



EMC Host Connectivity Guide for Windows

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Preface	xiii
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PART 1 Symmetrix Connectivity

Chapter 1 Windows/Symmetrix Environment

Windows/Symmetrix Environment	1-2
Hardware Connectivity	1-2
Symmetrix Configuration.....	1-2
Bootting the Host from the Symmetrix System.....	1-3
General Windows Information	1-4
Terminology.....	1-4
Utilities and Functions	1-4
Configuring for Windows 2000/Windows 2003 and Symmetrix Systems	1-5
Configuring the HBA Driver	1-5
Initializing Symmetrix Disks.....	1-5
Creating Volumes.....	1-8
System Status and Error Messages.....	1-10
Adding Devices On Line	1-11
Configuring for Windows NT and Symmetrix.....	1-12
Configuring the HBA Driver	1-12
Specifying the Configuration.....	1-12
Partitioning Symmetrix Disks.....	1-14
Adding Devices On Line	1-20
Editing the Windows I/O Timeout Value	1-21
Recovering from Drive Errors on Windows 2000/Windows 2003 Hosts	1-22
Recovery from Offline State	1-22
Rebooting to Recover from an Offline State	1-23

Recovery from At-Risk File System	1-24
Recovery from Fail State.....	1-25
Configuring VERITAS Volume Manager for Symmetrix.....	1-26

Chapter 2 Windows and Symmetrix over Fibre Channel

Windows/Symmetrix Fibre Channel Environment	2-2
Hardware Connectivity	2-2
Boot Device Support	2-2
Addressing	2-2
Planning for Fabric Zoning and Connections	2-3
Understanding Persistent Binding.....	2-3
Methods of Persistent Binding	2-3
Host Configuration with Compaq FC 223180-B21 HBA.....	2-5
Installing the HBA.....	2-5
Installing the HBA Driver	2-5
What Next?	2-5
Host Configuration with HP A5246A HBA.....	2-6
Installing the HBA.....	2-6
Installing the HBA Driver	2-6
What Next?	2-6
Host Configuration with HP D8602A/D8602B HBA.....	2-7
Installing the HBA.....	2-7
Installing the HBA Driver	2-7
What Next?	2-10
Host Configuration with Emulex HBAs	2-11
What Next?	2-11
Host Configuration with QLogic HBAs	2-12
What Next?	2-12
Recognizing LUNs.....	2-13
Addressing Symmetrix Devices	2-15
Arbitrated Loop Addressing.....	2-15
Fabric Addressing	2-17
SCSI-3 FCP Addressing	2-18

Chapter 3 Windows and Symmetrix over SCSI

Hosts That Also Run UNIX.....	3-2
Alpha Console Installation Issues.....	3-2
EMC AViiON Installations	3-3
Configuring Some Host Bus Adapters	3-4
Adaptec AHA-2944W (PCI Bus)	3-4
Adaptec AHA-2944UW (PCI Bus)	3-4
QLogic QLA1041 (PCI Bus).....	3-5

Chapter 4 Windows and Symmetrix over iSCSI

Windows/Symmetrix iSCSI Environment	4-2
Hardware	4-2
Software.....	4-2
LUN Addressing	4-2
Symmetrix Configuration	4-3
Planning for TCP/IP Network Connectivity	4-3
Planning for Persistent Binding	4-3
Configuring the Symmetrix iSCSI Director.....	4-4
Configuring CHAP Authentication	4-4
Configuring the Host with the Microsoft iSCSI Initiator Kernel Driver	4-5
Configuring the Header Digest.....	4-5
Configuring the Data Digest	4-5
Recognizing LUNs.....	4-5
Recovering from Initiator Driver Errors on Windows	4-5
Troubleshooting.....	4-6
Configuring the Windows iSCSI Initiator Kernel Driver	4-7
Terminology	4-7
Hardware	4-7
Storage	4-8
Software.....	4-8
Boot Device Support.....	4-9
Planning for the TCP/IP Network	4-9
Host Configuration.....	4-10

PART 2 CLARiiON Connectivity

Chapter 5 Windows Hosts with CLARiiON

CLARiiON/Windows Fibre Channel Environment	5-2
Storage Components	5-2
Required Storage System Setup	5-2
Host Connectivity	5-3
What is LUN_Z or LUNZ?	5-3
Reference Documentation.....	5-4
Boot Device Support.....	5-4
CLARiiON/Microsoft Windows iSCSI Environment.....	5-5
Storage Components	5-5
Required Storage System Setup	5-5
Host Connectivity	5-5
Host Configuration with Microsoft iSCSI Software Initiator	

Driver and iSCSI to FC Gateway	5-6
Host Configuration with Emulex HBAs	5-7
Installing GBICs onto 1 Gb HBAs	5-7
Creating a Switch Zone for Each HBA	5-8
Replacing HBAs Connected to Shared Storage Systems	5-8
Troubleshooting HBA Problems	5-10
Host Configuration with QLogic HBAs	5-14
Installing GBICs onto 1 Gb HBAs	5-14
Creating a Switch Zone for Each HBA	5-15
Replacing HBAs Connected to Shared Storage Systems ..	5-15
Troubleshooting HBA Problems.....	5-17
Recognizing LUNs.....	5-25
Making LUNs Available to Windows NT	5-26
Filling Out the Configuration Worksheet.....	5-26
Configuration Worksheet: Storage System with SPs	5-27
Creating Windows NT Partitions on LUNs	5-29
Making JBOD Disks Available to Windows NT	5-32
Making LUNs Available to Windows 2000 or Windows 2003 ..	5-37
Determining the Disk Number for Each LUN	5-37
Configuration Worksheet	5-38
Creating Windows 2000 or Windows 2003 Partitions	5-40
Creating Volumes on a LUN	5-43
LUN Expansion Recognition	5-45
Windows Server NT 4.0 Basic Disks.....	5-45
Windows Server 2000 and Windows Server 2003	
Basic Disks	5-46
Windows 2000 and Windows Server 2003	
Dynamic Disks	5-46
Configuring for Windows Clusters.....	5-49
About Windows Clusters.....	5-49
Using Navisphere Applications with Clusters	5-49
Configuring the Host Agent for Clusters.....	5-50
Adding a Generic Service Resource to the	
Cluster Group	5-51
Bootting with MSCS.....	5-52
Configuring VERITAS Volume Manager for CLARiiON	5-55

PART 3 Celerra Connectivity

Chapter 6 Windows Hosts with Celerra

Microsoft Windows Host with the iSCSI Celerra.....	6-2
System Configuration	6-2

	iSCSI Target Configuration Guidelines	6-2
	iSCSI LUN Mask Requirements.....	6-3
	Multi-path Support.....	6-3
	Target Discovery Support.....	6-3
	Configuration using the Microsoft Windows iSCSI Software Initiator and iSCSI Celerra	6-4
	Microsoft iSCSI Software Initiator Configuration.....	6-4
	Configuration QLogic iSCSI Host Adapter and Celerra	6-4
PART 4	Appendixes	
Appendix A	Inquiry Utility	
	Using the Inquiry Utility	A-2
	Obtaining the Inquiry Utility	A-3
	Using EMC.com	A-3
	Using FTP Software	A-3
Appendix B	Known Issues	
	Issues	B-2
Index		i-1

1-1	Disk Management in Computer Management Window	1-6
1-2	Upgrade to Dynamic Disk	1-7
1-3	Healthy Volumes and File Systems Example	1-9
1-4	Windows NT 4.0 Disk Administrator	1-13
1-5	Windows NT 4.0 Formatting Window	1-15
1-6	Two NTFS Partitions on Symmetrix Drive	1-16
1-7	Recovery from Offline State	1-22
1-8	Offline State Requires Reboot	1-23
1-9	Recovery from At-Risk File System	1-24
1-10	Recovery from Fail State	1-25
4-1	iSCSI Persistent Binding	4-4
4-2	iSCSI Initiator Properties Window	4-17
4-3	Add Target Portal Dialog Box	4-18
4-4	iSCSI Advanced Settings Window	4-19
4-5	iSCSI Initiator Properties Window	4-20
4-6	Log On To Target Window	4-21
4-7	iSCSI Session Details Window	4-22
4-8	iSCSI HBA Information Tab	4-25
4-9	iSCSI Session Information Window	4-26
4-10	iSCSI Connection Information Window	4-27
5-1	Windows Event Viewer	5-18

Tables

2-1	Maximum LUNs per Target	2-13
2-2	FC-AL Addressing Parameters	2-16
2-3	Symmetrix SCSI-3 Addressing Modes	2-19
5-1	Events Logged by the QLA2100 Windows NT Driver	5-18

As part of an effort to improve and enhance the performance and capabilities of its product line, EMC from time to time releases revisions of its hardware and software. Therefore, some functions described in this document may not be supported by all revisions of the software or hardware currently in use. For the most up-to-date information on product features, refer to your product release notes.

If a product does not function properly or does not function as described in this document, please contact your EMC Representative.

This guide describes the features and setup procedures for Windows NT and Windows 2000 host interfaces to EMC Symmetrix and CLARiiON systems over Fibre Channel, (Symmetrix only) SCSI, or (Symmetrix only) iSCSI.

Audience This guide is intended for use by storage administrators, system programmers, or operators who are involved in acquiring, managing, or operating Symmetrix, CLARiiON, and host devices.

Readers of this guide are expected to be familiar with:

- ◆ Symmetrix or CLARiiON system operation
- ◆ Windows NT, Windows 2000, or Windows 2003 operating environment

Organization Here is an overview of where information is located in this guide.

Part 1, Symmetrix Connectivity

Chapter 1, *Windows/Symmetrix Environment* : This chapter provides general information on Windows hosts connecting to Symmetrix systems.

Chapter 2, *Windows and Symmetrix over Fibre Channel*: This chapter provides information specific to Windows hosts connecting to Symmetrix systems over Fibre Channel.

Chapter 3, *Windows and Symmetrix over SCSI* : This chapter provides information specific to Windows hosts connecting to Symmetrix systems over SCSI.

Chapter 4, *Windows and Symmetrix over iSCSI* : This chapter provides information specific to Windows hosts connecting to Symmetrix systems over iSCSI.

Part 2, CLARiiON Connectivity

Chapter 5, *Windows Hosts with CLARiiON*: This chapter provides information specific to Windows hosts connecting to CLARiiON arrays.

Part 3, Celerra Connectivity

Chapter 6, *Windows Hosts with Celerra*: This section is limited to the iSCSI host connectivity to Celerra iSCSI storage. All of the referenced documents are available in the EMC Powerlink™ website.

Part 4, Appendixes

Appendix A, *Inquiry Utility*: This appendix describes the Inquiry utility (inq), which can be used with Symmetrix or CLARiiON systems to display system information.

Appendix B, *Known Issues*: This appendix describes known issues.

Index

Conventions Used in This Guide

EMC uses the following conventions for notes and cautions.

A note presents information that is important, but not hazard-related.



CAUTION

A caution contains information essential to avoid damage to the system or equipment. The caution may apply to hardware or software.

Typographical Conventions

EMC uses the following type style conventions in this guide:

AVANT GARDE	Keystrokes
Palatino, bold	◆ Dialog box, button, icon, and menu items in text ◆ Selections you can make from the user interface, including buttons, options, and field names
<i>Palatino, italic</i>	◆ New terms or unique word usage in text ◆ Command line arguments when used in text ◆ Book titles
<i>Courier, italic</i>	Arguments used in examples of command line syntax.
Courier	System prompts and displays and specific filenames or complete paths. For example: working root directory [/user/emc]: c:\Program Files\EMC\Symapi\db
Courier, bold	◆ User entry. For example: sympoll -p ◆ Options in command line syntax

Where to Get Help

For questions about technical support, call your local sales office or service provider.

If you have a valid EMC service contract, contact EMC Customer Service at:

- United States: (800) 782-4362 (SVC-4EMC)
- Canada: (800) 543-4782 (543-4SVC)
- Worldwide: (508) 497-7901

Follow the voice menu prompts to open a service call and select the applicable product support.

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Your Comments

Your suggestions will help us continue to improve the accuracy, organization, and overall quality of the user publications. Please send a message to **techpub_comments@emc.com** with your opinions of this guide.

PART 1

Symmetrix Connectivity

This part includes:

- Chapter 1, *Windows/Symmetrix Environment*
- Chapter 2, *Windows and Symmetrix over Fibre Channel*
- Chapter 3, *Windows and Symmetrix over SCSI*
- Chapter 4, *Windows and Symmetrix over iSCSI*

Windows/Symmetrix Environment

This chapter provides general information on Windows hosts connecting to Symmetrix systems.

- ◆ Windows/Symmetrix Environment 1-2
- ◆ General Windows Information 1-4
- ◆ Configuring for Windows 2000/Windows 2003 and Symmetrix Systems 1-5
- ◆ Configuring for Windows NT and Symmetrix 1-12
- ◆ Editing the Windows I/O Timeout Value 1-21
- ◆ Recovering from Drive Errors on Windows 2000/Windows 2003 Hosts 1-22

Windows/Symmetrix Environment

This section lists some Symmetrix® Fibre Channel support information specific to the Windows environment.

For more information, refer to the appropriate chapter:

- ◆ Chapter 2, *Windows and Symmetrix over Fibre Channel*
- ◆ Chapter 3, *Windows and Symmetrix over SCSI*

Hardware Connectivity

Refer to the *EMC Support Matrix* or contact your EMC representative for the latest information on qualified hosts, host bus adapters, and connectivity equipment.

EMC does not recommend mixing HBAs from different vendors in the same host.

Symmetrix Configuration

The Symmetrix system is configured by an EMC Customer Engineer via the Symmetrix service processor.

Refer to the *EMC Support Matrix* for required bit settings on Symmetrix channel directors.

The EMC Customer Engineer (CE) should contact the EMC Configuration Specialist for updated online information. This information is necessary to configure the Symmetrix system to support the customer's host environment.

After the EMC CE has assigned target IDs and LUNs and brought the Symmetrix channel and disk directors on line, reboot the network operating system and go into the configuration program. Set up the host adapter card parameters as instructed in the appropriate section of Chapter 2 or Chapter 3.

All qualified HBAs are listed in the *EMC Support Matrix*.

Booting the Host from the Symmetrix System

EMC does not recommend booting a Windows host from the Symmetrix system unless the host is using EMC PowerPath®. However, if it is necessary to use the Symmetrix system as a boot disk, be sure to read the following caution.



CAUTION

Windows uses virtual memory paging files that reside on the boot disk by default. In the event that this paging file becomes unavailable to the memory management system when it is needed, the operating system will crash with a blue screen. For this reason, EMC does not recommend booting a Windows host from the Symmetrix system unless PowerPath is used (providing a failover path). However, if PowerPath is not used and it is necessary to use a Symmetrix device as a boot disk, you should shut down the host server during any maintenance procedures that might cause the boot disk to become unavailable to the host.

Events that could cause a system booting from the Symmetrix system to crash include:

- ◆ Lost connection to the Symmetrix system (pulled or damaged cable connection)
- ◆ Symmetrix service/upgrade procedures, such as online microcode upgrades and/or configuration changes
- ◆ Symmetrix director failures
- ◆ Symmetrix system power failure
- ◆ Storage area network service/upgrade procedures such as firmware upgrades or hardware replacements

General Windows Information

This section provides information that is common to all supported versions of Windows. Please read the entire section before proceeding to the rest of the chapter.

Terminology

You should understand these terms:

- ◆ **Free space** — An unused and unformatted portion of a hard disk that can be partitioned or subpartitioned.
- ◆ **Partition** — A portion of a physical hard disk that functions as though it were a physically separate unit.
- ◆ **Volume** — A partition or collection of partitions that have been formatted for use by a file system. A volume is assigned a drive letter.
- ◆ **Primary partition** — A portion of a physical disk that can be marked for use by an operating system. A physical disk can have up to four primary partitions. A primary partition cannot be subpartitioned.
- ◆ **Extended partition** (Windows NT only) — A portion created from free space on a hard disk that can be subpartitioned into zero or more logical drives.

Utilities and Functions

Here are some Windows functions and utilities you can use to define and manage Symmetrix devices. The use of these functions and utilities is optional; they are listed for reference only:

- ◆ **Disk Manager** — Graphical tool for managing disks; for example, partitioning, creating, and deleting volumes.
- ◆ **Registry Editor** — Graphical tool for displaying detailed hardware and software configuration information. Not normally part of the Administrative Tools group, the registry editor, `REGEDT32.EXE`, can be found in the `Windows\system32` subdirectory.
- ◆ **Event Viewer** — Graphical tool for viewing system or application errors.

Configuring for Windows 2000/Windows 2003 and Symmetrix Systems

Configuring the HBA Driver

Driver software for Windows hosts is provided with each HBA. Standard Windows driver installation procedures enable use of the HBAs.

The driver for the host bus adapter must be installed and configured prior to partitioning the Symmetrix disks. Refer to the appropriate section of Chapter 2 or Chapter 3.

SCSI HBAs supported by EMC for Windows 2000 and Windows 2003 have drivers native to the Windows distribution CD. These drivers should install automatically. To upgrade to a newer driver, follow the procedures in the appropriate section of Chapter 3.

Initializing Symmetrix Disks

To view the Symmetrix drives seen by your host, select **Start, Programs, Administrative Tools, Computer Management** from the Windows desktop. A window with all the physical disks connected to your workstation (along with their partitions) similar to Figure 1-1 on page 1-6 appears.

Select **Disk Management** from the list on the left. In Figure 1-1 on page 1-6, the disks have not been formatted or partitioned. (The **Disk Management** utility uses the term *basic disk*, which is the same as a Windows NT 4.0 disk.)

To create volumes and format Symmetrix disks, you must write signatures on all the disks to make them recognizable by Windows 2000/Windows 2003.

NOTE: Windows 2000 currently supports a maximum LUN size of 2TB. Windows 2003 is currently not capable of managing single LUNs of 2TB capacity. This limitation should be taken into account when planning your storage environment.

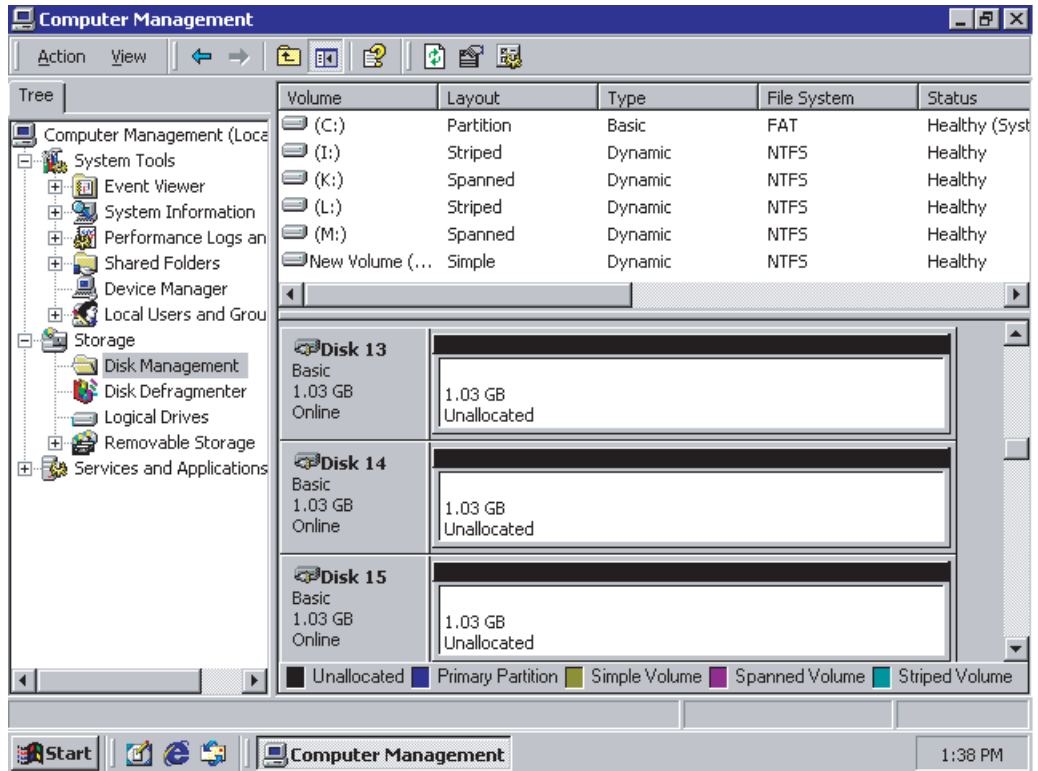


Figure 1-1 Disk Management in Computer Management Window

Disk Types

Windows 2000 and Windows 2003 group all disks into two types: *basic* and *dynamic*. This convention is derived from enhancements to the Windows file systems. By default, all new disks and disks being migrated from Windows NT 4.0 systems are designated as basic disks.

Basic disks can be formatted with FAT, FAT32, and NTFS file systems.

Basic disks cannot be used to create striped, spanned, or RAID volumes using Windows Disk Manager. Windows 2000 and Windows 2003 require that basic disks be upgraded to a dynamic status before being used for striped, spanned, or RAID volumes, with one exception: striped or spanned volumes that existed on a Windows NT 4.0 system remain intact as striped or spanned volumes when that system is upgraded to Windows 2000 or Windows 2003. These volumes are not changed even though the disks that make them up are basic disks.

Refer to *Upgrading to Dynamic Disks*.

Upgrading to Dynamic Disks

In order to use the Windows 2000 or Windows 2003 file systems (spanned, striped, and RAID), you must upgrade your disks to dynamic disks. If you have a basic disk with a partition, you must have at least 2 MB of unallocated free space on the disk to perform the upgrade.

Dynamic disks cannot be used for clusters.

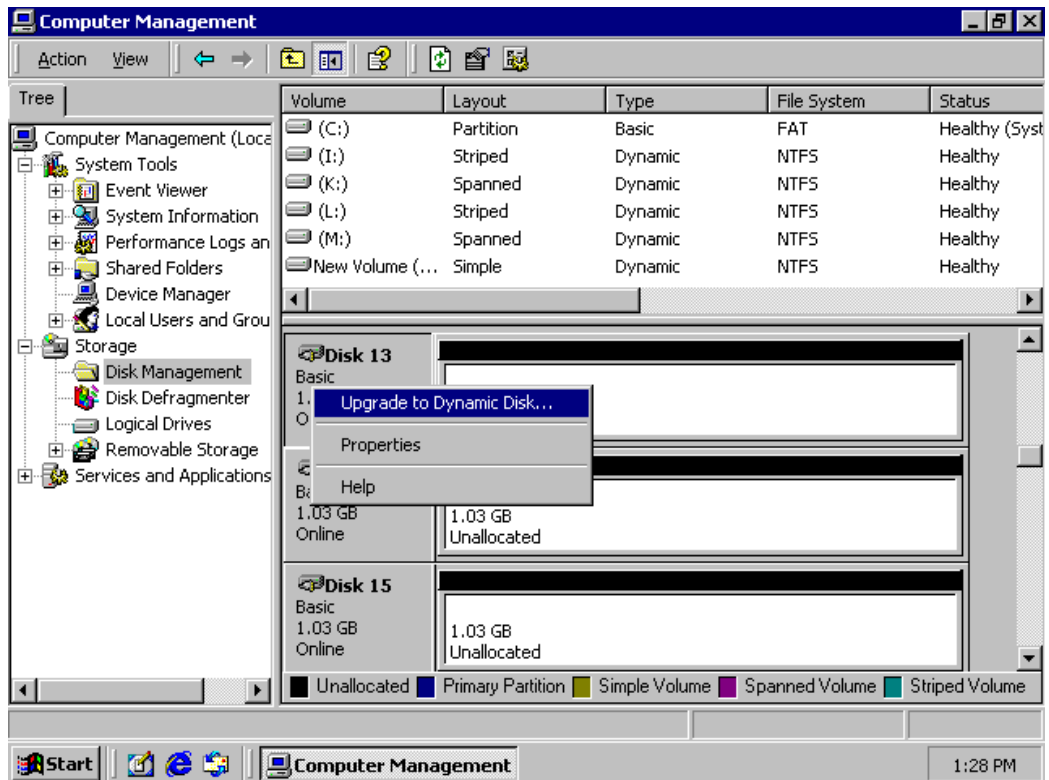


Figure 1-2 Upgrade to Dynamic Disk

Select the disk to upgrade. In the example in Figure 1-2, Disk 13 has been selected. Right-click to open the pop-up menu shown in Figure 1-2. Windows 2000 and Windows 2003 file systems can be used after upgrading.

Creating Volumes

Windows 2000 and Windows 2003 allow you to create up to four partitions in the free space of a physical hard disk, create multiple logical drives in the free space, and delete partitions.

You can use `Create Volume Wizard` to create the following:

- ◆ **Spanned disk volume** — Windows 2000 and Windows 2003 create spanned volumes (called volume sets in Windows NT) from unpartitioned free space on one or more drives.
- ◆ **Striped volume without parity** — Windows 2000 and Windows 2003 create striped volumes from unpartitioned free space on two or more drives. Unlike spanned volumes, each member partition of the striped volume must be on a different disk. Disk Manager makes partitions on all disks approximately the same size. Up to 32 disks can participate in a striped volume.
- ◆ **Striped volume with parity** — Striped volumes with parity require a minimum of three partitions on different drives.
- ◆ **Host-based mirrored volume** — The procedures for each of the four volumes are explained by the Wizard. For more information about these volumes, click **Help**.

Creating Simple, Spanned and Stripe Volumes

The following steps partition and format one disk at a time:

1. Right-click the Symmetrix disk you want to partition.
2. Select **Create Volume** from the menu.
3. In the Wizard program, select **Simple Volume**, **Spanned Volume**, or **Striped Volume**.

Mirrored and **RAID 5** are not good choices here, because you can mirror disks and create RAID 5 volumes more efficiently on the Symmetrix system.

4. Enter the size of the partition, or do nothing if you are using the whole disk.
5. Click **OK** to continue the operation.
6. Assign a drive letter and click **OK**.
7. Select the file system type (NTFS or FAT) from the File System menu and type in a label for the partition and click **OK**.
8. Check **Perform a Quick Format** to prevent excessively long waits.

9. Read the summary, and click **OK**.

Disk Manager displays the successful creation of the new drives and volumes like those shown in Figure 1-3. The color identifies the type of volume.

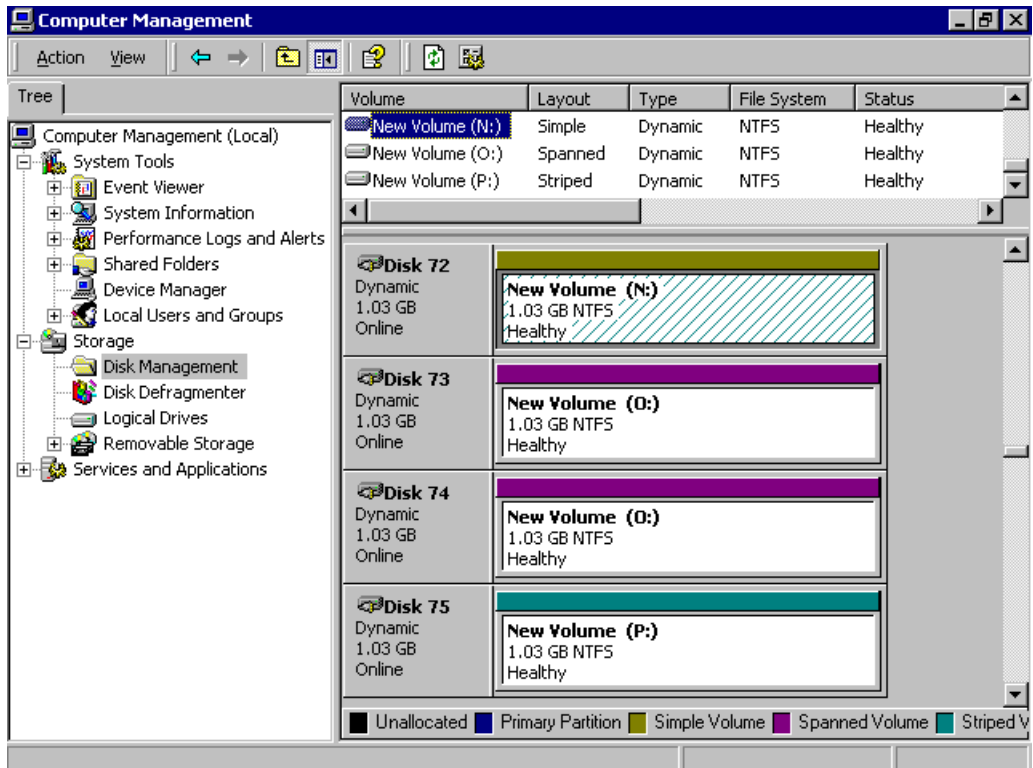


Figure 1-3 Healthy Volumes and File Systems Example

If file systems are not reported as healthy, refer to *Addressing Symmetrix Devices* on page 2-15.

Deleting Partitions

Back up the contents of any partition, volume, or logical drive before you delete it:

1. Right-click the partition, volume, or drive to select it.
2. Select **Delete** from the pop-up menu.

Windows warns you that all data will be lost and asks you to confirm.

3. Click **YES** to delete the selected item. That item becomes free space.

System Status and Error Messages

In a Windows 2000 or Windows 2003 environment you can view, save, or clear system status and error messages. The Windows host logs all errors it detects into a system event log.

To open the event log:

1. Click the **Administrative Tools** icon.
2. Select the **Event Viewer** option.
3. From here:
 - To view an event, double-click the event in the list, or select **View, Details** from the menu bar.
 - To save the contents of the system event log:
 - a. Select **Action** on the menu bar.
 - b. Click **Save As**, and enter the full path of the location to which the file is to be saved.
 - To clear the contents of the system event log:
 - a. Select **Action** on the menu bar.
 - b. Select **Clear All Events**.
 - c. Click **No** when prompted to save the events.

Adding Devices On Line

Whenever devices are added on line to the Symmetrix system or the device channel addresses are changed, you must perform the actions described below in order to introduce the new devices to the system.

To add new Symmetrix devices while the system remains on line:

1. Add the new Symmetrix devices into the Symmetrix configuration using the `AutoInstall` utility.

Important — Always consult the EMC PSE Configuration Group for assistance when working with a system with live data.

2. Run the `Disk Management` utility and perform a disk rescan, in either of these ways:
 - Right-click the **Disk Management** icon and select **Rescan Disks**.
 - Select **Disk Management**, and **Rescan Disks** from the **Action** menu.

If Disk Manager does not see the new drives, you must reboot the host.

Configuring for Windows NT and Symmetrix

Configuring the HBA Driver

Driver software for Windows hosts is provided with each HBA. Standard Windows driver installation procedures enable use of the HBAs.

The driver for the host bus adapter must be installed and configured prior to partitioning the Symmetrix disks. Refer to the appropriate section of Chapter 2 or Chapter 3.

If the driver is not available on your system, you can find it on the distribution CD for Windows NT 4.0, or obtain it directly from the manufacturer of your HBA.

To configure the HBA driver:

1. Boot your host with Windows NT 4.0.
2. Open the control panel and double-click the **SCSI Adapters** icon.
3. Select the **Drivers** tab.
4. Click on **Add** to display the **SCSI Adapter Drivers** database.
5. Select the manufacturer of your HBA from the list.
6. Select the appropriate driver from the list.

If you are installing an updated driver or a new driver not listed, click **Have Disk**, and enter the path to the drive where the driver resides. Then select the driver name from the list that appears.

7. Reboot the host. It should recognize the new HBA.
8. Use the `Disk Administrator` utility to view or edit your attached drives.

Specifying the Configuration

Once the HBA and driver have been installed, the system administrator can partition Symmetrix disks the same as other disks.

To view the Symmetrix disks seen by your host, select **Disk Administrator** from the **Administrative Tools** group. A window with all the physical disks connected to your workstation (along with their partitions) similar to the one shown in Figure 1-4 appears.

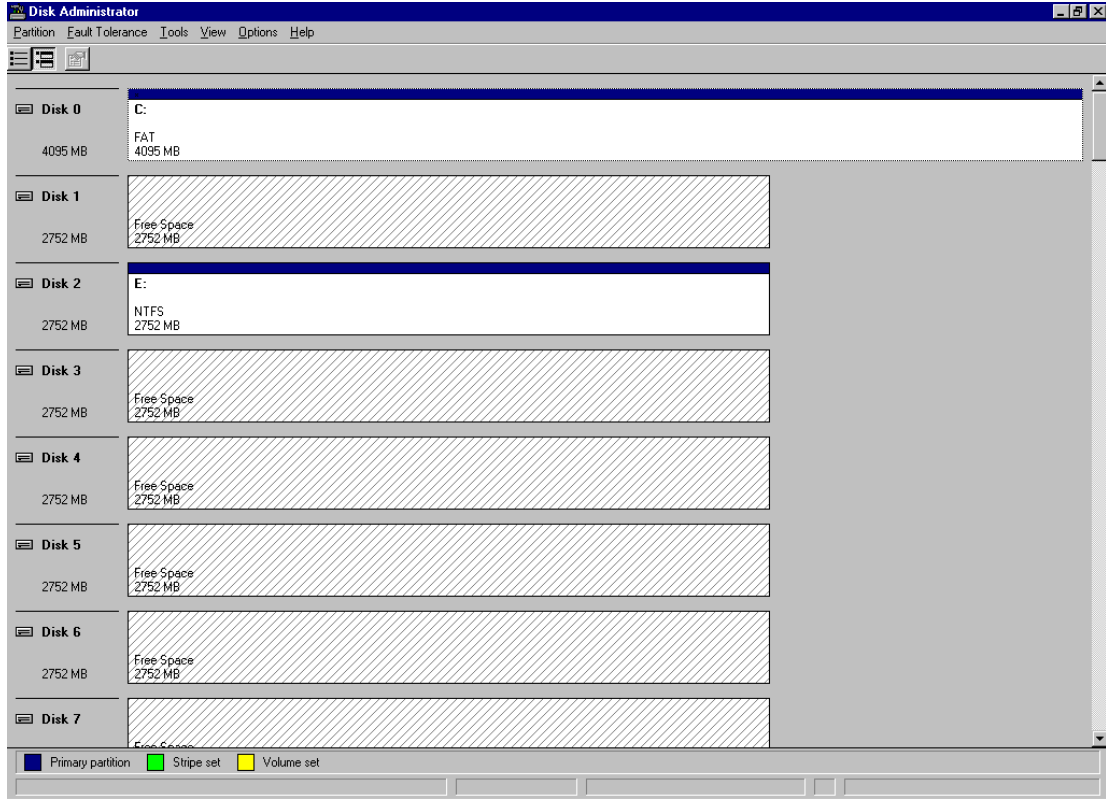


Figure 1-4 Windows NT 4.0 Disk Administrator

Partitioning Symmetrix Disks

Windows NT allows you to create up to four partitions in the free space of a physical hard disk, create multiple logical drives in the free space of an extended partition, and delete partitions.

The following steps partition and format one disk at a time.

Creating a Primary Partition

To create an unformatted partition:

1. Click the Symmetrix disk to partition.
2. Select **Create** from the **Partition** menu. The **Create Primary Partition** window appears.
3. Enter the size of the primary partition for that drive.
4. Click **OK** to continue the operation.

Formatting and Labeling a Volume

To format the newly created partition and label the volume:

1. Select **Commit Changes Now** from the **Partition** menu.
2. Answer **y** to all prompts.
3. Click on the new partition to select it.
4. Select **Format** from the **Tools** menu. The **Formatting** window (Figure 1-5) appears.

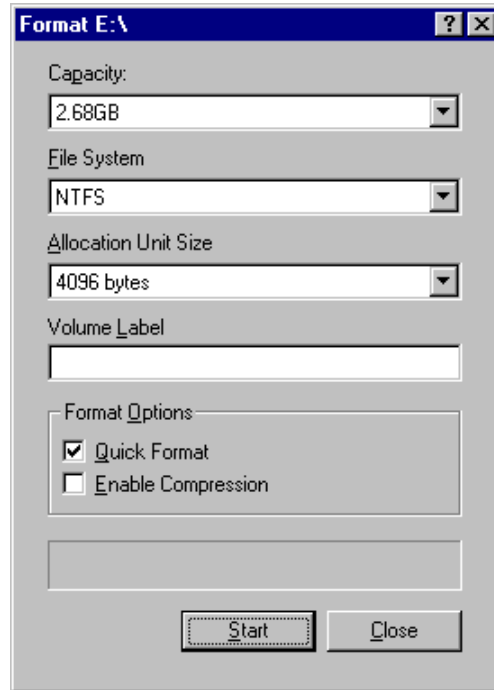


Figure 1-5 Windows NT 4.0 Formatting Window

5. Select the file system type (NTFS or FAT) from the **File System** menu and type in a label for the partition.
6. Click **Start**.

Assigning a Drive Letter

To assign a drive letter:

1. Click the partition to select it.
2. Select **Drive Letter** from the **Tools** menu.
3. Accept the next available letter or choose a different one.
4. Click **OK** to save the drive letter change.

Figure 1-6 on page 1-16 shows two NTFS partitions on a Symmetrix drive.

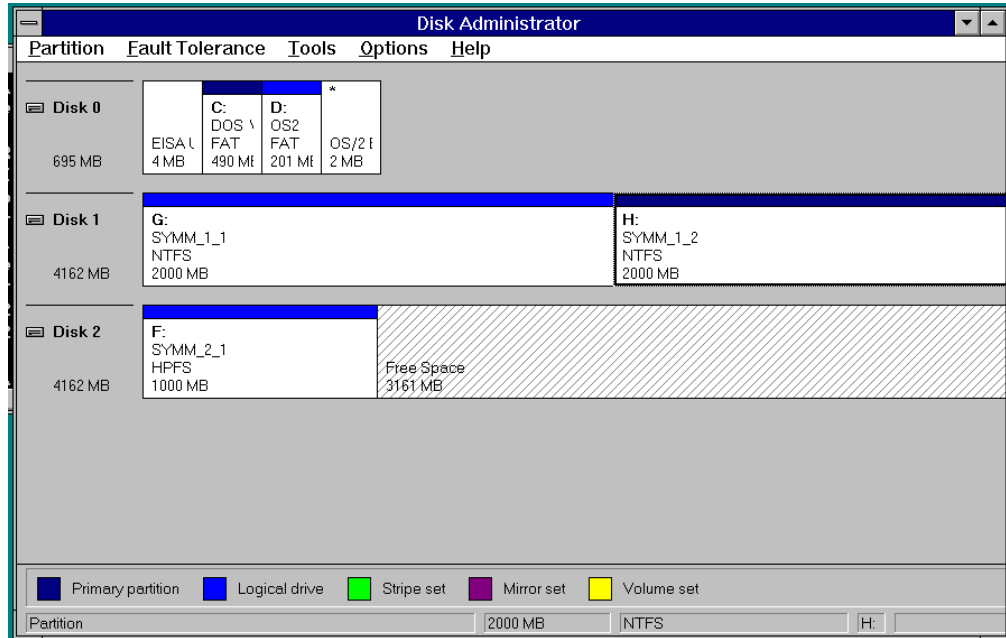


Figure 1-6 Two NTFS Partitions on Symmetrix Drive

Extended Partitions

In addition to the primary partition, the Windows NT Disk Administrator also allows you to configure one of the four partitions on a disk as an extended partition. Multiple logical volumes can then be created in this extended partition.

This extended partition also allows you to create volume sets, stripe sets (with or without parity), and mirrors.

To create an extended partition:

1. Select the Symmetrix disk to partition.
2. Select **Create Extended** from the **Partitions** menu. The **Create Extended Partition** dialog box appears.
3. Enter the size of the extended partition for that drive. (The default size is all available free space.)
4. Click **OK** to continue the operation. Windows NT creates an empty extended partition on that drive.
5. Click the partition to select it.

6. Select **Create** from the **Partitions** menu. The **Create Logical Drive** dialog box appears.
7. Enter the size of the logical drive to be created in the extended partition and click **OK**.

Click **OK** when the warning message appears.

Windows NT creates an unformatted volume in the extended partition.

8. Repeat steps 5 through 7 to create additional logical volumes in the extended partition if desired.
9. Select **Commit Changes**, and continue formatting the logical volume(s) and assigning drive letter(s) to these volumes as described under *Formatting and Labeling a Volume* on page 1-14 and *Assigning a Drive Letter* on page 1-15.

Creating a Volume Set

Windows NT creates volume sets from empty extended partitions or unpartitioned free space on one or more drives.

1. Select two or more areas of free space by clicking on the first area of free space and then holding down the CTRL key and clicking on additional areas that will be part of the volume set.
2. Select **Create Volume Set** from the **Partitions** menu.
3. In the **Create Volume Set** dialog box, type the size of the volume set you wish to create. (The default is all available space.)

If the volume set size is less than the total available free space in the areas selected, the volume set will be proportionally allocated across the selected areas.

4. Click **OK** to create the volume set.
5. Select **Commit Changes**, and continue formatting the logical volume(s) and assigning drive letter(s) to these volumes as described under *Formatting and Labeling a Volume* on page 1-14 and *Assigning a Drive Letter* on page 1-15.

Creating a Stripe Set Without Parity

Windows NT creates stripe sets from empty extended partitions or unpartitioned free space on two or more drives. Unlike volume sets, each member partition of the stripe set must be on a different disk. Disk Administrator will make partitions on all disks approximately the same size. Up to 32 disks can participate in a stripe set.

If you attempt to use areas of different size, the maximum size of the resulting volume may be limited by the size of the smallest free area used.

1. Select two or more areas of free space by clicking on the first area of free space and then holding down the CTRL key and clicking on additional areas that will be part of the stripe set.
2. Select **Create Stripe Set** from the **Partitions** menu.
3. In the **Create Stripe Set** dialog box, type the size of the stripe set you wish to create.
4. Click **OK** to create the stripe set volume.
5. Select **Commit Changes**, and continue formatting the logical volume(s) and assigning drive letter(s) to these volumes as described under *Formatting and Labeling a Volume* on page 1-14 and *Assigning a Drive Letter* on page 1-15.

Creating a Stripe Set With Parity

Stripe sets with parity require a minimum of three partitions on different drives.

1. Select three or more areas of free space by clicking on the first area of free space and then holding down the CTRL key and clicking on additional areas that will be part of the stripe set.
2. Select **Create Stripe Set With Parity** from the **Fault Tolerance** menu.
3. In the **Create Stripe Set With Parity** dialog box, type the size of the stripe set you wish to create.
4. Click on **OK** to create the stripe set volume.
5. Select **Commit Changes**, and continue formatting the logical volume(s) and assigning drive letter(s) to these volumes as described under *Formatting and Labeling a Volume* on page 1-14 and *Assigning a Drive Letter* on page 1-15.

Windows NT automatically initializes a stripe set with parity. The length of this process depends on the size of your volume.

Creating a Host-Based Mirror Set

Follow these steps to create a host-based mirror set:

1. Select the existing partition you wish to mirror.
2. Select an area of free space equal to or larger than the partition chosen in step 1 by holding down the CTRL key and clicking on the area.
3. Select **Establish Mirror** from the **Fault Tolerance** menu. Windows NT creates the mirror set.
4. Select **Commit Changes**, and continue formatting the logical volume(s) as described under *Formatting and Labeling a Volume* on page 1-14.

Windows NT automatically initializes a mirror set. The length of this process depends on the size of your volume.

Deleting Partitions

Back up the contents of any partition, volume, or logical drive before you delete it.

1. Click the partition, volume, or drive to select it.
2. Select **Delete** from the **Partitions** menu.
3. Windows NT warns you that all data will be lost and asks you to confirm.

Click **Yes** to delete the selected item. That item becomes free space.

System Status and Error Messages

In a Windows NT environment you can view, save, or clear system status and error messages. The Windows NT host logs all errors it detects into a system log in its memory.

Viewing the System Log

To view the error log:

1. Click the **Administrative Tools** icon.
2. Select the **Event Viewer** option.
3. To view an event, go to **View** and then click **Details** on the menu bar. Or, double-click the desired event in the list.

Saving the System Log

To save the contents of the system log:

1. Click the **Administrative Tools** icon.
2. Select the **Event Viewer** option.
3. Select **Log** on the menu bar, and click **Save As**.

Type in the full path of the location to which the file is to be saved.

Clearing the System Log

To clear the contents of the system log:

1. Click the **Administrative Tools** icon.
2. Select the **Event Viewer** option.
3. Select **Log** on the menu bar.
4. Click **Clear All Events**.
5. Click **No** when prompted to save the events.
6. Click **Yes** when prompted to clear the log.

Adding Devices On Line

Whenever devices are added to the Symmetrix system on line or the device channel addresses are changed, you must perform the following actions to introduce the new devices to the system:

1. Add the new Symmetrix devices into the Symmetrix configuration using the AutoInstall utility.

Important — Always consult the EMC PSE Configuration Group for assistance when working with a system with live data.

2. Run Disk Administrator. The new devices will have a *free space* designation.
3. Partition and format the new devices as described in *Partitioning Symmetrix Disks* on page 1-14.

Not all HBAs will properly add new disk devices on line. In some cases, you may have to reboot to gain access to new devices.

Editing the Windows I/O Timeout Value

This section does not apply to hosts with QLogic HBAs, because the I/O timeout value is specified in the setup files.

The section also does not apply to hosts with Emulex HBAs with driver versions above 2.11a2, because the Emulex Configuration Tool in those versions automatically updates the I/O timeout value.

Some Windows configurations, especially those using the Symmetrix system as a boot device, periodically encounter I/O timeouts, which can cause unusual error messages and performance degradation. To avoid this potential problem, EMC recommends increasing the Windows default I/O timeout value, as follows:

1. Open the Windows registry editor:
 - a. On the Windows taskbar, click **Start**.
 - b. Select **Run**.
 - c. Type **regedt32.exe** in the **Open** field, and click **OK**.
2. Follow this path: **HKEY_LOCAL_MACHINE, System, CurrentControlSet, Services, Disk**.
3. Look for **TimeOutValue** in the right pane of the registry editor:
 - If the **TimeOutValue** exists, double-click it, and go to step 4.
 - If the **TimeOutValue** does *not* exist:
 - a. Select **Add Value** from the **Edit** menu.
 - b. In the **Value Name** box, type **TimeOutValue** (exactly as shown).
 - c. For the data type, select **REG_DWORD** from the pull-down menu.
 - d. Click **OK**, and go to step 4.
4. In the **DWORD Editor** window:
 - a. Click **decimal** in the **radix** box.
 - b. Change the value in the **data** box to **60**.
5. Click **OK**.
6. Close the registry editor.
7. Reboot the host.

Recovering from Drive Errors on Windows 2000/Windows 2003 Hosts

The following paragraphs describe various drive errors and the recovery procedures.

Recovery from Offline State

When a failure happens from a fiber cable being disconnected or a Fibre Channel director going to a *Dead Director* state, the drives on a Windows 2000 or Windows 2003 system may be put into an offline state. (You can view this by going to the Disk Management utility.) This is a normal behavior that guards against data errors. To recover from this condition, you must reactivate one offline drive and then perform a disk rescan. (Refer to Figure 1-7.)

This brings up all of the offline drives at once.

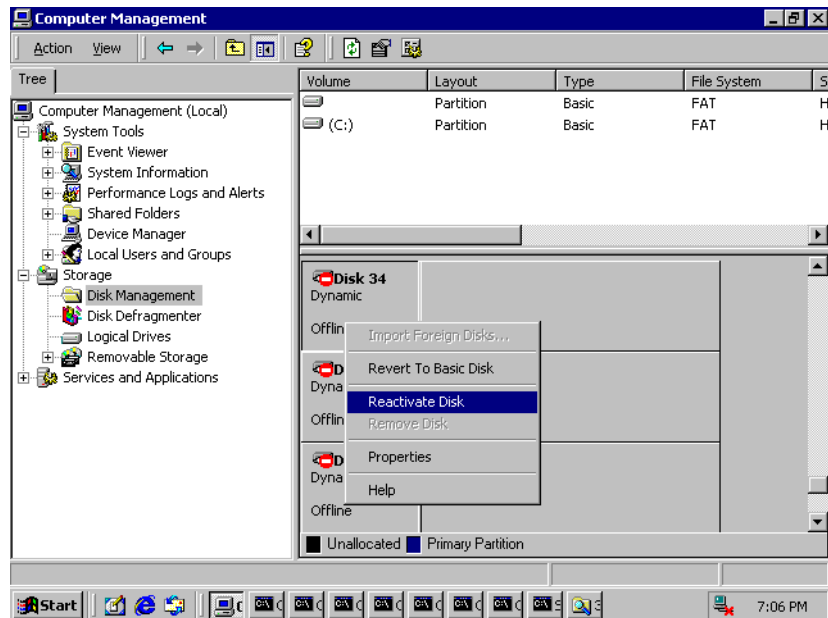


Figure 1-7 Recovery from Offline State

Rebooting to Recover from an Offline State

If a drive is off line for a long time, Windows 2000/2003 will not let you reactivate the drive. In this case, you must reboot the host to reactivate the drive. (Refer to Figure 1-8; you cannot select **Reactivate Volume** from the menu shown here, so you must reboot.)

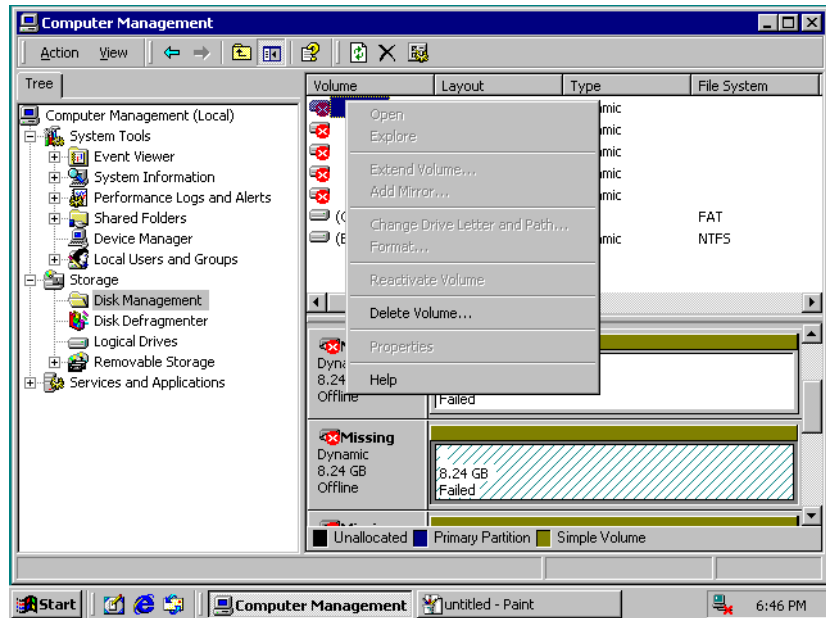


Figure 1-8 Offline State Requires Reboot

Recovery from At-Risk File System

To recover from an *At-Risk File System*, you must reactivate each individual disk. (Refer to Figure 1-9.)

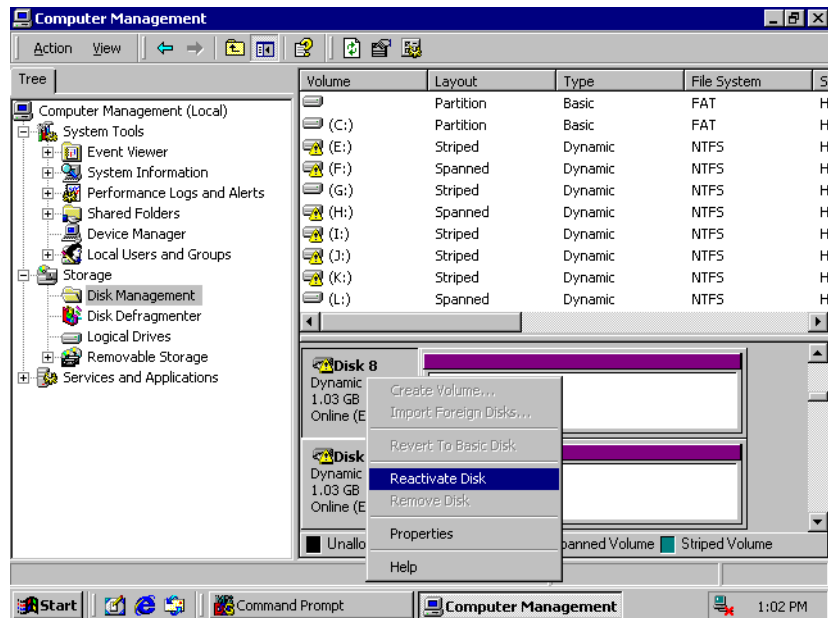


Figure 1-9 Recovery from At-Risk File System

Recovery from Fail State

Another case is where the drive is in a *Fail* state. To recover, activate the failed volume. (Refer to Figure 1-10.)

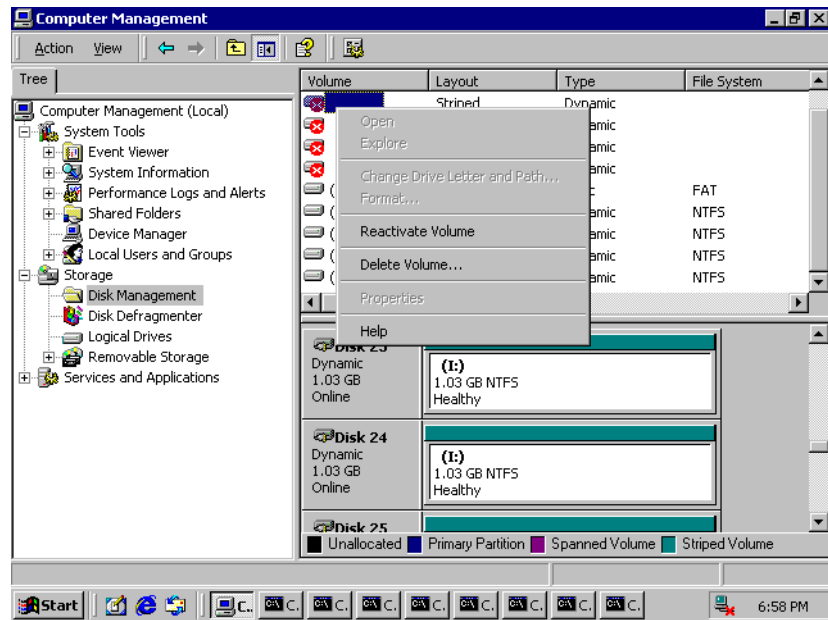


Figure 1-10 Recovery from Fail State

Configuring VERITAS Volume Manager for Symmetrix

When using VERITAS Volume Manager (VxVM) with Windows servers and Symmetrix, no special configuration is needed.

- ◆ The VERITAS Volume Manager replaces the native disk manager that is accessed from the system management console. Refer to VERITAS documentation for installation and operating instructions for your version.
- ◆ If the VERITAS DMP (Dynamic Multi-Pathing) feature is to be used with Symmetrix in your configuration, the C bit must be enabled on the ports that will be connected to the host server. This allows DMP to properly protect LUNs for failover.
- ◆ HBA settings for DMP are the same as those that are configured for use with EMC Powerpath. Refer to EMC documentation for your HBA on which settings are used for Powerpath configurations.

Refer to the *EMC Support Matrix* for supported VxVM versions, service packs, and hotfixes.

Windows and Symmetrix over Fibre Channel

This chapter provides information specific to Windows hosts connecting to Symmetrix systems over Fibre Channel.

- ◆ Windows/Symmetrix Fibre Channel Environment2-2
- ◆ Planning for Fabric Zoning and Connections2-3
- ◆ Host Configuration with Compaq FC 223180-B21 HBA2-5
- ◆ Host Configuration with HP A5246A HBA2-6
- ◆ Host Configuration with HP D8602A/D8602B HBA2-7
- ◆ Host Configuration with Emulex HBAs2-11
- ◆ Host Configuration with QLogic HBAs2-12
- ◆ Recognizing LUNs2-13
- ◆ Addressing Symmetrix Devices2-15

Windows/Symmetrix Fibre Channel Environment

This section lists some Symmetrix Fibre Channel support information specific to the Windows environment.

Also refer to Chapter 1 for information that is common to both Fibre Channel and SCSI configurations.

Hardware Connectivity

The Symmetrix Fibre Channel implementation supports up to eight Fibre Channel HBAs per host (depending on the number of available PCI slots).

Boot Device Support

Windows hosts have been qualified for booting from Symmetrix devices interfaced over Fibre Channel as described in the *EMC Support Matrix* and:

- ◆ *Host Configuration with Emulex HBAs* on page 2-11
- ◆ *Host Configuration with QLogic HBAs* on page 2-12
- ◆ *Recognizing LUNs* on page 2-13

Addressing

Windows SCSI drivers and host adapter drivers use SCSI-2 device access protocol in addressing Fibre Channel devices. SCSI-3 Array Controller addressing modes are not supported. The peripheral device access mode is supported in the Symmetrix to address up to 256 logical devices per port (up to 8 with an HP A5246A or Compaq adapter).

Driver software for Windows hosts is provided with each HBA. Standard Windows driver installation procedures enable use of the HBAs.

Refer to *Addressing Symmetrix Devices* on page 2-15 for descriptions of the available addressing modes.

Planning for Fabric Zoning and Connections

This section applies only to fabric configurations.

Plan for the switch topology, target to hosts mapping, and the zone. Draw the connectivity between the hosts, switch and the Symmetrix system for a verification of the fabric configuration. After the user has decided on the desired connections, the user must configure the zone capability in the switch before proceeding. Refer to the *Connectrix Enterprise Storage Network System Planning Guide* for information on the zone configuration.

Understanding Persistent Binding

Persistent binding is the mechanism to create a continuous logical route from a storage device object in the Windows host to a volume in a Symmetrix system across the fabric.

Without a persistent binding mechanism, the host cannot maintain persistent logical routing of the communication from a storage device object across the fabric to a Symmetrix volume. If the physical configuration of the switch is changed (for example, the cable is swapped or the host is rebooted), the logical route becomes inconsistent, causing possible data corruption.

Methods of Persistent Binding

The Windows device naming convention and disk discovery process does not allow the Windows operating system to establish persistent binding. Therefore, one of these methods must be used:

- ◆ EMC Volume Logix — Provides persistent binding through centralized control by the Symmetrix Fibre Channel fabric ports.
For more information, refer to the *EMC Volume Logix Product Guide*.
- ◆ Switch zone mapping — Provides persistent binding through centralized control by the Fibre Channel switch.
For more information, refer to the *EMC Connectrix Enterprise Storage Network System Planning Guide*.
- ◆ (Emulex HBAs only) Emulex configuration tool mapping — Provides persistent binding of targets through centralized control by the Emulex host adapter. This requires the user to modify the mapping manually.

For more information, refer to *EMC Fibre Channel with Emulex Host Bus Adapters in the Windows Environment*, available on <http://www.emulex.com>:

- a. Click **drivers, software and manuals** at the left side of the screen.
- b. Click **EMC** at the upper center of the next screen.
- c. Click the link to your HBA at the left side of the screen.
- d. Under **EMC Drivers, Software and Manuals**, click the **Installation and Configuration** link under **Drivers for Windows <version>**.

Host Configuration with Compaq FC 223180-B21 HBA

This section describes the procedures required to install one or more Compaq 223180-B21 host bus adapters into a Windows host and configure the host for connection to the Symmetrix over Fibre Channel arbitrated loop.

Installing the HBA

Before installing the HBA, be sure to edit the Windows registry as described under *Planning for Fabric Zoning and Connections* on page 2-3.

With host system power removed, install the adapter card and make cable connections. (The card has no user-configurable jumpers or switches.) Reapply power and allow the system to boot normally.

Installing the HBA Driver

To use Symmetrix disks with a Windows host, you need a Fibre Channel host adapter driver, which you can obtain from the manufacturer of your adapter card. The driver must be installed and configured before Windows can access the Symmetrix disks.

To configure the driver:

1. Boot the host with the Windows OS.
2. Open the Control Panel and double-click the **SCSI Adapter** icon.
3. Select the **Drivers** tab.
4. Click **Add** to display the SCSI adapter drivers database.
5. Select **HAVE DISK**.
6. Locate the appropriate driver for your adapter and continue with the install procedure.
7. Reboot the host. It should recognize all new host adapter cards.

After rebooting you can verify that the driver installed and started by checking the **Control Panel, SCSI Adapter, Drivers** window for a statement similar to the following:

SCSI driver for Compaq Fibre Channel Controller (Started)

The driver is now loaded and the adapter is available to the system.

What Next?

Proceed to *Recognizing LUNs* on page 2-13.

Host Configuration with HP A5246A HBA

This section describes the procedures required to install one or more HP A5246A (Agilent HHBA-5000A) host bus adapters into a Windows NT/Windows 2000 host and configure the host for connection to the Symmetrix over Fibre Channel arbitrated loop.

Before installing the HBA, be sure to edit the Windows registry as described under *Planning for Fabric Zoning and Connections* on page 2-3.

Installing the HBA

With host system power removed, install the adapter card and make cable connections. Reapply power and allow the system to boot normally. (The card has no user-configurable jumpers or switches.)

Installing the HBA Driver

To use Symmetrix disks with a Windows host, you need a Fibre Channel host adapter driver, which can be obtained from Hewlett Packard. The driver must be installed and configured before Windows can access the Symmetrix disks.

To configure the driver, follow these steps:

1. Boot the host with the Windows OS.
2. Open the Control Panel and double-click the **SCSI Adapter** icon.
3. Select the **Drivers** tab.
4. Click **Add** to display the SCSI adapter drivers database.
5. Select **HAVE DISK**.
6. Locate the appropriate driver for your adapter and continue with the install procedure.
7. Reboot the host. It should recognize all new host adapter cards.

After rebooting you can verify that the driver installed and started by checking the **Control Panel, SCSI Adapter, Drivers** window for a statement similar to the following:

SCSI driver for HP HHBA-5000 Fibre Channel Controller (Started)

The driver is now loaded and the adapter is available to the system.

What Next?

Proceed to *Recognizing LUNs* on page 2-13.

Host Configuration with HP D8602A/D8602B HBA

This section describes the procedures required to install one or more HP D8602A (Agilent HHBA-5101B) or D8602B (Agilent HHBA-5101C) host bus adapters into a Windows NT host and configure the host for connection to the Symmetrix over Fibre Channel arbitrated loop.

The HP D8602A/D8602B requires that the Disk Array Mode and Volume Set Addressing bits be enabled.

Before installing the HBA, be sure to edit the Windows registry as described under *Planning for Fabric Zoning and Connections* on page 2-3.

Installing the HBA

With host system power removed, install the adapter card and make cable connections. Reapply power and allow the system to boot normally. (The card has no user-configurable jumpers or switches.)

Installing the HBA Driver

The procedure for installing the HBA driver differs depending on the Windows operating system.

Installing the HBA Driver into Windows NT Hosts

To use Symmetrix disks with a Windows NT host, you need a Fibre Channel host adapter driver, which can be obtained from Hewlett Packard. The driver must be installed and configured before Windows can access the Symmetrix disks.

To configure the driver, follow these steps:

1. Boot the host with the Windows OS.
2. Open the Control Panel and double-click the **SCSI Adapter** icon.
3. Select the **Drivers** tab.
4. Click **Add** to display the SCSI adapter drivers database.
5. Select **HAVE DISK**.
6. Locate the appropriate driver for your adapter and continue with the install procedure.
7. Reboot the host. It should recognize all new host adapter cards.

After rebooting you can verify that the driver installed and started by checking the **Control Panel, SCSI Adapter, Drivers** window for a statement similar to the following:

SCSI driver for HP HHBA-5100 Fibre Channel Controller (Started)

The driver is now loaded and the adapter is available to the system.

Editing Windows NT Registry Settings

In a Windows NT 4.0 host, the HP D8602A/D8602B HBA requires that these two settings be edited in the Windows registry:

- ◆ **System Pages** — Determines the number of memory pages Windows allocates.
- ◆ **Number of Requests** — Determines the number of requests the HBA queues.

Newer versions of the D8602A/D8602B driver include an EMC icon that you can click to automatically make these registry settings. After installing the driver, you should follow the below procedure to verify that the correct settings have been made.

Follow this procedure to modify the settings:

1. Open the registry:
 - a. On the Windows taskbar, click **Start**.
 - b. Click **Run**.
 - c. Type **regedt32.exe** in the **Open** field and click **OK**.
2. Follow this path (noting that **Session Manager** is the entry with a space between the words, not **SessionManager**):
HKEY_LOCAL_MACHINE, System, CurrentControlSet, Control, Session Manager, Memory Management.

If the registry editor window is not split into left and right panes, click the **View** menu, and make sure **Tree and Data** is checked.

3. In the right pane of the registry window, double-click the **SystemPages** value.
4. In the **DWORD Editor** window, select **Decimal** in the **Radix** box.
5. In the **Data** box, type **50000**.
6. Click **OK**.

7. Go back to the **CurrentControlSet** level (the third line below), then follow the path as shown:
HKEY_LOCAL_MACHINE, System, CurrentControlSet, Services, HHBA5100, Parameters, Device "n".
8. In the right pane of the registry window, double-click the **NumberOfRequests** value.
9. In the **DWORD Editor** window, select **Decimal** in the **Radix** box.
10. In the **Data** box, type **128**.
11. Click **OK**.
12. Exit the registry editor, then reboot the host. (This is necessary for the changes to take effect.)

Installing the HBA Driver into Windows 2000 Hosts

To install the HBA driver into a Windows 2000 host, follow these steps:

1. Boot the host with Windows 2000.
2. Open the **Computer Management** utility by clicking **Start, Programs, Administrative Tools, Computer Management**.
3. In the left pane of the **Computer Management** window, click the **Device Manager** icon.
4. Since Plug & Play does not detect D8602A/D8602BHBA's, double-click the **Other Devices** icon in the right pane.
5. Double-click the first instance of **Fibre Channel Controller** under **Other Devices**.
6. In the next window, click **ReInstall Driver**, then **Next**.
7. Select **Display a list of the unknown drivers for this device so that I can choose a specific driver**, then click **Next**.
8. Select **SCSI and RAID Controllers**, then click **Next**.
9. Click **Have Disk**.
10. Enter the path to the diskette containing the driver (for example, **A:**), then click **OK**.
11. Select the appropriate D8602A/D8602B PCI Fibre Channel adapter in the list of drivers that appears; then click **Next**.
12. Click **Next** in the next window.
13. Click **YES** to continue the installation.

14. Click **Finish** to complete the driver installation.
15. The system will request that you reboot the system. Select **NO** and click **Close**.
16. The system will again request the you reboot the system. Select **NO** again.
17. If there are other HP HBAs installed, repeat steps 5 through 16 until all adapters have been installed.
18. Reboot the host.

What Next?

Proceed to *Recognizing LUNs* on page 2-13.

Host Configuration with Emulex HBAs

To install one or more EMC-qualified Emulex host bus adapters into a Windows host and configure the host for connection to Symmetrix over Fibre Channel, follow the procedures in *EMC Fibre Channel with Emulex Host Bus Adapters in the Windows Environment*, available on the Emulex website:

1. Access <http://www.emulex.com>.
2. Click **drivers, software and manuals** at the left side of the screen.
3. Click **EMC** at the upper center of the next screen.
4. Click the link to your HBA at the left side of the screen.
5. Under **EMC Drivers, Software and Manuals**, click the **Installation and Configuration** link under **Drivers for Windows <version>**.

What Next?

Proceed to *Recognizing LUNs* on page 2-13.

Host Configuration with QLogic HBAs

To install one or more EMC-approved QLogic host bus adapters (HBAs) into a Windows host and configure the host for connection to the Symmetrix over a Fibre Channel, follow the procedures in *EMC Fibre Channel with QLogic Host Bus Adapters in the Windows Environment*, available on the QLogic website:

1. Access <http://www.qlogic.com>.
2. Click **Downloads** at the left side of the screen.
3. Click the **EMC** link to the right of **OEM-approved Drivers/Firmware**.
4. Find the description of your HBA driver in the **Name** column of the table for your HBA model. Then click the **Readme** link in the associated **Description** column.

What Next?

Proceed to *Recognizing LUNs* on page 2-13.

Recognizing LUNs

Once a Symmetrix system has devices assigned with device addresses and the directors have been switched on line, the host can see all the target Symmetrix devices assigned to that host interface. Devices are presented to the host in the same manner as devices accessed through a standard SCSI interface.

Symmetrix devices are addressed on the SCSI bus using SCSI target IDs and SCSI LUNs. Each target ID can have multiple LUNs associated with it, as shown in Table 2-1.

Table 2-1 Maximum LUNs per Target

HBA	Max LUNS/Target
Compaq FC 223180-B21	128
HP A5246A	8
HP D8602A, D8602B	256
Emulex	256
QLogic	256

Refer to the *EMC Support Matrix* for supported Emulex and QLogic HBA models.

In arbitrated loop configurations, the target ID needed to address a device is determined by the Fibre Channel Arbitrated Loop Physical Address (AL_PA). A Loop_ID of 00 (AL_PA of EF) will have LUNS behind Target ID 0, Loop_ID 01 has LUNs behind target ID 1, and so on.

Your actual target/LUN assignment will vary depending on unique system configuration requirements.

If replacing a Symmetrix SCSI director with a Fibre Channel director, be sure that existing and new configurations are well documented before you begin the procedure.

The first time a disk appears on a Windows NT/Windows 2000 system, the Windows Disk Administrator writes a signature to that disk. The signature is a unique 32-bit number that Windows uses as

an internal identification number for that disk. Windows uses the signature to associate drive letters with a disk and disks with volume sets. The Disk Administrator can reassociate the drive letter with the correct disk even if you reconfigure device channels or change the disk target and LUN.

Windows searches for disks on each host adapter in target ID/LUN sequence. Adapters are also accessed in a particular sequence that is unique to each host. This process determines the order in which the disk devices are assigned drive letters.

Drive letters can be reassigned manually using Disk Administrator after a new signature is written.

Once all disk signatures are written, devices are ready to be used by the Windows operating system.

Addressing Symmetrix Devices

This section describes the methods of addressing Symmetrix devices over Fibre Channel.

Arbitrated Loop Addressing

The Fibre Channel arbitrated loop (FC-AL) topology defines a method of addressing ports, arbitrating for use of the loop, and establishing a connection between Fibre Channel NL_Ports (level FC-2) on HBAs in the host and Fibre Channel directors (via their adapter cards) in the Symmetrix system. Once loop communications are established between the two NL_Ports, device addressing proceeds in accordance with the SCSI-3 Fibre Channel protocol (SCSI-3 FCP, level FC-4).

The Loop Initialization Process (LIP) assigns a physical address (AL_PA) to each NL_Port in the loop. Ports that have a previously acquired AL_PA are allowed to keep it. If the address is not available, another address may be assigned, or the port may be set to non-participating mode.

The AL_PA is the low-order 8 bits of the 24-bit address. (The upper 16 bits are used for Fibre Channel fabric addressing only; in FC-AL addresses, these bits are x'0000'.)

Symmetrix Fibre Channel director parameter settings, shown under *FC-AL Addressing Parameters* on page 2-16, control how the Symmetrix system responds to the LIP.

After the loop initialization is complete, the Symmetrix port can participate in a logical connection using the hard-assigned or soft-assigned address as its unique AL_PA. If the Symmetrix port is in non-participating mode, it is effectively off line and cannot make a logical connection with any other port.

A host initiating I/O with the Symmetrix system uses the AL_PA to request an open loop between itself and the Symmetrix port. Once the arbitration process has established a logical connection between the Symmetrix system and the host, addressing specific logical devices is done through the SCSI-3 FCP.

FC-AL Addressing Parameters

Table 2-2 FC-AL Addressing Parameters

Parameter	Bit	Description	Default
Disk Array	A	If enabled, the Fibre Channel Director presents the port as a disk array. Refer to <i>Symmetrix SCSI-3 Addressing Modes</i> on page 2-19 for settings for each addressing mode.	Enabled
Volume Set	V	If enabled <i>and</i> Disk Array is enabled, Volume Set addressing mode is enabled. Refer to <i>Symmetrix SCSI-3 Addressing Modes</i> on page 2-19 for settings for each addressing mode.	Enabled
Use Hard Addressing	H	If enabled, entering an address (00 through 7D) in the Loop ID field causes the port to attempt to get the AL_PA designated by the Loop ID. If the port does not acquire the AL_PA, the Symmetrix reacts based on the state of the non-participating (NP) bit. If the NP bit is set, the port switches to non-participating mode and is not assigned an address. If non-participating mode is not selected, or if the H-bit was not set, the Symmetrix port accepts the new address that is <i>soft-assigned</i> by the host port.	Enabled
Hard Addressing Non-participating	NP	If enabled <i>and</i> the H bit is set, the director uses <i>only</i> the hard address. If it cannot get this address, it re-initializes and changes its state to non-participating. If the NP bit is not set, the director accepts the soft-assigned address.	Disabled
Loop ID	---	One-byte address (00 through 7D), valid only if the H bit is set.	00
Third-party Logout Across the Port	TP	Allows broadcast of the TPRLO extended link service through all of the FC-AL ports.	Disabled

Fabric Addressing

Each port on a device attached to a fabric is assigned a unique 64-bit identifier called a World Wide Port Name (WWPN). These names are factory-set on the HBAs in the hosts, and are generated on the Fibre Channel directors in the Symmetrix system.

For comparison to Ethernet terminology, an HBA is analogous to a NIC card, and a WWPN to a MAC address.

The ANSI standard also defines a World Wide Node Name (WWNN), but this name has not been consistently defined by the industry.

When an N_Port (host server or storage device) connects to the fabric, a login process occurs between the N_Port and the F_Port on the fabric switch. During this process, the devices agree on such operating parameters as class of service, flow control rules, and fabric addressing. The N_Port's fabric address is assigned by the switch and sent to the N_Port. This value becomes the Source ID (SID) on the N_Port's outbound frames and the Destination ID (DID) on the N_Port's inbound frames.

The physical address is a pair of numbers that identify the switch and port, in the format **s,p**, where **s** is a domain ID and **p** is a value associated to a physical port in the domain. The physical address of the N_Port can change when a link is moved from one switch port to another switch port. The WWPN of the N_Port, however, does not change. A Name Server in the switch maintains a table of all logged-in devices, so N_Ports can automatically adjust to changes in the fabric address by keying off the WWPN.

The highest level of login that occurs is the process login. This is used to establish connectivity between the upper-level protocols on the nodes. An example is the login process that occurs at the SCSI FCP level between the HBA and the Symmetrix system.

SCSI-3 FCP Addressing

The Symmetrix director extracts the SCSI Command Descriptor Blocks (CDB) from the frames received through the Fibre Channel link. Standard SCSI-3 protocol is used to determine the addressing mode and to address specific devices.

The Symmetrix supports three addressing methods based on a single-layer hierarchy as defined by the SCSI-3 Controller Commands (SCC):

- ◆ Peripheral Device Addressing
- ◆ Logical Unit Addressing
- ◆ Volume Set Addressing

All three methods use the first two bytes (0 and 1) of the 8-byte LUN addressing structure. The remaining six bytes are set to 0s.

For Logical Unit and Volume Set addressing, the Symmetrix port identifies itself as an Array Controller in response to a host's Inquiry command sent to LUN 00. This identification is done by returning the byte 0x0C in the Peripheral Device Type field of the returned data for Inquiry. If the Symmetrix system returns the byte 0x00 in the first byte of the returned data for Inquiry, the Symmetrix system is identified as a Direct Access device.

Upon identifying the Symmetrix system as an Array Controller device, the host should issue a SCSI-3 Report LUNS command (0xA0), in order to discover the LUNS.

The three addressing modes, contrasted under *Symmetrix SCSI-3 Addressing Modes* on page 2-19, differ in the addressing scheme (target ID, LUN and virtual bus) and number of addressable devices.

Symmetrix SCSI-3 Addressing Modes

Table 2-3 Symmetrix SCSI-3 Addressing Modes

Addressing Mode	Code ^a	“A” Bit	“V” Bit	Response to “Inquiry”	LUN Discovery Method	Possible Addresses	Maximum Logical Devices ^b
Peripheral Device	00	0	X	0x00 Direct Access	Access LUNs directly	16,384	256
Logical Unit	10	1	0	0x0C Array Controller	Host issues “Report LUNS” command	2,048	128
Volume Set	01	1	1	0x0C Array Controller	Host issues “Report LUNS” command	16,384	512

a. Bits 7-6 of byte 0 of the address.

b. The actual number of supported devices may be limited by the type host or host bus adapter used.

The addressing modes are provided to allow flexibility in interfacing with various hosts. In all three cases the received address is converted to the internal Symmetrix addressing structure. Volume Set addressing is the default for Symmetrix systems. Select the addressing mode that is appropriate to your host.

Windows and Symmetrix over SCSI

This chapter provides information specific to Windows hosts connecting to Symmetrix systems over SCSI.

- ◆ Hosts That Also Run UNIX3-2
- ◆ Configuring Some Host Bus Adapters3-4

Hosts That Also Run UNIX

This section describes considerations of which you should be aware if your particular host can run different operating systems.

Alpha Console Installation Issues

PCI-based Alpha systems can run any of three different operating systems: Digital UNIX, OpenVMS, or Windows NT. The Alpha console in Digital UNIX or OpenVMS uses the SRM display mode, while Windows NT uses the ARC display mode. If this is a new installation of Windows NT on your Alpha system, you may need to switch from SRM to ARC to perform the installation.

To determine if your system is in the SRM mode:

1. Power on your Alpha system.
2. If the system displays a console prompt of `P00>>>` or `>>>`, it is in SRM mode.

If the system displays a console prompt of `Boot menu:` and a list of options, it is in ARC mode.

To switch from the SRM mode to the ARC mode:

1. Type **set OS_TYPE NT** and press ENTER.

If you enter **arc** at the `>>>` prompt, ARC mode will be loaded, but SRM will still be loaded at the next powerup. You must enter **set OS_TYPE NT** to switch.

2. Reboot the system.
3. Run **ECU** from the diskette. Make sure **ECU** is for use with Windows, and not UNIX or VMS.
4. Enter the program and then exit, saving all changes.
5. Reboot again.
6. If a system time error message appears, use the arrow keys to select **Supplementary Menu** from the Boot menu list; then continue to step 7.

If a system time error message does *not* appear, go to step 9.

7. Select **Set up the system...** from the **Supplementary** menu followed by **Set system time**. Enter the correct date and time.

8. Select **Supplementary menu and save changes**.

Updating NVRAM appears; eventually you will return to the Boot list.

If **Supplementary menu and save changes** does not appear, select **Set default configuration....** from the Setup menu and select all the defaults. When you are finished, **Supplementary menu and save changes** should appear.

9. If Windows has already been installed, the Boot list will have a **Boot Windows <version>** selection. Select this option to boot Windows NT, and then proceed with the rest of the Symmetrix installation.

If the Boot list does not offer the Windows selection, install Windows at this time.

EMC AViiON Installations

EMC AViiON systems can run both DG UNIX and Windows operating systems. At installation you will need to specify which operating system to use.

To specify (and install) Windows, if necessary:

1. Power on the AViiON system.
2. The host goes through its initialization and boot routines. When the console prompt `SMC286>` appears:
 - If Windows has already been installed, go to step 3.
 - If Windows has not yet been installed, insert the Windows boot diskette into the host's diskette drive, and go to step 3.
3. At the prompt, type **B bios**, and press ENTER.
 - If Windows is already installed, the OS boots from the internal drive.
 - If Windows has not yet been installed, answer the prompts as they appear on the console during the installation process.
4. Select **Windows <version> Server Version <version>** from the menu on the screen.
5. Install the HBA driver.

Configuring Some Host Bus Adapters

This section describes how to configure some of the host bus adapters for connection to a Symmetrix system. All of the qualified the host bus adapters (also called controller cards) used with all qualified host systems are listed in the *EMC Support Matrix*.

Adaptec AHA-2944W (PCI Bus)

After the AHA-2944W card(s) has been installed in the host computer, run the System Setup program at boot time to set the SCSI parameters and configure the adapter card(s) in the system:

1. Run the SCSI Select program when prompted to configure each adapter card installed in your system.

A screen appears listing the adapter cards the host has detected.

2. Select the first adapter card, and select **Advanced Options**.
3. Under the Advanced SCSI options parameter settings, make sure this parameter is set to **> 1 GB**.
4. Repeat steps 2 and 3 for each card in the system.
5. Exit the SCSI Select program. The system reboots automatically.
6. Install the Adaptec 2944 disk device driver.

Adaptec AHA-2944UW (PCI Bus)

After the AHA-2944W card(s) has been installed in the host computer, run the System Setup program at boot time to set the SCSI parameters and configure the adapter card(s) in the system:

1. Run the SCSI Select program when prompted to configure each adapter card installed in your system.

A screen appears listing the adapter cards the host has detected.

2. Select the first adapter card, and select **Advanced Options**.
3. Make sure the **Advanced SCSI options** parameter settings are as follows:

```
Host Adapter Bios = disabled
Extended Translation for drives > 1 GB = enabled
Multiple LUN support = enabled
Support for Ultra SCSI speed = enabled
BIOS Support for INT13 extensions = enabled
Display <CTRL-A> message = enabled
```

4. Repeat steps 2 and 3 for each card in the system.

QLogic QLA1041 (PCI Bus)

5. Exit the SCSI Select program. The system reboots automatically.
6. Install the Adaptec 2944 disk device driver.

After the QLA1041 card(s) has been installed in the host computer, run the System Setup program at boot time to set the SCSI parameters and configure the adapter card(s) in the system.

The HBA BIOS must be disabled to prevent the host from using the Symmetrix system as a boot device.

1. Run the SCSI BIOS setup program by pressing ALT-Q when prompted.
A BIOS screen appears listing the adapter cards the host has detected.
2. Select the first adapter card from the **Select Host Adapter** menu.
3. Select **Configuration Settings** from the **Fast! UTIL Options** menu.
4. Select **Host Adapter Settings** from the **Configuration Settings** menu.
5. Make sure the **HOST ADAPTER BIOS** parameter is set to **DISABLE**.

To toggle a parameter value, move the cursor to the option and press ENTER.

6. Press ESC to return to the **Configuration Settings** menu.
7. Select **SCSI Device Settings** from the menu.
8. Make sure that the following parameters are set to **YES** for all targets:
 - **DISCONNECT**
 - **PARITY**
 - **NEGOTIATE WIDE**
 - **NEGOTIATE SYNC**
 - **TAG QUEUEING**
9. Press ESC to return to the **Fast! UTIL Options** menu.

10. Select **Host Adapter Settings** for other adapter cards, and repeat steps 3 through 8 for each SCSI adapter in the system.
11. Press ESC twice, and reboot the host system.

Windows and Symmetrix over iSCSI

This chapter provides information specific to Windows hosts connecting to Symmetrix systems over iSCSI.

- ◆ Windows/Symmetrix iSCSI Environment4-2
- ◆ Configuring the Windows iSCSI Initiator Kernel Driver4-7

Windows/Symmetrix iSCSI Environment

This section contains the Symmetrix Multi Protocol Channel Director (MPCD) iSCSI connectivity implementation details for the Microsoft Windows iSCSI software initiator kernel mode driver.

Hardware

Although the Symmetrix MPCD iSCSI connector is an LC optical connector type, the host can be configured with a copper interface. The media conversion can happen in an IP Ethernet switch or an Ethernet media converter device. The same set of rules also applies with the Ethernet speed. Although the Symmetrix MPCD iSCSI connector is a Gigabit Ethernet interface, the host can be configured with a 10/100 Mbps interface.

References

Refer to *Symmetrix iSCSI Multi-Protocol Channel Director* in the *EMC Networked Storage Topology Guide* (available on <http://powerlink.emc.com>) for further information on the supported topologies.

Refer to the *EMC Support Matrix* for the information about the maximum supported number of LUNs per host, as well as the fan-in ratio for an MPCD iSCSI port.

Refer to *Configuring the Windows iSCSI Initiator Kernel Driver* on page 4-7 for the complete information for the network interface card (NIC).

Software

The Symmetrix iSCSI MPCD director supports the iSCSI target discovery method via the `SendTargets` text command. The authentication method is uni-directional CHAP (Challenge Handshake Access Protocol) for initiator authentication. The MPCD director uses **ErrorRecoveryLevel=0**, which means that the recovery is performed on the iSCSI session level.

For the latest detailed Symmetrix MPCD director support information, refer to the *EMC Support Matrix*.

LUN Addressing

Symmetrix systems support the peripheral device addressing mode of the SAM-2 T10/1157 (multiple LUNs behind a single port).

Symmetrix Configuration

Refer to the *DMX MPCD For iSCSI Version 1.0.0 Technical Notes* (P/N 300-001-170) for information on the configuration of the MPCD for iSCSI into Symmetrix DMX™ systems.

Planning for TCP/IP Network Connectivity

Refer to *Planning for the TCP/IP Network* on page 4-9 for details on planning for TCP/IP network connectivity between the Windows host and the Symmetrix DMX iSCSI director.

Planning for Persistent Binding

Persistent binding is the mechanism to create a continuous logical route from a storage device object in the Windows host to a volume in the Symmetrix system across the network. The Windows iSCSI software kernel initiator relies on the network partition (in the case of Ethernet switch, the partitioning is accomplished via VLAN) and the WideSky Solutions Enabler Symmetrix Device Masking CLI in order to maintain the persistent binding.

For more information about the VLAN partition, refer to the IP switch configuration documentation from the IP switch vendor.

For more information about the device masking solution, refer to the *EMC Solutions Enabler Symmetrix Device Masking CLI Product Guide*.

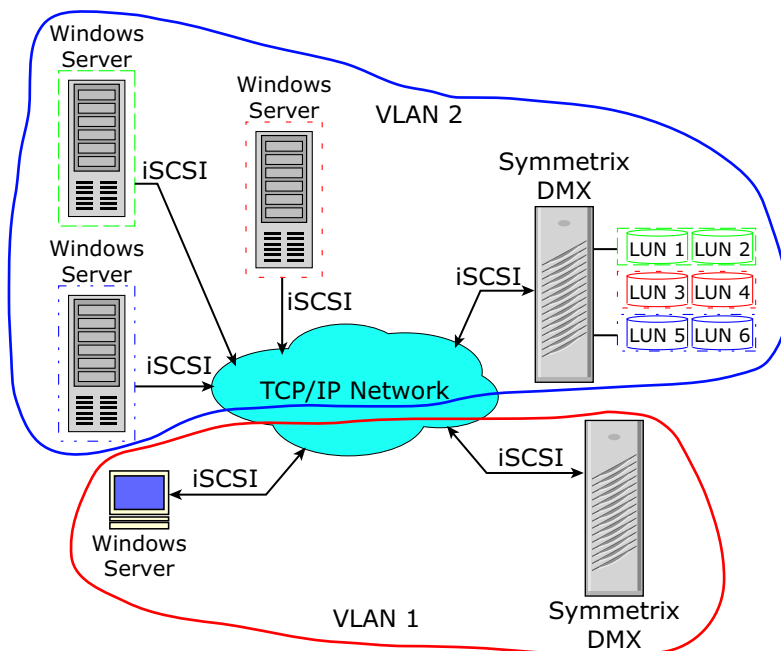


Figure 4-1 iSCSI Persistent Binding

Configuring the Symmetrix iSCSI Director

Refer to section **Fibre Bit Settings** under **Symmetrix DMX Series** in the *EMC Support Matrix* for the recommended director bit setting for Windows host iSCSI connectivity.

Configuring CHAP Authentication

Both the user-name (credential) and target secret (secret) for the CHAP for the particular host must be configured for the Symmetrix system prior to the host CHAP authentication configuration. The CHAP authentication applies for both the target discovery and the normal login.

Refer to the *EMC Solutions Enabler Symmetrix Device Masking CLI Product Guide* for the information on how to setup the CHAP user-name and secret for the Symmetrix system.

Configuring the Host with the Microsoft iSCSI Initiator Kernel Driver

Refer to *Host Configuration* on page 4-10.

Configuring the Header Digest

By default, Symmetrix iSCSI MPCD can negotiate for the header digest both in the target discovery login and the normal login. To enable the header digest, refer to *Host Configuration* on page 4-10.

Configuring the Data Digest

By default, Symmetrix iSCSI MPCD can negotiate for the data digest. To enable the header digest, refer to *Host Configuration* on page 4-10.

Recognizing LUNs

If the proper configuration had been administered, then the host will be able to recognize the Symmetrix LUNs as disks presented by the Disk Management utility. Each disk is assigned a port ID, target ID, and LUN number. The Microsoft iSCSI initiator associates the target ID with a particular Symmetrix MPCD target port, and also associates the LUN with the particular LUN ID mapped by the Symmetrix system.

Refer to the Microsoft Disk Administration guide for the administration of the disks and the volume assignment of these disks.

For further information regarding each Symmetrix disk, use the `syminq` utility. Refer to the *EMC Solutions Enabler Symmetrix Base Management CLI Product Guide* for information on the `syminq` utility.

Recovering from Initiator Driver Errors on Windows

Refer to *Recovering from Drive Errors on Windows 2000/Windows 2003 Hosts* on page 1-22.

Troubleshooting

Note the following potential problems and their solutions.

Problem

Adding a Symmetrix IP address to the target portals returns initiator error.

Solution

- ◆ Verify that the iSCSI login parameter is correct.
- ◆ Verify that the Volume Logix setup is correct.

Problem

Adding a Symmetrix IP address to the target portals returns authentication error.

Solution

- ◆ Verify that the CHAP feature is enabled, and that the user name and secret are correct.
- ◆ Verify that the Symmetrix system has the correct user name and secret.

Problem

Login to the Symmetrix target returns The target had already been logged via a Symmetrix.

Solution

- ◆ Press the **Refresh** button to verify that only one iSCSI session is established.
- ◆ Log out of the current iSCSI session to the Symmetrix system, and log in again.

Problem

Adding a target portal returns Connection Failed.

Solution

- ◆ Make sure the IP address of the Symmetrix system is correct.
- ◆ Make sure the connectivity is correct by using the ping utility to the Symmetrix GE port and vice versa.

Configuring the Windows iSCSI Initiator Kernel Driver

This section contains the procedure to set up the Microsoft iSCSI software initiator kernel driver with the EMC-supported products. The iSCSI driver consists of multiple kernel modules, a user service, and an interface module.

Refer the *Microsoft iSCSI Initiator 1.0 User's Guide* for the complete information about the architecture of the Microsoft iSCSI software initiator kernel driver. The user's guide is included in the MSI installer package that can be downloaded from the Microsoft Download website. Refer to *Downloading the Microsoft iSCSI Driver* on page 4-15.

Terminology

You should understand these terms:

- ◆ **Challenge Handshake Access Protocol (CHAP)** — An authentication method that is used during the iSCSI login in both the target discovery and the normal login. Refer to the *CHAP* section in *IETF iSCSI Standard 1.0*.
- ◆ **iSCSI Network Portal** — The host NIC IP address that is used for the iSCSI driver to create a session with the storage. Refer to the *Network Portal* section in *IETF iSCSI Standard 1.0*.

Hardware

To use the Microsoft iSCSI software initiator kernel mode driver, the host must be configured with a qualified *designed for Windows* network interface card (NIC). The card must also be configured to support the TCP/IP protocol. For a list of Windows-qualified NICs, refer to <http://www.microsoft.com/wdhc/hcl/default.mspx>.

EMC recommends using different NICs for the iSCSI network portal and the non-iSCSI network interface. Refer to the *EMC Support Matrix* for the iSCSI host/initiator fan-in ratio for each storage configuration.

Since this iSCSI initiator is a software solution, the host CPU utilization will increase along with the number of NICs per host. NICs can be mixed and matched as long as they have been qualified by Microsoft. The max number of NICs per host is limited by each particular host capacity (CPU speed, number of expansion slots, RAM capacity, etc.). Refer to Microsoft documentation for the maximum number of NICs per host.

Storage

Refer to *Windows/Symmetrix iSCSI Environment* on page 4-2 for further details on configuring the Microsoft Windows iSCSI initiator kernel driver with a Symmetrix iSCSI Multi-Protocol Channel Director (MPCD).

Software

Node-names

The Microsoft iSCSI initiator supports an iSCSI target that is configured with a node-name as the following rules:

- ◆ Node-names are encoded in UTF8 Character set.
- ◆ The length of a node-name should be 223 characters or less.
- ◆ The valid characters are:
- ◆ A name can include any of these characters:
 - a through z (upper or lower case; uppercase characters are always mapped to lowercase)
 - 0 through 9
 - . (period)
 - - (dash)
 - : (colon)

Refer to the *Microsoft iSCSI Initiator 1.0 User's Guide* for the complete set of rules for setting up the valid initiator and target node-names.

Discovery

The Microsoft iSCSI initiator supports the `SendTargets` method of discovery. In this method, the Microsoft iSCSI initiator supports digests and authentication on the target portal discovery.

Refer to the *Microsoft iSCSI Initiator 1.0 User's Guide* for more details on the complete discovery mechanism.

Security

The Microsoft iSCSI initiator supports the CHAP (unidirectional CHAP authentication) security option.

Refer to the *Microsoft iSCSI Initiator 1.0 User's Guide* for more details on the complete security mechanism.

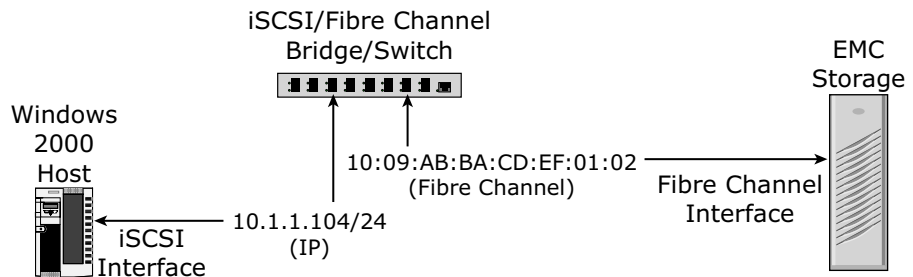
Boot Device Support

The Microsoft iSCSI initiator does not support booting the iSCSI host from iSCSI storage. Refer to the *EMC Support Matrix* for the latest information about boot device support.

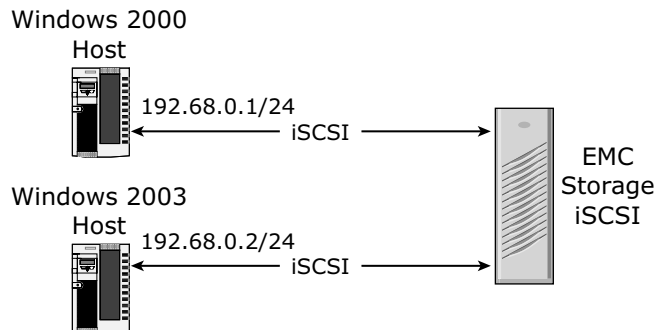
Planning for the TCP/IP Network

The Microsoft software iSCSI solution is supported in several LAN configurations. Refer to the *EMC Support Matrix* for the latest supported configurations:

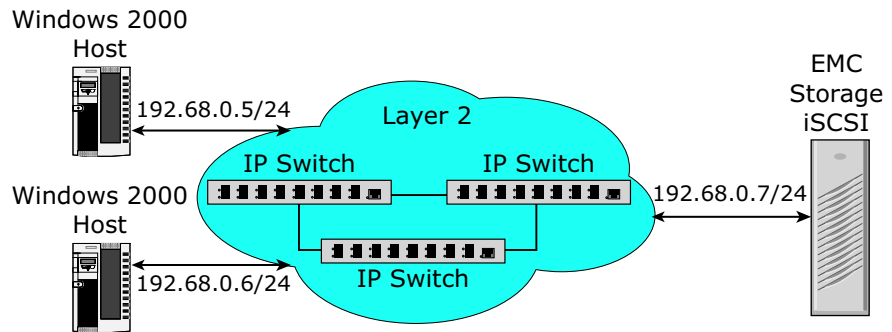
- ◆ iSCSI -FC bridge between iSCSI host and Fibre Channel storage:



- ◆ Direct connect between iSCSI hosts and iSCSI storage:



- ◆ Switched with layer 2 LAN (same subnet, no router):



The switched connectivity provides the sharing of the iSCSI storage port and the aggregation of the bandwidth.

Host Configuration

Limitations with the Microsoft iSCSI Software Initiator Kernel Driver

Dynamic Disks

The *Microsoft iSCSI Initiator 1.0 User's Guide* notes that iSCSI dynamic disk volumes using the software initiator kernel driver is not supported. The reason for the unsupported feature is that timing issues can prevent the dynamic disk volumes on iSCSI disks from being reactivated at system startup. The iSCSI disks that are provided by the Microsoft iSCSI software initiator kernel driver might not be available until after the Windows TCP/IP stack is loaded and after the service control manager begins to start automatic services.

Refer to the *Microsoft iSCSI Initiator 1.0 User's Guide* for the workaround on the dynamic disks.

Running Automatic Start Services on the Volumes from the iSCSI Disks

The Microsoft iSCSI Initiator service also provides an interface to synchronize any automatically started services and the appearance of volumes that are created from the iSCSI disks. After the iSCSI targets are configured as persistent targets, follow these steps to install automatic start services on the volumes created:

1. After configuring the Symmetrix iSCSI target (as described under *Configuring iSCSI Target Node Names* on page 4-20), click the **Initiator Settings** tab of the Microsoft iSCSI initiator GUI.

2. Click **Bind Volumes** to make the list of the iSCSI volumes synchronized.

Note that this function must be restarted every time that the disk configuration or the volumes configuration is changed.

3. Make the automatically started services depend on the Microsoft iSCSI services.

Driver Installation

Follow the procedures in this section to install the iSCSI driver.

Installing the NIC

EMC recommends using different network interfaces for the iSCSI network portal and non-iSCSI network interface (primary host network interface). Refer to the network interface installation documentation from the NIC vendor for details on installing the NIC hardware and driver.

The following are the recommended Ethernet options:

Number	Setting	Value
1	Rx-Tx Flow Control	enable
2	Selective-Acknowledgement	enable
3	Link Aggregation (802.3ad)	disable
4	Quality of Service (802.3q)	disable

Network Connectivity

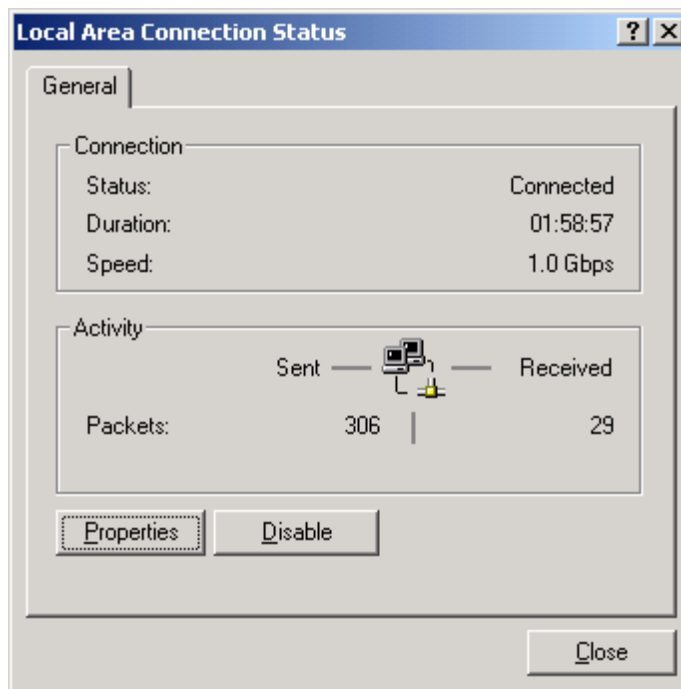
Configure the host network interface and the iSCSI target network portal so that both nodes can reach by each other using the ping utility. Refer to the *DMX iSCSI Director Technical Note*, *Microsoft Windows Administration Guide*, and switch vendor configuration document (if available) for the network connectivity setup (IP configuration).

Verify that the network connectivity is layer 2 only (single subnet with no gateway). Refer to *Symmetrix iSCSI MPCD* in the *EMC Networked Storage Topology Guide* (available at <http://powerlink.emc.com>) for the latest supported topology.

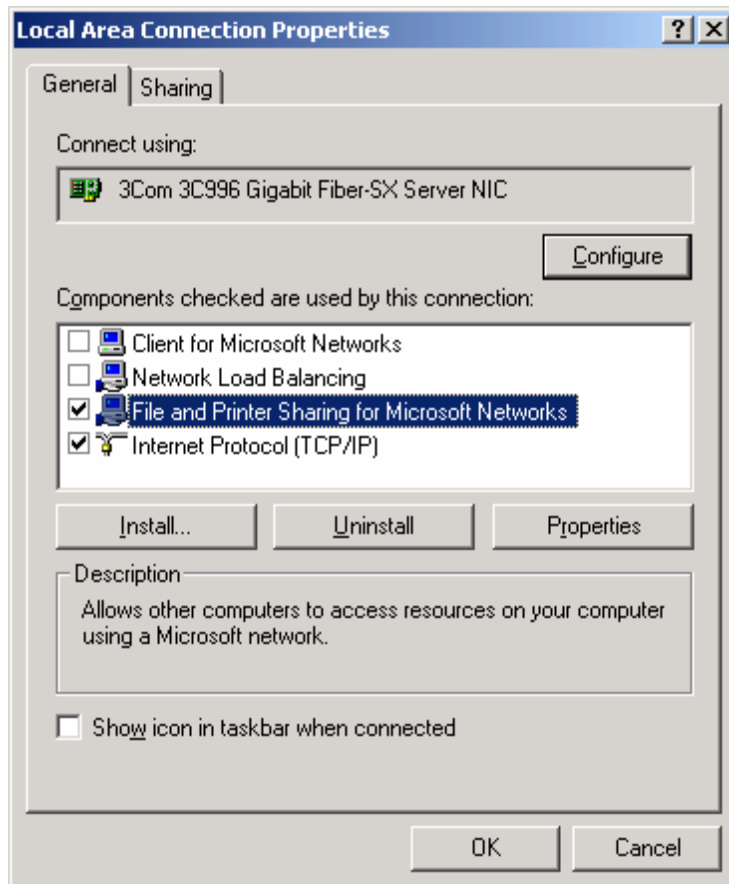
Required Setting for the iSCSI Network Portal

For the iSCSI network portal, EMC requires that server optimization for **File and Printer Sharing** be set as follows:

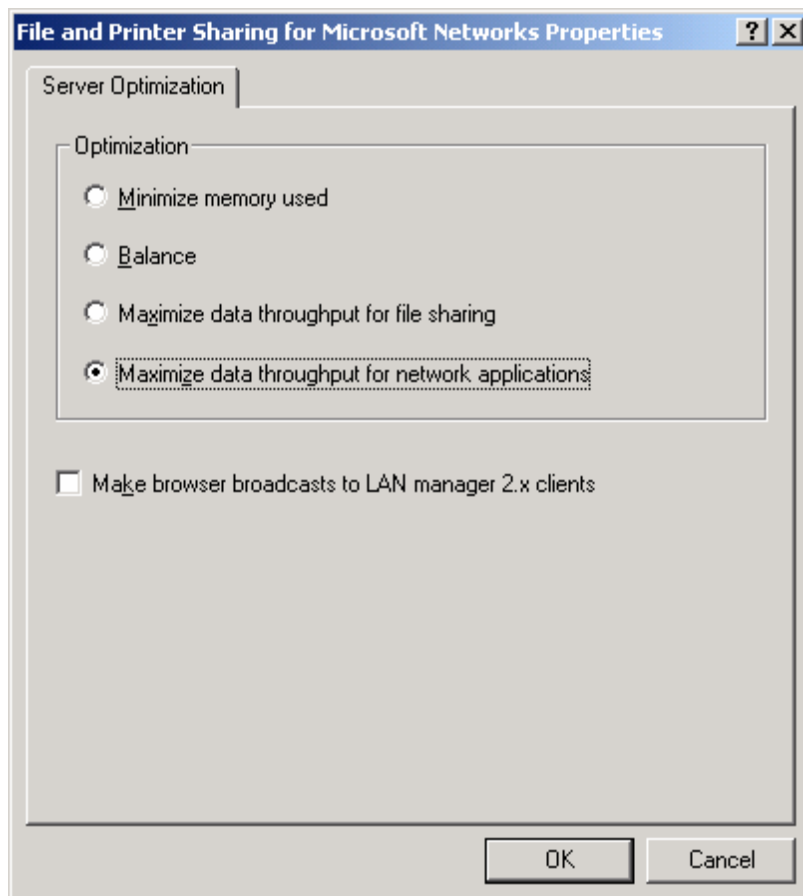
1. Go to **Local Area Connection Status** dialog of the particular NIC for the iSCSI network portal.



2. Click **Properties** to open the **Local Area Connection Properties** dialog.



3. Highlight **File and Printer Sharing for Microsoft Networks**, and click **Properties** to open the **File and Printer Sharing for Microsoft Network Properties** dialog.



4. Click **Maximize data throughput for network applications** on the **Server Optimization** tab.
5. Click **OK** to enable this setting.

Upgrading a Prior Microsoft iSCSI Driver Installation

To upgrade from a previous iSCSI driver, uninstall the previous driver using the previous version of the iSCSI initiator package, and reinstall the updated MSI installer:

1. Remove the previous-release iSCSI driver by double-clicking on the MSI installer package, or by using the host software removal from the control panel.
2. In the **Microsoft iSCSI Initiator Setup Wizard** window, click **Remove Microsoft iSCSI Initiator**.
Click **Finish** to continue the removal process.
3. In the **Microsoft iSCSI Installation Program** window, click **Uninstall iSCSI Initiator and Service**.
Click **OK** to complete the removal process.
4. Click **Agree** on the EULA window.
5. Complete the removal process by clicking **Yes**.
6. Click **Yes** to continue.
7. After the Microsoft iSCSI initiator has been successfully removed, click **Close** to exit.

Downloading the Microsoft iSCSI Driver

The iSCSI software driver is available for free download at <http://www.microsoft.com/downloads> (under **Windows Components**):

1. Using a web browser, go to <http://www.microsoft.com/downloads>
2. Enter **iSCSI** in the keywords search field, and click **Go** to initiate a search.
3. Click the link to the Microsoft iSCSI Software Initiator version 1.0 to get to the iSCSI software driver download site.
4. Download the appropriate MSI installer package for the particular architecture of the host.

MSI Installer Package Name	Host Architecture
Initiator_ia64fre.msi	Retail version for the host with ia64 CPU
Initiator_x86fre.msi	Retail version for the host with X86 CPU

Installing the Microsoft iSCSI Driver

To install the driver:

1. Start the installation by either double-clicking the MSI installer package or typing the MSI installer package name using the command line.
2. Click **Next** on the **Welcome to Microsoft iSCSI Initiator Setup Wizard** window.
3. Click **I Agree**.
Click **Next** to continue the installation.
4. Click **Next** after the selection of the designated folder for the installation. The default folder is the `c:\Program Files\Microsoft iSCSI Initiator`.
5. Click **Install Complete iSCSI Initiator**.
Click **OK** to continue.
6. Click **Agree** on the EULA window to continue.
7. If the installer displays `continue installation`, click **Yes**.
8. Once the installation has completed, click **Close** to exit.

Configuring the Microsoft iSCSI Initiator

The Microsoft iSCSI software initiator kernel mode driver provides a Microsoft iSCSI initiator GUI, which is part of the console control. The GUI is available as a link on the desktop, and as an application in the Control Panel menu.

Configuring the iSCSI Initiator Node Name

The Microsoft iSCSI initiator automatically provides the following name structure for each host that is configured:

```
iqn.1991-05.com.microsoft:<hostname><primary DNS suffix of the host>
```

For example, host ABC with the domain *xyz.com* will be configured as this iSCSI initiator name:

```
iqn.1991-05.com.microsoft:ABC.xyz.com
```

This iSCSI initiator name can be retrieved from the **Initiator Settings** tab of the iSCSI initiator GUI (shown in Figure 4-2 on page 4-17).

iSCSI initiator node name must be unique among the iSCSI nodes. The iSCSI initiator name should be modified only before configuring the iSCSI target (as described under *Configuring iSCSI Target Discovery*). Modifying the initiator name after the iSCSI target configuration during the iSCSI session can isolate the particular host from the iSCSI storage.

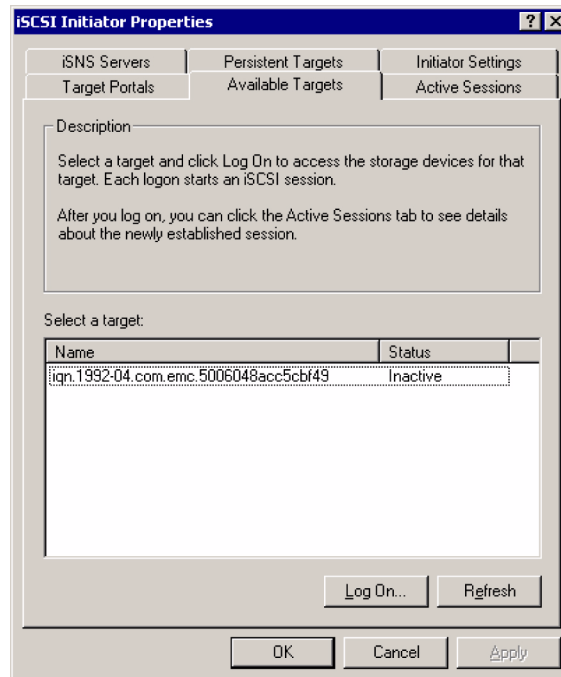


Figure 4-2 iSCSI Initiator Properties Window

Configuring iSCSI Target Discovery

This section describes the iSCSI *SendTargets* discovery procedures. To enable the *SendTargets=All* discovery mechanism, the iSCSI storage IP address (network portal address) must be provided to the Microsoft software iSCSI initiator:

1. On the **Target Portals** tab of the **Microsoft iSCSI Initiator** panel, click **Add**.
2. In the **Add Target Portal** window (Figure 4-3), enter the IP address of the iSCSI storage network portal in the **IP address or DNS name** field.

You can enter a DNS name only if the DNS service is available for the iSCSI network.

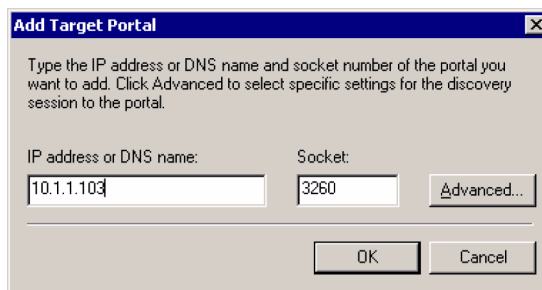


Figure 4-3

Add Target Portal Dialog Box

3. Click **Advanced** Settings to enable these Microsoft iSCSI initiator options:
 - **Header digest** and **Data digest** — The optional header and data integrity protection provide checking of end-to-end data integrity beyond the integrity protection that is given by the GigE CRC32, TCP/IP checksums. Data digest integrity protection covers all communication paths that translate, fragment, and assemble the network level PDU, such as routers, switches, and proxies.



CAUTION

Turning on the digests with the Microsoft software iSCSI kernel driver increases the host CPU workload. EMC recommends turning on the header digest and data digest.

- **Authentication using CHAP** (Challenge Handshake Authentication Protocol) — This option enables the initiator to invoke in-band CHAP for the iSCSI login. In-band initiator-target authentication prevents an unauthorized login to the storage resources by using false identity (spoofing). EMC recommends turning on the CHAP if the TCP/IP network is not secure.
4. In the **Advanced Settings** window (Figure 4-4), check any of the options box to enable the particular option. (For example, check the header digest box to enable the header digest.)

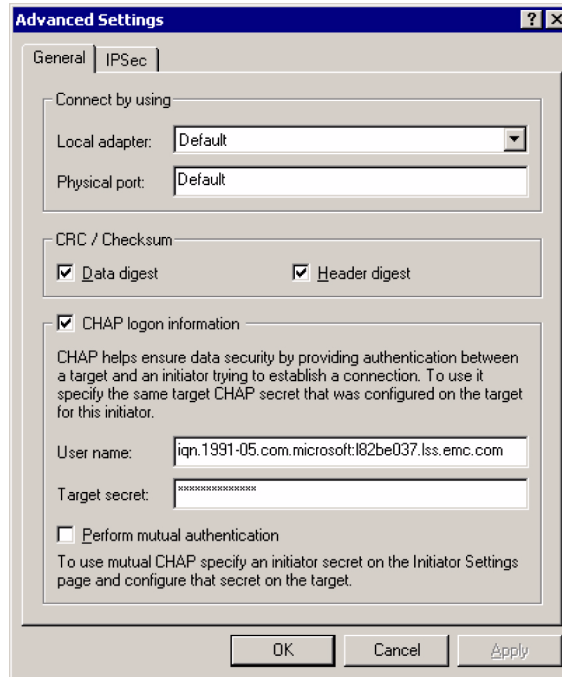


Figure 4-4 iSCSI Advanced Settings Window

If the target is configured to authenticate the initiator, the CHAP logon information must be checked, the user name must be filled, and the target secret must be filled.

The user name and target secret must match the target's user name and target secret. Refer to the *EMC Solutions Enabler Symmetrix Device Masking CLI Product Guide* for the target's CHAP configuration.

5. Click **OK** to finish the advanced settings.
6. Click **OK** to finish the **Target Portals** addition.
7. Verify that the iSCSI storage returns the iSCSI target node name with Status = Available in the **Available Targets** tab. (Refer to Figure 4-5 on page 4-20.)

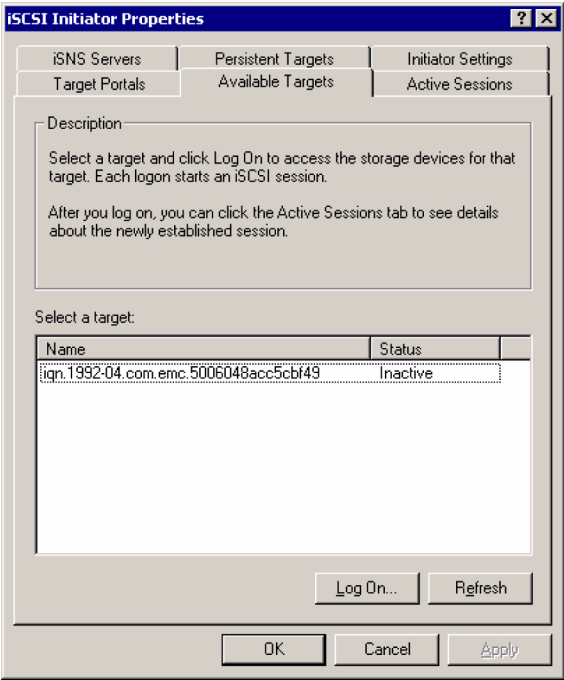


Figure 4-5 iSCSI Initiator Properties Window

Configuring iSCSI
Target Node Names

After the iSCSI Target had been discovered, the initiator must establish the normal iSCSI session:

1. On the **Available Targets** tab, highlight the particular iSCSI target nodes.
2. Click **Log On** to start the normal login session.
3. In the **Log On to Target** window (Figure 4-6), check the **Automatically restore this connection when system boots**. This will assign this particular target as persistent target.

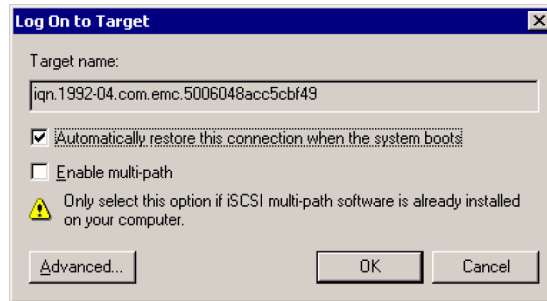


Figure 4-6 Log On To Target Window

Microsoft iSCSI initiator service provides an interface to configure the software and hardware initiators to reconnect to a designated target persistently across the host reboot. The interface is provided in the **Persistent Targets** tabs of the Microsoft iSCSI initiator GUI.

All of the login information (such as security, authentication, and digests) is stored in non-volatile storage. Assigning the persistent target also enables the Microsoft iSCSI software kernel mode driver to re-initiate the reconnections as soon as the Windows TCP/IP stack and the Microsoft iSCSI initiator service loads.

4. In the **Log On to Target** window click **Advanced** to display these advanced settings:
 - **Header digest** and **Data digest** — This optional header and data integrity protection provides checking of end-to-end data integrity beyond the integrity protection that is given by the GigE, TCP/IP. This data integrity protection covers all communication paths that translate, fragment, and assemble the network level PDU (such as routers, switches, and proxies).



CAUTION

Turning on the digests with the Microsoft software iSCSI kernel driver increases the host CPU workload. EMC recommends turning on the header digest and data digest.

- **Authentication using CHAP** (Challenge Handshake Authentication Protocol) — This option enables the initiator to invoke in-band CHAP for the iSCSI login. In-band

initiator-target authentication prevents an unauthorized login to the storage resources by using false identity (spoofing). EMC recommends turning on the CHAP if the TCP/IP network is not secure.

5. In the **Advanced Settings** window (Figure 4-4 on page 4-19), check the **Data digest** and/or **Header digest** box(es) if desired. If the target is configured to do the CHAP authentication with the initiator, the CHAP login information must be checked.

Along with the CHAP login information, the user name and the target secret must be provided.

The user name and target secret must match the target's user name and target secret. Refer to the storage configuration manual for setup of the target's CHAP configuration. The CHAP secrets must be 16 characters long.

6. Click **OK** to finish the target login.
7. Verify that the host established the normal iSCSI session to the target by clicking **Details** on the **Active Session** tab of the **iSCSI Initiator Properties** window (Figure 4-2 on page 4-17).

Figure 4-7 shows the **Session Details** window.

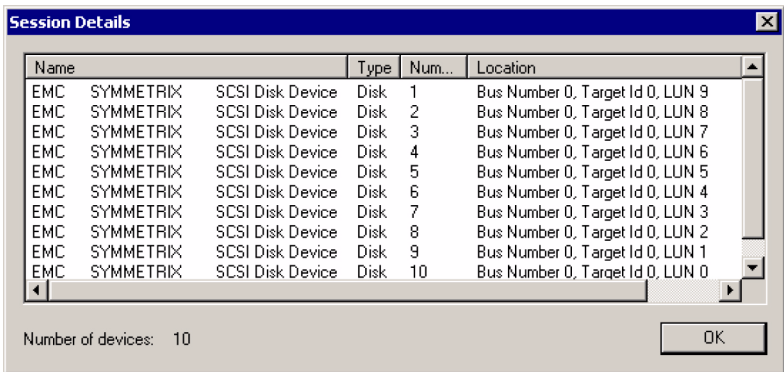


Figure 4-7 iSCSI Session Details Window

Removing iSCSI Targets From the iSCSI Configuration

Follow these steps to remove the persistent iSCSI session from the iSCSI host configuration:

1. Select the **Persistent Targets** tab of the Microsoft iSCSI driver GUI (Figure 4-2 on page 4-17).
2. Highlight the persistent iSCSI target you wish to delete from the list of the persistent targets.
3. Press **Remove**.

EMC PowerPath Recommendation

The Microsoft iSCSI software kernel driver uses the iSCSI name and address convention where a host is using a single iSCSI initiator name with multiple network portal address. This means that PowerPath will present the connections as a single bus with multiple targets, rather than multiple buses with multiple targets.

If there are multiple NICs in a single host (multi-homed host), it is necessary to use a different subnet for each NIC so the host is capable of routing the Ethernet packet to each NIC.



CAUTION

The Microsoft iSCSI software driver does not maintain persistent SCSI addresses if the user logs off the target and re-establishes a session with the same target. PowerPath will present a new path, and the previous path will be invalid. Therefore, do not manually log off the iSCSI target and re-establish a session with the same target while the host is up.

Troubleshooting

Note the following potential problems and their solutions.

Problem

Adding an iSCSI Storage IP address to the target portals returns initiator error.

Solution

- ◆ Verify that the iSCSI login parameter is correct.
- ◆ Verify that the CHAP configuration and the digest configuration on the storage are correct.

Problem

Adding a Symmetrix IP address to the target portals returns authentication error.

Solution

- ◆ Verify that the CHAP feature is enabled, and that the user name and secret are correct.
- ◆ Verify that the iSCSI Storage system has the correct user name and secret.

Problem

Login to the iSCSI target returns The target had already been logged via a Symmetrix.

Solution

- ◆ Press the **Refresh** button to verify that only one iSCSI session is established.
- ◆ Log out of the current iSCSI session to the iSCSI storage system, and log in again.

Problem

Information is needed regarding the iSCSI initiator session that is currently established.

Solution

1. Go to the Microsoft Management Console.
2. Inside the Device Manager, open the properties of **host-SCSI-RAID controllers-Microsoft iSCSI Initiator**.
Click the **HBA Information** tab (Figure 4-8).

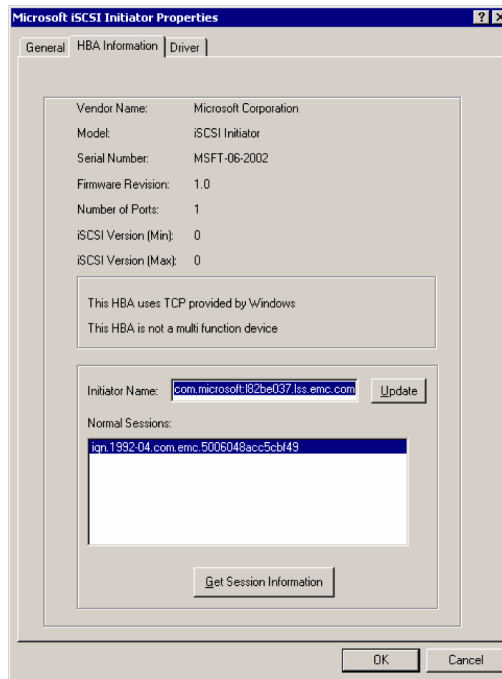


Figure 4-8 iSCSI HBA Information Tab

3. Click **Get Session Information** to display the **Session Information** window (Figure 4-9 on page 4-26).

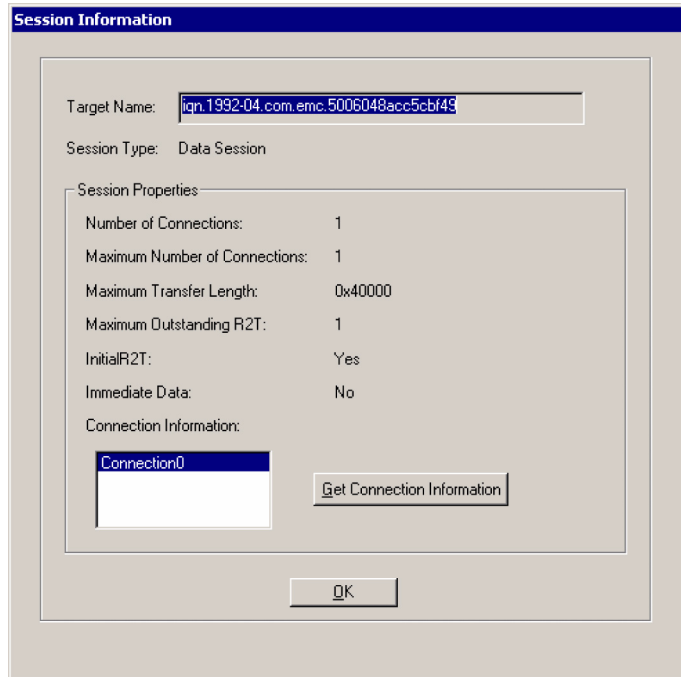


Figure 4-9 iSCSI Session Information Window

4. Click **Get Connection Information** button to display the **Connection Information** window (Figure 4-10).

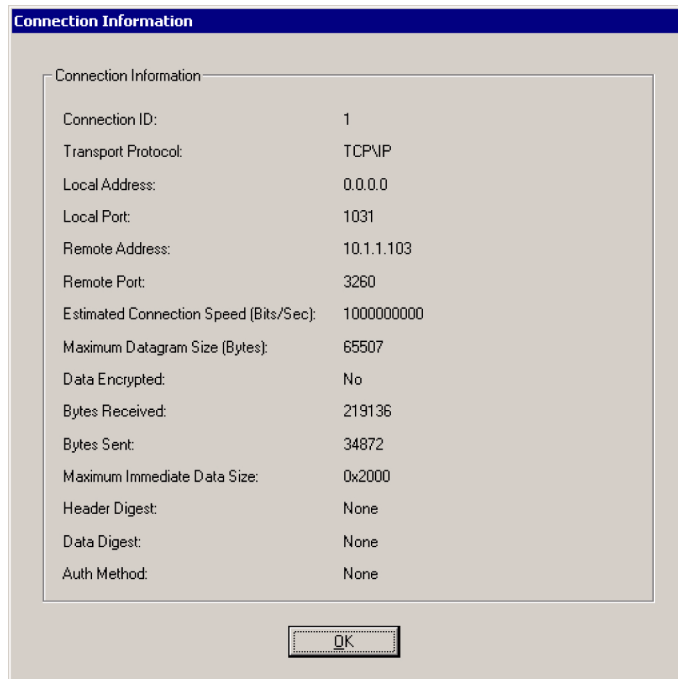


Figure 4-10 iSCSI Connection Information Window

5. The iSCSI disks are lost after the host reboot.
Verify that the iSCSI target is listed on the **Persistent Targets** tab.

PART 2

CLARiiON Connectivity

This part includes:

- Chapter 5, *Windows Hosts with CLARiiON*

Windows Hosts with CLARiiON

This chapter provides information specific to Windows hosts connecting to CLARiiON arrays.

- ◆ CLARiiON/Windows Fibre Channel Environment5-2
- ◆ CLARiiON/Microsoft Windows iSCSI Environment5-5
- ◆ Host Configuration with Emulex HBAs.....5-7
- ◆ Host Configuration with QLogic HBAs5-14
- ◆ Recognizing LUNs5-25
- ◆ Making LUNs Available to Windows NT5-26
- ◆ Making LUNs Available to Windows 2000 or Windows 2003 ..5-37
- ◆ LUN Expansion Recognition.....5-45
- ◆ Configuring for Windows Clusters5-49

CLARiiON/Windows Fibre Channel Environment

This section lists some CLARiiON® support information specific to the Windows/Fibre Channel environment.

Storage Components

The basic components of a storage system configuration for CLARiiON arrays are:

- ◆ One or more storage systems.
- ◆ One or more servers connected to the storage system(s), directly or through hubs or switches.
- ◆ For Navisphere® 5.X or lower, a Windows host (called a *management station*) that is running Navisphere Manager and is connected over a local area network (LAN) to storage system servers and the CLARiiON storage processors (SPs). (A management station can also be a storage system server if it is connected to a storage system.)
- ◆ For Navisphere 6.X, a host that is running an operating system that supports the Navisphere Manager browser-based client and is connected over a LAN to storage-system servers and CLARiiON FC4700 or CX-series storage systems. For a current list of such operating systems, refer to the *Navisphere Manager 6.X Release Notes* at <http://powerlink.emc.com>.

The procedures described in this document assume that all hardware equipment (for example: hubs/switches and storage systems) used in the documented configuration is already installed and connected.

Required Storage System Setup

CLARiiON configuration is done by an EMC Customer Engineer (CE) through Navisphere Manager. The CE will configure your FC4700 or CX-series system settings for each Fibre Channel port.

The procedures in this document assume that you have already installed any hubs/switches and storage systems used in this configuration, and connected the storage system SPs (storage processors) to the hub/switch ports.

When installing FC4500, FC5300, or FC5700 storage systems in an FC-AL environment, be sure to set the Address ID switches for each SP to a unique number. Use consecutive even numbers starting with 0 for the SP As and consecutive odd numbers starting with 1 for the SP Bs:

Storage System	SP A Switches	SP B Switches
First	0	1
Second	2	3
Third	4	5
Fourth	6	7

For an FC-4700 or CX-series storage system in an FC-AL environment, you set the Address ID (AL_PA address) for each SP during storage system setup, as described in the *EMC Navisphere Manager Version 5.X Administrator's Guide*.

Queue Depth

You might need to adjust the Queue Depth setting so the total number of I/O requests (simultaneous threads) on the I/O subsystem is less than 256 per storage processor (SP) for FC4500, FC5300, or FC5700 storage systems or less than 2048 per storage processor (SP) for FC4700 or CX-series storage systems.

This adjustment applies only to those applications that put a very large number of simultaneous threads on the I/O subsystem. This is due to continuous retries on Queue Full conditions, which is a standard Windows behavior.

Host Connectivity

Refer to the *EMC Support Matrix* or contact your EMC representative for the latest information on qualified hosts and host bus adapters.

Driver software for Windows hosts is provided with each HBA. Standard Windows driver installation procedures enable use of the HBAs.

What is LUN_Z or LUNZ?

Refer to EMC Primus article emc65060 for a discussion on this topic.

Reference Documentation

Emulex HBA

For the steps to install the HBA and cable, install and configure the HBA driver, and configure a boot device on the storage array, refer to the appropriate document.

Refer to *EMC Fibre Channel with Emulex Host Bus Adapters in the Windows Environment*, available on the Emulex website:

1. Access <http://www.emulex.com>.
2. Click **drivers, software and manuals** at the left side of the screen.
3. Click **EMC** at the upper center of the next screen.
4. Click the link to your HBA at the left side of the screen.
5. Under **EMC Drivers, Software and Manuals**, click the **Installation and Configuration** link under **Drivers for Windows <version>**.

QLogic HBA

Refer to *EMC Fibre Channel with QLogic Host Bus Adapters in the Windows Environment*, available on the QLogic website:

1. Access <http://www.qlogic.com>.
2. Click **Downloads** at the left side of the screen.
3. Click the **EMC** link to the right of **OEM-approved Drivers/Firmware**.
4. Find the description of your HBA driver in the **Name** column of the table for your HBA model. Then click the **Readme** link in the associated **Description** column.

Boot Device Support

Windows hosts have been qualified for booting from CLARiiON devices interfaced through Fibre Channel as described in the *EMC Support Matrix*. Also refer to the appropriate HBA-specific document described under *Reference Documentation*.

CLARiiON/Microsoft Windows iSCSI Environment

This section lists some CLARiiON support information specific to the Windows/iSCSI environment.

Storage Components

Storage system iSCSI configuration for CLARiiON arrays are:

- ◆ One or more CLARiiON storage systems with one or more FC ports.
- ◆ One iSCSI to FC gateway/switch that enables X86 hosts to connect to the CLARiiON using the Microsoft iSCSI software initiator kernel driver.
- ◆ A management host that connects to the CLARiiON storage systems using a LAN. The host must either be installed with Navisphere Manager for Navisphere 5.X or support the web-browser that can be used by the Navisphere 6.X. For more information about the host management, please refer to the Navisphere Manager 6.X release notes at <http://powerlink.emc.com>.
- ◆ The iSCSI storage connectivity that is supported is available in the section Internet Protocol of the EMC Networked Storage Topology Guide at <http://powerlink.emc.com>.

Required Storage System Setup

Refer to the *Required Storage System Setup of CLARiiON/Windows Fibre Channel Environment* on page 5-2.

Host Connectivity

Refer to the *EMC Support Matrix* or contact your EMC representative for the latest information on Microsoft iSCSI software initiator kernel driver

Refer to *Configuring the Windows iSCSI Initiator Kernel Driver* on page 4-7 for information about where to get the Microsoft iSCSI software initiator kernel driver, the installation procedures, requirements and recommendations on the setup of the Microsoft iSCSI software initiator kernel driver on the Microsoft Windows host.

Host Configuration with Microsoft iSCSI Software Initiator Driver and iSCSI to FC Gateway

The Microsoft Windows host must be installed with the latest ESM-approved Navisphere Agent for the Microsoft Windows OS. Refer to the *Navisphere Host Agent and CLI for Windows 2000 and Windows NT* document at the <http://powerlink.emc.com>.



WARNING

EMC Navisphere agent can report the wrong IP address to the CLARiiON Navisphere Manager, because the Windows host is configured with multiple NICs (multi-homed server). Please refer to the Known Problems and Limitations section of EMC Navisphere Host Agent and CLI Release Notes for the workaround.

Before the storage group of the iSCSI host can be created on the CLARiiON, the host must be logged into the iSCSI to FC gateway. Refer to the vendor-specific iSCSI to FC gateway white paper on the information about setting up the iSCSI port and also the zoning of the Microsoft iSCSI host. Also refer to the *Configuring the Windows iSCSI Initiator Kernel Driver* on page 4-7 section in this document.

After the host finishes the iSCSI login to the iSCSI to FC gateway, please verify that the host can identify the CLARiiON LUNZ by using either the EMC *inq* or Disk Drives display of the Microsoft Device Manager MMC. The host may need to be rebooted in order to pick up the LUNZ

Restart the Navisphere Agent by using the Services application. Highlight the Navisphere agent, and restart using the right mouse click menu. Refer to the *Starting the Host Agent Service* of the *Navisphere Host Agent and CLI for Windows 2000 and Windows NT*.

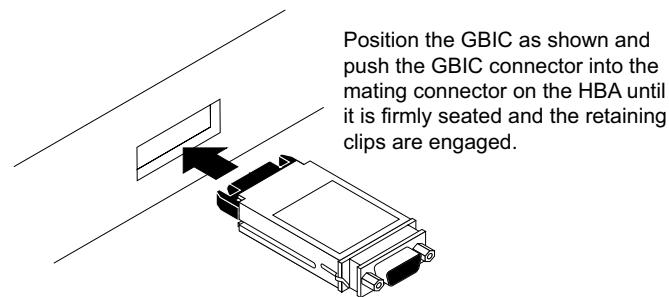
Refer to the *Storage Group Creation* of the CLARiiON Navisphere Manager UI to proceed for the creation of the storage group.

Host Configuration with Emulex HBAs

This section describes the procedures required to configure an EMC-qualified Emulex host bus adapter in a Windows host for connection to CLARiiON over Fibre Channel. (Refer to the *EMC Support Matrix* for approved HBAs.)

Installing GBICs onto 1 Gb HBAs

The 1 Gb HBAs require GBICs (Gigabit Interface Converters). Install a GBIC as shown in the following figure:



The hardware might be rotated 90 degrees clockwise from the orientation shown.

Push the GBIC connector into the mating connector on the HBA until it is firmly seated. For an optical GBIC, make sure the retaining clips are engaged.

What Next?

For the steps to install the HBA and cable, and to install and configure the HBA driver, refer to *EMC Fibre Channel with Emulex Host Bus Adapters in the Windows Environment*, which is available on the Emulex website as described under *Reference Documentation* on page 5-4.

After completing the installation:

- ◆ For an FC-AL environment — Install and configure the Navisphere server software. Refer to the *EMC Navisphere Server Software Administrator's Guide*.
- ◆ For an FC-SW environment:
 - a. Verify the HBA connection to the switch, by ensuring that the LED on the switch port connected to the HBA is green.
 - b. Proceed to *Creating a Switch Zone for Each HBA* on page 5-8.

Creating a Switch Zone for Each HBA

This section applies only to fabric configurations.

EMC requires single-initiator zoning. This means that each HBA has a separate zone that contains it and the SPs with which it communicates.

For information on setting up a zone on a switch, refer to the following:

- ◆ Documentation for the switch.
- ◆ *Fibre Connectivity: Switch* section under the appropriate CLARiiON model number in the *EMC Support Matrix*.

Replacing HBAs Connected to Shared Storage Systems

A shared storage system is a storage system with the Access Logix™ software.

If you can manage the server whose HBA you need to replace from another server, follow *Procedure 1*. If you cannot manage it from another server, follow *Procedure 2* on page 5-9.

Procedure 1

Use this procedure to replace an HBA if you can manage the storage system from another host.

1. Stop all I/O to each storage system connected to the HBA you are replacing.
2. Shut down Windows on the server whose HBA you are replacing.
3. Power down the server.
4. Using Navisphere Manager, disconnect any Storage Groups connected to the server through the HBA.
5. Remove the HBA you want to replace and install the new HBA.
6. Power up the server.

Make sure that you have installed the correct driver for the new HBA. If the wrong driver was installed, download and install the correct one from the Emulex website.

7. In the switch zones that include the HBA, change the World Wide Port Name (WWPN) of the old HBA to the WWPN of the new HBA.
8. Remove the connection path to the old HBA from each storage system's persistent memory using the **navicli port -removeHBA** CLI command.

See the CLI reference manual for information on this command.
9. Reboot the server.
10. Using Navisphere Manager, reconnect any Storage Groups previously connected to the server.
11. Restart I/O to each storage system connected to the new HBA.

Procedure 2

Use this procedure to replace an HBA if you cannot manage the server from another host:

1. Shut down Windows on the server whose HBA you are replacing.
2. Power down the server.
3. Remove the HBA you want to replace and install the new HBA.
4. Power up the server.
5. Stop all I/O to each storage system connected to the new HBA.
6. In the switch zones that include the HBA, change the World Wide Port Name (WWPN) of the old HBA to the WWPN of the new HBA.
7. Remove the connection path to the old HBA from each storage system's persistent memory using the **navicli port -removeHBA** CLI command.

See the CLI reference manual for information on this command.
8. Reboot the server.
9. Using Navisphere Manager, reconnect any Storage Groups previously connected to the server.
10. Restart I/O to each storage system connected to the new HBA.

Troubleshooting HBA Problems

This section describes how to use the Windows Event Viewer and how to identify problems. It also describes how to troubleshoot some problems you might encounter after installing the adapter or configuring the storage system.

Using the Windows Event Viewer

To view the Windows error log and determine the meaning of error codes, follow these steps:

1. From the Windows taskbar, click **Start, Programs, Administrative Tools, Event Viewer**.
2. In the Event Viewer, follow the menu path **Log, System**.

The display shows a list of discrete system events, specifying their sources.

3. Double-click any event with the source name **ELXSLI2**.
4. Change the data view from **Bytes** (default) to **Words**.
5. Examine the entry at offset 0x10.

If the low byte = En, match the low byte with the error found in the table in step 6.

6. Record the errors before calling for help.

Error Code	Meaning	Additional Information
0xE1	HA_ERRATT set; 31:8 = Status register	Error bit set in the Host Attention register; bits 31:8 reflect additional error status found in Status register
0xE2	MB cmd Timeout; 15:8 = timed-out command	
0xE3	MB err: 15:8 = cmd; 31:16 = mbx Status code	
0xE4	FFRDY or MBRDY not set; 31:8 = Status register	Adapter not ready
0xE5	Topology != LOOP	Initialization
0xE6	MBATT, but OWN = 1; 31:8 = MB word 0	
0xE7	SRB already queued to ring when attempted.	Internal driver software error

Error Code	Meaning	Additional Information
0xE8	RESTART failed.	
0xE9	Received an FC-AL PORT BYPASS primitive.	Port taken off line
0xEA	IOCB error: 15:8 = cmd, 16:23 = IOSTAT code ; 24:31 = parm field 0:7	
0xEB	Unsupported IOCB cmd rsp:15:8 = cmd field	
0xEC	Could not allocate an uncached Extension from Windows.	
0xED	Did not get a LINK_ATT in 30 seconds of wait.	Failed on startup; host adapter inoperative

Server Passed Self-Test But Operating System Does Not Boot from Boot Disk

Look for conflicts with the adapter.

If your system has an IDE fixed disk device, it is assigned device number 80 and is the boot device. If your system does not have an IDE disk device, the first *bootable* disk device configured (the one with the lowest ID) is assigned device number 80 and is the boot device. If you do not have an IDE drive, set the motherboard BIOS parameters to **None** or **Not Installed**.

Hardware Problems

Make sure that:

- ◆ you have installed the adapter correctly and have seated it firmly in the PC slot.
- ◆ you have connected all cables securely to the correct connectors.
- ◆ you have powered up all storage systems.
- ◆ the interrupt request levels are correct.

System Configuration Problems

Check for the following problems:

- ◆ Incorrect motherboard configuration. See the documentation supplied with your computer to determine if you need to reconfigure your motherboard.
- ◆ If the system message *Missing Operating System* or *No ROM BASIC, System Halted* appears, the disk drive attached to the adapter is not partitioned in a format compatible with the board. The proper geometry for use with the adapters is the Microsoft standard as follows:
 - Drives less than 1 Gb are 64 heads, 32 sectors per track.
 - Drives greater than 1 Gb are 255 heads, 63 sectors per track.
 If the drive is not formatted with this geometry, repartition and format the drive using the **DOS FDISK** and **FORMAT** utilities.

Windows Does Not Detect the Adapter

If Windows does not appear to detect the adapter, follow these steps:

1. Open the Device Manager.

The HBA may be listed in *Other Devices* as *Fibre Channel Controller* and the driver as *unknown/none*. If not, it will be listed in *Device Manager* in *SCSI* as *Emulex LightPulse Fibre Channel Host Adapter*.

If no adapters appear, continue to step 2.

2. If the setup program does not find the adapter and the server has two PCI buses (6 or 7 PCI slots, instead of 3 or 4 slots):
 - a. Power the server off if necessary.
 - b. Move the adapter to a slot on another bus.
 - c. Power the server up if necessary.
 - d. Repeat step 1.

If the setup program still does not find the HBA and the server had PCI-to-SCSI adapters on these buses before you installed the HBA, Windows may assign resources to the Fibre Channel adapter that it has already assigned to other adapters. Such a conflict in resources prevents Windows from detecting the Fibre Channel adapter.

To correct this problem, follow these steps:

- a. In the server's **boot.ini** file, add the **/pcilock** switch to the end of the line for the boot path.
- b. Power down the server.
- c. Remove the Fibre Channel adapters from the server.
- d. Power up the server and then power it down again.

Note that when you power the server up and down, the **/pcilock** switch is in the **boot.ini** file, but no Fibre Channel adapters are in the server.

- e. Reinstall the Fibre Channel adapters.
- f. Power up the server.

The **/pcilock** switch locks previously assigned resources to the adapters to which they were originally assigned, forcing Windows to allocate new resources to the Fibre Channel adapter. Although the **/pcilock** switch lets Windows detect the adapter, it may cause other problems. For example, you must configure new resources manually. For more information, contact your provider or Microsoft Corporation.

HBA Does Not Display Banner

This is normal; either the adapter does not contain a BIOS or the BIOS is not enabled. Refer to *EMC Fibre Channel with Emulex Host Bus Adapters in the Windows Environment*, which is available on the Emulex website as described under *Reference Documentation* on page 5-4.

Fibre Channel Problems

Make sure the Fibre Channel devices were powered up before you powered up the PC.

Windows Does Not Display Disks

If Windows does not display disks:

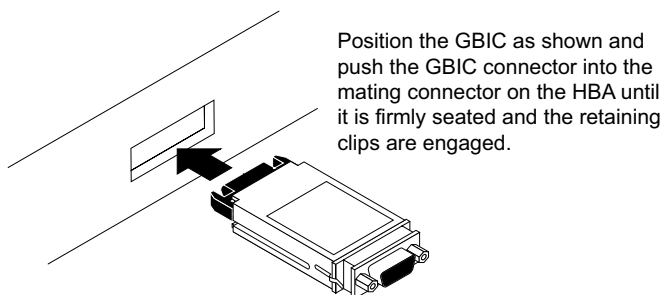
- ◆ Make sure that you have installed the Windows Fibre Channel disk driver for the storage system.
- ◆ Run `Disk Management` to view disk information.
- ◆ Make sure you have connected the cables correctly and securely.

Host Configuration with QLogic HBAs

This section describes the procedures required to configure an EMC-qualified QLogic host bus adapter in a Windows host for connection to CLARiiON over Fibre Channel. (Refer to the *EMC Support Matrix* for approved HBAs.)

Installing GBICs onto 1 Gb HBAs

The 1 Gb HBAs require GBICs (Gigabit Interface Converters). Install a GBIC as shown in the following figure:



The hardware might be rotated 90 degrees clockwise from the orientation shown.

Push the GBIC connector into the mating connector on the HBA until it is firmly seated. For an optical GBIC, make sure the retaining clips are engaged.

What Next?

For the steps to install the HBA and cable, and to install and configure the HBA driver, refer to *EMC Fibre Channel with QLogic Host Bus Adapters in the Windows Environment*, which is available on the QLogic website as described under *Reference Documentation* on page 5-4.

After completing the installation:

- ◆ For an FC-AL environment — Install and configure the Navisphere server software. Refer to the *EMC Navisphere Server Software Administrator's Guide*.
- ◆ For an FC-SW environment:
 - a. Verify the HBA connection to the switch, by ensuring that the LED on the switch port connected to the HBA is green.
 - b. Proceed to *Creating a Switch Zone for Each HBA* on page 5-15.

Creating a Switch Zone for Each HBA

This section applies only to fabric configurations.

EMC requires single-initiator zoning. This means that each HBA has a separate zone that contains it and the SPs with which it communicates.

For information on setting up a zone on a switch, refer to the following:

- ◆ Documentation for the switch
- ◆ *Fibre Connectivity: Switch* section under the appropriate CLARiiON model number in the *EMC Support Matrix*

Replacing HBAs Connected to Shared Storage Systems

A shared storage system is a storage system with the Access Logix software.

If you can manage the server whose HBA you need to replace from another server, follow *Procedure 1*. If you cannot manage it from another server, follow *Procedure 2* on page 5-16.

Procedure 1

Use this procedure to replace an HBA if you can manage the storage system from another host.

1. Stop all I/O to each storage system connected to the HBA you are replacing.
2. Shut down Windows on the server whose HBA you are replacing.
3. Power down the server.
4. Using Navisphere Manager, disconnect any Storage Groups connected to the server through the HBA.
5. Remove the HBA you want to replace and install the new HBA.
6. Power up the server.

Make sure that you have installed the correct driver for the new HBA. If the wrong driver was installed, download and install the correct one from the Emulex website.

7. In the switch zones that include the HBA, change the World Wide Port Name (WWPN) of the old HBA to the WWPN of the new HBA.

8. Remove the connection path to the old HBA from each storage system's persistent memory using the **navicli port -removeHBA** CLI command.

See the CLI reference manual for information on this command.

9. Reboot the server.
10. Restart I/O to each storage system connected to the new HBA.

Procedure 2

Use this procedure to replace an HBA if you cannot manage the server from another host:

1. Shut down Windows on the server whose HBA you are replacing.
2. Power down the server.
3. Remove the HBA you want to replace and install the new HBA.
4. Power up the server.
5. Stop all I/O to each storage system connected to the new HBA.
6. In the switch zones that include the HBA, change the World Wide Port Name (WWPN) of the old HBA to the WWPN of the new HBA.
7. Remove the connection path to the old HBA from each storage system's persistent memory using the **navicli port -removeHBA** CLI command.

See the CLI reference manual for information on this command.

8. Reboot the server.
9. Restart I/O to each storage system connected to the new HBA.

Troubleshooting HBA Problems

Using the Windows Event Viewer

This section describes how to use the Windows Event Viewer and how to identify problems. It also describes how to troubleshoot some problems you might encounter after installing the adapter or configuring the storage system.

To view the Windows error log and determine the meaning of error codes, follow these steps:

1. From the Windows taskbar, click **Start, Programs, Administrative Tools, Event Viewer**.
2. In the Event Viewer, follow the menu path **Log, System**.

The display shows a list of discrete system events, specifying their sources.

Events logged by the driver are listed with the **Source** field set to a QLogic adapter. For example, for the QLA2100 the **Source** field is set to **ql2100** and the **Event** field set to **11**.

3. Double-click an event to view the details, and set the data format to **Words**.

The detailed event code is displayed at offset 0x34.

For the latest list of QLogic error messages, visit the **Support** section on www.qlogic.com.

The following figure shows a list of detailed event codes for the QLogic adapters. For some of the event codes, additional data is recorded in the least significant 16 bits of the longword. Additional data may also be recorded in the longword at offset 0x10.

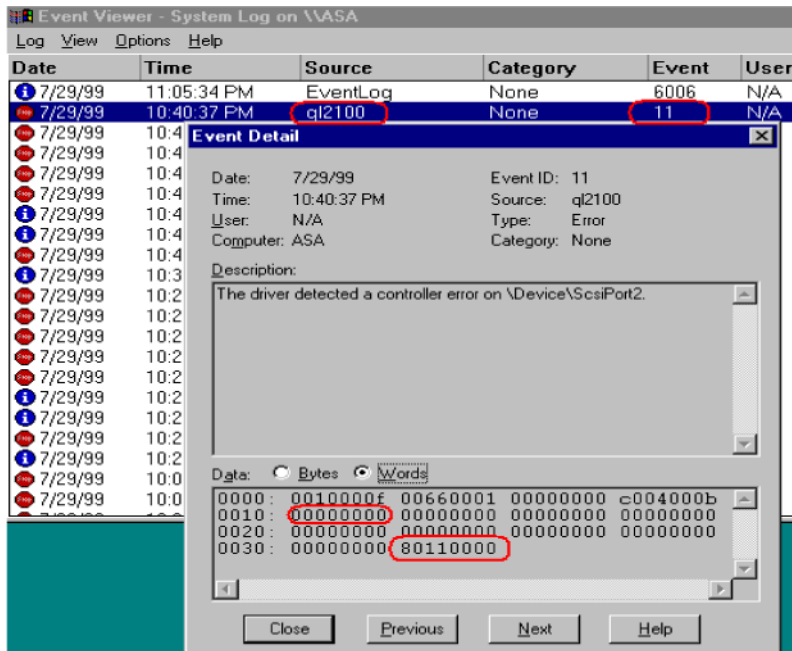


Figure 5-1 Windows Event Viewer

The Fast!UTIL parameter enables additional event logging. The event codes listed with asterisks (*) in the following table are enabled with this parameter. By default, these events are not logged.

Table 5-1 Events Logged by the QLA2100 Windows NT Driver

Event Code Offset 34h	More Data Offset 10h	Description	Suggested Action
4001xxxx	yyyy00zz	Invalid mailbox command xxxx = mailbox1 yyyy = mailbox2 zz = command	Should not occur; send event log to EMC.
4002xxxx	yyyy00zz	Host interface error xxxx = mailbox1 yyyy = mailbox2 zz = command	Hardware DMA error; replace adapter.
4003xxxx	yyyy00zz	Mailbox command test failed xxxx = mailbox1 yyyy = mailbox2 zz = command	Should not occur; send event log to EMC.
4005xxxx	Yyyy00zz	Mailbox command error xxxx = mailbox1 yyyy = mailbox2 zz = command	Normally indicates loop down; check all cabling.

Table 5-1 Events Logged by the QLA2100 Windows NT Driver (continued)

Event Code Offset 34h	More Data Offset 10h	Description	Suggested Action
4005xx6F	yyyyyyzz	Login Fabric port mailbox command error xx = adapter state yyyyyy = port id zz = loop id	Normally indicates loop down; check all cabling.
4006xxxx	yyyy00zz	Mailbox command parameter error xxxx = mailbox1 yyyy = mailbox2 zz = command	Should not occur; send event log to EMC.
* 80010000	00000000	Reset detected	Not logged during normal operation.
8002xxxx	yyyyzzzz	RISC system error xxxx = mailbox1 yyyy = mailbox2 zzzz = mailbox3	Should not occur; send event log to EMC.
8003xxxx	yyyyzzzz	RISC request queue transfer error xxxx = mailbox1 yyyy = mailbox2 zzzz = mailbox3	Hardware error; replace adapter.
8004xxxx	yyyyzzzz	RISC response queue transfer error xxxx = mailbox1 yyyy = mailbox2 zzzz = mailbox3	Hardware error; replace adapter.
* 80100000	0000xxxx	LIP occurred xxxx = mailbox1	Not logged during normal operation.
* 80110000	xxxxyyzz	Link up 2200: xxxx = current ISP connection mode (0 = Loop, 1 = P2P) yy = ISP connection option (0 = Loop, 1 = P2P, 2 = Loop->P2P, 3 = P2P->Loop) zz = starting loop id for remote devices 2100: xxxx = 0000 yyyy = 0000	Not logged during normal operation.
80120000	00000000	Link down error	Not logged during normal operation.
80130000	0000xxxx	LIP reset occurred xxxx = mailbox1	Not logged during normal operation.
**80300000	xxxxyyzz	Link mode up xxxx = current ISP connection mode (0 = Loop, 1 = P2P) yy = ISP connection option (0 = Loop, 1 = P2P, 2 = Loop->P2P, 3 = P2P->Loop) zz = starting loop id for remote devices	Not logged during normal operation.
**8036aabb	xxxxyyzz	Point-to-Point update configuration Xxxx = mailbox1 Yy = current ISP connection mode (0 = Loop, 1 = P2P) zz = ISP connection option 0 = Loop, 1 = P2P, 2 = Loop->P2P, 3 = P2P->Loop aa = starting loop id value for remote devices bb = current retry count for the ISP initialization mode	Not logged during normal operation.
* F0000000	00000000	Restarting RISC firmware	Initial driver load or loop down longer than four minutes.
F0010000	0000xxxx	Invalid IOCB/IOSB handle from RISC xxxx = IOCB/IOSB handle	Should not occur; send event log to EMC.

Table 5-1 Events Logged by the QLA2100 Windows NT Driver (continued)

Event Code Offset 34h	More Data Offset 10h	Description	Suggested Action
F0020000	000000xx	Invalid entry type in response queue xx = response queue entry type	Should not occur; send event log to EMC.
F0030002	00xx00yy	Command DMA direction error xx = CDB opcode yy = target loop ID	Should not occur; send event log to EMC.
* F0030004	00xx00yy	Reset command completion error xx = CDB opcode yy = target loop ID	Not logged during normal operation.
* F0030005	00xx00yy	Command aborted by OS xx = CDB opcode yy = target loop ID	Not logged during normal operation.
F0030006	00xx00yy	Command timeout error xx = CDB opcode yy = target loop ID	Should not occur; send event log to EMC.
F0030028	00xx00yy	Port unavailable command completion error xx = CDB opcode yy = target loop ID	Check target device and cabling.
F0030029	00xx00yy	Port logged out command completion error xx = CDB opcode yy = target loop ID	Check target device and cabling.
F003001C	00xx00yy	Target device queue full (SCSI status 28 from target) xx = CDB opcode yy = target loop ID	Check target device and cabling.
F0040000	00000000	Command not returned error	Should not occur; send event log to EMC.
F0050000	000000xx	Mailbox command error xx = mailbox command opcode	Should not occur; send event log to EMC.
F0060000	000000xx	Mailbox command timeout error xx = mailbox command opcode	Should not occur; send event log to EMC.
F0070000	0000xxxx	Invalid response queue pointer from RISC xxxx = response queue pointer	Should not occur; send event log to EMC.
F0080000	0000xxxx	Invalid/unexpected async event code from RISC xxxx = async event code	Should not occur; send event log to EMC.
* F00A0000	0000xxxx	RISC firmware state during adapter initialization xxxx = firmware state	Not logged during normal operation.
F00B0000	00000000	Reset ISP chip failed	
F00D0000	00000000	Fail to allocate non-cached memory	
F00E0000	00000000	Fail to map ISP registers	

Table 5-1 Events Logged by the QLA2100 Windows NT Driver (continued)

Event Code Offset 34h	More Data Offset 10h	Description	Suggested Action
F00F0000	00000000	Fail to load RISC code	
F0100000	0000xxxx	Fail to start RISC code xxxx = mailbox0	
F0110000	0000xxxx	Fail to initialize firmware xxxx = mailbox0	
F0120000	0000xxxx	Fail to get firmware state xxxx = mailbox0	
* F0130000	00000000	Port Update notification (RISC database changed)	
* F0140000	xxxxxxx	RSCN notification (Name server change detected) xxxx = RSCN Information	
* F0150000	00xx00yy	Name server query rejected (v6 2100) xx = 'Reason Code' yy = 'Explanation Code' (Valid if reason code is 0x09)	
* F0150000	xxxxyyzz	Name server query rejected (v7 2100/2200) xxxx = response status yy = 'Reason Code' zz = 'Explanation Code' (Valid if reason code is 0x09) e.g. if zz = 0x09, yy = 07, this means no SCSI device found	
* F0160000	00000000	Driver reset called - Command timed out	
* F0170000	00xxxxxx	Fabric port login (for information only) xxxxxx = Port Id	
F0180000	000000xx	Excessive link errors, loop down xx = Number of link errors per second	
* F0190000	00000000	Verify firmware checksum failure	
F01A0000	0000xxxx	Invalid IOCB/IOSB IP handle from RISC xxxx = IOCB/IOSB IP handle	Should not occur; send event log to EMC.
* F01B0000	000000xx	Device marked offline after being 'not ready' longer than port down retry count Xx = Loop Id of device	
* F01C0000	000000xx	Bad type field in IOCB from RISC Xx = IOCB type	
* F01D0000	00000000	Error down loading post RISC code	
* F01Exxxx	Yyyyyzzz	Error running post RISC code Xxxx = mailbox0 Yyyy = mailbox1 zzzz = mailbox2	
* F01Fxyyy	Zzzzzzzz	DMA 64 bit (PAE) configuration (for information only) Xx = Dma64BitAddressess flag set by W2K Yy = Dma64BitAddressess flag set by driver Zzzzzzzz = driver adapter flags	

Table 5-1 Events Logged by the QLA2100 Windows NT Driver (continued)

Event Code Offset 34h	More Data Offset 10h	Description	Suggested Action
F0200000	Xxxxxyyy	Error ISP not accessible Xxxx = ISP host command and control yyyy = ISP interrupt status	
* F0210000	xyyy00zz	ISP connection option/topology (for information only) xx = ISP connection option from NVRAM yy = previous ISP topology zz = current ISP topology Topology Code: 0000 = Loop 0001 = FL_Port 0002 = N_Port to N_Port 0003 = F_Port	
* F0220000	0000xxxx	External RISC ram parity error (for 2200G only) xxxx = number of parity errors detected	
* F0230000	Xxxxxyyy	Subvendor Id not match (for information only) xxxx = actual subvendor id yyyy = expected subvendor id	

Server Passed Self-Test But Operating System Does Not Boot from Boot Disk

Look for conflicts with the adapter.

If your system has an IDE fixed disk device, it is assigned device number 80 and is the boot device. If your system does not have an IDE disk device, the first *bootable* disk device configured (the one with the lowest ID) is assigned device number 80 and is the boot device. If you do not have an IDE drive, set the motherboard BIOS parameters to **None** or **Not Installed**.

Hardware Problems

Make sure that:

- ◆ you have installed the adapter correctly and have seated it firmly in the PC slot.
- ◆ you have connected all cables securely to the correct connectors.
- ◆ you have powered up all storage systems.
- ◆ the interrupt request levels are correct.

System Configuration Problems

Check for the following problems:

- ◆ Incorrect motherboard configuration. See the documentation supplied with your computer to determine if you need to reconfigure your motherboard.
- ◆ If the system message *Missing Operating System* or *No ROM BASIC, System Halted* appears, the disk drive attached to the adapter is not partitioned in a format compatible with the board. The proper geometry for use with the adapters is the Microsoft standard as follows:
 - Drives smaller than 1 Gb are 64 heads, 32 sectors per track.
 - Drives greater than 1 Gb are 255 heads, 63 sectors per track.
 If the drive is not formatted with this geometry, repartition and format the drive using the **DOS FDISK** and **FORMAT** utilities.

Windows Does Not Detect the Adapter

If Windows does not appear to detect the adapter, follow these steps:

1. Open the Device Manager.

The HBA may be listed in *Other Devices* as *Fibre Channel Controller* and the driver as *unknown/none*. If not, it will be listed in *Device Manager* in *SCSI* as *Qlogic QLA23xx PCI Fibre Channel Adapter*.

If no adapters appear, continue to step 2.

2. If the setup program does not find the adapter and the server has two PCI buses (6 or 7 PCI slots, instead of 3 or 4 slots):
 - a. Power the server off if necessary.
 - b. Move the adapter to a slot on another bus.
 - c. Power the server up if necessary.
 - d. Repeat step 1.

If the setup program still does not find the HBA and the server had PCI-to-SCSI adapters on these buses before you installed the HBA, Windows may assign resources to the Fibre Channel adapter that it has already assigned to other adapters. Such a conflict in resources prevents Windows from detecting the Fibre Channel adapter.

To correct this problem, follow these steps:

- a. In the server's **boot.ini** file, add the **/pcilock** switch to the end of the line for the boot path.
- b. Power down the server.
- c. Remove the Fibre Channel adapters from the server.
- d. Power up the server and then power it down again.

Note that when you power the server up and down, the **/pcilock** switch is in the **boot.ini** file, but no Fibre Channel adapters are in the server.

- e. Reinstall the Fibre Channel adapters.
- f. Power up the server.

The **/pcilock** switch locks previously assigned resources to the adapters to which they were originally assigned, forcing Windows to allocate new resources to the Fibre Channel adapter. Although the **/pcilock** switch lets Windows detect the adapter, it may cause other problems. For example, you must configure new resources manually. For more information, contact your provider or Microsoft Corporation.

HBA Does Not Display Banner

This is normal; either the adapter does not contain a BIOS or the BIOS is not enabled. Refer to *EMC Fibre Channel with QLogic Host Bus Adapters in the Windows Environment*, which is available on the QLogic website as described under *Reference Documentation* on page 5-4.

Fibre Channel Problems

Make sure the Fibre Channel devices were powered up before you powered up the PC.

Windows Does Not Display Disks

If Windows does not display disks:

- ◆ Make sure that you have installed the Windows Fibre Channel disk driver for the storage system.
- ◆ Run `Disk Management` to view disk information.
- ◆ Make sure you have connected the cables correctly and securely.

Recognizing LUNs

Once the storage array has devices assigned with device addresses, the host can see all the target storage devices assigned to that host interface. Devices are presented to the host in the same manner as devices accessed through a standard SCSI interface.

EMC storage devices are addressed on the SCSI bus using SCSI target IDs and SCSI LUNs. Each target ID can have up to 256 LUNs associated with it.

In arbitrated loop configurations, the Target ID needed to address a device is determined by the Fibre Channel Arbitrated Loop Physical Address (AL_PA). A Loop_ID of 00 (AL_PA of EF) will have LUNs behind Target ID 0, Loop_ID 01 has LUNs behind target ID 1, and so on.

Your actual target/LUN assignment will vary depending on unique system configuration requirements.

The first time a disk appears on a Windows NT/Windows 2000 system, the Windows Disk Administrator writes a signature to that disk. The signature is a unique 32-bit number that Windows uses as an internal identification number for that disk. Windows uses the signature to associate drive letters with a disk and disks with volume sets. The Disk Administrator can reassociate the drive letter with the correct disk even if you reconfigure device channels or change the disk target and LUN.

Windows searches for disks on each host adapter in Target ID/LUN sequence. Adapters are also accessed in a particular sequence that is unique to each host. This process determines the order in which the disk devices are assigned drive letters.

Drive letters can be reassigned manually using Disk Administrator after a new signature is written.

Once all disk signatures are written, devices are ready to be used by the Windows operating system.

Making LUNs Available to Windows NT

Before you can use the LUNs in a storage system available to Windows NT, you must partition the LUNs (disks). This section describes how to plan and create your LUN or disk partitions, including how to fill out the relevant configuration worksheet. To help with the planning, you may want to refer to the appropriate configuration planning guide for your storage system type.

Filling Out the Configuration Worksheet

1. Make a copy of the worksheet shown under *Configuration Worksheet: Storage System with SPs* on page 5-27.
2. From the Windows NT taskbar, follow the path **Start, Settings, Control Panel**.
The **Control Panel** dialog box appears.
3. Double-click **SCSI Adapters**.
4. In the **SCSI Adapters** dialog box, click the appropriate adapter.
You will see one or more buses.
5. Click a bus.
All of the target ID LUNs will appear.
6. Select a target and click **Properties**.
7. From the **Properties** dialog box with the **General** tab selected, record the LUN Type (for example, RAID 1) on the configuration worksheet.
8. Click the **Settings** tab.
9. Record the following data on the configuration worksheet:
 - Target ID (for example, 21)
 - Adapter name (for example, lp8d)
 - Bus number (for example, 0)

What Next? Go to *Creating Windows NT Partitions on LUNs* on page 5-29.

Configuration Worksheet: Storage System with SPs

This worksheet can be useful when you create partitions.

Configuration Worksheet									
First Fibre Channel adapter - Host slot number: _____									
Second Fibre Channel adapter - Host slot number: _____									
Adapter Name	Bus Number	RAID Group	Target ID	LUN Number	LUN Type	Drive Letter	Volume Label	File System Type	Capacity
Configured by _____ Date _____									

Adapter Name	The description of the adapter. For any target LUN connected to the adapter, you can find the adapter name in the SCSI Adapters window under the Settings tab.
Bus Number	A calculated value based on the driver's mapping. For any target LUN connected to the adapter, you can find the bus number in the SCSI Adapters window under the Settings tab.
RAID Group	See the Manager documentation for information on RAID groups.
Target ID	A calculated value based on the driver's mapping. For any target LUN connected to the adapter, you can find the target ID in the SCSI Adapters window under the Settings tab.
LUN Number	The logical unit (LUN) number. For any target LUN connected to the adapter, you can find the LUN number in the SCSI Adapters window under the Settings tab.
LUN Type	The type of LUN that the volume will be on. For any target LUN connected to the adapter, you can find the LUN type in the SCSI Adapters window under the General tab. The types are: ◆ RAID 0 for a non-redundant array ◆ RAID 1 for a mirrored pair ◆ RAID 10 for a mirrored RAID 0 ◆ RAID 3 for a parallel access array ◆ RAID 5 for an independent access array ◆ DISK for an individual disk unit
Drive Letter	The letter assigned to the partition that you create. You use the Windows NT Disk Administrator to create partitions on a LUN. You fill this in while creating partitions.
Volume Label	The name that you specify when you create the volume group. You fill this in while creating partitions.
File System Type	FAT or NTFS.
Capacity	The user-accessible capacity of the logical volume. A volume containing a FAT file system must not exceed 2 GB. You fill this in while creating partitions.

Configuration Worksheet - Sample

First Fibre Channel adapter - Host slot number: 1

Second Fibre Channel adapter - Host slot number:

Adapter Name	Bus Number	RAID Group	Target ID	LUN Number	LUN Type	Drive Letter	Volume Label	File System Type	Capacity
xxx SCSI	0	-----		0	-----	C	System	FAT	1.8 GB
"	0	-----		1	-----	D	Temp	FAT	1.8 GB
lp8000	0	0	21	0	RAID 1/0	E	Projects	FAT	2 GB
"	0	0	21	0	RAID 1/0	F	Admin	NTFS	2 GB
"	0	1	1	1	RAID 5	G, H	Database	NTFS	9 GB, 5 GB
"	0	2	2	2	RAID 3	J	Misc	NTFS	8 GB

What Next? Create partitions as described in the next section.

Creating Windows NT Partitions on LUNs

A LUN functions like a disk for Windows NT.

You can create a maximum of four partitions on one disk (LUN). Only one of the four partitions can be an extended partition; the others must be primary partitions. You can create an extended partition on a disk without creating any primary partitions. As you create partitions, finish filling out the configuration worksheet as outlined in this procedure.

1. From the Windows NT taskbar, follow the path **Start, Programs, Administrative Tools (Common), Disk Administrator**.
2. If you see a dialog box that calls this a first-time installation, click **OK**.
3. Click **Yes** to the confirmation message asking if you want to create a signature on your disk drive, and repeat this procedure for each new LUN you created.

The Disk Administrator dialog box appears. You use it to create partitions on the disk.

Before you decide which file system you want to use, see the Windows NT online help topic, *file systems supported by Windows*. A partition containing a FAT file system cannot have a capacity greater than 2 GB. A partition containing a FAT32 file system cannot have a capacity greater than 4 GB.

4. To create a primary partition, follow these steps:
 - a. Select the area of free space on the disk for the partition by clicking on the space.
 - b. On the Partition menu, click **Create**.
 - c. Enter the size of the partition.
 - d. Click **OK**.
 - e. Click **Yes**.

To create additional primary partitions, repeat steps a through e. You can create a maximum of either four primary partitions, or three primary partitions and one extended partition on a single disk.

5. To create an extended partition, follow these steps:
 - a. Select the area of free space on the disk for the partition by clicking on the space.
 - b. On the **Partition** menu, click **Create Extended**.
 - c. Enter the size of the extended partition.
 - d. Click **OK**.
 - e. Create a logical drive in the extended partition as follows:
 - Select an area of free space for the logical drive by clicking on the space.
 - On the **Partition** menu, click **Create**.
 - Enter the size of the logical drive.To create additional logical drives on the extended partition, repeat step e.
6. When you have created the desired partitions, save the changes by clicking **Commit Changes Now** on the Partition menu.
7. Click **No** to the confirmation message asking if you want to execute **Rdisk.exe**.

8. Enter the following information onto the configuration worksheet:
 - Drive letter
 - Capacity
 - Volume label
9. Format each partition as follows:
 - a. Select the partition.
 - b. On the **Tools** menu, click **Format**.
 - c. Select the file system type and enter a label.
 - d. Select the appropriate format option.
 - e. Click **OK**.
 - f. Confirm the format operation by clicking **Yes**.

What Next?

What you do next depends on whether you will use the server in a Windows NT cluster:

- ◆ If yes, go to *Configuring for Windows Clusters* on page 5-49.
- ◆ If no, applications can start using the LUNs. ATF provides the applications with access to the LUNs via the alternate path if either the primary or secondary path fails. However, the original high availability provided by ATF is not restored until the failed path is fixed. Also, if the server is booted while only one path is working, you must reboot to restore high availability.

Making JBOD Disks Available to Windows NT

This section describes how to determine the disk number for each disk and how to create partitions on the disks.

Determining the Disk Number for Each Disk

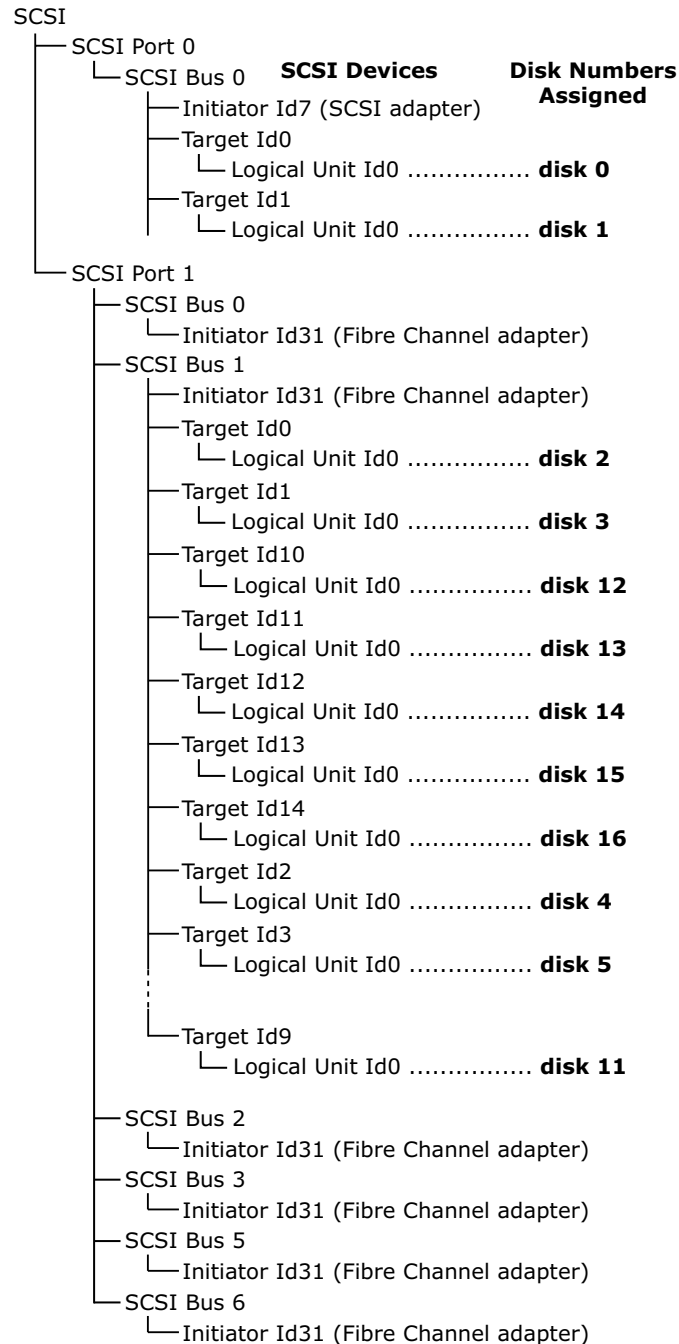
Each LUN functions like a disk for Windows NT.

Windows NT represents a Fibre Channel arbitrated loop (FC-AL) on a Fibre Channel adapter as one SCSI port with six SCSI buses, SCSI Bus 0 through SCSI Bus 5, each with the same initiator, which is the adapter. SCSI Bus 0 is reserved for the adapter. SCSI Bus 1 through SCSI Bus 5 are for the nodes on the FC-AL loop. Each of these six SCSI buses can have 32 nodes, which are targets with IDs of 0 through 30. Target ID 31 is reserved for the adapter.

Windows NT assigns *disk numbers* by scanning all SCSI buses for disk devices and naming the devices in the order in which it finds them. It names the first disk device it finds **disk 0**; the second disk **disk 1**; and so on.

The following figure illustrates how Windows NT assigns disk numbers. This figure shows a sample SCSI tree displayed by the Windows NT **regedit32** program, which you will use to determine the disk number for each disk. In the configuration shown by the tree, the server has one SCSI adapter and one Fibre Channel adapter, which Windows NT names **SCSI Port 0** and **SCSI Port 1**, respectively. The SCSI adapter has two disks connected to its SCSI bus. The Fibre Channel adapter has two DAEs connected to its Fibre Channel loop. One DAE has ten disks and the other has five.

When Windows NT scans a SCSI bus, it finds the Target IDs in numeric order, 0–30. However, **regedit32** displays these Target IDs in alphanumeric order. Since **regedit32** uses only one digit for Target IDs 0–9, it displays Target IDs for each SCSI bus in this order: 0, 1, 10–19, 2, 20–29, 3, 30, 4, 5, 6, 7, 8, 9.



In the example, Windows NT scans SCSI Port 0, SCSI Bus 0, and finds one internal SCSI adapter, Initiator Id7, with two internal SCSI devices, Target Id0, Logical Unit Id0 and Target Id1, Logical Unit Id0. It assigns the names **disk 0** and **disk 1** to these devices.

Windows NT continues scanning and finds SCSI Port 1, SCSI Bus 0 with one Fibre Channel adapter, initiator ID 31. It scans SCSI Port 1, SCSI Bus 1 and finds ten disk devices in the first DAE (enclosure address 0). These disk devices are target ID 0/logical unit ID 0 through target ID 9/logical unit ID 0, and they have FC-AL addresses 0 through 9. Windows NT names them **disk 2** through **disk 11**. Next, it finds five disk devices in the second DAE (enclosure address 1). These disk devices are target ID 10/logical unit ID 0 through target ID 14/logical unit ID 0, and they have FC-AL addresses 10 through 19. Windows NT names them **disk 12** through **disk 16**.

Creating Windows NT Partitions on JBOD Disks

After you have determined the drive number for each disk in the JBOD storage system, you can create partitions on them. You can create a maximum of four partitions on one disk. Only one of the four partitions can be an extended partition; the others must be primary partitions. You can create an extended partition on a disk without creating any primary partitions. While you create partitions, finish filling out the Configuration Worksheet as outlined in this procedure.

1. From the Windows NT taskbar, follow the path **Start, Programs, Administrative Tools (Common), Disk Administrator**.
2. If you see a dialog box that calls this a first-time installation, click **OK**.
3. Click **Yes** to the confirmation message asking if you want to create a signature on your disk drive, and repeat this procedure for each new LUN you created.

The **Disk Administrator** dialog box opens. You use it to create partitions on the disk.

A partition containing a FAT file system cannot have a capacity greater than 2 GB.

4. To create a primary partition, follow these steps:
 - a. Select the area of free space on the disk for the partition by clicking on the space.
 - b. On the **Partition** menu, click **Create**.
 - c. Enter the size of the partition.
 - d. Click **OK**.
 - e. Click **Yes**.

To create additional primary partitions, repeat steps a through e. You can create a maximum of either four primary partitions or three primary partitions and one extended partition on a single disk.

5. To create an extended partition, follow these steps:
 - a. Select the area of free space on the disk for the partition by clicking on the space.
 - b. On the **Partition** menu, click **Create Extended**.
 - c. Enter the size of the extended partition.
 - d. Click **OK**.
 - e. Create a logical drive in the extended partition as follows:
 - Select an area of free space for the logical drive by clicking on the space.
 - On the **Partition** menu, click **Create**.
 - Enter the size of the logical drive.

To create additional logical drives on the extended partition, repeat step e.
6. When you have created the desired partitions, save the changes by clicking **Commit Changes Now** on the **Partition** menu.
7. Click **No** to the confirmation message asking if you want to execute **Rdisk.exe**.
8. Enter the following information onto the configuration worksheet:
 - Drive letter
 - Capacity
 - Volume label

9. Format each partition as follows:
 - a. Select the partition.
 - b. On the **Tools** menu, click **Format**.
 - c. Select the file system type and enter a label.
 - d. Select the appropriate format option.
 - e. Click **OK**.
 - f. Confirm the format operation by clicking **Yes**.

What Next?

What you do next depends on whether you will use the server in a Windows NT cluster:

- ◆ If yes, go to *Configuring for Windows Clusters* on page 5-49.
- ◆ If no, applications can start using the LUNs. ATF/PowerPath provides the applications with access to the LUNs via the alternate path if either the primary or secondary path fails.

The original high availability provided by ATF or PowerPath is not restored until the failed path is fixed. Also, if the server is booted while only one path is working, you must reboot to restore high availability.

Making LUNs Available to Windows 2000 or Windows 2003

Before you can use the LUNs in a storage system available to Windows 2000 or Windows 2003, you must partition the LUNs (disks). This section describes how to plan and create your LUN or disk partitions, including how to fill out the relevant configuration worksheet. To help with the planning, you may want to refer to the appropriate configuration planning guide for your storage-system type.

Determining the Disk Number for Each LUN

1. Make a copy of the worksheet shown under *Configuration Worksheet* on page 5-38.
2. From the Windows 2000/Windows 2003 taskbar, follow the path **Start, Settings, Control Panel**.
3. In the **Control Panel** dialog box, double-click **Administrative Tools**.
4. In the **Administrative Tools** dialog box, double-click **Computer Management**.
5. In the **Computer Management** dialog box, click **Disk Management** under **Storage** in the tree.

The right side of the dialog box displays the volume and disk information.

If the **Write Signature and Upgrade Disk Wizard** opens, close it.

6. Right-click **disk**, and select **Properties**.
7. From the **Properties** dialog box, record the following data onto the configuration worksheet.
 - Target ID (for example, 21)
 - Adapter name
 - LUN number (for example, 1)

This worksheet can be useful when you create partitions.

First Fibre Channel adapter - Host slot number: _____

Second Fibre Channel adapter - Host slot number: _____

[illegible]

Configured by _____ Date _____

Adapter Name	The description of the adapter. For any target LUN connected to the adapter, you can find the adapter name in the Properties dialog box.
Target ID	Calculated value based on the driver's mapping. For any target LUN connected to the adapter, you can find the target ID in the Properties dialog box.
RAID Group	See the Navisphere documentation for information on RAID groups.
LUN Number	The logical unit (LUN) number. For any target LUN connected to the adapter, you can find the LUN number in the Properties dialog box.
LUN Type	The type of LUN that the volume will be on. For any target LUN connected to the adapter, you can find the LUN type in the Properties dialog box (as part of the device name). The types are: ◆ RAID 0 for a non-redundant array ◆ RAID 1 for a mirrored pair ◆ RAID 1/0 for a mirrored RAID 0 ◆ RAID 3 for a parallel access array ◆ RAID 5 for an independent access array ◆ DISK for an individual disk unit ◆ SPARE for a global hot spare disk
Drive Letter	The letter assigned to the partition that you create. You use the Windows 2000/Windows 2003 Disk Management folder to create partitions on a LUN. You fill this in while creating partitions.
Volume Label	The name that you specify when you create the volume group. You fill this in while creating partitions.
File System Type	FAT, FAT32, or NTFS.
Capacity	The user-accessible capacity of the logical volume. A volume containing a FAT file system must not exceed 2 GB, and a FAT32 file system must not exceed 4 GB. You fill this in while creating partitions.

Configuration Worksheet - Sample

First Fibre Channel adapter - Host slot number: ____1____

Second Fibre Channel adapter - Host slot number: _____

Adapter Name	Bus #	RAID Group	Target ID	LUN Number	LUN Type	Drive Letter	Volume Label	File System Type	Capacity
xxx SCSI	0	----		0	-----	C	System	FAT	1.8 GB
"	0	----		1	-----	D	Temp	FAT	1.8 GB
lp8000	0	0	21	0	RAID 1/0	E	Projects	FAT	2 GB
"	0	0	21	0	RAID 1/0	F	Admin	NTFS	2 GB
"	0	1	1	1	RAID 5	G, H	Database	NTFS	9 GB, 5 GB
"	0	2	2	2	RAID 3	J	Misc	NTFS	8 GB

What next? Create partitions as described in the next section.

Creating Windows 2000 or Windows 2003 Partitions

After you have determined the drive number for each of the storage system's LUNs, you can create partitions on them. You can create a maximum of four partitions on one disk or LUN. Only one of the four partitions can be an extended partition; the others must be primary partitions. You can create an extended partition on a LUN without creating any primary partitions. While you create partitions, finish filling out the configuration worksheet as outlined in this procedure.

NOTE: Windows 2000 currently supports a maximum LUN size of 2TB. Windows 2003 is currently not capable of managing single LUNs of 2TB capacity. This limitation should be taken into account when planning your storage environment.

1. From the Windows 2000/Windows 2003 taskbar, follow the path **Start, Programs, Administrative Tools, Computer Management**.
2. In the **Computer Management** dialog box, click **Disk Management** under **Storage**.

The right side of the dialog box displays the volume and disk information.

3. If the signature is not written on the LUN, follow these steps to write the signature:

If the **Write Signature and Upgrade Disk Wizard** opens and you do not want to write a signature, close the dialog box. You cannot create partitions on a disk without a signature.

- a. Click **Next**.
- b. In the **Select Disk to Write Signature** dialog box, select the disk for which you want to write a signature.
- c. Click **Next**.
- d. In the **Select Disks to Upgrade** dialog box, deselect the disks, and click **Next**.

The **Write Signature and Upgrade Disk** dialog box displays the disks you selected.

- e. Click **Finish**.

A display of the volumes appears in the right side of the dialog box. When the signature is written on a disk, the small red icon next to the disk name disappears. If you do not write a signature on a disk, this icon remains and its type appears as unknown.

4. If you close the Write Signature wizard and need to use it again, follow these steps:
 - a. Right-click the disk without a signature, and click **Write Signature**.
 - b. In the **Write Signature** dialog box, select the disks for which you want to write a signature.
 - c. Click **OK**.

Before you decide which file system you want to use, see the Windows online help topic, *file systems supported by Windows*. A partition containing a FAT file system cannot have a capacity greater than 2 GB. A partition containing a FAT32 file system cannot have a capacity greater than 4 GB.

5. To create a primary partition, follow these steps:
 - a. Right-click the area of free space on the disk detail panel for the partition, and click **Create Partition**.
 - b. In the **Create Partition Wizard** dialog box, click **Next**.

- c. In the **Select Partition Type** dialog box, select **primary partition** and click **Next**.
- d. In the **Specify Partition Size** dialog box, select the amount of disk space to use and click **Next**.
- e. In the **Assign Drive Letter or Path** dialog box, click **Assign a drive letter**, specify an unused drive letter, and click **Next**.
- f. If you need to format the volume, then in the **Format Partition** dialog box, select the **Perform a Quick Format** check box.
- g. Click **Next**.
- h. Click **Finish**.

To create additional primary partitions, repeat steps a through g above. You can create a maximum of either four primary partitions or three primary partitions and one extended partition on a single disk.

6. To create an extended partition, follow these steps:
 - a. Right-click the area of free space on the disk for the partition, and click **Create Partition**.
 - b. In the **Create Partition Wizard** dialog box, click **Next**.
 - c. In the **Select Partition Type** dialog box, select **extended partition**, and click **Next**.
 - d. In the **Specify Partition Size** dialog box, specify the size of the extended partition, and click **Next**.

The status information for the partition appears in the dialog box.
 - e. Click **Finish**.
7. To create a logical drive in the extended partition, follow these steps:
 - a. Right-click the area of free space for the logical drive, and click **Create Logical Drive**.
 - b. In the **Create Partition** dialog box, click **Next**.
 - c. Enter the size of the logical drive, and click **Next**.
 - d. In the **Assign Drive Letter or Path** dialog box, select **Assign a drive letter**, specify an unused drive letter, and click **Next**.

- e. In the **Format Partition** dialog box, format the partition if you want to.
- f. If you format the partition, choose the file system type you want to use, the allocation size, and the volume label.
- g. Click **Finish**.

To create additional logical drives on the extended partition, repeat steps a through g. You can create as many logical drives as you want until you run out of space. A dark green border surrounding the logical drives you created represents the extended partition.

If you want to create volumes on dynamic disks, continue to the next procedure.

Creating Volumes on a LUN

To create volumes on a LUN:

1. In the **Disk Management** dialog box, right-click the dynamic disk on which you want to create a volume.

To change a basic disk to a dynamic disk, right-click the disk, click **Upgrade to Dynamic Disk**, and click **OK**.

2. Click **Create Volume**.
3. In the **Create Volume Wizard** dialog box, click **Next**.
4. In the **Select Volume Type** dialog box, click the type of volume you want to create, depending on the number of disks you have, and click **Next**.

The **Select Disks** dialog box displays the list of dynamic disks.

5. In the **Select Disks** dialog box, select the dynamic disk and specify the size for this volume, and then click **Next**.
6. Assign a drive letter or path to access the volume, and click **Next**.
7. Accept the default, format this volume specifying the formatting information, including file system, allocation unit size, and volume label.

8. Click **Next**.

The Create Volume Wizard displays the new settings you selected.

9. Click **Finish**.

What Next?

What you do next depends on whether you will use the server in a Windows cluster:

- ◆ If yes, go to *Configuring for Windows Clusters* on page 5-49.
- ◆ If no, applications can start using the LUNs. ATF/PowerPath provides the applications with access to the LUNs via the alternate path if either the primary or secondary path fails.

The original high availability provided by ATF or PowerPath is not restored until the failed path is fixed. Also, if the server is booted while only one path is working, you must reboot to restore high availability.

LUN Expansion Recognition

After expanding one or more LUNs through Navisphere Manager, steps must be taken at the host operating system level and at the volume management level before Windows will recognize the increased LUN capacity. These steps have varying levels of impact on normal user operations.

There are two methods within a CLARiiON array to increase the capacity of a LUN: metaLUN expansion and RaidGroup LUN expansion. Each offers unique capabilities; refer to the array software guide for complete features and instructions.

In Windows, *partitions* are the building blocks for file system volumes. A LUN is viewed at the operating system level as a *physical disk*, and can contain partitions based on the classification of disk as assigned by the OS. In Windows, there are two types of disk groups: *basic* and *dynamic*. (Refer to Microsoft Knowledge Base article 175761, *Dynamic vs. Basic Storage in Windows 2000* for more information.) Basic disks have a maximum of four partitions. Dynamic disks refer to partitions as volumes, and the number of volumes is theoretically unlimited. (Refer to Microsoft Knowledge Base article 323442.) These two classifications of disks have different properties with respect to LUN expansion (called Data Volume Extension in Windows documentation). Refer to Microsoft Knowledge Base article 222189, *Description of Disk Groups in Windows Disk Management*, for a complete description.

Windows Server NT 4.0 Basic Disks

You can use the Disk Administrator tool to create a volume set from an existing NTFS partition or to extend an existing NTFS volume set. You cannot natively extend primary or extended partitions. If array LUN expansion is performed on an existing LUN, the increased capacity will be reported by the host, and can be used to create an additional separate partition and logical drives. Refer to the Disk Administrator help for instructions on how to perform these tasks. Depending on your OS revision, a reboot may be required before the increased capacity becomes visible.

Windows Server 2000 and Windows Server 2003 Basic Disks

Starting with Windows 2000, you have two options for natively configuring basic disk devices: the Disk Management MMC Graphical Interface and the `DISKPART` command line tool. Only the `DISKPART` tool can be used to extend Basic Disks. Refer to Microsoft Knowledge Base article 325590, *How to Use Diskpart.exe to Extend a Data Volume*, for further instructions. The Disk Management MMC Graphical Interface can be used to create a new volume or consolidate existing volumes with the increased capacity.

Windows 2000 and Windows Server 2003 Dynamic Disks



CAUTION

Windows 2000 systems must be upgraded to Service Pack 4 before using CLARiiON metaLUN expansion with Microsoft Dynamic Disks. Failure to do so can result in loss of dynamic volumes and/or volume data, and cause system STOP errors. Refer to Microsoft Knowledge Base article 327020 (formerly Q327020), *Error Message Occurs When You Start Disk Management After Extending a Hardware Array*, for more information.

Starting with Windows 2000, you have two options for natively configuring dynamic disk devices: the Disk Management MMC Graphical Interface and the `DISKPART` command line tool. Both interfaces can be used to extend Dynamic Disks. For use with the Disk Management MMC Graphical Interface, refer to Microsoft Knowledge Base article 323442, *HOW TO: Use the Disk Management Snap-in to Manage Basic and Dynamic Disks in Windows Server 2003*.

After LUN expansion has occurred at the array level, the Windows disk management console should reflect increased physical disk capacity (at the left side of display) with the additional space being represented to the far right side of the display as a separate unallocated segment of the disk.

If using the `DISKPART` command line tool, refer to Microsoft Knowledge Base article 325590, *How to Use Diskpart.exe to Extend a Data Volume*.

Please note that currently you can extend only new volumes that were created on a dynamic disk. You cannot use `DISKPART` to extend a volume that is currently on a dynamic disk but was originally created

on a basic disk. If you try to do this, you receive the following error message: Diskpart failed to extend the volume. Please make sure the volume is valid for extending.



CAUTION

There are limitations on the number of times a dynamic disk can be expanded. Refer to *Microsoft Knowledge Base article 294244, Extending Hardware RAID Array May Cause Dynamic Unreadable/Offline Error*, for more information.

After expanding one or more LUNs thru Navisphere Manager, the new storage space you added might not be available at the end of the dynamic disk. Also, the Disk Management tool might not start. When you try to start Disk Management, you might receive the following error messages:

```
Logical disk manager
The remote procedure call failed.
```

```
Windows - System Error
Unknown hard Error
```

```
The system process C:\Winnt\System32\Services.exe
terminated unexpectedly. Error code 128.
```

```
STOP: 0x0000007A (0x#####, 0xc000000e, 0x#####,
0x#####)
```

```
KERNEL_DATA_INPAGE_ERROR
(Status 0xc000000e = STATUS_NO_SUCH_DEVICE)
```

```
STOP: 0xC000021A (0x#####, 0xc0000006, 0x0, 0x0)
STATUS_SYSTEM_PROCESS_TERMINATED
(Status 0xc0000006 = STATUS_IN_PAGE_ERROR)
```

If you try to run Diskpart.exe, you receive the following error message:

```
The disk management services could not complete the
operation.
When this problem occurs, any of the following entries
may be recorded in the System event log:
```

```
Event Type: Information
Event Source: dmio
Event Category: None
Event ID: 31
Description:
dmio: Harddisk0 write error at block ##### due to
disk removal
```

Event Type: Warning
Event Source: LDM
Event Category: None
Event ID: 1000
Description:
Cannot grow LUN Harddisk0: Config copy write failed

Event Type: Warning
Event Source: LDM
Event Category: None
Event ID: 1000
Description:
Disk group CompernameDg0: Errors in some configuration
copies:
Disk Harddisk0, copy 1: Block 0: Disk read failure

Event Type: Information
Event Source: dmio
Event Category: None
Event ID: 34
Description:
dmio: Harddisk0 is re-online by PnP

To resolve this problem, obtain the latest service pack for Microsoft Windows 2000. This problem was first corrected in Microsoft Windows 2000 Service Pack 4. Refer to Microsoft Knowledge Base article 327020 for more information.

Configuring for Windows Clusters

This section describes Windows clusters and how to configure Navisphere applications to work with clusters.

About Windows Clusters

A Windows cluster consists of two or more nodes running the same version of the Windows OS and Windows clustering software. The clustering software allows only one server at a time to access the LUNs in a Storage Group on a shared storage system or all the LUNs on an unshared storage system. All servers in the cluster have access to the same hardware and storage processors (on SPA and SPB).

Prior to installing the clustering software, both servers in the cluster can read and write to all LUNs in the Storage Group if the storage system is shared or to all the LUNs on the storage system if the storage system is unshared. After installing the clustering software:

- ◆ Only one server at a time has access to the LUNs in the Storage Group or on the storage system.
- ◆ Resources in a cluster (for example, disks, IP addresses, and network names) are all placed into groups that, if necessary, fail back and forth between the two servers in the cluster.

For example, if one of the servers in the cluster fails, then the cluster group and any other groups that the failed server owns, fail over to the other server in the cluster. Also, if a server in the cluster polls any resources in a group that it currently owns, and receives no response within a given time period, the group with the non-responsive resource fails over to the peer server.

- ◆ The software creates a default cluster group which contains the network name and IP address for the cluster.

The server that currently owns the default cluster group responds to any network requests directed to the cluster name or IP address.

Using Navisphere Applications with Clusters

Navisphere client applications must use the cluster or network name (found in the default cluster group), rather than the physical server name, to connect to a cluster and manage any FC4500, FC5300, or

FC5700 storage systems connected to that cluster. As long as one server in the cluster is running, you can manage any FC4500, FC5300, or FC5700 storage systems. You manage any FC4700 storage systems in the cluster by managing their SP Agents as you normally would were they not in the cluster.

The server that owns the cluster group (containing the cluster name and IP address) receives requests from the Navisphere client application, and therefore must be running the Navisphere Host Agent. The second server in the cluster does not currently own the cluster group so, unless the cluster group fails over to this server, it does not need a running Host Agent. In order to handle the starting and stopping of the proper Host Agent on the servers you must add a Generic Service resource to the cluster group. (Refer to *Adding a Generic Service Resource to the Cluster Group* on page 5-51.)

Configuring the Host Agent for Clusters

You must set the Windows Service Startup for the Host Agent to **Manual** so that the clustering software is able to use the Generic Service resource to start and stop the appropriate Host Agent. (Refer to *Adding a Generic Service Resource to the Cluster Group* on page 5-51.)

To Configure the Host Agent for Clusters

1. Set the Service Startup for the Host Agent as follows:
 - a. Open the **Control Panel** dialog box, and double-click the **Services** icon.
 - b. Select **Navisphere Agent**, and then click **Startup**.
 - c. Under **Startup Type**, click **Manual**, and then click **OK**.
2. Click **Save**.
3. When the system prompts you to restart the Agent, click **No** if you are going to install the cluster software now; otherwise, click **Yes** to restart the Host Agent.

To Install the Cluster Software

EMC strongly recommends that you stop the Host Agent service before installing the Windows clustering software. Install the clustering software, as described in the clustering software installation instructions.

Adding a Generic Service Resource to the Cluster Group

Before adding the Generic Service resource to the cluster group, we recommend that you install the Navisphere Host Agent on both servers in the cluster. Once installed, configure both Agents to work with clusters as described under *Configuring the Host Agent for Clusters* on page 5-50.

You add the Generic Service resource to the cluster group to stop and start the Host Agent on the appropriate server in the cluster. For example, if the cluster group moves from server A to server B, the Generic Service resource for the Host Agent stops the Host Agent on server A, and then starts the Host Agent on server B. The only noticeable interruption may be a time-out in polling while one Host Agent stops and the other one starts.

To add a generic service resource to the cluster group

1. Open the **Cluster Administrator** dialog box from one of the servers in the cluster.
2. From the **Cluster Administrator** menu bar, follow the path **File, New, Resources**.
3. Enter the name of the resource that controls the Host Agent.
For example, enter **Navisphere_Agent**.
4. Under **Resource Type**, click **Generic Service**; under **Group**, click **Cluster Group**, and click **Next**.

The two servers with the Agent installed should be listed in the **Possible Owners** list. If not, highlight one or both servers, click the right arrow to move them into the **Possible Owners** list, and click **Next**.

The **Resource Dependencies** list should be empty. If not, highlight all the resources in the list, click the left arrow to move them out of the **Resource Dependencies** list, and click **Next**.

5. In **Service Name**, enter **Navisphere_Agent**, and click **Next**.
6. Click **Finish**.

A message appears stating that the service has been successfully created.

7. Return to the main **Cluster Administrator** dialog box, and follow the path **Clustername, Group, Cluster Group**.
8. Right-click the Navisphere Agent resource, and then click **Properties**.
9. Click the **Advanced** tab, select the **Don't restart** check box and click **OK**.
10. Bring the Agent resource on line.

To do so, right-click the **Navisphere Agent** resource and click **Bring Online**.

The Agent service should start on the server that currently owns the cluster group.

What Next?

ATF/PowerPath provides the applications with access to the LUNs via the alternate path if the primary path fails.

The original high availability provided by ATF or PowerPath is not restored until the failed path is fixed. Also, if the server is booted while only one path is working, you must reboot to restore high availability.

Bootting with MSCS

Refer to the *EMC Support Matrix* for supported boot-from-SAN MSCS configurations. MSCS for Windows 2000 and Windows Server 2003 can support booting from an external storage device. There are two possible path configurations depending on which HBA driver is used:

- ◆ **Dedicated boot HBA bus:** The SCSI drivers will support only this method of connectivity. This means that the boot HBA of each node must only be connected to the boot device, and not to any shared cluster devices. It can connect to other local devices for use by the local node only. This means that you will have a minimum of 2 HBAs (one for boot device, one for shared devices) and require additional HBAs to provide greater multi-HBA disaster tolerance.

In order to configure the Dedicated boot HBA bus configuration, install Windows as described in the appropriate vendor EMC HBA Installation Guide, then install MSCS using the default Microsoft procedure.

- ◆ **Shared boot HBA bus:** The STORPort drivers will support both the Dedicated boot HBA configuration, as well as a new configuration where both the boot device and shared cluster devices use the same HBA. This HBA can also connect to other local devices for the use of the local node. This configuration has additional complexity to ensure that the node does not accidentally expose its boot device as a cluster resource, and the instructions should be followed carefully. This means that you will have a minimum of 1 HBA (one for boot device and for shared devices) and require additional HBAs to provide greater multi-HBA disaster tolerance.

In order to configure the Shared boot HBA bus configuration, install Windows as described in the appropriate vendor EMC HBA Installation Guide, then follow the additional steps below:

- ◆ **Cluster Installation**

1. In **Disk Management** on both nodes, make sure you can see three formatted drives from the array.
2. Install cluster on the first node .

Start, Run> cluadmin

This starts the Cluster Wizard.

3. Name the cluster and select the node you are working on as the first cluster node.
4. During the Analyze Cluster phase, you will see a warning stating that a shareable quorum disk cannot be found. This is normal.
5. Continue installing the cluster by assigning an IP, administrator ID, and password.
6. On the **Proposed Cluster Configuration** dialog, you will notice that the quorum is set to local quorum.
7. Finish the cluster install.

- ◆ **Modify the Registry**

Using regedt32 add or change the following DWORD value:

**HKLM\SYSTEM\CurrentControlSet\Services\ClusSvc
\Parameters\ManageDisksOnSystemBuses**

Make sure you set the hex value to "1".

◆ Change Cluster Setup

1. In **Cluster Admin**, add a physical disk resource to the Cluster Group. You will now be able to use the shared disk available to the node.
2. Bring the disk resource you created above online.
3. Move the quorum disk from local to the new disk resource you created above.
4. Delete the local quorum disk.
5. You can now create other disk resources using the remaining shared drives.
6. Now add the second node to the cluster.
7. On the **Select Computers** dialog, make sure you click on the **Advanced** button. Select **Advanced (minimum) configuration**. This needs to be done, because the second node will not be able to see the shared quorum disk until the registry is modified.



CAUTION

NOTE: DO NOT FAILOVER ANY RESOURCES UNTIL THE REGISTRY ON NODE TWO IS MODIFIED.

8. Using regedt32, **on the second node**, add the following DWORD value:

**HKLM\SYSTEM\CurrentControlSet\Services\ClusSvc
\Parameters\ManageDisksOnSystemBuses**

Make sure you set the hex value to "1".

9. You should now be able to move a resource group from node 1 to node 2.

Configuring Veritas Volume Manager for CLARiiON
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Configuring VERITAS Volume Manager for CLARiiON

When using the VERITAS Volume Manager (VxVM) with Windows servers and CLARiiON, keep in mind the following:

- ◆ The VERITAS Volume Manager replaces the native disk manager that is accessed from the system management console. Refer to VERITAS documentation for installation and operating instructions for your version.
- ◆ If the VERITAS DMP (Dynamic Multi-Pathing) feature is to be used with a CLARiiON array, the minimum supported version of Flare that supports DMP must be installed on the array. Refer to the *EMC Support Matrix* for minimum Flare versions. Also, the Dynamic Multi-Pathing driver update for the EMC CLARiiON CX series arrays must be installed on the host server. This driver is available for download from <http://www.veritas.com>.
- ◆ HBA and array settings for DMP are the same as those that are configured for use with EMC Powerpath. Refer to EMC documentation for your HBA on which settings are used for Powerpath configurations.

Refer to the *EMC Support Matrix* for supported VxVM versions, service packs, and hotfixes.

PART 3

Celerra Connectivity

This part includes:

- Chapter 6, *Windows Hosts with Celerra*

Windows Hosts with Celerra

This section is limited to the iSCSI host connectivity to Celerra iSCSI storage. All of the referenced documents are available in the EMC Powerlink™ website.

- ◆ Microsoft Windows Host with the iSCSI Celerra6-2
- ◆ Configuration using the Microsoft Windows iSCSI Software
Initiator and iSCSI Celerra6-4

Microsoft Windows Host with the iSCSI Celerra

This section contains the detail of the host configuration using the Microsoft Windows and the Celerra iSCSI storage.

System Configuration

The basic components of storage system configuration for the iSCSI Celerra arrays are:

- ◆ One Celerra Data Mover system with multiple Gigabit Ethernet connections.
- ◆ One CLARiiON or Symmetrix FC Storage connected to the Celerra Data Movers directly, or through the FC switches.
- ◆ One server running Microsoft Windows OS (hosts) connected to the Celerra iSCSI Data Movers directly or through the Ethernet switches.
- ◆ The Microsoft Windows server must contain either TCP/IP network interfaces, such as the NIC, or iSCSI Host Adapters.
- ◆ One Celerra Manager Station.

The procedures described in this document assume that all hardware equipment (for example, switches, Data Movers, Storage Systems) used in the documented configuration are already installed and connected.

Refer to the *EMC Support Matrix* under the *iSCSI to FC Routing* section for the interoperability information of the Microsoft Window server to the iSCSI Celerra storage.

iSCSI Target Configuration Guidelines

Refer to the Celerra Network Server Technical Module: *Configuring iSCSI Targets on Celerra* (P/N 300-001-605) for the complete guidelines about configuring the iSCSI targets.

iSCSI LUN Mask Requirements

ATTENTION: Always grant access to the LUN 0 of the iSCSI target. Without LUN 0, the Microsoft Windows host may only be able to configure any LUN under LUN 8. Refer to Microsoft Knowledge Base Article – 310072 for more information.

Multi-path Support

Refer to the *EMC Support Matrix* under *iSCSI to FC Routing* section for the multi-path support of the Microsoft Windows server to the Celerra iSCSI storage.

Target Discovery Support

Refer to the *EMC Support Matrix* under section *iSCSI to FC Routing* for the target discovery support of the Microsoft Windows server to the Celerra iSCSI storage

Configuration using the Microsoft Windows iSCSI Software Initiator and iSCSI Celerra

Microsoft iSCSI Software Initiator Configuration

Refer to the *Configuring the Windows iSCSI Initiator Kernel Driver* on page 4-7 of this document.

Configuration QLogic iSCSI Host Adapter and Celerra

Downloading the QLogic iSCSI Host Adapter software

The latest qualified QLogic iSCSI Host Adapter software can be downloaded from the QLogic website under the **Home> Support> Downloads> EMC Approved Software** link. The Qlogic iSCSI Host Adapter software consist of the Microsoft Windows 2000/2003 Adapter Driver, Management Software (SANSurfer Control), iSCSI Firmware and the X86 based BIOS.

QLogic iSCSI Host Adapter configuration

Refer to the *QLA 4010/4010C User's Guide (P/N IS0053302)* that can be downloaded from the QLogic website under the **Home> Support> Downloads> EMC Approved Software** link.

PART 4

Appendixes

This part includes:

- Appendix A, *Inquiry Utility*
- Appendix B, *Known Issues*
- *Index*

Inquiry Utility

This appendix describes the Inquiry utility (`inq`), which can be used with Symmetrix or CLARiiON systems to display system information.

- ◆ Using the Inquiry Utility.....A-2
- ◆ Obtaining the Inquiry UtilityA-3

Using the Inquiry Utility

The Inquiry command (`inq`) displays several fields that can help you determine which storage volume is associated with a particular device as seen by the host.

Example The following figure shows a sample output of `inq` when run from the host console connected to a Symmetrix system.

```
Inquiry utility, Version 4.91
Copyright (C) by EMC Corporation, all rights reserved.
-----
DEVICE:VEND:PROD:REV:SER NUM:CAP (kb)
-----
/dev/hdisk0:IBMRISC:DFHSS2F:96C3:54843215:2202244
/dev/hdisk1:EMC:SYMMETRIX:5062:38000040:2080800
/dev/hdisk2:EMC:SYMMETRIX:5062:38001040:2080800
/dev/hdisk3:EMC:SYMMETRIX:5062:38002040:2080800
/dev/hdisk4:EMC:SYMMETIRX:5062:38003040:2080800
```

The output fields are as follows:

- ◆ DEVICE = full pathname for the SCSI device
- ◆ VEND = Vendor information
- ◆ PROD = Product name
- ◆ REV = Revision number — for a Symmetrix, this will be the microcode version
- ◆ SER NUM = Serial number, in the format SSVVDDP, where:
 - SS = last two digits of the Symmetrix serial number
 - VVV = Logical volume number
 - DD = Channel director number
 - P = port on the channel director
- ◆ CAP = Size of the device in kilobytes

Be sure to use the latest version of Inquiry, as changes were made for Windows 2003 support. (Refer to *Obtaining the Inquiry Utility* on page A-3.)

Obtaining the Inquiry Utility

The latest device definition files, as well as the Inquiry utility (`inq`) are available on the EMC FTP server. You can access the server through `EMC.com` or through an FTP software package.

Using EMC.com

You can connect to the EMC home page at `www.emc.com`. You also can go directly to the EMC anonymous FTP server by entering the URL `ftp://ftp.emc.com`:

1. Launch your web browser and enter this address:
`ftp://ftp.emc.com/pub/symm3000/inquiry/latest`
2. Copy `inq.wnt_exe` (`inq` for Windows NT) to your host.
3. Rename `inq.wnt_exe` to `inq.exe`, and copy the file to the `System32` directory.

Using FTP Software

To connect to the EMC anonymous FTP server:

1. At the host, log in with an authorized account, and create a temporary destination directory for the file you are about to download (for example, **`mkdir /ftp_emc`**).
2. Change to the temporary directory (for example, **`cd /ftp_emc`**).
3. Connect to the EMC FTP server:

`ftp ftp.emc.com`

4. At the FTP server login prompt, log in as **`anonymous`**.
5. At the password prompt, enter your e-mail address.

You are now connected to the FTP server. To display a listing of FTP commands available to you, type **`help`** and press ENTER at the prompt.

6. Navigate to `pub/symm3000/inquiry/latest` and transfer `inq.wnt_exe` (`inq` for Windows NT) to your host.
7. Rename `inq.wnt_exe` to `inq.exe` and copy the file to the `Windows \System32` directory for use.

Known Issues

This appendix describes known issues.

◆ Issues B-2

Issues

- ◆ **Basic-to-Dynamic Disk conversion is slower in Windows 2003 with a large number of disks** — The user-interface is slower in Windows 2003 because it converts the disks to dynamic one-by-one, as opposed to the Windows 2000 user interface, which runs the conversions in parallel. The change was required by the introduction of the VDS service in Windows 2003. The behavior is also present when using the `Diskpart` utility. For additional information on this issue, please refer to Microsoft Knowledge Base article 828220.
- ◆ **Windows 2000 Hosts running less than SP4 could be susceptible to data loss during LUN expansion operations** — This issue is corrected by Microsoft in SP4, or by applying hotfix 327020. Refer to EMC Solution IS emc73538 and Microsoft Knowledge Base article 327020 for more information.
- ◆ **To upgrade from Windows NT or Windows 2000 to Windows 2003, you must first uninstall PowerPath** — After upgrading the host, you can reinstall an approved Windows 2003 version. Refer to the EMC PowerPath documentation for further details.
- ◆ **Windows Server 2003 logs Event ID 51 although no data has been lost from the hard disk** — This message may appear during a StorageGroup change, and can be ignored. See Microsoft Knowledge Base article 834910 for details.

A

- Adaptec AHA-2944UW HBA, configuring for Symmetrix over SCSI 3-4
- Adaptec AHA-2944W HBA, configuring for Symmetrix over SCSI 3-4
- addressing, Windows/Symmetrix
 - arbitrated loop 2-15
 - fabric 2-17
 - SCSI-3 2-18

B

- bit settings, Symmetrix channel director 4-4
- boot support
 - CLARiiON 5-4
 - Symmetrix 2-2
- booting from Symmetrix 1-3

C

- Celerra iSCSI storage 6-2
- CHAP authentication, configuring 4-4
- CLARiiON
 - LUNZ 5-6
 - support information 5-2, 5-5
 - VERITAS DMP 5-55
 - VERITAS Volume Manager 5-55
- CLARiiON setup 5-2
- clusters
 - described 5-49
 - using Navisphere applications with 5-49
- comments xvi

- Compaq FC 223180-B21 HBA, installing and configuring for Symmetrix over Fibre Channel 2-5
- configuration, Windows/Symmetrix, specifying 1-12
- customer support xv

D

- devices, Symmetrix, adding on line
 - Windows 2000 1-11
 - Windows NT 1-20
- devices, Symmetrix, partitioning 1-14
- direct access device 2-18
- Disk Administrator 1-4
- disks, Symmetrix
 - initializing 1-5
 - partitioning 1-14

E

- Emulex HBA
 - installing/configuring
 - for CLARiiON 5-7
 - for Symmetrix over Fibre Channel 2-11
 - replacing in an Access Logix configuration 5-8
- error messages, Windows 2000/Windows 2003 1-10
- errors, drive, recovering from on Windows 2000 host 1-22
- Event Viewer, troubleshooting with 5-10, 5-17

F

FC-AL address ID 5-39
 Fibre Channel 5-2
 File and Printer Sharing 4-12
 file system type
 Windows 2000 5-39
 Windows NT 5-28
 files, obtaining from the EMC FTP server A-3
 FTP server, connecting to A-3
 functions, Windows 1-4

G

gateway, iSCSI to FC 5-6

H

HBA. *See* manufacturer name
 help xv
 host configuration, Celerra iSCSI storage 6-2
 HP A5246A HBA, installing/configuring for
 Symmetrix over Fibre Channel 2-6
 HP D8602A HBA, installing/configuring for
 Symmetrix over Fibre Channel 2-7

I

I/O timeout value, adjusting 1-21
 initializing Symmetrix disks 1-5
 initiator, iSCSI 4-5
 inq A-2, B-2
 Inquiry utility A-2, B-2
 iSCSI
 environment 5-5
 initiator 4-5
 Kernel Driver 5-5
 network portal 4-12
 iSCSI connections, Windows/Symmetrix
 hardware 4-2
 LUN addressing 4-2
 persistent binding 4-3
 software 4-2
 Symmetrix configuration 4-3
 iSCSI environment, Windows/Symmetrix 4-2
 iSCSI initiator kernel driver, configuring 4-7
 iSCSI storage, Celerra 6-2
 iSCSI targets, Celerra 6-2
 iSCSI to FC gateway 5-6

iSCSI, connecting Symmetrix over 4-1
 issues B-2

K

Kernel Driver
 iSCSI 5-5

L

LINZ, CLARiiON 5-6
 LIP 2-15
 logical unit addressing 2-18
 loop initialization process 2-15
 LUN expansion, CLARiiON 5-45
 LUNs, CLARiiON
 making available
 to Windows 2000/Windows 2003 5-37
 to Windows NT 5-26
 recognizing 5-25
 LUNs, recognizing
 in Symmetrix/iSCSI environment 4-5
 LUNs, recognizing, Symmetrix, 2-13

M

management station 5-2

N

Navisphere Agent 5-6

P

peripheral device addressing 2-18
 persistent binding 2-3
 Windows/Symmetrix iSCSI 4-3
 persistent targets 4-21

Q

QLogic HBA, installing/configuring
 for CLARiiON 5-14
 for Symmetrix over SCSI 3-5
 for Symmetrix/Fibre Channel 2-12
 QLogic HBA, replacing in an Access Logix
 configuration 5-15

S

- SCSI-3 FCP 2-15
- server optimization 4-12
- service xv
- status messages, Windows 2000/Windows 2003 1-10
- storage system components
 - CLARiiON 5-2
 - iSCSI Celerra arrays 6-2
- support information
 - CLARiiON 5-2, 5-5
 - Fibre Channel 5-2
 - iSCSI 5-5
- switch zone, creating
 - in CLARiiON/Emulex environment 5-8
 - in CLARiiON/QLogic environment 5-15
- Symmetrix
 - VERITAS DMP 1-26
 - VERITAS Volume Manager 1-26
- Symmetrix configuration 1-2
- Symmetrix over Fibre Channel
 - HP A5246 HBA 2-6
 - HP D8602A HBA 2-7

T

- technical support xv
- terminology, Windows 1-4
- timeout value, adjusting 1-21

U

- UNIX, running in Windows hosts 3-2
- utilities, Windows 1-4

V

- VERITAS DMP (Dynamic Multi-Pathing)
 - with CLARiiON 5-55
 - with Symmetrix 1-26
- VERITAS Volume Manager (VxVM)
 - with CLARiiON 5-55
 - with Symmetrix 1-26
- volume set addressing 2-18
- volumes, Symmetrix, creating for Windows 2000 or Windows 2003 1-8

W

- Windows clusters. *See* clusters
- Windows I/O timeout value, adjusting 1-21
- Windows/Fibre Channel environment 5-2
- Windows/iSCSI environment 5-5

Z

- zone, creating
 - in CLARiiON/Emulex environment 5-8
 - in CLARiiON/QLogic environment 5-15
- zone, planning in Windows/Symmetrix environment 2-3

