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Oracle Grid Infrastructure Installation Guide

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Preface

This guide explains how to configure a server in preparation for installing and configuring an Oracle Grid Infrastructure installation (Oracle Clusterware and Oracle Automatic Storage Management).

This guide also explains how to configure a server and storage in preparation for an Oracle Real Application Clusters (Oracle RAC) installation.

[Audience](#) (page xv)

[Documentation Accessibility](#) (page xv)

[Java Access Bridge and Accessibility](#) (page xvi)

[Related Documentation](#) (page xvi)

[Conventions](#) (page xvii)

Audience

Oracle Grid Infrastructure Installation Guide for Microsoft Windows x64 (64-Bit) 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 an Oracle Grid Infrastructure for a cluster installation.

For customers with specialized system roles who intend to install Oracle Real Application Clusters (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 Administrator user privileges. When the Oracle Grid Infrastructure installation and configuration is successfully completed, a system administrator should only provide configuration information and grant access to the database administrator to run scripts that require Administrator 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

For information about Oracle's commitment to accessibility, visit the Oracle Accessibility Program website at <http://www.oracle.com/pls/topic/lookup?ctx=acc&id=docacc>.

Access to Oracle Support

Oracle customers have access to electronic support through My Oracle Support. For information, visit <http://www.oracle.com/pls/topic/lookup?ctx=acc&id=info> or visit <http://www.oracle.com/pls/topic/lookup?ctx=acc&id=trs> if you are hearing impaired.

Java Access Bridge and Accessibility

Java Access Bridge enables assistive technologies to read Java applications running on the Windows platform. Assistive technologies can read Java-based interfaces, such as Oracle Universal Installer and Oracle Enterprise Manager Database Express.

See Also: *Oracle Database Installation Guide for Microsoft Windows* for more information about installing Java Access Bridge

Related Documentation

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.

Installing Oracle RAC or Oracle RAC One Node is a multi-step process. Perform the following steps by reviewing the appropriate documentation:

Installation Task	Documentation to Use
Preinstallation setup for Oracle Grid Infrastructure and Oracle RAC	<i>Oracle Grid Infrastructure Installation Guide for Microsoft Windows x64 (64-Bit)</i> (this guide)
Install Oracle Grid Infrastructure and configure Oracle Clusterware and Oracle ASM	<i>Oracle Grid Infrastructure Installation Guide for Microsoft Windows x64 (64-Bit)</i> (this guide)
Install Oracle Database software and configure Oracle RAC	<i>Oracle Real Application Clusters Installation Guide for Microsoft Windows x64 (64-Bit)</i>

You can install the Oracle Database software for standalone databases or Oracle RAC databases on servers that run Oracle Grid Infrastructure. You cannot install Oracle Restart on servers that run Oracle Grid Infrastructure. To install an Oracle Restart deployment of Oracle Grid Infrastructure, see *Oracle Database Installation Guide*.

Installation Guides for Microsoft Windows

- *Oracle Database Installation Guide for Microsoft Windows x64 (64-Bit)*
- *Oracle Real Application Clusters Installation Guide for Microsoft Windows x64 (64-Bit)*
- *Oracle Database Client Installation Guide for Microsoft Windows*

Operating System-Specific Administrative Guides

- *Oracle Database Platform Guide for Microsoft Windows*

Oracle Clusterware and Oracle Automatic Storage Management Administrative Guides

- *Oracle Clusterware Administration and Deployment Guide*
- *Oracle Automatic Storage Management 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*

Generic Documentation

- *Oracle Database 2 Day DBA*
- *Oracle Database Administrator's Guide*
- *Oracle Database Concepts*
- *Oracle Database New Features Guide*
- *Oracle Database Reference*
- *Oracle Database Global Data Services Concepts and Administration Guide*

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

<http://www.oracle.com/technetwork/community/join/overview/>

You can access the online documentation in the Oracle Help Center at:

<http://docs.oracle.com>

Most Oracle error message documentation is only available in HTML format. If you only have access to the Oracle Documentation, then browse the error messages by range. When you find the correct range of 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.

Conventions

These text conventions are used in this document:

Convention	Meaning
boldface	Boldface type indicates graphical user interface elements associated with an action, or terms defined in text or the glossary.
<i>italic</i>	Italic type indicates book titles, emphasis, or placeholder variables for which you supply values.

Convention	Meaning
monospace	Monospace type indicates commands within a paragraph, URLs, code in examples, text that appears on the screen, or text that you enter.

Changes in this Release for Oracle Clusterware

A list of changes in *Oracle Grid Infrastructure Installation Guide for Windows*.

[Changes in Oracle Clusterware 12c Release 1 \(12.1.0.2\)](#) (page xix)

[Changes in Oracle Clusterware 12c Release 1 \(12.1\)](#) (page xx)

Changes in Oracle Clusterware 12c Release 1 (12.1.0.2)

The following are changes in Oracle Grid Infrastructure Installation Guide for Oracle Clusterware 12c Release 1 (12.1.0.2):

[New Features for Oracle Clusterware 12.1.0.2](#) (page xix)

[Other Changes for Oracle Clusterware 12.1.0.2](#) (page xx)

New Features for Oracle Clusterware 12.1.0.2

- Automatic Installation of Grid Infrastructure Management Repository

The Grid Infrastructure Management Repository is automatically installed with Oracle Grid Infrastructure 12c Release 1 (12.1.0.2).

- Cluster and Oracle RAC Diagnosability Tools Enhancements

Oracle Clusterware uses Oracle Database fault diagnosability infrastructure to manage diagnostic data and its alert log. As a result, most diagnostic data resides in the Automatic Diagnostic Repository (ADR), a collection of directories and files located under a base directory that you specify during installation.

Note: The Oracle Trace File Analyzer (TFA) Collector is not supported on Windows operating systems.

- IPv6 Support for Public Networks

Oracle Clusterware 12c Release 1 (12.1) supports IPv6-based public IP and VIP addresses.

IPv6-based IP addresses have become the latest standard for the information technology infrastructure in today's data centers. With this release, Oracle RAC and Oracle Grid Infrastructure support this standard. You can configure cluster nodes during installation with either IPv4 or IPv6 addresses on the same network. Database clients can connect to either IPv4 or IPv6 addresses. The Single Client

Access Name (SCAN) listener automatically redirects client connection requests to the appropriate database listener for the IP protocol of the client request.

Other Changes for Oracle Clusterware 12.1.0.2

- Windows Server 2012 and Windows Server 2012 R2 are supported with this release

Changes in Oracle Clusterware 12c Release 1 (12.1)

The following are changes in Oracle Grid Infrastructure Installation Guide for Oracle Clusterware 12c Release 1 (12.1):

[New Features for Oracle Clusterware 12c Release 1 \(12.1\)](#) (page xx)

[Deprecated Features for Oracle Clusterware 12c Release 1 \(12.1\)](#) (page xxii)

[Desupported Features for Oracle Clusterware 12c Release 1 \(12.1\)](#) (page xxii)

[Other Changes for Oracle Clusterware 12c Release 1 \(12.1\)](#) (page xxii)

New Features for Oracle Clusterware 12c Release 1 (12.1)

- Oracle ASM File Access Control Enhancements on Windows
You can now use access control to separate roles in Windows environments. With Oracle Database services running with the privileges of an Oracle home user rather than Local System, the Oracle ASM access control feature is enabled to support role separation on Windows. In earlier releases, this feature was disabled on Windows because all Oracle services run as Local System.
You can change the identity of an Oracle ASM user from one operating system user to another operating system user without having to drop and re-create the user, which requires dropping all the files a user owns, which improves the manageability of Oracle ASM users and the files they own.
You can modify Windows file access controls while files are open using ASMCMD file access control commands, such as `chgrp`, `chmod`, and `chown`.
See *Oracle Automatic Storage Management Administrator's Guide* and *Oracle Database Platform Guide for Microsoft Windows*.
- Cluster Health Monitor Enhancements
Cluster Health Monitor (CHM) has been enhanced to provide a highly available server monitor service that provides improved detection of operating system and cluster resource-related degradation and failures.
See *Oracle Clusterware Administration and Deployment Guide*.
- Support for Storing the Oracle Cluster Registry Backup in an Oracle ASM Disk Group
The Oracle Cluster Registry (OCR) backup mechanism enables storing the OCR backup in an Oracle ASM disk group. Storing the OCR backup in an Oracle ASM disk group simplifies OCR management by permitting access to the OCR backup from any node in the cluster should an OCR recovery become necessary.
- Oracle Grid Infrastructure Rolling Migration for One-Off Patches

Oracle Grid Infrastructure one-off patch rolling migration and upgrade for Oracle Automatic Storage Management (Oracle ASM) and Oracle Clusterware enables you to independently upgrade or patch clustered Oracle Grid Infrastructure nodes with one-off patches, without affecting database availability. This feature provides greater uptime and patching flexibility. This release also introduces a new Cluster state, "Rolling Patch" Operations allowed in a patch quiesce state are similar to the existing "Rolling Upgrade" cluster state.

See *Oracle Automatic Storage Management Administrator's Guide*

- Oracle Home User Support for Oracle Database and Oracle Grid Infrastructure
Starting with Oracle Database 12c release 1 (12.1), Oracle Database supports the use of an Oracle Home User, which can be specified at installation time. The Oracle Home User can be a Built-in Account or a Windows Domain User Account. If you specify a Windows User Account, then the user should be a standard (non-Administrator) account to ensure that the Oracle Home User has a limited set of privileges. Using an Oracle Home User ensures that Oracle Database services have only those privileges required to run Oracle products.

See *Oracle Database Platform Guide for Microsoft Windows*

- Oracle RAC Hang Detection and Node Eviction Protection
Slowdowns in the cluster, mainly affecting the Oracle Database instances, are detected and classified as a hung process or instance and removed accordingly to prevent unnecessary node evictions as a consequence. While the occasional eviction of a node in an Oracle RAC cluster is mostly transparent to the application, this feature minimizes its occurrence. Also, the Global Conflict Resolution (GCR) process has been enhanced to provide better detection and avoidance of issues causing node evictions.

- Policy-Based Cluster Management and Administration
Oracle Grid Infrastructure allows running multiple applications in one cluster. Using a policy-based approach, the workload introduced by these applications can be allocated across the cluster using a policy. In addition, a policy set enables different policies to be applied to the cluster over time as required. Policy sets can be defined using a web-based interface or a command-line interface.

Hosting various workloads in the same cluster helps to consolidate the workloads into a shared infrastructure that provides high availability and scalability. Using a centralized policy-based approach allows for dynamic resource reallocation and prioritization as the demand changes.

See *Oracle Clusterware Administration and Deployment Guide*.

- Shared Grid Naming Service (GNS) Across Multiple Clusters
In earlier releases, the Grid Naming Service (GNS) was dedicated to one Oracle Grid Infrastructure-based cluster, providing name resolution only for its own cluster member nodes. With this release, one Oracle GNS can now manage just the cluster member nodes in its own cluster, or GNS can provide naming resolution for all nodes across all clusters in the data center that are delegated to Oracle GNS for resolution.

Using only one Oracle GNS for all nodes that are part of an Oracle Grid Infrastructure cluster in the data center not only streamlines the naming convention, but also enables a data center cloud, minimizing day-to-day administration efforts.

- Support for Separation of Database Administration Duties
Oracle Database 12c release 1 (12.1) provides support for separation of administrative duties for Oracle Database by introducing task-specific and least-privileged administrative privileges that do not require the SYSDBA system privilege. These new system privileges are: SYSBACKUP for backup and recovery, SYSDG for Oracle Data Guard, and SYSKM for encryption key management.
See "Managing Administrative Privileges" in *Oracle Database Security Guide* and "[Extended Oracle Database Groups for Job Role Separation](#) (page 5-13)"
- Updates to Oracle ASM File Access Control Commands and Open Files Support
This feature enables the modification of Windows file access controls while files are open. This feature supports updates to ASMCMD file access control commands, such as `chgrp`, `chmod`, and `chown`.
See *Oracle Automatic Storage Management Administrator's Guide*.

Deprecated Features for Oracle Clusterware 12c Release 1 (12.1)

The following features are deprecated in this release, and may be desupported in a future release:

- Standalone Deinstallation Tool
The deinstallation tool is now integrated with the installation media.
- The `-cleanupOBASE` option of the deinstallation tool
The `-cleanupOBASE` option is deprecated in this release. There is no replacement for this option.

Desupported Features for Oracle Clusterware 12c Release 1 (12.1)

The following features are no longer supported by Oracle:

- Direct use of raw devices with Oracle Clusterware and Oracle Database
- Oracle Cluster File System (OCFS) for Windows
- Oracle Objects for OLE
- Oracle Enterprise Manager Database Control

For a complete list of desupported features, see:

Oracle Database Upgrade Guide

Other Changes for Oracle Clusterware 12c Release 1 (12.1)

- Windows Server 2003 and Windows Server 2003 R2 are not supported with this release
- Document Structure Changes
This book is redesigned to provide an installation checklist to assist with preparing for installation, and chapters that subdivide preinstallation tasks into category topics.

System Hardware, Software and Configuration Checklists

The following tables provide lists of basic system requirements to check.

This list is not comprehensive for all deployment options. For more specific details about these checks, and other configuration information, see Chapter 3 through Chapter 7.

[Installation Differences Between Windows and Linux or UNIX](#) (page 1-1)

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.

[Oracle Grid Infrastructure Installation Server Hardware Checklist](#) (page 1-2)

Review the following hardware checklist for all installations:

[Oracle Grid Infrastructure and Oracle RAC Environment Checklist](#) (page 1-3)

Review the following environment checklist for all installations.

[Oracle Grid Infrastructure Network Checklist](#) (page 1-4)

Review all installations to ensure that you have the required hardware, names, and addresses for the cluster.

[Oracle Grid Infrastructure and Oracle RAC Upgrades Checklist](#) (page 1-6)

Review this upgrade checklist if you have an existing Oracle Grid Infrastructure or Oracle RAC installation. A cluster is being upgraded until all cluster member nodes run Oracle Grid Infrastructure 12c Release 1 (12.1), and the new clusterware becomes the active release.

[Oracle Grid Infrastructure Storage Configuration Tasks](#) (page 1-7)

Review the following storage configuration task checklist for all installations:

[Oracle Grid Infrastructure Starting the Installation Tasks](#) (page 1-8)

Use the following checklist to complete pre-installation tasks.

1.1 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 Linux or UNIX and Windows installations are:

- Startup and shutdown services

With Windows, you log in to a user account with Administrator privileges to install the Oracle Database software. You can also specify an Oracle Home User (based on a standard non-administrative Windows user account) during

installation. 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.

- Environment variables

On Windows systems, Oracle Universal Installer (OUI) sets environment variables such as PATH, ORACLE_BASE, ORACLE_HOME, and ORACLE_SID in the registry. On Linux and UNIX systems, you must manually set these environment variables.

If you have multiple Oracle databases in an Oracle home, then only the SID of the last Oracle database is set in the registry. See *Oracle Universal Installer and OPatch User's Guide for Windows and UNIX* for more information about managing Oracle homes.

- Operating System Groups

On Windows systems, OUI creates the ORA_DBA, ORA_OPER, ORA_HOMENAME_DBA, and ORA_HOMENAME_OPER groups, which are used for operating system authentication for Oracle instances. On Linux and UNIX systems, you must create the operating system groups manually.

- Account for running Oracle Universal Installer (OUI)

With Windows, you log in to a user account with Administrator privileges to install the Oracle Database software. You can also specify an Oracle Home User (based on a standard non-administrative Windows User Account) during installation. 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 Differences on Windows and UNIX," in *Oracle Database Platform Guide for Microsoft Windows*

1.2 Oracle Grid Infrastructure Installation Server Hardware Checklist

Review the following hardware checklist for all installations:

Table 1-1 Server Hardware Checklist for Oracle Grid Infrastructure

Check	Task
Server hardware	Server make, model, core architecture, and host bus adaptors (HBA) are supported to run with Oracle Grid Infrastructure and Oracle RAC.
Network Switches	<ul style="list-style-type: none"> • Public network switch, at least 1 GbE, connected to a public gateway. • Private network switch, at least 1 GbE, with 10 GbE recommended, dedicated for use only with other cluster member nodes. Alternatively, use InfiniBand for the interconnect.
Random Access Memory (RAM)	At least 4 GB of RAM for Oracle Grid Infrastructure for a Cluster installations, including installations where you plan to install Oracle RAC..
Virtual Memory configuration	Oracle recommends that you set the paging file size to match the amount of RAM available on the server, up to a maximum of 16 GB
Temp space allocation	At least 1 GB allocated to %TEMP%.

Table 1-1 (Cont.) Server Hardware Checklist for Oracle Grid Infrastructure

Check	Task
Operating System	<ul style="list-style-type: none"> Supported in the list of supported releases listed in "Identifying Software Requirements (page 3-5)". Same operating system version running on each cluster member node
Storage hardware	Either Storage Area Network (SAN) or Network-Attached Storage (NAS). You cannot use NTFS formatted disks or partitions for Oracle Clusterware files or data files because they cannot be shared.
Local Storage Space for Oracle Software	<ul style="list-style-type: none"> At least 7 GB of space for the Oracle Grid Infrastructure for a cluster home (Grid home). Oracle recommends that you allocate 100 GB to allow additional space for patches. At least 3.5 GB of space for the Oracle base of the Oracle Installation user for the Oracle Grid Infrastructure software (Grid user). The Oracle base includes Oracle Clusterware and Oracle ASM log files. At least 5.8 GB of space the Oracle Database software on x86_64 platforms.
Intelligent Platform Management Interface (IPMI) Configuration	<ul style="list-style-type: none"> Ensure installation is complete, with IPMI administrator account information available to the Oracle Installation user. If you intend to use IPMI, then ensure baseboard management controller (BMC) interfaces are configured, and have an administration account user name 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 user names and passwords for BMC interfaces on cluster nodes), then decide to reconfigure the BMC interface, or modify IPMI administrator account information after installation.
Time Synchronization	Configure either Windows Time Service (WTS), Network Time Protocol (NTP), or Oracle Cluster Time Synchronization Service (CTSS) to synchronize the time used by each server in the cluster.

Related Topics:

[Configuring Servers for Oracle Grid Infrastructure and Oracle RAC](#) (page 2-1)

You must complete certain operating system tasks on your servers before you install Oracle Grid Infrastructure for a Cluster and Oracle Real Application Clusters.

1.3 Oracle Grid Infrastructure and Oracle RAC Environment Checklist

Review the following environment checklist for all installations.

Table 1-2 Environment Configuration for Oracle Grid Infrastructure and Oracle RAC

Check	Task
Create Users	Review " Creating Installation Groups and Users for Oracle Grid Infrastructure and Oracle RAC (page 5-1)" for information about the users you need to create for your specific requirements. Oracle Installation users have different requirements from Oracle Home users. User names must use only ASCII characters.
Create mount point paths for the software executable files	Oracle recommends that you follow the guidelines for an Optimal Flexible Architecture configuration, as described in the appendix "Optimal Flexible Architecture," in <i>Oracle Database Installation Guide</i> for your platform.
Ensure that the Grid home (the Oracle home path you select for Oracle Grid Infrastructure) uses only ASCII characters	This restriction includes Oracle Installation user names, which are used as a default for some home paths, as well as other directory names you may select for paths.
Unset Oracle software environment variables	If you have set <code>ORA_CRS_HOME</code> as an environment variable, then unset it before starting an installation or upgrade. Do not use <code>ORA_CRS_HOME</code> as a user environment variable. If you have had an existing installation on your system, and you are using the same user account to install this installation, then unset the following environment variables: <code>ORA_CRS_HOME</code> ; <code>ORACLE_HOME</code> ; <code>ORA_NLS10</code> ; <code>TNS_ADMIN</code>

1.4 Oracle Grid Infrastructure Network Checklist

Review all installations to ensure that you have the required hardware, names, and addresses for the cluster.

During installation, you designate interfaces for use as public, private, or Oracle ASM interfaces. You can also designate interfaces that are in use for other purposes, and not available for Oracle Grid Infrastructure use.

Table 1-3 Network Configuration Tasks for Oracle Grid Infrastructure and Oracle RAC

Check	Task
Public Network Hardware	<ul style="list-style-type: none"> Public network switch (redundant switches recommended) connected to a public gateway and to the public interface ports for each cluster member node. Ethernet interface card. Redundant network cards recommended; use NIC teaming so they appear as one Ethernet port name. The switches and network interface cards must be at least 1 GbE. The network protocol is TCP/IP.
Private Network Hardware for the Interconnect	<ul style="list-style-type: none"> Private dedicated network switch (redundant switches recommended, with NIC teaming so they appear as one Ethernet port name), connected to the private interface ports for each cluster member node. The switches and network interface adapters must be at least 1 GbE, with 10 GbE recommended. Alternatively, use InfiniBand for the interconnect.

Table 1-3 (Cont.) Network Configuration Tasks for Oracle Grid Infrastructure and Oracle RAC

Check	Task
Perform Windows-specific network configuration tasks	<ul style="list-style-type: none"> • 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. • Configure the Network Binding Order and Protocol Priorities. Ensure that your public network adapter is first in the binding order, and the private network adapter is second • Deselect Automatic Registration with DNS for the Public Network Interface. To prevent Windows Server 2008 from potentially registering the wrong IP addresses for the node in DNS after a server restart, you must deconfigure the "Register this connection's addresses in DNS" option for the public network adapters. • Manually configure automatic metric values. Windows Server 2012 introduced the Automatic Metric, a new feature that automatically configures the metric for the local routes that are based on link speed. If you use the default values for this feature, OUI sometimes selects the private network interface as the default public host name for the server when installing Oracle Grid Infrastructure. <p>For more information about these tasks, refer to "Network Configuration Tasks for Windows Server Deployments (page 4-5)".</p>
Cluster Names and Addresses	<p>Determine and configure the following names and addresses for the cluster:</p> <ul style="list-style-type: none"> • Cluster name: The name for the cluster, which is entered during installation. The cluster name must be globally unique across all hosts, even across different DNS domains. The cluster name must be at least one character long and no more than 15 characters long. The cluster name should use the same set of characters that is used for host names, in accordance with RFC 1123: Hyphens (-), and single-byte alphanumeric characters (a to z, A to Z, and 0 to 9). • Grid Naming Service Virtual IP Address (GNS VIP): If you plan to use GNS, then configure a GNS name and fixed address on the DNS for GNS VIP, and cluster addresses. GNS domain delegation is mandatory with dynamic public networks (DHCP, autoconfiguration). • Single Client Access Name (SCAN) and addresses when using GNS: Do not configure SCAN names and addresses in your DNS. GNS manages the SCANS. • Manual configuration of SCAN and addresses: If you are not using GNS, then configure a SCAN name to resolve to three addresses on the domain name service (DNS).

Table 1-3 (Cont.) Network Configuration Tasks for Oracle Grid Infrastructure and Oracle RAC

Check	Task
Standard Node Public, Private and Virtual IP names and Addresses	<p>If you are configuring a Standard cluster with Grid Naming Service (GNS), then OUI displays the public and virtual host name addresses labeled as "AUTO" because they are configured automatically. To use this option, you must have configured a subdomain on your DNS that is delegated to GNS for resolution, and you must have a fixed GNS VIP address where the delegated service requests can be routed.</p> <p>If you are not using GNS, and you are configuring a Standard cluster, then configure the following for each node:</p> <ul style="list-style-type: none"> • Public node name and address, configured on the DNS and in the hosts (for example, <code>node1.example.com</code>, address <code>192.0.2.10</code>). The public node name should be the primary host name of each node, which is the name displayed by the <code>hostname</code> command. • Private node address, configured on the private interface for each node. The installer identifies addresses in the private range as private IP addresses by default. For example: <code>10.0.0.10</code> The private subnet that the private interfaces use must connect all the nodes you intend to have as cluster members. • Public node virtual IP name and address (for example, <code>node1-vip.example.com</code>, address <code>192.0.2.11</code>) 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 enables the rerouting of client requests sent to the node if the node is down. Oracle Database uses VIPs for client-to-database connections, so the VIP address must be publicly accessible. Oracle recommends that you provide a name in the format <code>hostname-vip</code>. For example: <code>myclstr2-vip</code>.

1.5 Oracle Grid Infrastructure and Oracle RAC Upgrades Checklist

Review this upgrade checklist if you have an existing Oracle Grid Infrastructure or Oracle RAC installation. A cluster is being upgraded until all cluster member nodes run Oracle Grid Infrastructure 12c Release 1 (12.1), and the new clusterware becomes the active release.

Note: On the Windows platform, to upgrade Oracle Clusterware from releases 10.2.0.5 and 11.1.0.7 to release 12.1, you must perform an interim upgrade to 11.2.0.3 for Oracle Clusterware. After upgrading Oracle Clusterware to release 11.2.0.3, you must move the Oracle Cluster Registry (OCR) and voting disk (VDSK) to Oracle ASM. You must also move any files stored on OCFS on Windows or RAW devices to a supported storage mechanism. You can then upgrade Oracle Clusterware release 11.2.0.3 to 12c Release 1 (12.1).

If you intend to install Oracle RAC, then you must first complete the upgrade to Oracle Grid Infrastructure 12c Release 1 (12.1) on all cluster nodes before you install the Oracle Database 12c Release 1 (12.1) release of Oracle RAC.

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

Check	Task
Review <i>Oracle Database Upgrade Guide</i>	Be familiar with the Oracle Database upgrade process.
Install the latest available patchset release	Upgrades from some earlier patchset releases might not be supported.
Confirm that the Oracle Automatic Storage Management (Oracle ASM) instances use standard Oracle ASM instance names	The default ASM SID for a single-instance database is <code>+ASM</code> , and the default SID for ASM on Oracle Real Application Clusters nodes is <code>+ASMnode#</code> , where <code>node#</code> is the node number. With Oracle Grid Infrastructure 11.2.0.1 and later, nondefault Oracle ASM instance names are not supported.. If you have nondefault Oracle ASM instance names, then before you upgrade your cluster, use your existing release <code>srvctl</code> to remove individual Oracle ASM instances with nondefault names, and add Oracle ASM instances with default names.
Check Network Addresses for Standard Oracle Grid Infrastructure deployments	Ensure the following IP addresses conditions for the public and private networks are met: <ul style="list-style-type: none"> The private and public IP addresses are in unrelated, separate subnets. The private subnet should be in a dedicated private subnet. The public and virtual IP addresses, including SCAN addresses, are in the same subnet (the range of addresses permitted by the subnet mask for the subnet network). Neither private nor public IP addresses use a link local subnet (169.254.*.*).
Verify the current operating system is supported for the new release	Confirm that you are using a supported operating system, patch release, and all required operating system packages for the new Oracle Grid Infrastructure installation.
Run the <code>ocrcheck</code> command	Confirm Oracle Cluster Registry (OCR) file integrity. If this check fails, then repair the OCRs before proceeding.
Review Oracle 12c Upgrade Companion (My Oracle Support Note 1462240.1)	This document contains the most current information regarding other upgrade issues: https://support.oracle.com/CSP/main/article?cmd=show&type=NOT&id=1462240.1
Run the Oracle Database Pre-Upgrade utility	The Pre-Upgrade utility is a SQL script located in the path <code>%ORACLE_HOME%\rdbms\admin</code> . Run this script after you complete the Oracle Grid Infrastructure installation to prepare your databases for upgrades. For more information, review My Oracle Support note 884522.1: https://support.oracle.com/CSP/main/article?cmd=show&type=NOT&id=884522.1

1.6 Oracle Grid Infrastructure Storage Configuration Tasks

Review the following storage configuration task checklist for all installations:

Table 1-4 Oracle Grid Infrastructure Storage Configuration Checks

Check	Task
Provide paths for Oracle Clusterware files	<p>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 on Oracle ASM because the files created during installation must be available to all cluster member nodes.</p> <ul style="list-style-type: none"> • Voting files are files that Oracle Clusterware uses to verify cluster node membership and status. • Oracle Cluster Registry (OCR) files contain cluster and database configuration information for Oracle Clusterware.

1.7 Oracle Grid Infrastructure Starting the Installation Tasks

Use the following checklist to complete pre-installation tasks.

Check	Task
Check running Oracle processes, and shut down if necessary	<ul style="list-style-type: none"> • On a node with a standalone database not using Oracle ASM: You do not need to shut down the database while you install Oracle Grid Infrastructure. • On an Oracle RAC Database node: This installation requires an upgrade of Oracle Clusterware, as 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.
Ensure scheduled tasks do not run during installation	<p>If the installer is running when daily scheduled tasks start, then you may encounter unexplained installation problems if your scheduled task is performing cleanup, and temporary files are deleted before the installation is finished. Oracle recommends that you complete installation before daily scheduled tasks are run, or disable daily scheduled tasks that perform file and directory cleanup until after the installation completes.</p>
Decide to install other languages	<p>During installation, you are asked if you want the user interface text translated into languages other than the default, which is English. If the language set for the operating system is not supported by the installer, then by default the installer runs in the English language.</p> <p>Refer to <i>Oracle Database Globalization Support Guide</i> for detailed information about character sets and language configuration.</p>
Obtain proxy realm authentication information if you have a proxy realm on your network	<p>During installation, the installer attempts to download Oracle software updates. If you have a proxy realm configured, then you must provide the proxy realm information and user authentication information to access the Internet through the proxy service. If you do not have a proxy realm, then leave the proxy authentication fields blank.</p>

Check	Task
Install the Oracle Grid Infrastructure Management Repository	<p data-bbox="753 275 1438 447">When performing an Advanced installation of Oracle Grid Infrastructure 12c Release 12.1.0.1, select the option to install the Oracle Grid Infrastructure Management Repository to monitor and analyze cluster performance. For Oracle Grid Infrastructure 12c Release 12.1.0.2 and later the Oracle Grid Infrastructure Management Repository is installed automatically.</p> <p data-bbox="753 457 1438 541">If you do not install the Oracle Grid Infrastructure Management Repository, then you permanently disable the following features for your installation:</p> <ul data-bbox="753 552 1146 642" style="list-style-type: none"><li data-bbox="753 552 1057 579">• Cluster Health Monitor<li data-bbox="753 583 1146 611">• Quality of Service Management<li data-bbox="753 615 976 642">• Memory Guard <p data-bbox="753 653 1438 730">If you decide later that you want to enable these features, then you must reinstall Oracle Grid Infrastructure with the Oracle Grid Infrastructure Management Repository.</p>

Configuring Servers for Oracle Grid Infrastructure and Oracle RAC

You must complete certain operating system tasks on your servers before you install Oracle Grid Infrastructure for a Cluster and Oracle Real Application Clusters.

The values provided in this chapter are for installation minimums only. Oracle recommends that you configure production systems in accordance with planned system loads.

[Checking Server Hardware and Memory Configuration](#) (page 2-1)

Perform these tasks to gather your current system information.

[General Server Requirements](#) (page 2-5)

Verify that servers where you install Oracle Grid Infrastructure meet the minimum requirements for installation.

[Server Minimum Hardware and Memory Requirements](#) (page 2-5)

Each system must meet certain minimum hardware and memory requirements.

[Server Minimum Storage Requirements](#) (page 2-5)

Each system must meet certain minimum storage requirements.

2.1 Checking Server Hardware and Memory Configuration

Perform these tasks to gather your current system information.

[Checking the Available RAM on Windows Systems](#) (page 2-2)

Use the control panel to check the available RAM on each server.

[Checking the Currently Configured Virtual Memory on Windows Systems](#) (page 2-2)

Virtual memory (also known as a paging file) stores information that cannot fit in RAM, the main memory for the computer. All processes share the paging files, and a lack of space in the paging files can prevent processes from allocating memory.

[Checking the Operating System Version](#) (page 2-2)

To determine whether your computer is running a 64-bit (x64) Windows operating system, perform these steps.

[Checking the System Processor Type](#) (page 2-2)

To view your processor type (32-bit or 64-bit), perform these steps.

[Checking the Available Disk Space for Oracle Home Directories](#) (page 2-3)

Additional disk space on a cluster file system is required for the Oracle Grid Infrastructure Management Repository, Oracle Cluster Registry (OCR) and voting files used by Oracle Clusterware.

[Checking the Available TEMP Disk Space](#) (page 2-4)

The amount of disk space available in the TEMP directory is equivalent to the total amount of free disk space, minus what is needed to install the Oracle software.

2.1.1 Checking the Available RAM on Windows Systems

Use the control panel to check the available RAM on each server.

The minimum required RAM is 4 gigabyte (GB) for Oracle Grid Infrastructure for a Cluster installations, including installations where you plan to install Oracle RAC.

To determine the physical RAM size, for a computer, you can use either of the following methods:

- Open **System** in the control panel and Select the **General** tab.
- Alternatively, start the Windows Task Manager, then select the **Performance** tab to view the available memory for your system.

2.1.2 Checking the Currently Configured Virtual Memory on Windows Systems

Virtual memory (also known as a paging file) stores information that cannot fit in RAM, the main memory for the computer. All processes share the paging files, and a lack of space in the paging files can prevent processes from allocating memory.

Oracle recommends that you set the paging file size to match the amount of RAM available on the server, up to a maximum of 16 GB. If possible, split the paging file into multiple files on multiple physical devices. This configuration encourages parallel access to virtual memory, and improves the software performance.

1. From the Control panel, select **System**.
2. In the System Properties window, select the **Advanced** tab.
3. Under Performance, click **Performance Options**, or **Settings**.
4. In the Performance Options window, click the **Advanced** tab.

The virtual memory configuration is displayed at the bottom of the window.

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

2.1.3 Checking the Operating System Version

To determine whether your computer is running a 64-bit (x64) Windows operating system, perform these steps.

1. Right-click My Computer and select **Properties**.
2. On the General tab, under the heading of System, view the displayed text.

You will see text similar to "64-bit Operating System" if you have the x64 version of the operating system installed.

2.1.4 Checking the System Processor Type

To view your processor type (32-bit or 64-bit), perform these 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.

2.1.5 Checking the Available Disk Space for Oracle Home Directories

Additional disk space on a cluster file system is required for the Oracle Grid Infrastructure Management Repository, Oracle Cluster Registry (OCR) and voting files used by Oracle Clusterware.

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

- The Oracle RAC software and log files
- The shared data files and, optionally, the shared Fast Recovery Area in an Oracle ASM disk group

If you use standard redundancy for Oracle Clusterware files, which is 3 Oracle Cluster Registry (OCR) files and 3 voting files, then you should have at least 2 GB of disk space available on three separate physical disks reserved for storing the Oracle Clusterware files in Oracle ASM.

Note: You cannot install OCR or voting files (Oracle Clusterware files) on raw partitions. You can install Oracle Clusterware files only on Oracle ASM. Raw devices can be used as Oracle ASM disks.

To ensure high availability of OCR or voting files on Oracle ASM, you need to 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.

If the temp space and the Grid home are on the same file system, then add together their respective requirements for the total minimum space required for that file system.

Note:

Oracle recommends that you choose the Oracle Grid Infrastructure Management Repository option when installing Oracle Grid Infrastructure. When you choose this option, OUI configures a Oracle Grid Infrastructure Management Repository database on one of the nodes in the cluster.

Starting with Oracle Grid Infrastructure 12c Release 12.1.0.2, installation of the Oracle Grid Infrastructure Management Repository is no longer optional and it is installed automatically.

To determine the amount of available free disk space, there are two methods you can use:

1. Using the Computer properties window:

- a. Open the **Start** menu, then click **Computer**.
 - b. View the free disk space for each drive.
 - c. Right-click the drive on which you plan to install the Oracle software and select **Properties** to view additional information about the disk space for that drive.
2. Using the Disk Management Microsoft Management Console (MMC) plug-in:
- a. From the **Start** menu, select **Run...**
 - b. In the Run window, type in `Diskmgmt.msc` to open the Disk Management graphical user interface (GUI).

The Disk Management GUI displays the available space on the available file systems.

See Also:

- ["Configuring Storage for Oracle Grid Infrastructure and Oracle RAC \(page 6-1\)"](#)
 - *Oracle Automatic Storage Management Administrator's Guide*
-
-

2.1.6 Checking the Available TEMP Disk Space

The amount of disk space available in the TEMP directory is equivalent to the total amount of free disk space, minus what is needed to install the Oracle software.

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

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 temporary disk space is still less than the required amount, then increase the partition size of the disk or set the TEMP environment variable to point to a different hard drive. Ensure 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. Log in as or switch to the user that will be performing the installation.
See "[About the Oracle Installation User \(page 5-2\)](#)"
2. From the Control Panel, select **System**.
3. Select **Advanced System Settings**.
4. In the System Properties windows, select the **Advanced** tab, then click **Environment Variables**.
5. Modify the value of the TEMP environment variable in the user variables list.

2.2 General Server Requirements

Verify that servers where you install Oracle Grid Infrastructure meet the minimum requirements for installation.

- Select servers with the same instruction set architecture as cluster members.
- Ensure servers run the same operating system binary.
- Oracle Grid Infrastructure installations and Oracle Real Application Clusters (Oracle RAC) support servers with different hardware in the same cluster. Your cluster can have nodes with CPUs of different speeds or sizes, but Oracle recommends that you use nodes with the same hardware configuration.

Oracle recommends that if you configure clusters using different configuration, that you categorize cluster nodes into homogenous pools as part of your server categorization management policy.

See Also: *Oracle Clusterware Administration and Deployment Guide* for more information about server state and configuration attributes, and about using server pools to manage resources and workloads

2.3 Server Minimum Hardware and Memory Requirements

Each system must meet certain minimum hardware and memory requirements.

Table 2-1 *Minimum Hardware and Memory Requirements for Oracle Grid Infrastructure Installation*

Hardware Component	Requirements
Memory (RAM)	Oracle Grid Infrastructure installations: At least 4 gigabyte (GB) of physical RAM for Oracle Grid Infrastructure for a cluster installations, including installations where you plan to install Oracle RAC
Virtual memory (swap)	If your server has between 4 GB and 16 GB of RAM, then you should configure a paging file of at least the same size as the RAM. If your server has more than 16 GB of RAM, then the paging file should be 16 GB.
Video adapter	256 color and at least 1024 x 768 display resolution, so that OUI displays correctly while performing a system console-based installation
Processor	x64: Intel Extended Memory 64 Technology (EM64T) or AMD 64

Note: 32-bit systems are no longer supported for Oracle Grid Infrastructure and Oracle RAC.

2.4 Server Minimum Storage Requirements

Each system must meet certain minimum storage requirements.

- 1 GB of space in the %TEMP% directory.

If the free space available in the %TEMP% directory is less than what is required, then complete one of the following steps:

- Delete unnecessary files from the %TEMP% directory to make available the space required.
- Extend the file system that contains the %TEMP% directory. If necessary, contact your system administrator for information about extending file systems.
- At least 7 GB of space for the Oracle Grid Infrastructure for a cluster home (Grid home). Oracle recommends that you allocate 100 GB to allow additional space for patches.
- At least 3.5 GB of space for the Oracle base of the Oracle Grid Infrastructure Installation user. The Oracle base includes Oracle Clusterware and Oracle ASM log files.
- If you intend to install Oracle Database, then allocate 5.89 GB of disk space for the Oracle home (the location for the Oracle Database software binaries).

If you plan to configure automated database backups for your Oracle Database, then you require additional space either in a file system or in an Oracle Automatic Storage Management disk group for the Fast Recovery Area.

Note: The base directory for Oracle Grid Infrastructure 12c and the base directory for Oracle RAC 12c must be different from the directories used by any Oracle RAC 11g Release 2 installations.

[Disk Format Requirements](#) (page 2-6)

Oracle recommends that you install Oracle software, or binaries, on New Technology File System (NTFS) formatted drives or partitions.

See Also:

- *Oracle Automatic Storage Management Administrator's Guide*
 - *Oracle Database Backup and Recovery User's Guide* for more information about Fast Recovery Area sizing
-
-

2.4.1 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 basic disks or disk partitions, called **raw partitions**, managed by Oracle ASM.

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

Configuring Operating Systems for Oracle Grid Infrastructure and Oracle RAC

Complete operating system configuration requirements and checks before you start the Oracle Grid Infrastructure installation.

[Reviewing Operating System and Software Upgrade Best Practices](#) (page 3-1)
Review the general planning guidelines and platform-specific information about upgrades and migration.

[Reviewing Operating System Security Common Practices](#) (page 3-3)
Secure operating systems are an important basis for general system security.

[Logging In To a Remote Windows Server](#) (page 3-3)
During installation, you are required to perform tasks as an Administrator user on the cluster nodes.

[Checking Hardware and Software Certification on My Oracle Support](#) (page 3-4)
The My Oracle Support website also provides compatible client and database releases, patches, and workaround information for bugs.

[Identifying Software Requirements](#) (page 3-5)
Depending on the products that you intend to install, verify that the required operating system software is installed on each node of your cluster.

[Oracle Enterprise Manager Requirements](#) (page 3-8)
Verify that your installed Oracle Enterprise Manager meets the minimum requirements for use with Oracle Grid Infrastructure.

[Installation Requirements for Web Browsers](#) (page 3-8)
Web browsers are required to use Oracle Enterprise Manager Database Express and Oracle Enterprise Manager Cloud Control.

[Configuring Time Synchronization for the Cluster](#) (page 3-8)
Oracle Clusterware requires the same time zone setting on all cluster nodes.

3.1 Reviewing Operating System and Software Upgrade Best Practices

Review the general planning guidelines and platform-specific information about upgrades and migration.

[General Upgrade Best Practices](#) (page 3-2)
Review these best practices before upgrading a current installation of Oracle Grid Infrastructure.

[Oracle ASM Upgrade Notifications](#) (page 3-2)

Be aware of these issues regarding Oracle ASM upgrades.

[Rolling Upgrade Procedure Notifications](#) (page 3-3)

Be aware of this information regarding rolling upgrades.

3.1.1 General Upgrade Best Practices

Review these best practices before upgrading a current installation of Oracle Grid Infrastructure.

If you have an existing Oracle installation, then do the following:

- Record the release numbers, patches, and other configuration information
- Review upgrade procedures for your existing installation
- Review Oracle upgrade documentation before proceeding with installation, to decide how you want to proceed

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

To find the most recent software updates, and to find best practices recommendations about preupgrade, postupgrade, compatibility, and interoperability, see Oracle 12c Upgrade Companion (My Oracle Support Note 1462240.1):

<https://support.oracle.com/CSP/main/article?cmd=show&type=NOT&id=1462240.1>

See Also: [How to Upgrade to Oracle Grid Infrastructure 12c Release 1](#) (page D-1)

3.1.2 Oracle ASM Upgrade Notifications

Be aware of these issues regarding Oracle ASM upgrades.

- You can upgrade Oracle Automatic Storage Management (Oracle ASM) 11g release 1 (11.1) and later without shutting down an 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 are upgrading from Oracle ASM 10g, then you must shut down the entire Oracle ASM cluster to perform the upgrade.
- The location of the Oracle ASM home changed in Oracle Grid Infrastructure 11g release 2 (11.2) so that Oracle ASM is installed with Oracle Clusterware in the Oracle Grid Infrastructure home (Grid home).

If you have an existing Oracle ASM home from a earlier release, then you may want to consider other configuration changes to simplify or customize storage administration.

- When upgrading from Oracle Grid Infrastructure 11g release 2 (11.2) or Oracle Grid Infrastructure 12c release 1 (12.1) to a later release, if there is an outage during the rolling upgrade, then when you restart the upgrade, ensure that you start the earlier release of Oracle Grid Infrastructure. You must then bring the

Oracle ASM cluster back in the rolling migration mode, because two nodes of different releases cannot run in the cluster.

- You must be an Administrator user to upgrade Oracle ASM.

3.1.3 Rolling Upgrade Procedure Notifications

Be aware of this information regarding rolling upgrades.

- 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.

- Using mixed operating system versions is supported during upgrade only.

Be aware that mixed operating systems are supported only for the duration of an upgrade, over the period of a few hours.

- Oracle Clusterware does not support nodes that have processors with different instruction set architectures (ISAs) in the same cluster. Each node must be binary compatible with the other nodes in the cluster.

For example, you cannot have one node using an Intel 64 processor and another node using an IA-64 (Itanium) processor in the same cluster. You could have one node using an Intel 64 processor and another node using an AMD64 processor in the same cluster because the processors use the same x86-64 ISA and run the same binary release of Oracle software.

Note: Your cluster can have nodes with processors of different manufacturers, speeds, or sizes, but this is not recommended.

3.2 Reviewing Operating System Security Common Practices

Secure operating systems are an important basis for general system security.

- Ensure that your operating system deployment is in compliance with common security practices as described in your operating system vendor security guide.

3.3 Logging In To a Remote Windows Server

During installation, you are required to perform tasks as an Administrator user on the cluster nodes.

Configure remote access for the user accounts that you want to enable for remote display.

[Windows Telnet Services Support](#) (page 3-4)

Ensure that the Telnet service is installed and started.

[Configuring Remote Desktop Services and Remote Desktop Connections](#) (page 3-4)

On Windows, Oracle supports installing, configuring, and running Oracle Database software through Remote Desktop Services (formerly known as Terminal Services).

3.3.1 Windows Telnet Services Support

Ensure that the Telnet service is installed and started.

Microsoft changed the name from Terminal Services to Remote Desktop Services with the release of Windows Server 2008 R2. Microsoft also introduced the Remote Desktop Connections client, which can be used to connect to a Windows server that has Terminal Services installed.

3.3.2 Configuring Remote Desktop Services and Remote Desktop Connections

On Windows, Oracle supports installing, configuring, and running Oracle Database software through Remote Desktop Services (formerly known as Terminal Services).

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.

[Configuring Remote Desktop Connections with Windows Server 2008 or Windows Server 2008 R2](#) (page 3-4)

Due to changes in Windows 2008 and Windows Server 2008 R2, you no longer need to connect to session 0 for installation.

See Also:

- The Microsoft website for more information about Remote Desktop Services: <http://www.microsoft.com/>
 - The My Oracle Support website for the latest Remote Desktop Services information: <https://support.oracle.com/>
-
-

3.3.2.1 Configuring Remote Desktop Connections with Windows Server 2008 or Windows Server 2008 R2

Due to changes in Windows 2008 and Windows Server 2008 R2, you no longer need to connect to session 0 for installation.

- Use the Remote Desktop Connection client, but do not specify the `/console` switch, as shown in the following example:

```
mstsc /v:servername /f
```

3.4 Checking Hardware and Software Certification on My Oracle Support

The My Oracle Support website also provides compatible client and database releases, patches, and workaround information for bugs.

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 website for the most up-to-date list of certified hardware platforms and operating system versions.

- View certification information on both Oracle Technology Network (OTN) and My Oracle Support.

The OTN certification page can be found on the following website: <http://www.oracle.com/technetwork/database/options/clustering/overview/index.html>

- View hardware certification details for Microsoft Windows platforms on Oracle Technology Network, at the following URL:

<http://www.oracle.com/technetwork/database/clustering/tech-generic-windows-new-166584.html>

- View My Oracle Support for guidance about supported hardware options that can assist you with your purchasing decisions and installation planning.

The My Oracle Support certifications page contains more detailed information about certified hardware and has information specific to each release and platform. My Oracle Support is available at the following URL:

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

You must register online before using My Oracle Support. Use the steps described in the support document "Locate Oracle Database Server Certification Information for Microsoft Windows Platforms (Doc ID 1062972.1)" to locate the certification information for your Windows operating system.

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

3.5 Identifying Software Requirements

Depending on the products that you intend to install, verify that the required operating system software is installed on each node of your cluster.

Requirements listed in this document are current as of the date listed on the title page. To obtain the most current information about operating system requirements, see the online version in the Oracle Help Center at the following URL:

docs.oracle.com

OUI performs checks on 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.

Note: 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 3-1 Oracle Grid Software Requirements for Windows Systems

Requirement	Value
System Architecture	<p>Processor: AMD64, or Intel Extended memory (EM64T)</p> <hr/> <p>Note: Oracle provides only x64 releases of Oracle Database with Oracle RAC for Windows.</p> <hr/> <p>The x64 release of Oracle RAC runs on the x64 version of Windows on AMD64 and EM64T hardware. For additional information, visit My Oracle Support, as described in "Checking Hardware and Software Certification on My Oracle Support (page 3-4)".</p>
Operating system	<p>Oracle Grid Infrastructure and Oracle RAC for x64 Windows:</p> <ul style="list-style-type: none"> • Windows Server 2008 x64 with service pack 2 (SP2) - Standard, Enterprise, DataCenter, and Web editions. • Windows Server 2008 R2 x64 - Foundation, Standard, Enterprise, DataCenter, and Web editions. • Windows Server 2012 x64 - Standard, Datacenter, Essentials, and Foundation editions • Windows Server 2012 R2 x64 - Standard, Datacenter, Essentials, and Foundation editions <p>The Windows Multilingual User Interface Pack is supported. The Server Core option is not supported.</p> <hr/> <p>Note: Oracle Clusterware, Oracle ASM and Oracle RAC 12c Release 1 (12.1) are not supported on x86 (32-bit) Windows operating systems.</p>
Compilers	<p>The following components are supported with the Microsoft Visual C++ 2010 SP1, Microsoft Visual C++ 2012, Microsoft Visual C++ 2013 Update 2, and Intel 12.1 C compilers:</p> <ul style="list-style-type: none"> • Oracle Call Interface (OCI) • Pro*C/C++ (not supported with Microsoft Visual C++ 2013 Update 2 at this time of release.) • External callouts • Oracle XML Developer's Kit (XDK) <p>Oracle C++ Call Interface is supported with:</p> <ul style="list-style-type: none"> • Microsoft Visual C++ 2010 SP1 • Microsoft Visual C++ 2012 - OCCI libraries are installed under <code>ORACLE_HOME\oci\lib\msvc\vc11</code>. When developing OCCI applications with MSVC++ 2012, ensure that the OCCI libraries are correctly selected from this directory for linking and executing. • Microsoft Visual C++ 2013 - OCCI libraries are installed under <code>ORACLE_HOME\oci\lib\msvc\vc12</code>. When developing OCCI applications with MSVC++ 2013, ensure that the OCCI libraries are correctly selected from this directory for linking and executing. • Intel 12.1 C compilers with Microsoft Visual Studio 2010 STLs

If you are currently running an operating system version that is not supported by Oracle Database 12c Release 1 (12.1), such as Windows Server 2003 x86, then see *Oracle Database Platform Guide for Microsoft Windows* for upgrade instructions.

Note:

The platform-specific hardware and software requirements included in this guide were current when 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 website for the most up-to-date list of certified hardware platforms and operating system versions:

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

Windows Firewall Feature on Windows Servers (page 3-7)

When installing Oracle Grid Infrastructure software or Oracle RAC software on Windows servers, it is mandatory to disable the Windows Firewall feature.

3.5.1 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), Network Configuration Assistant (NETCA), and Oracle Database Configuration Assistant (DBCA) will fail during Oracle RAC installation. Thus, you must disable the firewall on all the nodes of a cluster before performing an Oracle RAC installation.

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

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.

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 patch bundle or an emergency 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.

Related Topics:

[Configure Exceptions for the Windows Firewall](#) (page 8-4)

3.6 Oracle Enterprise Manager Requirements

Verify that your installed Oracle Enterprise Manager meets the minimum requirements for use with Oracle Grid Infrastructure.

All Oracle Enterprise Manager products that you use on your system must be of the same release. Oracle Database 12c Release 1 (12.1) does not support releases of Enterprise Manager earlier than Oracle Enterprise Manager Cloud Control 12c.

See Also: *Oracle Enterprise Manager Cloud Control Basic Installation Guide* available on the Enterprise Manager Cloud Control installation media

3.7 Installation Requirements for Web Browsers

Web browsers are required to use Oracle Enterprise Manager Database Express and Oracle Enterprise Manager Cloud Control.

Web browsers must support Java Script, and the HTML 4.0 and CSS 1.0 standards. For a list of browsers that meet these requirements, see the Oracle Enterprise Manager certification matrix on My Oracle Support: <https://support.oracle.com>

3.8 Configuring Time Synchronization for the Cluster

Oracle Clusterware requires the same time zone setting on all cluster nodes.

[About Cluster Time Synchronization](#) (page 3-8)

For the Microsoft Windows operating system, there are three different methods you can use to synchronize the time between the nodes of your cluster.

[Configuring the Windows Time Service](#) (page 3-9)

The Windows Time service (W32Time) provides network clock synchronization on computers running Microsoft Windows.

[Configuring Network Time Protocol](#) (page 3-10)

The Network Time Protocol (NTP) is a client/server application.

[Configuring Cluster Time Synchronization Service](#) (page 3-10)

Cluster Time Synchronization Service (CTSS) is provided by Oracle to synchronize the time across the nodes in your cluster.

3.8.1 About Cluster Time Synchronization

For the Microsoft Windows operating system, there are three different methods you can use to synchronize the time between the nodes of your cluster.

During installation, the installation process picks up the time zone environment variable setting of the Oracle Installation user for Oracle Grid Infrastructure on the node where OUI runs. Then the installation process uses that time zone value on all nodes as the default TZ environment variable setting for all processes managed by Oracle Clusterware. The time zone default is used for databases, Oracle ASM, and any other managed processes.

You have three options for time synchronization between cluster nodes:

- Windows Time service
- An operating system configured network time protocol (NTP)
- Oracle Cluster Time Synchronization Service

Oracle Cluster Time Synchronization Service is designed for organizations whose cluster servers are unable to access NTP services. If you use NTP, then the Oracle Cluster Time Synchronization daemon (ctssd) starts in observer mode. If neither NTP or the Windows Time service is found, then ctssd starts in active mode and synchronizes time among cluster members without contacting an external time server.

Note:

- Before starting the installation of Oracle Grid Infrastructure, Oracle recommends that you ensure the clocks on all nodes are set to the same time.
 - The IP address for an NTP server can be an IPv6 address.
-
-

3.8.2 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 jumps in time and allow the time to gradually match with the reference time. Restart the Windows Time service after you complete this task.

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

```
C:\> w32tm /register
```

2. To modify the Windows Time service to work in an Oracle RAC environment, perform the following steps:

- a. Open the Registry Editor (regedit)
- b. Locate the HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\W32Time\Config key.
- c. Set the following Windows Time service parameters to these decimal values:
 - MaxPosPhaseCorrection to 600
 - MaxNegPhaseCorrection to 600
 - MaxAllowedPhaseOffset to 600

These parameter settings specify that small time adjustments are allowed when the time difference between the reference and cluster nodes is under 10 minutes.

Note: You should configure the Windows Time service to meet the requirements of your environment, with assistance from Microsoft, if necessary. The recommended settings provided for the three parameters are the settings that Oracle recommends to allow time adjustments to happen through *slewing* (gradually adjusting the clock using small changes) rather than in large *steps* (setting the clock to a new time). Large time adjustments in a single step are not supported.

3. To put the changes into effect, use the following command:

```
C:\> w32tm /config /update
```

See Also: For more information about using and configuring the Windows Time Service, see:

- Microsoft® Support article ID 816042: "How to configure an authoritative time server in Windows Server"
 - Microsoft® Support article ID 939322: "Support boundary to configure the Windows Time service for high accuracy environments"
 - "The NTP FAQ and HOWTO" at <http://www.ntp.org/ntpfaq/>
-

3.8.3 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 cluster node, you must start the NTP service with the `-x` option to prevent time from being adjusted backward. Restart the network time protocol service after you complete this task.

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
```

3.8.4 Configuring Cluster Time Synchronization Service

Cluster Time Synchronization Service (CTSS) is provided by Oracle to synchronize the time across the nodes in your cluster.

When OUI discovers that neither the Windows Time or NTP services 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 found on the server, then the Cluster Time Synchronization Service is started in observer mode, and

no active time synchronization is performed by the Cluster Time Synchronization Service within the cluster.

To use Cluster Time Synchronization Service to provide synchronization service in the cluster, disable the Windows Time service and stop the NTP service. If you have an NTP service on your server but you cannot use the service to synchronize time with a time server, then you must deactivate and deinstall the NTP to use Cluster Time Synchronization Service.

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

```
crsctl check ctss
```

Configuring Networks for Oracle Grid Infrastructure and Oracle RAC

Check that you have the networking hardware and internet protocol (IP) addresses required for an Oracle Grid Infrastructure for a cluster installation.

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 website. See "[Checking Hardware and Software Certification on My Oracle Support](#) (page 3-4)" for instructions.

[Network Interface Hardware Requirements](#) (page 4-1)

Review these requirements to ensure that you have the minimum network hardware technology for Oracle Grid Infrastructure clusters.

[Oracle Grid Infrastructure IP Name and Address Requirements](#) (page 4-8)

The Oracle Grid Naming Service (GNS) is used with large clusters to ease network administration cost.

[Intended Use of Network Adapters](#) (page 4-19)

During installation, you are asked to identify the planned use for each network adapter (or network interface) that Oracle Universal Installer (OUI) detects on your cluster node.

[Broadcast Requirements for Networks Used by Oracle Grid Infrastructure](#) (page 4-19)

Broadcast communications address resolution protocol (ARP) must work properly across all the public and private interfaces configured for use by Oracle Grid Infrastructure.

[Multicast Requirements for Networks Used by Oracle Grid Infrastructure](#) (page 4-19)

On each cluster member node the Oracle multicast DNS (mDNS) daemon uses multicasting on all network interfaces to communicate with other nodes in the cluster.

4.1 Network Interface Hardware Requirements

Review these requirements to ensure that you have the minimum network hardware technology for Oracle Grid Infrastructure clusters.

[Network Requirements for Each Node](#) (page 4-2)

Verify that servers where you install Oracle Grid Infrastructure meet the minimum network requirements for installation.

[Network Requirements for the Private Network](#) (page 4-2)

The following is a list of requirements for the private network configuration:

[Network Requirements for the Public Network](#) (page 4-3)

The following is a list of requirements for the public network configuration:

[IPv6 Protocol Support for Windows](#) (page 4-4)

Oracle Grid Infrastructure and Oracle RAC support the standard IPv6 address notations specified by RFC 2732 and global and site-local IPv6 addresses as defined by RFC 4193.

[Using Multiple Public Network Adapters](#) (page 4-5)

You can configure multiple network adapters for the public network interface.

[Network Configuration Tasks for Windows Server Deployments](#) (page 4-5)

Microsoft Windows Server has many unique networking features. Some of these features require special configuration to enable Oracle software to run correctly on Windows Server.

[Network Interface Configuration Options for Performance](#) (page 4-8)

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.

4.1.1 Network Requirements for Each Node

Verify that servers where you install Oracle Grid Infrastructure meet the minimum network requirements for installation.

- 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 supported.
- 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, or the **interconnect**. Each network adapter has a network connection name.

Note: Do not use the names PUBLIC and PRIVATE (all caps) for the public or private (interconnect) network connection names.

- Network adapters must be at least 1 GbE, with 10 GbE recommended.
- If you plan to use Oracle ASM running in a different cluster for storage, then you must either have a third network adapter for accessing the ASM network, or use the same network adapter that is used for the private network interface.

4.1.2 Network Requirements for the Private Network

The following is a list of requirements for the private network configuration:

- The private network connection names must be different from the network connection names used for the public network.
- Each node's private interface for interconnects must be on the same subnet.

For example, if the private interfaces have a subnet mask of 255.255.255.0, then your private network is in the range 192.168.0.0–192.168.0.255, and your private addresses must be in the range of 192.168.0.[0-255]. If the private interfaces have a subnet mask of 255.255.0.0, then your private addresses can be in the range of 192.168.[0-255].[0-255]

- The private network connection name cannot contain any multibyte language characters. The private network connection names are case-sensitive.
- Both IPv4 and IPv6 addresses are supported.
- If you use OUI to install Oracle Grid Infrastructure, then the private network connection names associated with the private network adapters must be the same on all nodes.

For example, if you have a two-node cluster, and `PrivNIC` is the private network connection name for `node1`, then `PrivNIC` must be the private network connection name for `node2`.

- For the private network, the network adapters must use high-speed network adapters and switches that support TCP/IP (minimum requirement is 1 Gigabit Ethernet, 10GbE recommended). Alternatively, use InfiniBand for the interconnect.

Note:

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.

- For the private network adapters, the endpoints of all designated network connection names must be completely reachable on the network. There should be no node that is not connected to every other node on the private network. You can test if an interconnect interface is reachable using `ping`.

4.1.3 Network Requirements for the Public Network

The following is a list of requirements for the public network configuration:

- The public network connection names must be different from the private network connection names.
- Public network connection names are case-sensitive.
- The public network connection name cannot contain any multibyte language characters.
- If you use OUI to install Oracle Grid Infrastructure, then the public network connection names associated with the public network adapters for each network must be the same on all nodes.

For example, if you have a two-node cluster, you cannot configure network adapters on `node1` with `NIC1` as the public network connection name and on `node2` have `NIC2` as the public network connection name. Public network connection names must be the same, so you must configure `NIC1` as the public network connection name on *both* nodes.

- For the public network, each network adapter must support transmission control protocol and internet protocol (TCP/IP).
- The network adapters must use high-speed network adapters and switches that support TCP/IP (minimum requirement is 1 Gigabit Ethernet, 10GbE recommended).

4.1.4 IPv6 Protocol Support for Windows

Oracle Grid Infrastructure and Oracle RAC support the standard IPv6 address notations specified by RFC 2732 and global and site-local IPv6 addresses as defined by RFC 4193.

Cluster member node interfaces can be configured to use IPv4, IPv6, or both types of Internet protocol addresses. However, be aware of the following:

- **Configuring public VIPs:** During installation, you can configure VIPs for a given public network as IPv4 or IPv6 types of addresses. You can configure an IPv6 cluster by selecting VIP and SCAN names that resolve to addresses in an IPv6 subnet for the cluster, and selecting that subnet as public during installation. After installation, you can also configure cluster member nodes with a mixture of IPv4 and IPv6 addresses.

If you install using static virtual IP (VIP) addresses in an IPv4 cluster, then the VIP names you supply during installation should resolve only to IPv4 addresses. If you install using static IPv6 addresses, then the VIP names you supply during installation should resolve only to IPv6 addresses.

During installation, you cannot configure the cluster with VIP and SCAN names that resolve to both IPv4 and IPv6 addresses. For example, you cannot configure VIPs and SCANS on some cluster member nodes to resolve to IPv4 addresses, and VIPs and SCANS on other cluster member nodes to resolve to IPv6 addresses. Oracle does not support this configuration.

- **Configuring private IP interfaces (interconnects):** You must configure the private network as an IPv4 network. IPv6 addresses are not supported for the interconnect.
- **Redundant network interfaces:** If you configure redundant network interfaces for a public or VIP node name, then configure both interfaces of a redundant pair to the same address protocol. Also ensure that private IP interfaces use the same IP protocol. Oracle does not support names using redundant interface configurations with mixed IP protocols. You must configure both network interfaces of a redundant pair with the same IP protocol.
- **GNS or Multi-cluster addresses:** Oracle Grid Infrastructure supports IPv4 DHCP addresses, and IPv6 addresses configured with the Stateless Address Autoconfiguration protocol, as described in RFC 2462.

Note: Link-local and site-local IPv6 addresses as defined in RFC 1884 are not supported

See Also:

- <http://www.ietf.org/rfc/rfc2732.txt> for RFC 2732, and information about IPv6 notational representation
 - <http://www.ietf.org/rfc/rfc3513.txt> for RFC 3513, and information about proper IPv6 addressing
 - <http://www.ietf.org/rfc/rfc2462.txt> for RFC 2462, and information about IPv6 Stateless Address Autoconfiguration protocol
 - *Oracle Database Net Services Administrator's Guide* for more information about network communication and IP address protocol options
-
-

4.1.5 Using Multiple Public Network Adapters

You can configure multiple network adapters for the public network interface.

Oracle recommends that you do not identify multiple public network connection names during Oracle Grid Infrastructure installation.

1. Use a third-party technology for your platform to aggregate the multiple public network adapters before you start installation.
2. During installation, select the single network connection name for the combined network adapters as the public interface.

If you configure two network adapters as public network adapters in the cluster without using an aggregation technology, the failure of one public network adapter on a node does not result in automatic VIP failover to the other public network adapter.

4.1.6 Network Configuration Tasks for Windows Server Deployments

Microsoft Windows Server has many unique networking features. Some of these features require special configuration to enable Oracle software to run correctly on Windows Server.

[Disabling Windows Media Sensing](#) (page 4-6)

Windows Media Sensing must be disabled for the private network adapters.

[Setting the Bind Order for Network Adapters](#) (page 4-6)

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.

[Deconfigure DNS Registration for Public Network Adapter](#) (page 4-7)

To prevent Windows Server 2008 from potentially registering the wrong IP addresses for the node in DNS after a server restart, you must deconfigure the "Register this connection's addresses in DNS" option for the public network adapters.

[Manually Configure Automatic Metric Values](#) (page 4-7)

Automatic Metric feature automatically configures the metric for the local routes that are based on link speed. To prevent OUI from selecting

the wrong network interface during installation, you must customize the metric values for the public and private network interfaces.

[Set the TCP/IP Dynamic Port Range for Oracle RAC Installations](#) (page 4-8)

For certain configurations of Oracle RAC in high load environments it is possible for the system to exhaust the available number of sockets. To avoid this problem, expand the dynamic port range for TCP/IP.

[Verify Privileges for Copying Files in the Cluster](#) (page 4-8)

During installation, OUI copies the software from the local node to the remote nodes in the cluster. The installation user must have privileges on the other nodes in the cluster to copy the files.

4.1.6.1 Disabling Windows Media Sensing

Windows Media Sensing must be disabled for the private network adapters.

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.

1. Backup the Windows registry.
2. Use Registry Editor 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: 1
```

4. Exit the Registry Editor and restart the computer.
5. Repeat steps 1 through 4 on each node in your cluster.

4.1.6.2 Setting the Bind Order for Network Adapters

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.

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, `PublicCLAN`, if the same names are used for the same class of network adapters on each node in the network.

1. Right click **My Network Places** and choose **Properties**.
2. In the Advanced menu, click **Advanced Settings**.
3. If the public network connection 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 the list.
4. Click **OK** to save the settings and then exit the network setup dialog.

4.1.6.3 Deconfigure DNS Registration for Public Network Adapter

To prevent Windows Server 2008 from potentially registering the wrong IP addresses for the node in DNS after a server restart, you must deconfigure the "Register this connection's addresses in DNS" option for the public network adapters.

Due to a change in functionality in the Windows Server 2008 operating system, the DNS client service registers all of the network connections of a computer in DNS. In earlier versions of Windows Server, the DNS client service registered only the primary, or first, network adapter IP address in DNS.

1. Start the Windows Server Manager application.
2. Select **View Network Connections**.
3. Right-click the network adapter that provides the Public network interface and select **Properties**.
4. Select the Networking tab, and then select **Internet Protocol Version 4 (TCP/IPv4)**.

Note: If you configure this setting in IPv4, then Windows automatically configures the same setting for IPv6

5. Click **Properties**.
6. On the General tab, click **Advanced**.
7. Select the DNS tab.
8. Deselect **Register this connection's addresses in DNS**.

See Also: "Best Practices Analyzer for Domain Name System: Configuration" on Microsoft Technet, specifically [http://technet.microsoft.com/en-us/library/ff807401\(v=ws.10\).aspx](http://technet.microsoft.com/en-us/library/ff807401(v=ws.10).aspx)

4.1.6.4 Manually Configure Automatic Metric Values

Automatic Metric feature automatically configures the metric for the local routes that are based on link speed. To prevent OUI from selecting the wrong network interface during installation, you must customize the metric values for the public and private network interfaces.

The Automatic Metric feature is enabled by default, and it can also be manually configured to assign a specific metric. The public and private network interface for IPv4 use the Automatic Metric feature of Windows. When the Automatic Metric feature is enabled and using the default values, it can sometimes cause OUI to select the private network interface as the default public host name for the server when installing Oracle Grid Infrastructure.

1. In Control Panel, double-click **Network Connections**.
2. Right-click a network interface, and then click **Properties**.
3. Click **Internet Protocol (TCP/IP)**, and then click **Properties**.
4. On the General tab, click **Advanced**.

5. To specify a metric, on the IP Settings tab, click to clear the Automatic metric check box.
6. In the Interface Metric field, set the public network interface metric to a lower value than the private network interface.

For example, you might set the public network interface metric to 100 and the private network interface metric to 300.

4.1.6.5 Set the TCP/IP Dynamic Port Range for Oracle RAC Installations

For certain configurations of Oracle RAC in high load environments it is possible for the system to exhaust the available number of sockets. To avoid this problem, expand the dynamic port range for TCP/IP.

1. Open a command line window as an Administrator user.
2. Run the following command:

```
netsh int ipv4 set dynamicport tcp start=20000 num=40000
```

4.1.6.6 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. The installation user must have privileges on the other nodes in the cluster to copy the files.

1. Verify that you have Administrator privileges on the other nodes in the cluster by running the following command on each node, where *nodename* is the name of the remote node:

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

2. After installation, if your system does not use the net share shown in the above example, then you can remove the unused net share using the following command:

```
net use \\nodename\C$ /delete
```

4.1.7 Network Interface Configuration Options for Performance

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 you access Oracle ASM remotely, or a 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 data communications. Failing to provide three separate network interfaces in this case can cause performance and stability problems under heavy system loads.

4.2 Oracle Grid Infrastructure IP Name and Address Requirements

The Oracle Grid Naming Service (GNS) is used with large clusters to ease network administration cost.

For small clusters, you can use a static configuration of IP addresses. For large clusters, manually maintaining the large number of required IP addresses becomes too cumbersome.

[About Oracle Grid Infrastructure Name Resolution Options](#) (page 4-9)

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

[Cluster Name and SCAN Requirements](#) (page 4-10)

During installation, you are prompted to confirm the default Single Client Access Name (SCAN), which is used to connect to databases within the cluster irrespective of which nodes the database instances run on. If you change the SCAN from the default, then the name that you use must be globally unique throughout your enterprise.

[IP Name and Address Requirements For Grid Naming Service \(GNS\)](#) (page 4-11)

The network administration must configure the domain name server (DNS) to delegate resolution requests for cluster names (any names in the subdomain delegated to the cluster) to the GNS.

[IP Name and Address Requirements For Multi-Cluster GNS](#) (page 4-11)

Review the following requirements for using Multi-cluster GNS:

[IP Address Requirements for Manual Configuration](#) (page 4-13)

If you do not enable GNS, then the public and VIP addresses for each node must be static IP addresses. Public, VIP and SCAN addresses must be on the same subnet.

[Confirming the DNS Configuration for SCAN](#) (page 4-14)

You can use the `nslookup` command to confirm that the DNS is correctly associating the SCAN with the addresses.

[Grid Naming Service for a Traditional Cluster Configuration Example](#) (page 4-14)

To use GNS, you must specify a static IP address for the GNS VIP address, and you must have a subdomain configured on your domain name servers (DNS) to delegate resolution for that subdomain to the static GNS IP address.

[Domain Delegation to Grid Naming Service](#) (page 4-16)

If you are configuring Grid Naming Service (GNS) for a standard cluster, then before installing Oracle Grid Infrastructure you must configure DNS to send to GNS any name resolution requests for the subdomain served by GNS.

[Manual IP Address Configuration Example](#) (page 4-17)

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.

4.2.1 About Oracle Grid Infrastructure Name Resolution Options

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

You can configure IP addresses for Oracle Grid Infrastructure and Oracle RAC with one of the following options:

- **Dynamic IP address assignment using Multi-cluster or standard Oracle Grid Naming Service (GNS).** If you select this option, then network administrators

delegate a subdomain to be resolved by GNS (standard or multicluster). Requirements for GNS are different depending on whether you choose to configure GNS with zone delegation (resolution of a domain delegated to GNS), or without zone delegation (a GNS virtual IP address without domain delegation).

- **For GNS with zone delegation:**
 - For IPv4, a DHCP service running on the public network the cluster uses
 - For IPv6, an autoconfiguration service running on the public network the cluster uses
 - Enough DHCP addresses to provide 1 IP address for each node, and 3 IP addresses for the cluster used by the Single Client Access Name (SCAN) for the cluster
- **Use an existing GNS configuration.** Starting with Oracle Grid Infrastructure 12c Release 1 (12.1), a single GNS instance can be used by multiple clusters. To use GNS for multiple clusters, the DNS administrator must have delegated a zone for use by GNS. Also, there must be an instance of GNS started somewhere on the network and the GNS instance must be accessible (not blocked by a firewall). All of the node names registered with the GNS instance must be unique.
- **Static IP address assignment using DNS or host file resolution.** If you select this option, then network administrators assign a fixed IP address for each physical host name in the cluster and for IPs for the Oracle Clusterware managed VIPs. In addition, domain name system (DNS)-based static name resolution is used for each node, or host files for both the clusters and clients have to be updated, and SCAN functionality is limited. 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 non-VIP server node public host names.
 - Public IP addresses and virtual IP addresses must be in the same subnet.
 - Oracle only supports DHCP-assigned networks for the default network, not for any subsequent networks.
-
-

For clusters using single interfaces for private networks, each node's private interface for interconnects must be on the same subnet, and that subnet must connect to every node of the cluster. For example, if the private interfaces have a subnet mask of 255.255.255.0, then your private network is in the range 192.168.0.0--192.168.0.255, and your private addresses must be in the range of 192.168.0.[0-255]. If the private interfaces have a subnet mask of 255.255.0.0, then your private addresses can be in the range of 192.168.[0-255].[0-255].

4.2.2 Cluster Name and SCAN Requirements

During installation, you are prompted to confirm the default Single Client Access Name (SCAN), which is used to connect to databases within the cluster irrespective of which nodes the database instances run on. If you change the SCAN from the default, then the name that you use must be globally unique throughout your enterprise.

The cluster name must be unique across your enterprise, must be at least one character long and no more than 15 characters in length, must be alphanumeric, cannot begin with a numeral, and may contain hyphens (-). Underscore characters (_) are not allowed.

If you configure a Standard cluster, and choose a Typical install, then the SCAN is also the name of the cluster. In that case, the SCAN must meet the requirements for a cluster name. The SCAN can be no longer than 15 characters.

In an Advanced installation, the SCAN and cluster name are entered in separate fields during installation, so cluster name requirements do not apply to the name used for the SCAN. The SCAN can be longer than 15 characters. If you enter a domain with the SCAN name, and you want to use GNS with zone delegation, then the domain must be the GNS domain.

Caution: Select your name carefully. After installation, you can only change the cluster name by reinstalling Oracle Grid Infrastructure.

4.2.3 IP Name and Address Requirements For Grid Naming Service (GNS)

The network administration must configure the domain name server (DNS) to delegate resolution requests for cluster names (any names in the subdomain delegated to the cluster) to the GNS.

If you enable Grid Naming Service (GNS), then name resolution requests to the cluster are delegated to the GNS, which listens on the GNS VIP address. When a request comes to the domain, GNS processes the requests and responds with the appropriate addresses for the name requested. To use GNS, you must specify a static IP address for the GNS VIP address.

Note: You cannot use GNS with another multicast DNS. To use GNS, disable any third-party mDNS daemons on your system.

Related Topics:

[Configuring DNS for Domain Delegation to Grid Naming Service](#) (page 4-16)

4.2.4 IP Name and Address Requirements For Multi-Cluster GNS

Review the following requirements for using Multi-cluster GNS:

[About Multi-Cluster GNS Networks](#) (page 4-12)

The general requirements for Multi-cluster GNS are similar to those for standard GNS. Multi-cluster GNS differs from standard GNS in that Multi-cluster GNS provides a single networking service across a set of clusters, rather than a networking service for a single cluster.

[Configuring GNS Server Clusters](#) (page 4-12)

Review these requirements to configure GNS server clusters.

[Configuring GNS Client Clusters](#) (page 4-12)

Review these requirements to configure GNS client clusters.

[Creating and Using a GNS Client Data File](#) (page 4-12)

Generate a GNS client data file and copy the file to the GNS client cluster member node on which you are running the Oracle Grid Infrastructure installation.

4.2.4.1 About Multi-Cluster GNS Networks

The general requirements for Multi-cluster GNS are similar to those for standard GNS. Multi-cluster GNS differs from standard GNS in that Multi-cluster GNS provides a single networking service across a set of clusters, rather than a networking service for a single cluster.

To provide networking service, Multi-cluster GNS is configured using DHCP addresses, and name advertisement and resolution is carried out with the following components:

- **The GNS Server cluster** performs address resolution for GNS Client clusters. A GNS Server cluster is the cluster where Multi-cluster GNS runs, and where name resolution takes place for the subdomain delegated to the set of clusters.
- **GNS Client clusters** receive address resolution from the GNS Server cluster. A GNS Client cluster is a cluster that advertises its cluster member node names using the GNS Server cluster.

4.2.4.2 Configuring GNS Server Clusters

Review these requirements to configure GNS server clusters.

To use this option, your network administrators must have delegated a subdomain to GNS for resolution.

1. Before installation, create a static IP address for the GNS VIP address.
2. Provide a subdomain that your DNS servers delegate to that static GNS IP address for resolution.

4.2.4.3 Configuring GNS Client Clusters

Review these requirements to configure GNS client clusters.

- To configure a GNS Client cluster, check to ensure all of the following requirements are completed:
 - A GNS Server instance must be running on your network, and it must be accessible (for example, not blocked by a firewall)
 - All of the node names in the GNS domain must be unique; address ranges and cluster names must be unique for both GNS Server and GNS Client clusters.
 - You must have a GNS Client data file that you generated on the GNS Server cluster, so that the GNS Client cluster has the information needed to delegate its name resolution to the GNS Server cluster, and you must have copied that file to the GNS Client cluster member node on which you run the Oracle Grid Infrastructure installation.

4.2.4.4 Creating and Using a GNS Client Data File

Generate a GNS client data file and copy the file to the GNS client cluster member node on which you are running the Oracle Grid Infrastructure installation.

1. On a GNS Server cluster member, run the following command, where *path_to_file* is the name and path location of the GNS Client data file you create:

```
srvctl export gns -clientdata path_to_file -role {client | secondary}
```

For example:

```
C:\> srvctl export gns -clientdata C:\Users\grid\gns_client_data -role client
```

2. Copy the GNS Client data file to a secure path on the GNS Client node where you run the GNS Client cluster installation.

The Oracle Installation user must have permissions to access that file. Oracle recommends that no other user is granted permissions to access the GNS Client data file.

3. During installation, you are prompted to provide a path to that file.
4. After you have completed the GNS Client cluster installation, you must run the following command on one of the GNS Server cluster members to start GNS service, where *path_to_file* is the name and path location of the GNS Client data file:

```
srvctl add gns -clientdata path_to_file
```

For example:

```
C:\> srvctl add gns -clientdata C:\Users\grid\gns_client_data
```

See Also: *Oracle Clusterware Administration and Deployment Guide* for more information about GNS Server and GNS Client administration

4.2.5 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. Public, VIP and SCAN addresses must be on the same subnet.

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

The cluster must have the following addresses configured:

- A public IP address for each node configured before installation, and resolvable to that node before installation
- A VIP address for each node configured before installation, but not currently in use
- Three static IP addresses configured on the domain name server (DNS) before installation so that the three IP addresses are associated with the name provided as the SCAN, and all three addresses are returned in random order by the DNS to the requestor. These addresses must be configured before installation in the DNS to resolve to addresses that are not currently in use. The SCAN name must meet the requirements specified in "[Cluster Name and SCAN Requirements](#) (page 4-10)"
- A private IP address for each node configured before installation, but on a separate, private network, with its own subnet. The IP address should not be resolvable except by other cluster member nodes.

- A set of one or more networks over which Oracle ASM serves its clients. The ASM network does not have to be a physical network; it can be a virtual network. The ASM network must use either a third NIC, or share a private network adapter. The NIC can be a virtual NIC.

Note:

Oracle strongly recommends that you do not configure SCAN VIP addresses in the hosts file. Use DNS resolution for SCAN VIPs. If you use the 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.

Configuring SCANs in a DNS or a hosts file is the only supported configuration. Configuring SCANs in a Network Information Service (NIS) is not supported.

Related Topics:

[Understanding Network Addresses](#) (page C-7)

4.2.6 Confirming the DNS Configuration for SCAN

You can use the `nslookup` command to confirm that the DNS is correctly associating the SCAN with the addresses.

After installation, when a client sends a request to the cluster, the Oracle Clusterware SCAN listeners redirect client requests to servers in the cluster.

- At a command prompt, use the `nslookup` command and specify the name of the SCAN for your cluster.

For example:

```
C:\> nslookup mycluster-scan
Server:         dns3.example.com
Address:        192.0.2.001

Name:   mycluster-scan.example.com
Address: 192.0.2.201
Name:   mycluster-scan.example.com
Address: 192.0.2.202
Name:   mycluster-scan.example.com
Address: 192.0.2.203
```

4.2.7 Grid Naming Service for a Traditional Cluster Configuration Example

To use GNS, you must specify a static IP address for the GNS VIP address, and you must have a subdomain configured on your domain name servers (DNS) to delegate resolution for that subdomain to the static GNS IP address.

To use GNS, you must specify a static IP address for the GNS VIP address, and you must have a subdomain configured on your DNS to delegate resolution for that subdomain to the static GNS IP 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 IPv6 networks, the IPv6 auto configuration feature assigns IP addresses and no DHCP server is required.

Assuming a two node cluster where you have defined the GNS VIP, after installation you might have a configuration similar to that shown in the following table. In this configuration, the cluster name is `mycluster`, the GNS parent domain is `gns.example.com`, the subdomain is `cluster01.example.com`, the 192.0.2 portion of the IP addresses represents the cluster public IP address subdomain, and 192.168.0 represents the private IP address subdomain.

Table 4-1 Example of a Grid Naming Service Network Configuration

Identity	Home Node	Host Node	Given Name	Type	Address	Address Assigned By	Resolved By
GNS VIP	None	Selected by Oracle Clusterware	<code>mycluster-gns-vip.example.com</code>	Virtual	192.0.2.1	Fixed by network administrator	DNS
Node 1 Public	Node 1	<code>node1</code>	<code>node1¹</code>	Public	192.0.2.101	Fixed	GNS
Node 1 VIP	Node 1	Selected by Oracle Clusterware	<code>node1-vip</code>	Virtual	192.0.2.104	DHCP	GNS
Node 1 Private	Node 1	<code>node1</code>	<code>node1-priv</code>	Private	192.168.0.1	Fixed or DHCP	GNS
Node 2 Public	Node 2	<code>node2</code>	<code>node2¹</code>	Public	192.0.2.102	Fixed	GNS
Node 2 VIP	Node 2	Selected by Oracle Clusterware	<code>node2-vip</code>	Virtual	192.0.2.105	DHCP	GNS
Node 2 Private	Node 2	<code>node2</code>	<code>node2-priv</code>	Private	192.168.0.2	Fixed or DHCP	GNS
SCAN VIP 1	none	Selected by Oracle Clusterware	<code>mycluster-scan.cluster01.example.com</code>	Virtual	192.0.2.201	DHCP	GNS
SCAN VIP 2	none	Selected by Oracle Clusterware	<code>mycluster-scan.cluster01.example.com</code>	Virtual	192.0.2.202	DHCP	GNS
SCAN VIP 3	none	Selected by Oracle Clusterware	<code>mycluster-scan.cluster01.example.com</code>	Virtual	192.0.2.203	DHCP	GNS

¹ Node host names may resolve to multiple addresses, including VIP addresses currently running on that host.

4.2.8 Domain Delegation to Grid Naming Service

If you are configuring Grid Naming Service (GNS) for a standard cluster, then before installing Oracle Grid Infrastructure you must configure DNS to send to GNS any name resolution requests for the subdomain served by GNS.

The subdomain that GNS serves represents the cluster member nodes.

[Choosing a Subdomain Name for Use with Grid Naming Service](#) (page 4-16)

To implement GNS, your network administrator must configure the DNS to set up a domain for the cluster, and delegate resolution of that domain to the GNS VIP. You can use a separate domain, or you can create a subdomain of an existing domain for the cluster.

[Configuring DNS for Domain Delegation to Grid Naming Service](#) (page 4-16)

You must configure the DNS to send GNS name resolution requests using DNS forwarders.

4.2.8.1 Choosing a Subdomain Name for Use with Grid Naming Service

To implement GNS, your network administrator must configure the DNS to set up a domain for the cluster, and delegate resolution of that domain to the GNS VIP. You can use a separate domain, or you can create a subdomain of an existing domain for the cluster.

The subdomain name, can be any supported DNS name such as `sales-cluster.rac.com`.

Oracle recommends that the subdomain name be distinct from your corporate domain. For example, if your corporate domain is `mycorp.example.com`, the subdomain for GNS might be `rac-gns.com`.

If the subdomain is not distinct, then it should be for the exclusive use of GNS. For example, if you delegate the subdomain `mydomain.example.com` to GNS, then there should be no other domains that share it such as `lab1.mydomain.example.com`.

See Also:

- *Oracle Clusterware Administration and Deployment Guide* for more information about GNS
 - "[Cluster Name and SCAN Requirements](#) (page 4-10)" for information about choosing network identification names
-
-

4.2.8.2 Configuring DNS for Domain Delegation to Grid Naming Service

You must configure the DNS to send GNS name resolution requests using DNS forwarders.

If the DNS server is running on a 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.

2. Use the wizard to create an entry for the GNS virtual IP address, where the address is a valid DNS name.

For example, if the cluster name is `mycluster`, and the domain name is `example.com`, and the IP address is `192.0.2.1`, you could create an entry similar to the following:

```
mycluster-gns-vip.example.com: 192.0.2.1
```

The address you provide must be routable.

Note: The domain name may not contain underscores. Windows may allow the use of underscore characters, but this practice violates the Internet Engineering Task Force RFC 952 standard and is not supported by Oracle.

3. To configure DNS forwarders, click **Start**, select **Administrative Tools**, and then select **DNS**.
4. Right-click *ServerName*, where *ServerName* is the name of the server, and then click the **Forwarders** tab.
5. 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**.
6. In the selected domain's forwarder IP address box, type the GNS VIP address, and then click **Add**.
7. Click **OK** to exit.

If the DNS server is running on a different operating system, then refer to the *Oracle Grid Infrastructure 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 reverse DNS zones configured, then you can automatically create associated reverse records when you create your original forward record.

4.2.9 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 the cluster name is `mycluster`, and 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 4-2 Manual Network Configuration Example

Identity	Home Node	Host Node	Given Name	Type	Address	Address Assigned By	Resolved By
Node 1 Public	Node 1	node1	node1 ¹	Public	192.0.2.101	Fixed	DNS
Node 1 VIP	Node 1	Selected by Oracle Clusterware	node1-vip	Virtual	192.0.2.104	Fixed	DNS, hosts file
Node 1 Private	Node 1	node1	node1-priv	Private	192.168.0.1	Fixed	DNS, hosts file, or none
Node 2 Public	Node 2	node2	node2 ¹	Public	192.0.2.102	Fixed	DNS
Node 2 VIP	Node 2	Selected by Oracle Clusterware	node2-vip	Virtual	192.0.2.105	Fixed	DNS, hosts file
Node 2 Private	Node 2	node2	node2-priv	Private	192.168.0.2	Fixed	DNS, hosts file, or none
SCAN VIP 1	none	Selected by Oracle Clusterware	mycluster-scan	Virtual	192.0.2.201	Fixed	DNS
SCAN VIP 2	none	Selected by Oracle Clusterware	mycluster-scan	Virtual	192.0.2.202	Fixed	DNS
SCAN VIP 3	none	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 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 previous 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.

4.3 Intended Use of Network Adapters

During installation, you are asked to identify the planned use for each network adapter (or network interface) that Oracle Universal Installer (OUI) detects on your cluster node.

Each NIC performs only one of the following roles:

- Public
- Private
- Do Not Use

You must use the same private adapters for both Oracle Clusterware and Oracle RAC. 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. Network interfaces must be at least 1 GbE, with 10 GbE recommended.

For network adapters that you plan to use for other purposes—for example, an adapter dedicated to a non-Oracle network file system—you must identify those network adapters as "do not use" adapters so that Oracle Clusterware ignores them.

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 load.

4.4 Broadcast Requirements for Networks Used by Oracle Grid Infrastructure

Broadcast communications address resolution protocol (ARP) must work properly across all the public and private interfaces configured for use by Oracle Grid Infrastructure.

The broadcast communications must work across any configured virtual local area networks (VLANs) that the public or private network interfaces uses.

4.5 Multicast Requirements for Networks Used by Oracle Grid Infrastructure

On each cluster member node the Oracle multicast DNS (mDNS) daemon uses multicasting on all network interfaces to communicate with other nodes in the cluster.

Multicasting is required on the private interconnect. For this reason, at a minimum, you must enable multicasting for the cluster for the following:

- Across the broadcast domain as defined for the private interconnect
- On the IP address subnet ranges 224.0.0.0/24 and 230.0.1.0/24

You do not need to enable multicast communications across routers.

Configuring Users, Groups and Environments for Oracle Grid Infrastructure and Oracle RAC

You must configure certain users, groups, and environment settings used during Oracle Grid Infrastructure for a Cluster and Oracle Real Application Clusters installations.

[Creating Installation Groups and Users for Oracle Grid Infrastructure and Oracle RAC](#) (page 5-1)

To install Oracle Grid Infrastructure and Oracle RAC, you must have an installation user and optionally an Oracle Home User.

[Configuring User Accounts](#) (page 5-16)

When installing Oracle Grid Infrastructure for a cluster, you run the installer software as an Administrator user. During installation, you can specify an Oracle Home user.

[Creating Oracle Software Directories](#) (page 5-18)

During installation, you are prompted to provide a path to a home directory to store Oracle Grid Infrastructure software.

[Enabling Intelligent Platform Management Interface \(IPMI\)](#) (page 5-22)

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. Oracle Clusterware can integrate IPMI to provide failure isolation support and to ensure cluster integrity.

5.1 Creating Installation Groups and Users for Oracle Grid Infrastructure and Oracle RAC

To install Oracle Grid Infrastructure and Oracle RAC, you must have an installation user and optionally an Oracle Home User.

Note: During an Oracle Grid Infrastructure installation, both Oracle Clusterware and Oracle Automatic Storage Management (Oracle ASM) are installed. You no longer can have separate Oracle Clusterware installation owners and Oracle ASM installation owners.

[About the Oracle Installation User](#) (page 5-2)

The Oracle Installation User can be either a local user or a domain user.

[About the Oracle Home User for the Oracle Grid Infrastructure Installation](#)
(page 5-3)

During installation of Oracle Grid Infrastructure, you can specify an optional **Oracle Home user** associated with the Oracle Grid home.

[About the Oracle Home User for the Oracle RAC Installation](#) (page 5-4)

During installation of Oracle RAC, you can either use a Windows built-in account or specify an optional, non-Administrator user that is a Windows domain user to be the **Oracle Home User** associated with the Oracle RAC home.

[When to Create an Oracle Home User](#) (page 5-4)

You must create an Oracle Home User in certain circumstances.

[Oracle Home User Configurations for Oracle Installations](#) (page 5-6)

When the Oracle software installation completes, you will have one of the following configurations:

[Understanding the Oracle Inventory Directory and the Oracle Inventory Group](#)
(page 5-7)

You must have a group whose members are given access to write to the Oracle Inventory directory, which is the central inventory record of all Oracle software installations on a server.

[Operating System Groups Created During Installation](#) (page 5-8)

When you install either Oracle Grid Infrastructure or Oracle RAC, the user groups listed in the following table are created, if they do not already exist.

[Operating System Groups and Users for Job Role Separation](#) (page 5-10)

A job role separation configuration of Oracle Database and Oracle ASM is a configuration with groups and users to provide separate groups for operating system authentication.

[Example of Using Role-Allocated Groups and Users](#) (page 5-15)

You can use role-allocated groups and users that is compliant with an Optimal Flexible Architecture (OFA) deployment.

5.1.1 About the Oracle Installation User

The Oracle Installation User can be either a local user or a domain user.

To install the Oracle Grid Infrastructure or Oracle Database software, you must use either a local or domain user that is a member of the Administrators group. This user is the **Oracle Installation User**.

If you use a local user account for installing Oracle Grid Infrastructure or Oracle Real Application Clusters (Oracle RAC), then:

- The user account must exist on all nodes in the cluster.
- The user name and password must be the same on all nodes.
- OUI displays a warning message.

If you use a domain user account for installing Oracle Grid Infrastructure or Oracle Real Application Clusters (Oracle RAC), 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 use the DBADMIN\dba1 user on the first node and the RACDBA\dba1 user on the second node.
- A local user of the same name cannot exist on any of the nodes. For example if you use RACDBA\dba1 as the installation user, none of the nodes can have a local NODE1\dba1 user account.

If you use different users to install Oracle Grid Infrastructure and Oracle RAC, then the user that installs Oracle RAC must be a member of the ASMDBA and ASMADMIN groups to access the Oracle Automatic Storage Management (Oracle ASM) Disks.

5.1.2 About the Oracle Home User for the Oracle Grid Infrastructure Installation

During installation of Oracle Grid Infrastructure, you can specify an optional **Oracle Home user** associated with the Oracle Grid home.

For example, assume that you use an Administrator user named OraSys to install the software (Oracle Installation user), then you can specify the ORADOMAIN\OraGrid domain user as the Oracle Home user for this installation. The specified Oracle Home domain user must exist before you install the Oracle Grid Infrastructure software.

The Oracle Home user for the Oracle Grid Infrastructure installation can be either the Windows built-in account (LocalSystem) or an existing user. If you specify an existing user as the Oracle Home user, then the Windows User Account you specify must be a domain user or Group Managed Service Account (gMSA) user. When you use an Oracle Home User, a secure wallet in Oracle Cluster Registry (created automatically) stores the Oracle Home User name and password information. If you decide not to create an Oracle Home user, then the Windows built-in account is used as Oracle Home User.

Note: You cannot change the Oracle Home User after the installation is complete. If you must change the Oracle Home User, then you must reinstall the Oracle Grid Infrastructure software.

For Oracle Grid Infrastructure 12c release 12.1.0.1, if you choose the Oracle Grid Infrastructure Management Repository option during installation, then use of an Oracle Home user is mandatory. Similarly, if you perform a software-only installation of Oracle Grid Infrastructure, then you must choose a Windows Domain User account to configure the Oracle Grid Infrastructure Management Repository after installation.

During installation, the installer creates the software services and configures the Access Control Lists (ACLs) based on the information you provided about the Oracle Home User. See the section "Setting File Permissions" in *Oracle Database Platform Guide for Microsoft Windows* for more information.

When you specify an Oracle Home user, the installer configures that user as the Oracle Service user for all software services that run from the Oracle home. The **Oracle Service user** is the operating system user that the Oracle software services run as, or the user from which the services inherit privileges.

See Also:

Oracle Database Platform Guide for Microsoft Windows for more information about the Oracle Home User and how database services run in this user account

5.1.3 About the Oracle Home User for the Oracle RAC Installation

During installation of Oracle RAC, you can either use a Windows built-in account or specify an optional, non-Administrator user that is a Windows domain user to be the **Oracle Home User** associated with the Oracle RAC home.

The Oracle Home User for Oracle RAC can be different from the Oracle Home User you specified during the Oracle Grid Infrastructure installation. If a Windows domain user account is chosen, then it should be an existing domain user account with no administration privileges.

For Oracle RAC installations, Oracle recommends that you use a Windows domain user (instead of Windows built-in account) as the Oracle Home User for enhanced security.

The services created for the Oracle RAC software run using the privileges of the Oracle Home User for Oracle RAC, or the Local System built-in Windows account if you did not specify an Oracle Home User during installation. Oracle Universal Installer (OUI) creates multiple operating system groups, such as the `ORA_DBA` group, on all nodes. The user performing the installation is automatically added to those groups necessary for proper database administration. For more information about the Oracle Home User implementation for Oracle Database, see *Oracle Database Platform Guide for Microsoft Windows*.

For an administrator-managed database, you have the option of storing Oracle Home User password in a secure wallet (stored in Oracle Cluster Registry). Use the following `CRSCTL` command to create this secure wallet for storing the Windows operating system user name and password:

```
crsctl add wallet -osuser -passwd
```

If the wallet (stored in Oracle Cluster Registry) exists, then Oracle administration tools automatically use the password from the wallet without prompting the administrator to enter the password of Oracle Home User for performing administrative operations.

A policy-managed database mandates the storage of Oracle Home User password in the wallet (stored in Oracle Cluster Registry). When a policy-managed database is created, DBCA automatically creates the wallet, if one does not exist.

Note: If you choose to use an Oracle Home User for your Oracle RAC installation, then the Windows User Account you specify must be a domain user.

5.1.4 When to Create an Oracle Home User

You must create an Oracle Home User in certain circumstances.

- If an Oracle Home User exists, but you want to use a different operating system user, with different group membership, to give database administrative privileges to those groups in a new Oracle Database installation

- If you have created an Oracle Home User for Oracle Grid Infrastructure, such as `grid`, and you want to create a separate Oracle Home User for Oracle Database software, such as `oracle`

[Restrictions and Guidelines for Oracle Home Users](#) (page 5-5)

Review the following restrictions and guidelines for Oracle Home Users for Oracle software installations.

[Determining if an Oracle Home User Exists](#) (page 5-5)

You must decide to use an existing user, or create a new user.

[Creating an Oracle Home User](#) (page 5-6)

Use the Manage User Accounts window to create a new user.

[Using an Existing Oracle Software Owner User](#) (page 5-6)

If the user you have decided to use as an Oracle Home user exists, then you can use this user as the Oracle Home user for a different installation.

5.1.4.1 Restrictions and Guidelines for Oracle Home Users

Review the following restrictions and guidelines for Oracle Home Users for Oracle software installations.

- If you intend to use multiple Oracle Home Users for different Oracle Database homes, then Oracle recommends that you create a separate Oracle Home User for Oracle Grid Infrastructure software (Oracle Clusterware and Oracle ASM).
- If you plan to install Oracle Database or Oracle RAC, then Oracle recommends that you create separate Oracle Home Users for the Oracle Grid Infrastructure and the Oracle Database installations. If you use one Oracle Home User, then when you want to perform administration tasks, you must select the utilities from the Oracle home for the instance you want to administer, or change the default `%ORACLE_HOME%` value to the location of the Oracle Home from which the instance runs. For Oracle ASM instances, you must use the Oracle Grid Infrastructure home and for database instance use the Oracle Database home.
- If you try to administer an Oracle home or Grid home instance using `sqlplus`, `srvctl`, `lsnrctl`, or `asmcmd` commands while the environment variable `%ORACLE_HOME%` is set to a different Oracle home or Grid home path, then you encounter errors. For example, when you start `SRVCTL` from a database home, `%ORACLE_HOME%` should be set to that database home, or `SRVCTL` fails. The exception is when you are using `SRVCTL` in the Oracle Grid Infrastructure home. In that case, `SRVCTL` ignores `%ORACLE_HOME%`, and the Oracle home environment variable does not affect `SRVCTL` commands. In all other cases, you must start the utilities from the Oracle home of the instance that you want to administer.

If you need to set the user environment to use a specific Oracle home, then use Oracle Universal Installer. On the landing page, click **Installed Products**. In the Inventory window, click the **Environment** tab. Select the Oracle Home you want to use, and deselect the other Oracle homes, then click **Apply**. You can then exit Oracle Universal Installer. When you use Oracle Universal Installer to set the Oracle Home, it updates the `ORACLE_HOME` environment variable and updates the `PATH` variable.

5.1.4.2 Determining if an Oracle Home User Exists

You must decide to use an existing user, or create a new user.

1. Open the Control Panel window.
2. Select **User Accounts**.
3. Select **Manage User Accounts**.
4. Scroll through the list of names until you find the ones you are looking for.

If the names do not appear in the list, then the user has not yet been created.

See one of the following sections for the next steps:

- [Creating an Oracle Home User](#) (page 5-6)
- [Using an Existing Oracle Software Owner User](#) (page 5-6)

5.1.4.3 Creating an Oracle Home User

Use the Manage User Accounts window to create a new user.

The user must not be a member of the Administrators group. If you are creating an Oracle Home User for an Oracle RAC installation, then the user must be a Windows domain user, and the user must be a member of the same domain on each node in the cluster.

1. Open the Control Panel window
2. Select **User Accounts**.
3. Select **Manage User Accounts**.
4. Create the user using the interface.

See Also: *Oracle Database Platform Guide for Microsoft Windows* for information about the Oracle Home User Control utility

5.1.4.4 Using an Existing Oracle Software Owner User

If the user you have decided to use as an Oracle Home user exists, then you can use this user as the Oracle Home user for a different installation.

Oracle does not support changing the ownership of an existing Oracle Database home from one Oracle Home user to a different user.

- During the software installation, specify the existing user for the Oracle Home user.

Oracle Universal Installer (OUI) creates the appropriate group memberships.

5.1.5 Oracle Home User Configurations for Oracle Installations

When the Oracle software installation completes, you will have one of the following configurations:

Installation Type	Oracle Home user configuration
Oracle Grid Infrastructure with a domain user specified for the Oracle Home User	The Oracle Home user owns the Oracle Grid Infrastructure Management Repository service. The other services are run under the built-in Administrator account, except for the listeners, which run as LocalService (a built-in Windows account).
Oracle Grid Infrastructure with the Windows built-in Administrator account as the Oracle Home User	The Oracle Grid Infrastructure services are run under the built-in Administrator account, except for the listeners, which run as LocalService.
Oracle RAC with specified Oracle Home User	The Oracle Home User owns all the services run by the Oracle Database software.
Oracle RAC with Built-in Oracle Home user	The services run under the built-in LocalSystem account.

Note: You cannot change the Oracle Home User after installation to a different Oracle Home User. Only out-of-place upgrade or move allows the Oracle Home User to be changed to or from the built-in Windows account.

5.1.6 Understanding the Oracle Inventory Directory and the Oracle Inventory Group

You must have a group whose members are given access to write to the Oracle Inventory directory, which is the central inventory record of all Oracle software installations on a server.

When you install Oracle software on the system for the first time, Oracle Universal Installer (OUI) creates the directories for the Oracle central inventory. OUI also creates the Oracle Inventory group, `ORA_INSTALL`. The `ORA_INSTALL` group contains all the Oracle Home users for all Oracle homes on the server. The location of the Oracle central inventory on Windows is always `%SYSTEM_DRIVE%\Program Files\Oracle\Inventory`.

Whether you are performing the first installation of Oracle software on this server, or are performing an installation of additional Oracle software on the server, you do not need to create the Oracle central inventory or the `ORA_INSTALL` group. You cannot change the name of the Oracle Inventory group - it is always `ORA_INSTALL`.

Members of the Oracle Inventory group have write privileges to the Oracle central inventory directory, and are also granted permissions for various Oracle Clusterware resources, OCR keys, directories in the Oracle Clusterware home to which DBAs need write access, and other necessary privileges. All Oracle software install users must be members of the Oracle Inventory group. Members of this group can talk to Cluster Synchronization Service (CSS).

Note: If Oracle software is already installed on the system, then, when you install new Oracle software, the existing Oracle Inventory group is used instead of creating a new Inventory group.

5.1.7 Operating System Groups Created During Installation

When you install either Oracle Grid Infrastructure or Oracle RAC, the user groups listed in the following table are created, if they do not already exist.

Table 5-1 Operating System Groups Created During Installation

Operating System Group Names	System Privileges	Description
ORA_ASMADMIN	SYSASM system privileges for Oracle ASM administration	The OSASM group for the Oracle ASM instance. Using this group and the SYSASM system privileges enables the separation of SYSDBA database administration privileges from Oracle ASM storage administration privileges. Members of the OSASM group are authorized to connect using the SYSASM privilege and have full access to Oracle ASM, including administrative access to all disk groups that the Oracle ASM instance manages.
ORA_ASMDBA	SYSDBA system privileges on the Oracle ASM instance	The OSDBA group for the Oracle ASM instance. This group grants access for the database to connect to Oracle ASM. During installation, the Oracle Installation Users are configured as members of this group. After you create an Oracle Database, this groups contains the Oracle Home Users of those database homes.
ORA_ASMOPER	SYSOPER for Oracle ASM system privileges	The OSOPER group for the Oracle ASM instance. Members of this group are granted SYSOPER system privileges on the Oracle ASM instance, which permits a user to perform operations such as startup, shutdown, mount, dismount, and check disk group. This group has a subset of the privileges of the OSASM group. Similar to the ORA_HOMENAME_OPER group, this group does not have any members after installation, but you can manually add users to this group after the installation completes.
ORA_GRIDHM_DBA	SYSDBA system privileges for the Oracle Grid Infrastructure Management Repository database	Members of this group are granted the SYSDBA system privileges for managing the Oracle Grid Infrastructure Management Repository database, where GRIDHM is the name of the Oracle Grid Infrastructure home. The default home name is OraGrid12Home1, so the default group name is ORA_OraGrid12Home1_DBA.
ORA_GRIDHM_OPER	SYSOPER system privileges for the Oracle Grid Infrastructure Management Repository database	Members of this group are granted the SYSOPER system privileges for managing the Oracle Grid Infrastructure Management Repository database, where GRIDHM is the name of the Oracle Grid Infrastructure home. If you use the default Grid home name of OraGrid12Home1, then the default operating system group name is ORA_OraGrid12Home1_OPER.

Table 5-1 (Cont.) Operating System Groups Created During Installation

Operating System Group Names	System Privileges	Description
ORA_DBDA	SYSDBA system privileges for all Oracle Database installations on the server	A special OSDBA group for the Windows operating system. Members of this group are granted SYSDBA system privileges for all Oracle Databases installed on the server.
ORA_OPER	SYSOPER system privileges for all Oracle databases installed on the server	A special OSOPER group for the Windows operating system. Members of this group are granted SYSOPER system privileges all Oracle Databases installed on the server. This group does not have any members after installation, but you can manually add users to this group after the installation completes.
ORA_HOMENAME_DBDA	SYSDBA system privileges for all database instances that run from the Oracle home with the name <i>HOMENAME</i>	An OSDBA group for a specific Oracle Home with a name of <i>HOMENAME</i> . Members of this group can use operating system authentication to gain SYSDBA system privileges for any database that runs from the specific Oracle home. If you specified an Oracle Home User during installation, the user is added to this group during installation.
ORA_HOMENAME_OPER	SYSOPER system privileges for all database instances that run from the Oracle home with the name <i>HOMENAME</i>	An OSDBA group for the Oracle Home with a name of <i>HOMENAME</i> . Members of this group can use operating system authentication to gain SYSOPER system privileges for any database that runs from the specific Oracle home. This group does not have any members after installation, but you can manually add users to this group after the installation completes.
ORA_HOMENAME_SYSDG	SYSBACKUP system privileges for all database instances that run from the Oracle home with a name of <i>HOMENAME</i>	OSBACKUPDBA group for a specific Oracle Home with a name of <i>HOMENAME</i> . Members of this group have privileges necessary for performing database backup and recovery tasks on all database instances that run from the specified Oracle Home directory.
ORA_HOMENAME_SYSDG	SYSDBG system privileges for all database instances that run from the Oracle home with a name of <i>HOMENAME</i>	OSDGDBA group for a specific Oracle Home with a name of <i>HOMENAME</i> . Members of this group have privileges necessary for performing Data Guard administrative tasks on all database instances that run from the specified Oracle Home directory.

Table 5-1 (Cont.) Operating System Groups Created During Installation

Operating System Group Names	System Privileges	Description
<code>ORA_HOMENAME_SYSKM</code>	SYSKM system privileges for all database instances that run from the Oracle home with a name of <code>HOMENAME</code> .	OSKMDBA group for a specific Oracle Home with a name of <code>HOMENAME</code> . Members of this group have privileges necessary for performing encryption key management tasks on all database instances that run from the specified Oracle Home directory.

During installation, the `gridconfig.bat` script creates the services and groups on each node of the cluster. The installed files and permissions are owned by the Oracle Installation user, and require the Administrator privilege.

Oracle creates and populates the groups listed in this table during installation to ensure proper operation of Oracle products. You can manually add other users to these groups to assign these database privileges to other Windows users.

Members of the `ORA_DBA` group can use operating system authentication to administer all Oracle databases installed on the server. Members of the `ORA_HOMENAME_DBA`, where `HOMENAME` is the name of a specific Oracle installation, can use operating system authentication to manage only the databases that run from that Oracle home.

Related Topics:

[Standard Administration and Job Role Separation User Groups](#) (page C-4)

5.1.8 Operating System Groups and Users for Job Role Separation

A job role separation configuration of Oracle Database and Oracle ASM is a configuration with groups and users to provide separate groups for operating system authentication.

[About Job Role Separation Operating System Privileges Groups and Users](#) (page 5-11)

With Oracle Database job role separation, each Oracle Database installation has separate operating system groups to provide authentication for system privileges on that Oracle Database, so multiple databases can be installed on the cluster without sharing operating system authentication for system privileges. In addition, each Oracle software installation is associated with an Oracle Installation user, to provide operating system user authentication for modifications to Oracle Database binaries.

[Oracle Software Owner for Each Oracle Software Product](#) (page 5-12)

Oracle recommends that you use the following operating system groups and users for all installations where you specify separate Oracle Home Users:

[Standard Oracle Database Groups for Job Role Separation](#) (page 5-12)

The Oracle Database supports multiple operating system groups to provide operating system authentication for database administration system privileges.

[Extended Oracle Database Groups for Job Role Separation](#) (page 5-13)

Starting with Oracle Database 12c Release 1 (12.1), in addition to the SYSOPER system privilege to start and shut down the database, you can create new administrative privileges that are more task-specific and less privileged than the `ORA_DBA` group (or SYSDBA system privilege) to support specific administrative privileges tasks required for everyday database operation. Users granted these system privileges are also authenticated through operating system group membership.

[Oracle ASM Groups for Job Role Separation](#) (page 5-13)

The SYSASM, SYSOPER for ASM, and SYSDBA for ASM system privileges enables the separation of the Oracle ASM storage administration privileges from SYSDBA.

[Changes in Oracle ASM System Privileges When Upgrading to Oracle Grid Infrastructure 12c Release 1 \(12.1.0.2\)](#) (page 5-14)

When upgrading from Oracle Grid Infrastructure release 12.1.0.1 to release 12.1.0.2, the upgrade process automatically updates the group memberships and the disk ACLs for Oracle ASM privileges.

5.1.8.1 About Job Role Separation Operating System Privileges Groups and Users

With Oracle Database job role separation, each Oracle Database installation has separate operating system groups to provide authentication for system privileges on that Oracle Database, so multiple databases can be installed on the cluster without sharing operating system authentication for system privileges. In addition, each Oracle software installation is associated with an Oracle Installation user, to provide operating system user authentication for modifications to Oracle Database binaries.

With Oracle Grid Infrastructure job role separation, Oracle ASM has separate operating system groups that provide operating system authentication for Oracle ASM system privileges for storage tier administration. This operating system authentication is separated from Oracle Database operating system authentication. In addition, the Oracle Grid Infrastructure Installation user provides operating system user authentication for modifications to Oracle Grid Infrastructure binaries.

During the Oracle Database installation, the OSDBA, OSOPER, OSBACKUPDBA, OSDGDBA and OSKMDBA groups are created and users assigned to these groups. Members of these groups are granted operating system authentication for the set of database system privileges each group authorizes. Oracle recommends that you use different operating system groups for each set of system privileges.

Note: This configuration is optional, to restrict user access to Oracle software by responsibility areas for different administrator users.

To configure users for installation that are on a network directory service such as Network Information Services (NIS), refer to your directory service documentation.

See Also:

- *Oracle Database Administrator's Guide* for more information about planning for system privileges authentication
 - *Oracle Automatic Storage Management Administrator's Guide* for more information about Oracle ASM operating system authentication
-
-

5.1.8.2 Oracle Software Owner for Each Oracle Software Product

Oracle recommends that you use the following operating system groups and users for all installations where you specify separate Oracle Home Users:

Separate Oracle Installation users for each Oracle software product (typically, `oracle`, for the Oracle Database software, and `grid` for the Oracle Grid Infrastructure software.

You must create at least one Oracle Installation user the first time you install Oracle software on the system. This user owns the Oracle binaries of the Oracle Grid Infrastructure software, and you can also use this same user as the Oracle Installation user for the Oracle Database or Oracle RAC binaries.

The Oracle Installation user for Oracle Database software has full administrative privileges for Oracle instances and is added to the `ORA_DBA`, `ORA_ASMDBA`, `ORA_HOMENAME_SYSBACKUP`, `ORA_HOMENAME_SYSDG`, and `ORA_HOMENAME_SYSKM` groups. Oracle Home users are added to the `ORA_HOMENAME_DBA` group for the Oracle home created during the installation. The `ORA_OPER` and `ORA_HOMENAME_OPER` groups are created, but no users are added to these groups during installation.

See Also: *Oracle Database Security Guide* for more information about the available operating system groups and the privileges associated with each group

5.1.8.3 Standard Oracle Database Groups for Job Role Separation

The Oracle Database supports multiple operating system groups to provide operating system authentication for database administration system privileges.

- **OSDBA group** (`ORA_DBA`)
 The installation process creates this group the first time you install Oracle Database software on the system. This group identifies operating system user accounts that have database administrative privileges (the `SYSDBA` system privilege) for all database instances running on the server.
 Members of the `ORA_DBA` group do not have `SYSASM` system privilege on Oracle ASM instances, which are needed for mounting and dismounting disk groups.
- **OSOPER group for Oracle Database** (`ORA_OPER`)
 Use this group if you want a separate group of operating system users to have a limited set of database administrative privileges for starting up and shutting down the database (the `SYSOPER` system privilege).
- **OSDBA group for a particular Oracle home** (`ORA_HOMENAME_DBA`)

This group is created the first time you install Oracle Database software into a new Oracle home. This group identifies operating system user accounts that have database administrative privileges (the SYSDBA system privilege) for the database instances that run from that Oracle home.

- **OSOPER group for a particular Oracle home** (`ORA_HOMENAME_OPER`)

Use this group if you want a separate group of operating system users to have a limited set of database administrative privileges for starting up and shutting down the database instances that run from a particular Oracle home (the SYSOPER system privilege).

5.1.8.4 Extended Oracle Database Groups for Job Role Separation

Starting with Oracle Database 12c Release 1 (12.1), in addition to the SYSOPER system privilege to start and shut down the database, you can create new administrative privileges that are more task-specific and less privileged than the `ORA_DBA` group (or `SYSDBA` system privilege) to support specific administrative privileges tasks required for everyday database operation. Users granted these system privileges are also authenticated through operating system group membership.

The installer automatically creates operating system groups whose members are granted these system privileges. The OSDBA subset job role separation privileges and groups consist of the following:

- **OSBACKUPDBA group for Oracle Database** (`ORA_HOMENAME_SYSBACKUP`)

Assign users to this group if you want a separate group of operating system users to have a limited set of database backup and recovery related administrative privileges (the `SYSBACKUP` privilege).

- **OSDGDBA group for Oracle Data Guard** (`ORA_HOMENAME_SYSDG`)

Assign users to this group if you want a separate group of operating system users to have a limited set of privileges to administer and monitor Oracle Data Guard (the `SYSDG` privilege).

- **OSKMDBA group for encryption key management** (`ORA_HOMENAME_SYSKM`)

Assign users to this group if you want a separate group of operating system users to have a limited set of privileges for encryption key management such as Oracle Wallet Manager management (the `SYSKM` privilege).

See Also:

Oracle Database Installation Guide for Microsoft Windows for information about these groups.

5.1.8.5 Oracle ASM Groups for Job Role Separation

The `SYSASM`, `SYSOPER` for ASM, and `SYSDBA` for ASM system privileges enables the separation of the Oracle ASM storage administration privileges from `SYSDBA`.

During installation, the following groups are created for Oracle ASM:

- **OSASM Group for Oracle ASM Administration** (`ORA_ASMADMIN`)

Use this separate group to have separate administration privilege groups for Oracle ASM and Oracle Database administrators. Members of this group are

granted the SYSASM system privilege to administer Oracle ASM. In Oracle documentation, the operating system group whose members are granted privileges is called the OSASM group. During installation, the Oracle Installation User for Oracle Grid Infrastructure and Oracle Database Service IDs are configured as members of this group. Membership in this group also grants database access to the ASM disks.

Members of the OSASM group can use SQL to connect to an Oracle ASM instance as SYSASM using operating system authentication. The SYSASM system privilege permits mounting and dismounting disk groups, and other storage administration tasks. SYSASM system privileges do not grant access privileges on an Oracle Database instance.

- **OSDBA for ASM Database Administrator group (ORA_ASMDBA)**

This group grants access for the database to connect to Oracle ASM. During installation, the Oracle Installation Users are configured as members of this group. After you create an Oracle Database, this groups contains the Oracle Home Users of those database homes.

- **OSOPER for ASM Group for ASM Operators (ORA_ASMOPER)**

This is an optional group. Use this group if you want a separate group of operating system users to have a limited set of Oracle ASM instance administrative privileges (the SYSOPER for ASM system privilege), including starting up and stopping the Oracle ASM instance. By default, members of the OSASM group also have all privileges granted by the SYSOPER for ASM system privilege.

To use the Oracle ASM Operator group to create an Oracle ASM administrator with fewer privileges than those granted by the SYSASM system privilege you must assign the user to this group after installation.

5.1.8.6 Changes in Oracle ASM System Privileges When Upgrading to Oracle Grid Infrastructure 12c Release 1 (12.1.0.2)

When upgrading from Oracle Grid Infrastructure release 12.1.0.1 to release 12.1.0.2, the upgrade process automatically updates the group memberships and the disk ACLs for Oracle ASM privileges.

- The disk ACLs are updated to add ORA_ASMADMIN and remove ORA_ASMDBA.
- The database service SIDs are added to both ORA_ASMADMIN and ORA_ASMDBA
- The Oracle Service user (typically the Oracle Home user) is added to ORA_ASMDBA

These updates ensure that databases using either Oracle Database release 12.1.0.1 or release 12.1.0.2 can use Oracle ASM after the upgrade to Oracle Grid Infrastructure release 12.1.0.2.

If Oracle ASM is freshly installed as part of Oracle Grid Infrastructure 12c Release 1 (12.1.0.2), then only the 12.1.0.2 version of the privileges are configured:

- The database service SIDs are added to ORA_ASMADMIN
- The Oracle Service user (typically the Oracle Home user) is added to ORA_ASMDBA
- The disk ACLs are updated to include ORA_ASMADMIN

Before you install Oracle Database 12c release 12.1.0.1 software on a system with a new installation (not an upgraded installation) of Oracle Grid Infrastructure 12c Release 1 (12.1.0.2), you must apply a patch to ensure the proper privileges are configured when you create an Oracle Database 12c release 12.1.0.1 database.

5.1.9 Example of Using Role-Allocated Groups and Users

You can use role-allocated groups and users that is compliant with an Optimal Flexible Architecture (OFA) deployment.

Assumptions:

- The user installing the Oracle Grid Infrastructure software is named `RACDOMAIN\grid`. This user was created before starting the installation.

The option to use the Windows Built-in Account was selected for the Oracle Home user for Oracle Grid Infrastructure.

- The name of the home directory for the Oracle Grid Infrastructure installation is `OraGrid12c`.

- The user installing the Oracle RAC software is named `oracle`. This user was created before starting the installation.

During installation of Oracle RAC, an Oracle Home user named `RACDOMAIN\oradba1` is specified. The `oradba1` user is a Windows domain user that was created before the installation was started.

The name of the Oracle home for the Oracle RAC installation is `OraRAC12c_home1`.

- You have a second, Oracle Database installation (not Oracle RAC) on this server. The installation was performed by the `oracle` user. The Oracle Home user is `oradba2`, and this user was not created before starting the installation.

The Oracle Home name is `OraDB12c_home1`.

- Both the Oracle databases and Oracle Clusterware are configured to use Oracle ASM for data storage.

After installing the Oracle software, you have the following groups and users:

Operating System Group Name	Type of Group	Members
<code>ORA_DBA</code>	OSDBA group	<code>oracle</code> , <code>RACDOMAIN\grid</code> , and the Local System built-in Windows account
<code>ORA_OraRAC12c_home1_DBA</code>	OSDBA group for the Oracle RAC home directory	<code>RACDOMAIN\oradba1</code>
<code>ORA_OraDB12c_home1_DBA</code>	OSDBA group for the Oracle Database home directory	<code>oradba2</code>
<code>ORA_OPER</code>	OSOPER group	none
<code>ORA_OraRAC12c_home1_OPER</code>	OSOPER group for the Oracle RAC home directory	none

Operating System Group Name	Type of Group	Members
ORA_OraDB12c_home1_OPER	OSOPER group for the Oracle Database home directory	none
ORA_ASMADMIN	OSASM group	RACDOMAIN\grid and the Local System built-in Windows account, and the database service IDs
ORA_ASMOPER	OSOPER for ASM group	
ORA_ASMDBA	OSDBA for ASM group for Oracle ASM clients	RACDOMAIN\grid, oracle, the Local System built-in Windows account, and Oracle Home Users of database homes
ORA_RAC12c_home1_SYSDG, ORA_RAC12c_home1_SYSDG, and ORA_RAC12c_home1_SYSKM	Specialized role groups that authorize users with the SYSDG, SYSDG, and SYSKM system privileges.	none
ORA_DB12c_home1_SYSDG, ORA_DB12c_home1_SYSDG, and ORA_DB12c_home1_SYSKM	Specialized role groups that authorize users with the SYSDG, SYSDG, and SYSKM system privileges.	none

If there are no users listed for an operating system group, then that means the group has no members after installation.

5.2 Configuring User Accounts

When installing Oracle Grid Infrastructure for a cluster, you run the installer software as an Administrator user. During installation, you can specify an Oracle Home user.

Before starting the installation, there are a few checks you need to perform for the Oracle Installation users, to ensure the installation will succeed.

[Configuring Environment Variables for the Oracle Installation User](#) (page 5-16)

The installer uses environment variables set for the Oracle Installation User.

[Verifying User Privileges to Update Remote Nodes](#) (page 5-17)

You must insure that operations that are performed on multiple nodes can be performed during installation of the Oracle Grid Infrastructure software.

[Managing User Accounts with User Account Control](#) (page 5-18)

To ensure that only trusted applications run on your computer, Windows Server 2008 and Windows Server 2008 R2 provide User Account Control.

5.2.1 Configuring Environment Variables for the Oracle Installation User

The installer uses environment variables set for the Oracle Installation User.

- Before starting the Oracle Grid Infrastructure installation, ensure the %TEMP% environment variable is set correctly.

See "[Checking the Available TEMP Disk Space](#) (page 2-4)".

5.2.2 Verifying User Privileges to Update Remote Nodes

You must insure that operations that are performed on multiple nodes can be performed during installation of the Oracle Grid Infrastructure software.

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. You must explicitly grant membership in the local Administrators group to the installation user on all of the nodes in your cluster.

1. Determine if User Account Control (UAC) remote restrictions have been disabled for the local installation user. If you are using a domain user for installation, then skip this step.

Check the value of the `LocalAccountTokenFilterPolicy` registry entry for the registry key `HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Windows\CurrentVersion\Policies\System`. The value should be set to 1. If this registry entry does not exist, then, do the following:

- a. Click **Start**, click **Run**, type `regedit`, and then press **Enter**.
- b. Navigate to the registry key `HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Windows\CurrentVersion\Policies\System`.
- c. On the **Edit** menu, select **New**, and then click **DWORD Value**.
- d. Type `LocalAccountTokenFilterPolicy` and then press **Enter**.
- e. Right-click `LocalAccountTokenFilterPolicy`, then click **Modify**.
- f. In the Value data box, type 1, then click **OK**.
- g. Exit the registry editor.

By setting the value of `LocalAccountTokenFilterPolicy` to 1, a user who is a member of the local administrators group on the target remote computer establishes a remote administrative connection with an elevated token, enabling the user to perform administrative tasks. If you do not disable the UAC remote restrictions for administrative users, then when installing Oracle Grid Infrastructure on multiple nodes you might encounter the following error:

```
INS-40937 The following hostnames are invalid
```

2. 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.

Enter the following command for each node that is a part of the cluster where *nodename* is the node name:

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

3. If you will be using other disk drives in addition to the C: drive, then repeat the `net use` command for every node in the cluster, substituting the drive letter for each drive you plan to use.
4. Verify the installation user is configured to update the Windows registry on each node in the cluster.

- a. Run `regedit` from the Run menu or the command prompt.
- b. From the **File** menu select **Connect Network Registry**.
- c. In the 'Enter the object name...' edit box enter the name of a remote node in the cluster, then click **OK**.
- d. 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.

5.2.3 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 the User Account Control security feature, then depending on how you have it configured, 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 Administrators group," then you must explicitly run these tools with Windows Administrator privileges.

All of the Oracle shortcuts that require Administrator privileges are automatically run as an "Administrator" user 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 Administrator command prompt.

OPatch does not have a shortcut and must be run from an Administrator command prompt.

5.3 Creating Oracle Software Directories

During installation, you are prompted to provide a path to a home directory to store Oracle Grid Infrastructure software.

You also need to provide a home directory when installing Oracle RAC. Each directory has certain requirements that must be met for the software to work correctly.

Oracle Universal Installer creates the directories during installation if they do not exist.

[About the Directories Used During Installation of Oracle Grid Infrastructure](#) (page 5-19)

OUI uses several directories during installation of Oracle Grid Infrastructure.

[Requirements for the Oracle Grid Infrastructure Home Directory](#) (page 5-21)

Review directory path requirements for Oracle Grid Infrastructure Home directory.

[About Creating the Oracle Base Directory Path](#) (page 5-22)

The Oracle base directory for the Oracle Installation User for Oracle Grid Infrastructure is the location where diagnostic and administrative logs,

and other logs associated with Oracle ASM and Oracle Clusterware are stored.

5.3.1 About the Directories Used During Installation of Oracle Grid Infrastructure

OUI uses several directories during installation of Oracle Grid Infrastructure.

Note: The base directory for Oracle Grid Infrastructure 12c and the base directory for Oracle RAC 12c must be different from the directories used by the Oracle RAC 11g Release 2 installation.

Temporary Directories (page 5-19)

To install properly across all nodes, OUI uses the temporary folders defined within Microsoft Windows.

Grid Home Directory (page 5-19)

The directory that Oracle Grid Infrastructure is installed in is the **Grid home**.

Oracle Base Directory (page 5-20)

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.

Oracle Inventory Directory (page 5-21)

The **Oracle Inventory directory** is the central inventory location for all Oracle software installed on a server.

5.3.1.1 Temporary Directories

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 %WINDIR%\temp and %WINDIR%\tmp.

For example, if Windows is installed on the C drive, then the temporary directories would be defined as C:\Windows\temp or C:\Windows\tmp for all nodes.

5.3.1.2 Grid Home Directory

The directory that Oracle Grid Infrastructure is installed in is the **Grid home**.

When installing Oracle Grid Infrastructure, you must determine the location of the Grid home. Oracle ASM is also installed in this home directory.

If you plan to install Oracle RAC, you must choose a different directory in which to install the Oracle Database software. The location of the Oracle RAC installation is the **Oracle home**.

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

5.3.1.3 Oracle Base Directory

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.

If you install Oracle Database 12c Release 1 (12.1) on a computer with no other Oracle software installed, OUI creates an Oracle base directory for you. If Oracle software is already installed, then one or more Oracle base directories already exist. In the latter case, OUI offers you a choice of Oracle base directories to use during installation.

Caution: After installing Oracle Database 12c Release 1 (12.1) (or later) release with a Windows User Account as Oracle Home User, do not install older releases of Oracle Databases that share the same Oracle Base Directory. During installation of the software for older releases, the ACLs are reset and Oracle Database 12c Release 1 (12.1) (or later) services may not be able to access the Oracle Base directory and files.

In a default Windows installation, the Oracle base directory appears as follows, where *X* represents a disk drive and *username* is the name of the currently logged in user:

```
X: \app\username
```

Using the Oracle base directory path helps to facilitate the organization of Oracle installations, and helps to ensure that installations of multiple databases maintain an Optimal Flexible Architecture (OFA) configuration.

The Oracle base directory for the Oracle Grid Infrastructure installation is the location where diagnostic and administrative logs, and other logs associated with Oracle ASM and Oracle Clusterware are stored. For Oracle installations other than Oracle Grid Infrastructure for a cluster, the Oracle base directory is also the location under which an Oracle home is placed.

However, for an Oracle Grid Infrastructure installation, you must create a *different* path for the Grid home, so that the path for Oracle base remains available for other Oracle installations. You can have only one active Oracle Grid Infrastructure installation on a cluster, and all upgrades are out-of-place upgrades. Because of this, Oracle recommends that you create both an Oracle base for the Grid Installation User (grid), and an Oracle home for the Oracle Grid Infrastructure binaries using the release number of that installation. For example, use the following path to create an Oracle Grid Infrastructure home (Grid home):

```
D: \app\12.1.0\grid
```

During installation, ownership of the path to the Grid home is changed to the LocalSystem user. If you do not create a unique path to the Grid home, then after the Oracle Grid Infrastructure installation, you might encounter permission errors for other installations, including any existing installations under the same path.

Caution:

For Oracle Grid Infrastructure (for a cluster) installations, note the following restrictions for the Oracle Grid Infrastructure home (the Grid home directory for Oracle Grid Infrastructure):

- It must not be placed under one of the Oracle base directories, including the Oracle base directory of the Oracle Grid Infrastructure installation owner.
- It must not be placed in the home directory of an installation owner.

These requirements are specific to Oracle Grid Infrastructure for a cluster installations. Oracle Grid Infrastructure for a standalone server (Oracle Restart) can be installed under the Oracle base for the Oracle Database installation.

Oracle recommends that you let the Oracle Universal Installer create the Oracle Grid Infrastructure Grid home and Oracle base directories.

Note:

Placing Oracle Grid Infrastructure for a cluster binaries on a cluster file system is not supported.

Oracle recommends that you install Oracle Grid Infrastructure locally, on each cluster member node. Using a shared Grid home prevents rolling upgrades, and creates a single point of failure for the cluster.

5.3.1.4 Oracle Inventory Directory

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`. This directory is created automatically the first time you install Oracle software on a Windows server.

5.3.2 Requirements for the Oracle Grid Infrastructure Home Directory

Review directory path requirements for Oracle Grid Infrastructure Home directory.

- It is located in a path outside existing Oracle homes, including Oracle Clusterware homes.
- It is not located in a user home directory.
- If you create the path before installation, then the Oracle Installation user for Oracle Grid Infrastructure can create the directories in the path.

Oracle recommends that you install Oracle Grid Infrastructure on local homes, rather than using a shared home on shared storage.

For installations with Oracle Grid Infrastructure only, Oracle recommends that you create a path compliant with Oracle Optimal Flexible Architecture (OFA) guidelines, so that Oracle Universal Installer (OUI) can select that directory during installation.

Note:

Oracle Grid Infrastructure homes can be placed in a local home on servers, even if your existing Oracle Clusterware home from a prior release is in a shared location.

If you are installing Oracle Grid Infrastructure for a database (Oracle Restart), then the home directory for Oracle Restart can be under the Oracle base directory for the Oracle Installation user for Oracle Database. Refer to *Oracle Database Installation Guide* for your platform for more information about Oracle Restart.

5.3.3 About Creating the Oracle Base Directory Path

The Oracle base directory for the Oracle Installation User for Oracle Grid Infrastructure is the location where diagnostic and administrative logs, and other logs associated with Oracle ASM and Oracle Clusterware are stored.

If the directory or path you specify during installation for the Grid home does not exist, then OUI creates the directory.

Note:

- Placing Oracle Grid Infrastructure for a cluster binaries on a cluster file system is not supported.
 - The base directory for Oracle Grid Infrastructure 12c and the base directory for Oracle RAC 12c must be different from the directories used by the Oracle RAC 11g Release 2 installation.
-
-

Related Topics:

[Understanding the Oracle Base Directory](#) (page C-4)

5.4 Enabling Intelligent Platform Management Interface (IPMI)

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. 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.

[Requirements for Enabling IPMI](#) (page 5-23)

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

[Configuring the IPMI Management Network](#) (page 5-23)

You can configure the Baseboard Management Controller (BMC) for Dynamic Host Configuration Protocol (DHCP), or for static IP addresses.

Configuring the IPMI Driver (page 5-24)

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.

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

5.4.1 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 Server 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.

Note: IPMI operates on the physical hardware platform through the network interface of the Baseboard Management Controller (BMC). Depending on your system configuration, an IPMI-initiated restart of a server can affect all virtual environments hosted on the server. Contact your hardware and OS vendor for more information.

5.4.2 Configuring the IPMI Management Network

You can configure the Baseboard Management Controller (BMC) for Dynamic Host Configuration Protocol (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 Intelligent Platform Management Interface (IPMI), and you use Grid Naming Services (GNS), then you still must configure separate addresses for the IPMI interfaces. Because the IPMI adapter is not seen directly by the host, the IPMI adapter is not visible to GNS as an address on the host.

5.4.3 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`) is installed, which is included with the 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: 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.

[Configuring the Hardware Management Component](#) (page 5-24)

Hardware management is installed using the Add/Remove Windows Components Wizard.

5.4.3.1 Configuring the Hardware Management Component

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 ipmissetp.dll,AddTheDevice
```

Configuring Storage for Oracle Grid Infrastructure 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.

Note: If you are currently using OCFS for Windows as your shared storage, then you must migrate to using Oracle ASM *before* the upgrade of Oracle Database and Oracle Grid Infrastructure.

[Reviewing Oracle Grid Infrastructure Storage Options](#) (page 6-2)

This section describes the supported storage options for Oracle Grid Infrastructure for a cluster, and for features running on Oracle Grid Infrastructure.

[Guidelines for Choosing a Shared Storage Option](#) (page 6-6)

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 option.

[Storage Requirements for Oracle Clusterware and Oracle RAC](#) (page 6-9)

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.

[After You Have Selected the Shared Storage Options](#) (page 6-19)

When you have determined your disk storage options, you then start the configuration. The exact steps to perform depend on the type of shared storage you use.

[Preliminary Shared Disk Preparation](#) (page 6-19)

When using shared storage on a Windows platform, there are additional preinstallation tasks to complete.

[Configuring Shared Storage for Oracle ASM](#) (page 6-20)

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

[Configuring Disk Partitions on Shared Storage](#) (page 6-24)

To create disk partitions, use the disk administration tools provided by the operating system or third party vendors. You can create the disk

partitions using either the Disk Management Interface or the DiskPart utility, both of which are provided by the operating system.

[Configuring Direct NFS Client for Oracle RAC Data Files](#) (page 6-26)

Direct NFS Client is an interface for NFS systems provided by Oracle.

[Upgrading Existing Oracle ASM Instances](#) (page 6-32)

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) to upgrade the existing Oracle ASM instance to Oracle ASM 12c Release 1 (12.1).

[Configuring Oracle Automatic Storage Management Cluster File System](#) (page 6-33)

If you want to install Oracle RAC on Oracle ACFS, you must first create the Oracle home directory in Oracle ACFS.

6.1 Reviewing Oracle Grid Infrastructure Storage Options

This section describes the supported storage options for Oracle Grid Infrastructure for a cluster, and for features running on Oracle Grid Infrastructure.

[Supported Storage Options for Oracle Grid Infrastructure and Oracle RAC](#) (page 6-3)

Both Oracle Clusterware and the Oracle RAC database use files that must be available to all the nodes in the cluster. The following table shows the storage options supported for storing Oracle Clusterware and Oracle RAC files.

[General Storage Considerations for Oracle Grid Infrastructure](#) (page 6-3)

Oracle Clusterware uses voting files to monitor cluster node status, and the Oracle Cluster Registry (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. Oracle Database Configuration Assistant (DBCA) uses the OCR for storing the configurations for the cluster databases that it creates.

[General Storage Considerations for Oracle RAC](#) (page 6-5)

For all Oracle RAC installations, you must choose the shared 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.

[About Oracle ACFS and Oracle ADVM](#) (page 6-5)

Oracle Automatic Storage Management Cluster File System (Oracle ACFS) and Oracle ASM Dynamic Volume Manager (Oracle ADVM) are the main components of Oracle Cloud File System (Oracle CloudFS).

See Also: The Certification page in My Oracle Support for the most current information about certified storage options: <https://support.oracle.com>

6.1.1 Supported Storage Options for Oracle Grid Infrastructure and Oracle RAC

Both Oracle Clusterware and the Oracle RAC database use files that must be available to all the nodes in the cluster. The following table shows the storage options supported for storing Oracle Clusterware and Oracle RAC files.

Table 6-1 Supported Storage Options for Oracle Clusterware and Oracle RAC Files and Home Directories

Storage Option	OCR and Voting Files	Oracle Grid Infrastructure Home	Oracle RAC Home	Oracle RAC Database Files	Oracle Recovery Files
Oracle Automatic Storage Management (Oracle ASM)	Yes	No	No	Yes	Yes
Oracle Automatic Storage Management Cluster File System (Oracle ACFS)	No	No	Yes	Yes (Oracle Database 12c Release 12.1.0.2 and later)	Yes (Oracle Database 12c Release 12.1.0.2 and later)
Direct NFS Client access to a certified network attached storage (NAS) filer Note: NFS or Direct NFS Client cannot be used for Oracle Clusterware files.	No	No	No	Yes	Yes
Shared disk partitions (raw devices)	No	No	No	No	No
Local file system (NTFS formatted disk)	No	Yes	Yes	No	No

6.1.2 General Storage Considerations for Oracle Grid Infrastructure

Oracle Clusterware uses voting files to monitor cluster node status, and the Oracle Cluster Registry (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. Oracle Database Configuration Assistant (DBCA) uses the OCR for storing the configurations for the cluster databases that it creates.

Use the following guidelines when choosing storage options for the Oracle Clusterware files:

- The Oracle Grid Infrastructure home (Grid home) cannot be stored on a shared file system; it must be installed on a local disk.
- 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 store Oracle Cluster Registry (OCR) and voting files in Oracle ASM disk groups. You can also store a backup of the OCR file in a disk group.

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

- 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 to provide redundancy, 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 files.
- Each OCR location should be placed on a different disk.
- For voting files, ensure that each file does not share any hardware device or disk, or other single point of failure with the other voting files. Any node that does not have available to it an absolute majority of voting files (more than half, or a **quorum**) configured will be restarted.
- If you do not have a storage option that provides external file redundancy, then you must use Oracle ASM, or configure at least three voting file locations to provide redundancy.
- Except when using external redundancy, Oracle ASM mirrors all Oracle Clusterware files in separate failure groups within a disk group. A **quorum failure group**, a special type of failure group, contains mirror copies of voting files when voting files are stored in normal or high redundancy disk groups.

[Storage Requirements When Using Oracle ASM for Oracle Clusterware Files](#) (page 6-4)

Be aware of the following requirements and recommendations when using Oracle ASM to store the Oracle Clusterware files:

6.1.2.1 Storage Requirements When Using Oracle ASM for Oracle Clusterware Files

Be aware of the following requirements and recommendations when using Oracle ASM to store the Oracle Clusterware files:

- You can store Oracle Cluster Registry (OCR) and voting files in Oracle ASM disk groups. You can also store a backup of the OCR file in a disk group.
- The Oracle ASM instance must be clustered and the disks available to all the nodes in the cluster. Any node that does not have access to an absolute majority of voting files (more than half) will be restarted.
- To store the Oracle Clusterware files in an Oracle ASM disk group, the disk group compatibility must be at least 11.2.

Note: If you are upgrading an Oracle ASM installation, then see *Oracle Automatic Storage Management Administrator's Guide* for more information about disk group compatibility.

6.1.3 General Storage Considerations for Oracle RAC

For all Oracle RAC installations, you must choose the shared 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.

If you plan to configure automated backups, then you must also choose a shared storage option to use for recovery files (the fast recovery area). Oracle recommends that you choose Oracle ASM as the shared storage option for the database data files and recovery files. The shared storage option that you choose for recovery files can be the same as or different from the shared storage option that you choose for the data files.

If you do not use Oracle ASM, then Oracle recommends that you place the data files and the Fast Recovery Area in shared storage located outside of the Oracle home, in separate locations, so that a hardware failure does not affect availability.

Use the following guidelines when choosing storage options for the Oracle RAC files:

- 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.
- Oracle recommends that you choose Oracle ASM as the storage option for database and recovery files.
- 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 the nodes in the cluster must have Oracle Clusterware and Oracle ASM 12c Release 1 (12.1) 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 before installing Oracle RAC or creating the Oracle RAC database.
- For Standard Edition and Standard Edition 2 (SE2) 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 file (SPFILE), and the fast recovery area.

6.1.4 About Oracle ACFS and Oracle ADVM

Oracle Automatic Storage Management Cluster File System (Oracle ACFS) and Oracle ASM Dynamic Volume Manager (Oracle ADVM) are the main components of Oracle Cloud File System (Oracle CloudFS).

Oracle ACFS extends Oracle ASM technology to support all your application data in both single instance and cluster configurations. Oracle ADVM provides volume management services and a standard disk device driver interface to clients. Oracle Automatic Storage Management Cluster File System communicates with Oracle ASM through the Oracle Automatic Storage Management Dynamic Volume Manager interface.

See Also:

- My Oracle Support Note 1369107.1 for more information about platforms and releases that support Oracle ACFS and Oracle ADVN: <https://support.oracle.com/CSP/main/article?cmd=show&type=NOT&id=1369107.1>
 - "[Restrictions and Guidelines for Oracle ACFS](#) (page 6-7)"
-

6.2 Guidelines for Choosing a Shared Storage Option

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 option.

[Guidelines for Using Oracle ASM Disk Groups for Storage](#) (page 6-6)

During Oracle Grid Infrastructure installation, you can create one or two Oracle ASM disk groups. After the Oracle Grid Infrastructure installation, you can create additional disk groups using Oracle Automatic Storage Management Configuration Assistant (ASMCA), SQL*Plus, or Automatic Storage Management Command-Line Utility (ASMCMD).

[Guidelines for Using Direct Network File System \(NFS\) with Oracle RAC](#) (page 6-7)

Network-attached storage (NAS) systems use a network file system (NFS) to access data. You can store Oracle RAC data files and recovery files on a supported NAS server using Direct NFS Client.

[Restrictions and Guidelines for Oracle ACFS](#) (page 6-7)

Oracle Automatic Storage Management Cluster File System (Oracle ACFS) provides a general purpose file system. Oracle ACFS extends Oracle ASM technology to support all your application data in both single instance and cluster configurations.

[Guidelines for Placing Recovery Files on a File System](#) (page 6-8)

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

6.2.1 Guidelines for Using Oracle ASM Disk Groups for Storage

During Oracle Grid Infrastructure installation, you can create one or two Oracle ASM disk groups. After the Oracle Grid Infrastructure installation, you can create additional disk groups using Oracle Automatic Storage Management Configuration Assistant (ASMCA), SQL*Plus, or Automatic Storage Management Command-Line Utility (ASMCMD).

Note that with Oracle Database 11g Release 2 (11.2) and later releases, Oracle Database Configuration Assistant (DBCA) does not have the functionality to create disk groups for Oracle ASM.

If you choose to create a second disk group during Oracle Grid Infrastructure installation, then the second disk group stores the Grid Infrastructure Management Repository (GIMR) data files and Oracle Cluster Registry (OCR) backup files. It is strongly recommended that you store the OCR backup files in a different disk group from the disk group where you store OCR files. Storing OCR backups in a separate location is also advisable for performance, availability, sizing, and manageability of storage.

Note: You can choose the Grid Infrastructure Management Repository (GIMR) location at the time of installing Oracle Grid Infrastructure. You cannot migrate a Grid Infrastructure Management Repository (GIMR) from one disk group to another later.

If you install Oracle Database or Oracle RAC after you install Oracle Grid Infrastructure, then you can either use the same disk group for database files, OCR, and voting files, or you can use different disk groups. If you create multiple disk groups before installing Oracle RAC or before creating a database, then you can do one of the following:

- Place the data files in the same disk group as the Oracle Clusterware files.
- Use the same Oracle ASM disk group for data files and recovery files.
- Use different disk groups for each file type.

If you create only one disk group for storage, then the OCR and voting files, database files, and recovery files are contained in the one disk group. If you create multiple disk groups for storage, then you can place files in different disk groups.

See Also:

Oracle Automatic Storage Management Administrator's Guide for information about creating disk groups

6.2.2 Guidelines for Using Direct Network File System (NFS) with Oracle RAC

Network-attached storage (NAS) systems use a network file system (NFS) to access data. You can store Oracle RAC data files and recovery files on a supported NAS server using Direct NFS Client.

NFS file systems must be mounted and available over NFS mounts before you start the Oracle RAC installation. See your vendor documentation for NFS configuration and mounting information.

Note that the performance of Oracle Database software and the databases that use NFS storage depend on the performance of the network connection between the database server and the NAS device. For this reason, Oracle recommends that you connect the database server (or cluster node) to the NAS device using a private, dedicated, network connection, which should be Gigabit Ethernet or better.

6.2.3 Restrictions and Guidelines for Oracle ACFS

Oracle Automatic Storage Management Cluster File System (Oracle ACFS) provides a general purpose file system. Oracle ACFS extends Oracle ASM technology to support all your application data in both single instance and cluster configurations.

You can place the Oracle home for Oracle Database 12c Release 1 (12.1) software on Oracle ACFS, but you cannot place Oracle Clusterware files on Oracle ACFS.

Note the following about Oracle ACFS:

- You cannot place Oracle Clusterware executable files or shared files on Oracle ACFS.

- You must use a domain user when installing Oracle Grid Infrastructure if you plan to use Oracle ACFS.
- Starting with Oracle Grid Infrastructure 12c Release 1 (12.1) for a cluster, creating Oracle data files on an Oracle ACFS file system is supported.
You can put Oracle Database binaries and administrative files (for example, trace files) on Oracle ACFS.
- Oracle ACFS does not support replication or encryption with Oracle Database data files, tablespace files, control files, and redo logs.
- For policy-managed Oracle Flex Cluster databases, Oracle ACFS can run on Hub Nodes, but cannot run on Leaf Nodes. For this reason, Oracle RAC binaries cannot be placed on Oracle ACFS located on Leaf Nodes.
- When creating Oracle ACFS file systems on Windows, log on as a Windows domain user. Also, when creating files in an Oracle ACFS file system on Windows, you should be logged in as a Windows domain user to ensure that the files are accessible by all nodes.

When using a file system across cluster nodes, the best practice is to mount the file system using a domain user, to ensure that the security identifier is the same across cluster nodes. Windows security identifiers, which are used in defining access rights to files and directories, use information which identifies the user. Local users are only known in the context of the local node. Oracle ACFS uses this information during the first file system mount to set the default access rights to the file system.

- Oracle Restart does not support root-based Oracle Clusterware resources. For this reason, the following restrictions apply if you run Oracle ACFS on an Oracle Restart Configuration:
 - Oracle Restart does not support Oracle ACFS resources on all platforms.
 - Starting with Oracle Database 12c, Oracle Restart configurations do not support the Oracle ACFS registry.
 - You must manually load Oracle ACFS drivers after a system restart.
 - You must manually mount an Oracle ACFS file system, and unmount it after the Oracle ASM instance has finished running.
 - Creating Oracle data files on an Oracle ACFS file system is not supported in Oracle Restart configurations. Creating Oracle data files on an Oracle ACFS file system is supported on Oracle Grid Infrastructure for a Cluster configurations.

6.2.4 Guidelines for Placing Recovery Files on a File System

If you choose to place the 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 data files, recovery files, 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 User's Guide* for more information about sizing the fast recovery area.

6.3 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 Oracle Database Files](#)
(page 6-10)

[Identifying Storage Requirements for Using Oracle ASM for Shared Storage](#)
(page 6-10)

Before installing Oracle Grid Infrastructure, you must identify and determine how many devices are available for use by Oracle ASM, the amount of free disk space available on each disk, and the redundancy level to use with Oracle ASM. When Oracle ASM provides redundancy, you must have sufficient capacity in each disk group to manage a re-creation of data that is lost after a failure of one or two failure groups.

[Restrictions for Disk Partitions Used By Oracle ASM](#) (page 6-15)

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

[Preparing Your System to Use Oracle ASM for Shared Storage](#) (page 6-15)

To use Oracle ASM as the shared storage solution for Oracle Clusterware or Oracle RAC files, you must perform certain tasks before you begin the software installation.

[Requirements for Using a Shared File System](#) (page 6-17)

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

[Requirements for Files Managed by Oracle](#) (page 6-18)

If you use Oracle ASM for your database files, then Oracle creates the database with Oracle Managed files by default. 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.

6.3.1 Requirements for Using a Cluster File System for Oracle Database Files

If you choose to place your Oracle Database software or data files on a clustered 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).
- You use 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 must be able to create the files in the path that you specify.

Note: On Windows platforms, the only supported method for storing Oracle Clusterware files is Oracle ASM.

6.3.2 Identifying Storage Requirements for Using Oracle ASM for Shared Storage

Before installing Oracle Grid Infrastructure, you must identify and determine how many devices are available for use by Oracle ASM, the amount of free disk space available on each disk, and the redundancy level to use with Oracle ASM. When Oracle ASM provides redundancy, you must have sufficient capacity in each disk group to manage a re-creation of data that is lost after a failure of one or two failure groups.

Tip: As you progress through the following steps, make a list of the raw device names you intend to use to create the Oracle ASM disk groups and have this information available during the Oracle Grid Infrastructure installation or when creating your Oracle RAC database.

1. Determine whether you want to use Oracle ASM for Oracle Clusterware files (OCR and voting files), Oracle Database data files, recovery files, or all file types.

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.
 - There are two types of Oracle Clusterware files: OCR files and voting files. Each type of file can be stored on either Oracle ASM or a cluster file system. All the OCR files or all the voting files must use the same type of storage. You cannot have some OCR files stored in Oracle ASM and other OCR files in a cluster file system. However, you can use one type of storage for the OCR files and a different type of storage for the voting files if all files of each type use the same type of storage.
-
-

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. If the voting files are in a disk group, then the disk groups that contain Oracle Clusterware files (OCR and voting files) have a higher minimum number of failure groups than other disk groups because the voting files are stored in quorum failure groups.

A **quorum failure group** is a special type of failure group that stores the Oracle Clusterware voting files. The quorum failure group ensures that a quorum of the specified failure groups are available. When Oracle ASM mounts a disk group that contains Oracle Clusterware files, the quorum failure group determines if the disk group can be mounted in the event of the loss of one or more failure groups. Disks in the quorum failure group do not contain user data, therefore a quorum failure group is not considered when determining redundancy requirements in respect to storing user data.

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 use external redundancy with storage devices such as RAID, or other similar devices that provide their own data protection mechanisms.

- 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 Oracle Clusterware files, a normal redundancy disk group requires a minimum of three disk devices (failure groups use two of the three disks and the quorum failure group uses all three disks) and provides three voting files and one OCR and mirror of the OCR. When using a normal redundancy disk group, the cluster can survive the loss of one failure group.

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 its devices.

For Oracle Clusterware files, a high redundancy disk group requires a minimum of five disk devices (failure groups use three of the five disks and the quorum failure group uses all five disks) and provides five voting files and one OCR and two mirrors of the OCR. With high redundancy, the cluster can survive the loss of two failure groups.

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

Note: After a disk group is created, you cannot alter the redundancy level of the disk group.

- Determine the total amount of disk space that you require for the Oracle Clusterware files using Oracle ASM for shared storage.

Use the following table to determine the minimum number of disks and the minimum disk space requirements for installing Oracle Clusterware using Oracle ASM for shared storage:

Table 6-2 Oracle Clusterware Storage Required by Redundancy Type

Redundancy Level	Minimum Number of Disks	Oracle Cluster Registry (OCR) Files	Voting Files	Both File Types	Total
External	1	400 MB	300 MB	700 MB	At least 5.9 GB for a cluster with 4 nodes or less (5.2 GB ¹ + 400 MB + 300 MB). Additional space required for clusters with 5 or more nodes. For example, a six-node cluster allocation should be at least 6.9 GB: (5.2 GB + 2*(500 MB) + 400 MB + 300 MB).
Normal	3	At least 400 MB for each failure group, or 800 MB	At least 300 MB for each voting file, or 900MB	1.7 GB	At least 12.1 GB for a cluster with 4 nodes or less (10.4 GB + 2*400 MB + 3*300 MB). Additional space required for clusters with 5 or more nodes. For example, for a six-node cluster allocation should be at least 14.1 GB: (2 * (5.2 GB + 2*(500 MB)) + (2 * 400 MB) + (3 * 300 MB)).
High	5	At least 400 MB for each failure group, or 1.2 GB	At least 300 MB for each voting file, or 1.5 GB	2.7 GB	At least 18.3 GB for a cluster with 4 nodes or less (3* 5.2 GB + 3*400 MB + 5*300 MB). Additional space required for clusters with 5 or more nodes. For example, for a six-node cluster allocation should be at least 21.3 GB: (3* (5.2 GB + 2*(500 MB))+ (3 * 400 MB) + (5 * 300 MB)).

¹ The size of the Grid Infrastructure Management Repository for Oracle Clusterware 12.1.0.2 is 5.2 GB. For Oracle Clusterware 12.1.0.1, the size is 4.5 GB.

Note:

If the voting files are in a disk group, then the disk groups that contain Oracle Clusterware files (OCR and voting files) have a higher minimum number of failure groups than other disk groups.

If you create a disk group for the OCR and voting files as part of the installation, then the installer requires that you create these files on a disk group with at least 2 GB of available space.

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.

4. Determine an allocation unit size.

Every Oracle ASM disk is divided into allocation units (AU). An **allocation unit** is the fundamental unit of allocation within a disk group. You can select the AU Size value from 1, 2, 4, 8, 16, 32 or 64 MB, depending on the specific disk group compatibility level. The default value is set to 1 MB.

5. For Oracle Clusterware installations, you must also add additional disk space for the Oracle ASM metadata.

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 disk space requirements (in MB) for OCR and voting files, and the Oracle ASM metadata:

$$\text{total} = [2 * \text{ausize} * \text{disks}] + [\text{redundancy} * (\text{ausize} * (\text{nodes} * (\text{clients} + 1) + 30) + (64 * \text{nodes}) + 533)]$$

Where:

- *redundancy* = Number of mirrors: external = 1, normal = 2, high = 3
- *ausize* = Metadata AU size in megabytes (default is 1 MB)
- *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, and a default AU size of 1 MB, you require an additional 1684 MB of space:

$$[2 * 1 * 3] + [2 * (1 * (4 * (4 + 1) + 30) + (64 * 4) + 533)] = 1684 \text{ MB}$$

To ensure high availability of Oracle Clusterware files on Oracle ASM, for a normal redundancy disk group, 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 2.1 GB of capacity, with total capacity of at least 6.3 GB for three disks, to ensure that the effective disk space to create Oracle Clusterware files is 2 GB.

- 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:

Table 6-3 Total Oracle Database Storage Space Required by Redundancy Type

Redundancy Level	Minimum Number of Disks	Database Files	Recovery Files	Both File Types
External	1	1.5 GB	3 GB	4.5 GB
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.

- 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 "[Identifying Existing Oracle ASM Disk Groups to Use](#) (page 6-16)" for more information about using an existing disk group.

- If there is no existing Oracle ASM disk group to use, then create one or more Oracle ASM disk groups, as needed, before installing Oracle RAC.

See "[Selecting Disks to use with Oracle ASM Disk Groups](#) (page 6-16)" for more information about selecting disks to use in a disk group.

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

Note: You only have to complete this step if you plan to use an installation method that includes configuring Oracle ASM disk groups before installing Oracle RAC, or creating an Oracle RAC database.

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 you choose to define custom failure groups, then note the following:

You must specify a minimum of two failure groups for normal redundancy disk groups and three failure groups for high redundancy disk groups.

If the disk group contains data files and Oracle Clusterware files, including the voting files, then you must specify a minimum of three failure groups for normal redundancy disk groups and five failure groups for high redundancy disk groups.

Disk groups containing voting files must have at least three failure groups for normal redundancy or at least five failure groups for high redundancy. If the disk group does not contain the voting files, then the minimum number of required failure groups is two for normal redundancy and three for high redundancy. The minimum number of failure groups applies whether or not they are custom failure groups.

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 SCSI 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 enables the disk group to tolerate the failure of one SCSI controller.

Note: You can define custom failure groups after installation of Oracle Grid Infrastructure using the GUI tool ASMCA, the command-line tool `asmcmd`, or SQL*Plus commands.

See Also: *Oracle Automatic Storage Management Administrator's Guide* for more information about Oracle ASM failure groups

6.3.3 Restrictions for Disk Partitions Used By Oracle ASM

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

- With x64 Windows, you can create up to 128 primary partitions for each disk.
- 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.

6.3.4 Preparing Your System to Use Oracle ASM for Shared Storage

To use Oracle ASM as the shared storage solution for Oracle Clusterware or Oracle RAC files, you must perform certain tasks before you begin the software installation.

[Identifying Existing Oracle ASM Disk Groups to Use](#) (page 6-16)

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 12c Release 1 (12.1) and creating an Oracle RAC database.

[Selecting Disks to use with Oracle ASM Disk Groups](#) (page 6-16)

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.

[Specifying the Oracle ASM Disk Discovery String](#) (page 6-17)

When an Oracle ASM instance is initialized, Oracle ASM discovers and examines the contents of all of the disks that are in the paths that you designated with values in the `ASM_DISKSTRING` initialization parameter.

6.3.4.1 Identifying Existing Oracle ASM Disk Groups to Use

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 12c Release 1 (12.1) and creating an Oracle RAC database.

To determine if an Oracle ASM disk group currently exists, or to determine whether there is sufficient disk space in an existing disk group, the Oracle ASM command line tool (asmcmd), or Oracle Enterprise Manager Cloud 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. If the ORACLE_HOME environment variable is not set to the Grid home, then temporarily set this variable to the location of the Grid home using a command similar to the following:

```
C:\> set ORACLE_HOME=C:\app\12.1.0\grid
```

4. Use ASMCMD to connect to the Oracle ASM instance and start the instance if necessary with a command similar to the following:

```
C:\>%ORACLE_HOME%\bin\asmcmd  
ASMCMD> startup
```

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

```
ASMCMD> lsdg
```

or:

```
C:\> %ORACLE_HOME%\bin\asmcmd -p lsdg
```

6. From the output, identify a disk group with the appropriate redundancy level and note the free space that it contains.
7. 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.

6.3.4.2 Selecting Disks to use with Oracle ASM Disk Groups

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.
- Nonshared logical partitions are not supported with Oracle RAC. To use logical partitions for your Oracle RAC database, you must use shared logical volumes created by a logical volume manager such as `diskpart.msc`.
- Although you can specify a logical volume as a device in an Oracle ASM disk group, Oracle does not recommend their use because it adds a layer of complexity that is unnecessary with Oracle ASM. In addition, Oracle RAC requires a cluster logical volume manager in case you decide to use a logical volume with Oracle ASM and Oracle RAC.

Related Topics:

[Preliminary Shared Disk Preparation](#) (page 6-19)

[Configuring Disk Partitions on Shared Storage](#) (page 6-24)

6.3.4.3 Specifying the Oracle ASM Disk Discovery String

When an Oracle ASM instance is initialized, Oracle ASM discovers and examines the contents of all of the disks that are in the paths that you designated with values in the `ASM_DISKSTRING` initialization parameter.

The value for the `ASM_DISKSTRING` initialization parameter is an operating system–dependent value that Oracle ASM uses to limit the set of paths that the discovery process uses to search for disks. The exact syntax of a discovery string depends on the platform, ASMLib libraries, and whether Oracle Exadata disks are used. The path names that an operating system accepts are always usable as discovery strings.

The default value of `ASM_DISKSTRING` might not find all disks in all situations. If your site is using a third-party vendor ASMLib, then the vendor might have discovery string conventions that you must use for `ASM_DISKSTRING`. In addition, if your installation uses multipathing software, then the software might place pseudo-devices in a path that is different from the operating system default.

See Also:

- *Oracle Automatic Storage Management Administrator's Guide* for more information about the initialization parameter `ASM_DISKSTRING`
 - See "Oracle ASM and Multipathing" in *Oracle Automatic Storage Management Administrator's Guide* for information about configuring Oracle ASM to work with multipathing, and consult your multipathing vendor documentation for details.
-
-

6.3.5 Requirements for Using a Shared File System

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

- To use NFS, it must be on a certified network attached storage (NAS) device. Access the My Oracle Support website as described in "[Checking Hardware and Software Certification on My Oracle Support](#) (page 3-4)" to find a list of certified NAS devices.
- If placing the Oracle RAC data 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 data files on one file system, and the recovery files on a different file system.
- The user account with which you perform the installation must be able to create the files in the path that you specify for the shared storage.

Note:

If you are upgrading Oracle Clusterware, and your existing cluster uses 100 MB OCR and 20 MB voting file partitions, then you must extend these partitions to at least 300 MB. Oracle recommends that you do not use partitions, but instead place OCR and voting files in Oracle ASM disk groups marked as QUORUM disk groups.

All storage products must be supported by both your server and storage vendors.

Use the following table to determine the minimum size for shared file systems:

Table 6-4 Oracle RAC Shared File System Volume Size Requirements

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

The total required volume size is cumulative. For example, if you use one volume for data files and one volume for recovery files, then you should have at least 3.5 GB of available storage over two volumes.

6.3.6 Requirements for Files Managed by Oracle

If you use Oracle ASM for your database files, then Oracle creates the database with Oracle Managed files by default. 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*.

6.4 After You Have Selected the Shared Storage Options

When you have determined your disk storage options, you then start the configuration. The exact steps to perform depend on the type of shared storage you use.

1. First perform the steps listed in the section "[Preliminary Shared Disk Preparation](#) (page 6-19)."
2. Configure the shared storage:
 - **To use Oracle ASM**, refer to "[Configuring Shared Storage for Oracle ASM](#) (page 6-20)".
 - **To use a file system**, refer to "[Configuring Disk Partitions on Shared Storage](#) (page 6-24)".

6.5 Preliminary Shared Disk Preparation

When using shared storage on a Windows platform, there are additional preinstallation tasks to complete.

[Disabling Write Caching](#) (page 6-19)

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

[Enabling Automounting for Windows](#) (page 6-19)

Even though the automount feature is enabled by default, you should verify that automount is enabled.

6.5.1 Disabling Write Caching

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

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.

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

6.5.2 Enabling Automounting for Windows

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 ASM
- Oracle Clusterware
- 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

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

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

2. To enable automounting:

- a. Enter the following commands at a command prompt:

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

- b. Type `exit` to end the `diskpart` session.
- c. Repeat steps 1 and 2 for each node in the cluster.

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 or Oracle ASM.

You must restart each node after enabling disk automounting.

After disk automounting is enabled and the node is restarted, automatic mounting remains active until it is disabled.

6.6 Configuring Shared Storage for Oracle ASM

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

[Create Disk Partitions for Use With Oracle ASM](#) (page 6-21)

The following steps outline the procedure for creating disk partitions for use with Oracle ASM.

[Marking Disk Partitions for Oracle ASM Before Installation](#) (page 6-21)

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 marked (or **stamped**) with `asmtool`.

6.6.1 Create Disk Partitions for Use With Oracle ASM

The following steps outline the procedure for creating disk partitions for use with 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 file; Oracle Clusterware creates individual files for the OCR and voting file in the specified location.

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.
4. 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.

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

See "[Configuring Disk Partitions on Shared Storage](#) (page 6-24)" for instructions on creating disk partitions using the DISKPART utility.

- b. On each node in the cluster, ensure that the partitions are visible and that none of the disk partitions created for shared storage 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

Related Topics:

[Configuring Shared Storage for Oracle ASM](#) (page 6-20)

[Configuring Disk Partitions on Shared Storage](#) (page 6-24)

6.6.2 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 marked (or **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.

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 `\\.\ORCLDISKprefixn`, where *prefixn* either can be `DATA`, or a value you supply, and where *n* represents the disk number.

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. These utilities are installed automatically as part of Oracle Grid Infrastructure.

Note: If user account control (UAC) is enabled, then running `asmtoolg` or `asmtool` requires administrator-level permissions.

[Overview of asmtoolg and asmtool](#) (page 6-22)

The `asmtoolg` and `asmtool` tools associate meaningful, persistent names with disks to facilitate using those disks with Oracle ASM.

[Using asmtoolg \(Graphical User Interface\) To Mark Disks](#) (page 6-22)

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

[Using asmtoolg To Remove Disk Stamps](#) (page 6-23)

You can use `asmtoolg` (GUI version) to delete disk stamps.

[asmtool Command Line Reference](#) (page 6-23)

`asmtool` is a command-line interface for marking (or stamping) disks to be used with Oracle ASM.

6.6.2.1 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 `\\.\ORCLDISKprefixn`, where *prefixn* either can be `DATA`, or a value you supply, and where *n* represents the disk number.

6.6.2.2 Using asmtoolg (Graphical User Interface) To Mark Disks

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

1. In the installation media for Oracle Grid Infrastructure, go to 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`.

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 the 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 "[Create Disk Partitions for Use With Oracle ASM](#) (page 6-21)" to create disk partitions for the Oracle ASM instance.

3. On the Stamp Disks window, select the disks to you want to use with Oracle ASM.

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. Optional: Select a disk to edit the individual stamp (Oracle ASM link name).
5. Click **Next**.
6. Click **Finish**.

6.6.2.3 Using `asmtoolg` To Remove Disk Stamps

You can use `asmtoolg` (GUI version) to delete 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`.

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 the context menu, and launch `asmtoolg`.

2. 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.

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

6.6.2.4 `asmtool` Command Line Reference

`asmtool` is a command-line interface for marking (or stamping) disks to be used with Oracle ASM.

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 <code>-force</code> option. If necessary, follow the steps under " Create Disk Partitions for Use With Oracle ASM (page 6-21)" to create disk partitions for the Oracle ASM instance.	<pre>asmtool -add [-force] \Device\Harddisk1\Partition1 ORCLDISKASM0 \Device\Harddisk2\Partition1 ORCLDISKASM2 ...</pre>
-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 <code>-force</code> option.	<pre>asmtool -addprefix ORCLDISKASM [-force] \Device\Harddisk1\Partition1 \Device\Harddisk2\Partition1 ...</pre>
-create	Creates an Oracle ASM disk device from a file instead of a partition. Note: Usage of this command is not supported for production environments.	<pre>asmtool -create \\server\share\file 1000 asmtool -create D:\asm\asmfile02.asm 240</pre>
-list	List available disks. The stamp, windows device name, and disk size in MB are shown.	<pre>asmtool -list</pre>
-delete	Removes existing stamps from disks.	<pre>asmtool -delete ORCLDISKASM0 ORCLDISKASM1...</pre>

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 the context menu, and launch `asmtool`.

Note: If you use `-add`, `-addprefix`, or `-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.

6.7 Configuring Disk Partitions on Shared Storage

To create disk partitions, use the disk administration tools provided by the operating system or third party vendors. You can create the disk partitions using either the Disk Management Interface or the `DiskPart` utility, both of which are provided by the operating system.

To use shared disks not managed by Oracle ASM for the 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

[Creating Disk Partitions Using the Disk Management Interface](#) (page 6-25)

Use the graphical user interface Disk Management snap-in to manage disks.

[Creating Disk Partitions using the DiskPart Utility](#) (page 6-25)

You can also use the DiskPart utility to manage disks.

6.7.1 Creating Disk Partitions Using the Disk Management Interface

Use the graphical user interface Disk Management snap-in to manage disks.

1. To access the Disk Management snap-in, do one of the following:
 - Type `diskmgmt.msc` at the command prompt
 - From the **Start** menu, select **All Programs**, then **Administrative Tools**, then **Computer Management**. Then select the **Disk Management** node in the Storage tree.
2. Create primary partitions and logical drives in extended partitions by selecting the **New Simple Volume** option.

You must select **Do not format this partition** to specify raw partition. Do not use spanned volumes or striped volumes. These options convert the volume to a dynamic disk. Oracle Automatic Storage Management does not support dynamic disks.

For other Windows, create primary partitions by selecting the **New Partition** option. Create the logical drives by selecting the **New Logical Drive** option.

3. To create a raw device, after the partition is created, you must remove the drive letter that was assigned to the partition.

6.7.2 Creating Disk Partitions using the DiskPart Utility

You can also use the DiskPart utility to manage disks.

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 4 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. 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:

- a. Right-click the partition in the Windows Disk Management utility
- b. Select **Change Drive Letters and Paths** from the menu
- c. Click **Remove** in the Change Drive Letter and Paths window.

6.8 Configuring Direct NFS Client for Oracle RAC Data Files

Direct NFS Client is an interface for NFS systems provided by Oracle.

[About Direct NFS Client Storage](#) (page 6-27)

With Oracle Database, instead of using the operating system NFS client or third-party NFS client, you can configure Oracle Database to use Direct NFS Client NFS to access NFS servers directly.

[About the Oranfstab File for Direct NFS Client](#) (page 6-27)

[Configurable Attributes for the oranfstab File](#) (page 6-28)

You can configure various settings in the `oranfstab` file.

[Mounting NFS Storage Devices with Direct NFS Client](#) (page 6-29)

Direct NFS Client determines mount point settings for NFS storage devices based on the configuration information in `oranfstab`. Direct NFS Client uses the first matching entry as the mount point.

[Specifying Network Paths for a NFS Server](#) (page 6-30)

Direct NFS Client can use up to four network paths defined in the `oranfstab` file for an NFS server.

[Enabling Direct NFS Client](#) (page 6-30)

To enable Direct NFS Client, you must add an `oranfstab` file to `Oracle_home\dbs`.

[Performing Basic File Operations Using the ORADNFS Utility](#) (page 6-31)

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

[Monitoring Direct NFS Client Usage](#) (page 6-32)

You use data dictionary view to monitor the Direct NFS client.

[Disabling Oracle Disk Management Control of NFS for Direct NFS Client](#) (page 6-32)

If you no longer want to use the Direct NFS client, you can disable it.

6.8.1 About Direct NFS Client Storage

With Oracle Database, instead of using the operating system NFS client or third-party NFS client, you can configure Oracle Database to use Direct NFS Client NFS to access NFS servers directly.

Direct NFS Client supports NFSv3, NFSv4 and NFSv4.1 protocols (excluding the Parallel NFS extension) to access the NFS server. Direct NFS Client tunes itself to make optimal use of available resources and enables the storage of data files on supported NFS servers.

Note: Use NFS servers supported for Oracle RAC. Check My Oracle Support, as described in "[Checking Hardware and Software Certification on My Oracle Support](#) (page 3-4)" for support information.

To enable Oracle Database to use Direct NFS Client, the NFS file systems must be mounted and available over regular NFS mounts before you start installation. Direct NFS Client manages settings after installation. If Oracle Database cannot open an NFS server using Direct NFS Client, then an informational message is logged into the Oracle alert log. A trace file is also created, indicating that Direct NFS Client could not connect to an NFS server.

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 accessed by Direct NFS Client can also be accessed through a third party NFS client. Management of Oracle data files created with Direct NFS Client should be done according to the guidelines specified in the "Managing Datafiles and Tempfiles" chapter of *Oracle Database Administrator's Guide*.

Volumes mounted through Common Internet File System (CIFS) can not be used for storing Oracle database files without configuring Direct NFS Client. The atomic write requirements needed for database writes are not guaranteed through the CIFS protocol, consequently CIFS can only be used for OS level access, for example, for commands such as copy.

Some NFS file servers require NFS clients to connect using reserved ports. If your filer is running with reserved port checking, then you must disable it for Direct NFS to operate. To disable reserved port checking, consult your NFS file server documentation.

For NFS servers that restrict port range, you can use the `insecure` option to enable clients other than an Administrator user to connect to the NFS server. Alternatively, you can disable Direct NFS Client as described in "[Disabling Oracle Disk Management Control of NFS for Direct NFS Client](#) (page 6-32)"

6.8.2 About the Oranfstab File for Direct NFS Client

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

When the `oranfstab` file is placed in `Oracle_home\db`, the entries in the file are specific to a single database. For Oracle RAC installations in a shared Oracle home, the `oranfstab` file is globally available to all database instances.

All instances that use the shared Oracle home use the same `Oracle_home\db\oranfstab` file. For a nonshared Oracle home, because all the Oracle RAC instances use the same `oranfstab` file, you must replicate the `oranfstab` file on all of the nodes. Also, you must keep the `oranfstab` file synchronized on all the nodes.

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.

Related Topics:

[Enabling Direct NFS Client](#) (page 6-30)

To enable Direct NFS Client, you must add an `oranfstab` file to `Oracle_home\db`.

6.8.3 Configurable Attributes for the `oranfstab` File

You can configure various settings in the `oranfstab` file.

Table 6-5 Configurable Attributes for the `oranfstab` File

Attribute	Description
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 <code>ifconfig</code> 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 <code>ipconfig</code> 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 a 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 (600).
uid	(Optional) The UNIX user ID to be used by Direct NFS Client to access all NFS servers listed in <code>oranfstab</code> . The default value is <code>uid:65534</code> , which corresponds to <code>user:nobody</code> on the NFS server.

Table 6-5 (Cont.) Configurable Attributes for the `orandstab` File

Attribute	Description
<code>gid</code>	(Optional) The UNIX group ID to be used by Direct NFS Client to access all NFS servers listed in <code>orandstab</code> . The default value is <code>gid:65534</code> , which corresponds to <code>group:nogroup</code> on the NFS server.
<code>nfs_version</code>	(Optional) Specifies the NFS protocol that Direct NFS Client uses. Possible values are NFSv3, NFSv4, and NFSv4.1. The default version is NFSv3. To specify NFSv4 or NFSv4.1, you must set the <code>nfs_version</code> parameter accordingly in the <code>orandstab</code> file.
<code>management</code>	Enables Direct NFS Client to use the management interface for SNMP queries. You can use this parameter if SNMP is running on separate management interfaces on the NFS server. The default value is <code>server</code> .
<code>community</code>	Specifies the community string for use in SNMP queries. Default value is <code>public</code> .

See Also: "Limiting Asynchronous I/O in NFS Server Environments" in *Oracle Database Performance Tuning Guide*

6.8.4 Mounting NFS Storage Devices with Direct NFS Client

Direct NFS Client determines mount point settings for NFS storage devices based on the configuration information in `orandstab`. Direct NFS Client uses the first matching entry as the mount point.

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

Note: You can have only one active Direct NFS Client implementation for each instance. Using Direct NFS Client on an instance will prevent another Direct NFS Client implementation.

Direct NFS Client requires an NFS server supporting NFS read/write buffers of at least 16384 bytes.

Direct NFS Client issues writes at `wtmax` granularity to the NFS server. Direct NFS Client does not serve an NFS server with a `wtmax` less than 16384. Oracle recommends that you use the value 32768.

See Also: "[Supported Storage Options for Oracle Grid Infrastructure and Oracle RAC](#) (page 6-3)" for a list of the file types that are supported with Direct NFS Client.

6.8.5 Specifying Network Paths for a NFS Server

Direct NFS Client can use up to four network paths defined in the `oranfstab` file for an NFS server.

Direct NFS Client performs load balancing across all specified paths. If a specified path fails, then Direct NFS Client re-issues all outstanding requests over any remaining paths.

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

[Example 6-1](#) (page 6-31) and [Example 6-2](#) (page 6-31) provide examples of configuring network paths for Direct NFS Client attributes in an `oranfstab` file.

6.8.6 Enabling Direct NFS Client

To enable Direct NFS Client, you must add an `oranfstab` file to `Oracle_home\dbs`.

When `oranfstab` is placed in the `Oracle_home\dbs` directory, the entries in this file are specific to one particular database. Direct NFS Client searches for the mount point entries as they appear in `oranfstab`. Direct NFS Client uses the first matched entry as the mount point.

1. Create an `oranfstab` file and specify the attributes listed in "[Configurable Attributes for the oranfstab File](#) (page 6-28)" for each NFS server that Direct NFS Client accesses:

See Also: "Limiting Asynchronous I/O in NFS Server Environments" in *Oracle Database Performance Tuning Guide*

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

[Example 6-1](#) (page 6-31) and [Example 6-2](#) (page 6-31) provide examples of how Direct NFS Client attributes can be used in an `oranfstab` file.

Note:

- Direct NFS Client ignores a `uid` or `gid` value of 0.
 - 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. Replace the standard ODM library, `oraodm12.dll`, with the ODM NFS library

Oracle Database uses the ODM library, `oranfsodm12.dll`, to enable Direct NFS Client. To replace the ODM library, complete the following steps:

- a. Change directory to `Oracle_home\bin`.
- b. Shut down the Oracle Database instance on a node using the Server Control Utility (SRVCTL).

- c. Enter the following commands:

```
copy oraadm12.dll oraadm12.dll.orig
copy /Y oranfsodm12.dll oraadm12.dll
```

- d. Restart the Oracle Database instance using SRVCTL.

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

Example 6-1 *oranfstab* File Using Local and Path NFS Server Entries

The following example of an `oranfstab` file shows an NFS server entry, where the NFS server, `MyDataServer1`, uses two network paths specified with IP addresses.

```
server: MyDataServer1
local: 192.0.2.0
path: 192.0.2.1
local: 192.0.100.0
path: 192.0.100.1
nfs_version: nfsv3
export: /vol/oradata1 mount: C:\APP\ORACLE\ORADATA\ORCL
```

Example 6-2 *oranfstab* File Using Network Connection Names

The following example of an `oranfstab` file shows an NFS server entry, where the NFS server, `MyDataServer2`, uses four network paths specified by the network interface to use, or the network connection name. Multiple export paths are also used in this example.

```
server: MyDataServer2
local: LocalInterface1
path: NfsPath1
local: LocalInterface2
path: NfsPath2
local: LocalInterface3
path: NfsPath3
local: LocalInterface4
path: NfsPath4
nfs_version: nfsv4
export: /vol/oradata2 mount: C:\APP\ORACLE\ORADATA\ORCL2
export: /vol/oradata3 mount: C:\APP\ORACLE\ORADATA\ORCL3
management: MgmtPath1
community: private
```

6.8.7 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`. A valid copy of the `oranfstab` configuration file must be present in `Oracle_home\dfs` for `ORADNFS` to operate.

- 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
```

6.8.8 Monitoring Direct NFS Client Usage

You use data dictionary view to monitor the Direct NFS client.

- Use the following global dynamic performance views for managing Direct NFS Client usage with your Oracle RAC database:
 - `GV$DNFS_SERVERS`: Lists the servers that are accessed using Direct NFS Client.
 - `GV$DNFS_FILES`: Lists the files that are currently open using Direct NFS Client.
 - `GV$DNFS_CHANNELS`: Lists the open network paths, or channels, to servers for which Direct NFS Client is providing files.
 - `GV$DNFS_STATS`: Lists performance statistics for Direct NFS Client.

6.8.9 Disabling Oracle Disk Management Control of NFS for Direct NFS Client

If you no longer want to use the Direct NFS client, you can disable it.

1. Log in as the Oracle Grid Infrastructure software owner.
2. Restore the original `oraodm12.dll` file by reversing the process you completed in "[Enabling Direct NFS Client](#) (page 6-30)".
3. Remove the `oranfstab` file.

6.9 Upgrading 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) to upgrade the existing Oracle ASM instance to Oracle ASM 12c Release 1 (12.1).

The ASMCA utility is located in the path `Grid_home\bin`. You can also use ASMCA to configure failure groups, Oracle ASM volumes and Oracle Automatic Storage Management Cluster File System (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 are upgrading from an Oracle ASM release before 11.2, and you chose to use Oracle ASM and ASMCA detects that there is a prior Oracle ASM release installed in another Oracle ASM home, then after installing the Oracle ASM 12c Release 1 (12.1) 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.

If you are upgrading from Oracle ASM 11g Release 2 (11.2.0.1) or later, then Oracle ASM is always upgraded with Oracle Grid Infrastructure as part of the rolling upgrade, and ASMCA is started during the upgrade. ASMCA cannot perform a separate upgrade of Oracle ASM from a prior release to the current release.

On an existing Oracle Clusterware or Oracle RAC installation, if the prior release of Oracle ASM instances on all nodes is Oracle ASM 11g Release 1 or later, then you are provided with the option to perform a rolling upgrade of Oracle ASM instances. If the prior release of the Oracle ASM instances for an Oracle RAC installation are from a release prior to Oracle ASM 11g Release 1, then rolling upgrades cannot be performed. Oracle ASM on all nodes will be upgraded to Oracle ASM 12c Release 1 (12.1).

6.10 Configuring Oracle Automatic Storage Management Cluster File System

If you want to install Oracle RAC on Oracle ACFS, you must first create the Oracle home directory in Oracle ACFS.

You can also create a General Purpose File System configuration of ACFS using ASMCA. Oracle ACFS is installed as part of an Oracle Grid Infrastructure installation (Oracle Clusterware and Oracle Automatic Storage Management) for 12c Release 1 (12.1).

The compatibility parameters `COMPATIBLE.ASM` and `COMPATIBLE.ADVM` must be set to 11.2 or higher for the disk group to contain an Oracle ADVM volume.

See Also: ["Restrictions and Guidelines for Oracle ACFS \(page 6-7\)"](#)

1. Install Oracle Grid Infrastructure for a cluster (Oracle Clusterware and Oracle ASM).
2. Go to the `bin` directory in the Grid home, for example:

```
C:\> cd app\12.1.0\grid\bin
```

3. Ensure that the Oracle Grid Infrastructure installation owner has read and write permissions on the storage mountpoint you want to use.

For example, to use the mountpoint `E:\data\acfsmounts\`

```
C:\..bin> dir /Q E:\data\acfsmounts
```

4. Start ASMCA as the Oracle Installation user for Oracle Grid Infrastructure, for example:

```
C:\..\bin> asmca
```

The Configure ASM: Disk Groups page is displayed. The Configure ASM: ASM Disk Groups page shows you the Oracle ASM disk group you created during installation.

5. Click the **ASM Cluster File Systems** tab.
6. On the ASM Cluster File Systems page, right-click the disk group in which you want to create the Oracle ADVM volume, then select **Create ACFS for Database Use**.
7. 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 or logical drive letter 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.
 - **Database Home Owner Name:** Enter the name of the Oracle Installation user you plan to use to install the database. For example: `oracle1`
8. Click **OK** when you have entered the required information.
9. If prompted, run any scripts as directed by ASMCA as the Local Administrator user.

On an Oracle Clusterware environment, the script registers the ACFS as a resource managed by Oracle Clusterware. Registering ACFS as a resource helps Oracle Clusterware to mount the ACFS automatically in the proper order when ACFS is used for an Oracle RAC database home.

10. During Oracle RAC 12c Release 1 (12.1) 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, this was `M:\acfsdisks\racdb_01`).

Note: You cannot place the Oracle home directory for Oracle Database 11g Release 1 or earlier releases on Oracle ACFS.

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

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.

[About Default File Permissions Set by Oracle Universal Installer](#) (page 7-1)

During Oracle Database installation, by default Oracle Universal Installer installs software in the `ORACLE_HOME` directory. Oracle Universal Installer sets the permissions for this directory, and for all files and directories under this directory.

[Installing Oracle Grid Infrastructure](#) (page 7-2)

You use Oracle Universal Installer (OUI) to install Oracle Grid Infrastructure.

[Installing Grid Infrastructure Using a Software-Only Installation](#) (page 7-5)

This installation option requires manual postinstallation steps to enable the Oracle Grid Infrastructure software.

[Confirming Oracle Clusterware Function](#) (page 7-9)

After installation, use the `crsctl` utility to verify Oracle Clusterware installation is installed and running correctly.

[Confirming Oracle ASM Function for Oracle Clusterware Files](#) (page 7-9)

After installation, use the `srvctl` utility to verify Oracle ASM software is operational.

[Understanding Offline Processes in Oracle Grid Infrastructure](#) (page 7-10)

Oracle Grid Infrastructure provides required resources for various Oracle products and components. Some of those products and components are optional, so you can install and enable them after installing Oracle Grid Infrastructure.

7.1 About Default File Permissions Set by Oracle Universal Installer

During Oracle Database installation, by default Oracle Universal Installer installs software in the `ORACLE_HOME` directory. Oracle Universal Installer sets the permissions for this directory, and for all files and directories under this directory.

For the `ORACLE_HOME` of Oracle Grid Infrastructure, OUI grants the following permissions to the groups and users:

- Full control - Administrators, SYSTEM, ORA_GRID_LISTENERS, Oracle Installation User, Oracle Home User
- Read, Execute, and List Contents - Authenticated Users

See Also: *Oracle Database Platform Guide for Microsoft Windows*

7.2 Installing Oracle Grid Infrastructure

You use Oracle Universal Installer (OUI) to install Oracle Grid Infrastructure.

[Running OUI to Install Oracle Grid Infrastructure](#) (page 7-2)

Complete the following steps to install Oracle Grid Infrastructure (Oracle Clusterware and Oracle ASM) on your cluster.

[Performing a Silent Installation of Oracle Grid Infrastructure](#) (page 7-4)

During installation of Oracle Grid Infrastructure, you are given the option either of providing cluster configuration information manually, or of using a cluster configuration file.

7.2.1 Running OUI to Install Oracle Grid Infrastructure

Complete the following steps to install Oracle 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.
2. Navigate to the location of the installation media for Oracle Database 12c Release 1 (12.1), open a command prompt with administrator privileges, and run the `setup.exe` command.
3. Select one of the following installation options:
 - **Install and Configure Oracle Grid Infrastructure for a Cluster**
Select this option to install a standard cluster.
 - **Install and Configure Oracle Grid Infrastructure for a Standalone Server**
Select this option to install Oracle Grid Infrastructure in an Oracle Restart configuration. Use this option for single servers supporting Oracle Database and other applications.
 - **Upgrade Oracle Grid Infrastructure or Oracle Automatic Storage Management**
Select this option to upgrade Oracle Grid Infrastructure (Oracle Clusterware and Oracle Grid Infrastructure), or to upgrade Oracle ASM.

Note: Oracle Clusterware must always be the later release, so you cannot upgrade Oracle ASM to a release that is more recent than Oracle Clusterware.

- **Install Oracle Grid Infrastructure Software Only**
Select this option to install Oracle Grid Infrastructure in a Grid home, without configuring the software.

4. Installation screens vary depending on the installation option you select. Respond to the configuration prompts as needed to configure your cluster.

Note: Click **Help** if you have any questions about the information you are asked to submit during installation.

For cluster member node public and VIP network addresses, provide the information required depending on the kind of cluster you are configuring:

- If you plan to use automatic cluster configuration with DHCP addresses configured and resolved through GNS, then you only need to provide the GNS VIP names as configured on your DNS.

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.
- Host names and virtual host names are not domain-qualified. If you provide a domain in the address field during installation, then OUI removes the domain from the address.
- 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.

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.

5. 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.
6. After you have specified all the information needed for installation, OUI installs the software. OUI then runs Oracle Net Configuration Assistant (NETCA), Oracle Private Interconnect Configuration Assistant, and Cluster Verification Utility (CVU). These programs run without user intervention.
7. If you selected to Oracle ASM as the storage option for the OCR and voting files, 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 Oracle Clusterware 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 home:

```
Grid_home\bin\asmca
```

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

If you intend to install Oracle Database 12c Release 1 (12.1) with Oracle RAC, then see *Oracle Real Application Clusters Installation Guide for Microsoft Windows x64 (64-Bit)*. 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 Clusterware Administration and Deployment Guide* for cloning Oracle Grid Infrastructure
 - *Oracle Real Application Clusters Administration and Deployment Guide* for information about using cloning and node addition procedures for Oracle RAC nodes
 - *Oracle Database Installation Guide for Microsoft Windows* for information about standalone server installations, which is not discussed in this document
-
-

7.2.2 Performing a Silent Installation of Oracle Grid Infrastructure

During installation of Oracle 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 name and 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).

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.

There are two steps involved when installing Oracle Grid Infrastructure using the silent method.

[Creating a Cluster Configuration File](#) (page 7-4)

To create a cluster configuration file manually, start a text editor, and create a file that provides the name of the public and virtual IP addresses for each cluster member node.

[Installing Oracle Grid Infrastructure Using a Cluster Configuration File](#) (page 7-5)

During installation of Oracle Grid Infrastructure, you are given the option either of providing cluster configuration information manually, or of using a cluster configuration file.

7.2.2.1 Creating a Cluster Configuration File

To create a cluster configuration file manually, start a text editor, and create a file that provides the name of the public and virtual IP addresses for each cluster member node.

1. Create a text file name `cluster_config.ccf` using the following format 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:


```
node1 node1-vip
node2 node2-vip
...
```

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

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

2. Save the file.

Related Topics:

[Installing and Configuring Oracle Grid Infrastructure Using Response Files](#)
(page B-1)

7.2.2.2 Installing Oracle Grid Infrastructure Using a Cluster Configuration File

During installation of Oracle Grid Infrastructure, you are given the option either of providing cluster configuration information manually, or of using a cluster configuration file.

1. On the installation media, and go to the directory `/response`.
2. Using a text editor, open the response file `grid_install.rsp`.
3. Follow the directions in the sections relevant to the type of installation you are performing, and supply values appropriate for your environment.
4. Create a cluster configuration file as described in the previous section, "[Creating a Cluster Configuration File](#) (page 7-4)".
5. Use the following command syntax to run OUI in silent mode:

```
setup.exe -silent -responseFile path_to_your_response_file
```

For example:

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

Related Topics:

[Installing and Configuring Oracle Grid Infrastructure Using Response Files](#)
(page B-1)

7.3 Installing Grid Infrastructure Using a Software-Only Installation

This installation option requires manual postinstallation steps to enable the Oracle Grid Infrastructure software.

A software-only installation consists of installing Oracle Grid Infrastructure for a cluster on one node.

If you use the Install Grid Infrastructure Software Only option during installation, then this installs the software binaries on the local node. To complete the installation for your cluster, you must perform the additional steps of configuring Oracle Clusterware and Oracle ASM, creating a clone of the local installation, deploying this clone on other nodes, and then adding the other nodes to the cluster.

Note: *Oracle Clusterware Administration and Deployment Guide* for information about how to clone an Oracle Grid Infrastructure installation to other nodes, and then adding them to the cluster

[Installing Only the Oracle Grid Infrastructure Software](#) (page 7-6)

[Configuring the Software Binaries Using Configuration Wizard Mode of OUI](#) (page 7-7)

You can configure the software binaries by starting Oracle Grid Infrastructure configuration wizard in GUI mode.

[Configuring the Software Binaries Using a Response File](#) (page 7-7)

When you install or copy Oracle Grid Infrastructure software on any node, you can defer configuration for a later time. This section provides the procedure for completing configuration after the software is installed or copied on nodes, using the configuration wizard utility (`config.bat`).

[Configuring the Software Binaries in Silent Mode Using a Response File](#) (page 7-8)

This section provides the procedure for completing configuration after the software is installed or copied on nodes, using the configuration wizard utility (`config.bat`) in silent (non-response) mode.

[Setting Ping Targets for Network Checks](#) (page 7-8)

Receive notification about the status of public networks by setting the `Ping_Targets` parameter during the Oracle Grid Infrastructure installation.

7.3.1 Installing Only the Oracle Grid Infrastructure Software

1. Log in to Windows using a member of the Administrators group and run the `setup.exe` command from the Oracle Grid Infrastructure 12c Release 1 (12.1) installation media or download directory.
2. Complete a software-only installation of Oracle Grid Infrastructure for a cluster on the first node, or the local node.
3. Verify that all of the cluster nodes meet the installation requirements..

Use the command:

```
runcluvfy.bat stage -pre crsinst -n node_list
```

4. Ensure that you have completed all storage and server preinstallation requirements.
5. Use OUI as described in steps 1 through 3 to install the Oracle Grid Infrastructure software on every remaining node that you want to include in the cluster, and complete a software-only installation of Oracle Grid Infrastructure on every node.
6. Configure the cluster using the full OUI configuration wizard GUI as described in "[Configuring the Software Binaries Using Configuration Wizard Mode of OUI](#) (page 7-7)" or configure the cluster using a response file as described in section "[Configuring the Software Binaries Using a Response File](#) (page 7-7)."

7.3.2 Configuring the Software Binaries Using Configuration Wizard Mode of OUI

You can configure the software binaries by starting Oracle Grid Infrastructure configuration wizard in GUI mode.

1. On one of the nodes, log in as the Oracle Installation user, and enter the following command from the `crs\config` directory of the Grid home:

```
C:\..\crs\config> config.bat
```

The configuration script starts OUI in Configuration Wizard mode.

2. Provide information as needed for configuration.

Each page shows the same user interface and performs the same validation checks that OUI normally does. However, instead of running an installation, the configuration wizard mode validates inputs and configures the installation on all cluster nodes.

When you complete inputs, OUI shows you the Summary page, listing all inputs you have provided for the cluster.

3. Verify that the summary has the correct information for your cluster, and click **Install** to start configuration of the local node.

When configuration of the local node is complete, OUI copies the Oracle Grid Infrastructure configuration file to other cluster member nodes.

4. OUI checks the cluster configuration status, and starts other configuration tools as needed.

7.3.3 Configuring the Software Binaries Using a Response File

When you install or copy Oracle Grid Infrastructure software on any node, you can defer configuration for a later time. This section provides the procedure for completing configuration after the software is installed or copied on nodes, using the configuration wizard utility (`config.bat`).

1. As the Oracle Installation user for Oracle Grid Infrastructure (for example, `grid`), start OUI in Oracle Grid Infrastructure configuration wizard mode from the Oracle Grid Infrastructure software-only home using the following syntax, where *Grid_home* is the Oracle Grid Infrastructure home, and *filename* is the response file name:

```
Grid_home\crs\config\config.bat [-debug] [-silent -responseFile filename]
```

For example:

```
C:\> cd Grid_home\crs\config\  
C:\..\config> config.bat -responseFile ..\..\response\installGrid.rsp
```

The configuration script starts OUI in Configuration Wizard mode. Each page shows the same user interface and performs the same validation checks that OUI normally does. However, instead of running an installation, the configuration wizard mode validates inputs and configures the installation on all cluster nodes.

When you complete inputs, OUI shows you the Summary page, listing all inputs you have provided for the cluster.

2. Verify that the summary has the correct information for your cluster, and click **Install** to start configuration of the local node.

When configuration of the local node is complete, OUI copies the Oracle Grid Infrastructure configuration file to other cluster member nodes.

3. OUI checks the cluster configuration status, and starts other configuration tools as needed.

See Also:

- *Oracle Clusterware Administration and Deployment Guide* for more information about the configuration wizard.
 - *Oracle Database Installation Guide for Microsoft Windows* for more information about how to configure and activate a software-only Oracle Grid Infrastructure installation for a standalone server.
-
-

7.3.4 Configuring the Software Binaries in Silent Mode Using a Response File

This section provides the procedure for completing configuration after the software is installed or copied on nodes, using the configuration wizard utility (`config.bat`) in silent (non-response) mode.

1. As the Oracle Grid Infrastructure installation owner (`grid`), start OUI in Oracle Grid Infrastructure configuration wizard mode from the Oracle Grid Infrastructure software-only home using the following syntax, where *Grid_home* is the Oracle Grid Infrastructure home, and *filename* is the response file name, as shown in the following example:

```
C:\> cd app\12.1.0\grid\crs\config
C:\> config.bat -responseFile C:\app\12.1.0\grid\response\grid_install.rsp
```

The wizard validates the cluster configuration file and proceeds with the configuration. If any of the inputs in the cluster configuration file are found to be invalid, then the Configuration Wizard displays an error and exits. Run the `configToolAllCommands` scripts as prompted.

2. When configuration of the local node is complete, OUI copies the Oracle Grid Infrastructure configuration file to other cluster member nodes.
3. OUI checks the cluster configuration status, and starts other configuration tools as needed.

7.3.5 Setting Ping Targets for Network Checks

Receive notification about the status of public networks by setting the `Ping_Targets` parameter during the Oracle Grid Infrastructure installation.

In certain environments, for example, in a virtual machine, the network link status is not correctly returned when the network cable is disconnected. You can receive notification about public network status in these environments by setting the `Ping_Targets` parameter during the Oracle Grid Infrastructure installation. You should use this parameter for addresses outside the cluster, like a switch or router.

- Run the installer:

```
C:\.> setup.exe oracle_install_crs_Ping_Targets={Host1|IP1},{Host2|IP2}
```

For example:

```
C:\.> setup.exe oracle_install_crs_Ping_Targets=192.0.2.1,192.0.2.2
```

The ping utility contacts the comma-separated list of host names or IP addresses *Host1/IP1,Host2/IP2* to determine whether the public network is available. If none of the hosts respond, then the network is considered to be offline.

7.4 Confirming Oracle Clusterware Function

After installation, use the `crsctl` utility to verify Oracle Clusterware installation is installed and running correctly.

- Log in as a member of the Administrators group, and run the following command from the `bin` directory in the Grid home:

```
crsctl check cluster -all
```

Caution: After installation is complete, do not remove manually or run cron jobs that remove `/tmp/.oracle` or `/var/tmp/.oracle` or its files while Oracle Clusterware is up. If you remove these files, then Oracle Clusterware could encounter intermittent hangs, and you will encounter error `CRS-0184: Cannot communicate with the CRS daemon`.

Example 7-1 Checking the Status of Oracle Clusterware

To check the status of the Oracle Clusterware components on each node of your cluster, run the following command:

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

The output for this command is similar to the following:

```
*****
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
*****
```

7.5 Confirming Oracle ASM Function for Oracle Clusterware Files

After installation, use the `srvctl` utility to verify Oracle ASM software is operational.

- If you installed the OCR and voting files on Oracle ASM, then run the following command from the `Grid_home\bin` directory:

```
srvctl status asm
```

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 12c Release 1 (12.1) 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` program in the database home (Oracle home) to manage Oracle ASM or Oracle Net Services.

Example 7-2 Checking the Status of Oracle ASM After Installing Oracle Grid Infrastructure

To verify that your Oracle ASM installation is operational, run the following command, replacing `C:\app\12.1.0\grid` with the location of your Grid home. The text below the command is an example of the output returned by the command.

```
C:\app\12.1.0\grid\BIN> srvctl status asm
ASM is running on node node1
ASM is running on node node2
```

7.6 Understanding Offline Processes in Oracle Grid Infrastructure

Oracle Grid Infrastructure provides required resources for various Oracle products and components. Some of those products and components are optional, so you can install and enable them after installing Oracle Grid Infrastructure.

To simplify postinstallation additions, Oracle Grid Infrastructure preconfigures and registers all required resources for all products available for these products and components, but only activates them when you choose to add them. As a result, some components may be listed as OFFLINE after the installation of Oracle Grid Infrastructure.

Resources listed as TARGET:OFFLINE and STATE:OFFLINE do not need to be monitored. They represent components that are registered, but not enabled, so they do not use any system resources. If an Oracle product or component is installed on the system, and it requires a particular resource to be online, then the software will prompt you to activate the required offline resource.

Oracle Grid Infrastructure Postinstallation Tasks

Complete the postinstallation tasks after you have installed the Oracle Grid Infrastructure software.

You are required to complete some configuration tasks after Oracle Grid Infrastructure is installed. In addition, Oracle recommends that you complete additional tasks immediately after installation. You must also complete product-specific configuration tasks before you use those products.

Note: This chapter describes basic configuration only. Refer to product-specific administration and tuning guides for more detailed configuration and tuning information.

[Required Postinstallation Tasks](#) (page 8-1)

Certain postinstallation tasks are critical for your newly installed software.

[Recommended Postinstallation Tasks](#) (page 8-8)

Oracle recommends that you complete these tasks as needed after installing Oracle Grid Infrastructure.

[Configuring Oracle Enterprise Manager Cloud Control After an Upgrade](#) (page 8-11)

If you are managing Oracle Clusterware as target from Database Control or Cloud Control, you might notice that the Oracle ASM targets have a status of Down, even if the services and instances are running.

[Using Earlier Oracle Database Releases with Grid Infrastructure](#) (page 8-11)

Review the following sections for information about using earlier Oracle Database releases with Oracle Grid Infrastructure 12c Release 1 (12.1) installations

[Modifying Oracle Clusterware Binaries After Installation](#) (page 8-13)

After installation, if you must modify the software installed in your Grid home, then you must first stop the Oracle Clusterware stack.

8.1 Required Postinstallation Tasks

Certain postinstallation tasks are critical for your newly installed software.

Note: Backing up a voting file is no longer required.

Download and Install Patch Updates (page 8-2)

On a regular basis Oracle provides **patch sets** that include generic and port specific fixes encountered by customers since the base product was released. Patch sets increment the 4th digit of the release number e.g. 11.2.0.1.0 to 11.2.0.3.0, these patch sets are fully regression tested in the same way that the base release is (for example, 11.2.0.1.0). Customers are encouraged to apply these fixes.

Configure the Oracle ARP Driver (page 8-3)

Oracle Grid Infrastructure on Windows Server 2008 or Windows Server 2008 R2 requires the Oracle Address Resolution Protocol (ARP) driver.

Configure Exceptions for the Windows Firewall (page 8-4)

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.

8.1.1 Download and Install Patch Updates

On a regular basis Oracle provides **patch sets** that include generic and port specific fixes encountered by customers since the base product was released. Patch sets increment the 4th digit of the release number e.g. 11.2.0.1.0 to 11.2.0.3.0, these patch sets are fully regression tested in the same way that the base release is (for example, 11.2.0.1.0). Customers are encouraged to apply these fixes.

If a customer encounters a critical problem that requires a fix prior to the next patch set becoming available, they can request that a one off fix is made available on top of the latest patch set. This delivery mechanism is similar to the Microsoft Hot Fixes and is known as an Oracle patch set exception (or interim patch). Unlike Unix platforms these patch set exceptions are delivered in a **patch set exception bundle** (cumulative patch bundle), which includes all fixes since the current patch set. For example, bug 12393432 is a patch set exception bundle, Patch 12, for Oracle Database Release 11.2.0.1 for Microsoft Windows (x64). You should always apply the latest patch bundle available for your release.

The patch set exception bundles also include the fixes for the CPU (Critical Patch Update), DST (Daylight Saving Time), PSU (Patch Set Update) and Recommended Patch Bundles. It is not required to have the previous security patches applied before applying the patch set exception bundle. However, you must be on the stated patch set level for a given product home before applying the patch set exception bundle for that release.

Refer to "[How to Upgrade to Oracle Grid Infrastructure 12c Release 1](#) (page D-1)" for information about how to stop database processes in preparation for installing patches.

- Refer to the My Oracle Support website for required patch updates for your installation.

<https://support.oracle.com>

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

8.1.2 Configure the Oracle ARP Driver

Oracle Grid Infrastructure on Windows Server 2008 or Windows Server 2008 R2 requires the Oracle Address Resolution Protocol (ARP) driver.

Note: The Oracle ARP driver is not needed for IPv6 connections, or for IPv4 connections when the operating system is Windows Server 2012 or Windows Server 2012 R2.

1. Start the Oracle Grid Infrastructure stack, if it is not started.

To check the status of the Oracle Grid Infrastructure stack, use:

```
crsctl check crs
```

To start the Oracle Grid Infrastructure stack, use:

```
crsctl start crs
```

2. Use the `netcfg` utility to install the Oracle ARP driver, as shown in the following command:

```
%systemroot%\system32\netcfg.exe -l Grid_home\bin\oraarprv.inf -c p  
-i orcl_ndisprot
```

If "Oracle America, Inc." is not in list of the trusted publishers for the node, then select **Install** to allow the installation to continue.

3. Configure the Oracle ARP driver to start automatically following system restarts:

```
sc config oraarprv start= auto
```

4. Start the Oracle ARP Protocol Driver.

```
net.exe start oraarprv
```

5. Stop the following Oracle Clusterware resources:

- a. If GNS is configured for your cluster, then stop the GNS resource:

```
Grid_home\bin\srvtcl stop gns
```

To determine if GNS is configured for your cluster, use the following command:

```
Grid_home\bin\srvtcl config gns
```

- b. Stop the SCAN resource.

```
Grid_home\bin\srvtcl stop scan -f
```

- c. Stop all node applications running on the cluster.

```
Grid_home\bin\srvtcl stop nodeapps -n nodename -f
```

6. Restart the Oracle Clusterware resources in the opposite order.

- a. Start all node applications running on the cluster.

```
Grid_home\bin\srvtcl start nodeapps -n nodename -f
```

- b. Start the SCAN resource.

```
Grid_home\bin\srvtcl start scan
```

- c. If GNS is configured for your cluster, then start the GNS resource:

```
Grid_home\bin\srvtcl start gns
```

8.1.3 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 executable files so they can receive connection requests on any ports they choose.

- Use one of the following methods to configure the firewall:
 - 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 file. If you choose the create the exception in this way, the effect is the same as creating an exception for the executable file either through Control Panel or from the command line.

The following sections list the Oracle Database 11g release 2 (11.2) executable files that listen on TCP ports on Windows, along with a brief description of the executable file. It is recommended that these executable files (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 file, for example, `oracle.exe`, multiple times, once for each Oracle home from which that executable file loads.

[Firewall Exceptions for Oracle Database](#) (page 8-5)

For basic database operation and connectivity from remote clients, such as SQL*Plus, Oracle Call Interface (OCI), Open Database Connectivity (ODBC), and so on, you must add executable files to the Windows Firewall exception list.

[Firewall Exceptions for Oracle Database Examples \(or the Companion CD\)](#) (page 8-6)

After installing the Oracle Database Companion CD, you must add executable files to the Windows Firewall exception list.

[Firewall Exceptions for Oracle Gateways](#) (page 8-6)

If your Oracle database interacts with non-Oracle software through a gateway, then you must add the gateway executable file to the Windows Firewall exception list. The following table lists the gateway executable files used to access non-Oracle software.

[Firewall Exceptions for Oracle Clusterware and Oracle ASM](#) (page 8-6)

If you installed the Oracle Grid Infrastructure software on the nodes in your cluster, then you can enable the Windows Firewall only *after* adding certain executable files and ports to the Firewall exception list.

[Firewall Exceptions for Oracle RAC Database](#) (page 8-7)

After installing the Oracle Real Application Clusters (Oracle RAC), you must add executable files to the Windows Firewall exception list.

[Firewall Exceptions for Other Oracle Products](#) (page 8-7)

In addition 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 file.

Related Topics:

[Troubleshooting Windows Firewall Exceptions](#) (page A-13)

8.1.3.1 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), and so on, you must add executable files to the Windows Firewall exception list.

The following executable files 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 executable files must be added to the Windows Firewall exception list:

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

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

After installing the Oracle Database Companion CD, you must add executable files to the Windows Firewall exception list.

The following executable files 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

8.1.3.3 Firewall Exceptions for Oracle Gateways

If your Oracle database interacts with non-Oracle software through a gateway, then you must add the gateway executable file to the Windows Firewall exception list. The following table lists the gateway executable files used to access non-Oracle software.

Table 8-1 Oracle Executables Used to Access Non-Oracle Software

Executable Name	Description
<code>omtsreco.exe</code>	Oracle Services for Microsoft Transaction Server
<code>dg4sybs.exe</code>	Oracle Database Gateway for Sybase
<code>dg4tera.exe</code>	Oracle Database Gateway for Teradata
<code>dg4msql.exe</code>	Oracle Database Gateway for SQL Server
<code>dg4db2.exe</code>	Oracle Database Gateway for Distributed Relational Database Architecture (DRDA)
<code>pg4arv.exe</code>	Oracle Database Gateway for Advanced Program to Program Communication (APPC)
<code>pg4t4ic.exe</code>	Oracle Database Gateway for APPC
<code>dg4mq5.exe</code>	Oracle Database Gateway for WebSphere MQ
<code>dg4mqc.exe</code>	Oracle Database Gateway for WebSphere MQ
<code>dg4odbc.exe</code>	Oracle Database Gateway for ODBC

8.1.3.4 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 certain executable files 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 file (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\TNLSNR.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

8.1.3.5 Firewall Exceptions for Oracle RAC Database

After installing the Oracle Real Application Clusters (Oracle RAC), you must add executable files to the Windows Firewall exception list.

For the Oracle RAC database, the executable file 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)
 - TCP ports from 135 through 139
- Direct-hosted SMB traffic without a network basic I/O system (NetBIOS)
 - port 445 (TCP)

8.1.3.6 Firewall Exceptions for Other Oracle Products

In addition 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 file.

Table 8-2 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

Table 8-2 (Cont.) Other Oracle Software Products Requiring Windows Firewall Exceptions

Oracle Software Product	Executable Name
External Procedural Calls	extproc.exe

8.2 Recommended Postinstallation Tasks

Oracle recommends that you complete these tasks as needed after installing Oracle Grid Infrastructure.

[Optimize Memory Usage for Programs](#) (page 8-8)

The Windows operating system should be optimized for Memory Usage of 'Programs' instead of 'System Caching'.

[Create a Fast Recovery Area Disk Group](#) (page 8-8)

You should create a separate disk group for the fast recovery area.

[Checking the SCAN Configuration](#) (page 8-10)

The SCAN is a name that provides service access for clients to the cluster. You can use the command `cluvfy comp scan` (located in `Grid_home\bin`) to confirm that the DNS is correctly associating the SCAN with the addresses.

8.2.1 Optimize Memory Usage for Programs

The Windows operating system should be optimized for Memory Usage of 'Programs' instead of 'System Caching'.

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, ensure Programs is selected.

8.2.2 Create a Fast Recovery Area Disk Group

You should create a separate disk group for the fast recovery area.

During installation of Oracle Grid Infrastructure, if you select Oracle ASM for storage, a single disk group is created to store the Oracle Clusterware files. If you plan to create a single-instance database, an Oracle RAC database, or an Oracle RAC One Node database, then this disk group can also be used to store the data files for the database. However, Oracle recommends that you create a separate disk group for the fast recovery area.

[About the Fast Recovery Area and the Fast Recovery Area Disk Group](#) (page 8-9)

The fast recovery area is a unified storage location for all Oracle Database files related to recovery.

[Creating the Fast Recovery Area Disk Group](#) (page 8-9)

You can use ASMCA to create an Oracle ASM disk group for the fast recovery area.

8.2.2.1 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 fast 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 fast recovery area must be shared among all of the instances of an Oracle RAC database. 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 the parameter `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 `test1` is your least important database, `products` is of greater importance and `orders` 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 `test1`, 50 GB for `products`, and 70 GB for `orders`.

See Also: *Oracle Automatic Storage Management Administrator's Guide*

8.2.2.2 Creating the Fast Recovery Area Disk Group

You can use ASMCA to create an Oracle ASM disk group for the fast recovery area.

1. Navigate to the bin directory in the Grid home and start Oracle ASM Configuration Assistant (ASMCA).

For example:

```
C:\> cd app\12.1.0\grid\bin
C:\> asmca
```

ASMCA opens at the Disk Groups tab.

2. Click **Create** to create a new disk group.

The Create Disk Groups window opens.

3. In the Create Disk Groups window, enter the following information, then click **OK**:

- a. In the Disk Group Name field, enter a descriptive name for the fast recovery area disk group, for example, FRA.
- b. In the Redundancy section, select the level of redundancy you want to use.
- c. In the Select Member Disks field, select eligible disks to be added to the fast recovery area.

The Diskgroup Creation window opens to inform you when disk group creation is complete.

4. Click **OK** to acknowledge the message, then click **Exit** to quit the application.

8.2.3 Checking the SCAN Configuration

The SCAN is a name that provides service access for clients to the cluster. You can use the command `cluvfy comp scan` (located in `Grid_home\bin`) to confirm that the DNS is correctly associating the SCAN with the addresses.

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 run a particular database instance. Clients can continue to access the cluster in the same way as with earlier releases, but Oracle recommends that clients accessing the cluster use the SCAN.

After installation, when a client sends a request to the cluster, the Oracle Clusterware SCAN listeners redirect client requests to servers in the cluster.

- Confirm that the DNS is correctly associating the SCAN with the specified addresses.

```
cluvfy comp scan
```

Example 8-1 Using CLUVFY to Confirm DNS is Correctly Associating the SCAN Addresses

This example shows the output from the `cluvfy comp scan` command for a cluster node named `node1.example.com`.

```
C:\> cluvfy comp scan
Verifying scan

Checking Single Client Access Name (SCAN)...

Checking TCP connectivity to SCAN Listeners...
TCP connectivity to SCAN Listeners exists on all cluster nodes

Checking name resolution setup for "node1.example.com"...
```


Verification of SCAN VIP and Listener setup passed

Verification of scan was successful.

8.3 Configuring Oracle Enterprise Manager Cloud Control After an Upgrade

If you are managing Oracle Clusterware as target from Database Control or Cloud Control, you might notice that the Oracle ASM targets have a status of Down, even if the services and instances are running.

- If the Oracle ASM targets have a status of Down but are actually running, then use Cloud control to update the ASMSNMP password.

8.4 Using Earlier Oracle Database Releases with Grid Infrastructure

Review the following sections for information about using earlier Oracle Database releases with Oracle Grid Infrastructure 12c Release 1 (12.1) installations

[General Restrictions for Using Earlier Oracle Database Releases](#) (page 8-11)

You can use Oracle Database 10g and Oracle Database 11g with Oracle Clusterware and Oracle ASM 12c Release 1 (12.1).

[Using ASMCA to Administer Disk Groups for Earlier Database Releases](#) (page 8-12)

Starting with Oracle Grid Infrastructure 11g Release 2, Oracle ASM is installed as part of an Oracle Grid Infrastructure installation, with Oracle Clusterware.

[Using the Correct LSNRCTL Commands](#) (page 8-12)

Do not attempt to use the `lsnrctl` programs from Oracle home locations for earlier releases because they cannot be used with the new release.

[Starting and Stopping Cluster Nodes or Oracle Clusterware Resources](#) (page 8-12)

Before shutting down Oracle Clusterware 12c Release 1 (12.1), if you have an Oracle Database 11g Release 2 (11.2) database registered with Oracle Clusterware 12c, then you must perform additional steps to ensure the resources are stopped.

8.4.1 General Restrictions for Using Earlier Oracle Database Releases

You can use Oracle Database 10g and Oracle Database 11g with Oracle Clusterware and Oracle ASM 12c Release 1 (12.1).

If you upgrade an existing release of Oracle Clusterware and Oracle ASM to Oracle Grid Infrastructure 11g Release 2 (11.2) (which includes Oracle Clusterware and Oracle ASM), and you also plan to upgrade your Oracle RAC database to Oracle Database 12c Release 1 (12.1), then the required configuration of the existing databases is completed automatically when you complete the Oracle RAC upgrade, and this section does not concern you.

However, if you upgrade to Oracle Grid Infrastructure 12c Release 1 (12.1), and you have existing Oracle RAC installations that you do not plan to upgrade, or if you install an earlier release of Oracle RAC (11.2) on a cluster running Oracle Grid Infrastructure 12c Release 1 (12.1), then you must complete additional configuration

tasks or apply patches, or both, before the earlier database releases will work correctly with Oracle Grid Infrastructure.

Oracle Database homes can only be stored on Oracle ACFS if the database release is Oracle Database 11g Release 2 or higher. Earlier releases of Oracle Database cannot be installed on Oracle ACFS because these releases were not designed to use Oracle ACFS.

Note: Before you start an Oracle RAC or Oracle Database install on an Oracle Clusterware 12c Release 1 (12.1) installation, if you are upgrading from Oracle Clusterware 11g Release 1 or Oracle Clusterware 10g Release 2, you must first upgrade to Oracle Clusterware 11g Release 2. Then, you must move the OCR and voting files to Oracle ASM storage before upgrading to Oracle Clusterware 12c.

See Also:

- "[Download and Install Patch Updates](#) (page 8-2)"
 - "Oracle 12c Upgrade Companion," which is available through Note 1462240.1 on My Oracle Support: <https://support.oracle.com/CSP/main/article?cmd=show&type=NOT&id=1462240.1>
-
-

8.4.2 Using ASMCA to Administer Disk Groups for Earlier Database Releases

Starting with Oracle Grid Infrastructure 11g Release 2, Oracle ASM is installed as part of an Oracle Grid Infrastructure installation, with Oracle Clusterware.

You can no longer use Database Configuration Assistant (DBCA) to perform administrative tasks on Oracle ASM.

- Use Oracle ASM Configuration Assistant (ASMCA) to create and modify disk groups when you install earlier Oracle Database and Oracle RAC releases on Oracle Grid Infrastructure 11g installations.

See Also: *Oracle Automatic Storage Management Administrator's Guide* for details on configuring disk group compatibility for databases using Oracle Database 11g Release 2 with Oracle Grid Infrastructure 12c Release 1 (12.1)

8.4.3 Using the Correct LSNRCTL Commands

Do not attempt to use the `lsnrctl` programs from Oracle home locations for earlier releases because they cannot be used with the new release.

- Use the Listener Control utility, `lsnrctl`, located in the Oracle Grid Infrastructure 12c home to administer local and SCAN listeners for Oracle Clusterware and Oracle ASM 11g Release 2.

8.4.4 Starting and Stopping Cluster Nodes or Oracle Clusterware Resources

Before shutting down Oracle Clusterware 12c Release 1 (12.1), if you have an Oracle Database 11g Release 2 (11.2) database registered with Oracle Clusterware 12c, then you must perform additional steps to ensure the resources are stopped.

1. If you have an Oracle Database 11g Release 2 (11.2) database registered with Oracle Clusterware 12c, then perform one of the following steps:
 - a. Stop the Oracle Database 11g Release 2 database instances first, then stop the Oracle Clusterware stack
 - b. Use the `crsctl stop crs -f` command to shut down the Oracle Clusterware stack and ignore any errors that are raised
2. If you need to shut down a cluster node that currently has Oracle Database and Oracle Grid Infrastructure running on that node, then you must perform the following steps to cleanly shutdown the cluster node:
 - a. Use the `crsctl stop crs` command to shut down the Oracle Clusterware stack
 - b. After Oracle Clusterware has been stopped, you can shutdown the Windows server using `shutdown -r`.

8.5 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 Oracle Clusterware.

Caution: To put the changes you make to the Oracle Grid Infrastructure home into effect, you must shut down all executable files 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.

1. Log in using a member of the Administrators group and go to the directory `Grid_home\bin`, where `Grid_home` is the path to the Oracle Grid Infrastructure home.
2. Shut down Oracle Clusterware using the following command:


```
C:\..\bin> crsctl stop crs -f
```
3. After Oracle Clusterware is completely shut down, perform the updates to the software installed in the Grid home.
4. Use the following command to restart Oracle Clusterware:


```
C:\..\bin> crsctl start crs
```
5. Repeat steps 1 through 4 on each cluster member node.

Note: Do not delete directories in the Grid home. For example, do not delete the directory `Grid_home/Opatch`. If you delete the directory, then the Grid infrastructure installation owner cannot use Opatch to patch the Grid home, and Opatch displays the error message "checkdir error: cannot create `Grid_home/OPatch`".

Modifying or Deinstalling Oracle Grid Infrastructure

You must follow a specific procedure when modifying or removing Oracle Clusterware and Oracle Automatic Storage Management (Oracle ASM) software.

[Deciding When to Deinstall Oracle Clusterware](#) (page 9-1)

There are certain situations in which you might be required to remove Oracle software.

[Migrating Standalone Grid Infrastructure Servers to a Cluster](#) (page 9-2)

If you have an Oracle Database installation using Oracle Restart (an Oracle Grid Infrastructure installation for a standalone server), you can reconfigure that server as a cluster member node.

[Changing the Oracle Grid Infrastructure Home Path](#) (page 9-3)

You must reconfigure Oracle Clusterware and Oracle ASM every time you move the Grid home.

[Unconfiguring Oracle Clusterware Without Removing the Software](#) (page 9-4)

By running `rootcrs.bat -deconfig -force` on nodes where you encounter an installation error, you can unconfigure Oracle Clusterware on those nodes, correct the cause of the error, and then run `rootcrs.bat` again to reconfigure Oracle Clusterware.

[Removing Oracle Clusterware and Oracle ASM Software](#) (page 9-5)

The `deinstall` command removes Oracle Clusterware and Oracle ASM from your server.

[Example Response File for Deinstall of Oracle Grid Infrastructure](#) (page 9-12)

When you run the `deinstall` command with the `-paramfile` option, the deinstallation tool uses the values specified in the response file and, if needed, prompts you to supply any missing information.

See Also: Product-specific documentation for requirements and restrictions to remove an individual product

9.1 Deciding When to Deinstall Oracle Clusterware

There are certain situations in which you might be required to remove Oracle software.

Remove installed components in the following situations:

- You have successfully installed Oracle Clusterware, and you want to remove the Oracle 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.

9.2 Migrating Standalone Grid Infrastructure Servers to a Cluster

If you have an Oracle Database installation using Oracle Restart (an Oracle Grid Infrastructure installation for a standalone server), you can reconfigure that server as a cluster member node.

1. Inspect the Oracle Restart configuration with the Server Control (SRVCTL) utility 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 -db db_unique_name
srvctl config service -db db_unique_name
srvctl config listener -listener lsnrname
```

Write down the configuration information for the server; you will need this information in a later step.

2. Stop all of the databases, services, and listeners that you discovered in step 1.
3. If present, unmount all Oracle Automatic Storage Management Cluster File System (Oracle ACFS) file systems.
4. Go to the directory *Grid_home\crs\install*, where *Grid_home* is the location of your Oracle Grid Infrastructure home (Grid home) directory, for example:

```
C:\> cd app\12.1.0\grid\crs\install
```

5. Deconfigure and deinstall the Oracle Grid Infrastructure installation for a standalone server (Oracle Restart) using the following command:

```
C:\..\install> perl roothas.bat -deconfig -force
```

6. Prepare the server for Oracle Clusterware configuration, as described in Chapter 2 through Chapter 6 of this guide. In addition, choose to install Oracle Grid Infrastructure for a cluster in the same location as Oracle Restart or in a different location:

Option	Description
Installing in the Same Location as Oracle Restart	<ol style="list-style-type: none"> a. Use the deinstallation tool to remove the Oracle Restart software, but with all disk groups intact. b. Proceed to step 7.
Installing in a Different Location than Oracle Restart	Install Oracle Grid Infrastructure for a cluster in the new Grid home software location.

7. As the Oracle Installation user for Oracle Grid Infrastructure, run Oracle Clusterware Configuration Wizard, and save and stage the response file. For the –

`responseFile` parameter, specify the full path name where the response file should be written by the Oracle Clusterware Configuration Wizard, for example:

```
C:\> cd Grid_home\crs\config
C:\..\config> config.bat -silent -responseFile C:\Users\dbal\scripts\GI.rsp
```

8. Mount the Oracle ASM disk group used by Oracle Restart.
9. If you used Oracle ACFS with Oracle Restart, then:
 - a. Start Oracle ASM Configuration Assistant (ASMCA). Run the `volenable` command to enable all Oracle Restart disk group volumes.
 - b. Mount all Oracle ACFS file systems manually.
10. Add back Oracle Clusterware services to the Oracle Clusterware home, using the information you wrote down in step 1, including adding back Oracle ACFS resources, by performing the following tasks:
 - a. Register the Oracle ACFS resources using a command similar to the following, where `Grid_home` is the location of your Oracle Grid Infrastructure installation:

```
C:\> Grid_home\bin\srvctl add filesystem -device \\.\ORCLDATADISK4
-diskgroup ORestartData -volume db1
-mountpointpath C:\app\12.1.0\grid\db1 -user grid
```

- b. Add the Oracle Database for support by Oracle Grid Infrastructure for a cluster. Use the following command syntax, where `db_unique_name` is the unique name of the database on the node, and `nodename` is the name of the node:

```
srvctl add database -db db_unique_name -oraclehome %ORACLE_HOME% -node
nodename
```

For example, for the database name `mydb` on the local node `node1`, first verify that the `ORACLE_HOME` environment variable is set to the location of the database home directory, then enter the following command to register the database with Oracle Clusterware:

```
srvctl add database -db mydb -oraclehome %ORACLE_HOME% -node node1
```

- c. Register each database service, using the command `srvctl add service`. For example, if your database name is `mydb` and you created a service named `myservice` for this database, then enter the following command:

```
srvctl add service -db mydb -service myservice
```

See Also: *Oracle Clusterware Administration and Deployment Guide* for more information about the configuration wizard.

9.3 Changing the Oracle Grid Infrastructure Home Path

You must reconfigure Oracle Clusterware and Oracle ASM every time you move the Grid home.

Caution: Before changing the Grid home, you must shut down all executables that run in the Grid home directory that you are modifying. In addition, shut down all applications that use Oracle shared libraries.

1. Login as an Administrator user or the Oracle Installation user for Oracle Grid Infrastructure (for example, `grid`).
2. Change directory to `Grid_home\bin` and enter the command `crsctl stop crs`. For example:

```
C:\> cd app\12.1.0\grid\BIN
C:\..\BIN> crsctl stop crs
```

3. Detach the existing Grid home.

Run a command similar to the following command, where `C:\app\12.1.0\grid` is the existing Grid home location:

```
C:\> cd app\12.1.0\grid\oui\bin
C:\..\bin> setup.exe -silent -detachHome ORACLE_HOME=
'C:\app\12.1.0\grid' -local
```

4. Move the installed files for Oracle Grid Infrastructure from the old Grid home to the new Grid home.

For example, if the old Grid home is `C:\app\12.1.0\grid` and the new Grid home is `D:\app\12c\grid`, use the following command:

```
C:\> xcopy C:\app\12.1.0\grid D:\app\12c\grid /E /I /H /K
```

5. Clone the Oracle Grid Infrastructure installation, using the instructions provided in "Creating a Cluster by Cloning Oracle Clusterware Step 3: Run the clone.pl Script on Each Destination Node," in *Oracle Clusterware Administration and Deployment Guide*.

When you navigate to the `Grid_home\clone\bin` directory and run the `clone.pl` script, provide values for the input parameters that provide the path information for the new Grid home.

Note: You cannot specify a different Oracle Home user when changing the Oracle Grid Infrastructure home path.

6. Start Oracle Clusterware in the new home location.

```
D:\> cd app\12c\grid\crs\install
D:\..install> rootcrs.bat -patch -dstcrshome D:\app\12c\grid
```

7. Repeat steps 1 through 4 and step 6 on each cluster member node.

9.4 Unconfiguring Oracle Clusterware Without Removing the Software

By running `rootcrs.bat -deconfig -force` on nodes where you encounter an installation error, you can unconfigure Oracle Clusterware on those nodes, correct the cause of the error, and then run `rootcrs.bat` again to reconfigure Oracle Clusterware.

Running the `rootcrs.bat` command with the options `-deconfig -force` enables you to unconfigure Oracle Clusterware on one or more nodes without removing the installed software. This feature is useful if you encounter an error on one or more cluster nodes during installation, such as incorrectly configured shared storage.

Before unconfiguring Oracle Clusterware you must:

- Stop any databases, services, and listeners that may be installed and running
- Dismount ACFS file systems
- Disable ADVM volumes

Caution: Commands used in this section remove the Oracle Grid infrastructure installation for the entire cluster. To remove the installation from an individual node, refer to *Oracle Clusterware Administration and Deployment Guide*.

1. Log in using a member of the Administrators group on a node where you encountered an error during installation.
2. Stop any databases, services, and listeners currently running from the Grid home.
3. If present, unmount all Oracle Automatic Storage Management Cluster File System (Oracle ACFS) file systems.
4. Change directory to `Grid_home\crs\install`.

For example:

```
C:\> cd C:\app\12.1.0\grid\crs\install
```

5. Run `rootcrs.bat` with the `-deconfig -force` options.

For example:

```
C:\..\install> rootcrs.bat -deconfig -force
```

Note: The `-force` option must be specified when running the `rootcrs.bat` 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` option if you are removing a partial, or failed installation.

6. Repeat Step 1 through Step 5 on other nodes as required.
7. If you are unconfiguring Oracle Clusterware on all nodes in the cluster, then on the last node, enter the following command:

```
C:\..\install> rootcrs.bat -deconfig -force -lastnode
```

The `-lastnode` option completes the unconfiguring of the cluster, including the Oracle Cluster Registry (OCR) and voting files.

Caution: Run the `rootcrs.bat -deconfig -force -lastnode` command on a Hub Node. Deconfigure all Leaf Nodes before you run the command with the `-lastnode` flag.

9.5 Removing Oracle Clusterware and Oracle ASM Software

The `deinstall` command removes Oracle Clusterware and Oracle ASM from your server.

Caution: You must use the deinstallation tool from the same release to remove Oracle software. Do not run the deinstallation tool from a later release to remove Oracle software from an earlier release. For example, do not run the deinstallation tool from the 12.1.0.1 installation media to remove Oracle software from an existing 11.2.0.4 Oracle home.

[About the Deinstallation Tool](#) (page 9-6)

The deinstallation tool stops Oracle software, and removes Oracle software and configuration files on the operating system.

[Deinstallation Tool Command Reference](#) (page 9-7)

You can use the deinstallation tool to remove Oracle software. You can run this command in standalone mode, from an Oracle home directory, or through the installer.

[Using the Deinstallation Tool to Remove Oracle Clusterware and Oracle ASM](#) (page 9-10)

You can run the deinstallation tool in multiple ways.

9.5.1 About the Deinstallation Tool

The deinstallation tool stops Oracle software, and removes Oracle software and configuration files on the operating system.

Starting with Oracle Database 12c, the deinstallation tool is integrated with the database installation media. You can run the deinstallation tool using the `setup.exe` command with the `-deinstall` and `-home` options from the base directory of the Oracle Database or Oracle Database Client installation media.

The deinstallation tool is also available as a separate command (`deinstall.bat`) in Oracle home directories after installation. It is located in the `%ORACLE_HOME%\deinstall` directory.

The deinstallation tool stops Oracle software, and removes Oracle software and configuration files on the operating system for a specific Oracle home. If you run the deinstallation tool to remove an Oracle Grid Infrastructure for Windows installation, then the deinstaller automatically runs the appropriate scripts to deconfigure Oracle Grid Infrastructure or Oracle Grid Infrastructure for standalone server.

The deinstallation tool uses the information you provide, plus information gathered from the software home to create a response file. You can alternatively supply a response file generated previously by the `deinstall.bat` command using the `-checkonly` option and `-o` option. You can also edit a response file template to create a response file.

Note: You must run the deinstallation tool from the same release to remove Oracle software. Do not run the deinstallation tool from a later release to remove Oracle software from an earlier release. For example, do not run the deinstallation tool from the Oracle Database 12.1 installation media to remove Oracle software from an existing 11.2.0.4 Oracle home.

If the software in the Oracle home is not running (for example, after an unsuccessful installation), then the deinstallation tool cannot determine the configuration and you must provide all the configuration details either interactively or in a response file.

9.5.2 Deinstallation Tool Command Reference

You can use the deinstallation tool to remove Oracle software. You can run this command in standalone mode, from an Oracle home directory, or through the installer.

Purpose

The deinstallation tool stops Oracle software, and removes Oracle software and configuration files on the operating system.

File Path

%ORACLE_HOME%\deinstall\deinstall

Prerequisites

Before you run the deinstallation tool for Oracle Grid Infrastructure installations:

- Dismount Oracle Automatic Storage Management Cluster File System (Oracle ACFS) and disable Oracle Automatic Storage Management Dynamic Volume Manager (Oracle ADVM).
- If Grid Naming Service (GNS) is in use, then notify your DNS administrator to delete the subdomain entry from the DNS.

Syntax When Using the deinstall.bat Program

```
deinstall.bat [-silent] [-checkonly] [-local]
[-paramfile complete path of input response file]
[-params name1=value [name2=value . . .]]
[-o complete path of directory for saving files]
[-tmpdir complete path of temporary directory to use]
[-logdir complete path of log directory to use] [-help]
```

Syntax When Using the setup.exe Program

```
setup.exe -deinstall -home complete path of Oracle home [-silent] [-checkonly]
[-local] [-paramfile complete path of input response file]
[-params name1=value [name2=value . . .]]
[-o complete path of directory for saving files]
[-tmpdir complete path of temporary directory to use]
[-logdir complete path of log directory to use] [-help]
```

Options

Table 9-1 Options for the Deinstallation Tool

Command Option	Description
<i>home</i> <i>complete path of Oracle home</i>	<p>Specify this option to indicate the home path of the Oracle home to check or deinstall. To deinstall Oracle software using the <code>deinstall.bat</code> command located within the Oracle home being removed, provide a response file in a location outside the Oracle home, and do not use the <code>-home</code> option.</p> <p>If you run <code>deinstall.bat</code> from the <code>%ORACLE_HOME%\deinstall</code> path, then the <code>-home</code> option is not required because the tool knows from which home it is being run. If you use the command <code>setup.exe -deinstall</code> from the installation media, then the <code>-home</code> option is mandatory.</p>
<i>silent</i>	<p>Specify this option to run the deinstallation tool in noninteractive mode. This option requires one of the following:</p> <ul style="list-style-type: none"> • A working system that it can access to determine the installation and configuration information; the <code>-silent</code> option does not work with failed installations. • A response file that contains the configuration values for the Oracle home that is being deinstalled or deconfigured.
<i>checkonly</i>	<p>Specify this option to check the status of the Oracle software home configuration. Running the <code>deinstall</code> command with the <code>-checkonly</code> option does not remove the Oracle configuration. This option generates a response file that you can use with the <code>deinstall.bat</code> command.</p> <p>When you use the <code>-checkonly</code> option to generate a response 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 (<code>[]</code>), or you can provide different values. To accept the defaults, press <code>Enter</code> at each prompt.</p>

Table 9-1 (Cont.) Options for the Deinstallation Tool

Command Option	Description
<p><code>local</code></p>	<p>Specify this option on a multinode environment to deconfigure Oracle software in a cluster.</p> <p>When you run <code>deinstall.bat</code> with this option, it deconfigures and deinstalls the Oracle software only on the local node (the node on which you run <code>deinstall.bat</code>) for non-shared Oracle home directories. The deinstallation tool does not deinstall or deconfigure Oracle software on remote nodes.</p>
<p><code>paramfile</code> <i>complete path of input response file</i></p>	<p>(Optional) You can specify this option to run <code>deinstall.bat</code> with a response file in a location other than the default. When you use this option, provide the complete path where the response file is located. If you run the <code>deinstall.bat</code> command from the Oracle home that you plan to deinstall, then you do not need to specify the <code>-paramfile</code> option. The default location of the response file depends on the location of the deinstallation tool:</p> <ul style="list-style-type: none"> • From the installation media or stage location: <code>X:\staging_location\deinstall\response</code> • After installation, from the installed Oracle home: <code>%ORACLE_HOME%\deinstall\response</code>.
<p><code>params</code> <i>name1=value [name2=value name3=value...]</i></p>	<p>Use this option with a response file to override one or more values in a response file that you created.</p>
<p><code>o</code> <i>complete path of directory for saving response files</i></p>	<p>Use this option to provide a path other than the default location where the response file (<code>deinstall.rsp.tmpl</code>) is saved. The default location of the response file depends on the invocation method of the deinstallation tool:</p> <ul style="list-style-type: none"> • From the installation media or stage location: <code>stagelocation\response</code> • After installation, from the installed Oracle home: <code>%ORACLE_HOME%\deinstall\response</code>.

Table 9-1 (Cont.) Options for the Deinstallation Tool

Command Option	Description
<code>tmpdir</code> <i>complete path of temporary directory to use</i>	Specifies a non-default location where the deinstallation tool writes the temporary files for the deinstallation.
<code>logdir</code> <i>complete path of log directory to use</i>	Specifies a non-default location where the deinstallation tool writes the log files for the deinstallation.
<code>help</code>	Use the <code>-help</code> option to obtain additional information about the deinstallation tool options.

Location of Log Files for the Deinstallation Tool

If you use the `deinstall.bat` command located in an Oracle home, then the deinstallation tool writes log files in the `C:\Program Files\Oracle\Inventory\logs` directory.

If 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%\deinstall<timestamp>\logs`.

9.5.3 Using the Deinstallation Tool to Remove Oracle Clusterware and Oracle ASM

You can run the deinstallation tool in multiple ways.

[Running the Deinstallation Tool From an Oracle Home](#) (page 9-10)

You can run the deinstallation tool from an Oracle home or from the software installation media.

[Running the Deinstallation Tool Interactively From the Installer](#) (page 9-11)

You can run the deinstallation tool from an Oracle home or from the software installation media.

[Running the Deinstallation Tool with a Response File](#) (page 9-12)

The deinstallation tool uses the information you provide, plus information gathered from the software home to create a response file. You can alternatively supply a response file generated previously by the `deinstall.bat` command using the `-checkonly` option and `-o` option. You can also edit a response file template to create a response file.

[Generating a Response File For Use With the Deinstallation Tool](#) (page 9-12)

You can generate the a response file by running the `deinstall.bat` command with the `-checkonly` and `-o` options 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 response file.

9.5.3.1 Running the Deinstallation Tool From an Oracle Home

You can run the deinstallation tool from an Oracle home or from the software installation media.

1. The default method for running the deinstallation tool is from the `deinstall` directory in the Oracle home as the Oracle Installation user:

```
C:\> %ORACLE_HOME%\deinstall\deinstall.bat
```

2. Provide information about your servers as prompted or accept the defaults.

The deinstallation tool stops Oracle software, and removes Oracle software and configuration files on the operating system.

Example 9-1 Running `deinstall.bat` From Within the Oracle Home

The most common method of running the deinstallation tool is to use the version installed in the Oracle home being removed. The deinstallation tool determines the software configuration for the local Oracle home, and then provides default values at each prompt. You can either accept the default value, or override it with a different value. If the software in the Oracle home is not running (for example, after an unsuccessful installation), then the deinstallation tool cannot determine the configuration, and you must provide all the configuration details either interactively or in a response file. To use the deinstallation tool located in the Oracle home directory, issue the following command, where `C:\app\12.1.0\grid` is the location of Grid home:

Use the following command while logged in as a member of the Administrators group to remove the Oracle Grid Infrastructure installation from your cluster:

```
C:\> app\12.1.0\grid\deinstall\deinstall.bat
```

Provide additional information as prompted.

Note: When using the deinstallation tool from a location other than within the Oracle home being removed, you must specify the `-home` option on the command line.

9.5.3.2 Running the Deinstallation Tool Interactively From the Installer

You can run the deinstallation tool from an Oracle home or from the software installation media.

1. Use the `setup.exe` command with the `-deinstall` option, followed by the `-home` option to specify the path of the Oracle home you want to remove
2. Provide information about your servers as prompted or accept the defaults.

The deinstallation tool stops Oracle software, and removes Oracle software and configuration files on the operating system.

Example 9-2 Running the Deinstallation Tool from the Software Installation Media

If you run the deinstallation tool from the installer in the installation media, then when the `deinstall.bat` command runs, it uses the information you provide to determine the system configuration and then provides default values at each prompt. You can either accept the default value, or override it with a different value. If the software in the specified Oracle home is not running (for example, after an unsuccessful install attempt), then the deinstallation tool cannot determine the configuration, and you must provide all the configuration details either interactively or in a response file.

In this example, the `setup.exe` command is in the path `/directory_path`, where `directory_path` is the path to the database directory on the installation media, and `C:\app\12.1.0\grid` is the path to the Grid home that you want to remove.

Use the following command while logged in as a member of the Administrators group to remove the Oracle Grid Infrastructure installation from your cluster:

```
C:\> cd directory_path
C:\..database> setup.exe -deinstall -home C:\app\12.1.0\grid
```

Provide additional information as prompted.

Note: When using the deinstallation tool from a location other than within the Oracle home being removed, you must specify the `-home` option on the command line.

9.5.3.3 Running the Deinstallation Tool with a Response File

The deinstallation tool uses the information you provide, plus information gathered from the software home to create a response file. You can alternatively supply a response file generated previously by the `deinstall.bat` command using the `-checkonly` option and `-o` option. You can also edit a response file template to create a response file.

- To run the `deinstall.bat` command located in an Oracle Grid Infrastructure home and use a response file located at `D:\Users\oracle\paramfile4.tpl`, enter the following commands while logged in as a member of the Administrators group:

```
C:\> cd %ORACLE_HOME% C:\..\grid> deinstall\deinstall.bat -paramfile D:\Users
\oracle\paramfile4.tpl
```

9.5.3.4 Generating a Response File For Use With the Deinstallation Tool

You can generate the a response file by running the `deinstall.bat` command with the `-checkonly` and `-o` options 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 response file.

Alternatively, you can use the response file template located at `%ORACLE_HOME%\deinstall\response\deinstall.rsp.tpl`.

- To generate the response file `deinstall_OraCrs11g_home1.rsp` using the `deinstall.bat` command located in the Oracle home and the `-checkonly` option, enter a command similar to the following, where `C:\app\12.1.0\grid` is the location of the Grid home and `C:\Users\oracle` is the directory in which the generated response file is created:

```
C:\> app\12.1.0\grid\deinstall\deinstall.bat -checkonly -o C:\Users\oracle\
```

9.6 Example Response File for Deinstall of Oracle Grid Infrastructure

When you run the `deinstall` command with the `-paramfile` option, the deinstallation tool uses the values specified in the response file and, if needed, prompts you to supply any missing information.

Example 9-3 Example of a Response File for the Deinstallation Tool on a Cluster

The following is an example of a response file for a cluster on nodes `node1` and `node2`, in which the Oracle Grid Infrastructure for a cluster is installed by the user `grid`, the Grid home is `C:\app\12.1.0\grid`, the Oracle base (the Oracle base for Oracle Grid Infrastructure, containing Oracle ASM log files, Oracle Clusterware logs, and other administrative files) is `C:\app\grid\`, 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`, and the local node (the node on which you run the `deinstall.bat` command) 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\ut1\...
HELPJAR_NAME=help4.jar
local=false
ORACLE_HOME=C:\app\12.1.0\grid
ASM_HOME=C:\app\12.1.0\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\12.1.0\grid\jlib
OCRLOC=
JEW TJAR_NAME=jewt4.jar
EMBASEJAR_NAME=oemlt.jar
CRS_STORAGE_OPTION=1
ASM_REDUNDANCY=EXTERNAL
GPNPGCONFIGDIR=$ORACLE_HOME
LANGUAGE_ID='AMERICAN_AMERICA.WE8MSWIN1252'
CRS_NODEVIPS='node1-vip/255.255.252.0/PublicNIC,node2-vip/255.255.252.0/PublicNIC'
ORACLE_OWNER=Administrator
OLD_ACTIVE_ORACLE_HOME=
GNS_ALLOW_NET_LIST=
silent=false
LOGDIR=C:\Temp\OraDeinstall112010-02-11_10-14-30AM\logs\
OCFS_CONFIG=
NODE_NAME_LIST=node1,node2
GNS_DENY_ITF_LIST=
ORA_CRS_HOME=C:\app\12.1.0\grid
JREDIR=C:\app\12.1.0\grid\jdk\jre
ASM_LOCAL_SID=+asm1
ORACLE_BASE=C:\app\oracle\
GNS_CONF=false
NETCFGJAR_NAME=netcfg.jar
ORACLE_BINARY_OK=true
OCR_LOCATIONS=NO_VAL
ASM_ORACLE_BASE=C:\app\oracle
OLRLOC=
GPNPCONFIGDIR=$ORACLE_HOME
ORA_ASM_GROUP=
GNS_DENY_NET_LIST=
```

```
OLD_CRIS_HOME=
EWTJAR_NAME=ewt3.jar
NEW_NODE_NAME_LIST=
GNS_DOMAIN_LIST=
ASM_UPGRADE=false
NETCA_LISTENERS_REGISTERED_WITH_CRIS=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=CRIS
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_SPPFILE=
HOST_NAME_LIST=node1,node2
SCAN_NAME=myrac-scan
VIP1_MASK=255.255.252.0
INVENTORY_LOCATION=C:\Program Files\Oracle\Inventory
```

Note: Do not use quotation marks around any of the values in this file, except in the following cases:

- Around addresses for the CRS_NODEVIPS parameter:

```
CRS_NODEVIPS='node1-vip/255.255.252.0/PublicNIC,node2-vip/..'
```

- Around interface names for the NETWORKS parameters:

```
NETWORKS="PublicNIC"/192.0.2.1:public,"PrivateNIC"/
10.0.0.1 :cluster_interconnect
```

Troubleshooting the Oracle Grid Infrastructure Installation Process

This appendix provides troubleshooting information for installing Oracle Grid Infrastructure.

[Best Practices for Contacting Oracle Support](#) (page A-2)

If you find that it is necessary for you to contact Oracle Support to report an issue, then Oracle recommends that you follow these guidelines when you enter your service request.

[General Installation Issues](#) (page A-2)

The following is a list of examples of types of errors that can occur during installation.

[Interpreting CVU "Unknown" Output Messages Using Verbose Mode](#) (page A-4)

If you run Cluster Verification Utility (CVU) using the `-verbose` argument, and a Cluster Verification Utility command responds with UNKNOWN for a particular node, then this is because Cluster Verification Utility cannot determine if a check passed or failed.

[Interpreting CVU Messages About Oracle Grid Infrastructure Setup](#) (page A-5)

If the Cluster Verification Utility report indicates that your system fails to meet the requirements for Oracle Grid Infrastructure installation, then use the topics in this section to correct the problem or problems indicated in the report, and run Cluster Verification Utility again.

[About the Oracle Clusterware Alert Log](#) (page A-6)

Oracle Clusterware uses Oracle Database fault diagnosability infrastructure to manage diagnostic data and its alert log. As a result, most diagnostic data resides in the Automatic Diagnostic Repository (ADR), a collection of directories and files located under a base directory that you specify during installation.

[Oracle Clusterware Install Actions Log Errors and Causes](#) (page A-7)

During installation of the Oracle Grid Infrastructure software, a log file named `installActions<Date_Stamp>.log` is written to the `%TEMP%\OraInstall<Date_Stamp>` directory.

[Performing Cluster Diagnostics During Oracle Grid Infrastructure Installations](#) (page A-8)

If the installer does not display the Node Selection page, then use `cluvfy` to check the integrity of the Cluster Manager.

[CVU Cluster Healthchecks Command Reference](#) (page A-8)

Starting with Oracle Grid Infrastructure 11g Release 2 (11.2.0.3) and later, you can use the CVU `healthcheck` command option to check

your Oracle Clusterware and Oracle Database installations for their compliance with mandatory requirements and best practices guidelines, and to check to ensure that they are functioning properly.

[Interconnect Configuration Issues](#) (page A-10)

If the interconnect is not configured correctly, it can lead to errors or availability issues.

[Storage Configuration Issues](#) (page A-10)

The following is a list of issues involving storage configuration:

[Troubleshooting Windows Firewall Exceptions](#) (page A-13)

If you cannot establish certain connections even after granting exceptions to the executable files, then follow these steps to troubleshoot the installation.

[Completing Failed or Incomplete Installations and Upgrades](#) (page A-14)

Even if the installation or upgrade fails initially, you can take steps to complete the operation.

See Also:

- *Oracle Clusterware Administration and Deployment Guide*
 - *Oracle Real Application Clusters Administration and Deployment Guide*
-
-

A.1 Best Practices for Contacting Oracle Support

If you find that it is necessary for you to contact Oracle Support to report an issue, then Oracle recommends that you follow these guidelines when you enter your service request.

- Provide a clear explanation of the problem, including exact error messages.
- Provide an explanation of any steps you have taken to troubleshoot issues, and the results of these steps.
- Provide exact releases (major release and patch release) of the affected software.
- Provide a step-by-step procedure of what actions you carried out when you encountered the problem, so that Oracle Support can reproduce the problem.
- Provide an evaluation of the effect of the issue, including affected deadlines and costs.
- Provide screen shots, logs, Remote Diagnostic Agent (RDA) output, or other relevant information.

A.2 General Installation Issues

The following is a list of examples of types of errors that can occur during installation.

[CLSRSC-444: Run root script on the Node with OUI session](#) (page A-3)

[Failure to start network or VIP resources when Microsoft Failover Cluster is installed](#) (page A-3)

[Nodes unavailable for selection from the OUI Node Selection screen](#)
(page A-3)

[Node nodename is unreachable](#) (page A-4)

[PROT-8: Failed to import data from specified file to the cluster registry](#)
(page A-4)

[Timed out waiting for the CRS stack to start](#) (page A-4)

[Other Installation Issues and Errors](#) (page A-4)

For additional help in resolving error messages, see My Oracle Support.

See Also: For additional help in resolving error messages, see My Oracle Support. For example, the note with Doc ID 1367631.1 contains some of the most common installation issues for Oracle Grid Infrastructure and Oracle Clusterware.

A.2.1 CLSRSC-444: Run root script on the Node with OUI session

Cause: If this message appears listing a node that is not the one where you are running OUI, then the likely cause is that the named node shut down during or before the `root` script completed its run.

Action: Retry the installation from the first node. After you complete Oracle Grid Infrastructure on all or part of the set of planned cluster member nodes, start OUI and deinstall the failed Oracle Grid Infrastructure installation on the node named in the error. When you have deinstalled the failed installation on the node, add that node manually to the cluster.

See Also: *Oracle Clusterware Administration and Deployment Guide* for information about how to add a node

A.2.2 Failure to start network or VIP resources when Microsoft Failover Cluster is installed

Cause: If Microsoft Failover Cluster (MSFC) is installed on a Windows Server 2008 cluster (even if it is not configured) and you attempt to install Oracle Grid Infrastructure, the installation fails during the 'Configuring Grid Infrastructure' phase with an indication that it was unable to start the resource `ora.net1.network` or the VIP resources.

When MSFC is installed, it creates a virtual network adapter and places it at the top of the binding order. This change in the binding order can only be seen in the registry; it is not visible through 'View Network Connections' under Server Manager.

Action: The only solution is not to install MSFC and Oracle Grid Infrastructure or Oracle Clusterware on the same Windows Server 2008 cluster.

A.2.3 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, as doing so may resolve the problem.

A.2.4 Node *nodename* is unreachable

Cause: Unavailable IP host

Action: Attempt the following:

1. At a command prompt, run the command `ipconfig /all`. Compare the output of this command with the contents of the `hosts` file to ensure that the node IP is listed.
2. Run the operating system command `nslookup` to see if the host is reachable.

A.2.5 PROT-8: Failed to import data from specified file to the cluster registry

Cause: Insufficient space in an existing Oracle Cluster Registry device partition, which causes a migration failure while performing an upgrade. To confirm, look for the error "utopen:12:Not enough space in the backing store" in the log file `%GRID_HOME%\log\hostname\client\ocrconfig_pid.log`, where *pid* stands for the process id.

Action: Identify a storage device that has 400 MB or more available space. Oracle recommends that you allocate the entire disk to Oracle ASM.

A.2.6 Timed out waiting for the CRS stack to start

Cause: If a configuration issue prevents the Oracle Grid Infrastructure software from installing successfully on all nodes, then you may see error messages such as "Timed out waiting for the CRS stack to start," or you may notice that Oracle Clusterware-managed resources were not created on some nodes after you exit the installer. You also may notice that resources have a status other than ONLINE.

Action: Unconfigure the Oracle Grid Infrastructure installation without removing binaries, and review log files to determine the cause of the configuration issue. After you have fixed the configuration issue, rerun the scripts used during installation to configure Oracle Clusterware.

See Also: ["Unconfiguring Oracle Clusterware Without Removing the Software" \(page 9-4\)](#)

A.2.7 Other Installation Issues and Errors

For additional help in resolving error messages, see My Oracle Support.

For example, the note with Doc ID 1367631.1 contains some of the most common installation issues for Oracle Grid Infrastructure and Oracle Clusterware.

A.3 Interpreting CVU "Unknown" Output Messages Using Verbose Mode

If you run Cluster Verification Utility (CVU) using the `-verbose` argument, and a Cluster Verification Utility command responds with UNKNOWN for a particular node, then this is because Cluster Verification Utility cannot determine if a check passed or failed.

Possible causes for an "Unknown" response include:

- The node is down

- Common operating system command binaries required by Cluster Verification Utility are missing in the `bin` directory of the Oracle Grid Infrastructure home or Oracle home directory
- The user account starting Cluster Verification Utility does not have privileges to run common operating system commands on the node
- The node is missing an operating system patch, or a required package

A.4 Interpreting CVU Messages About Oracle Grid Infrastructure Setup

If the Cluster Verification Utility report indicates that your system fails to meet the requirements for Oracle Grid Infrastructure installation, then use the topics in this section to correct the problem or problems indicated in the report, and run Cluster Verification Utility again.

User Equivalence Check Failed

Cause: Failure to establish user equivalency across all nodes. This can be due to not creating the required users, the installation user not being the same on all nodes, or using a different password on the failed nodes.

Action: Cluster Verification Utility provides a list of nodes on which user equivalence failed. For each node listed as a failure node, review the Oracle Installation user configuration to ensure that the user configuration is properly completed, and that user equivalence is properly completed.

Check to ensure that:

- You are using a Domain user account that has been granted explicit membership in the Administrators group on each cluster node.
- The user account has the same password on each node.
- The domain for the user is the same on each node.
- The user account has administrative privileges on each node.
- The user can connect to the registry of each node from the local node.
- You might have to change the User Account Control settings on each node:
 - Change the elevation prompt behavior for administrators to "Elevate without prompting". See <http://technet.microsoft.com/en-us/library/cc709691.aspx>
- Confirm that the Administrators group is listed under 'Manage auditing and security log'.

Node Reachability Check or Node Connectivity Check Failed

Cause: One or more nodes in the cluster cannot be reached using TCP/IP protocol, through either the public or private interconnects.

Action: Use the command `ping address` to check each node address. When you find an address that cannot be reached, check your list of public and private addresses to ensure that you have them correctly configured. Ensure that the public and private network interfaces have the same interface names on each node of your cluster.

Do not use the names PUBLIC and PRIVATE (all capital letters) for your public and interconnect network adapters (NICs). You can use the variations of private, Private, public, and Public for the network interface names.

See Also:

- ["Configuring Operating Systems for Oracle Grid Infrastructure and Oracle RAC \(page 3-1\)"](#)
 - *Oracle Clusterware Administration and Deployment Guide*
-
-

A.5 About the Oracle Clusterware Alert Log

Oracle Clusterware uses Oracle Database fault diagnosability infrastructure to manage diagnostic data and its alert log. As a result, most diagnostic data resides in the Automatic Diagnostic Repository (ADR), a collection of directories and files located under a base directory that you specify during installation.

Starting with Oracle Clusterware 12c release 1 (12.1.0.2), diagnostic data files written by Oracle Clusterware programs are known as trace files (have a `.trc` file extension), and appear together in the trace subdirectory of the ADR home. Besides trace files, the trace subdirectory in the Oracle Clusterware ADR home contains the simple text Oracle Clusterware alert log. The Oracle Clusterware alert log always has the name `alert.log`. The Oracle Clusterware alert log is also written as an XML file in the alert subdirectory of the ADR home, but the text alert log is most easily read.

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 may see alert messages from the Cluster Ready Services daemon process (CRSD) when it starts, if it aborts, if the fail over process fails, or if automatic restart of an Oracle Clusterware resource fails.

Oracle Enterprise Manager monitors the Oracle Clusterware alert log and posts an alert on the Cluster Home page if an error is detected. For example, if a voting file is not available, then a CRS-1604 error is raised, and a critical alert is posted on the Cluster Home page of Oracle Enterprise Manager. 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 `ORACLE_BASE\diag\crs\hostname\crs\trace>alert.log`, where `ORACLE_BASE` is the directory in which Oracle Clusterware was installed and `hostname` is the host name of the local node

Note:

- *Oracle Clusterware Administration and Deployment Guide* for information about Oracle Clusterware troubleshooting
 - *Oracle Database Utilities* for information about the Automatic Diagnostic Repository Command Interpreter (ADCRI) utility to manage Oracle Database diagnostic data
 - *Oracle Database Administrator's Guide* for information on the Automatic Diagnostic Repository (ADR)
-
-

A.6 Oracle Clusterware Install Actions Log Errors and Causes

During installation of the Oracle Grid Infrastructure software, a log file named `installActions<Date_Stamp>.log` is written to the `%TEMP%\OraInstall<Date_Stamp>` 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:

[Symbolic links for disks were not removed](#) (page A-7)

When you stamp a disk with ASMTOOL, it creates symbolic links for the disks.

[Discovery string used by Oracle Automatic Storage Management is incorrect](#) (page A-7)

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.

[You used a period in a node name during Oracle Clusterware install](#) (page A-8)

Periods (.) are not permitted in node names. Instead, use a hyphen (-).

[Ignoring upgrade failure of `ocr\(-1073740972\)`](#) (page A-8)

This error indicates that the user that is performing the installation does not have Administrator privileges.

A.6.1 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.6.2 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.6.3 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 Grid Infrastructure installation, and reinstall with a supported node name.

A.6.4 Ignoring upgrade failure of ocr(-1073740972)

This error indicates that the user that is performing the installation does not have Administrator privileges.

A.7 Performing Cluster Diagnostics During Oracle Grid Infrastructure Installations

If the installer does not display the Node Selection page, then use `cluvfy` to check the integrity of the Cluster Manager.

- 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.8 CVU Cluster Healthchecks Command Reference

Starting with Oracle Grid Infrastructure 11g Release 2 (11.2.0.3) and later, you can use the CVU healthcheck command option to check your Oracle Clusterware and Oracle Database installations for their compliance with mandatory requirements and best practices guidelines, and to check to ensure that they are functioning properly.

Syntax

```
cluvfy comp healthcheck [-collect {cluster|database}] [-db db_unique_name]
[-bestpractice|-mandatory] [-deviations] [-html] [-save [-savedir directory_path]]
```

Example A-1 Example CVU Healthcheck Command

```
C:\> cd app\12.1.0\grid\cvu_home\bin
C:\..\bin> cluvfy comp healthcheck -collect cluster -bestpractice -deviations
-html
```

Security

CVU uses JDBC to connect to the database as the user `cvusys` to verify various database parameters. For this reason, if you want checks to be performed for the database you specify with the `-db` option, then you must first create the `cvusys` user on that database, and grant that user the CVU-specific role, `CVUSAPP`. You must also grant members of the `CVUSAPP` role `SELECT` permissions on system tables.

A SQL script, *Grid_home\cv\admin\cvusys.sql*, is provided to facilitate the creation of this user. Use this SQL script to create the *cvusys* user on all the databases that you want to verify using CVU.

Command Options

- `-collect [cluster|database]`

Use this option to specify that you want to perform checks for Oracle Clusterware (cluster) or Oracle Database (database). If you do not use the `collect` option with the `healthcheck` command, then the `clufy comp healthcheck` command performs checks for both Oracle Clusterware and Oracle Database.

- `-db db_unique_name`

Use this option to specify checks on the database unique name that you enter after the `db` option.

If you use the `db` option but do not provide a database unique name, then CVU discovers all the Oracle Databases on the cluster. To perform best practices checks on these databases, you must create the *cvusys* user on each database, and grant that user the *CVUSAPP* role with the *SELECT* privileges needed to perform the best practice checks.

- `[-bestpractice | -mandatory] [-deviations]`

Use the `bestpractice` option to specify best practice checks, and the `mandatory` option to specify mandatory checks. Add the `deviations` option to specify that you want to see only the deviations from either the best practice recommendations or the mandatory requirements. You can specify either the `-bestpractice` or `-mandatory` option, but not both options. If you specify neither `-bestpractice` or `-mandatory`, then both best practices and mandatory requirements are displayed.

- `-html`

Use the `html` option to generate a detailed report in HTML format.

If you specify the `html` option, and a browser CVU recognizes is available on the system, then the browser is started and the report is displayed on the browser when the checks are complete.

If you do not specify the `html` option, then the detailed report is generated in a text file.

- `-save [-savedir dir_path]`

Use the `-save` or `-save -savedir` options to save validation reports (*cvuheckdreport_timestamp.txt* and *cvuheckreport_timestamp.htm*), where *timestamp* is the time and date of the validation report.

If you use the `save` option by itself, then the reports are saved in the path *CVU_home/cv/report*, where *CVU_home* is the location of the CVU binaries.

If you use the options `-save -savedir`, and enter a path where you want the CVU reports saved, then the CVU reports are saved in the path you specify.

A.9 Interconnect Configuration Issues

If the interconnect is not configured correctly, it can lead to errors or availability issues.

If you plan to use multiple network interface cards (NICs) for the interconnect, then you should use a third party solution to bond the interfaces 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 bonded NIC cards or teamed NIC cards for the interconnect. If you use bonded or 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 virtual local area network (VLAN) configurations, duplex settings, and auto-negotiation in accordance with vendor and Oracle recommendations.

A.10 Storage Configuration Issues

The following is a list of issues involving storage configuration:

[Recovering from Losing a Node File System or Grid Home](#) (page A-10)

If you remove a file system by mistake, or encounter another storage configuration issue that results in losing the Oracle Local Registry or otherwise corrupting a node, you can recover the node in one of two ways.

[Oracle ASM Storage Issues](#) (page A-11)

This section describes Oracle ASM storage error messages, and how to address these errors.

[Oracle ASM Issues After Downgrading Oracle Grid Infrastructure for Standalone Server \(Oracle Restart\)](#) (page A-12)

The following section explains an error that can occur when you downgrade Oracle Grid Infrastructure for standalone server (Oracle Restart), and how to address it.

A.10.1 Recovering from Losing a Node File System or Grid Home

If you remove a file system by mistake, or encounter another storage configuration issue that results in losing the Oracle Local Registry or otherwise corrupting a node, you can recover the node in one of two ways.

If you add nodes in a GNS configuration, then that is called Grid Plug and Play (GPnP). GPnP uses profiles to configure nodes, which eliminates configuration data requirements for nodes and the need for explicit add and delete nodes steps. GPnP allows a system administrator to take a template system image and run it on a new node with no further configuration. GPnP removes many manual operations, reduces

the opportunity for errors, and encourages configurations that can be changed easily. Removal of individual node configuration makes the nodes easier to replace, because nodes do not need to contain individually-managed states.

Grid Plug and Play reduces the cost of installing, configuring, and managing database nodes by making their state disposable. It allows nodes to be easily replaced with regenerated state.

1. Restore the node from an operating system level backup (preferred)
2. Remove the node from the cluster, and then add the node to the cluster, using `Grid_home/addnode/addnode.bat`.

You must run the `addNode.bat` command as an Administrator user on the node that you are restoring, to recreate OCR keys and to perform other configuration tasks. You initiate recovery of a node using the `addnode` command, similar to the following, where *lostnode* is the node that you are adding back to the cluster:

- a. If you are using Grid Naming Service (GNS):

```
C:\Grid_home\addnode\bin> addNode.bat -silent "CLUSTER_NEW_NODES=lostnode"
```

- b. If you are not using GNS:

```
C:\Grid_home\addnode\bin> addNode.bat -silent "CLUSTER_NEW_NODES={lostnode}"
"CLUSTER_NEW_VIRTUAL_HOSTNAMES={lostnode-vip}"
```

Using `addnode.bat` enables cluster nodes to be removed and added again, so that they can be restored from the remaining nodes in the cluster. Profile information for the cluster is copied to the node, and the node is restored.

After the `addNode.bat` command finishes, run the following command on the node being added to the cluster:

```
C:\>Grid_home\crs\config\gridconfig.bat
```

See Also: *Oracle Clusterware Administration and Deployment Guide* for information about how to add nodes manually or with GNS

A.10.2 Oracle ASM Storage Issues

This section describes Oracle ASM storage error messages, and how to address these errors.

ASM-0001: could not open device \\?\volume... O/S-Error: (OS-5) Access is denied.

Cause: User Account Control (UAC) can require administrators to specifically approve administrative actions or applications before they are allowed to run. If you do not supply the proper credentials, the `asmtool` and `asmtoolg` utilities report these errors.

Action: There are a few ways to resolve this problem:

1. Click **Continue** in the UAC dialog box if you are logged in as an administrative user, or provide the credentials for an administrator user, then click **Continue**.
2. Create a desktop shortcut to a command window. Open the command window using the **Run as Administrator** option, then right-click the context menu, and launch `asmtool`.

3. Configure the UAC implementation on your Windows Server to turn off UAC or to change the elevation prompt behavior for administrator users.

Note: For information about managing security and UAC in a business or enterprise environment, see the User Account Control paper at [http://technet.microsoft.com/en-us/library/cc731416\(WS.10\).aspx](http://technet.microsoft.com/en-us/library/cc731416(WS.10).aspx)

O/S-Error: (OS-2) The system cannot find the file specified.

Cause: If a disk is disabled at the operating system level and enabled again, some of the Oracle ASM operations such as CREATE DISKGROUP, MOUNT DISKGROUP, ADD DISK, ONLINE DISK, or querying V\$ASM_DISK fail with the error:

OS Error: (OS-2) The system cannot find the file specified.

This happens when a previously mounted disk is assigned a new volume ID by the operating system. When Oracle ASM uses the old volume ID, it fails to open the disk and signals the above error.

Action: Use ASMTTOOL to restamp the disk and update the volume ID used by Oracle ASM.

Unable to mount disk group; ASM discovered an insufficient number of disks for diskgroup

Cause: You performed an Oracle Grid Infrastructure software-only installation, and want to configure a disk group for storing the OCR and voting files during the postinstallation configuration of Oracle Clusterware. You used ASMTTOOL to stamp the disks, and then used ASMCMD to create a disk group using the stamped disks. If you then update a crsconfig_params file with the disk device or disk partition names that constitute the Oracle ASM disk group. During the configuration of Oracle Clusterware, errors are displayed such as ORA-15017: diskgroup "DATA" cannot be mounted.

Action: Change the crsconfig_params file to use the stamped names generated by ASMTTOOL instead of the disk partition names, for example:

```
"\\.\ORCLDISKDATA0"
```

A.10.3 Oracle ASM Issues After Downgrading Oracle Grid Infrastructure for Standalone Server (Oracle Restart)

The following section explains an error that can occur when you downgrade Oracle Grid Infrastructure for standalone server (Oracle Restart), and how to address it.

CRS-2529: Unable to act on 'ora.cssd' because that would require stopping or relocating 'ora.asm'

Cause: After downgrading Oracle Grid Infrastructure for a standalone server (Oracle Restart) from 12.1.0.2 to 12.1.0.1, the ora.asm resource does not contain the Server Parameter File (SPFILE) parameter.

Action: When you downgrade Oracle Grid Infrastructure for a standalone server (Oracle Restart) from 12.1.0.2 to 12.1.0.1, you must explicitly add the Server Parameter File (SPFILE) from the ora.asm resource when adding the Oracle ASM resource for 12.1.0.1.

Follow these steps when you downgrade Oracle Restart from 12.1.0.2 to 12.1.0.1:

1. In your 12.1.0.2 Oracle Restart installed configuration, query the SPFILE parameter from the Oracle ASM resource (ora.asm) and remember it:

```
srvctl config asm
```

2. Deconfigure the 12.1.0.2 release Oracle Restart:

```
Grid_home/crs/install/roothas.bat -deconfig -force
```

3. Install the 12.1.0.1 release Oracle Restart by running root.sh:

```
Grid_home/root.sh
```

4. Add the listener resource:

```
Grid_home/bin/srvctl add LISTENER
```

5. Add the Oracle ASM resource and provide the SPFILE parameter for the 12.1.0.2 Oracle Restart configuration obtained in Step 1:

```
Grid_home/bin/srvctl add asm [-spfile <spfile>]
[-diskstring <asm_diskstring>]
```

See Also: *Oracle Database Installation Guide* for your platform for information about installing and deconfiguring Oracle Restart

A.11 Troubleshooting Windows Firewall Exceptions

If you cannot establish certain connections even after granting exceptions to the executable files, then follow these steps to troubleshoot the installation.

1. Examine Oracle configuration files (such as *.conf files), the Oracle key in the Windows registry, and network configuration files in %ORACLE_HOME%\network\admin.
2. Grant an exception in the Windows Firewall to any executable listed in %ORACLE_HOME%\network\admin\listener.ora in a PROGRAM= clause.

Each of these executables must be granted an exception in the Windows Firewall because a connection can be made through the TNS listener to that executable.

3. Examine Oracle trace files, log files, and other sources of diagnostic information for details on failed connection attempts.

Log and trace files on the database client computer may contain useful error codes or troubleshooting information for failed connection attempts. The Windows Firewall log file on the server may contain useful information as well.

4. If the preceding troubleshooting steps do not resolve a specific configuration issue on Windows, then provide the output from the following command to Oracle Support for diagnosis and problem resolution:

```
netsh firewall show state verbose=enable
```

See Also:

- [Configure Exceptions for the Windows Firewall](#) (page 8-4)
 - <http://support.microsoft.com/default.aspx?scid=kb;en-us;875357> for more information on Windows Firewall configuration
-

A.12 Completing Failed or Incomplete Installations and Upgrades

Even if the installation or upgrade fails initially, you can take steps to complete the operation.

[About Failed or Incomplete Installations and Upgrades](#) (page A-14)

During installations or upgrades of Oracle Grid Infrastructure, the following actions take place:

[Completing Failed or Interrupted Installations and Upgrades](#) (page A-15)

If OUI exits on the node from which you started the installation (the *first node*), or the node reboots before you confirm that the `rootupgrade.bat` script was run on all cluster nodes, then the upgrade remains incomplete.

[Completing Failed or Interrupted Installations](#) (page A-16)

If OUI exits on the node from which you started the installation (the *first node*), or the node reboots before you confirm that `gridconfig.bat` script was run on all nodes, then the installation remains incomplete.

A.12.1 About Failed or Incomplete Installations and Upgrades

During installations or upgrades of Oracle Grid Infrastructure, the following actions take place:

1. Oracle Universal Installer (OUI) accepts inputs to configure Oracle Grid Infrastructure software on your system.
2. OUI runs the `gridconfig.bat` script on each node.
3. OUI runs configuration assistants. The Oracle Grid Infrastructure software installation completes successfully.

If OUI exits before the `gridconfig.bat` script runs, or if OUI exits before the installation or upgrade session completes successfully, then the Oracle Grid Infrastructure installation is incomplete. If your installation or upgrade does not complete, then Oracle Clusterware does not work correctly. If you are performing an upgrade, then an incomplete upgrade can result in some nodes being upgraded to the latest software and others nodes not upgraded at all. If you are performing an installation, the incomplete installation can result in some nodes not being a part of the cluster.

Additionally, with Oracle Grid Infrastructure release 11.2.0.3 or later releases, the following messages may be seen during installation or upgrade:

```
ACFS-9427 Failed to unload ADVN/ACFS drivers. A system reboot is recommended
```

```
ACFS-9428 Failed to load ADVN/ACFS drivers. A system reboot is recommended
```


CLSRSC-400: A system reboot is required to continue installing
 To resolve this error, you must reboot the server, and then follow the steps for completing an incomplete installation or upgrade.

A.12.2 Completing Failed or Interrupted Installations and Upgrades

If OUI exits on the node from which you started the installation (the *first node*), or the node reboots before you confirm that the `rootupgrade.bat` script was run on all cluster nodes, then the upgrade remains incomplete.

In an incomplete upgrade, configuration assistants still need to run, and the new Grid home still needs to be marked as active in the central Oracle inventory. You must complete the upgrade on the affected nodes manually.

[Continuing Upgrade When Upgrade Fails on the First Node](#) (page A-15)

When the first node cannot be upgraded, use these steps to continue the upgrade process.

[Continuing Upgrade When Upgrade Fails on Nodes Other Than the First Node](#) (page A-15)

For nodes other than the first node (the node on which you started the upgrade), use these steps to continue the upgrade process.

A.12.2.1 Continuing Upgrade When Upgrade Fails on the First Node

When the first node cannot be upgraded, use these steps to continue the upgrade process.

1. If the OUI failure indicated a need to reboot by raising error message CLSRSC-400, then reboot the first node (the node on which you started the upgrade). Otherwise, manually fix or clear the error condition, as reported in the error output.
2. Complete the upgrade of all other nodes in the cluster.
3. Configure a response file, and provide passwords for the upgrade.

See "[Postinstallation Configuration Using Response Files](#) (page B-7)" for information about how to create the response file.

4. To complete the upgrade, log in as the Oracle Installation user for Oracle Grid Infrastructure and run the script `configToolAllCommands`, located in the path `Grid_home\cfgtoollogs\configToolAllCommands`, specifying the response file that you created.

For example, if the response file is named `gridinstall.rsp`:

```
[C:\] cd app\12.1.0\grid\cfgtoollogs
[C:\..\cfgtoollogs] configToolAllCommands RESPONSE_FILE=gridinstall.rsp
```

A.12.2.2 Continuing Upgrade When Upgrade Fails on Nodes Other Than the First Node

For nodes other than the first node (the node on which you started the upgrade), use these steps to continue the upgrade process.

1. If the OUI failure indicated a need to reboot, by raising error message CLSRSC-400, then reboot the node with the error condition. Otherwise, manually fix or clear the error condition that was reported in the error output.

2. On the first node, within OUI, click **Retry**.

This instructs OUI to retry the upgrade on the affected node.

3. Continue the upgrade from the OUI instance on the first node.

A.12.3 Completing Failed or Interrupted Installations

If OUI exits on the node from which you started the installation (the *first node*), or the node reboots before you confirm that `gridconfig.bat` script was run on all nodes, then the installation remains incomplete.

In an incomplete installation, configuration assistants still need to run, and the new Grid home still needs to be marked as active in the central Oracle inventory. You must complete the installation on the affected nodes manually.

[Continuing Incomplete Installations on First Nodes](#) (page A-16)

To continue an incomplete installation, the first node must finish before the rest of the clustered nodes.

[Continuing Installations on Nodes Other Than the First Node](#) (page A-17)

For nodes other than the first node (the node on which you started the installation), use these steps to continue the installation process.

A.12.3.1 Continuing Incomplete Installations on First Nodes

To continue an incomplete installation, the first node must finish before the rest of the clustered nodes.

1. If the OUI failure indicated a need to reboot, by raising error message CLSRSC-400, then reboot the first node (the node where the installation was started). Otherwise, manually fix or clear the error condition that was reported in the error output.
2. If necessary, log in as the Oracle Installation user for Oracle Grid Infrastructure. Change directory to the Grid home on the first node and run the `gridconfig.bat` script on that node again.

For example:

```
[C:\] cd app\12.1.0\grid\crs\config\  
[C:\..\config] gridconfig.bat
```

3. Complete the installation on all other nodes.
4. Configure a response file, and provide passwords for the installation.

See "[Postinstallation Configuration Using Response Files](#) (page B-7)" for information about how to create the response file.

5. To complete the installation, log in as the Oracle Installation user for Oracle Grid Infrastructure, and run the script `configToolAllCommands`, located in the path `Grid_home\cfgtoollogs\configToolAllCommands`, specifying the response file that you created.

For example, if the response file is named `gridinstall.rsp`:

```
[C:\] cd app\12.1.0\grid\cfgtoollogs  
[C:\..\cfgtoollogs] configToolAllCommands RESPONSE_FILE=gridinstall.rsp
```

A.12.3.2 Continuing Installations on Nodes Other Than the First Node

For nodes other than the first node (the node on which you started the installation), use these steps to continue the installation process.

1. If the OUI failure indicated a need to reboot, by raising error message `CLSRSC-400`, then reboot the node with the error condition. Otherwise, manually fix or clear the error condition that was reported in the error output.
2. On the first node, within OUI, click **Retry**.
3. Continue the installation from the OUI instance on the first node.

Installing and Configuring Oracle Grid Infrastructure Using Response Files

You can install and configure Oracle Grid Infrastructure software using response files.

[About Response Files](#) (page B-1)

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.

[Preparing Response Files](#) (page B-3)

There are two methods you can use to prepare response files for silent mode or response file mode installations.

[Running the Installer Using a Response File](#) (page B-6)

To use a response file during installation, you start OUI from the command line, specifying the response file you created.

[Running Oracle Net Configuration Assistant Using Response Files](#) (page B-6)

You can run Oracle 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.

[Postinstallation Configuration Using Response Files](#) (page B-7)

You can create and run a response file configuration after installing Oracle software.

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="OraCrsl1g_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=OraCrsl1g_home1" ...
```

Ensure that you enclose the variable and its setting in double-quotes.

[Deciding to Use Silent Mode or Response File Mode](#) (page B-2)

There are several reasons for running the installer in silent mode or response file mode.

[Using Response Files](#) (page B-3)

Use these general steps for installing and configuring Oracle products using the installer in silent or response file mode.

See Also: *Oracle Universal Installer and OPatch User's Guide for Windows and UNIX* for more information about response files

B.1.1 Deciding to Use Silent Mode or Response File Mode

There are several reasons for running the installer in silent mode or response file mode.

Table B-1 *Reasons for Using Silent Mode or Response File Mode*

Mode	Reasons to Use
Silent	<p>Use silent mode for the following installations:</p> <ul style="list-style-type: none"> To complete an unattended installation, which you schedule using operating system utilities To complete several similar installations on multiple systems without user interaction Install the software on a system that cannot display the Oracle Universal Installer (OUI) graphical user interface <p>OUI displays progress information on the terminal that you used to start it, but it does not display any of the installer screens.</p>

Table B-1 (Cont.) Reasons for Using Silent Mode or Response File Mode

Mode	Reasons to Use
Response file	<p>Use response file mode to complete similar Oracle software installations on more than one system, providing default answers to some, but not all the installer prompts.</p> <p>If you do not specify information required for a particular OUI screen in the response file, then the installer displays that screen. OUI suppresses screens for which you have provided all of the required information.</p>

B.1.2 Using Response Files

Use these general steps for installing and configuring 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. Verify the Windows Registry key `HKEY_LOCAL_MACHINE\Software\Oracle` exists and that the value for `inst_loc` is the location of the Oracle Inventory directory on the local node.

Note: Changing the value for `inst_loc` in the Windows registry is not supported after the installation of Oracle software

2. Prepare a response file.
3. Run the installer in silent or response file mode.
4. If you completed a software-only installation, then perform the steps necessary to configure the Oracle product.

B.2 Preparing Response Files

There are two methods you can use to prepare response files for silent mode or response file mode installations.

[Editing a Response File Template](#) (page B-4)

Oracle provides response file templates for each product and installation type and for each configuration tool. You can copy and modify a response file template.

[Recording Response Files](#) (page B-4)

You can use the installer in interactive mode to record response files, which you can then edit and use to complete silent mode or response file mode installations.

[Creating a Password Response File](#) (page B-5)

Use these steps to create a password response file for use with the configuration assistants.

B.2.1 Editing a Response File Template

Oracle provides response file templates for each product and installation type and for each configuration tool. You can copy and modify a response file template.

1. Copy the response file from the response file directory to a directory on your system.

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.

2. Open the response file in a text editor.

See Also: *Oracle Universal Installer and OPatch User's Guide for Windows and UNIX* for detailed information about creating response files

3. Follow the instructions in the file to edit it.

Note: The installer or configuration assistants fail if you do not correctly configure the response file. Also, ensure that your response file name has the .rsp suffix.

4. Secure the response file.

Ensure that only the user that installed the Oracle software can view or modify response files. Consider deleting the modified response file after the installation succeeds.

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 operating system groups ORA_DBA and Administrators. Oracle strongly recommends that database administrators or other administrators delete or secure response files when they are not in use.

B.2.2 Recording Response Files

You can use the installer in interactive mode to record response files, which you can then edit and use to complete silent mode or response file mode installations.

This method is useful for Advanced or software-only installations. 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 the installer starts to copy the software to the local disk.

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.

Note: You cannot save passwords while recording the response file.

1. Complete preinstallation tasks as for a standard installation.

When you use 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 the Oracle Installation User. Ensure that the Oracle Installation User has permissions to create or write to the Grid home path that you specify during installation.
3. Start the installer. On each installation screen, specify the required information.
4. When the installer displays the Summary screen, perform the following steps:
 - a. Click **Save Response File**. In the pop up window, specify a file name and location to save the values for the response file, then click **Save**.
 - b. Click **Finish** to continue with the installation.

Click **Cancel** if you do not want to continue with the installation. The installation stops, but the recorded response file is retained.

Note: Your response file name must end with the `.rsp` suffix.

5. 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.2.3 Creating a Password Response File

Use these steps to create a password response file for use with the configuration assistants.

1. Create a response file that has a name of the format `filename.properties`.
2. Open the file with a text editor, and cut and paste the sample password file contents, as shown in the example below, modifying as needed.
3. If the file is stored on a volume formatted for Windows New Technology File System (NTFS), then modify the security permissions to secure the file.

Example B-1 Sample Password Response File for Oracle Grid Infrastructure

This example provides a template for a password response file to use with 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. Also, if you specified an Oracle Home user for the Oracle Grid Infrastructure installation, you must specify the password as the Windows Service user password.

```
oracle.assistants.asm|S_ASMPASSWORD=password
oracle.assistants.asm|S_ASMMONITORPASSWORD=password
```

```
oracle.crs|S_BMCPASSWORD=password  
oracle.crs|S_WINSERVICEUSERPASSWORD=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.

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 information appears in your session window after a short period of time.

1. Complete the preinstallation tasks as for any installation.
2. Log in as an Administrator 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 software.
- `-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.

Note: 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 Oracle Net Configuration Assistant Using Response Files

You can run Oracle 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.

Oracle provides a response file template named `netca.rsp` in the `response` subdirectory of:

- The `Oracle_home\database\inventory\response` directory after a software-only installation
- The `database\response` directory on the installation media or staging area

To run NETCA in silent mode, you must copy and edit a response file template.

1. Copy the `netca.rsp` response file template from the response file directory to a directory on your system.

If the software is staged on a hard drive, or has already been installed, then you can edit the file in the `response` directory located on the local disk instead.

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 Administrator user and set the `%ORACLE_HOME%` environment variable to specify the correct Oracle home directory.
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 Response Files

You can create and run a response file configuration after installing Oracle software.

[About the Postinstallation Configuration File](#) (page B-7)

The configuration assistants are started with a script called `configToolAllCommands`.

[Running Postinstallation Configuration Using a Response File](#) (page B-8)

You can run the postinstallation configuration assistants with the `configToolAllCommands` script.

B.5.1 About the Postinstallation Configuration File

The configuration assistants are started with a script called `configToolAllCommands`.

When you perform an installation using silent mode or response file mode, 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. To run the configuration assistants after the installation

completes in silent mode, you must run the `configToolAllCommands` script and provide the passwords used by the assistants in a password file.

You can run the `configToolAllCommands` script in silent mode by using a password response file. The script uses the passwords in the file to run the configuration tools in succession to complete the software configuration. If you keep the password file to use when cloning installations, then Oracle strongly recommends that you store the password file in a secure location.

You can also use the password file to restart a failed installation. If you stop an installation to fix an error, then you can rerun the configuration assistants using `configToolAllCommands` and a password response file.

The `configToolAllCommands` password response file has the following 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, to set the password for the SYS user of Oracle ASM:

```
oracle.assistants.asm|S_ASMPASSWORD=myPassWord
```

B.5.2 Running Postinstallation Configuration Using a Response File

You can run the postinstallation configuration assistants with the `configToolAllCommands` script.

1. Create a response file using the format `filename.properties` for the file name.
2. Open the file with a text editor, and cut and paste the password template, modifying as needed.
3. Change directory to `Oracle_home\cfgtoollogs`, and run the configuration script using the following syntax:

```
configToolAllCommands RESPONSE_FILE=\path\filename.properties
```

For example:

```
C:\..\cfgtoollogs> configToolAllCommands RESPONSE_FILE=C:\users\oracle  
\grid\cfgrsp.properties
```

Example B-2 Password response file for Oracle Grid Infrastructure Installation

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. Also, if you specified an Oracle Home user for the Oracle Grid Infrastructure installation, you must specify the password as the Windows Service user password. Provide the following response file:

```
oracle.assistants.asm|S_ASMPASSWORD=password  
oracle.assistants.asm|S_ASMMONITORPASSWORD=password
```

```
oracle.crs|S_BMCPASSWORD=password
oracle.crs|S_WINSERVICEUSERPASSWORD=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.

Note: If you are upgrading Oracle ASM 11g Release 1 or earlier releases, then you only need to provide the input field for `oracle.assistants.asm|S_ASMMONITORPASSWORD`.

Example B-3 Password response file for Oracle Real Application Clusters

Oracle Database configuration requires the SYS, SYSTEM, and DBSNMP passwords for use with Database Configuration Assistant (DBCA). The `S_ASMSNMPPASSWORD` response is necessary only if the database is using Oracle ASM for storage. Similarly, the `S_PDBADMINPASSWORD` password is necessary only if you create a multitenant container database (CDB) with one or more pluggable databases (PDBs). Also, if you selected to configure Oracle Enterprise Manager Cloud Control, then you must provide the password for the Oracle software installation owner for `S_EMADMINPASSWORD`, similar to the following example, where the phrase *password* represents the password string:

```
oracle.assistants.server|S_SYSPASSWORD=password
oracle.assistants.server|S_SYSTEMPASSWORD=password
oracle.assistants.server|S_DBSNMPPASSWORD=password
oracle.assistants.server|S_PDBADMINPASSWORD=password
oracle.assistants.server|S_EMADMINPASSWORD=password
oracle.assistants.server|S_ASMSNMPPASSWORD=password
oracle.assistants.server|S_WINSERVICEUSERPASSWORD=password
```

If you do not want to enable Oracle Enterprise Manager for Oracle ASM, then leave those password fields blank.

Oracle Grid Infrastructure for a Cluster Installation Concepts

This appendix provides an overview of concepts and terms that may be necessary to complete your installation.

[Understanding the Software Directories](#) (page C-1)

Oracle Universal Installer uses various directories when installing the software.

[Standard Administration and Job Role Separation User Groups](#) (page C-4)

Oracle Grid Infrastructure uses various operating system groups. These operating system groups are designated with the logical role of granting operating system group authentication for administration system privilege for Oracle Clusterware and Oracle ASM.

[Understanding Network Addresses](#) (page C-7)

During installation, you are asked to identify the planned use for each network interface that Oracle Universal Installer (OUI) detects on your cluster node.

[Understanding Network Time Requirements](#) (page C-10)

Oracle Clusterware 12c Release 1 (12.1) is automatically configured with Cluster Time Synchronization Service (CTSS).

[Understanding Storage Configuration](#) (page C-11)

The following sections describe concepts related to Oracle Automatic Storage Management (Oracle ASM) storage.

[Understanding Out-of-Place Upgrade](#) (page C-12)

During an out-of-place upgrade of Oracle Grid Infrastructure, the installer installs the newer release of the software in a separate Grid home. Both releases of Oracle Clusterware are on each cluster member node, but only one release is active.

[Oracle Grid Infrastructure for a Cluster and Oracle Restart Differences](#) (page C-13)

Requirements for Oracle Grid Infrastructure for a cluster are different from Oracle Grid Infrastructure on a single instance in an Oracle Restart configuration.

C.1 Understanding the Software Directories

Oracle Universal Installer uses various directories when installing the software.

[Optimal Flexible Architecture Guidelines for Oracle Grid Infrastructure](#)
(page C-2)

Oracle Optimal Flexible Architecture (OFA) rules help you to organize database software and configure databases to allow multiple databases, of different versions, owned by different users to coexist.

[Understanding the Oracle Inventory Directory](#) (page C-3)

The Oracle Inventory directory is the central inventory location for all Oracle software installed on a server.

[Understanding the Oracle Base Directory](#) (page C-4)

During installation, you are prompted to specify an Oracle base location, which is based on the Oracle Installation user. 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\`.

C.1.1 Optimal Flexible Architecture Guidelines for Oracle Grid Infrastructure

Oracle Optimal Flexible Architecture (OFA) rules help you to organize database software and configure databases to allow multiple databases, of different versions, owned by different users to coexist.

For installations with Oracle Grid Infrastructure only, Oracle recommends that you create an Oracle base and Grid home path compliant with Oracle Optimal Flexible Architecture (OFA) guidelines, so that Oracle Universal Installer (OUI) can select that directory during installation.

The OFA path for an Oracle base is `X:\app\user`, where *user* is the name of the Oracle Installation user account.

The OFA path for an Oracle Grid Infrastructure Oracle home is `X:\app\release\grid` where *release* is the three-digit Oracle Grid Infrastructure release (for example, 12.1.0).

When OUI finds an OFA-compliant software path, it creates the Oracle Grid Infrastructure Grid home and Oracle Inventory (`oraInventory`) directories for you. For example, the path `C:\app` and `G:\app` are OFA-compliant paths.

The Oracle Grid Infrastructure home must be in a path that is different from the Grid home for the Oracle Installation user for Oracle Grid Infrastructure. If you create an Oracle Grid Infrastructure base path manually, then ensure that it is in a separate path specific for this release, and not under an existing Oracle base path.

Note:

If you choose to create an Oracle Grid Infrastructure home manually, then do not create the Oracle Grid Infrastructure home for a cluster under either:

- The Oracle base directory for the Oracle Installation user for Oracle Grid Infrastructure (for example, `grid`)
- The Oracle base directory for the Oracle Installation user for Oracle Database (for example, `oracle`)

Creating an Oracle Clusterware installation in an Oracle base directory will cause succeeding Oracle installations to fail.

Oracle Grid Infrastructure homes can be placed in a local home on servers, even if your existing Oracle Clusterware home from a prior release is in a shared location.

C.1.2 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`.

Note:

Changing the value for `inst_loc` in the Windows registry is not supported.

By default, the Oracle Inventory directory is not installed under the Oracle base directory for the Oracle Installation user. 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.

The Oracle Inventory directory contains the following:

- A registry of the Oracle home directories (Oracle Grid Infrastructure and Oracle Database) on the system
- Installation logs and trace files from installations of Oracle software. These files are also copied to the respective Oracle homes for future reference.
- Other metadata inventory information regarding Oracle installations are stored in the individual Oracle home inventory directories, and are separate from the central inventory.

The central inventory is created on all cluster nodes. On core nodes, the inventory does not include processing nodes in the Oracle home's nodelist. For processing nodes, the nodelist in the central inventory includes only the local node. The list of core nodes is updated only in the central inventory on core nodes.

C.1.3 Understanding the Oracle Base Directory

During installation, you are prompted to specify an Oracle base location, which is based on the Oracle Installation user. 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, 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.

However, Oracle Restart can be in the same location as other Oracle software.

Because you can have only one Oracle Grid Infrastructure installation on a cluster, and all upgrades are out-of-place upgrades, Oracle recommends that you have an Oracle base for the Oracle Installation user for Oracle Grid Infrastructure (for example, `C:\app\grid`), and use an Oracle home for the Oracle Grid Infrastructure binaries using the release number of that installation (for example, `C:\app\12.1.0\grid`).

C.2 Standard Administration and Job Role Separation User Groups

Oracle Grid Infrastructure uses various operating system groups. These operating system groups are designated with the logical role of granting operating system group authentication for administration system privilege for Oracle Clusterware and Oracle ASM.

[Understanding the Oracle Inventory Group](#) (page C-4)

You must have a group whose members are given access to write to the Oracle Inventory directory, which is the central inventory record of all Oracle software installations on a server.

[Understanding Operating System Groups for Oracle Database](#) (page C-5)

On the Windows platform, the operating system groups used to manage Oracle Database are the `ORA_DBA` group, the `ORA_HOMENAME_DBA` group. Two optional groups, `ORA_OPER` and `ORA_HOMENAME_OPER` can also be used.

[Operating System Groups for Oracle ASM Administration](#) (page C-5)

By default, members of the database `ORA_DBA` group are not granted `SYSASM` privileges.

[Understanding Administrative Operating System Groups](#) (page C-6)

Oracle Database and Oracle RAC provide two special administrative privileges, `SYSDBA` and `SYSOPER`, which allow grantees to perform critical database administration tasks, such as creating databases and starting up or shutting down database instances.

C.2.1 Understanding the Oracle Inventory Group

You must have a group whose members are given access to write to the Oracle Inventory directory, which is the central inventory record of all Oracle software installations on a server.

Members of the Oracle Inventory group have write privileges to the Oracle central inventory directory, and are also granted permissions for various Oracle Clusterware resources, OCR keys, directories in the Oracle Clusterware home to which DBAs need write access, and other necessary privileges. By default, this group is called `ORA_INSTALL`.

All Oracle software install users must be members of the Oracle Inventory group. Members of this group can talk to Cluster Synchronization Service (CSS).

Note: If Oracle software is already installed on the system, then the existing Oracle Inventory group is used instead of creating a new Inventory group.

C.2.2 Understanding Operating System Groups for Oracle Database

On the Windows platform, the operating system groups used to manage Oracle Database are the `ORA_DBA` group, the `ORA_HOMENAME_DBA` group. Two optional groups, `ORA_OPER` and `ORA_HOMENAME_OPER` can also be used.

When you install Oracle Database, a special Windows local group called `ORA_DBA` is created (if it does not already exist from an earlier Oracle Database installation), and the Oracle Installation user is automatically added to this group. Members of the `ORA_DBA` group automatically receive the `SYSDBA` privilege. Membership in the `ORA_DBA` group allows a user to:

- Connect to Oracle Database instances without a password
- Perform database administration procedures such as starting and shutting down local databases
- Add additional Windows users to `ORA_DBA`, enabling them to have the `SYSDBA` privilege

Membership in the `ORA_DBA` group grants full access to all databases on the server. Membership in the `ORA_HOMENAME_DBA` group grants full access to all databases that run from the specific Oracle home. Belonging to either group does not grant any special privileges for the user with respect to the Oracle ASM instance. Members of these groups will not be able to connect to the Oracle ASM instance.

The `ORA_OPER` and `ORA_HOMENAME_OPER` groups are also created during installation. However, these are optional groups. You assign users to these groups if you want a separate group of users that have a limited set of database administrative privileges (the `SYSOPER` privilege) for either all databases or databases that run from one Oracle home.

See Also: "[Standard Oracle Database Groups for Job Role Separation](#) (page 5-12)"

C.2.3 Operating System Groups for Oracle ASM Administration

By default, members of the database `ORA_DBA` group are not granted `SYSASM` privileges.

`SYSASM` is a system privilege that enables the separation of the Oracle ASM storage administration privilege from `SYSDBA`. The following table lists the groups created during installation for managing Oracle ASM privileges:

Table C-1 Oracle ASM Operating System Groups and Privileges for Windows

Role	Operating System Group	Description
OSASM	ORA_ASMADMIN	Members of this group can connect to the Oracle ASM instance with the SYSASM privilege using operating system authentication. During installation, the Oracle Installation User for Oracle Grid Infrastructure and Oracle Database Service IDs are configured as members of this group.
OSDBA for ASM	ORA_ASMDBA	This group grants database access to Oracle ASM. Any client of ASM that needs to access storage managed by Oracle ASM needs to be in this group.
OSOPER for ASM	ORA_ASMOPER	Members of this group can connect to the Oracle ASM instance with the SYSOPER privilege using operating system authentication. This group does not have any members after installation, but you can manually add users to this group after the installation completes

See Also: ["Oracle ASM Groups for Job Role Separation \(page 5-13\)"](#)

C.2.4 Understanding Administrative Operating System Groups

Oracle Database and Oracle RAC provide two special administrative privileges, SYSDBA and SYSOPER, which allow grantees to perform critical database administration tasks, such as creating databases and starting up or shutting down database instances.

In Windows, the operating system groups for the SYSDBA and SYSOPER database administrative privileges are fixed to ORA_DBA and ORA_OPER groups and these group names cannot be changed. However, while the SYSDBA privilege is convenient to use, the authority provided by SYSDBA privilege provides more access than what is necessary for the assigned tasks of administrators.

Oracle Database 12c introduces new administrative privileges that are more task-specific and least privileged to support those tasks. Four new administrative privileges are created to satisfy the needs of common database tasks. These new privileges and their related operating systems groups are described in the following table:

Table C-2 Oracle Database Administrative Privileges and Roles for Specific Tasks

Privilege	Operating System Group	Description
SYSBACKUP	ORA_HOMENAME_SYSBACKUP	Administrative privilege for backup and recovery tasks
SYSDG	ORA_HOMENAME_SYSDG	Administrative privilege for Data Guard administrative tasks

Table C-2 (Cont.) Oracle Database Administrative Privileges and Roles for Specific Tasks

Privilege	Operating System Group	Description
SYSKM	ORA_HOMENAME_SYSKM	Administrative privilege for encryption key management tasks

You cannot change the name of these operating system groups. These groups do not have any members after database creation, but an Administrator user can assign users to these groups after installation. Each operating system group identifies a group of operating system users that are granted the associated set of database privileges.

See Also: ["Extended Oracle Database Groups for Job Role Separation \(page 5-13\)"](#)

C.3 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 Grid Infrastructure or Oracle ASM to use. Public and virtual internet protocol (VIP) 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 \(page C-7\)](#)

The public IP address uses the public interface (the interface with access available to clients).

[About the Private IP Address \(page C-8\)](#)

Oracle Clusterware uses interfaces marked as private for internode communication.

[About the Virtual IP Address \(page C-8\)](#)

The virtual IP (VIP) address is registered in the grid naming service (GNS), or the DNS.

[About the Grid Naming Service \(GNS\) Virtual IP Address \(page C-8\)](#)

The GNS virtual IP address is a static IP address configured in the DNS.

[About the SCAN \(page C-9\)](#)

Oracle Database clients connect to the database using a single client access name (SCAN).

C.3.1 About the Public IP Address

The public IP address uses the public interface (the interface with access available to clients).

The public IP address is assigned dynamically using Dynamic Host Configuration Protocol (DHCP), or defined statically in a domain name system (DNS) or `hosts` file. The public IP address is the primary address for a cluster member node, and should be the address that resolves to the name returned when you enter the command `hostname`.

If you configure 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.

C.3.2 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 the interfaces you identify as private for the cluster interconnect. If you identify multiple interfaces during information for the private network, then Oracle Clusterware configures them with Redundant Interconnect Usage. 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 the interconnect for 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.

C.3.3 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

If you are not using Grid Naming Service (GNS), then determine a virtual host name for each node. A virtual host name is a public node name that reroutes client requests sent to the node if the node is down. Oracle Database uses VIPs 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`.

C.3.4 About the Grid Naming Service (GNS) Virtual IP Address

The GNS virtual IP address is a static IP address configured in the DNS.

The DNS delegates queries to the GNS virtual IP 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 virtual IP address for the cluster, which GNS serves. DHCP provides the set of IP addresses to the cluster; DHCP must be available on the public network for the cluster.

See Also: *Oracle Clusterware Administration and Deployment Guide* for more information about GNS

C.3.5 About the SCAN

Oracle Database clients connect to the database using a single client access name (SCAN).

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 virtual IP name, similar to the names used for virtual IP addresses, such as `node1-vip`. However, unlike a virtual IP, 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 that handle public client connections. When a client submits a request, the SCAN listener listening on a SCAN IP address and the SCAN port is made available to a client. 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. These SCAN listeners listen on the SCAN IP addresses. The SCAN listeners are started on nodes determined by Oracle Clusterware. 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 Grid Naming Service (GNS) within the cluster, or by using Domain Name Service (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 11g Release 2 can continue to use their existing connection addresses; using SCAN is not required. When you upgrade to Oracle Clusterware 12c Release 1 (12.1), the SCAN becomes available, and you should use the SCAN for connections to Oracle Database 11g Release 2 or later databases. When an earlier release 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 `REMOTE_LISTENER` parameter must be set to `SCAN:PORT`. Do not set it to a `TNSNAMES` alias with a single address for the SCAN, for example, using `HOST= SCAN_name`.

The SCAN is optional for most deployments. However, clients using Oracle Database 11g 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.

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.
 - Host names and virtual host names are not domain-qualified. If you provide a domain in the address field during installation, then OUI removes the domain from the address.
 - 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.

C.4 Understanding Network Time Requirements

Oracle Clusterware 12c Release 1 (12.1) is automatically configured with Cluster Time Synchronization Service (CTSS).

CTSS provides automatic synchronization of the time settings on all cluster nodes. CTSS uses 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) or Windows Time Service, then CTSS starts in an observer mode. Otherwise, CTSS starts 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.

C.5 Understanding Storage Configuration

The following sections describe concepts related to Oracle Automatic Storage Management (Oracle ASM) storage.

[Understanding Oracle Automatic Storage Management Cluster File System](#) (page C-11)

Oracle ASM has been extended to include a general purpose file system, called Oracle Automatic Storage Management Cluster File System (Oracle ACFS).

[About Migrating Existing Oracle ASM Instances](#) (page C-11)

You can use Oracle Automatic Storage Management Configuration Assistant (ASMCA) to upgrade the existing Oracle ASM instance to Oracle ASM 12c Release 1 (12.1) or higher.

[About Converting Standalone Oracle ASM Installations to Clustered Installations](#) (page C-12)

C.5.1 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 executable files, data files, and application reports. Other supported files are video, audio, text, images, engineering drawings, and other general-purpose application file data.

Note: Starting with Oracle ASM 11g Release 2 (11.2.0.2), Oracle ACFS is supported on Windows Server 2008 R2 x64.

Oracle ACFS can provide optimized storage for all Oracle files, including Oracle Database binaries. It can also store other application files. However, it cannot be used for Oracle Clusterware binaries or Oracle Clusterware files.

See Also: *Oracle Automatic Storage Management Administrator's Guide* for more information about Oracle ACFS

C.5.2 About Migrating Existing Oracle ASM Instances

You can use Oracle Automatic Storage Management Configuration Assistant (ASMCA) to upgrade the existing Oracle ASM instance to Oracle ASM 12c Release 1 (12.1) or higher.

ASMCA is located in the path `Grid_home\bin`. You can also use ASMCA to 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 release installed in another Oracle ASM home, then after installing the Oracle ASM 12c Release 1 (12.1) software, 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 release of Oracle ASM instances on all nodes is Oracle ASM 11g Release 1 or higher, then you are provided with the option to perform a rolling upgrade of Oracle ASM instances. If the prior release of Oracle ASM instances on an Oracle RAC installation are from an Oracle ASM release prior to Oracle ASM 11g Release 1, then rolling upgrades cannot be performed. Oracle ASM is then upgraded on all nodes to 12c Release 1 (12.1).

C.5.3 About Converting Standalone Oracle ASM Installations to Clustered Installations

If you have an existing standalone Oracle ASM installation on one or more nodes that are member nodes of the cluster, then OUI proceeds to install Oracle Grid Infrastructure for a cluster. If you place Oracle Clusterware files (OCR and voting files) on Oracle ASM, then ASMCA is started at the end of the clusterware installation, and provides prompts for you to migrate and upgrade the Oracle ASM instance on the local node, so that you have an Oracle ASM 12c Release 1 (12.1) installation.

On remote nodes, ASMCA identifies any running standalone Oracle ASM instances, and prompts you to shut down those Oracle ASM instances, and any database instances that use them. ASMCA then extends clustered Oracle ASM instances to all nodes in the cluster. However, disk group names on the cluster-enabled Oracle ASM instances must be different from existing standalone disk group names.

See Also: *Oracle Automatic Storage Management Administrator's Guide*

C.6 Understanding Out-of-Place Upgrade

During an out-of-place upgrade of Oracle Grid Infrastructure, the installer installs the newer release of the software in a separate Grid home. Both releases of Oracle Clusterware are on each cluster member node, but only one release is active.

Rolling upgrade avoids downtime and ensure continuous availability while the software is upgraded to a new release.

If you have separate Oracle Clusterware homes on each node, then you can perform an out-of-place upgrade on all nodes, or perform an out-of-place rolling upgrade, so that some nodes run Oracle Clusterware from the earlier release Oracle Clusterware home, and other nodes run Oracle Clusterware from the new Oracle Clusterware home.

An in-place upgrade of Oracle Clusterware 11g Release 2 or later is not supported.

Related Topics:

[How to Upgrade to Oracle Grid Infrastructure 12c Release 1](#) (page D-1)

C.7 Oracle Grid Infrastructure for a Cluster and Oracle Restart Differences

Requirements for Oracle Grid Infrastructure for a cluster are different from Oracle Grid Infrastructure on a single instance in an Oracle Restart configuration.

See Also: *Oracle Database Installation Guide* for information about Oracle Restart requirements

How to Upgrade to Oracle Grid Infrastructure 12c Release 1

This appendix describes how to perform Oracle Clusterware and Oracle Automatic Storage Management (Oracle ASM) upgrades.

[Back Up the Oracle Software Before Upgrades](#) (page D-2)

Without a valid backup, you will not be able to restore the Oracle software to a working state if the upgrade of Oracle Grid Infrastructure or Oracle Database fails and you want to revert to the previous software installation.

[About Oracle Grid Infrastructure and Oracle ASM Upgrade and Downgrade](#) (page D-2)

There are different methods you can use to upgrade the Oracle Grid Infrastructure software.

[Options for Oracle Clusterware and Oracle ASM Upgrades and Downgrades](#) (page D-4)

There are different options for upgrading and downgrading your installation, depending on which previous version of Oracle Grid Infrastructure you currently use.

[Restrictions and Guidelines for Oracle Grid Infrastructure Upgrades](#) (page D-4)

Oracle recommends that you use CVU to check if there are any patches required for upgrading your existing Oracle Grid Infrastructure 11g Release 2 or Oracle RAC 11g Release 2 installations.

[Understanding Out-of-Place and Rolling Upgrades](#) (page D-6)

All upgrades are out-of-place upgrades, meaning that the software binaries are placed in a different Grid home from the Grid home used for the prior release. You can also perform the upgrade in a rolling manner, which means there is always at least one cluster node operational during the upgrade.

[Preparing to Upgrade an Existing Oracle Clusterware Installation](#) (page D-7)

If you have an existing Oracle Clusterware installation, then you upgrade your existing cluster by performing an out-of-place upgrade. You cannot perform an in-place upgrade.

[Using CVU to Validate Readiness for Oracle Clusterware Upgrades](#) (page D-9)

You can use Cluster Verification Utility (CVU) to assist you with system checks in preparation for starting an upgrade. CVU runs the appropriate system checks automatically, and prompts you to fix problems before proceeding with the upgrade.

[Understanding Rolling Upgrades Using Batches](#) (page D-11)

Instead of shutting down all nodes when applying patches, you can shut down some nodes while other nodes remaining running.

[Performing Rolling Upgrades of Oracle Grid Infrastructure](#) (page D-11)

Review this information to perform rolling upgrade of Oracle Grid Infrastructure.

[Performing Rolling Upgrades of Oracle ASM](#) (page D-14)

After you have completed the Oracle Clusterware portion of Oracle Grid Infrastructure 12c Release 1 (12.1) upgrade, you may need to upgrade Oracle ASM separately if the Oracle ASM portion of the Oracle Grid Infrastructure upgrade failed, or for some other reason Automatic Storage Management Configuration assistant (ASMCA) did not run.

[Applying Patches to Oracle ASM](#) (page D-16)

After you have upgraded Oracle ASM with Oracle Grid Infrastructure 12c Release 1, you can install individual patches for Oracle ASM by downloading them from My Oracle Support.

[Checking Cluster Health Monitor Repository Size After Upgrading](#) (page D-18)

If you are upgrading from a prior release using IPD/OS to Oracle Grid Infrastructure 11g Release 2 (11.2.0.2 and later), then you should review the Cluster Health Monitor repository size (the CHM repository).

[Downgrading Oracle Clusterware After an Upgrade](#) (page D-18)

After a successful or a failed upgrade to Oracle Clusterware 12c Release 1 (12.1), you can restore Oracle Clusterware to the earlier release.

[Updating Oracle Enterprise Manager Cloud Control Target Parameters](#) (page D-22)

Because the Oracle Clusterware upgrade is an out-of-place upgrade, the upgraded software has a new location for the Grid home. The path for the Oracle Clusterware home in some Oracle Enterprise Manager parameter files must be changed.

D.1 Back Up the Oracle Software Before Upgrades

Without a valid backup, you will not be able to restore the Oracle software to a working state if the upgrade of Oracle Grid Infrastructure or Oracle Database fails and you want to revert to the previous software installation.

- Before you make any changes to the Oracle software, Oracle recommends that you create a backup of the Oracle software and databases.
- For Oracle software running on Windows operating systems, you must also take a backup of the Windows registry.

Without a registry backup, you will not be able to restore the Oracle software to a working state if the upgrade of Oracle Grid Infrastructure or Oracle Database fails and you want to revert to the previous software installation.

D.2 About Oracle Grid Infrastructure and Oracle ASM Upgrade and Downgrade

There are different methods you can use to upgrade the Oracle Grid Infrastructure software.

You can upgrade Oracle Grid Infrastructure in any of the following ways:

- **Rolling Upgrade:** Involves upgrading individual nodes without stopping Oracle Grid Infrastructure on other nodes in the cluster
- **Non-Rolling Upgrade:** Involves bringing down all the nodes except one. A complete cluster outage occurs while the root script stops the old Oracle Clusterware stack and starts the new Oracle Clusterware stack on the node where you initiate the upgrade. After upgrade is completed, the new Oracle Clusterware is started on all the nodes.

Note that some services are disabled when one or more nodes are in the process of being upgraded. All upgrades are **out-of-place upgrades**, meaning that the software binaries are placed in a different Grid home from the Grid home used for the prior release.

You can downgrade from Oracle Grid Infrastructure 12c Release 1 (12.1) to prior releases of Oracle Grid Infrastructure. Be aware that if you downgrade to a prior release, then your cluster must conform with the configuration requirements for that prior release, and the features available for the cluster consist only of the features available for that prior release of Oracle Clusterware and Oracle ASM.

If you have an existing Oracle ASM 11g Release 1 (11.1) or Oracle ASM 10g instance, with Oracle ASM in a separate home, then you can either upgrade it at the time that you install Oracle Grid Infrastructure, or you can upgrade it after the installation, using Oracle ASM Configuration Assistant (ASMCA). Note that a number of Oracle ASM features are disabled until you upgrade Oracle ASM. Also, Oracle Clusterware management of Oracle ASM does not function correctly until Oracle ASM is upgraded, because Oracle Clusterware only manages Oracle ASM when it is running in the Oracle Grid Infrastructure home. For this reason, Oracle recommends that if you do not upgrade Oracle ASM at the same time as you upgrade Oracle Clusterware, then you should upgrade Oracle ASM immediately afterward. This issue does not apply to Oracle ASM 11g Release 2 (11.2) and later releases, because the Oracle ASM executable files are stored in the Oracle Grid Infrastructure home for those releases.

You can perform out-of-place upgrades to an Oracle ASM instance using ASMCA. In addition to running ASMCA using the graphical user interface (GUI), you can run ASMCA in non-interactive (silent) mode.

Note: If you are currently using OCFS for Windows as your shared storage, then you must migrate to using Oracle ASM during the upgrade of Oracle Database and Oracle Grid Infrastructure.

Note: You must complete an upgrade before attempting to use cluster backup files. You cannot use backups for a cluster that has not completed the upgrade.

See Also: *Oracle Database Upgrade Guide* and *Oracle Automatic Storage Management Administrator's Guide* for additional information about upgrading existing Oracle ASM installations

D.3 Options for Oracle Clusterware and Oracle ASM Upgrades and Downgrades

There are different options for upgrading and downgrading your installation, depending on which previous version of Oracle Grid Infrastructure you currently use.

Upgrade Options from Oracle Grid Infrastructure 11g to Oracle Grid Infrastructure 12c

Upgrade options from Oracle Grid Infrastructure 11g to Oracle Grid Infrastructure 12c include the following:

- Oracle Grid Infrastructure rolling upgrades, with OCR and voting files on Oracle ASM
- Oracle Grid Infrastructure complete cluster (downtime, non-rolling), with OCR and voting files on Oracle ASM
- Oracle Grid Infrastructure rolling upgrades with OCR and voting files on storage other than Oracle ASM
- Oracle Grid Infrastructure complete cluster (downtime, non-rolling), with OCR and voting files on storage other than Oracle ASM

Upgrade Options from Releases Before Oracle Grid Infrastructure 11g Release 2 (11.2)

Upgrade options from releases before Oracle Grid Infrastructure 11g Release 2 (11.2) to Oracle Grid Infrastructure 12c include the following:

- Oracle Grid Infrastructure rolling upgrades, with OCR and voting files on storage other than Oracle ASM
- Oracle Grid Infrastructure complete cluster (downtime, non-rolling), with OCR and voting files on storage other than Oracle ASM

Downgrade Options from Oracle Grid Infrastructure 12c to Earlier Releases

Downgrade options from Oracle Grid Infrastructure 12c to earlier releases include the following:

- Oracle Grid Infrastructure downgrade to Oracle Grid Infrastructure 11g Release 2 (11.2)

D.4 Restrictions and Guidelines for Oracle Grid Infrastructure Upgrades

Oracle recommends that you use CVU to check if there are any patches required for upgrading your existing Oracle Grid Infrastructure 11g Release 2 or Oracle RAC 11g Release 2 installations.

See Also: ["Using CVU to Validate Readiness for Oracle Clusterware Upgrades \(page D-9\)"](#)

Be aware of the following restrictions and changes for upgrades to Oracle Grid Infrastructure installations, which consists of Oracle Clusterware and Oracle ASM:

- If the OCR and Voting File locations for your current installation are on raw devices, then you must migrate them to Oracle ASM disk groups or shared file systems before upgrading to Oracle Grid Infrastructure 12c Release 1 (12.1).
- To upgrade existing Oracle Clusterware installations to Oracle Grid Infrastructure 12c Release 1 (12.1), your current release must be Oracle Grid Infrastructure 11g Release 2.
- On the Windows platform, to upgrade Oracle Clusterware from releases 10.2.0.5 and 11.1.0.7 to Oracle Grid Infrastructure release 12.1, you must perform an interim upgrade to Oracle Grid Infrastructure 11g Release 2 for Oracle Clusterware. After upgrading Oracle Clusterware to Oracle Grid Infrastructure 11g Release 2, you must move the Oracle Cluster Registry (OCR) and voting files to Oracle ASM. You can then upgrade Oracle Grid Infrastructure 11g Release 2 to Oracle Grid Infrastructure release 12.1.
- If you are upgrading an Oracle Database release 10.2.0.5 or Oracle Database release 11.1.0.7 environment that stores Oracle Clusterware files on OCFS for Windows or RAW devices, then you cannot directly upgrade to Oracle Database 12c. See *Oracle Database Upgrade Guide*.
- To upgrade existing Oracle ASM installations to Oracle Grid Infrastructure 12c Release 1 (12.1), in a Standard configuration, your release must be greater than or equal to 10.1.0.5, 10.2.0.3, 11.1.0.6, or 11.2.
- To upgrade existing Oracle Grid Infrastructure installations to Oracle Grid Infrastructure, you must first verify if you need to apply any mandatory patches for upgrade to succeed. To upgrade Oracle Grid Infrastructure installations from 11.2.0.2 to a later release, you must install the latest bundle for the cumulative patches for Oracle Grid Infrastructure (Patch 11 bundle or higher). See [Using CVU to Validate Readiness for Oracle Clusterware Upgrades](#) (page D-9) for steps to check readiness.

See Also:

Oracle 12c Upgrade Companion (My Oracle Support Note 1462240.1): <https://support.oracle.com/oip/faces/secure/km/DocumentDisplay.jspx?id=1462240.1>

- Do not delete directories in the Grid home. For example, do not delete *Grid_home* \Opatch. If you delete the directory, then the Oracle Installation User for Oracle Grid Infrastructure cannot use Opatch to patch the Grid home, and Opatch displays the error "checkdir error: cannot create *Grid_home*\Opatch"
- Oracle Clusterware and Oracle ASM upgrades are always out-of-place upgrades. With Oracle Grid Infrastructure 12c Release 1 (12.1), you cannot perform an in-place upgrade of Oracle Clusterware and Oracle ASM to existing homes.
- With Oracle Clusterware 11g Release 2 (11.2) and later, you can perform upgrades on a shared Oracle Clusterware home.
- You must use an Administrator user to perform the Oracle Grid Infrastructure 12c Release 1 (12.1) upgrade.
- Oracle ASM and Oracle Clusterware both run in the Oracle Grid Infrastructure home.

- During a major release upgrade to Oracle Clusterware 12c Release 1 (12.1), the software in the Grid home for Oracle Grid Infrastructure 12c Release 1 (12.1) is not fully functional until the upgrade is completed. Running the Server Control Utility (SRVCTL), crsctl, and other commands from the 12c Release 1 (12.1) Grid home is not supported until the upgrade is complete across all nodes.

To manage databases using earlier releases (release 10.x, 11.1, or 11.2) of Oracle Database software during the Oracle Grid Infrastructure upgrade, use SRVCTL in the existing database homes.

- During Oracle Clusterware installation, if there is a single instance Oracle ASM release on the local node, then it is converted to a clustered Oracle ASM 12c Release 1 (12.1) installation, and Oracle ASM runs in the Oracle Grid Infrastructure home on all nodes.
- If a single instance (non-clustered) Oracle ASM installation is on a remote node, which is a node other than the local node (the node on which the Oracle Grid Infrastructure installation is being performed), then it will remain a single instance Oracle ASM installation. However, during installation, if you select to place the Oracle Cluster Registry (OCR) and voting files on Oracle ASM, then a clustered Oracle ASM installation is created on all nodes in the cluster, and the single instance Oracle ASM installation on the remote node will become nonfunctional.
- Before you can create an Oracle Database 12c release 1 (12.1.0.1) database that uses Oracle ASM release 12.1.0.2 for storage, you must apply the patch for bug 19168335.

See Also: *Oracle Database Upgrade Guide*

D.5 Understanding Out-of-Place and Rolling Upgrades

All upgrades are out-of-place upgrades, meaning that the software binaries are placed in a different Grid home from the Grid home used for the prior release. You can also perform the upgrade in a rolling manner, which means there is always at least one cluster node operational during the upgrade.

Rolling Upgrades

You can upgrade Oracle Grid Infrastructure either by bringing the cluster down and upgrading the complete cluster, or upgrading individual nodes without stopping Oracle Grid Infrastructure on other nodes in the cluster, which is called performing a rolling upgrade. 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 release.

Note: In contrast with releases prior to Oracle Clusterware 11g Release 2, Oracle Universal Installer (OUI) always performs rolling upgrades, even if you select all nodes for the upgrade.

Out-of-Place Upgrades

During an out-of-place upgrade, the installer installs the newer release in a separate Oracle Clusterware home. Both releases of Oracle Clusterware are on each cluster

member node, but only one release 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 perform an out-of-place rolling upgrade, so that some nodes run Oracle Clusterware from the original Oracle Clusterware home, and other nodes run 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 is not supported.

Related Topics:

[Performing Rolling Upgrades of Oracle Grid Infrastructure](#) (page D-11)

D.6 Preparing to Upgrade an Existing Oracle Clusterware Installation

If you have an existing Oracle Clusterware installation, then you upgrade your existing cluster by performing an out-of-place upgrade. You cannot perform an in-place upgrade.

Complete the following tasks before starting an upgrade:

[Verify System Readiness for Patches and Upgrades](#) (page D-7)

Use the Release Notes and Cluster Verification Utility to make sure you are ready to patch or upgrade your software.

[Gather the Necessary System Information](#) (page D-8)

Ensure that you have the information you will need when installing Oracle Grid Infrastructure into a new home directory.

[Upgrade to the Minimum Required Oracle Clusterware Release](#) (page D-8)

If your current Oracle Clusterware installation is not currently running at least the minimum supported release, then a prerequisite check failure is reported. You must upgrade your current Oracle Clusterware installation to at least the minimum supported release before upgrading.

[Unset Environment Variables Used By Oracle Software](#) (page D-8)

If you have had an existing installation on your system, and you are using the same user account to install Oracle Grid Infrastructure 12c Release 1 (12.1), then for the Oracle installation user you must unset environment variables that are connected with Oracle software homes.

D.6.1 Verify System Readiness for Patches and Upgrades

Use the Release Notes and Cluster Verification Utility to make sure you are ready to patch or upgrade your software.

1. 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.
2. Use the Cluster Verification Utility (CVU) to assist you with system checks in preparation for patching or upgrading.

You can run CVU before starting the upgrade, however, the installer runs the appropriate CVU checks automatically, and prompts you to fix problems before proceeding with the upgrade.

See Also: *Oracle Database Upgrade Guide*

D.6.2 Gather the Necessary System Information

Ensure that you have the information you will need when installing Oracle Grid Infrastructure into a new home directory.

- Gather the following information:
 - The Oracle base location for Oracle Clusterware
 - An Oracle Grid Infrastructure home location that is different from your existing Oracle Clusterware home (or Grid home) location
 - SCAN name and addresses, and other network addresses, as described in "[Configuring Networks for Oracle Grid Infrastructure and Oracle RAC](#) (page 4-1)"
 - Privileged user operating system groups to use, as described in "[Creating Installation Groups and Users for Oracle Grid Infrastructure and Oracle RAC](#) (page 5-1)"
 - Local Administrator user access, or access as the user who performed the previous Oracle Clusterware installation

D.6.3 Upgrade to the Minimum Required Oracle Clusterware Release

If your current Oracle Clusterware installation is not currently running at least the minimum supported release, then a prerequisite check failure is reported. You must upgrade your current Oracle Clusterware installation to at least the minimum supported release before upgrading.

To upgrade existing Oracle Clusterware installations to a standard configuration Oracle Grid Infrastructure 12c cluster, your release must be greater than or equal to Oracle Clusterware 10g Release 1 (10.1.0.5), Oracle Clusterware 10g Release 2 (10.2.0.3), Oracle Grid Infrastructure 11g Release 1 (11.1.0.6), or Oracle Grid Infrastructure 11g Release 2 (11.2.0.2) or later.

- Upgrade your current Oracle Clusterware installation to at least the minimum supported release before upgrading to Oracle Grid Infrastructure 12c Release 1.

For example, if you plan to upgrade your Oracle Clusterware 11g Release 1 installation to Oracle Clusterware 12c Release 1 (12.1) and your current Oracle Clusterware installation is release 11.1.0.2, then you must upgrade your current Oracle Clusterware installation to release 11.1.0.6 or higher before starting the upgrade.

D.6.4 Unset Environment Variables Used By Oracle Software

If you have had an existing installation on your system, and you are using the same user account to install Oracle Grid Infrastructure 12c Release 1 (12.1), then for the

Oracle installation user you must unset environment variables that are connected with Oracle software homes.

Before upgrading, you must unset the following environment variables:

- ORACLE_BASE
- ORACLE_HOME
- ORACLE_SID
- ORA_NLS10
- TNS_ADMIN
- ORA_CRS_HOME

If you have set ORA_CRS_HOME as an environment variable, following instructions from Oracle Support, then unset it before starting an installation or upgrade. You should *never* use ORA_CRS_HOME as an environment variable except under explicit direction from Oracle Support.

1. From the Start menu, right click **My Computer** and select **Properties**.
2. In the System Properties window, select **Advanced**, then click the **Environment Variables** button.
3. To unset an environment variable, select the variable then click **Delete**.
4. When finished unsetting the environment variables, click **OK**.
5. Check to ensure that the user profile for the Oracle Installation User does not set any of these environment variables.

D.7 Using CVU to Validate Readiness for Oracle Clusterware Upgrades

You can use Cluster Verification Utility (CVU) to assist you with system checks in preparation for starting an upgrade. CVU runs the appropriate system checks automatically, and prompts you to fix problems before proceeding with the upgrade.

[About the CVU Grid Upgrade Validation Command Options](#) (page D-9)

You can use the Cluster Verification Utility (CVU) to validate your system readiness before upgrading.

[Example of Verifying System Upgrade Readiness for Grid Infrastructure](#) (page D-10)

You can use the `runcluvfy.bat` command to check your system before upgrading.

See Also: *Oracle Database Upgrade Guide*

D.7.1 About the CVU Grid Upgrade Validation Command Options

You can use the Cluster Verification Utility (CVU) to validate your system readiness before upgrading.

You can run upgrade validations in one of two ways:

- Run OUI, and allow the CVU validation built into OUI to perform system checks
- Run the CVU manual script `cluvfy.bat` script to perform system checks

To use OUI to perform pre-install checks, run the installation as you normally would. OUI starts CVU, and performs system checks as part of the installation process. Selecting OUI to perform these checks is particularly appropriate if you think you have completed preinstallation checks, and you want to confirm that your system configuration meets minimum requirements for installation.

To use the `cluvfy.bat` command-line script for CVU, navigate to the staging area for the upgrade, where the `runcluvfy.bat` command is located, and run the following command to check the readiness of your Oracle Clusterware installation for upgrades:

```
runcluvfy.bat stage -pre crsinst -upgrade
```

Running `runcluvfy.bat` with the `-pre crsinst -upgrade` options performs system checks to confirm if the cluster is in a correct state for upgrading from an existing clusterware installation.

The `runcluvfy` command uses the following syntax, where variable content is indicated by italics:

```
runcluvfy.bat stage -pre crsinst -upgrade [-rolling] -src_crshome  
src_Gridhome -dest_crshome dest_Gridhome -dest_version dest_release  
[-verbose]
```

The options are:

- `-rolling`
Use this option to verify readiness for rolling upgrades.
- `-src_crshome src_Gridhome`
Use this option to indicate the location of the source Oracle Clusterware or Grid home that you are upgrading, where *src_Gridhome* is the path to the home to upgrade.
- `-dest_crshome dest_Gridhome`
Use this option to indicate the location of the upgrade Grid home, where *dest_Gridhome* is the path to the Grid home.
- `-dest_version dest_release`
Use the `dest_version` option to indicate the release number of the upgrade, including any patchset. The release number must include the five digits designating the release to the level of the platform-specific patch. For example: 12.1.0.1.0.
- `-verbose`
Use the `-verbose` option to produce detailed output of individual checks

D.7.2 Example of Verifying System Upgrade Readiness for Grid Infrastructure

You can use the `runcluvfy.bat` command to check your system before upgrading.

Verify that the permissions required for installing Oracle Clusterware have been configured by running the following command:

```
C:\> runcluvfy.bat stage -pre crsinst -upgrade -rolling
-src_crshome C:\app\11.2.0.3\grid -dest_crshome C:\app\12.1.0\grid
-dest_version 12.1.0.2.0 -verbose
```

D.8 Understanding Rolling Upgrades Using Batches

Instead of shutting down all nodes when applying patches, you can shut down some nodes while other nodes remaining running.

Upgrades from earlier releases require that you upgrade the entire cluster. You cannot select or de-select individual nodes for upgrade. Oracle does not support attempting to add additional nodes to a cluster during a rolling upgrade.

Oracle recommends that you leave Oracle RAC instances running when upgrading Oracle Clusterware. When you start the upgrade process on each node, the upgrade scripts shut down the database instances and then start the instances again. If you upgrade from Oracle Grid Infrastructure 11g Release 11.2.0.2 and later to any later release of Oracle Grid Infrastructure, then all nodes are selected for upgrade by default.

When performing the upgrade, you can divide the nodes into groups, or batches, and start upgrades of these node batches. Between batches, you can move services from nodes running the earlier release to the upgraded nodes, so that services are not affected by the upgrade.

D.9 Performing Rolling Upgrades of Oracle Grid Infrastructure

Review this information to perform rolling upgrade of Oracle Grid Infrastructure.

[Performing a Standard Upgrade from an Earlier Release](#) (page D-11)

Use the following procedure to upgrade Oracle Clusterware or Oracle Automatic Storage Management (Oracle ASM) from an earlier release to a later release.

[Completing an Oracle Clusterware Upgrade when Nodes Become Unreachable](#) (page D-13)

If some nodes become unreachable in the middle of an upgrade, then you cannot complete the upgrade without user intervention.

[Completing the Upgrade of Inaccessible Nodes After Forcing an Upgrade](#) (page D-14)

Starting with Oracle Grid Infrastructure 12c, after you complete a force cluster upgrade command, you can join inaccessible nodes to the cluster as an alternative to deleting the nodes, which was required in earlier releases.

[Changing the First Node for Install and Upgrade](#) (page D-14)

If the first node becomes inaccessible, you can force another node to be the first node for installation or upgrade.

D.9.1 Performing a Standard Upgrade from an Earlier Release

Use the following procedure to upgrade Oracle Clusterware or Oracle Automatic Storage Management (Oracle ASM) from an earlier release to a later release.

Note: When you upgrade to Oracle Clusterware 12c Release 1 (12.1), Oracle Automatic Storage Management (Oracle ASM) is installed in the same home as Oracle Clusterware. In Oracle documentation, this home is called the Oracle Grid Infrastructure home, or Grid home. Also note that Oracle does not support attempting to add additional nodes to a cluster during a rolling upgrade.

If you previously attempted to upgrade to a higher release of Oracle Grid Infrastructure, and that Grid home still exists, then instead of running the installer, run the config.bat script in the Grid_home\crs\config directory of the higher version Grid home. Select the Upgrade option to upgrade the existing Grid home to the later release.

1. If there are non-clustered, or single-instance, 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.

Note: Oracle recommends that you leave Oracle Real Application Clusters (Oracle RAC) instances running during the Oracle Clusterware upgrade. During the upgrade process, the database instances on the node being upgraded are stopped and started automatically during the upgrade process.

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 11g Release 2, all upgrades are rolling upgrades, even if you select all nodes for the upgrade. If you are upgrading from Oracle Clusterware 11g, then all nodes are selected by default. You cannot select or de-select the nodes.

4. Select installation options as prompted.
5. Confirm your selections, and then the upgrade scripts are run automatically.

Note: If you receive an error indicating the server must be restarted before the installation completes, see "[Completing Failed or Interrupted Installations and Upgrades](#) (page A-15)"

6. 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 and the Oracle ASM management tools in the Oracle Grid Infrastructure 12c Release 1 (12.1) home (for example, srvctl) do not work.

- After the Oracle Clusterware upgrade completes, if you are upgrading from a release earlier than Oracle ASM 11g Release 2 (11.2.0.2), and you left the check box for **ASM Configuration Assistant (ASMCA)** selected, as is the default, then the installer starts ASMCA to upgrade Oracle ASM. If you unchecked the

box on the interview stage of the upgrade, then ASMCA is not run automatically.

- If an earlier release of Oracle ASM is installed, then the installer starts ASMCA to upgrade Oracle ASM to 12c Release 1 (12.1). You can upgrade Oracle ASM at this time, or upgrade it later.

Note:

After the upgrade, if you set the Oracle Cluster Registry (OCR) backup location manually to the earlier 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 Oracle Clusterware home for the earlier release cannot be the location of the OCR backups. Backups in the old Oracle Clusterware home could be deleted.

7. Because the Oracle Grid Infrastructure home is in a different location than the former Oracle Clusterware and Oracle ASM homes, update any scripts or applications that use utilities or other files that reside in the Oracle Clusterware and Oracle ASM homes.

Related Topics:

[Completing Failed or Incomplete Installations and Upgrades](#) (page A-14)

D.9.2 Completing an Oracle Clusterware Upgrade when Nodes Become Unreachable

If some nodes become unreachable in the middle of an upgrade, then you cannot complete the upgrade without user intervention.

Because the upgrade did not complete successfully on the unreachable nodes, the upgrade is incomplete. Oracle Clusterware remains in the earlier release.

1. Confirm that the upgrade is incomplete by entering the following command:

```
crsctl query crs activeversion
```

2. To resolve the incomplete upgrade, run the `rootupgrade.bat` command with the `-force` option on any of the nodes where the `rootupgrade.bat` script has already completed as follows:

```
Grid_home/rootupgrade -force
```

For example, as the Oracle Installation User for Oracle Grid Infrastructure, run the following command:

```
C:\> C:\app\12.1.0\grid\rootupgrade -force
```

The force cluster upgrade has the following limitations:

- All active nodes must be upgraded to the newer release
- All inactive nodes (accessible or inaccessible) may be either upgraded or not upgraded

- For inaccessible nodes, after patch set upgrades, you can delete the node from the cluster. If the node becomes accessible later, and the patch version upgrade path is supported, then you can upgrade it to the new patch version.

This command forces the upgrade to complete.

3. Verify that the upgrade has completed by using the command `crsctl query crs activeversion`.

The active release should be the upgrade release.

D.9.3 Completing the Upgrade of Inaccessible Nodes After Forcing an Upgrade

Starting with Oracle Grid Infrastructure 12c, after you complete a force cluster upgrade command, you can join inaccessible nodes to the cluster as an alternative to deleting the nodes, which was required in earlier releases.

To use this option, Oracle Grid Infrastructure 12c Release 1 (12.1) software must already be installed on the nodes.

1. Log in as the Oracle Installation User for Oracle Grid Infrastructure on one of the nodes that is a member of the cluster.
2. Change directory to the `crs\install` directory in the Oracle Grid Infrastructure 12c Release 1 (12.1) Grid home.

For example:

```
C:\> cd app\12.1.0\grid\crs\install
```

3. Run the following PERL command, where *upgraded_node* is the inaccessible or unreachable node that you want to join to the cluster:

```
C:\> rootupgrade.bat -join -existing_node upgraded_node
```

Note: The `-join` operation is not supported for Oracle Clusterware releases earlier than 11.2.0.2.0. In such cases, delete the node and add it to the cluster using the `addNode` command.

D.9.4 Changing the First Node for Install and Upgrade

If the first node becomes inaccessible, you can force another node to be the first node for installation or upgrade.

- **Installation:** If `gridonfig.bat` fails to complete on the first node, run the following command on another node using the `-force` option:

```
Grid_home\crs\config\gridconfig.bat -force -first
```

- **Upgrade:** If `gridonfig.bat` fails to complete on the first node, run the following command on another node using the `-force` option:

```
Grid_home\crs\config\gridconfig.bat -upgrade -force -first
```

D.10 Performing Rolling Upgrades of Oracle ASM

After you have completed the Oracle Clusterware portion of Oracle Grid Infrastructure 12c Release 1 (12.1) upgrade, you may need to upgrade Oracle ASM separately if the Oracle ASM portion of the Oracle Grid Infrastructure upgrade failed,

or for some other reason Automatic Storage Management Configuration assistant (ASMCA) did not run.

After you have upgraded Oracle ASM to Oracle Grid Infrastructure 12c Release 1, you can install individual patches for Oracle ASM by downloading them from the Oracle Automated Release Update site. See "[Preparing to Upgrade Oracle ASM](#) (page D-15)" for steps to upgrade Oracle ASM separately from Oracle Grid Infrastructure.

[Preparing to Upgrade Oracle ASM](#) (page D-15)

If you must complete upgrade of Oracle ASM separately, then note these requirements.

[Upgrading Oracle ASM Separately from an Oracle Grid Infrastructure Upgrade](#) (page D-16)

Complete the following tasks if you must upgrade from an Oracle ASM release where Oracle ASM was installed in a separate Oracle home, or if the Oracle ASM portion of Oracle Grid Infrastructure upgrade failed to complete.

D.10.1 Preparing to Upgrade Oracle ASM

If you must complete upgrade of Oracle ASM separately, then note these requirements.

- The active release of Oracle Clusterware must be 12c Release 1 (12.1). To determine the active release, enter the following command from the Grid home:


```
crsctl query crs activeversion
```
- You can upgrade a single instance Oracle ASM installation to a clustered Oracle ASM installation. However, you can only upgrade an existing single instance Oracle ASM installation if you run the installation from the node on which Oracle ASM is installed. You cannot upgrade a single instance Oracle ASM installation on a remote node.
- You must ensure that any rebalance operations on your existing Oracle ASM installation are completed before starting the upgrade process.
- During the upgrade process, you alter the state of the Oracle ASM instances to an upgrade state. Because this upgrade state limits Oracle ASM operations, you should complete the upgrade process soon after you begin. You can perform the following operations when an Oracle ASM instance is in the upgrade state:
 - 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)
- You do not need to shut down database clients unless they are on Oracle ACFS.

D.10.2 Upgrading Oracle ASM Separately from an Oracle Grid Infrastructure Upgrade

Complete the following tasks if you must upgrade from an Oracle ASM release where Oracle ASM was installed in a separate Oracle home, or if the Oracle ASM portion of Oracle Grid Infrastructure upgrade failed to complete.

1. On the node you plan to start the upgrade, set the environment variable `ASMCA_ROLLING_UPGRADE` to `true`.

For example:

```
C:\> set ASMCA_ROLLING_UPGRADE=true
```

2. From the Oracle Grid Infrastructure 12c Release 1 (12.1) home, start ASMCA.

For example:

```
C:\> cd app\12.1\grid\bin
C:\..bin> asmca.bat
```

Oracle ASM Configuration Assistant (ASMCA) starts.

3. Select **Upgrade**.

ASMCA upgrades Oracle ASM in succession for all nodes in the cluster.

4. After you complete the upgrade, run the command to unset the `ASMCA_ROLLING_UPGRADE` environment variable.

```
C:\> set ASMCA_ROLLING_UPGRADE=
```

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

D.11 Applying Patches to Oracle ASM

After you have upgraded Oracle ASM with Oracle Grid Infrastructure 12c Release 1, you can install individual patches for Oracle ASM by downloading them from My Oracle Support.

[About Individual \(One-Off\) Oracle ASM Patches](#) (page D-16)

Individual patches are called **one-off** patches.

[About Oracle ASM Software Patch Levels](#) (page D-17)

Review this topic to understand how to apply patches for Oracle ASM and Oracle Grid Infrastructure.

[Patching Oracle ASM to a Software Patch Level](#) (page D-17)

Starting with Oracle Grid Infrastructure 12c Release 1 (12.1), a new cluster state called Rolling Patch is available.

D.11.1 About Individual (One-Off) Oracle ASM Patches

Individual patches are called **one-off** patches.

An Oracle ASM one-off patch is available for a specific release of Oracle ASM. If a patch you want is available, then you can download the patch and apply it to Oracle ASM using the OPatch Utility.

The OPatch inventory keeps track of the patches you have installed for your release of Oracle ASM. If there is a conflict between the patches you have installed and patches you want to apply, then the OPatch Utility advises you of these conflicts. See "[Patching Oracle ASM to a Software Patch Level](#) (page D-17)" for information about applying patches to Oracle ASM using the OPatch Utility.

D.11.2 About Oracle ASM Software Patch Levels

Review this topic to understand how to apply patches for Oracle ASM and Oracle Grid Infrastructure.

The software patch level for Oracle Grid Infrastructure represents the set of all one-off patches applied to the Oracle Grid Infrastructure software release, including Oracle ASM. The release is the release number, in the format of major, minor, and patch set release number. For example, with the release number 12.1.0.1, the major release is 12, the minor release is 1, and 0.1 is the patch set number. With one-off patches, the major and minor release numbers remain the same, though the patch levels change each time you apply or roll back an interim patch.

As with standard upgrades to Oracle Grid Infrastructure, at any given point in time for normal operation of the cluster, all the nodes in the cluster must have the same software release and patch level. Because one-off patches can be applied as rolling upgrades, all possible patch levels on a particular software release are compatible with each other.

See Also:

- "[Performing a Standard Upgrade from an Earlier Release](#) (page D-11)" for information about upgrading Oracle Grid Infrastructure
 - "[Patching Oracle ASM to a Software Patch Level](#) (page D-17)" for information about applying patches to Oracle ASM using the OPatch utility
-
-

D.11.3 Patching Oracle ASM to a Software Patch Level

Starting with Oracle Grid Infrastructure 12c Release 1 (12.1), a new cluster state called Rolling Patch is available.

Rolling Patch mode is similar to the existing Rolling Upgrade mode in terms of the Oracle ASM operations allowed in this quiesce state.

1. Download the patch you want to apply from My Oracle Support:
 - a. Go to <https://support.oracle.com>
 - b. Select the Patches and Updates tab to locate the patch.

To locate patch bundles, you can perform a **Product or Family (Advanced)** search for your platform and software release.

Oracle recommends that you select **Recommended Patch Advisor**, and enter the product group, release, and platform for your software. My Oracle Support

provides you with a list of the most recent patches and critical patch updates (CPUs).

- c. Place the patch in an accessible directory, such as `C:\downloads`.
2. Change directory to the `opatch` directory in the Grid home.

For example:

```
C:\> cd app\12.1.0\grid\opatch
```

3. Review the patch documentation for the patch you want to apply, and complete all required steps before starting the patch upgrade.
4. Follow the instructions in the patch documentation to apply the patch.

D.12 Checking Cluster Health Monitor Repository Size After Upgrading

If you are upgrading from a prior release using IPD/OS to Oracle Grid Infrastructure 11g Release 2 (11.2.0.2 and later), then you should review the Cluster Health Monitor repository size (the CHM repository).

1. Review your CHM repository needs, and enlarge the repository size to maintain a larger CHM repository.

Note: Your previous IPD/OS repository is deleted when you install Oracle Grid Infrastructure.

By default, the CHM repository size is a minimum of either 1GB or 3600 seconds (1 hour), regardless of the size of the cluster.

2. To enlarge the CHM repository, use the following command syntax, where *RETENTION_TIME* is the size of CHM repository in number of seconds:

```
oclumon manage -repos changeretentiontime RETENTION_TIME
```

For example, to set the repository size to four hours:

```
C:\> oclumon manage -repos changeretentiontime 14400
```

The value for *RETENTION_TIME* must be more than 3600 (one hour) and less than 259200 (three days). If you enlarge the CHM repository size, then you must ensure that there is local space available for the repository size you select on each node of the cluster. If there is not sufficient space available, then you can move the repository to shared storage.

D.13 Downgrading Oracle Clusterware After an Upgrade

After a successful or a failed upgrade to Oracle Clusterware 12c Release 1 (12.1), you can restore Oracle Clusterware to the earlier release.

[About Downgrading Oracle Clusterware After an Upgrade](#) (page D-19)

Downgrading Oracle Clusterware restores the Oracle Clusterware configuration to the state it was in before the Oracle Clusterware 12c Release 1 (12.1) upgrade. Any configuration changes you performed during or after the Oracle Grid Infrastructure 12c Release 1 (12.1) upgrade are removed and cannot be recovered.

[Downgrading to Oracle Clusterware 11g Releases Prior to Release 11.2.0.2](#)
(page D-19)

These steps describe how to restore Oracle Clusterware to the earlier release.

[Downgrading to Oracle Clusterware 11g Release 2 \(11.2.0.2\) or Later Release](#)
(page D-21)

Use these steps to restore Oracle Clusterware to the earlier release.

D.13.1 About Downgrading Oracle Clusterware After an Upgrade

Downgrading Oracle Clusterware restores the Oracle Clusterware configuration to the state it was in before the Oracle Clusterware 12c Release 1 (12.1) upgrade. Any configuration changes you performed during or after the Oracle Grid Infrastructure 12c Release 1 (12.1) upgrade are removed and cannot be recovered.

In the downgrade procedures, the following variables are used:

- *local node* is the first node on which you started the upgrade process.
- *remote nodes* are all other nodes where you started the upgrade process.

To restore Oracle Clusterware to the earlier release, use the downgrade procedure for the release to which you want to downgrade.

Note: When downgrading after a failed upgrade, if the `rootcrs.bat` file does not exist on a node, then instead of the executing the script `rootcrs.bat` use the command `perl rootcrs.pl` in the following sections. Use the perl interpreter located in the Oracle Home directory.

D.13.2 Downgrading to Oracle Clusterware 11g Releases Prior to Release 11.2.0.2

These steps describe how to restore Oracle Clusterware to the earlier release.

1. If the `rootupgrade` script failed on a node other than the node on which you started the upgrade (the first node), then downgrade the node where the upgrade failed:

```
Grid_home\crs\install\rootcrs.bat -downgrade
```

2. On all other nodes where the `rootupgrade` script ran successfully, except the first node, as an Administrator user, use the following command:

```
Grid_home\crs\install\rootcrs.bat -downgrade
```

This command stops the Oracle Clusterware 12c Release 1 (12.1) resources, and shuts down the Oracle Grid Infrastructure 12c Release 1 (12.1) stack.

3. After the `rootcrs.bat -downgrade` script has completed on all non-first nodes, on the first node use the following command syntax:

```
Grid_home\crs\install\rootcrs.bat -downgrade -lastnode
```

For example:

```
C:\app\12.1.0\grid\crs\install> rootcrs.bat -downgrade -lastnode
```

Note: With Oracle Grid Infrastructure 12c, you no longer need to provide the location of the earlier release Grid home or release number.

Run this command from a directory that has write permissions for the Oracle Grid Infrastructure installation user.

4. On any of the cluster member nodes where the `rootcrs` script has run successfully:
 - a. Log in as the Oracle Grid Infrastructure installation owner.
 - b. Use the following command to start the installer, where `C:\app\12.1.0\grid` represents the location of the new (upgraded) Grid home:

```
setup.exe -nowait -waitforcompletion -ignoreSysPrereqs -updateNodeList  
-silent CRS=false ORACLE_HOME=C:\app\12.1.0\grid
```

Add the option `-cfs` if the Grid home is a shared home.

5. On any of the cluster member nodes where the upgrade completed successfully:
 - a. Log in as the Oracle Grid Infrastructure installation owner.
 - b. Use the following command to start the installer, where the path you provide for the option `ORACLE_HOME` is the location of the home directory from the earlier Oracle Clusterware installation

For example, if the location of the earlier Oracle Clusterware installation is `C:\app\crs`, then you would use a command similar to the following:

```
C:\> cd C:\app\12.1.0\grid\oui\bin  
C:\..bin> setup.exe -nowait -waitforcompletion -ignoreSysPrereqs  
-updateNodeList -silent CRS=true ORACLE_HOME=C:\app\crs
```

c. For downgrades to 11.1 and earlier releases

If you are downgrading to Oracle Clusterware 11g Release 1 (11.1) or an earlier release, then you must run `root.bat` manually from the earlier release Oracle Clusterware home to complete the downgrade after you complete step b.

OUI prompts you to run `root.bat` manually from the earlier release Oracle Clusterware installation home in sequence on each member node of the cluster to complete the downgrade. After you complete this task, downgrade is completed.

Running `root.bat` from the earlier release Oracle Clusterware installation home restarts the Oracle Clusterware stack, starts all the resources previously registered with Oracle Clusterware in the older release, and configures the old initialization scripts to run the earlier release Oracle Clusterware stack.

The installer stops the Oracle Grid Infrastructure 12c software stack.

The Windows services used by Oracle Grid Infrastructure are recreated to refer to the Grid home for the older software release by one of the scripts during the downgrade process.

D.13.3 Downgrading to Oracle Clusterware 11g Release 2 (11.2.0.2) or Later Release

Use these steps to restore Oracle Clusterware to the earlier release.

1. On all remote nodes, as an Administrator user, use the command syntax `Grid_home\crs\install\rootcrs.bat -downgrade [-force]` to stop the Oracle Clusterware 12c Release 1 (12.1) resources, and shut down the Oracle Grid Infrastructure 12c Release 1 (12.1) stack.

For example:

```
C:\app\12.1.0\grid\crs\install> rootcrs.bat -downgrade
```

2. After the `rootcrs.bat -downgrade` script has completed on all remote nodes, on the local node use the following command syntax:

```
Grid_home\crs\install\rootcrs.bat -downgrade -lastnode
```

For example:

```
C:\app\12.1.0\grid\crs\install> rootcrs.bat -downgrade -lastnode
```

Note: Starting with Oracle Grid Infrastructure 12c, you no longer need to provide the location of the earlier release Grid home or release number.

Run this command from a directory that has write permissions for the Oracle Grid Infrastructure installation user.

3. On each cluster member node where the upgrade to Oracle Grid Infrastructure 12c has completed successfully:

- a. Log in as an Administrator user or the Oracle Installation user.

- b. Use the following command to start the installer, where `C:\app\12.1.0\grid` is the location of the new (upgraded) Grid home (12.1):

```
setup.exe -updateNodeList -silent CRS=false ORACLE_HOME=C:\app\12.1.0\grid
```

Add the option `-cfs` if the Grid home is a shared home.

- c. Use the following command to start the installer from the Grid home (12.1), where the path you provide for the option `ORACLE_HOME` is the location of the home directory from the earlier Oracle Clusterware installation, for example `C:\app\11.2.0.2\grid`:

```
cd C:\app\12.1.0\grid\bin
setup.exe -updateNodeList -silent CRS=true ORACLE_HOME=C:\app\11.2.0.2\grid
```

- d. **For downgrades to 11.2.0.2**

If you are downgrading to Oracle Clusterware 11g Release 1 (11.2.0.2), then you must start the Oracle Clusterware stack manually after you complete step c.

On each node, start Oracle Clusterware from the earlier release Oracle Clusterware home using the command `crsctl start crs`. For example, where the earlier release home is `C:\app\11.2.0.2\grid`, use the following command on each node:

```
C:\app\11.2.0.2\grid\bin\crsctl start crs
```

4. For downgrades to 12.1.0.1

If you are downgrading to Oracle Grid Infrastructure 12c Release 1 (12.1.0.1), then run the following commands to configure the Grid Management Database:

- a. Start the 12.1.0.1 Oracle Clusterware stack on all nodes.
- b. On any node, remove the MGMTDB resource as follows:

```
C:\> 12101_Grid_home\bin\srvcctl remove mgmtdb
```

- c. Run DBCA in the silent mode from the Oracle Grid Infrastructure 12c home and create the Management Database as follows, where *ASM_DG_NAME* is the name of a valid Oracle ASM disk group:

```
12101_Grid_home\bin\dbca -silent -createDatabase -templateName
MGMTSeed_Database.dbc -sid "-MGMTDB" -gdbName _mgmtdb -storageType ASM
-diskGroupName ASM_DG_NAME -characterSet AL32UTF8
-datafileJarLocation 12101_Grid_home/assistants/dbca/templates
-autoGeneratePasswords
```

- d. Configure the Management Database by running the Configuration Assistant from the location *12101_Grid_home\bin\mgmtca*.

D.14 Updating Oracle Enterprise Manager Cloud Control Target Parameters

Because the Oracle Clusterware upgrade is an out-of-place upgrade, the upgraded software has a new location for the Grid home. The path for the Oracle Clusterware home in some Oracle Enterprise Manager parameter files must be changed.

If you do not change the CRS_HOME parameter, then you can encounter errors such as "cluster target broken" on Oracle Enterprise Manager Cloud Control.

To resolve the issue, upgrade the Enterprise Manager Cloud Control target, and then update the Enterprise Manager Agent Base Directory on each cluster member node running an agent.

[Updating the Enterprise Manager Cloud Control Target After Upgrades](#) (page D-22)

After upgrading Oracle Grid Control, you might need to update the targets in Oracle Enterprise Manager Cloud Control.

[Updating the Enterprise Manager Agent Base Directory After Upgrades](#) (page D-23)

The Agent Base Directory is a directory where the Management Agent home is created.

D.14.1 Updating the Enterprise Manager Cloud Control Target After Upgrades

After upgrading Oracle Grid Control, you might need to update the targets in Oracle Enterprise Manager Cloud Control.

1. Log in to Enterprise Manager Cloud Control
2. Navigate to the **Targets** menu, and then to the **Cluster** page.
3. Click a cluster target that was upgraded.

4. Click **Cluster**, then **Target Setup**, and then **Monitoring Configuration** from the menu.
5. Update the value for **Oracle Home** with the new Grid home path.
6. Save the updates.

D.14.2 Updating the Enterprise Manager Agent Base Directory After Upgrades

The Agent Base Directory is a directory where the Management Agent home is created.

The Management Agent home is in the path *Agent_Base_directory*\core\EMAgent_Version. For example, if the Agent Base Directory is C:\app\emagent, then Oracle creates the Management Agent home as C:\app\emagent\core\12.1.0.1.0.

1. Navigate to the bin directory in the Management Agent home.
2. In the C:\app\emagent\core\12.1.0.1.0\bin directory, open the file emctl with a text editor.
3. Locate the parameter CRS_HOME, and update the parameter to the new Grid home path.
4. Repeat steps 1-3 on each node of the cluster with an Enterprise Manager agent.

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