

IBM TotalStorage SAN Volume Controller



# Host Attachment User's Guide

*Version 1.2.1*



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*Version 1.2.1*

**Third Edition (October 2004)**

**Note:** Before using this information and the product it supports, read the information in "Notices."

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## 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 e(logo)server xSeries (xSeries)
- IBM RS/6000 and pSeries
- Intel with Linux
- Microsoft Windows 2000 or 2003
- Microsoft Windows NT
- Sun

Each chapter describes how to attach a SAN Volume Controller to a specific open-system host with Fibre Channel adapters.

### **Related concepts**

“Fibre Channel (SCSI-FCP) attached open-systems host support” on page 1  
These are requirements for attaching the SAN Volume Controller to a Fibre Channel open systems host.

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## 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.

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## Summary of Changes

This document contains terminology, maintenance, and editorial changes.

Technical changes or additions to the text and illustrations are indicated by a vertical line to the left of the change. This summary of changes describes new functions that have been added to this release.

## Summary of Changes for SC26-7563-02 SAN Volume Controller Host Attachment Guide

The Summary of Changes provides a list of new, modified, and changed information since the last version of the SC26-7563-02 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.

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## Emphasis

Different typefaces are used in this guide to show emphasis.

The following typefaces are used to show emphasis:

Table 1. *Emphasis descriptions*

<b>Boldface</b>	Text in <b>boldface</b> represents menu items and command names.
<i>Italics</i>	Text in <i>italics</i> 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

Table 2 on page xi 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>

Table 2. Publications in the SAN Volume Controller library

Title	Description	Order number
<i>IBM TotalStorage SAN Volume Controller: CIM Agent Developer's Reference</i>	This reference guide describes the objects and classes in a Common Information Model (CIM) environment.	SC26-7590
<i>IBM TotalStorage SAN Volume Controller: Command-Line Interface User's Guide</i>	This guide describes the commands that you can use from the SAN Volume Controller command-line interface (CLI).	SC26-7544
<i>IBM TotalStorage SAN Volume Controller: Configuration Guide</i>	This guide provides guidelines for configuring your SAN Volume Controller.	SC26-7543
<i>IBM TotalStorage SAN Volume Controller: Host Attachment Guide</i>	This guide provides guidelines for attaching the SAN Volume Controller to your host system.	SC26-7575
<i>IBM TotalStorage SAN Volume Controller: Installation Guide</i>	This guide includes the instructions the service representative uses to install the SAN Volume Controller.	SC26-7541
<i>IBM TotalStorage SAN Volume Controller: Planning Guide</i>	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
<i>IBM TotalStorage SAN Volume Controller: Service Guide</i>	This guide includes the instructions the service representative uses to service the SAN Volume Controller.	SC26-7542
<i>IBM TotalStorage SAN Volume Controller: Translated Safety Notices</i>	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

### Other IBM publications

Table 3 on page xii lists and describes other IBM publications that contain additional information related to the SAN Volume Controller.

Table 3. Other IBM publications

Title	Description	Order number
<i>IBM TotalStorage Enterprise Storage Server, IBM TotalStorage SAN Volume Controller, IBM TotalStorage SAN Volume Controller for Cisco MDS 9000, Subsystem Device Driver: User's Guide</i>	This guide describes the IBM 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 <i>IBM TotalStorage Subsystem Device Driver: User's Guide</i> .	SC26-7608

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## Related Web sites

Table 4 lists Web sites that have information about SAN Volume Controller or related products or technologies.

Table 4. Web sites

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

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## 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/](http://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/](http://www.ibm.com/shop/publications/order/)

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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.

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## Chapter 1. SAN Volume Controller and host system overview

This is an overview of the relationship between the SAN Volume Controller and the host systems.

The SAN Volume Controller provides heterogeneous host attachments so that you can consolidate storage capacity and workloads for open-systems hosts. The SAN Volume Controller supports a maximum of 64 separate hosts and a maximum of 128 host fibre-channel ports, identified by their World-Wide Port Numbers (WWPNs).

Hosts are attached to the SAN Volume Controller using a switched fibre channel fabric.

---

### Fibre Channel (SCSI-FCP) attached open-systems host support

These are requirements for attaching the SAN Volume Controller to a Fibre Channel open systems host.

For information about host systems, operating system levels, host bus adapters, cables, and fabric that IBM® supports, see:<http://www-1.ibm.com/servers/storage/support/virtual/2145.html>

Each SAN Volume Controller fibre-channel adapter has two ports. You can configure the port to operate with the SCSI-FCP upper layer protocol.

Fibre-channel adapters that are configured for SCSI-FCP (fibre-channel protocol) 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 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:

- IBM RS/6000®, pSeries™, RS/6000 SP™, and pSeries SP server that run an IBM AIX® operating system
- Hewlett-Packard servers that run an HP/UX operating system
- Intel-based servers that run a Microsoft® Windows® 2000 or 2003 operating system
- Sun servers that run a Solaris operating system

---

### Targets and LUNs

This is a description of the LUN support.

For fibre-channel attachment, each fibre-channel host adapter can architecturally attach up to 2 LUNs. The SAN Volume Controller supports a maximum of 1024 LUNs with a maximum of 512 configured to any one host. Not all hosts will support 512 LUNs.

Each virtual disk created on the SAN Volume Controller can be mapped to multiple Host Bus Adapter (HBA) fibre channel ports in a given host. There may also be multiple paths across the Storage Area Network. For these reasons the SAN Volume Controller needs the IBM Subsystem Device Driver (SDD) to be running on each host. The SDD software handles the many paths that are available to the virtual disk and presents a single storage device to the operating system.

---

## FlashCopy and Remote Copy restrictions

These are requirements and descriptions for the conditions required for using FlashCopy® and Remote Copy.

When you copy a source volume to a target volume with FlashCopy or Remote Copy, 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 Remote Copy 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 those 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. Requirements for attaching to a Hewlett-Packard 9000 host

You need this information to attach a Hewlett-Packard host system to a SAN Volume Controller with the following adapter cards:

- A5158A
- A6795A

For up to date information about the servers, operating systems, and fabric connections that IBM supports for the Hewlett-Packard host, check the storage support Web site.

### Requirements

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

- Check the LUN limitations for your host system. The maximum configuration for HP-UX is 8 virtual disks per I/O group per host.
- Ensure that you have the documentation for your host system.
- See [ssddom02.storage.ibm.com/techsup/webnav.nsf/support/2145](http://ssddom02.storage.ibm.com/techsup/webnav.nsf/support/2145) for details about the release level for your operating system.

The following tasks must be performed to configure a SAN Volume Controller.

1. An IBM Systems Services Representative (SSR) installs the SAN Volume Controller by using the procedures in the *IBM TotalStorage SAN Volume Controller: Installation Guide*.
2. Configure the fibre-channel host system with the worldwide port name identifiers. You will have to locate the list of worldwide port names.
3. Define the fibre-port configuration if it was not done when the SAN Volume Controller or fibre-channel adapters were installed.
4. Configure the host system for the SAN Volume Controller using the instructions in your host system publications.
5. Install the IBM Subsystem Device Driver for HP-UX to enable the management of multiple paths to SAN Volume Controller virtual disks. SDD does not support HP-UX in a clustering environment. Also note that SDD is not supported in the HP-UX 32-bit mode operating environment.

**Note:** 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 4 for a total of 4 fibre-channel ports.

### Related tasks

“Locating the WWPN for a Hewlett Packard host” on page 47

To locate the WWPN for a Hewlett Packard host, follow these steps.

---

## Installing the adapter drivers for the HP-UX 11.0 and HP-UX 11.i operating systems

How to download and configure the following adapter drivers:

- A5158A
- A6795A

**Note:** The steps to install and configure adapter cards are examples. Your configuration might be different.

1. Go to <http://www-1.ibm.com/servers/storage/support/virtual/2145.html>.
2. From the IBM TotalStorage® SAN Volume Controller (2145) page, click **Fibre channel host bus adapter firmware and driver level matrix**.
3. Find the section for the current version of the driver and firmware and driver you want.
4. Obtain the driver and firmware from Hewlett-Packard and install them according to the documentation provided.

After installing the fibre-channel adapters and drivers, you can verify their status using the `fcmsutil /dev/tdx` 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 .

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

---

## Known problems and limitations

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

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

---

## Chapter 3. Requirements for attaching to an IBM RS/6000 or IBM eServer pSeries host

The host system requirements to attach a SAN Volume Controller to the following host systems are:

- RS/6000 with fibre-channel adapters
- pSeries with fibre-channel adapters
- RS/6000 ScalablePOWER Parallel (SP) Complex with fibre-channel adapters
- pSeries SP Complex with fibre-channel adapters

For up-to-date information about the servers, operating systems, host adapters, and fabric connections that IBM supports, see the following Web site:  
<http://www-1.ibm.com/servers/storage/support/virtual/2145.html>

### Requirements

This section lists the requirements for attaching the SAN Volume Controller to your host system:

- 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 the correct updates and APARs for your operating system:
  - For AIX 5.1, ensure that you have obtained and installed maintenance level AIX 5100-05. Type the command: **oslevel -r** to determine the current AIX level.
  - For AIX 5.2, ensure that you have obtained and installed maintenance level AIX 5200-02. Type the command: **oslevel -r** to determine the current AIX level.
- 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 host system and the *IBM TotalStorage SAN Volume Controller: Installation Guide*.
- For details about the release level for your operating system, see the following Web site: <http://www-1.ibm.com/servers/storage/support/virtual/2145.html>

The following tasks must be performed to configure a SAN Volume Controller:

1. The IBM Systems Services Representative (SSR) installs the SAN Volume Controller by using the procedures in the *IBM TotalStorage SAN Volume Controller: Installation Guide*.
2. Define the fibre-port configuration if you did perform the installation of the SAN Volume Controller or fibre-channel adapters.
3. Configure the host system for the SAN Volume Controller. Use the instructions in your host system publications.
4. Install the IBM Subsystem Device Driver for AIX to enable the management of multiple paths to SAN Volume Controller virtual disks.

**Note:** The SDD 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 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 attached to the SAN Volume Controller does not exceed four.


#### Related tasks

“Locating the WWPN for an IBM e(logo)server pSeries or an RS/6000 host” on page 47

To locate the WWPN for an IBM e(logo)server pSeries or an RS/6000 host, follow these steps.

---

## Preparing for installation

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


1. Attach the SAN Volume Controller to your host system.
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 are using a Cisco MDS 9000 Family switch with your AIX or HP-UX host, please be aware that it may be possible to disable 'persistent FC IDs'. Cisco highlights the need to ensure that persistent FC IDs are enabled for AIX and HP-UX hosts. More information on this switch option can be found in the appropriate Cisco manual.

---

## Installing the host attachment package

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

---

## Completing the installation

To upgrade the data on existing SAN Volume Controller disks when you install or upgrade the host attachment package on an IBM RS/6000 or IBM  pSeries host you must follow these instructions.

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

This procedure applies if you want to replace a previous version of the host attachment package and have data that exists on all configured SAN Volume Controller disks.

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 `suspendvds` to suspend the virtual shared disks associated with the volume groups.
3. Type `stopvds` 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.
9. Install the IBM Subsystem Device Driver (SDD) for AIX to enable the management of multiple paths to SAN Volume Controller virtual disks. The SAN Volume Controller does not support MPIO.

---

## 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 adapter cards 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 -d1 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 SAN Volume Controller devices with multiple paths per LUN

To dynamically change the size of a vdisk you must:

### Dynamically increasing the size of a SAN Volume Controller virtual disk:

In AIX 5.2 and later versions, the **chvg** command options provide the ability to grow the size of a physical volume that LVM uses, without interruptions to the use or availability of the system. Refer to the System Management Guide: Operating System and Devices LVM – Maintenance Tasks for more information.

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 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.

---

## Known issues and limitations

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

On heavily loaded systems, you might see lower than expected performance without any errors being logged. One possible cause is that the host is low on DMA resources.

On a heavily loaded system you might see errors indicating that the host bus adapter (HBA) was unable to activate an I/O request on the first attempt. The most likely cause of these errors is that the host is low on DMA resources.

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`

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

To attach an Intel™ server running Linux to a SAN Volume Controller with the following fibre-channel adapters you must:

- QLogic QLA2310FL adapter card
- QLogic QLA2340FL adapter card
- QLogic QLA2342FL adapter card

See <http://www-1.ibm.com/servers/storage/support/virtual/2145.html> for details about the release level for your operating system.

### Attachment requirements

**Note:** The steps to install and configure adapter cards are examples. Your configuration might be different.

This section lists the requirements for attaching the SAN Volume Controller to your host system:

- Check the LUN limitations for your host system.
- Ensure that you have the documentation for your host system and related information *IBM TotalStorage SAN Volume Controller: Installation Guide*.
- Ensure that you are running a supported kernel of Red Hat Linux AS.
- See <http://www-1.ibm.com/servers/storage/support/virtual/2145.html> for details about the release level for your operating system.
- When attaching the SAN Volume Controller to a BladeCenter HS20 with blade 8678, refer to the BladeCenter documentation for SAN configuration details.

The following tasks must be performed to configure a SAN Volume Controller:

1. An IBM Systems Services Representative (SSR) installs the SAN Volume Controller by using the procedures in the *IBM TotalStorage SAN Volume Controller: Configuration Guide*.
2. Define the fibre-channel host system with the worldwide port name identifiers. You will have to locate the worldwide port names.
3. Define the fibre-port configuration if you did not do it during the installation of the SAN Volume Controller or fibre-channel adapters.
4. Configure the host system for the SAN Volume Controller by using the instructions in your host system publications.
5. Install the IBM Subsystem Device Driver for Linux to enable the management of multiple paths to SAN Volume Controller virtual disks.

### Related tasks

“Locating the WWPN for a Linux host” on page 48

To locate the WWPN for an Intel server running the Linux operating system with a QLogic adapter, read these instructions.

---

## Installing the QLogic adapter card

To attach an Intel host system running Linux to a SAN Volume Controller with the QLogic QLA23xx adapter card you must follow these instructions.

**Note:** The following steps are an example configuration. The configuration for your adapter might differ.

Shutdown your Linux host. This will involve closing applications and then issuing the shutdown command to the operating system. Follow your manufacturer's recommendations for powering down the Linux host and its attached peripherals.

Open the Linux host case. Ensure that, when you are handling the host and adapter hardware that you use the manufacturer's recommended ESD procedures throughout the replacement procedure.

1. Install the QLogic QLA23xx adapter card in the host system.
2. Connect the cable to the Fibre Channel switch.
3. Restart the server.
4. Press Ctrl+Q to get to the FAST!Util menu panel.
5. From the Select Host Adapter menu, select the adapter type QLA23xx.
6. From the Fast!UTIL Options menu, select **Configuration settings**.
7. From the Configuration Settings menu, click **Host Adapter Settings**.
8. Set the parameters and values from the Host Adapter Settings menu as follows:
  - a. Host adapter Basic Input/Output System (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**
9. Press Esc to return to the Configuration Settings menu.
10. From the Configuration Settings menu, select **Advanced Adapter Settings**.
11. From the Advanced Adapter Settings menu, press the Down Arrow to highlight **LUNs per target**. Press Enter. 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: **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**
12. Press Esc to return to the Configuration Settings menu.
13. Press Esc.
14. From the Configuration settings modified window, select **Save changes**.

15. From the Fast!UTIL options menu, select **Select Host Adapter** and repeat steps 5 on page 12 through 14 on page 12 for any additional QLogic QLA23xx adapters.
16. Restart the server.

## Downloading the current QLogic adapter driver

To download the current QLogic adapter driver for the adapter installed in your Intel host running Linux, read this information.

1. Go to <http://www-1.ibm.com/servers/storage/support/virtual/2145.html>.
2. Click **Interoperability matrix**.
3. Click **SAN Volume Controller interoperability matrix**.
4. Find the section for the current version of the driver and firmware and driver you want.
5. Go to the QLogic web site.
6. Click **Drivers / Software** from the **Quick Links** list.
7. Select **IBM** from the **OEM-approved Drivers/Firmware** section.
8. Navigate to the adapter you want to download, then click **Download**.

## Installing the QLogic adapter drivers

To install the QLogic adapter drivers on the adapter installed on an Intel host running Linux, read this information.

Before installing the QLogic adapter drivers, you must install the QLogic adapter card, set the correct BIOS settings, and download the driver.

1. Enter:  

```
mkdir /usr/src/qlogic
```
2. Enter:  

```
mv download location/driver source /usr/src/qlogic
```
3. Enter:  

```
cd /usr/src/qlogic
```
4. Enter:  

```
tar -xzf [driver source]
```
5. Unpack the driver source code provided by QLogic by entering:  

```
./drvsetup
```
6. Read and follow the instructions contained in the driver readme file for compiling and installing the driver. This file is included in the README.ql2x00 distribution.

### Related tasks

“Defining the number of disks on Linux”

To define the number of disks on Linux, read this information.

---

## Defining the number of disks on Linux

To define the number of disks on Linux, read this information.

There are 256 minor numbers available for each of the eight major numbers. The following formula provides the maximum number of devices for Linux host systems:  
Number of devices = (number of major numbers) x (number of minor numbers) ÷ (number of partitions)

For example: Number of devices = 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 Subsystem Device Driver, or from `/dev/vpatha` (LUN 0) to `/dev/vpathdx` (LUN 127) with an IBM Subsystem Device Driver. 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 IBM Subsystem Device Driver

```
# 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 IBM Subsystem Device Driver

## 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 on page 15 shows an example of the different options for the `fdisk` utility.

**Note:** If you are using the IBM Subsystem Device Driver, 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 shows an example of a primary partition on the disk /dev/sdb.

**Note:** If you are using the IBM Subsystem Device Driver, 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 on page 16 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 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 on page 17 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.



---

## Chapter 5. Attaching to a Sun host

To attach a SAN Volume Controller to a Sun host system with the following fibre-channel adapters you must have the following adapter cards:

- JNI FCE-1473 adapter card
- JNI FCE-6460 adapter card

### Attachment requirements

This section lists the requirements for attaching the SAN Volume Controller to 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*. This documentation is on the TotalStorage® CD that you receive with the SAN Volume Controller.
- Ensure that you have installed Solaris 9, update 5.
- Review device driver installation documents and configuration utility documents for additional Solaris patches that you might need.

The following tasks must be performed to configure a SAN Volume Controller:

1. The IBM Systems Services Representative (SSR) installs the SAN Volume Controller by using the procedures in the *IBM TotalStorage SAN Volume Controller: Installation Guide*.
2. Define the fibre-channel host system with the worldwide port name identifiers. You will have to locate the list of worldwide port names.
3. Define the fibre-port configuration if you did not do it during the installation of the SAN Volume Controller or fibre-channel adapters.
4. Configure the host system for the SAN Volume Controller by using the instructions in your host system publications.
5. Install the IBM Subsystem Device Driver for Solaris to enable the management of multiple paths to SAN Volume Controller virtual disks. SDD does not support the Sun host system in a clustering environment.

### Related tasks

“Locating the WWPN for a Sun host” on page 48

To locate the WWPN for a Sun host, follow these instructions.

---

## Installing the JNI PCI adapter card

To attach a SAN Volume Controller to a Sun host system running Solaris 9, update 5, with the JNI PCI adapter card, follow these instructions.

Shutdown your Sun host. This will involve closing applications and then issuing the shutdown command to the operating system. Follow your manufacturer’s recommendations for powering down the Sun host and its attached peripherals.

Open the case of the Sun host. Ensure that, when you are handling the host and adapter hardware that you use the manufacturer’s recommended ESD procedures throughout the replacement procedure.

1. Insert the host adapter board into the empty PCI bus slot. Press firmly until seated.

2. Secure the mounting bracket for the adapter to the case with the panel screw.
3. Replace the computer case by tightening the screws on the case or use the clamp to secure the cover.
4. Connect the adapter card to the fabric with an optical cable.

## Downloading the current JNI PCI adapter driver

These are the required steps to download the JNI PCI fibre-channel adapter driver.

1. Restart your host system.
2. Go to the IBM storage support Web site to determine the level of the drivers that you will need for your adapter.
3. Go to the JNI web site.
4. From the navigation menu at the top of the page, click **Drivers**.
5. Click the link: **Click for IBM Drivers**
6. In the IBM Drivers window, download the following:
  - a. EZF\_2.2.2.tar
  - b. JNIC146.pkg file for the recommended JNI driver
  - c. Recommended JNI Fcode
7. For each download, in the **File Download** menu, click **Save this file to disk**. Click **OK**.
8. In the Save As window, create a temporary folder. For example, create a folder called Temp.  
  
**Note:** If you already have a folder called Temp, change to the Temp directory.
9. Click **Save**. A window opens that shows the progress of the download.
10. When each download completes, click **Close**.
11. If you downloaded the driver file from a Sun host system, install the driver. If you downloaded the driver file from a non-Sun host system, transfer the drive file to a Sun host system.

You are now ready to install the adapter driver.

## Installing the JNI PCI adapter driver

Follow this procedure for installing the JNI PCI adapter driver.

Before installing the JNI PCI adapter driver, make sure that you have downloaded the driver.

1. Install JNI HBA Driver and Fcode per JNI instructions. For the `/kernel/drv/jnic146x.conf` file, settings should be initially set to:

```
automap=1; (dynamic binding)
FcLoopEnabled=0;
FcFabricEnabled=1;
TargetOfflineEnable=0;
LunDiscoveryMethod=1; (should be default)
LunRecoveryInterval=10000;
```
2. Restart the host using the `reboot -- -r` command.
3. Run `format` to determine whether you can see all of the disks, then quit `format`.
4. Install the EZFibre tool following the JNI instructions. Follow the on-screen instructions when running `install.sh` and select the default settings.
5. Start the EZFibre tool and load it. This does not require restarting the host.

**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. Logon to the attached console of the Sun or Remote Host with xhost capability.
- b. Start the EZFibre tool by entering: `/opt/jni/ezfibre/standalone/ezf`.
- c. The user interface will display a list with both adapters listed, and all of the connected remote ports listed as targets.
- d. Use the SAN Volume Controller command line interface or user interface to register the HBA ports with the SAN Volume Controller.
- e. Create the necessary VDisks and map them to the host.

**Note:** You can obtain the HBA WWPN from the `/var/adm/messages` file, the EZFibre tool, or the SVC/SIS candidate HBA port list.

- f. When the LUNs are created and mapped, restart the host with the `reboot --r` command.
6. When the restart is finished, restart the EZFibre tool. It should show all of the available LUNs under the listing of their corresponding HBA targets.
7. Map the SVC/SIS controlled LUNs to the host with persistent bindings:
  - a. 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 7a through 7j until you have performed it on all of the HBAs.

**Attention:** The EZFibre tool will append any changes to the end of the `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 install and restore it before making any configuration changes.

**Note:** JNI supports this function without restarting the host, but the IBM SDD requires restarts during its process.

8. Restart the host system.

Update the parameter list and restart the host system. Set the recommended parameters and settings.

---

## Installing the JNI SBUS adapter card

Follow this required procedure to attach a SAN Volume Controller to a Sun host system running Solaris 9, update 5 with SAN Foundation Kit Version 1.0 (SUNWsan) with the JNI SBUS adapter card.

Shutdown your Sun host. This will involve closing applications and then issuing the shutdown command to the operating system. Follow your manufacturer's recommendations for powering down the Sun host and its attached peripherals.

Open the case of the Sun host. Ensure that, when you are handling the host and adapter hardware that you use the manufacturer's recommended ESD procedures throughout the replacement procedure.

1. Insert the host adapter board into the empty SBUS slot. Press firmly until seated.
2. Secure the mounting bracket for the adapter to the case with the panel screw.
3. Replace the computer case by tightening the screws on the case or use the clamp to secure the cover.
4. Connect the adapter card to the fabric with suitable optical cables.

## Downloading the current JNI SBUS adapter driver

This information lists the steps required to download the JNI SBUS adapter driver.

1. Restart your host system.
2. Go to the IBM storage support Web site to determine which driver you will need based on the adapter that you are installing.
3. Go to the JNI Web site.
4. From the navigation menu at the top of the page, click **Drivers**.
5. Click the link: **Click for IBM Drivers**.
6. In the IBM drivers window, download the following:
  - a. EZF\_2.2.2.tar
  - b. JNIC146.pkg file recommended JNI driver
  - c. Recommended JNI Fcode
7. For each download, in the **File Download** menu, click **Save this file to disk**. Click **OK**.
8. In the Save As window, create a temporary folder. For example, create a folder called Temp.

**Note:** If you already have a folder called Temp, change to the Temp directory.
9. Click **Save**. A window opens that shows the progress of the download.
10. When each download completes, click **Close**.

If you downloaded the driver file from a Sun host system, install the driver. If you downloaded the driver file from a non-Sun host system, transfer the driver file to a Sun host system, and then install the driver.

## Installing the JNI SBUS adapter driver

These are the required steps to install the JNI SBUS adapter driver.

Before installing the JNI SBUS adapter driver, you will have to download the driver.

Perform the following steps to install the JNI SBUS adapter:

**Note:** You will need access to the host system using either the direct console or an xhost remote console.

1. Install JNI HBA Driver and Fcode per JNI instructions. For the `/kernel/drv/jnic146x.conf *`, settings should be initially set to:

```
automap=1; (dynamic binding)
FcLoopEnabled=0;
FcFabricEnabled=1;
```

```
TargetOfflineEnable=0;
LunDiscoveryMethod=1; (should be default)
LunRecoveryInterval=10;
```

2. Restart the host using the `reboot -- -r` command.
3. Run `format` to determine whether you can see all of the disks, then quit `format`.
4. Install the EZFibre tool following the JNI instructions. Follow the on-screen instructions when running `install.sh` and select the default settings.
5. Start the EZFibre tool and load it. This does not require restarting the host.

**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.

6. Logon to the attached console of the Sun or Remote Host with xhost capability.
7. Start the EZFibre tool by entering: `/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.
8. Use the SAN Volume Controller command line interface or user interface to register the HBA ports with the SAN Volume Controller.
9. Create the necessary VDisks and map them to the host.

**Note:** You can obtain the HBA WWPN from the `/var/adm/messages` file, the EZFibre tool, or the SVC/SIS candidate HBA port list.

10. When the LUNs are created and mapped, restart the host with the `reboot -- -r` command.
11. When the restart is finished, restart the EZFibre tool. It should show all of the available LUNs under the listing of their corresponding HBA targets.
12. Map the SVC/SIS controlled LUNs to the host with persistent bindings:
  - a. 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 12a through 12j until you have performed it on all of the HBAs.
13. If you add or delete LUNs at a later date, repeat this procedure to acquire the new adapters.

**Attention:** The EZFibre tool will append any changes to the end of the `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 install and restore it before making any configuration changes.

**Note:** JNI supports this function without restarting the host, but the IBM SDD requires restarts during its process.

14. Restart the host system.

Update the parameter list and restart the host system. Set the recommended parameters and settings.

**Related reference**

“Parameter settings for the JNI FCE-6460 and JNI FCE-1473 adapters” on page 25

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

---

## Configuring the host bus adapters

To configure host bus adapters (HBAs) for Solaris, follow these steps.

1. Informing Solaris about the new SCSI target device and LUNs.
2. Configuring the HBA.
  1. When you install the JNI driver you will also install the `/kernel/drv/jnic146x.conf` file. Edit this file to set up the HBA connection to the switch fabric by changing the following lines:

```
FcLoopEnable = 0;  
FcFabricEnable = 1;  
Automap = 0 (for persistent binding)
```

You must also add a line similar to the following to enable static binding. You must use static binding with the SAN Volume Controller.

```
target0_wwpn = "5005076801300018";  
target1_wwpn = "5005076801100018";  
target2_wwpn = "5005076801200018";
```

2. Restart and examine the `/var/adm/messages` file to ensure that the JNI HBA is set up as a switch-fabric connection.

## Running the LUN configuration method

The configuration method depends on the level of Solaris that you are using. 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.

1. After the cluster 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 the Software Device Driver 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. When the host comes back up, 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#`.



## 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>.

---

## Setting the Sun host system parameters for JNI adapters

To set the Sun host system parameters for optimum performance on the SAN Volume Controller with the supported JNI adapters follow these 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 JNI adapters:

### **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:

$$256 \div (\text{LUNs per adapter})$$

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
```

---

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

This information provides an overview of how to attach a SAN Volume Controller to a Windows 2000 or 2003 host system running Windows 2000 or 2003 Server, Service Pack 3 or Windows 2000 or 2003 Advanced Server, Service Pack 3 with the following fibre-channel adapters:

- Netfinity® FAStT adapter card
- QLogic QLA2310FL adapter card
- QLogic QLA2340FL adapter card
- QLogic QLA2342FL adapter card
- Emulex LP9002 adapter card
- Emulex LP9002DC adapter card
- Emulex LP9402 adapter card

In addition, this information lists the requirements for installing, downloading, and configuring the adapter cards.

For information about host systems, adapter cards, operating system levels, host bus adapters, cables, and fabric that IBM supports, see:<http://www-1.ibm.com/servers/storage/support/virtual/2145.html>

### Attachment requirements

This section lists the requirements for attaching the SAN Volume Controller to your host system:

- Check the LUN limitations for your host system.
- Ensure that you have the documentation for your host system and the *IBM TotalStorage SAN Volume Controller: Installation Guide*.
- See support Web site for details about the release level for your operating system.

The following tasks must be performed to configure a SAN Volume Controller:

1. An IBM Systems Services Representative (SSR) installs the SAN Volume Controller by using the procedures in the *IBM TotalStorage SAN Volume Controller: Installation Guide*.
2. Define the fibre-channel host system with the worldwide port name identifiers. You will have to locate the list of worldwide port names.
3. Define the fibre-port configuration if you did not do it during the installation of the SAN Volume Controller or fibre-channel adapters.
4. Configure the host system for the SAN Volume Controller by using the instructions in your host system publications.
5. Install the IBM Subsystem Device Driver (SDD) for Windows to enable the management of multiple paths to SAN Volume Controller virtual disks.

### Related tasks

“Locating the WWPN for a Windows 2000 or 2003 host” on page 48  
To locate the WWPN for a Windows 2000 or 2003 host with a QLogic adapter, follow these steps.

---

## Installing and configuring the Netfinity FAStT adapter card

To install and configure the Netfinity FAStT adapter on a Microsoft Windows 2000 or 2003 host, follow these steps.

1. Obtain an optical multimode cable with a standard-connector style of duplex connector.
2. Write down the serial number of the adapter card.  
In the unlikely event that the nonvolatile random access memory is damaged, the system will prompt you for the Netfinity FAStT adapter serial number.
3. Check the system board and make any configuration changes necessary to accommodate the Netfinity FAStT adapter.
4. Power off the peripheral devices and then the host.
5. Disconnect the power cord.
6. Remove the cover to the host.
7. Choose any PCI bus slot that supports 32- or 64-bit adapters.  
You can install the adapter in a 64-bit PCI slot if one is available. If a 64-bit slot is not available, use a 32-bit PCI slot.
8. Align the adapter with the expansion slot, and carefully press the adapter into the slot until you hear the adapter snap into place.
9. Secure the adapter.
10. Connect one end of the fiber cable from the devices to the J1 connector on the adapter.
11. Carefully reinstall and secure the cover.
12. Connect the power cables.
13. Turn on all external fibre-channel devices.
14. Observe the monitor.

**Note:** You will not see the BIOS menu because the adapter BIOS is set to disabled by default. Instead, you should see the information in Figure 10.

```
QLogic Corporation
QLA2xxx PCI Fibre Channel ROM BIOS Version X.XX
Copyright (C) QLogic Corporation 1998 All rights reserved.
www.q1c.com

Press <Alt+Q> for FAST!Util

BIOS for Adapter X is disabled.

ROM BIOS not installed
```

Figure 10. Example of what is displayed when starting the Windows 2000 host

15. To see the devices, press Alt+Q, and then use the utility program.

## Checking the level of the device driver in the Netfinity FAStT adapter card

To determine the level of the device driver on the Netfinity FAStT adapter card, follow these instructions.

1. For the latest versions of the device drivers, utilities, and documentation, see the Web site for the device drivers.

2. Create backup copies of the following driver diskettes that are included with the FAStT adapter:
  - a. Netfinity FAStT host adapter for Windows 2000
  - b. Netfinity FAStT host adapter for Windows 2003
3. Read the software installation chapters to determine which device driver you want to install.
4. Place the device driver diskette in the diskette drive.
5. Copy the QLVER.EXE file from the diskette into the directory that contains the QLogic device drivers.  
For example, type: `COPY A:\QLVER.EXE C:\QLC\QLVER.EXE`
6. Change directories to the subdirectory that contains the QLogic drivers.  
For example, type: `CD \QLC`
7. At the command prompt, type: `QLVER *.*`  
This action invokes the QLogic banner, followed by a list of drivers and version numbers.

## Documentation included with the Netfinity FAStT adapter card

This information lists the documentation included with the Netfinity FAStT adapter card.

The following files are on the diskette that is shipped with your adapter card:

<b>TXTSETUP.OEM</b>	The driver installation script for the initial Windows NT <sup>®</sup> text setup
<b>QLOGIC</b>	The identification file for the Windows NT setup program
<b>\W2K\OEMSETUP.INF</b>	The driver installation script for the Windows NT setup program
<b>\W2K\QL2200.SYS</b>	The Windows 2000 device driver
<b>\W2K\README.TXT</b>	Helpful hints about the Windows 2000 device driver
<b>\W2K\RELEASE.TXT</b>	The history of release fixes

## Installing the device driver for a Netfinity FAStT adapter card

To install the device driver on the Netfinity FAStT adapter card, follow these instructions.

1. Install the Netfinity adapter.
2. Restart Windows 2000 or 2003 depending on your host system.
3. Insert the Netfinity FAStT host adapter device driver for Windows 2000 or 2003 diskette and follow the instructions that are displayed.

## Updating the Microsoft Windows 2000 or 2003 device driver

To update the Windows 2000 or 2003 device driver, follow these step.

1. Right click **My Computer** → **Manage** → **Device Manager**.
2. Click the plus (+) sign to expand the menu for **SCSI and RAID Controllers**.
3. Click the QLogic adapter you want to update.
4. Click on the adapter that you want and select **Properties**.
5. Select the tab for **Driver**.

6. Click **Update Driver** and follow the instructions that appear on the screen.

---

## Installing the QLogic QLA23xx adapter card

To install the QLogic QLA23xx adapter card on a Microsoft Windows 2000 or 2003 host, follow these steps.

Shutdown your Windows 2000 or 2003 host. This will involve closing applications and then issuing the shutdown command to the operating system. Follow your manufacturer's recommendations for powering down the Windows 2000 or 2003 host and its attached peripherals.

Ensure that, when you are handling the host and adapter hardware that you use the manufacturer's recommended ESD procedures throughout the replacement procedure.

1. Install the QLogic QLA23xx adapter card in the host system.
2. Connect the cable to the Fibre Channel switch.
3. Restart the server.
4. Press Ctrl+Q to get to the FAST!UTIL menu panel.
5. From the Select Host Adapter menu select the Adapter Type QLA23xx.
6. From the Fast!UTIL Options menu select **Configuration Settings**.
7. From the Configuration Settings menu, click **Host Adapter Settings**.
8. Set the parameters and values from the Host Adapter Settings menu 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**
9. Press Esc to return to the Configuration Settings menu.
10. From the Configuration Settings menu select **Advanced Adapter Settings**.
11. 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**
12. Press Esc to return to the Configuration Settings menu.

13. Press Esc.
14. From the Configuration settings modified window select **Save changes**.
15. From the Fast!UTIL Options menu select **Select Host Adapter**, and repeat steps 5 on page 30 to 14, if more than one QLogic QLA23xx adapter card has been installed.
16. Restart the server.

## Downloading the QLogic adapter driver

To download the QLogic adapter driver for the Microsoft Windows 2000 or 2003 host, follow these steps.

1. Visit the support Web site.
2. Click **Interoperability matrix**.
3. Click **SAN Volume Controller interoperability matrix**.
4. Find the section for the current version of the driver and firmware and driver you want.
5. Go to the QLogic web site.
6. Click **Drivers / Software** from the **Quick Links** list.
7. Select **IBM** from the **OEM-approved Drivers/Firmware** section.
8. Navigate to the adapter that you want to download, then click **Download**.

You will now have to install the adapter driver.

## Installing the QLogic adapter driver

To install the QLogic adapter driver on the Microsoft Windows 2000 host, read this information.

Before installing the QLogic adapter drivers, you must install the QLogic adapter card, set the correct BIOS settings, and download the driver.

1. Go to the QLogic Web site.
2. From the navigation pane, click **Drivers / Software**.
3. In the Download Drivers / Software and HBAs window, click the Down Arrow to open the **Select a Series** menu.
4. Highlight and click **Fibre-Channel HBAs**.
5. In the Download Drivers / Software and HBAs window, click the Down Arrow to open the **Select a Product** menu.
6. Highlight and click the fibre-channel adapter that you want.
7. In the **Drivers and Management Software** menu, click **Windows 2000**.
8. In the Windows 2000 Drivers table, click **Read Me**.

See the following list for an example of information that you might find in a readme file:

- a. Operating system support
- b. Supported features
- c. Creating the driver diskette
- d. Installing the driver
- e. Initial operating system installation with the QLogic controller as the boot
- f. Adding the QLogic controller to the existing operating system
- g. Updating the existing QLogic driver
- h. Removing the driver

- i. Driver parameters
- j. System registry parameters
- k. NVRAM parameters
- l. Limitations
- m. Additional notes
- n. Using Fast!UTIL menu to change the connection options
- o. Diskette content
- p. Contacting QLogic

---

## Installing the Emulex adapter card

To attach a SAN Volume Controller to a Windows 2000 host system with an Emulex adapter card, follow these steps.

1. Record the IEEE number that is printed on the card. You can use the IEEE number to determine the WWPN.
2. Insert the host adapter board into the empty PCI bus slot. Press firmly until seated.
3. Secure the mounting bracket for the adapter to the case with the panel screw.
4. Replace the computer case by tightening the screws on the case or use the clamp to secure the cover.

### Related tasks

“Locating the WWPN for a Windows 2000 or 2003 host” on page 48

To locate the WWPN for a Windows 2000 or 2003 host with a QLogic adapter, follow these steps.

## Downloading the Emulex adapter driver

To download the Emulex adapter drivers, read this information.

1. Restart your host system.
2. Go to the IBM storage support Web site.
3. Click **Interoperability matrix**.
4. Click **SAN Volume Controller interoperability matrix**.
5. Find the section for the current version of the driver and firmware you want.
6. Go to [www.emulex.com](http://www.emulex.com).
7. Click **Drivers, software, and manuals** from the left navigation pane
8. Click **IBM**.
9. Click the link for the adapter that you want to get the firmware, driver, and documentation to install and download the adapter driver.

After downloading the driver, you will have to install it.

## Installing the Emulex adapter drivers

To install the Emulex adapter drivers, follow these steps.

You must download the driver before installing it.

1. Restart your host system.
2. Go to [www.emulex.com](http://www.emulex.com).
3. Click **drivers, software, and manuals** from the left navigation pane.



4. In the **Drivers, software, and manuals by operating system** section, click **Windows**.
5. Click **Windows 2000** for the Port Driver.
6. Click **Installation** to get the documentation that tells you how to install the adapter driver.

You will now have to configure the adapter drivers.

## Configuration settings for the Emulex adapter drivers

The recommended settings for configuring the Emulex adapter drivers are as follows.

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

*Table 5. Recommended Configuration file parameters for the Emulex LP8000, LP9002 and LP9402 adapters*

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	<ul style="list-style-type: none"> <li>• Checked for fabric attach</li> <li>• Arbitrated loop for direct attach</li> </ul>
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)
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

Table 5. Recommended Configuration file parameters for the Emulex LP8000, LP9002 and LP9402 adapters (continued)

Parameters	Recommended Settings
R_A_TOV	2 seconds
ARB_TOV	1000 milliseconds
<b>Link Control</b>	
Topology	Point-to-point (fabric)
Link speed	Auto

---

## 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

To set the TimeOutValue registry, read this information.

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 2000 or 2003 server for the changes to take effect.

---

## 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 VDIs using the command line interface, you enter these commands to assign your VDIs to a host:

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



---

## Chapter 7. Attaching to a Microsoft Windows NT host

These are requirements for attaching the SAN Volume Controller to a Windows NT host system running Windows NT Service Pack 6A with the following fibre-channel adapters:

- Netfinity FAStT adapter card
- QLogic QLA2310FL adapter card
- QLogic QLA2340FL adapter card
- QLogic QLA2342FL adapter card
- Emulex LP9002 adapter card
- Emulex LP9002DC adapter card
- Emulex LP9402 adapter card

In addition, this information lists the requirements for installing, downloading, and configuring the adapter cards. See the following websites for up-to-date information about the switch and fabric connections that IBM supports.

For information about host systems, operating system levels, host bus adapters, cables, and fabric that IBM supports, see:<http://www-1.ibm.com/servers/storage/support/virtual/2145.html>

The following tasks must be performed to configure a SAN Volume Controller:

1. An IBM Systems Services Representative (SSR) installs the SAN Volume Controller by using the procedures in the *IBM TotalStorage SAN Volume Controller: Installation Guide*
2. Define the fibre-channel host system with the worldwide port name identifiers. You must locate the worldwide port names to accomplish this task. This procedure is detailed in the “Fibre Channel port name identification” chapter.
3. Define the fibre-port configuration if you did not do it during the installation of the SAN Volume Controller or fibre-channel adapters.
4. Configure the host system for the SAN Volume Controller by using the instructions in your host system publications.
5. Install the IBM Subsystem Device Driver (SDD) for Windows to enable the management of multiple paths to SAN Volume Controller virtual disks.

---

### Installing the Emulex adapter card

This section tells you how to attach a SAN Volume Controller to a Windows NT host system with an Emulex adapter card.

Ensure that you shutdown your Windows host before installing the card. This will involve closing applications and then issuing the shutdown command to the operating system. Follow your manufacturer’s recommendations for powering down the Windows NT host and its attached peripherals.

Open the Windows NT host case. Ensure that when you are handling the host and adapter hardware, that you use the manufacturer’s recommended ESD procedures throughout the replacement procedure.

1. Record the IEEE number that is printed on the card. You can use the IEEE number to determine the WWPN.

2. Insert the host adapter board into the empty PCI bus slot. Press firmly until seated.
3. Secure the mounting bracket for the adapter to the case with the panel screw.
4. Replace the computer case by tightening the screws on the case or use the clamp to secure the cover.
5. Connect the Emulex adapter card to the fibre channel SAN with an appropriate cable.

---

## Downloading the Emulex adapter driver

This information provides the steps necessary to download the driver for the Emulex adapter.

1. Restart your host system.
2. Go to the support Web site to determine the required driver.
3. Click **Interoperability matrix**.
4. Click **SAN Volume Controller interoperability matrix**.
5. Find the section for the current version of the driver and firmware and driver you want.
6. Go to [www.emulex.com](http://www.emulex.com).
7. Click **Drivers, software, and manuals** from the left navigation pane
8. Click **IBM**.
9. Click the link for the adapter that you want to get the firmware, driver, and documentation to install and download the adapter driver.

When the adapter driver is downloaded, you can install the driver.

---

## Installing the Emulex drivers

This information provides the steps required to install the Emulex drivers.

You should have already downloaded the driver.

1. Restart your host system.
2. Go to [www.emulex.com](http://www.emulex.com).
3. Click **drivers, software, and manuals** from the left navigation pane
4. In the **Drivers, software, and manuals by operating system** section, click **Windows**.
5. Click **Windows NT** for the Port Driver.
6. Click **Installation** to get the documentation that tells you how to install the adapter driver.

After installing the driver, you will have to configure the adapter drivers.

---

## Configuration settings for the Emulex adapter driver

This information lists the recommended settings when configuring the Emulex adapter drivers.

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

Table 6. Recommended Configuration file parameters for the Emulex LP8000, LP9002 and LP9402 adapters

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	<ul style="list-style-type: none"> <li>• Checked for fabric attach</li> <li>• Arbitrated loop for direct attach</li> </ul>
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)
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
<b>Link Control</b>	
Topology	Point-to-point (fabric)
Link speed	Auto

## Installing the Netfinity FAStT adapter card

This information provides the required steps for installing the Netfinity FAStT adapter card when attaching to a Microsoft Windows NT host.

Shutdown your Windows NT host. This will involve closing applications and then issuing the shutdown command to the operating system. Follow your manufacturer's recommendations for powering down the Windows NT host and its attached peripherals.

Ensure that, when you are handling the host and adapter hardware that you use the manufacturer's recommended ESD procedures throughout the replacement procedure.

1. Obtain an optical multimode cable with a standard-connector style of duplex connector.
2. Write down the serial number of the adapter card.  
In the unlikely event that the nonvolatile random access memory is damaged, the system will prompt you for the Netfinity FAStT adapter serial number.
3. Check the system board and make any configuration changes necessary to accommodate the Netfinity FAStT adapter.
4. Turn off the peripheral devices and then the host.
5. Disconnect the power cord.
6. Remove the cover to the host.
7. Choose any PCI bus slot that supports 32- or 64-bit adapters.  
You can install the adapter in a 64-bit PCI slot if one is available. If a 64-bit slot is not available, use a 32-bit PCI slot.
8. Align the adapter with the expansion slot, and carefully press the adapter into the slot until you hear the adapter snap into place.
9. Secure the adapter.
10. Connect one end of the fiber cable from the devices to the J1 connector on the adapter.
11. Carefully reinstall and secure the cover.
12. Connect the power cables.
13. Turn on all external fibre-channel devices.
14. Observe the monitor.

**Note:** You will not see the BIOS menu because the adapter BIOS is set to disabled by default. Instead, you should see the information in Figure 11.

```
QLogic Corporation
QLA2xxx PCI Fibre Channel ROM BIOS Version X.XX
Copyright (C) QLogic Corporation 1998 All rights reserved.
www.q1c.com

Press <Alt+Q> for FAST!Util

BIOS for Adapter X is disabled.

ROM BIOS not installed
```

Figure 11. Example of what is displayed when starting the Windows NT host

15. To see the devices, press Alt+Q, and then use the utility program.



---

## Checking the level of the device driver for the Netfinity FAS<sup>t</sup>T adapter card

This information provides the steps required to determine the level of device driver that is on the Netfinity FAS<sup>t</sup>T adapter card.

1. Check [www.ibm.com/pc/support](http://www.ibm.com/pc/support) for the latest versions of the device drivers, utilities, and documentation.
2. Create backup copies of the following driver diskettes that are included with the FAS<sup>t</sup>T adapter:
  - a. Netfinity FAS<sup>t</sup>T host adapter for Windows NT and NetWare
  - b. Netfinity FAS<sup>t</sup>T host adapter for Windows NT
3. Read the software installation chapters to determine which device driver you want to install.
4. Place the device driver diskette in the diskette drive.
5. Copy the QLVER.EXE file from the diskette into the directory that contains the QLogic device drivers.  
For example, type: `COPY A:\QLVER.EXE C:\QLC\QLVER.EXE`
6. Change directories to the subdirectory that contains the QLogic drivers.  
For example, type: `CD \QLC`
7. At the command prompt, type: `QLVER *.*`  
This action invokes the QLogic banner, followed by a list of drivers and version numbers.

---

## Documentation provided with your Netfinity FAS<sup>t</sup>T adapter card

This is a list of the documentation provided with the Netfinity FAS<sup>t</sup>T adapter card:

### **TXTSETUP.OEM**

The driver installation script for the initial Windows NT text setup

### **QLOGIC**

The identification file for the Windows NT setup program

### **\W2K\OEMSETUP.INF**

The driver installation script for the Windows NT setup program

### **\W2K\QL2200.SYS**

The Windows NT device driver

### **\W2K\README.TXT**

Helpful hints about the Windows NT device driver

### **\W2K\RELEASE.TXT**

The history of release fixes

---

## Installing the device driver for the Netfinity FAS<sup>t</sup>T adapter card

This information lists the steps required to install the device driver for the Netfinity FAS<sup>t</sup>T adapter card.

1. Install the Netfinity adapter.
2. Restart Windows NT.
3. Insert the Netfinity FAS<sup>t</sup>T host adapter device driver for Windows NT diskette and follow the instructions that are displayed.

---

## Updating the Microsoft Windows NT device driver

This information provides the steps required to update the Windows NT device driver.

1. Right click **My Computer** → **Manage** → **Device Manager**.
2. Click the plus (+) sign to expand the menu for **SCSI and RAID Controllers**.
3. Click the QLogic adapter that you want to update.
4. Click on the adapter that you want and select **Properties**.
5. Select the tab for **Driver**.
6. Click **Update Driver** and follow the instructions.

---

## Installing the QLogic QLA23xx adapter card

This information lists the required steps for attaching a SAN Volume Controller to a Windows NT host system with the QLogic QLA23xx adapter card.

Shutdown your Windows NT host. This will involve closing applications and then issuing the shutdown command to the operating system. Follow your manufacturer's recommendations for powering down the Windows NT host and its attached peripherals.

Ensure that, when you are handling the host and adapter hardware that you use the manufacturers recommended ESD procedures throughout the replacement procedure.

1. Install the QLogic QLA23xx adapter card in the host system.
2. Connect the cable to the Fibre Channel switch.
3. Restart the server.
4. Press Ctrl+Q to get to the FAST!UTIL menu panel.
5. From the Select Host Adapter menu select the Adapter Type QLA23xx.
6. From the Fast!UTIL Options menu select **Configuration Settings**.
7. From the Configuration Settings menu, click **Host Adapter Settings**.
8. Set the parameters and values from the Host Adapter Settings menu 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**
9. Press Esc to return to the Configuration Settings menu.
10. From the Configuration Settings menu select **Advanced Adapter Settings**.
11. 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**
12. Press Esc to return to the Configuration Settings menu.
  13. Press Esc.
  14. From the Configuration settings modified window select **Save changes**.
  15. From the Fast!UTIL Options menu select **Select Host Adapter**, and repeat steps 5 on page 42 to 14, if more than one QLogic QLA23xx adapter card has been installed.
  16. Restart the server.

---

## Downloading the QLogic adapter driver

This information lists the steps required to download the QLogic adapter driver for a Microsoft Windows NT host.

1. Go to the support Web site.
2. Click **Interoperability matrix**.
3. Click **SAN Volume Controller interoperability matrix**.
4. Find the section for the current version of the driver and firmware and driver you want.
5. Go to the QLogic web site.
6. Click **Drivers / Software** from the **Quick Links** list.
7. Select **IBM** from the **OEM-approved Drivers/Firmware** section.
8. Navigate to the adapter that you want to download, then click **Download**.

After you have downloaded the driver, you must install it.

---

## Installing the QLogic adapter driver

This information provides the steps required to install the QLogic adapter driver for a Microsoft Windows NT host.

Before installing the QLogic adapter drivers, you must install the QLogic adapter card, set the correct BIOS settings, and download the driver.

1. Go to the QLogic Web site.
2. From the navigation pane, click **Drivers / Software**.
3. In the Download Drivers / Software and HBAs window, click the Down Arrow to open the **Select a Series** menu.
4. Highlight and click **Fibre-Channel HBAs**.
5. In the Download Drivers / Software and HBAs window, click the Down Arrow to open the **Select a Product** menu.
6. Highlight and click the fibre-channel adapter that you want.
7. In the **Drivers and Management Software** menu, click **Windows NT**.
8. In the Windows NT Drivers table, click **Read Me**.

See the following list for an example of information that you might find in a readme file:

- a. Operating system support
- b. Supported features
- c. Creating the driver diskette
- d. Installing the driver
- e. Initial operating system installation with the QLogic controller as the boot
- f. Adding the QLogic controller to the existing operating system
- g. Updating the existing QLogic driver
- h. Removing the driver
- i. Driver parameters
- j. System registry parameters
- k. NVRAM parameters
- l. Limitations
- m. Additional notes
- n. Using Fast!UTIL menu to change the connection options
- o. Diskette content
- p. Contacting QLogic

---

## 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

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. 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
- Windows 2003
- Windows NT

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

**Note:** If your host uses more than one fibre-channel adapter 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 adapter. Each adapter will have its own 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

To locate the WWPN for a Hewlett Packard host, follow these steps.

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 e(logo)server pSeries or an RS/6000 host

To locate the WWPN for an IBM e(logo)server pSeries or an RS/6000 host, follow these steps.

1. Log in as root.
2. Type `lscfg -v1 fcsx`, where `x` is the adapter number.  
The network address is the fibre-channel adapter port WWPN value.

---

## Locating the WWPN for a Linux host

To locate the WWPN for an Intel server running the Linux operating system with a QLogic adapter, read these instructions.

1. Restart the server.
2. Press Alt+Q to get the **FAST!Util** menu.  
If you have more than one fibre-channel adapter installed, all the fibre-channel adapters 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.

---

## Locating the WWPN for a Sun host

To locate the WWPN for a Sun host, follow these instructions.

**Note:** If you have multiple host adapters installed, you will see more than one WWPN.

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 adapter:
  - a. For the JNI SBUS adapter, search for `fcawx: 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 adapter, search for `fca-pcix: 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 adapter, search for `qla2200-hbax-adapter-port-name` where `x` is the adapter number (0, 1, and so on).

---

## Locating the WWPN for a Windows 2000 or 2003 host

To locate the WWPN for a Windows 2000 or 2003 host with a QLogic adapter, follow these steps.

1. Restart the server.
2. Press Alt+Q to get the **FAST!Util** menu.  
If you have more than one fibre-channel adapter installed, all the fibre-channel adapters 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 on your screen.

---

## Locating the WWPN for a Windows NT host

This information lists the steps required to locate the WWPN for a Windows NT host with a QLogic adapter.

1. Restart the server.



2. Press Alt+Q to get the **FAST!Util** menu. If you have more than one fibre-channel adapter installed, all the adapters 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.



---

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



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## 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 Remote Copy 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 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.

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