

Dell PowerEdge Systems

Oracle Database on

Enterprise Linux x86\_64

# Operating System and Hardware Installation Guide

Version 1.5



# Notes, Cautions, and Warnings



**NOTE:** A NOTE indicates important information that helps you make better use of your computer.



**CAUTION:** A CAUTION indicates potential damage to hardware or loss of data if instructions are not followed.



**WARNING:** A WARNING indicates a potential for property damage, personal injury, or death.

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# Overview

This document applies to Oracle Database 11g R2 running on Red Hat Enterprise Linux 5.5 AS x86\_64 or Oracle Enterprise Linux 5.5 AS x86\_64.

## Required Documentation for Deploying the Dell|Oracle 11g R2 Database

The Dell|Oracle Database Installation documentation set includes the following guides:

- *Dell PowerEdge Systems Oracle Database on Enterprise Linux x86\_64-Storage and Network Guide*—Describes how to install and configure the network and storage solutions.
- *Dell PowerEdge Systems Oracle Database on Enterprise Linux x86\_64-Database Setup and Installation Guide*—Describes how to install and configure the Oracle database.
- *Dell PowerEdge Systems Oracle Database on Enterprise Linux x86\_64-Troubleshooting Guide*—Describes how to troubleshoot and resolve errors encountered during the installation procedures described in the previous modules.



**NOTE:** All modules provide information on how to receive technical assistance from Dell.

# Terminology Used in This Document

- This document uses the terms logical unit number (LUN) and virtual disk. These terms are synonymous and can be used interchangeably. The term LUN is commonly used in a Dell/EMC Fibre Channel storage system environment and virtual disk is commonly used in a Dell PowerVault SAS and iSCSI (Dell PowerVault MD3000 and Dell PowerVault MD3000i with Dell PowerVault MD1000 expansion) storage environment.
- This document uses the term Enterprise Linux that applies to both Red Hat Enterprise Linux and Oracle Enterprise Linux unless stated specifically.

# Getting Help

## Dell Support

- For detailed information about using your system, see the documentation that was shipped with your system components.
- For whitepapers, Dell-supported configurations, and general information, see [dell.com/oracle](http://dell.com/oracle).
- For Dell technical support for your hardware and operating system software, and to download the latest updates for your system, see [support.dell.com](http://support.dell.com).
- For information on Dell enterprise training services, see [dell.com/training](http://dell.com/training).



**NOTE:** The training service may not be offered in all locations.

## Oracle Support

- For training information on your Oracle software and application clusterware, and for information about contacting Oracle, see [oracle.com](http://oracle.com) or see your Oracle documentation.
- Technical support, downloads, and other technical information is available at [support.oracle.com](http://support.oracle.com).
- For information on installing and configuring Oracle, see the *Oracle Dell PowerEdge Systems Oracle Database on Enterprise Linux x86\_64-Database Setup and Installation Guide* at [support.dell.com/manuals](http://support.dell.com/manuals).



# Software and Hardware Requirements

The following sections describe the minimum software and hardware requirements for Dell-supported configurations for Oracle. For more information on the minimum software versions for drivers and applications, see the Solution Deliverable List (SDL) that can be found for each Dell Validated Component at [dell.com/oracle](http://dell.com/oracle).

## Minimum Software Requirements



**NOTE:** Your Dell configuration includes a 30-day trial license of Oracle software. Contact your Dell sales representative if you do not have a license for this product.

Table 2-1 lists basic software requirements for Dell-supported configurations for Oracle 11g R2 on Enterprise Linux version 5.5.

**Table 2-1. Software Requirements**

Software Component	Configuration
Red Hat or Oracle Enterprise Linux AS x86_64 (Version 5)	Update 5 (kernel-2.6.18-194.3.1.el5 or higher)
Oracle Database 11g R2 Version	Version 11.2.0.1.0 <ul style="list-style-type: none"> <li>• Enterprise/Standard Edition, including the RAC option for clusters</li> <li>• Enterprise/Standard and Standard Edition for single-node configuration</li> </ul>
EMC PowerPath	Version 5.3.1

**Table 2-1. Software Requirements (continued)**

<b>Software Component</b>	<b>Configuration</b>
Dell PowerVault MD3000 Modular Disk Storage Manager software	Version 03.35.G6.45
Dell PowerVault MD3000i Modular Disk Storage Manager software	Version 03.35.G6.45

## Minimum Hardware Requirements

The following sections list the hardware requirements for Fibre Channel, direct-attached SAS, and iSCSI configurations. For more information on specific hardware components, see the documentation included with your system. For more information about Dell supported hardware configurations, see the SDL for each Dell Validated Component at [dell.com/oracle](http://dell.com/oracle).



**NOTE:** To achieve the required performance, select a system that exceeds the minimum hardware requirements based on the number of users, the applications you use, and the batch processes.

## Minimum Hardware Requirements for a Fibre Channel Configuration

Table 2-2 through Table 2-3 indicate the minimum hardware requirements for a Fibre Channel cluster and single-node configuration.



**NOTE:** The hardware configuration of all the nodes in a cluster must be identical.

**Table 2-2. Minimum Hardware Requirements for a Fibre Channel Cluster**

Hardware Component	Configuration
Dell PowerEdge system [up to eight nodes for Oracle Enterprise Edition or up to two nodes for Oracle Standard Edition using Automatic Storage Management (ASM)]	Intel Xeon or AMD Opteron supported processor families 2.5 GB of RAM with ASM Internal RAID controller for internal hard drives Two 73-GB hard drives (RAID 1) connected to PowerEdge RAID Controller (PERC) Three network interface controller (NIC) ports (one public and two private) Two optical host bus adapter (HBA) ports (SAN)
Dell/EMC Fibre Channel storage system (optional)	See the SDL at <a href="http://dell.com/oracle">dell.com/oracle</a> for information on supported configurations.
Ethernet switch (three)	One switch for public and two switches for private interconnect. See the SDL at <a href="http://dell.com/oracle">dell.com/oracle</a> for information on supported configurations.
Dell/EMC Fibre Channel switch (two)	8 port Fibre Channel switch for two to six nodes 16 port Fibre Channel switch for seven or eight nodes

**Table 2-3. Minimum Hardware Requirements for a Fibre Channel Single Node**

<b>Hardware Component</b>	<b>Configuration</b>
PowerEdge system (single node using ASM)	Intel Xeon or AMD Opteron supported processor families 2.5 GB of RAM Two 73-GB hard drives (RAID 1) connected to PERC adapter or SAS controller One NIC port (public)
Dell/EMC Fibre Channel storage system (optional)	See the SDL at <a href="http://dell.com/oracle">dell.com/oracle</a> for information on supported configurations.
Dell/EMC Fibre Channel switch (optional)	8-port Fibre Channel switch
Ethernet switch (one)	One switch for public. See the SDL at <a href="http://dell.com/oracle">dell.com/oracle</a> for information on supported configurations.

## Minimum Hardware Requirements for a Direct-Attached SAS Configuration

Table 2-4 through Table 2-5 indicate the minimum hardware requirements for a direct-attached SAS cluster and single-node configuration.



**NOTE:** The hardware configuration of all the nodes in a cluster must be identical.

**Table 2-4. Minimum Hardware Requirements for a Direct-Attached SAS Cluster**

Hardware Component	Configuration
Dell PowerEdge system (up to two nodes using ASM)	Intel Xeon or AMD Opteron supported processor families 2.5 GB of RAM with ASM Internal RAID controller for internal hard drives Two 73-GB hard drives (RAID 1) connected to PERC Three NIC ports (1 public and 2 private) Two SAS HBA ports
Dell PowerVault storage system	See your Dell PowerVault storage system documentation for more details. See the SDL at <a href="http://dell.com/oracle">dell.com/oracle</a> for information on supported Dell PowerVault storage systems.
Dell PowerVault storage expansion enclosure (optional)	See your Dell PowerVault storage expansion enclosure documentation for more details. See the SDL at <a href="http://dell.com/oracle">dell.com/oracle</a> for information on supported Dell PowerVault expansion storage systems.
Ethernet switch (three)	One switch for public and two switches for private interconnect. See the SDL at <a href="http://dell.com/oracle">dell.com/oracle</a> for information on supported configurations.

**Table 2-5. Minimum Hardware Requirements for a Direct-Attached SAS Single Node**

<b>Hardware Component</b>	<b>Configuration</b>
Dell PowerEdge system	Intel Xeon or AMD Opteron supported processor families 2.5 GB of RAM Two 73-GB hard drives (RAID 1) connected to PERC One NIC port (public)
Dell PowerVault storage system	See your Dell PowerVault storage system documentation for more details. See the SDL at <a href="http://dell.com/oracle">dell.com/oracle</a> for information on supported Dell PowerVault storage systems.
Dell PowerVault storage expansion enclosure (optional)	See your Dell PowerVault storage expansion enclosure documentation for more details. See the SDL at <a href="http://dell.com/oracle">dell.com/oracle</a> for information on supported Dell PowerVault expansion storage systems.

## Minimum Hardware Requirements for an iSCSI Configuration

Table 2-6 through Table 2-8 indicate the minimum hardware requirements for an iSCSI cluster (direct-attached and switched) and a direct-attached, single-node configuration.



**NOTE:** The hardware configuration of all the nodes in a cluster must be identical.

**Table 2-6. Minimum Hardware Requirements for a Direct-Attached iSCSI Cluster**

Hardware Component	Configuration
Dell PowerEdge system (up to two nodes using ASM)	Intel Xeon or AMD Opteron supported processor families 2.5 GB of RAM with ASM Internal RAID controller for internal hard drives Two 73-GB hard drives (RAID 1) connected to PERC Three NIC ports (1 public and 2 private) Two NIC ports (iSCSI)
Dell PowerVault storage system	See your Dell PowerVault storage system documentation for more details. See the SDL at <a href="http://dell.com/oracle">dell.com/oracle</a> for information on supported Dell PowerVault storage systems.
Dell PowerVault storage expansion enclosure (optional)	See your Dell PowerVault storage expansion enclosure documentation for more details. See the SDL at <a href="http://dell.com/oracle">dell.com/oracle</a> for information on supported Dell PowerVault expansion storage systems.
Ethernet switch (three)	One switch for public and two switches for private interconnect. See the SDL at <a href="http://dell.com/oracle">dell.com/oracle</a> for information on supported configurations.

**Table 2-7. Minimum Hardware Requirements for a Switched iSCSI Cluster**

<b>Hardware Component</b>	<b>Configuration</b>
Dell PowerEdge system (up to eight nodes for Oracle Enterprise Edition or up to two nodes for Oracle Standard Edition using ASM)	Intel Xeon or AMD Opteron supported processor families 2.5 GB of RAM with ASM Internal RAID controller for internal hard drives Two 73-GB hard drives (RAID 1) connected to PERC Three NIC ports (1 public and 2 private) Two NIC ports (iSCSI)
Dell PowerVault storage system	See your Dell PowerVault storage system documentation for more details. See the SDL at <a href="http://dell.com/oracle">dell.com/oracle</a> for information on supported Dell PowerVault storage systems.
Dell PowerVault storage expansion enclosure (optional)	See your Dell PowerVault storage expansion enclosure documentation for more details. See the SDL at <a href="http://dell.com/oracle">dell.com/oracle</a> for information on supported Dell PowerVault expansion storage systems.
Dell EqualLogic PS Series storage*	One Dell EqualLogic PS Series array
Ethernet Switch (two required)	Two switches for iSCSI SAN. See the SDL at <a href="http://dell.com/oracle">dell.com/oracle</a> for information on supported configurations.
Ethernet Switch (three required)	One switch for public and two switches for private interconnect. See the SDL at <a href="http://dell.com/oracle">dell.com/oracle</a> for information on supported configurations.

\*Dell EqualLogic PS Series Storage is supported only with Red Hat or Oracle Enterprise Linux AS x86\_64 Version 5.x.



**Table 2-8. Minimum Hardware Requirements for a Switched or Direct-Attached Single Node iSCSI**

<b>Hardware Component</b>	<b>Configuration</b>
Dell PowerEdge system (single node using ASM)	Intel Xeon or AMD Opteron supported processor families 2.5 GB of RAM with ASM Internal RAID controller for internal hard drives Two 73-GB hard drives (RAID 1) connected to the PERC One NIC port (public) Two NIC ports (iSCSI)
Dell PowerVault storage system	See your Dell PowerVault storage system documentation for more details. See the SDL at <a href="http://dell.com/oracle">dell.com/oracle</a> for information on supported Dell PowerVault storage systems.
Dell PowerVault storage expansion enclosure (optional)	See your Dell PowerVault storage expansion enclosure documentation for more details. See the SDL at <a href="http://dell.com/oracle">dell.com/oracle</a> for information on supported Dell PowerVault expansion storage systems.
Ethernet Switch (one required)	One switch for public. See the SDL at <a href="http://dell.com/oracle">dell.com/oracle</a> for information on supported configurations.
Ethernet switch (two, required for switched configuration only)	Two switches for iSCSI SAN. See the SDL at <a href="http://dell.com/oracle">dell.com/oracle</a> for information on supported configurations.



# Installing and Configuring the Operating System


 **CAUTION:** To ensure that the operating system is installed correctly, disconnect all the external storage devices from the system before you install the operating system.

This section describes the installation of the Red Hat and Oracle Enterprise Linux AS operating systems and the configuration of the operating system for Oracle Database deployment.

## Before You Begin

Download the ISO image for Red Hat Enterprise Linux or Oracle Enterprise Linux from the Red Hat Network (RHN) or Unbreakable Linux Network (ULN), depending upon your operating system. For more information on installing Red Hat Enterprise Linux, see [redhat.com/docs/manuals/enterprise](http://redhat.com/docs/manuals/enterprise).

The Oracle Enterprise Linux ISO images can be downloaded from [edelivery.oracle.com/linux](http://edelivery.oracle.com/linux).

 **NOTE:** Oracle recommends to choose a **default list of RPMs** during the operating system installation as described in Metalink Note 376183.1, *Defining a “default RPMs” installation of the RHEL Operating System*.

# Recommended Operating System Partitioning Scheme

Creation of a logical volume group is necessary in order to create a logical volume within this logical volume group. Table 3-1 lists the partitions and logical volumes required to be created within the logical volume group named osvg (Oracle Solution Volume Group).

**Table 3-1. Volumes for Oracle RAC Configuration**

Partition	File System Type	Name	Volume Group Name	Size (MB)
/tmp	ext3	swap	osvg	4096
/home	ext3	home	osvg	8192
/opt/app	ext3	grid	osvg	20480
/	ext3	root	osvg	10240
/usr	ext3	usr	osvg	5120
/var	ext3	var	osvg	2048
swap	swap	swap	osvg	*
/boot	ext3			256

\*Use the following formula to calculate the size of your swap partition:

- For RAM size between 1024 MB and 2048 MB—1.5 x RAM size
- For RAM size between 2049 MB and 16384 MB—the same size as your RAM size
- For RAM size greater than 16384 MB—16384 MB

## Attaching Systems to Your Operating System Channel

RHN or ULN allows you to efficiently manage systems over the network. You can perform software patches, updates, and maintenance on the systems through a simple user interface.

The Dell|Oracle Deployment Automation Scripts provide you the option to make use of the operating system channels to automatically update your system with packages and RPMs required for Oracle Database installation.

For information about attaching your system to RHN, or setting up your own RHN Satellite Server, see [redhat.com/red\\_hat\\_network](http://redhat.com/red_hat_network).

For information about setting up your own ULN, see [linux.oracle.com](http://linux.oracle.com).

The Dell|Oracle Deployment Automation process requires you to subscribe to the Oracle Software Channel and the Installation Media Copy Channel appropriate for your kernel version. Log on to [linux.oracle.com](http://linux.oracle.com) to subscribe to these two channels. You must be subscribed to these ULN Channels to download the required *oracleasm* RPMs automatically using the Dell Automated Scripts.

## Updating Your System Packages Using Red Hat Network or Unbreakable Linux Network

Red Hat and Oracle periodically release software updates to fix bugs, address security issues, and add new features. You can download these updates through the RHN service or the ULN. Before updating your system software to the latest revisions, see [dell.com/oracle](http://dell.com/oracle), for the latest, supported configurations.

# Configuring the Operating System for Oracle Database Installation

## About the Dell|Oracle Deployment Automation Scripts

The Dell|Oracle Deployment Automation Scripts are packaged as a *tar* file that can be downloaded from [dell.com/oracle](http://dell.com/oracle). This *tar* file contains automated scripts, Dell|Oracle Setup RPM, Dell PowerEdge system component driver RPMs, and Oracle RPMs.

The Dell|Oracle Deployment Automation Scripts provide the convenience of having an automated way of setting up an Oracle environment quickly and easily.

The automated scripts are designed to do the following Dell- and Oracle-recommended settings:

- Create Grid Infrastructure, Oracle Software Owner and group(s).
- Create the required directories and set their ownership and permissions.
- Set up the kernel parameters (*/etc/sysctl.conf*).
- Set up the kernel module parameters (*/etc/modprobe.conf*).
- Set up the Grid Infrastructure, Oracle Software Owner limits (*/etc/security/limits.conf* file).
- Set up the pam limits (*/etc/pam.d/login* file).
- Set up the */etc/profile*.
- Disable SELinux.
- Automatically resolve the missing RPMs, packages, and dependencies required for a Grid Infrastructure, Oracle Database installation.
- Install the Dell PowerEdge system component drivers.
- Install the *oracleasm* RPMs.

## Install the Errata Kernel

- 1 Log in as root.
- 2 Download and install the minimum supported kernel (2.6.18-194.3.1 or higher) RPMs (kernel), kernel-headers and kernel-devel from RHN or ULN.
- 3 Reboot your system.
- 4 Boot in to the new kernel installed in step 2.

## Installing the Dell|Oracle Deployment Automation Scripts

The Dell|Oracle tested and validated *tar* file, appropriate for your operating system version and the Oracle database version, can be downloaded from [dell.com/oracle](http://dell.com/oracle).

Extract the *tar* file on your Dell PowerEdge system to be used for database installation and run the following scripts:

- 1 Log in as root.
- 2 Change the directory to the root directory using the command:

```
$> cd /
```

- 3 Extract the *tar* file using the command:

```
$> tar -xvf dell-oracle-deployment-  
<release_ver>.<os_ver>.<oracle_ver>.tar -C /
```



**NOTE:** Ensure that the *os\_ver* and *oracle\_ver* on the *tar*file is appropriate for your installation.

- 4 Change to the Dell|Oracle Scripts directory:

```
$> cd /dell-oracle-deployment/scripts/
```

- 5 Run the Oracle Setup script with the Dell Oracle Setup RPM:

```
$> ./00-oracle-setup.sh ../rpms/oracle-setup-  
scripts-  
<release_ver>.<os_ver>.<oracle_ver>.noarch.rpm
```



**NOTE:** Ensure that the *os\_ver* and *oracle\_ver* on the RPM are appropriate for your installation.

If the script reports any failed RPM dependencies, then resolve the required RPMs by choosing one of the three options listed below:



**NOTE:** You must install the missing RPMs to install the Oracle Grid and Database successfully.


- **Automatically using Online Operating System Channel Repository (RHN/ULN)**—Choose this option if your system is connected to either Red Hat's RHN or Oracle's ULN network according to your operating system. This option is the recommended method since the missing RPMs and the inter dependencies are automatically resolved, downloaded and installed on your system from the Operating System Channel. Also, the Operating System Channels always provide the latest versions of the missing RPMs.
- **Automatically using Operating System DVD-ROM/ISO media**—Choose this option if your system is not connected to Red Hat's RHN or Oracle's ULN network. This method automatically resolves the required missing RPMs from either a local operating system media or an operating system media on the network. The script provides the following three options to select the type or the location of the operating system media:
  - **DVD-ROM**—Choose this option if you have installed the operating system using the operating system DVD media or would like to resolve the missing RPMs using the Operating System DVD-ROM.
  - **LOCAL-ISO image (.iso) on local HDD or USB Drive**—Choose this option if you want to use an .iso image of the operating system DVD that is located on the local hard drive or on an external USB or a flash drive to resolve the missing RPMs.
  - **NETWORK- ISO image (.iso) on a remote NFS Server**—Choose this option if you want to use an .iso image of the operating system DVD that is located on an NFS server to resolve the missing RPMs.



**NOTE:** The script does not support SAMBA share or any remote server that needs authentication to mount the directories. Ensure that the server and directory that you specify do not require authentication.


- **Manually**—Choose this option if you want to manually resolve the missing RPMs. Choosing this option quits the script.




 **NOTE:** You can find the list of the missing RPMs in the `/dell-oracle-deployment/logs/rpm_install.log` file.

- 6 Run the following script to install the Dell PowerEdge system component drivers:


```
$> ./10-install-Dell-rpms.sh
```

 **NOTE:** This script installs the supported Dell Dynamic Kernel Module Support (DKMS) drivers located in the `/dell-oracle-deployment/rpms` folder. The DKMS driver installation requires the presence of the kernel-devel RPM in order to build the modules. This script attempts to automatically download and install the kernel-devel package from the operating system channel. If the kernel-devel package is not found on the operating system channel, then you may have to manually install the kernel-devel package before you install the Dell DKMS drivers through this script.

 **NOTE:** When the kernel is upgraded in a system where the DKMS driver is installed, certain DKMS drivers do not rebuild for the new kernel and are installed as a weak module. By default, the built-in modules have precedence over the weak-modules and hence the weak DKMS drivers do not get loaded. It is recommended to use the DKMS driver if the version is higher than the module version of the updated kernel. This script also creates depmod configuration files in the `/etc/depmod.d/` folder that overrides the updated kernel's modules for certain DKMS modules. If you want to use the updated kernel's modules, delete the `<module.conf>` files created by this script from the `/etc/depmod.d/` folder and run the `'depmod -a'` command to load the native modules.


- 7 Run the following script to install the Oracle asm RPMs after booting to the updated kernel:


```
$> ./20-install-oracle-rpms.sh
```

 **NOTE:** This script installs the Oracle asm RPMs. If the operating system on your system is OEL, then this script downloads and installs the Oracle asm RPMs from the ULN channel. If the operating system on your system is Red Hat Enterprise Linux, then this script installs the Oracle asm RPMs from the `/dell-oracle-deployment/rpms` directory.


- 8 Run the following script to setup the ownership and permissions for the Oracle Grid and Database installation directories:

```
$> ./30-oracle-crs-base-permissions.sh
```


 **NOTE:** It is recommended to have one separate operating system partition for Oracle Grid and Database binary software. See Table 3-1 for the recommended operating system partitions and their sizes. Ensure that Oracle Grid and Database binary are installed under the same root directory. For example, /opt or /u01.

 **NOTE:** Make sure you have permission to create directories for the below specified paths since the script will attempt to create them, if they do not exist already.


a At the prompt `Enter Oracle Grid installation base path/partition [ /opt/app/grid ] :`, enter the directory path where you would like to install the Oracle Grid software.

 **NOTE:** If you press <Enter> without entering a path, the default path of `'/opt/app/grid'` is setup as the base directory for Grid install.

b At the prompt `"Enter Oracle Grid Home path [ /opt/app/11.2.0/grid ] :`", enter the directory path that will be used for Grid home.

 **NOTE:** If you press <Enter> without entering a path, the default path of `'/opt/app/11.2.0/grid'` is setup as the Grid home directory.

c At the prompt `"Enter ORACLE_BASE path/partition [ /opt/app/oracle ] :`", enter the directory path that you would like to setup as the base directory for your Oracle Database Binary software.

 **NOTE:** If you press <Enter> without entering a path, the default path of `'/opt/app/oracle'` is setup as the base directory.

9 Reboot your system for the new Dell driver modules to load in the memory.

The Dell|Oracle installation logs can be found in the `/dell-oracle-deployment/logs` folder.

## Attaching to the Dell Firmware Repository Channel (Optional)

The Dell Firmware Repository provides a mechanism to update the BIOS and firmware of your Dell PowerEdge systems to the latest revision. Use the following commands to setup and install the Dell Firmware Repository:

```
# set up repos

wget -q -O -
http://linux.dell.com/repo/software/bootstrap.cgi |
bash

wget -q -O -
http://linux.dell.com/repo/firmware/bootstrap.cgi |
bash

# install firmware tools

yum -y install firmware-addon-dell

# install BIOS update

yum -y install $(bootstrap_firmware)
update_firmware
```



**NOTE:** For support questions related to this repository, subscribe to the following mailing list: [lists.us.dell.com/mailman/listinfo/linux-poweredge](https://lists.us.dell.com/mailman/listinfo/linux-poweredge). Monitor the mailing list for the latest status messages and announcements concerning this repository.



# Verifying Cluster Hardware and Software Configurations

This section provides setup information for hardware and software cluster configurations.

Before setting up the cluster, verify the hardware installation, communication interconnections, and node software configuration for the entire cluster.

- Each node must include the minimum hardware peripheral components as described in "Minimum Hardware Requirements" on page 8.
- Each node must have the following software installed:
  - Enterprise Linux software (see Table 2-1).
  - The Fibre Channel host bus adapter (HBA) driver (for a Fibre Channel cluster).
  - Correct version of the Multi-Path driver (for direct-attached SAS and iSCSI). For more information, see the documentation that came with your Dell PowerVault storage system.
  - Correct version of the Open-iSCSI initiator driver, and the Device Mapper Multipath driver, for the Dell EqualLogic iSCSI storage systems.
- The Fibre Channel, iSCSI, or direct-attached SAS storage system must be configured with a minimum of three LUNs/virtual disks created and assigned to the cluster storage group (see Table 4-1).



**NOTE:** For additional information regarding requirements for assigning virtual disks to a node in a direct-attached SAS configuration, see the documentation that came with your Dell PowerVault storage system.

**Table 4-1. LUNs/Virtual Disks for the Cluster Storage Group**

<b>LUN</b>	<b>Minimum Size</b>	<b>Number of Partitions</b>	<b>Used For</b>
Five LUNs/virtual disks	1024 MB	One	Voting disk, Oracle Cluster Registry (OCR)
One LUN/virtual disk	Larger than the size of your database	One	Database
One LUN/virtual disk	Minimum twice the size of your second LUN/virtual disk	One	Flash Recovery Area
One LUN/virtual disk (optional)	20 GB	One	Oracle Home shared across all nodes using ACFS

For information on configuring storage and networking, see the *Storage and Networking Guide*.

## Obtaining and Using Open Source Files

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