

Dell PowerVault MD3600f and
MD3620f Storage Arrays With
Microsoft Windows Server
Failover Clusters

Hardware Installation and Troubleshooting Guide



Notes and Cautions



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.

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Introduction

This document provides information for installing and managing your cluster solution using Dell PowerVault MD3600f and MD3620f storage systems. It is intended for experienced IT professionals who configure a cluster solution and for trained service technicians who perform upgrade and maintenance procedures. This document also addresses readers who are new to clustering.

Overview

The Dell PowerEdge Cluster with Microsoft Windows Server Failover Clustering combines specific hardware and software components to provide enhanced availability for applications and services that run on the cluster. A failover cluster is designed to reduce the possibility of any single point of failure within the system that can cause the clustered applications or services to become unavailable. It is recommended that you use redundant components like system and storage power supplies, connections between the nodes and the storage array(s), connections to client systems, or other systems in the multi-tier enterprise application architecture in your cluster.

This guide addresses the configuration of your Dell MD3600f and MD3620f Fibre Channel storage arrays for use with one or more Windows Server failover clusters. It provides information and specific configuration tasks that enable you to deploy the shared storage for your cluster.

For more information on deploying your cluster, see the *Dell Failover Clusters with Microsoft Windows Server Installation and Troubleshooting Guide* at support.dell.com/manuals.



NOTE: Throughout this document:

- Windows Server 2008 refers to Microsoft Windows Server 2008 x64 Enterprise Edition or Microsoft Windows Server 2008 R2 x64 Enterprise Edition.
- Dell PowerVault MD36x0f storage array refers to both Dell PowerVault MD3600f and Dell PowerVault MD3620f storage arrays.

For a list of recommended operating systems, hardware components, and driver or firmware versions for your Dell Windows Server Failover Cluster, see the *Dell Cluster Configuration Support Matrices* at dell.com/ha.

Cluster Solution

Your Fibre Channel cluster implements a minimum of two-node clustering and a maximum of sixteen-node clustering and provides the following features:

- 8 Gbps and 4 Gbps Fibre Channel technology.
- High availability of system services and resources to network clients.
- Redundant paths to the shared storage.
- Failure recovery for applications and services.
- Flexible maintenance capabilities, allowing you to repair, maintain, or upgrade a cluster node without taking the entire cluster offline.

Implementing Fibre Channel technology in a cluster provides the following advantages:

- **Flexibility**—Fibre Channel allows a distance of up to 10 km between switches without degrading the signal.
- **Availability**—Fibre Channel components use redundant connections, providing multiple data paths and greater availability for clients.
- **Connectivity**—Fibre Channel allows more device connections than Small Computer System Interface (SCSI) or Serial Attached SCSI (SAS). Because Fibre Channel devices are hot swappable, you can add or remove devices from the nodes without bringing down the cluster.

Cluster Requirements

Your cluster requires the following components:

- Servers (cluster nodes)
- Storage and storage management software

Cluster Nodes

Table 1-1 lists hardware requirements for the cluster nodes.

Table 1-1. Cluster Node Requirements

Component	Minimum Requirement
Processor	At least one processor for each cluster node.
Cluster Nodes	A minimum of two identical PowerEdge systems.
RAM	At least 1 GB RAM on each cluster node.
Host Bus Adapter (HBA) ports	Two Fibre Channel HBAs per node, unless the server employs an integrated or supported dual-port Fibre Channel HBA.
Network Interface Cards (NICs) (public and private)	At least two NICs—one NIC for the public network and another NIC for the private network. NOTE: It is recommended that the NICs on each public network are identical and that the NICs on each private network are identical.
Internal Disk Controller	One controller connected to internal disks for each node. Use any supported Redundant Array of Independent Disks (RAID) controller or disk controller. Two physical disks are required for mirroring (RAID 1) and at least three are required for disk striping with parity (RAID 5). NOTE: It is recommended that you use hardware-based RAID or software-based disk-fault tolerance for the internal drives.



NOTE: For more information about supported systems, HBAs, and operating system versions, see the *Dell Cluster Configuration Support Matrices* at dell.com/ha.

Cluster Storage

Table 1-2 provides the configuration requirements for the shared storage system.

Table 1-2. Cluster Storage Requirements

Hardware Components	Minimum Requirement
Supported storage systems	<ul style="list-style-type: none">• One Dell PowerVault MD3600f or MD3620f RAID enclosure.• Any combination of up to seven Dell PowerVault MD1200 and/or MD1220 expansion enclosures. <p>NOTE: The number of hard drives must not exceed 96.</p>
Cluster nodes	All nodes must be directly attached to a single storage system or attached to one or more storage systems through a SAN.
Switch and cable	At least two 8 Gbps Fibre Channel switches in a SAN-attached environment.
Power and cooling requirements	Two integrated hot-swappable power supply/cooling fan modules.
Physical disks	At least two physical disks in the PowerVault MD3600f or MD3620f RAID enclosure.
Multiple clusters and stand-alone systems	In a switch-attached configuration, clusters and stand-alone systems can share one or more PowerVault MD3600f or MD3620f systems.



NOTE: RAID 0 and independent disks can be used but are not recommended for a high-availability system because they do not offer data redundancy if a disk failure occurs.

Cluster Storage Management Software

Dell PowerVault Modular Disk Storage Manager

The software runs on the management station or any host attached to the array to centrally manage the PowerVault MD3600f and MD3620f RAID enclosures. You can use Dell PowerVault Modular Disk Storage Manager (MDSM) to perform tasks such as creating disk groups, creating and mapping virtual disks, monitoring the enclosure status, and downloading firmware.

MDSM is a graphical user interface (GUI) with wizard-guided tools and a task-based structure. MDSM is designed to:

- Reduce the complexity when you install, configure, manage, and perform diagnostic tasks for the storage arrays.
- Contain an event monitoring service that is used to send alerts when a critical problem with the storage array occurs.
- Provide a command line interface (CLI) to run commands from an operating system prompt.

Modular Disk Storage Manager Agent

This software resides on each cluster node to collect system-based topology data that can be managed by the MDSM.

Multipath I/O (MPIO) Software

Multipath I/O software (also referred to as the failover driver) is installed on each cluster node. The software manages the redundant data path between the system and the RAID enclosure. For the MPIO software to correctly manage a redundant path, the configuration must provide for redundant HBAs and cabling.

The MPIO software identifies the existence of multiple paths to a virtual disk and establishes a preferred path to that disk. If any component in the preferred path fails, the MPIO software automatically re-routes I/O requests to the alternate path so that the storage array continues to operate without interruption.

Advanced Features

Advanced features for the PowerVault MD3600f and MD3620f RAID storage systems include:

- **Snapshot Virtual Disk**—Captures point-in-time images of a virtual disk for backup, testing, or data processing without affecting the contents of the source virtual disk.
- **Virtual Disk Copy**—Generates a full copy of data from the source virtual disk to the target virtual disk in a storage array. You can use Virtual Disk Copy to back up data, copy data from disk groups that use smaller-capacity physical disks to disk groups using greater capacity physical disks, or restore snapshot virtual disk data to the source virtual disk.
- **Upgrading to High-Performance Tier**—Increases the performance of the system beyond that of a MD36x0f series array operating at the standard performance level.
- **Remote Replication**—Enables real-time replication of data between two storage arrays in separate locations.



NOTE: For more information on deploying the correct options in the cluster environment, see "Using Advanced (Premium) PowerVault Modular Disk Storage Manager Features" on page 63.

Supported Cluster Configurations

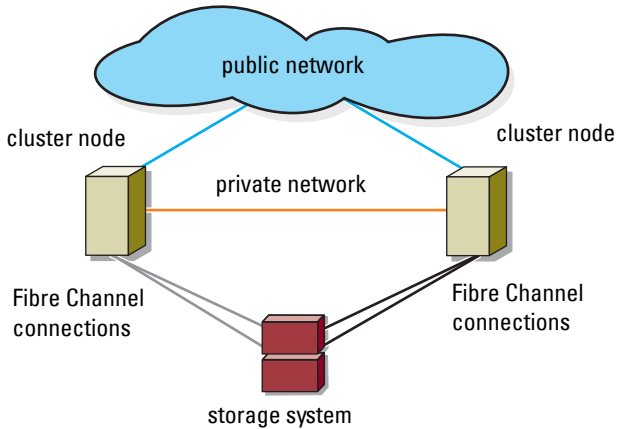
The following sections describe the supported cluster configurations.

Direct-Attached Cluster

In a direct-attached cluster, all the nodes of the cluster are directly attached to a single storage system. In this configuration, the RAID controllers on the storage system are connected by cables directly to the Fibre Channel HBA ports in the nodes.

Figure 1-1 shows a basic direct-attached, single-cluster configuration.

Figure 1-1. Direct-Attached, Single-Cluster Configuration



NOTE: The configuration can have up to 4 nodes. The nodes can be:

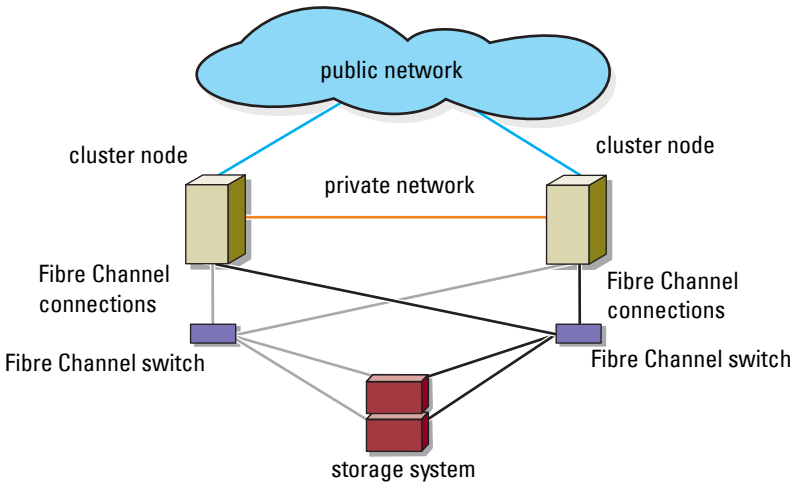
- One cluster (up to 4 nodes)
- Two two-node clusters
- One cluster and stand-alone server(s)

SAN-Attached Cluster

In a SAN-attached cluster, all nodes are attached to a single storage system or to multiple storage systems through a SAN using redundant switch fabrics. SAN-attached clusters are superior to direct-attached clusters in configuration flexibility, expandability, and performance.

Figure 1-2 shows a SAN-attached cluster.

Figure 1-2. SAN-Attached Cluster



NOTE: The configuration can have up to 64 nodes. The nodes can be:

- One cluster (up to 16 nodes)
- Multiple clusters
- Multiple clusters and stand-alone server(s)

Configuration Order for Direct-Attached and SAN-Attached Connections

This section describes the configuration steps for both direct-attached and SAN-attached connections. These steps assume that you are setting up a Fibre Channel storage for the first time.

NOTE: If you are adding a Fibre Channel storage array or if your host server is already configured to access Fibre Channel storage, some of the steps in this section may not apply. Before proceeding, see the *Dell Cluster Configuration Support Matrices* at dell.com/ha to confirm that your existing hardware components and Host Bus Adapter (HBA) firmware and BIOS levels are supported.

Direct-Attached Configuration Order

- 1 Install the supported HBAs on your cluster nodes. See "Installing Supported Fibre Channel HBAs" on page 44.
- 2 Cable the cluster nodes to the storage array. See "Cabling Storage for Your Direct-Attached Cluster" on page 24.
- 3 Install the required HBA drivers and firmware versions listed in the *Dell Cluster Configuration Support Matrices* at dell.com/ha.
- 4 Install and configure the MD Storage Manager software (included with your storage array) on your cluster nodes. See "Installing the Storage Management Software" on page 47.
- 5 Using MD Storage Manager (MDSM), configure the host servers, storage arrays, and virtual disks. See "Configuring the Shared Storage System" on page 48.
- 6 Activate and configure premium features (if applicable).

SAN-Attached Configuration Order



NOTE: A SAN-attached configuration is required to use the Remote Replication premium feature. Remote Replication is not supported in direct-attached configurations.

- 1 Install the supported HBAs on your cluster nodes. See "Installing Supported Fibre Channel HBAs" on page 44.
- 2 Cable the cluster nodes to the Fibre Channel switches. See "Cabling a SAN-Attached Cluster to an MD36x0f Storage System" on page 33 and "Remote Replication" on page 65.
- 3 Install the required HBA drivers and firmware versions listed in the *Dell Cluster Configuration Support Matrices* at dell.com/ha.
- 4 Install and configure the MD Storage Manager software (included with your storage array) on your cluster nodes. See "Installing the Storage Management Software" on page 47.
- 5 Cable the storage array to the Fibre Channel switches. See "Cabling Storage for Your SAN-Attached Cluster" on page 30.
- 6 Configure zoning on all Fibre Channel switches. See "Setting Up Zoning on the Fibre Channel Switch Hardware" on page 47.



NOTE: All equipment attached to the switch must be powered on before establishing zoning. For additional switch hardware requirements, see the manufacturer's documentation.

- 7 Using MDSM, configure the cluster nodes, storage arrays, and virtual disks. See "Configuring the Shared Storage System" on page 48.
- 8 Activate and configure premium features (if applicable).

Other Documents You May Need



CAUTION: The safety information that shipped with your system provides important safety and regulatory information. Warranty information may be included within this document or as a separate document.

- The *Rack Installation Guide* included with your rack solution describes how to install your system into a rack.
- The *Getting Started Guide* provides an overview to initially set up your system.
- The *Dell Failover Clusters with Microsoft Windows Server 2008 Installation and Troubleshooting Guide* provides more information about deploying your cluster.
- The *Dell Cluster Configuration Support Matrices* provides a list of recommended operating systems, hardware components, and driver or firmware versions for your Dell Windows Server Failover Cluster.
- The operating system documentation describes how to install (if necessary), configure, and use the operating system software.
- Documentation for any components you purchased separately provides information to configure and install those options.
- The Dell PowerVault tape library documentation provides information about installing, troubleshooting, and upgrading the tape library.
- Updates are sometimes included with the system to describe changes to the system, software, and/or documentation.
- The User's Guide for your PowerEdge system describes system features and technical specifications, the System Setup program (if applicable), software support, and the system configuration utility.

- The *Dell PowerVault MD3600f and MD3620f Storage Arrays Configuring Fibre Channel With Dell MD3600f Series Storage Arrays* document provides information about configurations, HBA installation, and zoning.
- The *Dell PowerVault MD3600f and MD3620f Storage Arrays Getting Started Guide* provides an overview of setting up and cabling your storage array.
- The *Dell PowerVault MD3600f and MD3620f Storage Arrays Owner's Manual* provides information about system features and describes how to troubleshoot the system and install or replace system components.
- The *Dell PowerVault MD3600f and MD3620f Storage Arrays Deployment Guide* provides information about installing and configuring the software and hardware.
- The *Dell PowerVault Modular Disk Storage Arrays CLI Guide* provides information about using the command line interface (CLI) to configure and manage your storage array.
- The *Dell PowerVault MD36x0f Resource DVD* provides documentation for configuration and management tools, as well as the full documentation set included here.
- The *Dell PowerVault MD Systems Support Matrix* provides information on supported software and hardware for PowerVault MD systems.



NOTE: Always read the updates first because they often supersede information in other documents.

- Release notes or readme files may be included to provide last-minute updates to the system documentation or advance technical reference material intended for experienced users or technicians.

Cabling Your Cluster Hardware

The following sections provide information on cabling various components of your cluster.

Cabling the Mouse, Keyboard, and Monitor

When installing a cluster configuration in a rack, you must include a switch box to connect the mouse, keyboard, and monitor to the nodes. See the documentation included with your rack for instructions on cabling each node's connections to the switch box.

Cabling the Power Supplies

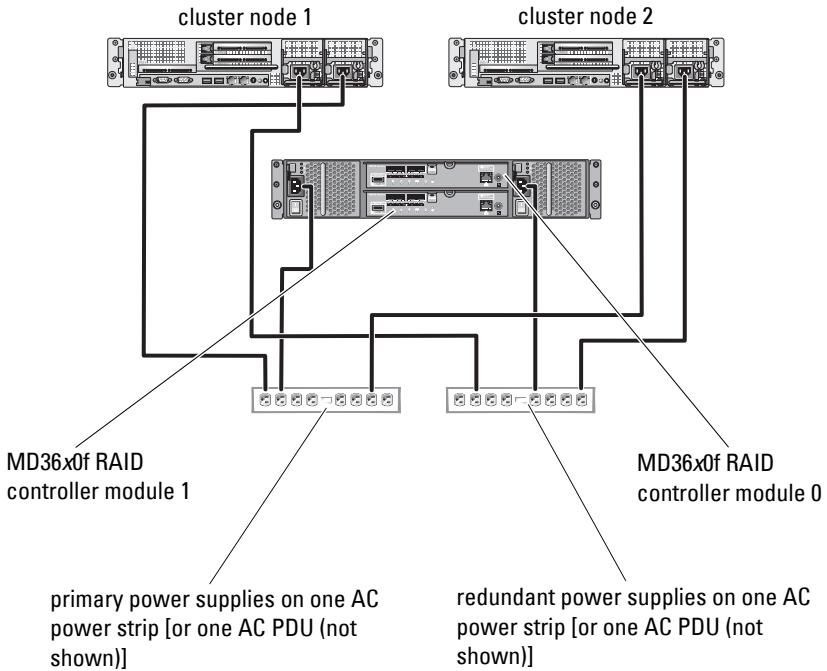
To ensure that the specific power requirements are satisfied, see the documentation for each component in your cluster solution.

It is recommended that you adhere to the following guidelines to protect your cluster solution from power-related failures:

- For nodes with multiple power supplies, plug each power supply into a separate AC circuit.
- Use uninterruptible power supplies (UPS).
- For some environments, consider having backup generators and power from separate electrical substations.

Figure 2-1 illustrates a recommended method for power cabling of a cluster solution consisting of two Dell PowerEdge systems and one storage system. To ensure redundancy, the primary power supplies of all the components are grouped onto one or two circuits and the redundant power supplies are grouped onto a different circuit.

Figure 2-1. Power Cabling Example



NOTE: This illustration is intended only to demonstrate the power distribution of the components.

Cabling Your Public and Private Networks

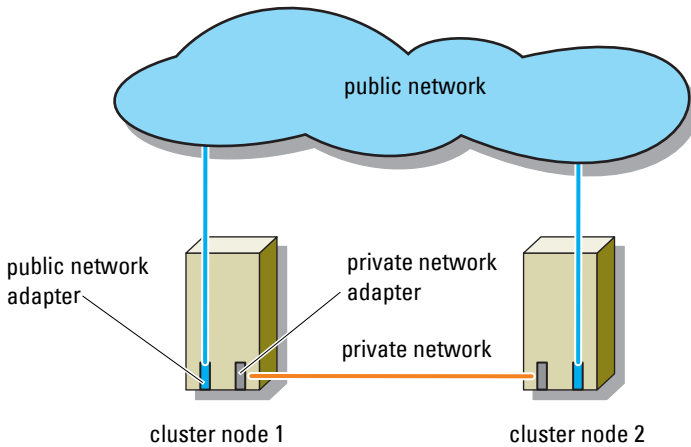
The network adapters in the cluster nodes provide at least two network connections for each node. These connections are described in Table 2-1.

Table 2-1. Network Connections

Network Connection	Description
Public Network	All connections to the client LAN. At least one public network must be configured for mixed mode (public mode and private mode) for private network failover.
Private Network	A dedicated connection for sharing cluster health and status information between the cluster nodes. Network adapters connected to the LAN can also provide redundancy at the communications level in case the cluster interconnect fails. For more information on private network redundancy, see your Microsoft Failover Clustering documentation.

Figure 2-2 shows an example of network adapter cabling in which dedicated network adapters in each node are connected to the public network and the remaining network adapters are connected to each other (for the private network).

Figure 2-2. Example of Network Cabling Connection



Cabling Your Public Network

Any network adapter supported by a system running TCP/IP may be used to connect to the public network segments. You can install additional network adapters to support additional public network segments or to provide redundancy in the event of a faulty primary network adapter or switch port.

Cabling Your Private Network

The private network connection to the cluster nodes is provided by a second or subsequent network adapter that is installed in each node. This network is used for intra-cluster communications.

Table 2-2 lists the required hardware components and connection method for three possible private network configurations.

Table 2-2. Private Network Hardware Components and Connections

Method	Hardware Components	Connection
Network switch	Gigabit or 10 Gigabit Ethernet network adapters and switches	Depending on the hardware, connect the CAT5e or CAT6 cables, the multimode optical cables with Local Connectors (LCs), or the twinax cables from the network adapters in the nodes to a switch.
Point-to-Point (two node cluster only)	Copper Gigabit or 10 Gigabit Ethernet network adapters with RJ-45 connectors	Connect a standard CAT5e or CAT6 Ethernet cable between the network adapters in both nodes.
	Copper 10 Gigabit Ethernet network adapters with SFP+ connectors	Connect a twinax cable between the network adapters in both nodes.
	Optical Gigabit or 10 Gigabit Ethernet network adapters with LC connectors	Connect a multi-mode optical cable between the network adapters in both nodes.



NOTE: Throughout this document, Ethernet refers to either Gigabit Ethernet or 10 Gigabit Ethernet.

Using Dual-Port Network Adapters for Your Private Network

You can configure your cluster to use the public network as a failover for private network communications. However, if dual-port network adapters are used, do not use two ports simultaneously to support both the public and private networks.

NIC Teaming

Network Interface Card (NIC) teaming combines two or more NICs to provide load balancing and/or fault tolerance. Your cluster supports NIC teaming, but only in a public network; NIC teaming is not supported in a private network.



NOTE: Use the same brand of NICs in a team. You cannot mix brands of teaming drivers.

Cabling the Storage Systems

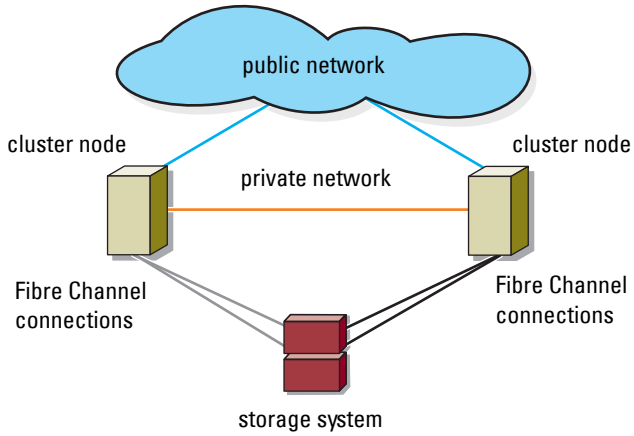
This section provides information on cabling your cluster to a storage system in a direct-attached configuration or to one or more storage systems in a SAN-attached configuration.

Cabling Storage for Your Direct-Attached Cluster

A direct-attached cluster configuration consists of redundant Fibre Channel host bus adapter (HBA) ports cabled directly to a Dell PowerVault MD36x0f storage system. If a component (for example, port, cable, or the storage controller) fails in the storage path, the MPIO software automatically re-routes the I/O requests to the alternate path so that the storage array continues to operate without interruption. The configuration with two single-port HBA provides higher availability. An HBA failure does not cause the failover cluster to move cluster resources to the other cluster node.


Figure 2-3 shows an example of a direct-attached, single cluster configuration with redundant HBA ports installed in each cluster node.

Figure 2-3. Direct-Attached Cluster Configuration



Cabling a Cluster to a Dell PowerVault MD36x0f Storage System

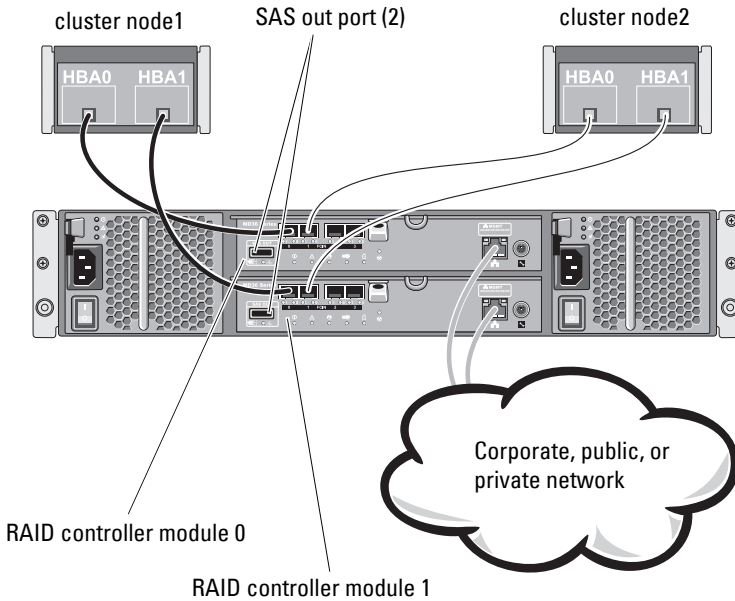
Each cluster node attaches to the storage system using two Fibre optic cables with duplex local connector (LC) multimode connectors that attach to the HBA ports in the cluster nodes and the MD36x0f RAID controller module ports in the MD36x0f storage system. These connectors consist of two individual Fibre optic connectors with indexed tabs that must be aligned properly into the HBA ports and the MD36x0f RAID controller module.

 **CAUTION: Do not remove the connector covers until you are ready to insert the connectors into the HBA port, MD36x0f RAID controller module port, or tape library port.**

Cabling a Two-Node Direct-Attached Cluster to an MD36x0f Storage System

- 1 Connect cluster node 1 to the storage system:
 - a Install a cable from cluster node 1 HBA port 0 to the fibre channel port on MD36x0f RAID controller module 0, port In-0.
 - b Install a cable from cluster node 1 HBA port 1 to the fibre channel port on MD36x0f RAID controller module 1, port In-0.
- 2 Connect cluster node 2 to the storage system:
 - a Install a cable from cluster node 2 HBA port 0 to the fibre channel port on MD36x0f RAID controller module 0, port In-1.
 - b Install a cable from cluster node 2 HBA port 1 to the fibre channel port on MD36x0f RAID controller module 1, port In-1.

Figure 2-4. Cabling a Two-Node Direct-Attached Cluster to a PowerVault MD36x0f Storage System



NOTE: The SAS out port provides SAS connection for cabling to MD1200 or MD1220 expansion enclosure(s).

Cabling a Four-Node Direct-Attached Cluster to an MD36x0f Storage System

You can configure a cluster with more than two nodes in a direct-attached configuration using a PowerVault MD36x0f storage system. The MD36x0f storage system can support up to four-node direct-attached cluster.

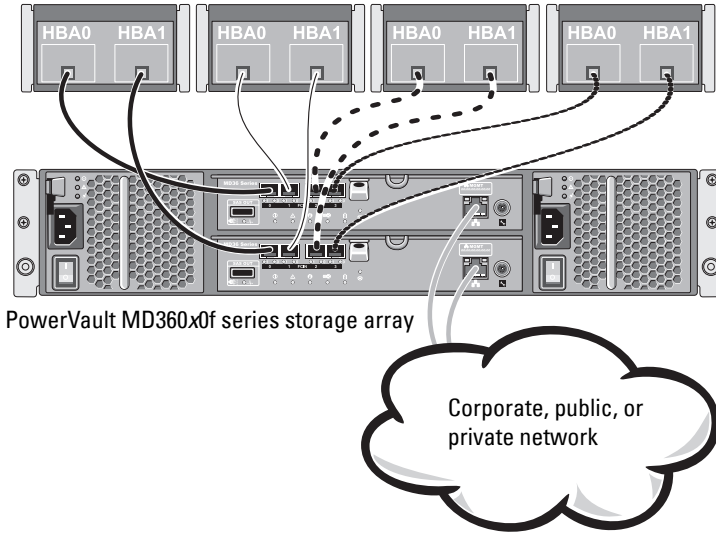
The following example explains how to cable a four-node direct-attached cluster:

- 1** Connect cluster node 1 to the storage system:
 - a** Install a cable from cluster node 1 HBA port 0 to the Fibre Channel port on the MD36x0f RAID controller module 0, port In-0.

- b** Install a cable from cluster node 1 HBA port 1 to the Fibre Channel port on the MD36x0f RAID controller module 1, port In-0.
- 2** Connect cluster node 2 to the storage system:
 - a** Install a cable from cluster node 2 HBA port 0 to the Fibre Channel port on the MD36x0f RAID controller module 0, port In-1.
 - b** Install a cable from cluster node 2 HBA port 1 to the Fibre Channel port on the MD36x0f RAID controller module 1, port In-1.
- 3** Connect cluster node 3 to the storage system:
 - a** Install a cable from cluster node 3 HBA port 0 to the Fibre Channel port on the MD36x0f RAID controller module 0, port In-2.
 - b** Install a cable from cluster node 3 HBA port 1 to the Fibre Channel port on the MD36x0f RAID controller module 1, port In-2.
- 4** Connect cluster node 4 to the storage system:
 - a** Install a cable from cluster node 4 HBA port 0 to the Fibre Channel port on the MD36x0f RAID controller module 0, port In-3.
 - b** Install a cable from cluster node 4 HBA port 1 to the Fibre Channel port on the MD36x0f RAID controller module 1, port In-3.

Figure 2-5 shows a four-cluster node connected to two RAID controller modules. Since each cluster node has redundant paths, loss of a single path still allows access to the storage array through the alternate path.

Figure 2-5. Cabling a Four-Node Direct-Attached Cluster to a PowerVault MD36x0f Storage System



Cabling Multiple Clusters to an MD36x0f Storage System

The high number of available Fibre Channel ports on the MD36x0f storage system also allows you to configure four-node clusters, 2 two-node clusters or a mix of cluster(s) and non-clustered server(s) in a direct-attached configuration.

Cabling Two Two-Node Direct-Attached Clusters to an MD36x0f Storage System

The following steps are an example of how to cable a two two-node cluster.

- 1** In the first cluster, connect cluster node 1 to the storage system:
 - a** Install a cable from cluster node 1 HBA port 0 to the Fibre Channel port on the MD36x0f RAID controller module 0, port In-0.
 - b** Install a cable from cluster node 1 HBA port 1 to the Fibre Channel port on the MD36x0f RAID controller module 1, port In-0.
- 2** In the first cluster, connect cluster node 2 to the storage system:
 - a** Install a cable from cluster node 2 HBA port 0 to the Fibre Channel port on the MD36x0f RAID controller module 0, port In-1.
 - b** Install a cable from cluster node 2 HBA port 1 to the Fibre Channel port on the MD36x0f RAID controller module 1, port In-1.
- 3** In the second cluster, connect cluster node 1 to the storage system:
 - a** Install a cable from cluster node 1 HBA port 0 to the Fibre Channel port on the MD36x0f the RAID controller module 0, port In-2.
 - b** Install a cable from cluster node 1 HBA port 1 to the Fibre Channel port on the MD36x0f RAID controller module 1, port In-2.
- 4** In the second cluster, connect cluster node 2 to the storage system:
 - a** Install a cable from cluster node 2 HBA port 0 to the Fibre Channel port on the MD36x0f RAID controller module 0, port In-3.
 - b** Install a cable from cluster node 2 HBA port 1 to the Fibre Channel port on the MD36x0f RAID controller module 1, port In-3.

Cabling Storage for Your SAN-Attached Cluster

A SAN-attached cluster is a cluster configuration where all cluster nodes that are attached to a single storage system or to multiple storage systems through SAN use a redundant switch fabric.

SAN-attached cluster configurations provide more flexibility, expandability, and performance than direct-attached configurations.

For more information on Fibre Channel switch fabrics, see "Implementing Zoning on a Fibre Channel Switched Fabric" on page 45.

Figure 2-6 shows an example of a two node SAN-attached cluster.

Figure 2-7 shows an example of an sixteen-node SAN-attached cluster.

Similar cabling concepts can be applied to clusters that contain a different number of nodes.

NOTE: The connections listed in this section are representative of one proven method of ensuring redundancy in the connections between the cluster nodes and the storage system. Other methods that achieve the same type of redundant connectivity may be acceptable.

Figure 2-6. Two-Node SAN-Attached Cluster

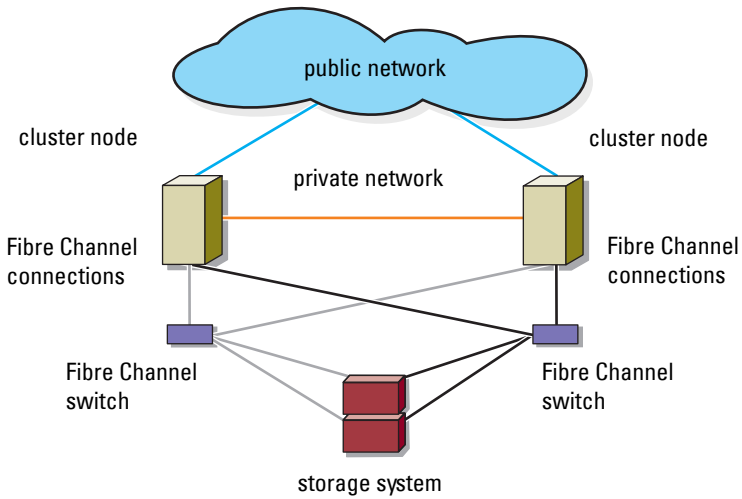
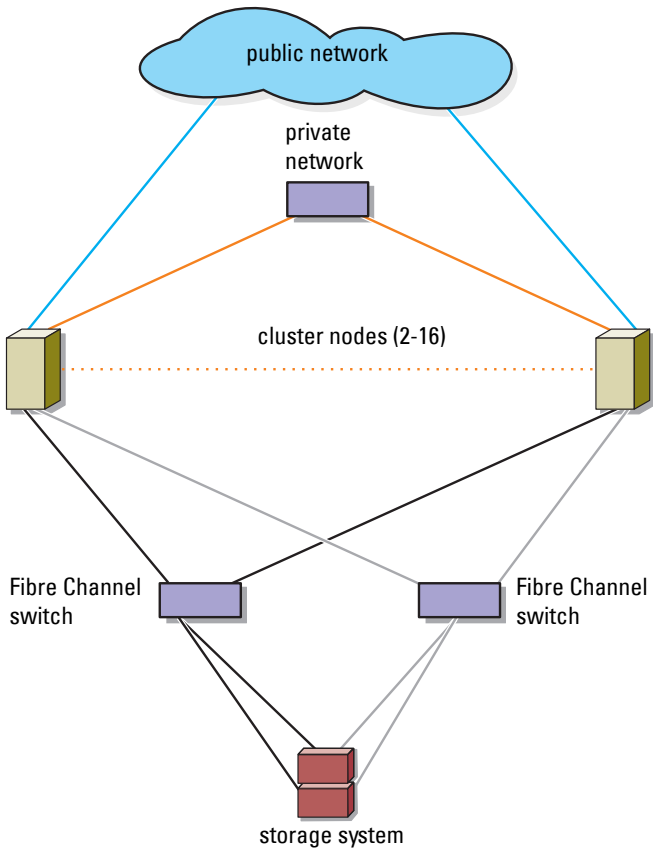


Figure 2-7. Sixteen-Node SAN-Attached Cluster



Cabling a SAN-Attached Cluster to an MD36x0f Storage System

The cluster nodes attach to the storage system using a redundant switch fabric and Fibre optic cables with duplex LC multimode connectors.

The switches, the HBA ports in the cluster nodes, and the RAID controller module ports in the storage system use duplex LC multimode connectors. The connectors consist of two individual fibre optic connectors with indexed tabs that must be inserted and aligned properly in the small form-factor pluggable (SFP) module connectors on the Fibre Channel switches and the connectors on the cluster nodes and storage systems.

Each HBA port is cabled to a port on a Fibre Channel switch. One or more cables connect from the outgoing ports on a switch to a RAID controller module on an MD36x0f storage system.



NOTE: Adding more cables from the storage system to the switches can increase the I/O bandwidth and high availability of data.

Figure 2-8 illustrates a method for cabling a SAN-attached cluster to an MD36x0f storage system.

Cabling a SAN-Attached Cluster to the MD36x0f Storage System

- 1** Connect cluster node 1 to the SAN:
 - a** Connect a cable from HBA port 0 to the Fibre Channel switch (Switch fabric A).
 - b** Connect a cable from HBA port 1 to the Fibre Channel switch (Switch fabric B).
- 2** Repeat step 1 for each additional cluster node.
- 3** Connect the storage system to the SAN:
 - a** Connect a cable from Fibre Channel switch (Switch fabric A) to the Fibre Channel port on the MD36x0f RAID controller module 1, port In-1.
 - b** Connect a cable from Fibre Channel switch (Switch fabric A) to the Fibre Channel port on the MD36x0f RAID controller module 1, port In-3.
 - c** Connect a cable from Fibre Channel switch (Switch fabric A) to the Fibre Channel port on the MD36x0f RAID controller module 0, port In-0.

- d** Connect a cable from Fibre Channel switch (Switch fabric A) to the Fibre Channel port on the MD36x0f RAID controller module 0, port In-2.
- e** Connect a cable from Fibre Channel switch (Switch fabric B) to the Fibre Channel port on the MD36x0f RAID controller module 0, port In-1.
- f** Connect a cable from Fibre Channel switch 1 (Switch fabric B) to the Fibre Channel port on the MD36x0f RAID controller module 0, port In-3.
- g** Connect a cable from Fibre Channel switch 1 (Switch fabric B) to the Fibre Channel port on the MD36x0f RAID controller module 1, port In-0.
- h** Connect a cable from Fibre Channel switch 1 (Switch fabric B) to the Fibre Channel port on the MD36x0f RAID controller module 1, port In-2.

Figure 2-8. Cabling a SAN-Attached Cluster to the MD36x0f

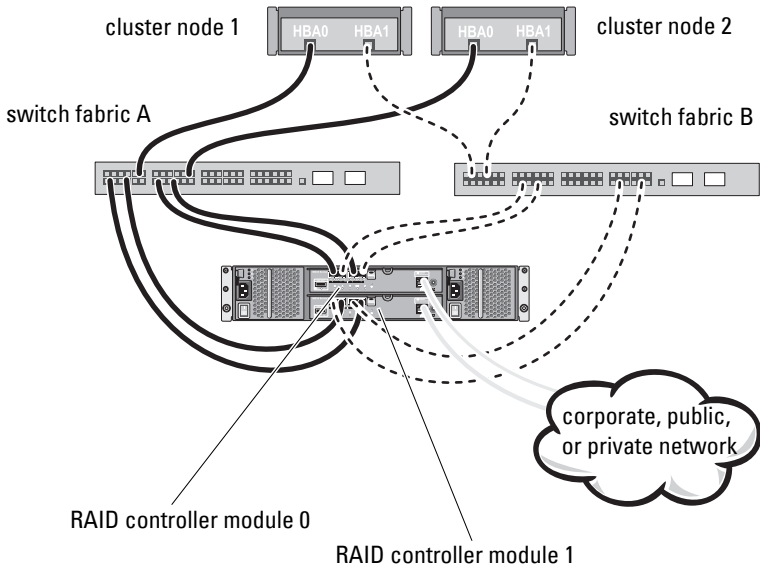


Table 2-3. Zoning Configuration Information

Switch Fabric A	Switch Fabric B
Zone_1_Cluster Node_1_HBA_0	Zone_3_Cluster Node_1_HBA_1
Cluster Node_1_HBA_0	Cluster Node_1_HBA_1
Array_Ctrl-0-0	Array_Ctrl-0-1
Array_Ctrl-0-2	Array_Ctrl-0-3
Array_Ctrl-1-1	Array_Ctrl-1-0
Array_Ctrl-1-3	Array_Ctrl-1-2
Zone_2_Cluster Node_2_HBA_0	Zone_4_Cluster Node_2_HBA_1
Cluster Node_2_HBA_0	Cluster Node_2_HBA_1
Array_Ctrl-0-0	Array_Ctrl-0-1
Array_Ctrl-0-2	Array_Ctrl-0-3
Array_Ctrl-1-1	Array_Ctrl-1-0
Array_Ctrl-1-3	Array_Ctrl-1-2

Cabling Multiple SAN-Attached Clusters to an MD36x0f Storage System

To cable multiple clusters to the storage system, connect the cluster nodes to the appropriate Fibre Channel switches and then connect the Fibre Channel switches to the appropriate MD36x0f RAID controller modules.

For rules and guidelines for SAN-attached clusters, see the *Dell Cluster Configuration Support Matrices* at dell.com/ha.

Connecting a PowerEdge Cluster to a Tape Library

To provide additional backup for your cluster, you can add tape backup devices to your cluster configuration. The Dell PowerVault tape libraries may contain an integrated Fibre Channel bridge or Storage Network Controller (SNC) that connects directly to your Fibre Channel switch.

Figure 2-9 shows a supported Failover Cluster configuration using redundant Fibre Channel switches and a tape library. In this configuration, each of the cluster nodes can access the tape library to provide backup for your local disk resources, as well as your cluster disk resources. This configuration allows you to add more servers and storage systems in the future, if needed. For more information on configuring these components, see the storage and tape backup documentation at support.dell.com/manuals.


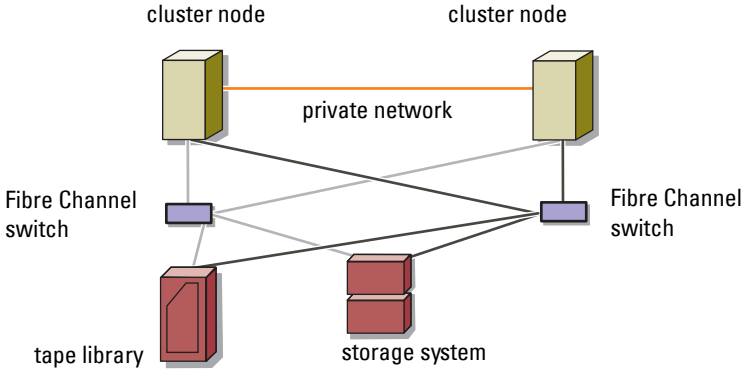
 **NOTE:** While tape libraries can be connected to multiple fabrics, they do not provide path failover.

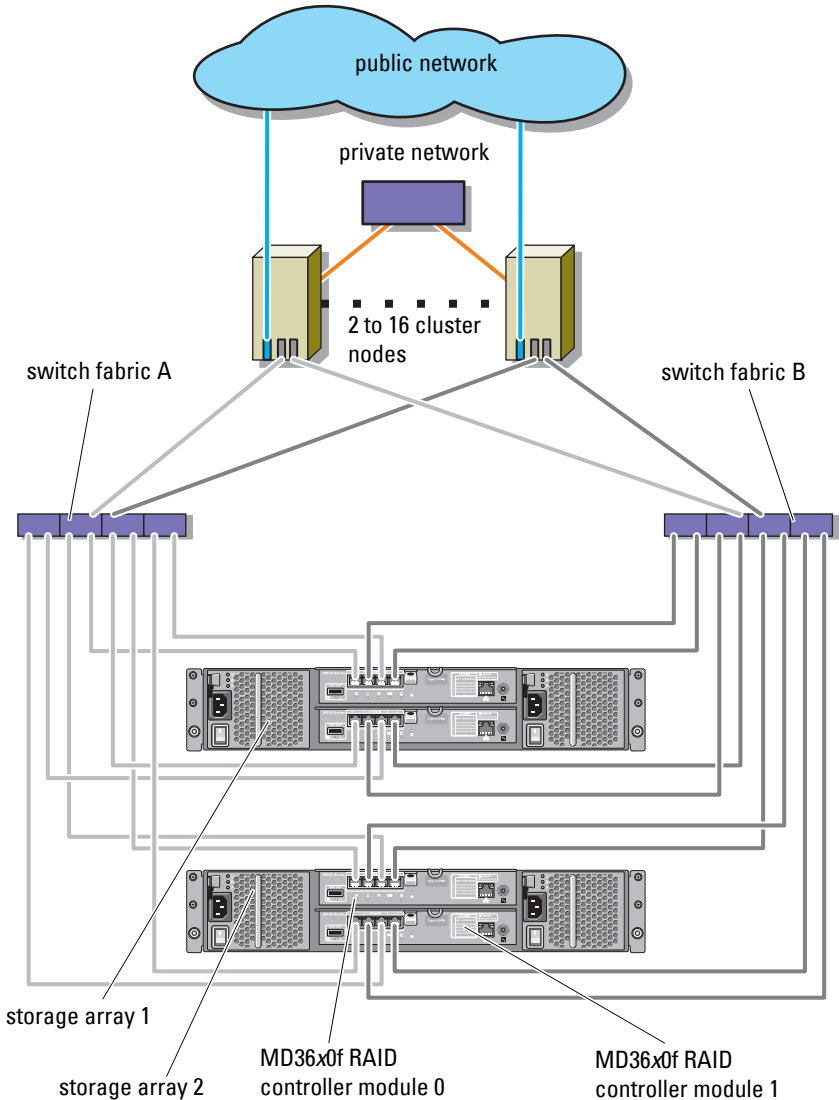
Figure 2-9. Cabling a Storage System and a Tape Library



Connecting a PowerEdge Cluster to Multiple PowerVault MD3600f or MD3620f Storage Systems

You can increase your cluster storage capacity by attaching multiple storage systems to your cluster using redundant Fibre Channel switch fabrics. The PowerEdge cluster systems support configurations with multiple PowerVault MD3600f or MD3620f storage systems attached to clustered systems. In this scenario, the Failover Cluster software can fail over disk drives in any cluster-attached shared storage system between the cluster nodes.

Figure 2-10. SAN-Attached Cluster Configuration With Multiple Storage Arrays



When attaching multiple PowerVault MD3600f and MD3620f storage systems with your cluster, the following rules apply:


- A maximum of four Power Vault MD3600f and MD3620f storage systems per cluster.
- The shared storage systems and firmware must be identical. Using dissimilar storage systems and firmware for your shared storage is not supported.
- Microsoft Windows limits access to drives using limited drive letters which is 22. A maximum of 22 drive letters (E to Z) can be used for your storage system disks.



NOTE: Drive letters A through D are reserved for local disks.

- Windows Server 2008 Enterprise Edition supports mount points, allowing greater than 22 drives per cluster.

Preparing Your Systems for Clustering

 **CAUTION:** Only trained service technicians are authorized to remove and access any of the components inside the system. See the safety information that shipped with your system for complete information about safety precautions, working inside the system, and protecting against electrostatic discharge.

Cluster Configuration Overview


- 1 Ensure that your site can handle the cluster's power requirements.

Contact your sales representative for information about your region's power requirements.

- 2 Install the servers, the shared storage array(s), and the interconnect switches (for example, in an equipment rack), and ensure that all these components are turned on.

 **NOTE:** For more information on step 3 through step 7 and step 10 through step 12, see the "Preparing your systems for clustering" section of the *Dell Failover Clusters with Microsoft Windows Server 2008 Installation and Troubleshooting Guide* at support.dell.com/manuals.

- 3 Deploy the operating system (including any relevant service pack and hotfixes), network adapter drivers, and storage adapter drivers (including the MPIO software) on each of the servers that must become cluster nodes. Depending on the deployment method that is used, it may be necessary to provide a network connection to successfully complete this step.

 **NOTE:** You can record the Cluster configuration to the Cluster Data Form to help in planning and deployment of your cluster. For more information, see the "Cluster Data Form" on page 73 and "Zoning Configuration Form" on page 77.

- 4 Establish the physical network topology and the TCP/IP settings for network adapters on each server node to provide access to the cluster public and private networks.

- 5 Configure each server node as a member server in the same Windows Active Directory Domain.



NOTE: You can configure the cluster nodes as Domain Controllers. For more information, see the "Selecting a Domain Model" section of the *Dell Failover Clusters with Microsoft Windows Server 2008 Installation and Troubleshooting Guide* at support.dell.com/manuals.

- 6 Establish the physical storage topology and any required storage network settings to provide connectivity between the storage array and the servers that must be configured as cluster nodes. Configure the storage system(s) as described in your storage system documentation.
- 7 Use storage array management tools to create at least one logical unit number (LUN). The LUN is used as a witness disk for Microsoft Windows Server 2008 Failover cluster. Ensure that this LUN is presented to the servers that must be configured as cluster nodes.



NOTE: It is recommended that you configure the LUN on a single node, for security reasons, as mentioned in step 8 when you are setting up the cluster. Later, you can configure the LUN as mentioned in step 9 so that other cluster nodes can access it.

- 8 Select one of the systems and form a new failover cluster by configuring the cluster name, cluster management IP, and quorum resource. For more information, see "Preparing Your Systems for Clustering" on page 41.



NOTE: For Windows Server 2008 Failover Clusters, run the **Cluster Validation Wizard** to ensure that your system is ready to form the cluster.

- 9 Join the remaining node(s) to the failover cluster. For more information, see "Preparing Your Systems for Clustering" on page 41.
- 10 Configure roles for cluster networks. Take any network interfaces that are used for other purposes outside of the cluster and out of the control of the cluster.

- 11 Test the failover capabilities of your new cluster.



NOTE: You can also use the **Cluster Validation Wizard**.

- 12 Configure highly-available applications and services on your failover cluster. Depending on your configuration, this may also require providing additional LUNs to the cluster or creating new cluster resource groups. Test the failover capabilities of the new resources.
- 13 Configure client systems to access the highly available applications and services that are hosted on your failover cluster.

Installation Overview

Each node in your Dell Windows Server failover cluster must have the same release, edition, service pack, and processor architecture of the Windows Server operating system installed. For example, all nodes in your cluster may be configured with Windows Server 2008 R2, Enterprise x64 Edition. If the operating system varies among nodes, it is not possible to configure a failover cluster successfully. It is recommended to establish system roles prior to configuring a failover cluster, depending on the operating system configured on your cluster.

For a list of recommended operating systems, hardware components, and driver or firmware versions for your Dell Windows Server Failover Cluster, see the *Dell Cluster Configuration Support Matrices* at dell.com/ha.

For more information on deploying your cluster with the Windows Server 2008 operating systems, see the *Dell Failover Clusters with Microsoft Windows Server 2008 Installation and Troubleshooting Guide* at support.dell.com/manuals.

The following sub-sections describe steps that enable you to establish communication between the cluster nodes and your shared MD3600f or MD3620f storage array(s), and to present disks from the storage array to the cluster:

- 1 Installing Supported Fibre Channel HBAs
- 2 Implementing Zoning on a Fibre Channel Switched Fabric
- 3 Installing the Storage Management Software
- 4 Configuring the Shared Storage System
- 5 Configuring a Failover Cluster

Installing Supported Fibre Channel HBAs

The storage array supports a specific set of Fibre Channel HBAs, each requiring a unique driver and firmware level. For more information on supported HBAs with the drivers, firmware, and BIOS versions, see the *Dell Cluster Configuration Support Matrices* at dell.com/ha.

If an HBA is already installed on your host server, verify that it is listed in the Support Matrices and operates at the driver and/or firmware level specified. If the HBA is not listed in the Support Matrices, it should not be used to connect to the storage array.



CAUTION: Connecting the storage array to a non-supported host server HBA or installing non-qualified HBA drivers or firmware can cause instability or loss of access to your data.

Installing Fibre Channel HBA on Your Host Server

For instructions about physically installing an HBA in your host server and loading supported drivers and firmware, see the documentation supplied with your HBA hardware.

Customizing HBA Drivers and Firmware Settings

In most cases, the default manufacturer HBA driver and firmware settings are sufficient to support Fibre Channel communication with the storage array.

However, in the case of certain HBA manufacturers, the *Dell Cluster Configuration Support Matrices* at dell.com/ha may contain information about specific driver and firmware settings necessary to optimize storage arrays. Review the Support Matrices to ensure that you are aware of any customized settings that may affect the performance of your HBA.



NOTE: Most Fibre Channel HBAs require a link timeout and node timeout value of 10 seconds. This value can be set using the HBA manufacturer's management utilities, for example, Emulex's OneCommand Manager and QLogic's Enterprise Fabric Suite.

For more information about installing and configuring HBAs, see the following:

- Emulex HBAs—Emulex support website at emulex.com or the Dell Support website at support.dell.com.
- QLogic HBAs—QLogic support website at qlogic.com or the Dell Support website at support.dell.com.
- Brocade HBAs—Brocade support website at brocade.com or the Dell Support website at support.dell.com.

For more information about supported HBA controllers and drivers, see the *Dell Cluster Configuration Support Matrices* at dell.com/ha.

Implementing Zoning on a Fibre Channel Switched Fabric

A Fibre Channel switch allows you to connect multiple devices to the SAN without compromising bandwidth or data throughput. Switch zoning implemented on each Fibre Channel switch hardware component using the manufacturer's embedded utility, allows you to divide port traffic between the host server and storage array to maintain the highest level of redundancy.

Figure 2-8 shows each connection to the cluster node routed to an individual logical zone on the SAN. Two physical switches provide an alternate (redundant) data path to the storage array. If a single HBA, switch or RAID controller fails, the host server can still access data on the storage array through one of the alternate paths provided by the switches.



NOTE: For a list of supported Fibre Channel switches, see the *Dell Cluster Configuration Support Matrices* at dell.com/ha.

World Wide Name Zoning

There are several different switch zoning techniques used across various SANs. When configuring zoning with your storage array, use 64 bit World Wide Name (WWN) port zoning to uniquely identify each component in your Fibre Channel switch fabric. An advantage of using WWN port zoning (also called *soft zoning*) is that it allows you to remove and/or replace cabling to and from the fabric without reconfiguring the existing zone logic.

When implemented on the Fibre Channel switch, port WWN zoning causes the host server to query the World Wide Identifier (WWID) name of all attached physical disks and/or expansion enclosures each time it access the switch fabric. By zoning specific ports on the host server, switch and storage array together, the switch allows the host server to *see* only devices included in that zone, decreasing the amount of time it would otherwise take for the host server to query attached, but out-of-zone, devices.

Switch Zoning Requirements

The storage array imposes specific requirements that must be followed when setting up Fibre Channel switch zoning:

- If a Fibre Channel switch is used to connect your host server and storage array, it must be zoned. Un-zoned or open switches cannot be used.
- Always use WWN port zoning, not *hard zoning* that blocks or grants access based on the device.
- No more than one HBA may be connected to a single logical switch zone.
- No more than four paths (port-to-port segments) can be established from a single, physical host server to a single RAID controller.
- A zone can contain multiple targets.
- A zone can span multiple storage arrays.
- If the Remote Replication premium feature is activated, a separate zone for each replication port is required. Only data traffic related to Remote Replication can move through that zone. For more details and requirements regarding Remote Replication, see the *Owner's Manual* at support.dell.com/manuals.


Setting Up Zoning on the Fibre Channel Switch Hardware

Setting up zoning on Fibre Channel switches varies greatly between manufacturers. For detailed information on how to set up zoning on your switch, see the manufacturer's product documentation or technical support website.

Table 3-1 provides a list of WWN identifiers that you can find in the Dell PowerVault MD36x0f cluster environment.

Table 3-1. Port Worldwide Names in a SAN Environment

Identifier	Description
xx:xx:xx:2b:xx:xx:xx:xx	PowerVault MD36x0f RAID controller module
xx:xx:00:00:C9:xx:xx:xx	Emulex HBA ports
xx:xx:00:E0:8B:xx:xx:xx	QLogic HBA ports (non-embedded)
xx:xx:00:0F:1F:xx:xx:xx	Dell 2362M HBA port
xx:xx:xx:60:45:xx:xx:xx	PowerVault 132T and 136T tape libraries
xx:xx:xx:E0:02:xx:xx:xx	PowerVault 128T tape autoloader
xx:xx:xx:C0:01:xx:xx:xx	PowerVault 160T tape library and Fibre Channel tape drives
xx:xx:xx:C0:97:xx:xx:xx	PowerVault ML6000 Fibre Channel tape drives

 **CAUTION: When you replace a Fibre Channel HBA in a PowerEdge server, reconfigure your zones to provide continuous client data access. Additionally, when you replace a switch module, reconfigure your zones to prevent data loss or corruption.**

Installing the Storage Management Software

The PowerVault MD3600f and MD3620f storage software installer provides features that include the core software, providers, and optional utilities. The core software feature includes the host-based storage agent, MPIO software, and MDSM application used to configure, manage and monitor the storage array solution. The providers feature includes a provider for the Microsoft Virtual Disk Service (VDS) and Microsoft Volume Shadow-Copy Service (VSS) frameworks.



NOTE: For more information about the Microsoft VDS, Microsoft VSS providers, see the *Dell PowerVault MD3600f and MD3620f Storage Arrays Owner's Manual*.

Follow these steps to install the Storage Management Software:

- 1 Close all other programs before installing any new software.
- 2 Insert the PowerVault MD36x0f resource media.

Depending on the outrun settings of the operating system, the **Dell PowerVault MD36x0f Resource DVD** window may be displayed or a prompt may be displayed to run the **md_launcher.exe** file. If the PowerVault MD launcher is not displayed and there is no prompt to run the **md_launcher.exe** file, navigate to the root of the resource media and run the **md_launcher.exe** file.

- 3 Select **Install MD36x0f Storage Software**.
- 4 Select one of the following installation options:
 - Full (recommended)—This package installs core software, providers, and utilities. It includes the necessary host-based storage agent, MPIO software, MD Storage Manager, providers, and optional utilities.
 - Host Only—This package includes the host-based storage agent, MPIO software, and optional utilities required to configure the host.
 - Management Station—This package includes the MD Storage Manager, providers, and optional utilities.
 - Custom—This option allows you to select specific components.
 - Reboot each host server.

Configuring the Shared Storage System

See Table 1-2 for a list of supported Dell Powervault MD36x0f storage systems. Before you begin configuring your storage system, you must fill out the "Zoning Configuration Form" on page 77. Gathering this type of information about your cluster node, HBAs, and storage before starting the configuration steps helps you complete the process faster.

Automatic Storage Array Discovery

1 Launch MDSM.

The **Enterprise Management** window opens. The **Enterprise Management** window contains the following tabs:

- **Devices** tab—Provides information about the storage arrays.
- **Setup** tab—Presents the initial setup tasks that guide you through adding storage arrays and configuring alerts.

If this is the first storage array to be set up, the **Add New Storage Array** window appears.

2 Select **Automatic** and click **OK**.

It may take several minutes for the discovery process to complete.

You can manage the array by launching the **Array Management** window from the **Enterprise Management** window. The **Array Management** window provides management functions for a single storage array. You can have multiple **Array Management** windows open simultaneously to manage different storage arrays.

To launch the **Array Management** window, click on the **Devices** tab from **Enterprise Management** window, and double-click on the relevant storage array.

Defining a Host

If the Host Context Agent is running on the host, the hosts and the host ports connected to the storage array are automatically detected by MDSM and appear in the **Mappings** tab in the **Array Management** window, under the **Default Group**.

After the storage software is installed, all the hosts should show up. If one host is not detected, it can be manually added:

- 1 In the **Array Management** window, select the **Mappings** tab and select the appropriate storage array.
- 2 Perform the following actions:
 - a Select **Mappings**→**Define**→**Host**.
 - b Select the **Setup** tab and click **Manually Define Hosts**.
 - c Select the **Mappings** tab.

- d Right-click the root node (storage array name), **Default Group** node, or **Host Group** node in the **Topology** pane to which you want to add the host, and select **Define Host** from the pop-up menu.

The **Specify Host Name** window is displayed.

- 3 In **Host name**, enter an up to 30 character alphanumeric name.
- 4 Select the relevant option in **Do you plan to use the storage partitions in the this storage array**, and click **Next**.

The **Specify Host Port Identifiers** window is displayed.

- 5 Select the relevant option to add a host port identifier to the host, you can select:
 - **Add by selecting a known unsolicited host port identifier**—In **Known unsolicited host port identifiers**, select the relevant host port identifier.
 - **Add by creating a new host port identifier**—In **New host port identifier**, enter a 16-character name and an **Alias** for the host port identifier (up to 30 characters only), and click **Add**.



NOTE: The host port identifier name must contain only the letters A through F.

- 6 Click **Next**.

The **Specify Host Type** window is displayed.

- 7 In **Host type**, select the relevant operating system for the host.

The **Host Group Question** window is displayed.

- 8 You can select:
 - **Yes**—this host shares access to the same virtual disks with other hosts.
 - **No**—this host does NOT share access to the same virtual disks with other hosts.

- 9 Click **Next**.

If you select **Yes**, the **Specify Host Group** window is displayed. If you select **No**, go to step 11.

- 10 Enter the name of the host group or select an existing host group and click **Next**.

The **Preview** window is displayed.

11 Click Finish.

Creating a Host Group

A host group is a logical entity of two or more hosts that share access to specific virtual disks on the storage array.

To create host groups:

- 1** In the **Array Management** window, select the **Mappings** tab.
- 2** In the **Topology** pane, select the storage array or the default group.
- 3** Perform one of the following actions:
 - Select **Mappings**→**Define**→**Host Group**.
 - Right-click the storage array or **Default Group** and select **Define**→**Host Group** from the pop-up menu.
- 4** Type the name of the new host group in the **Enter New Host Group Name** field.
- 5** Select the appropriate hosts in the **Select Hosts to Add Area** field and click **Add**.
- 6** Click **OK**. The host group is added to the storage array.

Creating Disk Groups and Virtual Disks

In some cases, the virtual disks may have been bound when the system was shipped. However, it is important that you install the management software and verify that the desired virtual disk configuration exists.

You can manage your virtual disks remotely using PowerVault Modular Disk Storage Manager. A minimum of one virtual disk is required for an active/passive cluster configuration and at least two virtual disks are required for an active/active cluster configuration.

Disk groups are created in the non-configured capacity of a storage array and virtual disks are created in the free capacity of a disk group. The hosts attached to the storage array read and write data to the virtual disks.



NOTE: Before you create virtual disks, you must first organize the physical disks into disk groups and configure host access. You can then create virtual disks within a disk group.

To create a virtual disk, use one of the following methods:

- Automatic configuration
- Manual configuration

Create disk groups using automatic configuration as follows:

- 1 To start the **Create Disk Group Wizard**, perform one of these actions:
 - To create a disk group from unconfigured capacity in the storage array—On the **Logical** tab, select **Unconfigured Capacity** node→ **Disk Group**→ **Create**.
Alternatively, you can right-click the **Unconfigured Capacity** node and select **Create Disk Group** from the pop-up menu.
 - To create a disk group from unassigned physical disks in the storage array—On the **Physical** tab, select one or more unassigned physical disks of the same physical disk type, and select **Disk Group**→ **Create**.
Alternatively, you can right-click the unassigned physical disks, and select **Create Disk Group** from the pop-up menu.
 - To create a secure disk group—On the **Physical** tab, select one or more unassigned security capable physical disks of the same physical disk type, and select **Disk Group**→ **Create**.
Alternatively, you can right-click the unassigned security capable physical disks, and select **Create Disk Group** from the pop-up menu. The **Create Disk Group** window is displayed.
- 2 Click **Next**. The **Disk Group Name and Physical Disk Selection** window is displayed.
- 3 Type a name (up to 30 characters) for the disk group in **Disk Group Name** field.
- 4 Select the appropriate configuration method of Physical Disk selection from the following:
 - Automatic (see step 6)
 - Manual (see step 7)
- 5 Click **Next**.
- 6 For automatic configuration, the **RAID Level and Capacity** window is displayed.

- a Select the appropriate RAID level in the **Select Raid Level** field. You can select RAID levels 0, 1/10, 6, and 5. Depending on your RAID level selection, the physical disks available for the selected RAID level is displayed in the **Select Capacity** table.
 - b In the **Select Capacity** table, select the relevant disk group capacity and click **Finish**.
- 7** For manual configuration, the **Manual Physical Disk Selection** window is displayed.
- a Select the appropriate RAID level in **Select RAID level**. You can select RAID levels 0, 1/10, 6, and 5. Depending on your RAID level selection, the physical disks available for the selected RAID level is displayed in **Unselected Physical Disks** table.
 - b In the **Unselected Physical Disks** table, select the appropriate physical disks and click **Add**.



NOTE: You can select multiple physical disks at the same time by holding <Ctrl> or <Shift> and selecting additional physical disks.

- 8** Click **Calculate Capacity** to view the capacity of the new disk group.
- 9** Click **Finish**. A message is displayed confirming that the disk group is successfully created and that you must create at least one virtual disk before you can use the capacity of the new disk group.

To create virtual disks:

- 1** Choose one of these methods to start the **Create Virtual Disk Wizard**:
 - To create a virtual disk from unconfigured capacity in the storage array—On the **Logical** tab, select an unconfigured capacity node and select **Virtual Disk→ Create**.
Alternatively, right-click the unconfigured capacity node and select **Create Virtual Disk** from the pop-up menu.
 - To create a virtual disk from free capacity on a disk group—On the **Logical** tab, select a free capacity node and select **Virtual Disk→ Create**.
Alternatively, right-click the free capacity node and select **Create Virtual Disk** from the pop-up menu.

- To create a virtual disk from unassigned physical disks in the storage array—On the **Physical** tab, select one or more unassigned physical disks of the same physical disk type, and select **Virtual Disk**→**Create**. Alternatively, right-click the unassigned physical disks, and select **Create Virtual Disk** from the pop-up menu.
- To create a secure virtual disk—On the **Physical** tab, select one or more unassigned security capable physical disks of the same physical disk type, and select **Virtual Disk**→**Create**.

Alternatively, you can right-click the unassigned security capable physical disks and select **Create Virtual Disk** from the pop-up menu.

If you chose an unconfigured capacity node or unassigned physical disks to create a virtual disk:

- a On the **Disk Group Required** window, click **Yes**.
- b Create a disk group by using the **Create Disk Group Wizard**. The **Create Virtual Disk Wizard** is displayed after you create the disk group.

If you chose a free capacity node, the **Create Virtual Disk** window is displayed.

- 2 Click **Next**. The **Specify Capacity/Name** window is displayed.
- 3 Select the appropriate unit for memory from the **Units** drop-down list and enter the capacity of the virtual disk in the **New Virtual Disk Capacity** field.
- 4 Enter a character name (up to 30 characters) for the virtual disk in the **Virtual Disk Name** field.
- 5 In the **Advanced Virtual Disk Parameters** field, you can select:
 - Use recommended settings
 - Customize settings
- 6 Click **Next**.
- 7 In the **Customize Advanced Virtual Disk Parameters** window, select the appropriate Virtual Disk I/O Characteristics type from the following options:
 - File system (typical)
 - Database

- Multimedia
- Custom



NOTE: If you select Custom, you must select an appropriate segment size.

- 8 Select the appropriate Preferred RAID controller module.

For more information on creating disk groups and virtual disks, see the *Dell PowerVault Modular Disk Storage Manager User's Guide* at support.dell.com/manuals.

It is recommended that you create at least one virtual disk for each application. If multiple NTFS volumes are created on a single virtual disk using **Windows Disk Management**, the volumes failover together, rather than individually from node-to-node.



NOTE: It is recommended that you use a RAID level other than RAID 0 (which is commonly called striping). RAID 0 configurations provide very high performance, but do not provide the level of availability required for the quorum resource. See the documentation for your storage system for more information about setting up RAID levels for the system.

Creating Host-to-Virtual Disk Mappings

Create host-to-virtual disk mappings to assign virtual disks to the host groups containing cluster nodes as follows:

- 1 In the **Array Management** window, select the **Mappings** tab.
- 2 In the **Topology** pane, select:
 - Default Group
 - Undefined Mappings Node
 - Individual Defined Mapping
 - Host Group
 - Host
- 3 In the tabular, select **Mappings**→**Define**→**Additional Mapping**. The **Define Additional Mapping** window is displayed.
- 4 Select the appropriate host group from the **Host Group** or **Host** field.
- 5 In **Logical Unit Number** field, select a LUN. The supported LUNs are 0 through 255.

6 Select the virtual disk to be mapped in the **Virtual Disk** section. The **Virtual Disk** section lists the names and capacity of the virtual disks that are available for mapping based on the selected host group or selected host.

7 Click **Add**.



NOTE: The **Add** button is inactive until a host group or host, LUN, and virtual disk are selected.

8 To define additional mappings, repeat step 4 through step 7.



NOTE: After a virtual disk has been mapped once, it is no longer available in the **Virtual Disk** area.

9 Click **Close**. The mappings are saved. The **Topology** pane and the **Defined Mappings** pane in the **Mappings** tab are updated to display the mappings.

Troubleshooting Tools

The Dell PowerVault MDSM establishes communication with each managed array and determines the current array status. When a problem occurs on a storage array, the MDSM provides several ways to troubleshoot the problem.

Event Log

You can use the Event Log Viewer to view a detailed list of events that occur in a storage array. The event log is stored on reserved areas on the storage array disks. It records configuration events and storage array component failures.



CAUTION: Use this option only under the guidance of your Technical Support representative.

The event log stores approximately 8000 events before it replaces an event with a new event. If you want to keep a record of the events, you may save them or clear them from the event log.

The **Event Log** window shows the following types of event views:

- Summary view—Shows an event summary in a table form.
- Detail view—Shows details about a selected event.

To view the event log:

- 1 In the **Array Management** window, select **Advanced**→**Troubleshooting**→**View Event Log**. The **Event Log** is displayed. By default, the summary view is displayed.

- 2 Select **View Details** to view the details of each selected log entry. A **Detail** pane is added to the event log that contains information about the log item. You can view the details of a single log entry at a time.
- 3 To save the event log:
 - a Click **Save As**. The **Save Events** dialog box is displayed.
 - b Navigate to the relevant folder and enter the relevant file name.
 - c Click **Save**.
- 4 Click **Clear All** to erase all log entries from the event log.
- 5 Click **Close** to exit the event log.

For more information, see the PowerVault Modular Disk Storage Manager online help topics.

Recovery Guru

The Recovery Guru is a component of MDSM that diagnoses critical events on the storage array and recommends step-by-step recovery procedures to resolve problems.

To display the **Recovery Guru** window in the **Array Management** window, perform one of the following actions:

- Click **Recovery Guru**.
- On the **Support** tab, click **Recover from Failure**.
- From the **Status** pane on the **Summary** tab, click **Storage Array Needs Attention**.

You can detect a problem using the following indicators:

- Non-Optimal status icons
- Alert notification messages that are sent to the appropriate destinations
- Hardware indicator lights

The status icons return to **Optimal** status when problems are resolved.


Storage Profile

The storage array profile provides a description of all components and properties of the storage array. The storage array profile also provides the option to save the storage array profile information in a text file. You can also

use the storage array profile as an aid during recovery or as an overview of the current configuration of the storage array. Create a new copy of the storage array profile if your configuration changes.

- 1 To open the storage array profile in the **Array Management** window, perform one of the following actions:
 - Select **Storage Array**→**View**→**Profile**.
 - Select the **Summary** tab and click **Storage Array Profile** in the **Status** area.
 - Select the **Support** tab and click **View Storage Array Profile**.

The **Storage Array Profile** screen is displayed. The **Storage Array Profile** screen contains several tabs, and the title of each tab corresponds to the subject of the information contained.

- 2 Perform one of these actions in the **Storage Array Profile** screen:
 - View detailed information (Go to step 3).
 - Search the storage array profile (Go to step 4).
 - Save the storage array profile (Go to step 5).
 - Close the storage array profile (Go to step 6).
- 3 Select one of the tabs, and use the horizontal scroll bar and the vertical scroll bar to view the storage array profile information. You can use other steps in this procedure to search the storage array profile, to save the storage array profile, or to close the storage array profile.
- 4 To search the storage array profile:
 - a Click **Find**.
 - b In the **Find** text box, type the term that you want to search. If the term is located on the current tab, it is highlighted in the storage array profile information.
 **NOTE:** The search is limited to the current tab. If you want to search for the term in other tabs, select the tab and click **Find** again.
 - c Click **Find** again to search for additional occurrences of the term.
- 5 To save the storage array profile:
 - a Click **Save As**.
 - b To save all sections of the storage array profile, select **All Sections**.

- c To save information from particular sections of the storage array profile, select the **Select Sections** option and click on the check boxes corresponding to the sections that you want to save.
- d Select an appropriate directory.
- e In **File Name** field, type a file name of your choice. To associate the file with a particular software application that opens it, specify a file extension, for example **.text**.



NOTE: The file is saved as ASCII text.

- f Click **Save**.
- 6 To exit the storage array profile, click **Close**.

Status Icons

Status icons identify the six possible health status conditions of the storage array. For every non-optimal status icon, use the Recovery Guru to detect and troubleshoot the problem. The six possible health status conditions are described below:

- **Optimal**—Every component in the managed array is in the desired working condition.
- **Needs Attention**—A problem exists with the managed array that requires intervention to correct it.
- **Fixing**—The *Needs Attention* condition has been corrected and the managed array is currently changing to an *Optimal* status.
- **Unresponsive**—The storage management station cannot communicate with the array, one controller, or both controllers in the storage array. Wait at least five minutes for the storage array to return to an *Optimal* status following a recovery procedure.
- **Unsupported**—The node is not supported by this version of MDSM.
- **Software Unsupported**—The storage array is running a level of software that is no longer supported by MDSM.

Configuring the RAID Level for the Shared Storage Subsystem

The virtual disks in your shared storage subsystem must be configured into disk groups or virtual disks using the Dell PowerVault MDSM software. All virtual disks, especially if they are used for the quorum resource, must be bound and must incorporate the appropriate RAID level to ensure high availability.



NOTE: It is recommended that you use a RAID level other than RAID 0 (which is called striping). RAID 0 configurations provide very high performance, but do not provide the level of availability required for the quorum resource. See the documentation for your storage system for more information about setting up RAID levels for your system.

Windows Operating System and Dynamic Volumes

The Windows operating system does not support dynamic disks (upgraded disks) or volumes as shared cluster storage. If the shared cluster storage is configured as a dynamic disk, the Cluster Configuration wizard is not able to discover the disks, preventing the cluster and network clients from accessing the disks.

Assigning Drive Letters and Mount Points

A mount point is a drive attached to an empty folder on an NTFS volume. A mount point functions the same as a normal drive but is assigned a label or name instead of a drive letter. Using mount points, a cluster can support more shared disks than the number of available drive letters.

The cluster installation procedure does not automatically add the mount point into the disks managed by the cluster. To add the mount point to the cluster, create a physical disk resource in the cluster resource group for each mount point. Ensure that the new physical disk resource is in the same cluster resource group and is dependent on the root disk (that is, the disk from which the mount point is attached).



NOTE: When mounting a drive to an NTFS volume, do not create mount points from the quorum resource or between the clustered disks and the local disks. Mount points must be in the same cluster resource group and must be dependent on the root disk.

Naming and Formatting Drives on the Shared Storage System

Each virtual disk being created in the PowerVault Modular Disk Storage Manager becomes a physical disk in Windows Disk Management. For each physical disk, perform the following:

- Write the disk signature
- Create the partition
- Assign the drive letter
- Format the partition with NTFS



CAUTION: The drive letters are manually assigned from the second node, the shared disks are simultaneously accessible from both nodes. To ensure file system integrity and prevent possible data loss before you install the Microsoft Failover Clustering software, prevent any I/O activity to the shared drives by performing the following procedure on one node at a time and ensuring that the other node is shut down.

The number of drive letters required by individual servers in a cluster may vary. It is recommended that the shared drives be named in reverse alphabetical order beginning with the letter z. To assign drive letters and format drives on the shared storage system, perform the following steps:

- 1 Turn off node 2 and open **Disk Management** on node 1.
- 2 Allow Windows to enter a signature on all new physical or logical drives.



NOTE: Do not upgrade or convert your disks to dynamic disks.

- 3 Locate the icon for the first unnamed, unformatted drive on the shared storage system.
- 4 Right-click the icon and select **Create** from the submenu. If the unformatted drives are not visible, verify the following:
 - The zoning is correct (for SAN-attached configurations only)
 - The LUNs have been assigned to the hosts.
 - The storage system is properly cabled to the servers.
- 5 In the dialog box, create a partition with the size of the entire drive (the default) and then click **OK**.



NOTE: A virtual disk that is mapped or assigned from the storage system to a cluster node(s) is represented as a physical disk within the Windows operating system on each node. Microsoft Cluster allows only one node to

access a given physical disk resource at a time. Therefore, if a disk is partitioned and contains multiple NTFS volumes, concurrent access to different volumes is only possible from the cluster node controlling the physical disk resource. If two NTFS volumes need to be controlled by different nodes, these volumes must reside on separate disks.

- 6 Click **Yes** to confirm the partition.
- 7 With the mouse pointer on the same icon, right-click and select **Change Drive Letter and Path** from the submenu.
- 8 Assign a drive letter to an NTFS volume or create a mount point.

To assign a drive letter to an NTFS volume:

- a Click **Edit** and select the letter you want to assign to the drive (for example, z).
- b Click **OK**.
- c Go to step 9.

To create a mount point:

- a Click **Add**.
- b Click **Mount** in the following empty NTFS folder.
- c Type the path to an empty folder on an NTFS volume, or click **Browse** to locate it.
- d Click **OK**.
- e Go to step 9.

- 9 Click **Yes** to confirm the changes.
- 10 Right-click the drive icon again and select **Format** from the submenu.
- 11 Under **Volume Label**, enter a descriptive name for the new volume; for example, `Disk_Z` or `Email_Data`.
- 12 In the dialog box, change the file system to **NTFS**, select **Quick Format**, and click **Start**.



NOTE: The NTFS file system format is required for shared-disk resources under Microsoft Cluster.

- 13 Click **OK** at the warning.
- 14 Click **OK** to acknowledge that the format is complete.
- 15 Click **Close** to close the dialog box.

- 16 Repeat step 3 through step 15 for each remaining drive.
- 17 Close **Disk Management**.
- 18 Turn off node 1.
- 19 Turn on node 2.
- 20 On node 2, open **Disk Management**.
- 21 Ensure that the drive letters for node 2 are correct and re-assign the drive letters, if necessary. To re-assign the drive letters, repeat step 7 through step 9.

Using Advanced (Premium) PowerVault Modular Disk Storage Manager Features

PowerVault Modular Disk Storage Manager includes the following advanced features:


- Snapshot Virtual Disk
- Virtual Disk Copy
- The High Performance Tier
- Remote Replication

To install and enable these premium features, you must purchase a feature key file for each feature and specify the storage array that must host them. For more information, see the *Premium Feature Activation* card that shipped along with your Dell PowerVault MD3600f or MD3620f storage system.

These premium features increase the high availability for your cluster solution. It is essential that you follow the instructions below to ensure proper cluster operations.

Snapshot Virtual Disk


Snapshot Virtual Disk captures point-in-time images of a virtual disk for backup, testing, or data processing without affecting the contents of the source virtual disk. You can use either Simple Path or Advanced Path to create a snapshot for your cluster disk. The Snapshot Virtual Disk can be mapped to the primary node (the node owning the source disk) or the secondary node (the node not owning the source disk) for backup, testing, or data processing.

 **CAUTION: Avoid mapping the Snapshot Virtual Disk to more than one node in the cluster at any point of time. The Snapshot Virtual Disk is not managed by Failover Cluster Manager, so mapping the Snapshot Virtual Disk to the host group or both nodes in the cluster may allow both nodes to access data concurrently and thus cause data corruption.**

You can use a Microsoft Volume Shadow-copy Service (VSS) application to create and map snapshots. If you are using MDSM instead, you must follow the procedures described below.

To map the Snapshot Virtual Disk to the primary node:


- 1 Use Host-to-Virtual Disk Mapping in the Modular Disk Storage Manager. This ensures that a different disk signature is assigned properly to the Snapshot Virtual Disk.
- 2 Use Windows Disk Management to re-scan for the Snapshot Virtual Disk, assign the drive letter, and start accessing the drive.

 **NOTE:** The disks may be re-scanned several times for the Snapshot Virtual Disk to be detected by Windows Disk Management. If the Snapshot Virtual Disk is not detected, wait for a few minutes and re-scan the disks. Repeat the process until the Snapshot Virtual Disk is detected; do not reboot the server.

To map the Snapshot Virtual Disk to the secondary node (the node not owning the source disk):

 **CAUTION: Attempts to map the Snapshot Virtual Disk to the secondary node, prior to obtaining the signature from the primary node, may cause the operating system to misidentify the Snapshot Virtual Disk as an existing system volume and that may result in data loss or an inaccessible Snapshot Virtual Disk.**

- 1 Map the Snapshot Virtual Disk to the primary node to ensure that the snapshot is assigned a new disk signature.
- 2 Use Modular Disk Storage Manager to unmap the Snapshot Virtual Disk from the primary node.
- 3 Map the Snapshot Virtual Disk to the secondary node and start accessing it.

 **NOTE:** For a cluster configuration with multiple Snapshot Virtual Disks, each virtual disk must be mapped to the node owning the associated source disk first. The primary node for a Snapshot Virtual Disk may not be the primary node for another Snapshot Virtual Disk.

Virtual Disk Copy

Virtual Disk Copy generates a full copy of data from the source virtual disk to the target virtual disk in a storage array. You can use Virtual Disk Copy to back up data, copy data from disk groups that use smaller-capacity physical disks to disk groups using greater-capacity physical disks, or restore Snapshot Virtual Disk data to the source virtual disk.

To create a Virtual Disk Copy of a Microsoft Cluster shared disk:

- 1 Create a Snapshot Virtual Disk using the cluster shared disk as a source disk.
- 2 Do not map that Snapshot Virtual Disk to any cluster node. Then, use the newly created Snapshot Virtual Disk as the source disk for the Virtual Disk Copy.



NOTE: When you attempt to create a Virtual Disk Copy of a Microsoft Cluster shared disk directly, the operation fails and the following error is displayed:

The operation cannot complete because the selected virtual disk is not a source virtual disk candidate.

If the cluster shared disk fails and you want to restore it from the target virtual disk, use Failover Cluster Manager to change the status of the cluster group containing the failed disk to offline. Use one of the following methods:

- Use Virtual Disk Copy to transfer the data from the target virtual disk to the cluster shared disk.
- Unassign the cluster shared disk from the host group and map the target virtual disk to the host group.

Remote Replication

Remote Replication is a storage array premium feature that provides online, real-time replication of data between storage arrays. When this feature is activated, a dedicated port (port 3) on each RAID controller is reserved exclusively for Remote Replication traffic. No other data traffic is allowed on that port until the Remote Replication feature is deactivated. A dedicated zone on each Fibre Channel switch is also required. For cabling examples, configurations, host bus adapter (HBA) installation and zoning, see *Configuring Fibre Channel with the Dell MD3600f Series Storage Array* at support.dell.com/manuals.

Configuring a Failover Cluster

You can configure the operating system services on your Windows Server failover cluster after you have established the private and public networks and assigned the shared disks from the storage array to the cluster nodes. The procedures for configuring the failover cluster are different depending on the Windows Server operating system you use.

For more information on deploying your cluster, see the *Dell Failover Clusters with Microsoft Windows Server 2008 Installation and Troubleshooting Guide* at support.dell.com/manuals.

Troubleshooting

Table A-1 describes the general cluster problems, the probable causes, and solutions for each problem.

Table A-1. General Cluster Troubleshooting

Problem	Probable Cause	Corrective Action
The nodes cannot access the storage system, or the cluster software is not functioning with the storage system.	The storage system is not cabled properly to the nodes or the cabling between the storage components is incorrect.	Ensure that the cables are connected properly from the node to the storage system. For more information, see "Cabling Your Cluster Hardware" on page 19.
	One of the cables is faulty.	Replace the faulty cable.
	Host Group or Host-to-Virtual Disk Mappings is not created correctly.	Verify the following: <ul style="list-style-type: none"> • Host Group is created and the cluster nodes are added to the Host Group. • Host-to-Virtual Disk Mapping is created and the virtual disks are assigned to the Host Group containing the cluster nodes.

Table A-1. General Cluster Troubleshooting (continued)

Problem	Probable Cause	Corrective Action
One of the nodes takes a long time to join the cluster. Or One of the nodes fails to join the cluster.	The node-to-node network has failed due to a cabling or hardware failure. Long delays in node-to-node communications may be normal. One or more nodes may have the Internet Connection Firewall enabled, blocking Remote Procedure Call (RPC) communications between the nodes.	Check the network cabling. Ensure that the node-to-node interconnection and the public network are connected to the correct NICs. Verify that the nodes can communicate with each other by running the ping command from each node to the other node. Try both the host name and IP address when using the ping command. Configure the Internet Connection Firewall to allow communications that are required by the Microsoft Failover Clustering and the clustered applications or services. For more information, see the Microsoft Knowledge Base article KB883398 at support.microsoft.com .

Table A-1. General Cluster Troubleshooting (continued)

Problem	Probable Cause	Corrective Action
Attempts to connect to a cluster using Failover Cluster Manager fail.	<ul style="list-style-type: none">• The Cluster Service has not been started.• A cluster has not been formed on the system.• The system has just booted and services are still starting.	Verify that Cluster Service is running and that a cluster has been formed.
	The cluster network name is not responding on the network because the Internet Connection Firewall is enabled on one or more nodes	Configure the Internet Connection Firewall to allow communications that are required by Microsoft Cluster and the clustered applications or services. For more information, see the Microsoft Knowledge Base article KB883398 at support.microsoft.com
You are prompted to configure one network instead of two during Microsoft Failover Cluster installation.	The TCP/IP configuration is incorrect.	The node-to-node network and public network must be assigned static IP addresses on different subnets. For more information about assigning the network IPs, see "Assigning Static IP Addresses to Your Cluster Resources and Components" in the <i>Dell Failover Clusters with Microsoft Windows Server 2008 Installation and Troubleshooting Guide</i> at support.dell.com/manuals .
	The private (point-to-point) network is disconnected.	Ensure that all systems are powered on so that the NICs in the private network are available.

Table A-1. General Cluster Troubleshooting (continued)

Problem	Probable Cause	Corrective Action
Unable to add a node to the cluster.	The new node cannot access the shared disks.	Ensure that the new cluster node can enumerate the cluster disks using Windows Disk Administration. If the disks do not appear in Disk Administration, check the following: <ul style="list-style-type: none">• All cable connections.• The Access Control settings on the attached storage systems.
	One or more nodes may have the Internet Connection Firewall enabled, blocking RPC communications between the nodes.	Configure the Internet Connection Firewall to allow communications that are required by the Microsoft Cluster and the clustered applications or services. For more information, see the Microsoft Knowledge Base article KB883398 at support.microsoft.com .
Public network clients cannot access the applications or services that are provided by the cluster.	One or more nodes may have the Internet Connection Firewall enabled, blocking RPC communications between the nodes.	Configure the Internet Connection Firewall to allow communications that are required by the Microsoft Cluster and the clustered applications or services. For more information, see the Microsoft Knowledge Base article KB883398 at support.microsoft.com .
Virtual Disk Copy operation fails.	The Virtual Disk Copy operation uses the cluster disk as the source disk.	Perform a Virtual Disk Copy operation on the cluster share disk: <ol style="list-style-type: none">1 Create a snapshot of the disk.2 Perform a Virtual Disk Copy of the snapshot virtual disk.

Table A-1. General Cluster Troubleshooting (continued)

Problem	Probable Cause	Corrective Action
Unable to assign the drive letter to the snapshot virtual disk. Unable to access the snapshot virtual disk. System Error Log displays a warning with event 59 from <code>partmgr</code> stating that the snapshot virtual disk is a redundant path of a cluster disk.	The snapshot virtual disk has been erroneously mapped to the node that does not own the source disk.	1 Unmap the snapshot virtual disk from the node not owning the source disk. 2 Assign it to the node that owns the source disk. For more information, see "Using Advanced (Premium) PowerVault Modular Disk Storage Manager Features" on page 63.

Cluster Data Form

You can attach the following form in a convenient location near each cluster node or rack to record information about the cluster. Use the form when you call for technical support.

Table B-1. Cluster Configuration Information

Cluster Information	Cluster Solution
Cluster name and IP address	
Server type	
Installer	
Date installed	
Applications	
Location	
Notes	

Table B-2. Cluster Node Configuration Information

Node Name	Service Tag Number	Public IP Address	Private IP Address

Table B-3. Additional Network Information

Additional Networks

Table B-4. Storage Array Configuration Information

Array	Array Service Tag	IP Address	Number of Attached Disk Array Enclosures (DAEs)	Virtual Disks
1				
2				
3				
4				

Zoning Configuration Form

Node	HBA WWPNS or Alias Names	Storage WWPNS or Alias Names	Zone Name	Zone Set for Configuration Name

FILE LOCATION:

C:\Users\philip_john\Documents\HA_Clusters_Compellent\FalconHead\Sources\appC.fm

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