, the disks must be stamped with a header before they can be used by Oracle ASM. You can configure the disk partitions manually by using either `asmtoolg` (GUI version) or using `asmtool` (command line version).

For more information about configuring your disks with `asmtoolg`, refer to the section "Using asmtoolg (Graphical User Interface)" on page 3-17. To configure the disks with `asmtool`, refer to the section "Using asmtool (Command Line)" on page 3-18.

## 1.3 Install Oracle Grid Infrastructure Software

For information, review "Installing Grid Infrastructure with OUI" on page 4-5.

1. Start OUI from the root level of the installation media. For example:

```
cd D:
setup.exe
```

2. Select **Install and Configure Grid Infrastructure for a Cluster**, then select **Typical Installation**. In the installation screens that follow, enter the configuration information as prompted.

3. After you have installed Oracle Grid Infrastructure, apply any available patch sets or critical patches for Oracle Clusterware and Oracle ASM 11*g* release 2 (11.2).

   **See Also:** Chapter 4, "Installing Oracle Grid Infrastructure for a Cluster"

# 2

# Advanced Installation Oracle Grid Infrastructure for a Cluster Preinstallation Tasks

This chapter describes the system configuration tasks that you must complete before you start Oracle Universal Installer (OUI) to install Oracle grid infrastructure.

This chapter contains the following topics:


- Installation Differences Between Windows and Linux or UNIX
- Reviewing Upgrade Best Practices
- Checking Hardware and Software Certification
- Checking the Hardware Requirements
- Checking the Disk Space Requirements
- Checking the Network Requirements
- Identifying Software Requirements
- Network Time Protocol Setting
- Enabling Intelligent Platform Management Interface
- Checking Individual Component Requirements
- Configuring User Accounts
- Verifying Cluster Privileges


## 2.1 Installation Differences Between Windows and Linux or UNIX

If you are experienced with installing Oracle components in Linux or UNIX environments, then note that many manual setup tasks required on Linux or UNIX are not required on Windows. The key differences between Windows and Linux or UNIX and installations are:

- Environment variables

  On Windows systems, OUI updates the PATH environment variable during installation, and does not require other environment variables to be set, such as `ORACLE_BASE`, `ORACLE_HOME`, and `ORACLE_SID`. On Linux and UNIX systems, you must manually set these environment variables.

- Operating System Groups

On Windows systems, OUI creates the `ORA_DBA` group, which is used for operating system authentication for Oracle instances. On Linux and UNIX systems, you must create this and other operating system groups manually, and they are used for granting permission to access various Oracle software resources and for operating system authentication. Windows does not use an Oracle Inventory group.

- Account for running OUI

  On Windows systems, you log in as the Administrator user or as a user that is a member of the local Administrators group. You do not need a separate account. On Linux and UNIX systems, you must create and use a software owner user account, and this user must belong to the Oracle Inventory group.

**See Also:** "Oracle Database Windows/UNIX Differences," in *Oracle Database Platform Guide for Microsoft Windows*

## 2.2 Reviewing Upgrade Best Practices

**Caution:** Always create a backup of existing databases before starting any configuration change.

If you have an existing Oracle installation, then record your version numbers, patches, and other configuration information. Before proceeding with installation of Oracle Grid infrastructure, review the Oracle upgrade documentation to decide the best method of upgrading your current software installation.

**Note:** To upgrade Oracle Clusterware Release 10.2 to Oracle Clusterware Release 11*g*, you must first apply the 10.2.0.3 or later patchset.

You can upgrade a clustered Oracle Automatic Storage Management (Oracle ASM) installation without shutting down an Oracle Real Application Clusters (Oracle RAC) database by performing a rolling upgrade either of individual nodes, or of a set of nodes in the cluster. However, if you have a standalone database on a cluster that uses Oracle ASM, then you must shut down the standalone database before upgrading.

If you have an existing standalone, or non-clustered, Oracle ASM installation, then review Oracle upgrade documentation. The location of the Oracle ASM home changes in this release, and you may want to consider other configuration changes to simplify or customize storage administration.

During rolling upgrades of the operating system, Oracle supports using different operating system binaries when both versions of the operating system are certified with the Oracle Database release you are using.

**Note:** Using mixed operating system versions is only supported for the duration of an upgrade, over the period of a few hours. Oracle does not support operating a cluster with mixed operating systems for an extended period. Oracle does not support running Oracle grid infrastructure and Oracle RAC on heterogeneous platforms (servers with different chip architectures) in the same cluster.

To find the most recent software updates, and to find best practices recommendations about preupgrade, postupgrade, compatibility, and interoperability, refer to "Oracle Upgrade Companion." "Oracle Upgrade Companion" is available through Note 785351.1 on My Oracle Support:

https://support.oracle.com

## 2.3 Checking Hardware and Software Certification

The following sections list the following certification information:

- View Certification Information at My Oracle Support
- Web Browser Support
- Windows Telnet and Terminal Services Support

### 2.3.1 View Certification Information at My Oracle Support

The hardware and software requirements included in this installation guide were current at the time this guide was published. However, because new platforms and operating system software versions might be certified after this guide is published, review the certification matrix on the My Oracle Support Web site for the most up-to-date list of certified hardware platforms and operating system versions. This Web site also provides compatible client and database versions, patches, and workaround information for bugs.

The My Oracle Support Web site is available at the following URL:

http://support.oracle.com/

You must register online before using My Oracle Support. After logging in, click the **More...** tab then select **Certifications**. In the Find Certification Information field, choose the following:

- Product Line: Oracle Database Products
- Product Family: Oracle Database
- Product Area: Oracle Database
- Product: Oracle Server - Enterprise Edition
- Product Release: 11gR2 RAC
- Product Version: 11gR2 RAC
- Platform: Microsoft Windows x64 (64-bit)

After you have made these selections, click **Search**. Click the **Certified** link next to the value of Platform Version that matches your operating system, for example, 2008 R2.

Click the link for Certification notes to check the Certification Matrix for Oracle RAC to ensure that your hardware configuration is supported for use with Oracle Clusterware and Oracle RAC. My Oracle Support contains guidance about supported hardware options that can assist you with your purchasing decisions and installation planning.

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 with Oracle RAC 11*g* release 2 (11.2) installation, including important information about configuration issues. View the Product Notes and Platform Notes to view this additional information.

**Note:** Contact your Oracle sales representative if you do not have a My Oracle Support account.

### 2.3.2 Web Browser Support

On 64-bit Windows systems, Microsoft Internet Explorer 6.0 and higher is supported for Oracle Enterprise Manager Database Control and Oracle Enterprise Manager Grid Control.

### 2.3.3 Windows Telnet and Terminal Services Support

This section contains these topics:

- Windows Telnet Services Support
- Windows Terminal Services and Remote Desktop Support

#### 2.3.3.1 Windows Telnet Services Support

Windows Server 2003 and Windows Server 2003 R2 can use a Telnet Service to enable remote users to log on to the operating system and run console programs using the command line. Oracle supports the use of database command line utilities such as `sqlplus`, `export`, `import` and `sqlldr` using this feature, but does not support the database graphical user interface (GUI) tools such as OUI, Database Configuration Assistant (DBCA), and Oracle Net Configuration Assistant (NetCA).

**Note:** Ensure that the Telnet service is installed and started.

#### 2.3.3.2 Windows Terminal Services and Remote Desktop Support

Oracle supports installing, configuring, and running Oracle Database through Terminal Services (console mode) on Windows 2003 Server. If you do not use Terminal Services in console mode, then you might encounter problems with configuration assistants after the installation or with starting Oracle Clusterware components after installation.

To start Terminal Services in console mode, enter the following command:

```
mstsc -v:servername /F /console
```

**Note:** The information in this section does not apply to systems running Windows Server 2008 or higher.

## 2.4 Checking the Hardware Requirements

Each system must meet the following minimum hardware requirements:

- At least 1.5 gigabyte (GB) of physical RAM for grid infrastructure for a cluster installations without Oracle RAC; at least 2.5 GB of physical RAM if you plan to install Oracle RAC after installing grid infrastructure for a cluster.

  To determine the physical RAM size, for a computer using Windows 2003 R2, open **System** in the control panel and select the **General** tab.

- Virtual memory: double the amount of RAM

To determine the size of the configured virtual memory (also known as paging file size), open the Control Panel and select **System**. Select the **Advanced** tab and then click **Settings** in the Performance section. In the Performance Options window, click the **Advanced** tab to see the virtual memory configuration.

If necessary, refer to your operating system documentation for information about how to configure additional virtual memory.

- Video adapter: 256 color and at least 1024 x 768 display resolution, so that OUI displays correctly
- Processor: Intel Extended Memory 64 Technology (EM64T) or AMD 64 for 64-bit. The minimum processor speed is 1 gigahertz (GHz) for all supported Windows Servers except for Windows Server 2008 R2, where the minimum processor speed is 1.4 GHz.

---

**Note:** While Oracle Database for Microsoft Windows can run on supported 32-bit systems, Oracle Real Application Clusters, Oracle Clusterware, and Oracle Automatic Storage Management are only supported on 64-bit Windows systems.

The Oracle Database software for Itanium is supported only on the Itanium hardware.

---

To view your processor speed, perform the following steps:

1. From the Start menu, select **Run** ... In the Run window, type in `msinfo32.exe`.
2. In the System Summary display, locate the System Type entry. If the value for System Type is x64-based PC, then you have a 64-bit system. If the value for System Type is x86-based PC, then you have a 32-bit system.
3. Locate the Processor entry. If necessary, scroll to the right until you can see the end of the Processor value. The last part of this string shows the processor speed, for example, ~2612 megahertz (MHz), which corresponds to 2.61 GHz.

To determine whether your computer is running a 64-bit Windows operating system, perform the following steps:

1. Right-click My Computer and select **Properties**.
2. On the General tab, under the heading of System, view the displayed text.
   - On Windows Server 2003 and Windows Server 2003 R2, you will see text similar to "x64 Edition" if you have the 64-bit version of the operating system installed.
   - On Windows Server 2008 and Windows Server 2008 R2, you will see text similar to "64-bit Operating System" if you have the 64-bit version of the operating system installed.

## 2.5 Checking the Disk Space Requirements

The requirements for disk space on your server are described in the following sections:

- Disk Format Requirements
- Disk Space Requirements for Oracle Home Directories
- TEMP Disk Space Requirements

### 2.5.1 Disk Format Requirements

Oracle recommends that you install Oracle software, or binaries, on New Technology File System (NTFS) formatted drives or partitions. Because it is difficult for OUI to estimate NTFS and file allocation table (FAT) disk sizes on Windows, the system requirements documented in this section are likely more accurate than the values reported on the OUI Summary screen.

---

**Note:** Oracle Grid Infrastructure software is not supported on Network File System (NFS).

---

You cannot use NTFS formatted disks or partitions for Oracle Clusterware files or data files because they cannot be shared. Oracle Clusterware shared files and Oracle Database data files can be placed on unformatted (raw) basic disks that are managed by Oracle ASM or Oracle Cluster File System for Windows (Oracle OCFS for Windows).

Oracle ASM is recommended for managing Oracle Clusterware and Oracle Database data files.

### 2.5.2 Disk Space Requirements for Oracle Home Directories

3 GB of disk space for the grid infrastructure home (Grid home) The Grid home includes Oracle Clusterware and Oracle ASM software, configuration, and log files. Additional disk space on a cluster file system or shared disks is required for the Oracle cluster registry (OCR) and voting files used by Oracle Clusterware.

To determine the amount of free disk space, open **My Computer**, right-click the drive where the Oracle software is to be installed, and choose **Properties**.

If you are installing Oracle Database, then you must configuration additional disk space for:

- The Oracle Database software and log files
- The shared data files and, optionally, the shared Fast Recovery Area on either a file system or in an Oracle Automatic Storage Management disk group

**See Also:**

- Chapter 3, "Configuring Storage for Grid Infrastructure for a Cluster and Oracle RAC"
- *Oracle Database Storage Administrator's Guide*

### 2.5.3 TEMP Disk Space Requirements

The amount of disk space available in the `TEMP` directory is equivalent to the total amount of free disk space, minus what will be needed for the Oracle software to be installed.

You must have 1 GB of disk space available in the `TEMP` directory. If you do not have sufficient space, then first delete all unnecessary files. If the temp disk space is still less than the required amount, then set the `TEMP` environment variable to point to a different hard drive.

To modify the `TEMP` environment variable open the **System** control panel, select the **Advanced** tab, and click **Environment Variables**.

**Note:** The temporary directory must reside in the same directory path on each node in the cluster.

## 2.6 Checking the Network Requirements

Review the following sections to check that you have the networking hardware and internet protocol (IP) addresses required for an Oracle grid infrastructure for a cluster installation:

- Network Hardware Requirements
- IP Address Requirements
- DNS Configuration for Domain Delegation to Grid Naming Service
- Grid Naming Service Configuration Example
- Manual IP Address Configuration Example
- Network Interface Configuration Options

**Note:** For the most up-to-date information about supported network protocols and hardware for Oracle RAC installations, refer to the Certify pages on the My Oracle Support Web site at the following URL:

`https://support.oracle.com`

### 2.6.1 Network Hardware Requirements

The following is a list of requirements for network configuration:

- The host name of each node must use only the characters a-z, A-Z, 0-9, and the dash or minus sign (-). Host names using underscores (_) are not allowed.
- Each node must have at least two network adapters or network interface cards (NICs): one for the public network interface, and one for the private network interface (the interconnect).

  To use multiple NICs for the public network or for the private network, Oracle recommends that you use NIC teaming. Use separate teaming for the public and private networks, because during installation each network connection is defined as a public or private interface.
- The private and public network connection names must be different from each other and cannot contain any multibyte language characters. The names are case-sensitive.
- The public network connection names associated with the network adapters for each network must be the same on all nodes, and the private network connection names associated with the network adapters must be the same on all nodes.

  For example: With a two-node cluster, you cannot configure network adapters on `node1` with `NIC1` as the public network connection name, but on `node2` have `NIC2` as the public network connection name. Public network connection names must be the same, so you must configure `NIC1` as public on *both* nodes. You must also configure the network adapters for the private network connection with the same network connection name. If `PrivNIC` is the private network connection name for `node1`, then `PrivNIC` must be the private network connection name for `node2`.

- In Windows Networking Properties, the public network connection on each node must be listed first in the bind order (the order in which network services access the node). The private network connection should be listed second.

  To ensure that your public adapter is first in the bind order, follow these steps:

  1. Right-click **My Network Places** and choose **Properties**.
  2. In the Advanced menu, click **Advanced Settings.**
  3. If the public adapter name is not the first name listed under the Adapters and Bindings tab, then select it and click the arrow to move it to the top of list
  4. Click **OK** to save the setting and then exit network setup dialog

- For the public and private networks, each network adapter must support transmission control protocol internet protocol (TCP/IP).
- For the private network, the interconnect must support the user datagram protocol (UDP) using high-speed network adapters and switches that support TCP/IP (minimum requirement 1 Gigabit Ethernet).

  **Note:** UDP is the default interconnect protocol for Oracle RAC, and TCP is the interconnect protocol for Oracle Clusterware. You must use a switch for the interconnect. Oracle recommends that you use a dedicated switch.

  Oracle does not support token-rings or crossover cables for the interconnect.

- Windows Media Sensing must be disabled for the private network connection.

  To disable Windows Media Sensing for TCP/IP, you must set the value of the `DisableDHCPMediaSense` parameter to 1 on each node. Because you must modify the Windows registry to disable Media Sensing, you should first backup the registry and confirm that you can restore it, using the methods described in your Windows documentation. Disable Media Sensing by completing the following steps on each node of your cluster:

  1. Backup the Windows registry.
  2. Use Registry Editor (`Regedt32.exe`) to view the following key in the registry:

     ```
     HKEY_LOCAL_MACHINE\System\CurrentControlSet\Services\Tcpip\Parameters
     ```

  3. Add the following registry value of type DWORD:

     ```
     Value Name: DisableDHCPMediaSense
     Data Type: REG_DWORD -Boolean
     Value: 1
     ```

  4. Restart the computer.

- For the private network, the endpoints of all designated interconnect interfaces must be completely reachable on the network. There should be no node that is not connected to every private network interface. You can test if an interconnect interface is reachable using `ping`.
- During installation, you are asked to identify the planned use for each network connection name that OUI detects on your cluster node. You must identify each network connection name as a public or private network connection name, and

you must use the same private network connection names for both Oracle Clusterware and Oracle RAC.

You can team separate interfaces to a common network connection to provide redundancy for a NIC failure. Oracle RAC and Oracle Clusterware will share this connection.

IP addresses on the subnet you identify as private are assigned as private IP addresses for cluster member nodes. You do not have to configure these addresses manually in a `hosts` file.

## 2.6.2 IP Address Requirements

Before starting the installation, you must have at least two network interfaces configured on each node: One for the private IP address and one for the public IP address.

You can configure IP addresses with one of the following options:

- Oracle Grid Naming Service (GNS) using a static public node address and dynamically allocated IPs for the Oracle Clusterware provided virtual IP (VIP) addresses, Dynamic Host Configuration Protocol (DHCP) server assigned, and resolved using a multicast domain name system configured within the cluster.
- Static addresses that network administrators assign on a network domain name system (DNS) for each node. Selecting this option requires that you request network administration updates when you modify the cluster.

---

**Note:** Oracle recommends that you use a static host name for all server node public host names.

Public IP addresses and virtual IP addresses must be in the same subnet.

---

### 2.6.2.1 IP Address Requirements with Grid Naming Service

If you enable GNS, then name resolution requests are delegated to the GNS service through its VIP address. You define this address in the DNS domain before installation. The DNS delegates name resolution requests for cluster names to the GNS. The GNS processes the requests and responds with the list of addresses for the names.

To use GNS, before installation the DNS administrator must establish DNS Lookup to direct DNS resolution of a subdomain to the cluster.

**See Also:** "DNS Configuration for Domain Delegation to Grid Naming Service" on page 2-10 for information on how to configure DNS delegation

### 2.6.2.2 IP Address Requirements for Manual Configuration

If you do not enable GNS, then the public and VIP addresses for each node must be static IP addresses, configured before installation for each node, but not currently in use. Public and VIP addresses must be on the same subnet.

Oracle Clusterware manages private IP addresses in the private subnet on network interfaces you identify as private during the installation interview.

The cluster must have the following addresses configured:

- A public IP address for each node
- A VIP address for each node
- A single client access name (SCAN) configured on the DNS for Round Robin resolution to three addresses (recommended) or at least one address.

The SCAN is a host name used to provide service access for clients to the cluster. Because the SCAN is associated with the cluster as a whole, rather than to a particular node, the SCAN makes it possible to add or remove nodes from the cluster without needing to reconfigure clients. It also adds location independence for the databases, so that client configuration does not have to depend on which nodes are running a particular database. Clients can continue to access the cluster in the same way as with previous releases, but Oracle recommends that clients access the cluster using the SCAN.

SCAN addresses should be defined in a DNS to resolve to the SCAN. The SCAN addresses must be on the same subnet as VIP addresses and public IP addresses. The SCAN must resolve to at least one address. For high availability and scalability, Oracle recommends that you configure the SCAN to use Round Robin resolution to three addresses. The name for the SCAN cannot begin with a numeral.

---

**Note:** If you manually configure SCAN VIP addresses, then Oracle strongly recommends that you do not configure SCAN VIP addresses in the system `hosts` file. Use DNS resolution for SCAN VIPs. If you use the system `hosts` file to resolve SCANs, then you will only be able to resolve to one IP address and you will have only one SCAN address.

---

**See Also:** Appendix C, "Understanding Network Addresses"for more information about network addresses

### 2.6.3 DNS Configuration for Domain Delegation to Grid Naming Service

If you plan to use GNS, then before grid infrastructure installation, you must configure your DNS to send to GNS any name resolution requests for the subdomain served by GNS. This subdomain represents the cluster member nodes.

You must configure the DNS to send GNS name resolution requests using DNS forwarders. If the DNS server is running on Windows server that you administer, then the following steps must be performed to configure DNS:

1. Click **Start**, then select **Programs**. Select **Administrative Tools** and then click **DNS manager**. The DNS server configuration wizard starts automatically. Use the wizard to create an entry for the GNS VIP address. For example:

   ```
   gns-server.clustername.com: 192.0.2.1
   ```

   The address you provide must be static and routable.

2. To configure DNS forwarders, click **Start**, select **Administrative Tools**, and then select **DNS**.
3. Right-click ***ServerName***, where *ServerName* is the name of the server, and then click the **Forwarders** tab.
4. Click **New**, then type the name of the DNS domain for which you want to forward queries in the DNS domain box, for example, `clusterdomain.example.com`. Click **OK**.

5. In the selected domain's forwarder IP address box, type the GNS VIP address, and then click **Add**.
6. Click **OK** to exit.

If the DNS server is running on a different operating system, then refer to the *Oracle Clusterware Installation Guide* for that platform, or your operating system documentation.

---

**Note:** Experienced DNS administrators may want to create a reverse lookup zone to enable resolution of reverse lookups. A *reverse lookup* resolves an IP address to a host name with a Pointer Resource (PTR) record. If you have your reverse DNS zones configured, then you can automatically create associated reverse records when you create your original forward record.

---

### 2.6.4 Grid Naming Service Configuration Example

If you use GNS, then you must specify a static IP address for the GNS VIP address, and delegate a subdomain to be delegated to that static GNS VIP address.

As nodes are added to the cluster, your organization's DHCP server can provide addresses for these nodes dynamically. These addresses are then registered automatically in GNS, and GNS provides resolution within the subdomain to cluster node addresses registered with GNS.

Because allocation and configuration of addresses is performed automatically with GNS, no further configuration is required. Oracle Clusterware provides dynamic network configuration as nodes are added to or removed from the cluster. The following example is provided only for information.

With a two node cluster where you have defined the GNS VIP, after installation you might have a configuration similar to the following, where the cluster name is `mycluster`, the GNS parent domain is `example.com`, the subdomain is `grid.example.com`, 192.0.2 in the IP addresses represents the cluster public IP address network, and 192.168.0 represents the private IP address network:

***Table 2–1 Example of a Grid Naming Service Network***

| Identity | Home Node | Host Node | Given Name | Type | Address | Address Assigned By | Resolved By |
|---|---|---|---|---|---|---|---|
| GNS VIP | n/a | Selected by Oracle Clusterware | `mycluster-gns.example.com` | Virtual | 192.0.2.1 | Fixed by net administrator | DNS |
| Node 1 Public | node1 | `node1` | `node1`[1] | Public | 192.0.2.101 | Fixed | GNS |
| Node 1 VIP | node1 | Selected by Oracle Clusterware | `node1-vip` | Virtual | 192.0.2.104 | DHCP | GNS |
| Node 1 Private | node1 | `node1` | `node1-priv` | Private | 192.168.0.1 | Fixed or DHCP | GNS |
| Node 2 Public | node2 | `node2` | `node2`[1] | Public | 192.0.2.102 | Fixed | GNS |
| Node 2 VIP | node2 | Selected by Oracle Clusterware | `node2-vip` | Virtual | 192.0.2.105 | DHCP | GNS |

*Table 2–1 (Cont.) Example of a Grid Naming Service Network*

| Identity | Home Node | Host Node | Given Name | Type | Address | Address Assigned By | Resolved By |
|---|---|---|---|---|---|---|---|
| Node 2 Private | node2 | `node2` | `node2-priv` | Private | 192.168.0.2 | Fixed or DHCP | GNS |
| SCAN VIP 1 | n/a | Selected by Oracle Clusterware | `mycluster-scan.grid.example.com` | Virtual | 192.0.2.201 | DHCP | GNS |
| SCAN VIP 2 | n/a | Selected by Oracle Clusterware | `mycluster-scan.grid.example.com` | Virtual | 192.0.2.202 | DHCP | GNS |
| SCAN VIP 3 | n/a | Selected by Oracle Clusterware | `mycluster-scan.grid.example.com` | Virtual | 192.0.2.203 | DHCP | GNS |

[1] Node host names may resolve to multiple addresses, including any private IP addresses or VIP addresses currently running on that host.

## 2.6.5 Manual IP Address Configuration Example

If you choose not to use GNS, then before installation you must configure public, virtual, and private IP addresses. Also, check that the default gateway can be accessed by a `ping` command. To find the default gateway, use the `ipconfig` command, as described in your operating system's help utility.

For example, with a two node cluster where each node has one public and one private interface, and you have defined a SCAN domain address to resolve on your DNS to one of three IP addresses, you might have the configuration shown in the following table for your network interfaces:

*Table 2–2 Manual Network Configuration Example*

| Identity | Home Node | Host Node | Given Name | Type | Address | Address Assigned By | Resolved By |
|---|---|---|---|---|---|---|---|
| Node 1 Public | node1 | `node1` | `node1`[1] | Public | 192.0.2.101 | Fixed | DNS |
| Node 1 VIP | node1 | Selected by Oracle Clusterware | `node1-vip` | Virtual | 192.0.2.104 | Fixed | DNS, hosts file |
| Node 1 Private | node1 | `node1` | `node1-priv` | Private | 192.168.0.1 | Fixed | DNS, hosts file, or none |
| Node 2 Public | node2 | `node2` | `node2`[1] | Public | 192.0.2.102 | Fixed | DNS |
| Node 2 VIP | node2 | Selected by Oracle Clusterware | `node2-vip` | Virtual | 192.0.2.105 | Fixed | DNS, hosts file |
| Node 2 Private | node2 | `node2` | `node2-priv` | Private | 192.168.0.2 | Fixed | DNS, hosts file, or none |

*Table 2–2 (Cont.) Manual Network Configuration Example*

| Identity | Home Node | Host Node | Given Name | Type | Address | Address Assigned By | Resolved By |
|---|---|---|---|---|---|---|---|
| SCAN VIP 1 | n/a | Selected by Oracle Clusterware | `mycluster-scan` | Virtual | 192.0.2.201 | Fixed | DNS |
| SCAN VIP 2 | n/a | Selected by Oracle Clusterware | `mycluster-scan` | Virtual | 192.0.2.202 | Fixed | DNS |
| SCAN VIP 3 | n/a | Selected by Oracle Clusterware | `mycluster-scan` | Virtual | 192.0.2.203 | Fixed | DNS |

[1] Node host names may resolve to multiple addresses.

You do not have to provide a private name for the interconnect. If you want name resolution for the interconnect, then you can configure private IP names in the system `hosts` file or the DNS. However, Oracle Clusterware assigns interconnect addresses on the interface defined during installation as the private interface (`Local Area Connection 2`, for example), and to the subnet used for the private subnet.

The addresses to which the SCAN resolves are assigned by Oracle Clusterware, so they are not fixed to a particular node. To enable VIP failover, the configuration shown in the preceding table defines the SCAN addresses and the public and VIP addresses of both nodes on the same subnet, 192.0.2.

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

### 2.6.6 Network Interface Configuration Options

The precise configuration you choose for your network depends on the size and use of the cluster you want to configure, and the level of availability you require.

If certified Network-attached Storage (NAS) is used for Oracle RAC and this storage is connected through Ethernet-based networks, then you must have a third network interface for NAS I/O. Failing to provide three separate interfaces in this case can cause performance and stability problems under heavy system loads.

## 2.7 Identifying Software Requirements

Depending on the products that you intend to install, verify that the following operating system software is installed on the system.

**Note:** OUI performs checks your system to verify that it meets the listed operating system requirements. To ensure that these checks complete successfully, verify the requirements before you start OUI.

Oracle does not support running different operating system versions on cluster members, unless an operating system is being upgraded. You cannot run different operating system version binaries on members of the same cluster, even if each operating system is supported.

Table 2–3 lists the software requirements for Oracle Grid Infrastructure and Oracle RAC 11*g* Release 2 (11.2).

***Table 2–3 Oracle Grid Software Requirements for Windows Systems***

| Requirement | Value |
|---|---|
| System Architecture | Processor: AMD64, or Intel Extended memory (EM64T)<br>**Note:** Oracle provides only 64-bit (x64) versions of Oracle Database with Oracle RAC for Windows.<br>The 64-bit (x64) version of Oracle RAC runs on the 64-bit version of Windows on AMD64 and EM64T hardware. For additional information, visit My Oracle Support at the following URL:<br>`http://support.oracle.com/` |
| Operating system for 64-bit Windows | **Oracle Grid Infrastructure and Oracle RAC for x64 Windows:**<br>■ Windows Server 2003 x64 with service pack 1 or higher.<br>■ Windows Server 2003 R2 x64.<br>■ Windows Server 2008 x64 Standard, Enterprise, Datacenter, Web, and Foundation editions.<br>■ Windows Server 2008 R2 x64 Standard, Enterprise, Datacenter, Web, and Foundation editions.<br>The Windows Multilingual User Interface Pack and Terminal Services are supported.<br>**NOTE:** Oracle Clusterware, Oracle ASM and Oracle RAC 11*g* release 2 are not supported on any 32-bit Windows operating systems. |
| Compiler for x64 Windows | Pro*Cobol has been tested and is certified with Micro Focus Net Express 5.0. Object Oriented COBOL (OOCOBOL) specifications are not supported.<br>The following components are supported with the Microsoft Visual C++ .NET 2005 9.0 and Intel 10.1 C compilers:<br>■ Oracle Call Interface (OCI)<br>■ Pro*C/C++<br>■ External callouts<br>■ Oracle XML Developer's Kit (XDK)<br>Oracle C++ Call Interface (OCCI) is supported with:<br>■ Microsoft Visual C++ .NET 2005 8.0<br>■ Microsoft Visual C++ .NET 2008 9.0 - OCCI libraries are installed under *ORACLE_HOME*`\oci\lib\msvc\vc9`. When developing OCCI applications with MSVC++ 9.0, ensure that the OCCI libraries are correctly selected from this directory for linking and executing.<br>■ Intel 10.1 C++ compiler with the relevant Microsoft Visual C++ .NET STLs |
| Network Protocol | Oracle Net foundation layer uses Oracle protocol support to communicate with the following industry-standard network protocols:<br>■ TCP/IP<br>■ TCP/IP with secure sockets layer (SSL)<br>■ Named Pipes |

If you are currently running an operating system version that is not supported by Oracle Database 11*g* release 2 (11.2), such as Windows 2000, then you must first upgrade your operating system before upgrading to Oracle Database 11*g* RAC.

If you are currently running a cluster with Oracle9*i* Clusterware and want to continue to use it, then you must upgrade to the latest patchset for Oracle9*i* Clusterware to ensure compatibility between Cluster Manager Services in Oracle9*i* Clusterware and Oracle Clusterware 11*g* release 2 (11.2).

### 2.7.1 Windows Firewall Feature on Windows Servers

When installing Oracle grid infrastructure software or Oracle RAC software on Windows servers, it is mandatory to disable the Windows Firewall feature. If the windows firewall is enabled, then remote copy and configuration assistants such as virtual IP configuration assistant (VIPCA), NetCA and DBCA will fail during Oracle RAC installation. Thus, the firewall must be disabled on all the nodes of a cluster before performing Oracle RAC installation.

---

**Note:** The Windows Firewall should *never* be enabled on a NIC that is used as a cluster interconnect (private network interface).

---

After the installation is successful, you can enable the Windows Firewall for the public connections. However, to ensure correct operation of the Oracle software, you must add certain executables and ports to the Firewall exception list on all the nodes of a cluster. See Section 5.1.2, "Configure Exceptions for the Windows Firewall" for details.

Additionally, the Windows Firewall must be disabled on all the nodes in the cluster before performing any clusterwide configuration changes, such as:

- Adding a node
- Deleting a node
- Upgrading to patch release
- Applying a one-off patch

If you do not disable the Windows Firewall before performing these actions, then the changes might not be propagated correctly to all the nodes of the cluster.

## 2.8 Network Time Protocol Setting

Each node in the cluster must use the same time reference. Follow the instructions in one of the following sections to configure time synchronization for your cluster nodes:

- Configuring the Windows Time Service
- Configuring Network Time Protocol
- Configuring Cluster Time Synchronization Service

### 2.8.1 Configuring the Windows Time Service

The Windows Time service (W32Time) provides network clock synchronization on computers running Microsoft Windows. If you are using Windows Time service, and you prefer to continue using it instead of Cluster Time Synchronization Service, then you must modify the Windows Time service settings to prevent the time from being adjusted backward. Restart the Windows Time service after you complete this task.

To configure Windows Time service, use the following command on each node:

```
C:\> W32tm /register
```

To modify the Windows Time service to prevent it from adjusting the time backward, perform the following steps:

1. Open the Registry Editor (`regedit`).
2. Locate the `HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\W32Time\Config` key.
3. Set the value for `MaxNegPhaseCorrection` to 0.
4. To put the change into effect, use the following command:

   ```
   C:\>W32tm /config /update
   ```

### 2.8.2 Configuring Network Time Protocol

The Network Time Protocol (NTP) is a client/server application. Each server must have NTP client software installed and configured to synchronize its clock to the network time server. The Windows Time service is not an exact implementation of the NTP, but it based on the NTP specifications.

If you decide to use NTP instead of the Windows Time service, then, after you have installed the NTP client software on each node server, you must start the NTP service with the `-x` option to prevent time from being adjusted backward.

To ensure the NTP service is running with the `-x` option, perform the following steps:

1. Use the registry editor to edit the value for the `ntpd` executable under HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\NTP
2. Add the `-x` option to the ImagePath key value, behind `%INSTALLDIR%\ntpd.exe`.
3. Restart the NTP service using the following commands:

   ```
   net stop NTP
   net start NTP
   ```

### 2.8.3 Configuring Cluster Time Synchronization Service

To use Cluster Time Synchronization Service to provide synchronization service in the cluster, disable the Windows Time service and stop the NTP service.

When the installer finds that neither the Windows Time service or NTP service are active, the Cluster Time Synchronization Service is installed in active mode and synchronizes the time across the nodes. If the Windows Time service or NTP service is active, then the Cluster Time Synchronization Service is started in observer mode, and no active time synchronization is performed by Oracle Clusterware within the cluster.

To confirm that the Cluster Time Synchronization Service is active after installation, enter the following command as the Grid installation owner:

```
crsctl check ctss
```

## 2.9 Enabling Intelligent Platform Management Interface

Intelligent Platform Management Interface (IPMI) provides a set of common interfaces to computer hardware and firmware that system administrators can use to monitor

system health and manage the system. With Oracle Database 11*g* release 2, Oracle Clusterware can integrate IPMI to provide failure isolation support and to ensure cluster integrity.

You can configure node-termination with IPMI during installation by selecting a node-termination protocol, such as IPMI. You can also configure IPMI after installation with `crsctl` commands.

> **See Also:** *Oracle Clusterware Administration and Deployment Guide* for information about how to configure IPMI after installation

### 2.9.1 Requirements for Enabling IPMI

You must have the following hardware and software configured to enable cluster nodes to be managed with IPMI:

- Each cluster member node requires a Baseboard Management Controller (BMC) running firmware compatible with IPMI version 1.5 or greater, which supports IPMI over local area networks (LANs), and configured for remote control using LAN.

  > **Note:** On servers running Windows 2008, you may have to upgrade the basic I/O system (BIOS), system firmware, and BMC firmware before you can use IPMI. Refer to Microsoft Support Article ID 950257 (`http://support.microsoft.com/kb/950257`) for details.

- Each cluster member node requires an IPMI driver installed on each node.
- The cluster requires a management network for IPMI. This can be a shared network, but Oracle recommends that you configure a dedicated network.
- Each cluster member node's Ethernet port used by BMC must be connected to the IPMI management network.
- Each cluster member must be connected to the management network.
- Some server platforms put their network interfaces into a power saving mode when they are powered off. In this case, they may operate only at a lower link speed (for example, 100 megabyte (MB), instead of 1 GB). For these platforms, the network switch port to which the BMC is connected must be able to auto-negotiate down to the lower speed, or IPMI will not function properly.

### 2.9.2 Configuring the IPMI Management Network

You can configure the BMC for DHCP, or for static IP addresses. Oracle recommends that you configure the BMC for dynamic IP address assignment using DHCP. To use this option, you must have a DHCP server configured to assign the BMC IP addresses.

> **Note:** If you configure IPMI, and you use GNS, then you still must configure separate addresses for the IPMI interfaces. As the IPMI adapter is not seen directly by the host, the IPMI adapter is not visible to GNS as an address on the host.

### 2.9.3 Configuring the IPMI Driver

For Oracle Clusterware to communicate with the BMC, the IPMI driver must be installed permanently on each node, so that it is available on system restarts. On

Windows systems, the implementation assumes the Microsoft IPMI driver (`ipmidrv.sys`), which is included on Windows Server 2008 and later versions of the Windows operating system. The driver is included as part of the Hardware Management feature, which includes the driver and the Windows Management Interface (WMI).

**Note:**

- The `ipmidrv.sys` driver is not supported by default on Windows Server 2003. It is available for Windows 2003 R2, but is not installed by default.
- An alternate driver (`imbdrv.sys`) is available from Intel as part of Intel Server Control, but this driver has not been tested with Oracle Clusterware.

#### 2.9.3.1 Configuring the Hardware Management Component

Hardware Management is not installed and enabled by default on Windows Server 2003 systems. Hardware management is installed using the Add/Remove Windows Components Wizard.

1. Press **Start**, then select **Control Panel**.
2. Select **Add or Remove Programs**.
3. Click **Add/Remove Windows Components**.
4. Select (but do not check) **Management and Monitoring Tools** and click the **Details** button to display the detailed components selection window.
5. Select the **Hardware Management** option.

   If a BMC is detected through the system management BIOS (SMBIOS) Table Type 38h, then a dialog box will be displayed instructing you to remove any third party drivers. If no third party IPMI drivers are installed or they have been removed from the system, then click **OK** to continue.

   **Note:** The Microsoft driver is incompatible with other drivers. Any third party drivers must be removed

6. Click **OK** to select the Hardware Management Component, and then click **Next**.

   Hardware Management (including Windows Remote Management, or WinRM) will be installed.

After the driver and hardware management have been installed, the BMC should be visible in the Windows Device Manager under System devices with the label "Microsoft Generic IPMI Compliant Device". If the BMC is not automatically detected by the plug and play system, then the device must be created manually.

To create the IPMI device, run the following command:

```
rundll32 ipmisetp.dll,AddTheDevice
```

#### 2.9.3.2 Configuring the BMC Using ipmiutil on Windows 2003 R2

For IPMI-based fencing to function properly, the BMC hardware must be configured for remote control through LAN. The BMC configuration may be effected from the

boot prompt (BIOS), using a platform specific management utility or one of many publicly available utilities, which can be downloaded from the Internet, such as:

IPMIutil, which is available for Linux and Windows:

http://ipmiutil.sourceforge.net

Refer to the documentation for these configuration tools for instructions on how to configure the BMC.

When you configure the BMC on each node, you must complete the following:

- Enable IPMI over LAN, so that the BMC can be controlled over the management network.
- Enable dynamic IP addressing using DHCP, or configure a static IP address for the BMC.
- Establish an administrator user account and password for the BMC
- Configure the BMC for virtual LAN (VLAN) tags, if you will use the BMC on a tagged VLAN.

The configuration tool you use does not matter, but these conditions must be met for the BMC to function properly.

#### Example of BMC Configuration Using ipmiutil on Windows 2003 R2

The following is an example of configuring BMC using `ipmiutil` (version 2.2.3):

1. Open a command window while logged in as a member of the Administrators group.
2. After the driver is loaded and the device special file has been created, verify that `ipmiutil` can communicate with the BMC through the driver:

   ```
   C:\> ipmiutil lan
   impiutil ver 2.23
   <PEFilter parameters displayed> . . .
   pefconfig, GetLanEntry for channel 1 . . .
   Lan Param(0) Set in progress: 00
   . . . <remaining Lan Param info displayed>
   ```

   The following steps establish the required configuration parameters described in this example.

   > **Note:** If you use the `-l` option, then `ipmiutil` sets certain LAN parameters only for enabling IPMI over LAN. This can have the undesired effect of resetting to default values of some previously established parameters if they are not supplied on the command line. Thus, the order of the following steps could be critical.

3. Establish remote LAN access with Administrator privileges (`-v 4`) and the desired user name and password (`ipmiutil` will find the LAN channel on its own):

   ```
   C:\> ipmiutil lan -l -v 4 -u user_name -p password
   ```

4. Configure dynamic or static IP address settings for BMC:

   - **Using dynamic IP addressing (DHCP)**

Dynamic IP addressing is the default assumed by OUI. Oracle recommends that you select this option so that nodes can be added or removed from the cluster more easily, as address settings can be assigned automatically.

**Note:** Use of DHCP requires a DHCP server on the subnet.

Set the channel. For example, if the channel is 1, then enter the following command to enable DHCP:

```
C:\> ipmiutil lan set -l -D
```

- **Using static IP Addressing**

  If the BMC shares a network connection with the operating system, then the IP address must be on the same subnet. You must set not only the IP address, but also the proper values for the default gateway and the netmask for your network configuration. for example:

  ```
  C:\> impiutil lan -l -I 192.168.0.55   (IP address)
  C:\> ipmiutil lan -l -G 192.168.0.1    (gateway IP address)
  C:\> ipmiutil lan -l -S 255.255.255.0  (netmask)
  ```

  The specified address (`192.168.0.55`) will be associated only with the BMC, and will not respond to normal pings.

  **Note:** Enabling IPMI over LAN with the `-l` option will reset the subnet mask to a value obtained from the operating system. Thus, when setting parameters one at a time using the `impiutil lan -l` command, as shown above, the `-S` option should be specified last.

5. Verify the setup.

   After the previous configuration steps have been completed, you can verify your settings on the node being configured as follows (the items in **bold** text reflect the settings just made):

   ```
   C:\> impiutil lan

   ipmiutil ver 2.23
   peconfig ver 2.23
   -- BMC version 1.40, IPMI version 1.5
   pefconfig, GetPefEntry ...
   PEFilter(01): 04 h : event ... <skipping PEF entries>
   ...

   pefconfig, GetLanEntry for channel 1 ...
   Lan Param(0) Set in progress: 00
   Lan Param(1) Auth type support: 17 : None MD2 MD5 Pswd
   Lan Param(2) Auth type enables: 16 16 16 16 00
   Lan Param(3) IP address: 192 168 0 55
   Lan Param(4) IP address src: 01 : Static
   Lan Param(5) MAC addr: 00 11 43 d7 4f bd
   Lan Param(6) Subnet mask: 255 255 255 0
   Lan Param(7) IPv4 header: 40 40 10
   GetLanEntry: completion code=cc
   GetLanEntry(10), ret = -1
   GetLanEntry: completion code=cc
   GetLanEntry(11), ret = -1
   ```

```
Lan Param(12) Def gateway IP: 192 168 0 1
Lan Param(13) Def gateway MAC: 00 00 0c 07 ac dc
...
Get User Access(1): 0a 01 01 0f : No access ()
Get User Access(2): 0a 01 01 14 : IPMI, Admin (user_name)
Get User Access(3): 0a 01 01 0f : No access ()
pefconfig, completed successfully
```

6. Finally, you can verify that the BMC is accessible and controllable from a remote node in your cluster:

```
C:\> ipmiutil health -N 192.168.0.55 -U user_name -P password
ipmiutil ver 2.23
bmchealth ver 2.23
Opening connection to node 192.168.0.55 ...
Connected to node racnode1.example.com 192.168.0.31
BMC version 1.23, IPMI version 1.5
BMC manufacturer = 0002a2 (Dell), product = 0000
Chassis Status   = 01   (on, restore_policy=stay_off)
Power State      = 00   (S0: working)
Selftest status  = 0055 (OK)
Channel 1 Auth Types: MD2 MD5
         Status = 14, OEM ID 000000 OEM Aux 00
bmchealth, completed successfully
```

## 2.10 Checking Individual Component Requirements

This section contains these topics:

- Oracle Advanced Security Requirements
- Oracle Enterprise Manager Requirements

### 2.10.1 Oracle Advanced Security Requirements

You must meet hardware and software requirements to use authentication support with Oracle components. Some Oracle Advanced Security components can use a Lightweight Directory Access Protocol (LDAP) such as Oracle Internet Directory.

**See Also:** *Oracle Database Advanced Security Administrator's Guide*

### 2.10.2 Oracle Enterprise Manager Requirements

All Oracle Enterprise Manager products that you use on your system must be of the same release. Older versions of Enterprise Manager are not supported with the current release.

---

**Note:** All Oracle Enterprise Manager products, except Oracle Enterprise Manager Database Control, are released on the Enterprise Manager Grid Control installation media. Enterprise Manager Database Control is available on the Oracle Database installation media.

---

**See Also:** *Oracle Enterprise Manager Grid Control Installation and Basic Configuration* available on the Enterprise Manager Grid Control installation media

## 2.11 Configuring User Accounts

To install the Oracle software, you must use a user that is a member of the Administrators group. If you use a local user account for the installation, then the user account must exist on all nodes in the cluster and the user name and password must be the same on all nodes.

If you use a domain account for the installation, then the domain user must be explicitly declared as a member of the local Administrators group on each node in the cluster. It is not sufficient if the domain user has inherited membership from another group. The user performing the installation must be in the same domain on each node. For example, you cannot have a `dba1` user on the first node in the `DBADMIN` domain and a `dba1` user on the second node in the `RACDBA` domain.

For example, assume that you have one Oracle installation owner, and the user name for this Oracle installation owner is `oracle`. The `oracle` user must be either a local Administrator user or a domain user, and the same user must exist (same user name, password, and domain) on each node in the cluster.

If you intend to install Oracle Database, then the `oracle` user must be part of the `ORA_DBA` group. During installation, the user performing the software is automatically added to the `ORA_DBA` group. If you use a domain user, then you must make sure the domain user on each node is a member of the `ORA_DBA` group.

### 2.11.1 Managing User Accounts with User Account Control

To ensure that only trusted applications run on your computer, Windows Server 2008 and Windows Server 2008 R2 provide User Account Control. If you have enabled this security feature, then depending on how you have configured it, OUI prompts you for either your consent or your credentials when installing Oracle Database. Provide either the consent or your Windows Administrator credentials as appropriate.

You must have Administrator privileges to run some Oracle tools, such as DBCA, NetCA, and OPatch, or to run any tool or application that writes to any directory within the Oracle home. If User Account Control is enabled and you are logged in as the local Administrator, then you can successfully run each of these commands. However, if you are logged in as "a member of the Administrator group," then you must explicitly invoke these tasks with Windows Administrator privileges.

All of the Oracle shortcuts that require Administrator privileges are invoked as "Administrator" automatically when you click the shortcuts. However, if you run the previously mentioned tools from a Windows command prompt, then you must run them from an Administrative command prompt. OPatch does not have a shortcut and has to be run from an Administrative command prompt.

## 2.12 Verifying Cluster Privileges

Before running OUI, from the node where you intend to run the installer, verify that the user account you are using for the installation is configured as a member of the Administrators group on each node in the cluster. To do this, enter the following command for each node that is a part of the cluster where *`nodename`* is the node name:

```
net use \\nodename\C$
```

If you will be using other disk drives in addition to the C: drive, then repeat this command for every node in the cluster, substituting the drive letter for each drive you plan to use.

The installation user must also be able to update the Windows registry on each node in the cluster. To verify the installation user is configured to do this, perform the following steps:

1. Run `regedit` from the Run menu or the command prompt.
2. From the 'File' menu choose: 'Connect Network Registry'
3. In the 'Enter the object name…' edit box enter the name of a remote node in the cluster, then click OK.
4. Wait for the node to appear in the registry tree.

If the remote node does not appear in the registry tree or you are prompted to fill in a username and password, then you must resolve the permissions issue at the operating system level before proceeding with the Oracle Grid infrastructure installation.

---

**Note:** For the installation to be successful, you must use the same user name and password on each node in a cluster or use a domain user. If you use a domain user, then you must have explicitly granted membership in the local Administrators group to the domain user on all of the nodes in your cluster.

---

# 3

# Configuring Storage for Grid Infrastructure for a Cluster and Oracle RAC

This chapter describes the storage configuration tasks that you must complete before you start the installer to install Oracle Clusterware and Oracle Automatic Storage Management (Oracle ASM), and that you must complete before adding an Oracle Real Application Clusters (Oracle RAC) installation to the cluster.

This chapter contains the following topics:


- Reviewing Storage Options
- Preliminary Shared Disk Preparation
- Storage Requirements for Oracle Clusterware and Oracle RAC
- Configuring the Shared Storage Used by Oracle ASM
- Configuring Storage for Oracle Database Files on OCFS for Windows
- Configuring Direct NFS Storage for Oracle RAC Data Files
- Desupport of Raw Devices


## 3.1 Reviewing Storage Options

This section describes supported options for storing Oracle Grid Infrastructure for a cluster storage options. It contains the following sections:


- General Storage Considerations for Oracle Grid Infrastructure
- General Storage Considerations for Oracle RAC
- Supported Storage Options for Oracle Clusterware and Oracle RAC
- After You Have Selected Disk Storage Options


> **See Also:** The Oracle Certify site for a list of supported vendors for Network Attached Storage options:
>
> `http://www.oracle.com/technology/support/`
>
> Refer also to the Certify site on My Oracle Support for the most current information about certified storage options:
>
> `https://support.oracle.com/`

### 3.1.1 General Storage Considerations for Oracle Grid Infrastructure

Oracle Clusterware voting disks are used to monitor cluster node status, and Oracle Cluster Registry (OCR) files contain configuration information about the cluster. You can place voting disks and OCR files either in an Oracle ASM diskgroup, or on a cluster file system or shared network file system. Storage must be shared; any node that does not have access to an absolute majority of voting disks (more than half) will be restarted.

For a storage option to meet high availability requirements, the files stored on the disk must be protected by data redundancy, so that if one or more disks fail, then the data stored on the failed disks can be recovered. This redundancy can be provided externally using Redundant Array of Independent Disks (RAID) devices, or logical volumes on multiple physical devices and implement the stripe-and-mirror-everything methodology, also known as SAME. If you do not have a RAID devices or logical volumes, then you can create additional copies, or **mirrors**, of the files on different file systems. If you choose to mirror the files, then you must provide disk space for additional OCR files and at least two additional voting disk files.

Each OCR location should be placed on a different disk. For voting disk file placement, ensure that each file is configured so that it does not share any hardware device or disk, or other single point of failure with the other voting disks. Any node that does not have available to it an absolute majority of voting disks configured (more than half) will be restarted.

Use the following guidelines when choosing storage options:

- You can choose any combination of the supported storage options for each file type if you satisfy all requirements listed for the chosen storage options.
- You can use Oracle ASM 11*g* release 2 (11.2) to store Oracle Clusterware files. You cannot use prior Oracle ASM releases to do this.
- If you do not have a storage option that provides external file redundancy, then you must configure at least three voting disk locations and at least three OCR locations to provide redundancy.

### 3.1.2 General Storage Considerations for Oracle RAC

For all Oracle RAC installations, you must choose the storage options to use for Oracle Database files. Oracle Database files include data files, control files, redo log files, the server parameter file, and the password file.

To enable automated backups during the installation, you must also choose the shared storage option to use for recovery files (the fast recovery area). Use the following guidelines when choosing the storage options to use for each file type:

- The shared storage option that you choose for recovery files can be the same as or different from the option that you choose for the database files. However, you cannot use raw storage to store recovery files.
- You can choose any combination of the supported shared storage options for each file type if you satisfy all requirements listed for the chosen storage options.
- Oracle recommends that you choose Oracle ASM as the shared storage option for database and recovery files.
- For Standard Edition Oracle RAC installations, Oracle ASM is the only supported shared storage option for database or recovery files. You must use Oracle ASM for the storage of Oracle RAC data files, online redo logs, archived redo logs, control files, server parameter files (SPFILE), and the fast recovery area.

- If you intend to use Oracle ASM with Oracle RAC, and you are configuring a new Oracle ASM instance, then your system must meet the following conditions:
  - All nodes on the cluster have Oracle Clusterware and Oracle ASM 11*g* release 2 (11.2) installed as part of an Oracle grid infrastructure for a cluster installation.
  - Any existing Oracle ASM instance on any node in the cluster is shut down.
- Raw devices are supported only when upgrading an existing installation using the configured partitions. On new installations, using raw device partitions is not supported by Oracle Automatic Storage Management Configuration Assistant (ASMCA) or Oracle Universal Installer (OUI), but is supported by the software if you perform manual configuration.

#### 3.1.2.1 Guidelines for Placing Oracle Data Files on a File System

If you decide to place the Oracle data files on Oracle Cluster File System for Windows (OCFS for Windows), then use the following guidelines when deciding where to place them:

- You can choose either a single cluster file system or multiple cluster file systems to store the data files:
  - To use a single cluster file system, choose a cluster file system on a physical device that is dedicated to the database.

    For best performance and reliability, choose a RAID device or a logical volume on multiple physical devices and implement the stripe-and-mirror-everything methodology, also known as SAME.
  - To use multiple cluster file systems, choose cluster file systems on separate physical devices or partitions that are dedicated to the database.

    This method enables you to distribute physical I/O and create separate control files on different devices for increased reliability. It also enables you to fully implement Oracle Optimal Flexible Architecture (OFA) guidelines. To implement this method, you must choose the Advanced database creation option.
- If you intend to create a preconfigured database during the installation, then the cluster file system (or systems) that you choose must have at least 4 gigabyte (GB) of free disk space.

  For production databases, you must estimate the disk space requirement depending on how you use the database.
- For optimum performance, the cluster file systems that you choose should be on physical devices that are used by only the database.

> **Note:** You must not create an New Technology File System (NTFS) partition on a disk that you are using for OCFS for Windows.

#### 3.1.2.2 Guidelines for Placing Oracle Recovery Files on a File System

You must choose a location for recovery files before installation only if you intend to enable automated backups during installation.

If you choose to place the Oracle recovery files on a cluster file system, then use the following guidelines when deciding where to place them:

- To prevent disk failure from making the database files and the recovery files unavailable, place the recovery files on a cluster file system that is on a different physical disk from the database files.

  **Note:** Alternatively use an Oracle ASM disk group with a normal or high redundancy level for either or both file types, or use external redundancy.

- The cluster file system that you choose should have at least 3 GB of free disk space.

  The disk space requirement is the default disk quota configured for the fast recovery area (specified by the `DB_RECOVERY_FILE_DEST_SIZE` initialization parameter).

  If you choose the Advanced database configuration option, then you can specify a different disk quota value. After you create the database, you can also use Oracle Enterprise Manager to specify a different value.

  **See Also:** *Oracle Database Backup and Recovery Basics* for more information about sizing the fast recovery area.

### 3.1.3 Supported Storage Options for Oracle Clusterware and Oracle RAC

There are two ways of storing Oracle Clusterware files:

- **Oracle ASM**: You can install Oracle Clusterware files (OCR and voting disks) in Oracle ASM diskgroups.

  Oracle ASM is an integrated, high-performance database file system and disk manager for Oracle Clusterware and Oracle Database files. It performs striping and mirroring of database files automatically.

  **Note:** You can no longer use OUI to install Oracle Clusterware or Oracle Database files directly on raw devices.

  Only one Oracle ASM instance is permitted for each node regardless of the number of database instances on the node.

- OCFS for Windows: OCFS for Windows is a cluster file system used to store Oracle Clusterware and Oracle RAC files on the Microsoft Windows platforms. OCFS for Windows is different from OCFS2, which is available on Linux.

  **Note:** You cannot put Oracle Clusterware files on Oracle Automatic Storage Management Cluster File System (Oracle ACFS). You cannot put Oracle Clusterware binaries on a cluster file system.

  **See Also:** The Certify page on My Oracle Support for supported cluster file systems

You cannot install the Oracle Grid infrastructure software on a cluster file system. The Oracle Clusterware home must be on a local, NTFS formatted disk.

There are several ways of storing Oracle Database (Oracle RAC) files:

- **Oracle ASM**: You can create Oracle Database files in Oracle ASM diskgroups.

  Oracle ASM is the required database storage option for Typical installations, and for Standard Edition Oracle RAC installations.

  > **Note:** You can no longer use OUI to install Oracle Clusterware or Oracle Database files or binaries directly on raw devices.
  >
  > Only one Oracle ASM instance is permitted for each node regardless of the number of database instances on the node.

- **A supported shared file system**: Supported file systems include the following:
  - **OCFS for Windows:** OCFS for Windows is a cluster file system used to store Oracle Database binary and data files. If you intend to use OCFS for Windows for your database files, then you should create partitions large enough for all the database and recovery files when you create partitions for use by Oracle Database.

    **See Also:** The Certify page on My Oracle Support for supported cluster file systems

  - **Oracle ACFS:** Oracle ACFS provides a general purpose file system that can store the Oracle Database binary files.

    > **Note:** You cannot put Oracle Database files on Oracle ACFS.

- **Network File System (NFS) with Oracle Direct NFS client**: You can configure Oracle RAC to access NFS V3 servers directly using an Oracle internal Direct NFS client.

  > **Note:** You cannot use Direct NFS to store Oracle Clusterware files. You can only use Direct NFS to store Oracle Database files. To install Oracle RAC on Windows using Direct NFS, you must have access to a shared storage method other than NFS for the Oracle Clusterware files.

  **See Also:** "About Direct NFS Storage" on page 3-23 for more information on using Direct NFS

The following table shows the storage options supported for storing Oracle Clusterware and Oracle RAC files.

***Table 3–1 Supported Storage Options for Oracle Clusterware and Oracle RAC Files and Binaries***

| Storage Option | OCR and Voting Disks | Oracle Clusterware Binaries | Oracle RAC Binaries | Oracle RAC Database Files | Oracle Recovery Files |
|---|---|---|---|---|---|
| Oracle ASM | Yes | No | No | Yes | Yes |
| Oracle ACFS | No | No | Yes | No | No |
| OCFS for Windows | Yes | No | Yes | Yes | Yes |

*Table 3–1 (Cont.) Supported Storage Options for Oracle Clusterware and Oracle RAC Files and Binaries*

| Storage Option | OCR and Voting Disks | Oracle Clusterware Binaries | Oracle RAC Binaries | Oracle RAC Database Files | Oracle Recovery Files |
|---|---|---|---|---|---|
| Direct NFS access to a certified network attached storage (NAS) filer<br>**Note:** Direct NFS does not support Oracle Clusterware files. | No | No | No | Yes | Yes |
| Shared disk partitions (raw devices) | Not supported by OUI or ASMCA, but supported by the software. They can be added or removed after installation. | No | No | Not supported by OUI or ASMCA, but supported by the software. They can be added or removed after installation. | No |
| Local storage | No | Yes | Yes | No | No |

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

`https://support.oracle.com`

### 3.1.4 After You Have Selected Disk Storage Options

When you have determined your disk storage options, first perform the steps listed in the section "Preliminary Shared Disk Preparation", then configure the shared storage:

- **To use a file system**, refer to "Configuring the Shared Storage Used by Oracle ASM" on page 3-16.
- **To use Oracle ASM**, refer to "Marking Disk Partitions for Oracle ASM Before Installation" on page 3-17.

## 3.2 Preliminary Shared Disk Preparation

Complete the following steps to prepare shared disks for storage:

- Disabling Write Caching
- Enabling Automounting for Windows

### 3.2.1 Disabling Write Caching

You must disable write caching on all disks that will be used to share data between the nodes in your cluster. Perform these steps to disable write caching:

1. Click **Start**, then select **Control Panel**, then **Administrative Tools**, then **Computer Management**, then **Device Manager**, and then **Disk drives**
2. Expand the Disk drives and double-click the first drive listed.
3. Under the Policies tab for the selected drive, uncheck the option that enables write caching.
4. Double-click each of the other drives that will be used by Oracle Clusterware and Oracle RAC and disable write caching as described in the previous step.

**Caution:** Any disks that you use to store files, including database files, that will be shared between nodes, must have write caching disabled.

### 3.2.2 Enabling Automounting for Windows

If you are using Windows 2003 R2 Enterprise Edition or Datacenter Edition, then you must enable disk automounting, as it is disabled by default. For other Windows releases, even though the automount feature is enabled by default, you should verify that automount is enabled.

You must enable automounting when using:

- Raw partitions for Oracle RAC
- OCFS for Windows
- Oracle Clusterware
- Raw partitions for single-node database installations
- Logical drives for Oracle ASM

**Note:** Raw partitions are supported only when upgrading an existing installation using the configured partitions. On new installations, using raw partitions is not supported by ASMCA or OUI, but is supported by the software if you perform manual configuration

If you upgrade the operating system from one version of Windows to another (for example, Windows Server 2003 to Windows Advanced Server 2003), then you must repeat this procedure after the upgrade is finished.

To determine if automatic mounting of new volumes is enabled, use the following commands:

```
c:\> diskpart
DISKPART> automount
Automatic mounting of new volumes disabled.
```

To enable automounting:

1. Enter the following commands at a command prompt:

   ```
   c:\> diskpart
   DISKPART> automount enable
   Automatic mounting of new volumes enabled.
   ```

2. Type `exit` to end the `diskpart` session
3. Repeat steps 1 and 2 for each node in the cluster.
4. When you have prepared all of the cluster nodes in your Windows 2003 R2 system as described in the previous steps, restart all of the nodes.

**Note:** All nodes in the cluster must have automatic mounting enabled to correctly install Oracle RAC and Oracle Clusterware. Oracle recommends that you enable automatic mounting before creating any logical partitions for use by the database, Oracle ASM, or OCFS for Windows.

You must restart each node after enabling disk automounting. After it is enabled and the node is restarted, automatic mounting remains active until it is disabled.

## 3.3 Storage Requirements for Oracle Clusterware and Oracle RAC

Each supported file system type has additional requirements that must be met to support Oracle Clusterware and Oracle RAC. Use the following sections to help you select your storage option:

- Requirements for Using a Cluster File System for Shared Storage
- Identifying Storage Requirements for Using Oracle ASM for Shared Storage
- Restrictions for Disk Partitions Used By Oracle ASM
- Requirements for Using a Shared File System
- Requirements for Files Managed by Oracle

### 3.3.1 Requirements for Using a Cluster File System for Shared Storage

To use OCFS for Windows for Oracle Clusterware files, you must comply with the following requirements:

- If you choose to place your OCR files on a shared file system, then Oracle recommends that one of the following is true:
  - The disks used for the file system are on a highly available storage device, (for example, a RAID device that implements file redundancy)
  - At least three file systems are mounted, and use the features of Oracle Clusterware 11*g* release 2 (11.2) to provide redundancy for the OCR and voting disks
- If you use a RAID device to store the Oracle Clusterware files, then you must have a partition that has at least 560 megabyte (MB) of available space for the OCR and voting disk.
- If you use the redundancy features of Oracle Clusterware to provide high availability for the OCR and voting disk files, then you need a minimum of three file systems, and each one must have 560 MB of available space for the OCR and voting disk.

**Note:** The smallest partition size that OCFS for Windows can use is 500 MB

The total required volume size listed in the previous paragraph is cumulative. For example, to store all OCR and voting disk files on a shared file system that does not provide redundancy at the hardware level (external redundancy), you should have at least 1.7 GB of storage available over a minimum of three volumes (three separate volume locations for the OCR and voting disk files, one on each volume). If you use a

file system that provides data redundancy, then you need only one physical disk with 560 MB of available space to store the OCR and voting disk files.

**Note:** If you are upgrading from a previous release of Oracle Clusterware, and the existing OCR and voting disk files are not 280 MB, then you do not have to change the size of the OCR or voting disks before performing the upgrade.

### 3.3.2 Identifying Storage Requirements for Using Oracle ASM for Shared Storage

To identify the storage requirements for using Oracle ASM, you must determine how many devices and the amount of free disk space that you require. To complete this task, follow these steps:

**Tip:** As you progress through the following steps, make a list of the raw device names you intend to use and have it available during your database or Oracle ASM installation.

1. Determine whether you want to use Oracle ASM for Oracle Clusterware files (OCR and voting disks), Oracle Database files, recovery files, or all files except for Oracle Clusterware binaries. Oracle Database files include data files, control files, redo log files, the server parameter file, and the password file.

   **Note:**

   - You do not have to use the same storage mechanism for data files and recovery files. You can store one type of file in a cluster file system while storing the other file type within Oracle ASM. If you plan to use Oracle ASM for both data files and recovery files, then you should create separate Oracle ASM disk groups for the data files and the recovery files.
   - Oracle Clusterware files must use either Oracle ASM or a cluster file system. You cannot have some Oracle Clusterware files in Oracle ASM and other Oracle Clusterware files in a cluster file system.
   - If you choose to store Oracle Clusterware files on Oracle ASM and use redundancy for the disk group, then Oracle ASM automatically maintains the ideal number of voting files based on the redundancy of the diskgroup. The voting files are created within a single disk group and you cannot add extra voting files to this disk group manually.

   If you plan to enable automated backups during the installation, then you can choose Oracle ASM as the shared storage mechanism for recovery files by specifying an Oracle ASM disk group for the fast recovery area. Depending how you choose to create a database during the installation, you have the following options:

   - If you select an installation method that runs Database Configuration Assistant (DBCA) in interactive mode (for example, by choosing the Advanced database configuration option), then you can decide whether you want to use the same Oracle ASM disk group for data files and recovery files.

You can also choose to use different disk groups for each file type. Ideally, you should create separate Oracle ASM disk groups for data files and recovery files.

The same choice is available to you if you use DBCA after the installation to create a database.

- If you select an installation type that runs DBCA in non-interactive mode, then you must use the same Oracle ASM disk group for data files and recovery files.

2. Choose the Oracle ASM redundancy level to use for the Oracle ASM disk group.

   The redundancy level that you choose for the Oracle ASM disk group determines how Oracle ASM mirrors files in the disk group, and determines the number of disks and amount of disk space that you require. The redundancy levels are as follows:

   - External redundancy

     An external redundancy disk group requires a minimum of one disk device. The effective disk space in an external redundancy disk group is the sum of the disk space in all of its devices.

     Because Oracle ASM does not mirror data in an external redundancy disk group, Oracle recommends that you select external redundancy only if you use RAID or similar devices that provide their own data protection mechanisms for disk devices.

     Even if you select external redundancy, you must have at least three voting disks configured, as each voting disk is an independent entity, and cannot be mirrored.

   - Normal redundancy

     A normal redundancy disk group requires a minimum of two disk devices (or two failure groups). The effective disk space in a normal redundancy disk group is *half* the sum of the disk space in all of its devices.

     For most installations, Oracle recommends that you select normal redundancy disk groups.

   - High redundancy

     In a high redundancy disk group, Oracle ASM uses three-way mirroring to increase performance and provide the highest level of reliability. A high redundancy disk group requires a minimum of three disk devices (or three failure groups). The effective disk space in a high redundancy disk group is *one-third* the sum of the disk space in all of the devices.

     While high redundancy disk groups provide a high level of data protection, you must consider the higher cost of additional storage devices before deciding to use this redundancy level.

3. Determine the total amount of disk space that you require for the Oracle Clusterware files.

   Use the following table to determine the minimum number of disks and the minimum disk space requirements for installing Oracle Clusterware, where you have voting disks in separate disk groups:

| Redundancy Level | Minimum Number of Disks | OCR files | Voting disks | Both File Types |
|---|---|---|---|---|
| External | 1 | 280 MB | 280 MB | 560 MB |
| Normal | 3 | 560 MB | 840 MB | 1.4 GB[1] |
| High | 5 | 840 MB | 1.4 GB | 2.3 GB |

[1] If you create a diskgroup during installation, then it must be at least 2 GB.

**Note:** If the voting disk files are in a disk group, then be aware that disk groups with Oracle Clusterware files (OCR and voting disks) have a higher minimum number of failure groups than other disk groups.

If you intend to place database files and Oracle Clusterware files in the same disk group, then refer to the section "Identifying Storage Requirements for Using Oracle ASM for Shared Storage" on page 3-9.

To ensure high availability of Oracle Clusterware files on Oracle ASM, you must have at least 2 GB of disk space for Oracle Clusterware files in three separate failure groups, with at least three physical disks. Each disk must have at least 1 GB of capacity to ensure that there is sufficient space to create Oracle Clusterware files.

For Oracle Clusterware installations, you must also add additional disk space for the Oracle ASM metadata. You can use the following formula to calculate the additional disk space requirements (in MB):

total = [2 * *ausize* * *disks*] + [*redundancy* * (*ausize* * (*nodes* * (*clients* + 1) + 30) + (64 * *nodes*) + 533)]

Where:

- *redundancy* = Number of mirrors: external = 1, normal = 2, high = 3.
- *ausize* = Metadata allocation unit (AU) size in megabytes.
- *nodes* = Number of nodes in cluster.
- *clients* = Number of database instances for each node.
- *disks* = Number of disks in disk group.

For example, for a four-node Oracle Grid Infrastructure installation, using three disks in a normal redundancy disk group, you require an additional 1684 MB of space:

```
[2 * 1 * 3] + [2 * (1 * (4 * (4 + 1)+ 30)+ (64 * 4)+ 533)] = 1684 MB
```

4. Determine the total amount of disk space that you require for the Oracle database files and recovery files.

   Use the following table to determine the minimum number of disks and the minimum disk space requirements for installing the starter database:

| Redundancy Level | Minimum Number of Disks | Data Files | Recovery FIles | Both File Types |
|---|---|---|---|---|
| External | 1 | 1.5 GB | 3 GB | 4.5 GB |

| Redundancy Level | Minimum Number of Disks | Data Files | Recovery FIles | Both File Types |
|---|---|---|---|---|
| Normal | 2 | 3 GB | 6 GB | 9 GB |
| High | 3 | 4.5 GB | 9 GB | 13.5 GB |

**Note:** The file sizes listed in the previous table are estimates of minimum requirements for a new installation (or a database without any user data). The file sizes for your database will be larger.

For Oracle RAC installations, you must also add additional disk space for the Oracle ASM metadata. You can use the following formula to calculate the additional disk space requirements (in MB):

total = [2 * *ausize* * *disks*] + [*redundancy* * (*ausize* * (*nodes* * (*clients* + 1) + 30) + (64 * *nodes*) + 533)]

Where:

- *redundancy* = Number of mirrors: external = 1, normal = 2, high = 3.
- *ausize* = Metadata AU size in megabytes.
- *nodes* = Number of nodes in cluster.
- *clients* = Number of database instances for each node.
- *disks* = Number of disks in disk group.

For example, for a four-node Oracle RAC installation, using three disks in a normal redundancy disk group, you require an additional 1684 MB of space:

```
[2 * 1 * 3] + [2 * (1 * (4 * (4 + 1)+ 30)+ (64 * 4)+ 533)] = 1684 MB
```

5. Determine if you can use an existing disk group.

   If an Oracle ASM instance currently exists on the system, then you can use an existing disk group to meet these storage requirements. If necessary, you can add disks to an existing disk group during the installation.

   See "Using an Existing Oracle ASM Disk Group" on page 3-13 for more information about using an existing disk group.

6. Optionally, identify failure groups for the Oracle ASM disk group devices.

   **Note:** You only have to complete this step to use an installation method that runs DBCA in interactive mode. Do this if, for example, you choose the Advanced database configuration option. Other installation types do not enable you to specify failure groups.

   If you intend to use a normal or high redundancy disk group, then you can further protect your database against hardware failure by associating a set of disk devices in a custom failure group. Failure groups define Oracle ASM disks that share a common potential failure mechanism. By default, each device comprises its own failure group.

   If two disk devices in a normal redundancy disk group are attached to the same small computer system interface (SCSI) controller, then the disk group becomes

unavailable if the controller fails. The controller in this example is a single point of failure. To protect against failures of this type, you could use two SCSI controllers, each with two disks, and define a failure group for the disks attached to each controller. This configuration would enable the disk group to tolerate the failure of one SCSI controller.

---

**Note:** If you define custom failure groups, then you must specify a minimum of two failure groups for normal redundancy disk groups and three failure groups for high redundancy disk groups.

---

For more information about Oracle ASM failure groups, refer to *Oracle Database Storage Administrator's Guide*.

7. If you are sure that a suitable disk group does not exist on the system, then install or identify appropriate disk devices to add to a new disk group. Use the following guidelines when identifying appropriate disk devices:
   - All of the devices in an Oracle ASM disk group should be the same size and have the same performance characteristics.
   - Do not specify multiple partitions on a single physical disk as a disk group device. Oracle ASM expects each disk group device to be on a separate physical disk.
   - Although you can specify a logical volume as a device in an Oracle ASM disk group, Oracle does not recommend their use. Logical volume managers can hide the physical disk architecture, preventing Oracle ASM from optimizing I/O across the physical devices. They are not supported with Oracle RAC.

#### 3.3.2.1 Using an Existing Oracle ASM Disk Group

To use Oracle ASM as the storage option for either database or recovery files, you must use an existing Oracle ASM disk group, or use ASMCA to create the necessary disk groups before installing Oracle Database 11*g* release 2.

To determine if an Oracle ASM disk group currently exists, or to determine whether there is sufficient disk space in an existing disk group, you can use Oracle Enterprise Manager, either Grid Control or Database Control. Alternatively, you can use the following procedure:

1. In the **Services** Control Panel, ensure that the `OracleASMService+ASM`*n* service, where *n* is the node number, has started.
2. Open a Windows command prompt and temporarily set the `ORACLE_SID` environment variable to specify the appropriate value for the Oracle ASM instance to use.

   For example, if the Oracle ASM system identifier (SID) is named `+ASM1`, then enter a setting similar to the following:

   ```
   C:\> set ORACLE_SID = +ASM1
   ```

3. Use SQL*Plus to connect to the Oracle ASM instance as the `SYS` user with the `SYSASM` privilege and start the instance if necessary with a command similar to the following:

   ```
   C:\> sqlplus /nolog
   SQL> CONNECT SYS AS SYSASM
   Enter password: sys_password
   Connected to an idle instance.
   ```

```
SQL> STARTUP
```

4. Enter the following command to view the existing disk groups, their redundancy level, and the amount of free disk space in each disk group:

```
SQL> SELECT NAME,TYPE,TOTAL_MB,FREE_MB FROM V$ASM_DISKGROUP;
```

5. From the output, identify a disk group with the appropriate redundancy level and note the free space that it contains.
6. If necessary, install, or identify the additional disk devices required to meet the storage requirements listed in the previous section.

> **Note:** If you are adding devices to an existing disk group, then Oracle recommends that you use devices that have the same size and performance characteristics as the existing devices in that disk group.

### 3.3.3 Restrictions for Disk Partitions Used By Oracle ASM

Be aware of the following restrictions when configuring disk partitions for use with Oracle ASM:

- You cannot use primary partitions for storing Oracle Clusterware files while running OUI to install Oracle Clusterware as described in Chapter 4, "Installing Oracle Grid Infrastructure for a Cluster". You must create logical drives inside extended partitions for the disks to be used by Oracle Clusterware files and Oracle ASM.
- With 64-bit Windows, you can create up to 128 primary partitions for each disk.
- You can create shared directories only on primary partitions and logical drives.
- Oracle recommends that you limit the number of partitions you create on a single disk to prevent disk contention. Therefore, you may prefer to use extended partitions rather than primary partitions.

For these reasons, you might prefer to use extended partitions for storing Oracle software files and not primary partitions.

### 3.3.4 Requirements for Using a Shared File System

To use a shared file system for Oracle Clusterware, Oracle ASM, and Oracle RAC, the file system must comply with the following requirements:

- To use a cluster file system, it must be a supported cluster file system, as listed in the section "Supported Storage Options for Oracle Clusterware and Oracle RAC" on page 3-4.
- To use an NFS file system, it must be on a certified network attached storage (NAS) device. Log in to My Oracle Support at the following URL, and click the Certify tab to find a list of certified NAS devices.

  https://support.oracle.com/

- If you choose to place your OCR files on a shared file system, then Oracle recommends that one of the following is true:
  - The disks used for the file system are on a highly available storage device, for example, a RAID device.

  - At least two file systems are mounted, and use the features of Oracle Clusterware 11*g* release 2 (11.2) to provide redundancy for the OCR.
- If you choose to place your database files on a shared file system, then one of the following should be true:
  - The disks used for the file system are on a highly available storage device, (for example, a RAID device).
  - The file systems consist of at least two independent file systems, with the database files on one file system, and the recovery files on a different file system.
- The user account with which you perform the installation (`oracle` or `grid`) must have write permissions to create the files in the path that you specify.

> **Note:** Upgrading from Oracle9*i* release 2 using the raw device or shared file for the OCR that you used for the SRVM configuration repository is not supported.
>
> If you are upgrading Oracle Clusterware, and your existing cluster uses 100 MB OCR and 20 MB voting disk partitions, then you can continue to use those partition sizes.
>
> All storage products must be supported by both your server and storage vendors.

Use Table 3–2 and Table 3–3 to determine the minimum size for shared file systems:

***Table 3–2 Oracle Clusterware Shared File System Volume Size Requirements***

| File Types Stored | Number of Volumes | Volume Size |
|---|---|---|
| Voting disks with external redundancy | 3 | At least 280 MB for each voting disk volume. |
| OCR with external redundancy | 1 | At least 280 MB for each OCR volume |
| Oracle Clusterware files (OCR and voting disks) with redundancy provided by Oracle software. | 1 | At least 280 MB for each OCR volume<br>At least 280 MB for each voting disk volume |

***Table 3–3 Oracle RAC Shared File System Volume Size Requirements***

| File Types Stored | Number of Volumes | Volume Size |
|---|---|---|
| Oracle Database files | 1 | At least 1.5 GB for each volume |
| Recovery files<br>**Note**: Recovery files must be on a different volume than database files | 1 | At least 2 GB for each volume |

In Table 3–2 and Table 3–3, the total required volume size is cumulative. For example, to store all Oracle Clusterware files on the shared file system with normal redundancy, you should have at least 2 GB of storage available over a minimum of three volumes (three separate volume locations for the OCR and two OCR mirrors, and one voting disk on each volume). You should have a minimum of three physical disks, each at

least 500 MB, to ensure that voting disks and OCR files are on separate physical disks. If you add Oracle RAC using one volume for database files and one volume for recovery files, then you should have at least 3.5 GB available storage over two volumes, and at least 5.5 GB available total for all volumes.

### 3.3.5 Requirements for Files Managed by Oracle

If you use OCFS for Windows or Oracle ASM for your database files, then your database is created by default with files managed by Oracle Database. When using the Oracle Managed files feature, you need specify only the database object name instead of file names when creating or deleting database files.

Configuration procedures are required to enable Oracle Managed Files.

> **See Also:** "Using Oracle-Managed Files" in *Oracle Database Administrator's Guide*

## 3.4 Configuring the Shared Storage Used by Oracle ASM

The installer does not suggest a default location for the OCR or the Oracle Clusterware voting disk. If you choose to create these files on Oracle ASM, then you must first create and configure disk partitions to by used by Oracle ASM.

The following sections describe how to create and configure disk partitions to be used by Oracle ASM for storing Oracle Clusterware files or Oracle Database data files, how to configure Oracle ACFS to store other file types, and what to do if you have configured storage for a previous release of Oracle ASM:

- Marking Disk Partitions for Oracle ASM Before Installation
- Marking Disk Partitions for Oracle ASM Before Installation
- Configuring Oracle Automatic Storage Management Cluster File System
- Migrating Existing Oracle ASM Instances

> **Note:** The OCR is a file that contains the configuration information and status of the cluster. The installer automatically initializes the OCR during the Oracle Clusterware installation.

### 3.4.1 Creating Disk Partitions for Oracle ASM

To use direct-attached storage (DAS) or storage area network (SAN) disks for Oracle ASM, each disk must have a partition table. Oracle recommends creating exactly one partition for each disk that encompasses the entire disk.

> **Note:** You can use any physical disk for Oracle ASM, if it is partitioned. However, you cannot use NAS or Microsoft dynamic disks.

Use Microsoft Computer Management utility or the command line tool `diskpart` to create the partitions. Ensure that you create the partitions without drive letters. After you have created the partitions, the disks can be configured.

**See Also:** "Stamp Disks for Oracle ASM" on page 1-7 for more information about using `diskpart` to create a partition

## 3.4.2 Marking Disk Partitions for Oracle ASM Before Installation

The only partitions that OUI displays for Windows systems are logical drives that are on disks that do not contain a primary partition, and have been stamped with `asmtool`. Configure the disks before installation either by using `asmtoolg` (graphical user interface (GUI) version) or using `asmtool` (command line version). You also have the option of using the `asmtoolg` utility during Oracle Grid infrastructure for a cluster installation.

The `asmtoolg` and `asmtool` utilities only work on partitioned disks; you cannot use Oracle ASM on unpartitioned disks. You can also use these tools to reconfigure the disks after installation.

The following section describes the `asmtoolg` and `asmtool` functions and commands.

---

**Note:** Refer to *Oracle Database Storage Administrator's Guide* for more information about using `asmtool`.

---

### 3.4.2.1 Overview of asmtoolg and asmtool

The `asmtoolg` and `asmtool` tools associate meaningful, persistent names with disks to facilitate using those disks with Oracle ASM. Oracle ASM uses disk strings to operate more easily on groups of disks at the same time. The names that `asmtoolg` or `asmtool` create make this easier than using Windows drive letters.

All disk names created by `asmtoolg` or `asmtool` begin with the prefix `ORCLDISK` followed by a user-defined prefix (the default is `DATA`), and by a disk number for identification purposes. You can use them as raw devices in the Oracle ASM instance by specifying a name `\\.\ORCLDISK`*`prefixn`*, where *`prefix`* either can be `DATA`, or can be a value you supply, and where *`n`* represents the disk number.

To configure your disks with `asmtoolg`, refer to the section "Using asmtoolg (Graphical User Interface)" on page 3-17. To configure the disks with `asmtool`, refer to the section "Using asmtool (Command Line)" on page 3-18.

### 3.4.2.2 Using asmtoolg (Graphical User Interface)

Use `asmtoolg` (GUI version) to create device names; use `asmtoolg` to add, change, delete, and examine the devices available for use in Oracle ASM.

To add or change disk stamps:

1. In the installation media for Oracle Grid Infrastructure, go the `asmtool` folder and double-click `asmtoolg`.

   If Oracle Clusterware is installed, then go to the *`Grid_home`*`\bin` folder and double-click `asmtoolg.exe`.

   On Windows Server 2008 and Windows Server 2008 R2, if user access control (UAC) is enabled, then you must create a desktop shortcut to a command window. Open the command window using the **Run as Administrator**, right-click context menu, and launch `asmtoolg`.

2. Select the **Add or change label** option, and then click **Next**.

`asmtoolg` shows the devices available on the system. Unrecognized disks have a status of "Candidate device", stamped disks have a status of "Stamped ASM device," and disks that have had their stamp deleted have a status of "Unstamped ASM device." The tool also shows disks that are recognized by Windows as a file system (such as NTFS). These disks are not available for use as Oracle ASM disks, and cannot be selected. In addition, Microsoft Dynamic disks are not available for use as Oracle ASM disks.

If necessary, follow the steps under "Stamp Disks for Oracle ASM" on page 1-7 to create disk partitions for the Oracle ASM instance.

3. On the Stamp Disks window, select the disks to stamp.

   For ease of use, Oracle ASM can generate unique stamps for all of the devices selected for a given prefix. The stamps are generated by concatenating a number with the prefix specified. For example, if the prefix is `DATA`, then the first Oracle ASM link name is `ORCLDISKDATA0`.

   You can also specify the stamps of individual devices.

4. Optionally, select a disk to edit the individual stamp (Oracle ASM link name).
5. Click **Next**.
6. Click **Finish**.

To delete disk stamps:

1. Select the **Delete labels** option, then click **Next**.

   The delete option is only available if disks exist with stamps. The delete screen shows all stamped Oracle ASM disks.

2. On the Delete Stamps screen, select the disks to unstamp.
3. Click **Next**.
4. Click **Finish**.

#### 3.4.2.3 Using asmtool (Command Line)

`asmtool` is a command-line interface for stamping disks. It has the following options:

| Option | Description | Example |
|---|---|---|
| `-add` | Adds or changes stamps. You must specify the hard disk, partition, and new stamp name. If the disk is a raw device or has an existing Oracle ASM stamp, then you must specify the `-force` option.<br>If necessary, follow the steps under "Stamp Disks for Oracle ASM" on page 1-7 to create disk partitions for the Oracle ASM instance. | `asmtool -add [-force] \Device\Harddisk1\Partition1 ORCLDISKASM0 \Device\Harddisk2\Partition1 ORCLDISKASM2...` |
| `-addprefix` | Adds or changes stamps using a common prefix to generate stamps automatically. The stamps are generated by concatenating a number with the prefix specified. If the disk is a raw device or has an existing Oracle ASM stamp, then you must specify the `-force` option. | `asmtool -addprefix ORCLDISKASM [-force] \Device\Harddisk1\Partition1 \Device\Harddisk2\Partition1...` |

| Option | Description | Example |
|---|---|---|
| `-create` | Creates an Oracle ASM disk device from a file instead of a partition.<br>**Note**: Usage of this command is not supported for production environments. | `asmtool -create \\server\share\file 1000`<br>`asmtool -create D:\asm\asmfile02.asm 240` |
| `-list` | List available disks. The stamp, windows device name, and disk size in MB are shown. | `asmtool -list` |
| `-delete` | Removes existing stamps from disks. | `asmtool -delete ORCLDISKASM0 ORCLDISKASM1...` |

**Note:** If you use `-add`, `-addprefix`, and `-delete`, `asmtool` notifies the Oracle ASM instance on the local node and on other nodes in the cluster, if available, to rescan the available disks.

### 3.4.3 Configuring Oracle Automatic Storage Management Cluster File System

Oracle ACFS is installed as part of an Oracle grid infrastructure installation, Oracle Clusterware and Oracle ASM, for 11*g* release 2 (11.2).

**Note:** Oracle ACFS is supported only on Windows Server 2003 64-bit and Windows Server 2003 R2 64-bit. All other Windows releases that are supported for Oracle grid infrastructure and Oracle Clusterware 11*g* release 2 (11.2) are not supported for Oracle ACFS.

To configure Oracle ACFS for an Oracle Database home for an Oracle RAC database, perform the following steps:

1. Install Oracle grid infrastructure for a cluster (Oracle Clusterware and Oracle ASM).
2. Start ASMCA as the grid installation owner.
3. The Configure ASM: ASM Disk Groups page shows you the Oracle ASM disk group you created during installation. Click the **ASM Cluster File Systems** tab.
4. On the ASM Cluster File Systems page, right-click the Data disk, then select **Create ACFS for Database Home**.
5. In the Create ACFS Hosted Database Home window, enter the following information:
   - Database Home ADVM Volume Device Name: Enter the name of the database home. The name must be unique in your enterprise. For example: `racdb_01`
   - Database Home Mountpoint: Enter the directory path for the mountpoint. For example: `M:\acfsdisks\racdb_01`

     Make a note of this mountpoint for future reference.
   - Database Home Size (GB): Enter in gigabytes the size you want the database home to be.
   - Click **OK** when you have completed your entries.
6. During Oracle RAC installation, ensure that you or the database administrator who installs Oracle RAC selects for the Oracle home the mountpoint you provided

in the Database Home Mountpoint field (in the preceding example, `M:\acfsdisks\racdb_01`).

> **See Also:** *Oracle Database Storage Administrator's Guide* for more information about configuring and managing your storage with Oracle ACFS

### 3.4.4 Migrating Existing Oracle ASM Instances

If you have an Oracle ASM installation from a prior release installed on your server, or in an existing Oracle Clusterware installation, then you can use ASMCA (located in the path `Grid_home\bin`) to upgrade the existing Oracle ASM instance to Oracle ASM 11*g* release 2 (11.2), and subsequently configure failure groups, Oracle ASM volumes and Oracle ACFS.

> **Note:** You must first shut down all database instances and applications on the node with the existing Oracle ASM instance before upgrading it.

During installation, if you chose to use Oracle ASM and ASMCA detects that there is a prior Oracle ASM version installed in another Oracle ASM home, then after installing the Oracle ASM 11*g* release 2 (11.2) binaries, you can start ASMCA to upgrade the existing Oracle ASM instance. You can then choose to configure an Oracle ACFS deployment by creating Oracle ASM volumes and using the upgraded Oracle ASM to create the Oracle ACFS.

On an existing Oracle Clusterware or Oracle RAC installation, if the prior version of the software on all nodes is Oracle ASM 11*g* release 1, then you are provided with the option to perform a rolling upgrade of Oracle ASM instances. If the prior version of the software for an Oracle RAC installation is from a release prior to Oracle ASM 11*g* release 1, then rolling upgrades cannot be performed. Oracle ASM on all nodes will be upgraded to Oracle ASM 11*g* release 2 (11.2).

## 3.5 Configuring Storage for Oracle Database Files on OCFS for Windows

To use OCFS for Windows for your Oracle home and data files, the following partitions, at a minimum, must exist before you run OUI to install Oracle Clusterware:

- 5.5 GB or larger partition for the Oracle home, if you want a shared Oracle home
- 3 GB or larger partitions for the Oracle Database data files and recovery files

Log in to Windows using a member of the Administrators group and perform the steps described in this section to set up the shared disk raw partitions for OCFS for Windows. Windows refers to raw partitions as logical drives. If you need more information about creating partitions, then refer to the Windows online help from within the Disk Management utility.

1. Run the Windows Disk Management utility from one node to create an extended partition. Use a basic disk; dynamic disks are not supported.
2. Create a partition for the Oracle Database data files and recovery files, and optionally create a second partition for the Oracle home.

   The number of partitions used for OCFS for Windows affects performance. Therefore, you should create the minimum number of partitions needed for the OCFS for Windows option you choose.

**Note:**

Oracle supports installing the database into multiple Oracle Homes on a single system. This allows flexibility in deployment and maintenance of the database software. For example, it enables different versions of the database to run simultaneously on the same system, or it enables you to upgrade specific database or Oracle Automatic Storage Management instances on a system without affecting other running databases.

However, when you have installed multiple Oracle Homes on a single system, there is also some added complexity introduced that you may have to consider allowing these Oracle Homes to coexist. For more information on this topic, refer to *Oracle Database Platform Guide for Microsoft Windows* and *Oracle Real Application Clusters Installation Guide*

To create the required partitions, perform the following steps:

1. From an existing node in the cluster, run the DiskPart utility as follows:

```
C:\> diskpart
DISKPART>
```

2. List the available disks. By specifying its disk number (*n*), select the disk on which you want to create a partition.

```
DISKPART> list disk
DISKPART> select disk n
```

3. Create an extended partition:

```
DISKPART> create part ext
```

4. Create a logical drive of the desired size after the extended partition is created using the following syntax:

```
DISKPART> create part log [size=n] [offset=n] [noerr]
```

5. Repeat steps 2 through 6 for the second and any additional partitions. An optimal configuration is one partition for the Oracle home and one partition for Oracle Database files.
6. List the available volumes, and remove any drive letters from the logical drives you plan to use.

```
DISKPART> list volume
DISKPART> select volume n
DISKPART> remove
```

7. If you are preparing drives on a Windows 2003 R2 system, then you should restart all nodes in the cluster after you have created the logical drives.
8. Check all nodes in the cluster to ensure that the partitions are visible on all the nodes and to ensure that none of the Oracle partitions have drive letters assigned. If any partitions have drive letters assigned, then remove them by performing these steps:
   - Right-click the partition in the Windows Disk Management utility
   - Select "Change Drive Letters and Paths..." from the menu

- Click Remove in the "Change Drive Letter and Paths" window

### 3.5.1 Formatting Drives to Use OCFS for Windows after Installation

If you installed Oracle Grid Infrastructure, and you want to use OCFS for Windows for storage for Oracle RAC, then run the `ocfsformat.exe` command from the *`Grid_home`*`\cfs` directory using the following syntax:

```
Grid_home\cfs\OcfsFormat /m link_name /c ClusterSize_in_KB /v volume_label /f /a
```

Where:

- `/m` *`link_name`* is the mountpoint for this file system which you want to format with OCFS for Windows. On Windows, provide a drive letter corresponding to the logical drive.
- *`ClusterSize_in_KB`* is the Cluster size or allocation size for the OCFS for Windows volume (this option must be used with the `/a` option or else the default size of 4 kilobytes (KB) is used)

> **Note:** The Cluster size is essentially the block size. Recommended values are 1024 (1 MB) if the OCFS for Windows disk partition is to be used for Oracle datafiles and 4 (4 KB) if the OCFS for Windows disk partition is to be used for the Oracle home.

- *`volume_label`* is an optional volume label
- The `/f` option forces the format of the specified volume
- The `/a` option, if specified, forces `OcfsFormat` to use the clustersize specified with the `/c` option

For example, to create an OCFS for Windows formatted shared disk partition named DATA, mounted as `U:`, using a shared disk with a nondefault cluster size of 1 MB, you would use the following command:

```
ocfsformat /m U: /c 1024 /v DATA /f /a
```

## 3.6 Configuring Direct NFS Storage for Oracle RAC Data Files

This section contains the following information about Direct NFS:

- About Direct NFS Storage
- About the Oranfstab File for Direct NFS
- Mounting NFS Storage Devices with Direct NFS
- Specifying Network Paths for a NFS Server
- Enabling the Direct NFS Client
- Performing Basic File Operations Using the ORADNFS Utility
- Disabling Direct NFS Client

### 3.6.1 About Direct NFS Storage

Oracle Disk Manager (ODM) can manage NFS on its own. This is referred to as Direct NFS. Direct NFS implements NFS version 3 protocol within the Oracle Database kernel. This change enables monitoring of NFS status using the ODM interface. The Oracle Database kernel driver tunes itself to obtain optimal use of available resources.

Starting with Oracle Database 11*g* release 1 (11.1), you can configure Oracle Database to access NFS version 3 servers directly using Direct NFS. This enables the storage of data files on a supported NFS system.

If Oracle Database cannot open an NFS server using Direct NFS, then an informational message is logged into the Oracle alert and trace files indicating that Direct NFS could not be established.

---

**Note:** Direct NFS does not work if the backend NFS server does not support a write size (`wtmax`) of 32768 or larger.

---

The Oracle files resident on the NFS server that are served by the Direct NFS Client can also be accessed through a third party NFS client. Management of Oracle data files created with Direct NFS should be done according to the guidelines specified in *Oracle Database Administrator's Guide*.

Use the following views for Direct NFS management:

- `V$DNFS_SERVERS`: Lists the servers that are accessed using Direct NFS.
- `V$DNFS_FILES`: Lists the files that are currently open using Direct NFS.
- `V$DNFS_CHANNELS`: Shows the open network paths, or channels, to servers for which Direct NFS is providing files.
- `V$DNFS_STATS`: Lists performance statistics for Direct NFS.

### 3.6.2 About the Oranfstab File for Direct NFS

If you use Direct NFS, then you must create a new configuration file, `oranfstab`, to specify the options, attributes, and parameters that enable Oracle Database to use Direct NFS. Direct NFS looks for the mount point entries in *`Oracle_home`*`\database\oranfstab`. It uses the first matched entry as the mount point. You must add the `oranfstab` file to the *`Oracle_home`*`\database` directory.

For Oracle RAC installations, to use Direct NFS you must replicate the `oranfstab` file on all of the nodes. You must also keep all of the `oranfstab` files synchronized on all nodes.

When the `oranfstab` file is placed in *`Oracle_home`*`\database`, the entries in the file are specific to a single database. All nodes running an Oracle RAC database should use the same *`Oracle_home`*`\database\oranfstab` file.

---

**Note:** If you remove an NFS path from `oranfstab` that Oracle Database is using, then you must restart the database for the change to be effective. In addition, the mount point that you use for the file system must be identical on each node.

---

**See Also:** "Enabling the Direct NFS Client" on page 3-24 for more information about creating the `oranfstab` file

### 3.6.3 Mounting NFS Storage Devices with Direct NFS

Direct NFS determines mount point settings to NFS storage devices based on the configuration information in `oranfstab`. If Oracle Database cannot open an NFS server using Direct NFS, then an error message is written into the Oracle alert and trace files indicating that Direct NFS could not be established.

### 3.6.4 Specifying Network Paths for a NFS Server

Direct NFS can use up to four network paths defined in the `oranfstab` file for an NFS server. The Direct NFS client performs load balancing across all specified paths. If a specified path fails, then Direct NFS re-issues all outstanding requests over any remaining paths.

---

**Note:** You can have only one active Direct NFS implementation for each instance. Using Direct NFS on an instance prevents the use of another Direct NFS implementation.

---

### 3.6.5 Enabling the Direct NFS Client

To enable the Direct NFS Client, you must add an `oranfstab` file to *`Oracle_home`*`\database`. When `oranfstab` is placed in this directory, the entries in this file are specific to one particular database. The Direct NFS Client searches for the mount point entries as they appear in `oranfstab`. The Direct NFS Client uses the first matched entry as the mount point.

Complete the following procedure to enable the Direct NFS Client:

1. Create an `oranfstab` file with the following attributes for each NFS server accessed by Direct NFS:
   - `server`: The NFS server name.
   - `path`: Up to four network paths to the NFS server, specified either by internet protocol (IP) address, or by name, as displayed using the `ifconfig` command on the NFS server.
   - `local`: Up to 4 network interfaces on the database host, specified by IP address, or by name, as displayed using the `ipconfig` command on the database host.
   - `export`: The exported path from the NFS server. Use a UNIX-style path.
   - `mount`: The corresponding local mount point for the exported volume. Use Windows-style path.
   - `mnt_timeout`: (Optional) Specifies the time (in seconds) for which Direct NFS client should wait for a successful mount before timing out. The default timeout is 10 minutes.
   - `uid`: (Optional) The UNIX user ID to be used by Direct NFS to access all NFS servers listed in `oranfstab`. The default value is `uid:65534`, which corresponds to `user:nobody` on the NFS server.
   - `gid`: (Optional) The UNIX group ID to be used by Direct NFS to access all NFS servers listed in `oranfstab`. The default value is `gid:65534`, which corresponds to `group:nogroup` on the NFS server.

---

**Note:** Direct NFS ignores a `uid` or `gid` value of `0`.

---

The following is an example of an `oranfstab` file with two NFS server entries, where the first NFS server uses 2 network paths and the second NFS server uses 4 network paths:

```
server: MyDataServer1
local: 132.34.35.10
path: 132.34.35.12
local: 132.34.55.10
path: 132.34.55.12
export: /vol/oradata1 mount: C:\APP\ORACLE\ORADATA\ORCL

server: MyDataServer2
local: LocalInterface1
path: NfsPath1
local: LocalInterface2
path: NfsPath2
local: LocalInterface3
path: NfsPath3
local: LocalInterface4
path: NfsPath4
export: /vol/oradata2 mount: C:\APP\ORACLE\ORADATA\ORCL2
export: /vol/oradata3 mount: C:\APP\ORACLE\ORADATA\ORCL3
```

The mount point specified in the `oranfstab` file represents the local path where the database files would reside normally, as if Direct NFS was not used. For example, if a database that does not use Direct NFS would have data files located in the `C:\app\oracle\oradata\orcl` directory, then you specify `C:\app\oracle\oradata\orcl` for the NFS virtual mount point in the corresponding `oranfstab` file.

---

**Note:** The exported path from the NFS server must be accessible for `read/write/execute` by the user with the `uid`, `gid` specified in `oranfstab`. If neither `uid` nor `gid` is listed, then the exported path must be accessible by the user with `uid:65534` and `gid:65534`.

---

2. Oracle Database uses the ODM library, `oranfsodm11.dll`, to enable Direct NFS. To replace the standard ODM library, `oraodm11.dll`, with the ODM NFS library, complete the following steps:

   a. Change directory to *`Oracle_home`*`\bin`.

   b. Shut down the Oracle Database instance on a node using SRVCTL.

   c. Enter the following commands:

   ```
   copy oraodm11.dll oraodm11.dll.orig
   copy /Y oranfsodm11.dll oraodm11.dll
   ```

   d. Restart the Oracle Database instance using SRVCTL.

   e. Repeat Step a to Step d for each node in the cluster.

### 3.6.6 Performing Basic File Operations Using the ORADNFS Utility

ORADNFS is a utility which enables the database administrators to perform basic file operations over Direct NFS Client on Microsoft Windows platforms.

ORADNFS is a multi-call binary, which is a single binary that acts like many utilities. You must be a member of the local `ORA_DBA` group to use ORADNFS. To execute

commands using ORADNFS you issue the command as an argument on the command line.

The following command prints a list of commands available with ORADNFS:

```
C:\> oradnfs help
```

To display the list of files in the NFS directory mounted as C:\ORACLE\ORADATA, use the following command:

```
C:\> oradnfs ls C:\ORACLE\ORADATA\ORCL
```

---

**Note:** A valid copy of the `oranfstab` configuration file must be present in *`Oracle_home`*`\database` for ORADNFS to operate.

---

### 3.6.7 Disabling Direct NFS Client

Use one of the following methods to disable the Direct NFS client:

- Remove the `oranfstab` file.
- Restore the original `oraodm11.dll` file by reversing the process you completed in "Enabling the Direct NFS Client" on page 3-24.
- Remove the specific NFS server or export paths in the `oranfstab` file.

## 3.7 Desupport of Raw Devices

With the release of Oracle Database 11*g* and Oracle RAC release 11*g*, writing datafiles directly to raw devices using DBCA or OUI is not supported. You can still use raw devices with Oracle ASM.

# 4

# Installing Oracle Grid Infrastructure for a Cluster

This chapter describes the procedures for installing Oracle Grid Infrastructure for a cluster. Oracle Grid Infrastructure consists of Oracle Clusterware and Oracle Automatic Storage Management (Oracle ASM). If you plan afterward to install Oracle Database with Oracle Real Application Clusters (Oracle RAC), then this is phase one of a two-phase installation.

This chapter contains the following topics:


- Preparing to Install Oracle Grid Infrastructure with Oracle Universal Installer
- Installing Grid Infrastructure with OUI
- Installing Grid Infrastructure Using a Software-Only Installation
- Confirming Oracle Clusterware Function
- Confirming Oracle ASM Function for Oracle Clusterware Files


> **Note:** The second phase of an Oracle RAC installation, installing Oracle RAC, is described in *Oracle Real Application Clusters Installation Guide*.

## 4.1 Preparing to Install Oracle Grid Infrastructure with Oracle Universal Installer

Before you install Oracle Grid Infrastructure with Oracle Universal Installer (OUI), use the following checklist to ensure that you have all the information you will need during installation, and to ensure that you have completed all tasks that must be done before starting your installation. Mark the box for each task as you complete it, and record the information needed, so that you can provide it during installation.

❑ **Verify Cluster Privileges**

Before running OUI, from the node where you intend to run the Installer, verify that you are logged in using a member of the Administrators group, and that this user is an Administrator user on the other nodes in the cluster. To do this, enter the following command for each node that is a part of the cluster:

```
net use \\nodename\C$
```

where *nodename* is the node name. Repeat for each node in the cluster.

❑ **Shut Down Running Oracle Processes**

You may have to shut down running Oracle processes:

**Installing on a node with a standalone database not using Oracle ASM**: You do not have to shut down the database while you install Oracle Grid Infrastructure software.

**Installing on an Oracle RAC database node**: This installation requires an upgrade of Oracle Clusterware, because Oracle Clusterware is required to run Oracle RAC. As part of the upgrade, you must shut down the database one node at a time as the rolling upgrade proceeds from node to node.

If a Global Services Daemon (GSD) from Oracle9*i* Release 9.2 or earlier is running, then stop it before installing Oracle Grid Infrastructure by running the following command, where `Oracle_home` is the Oracle Database home that is running the GSD:

```
Oracle_home\bin\gsdctl stop
```

---

**Caution:** If you have an existing Oracle9*i* release 2 (9.2) Oracle Cluster Manager installation, then *do not* shut down the Oracle Cluster Manager service. Shutting down the Oracle Cluster Manager service prevents the Oracle Grid Infrastructure 11*g* release 2 (11.2) software from detecting the Oracle9*i* release 2 node list, and causes failure of the Oracle Grid Infrastructure installation.

---

**Note:** If you receive a warning to stop all Oracle services after starting OUI, then run the command, where `Oracle_home` is the home that is running the cluster synchronization service (CSS):

```
Oracle_home\bin\localconfig delete
```

---

- **Prepare for Oracle ASM and Oracle Clusterware Upgrade If You Have Existing Installations**

  During installation, you can upgrade existing Oracle Clusterware and clustered Oracle ASM installations to Oracle Grid Infrastructure 11*g* release 2.

  When all member nodes of the cluster are running Oracle Grid Infrastructure 11*g* release 2 (11.2), then the new clusterware becomes the active version.

  If you intend to install Oracle RAC, then you must first complete the upgrade to Oracle Grid Infrastructure 11*g* release 2 (11.2) on all cluster nodes before you install the Oracle Database 11*g* release 2 (11.2) version of Oracle RAC.

  **Note:** All Oracle Grid Infrastructure upgrades (upgrades of existing Oracle Clusterware and clustered Oracle ASM installations) are out-of-place upgrades.

- **Obtain LOCAL_SYSTEM administrator access**

  Oracle Grid Infrastructure must be installed using an Administrator user, one with LOCAL_SYSTEM privileges, or a member of the local Administrators group. If you do not have Administrator access to each node in the cluster, then ask your system administrator to create and configure the user account on each node.

- **Decide if you want to install other languages**

  During an Advanced installation session, you are asked if you want translation of user interface text into languages other than the default, which is English.

  **Note:** If the language set for the operating system is not supported by the installer, then by default the installer runs in English.

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

- **Determine your cluster name, public node names, single client access names (SCAN), virtual node names, and planned interface use for each node in the cluster**

  During installation, you are prompted to provide the public and virtual host name, unless you use a third party cluster software. In that case, the public host name information will be filled in. You are also prompted to identify which interfaces are public, private, or interfaces in use for another purpose, such as a network file system.

  If you use Grid Naming Service (GNS), then OUI displays the public and virtual host name addresses labeled as "AUTO" because they are configured automatically by GNS.

  **Note:** If you configure internet protocol (IP) addresses manually, then avoid changing host names after you complete the Oracle Grid Infrastructure installation, including adding or deleting domain qualifications. A node with a new host name is considered a new host, and must be added to the cluster. A node under the old name will appear to be down until it is removed from the cluster.

  When you enter the public node name, use the primary host name of each node. In other words, use the name displayed by the `hostname` command. This node name can be either the permanent or the virtual host name. The node name should contain only single-byte alphanumeric characters (a to z, A to Z, and 0 to 9). Do not use underscores (_) or any other characters in the host name.

  In addition:

  – Provide a cluster name with the following characteristics:

    * It must be globally unique throughout your host domain.
    * It must be at least one character long and fewer than 15 characters long.
    * It must consist of the same character set used for host names, in accordance with Internet Engineering Task Force RFC 1123: Hyphens (-), and single-byte alphanumeric characters (a to z, A to Z, and 0 to 9).

  **Note:** Windows operating systems allow underscores to be used with host names, but underscored names are not legal host names for a domain name system (DNS), and they should be avoided.

- If you are not using GNS, then determine a virtual host name for each node. A virtual host name is a public node name that is used to reroute client requests sent to the node if the node is down. Oracle Database uses virtual IP (VIP) addresses for client-to-database connections, so the VIP address must be publicly accessible. Oracle recommends that you provide a name in the format *hostname*-vip. For example: `myclstr2-vip`.
- Provide SCAN addresses for client access to the cluster. These addresses should be configured as round robin addresses on the domain name service (DNS). Oracle recommends that you supply three SCAN addresses.

---

**Note:** The following is a list of additional information about node IP addresses:

- For the local node only, OUI automatically fills in public and VIP fields. If your system uses vendor clusterware, then OUI may fill additional fields.
- Node names are not domain-qualified. If you provide a domain in the host name field during installation, then OUI removes the domain from the name.
- Interfaces identified as private for private IP addresses should not be accessible as public interfaces. Using public interfaces for Cache Fusion can cause performance problems.

---

- Identify public and private interfaces. OUI configures public interfaces for use by public and virtual IP addresses, and configures private IP addresses on private interfaces.

  The private subnet that the private interfaces use must connect all the nodes you intend to have as cluster members.

❑ **Identify shared storage for Oracle Clusterware files and prepare storage if necessary**

During installation, you are asked to provide paths for the following Oracle Clusterware files. These files must be shared across all nodes of the cluster, either on Oracle ASM, or on a supported third party cluster file system:

- Voting disks are files that Oracle Clusterware uses to verify cluster node membership and status.
- Oracle Cluster Registry files (OCR) contain cluster and database configuration information for Oracle Clusterware.

If you intend to use Oracle Cluster File System for Windows (OCFS for Windows), then you are prompted to indicate which of the available disks you want to format with OCFS for Windows, what format type you want to use, and to what drive letter the formatted OCFS for Windows disk is mounted.

If your file system does not have external storage redundancy, then Oracle recommends that you provide two additional locations for the OCR disk and the voting disk, for a total of at least three partitions. Creating redundant storage locations protects the OCR and voting disk if a failure occurs. To completely protect your cluster, the storage locations given for the copies of the OCR and voting disks should have completely separate paths, controllers, and disks, so that no single point of failure is shared by storage locations.

**See Also:** Chapter 3, "Configuring Storage for Grid Infrastructure for a Cluster and Oracle RAC"

- **Disconnect all non-persistent drives**

  Before starting the Oracle Grid Infrastructure installation on Windows, ensure that you disconnect all nonpersistent drives that are temporarily mounted on all the nodes. Alternatively, to access the shared drive, make the shared drive persistent using the following command:

  ```
  net use * \\servername\sharename /persistent: YES
  ```

- **Have intelligent platform management interface (IPMI) configuration completed and have IPMI administrator account information**

  If you intend to use IPMI, then ensure baseboard management controller (BMC) interfaces are configured, and have an administration account username and password to provide when prompted during installation.

  For nonstandard installations, if you must change the configuration on one or more nodes after installation (for example, if you have different administrator usernames and passwords for BMC interfaces on cluster nodes), then decide if you want to reconfigure the BMC interface, or modify IPMI administrator account information after installation as described in Chapter 5, "Oracle Grid Infrastructure Postinstallation Procedures".

- **Ensure the Oracle home path you select for the grid infrastructure home uses only American standard code for information interchance (ASCII) characters**

  At the time of this release, the use of non-ASCII characters for a grid infrastructure home or Oracle Database home is not supported.

## 4.2 Installing Grid Infrastructure with OUI

This section provides information about how to use Oracle Universal Installer (OUI) to install Oracle Grid Infrastructure. It contains the following sections:

- Running OUI to Install Grid Infrastructure
- Installing Grid Infrastructure Using a Cluster Configuration File
- Silent Installation of Oracle Clusterware

### 4.2.1 Running OUI to Install Grid Infrastructure

Complete the following steps to install grid infrastructure (Oracle Clusterware and Oracle ASM) on your cluster. You can run OUI from a Virtual Network Computing (VNC) session, or Terminal Services in console mode.

At any time during installation, if you have a question about what you are being asked to do, then click the **Help** button on the OUI page.

1. Log in to Windows using a member of the Administrators group and run the `setup.exe` command from the Oracle Database 11*g* Release 2 (11.2) installation media.
2. Provide information as prompted by OUI. If you need assistance during installation, then click **Help**. After the installation interview, you can click **Details** to see the log file.

**Note:**

- If you are upgrading your cluster or part of your cluster from Oracle9*i* release 2 Clusterware to Oracle Clusterware 11*g*, then to ensure backward compatibility, OUI prevents you from changing the cluster name from the existing name by disabling the cluster name field.
- To use Oracle9*i* RAC, you must use Oracle9*i* Cluster Manager. You can run Oracle9*i* Cluster Manager on the same server as Oracle Clusterware; however, Oracle Clusterware will manage Oracle Database and Oracle RAC releases 10.1 and higher and Oracle9*i* Cluster Manager will manage Oracle9*i* RAC databases.
- You cannot use Oracle ASM with Oracle9*i* Cluster Manager.

3. After you have specified all the information needed for installation, OUI installs the software then runs the Oracle Net Configuration Assistant (NetCA), Oracle Private Interconnect Configuration Assistant, and Cluster Verification Utility (CVU). These programs run without user intervention.
4. If you selected to configure OCR and voting disk files on Oracle ACFS, then the Oracle Automatic Storage Management Configuration Assistant (ASMCA) configures Oracle ASM as part of the installation process. If you did not select Oracle ASM as the storage option for the OCR and voting disk files, then you must start ASMCA manually after installation to configure Oracle ASM.

   Start ASMCA using the following command, where `Grid_home` is the grid infrastructure home:

   ```
   Grid_home\bin\asmca
   ```

When you have verified that your Oracle Grid Infrastructure installation has completed successfully, you can either use it to maintain high availability for other applications, or you can install an Oracle Database software.

If you intend to install Oracle Database 11*g* release 2 (11.2) with Oracle RAC, then refer to *Oracle Real Application Clusters Installation Guide*. If you intend to use Oracle Grid Infrastructure on a standalone server (an Oracle Restart deployment), then refer to *Oracle Database Installation Guide for Microsoft Windows*.

**See Also:** *Oracle Real Application Clusters Administration and Deployment Guide* for information about using cloning and node addition procedures, and *Oracle Clusterware Administration and Deployment Guide* for cloning Oracle Grid Infrastructure

### 4.2.2 Installing Grid Infrastructure Using a Cluster Configuration File

During installation of grid infrastructure, you are given the option either of providing cluster configuration information manually, or of using a cluster configuration file. A cluster configuration file is a text file that you can create before starting OUI, which provides OUI with information about the cluster node names that it requires to configure the cluster. When creating the text file, save the file with the extension .ccf because the installer only accepts a file of type of Oracle Cluster Configuration File (.ccf).

The cluster configuration file should have the following syntax, where *node* is the name of the public host name for a node in the cluster, and *vip* is the VIP address for that node:

```
node     vip
node     vip
...
```

For example, if have three nodes for your cluster, with host names `RACnode1`, `RACnode2` and `RACnode3`, you could create a text file named `cluster_config.ccf`, with the following contents:

```
RACnode1  RACnode1-vip
RACnode2  RACnode2-vip
RACnode3  RACnode3-vip
```

Oracle suggests that you consider using a cluster configuration file if you intend to perform repeated installations on a test cluster, or if you intend to perform an installation on many nodes.

> **See Also:** Appendix B, "Installing and Configuring Oracle Grid Infrastructure Using Response Files" for more information about using configuration files

### 4.2.3 Silent Installation of Oracle Clusterware

Complete the following procedure to perform a noninteractive (silent) installation:

1. On the installation media, navigate to the directory `response`.
2. Using a text editor, open the response file `crs_install.rsp`. Follow the directions in each section, and supply values appropriate for your environment.
3. Use the following command syntax to run OUI in silent mode:

   ```
   setup.exe -silent -reponseFile path_to_your_reponse_file
   ```

   For example:

   ```
   E:\ setup.exe -silent -responseFile C:\users\oracle\installGrid.rsp
   ```

> **See Also:** Appendix B, "Installing and Configuring Oracle Grid Infrastructure Using Response Files" for more information about performing silent installations using configuration files

## 4.3 Installing Grid Infrastructure Using a Software-Only Installation

A software-only installation only copies the Oracle Grid Infrastructure for a cluster binaries to the specified node. Configuring Oracle Grid Infrastructure for a cluster and Oracle ASM on all the nodes and then adding the nodes to the cluster must be done manually after the installation has finished.

When you perform a software-only installation of Oracle Grid Infrastructure software, you must complete several manual configuration steps to enable Oracle Clusterware after you install the software on each node you intend to be a member of the cluster.

> **Note:** Oracle recommends that only advanced users perform the software-only installation, because this installation method provides no validation of the installation and this installation option requires manual postinstallation steps to enable the grid infrastructure software.

If you select a software-only installation, then ensure that the Oracle Grid Infrastructure home path is identical on each cluster member node.

Performing a software-only installation involves the following steps:

1. Installing the Software Binaries
2. Configuring the Software Binaries

### 4.3.1 Installing the Software Binaries

1. Log in to Windows using a member of the Administrators group and run the `setup.exe` command from the Oracle Database 11*g* Release 2 (11.2) installation media.
2. Complete a software-only installation of Oracle Grid Infrastructure for a cluster on the node.

   See "Configuring the Software Binaries" on page 8 for information about configuring Oracle Grid Infrastructure after preforming a software-only installation.
3. Enable the Oracle RAC option for Oracle Grid infrastructure by renaming the `orarac11.dll.dbl` file located in the *`Grid_home`*`\bin` directory to `orarac11.dll`.
4. Verify that all of the cluster nodes meet the installation requirements using the command `runcluvfy.bat stage -pre crsinst -n` *`node_list`*. Ensure that you have completed all storage and server preinstallation requirements.
5. Copy the Grid home directory to the same location on the other nodes you are configuring as cluster member nodes.
6. On each node that you copied the Grid home to, run the `clone.pl` script.

   Do not run the `clone.pl` script on the node where you performed the software-only installation.

### 4.3.2 Configuring the Software Binaries

To configure and activate a software-only grid infrastructure installation for a cluster, complete the following tasks:

1. Using a text editor, modify the template file *`Grid_home`*`\crs\install\crsconfig_params` for the installer to use to configure the cluster. For example:

```
...

OCR_LOCATIONS=E:\grid\stor1\ocr,F:\grid\stor2\ocr
CLUSTER_NAME=racwin-cluster
HOST_NAME_LIST=node1,node2,node3,node4
NODE_NAME_LIST=node1,node2,node3,node4
PRIVATE_NAME_LIST=
```

```
VOTING_DISKS=E:\grid\stor1\vdsk,F:\grid\stor2\vdsk,G:\grid\stor3\vdsk

...

CRS_STORAGE_OPTION=2
CSS_LEASEDURATION=400
CRS_NODEVIPS="node1-vip/255.255.255.0/PublicNIC,node2-vip/255.255.255.0/Pub
licNIC,node3-vip/255.255.255.0/PublicNIC,node4-vip/255.255.255.0/PublicNIC"
NODELIST=node1,node2,node3,node4
NETWORKS="PublicNIC"/192.0.2.0:public,"PrivateNIC"/10.0.0.0:cluster_interco
nnect
SCAN_NAME=racwin-cluster
SCAN_PORT=1521

...

#### Required by OUI add node
NEW_HOST_NAME_LIST=
NEW_NODE_NAME_LIST=
NEW_PRIVATE_NAME_LIST=
...
```

2. On all nodes, place the `crsconfig_params` file in the path *`Grid_home`*`\crs\install\crsconfig_params`, where *`Grid_home`* is the path to the Oracle Grid Infrastructure home for a cluster. For example, on `node1` you might issue a command similar to the following:

   ```
   C:> xcopy app\orauser\grid\crs\install\crsconfig_params
   \\NODE2\app\orauser\grid\crs\install /v
   ```

3. After configuring the `crsconfig_params` file, run the `rootcrs.pl` script from the *`Grid_home`* on each node, using the following syntax:

   ```
   Grid_home\perl\lib\perl -IGrid_home\perl\lib -IGrid_home\crs\install
   Grid_home\crs\install\rootcrs.pl
   ```

   For example, if your Grid home is `C:\app\11.2.0\grid`, then you would run the following script:

   ```
   C:\app\11.2.0\grid\perl\lib\perl -IC:\app\11.2.0\grid\perl\lib -IC:\app
   \11.2.0\grid\crs\install C:\app\11.2.0\grid\crs\install\rootcrs.pl
   ```

4. Change directory to *`Grid_home`*`\oui\bin`, where *`Grid_home`* is the path of the Grid Infrastructure home on each cluster member node.

5. Enter the following command syntax, where *`Grid_home`* is the path of the Grid home on each cluster member node, and *`node_list`* is a comma-delimited list of nodes on which you want the software enabled:

   ```
   setup.exe -updateNodeList ORACLE_HOME=Grid_home -defaultHomeName
   "CLUSTER_NODES={node_list}" CRS=TRUE
   ```

   For example:

   ```
   C:\..\bin> setup.exe -updateNodeList ORACLE_HOME=C:\app\orauser\grid
    -defaultHomeName "CLUSTER_NODES={node1,node2,node3,node4}" CRS=TRUE
   ```

   To enable the Oracle Clusterware installation on the local node only, enter the following command, where *`Grid_home`* is the Grid home on the local node, and *`node_list`* is a comma-delimited list of nodes on which you want the software enabled:

```
setup.exe -updateNodeList -local ORACLE_HOME=Grid_home
-defaultHomeName "CLUSTER_NODES={node_list}" CRS=TRUE
```

For example:

```
C:\..\bin> setup.exe -updateNodeList -local ORACLE_HOME=C:\app\orauser\
grid -defaultHomeName "CLUSTER_NODES={node1,node2,node3,node4}" CRS=TRUE
```

To configure and activate a software-only grid infrastructure installation for a standalone server, refer to *Oracle Database Installation Guide for Microsoft Windows*.

## 4.4 Confirming Oracle Clusterware Function

After installation, log in using a member of the Administrators group, and run the following command from the `bin` directory in the Grid home to confirm that your Oracle Clusterware installation is installed and running correctly:

```
crsctl check cluster -all
```

For example:

```
C:\..\bin\> crsctl check cluster -all

**************************************************************************
node1:
CRS-4537: Cluster Ready Services is online
CRS-4529: Cluster Synchronization Services is online
CRS-4533: Event Manager is online
**************************************************************************
node2:
CRS-4537: Cluster Ready Services is online
CRS-4529: Cluster Synchronization Services is online
CRS-4533: Event Manager is online
**************************************************************************
```

## 4.5 Confirming Oracle ASM Function for Oracle Clusterware Files

If you installed the OCR and voting disk files on Oracle ASM, then run the following command from the *`Grid_home`*`\bin` directory to confirm that your Oracle ASM installation is running:

```
srvctl status asm
```

For example:

```
C:\app\11.2.0\grid\BIN> srvctl status asm
ASM is running on node node1
ASM is running on node node2
```

Oracle ASM is running only if it is needed for Oracle Clusterware files. If you did not configure Oracle Clusterware storage on Oracle ASM during installation, then the Oracle ASM instance should be down.

**Note:** To manage Oracle ASM or Oracle Net Services on Oracle Clusterware 11*g* release 2 (11.2) or later installations, use the `srvctl` binary in the Oracle Grid Infrastructure home for a cluster (Grid home). If you have Oracle RAC or Oracle Database installed, then you cannot use the `srvctl` binary in the database home (Oracle home) to manage Oracle ASM or Oracle Net Services.

# 5

# Oracle Grid Infrastructure Postinstallation Procedures

This chapter describes how to complete the postinstallation tasks after you have installed the Oracle Grid Infrastructure software.

This chapter contains the following topics:

- Required Postinstallation Tasks
- Recommended Postinstallation Tasks
- Using Older Oracle Database Versions with Grid Infrastructure
- Modifying Oracle Clusterware Binaries After Installation

## 5.1 Required Postinstallation Tasks

You must perform the following tasks after completing your installation:

- Download and Install Patch Updates
- Configure Exceptions for the Windows Firewall

> **Note:** In prior releases, backing up the voting disks using the `ocopy.exe` command was a required postinstallation task. With Oracle Clusterware release 11.2 and later, backing up a voting disk is no longer required.

### 5.1.1 Download and Install Patch Updates

Refer to the My Oracle Support Web site for required patch updates for your installation.

To download required patch updates:

1. Use a Web browser to view the My Oracle Support Web site:

   `https://support.oracle.com`

2. Log in to My Oracle Support Web site.

   > **Note:** If you are not a My Oracle Support registered user, then click **Register Here** and register.

3. On the main My Oracle Support page, select **Patches & Updates**.

4. On the Patches & Update page, in the click **Advanced "Classic" Patch Search**.

   To search for patch sets, click the Latest Patchsets link under the heading Oracle Server/Tools.

5. On the Advanced Search page, click the search icon next to the Product or Product Family field.

6. In the Search and Select: Product Family field, select Database and Tools in the Search list field, enter Database in the text field, and click **Go**.

   Click **Oracle Database Family** in the list of Product Names to select it.

7. Click the search icon next to the Release field. In the Search and Select: Release window, type 11.2 in the Search field, then click **Go**. Click **Oracle 11.2.0.1.0** in the Release Name column to select it.

8. Select your platform from the Platform or Language drop-down list (for example, Microsoft Windows Server 2003 R2).

9. At the bottom of the Advanced Search section, click **Go**. Any available patch updates appear under the Results heading.

10. Click the patch number to view the patch description and access the README file for the patch. You can also download the patch from this page.

11. Click **View README** and read the page that appears. The README page contains information about the patch and how to apply the patch to your installation.

    Click **Patch Details** to return to the previous page.

12. Click **Download**, and save the patch file on your system.

13. Use the unzip utility provided with your Oracle software to uncompress the Oracle patch updates that you download from My Oracle Support. The unzip utility is located in the `Grid_home\BIN` directory.

14. Refer to Appendix D, "How to Upgrade to Oracle Grid Infrastructure 11g Release 2" for information about how to stop database processes in preparation for installing patches.

### 5.1.2 Configure Exceptions for the Windows Firewall

If the Windows Firewall feature is enabled on one or more of the nodes in your cluster, then virtually all transmission control protocol (TCP) network ports are blocked to incoming connections. As a result, any Oracle product that listens for incoming connections on a TCP port will not receive any of those connection requests and the clients making those connections will report errors.

You must configure exceptions for the Windows Firewall if your system meets all of the following conditions:

- Oracle server-side components are installed on a computer running a supported version of Microsoft Windows. The list of components includes the Oracle Database, Oracle grid infrastructure, Oracle Real Application Clusters (Oracle RAC), network listeners, or any Web servers or services.
- The Windows computer in question accepts connections from other computers over the network. If no other computers connect to the Windows computer to access the Oracle software, then no post-installation configuration steps are required and the Oracle software functions as expected.

- The Windows computer in question is configured to run the Windows Firewall. If the Windows Firewall is not enabled, then no post-installation configuration steps are required.

If all of the above conditions are met, then the Windows Firewall must be configured to allow successful incoming connections to the Oracle software. To enable Oracle software to accept connection requests, Windows Firewall must be configured by either opening up specific static TCP ports in the firewall or by creating exceptions for specific executables so they can receive connection requests on any ports they choose. This firewall configuration can be done by one of the following methods:

- Start the Windows Firewall application, select the **Exceptions** tab and then click either **Add Program** or **Add Port** to create exceptions for the Oracle software.
- From the command prompt, use the `netsh firewall add...` command.
- When Windows notifies you that a foreground application is attempting to listen on a port, and gives you the opportunity to create an exception for that executable. If you choose the create the exception in this way, the effect is the same as creating an exception for the executable either through Control Panel or from the command line.

The following sections list the Oracle Database 11*g* release 2 executables that listen on TCP ports on Windows, along with a brief description of the executable. It is recommended that these executables (if in use and accepting connections from a remote, client computer) be added to the exceptions list for the Windows Firewall to ensure correct operation. In addition, if multiple Oracle homes are in use, firewall exceptions may have to be created for the same executable, for example, `oracle.exe`, multiple times, once for each Oracle home from which that executable loads.

- Firewall Exceptions for Oracle Database
- Firewall Exceptions for Oracle Database Examples (or the Companion CD)
- Firewall Exceptions for Oracle Gateways
- Firewall Exceptions for Oracle Clusterware and Oracle ASM
- Firewall Exceptions for Oracle RAC Database
- Firewall Exceptions for Oracle Cluster File System for Windows
- Firewall Exceptions for Other Oracle Products

#### 5.1.2.1 Firewall Exceptions for Oracle Database

For basic database operation and connectivity from remote clients, such as SQL*Plus, Oracle Call Interface (OCI), Open Database Connectivity (ODBC), Object Linking and Embedding database (OLE DB) applications, and so on, the following executables must be added to the Windows Firewall exception list:

- *`Oracle_home`*`\bin\oracle.exe` - Oracle Database executable
- *`Oracle_home`*`\bin\tnslsnr.exe` - Oracle Listener

If you use remote monitoring capabilities for your database, the following executables must be added to the Windows Firewall exception list:

- *`Oracle_home`*`\bin\emagent.exe` - Oracle Database Control
- *`Oracle_home`*`\jdk\bin\java.exe` - Java Virtual Machine (JVM) for Enterprise Manager Database Control

#### 5.1.2.2 Firewall Exceptions for Oracle Database Examples (or the Companion CD)

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

- *Oracle_home*\opmn\bin\opmn.exe - Oracle Process Manager
- *Oracle_home*\jdk\bin\java.exe - JVM

#### 5.1.2.3 Firewall Exceptions for Oracle Gateways

If your Oracle database interacts with non-Oracle software through a gateway, then you must add the gateway executable to the Windows Firewall exception list. Table 5–1table lists the gateway executables used to access non-Oracle software.

***Table 5–1 Oracle Executables Used to Access Non-Oracle Software***

| Executable Name | Description |
|---|---|
| omtsreco.exe | Oracle Services for Microsoft Transaction Server |
| dg4sybs.exe | Oracle Database Gateway for Sybase |
| dg4tera.exe | Oracle Database Gateway for Teradata |
| dg4msql.exe | Oracle Database Gateway for SQL Server |
| dg4db2.exe | Oracle Database Gateway for Distributed Relational Database Architecture (DRDA) |
| pg4arv.exe | Oracle Database Gateway for Advanced Program to Program Communication (APPC) |
| pg4t4ic.exe | Oracle Database Gateway for APPC |
| dg4mqs.exe | Oracle Database Gateway for WebSphere MQ |
| dg4mqc.exe | Oracle Database Gateway for WebSphere MQ |
| dg4odbc.exe | Oracle Database Gateway for ODBC |

#### 5.1.2.4 Firewall Exceptions for Oracle Clusterware and Oracle ASM

If you installed the Oracle grid infrastructure software on the nodes in your cluster, then you can enable the Windows Firewall only *after* adding the following executables and ports to the Firewall exception list. The Firewall Exception list must be updated on each node.

- *Grid_home*\bin\gpnpd.exe - Grid Plug and Play daemon
- *Grid_home*\bin\oracle.exe - Oracle Automatic Storage Management (Oracle ASM) executable (if using Oracle ASM for storage)
- *Grid_home*\bin\racgvip.exe - Virtual Internet Protocol Configuration Assistant
- *Grid_home*\bin\evmd.exe - OracleEVMService
- *Grid_home*\bin\crsd.exe - OracleCRService
- *Grid_home*\bin\ocssd.exe - OracleCSService
- *Grid_home*\bin\octssd.exe - Cluster Time Synchronization Service daemon
- *Grid_home*\bin\mDNSResponder.exe - multicast-domain name system (DNS) Responder Daemon
- *Grid_home*\bin\gipcd.exe - Grid inter-process communication (IPC) daemon

- *Grid_home*\bin\gnsd.exe - Grid Naming Service (GNS) daemon
- *Grid_home*\bin\ohasd.exe - OracleOHService
- *Grid_home*\bin\TNSLSNR.EXE - single client access name (SCAN) listener and local listener for Oracle RAC database and Oracle ASM
- *Grid_home*\opmn\bin\ons.exe - Oracle Notification Service (ONS)
- *Grid_home*\jdk\jre\bin\java.exe - JVM

#### 5.1.2.5 Firewall Exceptions for Oracle RAC Database

For the Oracle RAC database, the executables that require exceptions are:

- *Oracle_home*\bin\oracle.exe - Oracle RAC database instance
- *Oracle_home*\bin\emagent.exe - Oracle Enterprise Manager agent
- *Oracle_home*\jdk\bin\java.exe - For the Oracle Enterprise Manager Database Console

In addition, the following ports should be added to the Windows Firewall exception list:

- Microsoft file sharing system management bus (SMB)
  - User Datagram Protocol (UDP) ports from 135 through 139
  - TCP ports from 135 through 139
- Direct-hosted SMB traffic without a network basic I/O system (NetBIOS)
  - port 445 (TCP and UPD)

#### 5.1.2.6 Firewall Exceptions for Oracle Cluster File System for Windows

If you use Oracle Cluster File System for Windows (OCFS for Windows) to store the Oracle Clusterware files, or Oracle RAC database files, then you must add the following exceptions to the Windows Firewall:

- *Grid_home*\cfs\Ocfsfindvol.exe - OCFS for Windows Volume Service
- %WINDOWS_HOME%\system32\drivers\Ocfs.sys - System file for OCFS (if using OCFS for Windows for Oracle Clusterware storage)

#### 5.1.2.7 Firewall Exceptions for Other Oracle Products

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

***Table 5–2 Other Oracle Software Products Requiring Windows Firewall Exceptions***

| Oracle Software Product | Executable Name |
|---|---|
| Data Guard Manager | dgmgrl.exe |
| Oracle Internet Directory lightweight directory access protocol (LDAP) Server | oidldapd.exe |
| External Procedural Calls | extproc.exe |

## 5.2 Recommended Postinstallation Tasks

Oracle recommends that you complete the following tasks as needed after installing Oracle Grid Infrastructure:

- Install Troubleshooting Tool
- Optimize Memory Usage for Programs
- Create a Fast Recovery Area Disk Group

### 5.2.1 Install Troubleshooting Tool

To address troubleshooting issues, Oracle recommends that you install Instantaneous Problem Detection OS Tool (IPD/OS).

#### 5.2.1.1 Installing Instantaneous Problem Detection OS Tool (IPD/OS)

On Windows systems running Windows Server 2003 with service pack 2 or higher, install IPD/OS.

The IPD/OS tool is designed to detect and analyze operating system and cluster resource-related degradation and failures. The tool can provide better explanations for many issues that occur in clusters where Oracle Clusterware and Oracle RAC are running, such as node evictions. It tracks the operating system resource consumption at each node, process, and device level continuously. It collects and analyzes clusterwide data. In real time mode, when thresholds are reached, an alert is shown to the operator. For root cause analysis, historical data can be replayed to understand what was happening at the time of failure.

You can download the tool at the following URL:

`http://www.oracle.com/technology/products/database/clustering/ipd_download_homepage.html`

To prevent performance problems, you cannot run the graphical user interface (GUI) interface for IPD/OS on the Oracle RAC node. You can install the client on any Linux or Windows client that is not a cluster member node. From this client you can view the data.

### 5.2.2 Optimize Memory Usage for Programs

The Windows operating system should be optimized for Memory Usage of 'Programs' instead of 'System Caching'. To modify the memory optimization settings, perform the following steps:

1. From the Start Menu, select **Control Panel**, then **System**.
2. In the System Properties window, click the **Advanced** tab.
3. In the Performance section, click **Settings**.
4. In the Performance Options window, click the **Advanced** tab.
5. In the Memory Usage section, make sure Programs is selected.

### 5.2.3 Create a Fast Recovery Area Disk Group

During installation, if you select Oracle ASM for storage, a single disk group is created. If you plan to add an Oracle Database for a standalone server or an Oracle RAC database, then you should create a separate disk group for the fast recovery area.

#### 5.2.3.1 About the Fast Recovery Area and the Fast Recovery Area Disk Group

The fast recovery area is a unified storage location for all Oracle Database files related to recovery. Database administrators can define the `DB_RECOVERY_FILE_DEST` parameter to the path for the Fast Recovery Area to enable on-disk backups, and rapid recovery of data. Enabling rapid backups for recent data can reduce requests to system administrators to retrieve backup tapes for recovery operations.

When you enable the fast recovery area in the database initialization parameter file, all RMAN backups, archive logs, control file automatic backups, and database copies are written to the fast recovery area. RMAN automatically manages files in the fast recovery area by deleting obsolete backups and archive files that are no longer required for recovery.

To use a flash recovery area in Oracle RAC, you must place it on an Oracle ASM disk group, a cluster file system, or on a shared directory that is configured through Direct network file system (NFS) for each Oracle RAC instance. In other words, the flash recovery area must be shared among all of the instances of an Oracle RAC database.Oracle recommends that you create a fast recovery area disk group. Oracle Clusterware files and Oracle Database files can be placed on the same disk group as fast recovery area files. However, Oracle recommends that you create a separate fast recovery area disk group to reduce storage device contention.

The fast recovery area is enabled by setting the parameter `DB_RECOVERY_FILE_DEST` to the same value on all instances. The size of the fast recovery area is set with `DB_RECOVERY_FILE_DEST_SIZE`. As a general rule, the larger the fast recovery area, the more useful it becomes. For ease of use, Oracle recommends that you create a fast recovery area disk group on storage devices that can contain at least three days of recovery information. Ideally, the fast recovery area should be large enough to hold a copy of all of your data files and control files, the online redo logs, and the archived redo log files needed to recover your database using the data file backups kept under your retention policy.

Multiple databases can use the same fast recovery area. For example, assume you have created one fast recovery area disk group on disks with 150 gigabyte (GB) of storage, shared by three different databases. You can set the size of the fast recovery area for each database depending on the importance of each database. For example, if `database1` is your least important database, `database2` is of greater importance and `database3` is of greatest importance, then you can set different `DB_RECOVERY_FILE_DEST_SIZE` settings for each database to meet your retention target for each database: 30 GB for `database1`, 50 GB for `database2`, and 70 GB for `database3`.

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

#### 5.2.3.2 Creating the Fast Recovery Area Disk Group

To create a fast recovery area disk group:

1. Navigate to the Grid home bin directory, and start Oracle ASM Configuration Assistant (ASMCA). For example:

   ```
   C:\> cd app\11.2.0\grid\bin
   C:\> asmca
   ```

2. ASMCA opens at the Disk Groups tab. Click **Create** to create a new disk group

3. The Create Disk Groups window opens.

   In the Disk Group Name field, enter a descriptive name for the fast recovery area group. For example: FRA.

In the Redundancy section, select the level of redundancy you want to use.

In the Select Member Disks field, select eligible disks to be added to the fast recovery area, and click **OK**.

4. The Diskgroup Creation window opens to inform you when disk group creation is complete. Click **OK**.
5. Click **Exit**.

## 5.3 Using Older Oracle Database Versions with Grid Infrastructure

Review the following sections for information about using older Oracle Database releases with Oracle Clusterware 11*g* release 2 (11.2) installations:

- General Restrictions for Using Older Oracle Database Versions
- Pinning Cluster Nodes for Oracle Database Release 10.x or 11.x
- Using DBCA or Applying Patches for Oracle Database Release 10.x or 11.x
- Enabling the Global Services Daemon (GSD) for Oracle Database Release 9.2
- Using the Correct LSNRCTL Commands

### 5.3.1 General Restrictions for Using Older Oracle Database Versions

You can use Oracle Database release 9.2, release 10.x and release 11.1 with Oracle Clusterware and Oracle ASM release 11.2.

If you upgrade an existing version of Oracle Clusterware and Oracle ASM to Oracle grid infrastructure release 11.2 (which includes Oracle Clusterware and Oracle ASM), and also upgrade your Oracle RAC database to release 11.2, then the required configuration of existing databases is completed automatically.

If you plan to use Oracle Clusterware and Oracle ASM release 11.2 with Oracle RAC 10.x or 11.1, then you must complete additional configuration tasks as described in the following sections. You also must apply patches to the Oracle RAC 10.x or 11.1 software installations before Oracle RAC 10.2 and 11.1 will work correctly with Oracle Clusterware 11.2 and Oracle ASM 11.2. Refer to the *Oracle Database Readme* for information about specific patches.

---

**Note:** If you are upgrading Oracle RAC or Oracle Database from releases 11.1.0.7, 11.1.0.6, or 10.2.0.4, and you upgraded Oracle Clusterware and Oracle ASM to release 11.2, then Oracle recommends that you check for the latest recommended patches for the release you are upgrading from, and install those patches as needed before upgrading to Oracle RAC or Oracle Database release 11.2.

For more information on recommended patches, refer to "Oracle Upgrade Companion," which is available through Note 785351.1 on My Oracle Support:

`https://metalink.oracle.com`

You can also refer to Oracle Support Notes 756388.1 and 756671.1 for the current list of recommended patches for each release.

---

**See Also:** "Download and Install Patch Updates" on page 5-1

### 5.3.2 Using DBCA or Applying Patches for Oracle Database Release 10.x or 11.x

Before you use DBCA to create an Oracle RAC or Oracle Database 10.x or 11.1 database on an Oracle Clusterware and Oracle ASM release 11.2 installation, you must install patches to the Oracle RAC or Oracle Database home. Refer to the *Oracle Database Readme* for information about specific patches.

**See Also:** "Download and Install Patch Updates" on page 5-1

Before applying any patches to your Oracle Database 10*g* release 2 software or Oracle Database 11*g* release 1 software, you must first stop the `OracleRemExecService` Windows service on all the nodes in your cluster. If you do not stop this process before applying patches to your Oracle Database 10*g* release 2 database, then you will receive errors during the patching operation and the Oracle software will not be patched correctly.

### 5.3.3 Pinning Cluster Nodes for Oracle Database Release 10.x or 11.x

When Oracle Database version 10.x or 11.x is installed on a new Oracle Grid Infrastructure for a cluster configuration, it is configured for dynamic cluster configuration, in which some or all internet protocol (IP) addresses are provisionally assigned, and other cluster identification information is dynamic. This configuration is incompatible with older database releases, which require fixed addresses and configurations.

You can change the nodes where you want to run the older database to create a persistent configuration. Creating a persistent configuration for a node is called pinning a node.

To pin a node in preparation for installing an older Oracle Database version, use *CRS_home*`\bin\crsctl` with the following command syntax, where *nodes* is a space-delimited list of one or more nodes in the cluster whose configuration you want to pin:

```
crsctl pin css -n nodes
```

For example, to pin nodes `node3` and `node4`, log in as an Administrator user and enter the following command:

```
C:\> crsctl pin css -n node3 node4
```

To determine if a node is in a pinned or unpinned state, use *CRS_home*`\bin\olsnodes` with the following syntax:

```
olsnodes -t -n
```

For example, to list all pinned nodes, use the following command:

```
C:\> app\11.2.0\grid\bin\olsnodes -t -n
node1 1       Pinned
node2 2       Pinned
node3 3       Pinned
node4 4       Pinned
```

To list the state of a particular node use the `-n` option, as shown in the following example:

```
C:\> app\11.2.0\grid\bin\olsnodes -t -n node3
node3 3       Pinned
```

**See Also:** *Oracle Clusterware Administration and Deployment Guide* for more information about pinning and unpinning nodes

### 5.3.4 Enabling the Global Services Daemon (GSD) for Oracle Database Release 9.2

To install an Oracle Database version 9.2 on a cluster running Oracle Clusterware 11*g* (version 11.1 or higher), perform the following additional configuration steps to prevent permission errors:

1. Create the OracleCRSToken_*username* Windows service for the Oracle9*i* software owner on each node in the cluster. After the service is created, change the ownership for the Global Services daemon (GSD) resource to the Oracle9*i* software owner.

   Run the following commands on each node using the specified syntax, where *Grid_home* is the Oracle Grid infrastructure home, *92_user_domain* is the domain of the Oracle9*i* software owner, *92_username* is the user name of the Oracle9*i* software owner, and *nodename* is the name of the node on which the service is being configured:

   ```
   Grid_home\bin\crsctl add crs administrator 92_domain/92_username
   Grid_home\bin\crsctl setperm resource ora.nodename.gsd -o 92_username
   ```

   For example, if the Oracle Clusterware home is `C:\app\11.2.0\grid`, the domain is ORAUSERS, the node name is `node1`, and the username is `ora92`, then you would enter the following commands:

   ```
   C:\app\11.2.0\grid\bin> crsctl add crs administrator ORAUSERS/ora92
   C:\app\11.2.0\grid\bin> crsctl setperm resource ora.node1.gsd
    -o ORAUSERS/ora92
   ```

2. Enable and start the GSD daemon on all nodes in the cluster.

   On any node in the cluster, run commands using the following syntax, where *Grid_home* is the Oracle Grid infrastructure home:

   ```
   Grid_home\bin\srvctl enable nodeapps -g
   Grid_home\bin\srvctl start nodeapps
   ```

   For example, if the Oracle Clusterware home is `C:\app\11.2.0\grid`, then enter the following commands:

   ```
   C:\app\11.2.0\grid\bin> srvctl enable nodeapps -g
   C:\app\11.2.0\grid\bin> srvctl start nodeapps
   ```

### 5.3.5 Using the Correct LSNRCTL Commands

To administer local and SCAN listeners using the `lsnrctl` command in Oracle Clusterware and Oracle ASM 11*g* release 2, use the Listener Control utility in the grid infrastructure home (Grid home). Do not attempt to use the `lsnrctl` commands from Oracle home locations for previous releases, because they cannot be used with the new release.

### 5.3.6 Starting and Stopping Oracle Clusterware Resources

Before shutting down Oracle Clusterware release 11.2, if you have an Oracle Database 10*g* release 2 or Oracle Database 11*g* release 1 database registered with Oracle Clusterware, then you must do one of the following:

- Stop the Oracle Database 10*g* release 2 or Oracle Database 11*g* release 1 database instances first, then stop the Oracle Clusterware stack
- Use the `crsctl stop crs -f` command to shut down the Oracle Clusterware stack and ignore any errors that are raised

## 5.4 Modifying Oracle Clusterware Binaries After Installation

After installation, if you must modify the software installed in your Grid home, then you must first stop the Oracle Clusterware stack. For example, to apply a one-off patch or modify any of the dynamic-link libraries (DLLs) used by Oracle Clusterware or Oracle ASM, you must follow these steps to stop and restart the Oracle Clusterware stack.

---

**Caution:** To put the changes you make to the Oracle grid infrastructure home into effect, you must shut down all executables that run in the Grid home directory and then restart them. In addition, shut down any applications that use Oracle shared libraries or DLL files in the Grid home.

---

Prepare the Oracle grid infrastructure home for modification using the following procedure:

1. Log in using a member of the Administrators group and change directory to the path *`Grid_home`*`\bin`, where *Grid_home* is the path to the Oracle grid infrastructure home.
2. Shut down the Oracle Clusterware stack using the following command:

   ```
   C:\..\bin> crsctl stop crs -f
   ```

3. After the Oracle Clusterware stack is completely shut down, perform the updates to the software installed in the Grid home.
4. Use the following command to restart the Oracle Clusterware stack:

   ```
   C:\..\bin> crsctl start crs
   ```

5. Repeat steps 1 through 4 on each cluster member node.

# 6

# How to Modify or Deinstall Oracle Grid Infrastructure

This chapter describes how to remove or deconfigure Oracle Clusterware software from your server.

This chapter contains the following topics:

- Deciding When to Deinstall Oracle Clusterware
- Adding Standalone Grid Infrastructure Servers to a Cluster
- Deconfiguring Oracle Clusterware without Removing Binaries
- Removing Oracle Clusterware and Oracle Automatic Storage Management

> **See Also:** Product-specific documentation for requirements and restrictions to remove an individual product

## 6.1 Deciding When to Deinstall Oracle Clusterware

Remove installed components in the following situations:

- You have successfully installed Oracle Clusterware, and you want to remove the Clusterware installation, either in an educational environment, or a test environment.
- You have encountered errors during or after installing or upgrading Oracle Clusterware, and you want to reattempt an installation.
- Your installation or upgrade stopped because of a hardware or operating system failure.
- You are advised by Oracle Support to reinstall Oracle Clusterware.

## 6.2 Adding Standalone Grid Infrastructure Servers to a Cluster

If you have an Oracle Database installation using Oracle Restart (Oracle Grid Infrastructure for a standalone server), and you want to configure that server as a cluster member node, then complete the following tasks:

1. Inspect the Oracle configuration with SRVCTL using the following syntax, where *db_unique_name* is the unique name for the database, and *lsnrname* is the name of the listener for the database:

```
srvctl config database -d db_unique_name
srvctl config service -d db_unique_name
srvctl config listener -l lsnrname
```

Record the configuration information for the server, as you will need this information in a later step.

2. Change directory to *Grid_home*\crs\install, for example:

```
C:\> cd app\product\grid\crs\install
```

3. Deconfigure and deinstall the Oracle grid infrastructure installation for a standalone server (Oracle Restart) using the following command:

```
C:\..\install> roothas.pl -deconfig
```

4. Prepare the server for Oracle Clusterware configuration, as described in either Chapter 1, "Typical Installation for Oracle Grid Infrastructure for a Cluster" or Chapter 2, "Advanced Installation Oracle Grid Infrastructure for a Cluster Preinstallation Tasks".
5. Install and configure Oracle grid infrastructure for a cluster on each node in the cluster.
6. Add Oracle grid infrastructure for a cluster support for your Oracle databases using the configuration information you recorded in Step 1. Use the following command syntax, where *db_unique_name* is the unique name of the database on the node, *Oracle_home* is the complete path of the Oracle home for the database, and *nodename* is the name of the node:

```
srvctl add database -d db_unique_name -o Oracle_home -x nodename
```

For example, if your database name is mydb1, and the node name is node1, enter the following command:

```
srvctl add database -d mydb1 -o C:\app\oracle\product\11.2.0\
db1 -x node1
```

7. Add each service listed in Step 1 to the database, using the command srvctl add service.

## 6.3 Deconfiguring Oracle Clusterware without Removing Binaries

Running the rootcrs.pl command with the flags -deconfig -force enables you to deconfigure Oracle Clusterware on one or more nodes without removing the installed binaries. This feature is useful if you encounter an error on one or more cluster nodes during installation, such as incorrectly configured shared storage. By running rootcrs.pl -deconfig -force on nodes where you encounter an installation error, you can deconfigure Oracle Clusterware on those nodes, correct the cause of the error, and then run rootcrs.pl again.

To deconfigure Oracle Clusterware:

1. Log in using a member of the Administrators group on a node where you encountered an error.
2. Change directory to *Grid_home*\crs\install. For example:

```
C:\> cd app\11.2.0\grid\crs\install
```

3. Run rootcrs.pl with the -deconfig -force flags. For example:

```
C:\..\install> perl rootcrs.pl -deconfig -force
```

Repeat on other nodes as required.

4. If you are deconfiguring Oracle Clusterware on all nodes in the cluster, then on the last node, enter the following command:

```
C:\..\install> perl rootcrs.pl -deconfig -force -lastnode
```

The `-lastnode` flag completes deconfiguration of the cluster, including the Oracle Cluster Registry (OCR) and voting disks.

> **Note:** The `-force` flag must be specified when running the rootcrs.pl script if there exist running resources that depend on the resources started from the Oracle Clusterware home you are deleting, such as databases, services, or listeners. You must also use the `-force` flag if you are removing a partial, or failed installation.

## 6.4 Removing Oracle Clusterware and Oracle Automatic Storage Management

The `deinstall` command removes Oracle Clusterware and Oracle Automatic Storage Management (Oracle ASM) from your server. The following sections describe the `deinstall.bat` command, and provide information about additional options to use with the command:

- About the Deinstallation Command
- Example of Running the Deinstall Command for Oracle Clusterware and ASM
- Example Parameter File for Deinstall of Oracle Grid Infrastructure

### 6.4.1 About the Deinstallation Command

The Deinstallation Tool (`deinstall.bat`) is available in Oracle home directories after installation as `%ORACLE_HOME%\deinstall\deinstall.bat`. The `deinstall.bat` command is also available for download from Oracle TechNet (OTN) (`http://www.oracle.com/technology/software/products/database/index.html`). You can download it with the complete Oracle Database 11*g* release 2 software, or as a separate archive file.

The `deinstall.bat` command uses the information you provide, plus information gathered from the software home to create a parameter file. You can alternatively supply a parameter file generated previously by the `deinstall.bat` command using the `-checkonly` flag and `-o` flag. You can also edit a response file template to create a parameter file.

The `deinstall.bat` command stops Oracle software, and removes Oracle software and configuration files on the operating system for a specific Oracle home. After the deinstallation process you are prompted to run the `rootcrs.pl` script as a user that is a member of the Administrators group.

The `deinstall.bat` command uses the following syntax, where variable content is indicated by italics:

```
deinstall.bat -home complete path of Oracle home [-silent] [-checkonly] [-local]
[-paramfile complete path of input parameter property file] [-params name1=value
name2=value . . .] [-o complete path of output file] [-help | -h]
```

The options are:

- `-home`

Use this flag to indicate the home path of the Oracle home to check or deinstall. To deinstall Oracle software using the `deinstall.bat` command located in the Oracle home being removed, provide a parameter file in a location outside the Oracle home, and do not use the `-home` flag.

If you run deinstall from the *`Grid_home`*`\deinstall` path, then the `-home` flag is not required because the tool knows from which home it is being run. If you use the standalone version of the tool, then `-home` is mandatory

- `-silent`

  Use this flag to run the command in noninteractive mode. This flag requires as input a properties file that contains the configuration values for the Oracle home that is being deinstalled or deconfigured. To provide these values, you must also specify the `-paramfile` flag when specifying this flag.

  To create a properties file and provide the required parameters, refer to the template file `deinstall.rsp.tmpl`, located in the `response` folder. Instead of using the template file, you can generate a properties file by using the `-checkonly` flag with the `deinstall` command. The generated properties file can then be used with the `-silent` flag.

- `-checkonly`

  Use this flag to check the status of the Oracle software home configuration. Running the command with the `-checkonly` flag does not remove the Oracle configuration. This flag generates a properties file that you can use with the `deinstall.bat` command.

  When you use the `-checkonly` flag to generate a properties file, you are prompted to provide information about your system. You can accept the default value the tool has obtained from your Oracle installation, indicated inside brackets ([]), or you can provide different values. To accept the defaults, click **Enter**.

- `-local`

  When you run `deinstall.bat` with this flag, it deconfigures and deinstalls the Oracle software only on the local node (the node on which you run `deinstall.bat`). On remote nodes, it deconfigures Oracle software, but does not deinstall the Oracle software.

  **Note:** This flag can only be used in cluster environments.

- `-paramfile` *`complete path of input parameter property file`*

  This is an optional flag. You can use this flag to run `deinstall.bat` with a parameter file in a location other than the default. When you use this flag, provide the complete path where the parameter file is located.

  The default location of the parameter file depends on the location of the Deinstallation tool:

  – From the installation media or stage location: <*Drive*> : `\`*staging_location*`\deinstall\response`

  – From a unzipped archive file downloaded from OTN: <*Drive*>:`\`*ziplocation*`\deinstall\response`, where <*Drive*>:`\`*ziplocation* refers to the directory in which the downloaded archive file was extracted.

  – After installation, from the installed Oracle home: `%ORACLE_HOME%\deinstall\response`.

- `-params` [`name1=value name2=value name3=value ...`]

  Use this flag with a parameter file to override one or more values in a parameter file that you created.

- `-o` *`complete directory path for output file`*

  Use this flag to provide a path other than the default location where the properties file is saved.

  The default location of the properties file depends on the location of the Deinstallation tool:

  – Extracted from an archive file downloaded from OTN: <*Drive*>:\ziplocation\`response`, where <*Drive*>:\ziplocation\ refers to directory in which the downloaded archive file was extracted.

  – After installation, from the installed Oracle home: `%ORACLE_HOME%\deinstall\response`.

- `-help | -h`

  Use the help option (`-help` or `-h`) to obtain additional information about the command option flags.

If you use the `deinstall.bat` command located in an Oracle home, or the `deinstall.bat` command downloaded from OTN (not installed in an Oracle home), then it writes log files in the `C:\Program Files\Oracle\Inventory\logs` directory. If, however, you are using the `deinstall.bat` command to remove the last Oracle home installed on the server, then the log files are written to:

- `%TEMP%\OraDeinstall`<*timestamp*>`\logs` if you use the `deinstall.bat` command located in the Oracle home
- <*Drive*>`:\`*`ziplocation`*`\deinstall\logs` if you use the `deinstall.bat` command downloaded from OTN

### 6.4.2 Example of Running the Deinstall Command for Oracle Clusterware and ASM

If you use the separately downloaded version of `deinstall.bat`, then when the `deinstall.bat` command runs, you are prompted to provide the home directory of the Oracle software to remove from your system. Provide additional information as prompted.

To run the `deinstall.bat` command located in an Oracle grid infrastructure home in the path `C:\app\11.2.0\grid`, enter the following command while logged in as a member of the Administrators group:

```
C:\> app\11.2.0\grid\deinstall\deinstall.bat
```

To run the `deinstall.bat` command located in an Oracle grid infrastructure home and use a parameter file located at `C:\users\oracle\myparamfile.tmpl`, enter the following command while logged in as a member of the Administrators group:

```
Grid_home\deinstall\deinstall.bat -paramfile C:\users\oracle\myparamfile.tmpl
```

You can generate the a parameter file by running the `deinstall.bat` command with the `-checkonly` and `-o` flags before you run the command to deinstall the Oracle home, or you can use the response file template and manually edit it to create the parameter file. For example, to generate the parameter file `deinstall_OraCrs11g_home1.rsp` using the `-checkonly` flag, enter a command similar to the following:

```
Grid_home\deinstall\deinstall -checkonly -o C:\users\oracle\
```

### 6.4.3 Example Parameter File for Deinstall of Oracle Grid Infrastructure

The following is an example of a parameter file for a cluster on nodes `node1` and `node2`, in which the Oracle grid infrastructure for a cluster is installed by the user `oracle`, the Oracle grid infrastructure home (Grid home) is in the path `C:\app\11.2.0\grid`, the Oracle base (where other Oracle software is installed) is `C:\app\oracle\`, the central Oracle Inventory home is `C:\Program Files\Oracle\Inventory`, the virtual IP addresses (VIP) are `192.0.2.2` and `192.0.2.4`, the local node (the node where you are running the deinstallation session from) is `node1`:

```
#Copyright (c) 2005, 2009 Oracle Corporation.  All rights reserved.
VIP1_IP=192.0.2.2
LOCAL_NODE=node1
ORA_VD_DISKGROUPS=+DATA
VIP1_IF=PublicNIC
OCRID=
ObaseCleanupPtrLoc=C:\Temp\OraDeinstall112010-02-11_10-14-30AM\utl\...
HELPJAR_NAME=help4.jar
local=false
ORACLE_HOME=C:\app\11.2.0\grid
ASM_HOME=C:\app\11.2.0\grid
ASM_DISK_GROUPS=
ASM_DISK_GROUP=DATA
ORA_DBA_GROUP=
ASM_DISCOVERY_STRING=
NEW_HOST_NAME_LIST=
PRIVATE_NAME_LIST=
ASM_DISKS=\\.\ORCLDISKDATA0,\\.\ORCLDISKDATA1,\\.\ORCLDISKDATA2
ASM_DISKSTRING=
CRS_HOME=true
JLIBDIR=C:\app\11.2.0\grid\jlib
OCRLOC=
JEWTJAR_NAME=jewt4.jar
EMBASEJAR_NAME=oemlt.jar
CRS_STORAGE_OPTION=1
ASM_REDUNDANCY=EXTERNAL
GPNPGCONFIGDIR=$ORACLE_HOME
LANGUAGE_ID='AMERICAN_AMERICA.WE8MSWIN1252'
CRS_NODEVIPS='node1-vip/255.255.252.0/PublicNIC,node2-vip/255.255.252.0/PublicNIC'
ORACLE_OWNER=Administrator
OLD_ACTIVE_ORACLE_HOME=
GNS_ALLOW_NET_LIST=
silent=false
LOGDIR=C:\Temp\OraDeinstall112010-02-11_10-14-30AM\logs\
OCFS_CONFIG=
NODE_NAME_LIST=node1,node2
GNS_DENY_ITF_LIST=
ORA_CRS_HOME=C:\app\11.2.0\grid
JREDIR=C:\app\11.2.0\grid\jdk\jre
ASM_LOCAL_SID=+asm1
ORACLE_BASE=C:\app\oracle\
GNS_CONF=false
NETCFGJAR_NAME=netcfg.jar
ORACLE_BINARY_OK=true
OCR_LOCATIONS=NO_VAL
ASM_ORACLE_BASE=C:\app\oracle
OLRLOC=
GPNPCONFIGDIR=$ORACLE_HOME
```

```
ORA_ASM_GROUP=
GNS_DENY_NET_LIST=
OLD_CRS_HOME=
EWTJAR_NAME=ewt3.jar
NEW_NODE_NAME_LIST=
GNS_DOMAIN_LIST=
ASM_UPGRADE=false
NETCA_LISTENERS_REGISTERED_WITH_CRS=LISTENER
CLUSTER_NODES=node1,node2
CLUSTER_GUID=
NEW_PRIVATE_NAME_LIST=
ASM_DIAGNOSTIC_DEST=C:\APP\ORACLE
CLSCFG_MISSCOUNT=
SCAN_PORT=1521
ASM_DROP_DISKGROUPS=true
NETWORKS="PublicNIC"/192.0.2.1:public,"PrivateNIC"/10.0.0.1:cluster_interconnect
OCR_VOTINGDISK_IN_ASM=true
NODELIST=node1,node2
ASM_IN_HOME=true
HOME_TYPE=CRS
GNS_ADDR_LIST=
CLUSTER_NAME=myrac-cluster
SHAREJAR_NAME=share.jar
VOTING_DISKS=NO_VAL
SILENT=false
VNDR_CLUSTER=false
GPNP_PA=
CSS_LEASEDURATION=400
REMOTE_NODES=node2
ASM_SPFILE=
NEW_NODEVIPS="node1-vip/255.255.252.0","node2-vip/255.255.252.0"
HOST_NAME_LIST=node1,node2
SCAN_NAME=myrac-scan
VIP1_MASK=255.255.252.0
INVENTORY_LOCATION=C:\Program Files\Oracle\Inventory
```

# A

# Troubleshooting the Oracle Grid Infrastructure Installation Process

This appendix provides troubleshooting information for installing Oracle Grid Infrastructure.

> **See Also:** The Oracle Database 11*g* Oracle Real Application Clusters (Oracle RAC) documentation set included with the installation media in the Documentation directory:
>
> - *Oracle Clusterware Administration and Deployment Guide*
> - *Oracle Real Application Clusters Administration and Deployment Guide*
> - *Oracle Real Application Clusters Installation Guide*

This appendix contains the following topics:

- General Installation Issues
- About the Oracle Clusterware Alert Log
- Oracle Clusterware Install Actions Log Errors and Causes
- Performing Cluster Diagnostics During Oracle Grid Infrastructure Installations
- Interconnect Configuration Issues

## A.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:

- Nodes unavailable for selection from the OUI Node Selection screen
- Node nodename is unreachable
- Shared disk access fails
- Installation does not complete successfully on all nodes

**Nodes unavailable for selection from the OUI Node Selection screen**

**Cause:** Oracle Grid Infrastructure is either not installed, or the Oracle Grid Infrastructure services are not up and running.

**Action:** Install Oracle Grid Infrastructure, or review the status of your installation. Consider restarting the nodes, because doing so may resolve the problem.

**Node *nodename* is unreachable**

**Cause:** Unavailable IP host.

**Action:** Attempt the following:

1. Run the command `ipconfig /all`. Compare the output of this command with the contents of the `C:\WINDOWS\system32\drivers\etc\hosts` file to ensure that the node IP is listed.
2. Run the command `nslookup` to see if the host is reachable.

**Shared disk access fails**

**Cause:** Windows 2003 R2 does not automount raw drives by default. This is a change from Windows 2000.

**Action:** Change the automount to enabled. Refer to "Enabling Automounting for Windows" on page 3-7

**Installation does not complete successfully on all nodes**

**Cause:** If a configuration issue prevents the Oracle grid infrastructure software from installing successfully on all nodes, you might see an error message such as "Timed out waiting for the CRS stack to start", or when you exit the installer you might notice that the Oracle Clusterware managed resources were not created on some nodes, or have a status other than ONLINE on those nodes.

**Action:** One solution to this problem is to deconfigure Oracle Clusterware on the nodes where the installation did not complete successfully, and then fix the configuration issue that caused the installation on that node to error out. After the configuration issue has been fixed, you can then rerun the scripts used during installation to configure Oracle Clusterware. See "Deconfiguring Oracle Clusterware without Removing Binaries" on page 6-2 for details.

## A.2 About the Oracle Clusterware Alert Log

During installation, the Oracle Clusterware alert log is the first place to look for serious errors. In the event of an error, it can contain path information to diagnostic logs that can provide specific information about the cause of errors.

After installation, Oracle Clusterware posts alert messages when important events occur. For example, you might see alert messages from the Cluster Ready Services (CRS) daemon when it starts, if it aborts, if the failover process fails, or if automatic restart of a CRS resource failed.

Enterprise Manager monitors the Oracle Clusterware log file and posts an alert on the Cluster Home page if an error is detected. For example, if a voting disk is not available, then a `CRS-1604` error is raised, and a critical alert is posted on the Cluster Home page. You can customize the error detection and alert settings on the Metric and Policy Settings page.

The location of the Oracle Clusterware log file is *`Grid_home`*`\log\`*`hostname`*`\alert`*`hostname`*`.log`, where *`Grid_home`* is the directory in which Oracle Grid infrastructure was installed and *`hostname`* is the host name of the local node.

> **See Also:** *Oracle Real Application Clusters Administration and Deployment Guide*

## A.3 Oracle Clusterware Install Actions Log Errors and Causes

During installation of the Oracle Grid Infrastructure software, a log file named `installActions<Date_Timestamp>.log` is written to the `%TEMP%\OraInstall<Date_Timestamp>` directory.

The following is a list of potential errors in the `installActions.log`:

- PRIF-10: failed to initialize the cluster registry

  Configuration assistant "Oracle Private Interconnect Configuration Assistant" failed
- KFOD-0311: Error scanning device *device_path_name*
- Step 1: checking status of Oracle Clusterware cluster

  Step 2: configuring OCR repository

  ignoring upgrade failure of ocr(-1073740972)

  failed to configure Oracle Cluster Registry with CLSCFG, ret -1073740972

Each of these error messages can be caused by one of the following issues:

### A.3.1 The OCFS for Windows format is not recognized on a remote cluster node

If you are using Oracle Cluster File System for Windows (OCFS for Windows) for your Oracle Cluster Registry (OCR) and Voting disk partitions, then:

1. Leave the Oracle Universal Installer (OUI) window in place.
2. Restart the second node, and any additional nodes.
3. Retry the assistants.

### A.3.2 You have a Windows 2003 system and Automount of new drives is not enabled

If this is true, then:

For Oracle RAC on Windows Server 2003, you must issue the following commands on all nodes:

```
C:\> diskpart
DISKPART> automount enable
```

If you did not enable automounting of disks before attempting to install Oracle Grid Infrastructure, and the configuration assistants fail during installation, then you must clean up your Oracle Clusterware install, enable automounting on all nodes, reboot all nodes, and then start the Oracle Clusterware install again.

### A.3.3 Symbolic links for disks were not removed

When you stamp a disk with ASMTOOL, it creates symbolic links for the disks. If these links are not removed when the disk is deleted or reconfigured, then errors can occur when attempting to access the disks.

To correct the problem, you can try stamping the disks again with ASMTOOL.

### A.3.4 Discovery string used by Oracle Automatic Storage Management is incorrect

When specifying Oracle Automatic Storage Management (Oracle ASM) for storage, you have the option of changing the default discovery string used to locate the disks. If the discovery string is set incorrectly, Oracle ASM will not be able to locate the disks.

### A.3.5 You used a period in a node name during Oracle Clusterware install

Periods (.) are not permitted in node names. Instead, use a hyphen (-).

To resolve a failed installation, remove traces of the Oracle installation, and reinstall with a permitted node name.

### A.3.6 Ignoring upgrade failure of ocr(-1073740972)

This error indicates that the user that is performing the installation does not have Administrator privileges.

## A.4 Performing Cluster Diagnostics During Oracle Grid Infrastructure Installations

If the installer does not display the Node Selection page, then 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.

---

**Note:** If you encounter unexplained installation errors during or after a period when scheduled tasks are run, then your scheduled task may have deleted temporary files before the installation is finished. Oracle recommends that you complete the installation before scheduled tasks are run, or disable scheduled tasks that perform cleanup until after the installation is completed.

---

## A.5 Interconnect Configuration Issues

If you use multiple network interface cards (NICs) for the interconnect, then the NICs should be bonded at the operating system level. Otherwise, the failure of a single NIC will affect the availability of the cluster node.

If you install Oracle Grid Infrastructure and Oracle RAC, then they must use the same NIC or teamed NIC cards for the interconnect.

If you use teamed NIC cards, then they must be on the same subnet.

If you encounter errors, then perform the following system checks:

- Verify with your network providers that they are using the correct cables (length, type) and software on their switches. In some cases, to avoid bugs that cause disconnects under loads, or to support additional features such as Jumbo Frames, you may need a firmware upgrade on interconnect switches, or you may need newer NIC driver or firmware at the operating system level. Running without such fixes can cause later instabilities to Oracle RAC databases, even though the initial installation seems to work.
- Review vitrual local area network (VLAN) configurations, duplex settings, and auto-negotiation in accordance with vendor and Oracle recommendations.

# B

# Installing and Configuring Oracle Grid Infrastructure Using Response Files

This appendix describes how to install and configure Oracle grid infrastructure software using response files. It includes information about the following topics:

- About Response Files
- Preparing a Response File
- Running the Installer Using a Response File
- Running Net Configuration Assistant Using a Response File
- Postinstallation Configuration Using a Response File

## B.1 About Response Files

When you start the installer, you can use a response file to automate the installation and configuration of Oracle software, either fully or partially. The installer uses the values contained in the response file to provide answers to some or all installation prompts.

Typically, the installer runs in interactive mode, which means that it prompts you to provide information in graphical user interface (GUI) screens. When you use response files to provide this information, you run the installer from a command prompt using either of the following modes:

- Silent mode

  If you include responses for all of the prompts in the response file and specify the `-silent` option when starting the installer, then it runs in silent mode. During a silent mode installation, the installer does not display any screens. Instead, it displays progress information in the terminal that you used to start it.

- Response file mode

  If you include responses for some or all of the prompts in the response file and omit the `-silent` option, then the installer runs in response file mode. During a response file mode installation, the installer displays all the screens, screens for which you specify information in the response file, and also screens for which you did not specify the required information in the response file.

You define the settings for a silent or response file installation by entering values for the variables listed in the response file. For example, to specify the Oracle home name, supply the appropriate value for the `ORACLE_HOME` variable:

```
ORACLE_HOME="OraCrs11g_home1"
```

Another way of specifying the response file variable settings is to pass them as command line arguments when you run the installer. For example:

```
-silent "ORACLE_HOME=OraCrs11g_home1" ...
```

This method is particularly useful if you do not want to embed sensitive information, such as passwords, in the response file. For example:

```
-silent "s_dlgRBOPassword=binks342" ...
```

Ensure that you enclose the variable and its setting in quotes.

> **See Also:** *Oracle Universal Installer and OPatch User's Guide for Windows and UNIX* for more information about response files

### B.1.1 Reasons for Using Silent Mode or Response File Mode

The following table provides use cases for running the installer in silent mode or response file mode.

| Mode | Uses |
|---|---|
| Silent | Use silent mode to do the following installations:<br>▪ Complete an unattended installation, which you schedule using operating system utilities such as `at`.<br>▪ Complete several similar installations on multiple systems without user interaction.<br>▪ Install the software on a system that cannot display the OUI graphical user interface.<br>The installer displays progress information on the terminal that you used to start it, but it does not display any of the installer screens. |
| Response file | Use response file mode to complete similar Oracle software installations on multiple systems, providing default answers to some, but not all of the installer prompts.<br>In response file mode, all the installer screens are displayed, but defaults for the fields in these screens are provided by the response file. You have to provide information for the fields in screens where you have not provided values in the response file. |

### B.1.2 General Procedure for Using Response Files

The following are the general steps to install and configure Oracle products using the installer in silent or response file mode:

> **Note:** You must complete all required preinstallation tasks on a system before running the installer in silent or response file mode.

1. Prepare a response file.
2. Run the installer in silent or response file mode.
3. If you completed a software-only installation, then perform the steps necessary to configure the Oracle product.

These steps are described in the following sections.

## B.2 Preparing a Response File

This section describes the following methods to prepare a response file for use during silent mode or response file mode installations:

- Editing a Response File Template
- Recording a Response File

### B.2.1 Editing a Response File Template

Oracle provides response file templates for each product and installation type, and for each configuration tool. For Oracle Grid Infrastructure, the response file is located in the *staging_dir*\clusterware\response directory on the installation media and in the *Grid_home*\inventory\response directory after installation.

Table B–1 lists the response files provided with this software:

***Table B–1 Response files for Oracle Grid Infrastructure***

| Response File | Description |
|---|---|
| crs_install.rsp | Silent installation of Oracle grid infrastructure installations |

> **Caution:** When you modify a response file template and save a file for use, the response file may contain plain text passwords. Ownership of the response file should be given to the Oracle software installation owner only. Oracle strongly recommends that database administrators or other administrators delete or secure response files when they are not in use.

To copy and modify a response file:

1. Copy the response file from the response file directory to a directory on your system.
2. Open the response file in a text editor.

   Remember that you can specify sensitive information, such as passwords, at the command line rather than within the response file. The section "About Response Files" on page B-1 explains this method.

   > **See Also:** *Oracle Universal Installer and OPatch User's Guide for Windows and UNIX* for detailed information on creating response files

3. Follow the instructions in the file to edit it.

   > **Note:** The installer or configuration assistant fails if you do not correctly configure the response file.

4. Secure the response file.

> **Note:** A fully specified response file for an Oracle grid infrastructure installation can contain the passwords for Oracle Automatic Storage Management (Oracle ASM) administrative accounts and for a user who is a member of the ORA_DBA group and the Administrators group. Ensure that only the Oracle software owner user can view or modify response files or consider deleting the modified response file after the installation succeeds.

### B.2.2 Recording a Response File

You can use the installer in interactive mode to record a response file, which you can edit and then use to complete silent mode or response file mode installations. This method is useful for customized or software-only installations.

Starting with Oracle Database 11*g* Release 2 (11.2), you can save all the installation steps into a response file during installation by clicking **Save Response File** on the Summary page. You can use the generated response file for a silent installation later.

When you record the response file, you can either complete the installation, or you can exit from the installer on the Summary page, before it starts to copy the software to the server.

> **Note:** Oracle Universal Installer (OUI) does not record passwords in the response file.

To record a response file:

1. Complete preinstallation tasks as for a normal installation.

   When you run the installer to record a response file, it checks the system to verify that it meets the requirements to install the software. For this reason, Oracle recommends that you complete all of the required preinstallation tasks and record the response file while completing an installation.

2. Log in as a user that is a member of the local Administrators group and start the installer. On each installation screen, specify the required information.

3. When the installer displays the Summary screen, perform the following:

   a. Click **Save Response File**. In the pop-up window, specify a file name and location for the response file, then click **Save** to write the settings you have entered to the response file.

   b. Click **Finish** to continue with the installation.

      Click **Cancel** if you do not want to continue with the installation. The installation will stop, but the recorded response file is retained.

4. Before you use the saved response file on another system, edit the file and make any required changes.

   Use the instructions in the file as a guide when editing it.

## B.3 Running the Installer Using a Response File

To use a response file during installation, you start OUI from the command line, specifying the response file you created. The OUI executable, `setup.exe`, provides

several options. For information about the full set of these options, run the `setup.exe` command with the `-help` option, for example:

```
C:\..\bin> setup.exe -help
```

The help appears in your session window after a short period of time.

To run the installer using a response file:

1. Complete the preinstallation tasks as for any installation
2. Log in as an Administrative user
3. To start the installer in silent or response file mode, enter a command similar to the following:

   ```
   C:\> directory_path\setup.exe [-silent] [-noconfig] \
    -responseFile responsefilename
   ```

   **Note:** Do not specify a relative path to the response file. If you specify a relative path, then the installer fails.

   In this example:

   - *`directory_path`* is the path of the DVD or the path of the directory on the hard drive where you have copied the installation binaries.
   - `-silent` runs the installer in silent mode.
   - `-noconfig` suppresses running the configuration assistants during installation, and a software-only installation is performed instead.
   - *`responsefilename`* is the full path and file name of the installation response file that you configured.

If you use record mode during a response file mode installation, then the installer records the variable values that were specified in the original source response file into the new response file.

## B.4 Running Net Configuration Assistant Using a Response File

You can run Net Configuration Assistant (NetCA) in silent mode to configure and start an Oracle Net listener on the system, configure naming methods, and configure Oracle Net service names. To run NetCA in silent mode, you must copy and edit a response file template. Oracle provides a response file template named `netca.rsp` in the `database\inventory\response` directory in the Oracle home directory after installation or in the `database\response` directory on the installation media.

To run NetCA using a response file:

1. Copy the `netca.rsp` response file template from the response file directory to a directory on your system.

   If you have copied the software to a hard drive, then you can edit the file in the `response` directory.
2. Open the response file in a text editor.
3. Follow the instructions in the file to edit it.

**Note:** NetCA fails if you do not correctly configure the response file.

4. Log in as an Administrative user.
5. Enter a command similar to the following to run NetCA in silent mode:

```
C:\> Oracle_home\bin\netca -silent -responsefile X:\local_dir\netca.rsp
```

In this command:

- The `-silent` option runs NetCA in silent mode.
- *`X:\local_dir`* is the full path of the directory where you copied the `netca.rsp` response file template where *X* represents the drive on which the file is located, and *local_dir* the path on that drive.

## B.5 Postinstallation Configuration Using a Response File

Use the following sections to create and run a response file configuration after installing Oracle software.

### B.5.1 About the Postinstallation Configuration File

When you run a silent or response file installation, you provide information about your servers in a response file that you otherwise provide manually using a graphical user interface. However, the response file does not contain passwords for user accounts that configuration assistants require after software installation is complete. The configuration assistants are started with a script called `configToolAllCommands`. You can run this script in response file mode by creating and using a password response file. The script uses the passwords to run the configuration tools in succession to complete configuration.

If you keep the password file to use for clone installations, then Oracle strongly recommends that you store it in a secure location. In addition, if you have to stop an installation to fix an error, then you can run the configuration assistants using `configToolAllCommands` and a password response file.

The `configToolAllCommands` password response file consists of the following syntax options:

- *internal_component_name* is the name of the component that the configuration assistant configures
- *variable_name* is the name of the configuration file variable
- *value* is the desired value to use for configuration.

The command syntax is as follows:

*internal_component_name*|*variable_name=value*

For example:

```
oracle.assistants.asm|S_ASMPASSWORD=myPassWord
```

Oracle strongly recommends that you maintain security with a password response file.

## B.5.2 Running Postinstallation Configuration Using a Response File

To run configuration assistants with the `configToolAllCommands` script:

1. Create a response file using the syntax *filename*.properties.
2. Open the file with a text editor, and cut and paste the password template, modifying as needed.

***Example B–1 Password response file for Oracle grid infrastructure***

Oracle grid infrastructure requires passwords for Oracle Automatic Storage Management Configuration Assistant (ASMCA), and for Intelligent Platform Management Interface Configuration Assistant (IPMICA) if you have a baseboard management controller (BMC) card and you want to enable this feature. Provide the following response file:

```
oracle.assistants.asm|S_ASMPASSWORD=password
oracle.assistants.asm|S_ASMMONITORPASSWORD=password
oracle.crs|S_BMCPASSWORD=password
```

If you do not have a BMC card, or you do not want to enable Intelligent Platform Management Interface (IPMI), then leave the `S_BMCPASSWORD` input field blank.

3. Change directory to *`Oracle_home`*`\cfgtoollogs`, and run the configuration script using the following syntax:

   ```
   configToolAllCommands RESPONSE_FILE=\path\name.properties
   ```

   For example:

   ```
   C:\..\cfgtoollogs> configToolAllCommands RESPONSE_FILE=C:\users\oracle
   \grid\cfgrsp.properties
   ```

# C

# Oracle Grid Infrastructure for a Cluster Installation Concepts

This appendix explains the reasons for preinstallation tasks that you are asked to perform and other installation concepts.

This appendix contains the following sections:

- Understanding Preinstallation Configuration
- Understanding Storage Configuration

## Understanding Preinstallation Configuration

This section reviews concepts about grid infrastructure for a cluster preinstallation tasks. It contains the following sections:

- Understanding Oracle Groups and Users
- Understanding the Oracle Base Directory Path
- Understanding Network Addresses
- Understanding Network Time Requirements

### Understanding Oracle Groups and Users

This section contains the following topic:

- Understanding the Oracle Inventory Directory

#### Understanding the Oracle Inventory Directory

The Oracle Inventory directory is the central inventory location for all Oracle software installed on a server. The location of the Oracle Inventory directory is `<System_drive>:\Program Files\Oracle\Inventory`.

The first time you install Oracle software on a system, the installer checks to see if an Oracle Inventory directory exists. The location of the Oracle Inventory directory is determined by the Windows Registry key `HKEY_LOCAL_MACHINE\SOFTWARE\Oracle\inst_loc`. If an Oracle Inventory directory does not exist, then the installer creates one in the default location of `C:\Program Files\Oracle\Inventory`.

By default, the Oracle Inventory directory is not installed under the Oracle Base directory. This is because all Oracle software installations share a common Oracle Inventory, so there is only one Oracle Inventory for all users, whereas there is a separate Oracle Base directory for each user.

## Understanding the Oracle Base Directory Path

During installation, you are prompted to specify an Oracle base location, which is owned by the user performing the installation. You can choose a location with an existing Oracle home, or choose another directory location that does not have the structure for an Oracle base directory. The default location for the Oracle base directory is `<SYSTEM_DRIVE>:\app\user_name\`.

Using the Oracle base directory path helps to facilitate the organization of Oracle installations, parameter, diagnostic, and log files, and helps to ensure that installations of multiple databases maintain an Optimal Flexible Architecture (OFA) configuration.

Multiple Oracle Database installations can use the same Oracle base directory. The Oracle grid infrastructure installation uses a different directory path, one outside of Oracle base. If you use different operating system users to perform the Oracle software installations, then each user will have a different default Oracle base location.

## Understanding Network Addresses

During installation, you are asked to identify the planned use for each network interface that Oracle Universal Installer (OUI) detects on your cluster node. Identify each interface as a public or private interface, or as an interface that you do not want Oracle Clusterware to use. Public and virtual internet protocol (IP) addresses are configured on public interfaces. Private addresses are configured on private interfaces.

Refer to the following sections for detailed information about each address type:

- About the Public IP Address
- About the Private IP Address
- About the Virtual IP Address
- About the Grid Naming Service (GNS) Virtual IP Address
- About the SCAN

### About the Public IP Address

The public IP address is assigned dynamically using dynamic host configuration protocol (DHCP), or defined statically in a domain name system (DNS) or in a `hosts` file. It uses the public interface (the interface with access available to clients).

### About the Private IP Address

Oracle Clusterware uses interfaces marked as private for internode communication. Each cluster node must have an interface that you identify during installation as a private interface. Private interfaces must have addresses configured for the interface itself, but no additional configuration is required. Oracle Clusterware uses interfaces marked as private as the cluster interconnects. Any interface that you identify as private must be on a subnet that connects to every node of the cluster. Oracle Clusterware uses all the interfaces you identify for use as private interfaces.

For the private interconnects, because of Cache Fusion and other traffic between nodes, Oracle strongly recommends using a physically separate, private network. If you configure addresses using a DNS, then you should ensure that the private IP addresses are reachable only by the cluster nodes.

After installation, if you modify interconnects on Oracle Real Application Clusters (Oracle RAC) with the `CLUSTER_INTERCONNECTS` initialization parameter, then you must change the interconnect to a private IP address, on a subnet that is not used with a public IP address, nor marked as a public subnet by `oifcfg`. Oracle does not

support changing the interconnect to an interface using a subnet that you have designated as a public subnet.

You should not use a firewall on the network with the private network IP addresses, because this can block interconnect traffic.

### About the Virtual IP Address

The virtual IP (VIP) address is registered in the grid naming service (GNS), or the DNS. Select an address for your VIP that meets the following requirements:

- The IP address and host name are currently unused (it can be registered in a DNS, but should not be accessible by a `ping` command)
- The VIP is on the same subnet as your public interface

### About the Grid Naming Service (GNS) Virtual IP Address

The GNS VIP address is a static IP address configured in the DNS. The DNS delegates queries to the GNS VIP address, and the GNS daemon responds to incoming name resolution requests at that address.

Within the subdomain, the GNS uses multicast Domain Name Service (mDNS), included with Oracle Clusterware, to enable the cluster to map host names and IP addresses dynamically as nodes are added and removed from the cluster, without requiring additional host configuration in the DNS.

To enable GNS, you must have your network administrator provide a set of IP addresses for a subdomain assigned to the cluster (for example, `grid.example.com`), and delegate DNS requests for that subdomain to the GNS VIP address for the cluster, which GNS will serve. The set of IP addresses is provided to the cluster through DHCP, which must be available on the public network for the cluster.

> **See Also:** *Oracle Clusterware Administration and Deployment Guide* for more information about GNS

### About the SCAN

Oracle Database 11*g* release 2 clients connect to the database using single client access names (SCANs). The SCAN and its associated IP addresses provide a stable name for clients to use for connections, independent of the nodes that make up the cluster. SCAN addresses, virtual IP addresses, and public IP addresses must all be on the same subnet.

The SCAN is a VIP name, similar to the names used for VIP addresses, such as `node1-vip`. However, unlike a VIP, the SCAN is associated with the entire cluster, rather than an individual node, and associated with multiple IP addresses, not just one address.

The SCAN resolves to multiple IP addresses reflecting multiple listeners in the cluster handling public client connections. When a client submits a request, the SCAN listener listening on a SCAN IP address and the SCAN port is contracted on a client's behalf. Because all services on the cluster are registered with the SCAN listener, the SCAN listener replies with the address of the local listener on the least-loaded node where the service is currently being offered. Finally, the client establishes connection to the service through the listener on the node where service is offered. All of these actions take place transparently to the client without any explicit configuration required in the client.

During installation, listeners are created on nodes for the SCAN IP addresses. Oracle Net Services routes application requests to the least loaded instance providing the service. Because the SCAN addresses resolve to the cluster, rather than to a node address in the cluster, nodes can be added to or removed from the cluster without affecting the SCAN address configuration.

The SCAN should be configured so that it is resolvable either by using GNS within the cluster, or by using DNS resolution. For high availability and scalability, Oracle recommends that you configure the SCAN name so that it resolves to three IP addresses. At a minimum, the SCAN must resolve to at least one address.

If you specify a GNS domain, then the SCAN name defaults to *clustername*-scan.*GNS_domain*. Otherwise, it defaults to *clustername*-scan.*current_domain*. For example, if you start Oracle grid infrastructure installation from the server `node1`, the cluster name is `mycluster`, and the GNS domain is `grid.example.com`, then the SCAN Name is `mycluster-scan.grid.example.com`.

Clients configured to use IP addresses for Oracle Database releases prior to Oracle Database 11*g* release 2 can continue to use their existing connection addresses; using SCANs is not required. When you upgrade to Oracle Clusterware 11*g* release 2 (11.2), the SCAN becomes available, and you should use the SCAN for connections to Oracle Database 11*g* release 2 or later databases. When an earlier version of Oracle Database is upgraded, it registers with the SCAN listeners, and clients can start using the SCAN to connect to that database. The database registers with the SCAN listener through the remote listener parameter in the init.ora file.

The SCAN is optional for most deployments. However, clients using Oracle Database 11*g* release 2 and later policy-managed databases using server pools must access the database using the SCAN. This is required because policy-managed databases can run on different servers at different times, so connecting to a particular node by using the virtual IP address for a policy-managed database is not possible.

### Understanding Network Time Requirements

Oracle Clusterware 11*g* release 2 (11.2) is automatically configured with Cluster Time Synchronization Service (CTSS). This service provides automatic synchronization of the time settings on all cluster nodes using the optimal synchronization strategy for the type of cluster you deploy. If you have an existing cluster synchronization service, such as network time protocol (NTP), then it will start in an observer mode. Otherwise, it will start in an active mode to ensure that time is synchronized between cluster nodes. CTSS will not cause compatibility issues.

The CTSS module is installed as a part of Oracle grid infrastructure installation. CTSS daemons are started by the Oracle High Availability Services daemon (`ohasd`), and do not require a command-line interface.

## Understanding Storage Configuration

Refer to the following sections for concepts about Oracle Automatic Storage Management (Oracle ASM) storage:

- Understanding Oracle Automatic Storage Management Cluster File System
- About Migrating Existing Oracle ASM Instances

### Understanding Oracle Automatic Storage Management Cluster File System

Oracle ASM has been extended to include a general purpose file system, called Oracle Automatic Storage Management Cluster File System (Oracle ACFS). Oracle ACFS is a

new multi-platform, scalable file system, and storage management technology that extends Oracle ASM functionality to support customer files maintained outside of the Oracle Database. Files supported by Oracle ACFS include application binaries and application reports. Other supported files are video, audio, text, images, engineering drawings, and other general-purpose application file data.

**Note:** Oracle ACFS is only supported on Windows Server 2003 64-bit and Windows Server 2003 R2 64-bit.

## About Migrating Existing Oracle ASM Instances

If you have an Oracle ASM installation from a prior release installed on your server, or in an existing Oracle Clusterware installation, then you can use Oracle Automatic Storage Management Configuration Assistant (ASMCA, located in the path *Grid_home*\bin) to upgrade the existing Oracle ASM instance to Oracle ASM 11*g* release 2 (11.2), and subsequently configure failure groups, Oracle ASM volumes, and Oracle ACFS.

**Note:** You must first shut down all database instances and applications on the node with the existing Oracle ASM instance before upgrading it.

During installation, if you chose to use Oracle ASM and ASMCA detects that there is a prior Oracle ASM version installed in another Oracle ASM home, then after installing the Oracle ASM 11*g* release 2 (11.2) binaries, you can start ASMCA to upgrade the existing Oracle ASM instance. You can then configure an Oracle ACFS deployment by creating Oracle ASM volumes and using the upgraded Oracle ASM to create the Oracle ACFS.

On an existing Oracle Clusterware or Oracle RAC installation, if the prior version of Oracle ASM instances on all nodes is Oracle ASM 11*g* release 1, then you are provided with the option to perform a rolling upgrade of Oracle ASM instances. If the prior version of Oracle ASM instances on an Oracle RAC installation are from an Oracle ASM release prior to Oracle ASM 11*g* release 1, then rolling upgrades cannot be performed. Oracle ASM is then upgraded on all nodes to 11*g* release 2 (11.2).

# D

# How to Upgrade to Oracle Grid Infrastructure 11*g* Release 2

This appendix describes how to perform Oracle Clusterware and Oracle Automatic Storage Management (Oracle ASM) upgrades.

This appendix contains the following topics:


- Restrictions for Clusterware and Oracle ASM Upgrades to Grid Infrastructure
- Understanding Out-of-Place and Rolling Upgrades
- Preparing to Upgrade an Existing Oracle Clusterware Installation
- Back Up the Oracle Software Before Upgrades
- Upgrading Oracle Clusterware
- Upgrading Oracle ASM
- Updating DB Control and Grid Control Target Parameters
- Downgrading Oracle Clusterware After an Upgrade


## D.1 Restrictions for Clusterware and Oracle ASM Upgrades to Grid Infrastructure

Be aware of the following restrictions and changes for upgrades to Oracle Grid Infrastructure installations, which consists of Oracle Clusterware and Oracle ASM:

- To upgrade existing Oracle Clusterware installations to Oracle Grid Infrastructure 11*g*, your current release must be at least 10.1.0.x, 10.2.0.3, 10.2.0.4, 11.1.0.6, or 11.1.0.7.
- To upgrade existing Oracle ASM installations to Oracle Grid Infrastructure 11*g* release 2 (11.2) using the rolling upgrade method, your current release must be at least 11.1.0.6 or 11.1.0.7.

  **See Also:** Oracle Upgrade Companion" Note 785351.1 on My Oracle Support:

  `https://support.oracle.com`

- Adding nodes to a cluster during a rolling upgrade is not supported.
- Oracle Clusterware and Oracle ASM upgrades are always out-of-place upgrades. With Oracle Grid Infrastructure 11*g* release 2 (11.2), you cannot perform an in-place upgrade of Oracle Clusterware and Oracle ASM to existing homes.

- Oracle ASM and Oracle Clusterware both run in the Oracle grid infrastructure home.

  **Note:** When you upgrade to Oracle Clusterware 11*g* release 2 (11.2), Oracle ASM is installed. In Oracle documentation, this home is called the "grid infrastructure home."

- Only one Oracle Clusterware installation can be active on a server at any time. During a major version upgrade to Oracle Clusterware 11*g* release 2 (11.2), the software in the Oracle Clusterware 11*g* release 2 (11.2) home is not fully functional until the upgrade is completed. Running `srvctl`, `crsctl`, and other commands from the Oracle Clusterware 11*g* release 2 (11.2) home is not supported until the final `rootupgrade.sh` script is run and the upgrade is complete across all nodes.

  To manage databases using earlier versions (release 10.x or 11.1) of Oracle Database during the grid infrastructure upgrade, use the `srvctl` utility in the existing database homes.

  **See Also:** *Oracle Database Upgrade Guide*

## D.2 Understanding Out-of-Place and Rolling Upgrades

Oracle Clusterware upgrades can be rolling upgrades, in which a subset of nodes are brought down and upgraded while other nodes remain active. Oracle ASM 11*g* release 2 (11.2) upgrades can be rolling upgrades. If you upgrade a subset of nodes, then a software-only installation is performed on the existing cluster nodes that you do not select for upgrade. Rolling upgrades avoid downtime and ensure continuous availability while the software is upgraded to a new version.

**Note:** In contrast with releases prior to Oracle Clusterware 11*g* release 2, Oracle Universal Installer (OUI) always performs rolling upgrades, even if you select all nodes for the upgrade.

During an out-of-place upgrade, the installer installs the newer version in a separate Oracle Clusterware home. Both versions of Oracle Clusterware are on each cluster member node, but only one version is active. By contrast, an in-place upgrade overwrites the software in the current Oracle Clusterware home.

To perform an out-of-place upgrade, you must create new Oracle Grid Infrastructure homes on each node. Then you can an out-of-place rolling upgrade, so that some nodes are running Oracle Clusterware from the original Oracle Clusterware home, and other nodes are running Oracle Clusterware from the new Oracle Grid Infrastructure home.

If you have an existing Oracle Clusterware installation, then you upgrade your existing cluster by performing an out-of-place upgrade. An in-place upgrade of Oracle Clusterware 11*g* release 2 is not supported.

**See Also:** "Upgrading Oracle Clusterware" on page D-4 for instructions on completing rolling upgrades

## D.3 Preparing to Upgrade an Existing Oracle Clusterware Installation

Before you upgrade Oracle Clusterware or Oracle ASM, there are certain tasks you should complete first. The following sections describe the tasks you should complete before starting an upgrade:

- Verify System Readiness for Patches and Upgrades
- Gather the Necessary System Information
- Upgrade to the Minimum Required Oracle Clusterware Version
- Unset Environment Variables

### D.3.1 Verify System Readiness for Patches and Upgrades

If you are completing a patch update of Oracle Clusterware or Oracle ASM, then after you download the patch software and before you start to patch or upgrade your software installation, review the Patch Set Release Notes that accompany the patch to determine if your system meets the system requirements for the operating system and the hardware platform.

Use the Cluster Verification Utility to assist you with system checks in preparation for patching or upgrading.

**See Also:** *Oracle Database Upgrade Guide*

### D.3.2 Gather the Necessary System Information

Ensure that you have the information you will need during installation, including the following:

- The Oracle home location for the current Oracle Clusterware installation.

  With Oracle Clusterware 11*g* release 2 (11.2), you can perform upgrades on a shared Oracle Clusterware home.
- An Oracle grid infrastructure home location that is different from your existing Oracle Clusterware home location
- A single client access name (SCAN) address
- Two network interface names (consisting of bonded or separate interfaces), which you can identify as public and private interfaces for the cluster

### D.3.3 Upgrade to the Minimum Required Oracle Clusterware Version

If you plan to upgrade your Oracle Clusterware 10*g* release 2 installation to Oracle Clusterware 11*g* release 2 (11.2) and your current Oracle Clusterware installation has not been upgraded to at least version 10.2.0.3, then a prerequisite check failure is reported. You must upgrade your current Oracle Clusterware installation to version 10.2.0.3 or higher before starting the upgrade to Oracle Clusterware 11*g* release 2.

If you plan to upgrade your Oracle Clusterware 10*g* release 1 installation to Oracle Clusterware 11*g* release 2 (11.2) and your current Oracle Clusterware installation is not 10.1.0.3 or higher, then you must upgrade your current Oracle Clusterware installation to version 10.1.0.3 or higher before starting the upgrade to Oracle Clusterware 11*g* release 2.

### D.3.4 Unset Environment Variables

For the user account used to perform the installation, if you have environment variables set for the existing installation, then remove the environment variables `ORACLE_HOME` and `ORACLE_SID`, as these environment variables are used during upgrade.

To remove the environment variable settings for all sessions, from the Start menu, right click **My Computer** and select **Properties**. In the System Properties window, select **Advanced**, then click the **Environment Variables** button.

## D.4 Back Up the Oracle Software Before Upgrades

Before you make any changes to the Oracle software, Oracle recommends that you create a backup of the Oracle software.

## D.5 Upgrading Oracle Clusterware

Use the following procedures to upgrade Oracle Clusterware. You can also choose to upgrade Oracle ASM during the upgrade of Oracle Clusterware.

---

**Note:** Oracle recommends that you leave Oracle Real Application Clusters (Oracle RAC) instances running. During the upgrade process, the database instances on the node being upgraded are stopped and started automatically.

---

1. If there are non-clustered, or standalone, Oracle databases that use Oracle ASM running on any of the nodes in the cluster, they must be shut down before you start the upgrade. Listeners associated with those databases do not have to be shut down.
2. Start the installer, and select the option to upgrade an existing Oracle Clusterware and Oracle ASM installation.
3. On the node selection page, select all nodes.

   ---

   **Note:** In contrast with releases prior to Oracle Clusterware 11*g* release 2, all upgrades are rolling upgrades, even if you select all nodes for the upgrade.

   Oracle recommends that you select all cluster member nodes for the upgrade, and then shut down the database instances on each node before you run the upgrade root script. Start the database instances on each node after the upgrade is complete. You can also use this procedure to upgrade a subset of nodes in the cluster.

   ---

4. Select installation options as prompted.
5. When the Oracle Clusterware upgrade is complete, if an earlier version of Oracle ASM is installed, then the installer starts Oracle ASM Configuration Assistant (ASMCA) to upgrade Oracle ASM to 11.2. You can upgrade Oracle ASM at this time, or upgrade it later.

   Oracle recommends that you upgrade Oracle ASM at the same time that you upgrade Oracle Clusterware. Until Oracle ASM is upgraded, Oracle databases that use Oracle ASM cannot be created. Until Oracle ASM is upgraded, the Oracle

ASM management tools in the Oracle Grid Infrastructure 11*g* release 2 (11.2) home (for example, `srvctl`) will not work.

---

**Note:** After the upgrade, if you set the Oracle Cluster Registry (OCR) backup location manually to the older release Oracle Clusterware home (CRS home), then you must change the OCR backup location to the Oracle grid infrastructure home (Grid home). If you did not set the OCR backup location manually, then this issue does not concern you.

Because upgrades of Oracle Clusterware are out-of-place upgrades, the previous release Oracle Clusterware home cannot be the location of the OCR backups. Backups in the old Oracle Clusterware home could be deleted.

---

## D.6 Upgrading Oracle ASM

After you have completed the Oracle Clusterware 11*g* release 2 (11.2) upgrade, if you did not choose to upgrade Oracle ASM when you upgraded Oracle Clusterware, then you can do it separately using ASMCA to perform rolling upgrades.

While you can use `asmca` to complete the upgrade of Oracle ASM separately, you should perform the upgrade as soon as possible after you upgrade Oracle Clusterware, because Oracle ASM management tools such as `srvctl` will not work until Oracle ASM has been upgraded.

---

**Note:** ASMCA performs a rolling upgrade only if the earlier version of Oracle ASM is either 11.1.0.6 or 11.1.0.7. Otherwise, ASMCA performs a normal upgrade, during which ASMCA brings down all Oracle ASM instances on all nodes of the cluster, and then brings them all up in the new Oracle Grid Infrastructure home.

---

### D.6.1 About Upgrading Oracle ASM

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

- The active version of Oracle Clusterware must be 11*g* release 2 (11.2). To determine the active version, enter the following command:

  ```
  C:\..\bin> crsctl query crs activeversion
  ```

- You must ensure that any rebalance operations on your existing Oracle ASM installation are completed before starting the upgrade.
- During the upgrade process, you place the Oracle ASM instances in an upgrade mode. Because this upgrade mode limits Oracle ASM operations, you should complete the upgrades soon after you begin. The following are the operations allowed during Oracle 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`)

### D.6.2 Using ASMCA to Upgrade Oracle ASM

Complete the following procedure to upgrade Oracle ASM:

1. On the node on which you plan to start the upgrade, set the environment variable `ASMCA_ROLLING_UPGRADE` to `true` to put the Oracle ASM instances in upgrade mode:

   ```
   C:\> set ASMCA_ROLLING_UPGRADE=true
   ```

2. From the Oracle Grid Infrastructure 11*g* release 2 (11.2) home, start ASMCA. For example:

   ```
   C:\> cd app\oracle\grid\11.2.0.1\bin
   C:\..\bin> asmca.bat
   ```

3. In the ASMCA graphical interface, select **Upgrade**.

   ASMCA upgrades Oracle ASM in succession for all nodes in the cluster.

4. When the upgrade is complete for all the nodes, unset the environment variable `ASMCA_ROLLING_UPGRADE`:

   ```
   C:\> set ASMCA_ROLLING_UPGRADE=
   ```

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

## D.7 Updating DB Control and Grid Control Target Parameters

Because Oracle Clusterware release 2 (11.2) is an out-of-place upgrade of the Oracle Clusterware home in a new location (the grid infrastructure for a cluster home, or Grid home), the path for the `CRS_HOME` parameter in some parameter files must be changed. If you do not change the parameter, then you will encounter errors such as "cluster target broken" on Enterprise Manager Database Control or Grid Control.

Use the following procedure to resolve this issue:

1. Log in to Enterprise Manager Database Control or Enterprise Manager Grid Control.
2. Select the **Cluster** tab.
3. Click **Monitoring Configuration**.
4. Update the value for **Oracle Hom**e with the new path for the Oracle Grid Infrastructure home.

## D.8 Downgrading Oracle Clusterware After an Upgrade

After a successful or a failed upgrade to Oracle Clusterware 11*g* release 2 (11.2), you can restore Oracle Clusterware to the previous version.

The restoration procedure in this section restores the Oracle Clusterware configuration to the state it was in before the Oracle Clusterware 11*g* release 2 (11.2) upgrade. Any configuration changes you performed during or after the 11*g* release 2 (11.2) upgrade are removed and cannot be recovered.

To restore Oracle Clusterware to the previous release:

1. On all remote nodes, use the command syntax `Grid_home\crs\install\rootcrs.pl -downgrade [-force]` to stop the Oracle Clusterware 11*g* release 2 (11.2) resources and shut down the Oracle Clusterware stack.

   **Note:** This command does not reset the OCR, or delete the `ocr` Windows Registry key.

   For example:

   ```
   C:\app\grid\11.2.0.1\crs\install> rootcrs.pl -downgrade
   ```

   To stop a partial or failed Oracle Clusterware 11*g* release 2 (11.2) upgrade and restore the previous release Oracle Clusterware, use the `-force` flag with this command.

2. After the `rootcrs.pl -downgrade` script has completed on all remote nodes, on the local node use the command syntax *Grid_home*`\crs\install\rootcrs.pl -downgrade -lastnode -oldcrshome` *pre11.2_crs_home* `-version` *pre11.2_crs_version* `[-force]`, where *pre11.2_crs_home* is the home of the earlier Oracle Clusterware installation, and *pre11.2_crs_version* is the release number of the earlier Oracle Clusterware installation.

   For example:

   ```
   C:\app\grid\11.2.0.1\crs\install> rootcrs.pl -downgrade -lastnode
   -oldcrshome C:\app\crs -version 11.1.0.6.0
   ```

   This script downgrades the OCR, and removes binaries from the Grid home. If the Oracle Clusterware 11*g* release 2 (11.2) upgrade did not complete successfully, then to restore the previous release of Oracle Clusterware using the `-force` flag with this command.

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