Dell PowerVault MD3200i and MD3220i 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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1

Introduction

This document provides information for installing and managing your Cluster solution using Dell PowerVault MD3200i and MD3220i storage systems. It is intended for experienced IT professionals who need to configure the cluster solution, and for trained service technicians who perform upgrade and maintenance procedures. This document also addresses readers who are new to clustering.

Overview

A Microsoft Windows Server Failover Clustering combines specific hardware and software components to provide enhanced availability for applications and services that are 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 MD3200i and MD3220i iSCSI 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 Windows Server 2008 x64 Enterprise Edition or Windows Server 2008 R2 x64 Enterprise Edition.

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

- Internet Small Computer System Interface (iSCSI) 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 iSCSI technology in a cluster provides the following advantages:

- **Flexibility**—as iSCSI is based on TCP/IP, it allows cluster nodes and storage systems to be located at different sites.
- **Availability**—iSCSI components use redundant connections, providing multiple data paths and greater availability for clients.
- **Connectivity**—iSCSI allows more device connections than SCSI. Because iSCSI 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.
iSCSI Initiator	Complete installation of the iSCSI port driver, Initiator Service, and Software Initiator on each node. **NOTE:** Microsoft Multipath I/O (MPIO) Multipathing Support for iSCSI is not installed.
Network Interface Cards (NICs) for iSCSI access	Two iSCSI NICs or NIC ports per node. Place the NICs on separate PCI buses to improve availability and performance. TCP/IP Offload Engine (TOE) NICs are also supported for iSCSI traffic. 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**.

Table 1-1. Cluster Node Requirements *(continued)*

Component	Minimum Requirement
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.

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	One Dell PowerVault MD3200i or MD3220i RAID enclosure. Up to seven Dell PowerVault MD1200 and MD1220 expansion enclosures with a maximum of 96 disks.
Power and cooling requirements	Two integrated hot-swappable power supply/cooling fan modules.
Physical disks	At least two physical disks in the PowerVault MD3200i or MD3220i RAID enclosure.
Multiple clusters and stand-alone systems	In a switch-attached configuration, clusters and stand-alone systems can share one or more PowerVault MD3200i or MD3220i systems.

NOTE: RAID 0 and independent disks are possible 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 MD3200i and MD3220i RAID enclosures. You can use Dell PowerVault Modular Disk Storage Manager (MDSM) to perform tasks such as creating or managing RAID arrays, binding virtual disks, 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 of installation, configuration, management, and performing 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 Software

Multipath I/O software (also referred to as the failover driver) is a software residing on each cluster node that provides management of the redundant data path between the system and the RAID enclosure. For the multipath software to correctly manage a redundant path, the configuration must provide for redundant NICs and cabling.

The multipath 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 multipath software automatically re-routes I/O requests to the alternate path so that the storage array continues to operate without interruption.

Advanced Features

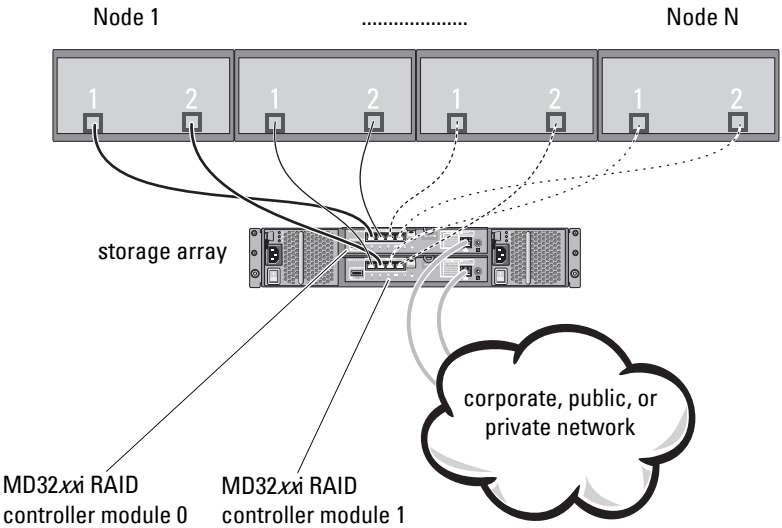
Advanced features for the PowerVault MD3200i and MD3220i RAID storage systems include:

- **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.

NOTE: For instructions on deploying the correct options in the cluster environment, see "Using Advanced (Premium) PowerVault Modular Disk Storage Manager Features" on page 61.

Supported Cluster Configurations

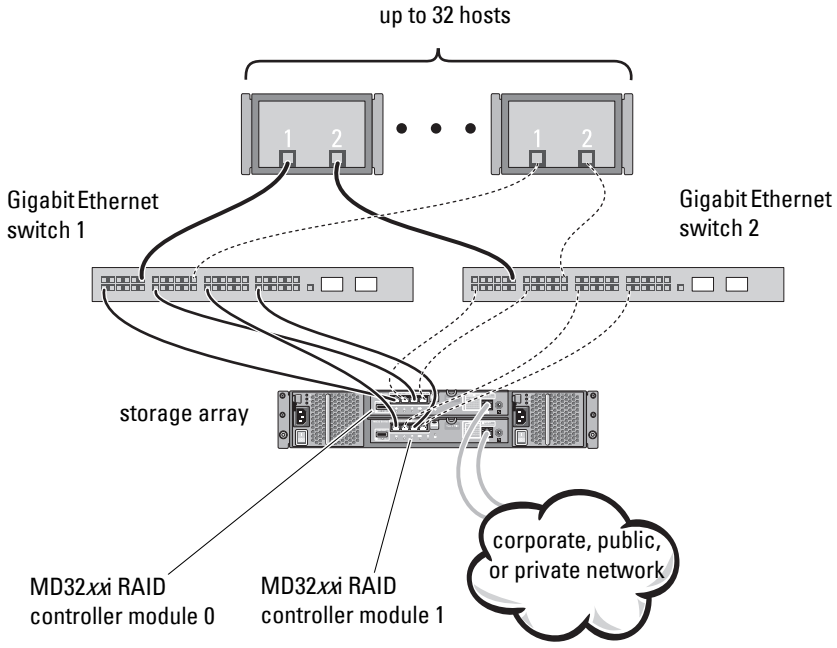
Figure 1-1. Direct-Attached Cluster Configuration



NOTE: The configuration can have up to four nodes (N is either 2, 3, or 4). The nodes can be:

- one cluster
- two different clusters
- one cluster and stand-alone server(s)

Figure 1-2. Redundant Network-Attached Cluster Configuration



NOTE: The configuration can have up to 32 nodes. The nodes can be:

- one cluster (up to 16 nodes)
- multiple clusters
- multiple cluster(s) and stand-alone server(s)

Other Documents You May Need

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

NOTE: To configure Dell blade system modules in a Dell PowerEdge Cluster, see the *Using Dell Blade Servers in a Dell PowerEdge High Availability Cluster* document at **support.dell.com/manuals.**

- 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.
- The *Dell PowerVault MD3200i and MD3220i RAID Enclosures Owner's Manual* provides instructions for using the array management software to configure RAID systems.
- Documentation for any components you purchased separately provides information to configure and install those options.
- The Dell PowerVault tape library documentation provides information for 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 MD3200i and MD3220i Owner's Manual* provides information about the hardware enclosure.

- The *PowerVault Modular Disk Storage Manager CLI Guide* provides information about using the CLI.
- The *Dell PowerVault MD3200i and MD3220i Resource* DVD provides documentation for configuration and management tools, as well as the full documentation set included here.
- The *Dell PowerVault MD Getting Started Guide* provides an overview of setting up and cabling your storage array.
- The *Dell PowerVault MD3200i and MD3220i Storage Arrays Deployment Guide* provides installation and configuration instructions to configure the storage system for initial use.
- 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.

2

Cabling Your Cluster Hardware

The following sections provide information on how to cable 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

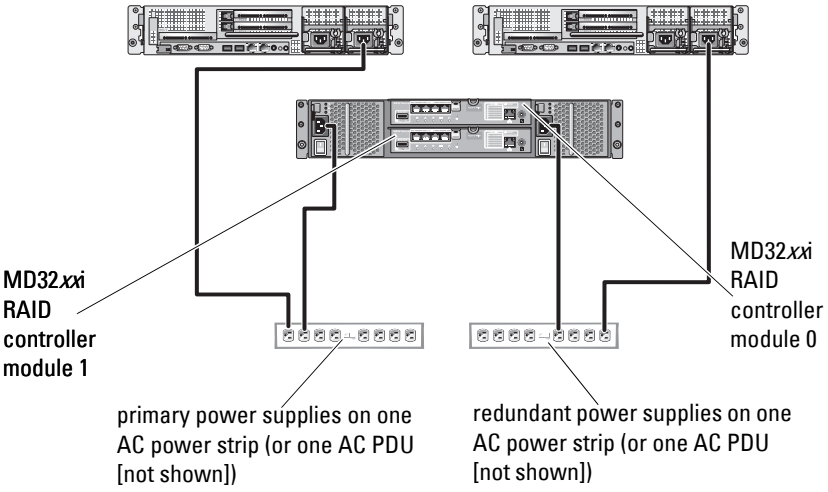
To ensure that the specific power requirements are satisfied, see the documentation for each component in your cluster solution.

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.

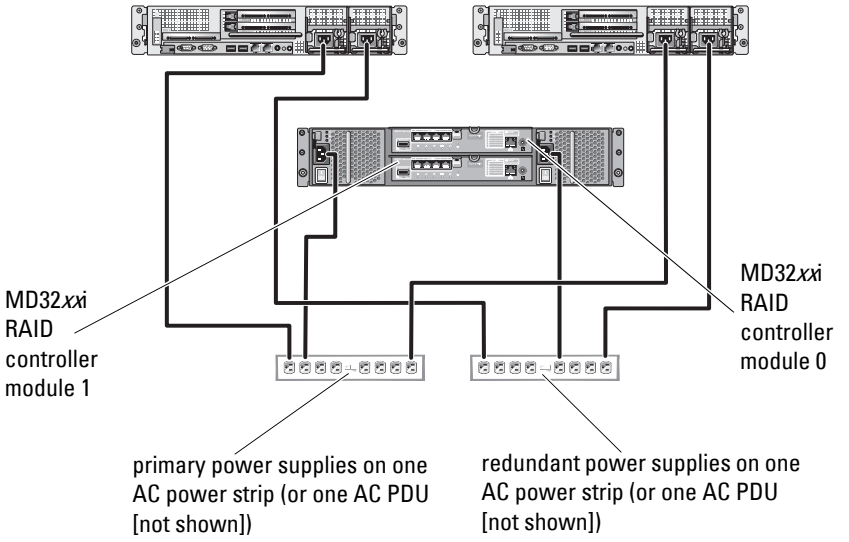
Figure 2-1 and Figure 2-2 illustrate recommended methods for power cabling of a cluster solution consisting of two Dell PowerEdge systems and one storage system. To ensure redundancy, the primary power supplies of all the components are grouped onto one or two circuits and the redundant power supplies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

Figure 2-1. Power Cabling Examples With One Power Supply in the PowerEdge Systems



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

Figure 2-2. Power Cabling Example With Two Power Supplies in the PowerEdge Systems



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

Cabling Your Public and Private Networks

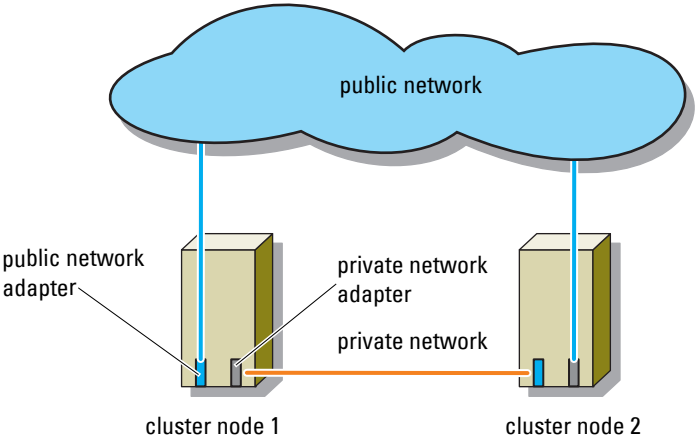
The network adapters in the cluster nodes provide at least two network connections for each node. These connections are described in Table 2-1.

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.
	See your Microsoft Failover Clustering documentation for more information on private network redundancy.

Figure 2-3 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 2-3. 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.

You must use the same brand of NICs in a team, and you cannot mix brands of teaming drivers.

Cabling the Storage Systems

This section provides information for connecting your cluster to a storage system.

NOTE: To configure Dell blade system modules in a Dell PowerEdge Cluster, see *Using Dell Blade Servers in a Dell PowerEdge High Availability Cluster* at **support.dell.com/manuals**.

NOTE: For more details on storage hardware settings and descriptions, see *Dell PowerVault MD3200i and MD3220i RAID Enclosure Owner's Manual* at **support.dell.com/manuals**.

Storage management can be either in-band through the host-to-controller interface or out-of-band using an Ethernet connection. For out-of-band storage management, cable the Ethernet ports on the storage array to the public network.

NOTE: It is recommended that you configure your Dell PowerVault MD3200i and MD3220i to use out-of-band management.

Cabling the Cluster in Direct-Attached Configuration

In the direct-attached configuration, each cluster node is directly attached to the PowerVault MD3200i or MD3220i RAID controller modules using two network cables, and either one dual-port NIC or two single-port NICs.

If a component fails in the storage path such as the port, the cable, or the storage controller, the multipath 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 NICs provides higher availability; a NIC failure does not cause failover cluster to move cluster resources to the other cluster node.

To cable the cluster:

1. Connect cluster node 1 to the storage system:
   a. Install a network cable from the cluster node 1 iSCSI NIC 1 (or NIC port 1) to the RAID controller module 0 port In-0.

b Install a network cable from the cluster node 1 iSCSI NIC 2 (or NIC port 2) to the RAID controller module 1 port In-1.

2 Connect cluster node 2 to the storage system:

a Install a network cable from the cluster node 2 iSCSI NIC 1 (or NIC port 1) to the RAID controller module 1 port In-0.

b Install a network cable from the cluster node 2 iSCSI NIC 2 (or NIC port 2) to the RAID controller module 0 port In-1.

3 If applicable, connect node 3 to the storage system. Node 3 can be either cluster node 3 of the only cluster in the configuration, cluster node 1 of the second cluster, or a stand-alone server.

a Install a network cable from the cluster node 3 iSCSI NIC 1 (or NIC port 1) to the RAID controller module 0 port In-2.

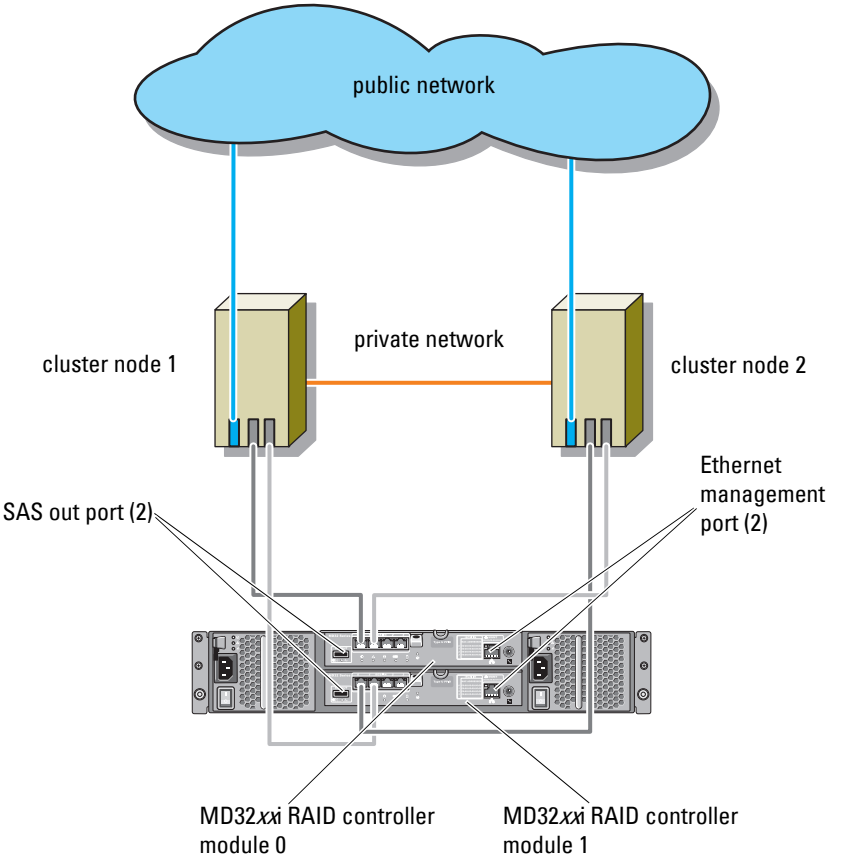
b Install a network cable from the cluster node 3 iSCSI NIC 2 (or NIC port 2) to the RAID controller module 1 port In-3.

4 If applicable, connect node 4 to the storage system. Node 4 can be either cluster node 4 of the only cluster in the configuration, cluster node 2 of the second cluster, or a stand-alone server.

a Install a network cable from the cluster node 4 iSCSI NIC 1 (or NIC port 1) to the RAID controller module 1 port In-2.

b Install a network cable from the cluster node 4 iSCSI NIC 2 (or NIC port 2) to the RAID controller module 0 port In-3.

Figure 2-4. Direct-Attached Cluster Configuration



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

Cabling the Cluster in Network-Attached Configuration

In the network-attached configuration, each cluster node attaches to the storage system using redundant IP storage area network (SAN) industry-standard 1 Gb Ethernet switches, and either with one dual-port iSCSI NIC or two single-port iSCSI NICs. If a component fails in the storage path such as the iSCSI NIC, the cable, the switch, or the storage controller, the multipath 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 NICs provides higher availability; a NIC failure does not cause Microsoft Failover Cluster to move cluster resources to the other cluster node.

This configuration can support up to 32 hosts simultaneously. Examples of this configuration are:

- One cluster.
- Two clusters.
- One eight-node cluster, two two-node clusters, and one stand-alone system.

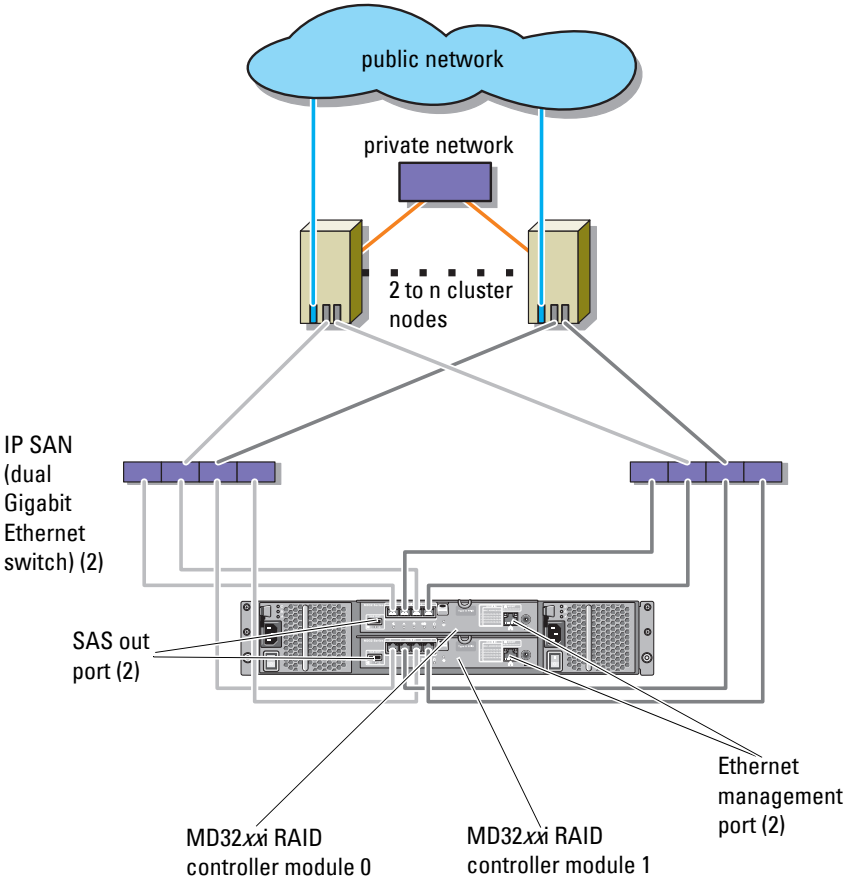
To cable the cluster:

1. Connect the storage system to the iSCSI network:
   a. Install a network cable from switch 1 to controller 0 port In-0.
   b. Install a network cable from switch 1 to controller 1 port In-0.
   c. Install a network cable from switch 2 to controller 0 port In-1.
   d. Install a network cable from switch 2 to controller 1 port In-1.
   e. Install a network cable from switch 1 to controller 0 port In-2.
   f. Install a network cable from switch 1 to controller 1 port In-2.
   g. Install a network cable from switch 2 to controller 0 port In-3.
   h. Install a network cable from switch 2 to controller 1 port In-3.
2. Connect the cluster to the iSCSI network:
   a. Install a network cable from the cluster node 1 iSCSI NIC 1 (or NIC port 1) to the network switch 1.
   b. Install a network cable from the cluster node 1 iSCSI NIC 2 (or NIC port 2) to the network switch 2.

c Repeat step a and step b for each additional cluster node.

3 Repeat step 2 to connect additional clusters or stand-alone systems to the iSCSI network.

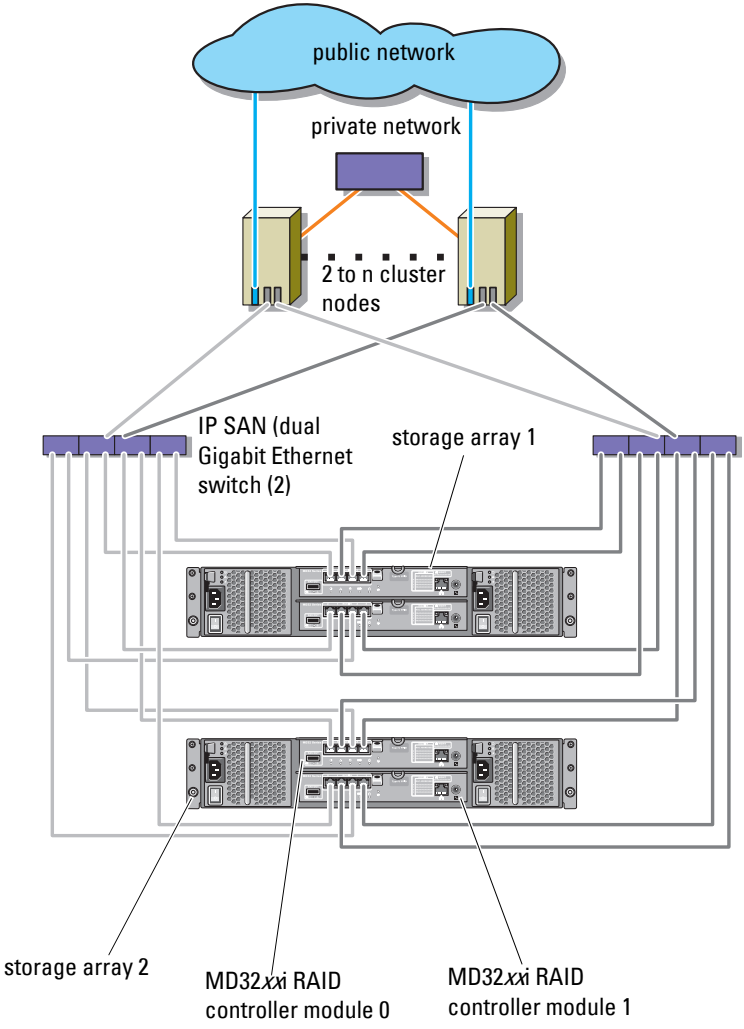
Figure 2-5. Network-Attached Cluster Configuration



Connecting a PowerEdge Cluster to Multiple PowerVault MD3200i or MD3220i Storage Systems

You can increase your cluster storage capacity by attaching multiple storage systems to your cluster using redundant network switches. The PowerEdge cluster systems support configurations with multiple PowerVault MD3200i or MD3220i 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 2-6. Network-Attached Cluster Configuration With Multiple Storage Arrays



When attaching multiple PowerVault MD3200i and MD3220i storage systems with your cluster, the following rules apply:

- A maximum of four Power Vault MD3200i and MD3220i 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.
- Windows limits access to drives using limited drive letters which is 22. Because drive letters A through D are reserved for local disks, a maximum of 22 drive letters (E to Z) can be used for your storage system disks.
- Windows Server 2008 Enterprise Edition supports mount points, allowing greater than 22 drives per cluster.

3

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 computer for complete information about safety precautions, working inside the computer, 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 (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 Multipath I/O drivers (MPIO)) 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 71 and the iSCSI configuration information in the worksheet located at "iSCSI Configuration Worksheet" on page 73.

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 31.

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 31.

10 Configure roles for cluster networks. Take any network interfaces that are used for iSCSI storage (or for other purposes outside of the cluster) 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 MD3200i or MD3220i storage array(s), and to present disks from the storage array to the cluster:

1. Installing the iSCSI NICs.
2. Installing the Microsoft iSCSI Software Initiator.
3. Installing and Configuring the Storage Management Software.
4. Configuring the Shared Storage System.
5. Configuring a Failover Cluster.

Installing the iSCSI NICs

It is recommended that you install the latest supported version of the driver. If the NIC driver requires any service packs or hotfixes to be installed along with the operating system, install them at this time.

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**.

Enabling TOE NIC

The purpose of TOE is to take the TCP/IP packets to be processed by the system processor(s) and offload them on the NIC. The TOE eliminates the bottlenecks with applications that generate significant network traffic, freeing up CPU cycles, and the amount of available main memory bandwidth. TOE NICs provide increased performance for iSCSI traffic.

NOTE: All the nodes in a cluster solution must use similar NICs (TOE NICs or regular NICs) for iSCSI traffic. Combining TOE NICs and regular NICs is not supported in a cluster solution.

You must configure the public, private, and iSCSI networks in each node before you install Microsoft Failover Clustering. The following sections explain the principles and procedures related to the networking prerequisites.

NOTE: If the iSCSI networks are not configured to use DHCP, you must configure static IPs. To fully utilize the iSCSI ports on the storage system, the IPs are configured such that access to each iSCSI port is balanced among the cluster nodes. For example, if the four subnets on the storage systems are .10, .11, .12, and .13, the two iSCSI NICs on the first cluster nodes can be on .10 and .11 subnets, the

two NICs on the second cluster node can be on .12 and .13 subnets, the two iSCSI NICs on the third cluster node can be on .10 and .11 subnets, and the fourth cluster node can be on .12 and .13 subnets.

Installing the Microsoft iSCSI Software Initiator

Microsoft iSCSI Initiator is installed natively on Windows Server 2008.

Installing and Configuring the Storage Management Software

The PowerVault MD3200i and MD3220i storage software installer provides features that include the core software, providers, and optional utilities.

The core software feature includes the host-based storage agent, multipath driver, 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 as well as a provider for the SNIA Storage Management Initiative Specification (SMI-S) standard.

The Modular Disk Configuration Utility (MDCU) is an optional utility that provides a consolidated approach for configuring the management ports, iSCSI host ports, and creating sessions for the iSCSI Modular Disk storage arrays. It is recommended that you use MDCU to configure iSCSI on each host connected to the PowerVault MD3200i or MD3220i.

NOTE: For more information about the Microsoft VDS, Microsoft VSS providers, see the Owner's Manual. For more information about working with the SMI-S provider, see the *SMI-S Programmer's Guide*.

Installing the Storage Management Software

1. Close all other programs before installing any new software.
2. Insert the resource media.
3. Select **Install MD32*xx*i Storage Software**.
4. Install the MD Storage software.
5. 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, multipath driver, MD Storage Manager, providers, and optional utilities.
- Host Only—This package includes the host-based storage agent, multipath drivers, 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.

6 Reboot each host server.

You can manage a storage array in two ways:

- Out-of-band management
- In-band management

NOTE: It is recommended that you use out-of-band management.

Configuring the Shared Storage System

Before you begin configuring iSCSI, you must fill out the "iSCSI Configuration Worksheet" on page 73. Gathering this type of information about your network prior to starting the configuration steps helps you complete the process faster.

Terminology

The following table outlines the terminology used in the iSCSI configuration steps later in this section.

Table 3-1. Standard Terminology Used in iSCSI Configuration

Term	Definition
CHAP (Challenge Handshake Authentication Protocol)	An optional security protocol used to control access to an iSCSI storage system by restricting use of the iSCSI data ports on both the host server and storage array.
host or host server	A server connected to the storage array through iSCSI ports.
host server port	iSCSI port on the host server used to connect it to the storage array.
iSCSI initiator	The iSCSI-specific software installed on the host server that controls communications between the host server and the storage array.
iSCSI storage port	The iSCSI port (four per controller) on the storage array.
iSNS (Microsoft Internet Storage Naming Service)	An automated discovery, management, and configuration tool used by some iSCSI devices.
management station	The system from which you manage your host server/storage array configuration.
storage array	The enclosure containing the storage data accessed by the host server.
target	An iSCSI port on the storage array that accepts and responds to requests from the iSCSI initiator installed on the host server.

Using Internet Storage Naming Service Server

Internet Storage Naming Service Server (iSNS) eliminates the need to manually configure each individual storage array with a specific list of initiators and target IP addresses. Instead, iSNS automatically discovers, manages, and configures all iSCSI devices in your environment.

For more information on iSNS, including installation and configuration, go to **microsoft.com**.

Configuring iSCSI on Your Storage Array

The following sections contain step-by-step instructions for configuring iSCSI on your storage array. However, before beginning, it is important to understand where each of these steps occur in relation to your host server/storage array environment.

Table 3-2 contains the sequence of steps for configuring each specific iSCSI connections and where it occurs. The following sub-sections describe each of the steps in more detail.

Table 3-2. Host Server vs. Storage Array

This step is performed on the HOST SERVER using the Microsoft iSCSI Initiator:	This step is performed on the STORAGE ARRAY using MD Storage Manager:
	1 Discover the storage array
	2 Configure the iSCSI ports on the storage array authentication on the storage array
3 Perform target discovery from the iSCSI initiator	
	4 Configure host access
	5 (Optional) Configure CHAP
6 (Optional) Configure CHAP authentication on the host server	
7 Connect to the storage array from the host server	
	8 (Optional) Set up in-band management

MDCU provides a consolidated approach to configure the iSCSI network of host servers and iSCSI-based Modular Disk storage arrays (PowerVault MD32*xx*i) using a wizard-driven interface. This utility also enables you to configure the iSCSI sessions of the host server according to the best practices and to achieve load-balanced paths with the storage array iSCSI host ports.

NOTE: The configuration tasks performed by this utility can also be performed manually. To perform a manual configuration, see Appendix A—Manual Configuration of the *Dell PowerVault MD3200i and MD3220i Storage Arrays Deployment Guide*.

This utility is launched automatically after installing MDSM and if you have selected the **Launch the MDCU After Reboot** option during the installation of the host software. This utility can also be launched manually.

The MDCU performs the following two major tasks:

- Storage array configuration
- Host configuration

To configure the iSCSI-based MD Storage Array(s) using MDCU:

1. Launch the utility (if it is not launched automatically) from the server where you have access to the management ports of the storage array(s) to be configured.
2. For Windows, click **Start→ All Programs→ Dell→ MD Storage Software→ Modular Disk Configuration Utility**.
3. For Linux, click the MDCU icon on the desktop or navigate to the **/opt/dell/mdstoragesoftware/mdconfigurationutility** directory in a terminal window and run the MDCU.
4. Click **Next** to continue.
5. Select **Configure Modular Disk Storage Array** and click **Next** to continue.
6. Select the method by which the utility must discover the storage arrays for configuration and click **Next**.
   - Automatic Discovery—Automatic discovery queries the local subnetwork for all iSCSI-based Modular Disk storage arrays and may take several minutes to complete.
   - Manual Discovery—Manual discovery allows you to locate iSCSI based Modular Disk storage arrays that are outside of the local subnetwork. Manual discovery requires you to select whether your

storage array has a single controller (simplex) or dual controllers (duplex) and whether to use IPv4 or IPv6 protocol to communicate with the management port of the storage array.

The next screen displays a list of the iSCSI-based MD storage arrays that were discovered based on the discovery process selected in step 3. If you select **Automatic Discovery**, the screen displays a list of iSCSI-based MD storage arrays that were discovered in the subnet. If you select **Manual Discovery**, the list contains only the array whose IP address was entered. To add additional arrays to the list, click on the **Add** button on this screen.

7. Select the array by clicking the radio button of the corresponding storage array and then click **Next**.
8. Enter the name of the storage array and the password.
9. Click the **Set Password** check-box if you want to set a new password for the array and enter the new password in the **New Password** and **Confirm New Password** fields. Click **Next** to continue.
10. Select the IP protocol (IPv4/IPv6) that the management ports must use. Also for each protocol, select whether the configuration of the management port IP addresses requires to be done manually or automatically. See the online help for more details.
11. Click **Next** to continue. If you have not selected the **Specify Configuration Manually** option for any of the two protocols, go to step 13.
12. If you have selected **Specify Configuration Manually** for any of the two protocols in the last step, a series of screens showing the backend view image of the storage array controllers are displayed. Each image contains IP addresses of management ports of the controllers. Also, each image has a management port highlighted in red.
    - For IPv4 address of the highlighted port, enter the IP address, subnet mask and gateway address in the fields below the image to modify it.
    - For IPv6 address of the highlighted port, enter the local IP address, routable IP, and router IP address in the fields below the image to modify it.

    Click **Next** to continue through these images to complete the configuration of all the management ports for the selected protocols.

13 In the **CHAP Configuration** screen, select the CHAP method and click **Next**. For more information on CHAP see "Understanding CHAP Authentication" on page 42.

14 In the **Summary** screen, review the information that you entered for the storage array.

15 Click **Apply** to save the changes to the storage array.

NOTE: Click **Cancel Array** to cancel the configuration for the storage array and go back to select another storage array for configuration.

16 On the **Configure Additional Arrays** screen, select whether you want to configure an additional array. Click **Next** to continue.

17 If you selected **Yes** in step 16, then repeat step 6 through step 15 to configure an additional array.

If you selected **No** in step 16, perform the following on the **Configure Host Connectivity** screen:

- **a** Select whether you want to configure the connectivity for the current host's iSCSI initiator.
- **b** Click **Next** to continue.
- **c** Click **No** to complete the configuration task and go to step f.
- **d** Click **Yes** to configure the connectivity for the current host's iSCSI initiator. The **Select Storage Array** screen is displayed.
- **e** Select the storage array that you want to configure for connectivity to the local host.
- **f** Click **Finish** on the last screen to exit the utility.

NOTE: The storage arrays just configured by the utility are marked as Configuration Complete against their names in the list. This helps you to identify the arrays that are ready to be configured for host access.

18 In the **Storage Array Login** screen, perform the following:

- **a** In the **Controller#** column, select the iSCSI host port of the storage array that you want to configure and its IP address(es).
- **b** In the **Host Address** column, from the drop-down menu, select the host IP address that must login to the iSCSI host port of the storage array.

c Click **Next** if you want to enter the login information for another controller or click **Apply** to commit the log in information.

19 In the **Connect to Additional Arrays** screen, select if you want to connect to another storage array. To connect to another storage array, repeat the steps above starting from step d. If you do not want to connect to additional arrays, click **Finish** on the final screen to exit the utility.

Understanding CHAP Authentication

Before proceeding to either "Configuring CHAP Authentication on the Storage Array (Optional)" on page 43 or "Configuring CHAP Authentication on the Host Server (Optional)" on page 45, it would be useful to gain an overview of how CHAP authentication works.

What is CHAP?

Challenge Handshake Authentication Protocol (CHAP) is an optional iSCSI authentication method where the storage array (target) authenticates iSCSI initiators on the host server. Two types of CHAP are supported: *target* CHAP and *mutual* CHAP.

Target CHAP

In target CHAP, the storage array authenticates all requests for access issued by the iSCSI initiator(s) on the host server through a CHAP secret. To set up target CHAP authentication, you enter a CHAP secret on the storage array, then configure each iSCSI initiator on the host server to send that secret each time it attempts to access the storage array.

Mutual CHAP

In addition to setting up target CHAP, you can set up mutual CHAP in which both the storage array *and* the iSCSI initiator authenticate each other. To set up mutual CHAP, configure the iSCSI initiator with a CHAP secret that the storage array must send to the host server in order to establish a connection. In this two-way authentication process, both the host server and the storage array send information that the other must validate before a connection is allowed.

CHAP is an optional feature and is not required to use iSCSI. However, if you do not configure CHAP authentication, any host server connected to the same IP network as the storage array can read from and write to the storage array.

NOTE: If you elect to use CHAP authentication, you must configure it on both the storage array (using MD Storage Manager) and the host server (using the iSCSI initiator) before preparing virtual disks to receive data. If you prepare disks to receive data before you configure CHAP authentication, you will lose visibility to the disks after CHAP is configured.

CHAP Definitions

To summarize the differences between target CHAP and mutual CHAP authentication, see Table 3-3.

Table 3-3. CHAP Types Defined

CHAP Type	Description
Target CHAP	Sets up accounts that iSCSI initiators use to connect to the target storage array. The target storage array then authenticates the iSCSI initiator.
Mutual CHAP	Applied *in addition* to target CHAP. Mutual CHAP sets up an account that a target storage array uses to connect to an iSCSI initiator. The iSCSI initiator then authenticates the target.

Setting up CHAP

The next two steps in your iSCSI configuration, "Configuring CHAP Authentication on the Storage Array (Optional)" on page 43 and "Configuring CHAP Authentication on the Host Server (Optional)" on page 45, offer step-by-step procedures for setting up CHAP on your storage array and host server.

Configuring CHAP Authentication on the Storage Array (Optional)

If you are configuring target-only CHAP authentication, complete "Configuring CHAP Authentication on the Storage Array (Optional)" on page 43 and "Configuring CHAP Authentication on the Host Server (Optional)" on page 45.

If you are configuring mutual CHAP authentication, complete "Configuring Mutual CHAP Authentication on the Storage Array" on page 45 and "Configuring CHAP Authentication on the Host Server (Optional)" on page 45.

If you are **not** configuring any type of CHAP, skip to "Configuring a Failover Cluster" on page 63.

NOTE: If you choose to configure mutual CHAP authentication, you must first configure target CHAP.

Remember, in terms of iSCSI configuration, the term *target* always refers to the storage array.

Configuring Target CHAP Authentication on the Storage Array

1. From MD Storage Manager, click the **iSCSI** tab and then **Change Target Authentication**.

   Make a selection based on the following:

Table 3-4. CHAP Settings

Selection	Description
None	This is the default selection. If **None** is the only selection, the storage array allows an iSCSI initiator to log on without supplying any type of CHAP authentication.
None and CHAP	The storage array allows an iSCSI initiator to log on with or without CHAP authentication.
CHAP	If **CHAP** is selected and **None** is not selected, the storage array requires CHAP authentication before allowing access.

2. To configure a CHAP secret, select **CHAP** and select **CHAP Secret**.
3. Enter the **Target CHAP secret** (or **Generate Random Secret**), confirm it in **Confirm Target CHAP Secret**, and click **OK**.

   Although the storage array allows sizes from 12 to 57 characters, many initiators only support CHAP secret sizes up to 16 characters (128-bit).

   NOTE: Once entered, a CHAP secret is not retrievable. Ensure that you record the secret in an accessible place. If Generate Random Secret is used, copy and paste the secret into a text file for future reference since the same CHAP secret is used to authenticate any new host servers you may add to the storage array. If you forget this CHAP secret, you must disconnect all existing hosts attached to the storage array and repeat the steps in this chapter to add them.
4. Click **OK**.

Configuring Mutual CHAP Authentication on the Storage Array

The initiator secret must be unique for each host server that connects to the storage array and must not be the same as the target CHAP secret.

1. From MD Storage Manager, click on the **iSCSI** tab, then select **Enter Mutual Authentication Permissions**.
2. Select an initiator on the host server and click the **CHAP Secret**.
3. Enter the **Initiator CHAP secret**, confirm it in **Confirm initiator CHAP secret**, and click **OK**.

   NOTE: In some cases, an initiator CHAP secret may already be defined in your configuration. If so, use it here.
4. Click **Close**.

   NOTE: To remove a CHAP secret, you must delete the host initiator and add it.

Configuring CHAP Authentication on the Host Server (Optional)

If you configured CHAP authentication in "Configuring CHAP Authentication on the Storage Array (Optional)" on page 43, complete the following steps. If not, skip to "Configuring a Failover Cluster" on page 63.

To optionally configure CHAP authentication on the host server:

1. Click **Start→ Programs→ Microsoft iSCSI Initiator**.
2. If you are NOT using mutual CHAP authentication, skip to step 4.
3. If you are using mutual CHAP authentication:
   a. Click the **General** tab.
   b. Select **Secret.**
   c. At the **Enter a secure secret** window, enter the mutual CHAP secret you entered for the storage array.
4. Click the **Discovery** tab.
5. Under **Target Portals**, select the IP address of the iSCSI port on the storage array and click **Remove**.

   The iSCSI port you configured on the storage array during target discovery must disappear. You must reset this IP address under CHAP authentication in the steps that immediately follow.

6 Under **Target Portals**, click **Add** and re-enter the **IP address or DNS name** of the iSCSI port on the storage array (removed above).

7 Click **Advanced** and set the following values on the **General** tab:

- **Local Adapter**: Must always be set to **Microsoft iSCSI Initiator**.
- **Source IP**: The source IP address of the host you want to connect with.
- **Data Digest and Header Digest**: Optionally, you can specify that a digest of data or header information be compiled during transmission to assist in troubleshooting.
- **CHAP logon information**: Enter the target CHAP authentication username and secret you entered (for the host server) on the storage array.
- **Perform mutual authentication**: If mutual CHAP authentication is configured, select this option.

NOTE: IPSec is not supported.

8 Click **OK**.

If a discovery session failover is desired, repeat step 5 and step 6 for all iSCSI ports on the storage array. Otherwise, single-host port configuration is sufficient.

NOTE: If the connection fails, ensure that all IP addresses are entered correctly. Incorrectly typed IP addresses are a common cause of connection problems.

Connecting to the Target Storage Array From the Host Server

1 Click **Start**→ **Programs**→ **Microsoft iSCSI Initiator**.

2 Click the **Targets** tab.

If previous target discovery was successful, the *iqn* of the storage array is displayed under **Targets**.

3 Click **Log On**.

4 Select **Automatically restore this connection when the system boots**.

5 Select **Enable multipath**.

6 Click **Advanced** and configure the following settings under the **General** tab:

- **Local Adapter**: Must be set to **Microsoft iSCSI Initiator**.

- **Source IP**: The source IP address of the host server you want to connect from.
- **Target Portal**: Select the iSCSI port on the storage array controller that you want to connect to.
- **Data Digest and Header Digest**: Optionally, you can specify that a digest of data or header information be compiled during transmission to assist in troubleshooting.
- **CHAP logon information**: If CHAP authentication is required, select this option and enter the **Target secret**.
- **Perform mutual authentication**: If mutual CHAP authentication is configured, select this option.

NOTE: IPSec is not supported.

7 Click **OK**.

To support storage array controller failover, the host server must be connected to at least one iSCSI port on each controller. Repeat step 3 through step 8 for each iSCSI port on the storage array that you want to establish as failover targets (the **Target Portal** address is different for each port you connect to).

The **Status** field on the **Targets** tab is displayed as **Connected**.

8 Click **OK** to close the Microsoft iSCSI initiator.

Viewing the Status of Your iSCSI Connections

In MD Storage Manager, click the **iSCSI** tab and then **Configure iSCSI Host Ports** to view the status of each iSCSI port you attempted to connect to and the configuration state of all IP addresses. If either **Disconnected** or **Unconfigured** is displayed, check the following and repeat the iSCSI configuration steps:

- Are all cables securely attached to each port on the host server and storage array?
- Is TCP/IP correctly configured on all target host ports?
- Is CHAP set up correctly on both the host server and the storage array?

Setting up In-Band Management (Optional)

Out-of-band management is the recommended method for managing the storage array. However, to optionally set up in-band management, configure the following:

Controller 0: IP: 192.168.128.101 Subnet Mask: 255.255.255.0

Controller 1: IP: 192.168.128.102 Subnet Mask: 255.255.255.0

NOTE: The management station you are using must be configured for network communication to the same IP subnet as the PowerVault MD3200i or MD3220i iSCSI host ports.

1. Establish an iSCSI session to the MD3200i or MD3220i RAID storage array.
2. Restart the SMagent service.
3. Launch MD Storage Manager, and then click **New**.

   NOTE: When you set up the first storage array management, the **Add New Storage Array** window appears.
4. Select **Manual** and click **OK**.
5. Select **In-band management** and enter the host server name(s) or IP address(es) of the attached host that is running the MD Storage Manager software.
6. Click **Add**.

   In-band management is now successfully configured.

Configuring Host Access

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 on the **Mappings** tab in the **Array Management** window.

If the host is not detected:

1. Launch MDSM.
2. Navigate to the **Array Management** window and click **Manually Define Hosts**.
3. In the **Enter Host Name** field, enter the host server for virtual disk mapping. This can be an informal name, not necessarily a name used to identify the host server to the network.

4 Select the relevant option in **Do you plan to use the storage partitions in the this storage array?** field and click **Next**.

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

NOTE: Select Yes if your cluster shares the array with other clustered or stand-alone system(s), and No otherwise.

5 Select a method for adding the host port identifier.

6 Select the host type.

7 Select whether or not the host server must be part of a host server group that shares access to the same virtual disks as other host servers. Select **Yes** only if the host is part of a Microsoft cluster.

8 Click **Next**.

9 Specify if this host must be part of a host group.

10 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 an **Unconfigured Capacity** node, and select **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 RAIDl 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, you can 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, you can 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, the **Disk Group Required** window is displayed. Click **Yes** and 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 how to create 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 toolbar, 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 else 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**.
- In 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, perform these steps:
   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 the **Find** button again.

c Click the **Find** button again to search for additional occurrences of the term.

5 To save the storage array profile, perform these steps:

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 **.txt**.

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—A *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 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 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 iSCSI Initiator target connections are active.
   - 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 the **Start** button.

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

To install and enable these premium features, you must purchase a feature key file for each feature and then specify the storage array that must host them. For instructions about this process, see the *Premium Feature Activation* card that shipped along with your Dell PowerVault MD3200i or MD3220i 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.

If you need to map the Snapshot Virtual Disk to the secondary node (the node not owning the source disk), you must map the Snapshot Virtual Disk to the primary node first, to ensure that the snapshot is assigned a new disk signature. Then, use Modular Disk Storage Manager to unmap the Snapshot Virtual Disk from the primary node, map it to the secondary node, and start accessing it.

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.

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 displays the following error: `The operation cannot complete because the selected virtual disk is not a source virtual disk candidate.`

If the cluster shared disk fails and you need 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, and then use one of the following methods:

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

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 have 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**.

A

Troubleshooting

This appendix provides troubleshooting information for your cluster configurations.

Table A-1 describes general cluster problems you may encounter and 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. See "Cabling Your Cluster Hardware" on page 15 for more information.
	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: • 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.
	The CHAP password entered is wrong.	If CHAP is used, enter correct user name and password.

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.	Check the network cabling. Ensure that the node-to-node interconnection and the public network are connected to the correct NICs.
	Long delays in node-to-node communications may be normal.	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.
	One or more nodes may have the Internet Connection Firewall enabled, blocking Remote Procedure Call (RPC) communications between the nodes.	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.	The Cluster Service has not been started. A cluster has not been formed on the system. The system has just been 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 *Dell Failover Clusters with Microsoft Windows Server 2008 Installation and Troubleshooting Guide*.
	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: • Check all cable connections • Check 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**.

Table A-1. General Cluster Troubleshooting *(continued)*

Problem	Probable Cause	Corrective Action
Virtual Disk Copy operation fails.	The Virtual Disk Copy operation uses the cluster disk as the source disk.	To perform a Virtual Disk Copy operation on the cluster share disk, create a snapshot of the disk, and then perform a Virtual Disk Copy of the snapshot virtual disk.
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 **partmgr** 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.	Unmap the snapshot virtual disk from the node not owning the source disk, then assign it to the node that owns the source disk. See Using Advanced (Premium) PowerVault Modular Disk Storage Manager Features for more information.

B

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-2. Cluster Node Configuration Information

Node Name	Service Tag Number	Public IP Address	Private IP Address

Table B-3. Additional Network Information

Additional Networks

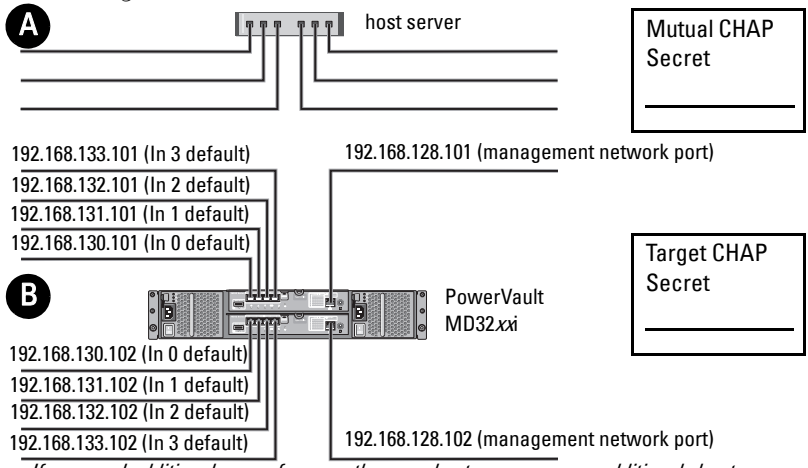
Table B-4. Storage Array Configuration Information

Array	Array Service Tag	IP Address	Number of Attached DAEs Virtual Disks
1			
2			
3			
4			

C

iSCSI Configuration Worksheet

IPv4 Settings

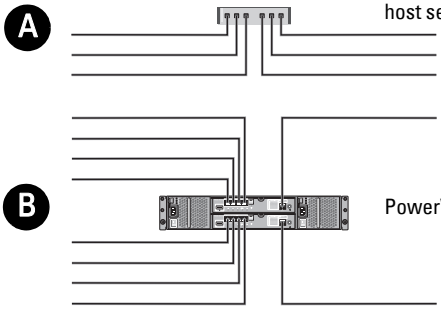


If you need additional space for more than one host server, use an additional sheet.

A Static IP address (host server)		Subnet *(should be different for each NIC)*	Default gateway
iSCSI port 1	___ . ___ . ___ . ___	___ . ___ . ___ . ___	___ . ___ . ___ . ___
iSCSI port 2	___ . ___ . ___ . ___	___ . ___ . ___ . ___	___ . ___ . ___ . ___
iSCSI port 3	___ . ___ . ___ . ___	___ . ___ . ___ . ___	___ . ___ . ___ . ___
iSCSI port 4	___ . ___ . ___ . ___	___ . ___ . ___ . ___	___ . ___ . ___ . ___
Management port	___ . ___ . ___ . ___	___ . ___ . ___ . ___	___ . ___ . ___ . ___
Management port	___ . ___ . ___ . ___	___ . ___ . ___ . ___	___ . ___ . ___ . ___

B Static IP address (host server)		Subnet	Default gateway
iSCSI controller 0, In 0	___ . ___ . ___ . ___	___ . ___ . ___ . ___	___ . ___ . ___ . ___
iSCSI controller 0, In 1	___ . ___ . ___ . ___	___ . ___ . ___ . ___	___ . ___ . ___ . ___
iSCSI controller 0, In 2	___ . ___ . ___ . ___	___ . ___ . ___ . ___	___ . ___ . ___ . ___
iSCSI controller 0, In 3	___ . ___ . ___ . ___	___ . ___ . ___ . ___	___ . ___ . ___ . ___
Management port cntrl 0	___ . ___ . ___ . ___	___ . ___ . ___ . ___	___ . ___ . ___ . ___
iSCSI controller 1, In 0	___ . ___ . ___ . ___	___ . ___ . ___ . ___	___ . ___ . ___ . ___
iSCSI controller 1, In 1	___ . ___ . ___ . ___	___ . ___ . ___ . ___	___ . ___ . ___ . ___
iSCSI controller 1, In 2	___ . ___ . ___ . ___	___ . ___ . ___ . ___	___ . ___ . ___ . ___
iSCSI controller 1, In 3	___ . ___ . ___ . ___	___ . ___ . ___ . ___	___ . ___ . ___ . ___
Management port cntrl 1	___ . ___ . ___ . ___	___ . ___ . ___ . ___	___ . ___ . ___ . ___

IPv6 Settings



Mutual CHAP Secret

Target CHAP Secret

If you need additional space for more than one host server, use an additional sheet.

A

Host iSCSI port 1		Host iSCSI port 2	
Link local IP address	___ . ___ . ___ . ___	Link local IP address	___ . ___ . ___ . ___
Routable IP address	___ . ___ . ___ . ___	Routable IP address	___ . ___ . ___ . ___
Subnet prefix	___ . ___ . ___ . ___	Subnet prefix	___ . ___ . ___ . ___
Gateway	___ . ___ . ___ . ___	Gateway	___ . ___ . ___ . ___

B

iSCSI controller 0, In 0	
IP address	FE80 : 0000 : 0000 : 0000 : ____ : ____ : ____ : ____
Routable IP address 1	____ : ____ : ____ : ____ : ____ : ____ : ____ : ____
Routable IP address 2	____ : ____ : ____ : ____ : ____ : ____ : ____ : ____
Router IP address	____ : ____ : ____ : ____ : ____ : ____ : ____ : ____
iSCSI controller 0, In 1	
IP address	FE80 : 0000 : 0000 : 0000 : ____ : ____ : ____ : ____
Routable IP address 1	____ : ____ : ____ : ____ : ____ : ____ : ____ : ____
Routable IP address 2	____ : ____ : ____ : ____ : ____ : ____ : ____ : ____
Router IP address	____ : ____ : ____ : ____ : ____ : ____ : ____ : ____
iSCSI controller 0, In 2	
IP address	FE80 : 0000 : 0000 : 0000 : ____ : ____ : ____ : ____
Routable IP address 1	____ : ____ : ____ : ____ : ____ : ____ : ____ : ____
Routable IP address 2	____ : ____ : ____ : ____ : ____ : ____ : ____ : ____
Router IP address	____ : ____ : ____ : ____ : ____ : ____ : ____ : ____

iSCSI controller 0, In 3

IP address	FE80 : 0000 : 0000 : 0000 : ____ : ____ : ____ : ____
Routable IP address 1	____ : ____ : ____ : ____ : ____ : ____ : ____ : ____
Routable IP address 2	____ : ____ : ____ : ____ : ____ : ____ : ____ : ____
Router IP address	____ : ____ : ____ : ____ : ____ : ____ : ____ : ____

iSCSI controller 1, In 0

IP address	FE80 : 0000 : 0000 : 0000 : ____ : ____ : ____ : ____
Routable IP address 1	____ : ____ : ____ : ____ : ____ : ____ : ____ : ____
Routable IP address 2	____ : ____ : ____ : ____ : ____ : ____ : ____ : ____
Router IP address	____ : ____ : ____ : ____ : ____ : ____ : ____ : ____

iSCSI controller 1, In 1

IP address	FE80 : 0000 : 0000 : 0000 : ____ : ____ : ____ : ____
Routable IP address 1	____ : ____ : ____ : ____ : ____ : ____ : ____ : ____
Routable IP address 2	____ : ____ : ____ : ____ : ____ : ____ : ____ : ____
Router IP address	____ : ____ : ____ : ____ : ____ : ____ : ____ : ____

iSCSI controller 1, In 2

IP address	FE80 : 0000 : 0000 : 0000 : ____ : ____ : ____ : ____
Routable IP address 1	____ : ____ : ____ : ____ : ____ : ____ : ____ : ____
Routable IP address 2	____ : ____ : ____ : ____ : ____ : ____ : ____ : ____
Router IP address	____ : ____ : ____ : ____ : ____ : ____ : ____ : ____

iSCSI controller 1, In 3

IP address	FE80 : 0000 : 0000 : 0000 : ____ : ____ : ____ : ____
Routable IP address 1	____ : ____ : ____ : ____ : ____ : ____ : ____ : ____
Routable IP address 2	____ : ____ : ____ : ____ : ____ : ____ : ____ : ____
Router IP address	____ : ____ : ____ : ____ : ____ : ____ : ____ : ____

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