IBM TotalStorage SAN Volume Controller

Host Attachment User's Guide

Version 2.1.0

SC26-7563-04

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Fifth Edition (February 2005)

Before using this information and the product it supports, read the information in “Notices.”

Contents

Figures

Tables

About this guide

This guide provides information that is required when attaching the SAN Volume Controller to an open-systems host with fibre-channel adapters.

You can attach the following host systems to a SAN Volume Controller:

- Hewlett-Packard
- IBM RS/6000 and pSeries
- Intel with Linux
- Microsoft Windows 2000 or 2003
- Microsoft Windows NT
- Sun
- VMware
- NetWare

Each chapter describes how to attach a SAN Volume Controller to a specific open-systems host with fibre-channel adapters.

Related concepts

"Support for open-systems hosts" on page 1
You can attach the SAN Volume Controller to fibre-channel (SCSI-FCP) open-systems hosts.

Who should use this guide

The *IBM TotalStorage SAN Volume Controller: Host Attachment Guide* is intended for system administrators or others who install and use the SAN Volume Controller.

Before using the IBM TotalStorage SAN Volume Controller, you should have an understanding of storage area networks (SANs), the storage requirements of your enterprise, and the capabilities of your storage units.

Summary of changes

This document contains terminology, maintenance, and editorial changes.

Technical changes or additions to the text and illustrations for the latest release are indicated by a vertical line to the left of the change.

The summary of changes topics describes new functions that have been added to this release and to the previous release.

Summary of changes for SC26-7563-04 SAN Volume Controller Host Attachment Guide

This summary of changes provides a list of new, modified, and changed information since the SC26-7563-03 version of the *IBM TotalStorage SAN Volume Controller: Host Attachment Guide*.

The following new or changed information appears throughout the publication:

- The following new sections and chapters were added:
  - New chapters for VMware hosts and Novell NetWare hosts were added.

  - New sections for Operating systems, host bus adapters (HBAs), drivers, and firmware support were added to most host chapters.
  - New sections for configuring the host operating system were added. These sections include information about multipath support, clustering support, and SAN boot support.
- For Hewlett-Packard hosts, the following new information that is specific to Hewlett-Packard systems was incorporated:
  - Information for configuring physical volume timeout was added.
  - The instructions for installing the HBA driver were modified.
  - You must enable the Cisco persistent FC (fibre channel) ID feature if you use a Cisco MDS 9000 Family switch with an HP-UX host.
  - You can configure the SAN Volume Controller to see new disk mappings without rebooting.
  - Additional known issues and resolutions were added.
- For IBM pSeries and RS/6000 hosts, the following new information that is specific to pSeries and RS/6000 hosts was incorporated:
  - You must enable the Cisco persistent FC (fibre channel) ID feature for AIX hosts if the hosts use a Cisco MDS 9000 Family switch
- For Intel hosts that run Linux, the following new information that is specific to Linux hosts was incorporated:
  - Vendor-specific instructions for installing the HBAs were removed and the instructions now refer you to the vendor's instructions.
  - The instructions for installing the QLogic HBA driver have changed.
- For Sun hosts, the following new information that is specific to Sun hosts was incorporated:
  - Vendor-specific instructions for installing the HBAs were removed and the instructions now refer you to the vendor's instructions.
  - The instructions for installing and configuring the HBA drivers have changed.
  - The instructions for setting the host system parameters apply to all HBAs.
- For Windows 2000 and 2003 hosts, the following new information that is specific to these hosts was incorporated:
  - Vendor-specific instructions for installing the HBAs were removed and the instructions now refer you to the vendor's instructions.
  - The instructions for installing and configuring the HBA drivers have changed.
  - The instructions for locating the worldwide port number (WWPN) has been changed.
- For Windows NT hosts, the following new information that is specific to Windows NT hosts was incorporated:
  - Vendor-specific instructions for installing the HBAs were removed and the instructions now refer you to the vendor's instructions.
  - The instructions for installing and configuring the HBA drivers have changed.
  - The instructions for locating the worldwide port number (WWPN) has been changed.
- Other changes that were incorporated include the following:
  - The SAN Volume Controller supports up to 256 separate hosts.
  - The SAN Volume Controller supports various types of multipathing software. The software supported depends on the host.
  - The IBM TotalStorage Subsystem Device Driver is now called the IBM TotalStorage Multipath Subsystem Device Driver (SDD).

– The Netfinity FAStT is now called Netfinity DS4000.

Summary of changes for SC26-7563-03 SAN Volume Controller Host Attachment Guide

This summary of changes provides a list of new, modified, and changed information since the SC26-7563-02 version of the *IBM TotalStorage SAN Volume Controller: Host Attachment Guide*.

New information

This edition includes the following new information.

- A note for AIX configuration has been added.
- A note for using a Cisco MDS 9000 Family switch with an AIX or HP-UX host has been added.
- Sun update information from has been added.

Changed information

This section lists the updates that were made in this document:

- The Windows NT information was restored after being removed from the previous edition.

Deleted information

No information was deleted from this guide.

Emphasis

Different typefaces are used in this guide to show emphasis.

The following typefaces are used to show emphasis:

Boldface	Text in **boldface** represents menu items and command names.
Italics	Text in *italics* is used to emphasize a word. In command syntax, it is used for variables for which you supply actual values, such as a default directory or the name of a cluster.
`Monospace`	Text in `monospace` identifies the data or commands that you type, samples of command output, examples of program code or messages from the system, or names of command flags, parameters, arguments, and name-value pairs.

SAN Volume Controller library and related publications

A list of other publications that are related to this product are provided to you for your reference.

The tables in this section list and describe the following publications:

- The publications that make up the library for the IBM TotalStorage SAN Volume Controller

- Other IBM publications that relate to the SAN Volume Controller

SAN Volume Controller library

The following table lists and describes the publications that make up the SAN Volume Controller library. Unless otherwise noted, these publications are available in Adobe portable document format (PDF) on a compact disc (CD) that comes with the SAN Volume Controller. If you need additional copies of this CD, the order number is SK2T-8811. These publications are also available as PDF files from the following Web site:

http://www-1.ibm.com/servers/storage/support/virtual/2145.html

Title	Description	Order number
IBM TotalStorage SAN Volume Controller: CIM Agent Developer's Reference	This reference guide describes the objects and classes in a Common Information Model (CIM) environment.	SC26-7590
IBM TotalStorage SAN Volume Controller: Command-Line Interface User's Guide	This guide describes the commands that you can use from the SAN Volume Controller command-line interface (CLI).	SC26-7544
IBM TotalStorage SAN Volume Controller: Configuration Guide	This guide provides guidelines for configuring your SAN Volume Controller.	SC26-7543
IBM TotalStorage SAN Volume Controller: Host Attachment Guide	This guide provides guidelines for attaching the SAN Volume Controller to your host system.	SC26-7575
IBM TotalStorage SAN Volume Controller: Installation Guide	This guide includes the instructions the service representative uses to install the SAN Volume Controller.	SC26-7541
IBM TotalStorage SAN Volume Controller: Planning Guide	This guide introduces the SAN Volume Controller and lists the features you can order. It also provides guidelines for planning the installation and configuration of the SAN Volume Controller.	GA22-1052
IBM TotalStorage SAN Volume Controller: Service Guide	This guide includes the instructions the service representative uses to service the SAN Volume Controller.	SC26-7542
IBM TotalStorage SAN Volume Controller: Translated Safety Notices	This guide contains the danger and caution notices for the SAN Volume Controller. The notices are shown in English and in numerous other languages.	SC26-7577

Title	Description	Order number
IBM TotalStorage Master Console Installation and User's Guide	This guide includes the instructions on how to install and use the SAN Volume Controller Console	

Other IBM publications

The following table lists and describes other IBM publications that contain additional information related to the SAN Volume Controller.

Title	Description	Order number
IBM TotalStorage Enterprise Storage Server, IBM TotalStorage SAN Volume Controller, IBM TotalStorage SAN Volume Controller for Cisco MDS 9000, IBM TotalStorage Multipath Subsystem Device Driver: User's Guide	This guide describes the IBM TotalStorage Multipath Subsystem Device Driver Version 1.5 for TotalStorage Products and how to use it with the SAN Volume Controller. This publication is referred to as the *IBM TotalStorage Multipath Subsystem Device Driver: User's Guide*.	SC26-7608

Related Web sites

The following Web sites provide information about the SAN Volume Controller or related products or technologies.

Type of information	Web site
SAN Volume Controller support	http://www-1.ibm.com/servers/storage/support/virtual/2145.html
Technical support for IBM storage products	http://www.ibm.com/storage/support/

How to order IBM publications

The publications center is a worldwide central repository for IBM product publications and marketing material.

The IBM publications center

The IBM publications center offers customized search functions to help you find the publications that you need. Some publications are available for you to view or download free of charge. You can also order publications. The publications center displays prices in your local currency. You can access the IBM publications center through the following Web site:

www.ibm.com/shop/publications/order/

Publications notification system

The IBM publications center Web site offers you a notification system for IBM publications. Register and you can create your own profile of publications that interest you. The publications notification system sends you a daily e-mail that contains information about new or revised publications that are based on your profile.

If you want to subscribe, you can access the publications notification system from the IBM publications center at the following Web site:

www.ibm.com/shop/publications/order/

How to send your comments

Your feedback is important to help us provide the highest quality information. If you have any comments about this book or any other documentation, you can submit them in one of the following ways:

- e-mail

  Submit your comments electronically to the following e-mail address:

  starpubs@us.ibm.com

  Be sure to include the name and order number of the book and, if applicable, the specific location of the text you are commenting on, such as a page number or table number.
- Mail

  Fill out the Readers' Comments form (RCF) at the back of this book. If the RCF has been removed, you can address your comments to:

  International Business Machines Corporation
  RCF Processing Department
  Department 61C
  9032 South Rita Road
  Tucson, Arizona 85775-4401
  U.S.A.

Chapter 1. Host attachment overview for the SAN Volume Controller

The SAN Volume Controller supports IBM and non-IBM storage systems hosts so that you can consolidate storage capacity and workloads for open-systems hosts into a single storage pool, which can be managed from a central point.

By allowing you to attach hosts from different vendors, the SAN Volume Controller offers you the following advantages:

- Makes your storage easier to manage.
- Helps increase utilization of your data.
- Allows you to apply advanced copy services across storage systems from many different vendors.

Support for open-systems hosts

You can attach the SAN Volume Controller to fibre-channel (SCSI-FCP) open-systems hosts.

Hosts are attached to the SAN Volume Controller using a switched fibre-channel fabric. The SAN Volume Controller supports up to 256 separate hosts and up to 128 host fibre-channel ports, identified by their worldwide port numbers (WWPNs). Each SAN Volume Controller fibre-channel adapter has two ports.

You can configure the ports to operate with the SCSI-FCP upper-layer protocol. Fibre-channel adapters that are configured for SCSI-FCP (fibre-channel protocol) provide the following support:

- A maximum of 128 host logins per fibre-channel port
- A maximum of 512 SCSI-FCP host logins or SCSI-3 initiators per SAN Volume Controller
- A maximum of 4096 logical unit numbers (LUNs) per target (one target per host adapter), depending on host type
- Switched fabric topology

The SAN Volume Controller supports the following host systems for shortwave fibre-channel attachment and longwave fibre-channel attachment:

- Hewlett-Packard servers that run HP/UX operating systems
- IBM® RS/6000®, pSeries™, RS/6000 SP™, and pSeries SP servers that run IBM AIX® operating systems
- Intel-based servers that run Linux, Microsoft® Windows® 2000, Windows 2003, and Windows NT operating systems
- Sun servers that run Solaris operating systems
- VMware servers that run on various guest operating systems
- Novell NetWare servers that run NetWare operating systems

For the most current information about host systems, operating system levels, host bus adapters, cables, and fabric that IBM supports, see the following IBM Web sites:

http://www.ibm.com/servers/storage/software/virtualization/svc

http://www-1.ibm.com/servers/storage/support/virtual/2145.html

Targets and LUNs

This is a description of the logical unit number (LUN) support.

Each fibre-channel host bus adapter (HBA) can architecturally attach up to two LUNs. The SAN Volume Controller supports a maximum of 1024 LUNs with a maximum of 512 configured to any one host.

Note: Not all hosts support 512 LUNs.

Each virtual disk created on the SAN Volume Controller can be mapped to multiple HBA fibre-channel ports in a given host. There can also be multiple paths across the storage area network. For these reasons, each host must run multipathing software, such as the IBM TotalStorage Multipath Subsystem Device Driver (SDD). The multipathing software handles the many paths that are available to the virtual disk and presents a single storage device to the operating system. The SAN Volume Controller supports various types multipathing software. The software supported depends on the host operating system.

FlashCopy and Metro Mirror support

You can use IBM TotalStorage FlashCopy® and IBM TotalStorage Metro Mirror for SAN Volume Controller across the host storage systems to help further simplify operations.

When you use FlashCopy and Metro Mirror, keep in mind the following requirements and restrictions:

- When you copy a source volume to a target volume with FlashCopy or Metro Mirror, the source and target volumes should be on different host systems. That is, if you require concurrent read/write access of both volumes. A copy operation with the target volume and the source on the same host system creates a target volume with the same identification as the source volume. The host system sees two identical volumes.
- When the copy operation creates the same identification for the target volume as for the source volume, you cannot distinguish one from the other. Therefore, you might not be able to access the original data.
- The target volume and the source volume can be on the same host system for a Metro Mirror or FlashCopy operation only under the following conditions:
  - For AIX, when the host is using a logical volume manager (LVM) with **recreatevg** command.
  - For HP, when the host is using LVM with the **vfchigid -f** command.
  - For AIX and Sun, when the host is *not* using an LVM.
  - For host systems that run the VERITAS Volume Manager, the SAN Volume Controller sets a bit in the inquiry data that enables the VERITAS Volume Manager to distinguish between the source and target VDisks for those mapping states where the source and target VDisks could be identical copies.
  - For any host system, when the host system can distinguish between a source and a target volume that has the same identification.

Chapter 2. Attaching to a Hewlett-Packard 9000 host

This information explains the requirements and other information for attaching the SAN Volume Controller to a Hewlett-Packard host.

Attachment requirements for Hewlett-Packard hosts

This section provides an overview of the requirements for attaching the SAN Volume Controller to a Hewlett-Packard host.

The requirements for attaching the SAN Volume Controller to your Hewlett-Packard host system are:

- Check the LUN limitations for your host system. Ensure that there are enough fibre-channel adapters installed in the server to handle the total LUNs that you want to attach.
- Ensure that you have the documentation for your Hewlett-Packard system and the *IBM TotalStorage SAN Volume Controller: Installation Guide*. The *IBM TotalStorage SAN Volume Controller: Installation Guide* is on the IBM TotalStorage® CD that you receive with the SAN Volume Controller.
- Ensure that you have installed the correct operating systems and version levels on your host. See the supported software levels for the SAN Volume Controller at the following Web site for details about the release level for your operating system:

  http://www.ibm.com/servers/storage/software/virtualization/svc

Supported Hewlett-Packard operating systems

Ensure that each Hewlett-Packard host uses a supported operating system and level.

The SAN Volume Controller supports the HP-UX 11i host operating system for Hewlett-Packard hosts.

Note: See the supported software levels at the following IBM Web site for current information about supported Hewlett-Packard operating system levels:

http://www.ibm.com/servers/storage/software/virtualization/svc

Supported host bus adapters for Hewlett-Packard hosts

Ensure that your Hewlett-Packard hosts use the correct host bus adapters.

To see the specific host bus adapter and platform levels, see the supported hardware list at the following IBM Web site:

http://www.ibm.com/servers/storage/software/virtualization/svc

Supported drivers and firmware for Hewlett-Packard hosts

Be sure that you use the correct host bus adapter device driver and firmware levels for your Hewlett-Packard (HP-UX 11i) hosts.

See the supported hardware list at the following IBM Web site for the most current information about supported device driver and firmware levels:

http://www.ibm.com/servers/storage/software/virtualization/svc

Installing adapter drivers for HP-UX 11i operating systems

To attach a Hewlett-Packard (HP-UX 11i) host, you must download and configure the appropriate host bus adapter (HBA) driver.

1. Obtain the appropriate HBA driver using the following steps:
   a. Go to the supported hardware list on the following Web site and find the sections for the HP-UX 11i operating system and then the HBA that is installed on your host machine.

      http://www.ibm.com/servers/storage/software/virtualization/svc

      The specific versions of the driver is indicated on the hardware list.
   b. Note the version number for the driver.
   c. Obtain the driver from Hewlett-Packard.
2. Install the driver according to the documentation provided with the driver.

After installing the fibre-channel adapters and drivers, you can verify their status using the `fcmsutil /dev/td`*x* command, where *x* is the number of the adapter, normally beginning with 0.

After storage has been configured and mapped to the host, you can discover the disks by running `ioscan -f -n`. The disks are discovered as IBM 2145 disks, and the number of devices discovered depends on the number of adapters and zoned paths to the SAN Volume Controller.

After discovering the disks, run `insf -e` to build the device nodes in the `/dev/dsk` and `/dev/rdsk` directories. When this is done, you can build your host disk devices using the IBM TotalStorage Multipath Subsystem Device Driver (SDD). For more information, see *IBM TotalStorage Multipath Subsystem Device Driver: User's Guide*.

Note: If you use a Cisco MDS 9000 Family switch with an HP-UX 11i host, you must ensure that you enable the Cisco persistent FC (fibre channel) ID feature for the HP-UX 11i host. See your Cisco manual for more information.

Configuring the HP-UX 11i host operating system

You must configure the HP-UX 11i operating system before you can use the Hewlett-Packard hosts with the SAN Volume Controller.

Before you configure the host operating systems, the following tasks must be completed:

- IBM Systems Services Representative (SSR) must have installed the SAN Volume Controller.
- You must have installed the appropriate host bus adapter (HBA) and driver on your host system.

After the prerequisite tasks are complete, use the following general steps to configure your HP-UX 11i host system.

1. Zone the host system to the SAN Volume Controller on the fibre-channel SAN.
2. Install the appropriate multipathing driver for your host system to enable the management of multiple paths to SAN Volume Controller virtual disks (VDisks).

Notes:

- The IBM TotalStorage Multipath Subsystem Device Driver (SDD) does not support HP-UX 11i in a clustering environment. Also note that SDD is not supported in the HP-UX 32-bit mode operating environment.
- To have failover protection on an open system, SDD requires a minimum of two fibre-channel adapters. The maximum number of fibre-channel adapters supported is four, for a total of four fibre-channel ports

3. Create the host system on the SAN Volume Controller, using the worldwide port names (WWPNs). Map the VDisks to the host as required.
4. Create volumes/disks on your host using instructions in your host system publications.

Related tasks

"Locating the WWPN for a Hewlett-Packard host" on page 65
You can locate the WWPN for a Hewlett-Packard host by following the steps in this topic.

Multipath support for HP-UX 11i

SAN Volume Controller supports multipathing for HP-UX 11i hosts.

Multipathing support is available using either of the following software:

- IBM TotalStorage Multipath Subsystem Device Driver (SDD)
- Hewlett-Packard PV (physical volume) links

SDD dynamic pathing on HP-UX 11i

HP-UX 11i hosts support IBM TotalStorage Multipath Subsystem Device Driver (SDD) dynamic pathing when you add more paths to a virtual disk (VDisk) or when you present a new VDisk to a host.

On HP-UX 11i, SDD is aware of the preferred paths that are set by SAN Volume Controller for each VDisk. When failing over paths, SDD tries the first preferred path, then the next known preferred path, and so on, until it has tried all preferred paths. If SDD cannot find an available path using the preferred paths, it begins trying nonpreferred paths. If all paths are unavailable, the VDisk goes offline.

Under HP-UX 11i, SDD performs load balancing across the preferred paths where appropriate.

PV links dynamic pathing on HP-UX 11i

HP-UX 11i hosts support Hewlett-Packard PV links dynamic pathing when you add more paths to a virtual disk (VDisk) or when you present a new VDisk to a host.

Unlike the IBM TotalStorage Multipath Subsystem Device Driver (SDD), PV links does *not* balance I/O loads and is unaware of the preferred paths that are set by SAN Volume Controller for each VDisk. Therefore SDD is strongly recommended, unless you are using a clustering environment or if you are using a VDisk as your boot disk.

When failing over paths, PV links uses a simple algorithm: it tries the first path, then the next known path, and so on, until it has tried all paths. If all paths are unavailable, the VDisk goes offline.

If you use PV links, keep the following configuration considerations in mind:

- When you create a volume group, be sure to perform the following actions:

  - Specify the primary path that you want the HP-UX 11i host to use when it accesses the physical volume that is presented by SAN Volume Controller. This is the only path that will access the physical volume. (The preferred path to the VDisk set by the SAN Volume Controller is ignored.)
  - Ensure that the primary links to the physical volumes (and, thus, the load) are balanced over the host bus adapters, the fibre-channel switches, SAN Volume Controller nodes, and any other devices.
- When extending a volume group to add alternate paths to the physical volume, add the new paths in the preferred order that you want the HP-UX host to use if the primary path become unavailable. To avoid unnecessary node failover due to host bus adapter, fibre-channel link, or fibre-channel switch failure, the first alternate path that you add should be from the same SAN Volume Controller node as the primary path.

Multipathing configuration maximums on HP-UX 11i

When you configure, keep in mind the maximum configuration for the IBM TotalStorage Multipath Subsystem Device Driver (SDD) on HP-UX 11i hosts.

Table 1 provides the maximum virtual disks (VDisks) and paths per VDisk for SDD.

Table 1. Configuration maximums for SDD on Hewlett-Packard (HP-UX 11i) hosts

Object	SDD maximum	Description
VDisk (HDisk)	512	The maximum number of VDisks that can be supported by the SDD (per host object).
Paths per VDisk	4	The maximum number of paths to each VDisk.

Coexistence of SDD and PV links on HP-UX 11i

If you want to use PV links for multipathing a VDisk while the IBM TotalStorage Multipath Subsystem Device Driver (SDD) is installed, you must make sure that SDD does not configure a VPath for that VDisk.

To do this, add the serial number of any VDisks that you want SDD to ignore in the /etc/vpathmanualexcl.cfg file.

Note: If you are using the SAN boot function, SDD will automatically ignore the boot VDisk.

Clustering support for HP-UX 11i operating system

The SAN Volume Controller provides clustering support on the HP-UX 11i operating system.

Table 2 provides information about the supported cluster software and other information for clustering on an HP-UX host.

Table 2. Clustering support for HP-UX 11i operating system

Operating system	Cluster software	Number of hosts in cluster
HP-UX	ServiceGuard version 11.16 with physical volume (PV) links	16

Note: SAN Volume Controller supports version A.01.00 of ServiceGuard Extension for Faster Failover (SGeFF).

Restriction: HP-UX does not currently support the use of high availability monitors to monitor disks presented by the SAN Volume Controller.

SAN boot support for HP-UX 11i operating system

SAN boot for HP-UX 11i operating system is supported by the SAN Volume Controller.

SAN boot is supported on HP-UX by using physical volume (PV) links as the multipathing software on the boot device. PV links or the IBM TotalStorage Multipath Subsystem Device Driver (SDD) provides the multipathing support for the other devices attached to the system.

Note: See the software restrictions page on the following IBM support Web site for any known restrictions for SAN boot support:

http://www-1.ibm.com/servers/storage/support/virtual/2145.html

Configuring physical volume timeout

Physical volumes (PV) can be multipathed with the Multipath Subsystem Device Driver (SDD) or PV links.

You must set the PV timeout as follows:

- Physical volumes that are multipathed with SDD must have a PV timeout of 90 seconds.
- Physical volumes that are multipathed with PV links must have a PV timeout of 60 seconds. (The timeout default set by PV links is 4 minutes.)

Known problems and limitations

This information lists the known problems and limitations of attaching the SAN Volume Controller to the Hewlett-Packard 9000 host.

Note: You can also see the software restrictions page on the following IBM support Web site for the most current information about known restrictions:

http://www-1.ibm.com/servers/storage/support/virtual/2145.html

Setting domain IDs

It is recommended that you manually set the domain IDs prior to building the multiswitch fabric and prior to rezoning.

This is recommended for the following reasons:

- When two switches are joined while active, they will determine if the domain ID is already in use as before, but if there is a conflict it cannot be changed in an active switch. A conflict will cause an active switch to fail.
- The domain ID is used to identify switch ports when you implement zoning using the domain and switch port number. If domain IDs are negotiated at every fabric start up, there is no guarantee that switch IDs will persist from one session to the next. If the switch ID changes, any zoning definitions will become invalid.
- If the domain ID is changed after a SAN is set up, some host systems may have difficulty logging back in with the switch, and a host reconfiguration might be required to detect devices on the switch again.

Attaching to 4-node clusters

When you attach an HP-UX host to a 4-node cluster that presents virtual disks from two I/O groups, you must implement a specific configuration to immediately view any new disk mappings without having to reboot the HP-UX.

To avoid having to reboot the host, configure the SAN Volume Controller to present the logical unit number 0 (zero) from both I/O groups.

ServiceGuard issues

Note these known issues when using ServiceGuard.

Starting ServiceGuard packages with degraded VDisks

If you use ServiceGuard and PV links in an HP-UX clustering environment, the package startup time can take from 20 to 60 minutes when you use the command `vgchange - a e vgxx` to start a package containing a degraded VDisk.

To avoid this issue, you can perform the following actions:

- Do not start packages on an HP-UX cluster while upgrading the SAN Volume Controller cluster.
- Configure your HP-UX cluster so that each HP-UX node is running a package containing a VDisk from each I/O group. This allows any automatic failover and failback to complete within a reasonable time.

Note: The lengthy startup time does not occur under the following circumstances:

- If the HP-UX host already has an active volume group containing a degraded VDisk from the same I/O group.
- If the HP-UX host booted while the VDisk was degraded.

Using a VDisk as a cluster lock disk

ServiceGuard does not provide a way to specify alternate links to a cluster lock disk.

When you use a VDisk as your lock disk in an HP-UX clustering environment, the HP-UX node cannot access the lock disk when *both* of the following situations apply:

- The path that is defined for the FIRST_CLUSTER_LOCK_PV variable is unavailable.
- A 50-50 split in the quorum occurs.

To resolve this issue and to ensure redundancy, specify a different path to the lock disk for each HP-UX node in your cluster using the FIRST_CLUSTER_LOCK_PV variable in the cluster configuration ASCII file. For example, if you are configuring a two-node HP-UX cluster, set the path of FIRST_CLUSTER_LOCK_PV on HP-UX server A to the first SAN Volume Controller node (through one fibre-channel switch) and set the FIRST_CLUSTER_LOCK_PV for HP server B to the second node (through another fibre-channel switch).

Chapter 3. Attaching to an IBM pSeries or RS/6000 AIX host

This information explains the requirements and other information for attaching the SAN Volume Controller to an IBM eServer pSeries or an IBM RS/6000 host.

Attachment requirements for RS/6000 and pSeries hosts

This section provides an overview of the requirements for attaching the SAN Volume Controller to an IBM RS/6000 or pSeries host.

The requirements for attaching the SAN Volume Controller to your RS/6000 or pSeries host system are:

- Ensure that you have the installation script files. These files are on the Compact Disc (CD) that you receive with the SAN Volume Controller.
- Ensure that you have installed the correct operating systems and version levels on your host, including any updates and APARs for the operating system.
- Ensure that you have 1 MB minimum of hard disk space available to install the AIX host attachment package.
- Ensure that you have the documentation for your RS/6000 or pSeries system and the *IBM TotalStorage SAN Volume Controller: Installation Guide*. The *IBM TotalStorage SAN Volume Controller: Installation Guide* is on the TotalStorage CD that you receive with the SAN Volume Controller.

Supported pSeries and RS/6000 operating systems

Ensure that each pSeries and RS/6000 host uses a supported operating system and level.

The SAN Volume Controller supports pSeries and RS/6000 hosts that run the operating systems listed on Table 3.

Table 3. Supported pSeries and RS/6000 host operating systems

Operating systems	Level
AIX	AIX 4
	AIX 5

Note: See the supported software levels at the following IBM Web site for more specific details and the most up-to-date information about supported operating system levels for pSeries and RS/6000 hosts:

http://www.ibm.com/servers/storage/software/virtualization/svc

Supported host bus adapters for pSeries and RS/6000 hosts

Ensure that your pSeries and RS/6000 (AIX) hosts use the correct host bus adapters.

See the supported hardware list at the following IBM Web site to see the current information about supported host bus adapters for pSeries and RS/6000 hosts:

http://www.ibm.com/servers/storage/software/virtualization/svc

Supported drivers and firmware for pSeries and RS/6000 hosts

Be sure that you use the correct host bus adapter device driver and firmware levels for your pSeries and RS/6000 (AIX) hosts.

See the supported hardware list at the following IBM Web site for the most current information about supported device driver and firmware levels:

http://www.ibm.com/servers/storage/software/virtualization/svc

Installing the host attachment package for AIX operating systems

To attach a pSeries or RS/6000 (AIX) host, you must install and configure the host attachment package.

Preparing for installation

Follow these steps before installing the host attachment package on the RS/6000 or pSeries host.

1. Attach the SAN Volume Controller to your host system by installing the software package that allows AIX to recognize the SAN Volume Controller.
2. Turn on the host system and all attachments.
3. Ensure that you have root access.
4. Ensure that you have administrator knowledge.
5. Ensure that you have knowledge of the System Management Interface Tool (SMIT).
6. Ensure that you have installed the prerequisite package devices.fcp.disk, which is required by the host attachment package.

You are now ready to install the host attachment package.

Note: If you use a Cisco MDS 9000 Family switch with your AIX host, you must ensure that you enable the Cisco persistent FC (fibre channel) ID feature for the AIX host. See your Cisco manual for more information.

Installing the host attachment package

Perform these steps to install the host attachment to an RS/6000 or pSeries host.

Before installing the host attachment package, be sure that you are aware of the preinstall procedures. You must have superuser authority to complete this procedure.

1. From your desktop window, type `smit install_update` to go directly to the installation panel.
2. Select **Install and Update from the Latest Available Software** and press Enter.
3. Press F4 to open the Input Device/Directory for Software window.
4. Select the CD drive that you are using for the installation, for example, /dev/cd0, or enter the absolute path and package name for the host attachment package.
5. Press Enter.

   The Install and Update from the Latest Available Software window opens.
6. Select **Software to Install** and press F4.
7. Select **Software Packages** and press F7.

The Install and Update from the Latest Available Software panel displays with the name of the software you selected to install.

8. Check the default option settings to ensure that they are what you need.
9. Press Enter to install the software.

   SMIT prompts you for confirmation.
10. Press Enter to continue.

    The installation process might take several minutes. A message is displayed when the installation process is complete, and you are prompted to restart the host system.
11. Press F10 when the installation process is complete.
12. Exit from SMIT.
13. Remove the CD.
14. Restart the host system.

Replacing the host attachment package

This procedure applies if you want to replace a previous version of the host attachment package on an IBM RS/6000 or IBM eServer pSeries host and have data that exists on all configured SAN Volume Controller disks.

Before performing these steps, be sure that you have installed the host attachment package.

To replace the host attachment package, use the following instructions:

1. Run the **umount** command to unmount the file system. For example, type `umount x`, where *x* is the file system name. If you are on an SP host, go to step 2, otherwise go to step 4.
2. Type `suspendvsd` to suspend the virtual shared disks associated with the volume groups.
3. Type `stopvsd` to stop the virtual shared disks associated with the volume groups.
4. Run the **varyoffvg** command for the 2145 volume group. For example, type `varyoffvg VGname`.
5. Type `rmdev -dl hdisk#` on the command line to remove or unconfigure the SAN Volume Controller devices.
6. Install devices.fcp.disk.ibm2145.rte.
7. Run cfgmgr so that the host can accept your changes.
8. After your host restarts, verify that the volume groups are set to autovaryon and that the file systems are set to automount. If the volume groups *are not* set to autovaryon and the file systems *are not* set to automount, you must perform the following tasks:
   a. Type the **varyonvg** command to varyon the volume groups.
   b. Type the **mount** command to mount the file systems.

Verifying the configuration

Follow these steps for verifying the configuration of the SAN Volume Controller on the AIX host system.

Enter the following command to verify the configuration of the SAN Volume Controller on the AIX host system:

```
lsdev -Ct 2145
```

Figure 1 shows an example of the results of the lsdev command if the configuration is successful.

```
hdisk235 Available 31-08-01 SAN Volume Controller Device
hdisk236 Available 31-08-01 SAN Volume Controller Device
hdisk237 Available 31-08-01 SAN Volume Controller Device
...
...
```

Figure 1. Example of a list of devices displayed by the lsdev command for a successful configuration

Figure 2 shows an example of the results of the lsdev command if the configuration was not successful.

```
hdisk3 Available 30-68-01, Other FCSCSI disk device
hdisk4 Available 30-68-01, Other FCSCSI disk device
hdisk5 Available 30-68-01, Other FCSCSI disk device
...
...
```

Figure 2. Example of a list of other devices displayed by the lsdev command for an unsuccessful configuration

Making SAN changes

To make changes to the SAN on the AIX host system, you must follow these instructions.

The 6227 and 6228 host bus adapters (HBAs) do not support dynamic SAN configuration changes. Do not change the domain ID of the switch port of the switch connected to the SAN Volume Controller, otherwise, you might lose the connection to the SAN Volume Controller.

1. Before you change the switch port connected to the SAN Volume Controller or the switch domain ID, remove the fibre-channel adapter:
   a. Run the **umount** command to unmount the files on the file system.
      For example, type `umount` *x*, where *x* is the file system name.
   b. Type `suspendvsd` to suspend the virtual shared disks with the volume groups.
   c. Type `stopvsd` to stop the virtual shared disks associated with the volume groups.
   d. Run the **varyoffvg** command for the 2145 volume group.
      For example, type `varyoffvg VGname`
   e. Type `rmdev -dl fcsx -R` on the command line to remove the fibre-channel adapter.
2. Type `cfgmgr` to reinstall the adapter and rediscover the 2145 hdisks.
3. Type `importvg VGname` to import the volume groups.
4. Type `varyonvg` to vary on the volume groups.
5. Remount the file system.

Configuring the AIX system

You must configure the AIX operating system before you can use pSeries and RS/6000 hosts with the SAN Volume Controller.

Before you configure the AIX host operating systems, the following tasks must be completed:

- IBM Systems Services Representative (SSR) must have installed the SAN Volume Controller.
- You must have installed the appropriate host bus adapters.

After the prerequisite tasks are complete, use the following general steps to configure your AIX host system.

1. Zone the host system to the SAN Volume Controller on the fibre-channel SAN.
2. Install the appropriate multipathing driver for your host system to enable the management of multiple paths to SAN Volume Controller virtual disks (VDisks).

   Note: The IBM TotalStorage Multipath Subsystem Device Driver (SDD) for AIX supports RS/6000 and pSeries host systems in a clustering environment. To have failover protection on an open system, the SDD requires a minimum of two fibre-channel adapters. The maximum number of fibre-channel ports that are supported in a single host (or logical partition) is four. This can be four single-port adapters or two dual-port adapters or a combination, as long as the maximum number of ports that are attached to the SAN Volume Controller does not exceed four.
3. Create the host system on the SAN Volume Controller, using the worldwide port names (WWPNs). Map the VDisks to the host as required.
4. Create volumes/disks on your host using instructions in your host system publications.

Related tasks

"Locating the WWPN for an IBM pSeries or an RS/6000 host" on page 65
You can locate the WWPN for an IBM pSeries or an RS/6000 host by following the steps in this topic.

Multipath support for AIX hosts

You must install multipathing software on all AIX hosts that are attached to the SAN Volume Controller.

On pSeries and RS/6000 (AIX) hosts, the following software provides multipathing support:

- IBM TotalStorage Multipath Subsystem Device Driver (SDD)

Configuring SAN Volume Controller devices with multiple paths per LUN

This information explains the SAN Volume Controller support for multiple LUNs on an AIX host.

The SAN Volume Controller supports multiple path configurations for a LUN. This means that you can have multiple hdisks (logical hard disks) available on the AIX server for each physical LUN. To configure multiple paths for all LUNs, add all of the adapters and fibre-channel cables, then use the `cfgmgr` command once for each adapter to discover all of the fibre-channel devices. If you add fibre-channel devices after running `cfgmgr`, you must run it again to discover the new devices.

Multipathing configuration maximums for AIX

When you configure, keep in mind the maximum configuration for pSeries and RS/6000 (AIX) hosts.

Table 4 on page 14 provides the maximum virtual disks (VDisks) and paths per VDisk for the IBM TotalStorage Multipath Subsystem Device Driver (SDD).

Table 4. Configuration maximums for SDD on pSeries and RS/6000 (AIX) hosts

Object	SDD maximum	Description
VDisk (HDisk)	512	The maximum number of VDisks that can be supported by the SDD (per host object). The maximum number of VDisks is enforced by the SAN Volume Controller.
Paths per VDisk	4	The maximum number of paths to each VDisk. The maximum number of paths is a recommendation. The number of paths directly corresponds with the resulting path-failover time.

Clustering support for AIX

The SAN Volume Controller provides clustering support for pSeries and RS/6000 (AIX) hosts.

Table 5 provides information about the cluster software supported for IBM pSeries and RS/6000 (AIX) hosts.

Table 5. Clustering software supported for IBM pSeries and RS/6000 (AIX) hosts

Operating system	Cluster software	Vendor
AIX 5	HACMP	IBM

SAN boot support for AIX

The SAN Volume Controller does not provide SAN boot support for pSeries and RS/6000 (AIX) hosts

Support for dynamically increasing VDisk size

If your AIX hosts are AIX 5.2 or later versions, the SAN Volume Controller supports the ability to dynamically increase VDisk size.

The `chvg` command options provide the ability to grow the size of a physical volume that the Logical Volume Manager (LVM) uses, without interruptions to the use or availability of the system. Refer to the AIX *System Management Guide: Operating System and Devices* for more information.

Known issues and limitations

This information provides a reference to known issues and limitations with the SAN Volume Controller and an AIX host.

Note: You can also see the software restrictions page on the following IBM support Web site for the most current information about known restrictions:

http://www-1.ibm.com/servers/storage/support/virtual/2145.html

On a heavily loaded system, you might see the following symptoms that can indicate that the host is low on direct memory access (DMA) resources:

- You might see errors that indicate that the host bus adapter (HBA) was unable to activate an I/O request on the first attempt.

- You might see lower-than-expected performance with no errors being logged.

To reduce the incidence of these messages you can increase the resources by modifying the maximum transfer size attribute for the adapter as follows:

1. Type the following command to view the current setting:

   ```
   lsattr -El <HBA> -a max_xfer_size
   ```

   where *HBA* is the name of the adapter logging the error. For this example the HBA is fcs0.
2. Type the following command to increase the size of the setting:

   ```
   chdev -l fcs0 -P -a max_xfer_size=0x1000000
   ```

   Note: To view the range of allowable values for the attribute, type: `lsattr -Rl fcs0 -a max_xfer_size`
3. Restart the host to put these changes into effect.

Sample AIX error log

This information provides an example of an AIX error log.

The errors shown in the following sample error log indicate that the HBA was unable to open an I/O request on the first attempt because the DMA resources were too low.

```
LABEL:  FCS_ERR6
IDENTIFIER: D0EAC662

Date/Time:       Wed Dec  4 16:41:48 MST
Sequence Number: 1949119
Machine Id:      0021DF9A4C00
Node Id:         lode1
Class:           H
Type:            TEMP
Resource Name:   fcs0
Resource Class:  adapter
Resource Type:   df1000f9
Location:        3V-08
VPD:
        Part Number.................03N2452
        EC Level....................D
        Serial Number...............1809102EC
        Manufacturer................0018
        FRU Number..................09P0102
        Network Address.............10000000C92BB50F
        ROS Level and ID............02C03891
        Device Specific.(Z0)........1002606D
        Device Specific.(Z1)........00000000
        Device Specific.(Z2)........00000000
        Device Specific.(Z3)........02000909
        Device Specific.(Z4)........FF401050
        Device Specific.(Z5)........02C03891
        Device Specific.(Z6)........06433891
        Device Specific.(Z7)........07433891
        Device Specific.(Z8)........20000000C92BB50F
        Device Specific.(Z9)........CS3.82A1
        Device Specific.(ZA)........C1D3.82A1
        Device Specific.(ZB)........C2D3.82A1

Description
MICROCODE PROGRAM ERROR

Probable Causes
ADAPTER MICROCODE
```

```
Failure Causes
ADAPTER MICROCODE

 Recommended Actions
 IF PROBLEM PERSISTS THEN DO THE FOLLOWING
 CONTACT APPROPRIATE SERVICE REPRESENTATIVE

Detail Data
SENSE DATA
0000 0000 0000 0029 0002 0039 0000 0000 0061 1613 0090 D5FD 0000 C98B 0000 012C
0000 0000 0000 0003 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
0000 0000 0608 0000 0000 0010 0000 0000 0000 0000 0000 2710 0000 07D0 0000 076C
0000 0064 0000 000F 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
0000 0000
```

Chapter 4. Attaching to an Intel host running Linux

This information provides an overview for attaching the SAN Volume Controller to an Intel host running Linux.

Attachment requirements for Intel hosts running Linux

This section provides an overview of the requirements for attaching the SAN Volume Controller to an Intel host running Linux.

The requirements for attaching the SAN Volume Controller to your Linux host system are as follows:

- Check the LUN limitations for your host system.
- Ensure that you have the documentation for your Linux host system and the *IBM TotalStorage SAN Volume Controller: Installation Guide*. The *IBM TotalStorage SAN Volume Controller: Installation Guide* is on the TotalStorage CD that you receive with the SAN Volume Controller.
- Ensure that you have installed the correct operating systems and are running a supported kernel of Linux.
- When attaching the SAN Volume Controller to a BladeCenter, refer to the Bladecenter documentation for SAN configuration details.

Supported Linux operating systems for Intel hosts

Ensure that each Intel host uses a supported Linux operating system and version.

The SAN Volume Controller supports Linux hosts that run the following operating systems:

- Red Hat Enterprise Linux AS
- SUSE Linux Enterprise Server

See the following IBM Web site for current information about supported software levels:

http://www.ibm.com/servers/storage/software/virtualization/svc

Supported Linux host bus adapters for Intel hosts

Ensure that your Intel hosts use the correct Linux host bus adapters and host software.

The SAN Volume Controller supports Intel (Linux) hosts that use the following types of host bus adapters:

- QLogic adapters (on Red Hat and SUSE operating systems with IBM xSeries platforms)
- HS20 and HS40 adapters (on RedHat and SUSE operating systems with IBM BladeCenter platforms)
- pSeries blades with HS20 adapters (on RedHat and SUSE operating systems with IBM BladeCenter platforms)

To see the specific host bus adapter and platform levels, see the supported hardware list at the following IBM Web site:

http://www.ibm.com/servers/storage/software/virtualization/svc

Supported drivers and firmware for Intel hosts running Linux

Be sure that you use the correct host bus adapter device driver and firmware levels for your Intel (Linux) hosts.

See the supported hardware list at the following IBM Web site for the most current information about supported device driver and firmware levels:

http://www.ibm.com/servers/storage/software/virtualization/svc

Installing the host bus adapter on a Linux host

The first step for attaching the Linux host is to install the host bus adapter (HBA).

Before you install the HBA, ensure that the adapter is supported by the SAN Volume Controller. See the supported hardware list at the following IBM Web site if you need to verify that the HBA is supported:

http://www.ibm.com/servers/storage/software/virtualization/svc

To install the HBA, use the following general steps:

1. Shutdown your Linux host and its attached peripherals, following the manufacturer's recommendations.
2. Install the HBA, using the manufacturer's installation instructions.

Installing a QLogic HBA driver

If your Linux host contains a QLogic host bus adapter (HBA), you must download and install the appropriate QLogic driver for the adapter.

1. Restart your host system.
2. Download the appropriate QLogic driver and associated files using the following steps:
   a. Go to the supported hardware list on the following Web site and find the specific operating system and then the QLogic HBA that is installed on your host machine.

      http://www.ibm.com/servers/storage/software/virtualization/svc

      The specific versions of the QLogic driver and the associated firmware version are indicated on the hardware list.
   b. Ensure that your QLogic HBA is running the correct firmware version. If you need to update the firmware to the version listed on the hardware list, click on the link for the firmware version to download and install the correct version.
   c. Click the link in the **HBA Driver** column.
   d. Download the driver file for the driver to a local disk.
   e. If you downloaded the driver file from a non-Linux host system, transfer the drive file to a Linux host system.
   f. Decompress the downloaded file.
3. Install the QLogic HBA driver using the instructions in the downloaded compressed file.
4. Restart the host using the `reboot -- -r` command.

Configuring the Linux system

You must configure the Linux operating system before you can use Intel-based Linux hosts with the SAN Volume Controller.

Before you configure the host operating systems, the following tasks must be completed:

- IBM Systems Services Representative (SSR) must have installed the SAN Volume Controller.
- You must have installed the appropriate host bus adapters.

After the prerequisite tasks are complete, use the following general steps to configure your Intel-based Linux host system.

1. Zone the host system to the SAN Volume Controller on the fibre-channel SAN.
2. Install the appropriate multipathing driver for your host system to enable the management of multiple paths to SAN Volume Controller virtual disks (VDisks).
3. Create the host system on the SAN Volume Controller, using the worldwide port names (WWPNs). Map the VDisks to the host as required.
4. Create volumes/disks on your host using instructions in your host system publications.

Related tasks

"Locating the WWPN for a Linux host" on page 66
You can locate the WWPN for an Intel™ server running the Linux operating system with a QLogic adapter by following the steps in this topic.

Multipath support for Linux

You must install multipathing software on all Intel-based Linux hosts that are attached to the SAN Volume Controller.

On Intel-based Linux hosts, the following software provides multipathing support:

- IBM TotalStorage Multipath Subsystem Device Driver (SDD)

SDD dynamic pathing on Linux

Intel-based Linux hosts do not support IBM TotalStorage Multipath Subsystem Device Driver (SDD) dynamic pathing. If you use a QLogic device driver, you must reload the device driver to pick up the new paths.

On Linux, SDD is aware of the preferred paths that are set by SAN Volume Controller for each VDisk. When failing over paths, SDD tries the first preferred path, then the next known preferred path, and so on until it has tried all preferred paths. If SDD cannot find an available path using the preferred paths, it begins trying non-preferred paths. If all paths are unavailable, the VDisk goes offline.

SDD under Linux does not perform load balancing across the preferred paths.

Multipathing configuration maximums for Linux

When you configure, keep in mind the maximum configuration for the IBM TotalStorage Multipath Subsystem Device Driver (SDD) on Linux hosts.

Table 6 on page 20 provides the maximum virtual disks (VDisks) and paths per VDisk for SDD on Linux.

Table 6. Configuration maximums for SDD on Intel-based Linux hosts

Object	Maximum	Description
VDisk (HDisk)	256	The maximum number of VDisks that can be supported by Linux (per host object).
Paths per VDisk	4	The maximum number of paths to each VDisk.

Clustering support for Linux

The SAN Volume Controller does not provide clustering support on Linux.

SAN boot support for Linux

The SAN Volume Controller does not provide SAN boot support for Intel-based Linux hosts.

Defining the number of disks on Linux

When you define the number of disks on Linux, you are allocating space for configured disks. On Linux, disks are represented as device files.

There are 256 minor numbers available for each of the eight major numbers that can be used to define Linux device files.

Use the following formula to define the maximum number of device files for Linux host systems:

(Number of major numbers) x (Number of minor numbers) / (Number of partitions) = Number of devices

For example, 8 x 256 / 16 = 128.

Setting queue depth

The steps required to set the queue depth are detailed here.

1. Add the following line to the /etc/modules.conf file:

   ```
   options qla2300 ql2xmaxqdepth=4
   ```

2. Run the `mkinitrd` command to rebuild the RAMdisk associated with the kernel being used.

Related concepts

"SAN Volume Controller storage configuration"
SAN Volume Controller storage configuration information is detailed below.

SAN Volume Controller storage configuration

SAN Volume Controller storage configuration information is detailed below.

Each of the attached SAN Volume Controller LUNs has a special device file in the Linux directory /dev. There is a maximum of 128 fibre-channel disks that are based on the major numbers that are available. The entries for all 128 devices are added by the operating system automatically.

The range of devices goes from /dev/sda (LUN 0) to /dev/sddx (LUN 127) without an IBM TotalStorage Multipath Subsystem Device Driver (SDD), or from /dev/vpatha

(LUN 0) to /dev/vpathdx (LUN 127) with an SDD. Figure 3 and Figure 4 show examples of the range for the devices.

```
# ls –l /dev/sda
brw-rw---- 1 root disk 8, 0 Aug 24 2000 /dev/sda
```

Figure 3. Example of range of devices for a Linux host when not using the SDD

```
# ls –l /dev/vpatha
brw-rw---- 1 root disk 8, 0 Aug 24 2000 /dev/vpatha
```

Figure 4. Example of range of devices for a Linux host when using the SDD

SAN Volume Controller disk partitions

Refer to this information when setting up SAN Volume Controller disk partitions.

Before you create a file system, partition the disk by using the fdisk utility. You have to specify the special device file of the disk you want to partition when executing fdisk. Figure 5 shows an example of the different options for the fdisk utility.

Note: If you are using the IBM TotalStorage Multipath Subsystem Device Driver (SDD), your path in the example would be /dev/vpathb instead of /dev/sdb.

```
# fdisk /dev/sdb

Command  (m for help): m
Command  action
a     toggle a bootable flag
b     edit bsd disklabel
c     toggle the dos compatibility flag
d     delete a partition
l     list known partition types
m     print this menu
n     add a new partition
o     create a new empty DOS partition table
p     print the partition table
q     quit without saving changes
s     create a new empty Sun disklabel
t     change a partitions system id
u     change display/entry units
v     verify the partition table
w     write table to disk and exit
x     extra functionality (experts only)
```

Figure 5. Example of different options for the fdisk utility

Figure 6 on page 22 shows an example of a primary partition on the disk /dev/sdb.

Note: If you are using the SDD, your path in the example would be /dev/vpathb instead of /dev/sdb.

```
Command (m for help): n

Command  action
e     extended
p     primary partition (1-4)
p
Partition number (1-4): 1
First cylinder (1-953, default 1): Enter
Using default value 1
Last cylinder or +size or +sizeM or +sizeK (1-953, default 953): Enter
Using default value 953

Command (m for help): p

Disk /dev/sdb: 64 heads, 32 sectors, 953 cylinders
Units = cylinders of 2048 * 512 bytes

 Device Boot  Start  End   Blocks  Id  System
 /dev/sdb1     1 953   975856  83  Linux
```

Figure 6. Example of a primary partition on the disk /dev/sdb

Assigning the system ID to the partition

To assign the system ID to the SAN Volume Controller partition on the Intel host running Linux, follow these steps.

1. Assign the system partition ID.
2. Write the information to the partition table on the disk.
3. Exit the fdisk program.

Figure 7 shows the assignment of the Linux system ID to the partition (hex code 83).

```
Command  (m for help): t
Partition number (1-4): 1

Hex code (type L to list codes): 83

Command  (m for help): w
The partition table has been altered!

Calling ioctl() to re-read partition table.
SCSI device sdb: hdwr sector= 512 bytes. Sectors= 1953152 [953 MB] [1.0 GB]
 sdb: sdb1
SCSI device sdb: hdwr sector= 512 bytes. Sectors= 1953152 [953 MB] [1.0 GB]
 sdb: sdb1

WARNING: If you have created or modified any DOS 6.x partitions, please see the
fdisk manual page for additional information.
Syncing disks.
[root@yahoo /data]#
```

Figure 7. Example of assigning a Linux system ID to the partition

File systems on the SAN Volume Controller

Refer to this information when you are ready to create and use file systems on the SAN Volume Controller.

After you partition the disk, the next step is to create a file system. Figure 8 on page 23 shows an example of how to use the **mke2fs** command to create an EXT2 Linux file system (which is nonjournaled).

Note: If you are using the IBM Subsystem Device Driver, your path in the example would be /dev/vpathb1 instead of /dev/sdb1.

```
[root@yahoo /data]# mke2fs /dev/sdb1
mke2fs 1.18, 11-Nov-1999 for EXT2 FS 0.5b, 95/08/09
Filesystem label=
OS type: Linux
Block size=4096 (log=2)
Fragment size=4096 (log=2)
122112 inodes, 243964 blocks
12198 blocks (5.00%) reserved for the super user
First data block=0
8 block groups
32768 blocks per group, 32768 fragments per group
15264 inodes per group
Superblock backups stored on blocks:
32768, 98304, 163840, 229376

Writing inode tables: done
Writing superblocks and filesystem accounting information: done
[root@yahoo /data]#
```

Figure 8. Example of creating a file with the mke2fs command

Figure 9 shows an example of the EXT2 Linux file system, which is nonjournaled, by using the **mkfs** command.

Note: If you are using the IBM Subsystem Device Driver, your path in the example would be /dev/vpathb1 instead of /dev/sdb1.

```
[root@yahoo /data]# mkfs -t ext2 /dev/sdb1
mke2fs 1.18, 11-Nov-1999 for EXT2 FS 0.5b, 95/08/09
Filesystem label=
OS type: Linux
Block size=4096 (log=2)
Fragment size=4096 (log=2)
122112 inodes, 243964 blocks
12198 blocks (5.00%) reserved for the super user
First data block=0
8 block groups
32768 blocks per group, 32768 fragments per group
15264 inodes per group
Superblock backups stored on blocks:
32768, 98304, 163840, 229376
Writing inode tables: done
Writing superblocks and filesystem accounting information: done
[root@yahoo /data]#
```

Figure 9. Example of creating a file with the mkfs command

Known problems and issues

This information contains known problems and issues when running the SAN Volume Controller with an Intel host running Linux.

In response to errors, the kernel might permanently disable a LUN and log a message stating **device set offline** and the specific device. If this happens, there is no way to bring the LUN online. It might be possible to remove the LUN and add it back through the /proc/scsi/scsi directory or reload the host adapter driver. If those fail, it is necessary to reboot the host.

Note: You can also see the software restrictions page on the following IBM support Web site for the most current information about known restrictions:

http://www-1.ibm.com/servers/storage/support/virtual/2145.html

Chapter 5. Attaching to a Sun host

This information provides an overview for attaching the SAN Volume Controller to a Sun host running Solaris.

Attachment requirements for Sun hosts

This section provides an overview of the requirements for attaching the SAN Volume Controller to Sun SPARC hosts.

The requirements for attaching the SAN Volume Controller to your Sun host system are as follows:

- Check the LUN limitations for your host system. Ensure that there are enough fibre-channel adapters installed in the server to handle the total LUNs you want to attach.
- Ensure that you have the documentation for your host system and the *IBM TotalStorage SAN Volume Controller: Installation Guide*. The *IBM TotalStorage SAN Volume Controller: Installation Guide* is on the TotalStorage CD that you receive with the SAN Volume Controller.
- Ensure that you have installed the correct operating system level and any updates.
- Review device driver installation documents and configuration utility documents for additional patches that you might need.

Supported operating systems for Sun hosts

Ensure that each Sun host uses a supported operating system and version.

The SAN Volume Controller supports Sun hosts that run the following operating systems:

- Solaris 8, SPARC Platform Edition
- Solaris 9, SPARC Platform Edition

See the following IBM Web site for current information about supported software levels:

http://www.ibm.com/servers/storage/software/virtualization/svc

Supported host bus adapters for Sun hosts

Ensure that your Sun hosts use the correct host bus adapters.

The SAN Volume Controller supports Sun hosts that use the following types of host bus adapters:

- JNI
- Emulex
- QLogic

To see the specific host bus adapter levels, see the supported hardware list at the following IBM Web site:

http://www.ibm.com/servers/storage/software/virtualization/svc

Supported drivers and firmware for Sun hosts

Be sure that you use the correct host bus adapter device driver and firmware levels for your Sun hosts.

See the supported hardware list at the following IBM Web site for the most current information about supported device driver and firmware levels:

http://www.ibm.com/servers/storage/software/virtualization/svc

Installing the host bus adapter on a Sun host

The first step for attaching the Sun host is to install the host bus adapter (HBA).

Before you install the HBA, ensure that the adapter is supported by the SAN Volume Controller. See the supported hardware list at the following IBM Web site if you need to verify that the HBA is supported:

http://www.ibm.com/servers/storage/software/virtualization/svc

To install the HBA, use the following general steps:

1. Shutdown your Sun host and its attached peripherals, following the manufacturer's recommendations.
2. Install the HBA, using the manufacturer's installation instructions.

Installing the HBA driver

After you install the host bus adapter (HBA) into the host machine, you must download and install the appropriate HBA driver.

Installing a JNI HBA driver

If your Sun host contains a JNI host bus adapter (HBA), you must download and install the appropriate JNI driver for the adapter.

1. Restart your host system.
2. Download the appropriate JNI driver and associated files using the following steps:
   a. Go to the supported hardware list on the following Web site and find the specific operating system and then the JNI HBA that is installed on your host machine.

      http://www.ibm.com/servers/storage/software/virtualization/svc

      The specific versions of the JNI driver and the associated firmware version are indicated on the hardware list.
   b. Ensure that your JNI HBA is running the correct firmware version. If you need to update the firmware to the version listed on the hardware list, click on the link for the firmware version to download and install the correct version.
   c. Note the version number for the JNI HBA driver and click the link (in the **HBA Driver** column). Your browser is redirected to a Web site where you can download the necessary driver files.
   d. Find the section for the appropriate JNI driver version and download the following files to a local disk:
      - JNIC146.pkg file for the recommended JNI driver
      - Recommended JNI Fcode

- EZF_2.2.2.tar

e. If you downloaded the driver file from a non-Sun host system, transfer the drive file to a Sun host system.

3. Install the JNI HBA driver (JNIC146.pkg) and the Fcode using the JNI instructions.

   Note: Ensure that the /kernel/drv/jnic146x.conf file uses the following settings:

   automap=1; (dynamic binding)
   FcLoopEnabled=0;
   FcFabricEnabled=1;
   TargetOfflineEnable=0;
   LunDiscoveryMethod=1; (this is typically the default)
   LunRecoveryInterval=10000;

4. Restart the host using the `reboot -- -r` command.
5. Install the EZ Fibre configuration utility (EZF_2.2.2.tar) following the JNI instructions. Follow the on-screen instructions when running install.sh and select the default settings.

Installing an Emulex HBA driver

If your Sun host contains a Emulex host bus adapter (HBA), you must download and install the appropriate Emulex driver for the adapter.

1. Restart your host system.
2. Download the appropriate Emulex driver and associated files using the following steps:
   a. Go to the supported hardware list on the following Web site and find the specific operating system and then the Emulex HBA that is installed on your host machine.

      http://www.ibm.com/servers/storage/software/virtualization/svc

      The specific versions of the Emulex driver and the associated firmware version are indicated on the hardware list.

   b. Ensure that your Emulex HBA is running the correct firmware version. If you need to update the firmware to the version listed on the hardware list, click on the link for the firmware version to download and install the correct version.
   c. Click the link in the **HBA Driver** column. Your browser is redirected to the Emulex Web site where you can download the necessary driver files.
   d. Find the section for the appropriate Emulex HBA and driver. Download the tar file for the driver to a local disk.
   e. If you downloaded the driver tar file from a non-Sun host system, transfer the drive file to a Sun host system.
   f. Decompress the downloaded tar file until you have the following files:
      - lpfc.1 (which is used to install the HBA driver)
      - Two tar.gz files (which are used to install the Emulex HBAnywhere client and the lputil command-line interface utility)
3. Install the Emulex HBA driver (lpfc.1) using the instructions on the Emulex Web site.
4. Restart the host using the `reboot -- -r` command.
5. Install the Emulex HBAnyware configuration utility and the lputil command-line interface utility using the instructions on the Emulex Web site.

6. Restart the host system.

Installing a QLogic HBA driver

If your Sun host contains a QLogic host bus adapter (HBA), you must download and install the appropriate QLogic driver for the adapter.

1. Restart your host system.
2. Download the appropriate QLogic driver and associated files using the following steps:
   a. Go to the supported hardware list on the following Web site and find the specific operating system and then the QLogic HBA that is installed on your host machine.

      http://www.ibm.com/servers/storage/software/virtualization/svc

      The specific versions of the QLogic driver and the associated firmware version are indicated on the hardware list.
   b. Ensure that your QLogic HBA is running the correct firmware version. If you need to update the firmware to the version listed on the hardware list, click on the link for the firmware version to download and install the correct version.
   c. Click the link in the **HBA Driver** column.
   d. Download the driver file for the driver to a local disk.
   e. If you downloaded the driver file from a non-Sun host system, transfer the drive file to a Sun host system.
   f. Decompress the downloaded file.
3. Install the QLogic HBA driver using the instructions in the downloaded compressed file.
4. Restart the host using the `reboot -- -r` command.

Configuring the HBA on the Sun host

After you install the host bus adapter (HBA) and driver on your Sun host, you must configure the HBAs.

Configuring the JNI HBA

After you have installed the JNI host bus adapter (HBA) and the driver, you must configure the HBA.

To configure a JNI host bus adapter (HBA) for Solaris, use the following steps.

1. Edit the jnic146x.conf file to set up the HBA connection to the switch fabric so that the file contains the following settings:

   ```
   FcLoopEnable = 0;
   FcFabricEnable = 1;
   Automap = 0
   ```

   Note: Setting the `Automap` line to `0`, specifies that only devices with persistent bindings are recognized by the system.
2. Modify the sd.config file (in the /kernel/drv/ directory) to inform Solaris about the new SCSI target device and LUNs. For example, if you had four LUNs, you would add lines similar to the following example lines:

   ```
   name="sd" class="scsi" target=0 lun=0;
   name="sd" class="scsi" target=0 lun=1;
   name="sd" class="scsi" target=0 lun=2;
   name="sd" class="scsi" target=0 lun=3;
   ```

3. Register the HBA ports and map virtual disks (VDisks) to the host using the following steps.

   Note: If a monitor is attached to the host, the user interface will display. If no monitor is attached, you must use an xhost capable client with an attached monitor.

   a. Log on to the attached console of the Sun or the remote host with xhost capability.
   b. Start the EZ Fibre configuration utility by entering the following:

      ```
      /opt/jni/ezfibre/standalone/ezf
      ```

      The user interface will display a list with both adapters listed, and all of the connected remote ports listed as targets.
   c. Use the SAN Volume Controller command line interface or user interface to register the HBA ports with the SAN Volume Controller.
   d. Create the necessary VDisks and map them to the host.

      Note: You can obtain the HBA worldwide port name (WWPN) from the /var/adm/messages file, the EZ Fibre utility, or the SVC/SIS candidate HBA port list.

   e. When the VDisks are created and mapped, restart the host with the `reboot -- -r` command.
4. After the host has been restarted, restart the EZ Fibre configuration utility. It should show all of the available VDisks under the listing of their corresponding HBA targets.
5. Decide whether you will use dynamic port binding or static (persistent) port binding. You can use dynamic port binding with the SAN Volume Controller if the host is not using the SAN boot feature.
6. If you decide to use static binding, use the following steps to map the SVC/SIS-controlled VDisks to the host with persistent bindings:
   a. Using the EZ Fibre utility, select an HBA.
   b. Select the third tab on the HBA panel.
   c. Click **Select All**.
   d. Click **Commit**.
   e. Click **Activate Changes**.
   f. Select the same HBA.
   g. On the first panel, change the **Dynamic Binding** tab to **Disabled**.
   h. Click **Commit**.
   i. Click **Activate Changes**.
   j. Repeat steps 6a through 6i until you have performed it on all of the HBAs.

      Attention: The EZ Fibre configuration utility will append any changes to the end of the /kernel/drv/jnic146x.conf file. After multiple reconfigurations, this file can become very large. It is recommended that you make a copy of the jnic146x.conf file after installing the driver and restore it before making any configuration changes.
7. Restart the host and examine the /var/adm/messages file to ensure that the JNI HBA is set up as a switch-fabric connection.

Related tasks

"Locating the WWPN for a Sun host" on page 66
You can locate the WWPN for a Sun host by following the steps in this topic.

Parameter settings for the JNI FCE-6460 and JNI FCE-1473 adapters

This information provides the recommended configuration settings for the JNI FCE-6460 and JNI FCE-1473 adapters.

For the most current information about fibre-channel adapter parameter settings, see http://www-1.ibm.com/servers/storage/support/virtual/2145.html.

Configuring the Emulex HBA

After you have installed the Emulex host bus adapter (HBA) and the driver on the Sun Solaris host, you must configure the HBA.

To configure the Emulex HBA for Solaris, use the following steps:

1. Modify the sd.config file (in the /kernel/drv/ directory) to inform Solaris about the new SCSI target device and LUNs. For example, if you had four LUNs, you would add lines similar to the following example lines:

   ```
   name="sd" class="scsi" target=0 lun=0;
   name="sd" class="scsi" target=0 lun=1;
   name="sd" class="scsi" target=0 lun=2;
   name="sd" class="scsi" target=0 lun=3;
   ```

2. Register the HBA ports and map virtual disks (VDisks) to the host using the following steps.
   a. Log on to the attached console of the Sun or the remote host with xhost capability.
   b. Start the HBAnyware configuration utility by entering the following:

      ```
      /usr/sbin/hbanyware/hbanyware
      ```

      The user interface will display a list with both adapters listed, and all of the connected remote ports listed as targets.
   c. Use the SAN Volume Controller command line interface or user interface to register the HBA ports with the SAN Volume Controller.
   d. Create the necessary VDisks and map them to the host.

      Note: You can obtain the HBA worldwide port name (WWPN) from the /var/adm/messages file, the HBAnyware utility, or the SVC/SIS candidate HBA port list.
   e. When the VDisks are created and mapped, restart the host with the `reboot -- -r` command.
3. After the host has been restarted, restart the HBAnyware utility. It should show all of the available VDisks under the listing of their corresponding HBA targets.
4. Decide whether you will use dynamic port binding or static port binding. (You can use dynamic port binding with the SAN Volume Controller if the host is not using the SAN book feature.) If you use static port binding with the SAN Volume Controller VDisks, use the following steps:
   a. Run the lputil utility by entering the following:

      ```
      /usr/sbin/lpfc/lputil
      ```
   b. From the **Main Menu**, press 5 (Persistent Bindings).
   c. From the **Persistent Bindings Menu**, press 1 (Display Current Bindings). Ensure that there are no current bindings. If there are any existing mappings, remove them.

d. Again, from the **Persistent Bindings Menu**, press 5 (Bind Automapped Targets) and then press the appropriate number to select adapter 0. Assuming that your SAN Volume Controller has four nodes, you should see four targets.

e. Press Enter and then enter `Y` (Yes) to bind the targets.

f. Repeat steps 4d through 4e for adapter 1. After you complete these steps, when you display the current bindings (by pressing 1 from the **Persistent Bindings Menu**), eight persistent targets should display.

5. Restart the host and examine the /var/adm/messages file to ensure that the Emulex HBA is set up as a switch-fabric connection.

Related tasks

"Locating the WWPN for a Sun host" on page 66
You can locate the WWPN for a Sun host by following the steps in this topic.

Configuring the QLogic HBA for Sun hosts

After you have installed the QLogic host bus adapter (HBA) and the driver, you must configure the HBA.

To configure the QLogic HBA for Solaris, use the following steps:

1. Set up the HBA connection to the switch fabric by editing the qla2300.conf configuration file. (When you install the QLogic driver, this file is installed in the /kernel/drv/ directory.) Make the following changes in the file:

   a. Set the maximum number of LUNs by adding or editing the following line. You can change `8` to the maximum number of LUNs that you need.

   ```
   Hba0-maximum-luns-per-target = 8
   ```

   a. Set the HBA to fabric-only mode by including the following line:

   ```
   Hba0-connection-options = 2
   ```

2. Decide whether you will use dynamic port binding or static port binding. (You can use dynamic port binding with the SAN Volume Controller if the host is not using the SAN book feature.) If you use static port binding, make the following changes to the configuration file:

   a. Add a line that is similar to the following example:

   ```
   hba0-SCSI-target-id-2-fibre-channel-port-name = "50057680130018"
   ```

   b. Set the Automap parameter to `0` as shown below:

   ```
   Automap = 0
   ```

3. Restart the host and examine the /var/adm/messages file to ensure that the QLogic HBA is set up as a switch-fabric connection.

Configuring the Solaris system

You must configure the Solaris operating system before you can use Sun hosts with the SAN Volume Controller.

Before you configure the host operating systems, the following tasks must be completed:

- IBM Systems Services Representative (SSR) must have installed the SAN Volume Controller.
- You must have installed the appropriate host bus adapters.

After the prerequisite tasks are complete, use the following general steps to configure your Sun host system.

1. Zone the host system to the SAN Volume Controller on the fibre-channel SAN.
2. Install the appropriate multipathing driver for your host system to enable the management of multiple paths to SAN Volume Controller virtual disks (VDisks).

   Note: The IBM TotalStorage Multipath Subsystem Device Driver (SDD) does not support the Sun host system in a clustering environment.
3. Create the host system on the SAN Volume Controller, using the worldwide port names (WWPNs). Map the VDisks to the host as required.
4. Create volumes/disks on your host using instructions in your host system publications.

Related tasks

"Locating the WWPN for a Sun host" on page 66
You can locate the WWPN for a Sun host by following the steps in this topic.

Setting the Sun host system parameters for the HBA

You can set the parameters on the Sun host system to optimize the performance between the HBA and the SAN Volume Controller.

To set the system parameters for optimum performance with the supported HBA, use the following instructions:

1. Type `cd /etc` to change to the /etc subdirectory.
2. Back up the system file in the subdirectory.
3. Edit the system file, and set the following parameters for servers with configurations that use the HBA:

   sd_max_throttle

   This sd_max_throttle parameter specifies the maximum number of commands that the sd driver can queue to the host adapter driver. The default value is 256, but you must set the parameter to a value less than or equal to a maximum queue depth for each LUN connected. Determine the value by using the following formula:

   `256 ÷ (`*`LUNs per adapter`*`)`

   where *LUNs per adapter* is the largest number of LUNs assigned to a single adapter.

   To set the sd_max_throttle parameter for the SAN Volume Controller LUNs in this example, you would add the following line to the /etc/system file:

   ```
   set sd:sd_max_throttle=5
   ```

   sd_io_time

   This parameter specifies the time-out value for disk operations. Add the following line to the /etc/system file to set the sd_io_time parameter for the SAN Volume Controller LUNs:

   ```
   set sd:sd_io_time=0x78
   ```

   sd_retry_count

   This parameter specifies the retry count for disk operations. Add the following line to the /etc/system file to set the sd_retry_count parameter for the SAN Volume Controller LUNs:

   ```
   set sd:sd_retry_count=5
   ```

   maxphys

   This parameter specifies the maximum number of bytes that you can

transfer for each SCSI transaction. The default value is 126976 (124 KB). If the I/O block size that you requested exceeds the default value, the request is broken into more than one request. The value should be tuned for the application requirements. For maximum bandwidth, set the maxphys parameter by adding the following line to the /etc/system file:

```
set maxphys=1048576 (1 MB)
```

Note: Do not set the value for maxphys greater than 1048576 (1 MB). Doing so can cause the system to hang.

If you are use the VERITAS Volume Manager on the SAN Volume Controller LUNs, you must set the VxVM maximum I/O size parameter (vol_maxio) to match the maxphys parameter. When you set the maxphys parameter to 1048576 and you use the VERITAS Volume Manager on your SAN Volume Controller LUNs, set the maxphys parameter like in the following sentence:

```
set vxio:vol_maxio=2048
```

Running the LUN configuration method

The configuration method depends on the level of Solaris that you are using and the multipathing driver you use.

Configuring LUNs for use with SDD

If you are using the IBM TotalStorage Multipath Subsystem Device Driver (SDD) for multipathing support, you must use these instructions to configure the LUNs.

The following instructions are based on the SunOS 5.8 Generic_108528–16 version. Use a bash shell as root to correctly configure your path.

You can use the following steps for all HBAs that are used with SDD:

1. After the host has rebooted, delete the following files:
   - `/etc/vpathsave.cfg`
   - `/etc/vpath.cfg`
2. Reboot the host using the `reboot -- -r` option to reconfigure for new hardware.
3. When the host restarts, use the `format` command to check for disks.
   a. If you see disks, proceed to the next step.
   b. If you do not see disks, verify the configuration of your HBAs and clustering configuration and try again.

   Note: You may see a “mode sense error” listed for each disk when running format for the first time. This is normal, and will not occur once the disks have been labeled.
4. Configure SDD by issuing the `cfgpath -c` command.
5. Shut down the host using the `shutdown -i6 -g0 -y` command. This will reboot the host and reconfigure it to find disks.
6. After the host restarts, issue the `devfsadm` command to scan for disks.
7. After the `devfsadm` command completes, enter `vpathmkdev` to create vpaths for the new disks.
8. Enter `format` and browse the returned list for your vpaths.
9. The devices are now accessible from `/dev/dsk/vpath#`.

Configuring LUNs for use with VERITAS DMP

If you are using the VERITAS Volume Manager with the Dynamic Multi-Pathing (DMP) for multipathing support, you must use these instructions to configure the LUNs.

The following instructions are based on the SunOS 5.8 Generic_108528–16 version. Use a bash shell as root to correctly configure your path.

You can use the following steps for all HBAs that are used with the VERITAS Volume Manager with DMP:

1. Reboot the host using the `reboot -- -r` option to reconfigure for new hardware.
2. When the host restarts, use the `format` command to check for disks.
   a. If you see disks, proceed to the next step.
   b. If you do not see disks, verify the configuration of your HBAs and clustering configuration and try again.

   Note: You may see a “mode sense error” listed for each disk when running format for the first time. This is normal, and will not occur once the disks have been labeled.
3. Label each device by using the Solaris `format` command.
4. Use the `vxdiskadm` utility to initialize the disks, using the following steps:
   a. Start the `vxdiskadm` utility.
   b. From the menu, select **21 (Get the newly connected/zoned disks in VxVM view)**.
   c. Press `c` to continue and then press Enter. Wait for the command to complete.
   d. From the menu, select **1 (Add or initialize one or more disks)** and initialize each disk.
5. Run the `vxdisk list` command to see the devices. You can now use the devices to create VERITAS Volume Manager devices when added to a volume group.

Multipath support for Solaris

You must install a multipathing software on all Sun Solaris hosts that are attached to the SAN Volume Controller.

Multipathing support is available for Sun Solaris using either of the following software:

- IBM TotalStorage Multipath Subsystem Device Driver (SDD)
- VERITAS Volume Manager

IBM TotalStorage Multipath Subsystem Device Driver (SDD) dynamic pathing on Solaris

Solaris supports dynamic pathing when you add paths to an existing VDisk or when a new VDisk is mapped to a host.

VERITAS Volume Manager with dynamic pathing on Solaris

Ensure that you are familiar with using VERITAS Volume Manager with the Dynamic Multi-Pathing (DMP) feature on Solaris.

VERITAS Volume Manager with DMP automatically selects the next available I/O path for I/O requests dynamically without action from the administrator. The Volume

Manager with DMP is also informed of when you repair or restore a connection and when you add or remove devices after the system has been fully booted (provided that the operating system recognizes the devices correctly). The JNI drivers support the mapping of new VDisks without rebooting the Solaris host.

VERITAS Volume Manager with DMP *does not* support preferred pathing with SAN Volume Controller. VERITAS Volume Manager with DMP does support load balancing across multiple paths with SAN Volume Controller.

Coexistence of SDD and VERITAS Volume Manager with DMP on Solaris

VERITAS Volume Manager with DMP will coexist in “pass-thru” mode with the IBM TotalStorage Multipath Subsystem Device Driver (SDD). This means that DMP uses the vpath devices provided by SDD.

Clustering support for Solaris hosts

The SAN Volume Controller provides clustering support for Solaris hosts.

Clustering support can be provided for Solaris hosts with the following cluster software:

- VERITAS Cluster Server

See the following IBM Web site for details and current information about supported software levels:

http://www.ibm.com/servers/storage/software/virtualization/svc

Restriction: When you use clustering software on Solaris, you must use the VERITAS Volume Manager with DMP for multipathing support with the SAN Volume Controller. The IBM TotalStorage Multipath Subsystem Device Driver (SDD) is not supported when using Solaris clustering.

SAN boot support for Solaris operating system

SAN boot for the Solaris operating system is supported by the SAN Volume Controller.

SAN boot is supported by Solaris 9 running VERITAS Volume Manager with DMP.

SAN boot is *not* supported when IBM TotalStorage Multipath Subsystem Device Driver (SDD) is used as the multipathing software.

Note: See the software restrictions page on the following IBM support Web site for any known restrictions for SAN boot support:

http://www-1.ibm.com/servers/storage/support/virtual/2145.html

Configuring for SAN boot

To use the SAN boot feature with a Solaris host that is using the SAN Volume Controller, the boot disk must be encapsulated by the VERITAS Volume Manager. (Encapsulation is the method for placing the boot disk under Volume Manager’s management.)

You must have your VERITAS Volume Manager administrator‘s guide to complete the following steps.

Use these high-level steps to ensure that your boot disk is encapsulated by the Volume Manager:

1. Configure the host bus adapter (HBA) for static port binding.
2. Configure the VDisk that is to be used as your SAN boot disk and then map the VDisk to the host.
3. Configure the LUNs for use with VERITAS Volume Manager with DMP
4. Mirror the boot volume onto the discovered LUNs using the instructions in the VERITAS Volume Manager administrator's guide.
5. Configure your HBA for SAN boot.

Configuring a JNI HBA for SAN boot:

To take advantage of the SAN boot feature with a JNI HBA, you must appropriately configure the HBA.

Before you configure the JNI HBA, ensure that you have already done the following:

- Configured the HBA for static port binding.
- Configured and mapped the VDisk that serves as the SAN boot disk.
- Configured the LUNs for use with VERITAS Volume Manager with DMP.
- Mirrored the boot volume onto the discovered LUNs.
- Installed the correct level of FCode on your HBA. To find the correct level, see the supported hardware list at the following Web site:

  http://www.ibm.com/servers/storage/software/virtualization/svc

To configure the JNI HBA for SAN boot, use the following steps:

1. Change to the OpenBoot prompt. For example, you might type in a command similar to the following:

   ```
   shutdown -i0 -g0 -y
   ```

2. At the OK prompt, type `setenv auto-boot? false`. This command specifies that the system will not reboot after a power failure or after using the reset command.
3. Type `setenv use-nvramrc? true` to enable script interpretation.
4. Type `reset-all` to clear the system's registers.
5. Type `devalias` to identify the device aliases and the associated paths of devices that are connected to the system. Note the device alias of the HBA, which presents your SAN boot volume.
6. Select the HBA device by typing " */devicestring*" `select-dev`, where */devicestring* is the device alias string that you wrote down. The following command is an example:

   ```
   " /pci@1f,2000/JNI,FCR@1" select-dev
   ```

   Note: There is a space between the opening quotation mark and the forward slash.
7. Type `set-pconfig`.
8. Type `set-speed`.
9. Run `probe-scsi-all` and note the WWPN associated with the boot volume.
10. Type `set-bootp-wwn` and enter the WWPN found in step 9.
11. Type `set-nvp-valid` and type `FF` as the offset when prompted
12. Type `reset-all`.
13. Type `boot vx-`*`disk`* `–rv`, where *disk* is the name of your boot disk.

Configuring an Emulex HBA for SAN boot:

To take advantage of the SAN boot feature with an Emulex host bus adapter (HBA), you must appropriately configure the HBA.

Before you configure the Emulex HBA, ensure that you have already done the following:

- Configured the HBA for static port binding.
- Configured and mapped the VDisk that serves as the SAN boot disk.
- Configured the LUNs for use with VERITAS Volume Manager with DMP.
- Mirrored the boot volume onto the discovered LUNs.
- Installed the correct level of FCode on your HBA. To find the correct level, see the supported hardware list at the following Web site:

  http://www.ibm.com/servers/storage/software/virtualization/svc

To configure the Emulex HBA for SAN boot, use the following steps:

1. Start the lputil utility (/usr/sbin/lpfc/lputil).
2. At the main menu, enter `3` (Firmware Maintenance).
3. At the firmware maintenance menu, enter `6` (Boot BIOS Maintenance). If the boot code is currently disabled, press `1` to enable it.
4. Change to the OpenBoot prompt. For example, you might type in a command similar to the following:

   ```
   shutdown -i0 -g0 -y
   ```

   Note: An `ok` displays for the prompt when you are at the OpenBoot prompt.
5. Type `setenv auto-boot? false`. This command specifies that the system will not reboot after a power failure or after using the reset command.
6. Type `setenv use-nvramrc? true` to enable script interpretation.
7. Type `reset-all` to clear the system's registers.
8. Type `devalias` to identify the device aliases and the associated paths of devices that are connected to the system. Note the device alias of the HBA, which presents your SAN boot volume.
9. Select the HBA device by typing `" /devicestring" select-dev`, where */devicestring* is the device alias string that you wrote down. The following command is an example:

   ```
   " /pci@1f,2000/lpfc@1" select-dev
   ```

   Note: There is a space between the opening quotation mark and the forward slash.
10. Type `set-default-mode` to reset the HBA parameters.
11. Type `set-ptp` to set the HBA to point mode.
12. Run `probe-scsi-all`. Note the WWPN associated with the boot volume, along with its LUN and target IDs. You will use this information for the next step.
13. Type `WWPN yourwwpn lun targetid`, where *yourwwpn* is the WWPN associated with the boot volume, *lun* is the associated LUN, and *targetid* is the associated target ID. The following command is an example:

    ```
    WWPN 5005076803041234 0 3
    ```
14. Type `reset-all`.
15. Type `boot vx-disk –rv`, where *disk* is the name of your boot disk.

Configuring an QLogic HBA for SAN boot:

To take advantage of the SAN boot feature with an QLogic host bus adapter (HBA), you must appropriately configure the HBA.

Before you configure the QLogic HBA, ensure that you have already done the following:

- Configured the HBA for static port binding.
- Configured and mapped the VDisk that serves as the SAN boot disk.
- Configured the LUNs for use with VERITAS Volume Manager with DMP.
- Mirrored the boot volume onto the discovered LUNs.
- Installed the correct level of FCode on your HBA. To find the correct level, see the supported hardware list at the following Web site:

  http://www.ibm.com/servers/storage/software/virtualization/svc

To configure the QLogic HBA for SAN boot, use the following steps:

1. Change to the OpenBoot prompt. For example, you might type in a command similar to the following:

   ```
   shutdown -i0 -g0 -y
   ```

   Note: An `ok` displays for the prompt when you are at the OpenBoot prompt.
2. Type `setenv auto-boot? false`. This command specifies that the system will not reboot after a power failure or after using the reset command.
3. Type `setenv use-nvramrc? true` to enable script interpretation.
4. Type `reset-all` to clear the system's registers.
5. Type `show-devs` to identify the device aliases and the associated paths of devices that are connected to the system. Write down the device alias of the first QLogic HBA.
6. Select the HBA device by typing `" /devicestring" select-dev`, where */devicestring* is the device alias string that you wrote down. The following command is an example:

   ```
   " /pci@1f,0/pci@1/QLGC,qla@4" select-dev
   ```

   Note: There is a space between the opening quotation mark and the forward slash.
7. Type `show-children` and write down the WWPN, loop ID and LUN of the boot device.
8. Type `WWPN yourwwpn loopid lun set-boot-id`, where *yourwwpn* is the WWPN associated with the boot volume, *loopid* is the associated loop ID, and *lun* is the associated LUN. The following command is an example:

   ```
   5005076812345678 80 0 set-boot-id
   ```
9. Type `reset-all`.
10. Type `boot vx-disk –rv`, where *disk* is the name of your boot disk.

Chapter 6. Attaching to a Microsoft Windows 2000 or 2003 host

This information explains the requirements and other information for attaching the SAN Volume Controller to a Windows 2000 or 2003 host.

Attachment requirements for Windows 2000 and 2003 hosts

This section provides an overview of the requirements for attaching the SAN Volume Controller to a Windows 2000 or 2003 host.

The requirements for attaching the SAN Volume Controller to your Windows 2000 or 2003 host system are as follows:

- Check the LUN limitations for your host system. Ensure that there are enough fibre-channel adapters installed in the server to handle the total LUNs that you want to attach.
- Ensure that you have the documentation for your Windows host system and the *IBM TotalStorage SAN Volume Controller: Installation Guide*.
- Ensure that you have installed the correct operating system levels on your host. Be sure to review the device driver installation documents and configuration utility documents for any additional patches that you might need.

Supported operating systems for Windows 2000 and 2003 hosts

Ensure that each Windows host uses a supported operating system and version.

The SAN Volume Controller supports Windows 2000 and 2003 hosts that run the operating systems listed in Table 7.

Table 7. Supported operating systems for Windows 2000 and 2003 hosts

Operating systems	Level
Windows 2000 (32-bit only)	Windows 2000 Server
	Windows 2000 Advanced Server
Windows 2003 (32-bit only)	Windows 2003 Server, Standard Edition
	Windows 2003 Server, Enterprise Edition

Note: See the supported software levels at the following IBM Web site for the most up-to-date information about supported host operating systems:

http://www.ibm.com/servers/storage/software/virtualization/svc

Supported host bus adapters for Windows 2000 and 2003 hosts

Ensure that your Windows 2000 and 2003 hosts use the correct host bus adapters.

The SAN Volume Controller supports Windows 2000 and 2003 hosts that use the following types of host bus adapters:

- Netfinity DS4000 (FAStT)
- QLogic (on IBM xSeries platforms)
- Emulex (on IBM xSeries platforms)
- HS20 and HS40 (on IBM BladeCenter platforms)

To see the specific host bus adapter and platform levels, see the supported hardware list at the following IBM Web site:

http://www.ibm.com/servers/storage/software/virtualization/svc

Supported drivers and firmware for Windows 2000 and 2003 hosts

Be sure that you use the correct host bus adapter device driver and firmware levels for your Windows 2000 and 2003 hosts.

See the supported hardware list at the following IBM Web site for the most current information about supported device driver and firmware levels:

http://www.ibm.com/servers/storage/software/virtualization/svc

Installing the host bus adapter on a Windows 2000 or 2003 host

The first step for attaching the Windows 2000 or 2003 host is to install the host bus adapter (HBA).

Before you install the HBA, ensure that the adapter is supported by the SAN Volume Controller. See the supported hardware list at the following IBM Web site if you need to verify that the HBA is supported:

http://www.ibm.com/servers/storage/software/virtualization/svc

To install the HBA, use the following general steps:

1. Shutdown your Windows 2000 or 2003 host and its attached peripherals, following the manufacturer's recommendations.
2. Install the HBA, using the manufacturer's installation instructions.

Installing the HBA driver for Windows 2000 or 2003 hosts

After you install the host bus adapter (HBA) into the host machine, you must download and install the appropriate HBA driver.

Installing a Netfinity DS4000 HBA driver

If your Windows 2000 or 2003 host contains a Netfinity DS4000 (FAStT) host bus adapter (HBA), you must install the appropriate driver for the adapter.

Installing the HBA driver for a Netfinity DS4000 HBA

To install the HBA driver for the Netfinity® DS4000 (FAStT) HBA, follow these instructions.

Before you begin this task, you must have installed the Netfinity DS4000 HBA.

To install the driver, use the following steps:

1. Download the appropriate HBA driver and associated files using the following steps:
   a. Open the supported hardware list on the following Web site:
      http://www.ibm.com/servers/storage/software/virtualization/svc
   b. On the supported hardware list, find the specific operating system and then find the section for the Netfinity DS4000 HBA that is installed on your host

machine. The current version of the HBA driver and the associated firmware version are provided on the hardware list.

c. Ensure that your Netfinity DS4000 HBA is running the correct firmware version. If you need to update the firmware to the version listed on the hardware list, click on the link for the firmware version to download and install the correct version.

d. Click the appropriate link in the **HBA Driver** column.

e. Download the driver file for the device driver to a local disk.

f. If you downloaded the device driver file to a system other than your Windows host system, transfer the device driver file to the Windows host system.

g. Unzip the downloaded file.

2. Install the HBA device driver using the instructions contained in the downloaded zip file.
3. Reboot your host system.

Installing a QLogic HBA driver

If your Windows 2000 or Windows 2003 host contains a QLogic host bus adapter (HBA), you must download and install the appropriate QLogic device driver for the adapter.

1. Download the appropriate QLogic device driver and associated files using the following steps:
   a. Go to the supported hardware list on the following Web site and find the specific operating system and then the QLogic HBA that is installed on your host machine.

      http://www.ibm.com/servers/storage/software/virtualization/svc

      The specific versions of the QLogic device driver and the associated firmware version are indicated on the hardware list.

   b. Ensure that your QLogic HBA is running the correct firmware version. If you need to update the firmware to the version listed on the hardware list, click on the link for the firmware version to download and install the correct version.

   c. Click the link in the **HBA Driver** column.

   d. Download the driver file for the driver to a local disk.

   e. If you downloaded the driver file to a system other than your Windows host system, transfer the drive file to the Windows host system.

   f. Unzip the downloaded file.
2. Install the QLogic HBA driver using the instructions contained in the downloaded zip file.
3. Reboot your host system.

Installing an Emulex HBA driver

If your Windows 2000 or Windows 2003 host contains a Emulex host bus adapter (HBA), you must download and install the appropriate Emulex driver for the adapter.

1. Download the appropriate Emulex driver and associated files using the following steps:
   a. Go to the supported hardware list on the following Web site and find the specific operating system and then the Emulex HBA that is installed on your host machine.

      http://www.ibm.com/servers/storage/software/virtualization/svc

The specific versions of the Emulex driver and the associated firmware version are indicated on the hardware list.

b. Ensure that your Emulex HBA is running the correct firmware version. If you need to update the firmware to the version listed on the hardware list, click on the link for the firmware version to download and install the correct version.

c. Click the link in the **HBA Driver** column. Your browser is redirected to the Emulex Web site where you can download the necessary driver files.

d. On the Emulex Web site, find the section for the appropriate Emulex HBA and driver. Download the zip file for the driver to a local disk.

e. If you downloaded the driver zip file to a system other than your Windows host system, transfer the drive file to your Windows host system.

f. Unzip the downloaded file.

2. Install the Emulex HBA driver using the installation instructions available from the Emulex Web site.
3. Install the Emulex HBAnyware and any other configuration utilities using the instructions on the Emulex Web site.
4. Reboot your host system.

Configuring the HBA on the Windows 2000 or 2003 host

After you install the host bus adapter (HBA) and driver on your Windows 2000 or 2003 host, you must configure the HBA.

Configuring the Netfinity DS4000 or QLogic HBA for Windows 2000 and 2003 hosts

After you have installed the Netfinity DS4000 or QLogic host bus adapter (HBA) and the device driver, you must configure the HBA.

To configure the Netfinity DS4000 or QLogic HBA for Windows 2000 and Windows 2003, use the following steps:

1. Reboot the server.
2. When you see the QLogic banner, press Ctrl+Q to get to the FAST!UTIL menu panel.
3. From the Select Host Adapter menu select the Adapter Type QLA23xx.
4. From the Fast!UTIL Options menu select **Configuration Settings**.
5. From the Configuration Settings menu, click **Host Adapter Settings**.
6. From the Host Adapter Settings menu, set the parameters and values as follows:
   a. Host Adapter BIOS: **Disabled**
   b. Frame size: **2048**
   c. Loop Reset Delay: **5 (minimum)**
   d. Adapter Hard Loop ID: **Disabled**
   e. Hard Loop ID: **0**
   f. Spinup Delay: **Disabled**
   g. Connection Options: **1 - point to point only**
   h. Fibre Channel Tape Support: **Disabled**
   i. Data Rate: **2**
7. Press Esc to return to the Configuration Settings menu.

8. From the Configuration Settings menu, select **Advanced Adapter Settings**.
9. From the Advanced Adapter Settings menu, set the following parameters:
   a. Execution throttle: **100**
   b. Luns per Target: **0**
   c. Enable LIP Reset: **No**
   d. Enable LIP Full Login: **Yes**
   e. Enable Target Reset: **Yes**
   f. Login Retry Count: **30**
   g. Port Down Retry Count: **30**
   h. Link Down Timeout: **0**
   i. Extended error logging: **Disabled (might be enabled for debugging)**
   j. RIO Operation Mode: **0**
   k. Interrupt Delay Timer: **0**
10. Press Esc to return to the Configuration Settings menu.
11. Press Esc.
12. From the Configuration settings modified window select **Save changes**.
13. From the Fast!UTIL Options menu, select **Select Host Adapter** and repeat steps 3 on page 42 to 12, if more than one QLogic adapter has been installed.
14. Restart the server.

Configuring the Emulex HBA for Windows 2000 and 2003 hosts

After you have installed the Emulex host bus adapter (HBA) and the driver, you must configure the HBA.

The recommended settings for configuring the Emulex HBA drivers are provided on Table 8.

Note: For the most current information about the HBA parameter settings that are supported by IBM, see the following IBM support Web site:

http://www-1.ibm.com/servers/storage/support/virtual/2145.html

Table 8. Recommended configuration file parameters for the Emulex HBA

Parameters	Recommended Settings
Automatically map SCSI devices	Checked (Enabled)
Query name server for all N-ports	Checked (Enabled)
Allow multiple paths to SCSI targets	Checked (Enabled)
Point-to-point	• Checked for fabric attach • Arbitrated loop for direct attach
Register for state change	Checked (enabled)
Use report LUNs	Checked (enabled)
Use name server after RSCN	Checked (enabled)
LUN mapping	Checked (enabled)
Automatic LUN mapping	Checked (enabled)
Scan in device ID order	Not checked (disabled)
Enable class 2 for SCSI devices	Not checked (disabled)

Table 8. Recommended configuration file parameters for the Emulex HBA (continued)

Parameters	Recommended Settings
Report unknown SCSI devices	Not checked (disabled)
Look for disappearing devices	Not checked (disabled)
Translate queue full to busy	Checked (enabled)
Use bus reset status for retries	Not checked (disabled)
Retry unit attention	Not checked (disabled)
Retry PLOGI open failures	Not checked (disabled)
Maximum number of LUNs	Equal to or greater than the number of the SAN Volume Controller LUNs available to the host bus adapter
Maximum queue depth	8
Link Timer	30 seconds
Retries	64
E_D_TOV	2000 milliseconds
AL_TOV	15 milliseconds
Wait ready time	45 seconds
Retry timer	2000 milliseconds
R_A_TOV	2 seconds
ARB_TOV	1000 milliseconds
Link Control	
Topology	Point-to-point (fabric)
Link speed	Auto

Configuring the Windows 2000 and 2003 host system

You must configure the Windows 2000 or 2003 operating system before you can use the Windows hosts with the SAN Volume Controller.

Before you configure the host operating systems, the following tasks must be completed:

- IBM Systems Services Representative (SSR) must have installed the SAN Volume Controller.
- You must have installed the appropriate host bus adapter and driver on your host system.

After the prerequisite tasks are complete, use the following general steps to configure your Windows 2000 or 2003 host system.

1. Zone the host system to the SAN Volume Controller on the fibre-channel SAN.
2. Install the appropriate multipathing driver for your host system to enable the management of multiple paths to SAN Volume Controller virtual disks (VDisks).
3. Create the host system on the SAN Volume Controller, using the worldwide port names (WWPNs). Map the VDisks to the host as required.
4. Create volumes/disks on your host using instructions in your host system publications.

Related tasks

"Locating the WWPN for a Windows 2000 or 2003 host" on page 66
You can locate the WWPN for a Windows 2000 or 2003 host with a QLogic host bus adapter (HBA) by using the Subsystem Device Driver Management tool.

Multipath support for Windows 2000 and 2003

You must install a multipathing software on all attached Windows 2000 and Windows 2003 SAN Volume Controller hosts.

For Windows 2000 hosts, you must use the following driver for multipathing support:

- IBM TotalStorage Multipath Subsystem Device Driver (SDD)

On Windows 2003 hosts, you can use either of the following drivers for multipathing support:

- IBM TotalStorage Multipath Subsystem Device Driver (SDD)
- Microsoft Multipath I/O (MPIO) driver, when used with the IBM Subsystem Device Driver Device Specific Module (SDDDSM).

SDD dynamic pathing on Windows 2000 and 2003

The IBM TotalStorage Multipath Subsystem Device Driver (SDD) for Windows supports dynamic pathing for both Windows 2000 and Windows 2003 hosts.

SDD supports dynamic pathing when you add more paths to an existing VDisk and when you present a new VDisk to the host. No user intervention is required, other than is normal for a new device discovery under Windows.

Preferred paths are also supported with SDD for Windows. When you use clustering, SDD is aware of the preferred paths that the SAN Volume Controller sets for each VDisk. In this case, SDD uses its reserve policy to reserve a single path to the device and uses a preferred path if one is available. If you do not use clustering, SDD uses a load-balancing policy and tries to equalize the load across all preferred paths. If preferred paths are available, SDD uses the path that has the least I/O at the time. If SDD finds no available preferred paths, it tries to balance the load across all the paths it does find and uses the least active non-preferred path.

Note: The SDD driver can coexist on a Windows 2000 host with the IBM DS4000 (FAStT) Redundant Dual Active Controller (RDAC) driver. Coexistence is not supported on Windows 2003 hosts. For supported levels of DS4000 RDAC, see the supported hardware list at the following IBM Web site:

http://www.ibm.com/servers/storage/software/virtualization/svc

When you configure, keep in mind the SDD for Windows maximum configuration, which is provided on Table 9.

Table 9. Configuration maximums for SDD for Windows

Object	SDD maximum	Description
VDisk	512 (See Note 1.)	The maximum number of VDisks that can be supported by the SAN Volume Controller for a Microsoft Windows host (per host object).
Paths per VDisk (See Note 2.)	4	The maximum number of paths to each VDisk.

Table 9. Configuration maximums for SDD for Windows (continued)

Object	SDD maximum	Description
Notes: 1. You can assign a maximum of 26 individual drive letters to a Windows host. However, both Windows 2000 and Windows 2003 support submounting drives as directories within other drives. 2. SDD for Windows supports 16 paths per VDisk, but SAN Volume Controller supports only a maximum of 4 paths to ensure a reasonable path-failover time.		

MPIO dynamic pathing

You can use the Microsoft Multipath I/O (MPIO) driver for dynamic pathing when you also use the IBM Subsystem Device Driver Device Specific Module (SDDDSM).

MPIO supports dynamic pathing when you add more paths to an existing VDisk and when you present a new VDisk to the host. No user intervention is required, other than is normal for a new device discovery under Windows.

Preferred path support is available through SDDDSM. When you use clustering, SDDDSM is aware of the preferred paths that the SAN Volume Controller sets for each VDisk. In this case, SDDDSM uses its reserve policy to reserve a single path to the device and uses a preferred path if one is available. If you do not use clustering, SDDDSM uses a load-balancing policy that tries to equalize the load across all preferred paths. If preferred paths are available, SDDDSM uses the path that has the least I/O at the time. If SDDDSM finds no available preferred paths, it tries to balance the load across all the paths it does find and uses the least active non-preferred path.

Path probing and reclamation is provided by MPIO/SDDDSM. For SDDDSM, the interval is set to 60 seconds. You can change this by modifying the following Windows system registry key:
HKLM\SYSTEM\CurrentControlSet\Services\mpio\Parameters\PathVerificationPeriod

When you configure, keep in mind the MPIO/SDDDSM for Windows maximum configuration, which is provided in Table 10.

Table 10. Configuration maximums for MPIO/SDDDSM for Windows

Object	MPIO/SDDDSM maximum	Description
VDisk	512 (See Note 1.)	The maximum number of VDisks that can be supported by the SAN Volume Controller for a Microsoft Windows host (per host object).
Paths per VDisk (See Note 2.)	4	The maximum number of paths to each VDisk.
Notes: 1. You can assign a maximum of 26 individual drive letters to a Windows host. However, both Windows 2000 and Windows 2003 support submounting drives as directories within other drives. 2. MPIO/SDDDSM for Windows actually supports 16 paths per VDisk, but the SAN Volume Controller supports only a maximum of four paths to ensure a reasonable path-failover time.		

Clustering support for Windows 2000 and 2003

The SAN Volume Controller provides clustering support for Windows 2000 and 2003 hosts.

Table 11 provides information about the cluster software supported for Windows 2000 and 2003 hosts.

Table 11. Clustering software supported for Windows 2000 and 2003 hosts

Operating system	Cluster software	Vendor
Windows 2000	Microsoft Cluster Server (MSCS)	Microsoft
Windows 2003	Microsoft Cluster Server (MSCS)	Microsoft
	Microsoft Cluster Server (MSCS), with IBM TotalStorage Geographically Dispersed Sites Clustering Service (See Note 1.)	Microsoft and IBM
Notes: 1. When you use MSCS with the IBM Geographically Dispersed Sites Clustering Service, Windows 2003 hosts can support IBM TotalStorage Metro Mirror for SAN Volume Controller.		

SAN boot support for Windows 2000 and 2003

The SAN Volume Controller can be used as a boot device for Windows 2000 and 2003 hosts.

For SAN boot support for Windows 2000 hosts, you must use one of the hardware and software configurations shown on Table 12.

Table 12. Supported configurations for Windows 2000 SAN boot support

Option 1	Option 2
• IBM TotalStorage Multipath Subsystem Device Driver (SDD) • Emulex host bus adapter (HBA) • Emulex FC Port driver	• IBM TotalStorage Multipath Subsystem Device Driver (SDD) • QLogic HBA • QLogic SCSI Miniport driver

For SAN boot support for Windows 2003 hosts, you must use one of the hardware and software configurations shown on Table 13.

Table 13. Supported configurations for Windows 2003 SAN boot support

Option 1	Option 2	Option 3
• IBM TotalStorage Multipath Subsystem Device Driver (SDD) • Emulex HBA • Emulex FC Port driver	• IBM TotalStorage Multipath Subsystem Device Driver (SDD) • QLogic HBA • QLogic SCSI Miniport driver	• Windows Multipath I/O driver with SDDDSM • QLogic 23*xx* HBA • QLogic STOR Miniport driver

Restrictions:

- SDDDSM is not supported for Windows 2000 hosts.
- See the supported hardware list at the following IBM Web site to ensure that you download and use the appropriate drivers for the SAN Volume Controller:

  http://www.ibm.com/servers/storage/software/virtualization/svc
- See the software restrictions page on the following IBM support Web site for the most current information about known restrictions for SAN boot support:

  http://www-1.ibm.com/servers/storage/support/virtual/2145.html

Configuring for SAN boot for Windows 2000 and 2003

If you want to use the SAN Volume Controller as a boot device for Windows 2000 and 2003 hosts, you must configure the system correctly.

Use the following steps to configure the system:

1. Configure the SAN Volume Controller so that only the boot virtual disk (VDisk) is mapped to the host.
2. Configure the fibre-channel SAN so that the host can see only one SAN Volume Controller node port. This means that there is only one path from the host to its boot disk.
3. Install Windows, using the normal procedure, selecting the VDisk as the partition on which to install.
4. After Windows and SDD or SDDDSM is installed, zoning should be modified to allow multiple paths.

   Restriction: For SDD, there can be no multipathing during the boot sequence, until after SDD is loaded.
5. Set redundant boot devices in the BIOS to allow the host to boot when its original boot path has failed.

Windows 2000 known problems and issues

This information provides information about known problems and issues when attaching to a Windows 2000 host.

After creating two VDisks using the command line interface, you enter these commands to assign your VDisks to a host:

1. `svctask mkdiskhostmap -host host1 VDISK1`
2. `svctask mkdiskhostmap -host host1 VDISK2`
3. `svctask mkdiskhostmap -host host2 VDISK2`
4. `svctask mkdiskhostmap -host host2 VDISK1`

In this example, host2 will assign VDISK2 to SCSI LUN 0 by default because it will be the first assigned disk. There will be a conflict because host1 has VDISK2 assigned to SCSI LUN 1.

To avoid this problem, issue the commands as follows:

1. `svctask mkdiskhostmap -host host1 -scsi 0 VDISK1`
2. `svctask mkdiskhostmap -host host1 -scsi 1 VDISK2`
3. `svctask mkdiskhostmap -host host2 -scsi 0 VDISK1`
4. `svctask mkdiskhostmap -host host2 -scsi 1 VDISK2`

Note: You can also see the software restrictions page on the following IBM support Web site for the most current information about known restrictions:

http://www-1.ibm.com/servers/storage/support/virtual/2145.html

Chapter 7. Attaching to a Microsoft Windows NT host

These are requirements for attaching the SAN Volume Controller to a Windows NT® host.

Attachment requirements for Windows NT hosts

This section provides an overview of the requirements for attaching the SAN Volume Controller to a Windows NT host.

The requirements for attaching the SAN Volume Controller to your Windows NT host system are as follows:

- Check the LUN limitations for your host system. Ensure that there are enough fibre-channel adapters installed in the server to handle the total LUNs that you want to attach.
- Ensure that you have the documentation for your Windows NT host system and the *IBM TotalStorage SAN Volume Controller: Installation Guide*.
- Ensure that you have installed the correct operating system levels on your host. Be sure to review the device driver installation documents and configuration utility documents for any additional patches that you might need.

Supported operating systems for Windows NT hosts

Ensure that each Windows NT host uses a supported operating system and version.

The SAN Volume Controller supports Windows NT hosts that run the operating systems listed on Table 14.

Table 14. Supported operating systems for Windows NT hosts

Operating systems	Level
Windows NT	Windows NT4 Server

Note: See the supported software levels at the following IBM Web site for the most up-to-date information about supported host operating systems:

http://www.ibm.com/servers/storage/software/virtualization/svc

Supported host bus adapters for Windows NT hosts

Ensure that your Windows NT hosts use the correct host bus adapters.

The SAN Volume Controller supports Windows NT hosts that use the following type of host bus adapters:

- Netfinity DS4000 (FAStT)
- QLogic (on IBM xSeries platforms)

To see the specific host bus adapter and platform levels, see the supported hardware list at the following IBM Web site:

http://www.ibm.com/servers/storage/software/virtualization/svc

Supported drivers and firmware for Windows NT hosts

Be sure that you use the correct host bus adapter device driver and firmware levels for your Windows NT hosts.

See the supported hardware list at the following IBM Web site for the most current information about supported device driver and firmware levels:

http://www.ibm.com/servers/storage/software/virtualization/svc

Installing the host bus adapter on a Windows NT host

The first step for attaching the Windows NT host is to install the host bus adapter (HBA).

Before you install the HBA, ensure that the adapter is supported by the SAN Volume Controller. See the supported hardware list at the following IBM Web site if you need to verify that the HBA is supported:

http://www.ibm.com/servers/storage/software/virtualization/svc

To install the HBA, use the following general steps:

1. Shutdown your Windows NT host and its attached peripherals, following the manufacturer's recommendations.
2. Install the HBA, using the manufacturer's installation instructions.

Installing the HBA driver for Windows NT hosts

After you install the host bus adapter (HBA) into the host machine, you must download and install the appropriate HBA driver.

Installing a Netfinity DS4000 HBA driver

If your Windows NT host contains a Netfinity DS4000 (FAStT) host bus adapter (HBA), you must install the appropriate driver for the adapter.

Before you begin this task, you must have installed the Netfinity DS4000 HBA.

To install the driver, use the following steps:

1. Download the appropriate HBA driver and associated files using the following steps:
   a. Open the supported hardware list on the following Web site:
      http://www.ibm.com/servers/storage/software/virtualization/svc
   b. On the supported hardware list, find the specific operating system and then find the section for the Netfinity DS4000 HBA that is installed on your host machine. The current version of the HBA driver and the associated firmware version are provided on the hardware list.
   c. Ensure that your Netfinity DS4000 HBA is running the correct firmware version. If you need to update the firmware to the version listed on the hardware list, click on the link for the firmware version to download and install the correct version.
   d. Click the appropriate link in the **HBA Driver** column.
   e. Download the driver file for the device driver to a local disk.

f. If you downloaded the device driver file to a system other than your Windows host system, transfer the device driver file to the Windows host system.
g. Unzip the downloaded file.

2. Install the HBA device driver using the instructions contained in the downloaded zip file.
3. Reboot your host system.

Installing a QLogic HBA driver

If you use the QLogic HBA on an Windows NT host, you must download and install the appropriate QLogic device driver.

1. Download the appropriate QLogic device driver and associated files using the following steps:
   a. Go to the supported hardware list on the following Web site and find the specific operating system and then the QLogic HBA that is installed on your host machine.

      http://www.ibm.com/servers/storage/software/virtualization/svc

      The specific versions of the QLogic device driver and the associated firmware version are indicated on the hardware list.
   b. Ensure that your QLogic HBA is running the correct firmware version. If you need to update the firmware to the version listed on the hardware list, click on the link for the firmware version to download and install the correct version.
   c. Click the link in the **HBA Driver** column.
   d. Download the driver file for the driver to a local disk.
   e. If you downloaded the driver file to a system other than your Windows host system, transfer the drive file to the Windows NT host system.
   f. Unzip the downloaded file.
2. Install the QLogic HBA driver using the instructions contained in the downloaded zip file.
3. Reboot your host system.

Configuring the Netfinity DS4000 or QLogic HBA for Windows NT hosts

After you have installed the Netfinity DS4000 or QLogic host bus adapter (HBA) and the device driver, you must configure the HBA.

To configure the Netfinity DS4000 or QLogic HBA for Windows NT hosts, use the following steps:

1. Reboot the server.
2. When you see the QLogic banner, press Ctrl+Q to get to the FAST!UTIL menu panel.
3. From the Select Host Adapter menu, select the Adapter Type QLA23*xx*.
4. From the Fast!UTIL Options menu, select **Configuration Settings**.
5. From the Configuration Settings menu, click **Host Adapter Settings**.
6. From the Host Adapter Settings menu, set the parameters and values as follows:
   a. Host Adapter BIOS: **Disabled**
   b. Frame size: **2048**

c. Loop Reset Delay: **5 (minimum)**
d. Adapter Hard Loop ID: **Disabled**
e. Hard Loop ID: **0**
f. Spinup Delay: **Disabled**
g. Connection Options: **1 - point to point only**
h. Fibre Channel Tape Support: **Disabled**
i. Data Rate: **2**

7. Press Esc to return to the Configuration Settings menu.
8. From the Configuration Settings menu, select **Advanced Adapter Settings**.
9. From the Advanced Adapter Settings menu, set the following parameters:
   a. Execution throttle: **100**
   b. Luns per Target: **0**
   c. Enable LIP Reset: **No**
   d. Enable LIP Full Login: **Yes**
   e. Enable Target Reset: **Yes**
   f. Login Retry Count: **30**
   g. Port Down Retry Count: **30**
   h. Link Down Timeout: **0**
   i. Extended error logging: **Disabled (might be enabled for debugging)**
   j. RIO Operation Mode: **0**
   k. Interrupt Delay Timer: **0**
10. Press Esc to return to the Configuration Settings menu.
11. Press Esc.
12. From the Configuration settings modified window select **Save changes**.
13. From the Fast!UTIL Options menu, select **Select Host Adapter** and repeat steps 3 on page 53 to 12, if more than one QLogic adapter has been installed.
14. Restart the server.

Configuring the Windows NT host system

You must configure the Windows NT operating system before you can use the Windows NT hosts with the SAN Volume Controller.

Before you configure the host operating systems, the following tasks must be completed:

- IBM Systems Services Representative (SSR) must have installed the SAN Volume Controller.
- You must have installed the appropriate host bus adapters.

After the prerequisite tasks are complete, use the following general steps to configure your Windows NT host system.

1. Zone the host system to the SAN Volume Controller on the fibre-channel SAN.
2. Install the appropriate multipathing driver for your host system to enable the management of multiple paths to SAN Volume Controller virtual disks (VDisks).
3. Create the host system on the SAN Volume Controller, using the worldwide port names (WWPNs). Map the VDisks to the host as required.
4. Create volumes/disks on your host using instructions in your host system publications.

Related tasks

"Locating the WWPN for a Windows NT host" on page 67
You can locate the WWPN for a Windows NT host with a QLogic host bus adapter (HBA) by using the Subsystem Device Driver Management tool.

Multipath support for Windows NT

You must install a multipathing software on all attached Windows NT SAN Volume Controller hosts.

For Windows NT hosts, you must use the following driver for multipathing support:

- IBM TotalStorage Multipath Subsystem Device Driver (SDD)

SDD dynamic pathing on Windows NT

The IBM TotalStorage Multipath Subsystem Device Driver (SDD) for Windows supports dynamic pathing for Windows NT hosts.

SDD supports dynamic pathing when you add more paths to an existing VDisk and when you present a new VDisk to the host. No user intervention is required, other than is normal for a new device discovery under Windows.

Preferred paths are also supported with SDD for Windows. When you use clustering, SDD is aware of the preferred paths that the SAN Volume Controller sets for each VDisk. In this case, SDD uses its reserve policy to reserve a single path to the device and uses a preferred path if one is available. If you do not use clustering, SDD uses its load-balancing policy that tries to equalize the load across all preferred paths. If preferred paths are available, SDD uses the path that has the least I/O at the time. If SDD finds no available preferred paths, it tries to balance the load across all the paths it does find and uses the least active non-preferred path.

When you configure, keep in mind the SDD for Windows maximum configuration, which is provided in Table 15.

Table 15. Configuration maximums for SDD for Windows

Object	SDD maximum	Description
VDisk	512 (See Note 1.)	The maximum number of VDisks that can be supported by the SAN Volume Controller for a Microsoft Windows host (per host object).
Paths per VDisk (See Note 2.)	4	The maximum number of paths to each VDisk.

Notes:

1. You can assign a maximum of 26 individual drive letters to a Windows host.
2. SDD for Windows supports 16 paths per VDisk, but SAN Volume Controller supports only a maximum of four paths to ensure a reasonable path-failover time.

Clustering support for Windows NT

The SAN Volume Controller does not provide clustering support for Windows NT hosts.

SAN boot support for Windows NT

The SAN Volume Controller does not provide SAN boot support for Windows NT hosts

Configuration for availability and recovery

This information provides a quick explanation of the configuration for availability and recovery.

The host adapter uses the time-out parameter to bind its recovery actions and responses to the disk subsystem. The value exists in different places in the system configuration. You can retrieve and use it in different ways depending on the type of host adapter that is installed.

Setting the TimeOutValue registry

The Windows NT HBA uses the time-out parameter to bind its recovery actions and responses to the disk subsystem.

This information provides the steps required for setting the TimeOutValue registry on a Microsoft Windows NT host.

1. From the **Run** menu or command prompt, type:
   `Regedit32.exe`
2. Navigate to the following registry key:
   `HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\Disk`
3. Look for the value called `TimeOutValue`. If the value called `TimeOutValue` does not exist, go to step 3a. If the `TimeOutValue` exists, go to step 4.
   a. Click **Edit → Add Value...**
   b. For ValueName, type: `TimeOutValue`.
   c. For data type, type: `REG-DWORD`.
   d. Click **OK**.
   e. For Value data, type: `3c`.
   f. For Base, click **Hex**.
   g. Click **OK**.
4. If the value exists and is less than 0x0000003c (60 decimal), perform the following steps to increase it to 0x3c.
   a. Click **TimeOutValue**.
   b. Click **Edit → DWORD...**.
   c. For Value data, type: `3c`.
   d. For Base, click **Hex**.
   e. Click **OK**.
5. Exit the Regedit32 program.
6. Restart your Windows NT server for the changes to take effect.

Chapter 8. Attaching to a VMware host

This information explains the requirements and other information for attaching the SAN Volume Controller to a variety of guest host operating systems running VMware.

Attachment requirements for VMware hosts

This section provides an overview of the requirements for attaching the SAN Volume Controller to a VMware host.

- Ensure that there are enough fibre-channel adapters installed in the server to handle the total LUNs that you want to attach.
- Ensure that you have the documentation for VMware, the guest host operating system, and the *IBM TotalStorage SAN Volume Controller: Installation Guide*. The *IBM TotalStorage SAN Volume Controller: Installation Guide* is on the TotalStorage CD that you receive with the SAN Volume Controller.
- Ensure that you have installed the correct operating systems and version levels on your host. Be sure to review the device driver installation documents and configuration utility documents for any additional VMware or guest operating system patches that you might need.

Supported VMware operating systems

Ensure that each VMware host uses a supported level of VMware and a supported guest operating system.

The SAN Volume Controller supports VMware hosts that run the VMware levels and guest operating systems listed in Table 16.

Table 16. Supported operating systems for VMware hosts

Operating system levels	Guest operating systems
VMware ESX Server	Windows 2000 Advanced Server
	Windows 2003 Server, Enterprise Edition
	Novell NetWare

Note: See the supported software levels at the following IBM Web site for the most up-to-date information about supported host operating systems:

http://www.ibm.com/servers/storage/software/virtualization/svc

Supported host bus adapters for VMware hosts

Ensure that your VMware hosts use the correct host bus adapters.

The SAN Volume Controller supports VMware hosts that use the following types of host bus adapters:

- QLogic (on IBM xSeries platforms)
- HS20 and HS40 (on IBM BladeCenter platforms)

To see the specific host bus adapter and platform levels, see the supported hardware list at the following IBM Web site:

http://www.ibm.com/servers/storage/software/virtualization/svc

Supported drivers and firmware for VMware hosts

Be sure that you use the correct host bus adapter device driver and firmware levels for your VMware hosts.

See the supported hardware list at the following IBM Web site for the most current information about supported device driver and firmware levels:

http://www.ibm.com/servers/storage/software/virtualization/svc

Installing the host bus adapter on a VMware host

The first step for attaching the VMware host is to install the host bus adapter (HBA).

Before you install the HBA, ensure that it is supported by the SAN Volume Controller. See the supported hardware list at the following IBM Web site if you need to verify that the HBA is supported:

http://www.ibm.com/servers/storage/software/virtualization/svc

To install the HBA, use the following general steps:

1. Shutdown your VMware host and its attached peripherals, following the manufacturer's recommendations.
2. Install the HBA, using the adapter manufacturer's installation instructions.

Installing the HBA drivers for VMware

Follow the instructions provided by VMware to install the HBA drivers and firmware. Installing these components should be part of the VMware installation and setup process.

Configuring the VMware system

You must configure the VMware operating system and the guest operating system before you can use VMware hosts with the SAN Volume Controller.

Before you configure the host operating systems, the following tasks must be completed:

- IBM Systems Services Representative (SSR) must have installed the SAN Volume Controller.
- You must have installed the appropriate host bus adapters.

After the prerequisite tasks are complete, use the following general steps to configure your VMware host system.

1. Define the host system with the worldwide port name identifiers. You will have to locate the list of worldwide port names.
2. Define the fibre-channel port configuration if it was not done during the installation of the SAN Volume Controller or fibre-channel adapters.
3. Configure the host system for the SAN Volume Controller by using the instructions in your VMware and guest operating system publications.

Multipath support for VMware

You must install a multipathing software on all VMware hosts that are attached to the SAN Volume Controller.

On VMware hosts, the following software provides multipathing support:

- VMware multipathing software

VMware multipathing software dynamic pathing

VMware multipathing software does not support dynamic pathing.

Preferred paths set in SAN Volume Controller are ignored.

VMware multipathing software performs static load balancing for I/O, based upon a host setting that defines the preferred path for a given volume.

Multipathing configuration maximums for VMware

When you configure, keep in mind the maximum configuration for the VMware multipathing software.

Table 17 provides the maximum SCSI devices and paths per virtual disk (VDisk).

Table 17. Configuration maximums for VMware multipathing software

Object	VMware maximum	Description
SCSI devices	256	The maximum number of SCSI devices supported by the VMware software. Note that each path to a VDisk equates to a single SCSI device
Paths per VDisk	4	The maximum number of paths to each VDisk.

Clustering support for VMware

The SAN Volume Controller does not provide clustering support on VMware guest operating systems.

SAN boot support for VMware

The SAN Volume Controller can be used as a boot device for the VMware guest operating system.

For SAN boot support for VMware hosts, you must meet the following requirement:

- The guest operating system must be on a SAN disk.

Note: See the software restrictions page on the following IBM support Web site for any other restrictions for SAN boot support:

http://www-1.ibm.com/servers/storage/support/virtual/2145.html

Chapter 9. Attaching to a Novell NetWare host

This information explains the requirements and other information for attaching the SAN Volume Controller to a Novell NetWare host.

Attachment requirements for NetWare hosts

This section provides an overview of the requirements for attaching the SAN Volume Controller to a Novell NetWare host.

- Ensure that there are enough fibre-channel adapters installed in the server to handle the total LUNs that you want to attach.
- Ensure that you have the documentation for NetWare and the *IBM TotalStorage SAN Volume Controller: Installation Guide*. The *IBM TotalStorage SAN Volume Controller: Installation Guide* is on the TotalStorage CD that you receive with the SAN Volume Controller.
- Ensure that you have installed the correct operating systems and version levels on your host. Be sure to review the device driver installation documents and configuration utility documents for any additional NetWare patches that you might need.

Supported NetWare operating systems

Ensure that each NetWare host uses a supported level of Novell NetWare.

Note: See the supported software levels at the following IBM Web site for the most up-to-date information about supported Novell NetWare operating system levels:

http://www.ibm.com/servers/storage/software/virtualization/svc

Supported host bus adapters for NetWare hosts

Ensure that your Novell NetWare hosts use the correct host bus adapters (HBAs).

The SAN Volume Controller supports NetWare hosts that use the following HBA type:

- QLogic (on IBM xSeries platforms)

To see the specific host bus adapter and platform levels, see the supported hardware list at the following IBM Web site:

http://www.ibm.com/servers/storage/software/virtualization/svc

Supported drivers and firmware for NetWare hosts

Be sure that you use the correct host bus adapter device driver and firmware levels for your Novell NetWare hosts.

See the supported hardware list at the following IBM Web site for the most current information about supported device driver and firmware levels:

http://www.ibm.com/servers/storage/software/virtualization/svc

Installing the host bus adapter on a NetWare host

The first step for attaching the NetWare host is to install the host bus adapter (HBA).

Before you install the HBA, ensure that it is supported by the SAN Volume Controller. See the supported hardware list at the following IBM Web site if you need to verify that the HBA is supported:

http://www.ibm.com/servers/storage/software/virtualization/svc

To install the HBA, use the following general steps:

1. Shutdown your NetWare host and its attached peripherals, following the manufacturer's recommendations.
2. Install the HBA, using the adapter manufacturer's installation instructions.

Installing the HBA driver for NetWare

Follow the instructions provided by NetWare to install the HBA drivers and firmware. Installing these components should be part of the NetWare installation and setup process.

Configuring the NetWare system

You must configure the Novell NetWare operating system before you can use NetWare hosts with the SAN Volume Controller.

Before you configure the host operating systems, the following tasks must be completed:

- IBM Systems Services Representative (SSR) must have installed the SAN Volume Controller.
- You must have installed the appropriate host bus adapters.

After the prerequisite tasks are complete, use the following general steps to configure your NetWare host system.

1. Define the host system with the worldwide port name identifiers. You will have to locate the list of worldwide port names.
2. Define the fibre-port configuration if it was not done during the installation of the SAN Volume Controller or fibre-channel adapters.
3. Configure the host system for the SAN Volume Controller by using the instructions in your NetWare publications.

Multipath support for NetWare

You must install a multipathing software on all NetWare hosts that are attached to the SAN Volume Controller.

On NetWare hosts, the following software provides multipathing support:

- IBM TotalStorage Multipath Subsystem Device Driver (SDD)
- Novell Storage Services (NSS)

Multipathing configuration maximums for NetWare

When you configure, keep in mind the maximum configuration for the IBM TotalStorage Multipath Subsystem Device Driver (SDD) when used with NetWare hosts.

Table 18 provides the maximum virtual disks (VDisks) and paths per VDisk for SDD.

Table 18. Configuration maximums for NetWare hosts using SDD

Object	SDD maximum	Description
VDisk	128	The maximum number of VDisks that can be supported by the SDD (per host object).
Paths per VDisk	4	The maximum number of paths to each VDisk.

Clustering support for NetWare

The SAN Volume Controller supports clustering for NetWare hosts.

Table 19 provides information about the cluster software supported for NetWare hosts.

Table 19. Clustering software supported for NetWare hosts

Operating system	Cluster software	Vendor
NetWare	Novell Cluster Services	Novell

SAN boot support for NetWare

The SAN Volume Controller does not provide SAN boot support for NetWare hosts

Chapter 10. Fibre-channel port name identification

This is an overview of the fibre-channel port name identification for the following host systems:

- Hewlett-Packard 9000
- IBM e(logo)server pSeries or RS/6000
- Linux
- Sun
- Windows 2000 and Windows 2003
- Windows NT

The WWPN consists of 16 hexadecimal characters (0 - 9 and A - F). The SAN Volume Controller uses it to uniquely identify the fibre-channel HBA that is installed in your host system. The SAN Volume Controller automatically finds the WWPN for your host fibre-channel HBA when you attach your host system to the SAN Volume Controller.

Note: If your host uses more than one fibre-channel HBA to connect to your SAN Volume Controller, you must add multiple entries to the host list for this host. You must add one for each fibre-channel HBA. Each HBA will have a unique WWPN.

The format and content of the fibre-channel port identifier are determined by the manufacturer of the link control facility for the applicable fibre-channel port. The identifier is an eight-byte field, which the fibre-channel protocols use to uniquely identify the fibre-channel port.

Locating the WWPN for a Hewlett-Packard host

You can locate the WWPN for a Hewlett-Packard host by following the steps in this topic.

1. Go to the root directory.
2. Type: `ioscan -fn | more`
3. Look under the description for the Fibre Channel Mass Storage adapter.

   For example, look for the device path name /dev/td1 or /dev/fcms1.
4. Type: `fcmsutil` */dev/td1* where */dev/td1* is the path.

Locating the WWPN for an IBM pSeries or an RS/6000 host

You can locate the WWPN for an IBM pSeries or an RS/6000 host by following the steps in this topic.

1. Log in as root.
2. Type `lscfg -vl fcs`*x*, where *x* is the adapter number.

   The network address is the fibre-channel adapter port WWPN value.

   Related tasks

   “Configuring the AIX system” on page 12
   You must configure the AIX operating system before you can use pSeries and RS/6000 hosts with the SAN Volume Controller.

Locating the WWPN for a Linux host

You can locate the WWPN for an Intel server running the Linux operating system with a QLogic adapter by following the steps in this topic.

1. Restart the server.
2. Press Alt+Q to get the **FAST!Util** menu.

   If you have more than one fibre-channel host bus adapter (HBA) installed, all the fibre-channel HBA are displayed. Scroll down to the adapter you want. Press Enter.
3. From the **FAST!Util** menu, scroll down and select **Select Host Adapter**.
4. Scroll up and highlight **Configuration Settings**. Press Enter.
5. From the **Configuration Settings** menu, click **Host Adapter Settings**.
6. Write down the 16-digit alphanumeric string that is displayed.

Related tasks

"Configuring the Linux system" on page 19
You must configure the Linux operating system before you can use Intel-based Linux hosts with the SAN Volume Controller.

Locating the WWPN for a Sun host

You can locate the WWPN for a Sun host by following the steps in this topic.

1. After you install the adapter and you restart the host system, view the /var/adm/messages file.
2. Search for the line that contains the applicable phrase for your host bus adapter (HBA):
   a. For the JNI SBUS HBA, search for `fcaw`*x*`: Fibre Channel WWNN`, where *x* is the adapter number (0, 1, and so on). You can find the WWPN on the same line immediately after the WWNN.
   b. For the JNI PCI HBA, search for `fca-pci`*x*`: Fibre Channel WWNN`, where *x* is the adapter number (0, 1, and so on). You can find the WWPN on the same line following the WWNN.
   c. For the QLogic QLA2200F HBA, search for `qla2200-hba`*x*`-adapter-port-name` where *x* is the adapter number (0, 1, and so on).

Locating the WWPN for a Windows 2000 or 2003 host

You can locate the WWPN for a Windows 2000 or 2003 host with a QLogic host bus adapter (HBA) by using the Subsystem Device Driver Management tool.

1. Open the Subsystem Device Driver Management tool.
2. Type `gethba`. This returns a list of WWPNs for the HBAs configured on the host.
3. Write down the 16-digit alphanumeric string for the HBA that is displayed on your screen.

Related tasks

"Configuring the Windows 2000 and 2003 host system" on page 44
You must configure the Windows 2000 or 2003 operating system before you can use the Windows hosts with the SAN Volume Controller.

Locating the WWPN for a Windows NT host

You can locate the WWPN for a Windows NT host with a QLogic host bus adapter (HBA) by using the Subsystem Device Driver Management tool.

1. Open the Subsystem Device Driver Management tool.
2. Type `gethba`. This returns a list of WWPNs for the HBAs configured on the host.
3. Write down the 16-digit alphanumeric string for the HBA that is displayed on your screen.

Related tasks

"Configuring the Windows NT host system" on page 54
You must configure the Windows NT operating system before you can use the Windows NT hosts with the SAN Volume Controller.

Accessibility

Accessibility features help a user who has a physical disability, such as restricted mobility or limited vision, to use software products successfully.

Features

These are the major accessibility features in the SAN Volume Controller master console:

- You can use screen-reader software and a digital speech synthesizer to hear what is displayed on the screen. The following screen readers have been tested: JAWS v4.5 and IBM Home Page Reader v3.0.
- You can operate all features using the keyboard instead of the mouse.

Navigating by keyboard

You can use keys or key combinations to perform operations and initiate many menu actions that can also be done through mouse actions. You can navigate the SAN Volume Controller Console and help system from the keyboard by using the following key combinations:

- To traverse to the next link, button, or topic, press Tab inside a frame (page).
- To expand or collapse a tree node, press →or ←, respectively.
- To move to the next topic node, press V or Tab.
- To move to the previous topic node, press ^ or Shift+Tab.
- To scroll all the way up or down, press Home or End, respectively.
- To go back, press Alt+←.
- To go forward, press Alt+→.
- To go to the next frame, press Ctrl+Tab.
- To move to the previous frame, press Shift+Ctrl+Tab.
- To print the current page or active frame, press Ctrl+P.
- To select, press Enter.

Accessing the publications

You can view the publications for the SAN Volume Controller in Adobe Portable Document Format (PDF) using the Adobe Acrobat Reader. The PDFs are provided on a CD that is packaged with the product or you can access them at the following Web site:

http://www-1.ibm.com/servers/storage/support/virtual/2145.html

Related reference

“SAN Volume Controller library and related publications” on page xiii
A list of other publications that are related to this product are provided to you for your reference.

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This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may need to perform practical actions.

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此为A级产品，在生活环境中，该产品可能会造成无线电干扰，
在这种情况下，可能需要用户对其干扰采取切实可行的措施。

Federal Communications Commission (FCC) statement

Ensure that you are familiar with the Federal Communications Commission (FCC) statement.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, might cause interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense.

Properly shielded and grounded cables and connectors must be used in order to meet FCC emission limits. Neither the provider nor the manufacturer is responsible for any radio or television interference caused by using other than recommended cables and connectors or by unauthorized changes or modifications to this equipment. Unauthorized changes or modifications could void the user's authority to operate the equipment.

This device complies with Part 15 of FCC Rules. Operation is subject to the following two conditions: (1) this device might not cause harmful interference, and (2) this device must accept any interference received, including interference that might cause undesired operation.

Japanese Voluntary Control Council for Interference (VCCI) statement

Ensure that you are familiar with the Japanese Voluntary Control Council for Interference (VCCI) statement.

This product is a Class A Information Technology Equipment and conforms to the standards set by the Voluntary Control Council for Interference by Information Technology Equipment (VCCI). In a domestic environment, this product might cause radio interference, in which event the user might be required to take adequate measures.

Korean Government Ministry of Communication (MOC) statement

Ensure that you are familiar with the Korean Government Ministry of Communication (MOC) statement.

Please note that this device has been approved for business purposes with regard to electromagnetic interference. If you find that this device is not suitable for your use, you can exchange it for one that is approved for non-business purposes.

New Zealand compliance statement

Ensure that you are familiar with the New Zealand compliance statement.

This is a Class A product. In a domestic environment this product might cause radio interference, in which event the user might be required to take adequate measures.

International Electrotechnical Commission (IEC) statement

This product has been designed and built to comply with (IEC) Standard 950.

Avis de conformité à la réglementation d'Industrie Canada

Ensure that you are familiar with the avis de conformité à la réglementation d'Industrie Canada.

Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

Industry Canada compliance statement

This Class A digital apparatus complies with IECS-003.

United Kingdom telecommunications requirements

This apparatus is manufactured to the International Safety Standard EN60950 and as such is approved in the U.K. under approval number NS/G/1234/J/100003 for indirect connection to public telecommunications systems in the United Kingdom.

European Union (EU) statement

Ensure that you are familiar with the European Union (EU) statement.

This product is in conformity with the protection requirements of EU council directive 89/336/EEC on the approximation of the laws of the Member States relating to electromagnetic compatibility. Neither the provider nor the manufacturer can accept responsibility for any failure to satisfy the protection requirements resulting from a non-recommended modification of the product, including the fitting of option cards not supplied by the manufacturer.

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Ensure that you are familiar with the radio protection for Germany.

Zulassungsbescheinigung laut Gesetz über die elektromagnetische Verträglichkeit von Geräten (EMVG) vom 30, August 1995.

Dieses Gerät ist berechtigt in Übereinstimmung mit dem deutschen EMVG das EG-Konformitätszeichen zu führen.

Der Aussteller der Konformitätserklärung ist die IBM Deutschland.

Informationen in Hinsicht EMVG Paragraph 3 Abs. (2):

Das Gerät erfüllt die Schutzanforderungen nach EN 50082-1 und EN 55022 Klasse A.

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Nach der EN 55022: ″Dies ist eine Einrichtung der Klasse A. Diese Einrichtung kann im Wohnbereich Funkstörungen verursachen; in diesem Fall kann vom Betreiber verlangt werden, angemessene Massnahmen durchzuführen und dafür aufzukommen.″

Anmerkung: Um die Einhaltung des EMVG sicherzustellen, sind die Geräte wie in den Handbüchern angegeben zu installieren und zu betreiben.

Taiwan Class A compliance statement

Ensure that you are familiar with the Taiwan Class A compliance statement.

警告使用者:
這是甲類的資訊產品，在居住的環境中使用
時，可能會造成射頻干擾，在這種情況下，
使用者會被要求採取某些適當的對策。

Glossary

Ensure you are familiar with the list of terms and their definitions used in this guide.

A

asymmetric virtualization
A virtualization technique in which the virtualization engine is outside the data path and performs a metadata-style service. The metadata server contains all the mapping and locking tables while the storage devices contain only data. See also *symmetric virtualization*

C

cache A high-speed memory or storage device used to reduce the effective time required to read data from or write data to lower-speed memory or a device. Read cache holds data in anticipation that it will be requested by a client. Write cache holds data written by a client until it can be safely stored on more permanent storage media such as disk or tape.

cluster
In SAN Volume Controller, a pair of nodes that provides a single configuration and service interface.

CIM See *Common Information Model*.

Common Information Model (CIM)
A set of standards developed by the Distributed Management Task Force (DMTF). CIM provides a conceptual framework for storage management and an open approach to the design and implementation of storage systems, applications, databases, networks, and devices.

D

degraded
Pertaining to a valid configuration that has suffered a failure but continues to be supported and legal. Typically, a repair action can be performed on a degraded configuration to restore it to a valid configuration.

directed maintenance procedures
The set of maintenance procedures that can be run for a cluster. These procedures are documented in the service guide.

disk zone
A zone defined in the storage area network (SAN) fabric in which the SAN Volume Controller can detect and address the logical units that the disk controllers present.

E

error code
A value that identifies an error condition.

excluded
In SAN Volume Controller, the status of a managed disk that the cluster has removed from use after repeated access errors.

extent A unit of data that manages the mapping of data between managed disks and virtual disks.

F

failover
In SAN Volume Controller, the function that occurs when one redundant part of the system takes over the workload of another part of the system that has failed.

fibre channel
A technology for transmitting data between computer devices at a data rate of up to 4 Gbps. It is especially suited for attaching computer servers to shared storage devices and for interconnecting storage controllers and drives.

FC See *fibre channel*.

G

GBIC See *gigabit interface converter*.

gigabit interface converter (GBIC)
An interface module that converts the light stream from a fibre-channel cable into electronic signals for use by the network interface card.

H

HBA See *host bus adapter*.

host bus adapter (HBA)
In SAN Volume Controller, an interface card that connects a host bus, such as a peripheral component interconnect (PCI) bus, to the storage area network.

host ID
In SAN Volume Controller, a numeric identifier assigned to a group of host fibre-channel ports for the purpose of logical unit number (LUN) mapping. For each host ID, there is a separate mapping of Small Computer System Interface (SCSI) IDs to virtual disks (VDisks).

host zone
A zone defined in the storage area network (SAN) fabric in which the hosts can address the SAN Volume Controllers.

I

inconsistent
In a Global Mirror relationship, pertaining to a secondary virtual disk (VDisk) that is being synchronized with the primary VDisk.

input/output (I/O)
Pertaining to a functional unit or communication path involved in an input process, an output process, or both, concurrently or not, and to the data involved in such a process.

Internet Protocol (IP)
In the Internet suite of protocols, a connectionless protocol that routes data through a network or interconnected networks and acts as an intermediary between the higher protocol layers and the physical network.

IP See *Internet Protocol*.

I/O See *input/output.*

I/O group
A collection of virtual disks (VDisks) and node relationships that present a common interface to host systems.

L

local fabric
In SAN Volume Controller, those storage area network (SAN) components (such as switches and cables) that connect the components (nodes, hosts, switches) of the local cluster together.

logical unit (LU)
An entity to which Small Computer System Interface (SCSI) commands are addressed, such as a virtual disk (VDisk) or managed disk (MDisk).

logical unit number (LUN)
The SCSI identifier of a logical unit within a target. (S)

LU See *logical unit*.

LUN See *logical unit number*.

M

managed disk (MDisk)
A Small Computer System Interface (SCSI) logical unit that a redundant array of independent disks (RAID) controller provides and a cluster manages. The MDisk is not visible to host systems on the storage area network (SAN).

managed disk group
A collection of managed disks (MDisks) that, as a unit, contain all the data for a specified set of virtual disks (VDisks).

mapping
See *FlashCopy mapping*.

MDisk See *managed disk*.

N

node One SAN Volume Controller. Each node provides virtualization, cache, and Copy Services to the storage area network (SAN).

O

object In object-oriented design or programming, a concrete realization of a class that consists of data and the operations associated with that data.

offline Pertaining to the operation of a functional unit or device that is not under the continual control of the system or of a host.

online Pertaining to the operation of a functional unit or device that is under the continual control of the system or of a host.

R

RAID See *redundant array of independent disks*.

reliability
The ability of a system to continue to return data even if a component fails.

S

SAN See *storage area network*.

SCSI See *Small Computer Systems Interface*.

Small Computer System Interface (SCSI)
A standard hardware interface that enables a variety of peripheral devices to communicate with one another.

SNMP See *Simple Network Management Protocol*.

storage area network (SAN)
A network whose primary purpose is the transfer of data between computer systems and storage elements and among storage elements. A SAN consists of a communication infrastructure, which provides physical connections, and a management layer, which organizes the connections, storage elements, and computer systems so that data transfer is secure and robust. (S)

IBM TotalStorage Multipath Subsystem Device Driver (SDD)
An IBM pseudo device driver designed to support the multipath configuration environments in IBM products.

U

uninterruptible power supply
A device connected between a computer and its power source that protects the computer against blackouts, brownouts, and power surges. The uninterruptible power supply contains a power sensor to monitor the supply and a battery to provide power until an orderly shutdown of the system can be performed.

V

valid configuration
A configuration that is supported.

VDisk See *virtual disk*.

virtual disk (VDisk)
In SAN Volume Controller, a device that host systems attached to the storage area network (SAN) recognize as a Small Computer System Interface (SCSI) disk.

virtualization
In the storage industry, a concept in which a pool of storage is created that contains several disk subsystems. The subsystems can be from various vendors. The pool can be split into virtual disks that are visible to the host systems that use them.

virtualized storage
Physical storage that has virtualization techniques applied to it by a virtualization engine.

W

worldwide node name (WWNN)
An identifier for an object that is globally unique. WWNNs are used by Fibre Channel and other standards.

worldwide port name (WWPN)
A unique 64-bit identifier associated with a fibre-channel adapter port. The WWPN is assigned in an implementation- and protocol-independent manner.

Index

E

F

G

H

I

J

K

L

M

N

O

P

Q

R

S

T

U

V

W

X

Z

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IBM TotalStorage SAN Volume Controller
Host Attachment User's Guide
Version 2.1.0

Publication No. SC26-7563-04

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Spine information:

IBM TotalStorage SAN Volume Controller

SAN Volume Controller Host Attachment User's Guide Version 2.1.0