



# Solaris SAN Configuration and Multipathing Guide



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# Preface

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The *Solaris SAN Configuration and Multipathing Guide* provides an overview of the Sun StorageTek™ Traffic Manager software as an integrated part of the Sun Solaris™ 10 Operating System (OS). This guide includes instructions about how to install and configure the software and devices.

This guide is intended for system, storage, and network administrators who create and maintain storage area networks (SANs) and have a high level of expertise in the management and maintenance of SANs.

## Before You Read This Document

Before you read this book, read the latest Solaris 10 Operating System Release Notes.

## How This Document Is Organized

Chapter 1 provides an overview of Solaris Fibre Channel and Sun StorageTek Traffic Manager software.

Chapter 2 provides an overview of configuring the Sun StorageTek Traffic Manager software.

Chapter 3 explains how to use the `mpathadm` command to enable multipathing administration through the ANSI standard Multipath Management API.

Chapter 4 explains how to configure the multipathing feature for FC devices provided in the Solaris 10 OS.

Chapter 5 provides high level overview of the steps used to configure SAN devices.

Chapter 6 explains considerations when configuring IPFC SAN Devices.

Chapter 7 describes how to manually install the Sun Solaris 10, x86/x64 FC Operating System.

Chapter 8 describes how you can specify tape binding in the Solaris OS while retaining the benefits of automatic discovery for disk-based devices.

Appendix A explains Manual configuration for Fabric Connected Devices.

Appendix B provides details on Supported FC-HBA API.

Appendix C provides trouble shooting information for potential problems that might occur while you run the Sun StorageTek Traffic Manager software.

## Using UNIX Commands

This document might not contain information about basic UNIX<sup>®</sup> commands and procedures such as shutting down the system, booting the system, and configuring devices. Refer to the following for this information:

- Software documentation that you received with your system
- Solaris Operating System documentation at <http://docs.sun.com>  
<http://docs.sun.com>

## Related Third-Party Web Site References

Third-party URLs are referenced in this document and provide additional, related information.

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## Documentation, Support, and Training

The Sun web site provides information about the following additional resources:

- [Documentation \(http://www.sun.com/documentation/\)](http://www.sun.com/documentation/)
- [Support \(http://www.sun.com/support/\)](http://www.sun.com/support/)
- [Training \(http://www.sun.com/training/\)](http://www.sun.com/training/)

## Typographic Conventions

The following table describes the typographic conventions that are used in this book.

TABLE P-1 Typographic Conventions

Typeface	Meaning	Example
AaBbCc123	The names of commands, files, and directories, and onscreen computer output	Edit your <code>.login</code> file. Use <code>ls -a</code> to list all files. <code>machine_name%</code> you have mail.
<b>AaBbCc123</b>	What you type, contrasted with onscreen computer output	<code>machine_name% su</code> Password:
<i>aabbcc123</i>	Placeholder: replace with a real name or value	The command to remove a file is <code>rm filename</code> .
<i>AaBbCc123</i>	Book titles, new terms, and terms to be emphasized	Read Chapter 6 in the <i>User's Guide</i> . <i>A cache</i> is a copy that is stored locally. Do <i>not</i> save the file. <b>Note:</b> Some emphasized items appear bold online.

## Shell Prompts in Command Examples

The following table shows the default UNIX® system prompt and superuser prompt for the C shell, Bourne shell, and Korn shell.

TABLE P-2 Shell Prompts

Shell	Prompt
C shell	<code>machine_name%</code>
C shell for superuser	<code>machine_name#</code>
Bourne shell and Korn shell	<code>\$</code>
Bourne shell and Korn shell for superuser	<code>#</code>



# Product Overview

---

This chapter provides an overview of the Sun StorageTek Traffic Manager software.

The Sun StorageTek Traffic Manager software is integrated in the Sun Solaris 10 Operating System (OS). Regardless of whether the system that is being upgraded has a prior version of the Sun StorageTek Traffic Manager software installed, you do *not* have to separately install the software package during or after a Sun Solaris 10 OS installation. This also applies to the Sun Solaris 10 OS new initial installation.

In Sun Solaris 10 OS, fabric-connected devices are configured and made available to the host automatically during install and boot time.

---

**Note** – If you are performing an upgrade and want to make any Fibre Channel (FC) devices unavailable after upgrade, those devices have to be manually unconfigured using `cfgadm -c unconfigure` commands. However, to make those devices permanently unavailable to the system, you may want to consider using switch zoning or LUN masking. The changes made by `cfgadm -c unconfigure` do not persist after a reboot unless manual configuration for fabric-connected devices has been turned on. To find out how to disable the fabric devices discovery during boot or install, please refer to [Appendix A, “Manual Configuration for Fabric-Connected Devices”](#).

---

This chapter contains the following sections:

- “Software Features” on page 12
- “Supported Standards” on page 14

## Software Features

The Sun StorageTek Traffic Manager software enables Fibre Channel (FC) connectivity for the Sun Solaris 10 hosts. The software resides on the server and identifies the storage and switch devices on your SAN. The software enables you to attach either loop or fabric SAN storage devices while providing a standard interface with which to manage them.

### Fibre Channel Software Features

The Sun StorageTek Traffic Manager software provides the following key features:

- Dynamic Storage Discovery – The software automatically recognizes devices and any modifications made to device configurations. This feature makes devices available to the system without requiring you to reboot or manually change information in configuration files.
- Persistent Device Naming – Devices that are configured within the software maintain their device naming through reboots or reconfiguration. The only exception to this policy are tape devices found in `/dev/rmt` that will not change unless they are removed and later regenerated.
- Fibre Channel Arbitrated Loop (FCAL) Support – OpenBoot™ PROM (OBP) commands that are used on servers can access FCAL attached storage for scanning the FC loop.
- Fabric Booting – The Solaris OS supports booting from fabric devices as well as non-fabric Fibre Channel devices. Fabric topologies with Fibre Channel switches provide higher speed, more connections, and port isolation.
- FC-HBA Library – What was previously known as the Storage Networking Industry Association Fibre Channel host bus adapter (SNIA FC-HBA) library is now known as the FC-HBA library. The FC-HBA library application programming interface (API) enables management of FC HBAs and provides a standards-based interface for other applications (such as Sun StorEdge™ Enterprise Storage Manager) that can be used to gather information about FC HBAs.

Man pages for common FC-HBA APIs are included in the Solaris 10 OS in `libhbaapi (3LIB)`. For additional information about FC specifications, refer to <http://www.t11.org>.

### Multipathing Software Features With Fibre Channel Storage

The Solaris 10 OS contains the Sun StorageTek Traffic Manager software. The software is enabled by default for x86-based platforms and optional for SPARC-based platforms. The software contains the following features:

- Path management – The Sun StorageTek Traffic Manager software dynamically manages the paths to any storage devices it supports. The addition or removal of paths to a device is done automatically when a path is brought online or removed from a service. This feature enables hosts configured with the software to begin with a single path to a device and add more host controllers, increasing bandwidth and RAS, without changing device names or modifying applications. Sun storage does not require configuration files to manage or databases to keep current. For storage other than Sun, contact your storage vendor for methods to enable support and to ensure it is qualified with the Sun StorageTek Traffic Manager software.
- Single Device Instances – Unlike other multipathing solutions, the Sun StorageTek Traffic Manager software is fully integrated with the Solaris 10 OS. The software displays multipath devices as single device instances instead of as one device, or device link, per path. This feature reduces the cost of managing complex storage architectures utilities such as format (1M) or higher level applications such as the Sun Solaris Volume Manager to “see” one representation of a storage device instead of a separate device for each path.
- Failover support – Implementing higher levels of RAS requires redundant host connectivity to storage devices. The Sun StorageTek Traffic Manager software manages the failure of storage paths while maintaining host I/O connectivity through available secondary paths.
- Symmetrical/Asymmetrical device support – The Sun StorageTek Traffic Manager software supports the following disk storage devices:
  - All Sun disk storage, both symmetric and asymmetric
  - All T10/T11 standards-complaint non-Sun symmetrical disk devices
  - Many non-Sun asymmetrical disk arrays.

Please contact your storage vendor to see whether your device is supported.

In addition, T10 ALUA support has been added for those asymmetrical devices that support this T10 standard.

- I/O load balancing – In addition to providing simple failover support, the Sun StorageTek Traffic Manager software can use any active paths to a storage device to send and receive I/O. With I/O routed through multiple host connections, bandwidth can be increased by the addition of host controllers. The software uses a round-robin load-balancing algorithm by which individual I/O requests are routed to active host controllers in a series one after the other.
- Queue depth – SCSI storage arrays present storage to a host in the form of a logical unit number (LUN). LUNs have a finite set of resources available, such as the amount of data that can be stored, as well as the number of active commands that a device or LUN can process at one time. The number of active commands that can be issued before a device blocks further I/O is known as queue depth. When the Sun StorageTek Traffic Manager software is enabled, a single queue is created for each LUN regardless of the number of distinct or separate paths it may have to the host. This feature enables the disk driver to maintain and balance one queue to the LUN, effectively managing queue depth. No other multipathing software available for the Solaris 10 OS has this ability.

- STMS Boot – `stmsboot` is a utility included with the Sun Solaris Operating System (OS) to manage the enable and disable process needed for SAN booting. Issuing the `stmsboot` command allows the automatic update of `/etc/vfstab` and the dump configuration to reflect device name changes when enabling or disabling the Sun StorageTek Traffic Manager multipathing feature. Note that the Sun StorageTek Traffic Manager multipathing feature for Fibre Channel devices is disabled by default on SPARC platforms, and enabled by default on x86 platforms.
- Dynamic reconfiguration – The Sun StorageTek Traffic Manager software supports the Solaris 10 OS dynamic reconfiguration (DR).

## Supported Standards

The Sun StorageTek Traffic Manager software is based on open standards for communicating with devices and device management, ensuring interoperability with other standards-based devices and software. The following standards are supported by the Sun StorageTek Traffic Manager software:

- T10 standards, including SCSI-3, SAM, FCP, SPC, and SBC
- T11.3 FC standards, including FC-PH, FC-AL, FC-LS, and FC-GS
- T11.5 storage management standards, including FC-HBA
- IETF standards, including RFC 2625

# Configuration Overview

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This chapter provides information about configuring the Sun StorageTek Traffic Manager software. This chapter contains the following sections:

- “[Configuration Task Overview](#)” on page 15
- “[Configuration Considerations](#)” on page 16

## Configuration Task Overview

This section provides a high level overview of the tasks that you should perform to configure the Sun StorageTek Traffic Manager software.

The following table lists the configuration tasks, description about each task and the reference information where you can find the procedures to perform each task.

**TABLE 2-1** Tasks to Configure Solaris FC and Sun StorageTek Traffic Manager Software

Configuration Task	Task Description	Reference Information
Enable Multipathing	<p>Multipathing capability is provided by the Sun StorageTek Traffic Manager software in the Solaris 10 OS. This software enables multipathing:</p> <p>* By default on x86 platforms.</p> <p>* By manual configuration on SPARC platforms.</p>	<p>The steps for enabling multipathing are outlined in “<a href="#">Configuring Multipathing</a>” on page 33.</p>

TABLE 2-1 Tasks to Configure Solaris FC and Sun StorageTek Traffic Manager Software (Continued)

Configuration Task	Task Description	Reference Information
Configure Devices	In the Solaris 10 OS, FCAL and fabric-connected devices are made available to the host. This feature differs from previous versions of the Sun StorageTek Traffic Manager software running on the Solaris 8 or 9 OS. In those versions, manual configuration steps were required to achieve fabric-connected device availability on the Solaris host.	Chapter 5, “Configuring SAN Devices”
Set up FC Boot Device	The Sun StorageTek Traffic Manager software enables a Solaris server to boot from a fabric device.	“SAN Device Considerations” on page 47
Configure IPFC SAN devices	You can configure host recognition of IPFC devices and implementation of IP over FC in a SAN. Configuration of IPFC depends on the instance of the Fabric Port (FP) driver for the FC adapter ports.	Chapter 6, “Configuring IPFC SAN Devices”

## Configuration Considerations

Before you configure the Sun StorageTek Traffic Manager software, consider the following:

- Configure ports and zones according to the vendor-specific documentation for storage and switches.
- LUN masking enables specific LUNs to be seen by specific hosts. See your vendor-specific storage documentation that describes masking.
- Power management needs to be disabled for hosts and devices on a SAN. See `power.conf` (4) for details about power management.
- The STMS Boot utility is included with the Sun StorageTek Traffic Manager software that manages the enable and disable process needed for SAN booting. Issuing the `stmsboot` command allows the automatic update of `/etc/vfstab` and the dump configuration to reflect device name changes when enabling or disabling the Sun StorageTek Traffic Manager software. Note that the software is disabled by default with SPARC devices and enabled by default with x86 devices.

# Administering Multipathing Devices Through `mpathadm` Commands

---

You determine and configure Solaris OS multipathing support by using `mpathadm` commands. Starting with Solaris 10 Update 3, the `mpathadm` command enables multipathing administration through the ANSI standard Multipath Management API. The terms used in this chapter to denote a path, initiator port, target port, and logical unit are consistent with the T10 specification. This chapter contains the following sections:

- “To Get a List of Multipathing Support That Can Be Administered by the `mpathadm` Command” on page 18
- “To Get the Multipathing Support Properties” on page 18
- “To Get a List of Initiator Ports Discovered on the System” on page 19
- “To Get the Properties of a Particular Initiator Port” on page 19
- “To Get a List of Logical Units Discovered on the System” on page 20
- “To Get the Properties and Associated Path Information of a Particular Logical Unit by Name” on page 20
- “To List All Logical Units Associated With a Particular Target Port” on page 21
- “To List a Logical Unit With a Particular Name Derived From the Hardware Used by the System” on page 23
- “To Configure Auto-Failback for a Particular Multipathing Support” on page 25
- “To Fail Over a Logical Unit” on page 26
- “To Enable a Path” on page 28
- “To Disable a Path” on page 30

## Administering Multipathing Devices

Perform the following tasks to administer any multipathing devices.

## ▼ To Get a List of Multipathing Support That Can Be Administered by the `mpathadm` Command

The multipathing support is identified with the Multipath Management API plug-in library name.

- List the multipathing support by typing the `mpathadm list mpath-support` command.

```
# mpathadm list mpath-support
mpath-support: libmpscsi_vhci.so
```

(Only one result is shown in the preceding example.)

## ▼ To Get the Multipathing Support Properties

The multipathing support properties are associated with Multipath Management API plug-in properties.

- 1 List the multipathing support by typing the `mpathadm list mpath-support` command.

```
# mpathadm list mpath-support
mpath-support: libmpscsi_vhci.so
```

(Only one `mpath` support name result is shown in the preceding output list example.)

- 2 Choose the `mpath` support name from the output list.

- 3 List the multipathing support properties for a specified `mpath` support name by typing the `mpathadm show mpath-support mpath-support-name` command.

```
# mpathadm show mpath-support libmpscsi_vhci.so
mpath-support: libmpscsi_vhci.so
  Vendor: Sun Microsystems
  Driver Name: scsi_vhci
  Default Load Balance: round-robin
  Supported Load Balance Types:
    round-robin
    logical-block
  Allows To Activate Target Port Group Access: yes
  Allows path Override: no
  Supported Auto Failback Config: yes
  Auto Failback: on
  Failback Polling Rate (current/max): 0/0
  Supported Auto Probing config: no
  Auto Probing: NA
  probing Polling Rate (current/max): NA/NA
  Supported Devices:
    Vendor: SUN
```

```

Product: T300
Revision:
Supported Load Balance Types:
    round-robin
Vendor: SUN
Product: T4
Revision:
Supported Load Balance Types:
    round-robin

```

The command output also shows a list of device products that is supported by the multipathing support software. The multipathing support `libmpscsi_vhci` . so supports T10 target port group compliant devices by default.

## ▼ To Get a List of Initiator Ports Discovered on the System

An initiator port is part of a path that consists of an initiator port, target port, and a logical unit.

- Run the `mpathadm list initiator-port` command.

```

# mpathadm list initiator-port
Initiator-Port: iqn.1986-03.com.sun:01:080020b7ac2b.437a3b3e,4000002affff
Initiator-Port: 2000000173018713

```

## ▼ To Get the Properties of a Particular Initiator Port

Display the properties of an initiator port by typing the show command.

- 1 Run the `mpathadm list initiator-port` command.

```

# mpathadm list initiator-port
Initiator-Port: iqn.1986-03.com.sun:01:080020b7ac2b.437a3b3e,4000002affff
Initiator-Port: 2000000173018713

```

- 2 Select an initiator port to use from the output.
- 3 Run the `mpathadm show initiator-port initiator-port-name` command.

```

# mpathadm show initiator-port 2000000173018713
initiator-port: 2000000173018713
    Transport Type: Fibre Channel
    OS Device File: /devices/pci@1f,2000/SUNW,glc@4/fp@0,0

```

## ▼ To Get a List of Logical Units Discovered on the System

The `mpathadm list lu` command displays the list of logical units attached to the initiator. This list displays the number of paths and the operational path count to each logical unit listed.

- Run the `mpathadm list lu` command.

```
# mpathadm list lu
/dev/rdisk/c4t60020F20000035AF4267CCCB0002CEE2d0s2
  Total Path Count: 2
  Operational Path Count: 2
/dev/rdisk/c4t60003BA27D2120004204AC2B000DAB00d0s2
  Total Path Count: 2
  Operational Path Count: 2
/dev/rdisk/c4t60003BA27D2120004204AC1A000F1D6Cd0s2
  Total Path Count: 2
  Operational Path Count: 2
```

## ▼ To Get the Properties and Associated Path Information of a Particular Logical Unit by Name

Display the list of logical units, along with the properties for each logical unit through the `mpathadm` command. The list of logical units contains logical unit names that in turn can be used to display the properties of a particular logical unit.

- 1 Run the `mpathadm list lu` command.

```
# mpathadm list lu
/dev/rdisk/c4t60020F20000035AF4267CCCB0002CEE2d0s2
  Total Path Count: 2
  Operational Path Count: 2
/dev/rdisk/c4t60003BA27D2120004204AC2B000DAB00d0s2
  Total Path Count: 2
  Operational Path Count: 2
/dev/rdisk/c4t60003BA27D2120004204AC1A000F1D6Cd0s2
  Total Path Count: 2
  Operational Path Count: 2
```

- 2 Select a logical unit name from the output.

- 3 Run the `mpathadm show lu logical-unit-name` command.

```
# mpathadm show lu /dev/rdisk/c4t60003BA27D2120004204AC2B000DAB00d0s2
logical unit: /dev/rdisk/c4t60003BA27D2120004204AC2B000DAB00d0s2
  mpath-support libmpscsi_vhci.so
```

```

Vendor: SUN
Product: T4
Revision: 0301
Name Type: SCSI Inquiry VPD page 83 type 3
Name: 60003ba27d2120004204ac2b000dab00
Asymmetric: yes
Current Load Balance: round-robin
Logical Unit Group ID: NA
Auto Failback: on
Auto Probing: NA

```

Paths:

```

Initiator Port Name: 2000000173818713
Target Port Name: 20030003ba27d212
Override Path: NA
Path State: OK
Disabled: no

```

```

Initiator Port Name: 2000000173018713
Target Port Name: 20030003ba27d095
Override path: NA
Path State: OK
Disabled: no

```

Target Port Groups:

```

ID: 2
Explicit Failover: yes
Access State: standby
Target Ports:
  Name: 20030003ba27d212
  Relative ID: 0

```

```

ID: 5
Explicit Failover: yes
Access State: active
Target Ports:
  Name: 20030003ba27d095
  Relative ID: 0

```

## ▼ To List All Logical Units Associated With a Particular Target Port

To list paths through a target port use the show command of a logical unit. First, retrieve the list of target ports associated with a logical unit. Then, use the target port to list all logical units associated with this target port.

**1 Run the `mpathadm list lu` command.**

```
# mpathadm list lu
/dev/rds/c4t60020F20000035AF4267CCCB0002CEE2d0s2
  Total Path Count: 2
  Operational Path Count: 2
/dev/rds/c4t60003BA27D2120004204AC2B000DAB00d0s2
  Total Path Count: 2
  Operational Path Count: 2
/dev/rds/c4t60003BA27D2120004204AC1A000F1D6Cd0s2
  Total Path Count: 2
  Operational Path Count: 2
```

**2 Select a logical unit name from the output.****3 Run the `mpathadm show lu` command.**

```
# mpathadm show lu /dev/rds/c4t60003BA27D2120004204AC2B000DAB00d0s2
logical unit: /dev/rds/c4t60003BA27D2120004204AC2B000DAB00d0s2
mpath-support libmpscsi_vhci.so
Vendor: SUN
Product: T4
Revision: 0301
Name Type: SCSI Inquiry VPD page 83 type 3
Name: 60003ba27d2120004204ac2b000dab00
Asymmetric: yes
Current Load Balance: round-robin
Logical Unit Group ID: NA
Auto Failback: on
Auto Probing: NA

Paths:
  Initiator Port Name: 2000000173818713
  Target Port Name: 20030003ba27d212
  Override Path: NA
  Path State: OK
  Disabled: no

  Initiator Port Name: 2000000173018713
  Target Port Name: 20030003ba27d095
  Override path: NA
  Path State: OK
  Disabled: no

Target Port Groups:
  ID: 2
  Explicit Failover: yes
  Access State: standby
```

```

Target Ports:
  Name: 20030003ba27d212
  Relative ID: 0

ID: 5
Explicit Failover: yes
Access State: active
Target Ports:
  Name: 20030003ba27d095
  Relative ID: 0

```

- 4 Select a target port from the output list.
- 5 Run the `mpathadm list lu -t` command.

```

# mpathadm list lu -t 20030003ba27d212
/dev/rdisk/c4t60003BA27D2120004204AC2B000DAB00d0s2
  Total Path Count: 2
  Operational Path Count: 2
/dev/rdisk/c4t60003BA27D2120004204AC1A000F1D6Cd0s2
  Total Path Count: 2
  Operational Path Count: 2

```

## ▼ To List a Logical Unit With a Particular Name Derived From the Hardware Used by the System

- 1 Run the `mpathadm list lu` command.

```

# mpathadm list lu
/dev/rdisk/c4t60020F20000035AF4267CCCB0002CEE2d0s2
  Total Path Count: 2
  Operational Path Count: 2
/dev/rdisk/c4t60003BA27D2120004204AC2B000DAB00d0s2
  Total Path Count: 2
  Operational Path Count: 2
/dev/rdisk/c4t60003BA27D2120004204AC1A000F1D6Cd0s2
  Total Path Count: 2
  Operational Path Count: 2

```

- 2 Select a logical unit name from the output.

**3 Run the `mpathadm show lu logical-unit-name` command.**

```
# mpathadm show lu /dev/rdisk/c4t60003BA27D2120004204AC2B000DAB00d0s2
logical unit: /dev/rdisk/c4t60003BA27D2120004204AC2B000DAB00d0s2
  mpath-support libmpscsi_vhci.so
  Vendor: SUN
  Product: T4
  Revision: 0301
  Name Type: SCSI Inquiry VPD page 83 type 3
  Name: 60003ba27d2120004204ac2b000dab00
  Asymmetric: yes
  Current Load Balance: round-robin
  Logical Unit Group ID: NA
  Auto Failback: on
  Auto Probing: NA

  Paths:
    Initiator Port Name: 2000000173818713
    Target Port Name: 20030003ba27d212
    Override Path: NA
    Path State: OK
    Disabled: no

    Initiator Port Name: 2000000173018713
    Target Port Name: 20030003ba27d095
    Override path: NA
    Path State: OK
    Disabled: no

  Target Port Groups:
    ID: 2
    Explicit Failover: yes
    Access State: standby
    Target Ports:
      Name: 20030003ba27d212
      Relative ID: 0

    ID: 5
    Explicit Failover: yes
    Access State: active
    Target Ports:
      Name: 20030003ba27d095
      Relative ID: 0
```

**4 Select an *inquiry-string-name* from the output.**

- 5 Run the `mpathadm list lu -n inquiry-string-name` command.

```
# mpathadm list lu -n 60003ba27d2120004204ac2b000dab00
mpath-support: libmpscsi_vhci.so
                /dev/rdsk/c4t60003BA27D2120004204AC2B000DAB00d0s2
                Total Path Count: 2
                Operational Path Count: 2
```

## ▼ To Configure Auto-Failback for a Particular Multipathing Support

Symmetrical devices allow for automatic failback to a possible optimal path. If a failover occurs on the initial path, the standby path becomes the new online path. Usually the standby path is a suboptimal path. When auto-failback is enabled, the initial path comes back online, failover to the initial path automatically occurs.

- 1 Run the `mpathadm list mpath-support` command.

```
# mpathadm list mpath-support
mpath-support: libmpscsi_vhci.so
```

- 2 Select an `mpath` support name from the output list.

- 3 Run the `mpathadm modify mpath-support -a [on | off] mpath-support-name` command.

```
# mpathadm modify mpath-support -a off libmpscsi_vhci.so
```

- 4 Run the `mpathadm show mpath-support mpath-support-name` command to check the change.

```
# mpathadm show mpath-support libmpscsi_vhci.so
mpath-support: libmpscsi_vhci.so
Vendor: Sun Microsystems
Driver Name: scsi_vhci
Default Load Balance: round-robin
Supported Load Balance Types:
    round-robin
    logical-block
Allows To Activate Target Port Group Access: yes
Allows path Override: no
Supported Auto Failback Config: yes
Auto Failback: on
Failback Polling Rate (current/max): 0/0
Supported Auto Probing config: no
Auto Probing: NA
probing Polling Rate (current/max): NA/NA
Supported Devices:
```

```

Vendor: SUN
Product: T300
Revision:
Supported Load Balance Types:
    round-robin
Vendor: SUN
Product: T4
Revision:
Supported Load Balance Types:
    round-robin

```

---

**Note** – The auto-failback display initiated by the `mpathadm modify` command setting is effective while the system is running. However, to keep the changed setting persistent, you must update the `/kernel/drv/scsi_vhci.conf` file. Refer to [“Configuring Automatic Failback” on page 46](#).

---

## ▼ To Fail Over a Logical Unit

This operation is applicable only to devices in the following two categories:

- Asymmetric devices with a proprietary failover mechanism recognized and supported by multipathing support
- Devices conforming to the T10 Standard Target Port Group Support `libmpscsi_vhci.so` and providing *explicit* mode asymmetric logical unit access

### 1 Run the `mpathadm list lu` command.

```

# mpathadm list lu
/dev/rdisk/c4t60020F20000035AF4267CCCB0002CEE2d0s2
    Total Path Count: 2
    Operational Path Count: 2
/dev/rdisk/c4t60003BA27D2120004204AC2B000DAB00d0s2
    Total Path Count: 2
    Operational Path Count: 2
/dev/rdisk/c4t60003BA27D2120004204AC1A000F1D6Cd0s2
    Total Path Count: 2
    Operational Path Count: 2

```

### 2 Select a logical unit name from the output.

### 3 Run the `mpathadm show lu logical-unit-name` command.

```

# mpathadm show lu /dev/rdisk/c4t60003BA27D2120004204AC2B000DAB00d0s2
logical unit: /dev/rdisk/c4t60003BA27D2120004204AC2B000DAB00d0s2
    mpath-support libmpscsi_vhci.so
    Vendor: SUN

```

```

Product: T4
Revision: 0301
Name Type: SCSI Inquiry VPD page 83 type 3
Name: 60003ba27d2120004204ac2b000dab00
Asymmetric: yes
Current Load Balance: round-robin
Logical Unit Group ID: NA
Auto Failback: on
Auto Probing: NA

```

Paths:

```

Initiator Port Name: 2000000173818713
Target Port Name: 20030003ba27d212
Override Path: NA
Path State: OK
Disabled: no

```

```

Initiator Port Name: 2000000173018713
Target Port Name: 20030003ba27d095
Override path: NA
Path State: OK
Disabled: no

```

Target Port Groups:

```

ID: 2
Explicit Failover: yes
Access State: standby
Target Ports:
  Name: 20030003ba27d212
  Relative ID: 0

```

```

ID: 5
Explicit Failover: yes
Access State: active
Target Ports:
  Name: 20030003ba27d095
  Relative ID: 0

```

**4 Run the `mpathadm failover lu logical-unit-name` command.**

```
# mpathadm failover lu /dev/rdisk/c4t60003BA27D2120004204AC2B000DAB00d0s2
```

If this operation is successful, the access state of the devices' target port groups changes as a result of the logical unit failover.

**5 Run the `mpathadm show lu logical-unit-name` command to verify the access state change.**

```
# mpathadm show lu /dev/rdisk/c4t60003BA27D2120004204AC2B000DAB00d0s2
logical unit: /dev/rdisk/c4t60003BA27D2120004204AC2B000DAB00d0s2
mpath-support libmpscsi_vhci.so
```

Vendor: SUN  
Product: T4  
Revision: 0301  
Name Type: SCSI Inquiry VPD page 83 type 3  
Name: 60003ba27d2120004204ac2b000dab00  
Asymmetric: yes  
Current Load Balance: round-robin  
Logical Unit Group ID: NA  
Auto Failback: on  
Auto Probing: NA

Paths:

Initiator Port Name: 2000000173818713  
Target Port Name: 20030003ba27d212  
Override Path: NA  
Path State: OK  
Disabled: no

Initiator Port Name: 2000000173018713  
Target Port Name: 20030003ba27d095  
Override path: NA  
Path State: OK  
Disabled: no

Target Port Groups:

ID: 2  
Explicit Failover: yes  
Access State: active  
Target Ports:  
Name: 20030003ba27d212  
Relative ID: 0

ID: 5  
Explicit Failover: yes  
Access State: standby  
Target Ports:  
Name: 20030003ba27d095  
Relative ID: 0

## ▼ To Enable a Path

If the path to a logical unit is disabled, the `enable` command changes the path back to enabled. The full path must be specified using the initiator port name, target port name, and the logical unit. To verify the change, run the `show` command for the logical unit.

**1 Run the `mpathadm list lu` command.**

```
# mpathadm list lu
/dev/rdisk/c4t60020F20000035AF4267CCCB0002CEE2d0s2
  Total Path Count: 2
  Operational Path Count: 2
/dev/rdisk/c4t60003BA27D2120004204AC2B000DAB00d0s2
  Total Path Count: 2
  Operational Path Count: 2
/dev/rdisk/c4t60003BA27D2120004204AC1A000F1D6Cd0s2
  Total Path Count: 2
  Operational Path Count: 2
```

**2 Select a logical unit name from the output.****3 Run the `mpathadm show lu logical-unit-name` command.**

```
# mpathadm show lu /dev/rdisk/c4t60003BA27D2120004204AC2B000DAB00d0s2
logical unit: /dev/rdisk/c4t60003BA27D2120004204AC2B000DAB00d0s2
mpath-support libmpscsi_vhci.so
Vendor: SUN
Product: T4
Revision: 0301
Name Type: SCSI Inquiry VPD page 83 type 3
Name: 60003ba27d2120004204ac2b000dab00
Asymmetric: yes
Current Load Balance: round-robin
Logical Unit Group ID: NA
Auto Failback: on
Auto Probing: NA

Paths:
  Initiator Port Name: 2000000173818713
  Target Port Name: 20030003ba27d212
  Override Path: NA
  Path State: OK
  Disabled: no

  Initiator Port Name: 2000000173018713
  Target Port Name: 20030003ba27d095
  Override path: NA
  Path State: OK
  Disabled: no

Target Port Groups:
  ID: 2
  Explicit Failover: yes
  Access State: standby
```

```
Target Ports:
  Name: 20030003ba27d212
  Relative ID: 0

ID: 5
Explicit Failover: yes
Access State: active
Target Ports:
  Name: 20030003ba27d095
  Relative ID: 0
```

**4 Select an initiator port and a target port name.**

**5 Run the `mpathadm enable path -i initiator-port-name -t target-port-name -l logical-unit-name` command.**

```
# mpathadm enable path -i 2000000173018713 -t 20030003ba27d095 -l /dev/rdisk/c4t60003BA27D2120004204AC2B000DAB00d0s2
```

## ▼ To Disable a Path

This operation makes the path unavailable for the logical unit, regardless of its operational state.

---

**Note** – The disabled state is not persistent across rebooting. If the path is operational before the next boot sequence, it is enabled by default.

---

---

**Note** – This operation is not allowed when the given path is the last operational path remaining.

---

**1 Run the `mpathadm list lu` command.**

```
# mpathadm list lu
/dev/rdisk/c4t60020F20000035AF4267CCCB0002CEE2d0s2
  Total Path Count: 2
  Operational Path Count: 2
/dev/rdisk/c4t60003BA27D2120004204AC2B000DAB00d0s2
  Total Path Count: 2
  Operational Path Count: 2
/dev/rdisk/c4t60003BA27D2120004204AC1A000F1D6Cd0s2
  Total Path Count: 2
  Operational Path Count: 2
```

**2 Select a logical unit name from the output.**

**3 Run the `mpathadm show lu logical-unit-name` command.**

```
# mpathadm show lu /dev/rdsk/c4t60003BA27D2120004204AC2B000DAB00d0s2
logical unit: /dev/rdsk/c4t60003BA27D2120004204AC2B000DAB00d0s2
  mpath-support libmpscsi_vhci.so
  Vendor: SUN
  Product: T4
  Revision: 0301
  Name Type: SCSI Inquiry VPD page 83 type 3
  Name: 60003ba27d2120004204ac2b000dab00
  Asymmetric: yes
  Current Load Balance: round-robin
  Logical Unit Group ID: NA
  Auto Failback: on
  Auto Probing: NA

  Paths:
    Initiator Port Name: 2000000173818713
    Target Port Name: 20030003ba27d212
    Override Path: NA
    Path State: OK
    Disabled: no

    Initiator Port Name: 2000000173018713
    Target Port Name: 20030003ba27d095
    Override path: NA
    Path State: OK
    Disabled: no

  Target Port Groups:
    ID: 2
    Explicit Failover: yes
    Access State: standby
    Target Ports:
      Name: 20030003ba27d212
      Relative ID: 0

    ID: 5
    Explicit Failover: yes
    Access State: active
    Target Ports:
      Name: 20030003ba27d095
      Relative ID: 0
```

**4 Select an initiator port and a target port name.**

- 5** Run the `mpathadm disable path -i initiator-port-name -t target-port-name -l logical-unit-name` command.

```
# mpathadm disable path -i 2000000173018713 -t 20030003ba27d095  
-l /dev/rdisk/c4t60003BA27D2120004204AC2B000DAB00d0s2
```

# Configuring Multipathing Software

---

This chapter explains how to configure the Sun StorageTek Traffic Manager software that is provided in the Solaris 10 OS for Fibre Channel (FC) devices. It also provides the considerations while enabling or disabling the multipathing feature on SPARC based systems, x86 based systems, per-port basis and third-party storage devices.

This chapter contains the following sections:

- “Configuring Multipathing” on page 33
- “Enabling or Disabling Multipathing” on page 34
- “Enabling or Disabling Multipathing on SPARC and Solaris 10 Update 4 x86 Based Systems” on page 34
- “Enabling or Disabling Multipathing on Solaris 10 Update 3 and Prior x86 Based Systems” on page 36
- “Enabling or Disabling Multipathing for Ports” on page 37
- “Configuring Third-Party Storage Devices” on page 41
- “Configuring Automatic Failback” on page 46

## Configuring Multipathing

The multipathing feature for FC devices can be configured to control all Sun supported FC HBAs. Multipathing is disabled by default for FC devices on SPARC based systems, but is enabled by default on x86 based systems. Configuration of the multipathing software depends on how you intend to use your system.

---

**Note** – The multipathing feature is not available for parallel SCSI devices but is available for FC disk devices. Multipathing is not supported on tape drives or libraries, or on IP over FC.

---

Before you configure third-party devices for multipathing, be aware of the following:

## Enabling or Disabling Multipathing

Before you change multipathing configuration note the following considerations. Then follow the instructions for your machine architecture (SPARC or x86) described in the subsequent sections.

- Device Specific Considerations

Some devices need to be properly configured to work with the multipathing software. Refer to your storage array documentation for details on the device specific configuration for your device.

- Device Name Change Considerations

In the `/dev` and `/devices` trees, multipath-enabled devices receive new names that indicate that they are under multipath control. A device therefore will have a different name from its original name when it is under multipath control.

Device name with multipath disabled:

```
/dev/dsk/c1t1d0s0
```

Device name with multipath enabled:

```
/dev/dsk/c3t2000002037CD9F72d0s0
```

Therefore, applications that use device names directly must be configured to use the new names whenever you change multipath configuration from disabled to enabled or vice-versa.

The system's `/etc/vfstab` file and the dump configuration also contain references to device names. On SPARC based systems and Solaris 10 Update 4 x86 systems, the `stmsboot(1M)` command described in the following sections automatically updates the `/etc/vfstab` and the dump configuration with the new device names. On Solaris 10 Update 3 and prior x86 based systems, this updating must be performed manually if the device names listed in `/etc/vfstab` or your dump device are affected by the device name changes. In the `/etc/vfstab` file, substitute new device names in place of old device names. Use the `dumpadm(1M)` command to update the dump configuration.

## Enabling or Disabling Multipathing on SPARC and Solaris 10 Update 4 x86 Based Systems

On SPARC and Solaris 10 Update 4 x86 systems, you can enable or disable multipathing on FC devices by using the `stmsboot(1M)` command. The command also updates `/etc/vfstab` and dump configuration to reflect devices name changes during the next reboot.

The following consideration apply for the `stmsboot -e`, `-d`, and `-u` options:

- Reboot immediately after running the `stmsboot` command.
- Because the `stmsboot` command reboots the machine to complete the operation, if you are running a SPARC system, ensure that the `eeprom(1M)` boot device is set to boot from your current boot device.
- The `stmsboot` command saves a copy of your original `/kernel/drv/fp.conf` and `/etc/vfstab` files before modifying them. For Solaris 10 Update 4 x86 based systems, the `stmsboot` command also saves a copy of your original `/boot/solaris/bootenv.rc` file before modifying it. You can use the saved files to recover from any unexpected problems. See [Appendix C, “Multipathing Troubleshooting”](#) if you encounter unexpected problems during `stmsboot`.

---

**Note** – The behavior of the `stmsboot` command in the Solaris 10 OS differs from the `stmsboot` command provided by Sun StorEdge SAN Foundation software in the Solaris 8 and 9 OS. In the Solaris 8 and Solaris 9 OS, the `stmsboot` command is used to enable or disable multipathing on the boot device only. In the Solaris 10 OS, the command is used to enable or disable multipathing on all devices.

---

## ▼ To Enable Multipathing

Perform the following steps to enable multipathing on all FC devices on SPARC and Solaris 10 Update 4 x86 and later systems. If you want to enable multipathing only on specific FC ports, refer to [“Enabling or Disabling Multipathing for Ports”](#) on page 37.

**Before You Begin** The multipathing software automatically recognizes Sun supported devices. If you want to enable multipathing on third-party devices, add entries to the `/kernel/drv/scsi_vhci.conf` file as mentioned in the section [“Considerations for Third-Party Device Configuration”](#) on page 42.

### 1 Run the `stmsboot -e` command:

```
# stmsboot -e
WARNING: This operation will require a reboot.
Do you want to continue ? [y/n] (default: y) y
The changes will come into effect after rebooting the system.
Reboot the system now ? [y/n] (default: y) y
```

---

**Note** – During the reboot, `/etc/vfstab` and the dump configuration will be updated to reflect the device name changes.

---

### 2 (Optional) After the reboot, if necessary, configure your applications to use new device names as described in [“Enabling or Disabling Multipathing”](#) on page 34.

## ▼ To Disable Multipathing

Perform the following steps to disable multipathing on all FC devices on SPARC and Solaris 10 Update 4 x86 and later systems, if you have enabled it before. If you want to disable multipathing only on specific FC ports, refer to the section [“Enabling or Disabling Multipathing for Ports” on page 37](#).

### 1 Run the `stmsboot -d` command.

```
# stmsboot -d
WARNING: This operation will require a reboot.
Do you want to continue? [y/n] (default: y) y
The changes will come into effect after rebooting the system.
Reboot the system now? [y/n] (default: y) y
```

---

**Note** – During the reboot, `/etc/vfstab` and the dump configuration will be updated to reflect the device name changes.

---

### 2 (Optional) After the reboot, if necessary, configure your applications to use new device names as described in [“Enabling or Disabling Multipathing” on page 34](#).

## Enabling or Disabling Multipathing on Solaris 10 Update 3 and Prior x86 Based Systems

For systems running Solaris 10 Update 3 and prior x86 versions, multipathing is enabled by default, but the `stmsboot(1M)` command is not supported. Use the following procedure to disable multipathing, and then to re-enable it.



---

**Caution** – Do not disable critical file systems needed for booting, such as the root (`/`), `/usr`, or `/var` file systems, that are on FC disks or your system will not boot. You may disable multipathing on all FC devices if the critical file systems are not on FC disks. If the critical file systems are on FC disks, you may disable multipathing only on those FC HBA controller ports that aren't connected to the disks containing the critical file systems. For more information, see [“Enabling or Disabling Multipathing for Ports” on page 37](#).

---

## ▼ To Enable or Disable Multipathing

### Before You Begin

The multipathing software automatically recognizes Sun supported devices. If you want to enable multipathing on third-party devices, add entries to the `/kernel/drv/scsi_vhci.conf` file as mentioned in the section [“Considerations for Third-Party Device Configuration” on page 42](#).

- 1 **Enable or disable multipathing by editing the `/kernel/drv/fp.conf` file.**
  - **To enable multipathing, change the value of `mpxio-disable` to "no." If the entry doesn't exist, add a new entry.**  
`mpxio-disable="no";`
  - **To disable multipathing, change the value of `mpxio-disable` to "yes." If the entry doesn't exist, add a new entry.**  
`mpxio-disable="yes";`

---

**Note** – This setting does not affect your per-port multipathing configuration. For information on per-port configuration refer to [“Enabling or Disabling Multipathing for Ports” on page 37.](#)

---

- 2 **Save and exit the `fp.conf` file.**
- 3 **Perform a reconfiguration reboot.**  

```
# touch /reconfigure
# shutdown -g0 -y -i6
```
- 4 **(Optional) Perform device name updates as described in [“Enabling or Disabling Multipathing” on page 34.](#)**

## Enabling or Disabling Multipathing for Ports

Multipathing can be enabled or disabled on specific FC Host Bus Adapter (HBA) controller ports for finer control. If you enable multipathing on a specific HBA controller port, all supported devices connected to the controller port will have multipathing enabled on them.

The procedure described in this section applies to both SPARC and x86 based machines.

## Considerations for Port Configurations

Before you start configuring the software by port, consider the following:

- You use the `/kernel/drv/fp.conf` file to set both global and per-port multipath settings. Per-port multipath settings have priority over the global setting. Therefore, if global multipathing is enabled but a specific port has been disabled for multipathing, the port will be unable to run multipathing. Conversely, even if global multipathing has been disabled but a specific port has been enabled for multipathing, the specific port will be enabled for multipathing.
- Load balancing is controlled by the global `load-balance` property in `/kernel/drv/scsi_vhci.conf` file and can not be applied on a per-port basis.

- If a device has more than one path to the host, all paths to the device must be configured with multipathing enabled or disabled.
- Configuring multipathing by port enables the multipathing software to co-exist with other multipathing solutions like Symantec (VERITAS) Dynamic Multipathing (DMP), or EMC PowerPath. However, devices and paths should not be shared between the multipathing software and other multipathing solutions.

## ▼ To Configure Multipathing by Port

Depending on how many ports you want the multipathing software to control, you can enable or disable multipathing globally or for specified ports.

### 1 Log in as superuser.

### 2 Determine the HBA controller ports that you want the multipathing software to control.

For example, to select the desired device, perform an `ls -l` command on `/dev/fc`. The following example shows the `ls -l` command output.

```
lrwxrwxrwx 1 root root          49 Apr 17 18:14 fp0 ->
../../../../devices/pci@6,2000/SUNW,qlc@2/fp@0,0:devctl
lrwxrwxrwx 1 root root          49 Apr 17 18:14 fp1 ->
../../../../devices/pci@7,2000/SUNW,qlc@2/fp@0,0:devctl
lrwxrwxrwx 1 root root          49 Apr 17 18:14 fp2 ->
../../../../devices/pci@a,2000/SUNW,qlc@2/fp@0,0:devctl
lrwxrwxrwx 1 root root          49 Apr 17 18:14 fp3 ->
../../../../devices/pci@b,2000/SUNW,qlc@2/fp@0,0:devctl
lrwxrwxrwx 1 root root          50 Apr 17 18:14 fp4 ->
../../../../devices/pci@12,2000/SUNW,qlc@2/fp@0,0:devctl
lrwxrwxrwx 1 root root          56 Apr 17 18:14 fp5 ->
../../../../devices/pci@13,2000/pci@2/SUNW,qlc@4/fp@0,0:devctl
lrwxrwxrwx 1 root root          56 Apr 17 18:14 fp6 ->
../../../../devices/pci@13,2000/pci@2/SUNW,qlc@5/fp@0,0:devctl
lrwxrwxrwx 1 root root          56 Apr 17 18:14 fp7 ->
../../../../devices/sbus@7,0/SUNW,qlc@0,30400/fp@0,0:devctl
```

---

**Note** – The fp7 is an SBus HBA. The fp5 and fp6 include two /pci elements, which indicates a dual PCI HBA. The rest of the entries do not have additional PCI bridges and are single PCI HBAs.

---

### 3 In the `/kernel/drv/fp.conf` file, explicitly enable or disable multipathing on an HBA controller port.

In this file, you enable or disable both the global `multipath` setting, as well as `multipath` settings for specific ports.

Change the value of the global `mpxio-disable` property. If the entry doesn't exist, add a new entry. The global setting applies to all ports except the ports specified by the per-port entries.

- **To enable multipathing globally, change to:**

```
mpxio-disable="no";
```

- **To disable multipathing globally, change to:**

```
mpxio-disable="yes";
```

Add the per-port `mpxio-disable` entries with one entry for every HBA controller port you want to configure. Per-port settings override the global setting for the specified ports.

- **To enable multipathing on an HBA port, add:**

```
name="fp" parent="parent name" port=port-number mpxio-disable="no";
```

- **To disable multipathing on an HBA port, add:**

```
name="fp" parent="parent name" port=port-number mpxio-disable="yes";
```

The following example disables multipathing on all HBA controller ports except the two specified ports.

```
mpxio-disable="yes";
name="fp" parent="/pci@6,2000/SUNW,qlc@2" port=0 mpxio-disable="no";
name="fp" parent="/pci@13,2000/pci@2/SUNW,qlc@5" port=0 mpxio-disable="no";
```

#### 4 Perform one of the following:

- **If running on a SPARC or Solaris 10 Update 4 (or later) x86 based system, run the `stmsboot -u` command.**

```
# stmsboot -u
```

```
WARNING: This operation will require a reboot.
```

```
Do you want to continue ? [y/n] (default: y) y
```

```
The changes will come into effect after rebooting the system.
```

```
Reboot the system now ? [y/n] (default: y) y
```

During the reboot, `/etc/vfstab` and the dump configuration will be updated to reflect the device name changes.

- **If running on a Solaris 10 Update 3 or prior version x86 based system, perform a reconfiguration reboot.**

```
# touch /reconfigure
```

```
# shutdown -g0 -y -i6
```

#### 5 If necessary, perform device name updates as described in [“Enabling or Disabling Multipathing” on page 34](#).

## ▼ To Configure an HBA Controller Port on a SPARC System

The following steps show the configuration of a sample single PCI HBA. `fp0`

-> `./././devices/pci@6,2000/SUNW,qlc@2/fp@0,0:devctl`. This sample entry from the `ls -l` command output shown in [“Considerations for Port Configurations” on page 37](#) indicates a single PCI HBA.

- 1 To Determine multipathing on the HBA ports, edit the `/kernel/drv/fp.conf` file.
- 2 Perform one of the following:
  - To explicitly enable multipathing on this HBA port, but disable on the rest of the HBA ports, add the following:
 

```
mpxio-disable="yes";
name="fp" parent="/pci@6,2000/SUNW,qlc@2" port=0 mpxio-disable="no";
```
  - To explicitly disable multipathing on this HBA port, but enable on the rest of the HBA ports, add the following:
 

```
mpxio-disable="no";
name="fp" parent="/pci@6,2000/SUNW,qlc@2" port=0 mpxio-disable="yes";
```
- 3 Save and exit the file.
- 4 Run the `stmsboot -u` command.
 

```
# stmsboot -u
WARNING: This operation will require a reboot.
Do you want to continue ? [y/n] (default: y) y
The changes will come into effect after rebooting the system.
Reboot the system now ? [y/n] (default: y) y
```

During the reboot, `/etc/vfstab` and the dump configuration will be updated to reflect the device name changes.
- 5 (Optional) After the reboot, if necessary, configure your applications to use new device names as described in [“Enabling or Disabling Multipathing” on page 34](#).

## ▼ To Configure an HBA Controller Port on an x86 Based System

The following steps show the configuration of a sample single PCI HBA. `fp0` ->

`./././devices/pci@ld,0/pci1022,7450@1/pci1077,149@1/fp@0,0:devctl`.

- 1 To Determine multipathing on the HBA ports, edit the `/kernel/drv/fp.conf` file,

2 Perform one of the following:

- To explicitly enable multipathing on this HBA port, but disable on the rest of the HBA ports, add the following:

```
mpxio-disable="yes";name="fp" parent="/pci@ld,0/pci1022,7450@1/pci1077,149@1"
port=0 mpxio-disable="no";
```

- To explicitly disable multipathing on this HBA port, but enable on the rest of the HBA ports, add the following:

```
mpxio-disable="no"; name="fp" parent="/pci@ld,0/pci1022,7450@1/pci1077,149@1"
port=0 mpxio-disable="yes";
```

3 Save and exit the file.

4 Perform one of the following:

- If running on a Solaris 10 Update 4 (or later) x86 based system, run the `stmsboot -u` command.

```
# stmsboot -u
WARNING: This operation will require a reboot.
Do you want to continue ? [y/n] (default: y) y
The changes will come into effect after rebooting the system.
Reboot the system now ? [y/n] (default: y) y
```

- If running on a Solaris 10 Update 3 and prior version x86 system, perform a reconfiguration reboot.

```
# touch /reconfigure
# shutdown -g0 -y -i6
```

5 (Optional) If necessary, perform device name updates as described in [“Enabling or Disabling Multipathing”](#) on page 34.

## Configuring Third-Party Storage Devices

---

**Note** – Before configuring any third-party device, ensure that they are supported. Refer to your third-party user documentation, or third-party vendor for information on proper vendor and product IDs, modes and various settings required for the device to work with multipathing software.

---

## Considerations for Third-Party Device Configuration

Before you configure third-party devices for multipathing, be aware of the following:

- The device must support the REPORT\_LUNS SCSI command, and SCSI-3 INQUIRY command VPD Device Identification Page (0x83).
- You will need the vendor ID and product ID of the device. You can obtain them by using the `format` command followed by the `inquiry` option on your system. See the `format(1M)` man page.

When multipathing is enabled, the multipath access still depends on a device specific `scsi_vhci` failover implementation accepting the device. The default way this occurs, automatically, is for the `scsi_vhci` code to call a *probe* function in each failover implementation, looking for the first *probe* result that indicates the device is supported. A *probe* implementation determines support based on some combination of `scsi_inquiry(9S)` data and compiled in VID/PID tables. To override the *probe* process, the `scsi_vhci.conf` file supports a `scsi-vhci-failover-override` property. The value of `scsi-vhci-failover-override` can be used to establish support for a device not currently accepted by *probe*, override *probe* support, or disable multipath support for a device.

## Configuring Third-Party Storage Devices: New Devices

Multipathing can be configured on third-party symmetric storage devices. A symmetric storage device is defined as a storage device in which all paths to the storage device are active and I/O commands can be issued through any path.

### ▼ To Configure Third-Party Devices

Perform the following steps to configure third-party devices if your system already has multipathing enabled. If your system has multipathing disabled, you can configure third-party devices while enabling multipathing as described earlier in this chapter.

#### 1 Add the vendor ID and product ID entries to the `/kernel/drv/scsi_vhci.conf` file.

The vendor ID and product ID are the vendor and product identification strings that the device returns in SCSI INQUIRY data. The vendor ID must be eight characters long. You must specify all eight characters even if the trailing characters are spaces.

The product ID can be up to 16 characters long.

```
device-type-scsi-options-list =
"VendorID1ProductID1", "symmetric-option",
"VendorID2ProductID2", "symmetric-option",
...
"VendorIDnProductIDn", "symmetric-option";
symmetric-option = 0x1000000;
```

Note that the entries are separated by the `,` character and the last vendor/product entry is terminated by the `;` character.

For example, to add a device from a “ACME” vendor with a product ID of “MSU”, you would add:

```
device-type-scsi-options-list =
"ACME  MSU", "symmetric-option";
symmetric-option = 0x1000000;
```

In addition, to register a new edition of an existing book or modify some general info in PubsTool2 about the book, see PubsTool2 2.4 User's Guide, 805-4432-11 by clicking PubsTool Documentation. “ACME”, to add a device from a “XYZ” vendor with a product ID of “ABC”, you would add:

```
device-type-scsi-options-list =
"ACME  MSU", "symmetric-option",
"XYZ   ABC", "symmetric-option";
symmetric-option = 0x1000000;
```

**2 Save and exit the `scsi_vhci.conf` file.**

**3 Perform one of the following:**

- **If running on a SPARC or Solaris 10 Update 4 x86 based system, issue the `stmsboot -u` command:**

```
# stmsboot -u
WARNING: This operation will require a reboot.
Do you want to continue ? [y/n] (default: y) y
The changes will come into effect after rebooting the system.
Reboot the system now ? [y/n] (default: y) y
```

You are prompted to reboot. During the reboot, `/etc/vfstab` and the dump configuration will be updated to reflect the device name changes.

- **If running on a Solaris 10 Update 3 and prior x86 version system, perform a reconfiguration reboot.**

```
# touch /reconfigure
# shutdown -g0 -y -i6
```

**4 If necessary, perform device name updates as described in [“Enabling or Disabling Multipathing” on page 34](#).**

# Configuring Third-Party Storage Devices: Disabling Devices

Multipathing can be disabled for all devices of a certain Vendor ID/Product ID combination from Inquiry data. This exclusion is specified in the `scsi_vhci.conf` file.

## ▼ To Disable Multipathing on Third-Party Devices

- 1 Add the vendor ID and product ID entries to the `/kernel/drv/scsi_vhci.conf` file.

The vendor ID and product ID are the vendor and product identification strings that the device returns in SCSI INQUIRY data. The vendor ID must be eight characters long. You must specify all eight characters even if the trailing characters are spaces. The product ID can be up to 16 characters long.

```
device-type-scsi-options-list =
"VendorID1ProductID1", "disable-option",
"VendorID2ProductID2", "disable-option",
...
"VendorIDnProductIDn", "disable-option";
disable-option = 0x7000000;
```

The entries in the preceding example are separated by the `,` character and the last vendor/product entry is terminated by the `;` character. For example, to add a device from a "ACME" vendor with a product ID of "MSU", you would add:

```
device-type-scsi-options-list =
"ACME MSU", "disable-option";
disable-option = 0x7000000;
```

In addition to "ACME," to add a device from the "XYZ" vendor with a product ID of "ABC," you would add:

```
device-type-scsi-options-list =
"ACME MSU", "disable-option",
"XYZ ABC", "disable-option";
disable-option = 0x7000000;
```

- 2 Save and exit the `scsi_vhci.conf` file.
- 3 Perform one of the following:
  - If running on a SPARC or Solaris 10 Update 4 (or later) x86 based system, issue the `stmsboot -u` command.

```
# stmsboot -u
WARNING: This operation will require a reboot.
Do you want to continue ? [y/n] (default: y) y
```

The changes will come into effect after rebooting the system.  
 Reboot the system now ? [y/n] (default: y) **y**

You are prompted to reboot. During the reboot, `/etc/vfstab` and the dump configuration are updated to reflect the device name changes.

- **If running on a Solaris 10 Update 3 and prior x86 version system, perform a reconfiguration reboot.**

```
# touch /reconfigure
# shutdown -g0 -y -i6
```

- 4 **If necessary, perform the device name updates as described in “Enabling or Disabling Multipathing” on page 34.**

## Displaying Device Name Changes

Use the `stmsboot(1M)` command, available only on SPARC and Solaris 10 Update 4 (or later) x86 based systems, to display the mapping between non-multipath enabled and multipath enabled devices names, after the changes made to the multipath configuration by the `stmsboot -e`, `-d`, or `-u` options take effect. Both the non-multipath enabled and multipath enabled device names must exist in order to show the mapping.

The `-L` option displays the mapping of devices on all controllers.

```
# stmsboot -L
non-STMS device name          STMS device name
-----
/dev/rdisk/c2t8d0            /dev/rdisk/c10t500000E01046DEE0d0
/dev/rdisk/c2t0d0            /dev/rdisk/c10t500000E01046B070d0
/dev/rdisk/c2t3d0            /dev/rdisk/c10t20000020372A40AFd0
/dev/rdisk/c2t12d0           /dev/rdisk/c10t500000E01046DEF0d0
/dev/rdisk/c2t11d0           /dev/rdisk/c10t500000E01046E390d0
/dev/rdisk/c3t8d0            /dev/rdisk/c10t500000E01046DEE0d0
/dev/rdisk/c3t0d0            /dev/rdisk/c10t500000E01046B070d0
/dev/rdisk/c3t3d0            /dev/rdisk/c10t20000020372A40AFd0
/dev/rdisk/c3t12d0           /dev/rdisk/c10t500000E01046DEF0d0
/dev/rdisk/c3t11d0           /dev/rdisk/c10t500000E01046E390d0
```

The `-l` option displays the mapping of devices on only the specified controller. The following example displays the mapping of controller 3.

```
# stmsboot -l3
non-STMS device name          STMS device name
-----
/dev/rdisk/c3t8d0            /dev/rdisk/c10t500000E01046DEE0d0
/dev/rdisk/c3t0d0            /dev/rdisk/c10t500000E01046B070d0
```

```
/dev/rdisk/c3t3d0    /dev/rdisk/c10t20000020372A40AFd0
/dev/rdisk/c3t12d0   /dev/rdisk/c10t500000E01046DEF0d0
/dev/rdisk/c3t11d0   /dev/rdisk/c10t500000E01046E390d0
```

## Configuring Automatic Failback

Some storage devices have controllers configured as PRIMARY and SECONDARY as part of the array configuration. The secondary paths may operate at a lower performance level than the primary paths. The multipathing software uses the primary path to talk to the storage device and keeps the secondary path on standby. In the event of a primary path failure, the multipathing software automatically directs all I/O traffic over the secondary path, with the primary path taken offline. This process is called a “failover” operation. When the failure associated with the primary path has been repaired, the multipathing software automatically directs all I/O traffic over the primary path and keeps the secondary path standby as before. This process is called a “failback” operation.

You can disable the automatic failback operation so the multipathing software does not automatically failback to the primary path. Later, after the failure associated with the primary path has been repaired, you can do a manual failback operation using the `luxadm(1M)` command.

### ▼ To Configure Automatic Failback

- 1 **Open the `/kernel/drv/scsi_vhci.conf` file in a text editor.**
- 2 **To disable automatic failback capability, change the `auto-failback` entry to:**

```
auto-failback="disable";
```

To enable automatic failback capability (if you disabled it before), change the `auto-failback` entry to:

```
auto-failback="enable";
```

- 3 **Save and exit the file.**
- 4 **Reboot the system.**

```
# shutdown -g0 -y -i6
```

# Configuring SAN Devices

---

This section provides the high level overview of the steps used to configure SAN devices. In Solaris 10, FCAL and fabric-connected devices are made available to the host automatically. This feature differs from previous versions of the SAN Foundation software running on the Solaris 8 or the Solaris 9 OS. In those versions, manual configuration steps were required to achieve fabric-connected device availability on the host. To find out how to manually configure fabric-connected devices, please refer to [Appendix A, “Manual Configuration for Fabric-Connected Devices.”](#)

This chapter contains the following sections:

- “SAN Device Considerations” on page 47
- “Adding SAN Devices” on page 48
- “Configuring Fabric Boot Devices on SPARC” on page 49

## SAN Device Considerations

Be aware of the following considerations before configuring the Sun StorageTek Traffic Manager software.

- Configure ports and zones according to the vendor-specific documentation for storage and switches.
- With the Solaris 10 OS you no longer have to manually configure devices unless you enable manual device configuration.
- LUN masking enables specific LUNs to be seen by specific hosts. See your vendor-specific storage documentation that describes masking.
- Turn off power management on servers connected to the SAN to prevent unexpected results as one server attempts to power down a device while another attempts to gain access. See `power.conf(1M)` man page for details about power management.

- Connect arrays and other storage devices to the SAN with or without multipathing capability. The Sun StorageTek Traffic Manager software is an associated application that is bundled with the product name.
- The STMS Boot utility is included with the Sun StorageTek Traffic Manager software that manages the enable and disable process needed for SAN booting. Issuing the `stmsboot` command allows the automatic update of `/etc/vfstab` and the dump configuration to reflect device name changes when enabling or disabling the Sun StorageTek Traffic Manager software. Note that the software is disabled by default with SPARC devices and enabled by default with x86 devices.

## Adding SAN Devices

Adding and removing SAN devices requires knowledge of the following commands:

- `luxadm(1M)`
- `format(1M)`
- `fscck(1M)`
- `newfs(1M)`
- `cfgadm(1M)` and `cfgadm_fp(1M)`

---

**Note** – If you use the `format` command when the Sun StorageTek Traffic Manager software multipathing feature is enabled, you will see only one instance of a device identifier for each LUN. Without the Sun StorageTek Traffic Manager software enabled, you will see one identifier for each path.

---

The `cfgadm` and `cfgadm_fp` commands are used most frequently to configure storage devices on a SAN. Refer to the appropriate man page for detailed instructions about how to use each command.

### ▼ To Add a SAN Device

- 1 Create the LUNs desired on the SAN device.
- 2 If necessary, apply LUN masking for HBA control on the SAN device.
- 3 Connect the storage device to the system.
- 4 If necessary, create port-based or WWN zones on the switch on the SAN device.
- 5 Run the `fscck` or `newfs` commands on the device, if used for file systems.

---

**6 Mount any existing file systems available on the storage device's LUNs or disk groups.**

---

**Note** – You might need to run the `fsck` command to repair any errors in the LUNs listed in the `/etc/vfstab` file.

---

## Configuring Fabric Boot Devices on SPARC

The Sun StorageTek Traffic Manager software allows a Solaris 10 SPARC server to be booted from a fabric disk device.

### Boot Considerations

Fabric boot devices can be added through the Solaris 10 interactive installation GUI or text installer just as internal boot devices have been added in the previous Solaris OS releases. Please refer to the Solaris 10 installation guide for details. You should consider the following points while enabling a fabric boot device.

- Minimize interference to boot devices through the following actions:
  - Ensuring the boot device is not an overly subscribed target or LUN
  - Avoiding installation of applications and software on target or LUN
  - Reducing physical distance between host and fabric device, as well as the number of hops
- Remove the boot disk from volume manager control prior to beginning the fabric boot procedure.
- Ensure that the latest HBA Fcode and drivers are loaded for the install HBAs on the system.
- If multipathing is desired on the boot device, use the `stmsboot` command as described in [Chapter 4, “Configuring Multipathing Software.”](#)



# Configuring IPFC SAN Devices

---

Configuring Internet Protocol over Fibre Channel (IPFC) on the host system describes host recognition of IPFC devices and implementation of IP over FC in a SAN. The IPFC driver is based on RFC 2625 and allows IP traffic to run over FC.

This chapter contains the following topics:

- “IPFC Considerations” on page 51
- “Invoking and Configuring IPFC” on page 54

## IPFC Considerations

The following table shows the supported features available for IPFC.

TABLE 6-1 IPFC (NFS/NAS and SNDR)

Feature	Supported
Cascading	Yes, with fabric zones only
Zone type	Fabric zone with the HBA configured as an F-port point-to-point connection
Maximum number of device ports per zone	253

The following restrictions apply:

- IPFC is not supported on 1 Gbit Sun switches.
- Promiscuous mode is not supported. The snoop(1M) utility cannot be used.
- Multicasting is supported through broadcasting only.
- Network cards using IPFC cannot be used as routers. The `/etc/not_router` file must be present on the host.

- Any standard network commands can be used after IPFC is attached. These commands (telnet, ping, or ftp) are used in this environment in the same way as in an Ethernet setup.

## Determining Fibre Channel Adapter Port Instances

This section explains how to configure the desired host system for IPFC. It includes the procedures to determine the port instance and to plumb an IPFC instance.

### ▼ To Determine Port Instances

#### 1 Determine the HBA PCI adapter slot and the I/O board PCI slot.

You need this information to perform the calculation in “[Determining Fibre Channel Adapter Port Instances](#)” on page 52.

For example, assume you have an array with an HBA card located in PCI adapter slot 5, and the PCI adapter is in slot 1 of the I/O board.

#### 2 Determine the instance number.

##### a. Search for the fp driver binding name in the /etc/path\_to\_inst file.

---

**Note** – Determine the correct entry by finding the hardware path described in your server hardware manual or Sun System Handbook. The Sun System Handbook is available at [http://sunsolve.sun.com/handbook\\_pub/](http://sunsolve.sun.com/handbook_pub/).

---

##### b. Narrow the search by using the I/O board and slot information from Step 1.

---

**Note** – The following method of deriving the Solaris 10 device path of an HBA from its physical location in server might not work for all Sun server hardware.

---

##### i. Multiply the PCI adapter slot number by the number of adapter ports.

For example, if the HBA has two ports, multiply by 2. Using the array with an HBA in the PCI adapter slot 5, multiply 5 by 2 to get 10.

##### ii. Add the PCI adapter I/O board slot number to the number derived in Step i.

Using an HBA in PCI adapter slot 5 and PCI slot 1 of the I/O board, add 1 to 10 for a sum of 11.

##### iii. Convert the number derived in Step ii to hexadecimal.

The number 11 converts to “b” in hexadecimal.

**iv. Search for the fp entry with pci@hex where hex is the number you derived in Step iii.**

The following table shows the elements of the device path for a PCI single FC network adapter device that has the following path:

```
"/pci@b,2000/SUNW,q1c@2/fp@0,0" 7 "fp"
```

EntryItem	EntryValue
Physical Name	/pci@b,2000/SUNW,q1c@2/fp@0,0
Instance Number	7
Driver Binding Name	fp

**c. Manually plumb each FP instance.**

Use the `ifconfig interface-number plumb` command. In this example, the value of `interface-number` is `fcip7`.

```
# ifconfig fcip7 plumb
```

When the command is successful, a message appears on both the console and in the messages file. For example:

```
Sep 13 15:52:30 bytownite ip: ip: joining multicasts failed (7) on fcip0 -
will use link layer brocasts for multicast
```

## ▼ To Plumb an IPFC Instance

Each FP instance on the system has an entry in `/dev/fc`. If HBAs have been removed, some stale links might exist. Use this procedure to load and plumb IPFC.

- 1 For each entry in `/dev/fc`, issue a `luxadm -e dump_map` command to view all the devices that are visible through that HBA port:**

```
# luxadm -e dump_map /dev/fc/fp0
Pos  Port_ID Hard_Addr Port WWN          Node WWN          Type
0    610100 0          210000e08b049f53 200000e08b049f53 0x1f (Unknown Type)
1    620d02 0          210000e08b02c32a 200000e08b02c32a 0x1f (Unknown Type)
2    620f00 0          210000e08b03eb4b 200000e08b03eb4b 0x1f (Unknown Type)
3    620e00 0          210100e08b220713 200100e08b220713 0x1f (Unknown Type,Host Bus Adapter)
# luxadm -e dump_map /dev/fc/fp1
No FC devices found. - /dev/fc/fp1
```

- 2 Based on the list of devices, determine which destination HBAs are visible to the remote host with which you want to establish IPFC communications.**

In the example for this procedure, the destination HBAs have port IDs `610100` and `620d02`. The originating HBA's port ID is `620e00`.

- 3 List the physical path of the originating HBA port from which you can see the destination HBA port, where *originating-hba-link* is a variable for the link determined in Step 2.

```
# ls -l /dev/fc/fp originating-hba-link
```

In the following example, 0 is the number for the *originating-hba-link*:

```
# ls -l /dev/fc/fp 0
lrwxrwxrwx 1 root root 51 Sep 4 08:23 /dev/fc/fp0 ->
../devices/pci@8,600000/SUNW,q1c@1/fp@0,0:devctl
```

- 4 Search the physical path identified in Step 3.

You must remove the leading `../devices` from the path name output. For example

```
# grep pci@8,600000/SUNW,q1c@1/fp@0,0 /etc/path_to_inst
"/pci@8,600000/SUNW,q1c@1/fp@0,0" 0 "fp"
```

- 5 Determine the `fp` instance for the originating HBA port from the output of the command in Step 4.

The instance number precedes “`fp`” in the output. In the following example output, the instance number is 0.

```
"/pci@8,600000/SUNW,q1c@1/fp@0,0" 0 "fp"
```

- 6 Use the instance number from Step 5 to load IPFC and plumb the IPFC interface.

In this example, the instance is 0.

```
# ifconfig fcip 0 plumb
```

## Invoking and Configuring IPFC

Immediately upon installation, start IPFC manually with the `ifconfig` command. You can configure the host so that on subsequent reboot, the IPFC network interface starts automatically. This section describes the procedures to start a network interface manually and to configure the host for automatic plumbing upon reboot.

### ▼ To Start a Network Interface Manually

Use this procedure when you want to plumb IPFC with specific netmask values and get the IPFC interface up and running.

**1 Use the `ifconfig` command with the appropriate interface.**

Ask your network administrator for an appropriate IP address and netmask information. For example, to enable an IPFC interface associated with `fp` instance `0` and an IP address of `192.9.201.10`, type:

```
# touch /etc/notrouter
# ifconfig fcip0 inet 192.9.201.10 netmask 255.255.255.0 up
```

The `ifconfig` command is described in more detail in the `ifconfig(1M)` man page.

**2 Use the command `ifconfig -a` to verify the network is functioning.**

The output of `ifconfig -a` should look like this:

```
lo0: flags=1000849<UP,LOOPBACK,RUNNING,MULTICAST,IPv4> mtu 8232 index 1
inet 127.0.0.1 netmask ffffffff
fcip0: flags=1001843<UP,BROADCAST,RUNNING,MULTICAST,MULTI_BCAST,IPv4> mtu 1500 index 2
inet 192.9.201.10 netmask ffffffff broadcast 192.9.201.255 ether 0:e0:8b:1:3c:f7
hme0: flags=1000843<UP,BROADCAST,RUNNING,MULTICAST,IPv4> mtu 1500 index 3
inet 192.9.200.70 netmask ffffffff broadcast 192.9.200.255
ether 8:0:20:fc:e9:49
```

## ▼ To Configure the Host for Automatic Plumbing Upon Reboot

Each network interface must have an `/etc/hostname.interface` file defining the name of the IP address associated with it. For example, IPFC network interface `fcip0` has a file named `/etc/hostname.fcip0`.

**1 Manually create a `/etc/hostname.interface` file that contains a single line that identifies the host name or interface IP address.****2 Make any additional entries to the `/etc/inet/hosts` file.**

The Solaris 10 installation program creates the `/etc/inet/hosts` file with minimum entries. You must manually make additional entries with a text editor. See the `hosts(4)` man page for additional information.

The `/etc/inet/hosts` file contains the hosts database. This file contains the host names and the primary network interface IP addresses, as well as the IP addresses of other network interfaces attached to the system and of any other network interfaces that the machine must know about.

The following example shows an `etc/inet/host` file.

```
127.0.0.1    localhost    loghost
192.9.200.70 sun1      #This is the local host name
192.9.201.10 fcip0    #Interface to network 192.9.201.10
```

- 3 Edit the `/etc/nsswitch.conf` file so that all un-commented entries have the word `files` before any other name service.**

The `/etc/nsswitch.conf` specifies which name service to use for a particular machine. The following code shows an example of an `/etc/nsswitch.conf` file.

```
hosts: files nis
```

# Sun Solaris 10 Update 1 x86/x64 Fibre Channel Operating System Booting Procedure

---

Starting with Sun Solaris 10 Update 1 (1/06), x86/x64 Operating System (OS), Fibre Channel (FC) devices now appear in the disk selection portion of Solaris SunInstall. An interactive Solaris 10 Update 1 installation is now required due to the potentially large number of devices that might appear in the disk selection portion of Solaris SunInstall.

This chapter describes how to manually install the Sun Solaris 10 Update 1 (1/06) x86/x64 FC OS. This OS includes Sun StorageTek SAN Foundation software with the Sun 2-Gbit and 4-Gbit Fibre Channel (FC) HBA drivers, and the Sun StorageTek Traffic Manager software.

---

**Note** – Sun 1 Gb HBAs do *not* support booting over a SAN on x86 machines. Sun 4 Gb HBAs do support booting over a SAN on x86 machines. Most Sun 2 Gb HBAs do support booting over a SAN on x86 machines, except for the following:

- Sun StorageTek 2 Gb Enterprise Class Dual-Port Fibre HBA, SG-XPCI2FC-QF2-Z
  - Sun StorageTek 2 Gb PCI Dual-Port Fibre HBA, SG-XPCI2FC-QF2
  - Sun StorageTek 2 Gb FC PCI Single-Channel Network Adapter, X6767A
  - Sun StorageTek 2 Gb FC PCI Dual-Channel Network Adapter, X6768A
  - Sun StorageTek 2 Gb FC PCI-X Enterprise Single-Port HBA, SG-XPCI1FC-QL2
  - Sun StorageTek 2 Gb FC PCI Single-Port Host Adapter, SG-XPCI1FC-QF2
- 

The Sun Solaris 10 Update 1 (1/06) x64/x86 OS can be installed from a CD-ROM, DVD-ROM, or network.

This chapter contains the following topics:

- [“Setup Requirements” on page 58](#)
- [“Installation Overview” on page 58](#)
- [“Installation Procedure” on page 59](#)
- [“Post-Installation Patches for the Sun Solaris 10 Update 1 OS” on page 66](#)

## Setup Requirements

You must have the following items for installation.

- Solaris 10 Update 1 (1/06)
- 10/100/1000 Mbit/sec Ethernet network for network-based OS installation
- One of the following for installation support
  - Jump-start server for a network-based OS installation
  - CD-ROM or DVD-ROM drive for a CD-ROM or DVD-ROM based OS installation

## Installation Overview

In order to successfully complete the installation, use an FC-based device during the disk selection portion of the installation. At the end of the interactive installation, you must select Manual Reboot.

After OS installation and before rebooting, gather the configuration information by issuing the `luxadm` command on the newly installed logical unit number (LUN). The `luxadm` command output provides a map from `c#t#d#` to the array WWN and LUN number. Record the HBA World Wide Name (WWN) and array WWN port information.

During rebooting, use the WWN and LUN number to set the HBA BIOS for each HBA to be used to boot from each LUN on the same array. Change the system BIOS to perform booting from CD-ROM or Network to disk.

---

**Note** – Console access is required for HBA and system BIOS changes.

---

In addition, note the following during the Sun Solaris OS installation.

- If using a custom disk layout, do not remove the overlap (`s2`) partition. The x86 boot installer has a dependency on this partition.
- By default, the Sun StorageTek Traffic Manager software manages the FC boot devices with multiple paths to a single boot device.

---

# Installation Procedure

## ▼ To Summarize the Procedure

- 1 **Install the HBA hardware.**

Follow the instructions in the appropriate Sun HBA installation guide found at <http://docs.sun.com/app/docs?q=StorageTek+Host+Bus+Adapter>.

- 2 **Install the Sun Solaris OS as described in the next section, “[Installation Procedure](#)” on page 59**

## ▼ To Perform a CD ROM, DVD ROM, or Network-Based OS Installation

After installing the HBA , perform the following steps for an interactive network-based installation of the Sun Solaris 10 Update 1 (1/06) x86/x64 OS.

For more information, refer to *Solaris 10 Installation Guide: Basic Installations*, 817-0544-xx, found at <http://docs.sun.com/>.

- 1 **If you are installing from a CD-ROM or DVD-ROM rather than over a network, insert the Sun Solaris Software into the CD-ROM or DVD-ROM drive.**
- 2 **Upon initial power up, provide the system BIOS and configure it to boot from either the network or CD-ROM (DVD-ROM) as applicable.**

See [Figure 7-1](#) for an example of one of several BIOS setup screens.

---

**Note** – The system BIOS setup screens are different for each system BIOS vendor.

---

- 3 **Install the Sun Solaris OS using the Solaris Interactive Installation (SunInstall). See [Figure 7-2](#) for**

```

                                PhoenixBIOS Setup Utility
Main    Advanced    Security    Power    Boot    Exit
-----
|
|                                     Item Specific Help
|-----
|
|    CD-ROM Drive
| +Hard Drive
| Network Boot
| MBA v7.0.3 Slot 0210
| MBA v7.0.3 Slot 0218
|
|
|                                     Keys used to view or
|                                     configure devices:
| <Enter> expands or
| collapses devices with
| a + or -
| <Ctrl+Enter> expands
| all
| <Shift + 1> enables or
| disables a device.
| <+> and <-> moves the
| device up or down.
| <n> May move removable
| device between Hard
| Disk or Removable Disk
| <d> Remove a device
| that is not installed.
|
|-----
|
| Help      Select Item      Change Values      Setup Defaults
| Exit      Select Menu      Select > Sub-Menu  Save and Exit

```

FIGURE 7-1 System BIOS for Selecting Disk, CD-ROM, or Network Boot Device Priority

**an example of one of several SunInstall screens.**



```

Host controller port WWN      210100e08b206812
Class          primary
State          ONLINE
Controller     /dev/cfg/c11
Device Address  213600015d207200,0
Host controller port WWN      210100e08b30a2f2
Class          primary
State          ONLINE

```

The screenshot shows the QLogic FastUTIL interface. At the top, it says "QLogic FastUTIL". Below that, a dashed box titled "Selected Adapter" contains a table with the following data:

Adapter	Type	I/O Address	Slot	Bus	Device	Function
QLA2462		3400	02	03	01	1

Below the table is another dashed box titled "Adapter Settings" with the following configuration:

```

BIOS Address:          CF000
BIOS Revision:         1.05
Adapter Serial Number: A04712
Interrupt Level:       5
Adapter Port Name:     210100E08B206812
Host Adapter BIOS:     Enabled
Frame Size:            2048
Loop Reset Delay:      5
Adapter Hard Loop ID:  Disabled
Hard Loop ID:          0
Spinup Delay:          Disabled
Connection Options:    2
Fibre Channel Tape Support: Enabled
Data Rate:             2

```

At the bottom of the screen, a message reads: "Use <Arrow keys> and <Enter> to change settings, <Esc> to exit".

FIGURE 7-3 luxadm display Command and Output

The following luxadm command output from the example in the figure can be used to map the MPxIO based c#t#d# to the HBA WWN and array WWN:

- MPxIO c#t#d# = c0t600015d000202800000000000000001142d0
- Array WWN = 213600015d207200, LUN 0
- HBA WWNs = 210100e08b206812 and 210100e08b30a2f2

- 7 During the reboot process, watch the monitor so you can enter the HBA #1 BIOS screen and specify the boot device to be the FC LUN onto which you just installed the Sun Solaris OS.**

Follow this step for each HBA to be used for multipathing, and specify the boot device to be the FC LUN on which you installed the Sun Solaris OS. See [Figure 7-4](#) and [Figure 7-5](#).

  - **For the QLogic HBA BIOS, perform the following steps.**
    - a. During host rebooting, press Control-Q to display the HBA BIOS screen.
    - b. Select the HBA that you want to enable as the boot device and enable boot.
    - c. Configure the boot device:
      - i. Select Configuration Settings.
      - ii. Select Selectable Boot Settings.
      - iii. Make sure that Selectable Boot is set to enable.

In this menu, you can select the boot device/LUN by the array WWPN.
      - iv. Save and then exit the HBA BIOS screen.
  - **For the Emulex HBA BIOS, perform the following steps.**
    - a. During host rebooting, press Alt-E to display the HBA BIOS screen.
    - b. Select the HBA that you want to enable as the boot device and enable boot.
    - c. Select Configure Boot Devices.
    - d. Select a boot entry.
    - e. Select the WWPN of the desired boot device.
    - f. Type the LUN number.
    - g. Select the boot LUN.
    - h. Select Boot Device with the Array WWPN.
    - i. Save and exit the HBA BIOS screen.

```
QLogic Fast!UTIL

-----Selected Adapter-----
Adapter Type I/O Address Slot Bus Device Function
QLA2462      3400          02  03  01    1

-----Adapter Settings-----

BIOS Address:           CF000
BIOS Revision:          1.05
Adapter Serial Number:  A04712
Interrupt Level:        5
Adapter Port Name:      210100E08B206812
Host Adapter BIOS:      Enabled
Frame Size:             2048
Loop Reset Delay:       5
Adapter Hard Loop ID:   Disabled
Hard Loop ID:           0
Spinup Delay:           Disabled
Connection Options:     2
Fibre Channel Tape Support: Enabled
Data Rate:              2

Use <Arrow keys> and <Enter> to change settings, <Esc> to exit
```

FIGURE 7-4 HBA BIOS Screen for an HBA WWN

```

QLogic Fast!UTIL
=====Selected Adapter=====
| Adapter Type I/O Address Slot Bus Device Function |
| QLA2462      3000      02  03  01  0 |
=====

=====Selectable Boot Settings=====
| Selectable Boot: Enabled |
| (Primary) Boot Port Name,Lun: 213600015D207200, 0 |
| Boot Port Name,Lun: 213600015D207200, 1 |
| Boot Port Name,Lun: 213600015D207200, 2 |
| Boot Port Name,Lun: 213600015D207200, 3 |
| Press "C" to clear a Boot Port Name entry |
=====

Use <arrow keys> and <Enter> to change settings, <Esc> to exit

```

FIGURE 7-5 HBA BIOS Screen for Enabling Boot From the FC LUN

**Note** – The figure shows the following modifications:

- Selectable boot = Enabled
- ARRAY WWN = 213600015d207200
- ARRAY LUN = 0
- HBA WWN = 210100e08b206812

- 8 Repeat the appropriate modifications for all HBAs and all LUNs.
- 9 Type the system BIOS per the vendor's access method and specify the boot device to be the FC LUN on which you installed the Solaris 10 Update 1 OS. The following figure shows an example of one screen in a vendor's system BIOS.

```

PhoenixBIOS Setup Utility
-----
Main      Advanced  Security  Power    Boot     Exit
-----
- Hard Drive
  HA 1 PortID 180F00 SE6920
  HA 2 PortID 180F00 SE6920
  #220 ID00 LUN0 SEAGATE ST373307LC
  Bootable Add-in Cards
  CD-ROM Drive
  Network Boot
  MBA v7.0.3 Slot 0210
  MBA v7.0.3 Slot 0218
- Removable Devices
  (LUN0) (LUN1) (LUN2) (LUN3)

Item Specific Help
-----
Keys used to view or
configure devices:
<Enter> expands or
collapses devices with
a + or -
<Ctrl+Enter> expands
all
<Shift + I> enables or
disables a device.
<+> and <-> moves the
device up or down.
<n> May move removable
device between Hard
Disk or Removable Disk
<d> Remove a device
that is not installed.
-----
F1 Help ^v Select Item -/+ Change Values F9 Setup Defaults
Esc Exit <> Select Menu Enter Select > Sub-Menu F10 Save and Exit

```

FIGURE 7-6 Example System BIOS for Enabling Booting from an FC LUN

- 10 Reboot to the newly installed Solaris 10 Update 1 OS using the FC LUN specified in the system BIOS.

## Post-Installation Patches for the Sun Solaris 10 Update 1 OS

The following patches are recommended for the OS:

- 120223-xx Emulex-Sun LightPulse FC adapter driver
- 119131-xx FC device drivers
- 119716-xx MPxIO
- 119471-xx luxadm

These patches can be found on the SunSolve<sup>SM</sup> web site at <http://sunsolve.sun.com>.

# Persistent Binding for Tape Devices

---

To simplify management of servers in SAN-based data-centers, the Sun StorageTek™ SAN Foundation software stack in the Solaris Operating System (OS) dynamically detects devices in a SAN and builds associated `/dev` tree entries without requiring you to edit configuration files.

In most cases, this process greatly simplifies SAN management. However, for tape devices, you might like the ability to explicitly specify how that `/dev` entries are created and to ensure the `/dev` entries are identical across multiple servers on a SAN. This chapter describes how you can specify this tape binding in the Solaris OS while retaining the benefits of automatic discovery for disk-based devices.

## Persistent Binding Overview

The `/dev/rmt` directory contains links to physical devices under `/devices` for tape devices. Each tape LUN seen by the system is represented by 24 minor nodes in the form of `/dev/rmt/N`, `/dev/rmt/Nb`, and `/dev/rmt/Nbn`, where  $N$  is an integer counter starting from 0. This number is picked by `devfsadm` during enumeration of new devices. Every new tape logical unit number (LUN) found by `devfsadm` gets the next available number in `/dev/rmt`.

Because the `/dev/rmt` name depends on the order in which devices appear in the device tree, it changes from host to host. For a given tape drive that is seen by two or more different hosts, the `/dev/rmt` link can be different on each of these hosts. This difference can cause problems for the most common usage of Symantec (VERITAS) NetBackup (SSO option). Also, if the drive is replaced, the links change unless the vendor provides a way to retain the port World-Wide Name (*PWWN*) of the drive.

## Creating Tape Links

The `/etc/devlink.tab` file is called the default device table file. It specifies rules that `devfsadm` uses to create links in the `/dev` directory. Type `man devlinks` on the command-line interface (CLI) for more information. This file does not contain any entries for tapes because `devfsadm` is already able to create links for tape drives, but rules can be added that will modify the default behavior for creating tape links.

For any tape drive visible to the Sun Solaris OS but not specified in the `devlink` file, `devfsadm` automatically assigns a minor node number starting from 0. These minor node numbers will conflict with any lower numbers assigned manually in `/etc/devlink.tab`, so be sure to assign numbers there that are high enough to avoid conflicts.

This approach can easily lead to duplicate links in `/dev/rmt`. Any tapes discovered before entries were specified in `/etc/devlink.tab` have automatically created links. When entries are added and `devfsadm` is run, the original links remain in `/dev/rmt`, resulting in duplicate links. To remove the original links in `/dev/rmt`, run the `rm /dev/rmt/*` command before running `devfsadm`.

This approach cannot be used with multiple-port tape drives that are attached to multiple HBA ports. If multiple HBA ports are attached to the same tape LUN, the system detects two tape drives instead of one. The one that appears last in the `prtconf` output gets the link generated by the `/etc/devlink.tab`.

The following example shows a sample entry for tape in the `devlink.tab` file.

```
type=ddi_byte:tape;addr=PWWN,LUN-number; rmt/rmt-number\M0
```

Change the `rmt #` to whatever `/dev/rmt/N` is required. Then change the PWWN and LUN to match the desired tape device. You can obtain this value by running the `ls -l` command on the existing `/dev/rmt/` link as shown below.

```
# ls -l /dev/rmt/4
lrwxrwxrwx 1 root root 69 Oct 6 14:57 /dev/rmt/4 ->
../../../../devices/pci@1f,700000/SUNW,qlc@2/fp@0,0/st@w5005076300617717,0:
```

If, for example, you wanted the `/dev/rmt/` number to be 40, you would create an entry in `/etc/devlink.tab` like the following example:

```
# type=ddi_byte:tape;addr=w5005076300617717,0; rmt/40\M0
```

You can then add this line to the `devlink` file on every Solaris server on the SAN that uses this drive so that it always appears as minor node 40.

## ▼ Configuration Steps

- 1 **Create the entries in `/etc/devlink.tab` as described in “Creating Tape Links” on page 68.**

If `devfsadm` has previously discovered the devices, you must determine the device address by running the `ls -l` command on the existing link.

---

**Note** – Be sure to assign `/dev/rmt/ N` numbers to avoid conflicts with any automatically configured devices, as described above.

---

- 2 **Remove existing links from `/dev/rmt` by running the `rm /dev/rmt/*` command.**
- 3 **Run `devfsadm`.**

This command creates new links as per the entries in `/etc/devlink.tab` in addition to automatically creating links for any unspecified devices.



# Manual Configuration for Fabric-Connected Devices

---

This appendix explains about configuring and unconfiguring the fabric devices in the Solaris 10 OS. It explains how the visible fabric devices on a host are detected and configured with and without enabling the Sun StorageTek Traffic Manager software.

This appendix contains the following sections:

- “Manual Configuration” on page 71
- “Fabric Device Node Configuration” on page 72
- “Configuring Device Nodes Without Multipathing Enabled” on page 74
- “Configuring Device Nodes With Solaris Multipathing Software Enabled” on page 77
- “Unconfiguring Fabric Devices” on page 81

## Manual Configuration

In the Solaris 10 OS, fabric-connected devices are made available to the Solaris host. This differs from previous versions of the Sun StorageTek Traffic Manager software running on the Solaris 8 or the Solaris 9 OS. In those versions, manual configuration steps were required to achieve fabric-connected device availability.

If you want to manually configure the fabric-connected devices, use the following steps to change the default behavior on the Solaris 10 host.

---

**Note** – Changing the default behavior makes all of your fabric-connected devices unavailable, which can cause problems for fabric-connected devices that are required to be available at boot time.

---

## ▼ To Configure Manually

- 1 To enable manual configuration, make sure that the following line in the `/kernel/drv/fp.conf` file does not start with an initial `#` character:

```
manual_configuration_only=1;
```

Refer to the `fp(7D)` man page and the `cfgadm_fp(1M)` man page for further information on this setting.

- 2 Reboot the host.

- 3 For each fabric-connected device that will need to be made available, follow the steps in [“Configuring Device Nodes Without Multipathing Enabled” on page 74](#) or [“Configuring Device Nodes With Solaris Multipathing Software Enabled” on page 77](#), depending on whether you are using the Sun StorageTek Traffic Manager software for multipathing.

If the original default behavior for fabric-connected devices is desired, use the following steps:

- 4 To disable manual configuration, make sure that the following line in the `/kernel/drv/fp.conf` file starts with an initial `#` character:

```
# manual_configuration_only=1;
```

Refer to the `fp(7D)` man page and the `cfgadm_fp(1M)` man page for further information on this setting.

- 5 Reboot the host.

## Fabric Device Node Configuration

After you configure the hardware in your direct-attach system or SAN, you must ensure that the hosts recognize the devices. This section explains host recognition of fabric devices, also known as 24-bit FC addressing devices on the SAN. After configuring the devices, ports, and zones in your SAN, make sure that the host is aware of the devices. You can have up to 16 million fabric devices connected together on a SAN with FC support.

This section is limited to the operations required from the perspective of the Solaris 10 OS. It does *not* cover other aspects, such as device availability and device-specific management. If devices are managed by other software, such as a volume manager, refer to the volume manager product documentation for additional instructions.

## Ensuring That LUN Level Information Is Visible

### ▼ To Ensure LUN Level Information is Visible

#### 1 Use the `cfgadm` command to identify LUN level information.

If you issue the `cfgadm -al -o show_SCSI_LUN controller-ID` command immediately after a system boots up, the output might not show the Fibre Channel Protocol (FCP) SCSI LUN level information. The information does not appear because the storage device drivers, such as the `ssd` and `st` driver, are not loaded on the running system.

#### 2 Use the `modinfo` command to check whether the drivers are loaded. After the drivers are loaded, the LUN level information is visible in the `cfgadm` output.

### ▼ To Detect Fabric Devices Visible on a Host

This section provides an example of the procedure for detecting fabric devices using FC host ports `c0` and `c1`. This procedure also shows the device configuration information that is displayed with the `cfgadm(1M)` command.

---

**Note** – In the following examples, only failover path attachment point IDs (`Ap_Ids`) are listed. The `Ap_Ids` displayed on your system depend on your system configuration.

---

#### 1 Become superuser.

#### 2 Display the information about the attachment points on the system.

```
# cfgadm -l
```

Ap_Id	Type	Receptacle	Occupant	Condition
c0	fc-fabric	connected	unconfigured	unknown
c1	fc-private	connected	configured	unknown

In this example, `c0` represents a fabric-connected host port, and `c1` represents a private, loop-connected host port. Use the `cfgadm(1M)` command to manage the device configuration on fabric-connected host ports.

By default, the device configuration on private, loop-connected host ports is managed by a host using the Solaris 10 OS.

#### 3 Display information about the host ports and their attached devices.

```
# cfgadm -al
```

Ap_Id	Type	Receptacle	Occupant	Condition
c0	fc-fabric	connected	unconfigured	unknown
c0::50020f2300006077	disk	connected	unconfigured	unknown
c0::50020f23000063a9	disk	connected	unconfigured	unknown
c0::50020f2300005f24	disk	connected	unconfigured	unknown

```

c0::50020f2300006107 disk      connected  unconfigured unknown
c1                    fc-private connected  configured  unknown
c1::220203708b69c32b disk      connected  configured  unknown
c1::220203708ba7d832 disk      connected  configured  unknown
c1::220203708b8d45f2 disk      connected  configured  unknown
c1::220203708b9b20b2 disk      connected  configured  unknown

```

---

**Note** – The `cfgadm -l` command displays information about FC host ports. You can also use the `cfgadm -al` command to display information about FC devices. The lines that include a port world wide name (WWN) in the `Ap_Id` field associated with `c0` represent a fabric device. Use the `cfgadm configure` and `unconfigure` commands to manage those devices and make them available to hosts using the Solaris 10 OS. The `Ap_Id` devices with port WWNs under `c1` represent private-loop devices that are configured through the `c1` host port.

---

## Configuring Device Nodes Without Multipathing Enabled

This section describes fabric device configuration tasks on a host that does not have multipathing enabled.

The procedures in this section show how to detect fabric devices that are visible on a host and to configure and make them available to a host using the Solaris 10 OS. The procedures in this section use specific devices as examples to illustrate how to use the `cfgadm(1M)` command to detect and configure fabric devices.

The device information that you supply and that is displayed by the `cfgadm(1M)` command depends on your system configuration.

### ▼ To Configure an Individual Device Without Multipathing

This sample procedure describes how to configure a fabric device that is attached to the fabric-connected host port `c0`.

- 1 **Become superuser.**
- 2 **Identify the device to be configured.**

```

# cfgadm -al
Ap_Id          Type      Receptacle  Occupant  Condition
c0             fc-fabric connected  unconfigured unknown
c0::50020f2300006077 disk      connected  unconfigured unknown
c0::50020f23000063a9 disk      connected  unconfigured unknown
c0::50020f2300005f24 disk      connected  unconfigured unknown

```

```

c0::50020f2300006107 disk      connected  unconfigured unknown
c1                fc-private connected  configured  unknown
c1::220203708b69c32b disk    connected  configured  unknown
c1::220203708ba7d832 disk    connected  configured  unknown
c1::220203708b8d45f2 disk    connected  configured  unknown
c1::220203708b9b20b2 disk    connected  configured  unknown

```

### 3 Configure the fabric device.

```
# cfgadm -c configure c0::50020f2300006077
```

### 4 Verify that the selected fabric device is configured.

```
# cfgadm -al
Ap_Id                Type      Receptacle Occupant  Condition
c0                   fc-fabric connected configured unknown
c0::50020f2300006077 disk      connected configured unknown
c0::50020f23000063a9 disk      connected unconfigured unknown
c0::50020f2300005f24 disk      connected unconfigured unknown
c0::50020f2300006107 disk      connected unconfigured unknown
c1                   fc-private connected configured unknown
c1::220203708b69c32b disk    connected configured unknown
c1::220203708ba7d832 disk    connected configured unknown
c1::220203708b8d45f2 disk    connected configured unknown
c1::220203708b9b20b2 disk    connected configured unknown

```

Notice that the Occupant column for both `c0` and `c0::50020f2300006077` displays as configured, indicating that the `c0` port has a configured occupant and that the `c0::50020f2300006077` device is configured.

### 5 Use the `show_SCSI_LUN` option to display FCP SCSI LUN information for multi-LUN SCSI devices.

The following code example shows that the physical devices connected through `Ap_Id` `c0::50020f2300006077` have four LUNs configured.

```
# cfgadm -al -o show_SCSI_LUN c0
Ap_Id                Type      Receptacle Occupant  Condition
c0                   fc-fabric connected configured unknown
c0::50020f2300006077,0 disk    connected configured unknown
c0::50020f2300006077,1 disk    connected configured unknown
c0::50020f2300006077,2 disk    connected configured unknown
c0::50020f2300006077,3 disk    connected configured unknown

```

The device is now available on the host using the Solaris 10 OS. The paths represent each SCSI LUN in the physical device represented by `c0::50020f2300006077`.

## ▼ To Configure Multiple Devices Without Multipathing

Make sure you first identify the devices visible to the host with the procedure “[Ensuring That LUN Level Information Is Visible](#)” on page 73. This procedure describes how to configure all unconfigured fabric devices that are attached to a fabric-connected host port. The port used as an example is `c0`.

- 1 Become superuser.
- 2 Identify the devices to be configured.

```
# cfgadm -al
```

Ap_Id	Type	Receptacle	Occupant	Condition
<code>c0</code>	<code>fc-fabric</code>	<code>connected</code>	<code>unconfigured</code>	<code>unknown</code>
<code>c0::50020f2300006077</code>	<code>disk</code>	<code>connected</code>	<code>unconfigured</code>	<code>unknown</code>
<code>c0::50020f23000063a9</code>	<code>disk</code>	<code>connected</code>	<code>unconfigured</code>	<code>unknown</code>
<code>c0::50020f2300005f24</code>	<code>disk</code>	<code>connected</code>	<code>unconfigured</code>	<code>unknown</code>
<code>c0::50020f2300006107</code>	<code>disk</code>	<code>connected</code>	<code>unconfigured</code>	<code>unknown</code>
<code>c1</code>	<code>fc-private</code>	<code>connected</code>	<code>configured</code>	<code>unknown</code>
<code>c1::220203708b69c32b</code>	<code>disk</code>	<code>connected</code>	<code>configured</code>	<code>unknown</code>
<code>c1::220203708ba7d832</code>	<code>disk</code>	<code>connected</code>	<code>configured</code>	<code>unknown</code>
<code>c1::220203708b8d45f2</code>	<code>disk</code>	<code>connected</code>	<code>configured</code>	<code>unknown</code>
<code>c1::220203708b9b20b2</code>	<code>disk</code>	<code>connected</code>	<code>configured</code>	<code>unknown</code>

- 3 Configure all of the unconfigured devices on the selected port.

```
# cfgadm -c configure c0
```

---

**Note** – This operation repeats the configure operation of an individual device for all the devices on `c0`. This can be time consuming if the number of devices on `c0` is large.

---

- 4 Verify that all devices on `c0` are configured.

```
# cfgadm -al
```

Ap_Id	Type	Receptacle	Occupant	Condition
<code>c0</code>	<code>fc-fabric</code>	<code>connected</code>	<code>configured</code>	<code>unknown</code>
<code>c0::50020f2300006077</code>	<code>disk</code>	<code>connected</code>	<code>configured</code>	<code>unknown</code>
<code>c0::50020f23000063a9</code>	<code>disk</code>	<code>connected</code>	<code>configured</code>	<code>unknown</code>
<code>c0::50020f2300005f24</code>	<code>disk</code>	<code>connected</code>	<code>configured</code>	<code>unknown</code>
<code>c0::50020f2300006107</code>	<code>disk</code>	<code>connected</code>	<code>configured</code>	<code>unknown</code>
<code>c1</code>	<code>fc-private</code>	<code>connected</code>	<code>configured</code>	<code>unknown</code>
<code>c1::220203708b69c32b</code>	<code>disk</code>	<code>connected</code>	<code>configured</code>	<code>unknown</code>
<code>c1::220203708ba7d832</code>	<code>disk</code>	<code>connected</code>	<code>configured</code>	<code>unknown</code>
<code>c1::220203708b8d45f2</code>	<code>disk</code>	<code>connected</code>	<code>configured</code>	<code>unknown</code>
<code>c1::220203708b9b20b2</code>	<code>disk</code>	<code>connected</code>	<code>configured</code>	<code>unknown</code>

**5 Use the `show_SCSI_LUN` command to display FCP SCSI LUN information for multi-LUN SCSI devices.**

The following code example shows that the physical devices represented by `c0::50020f2300006077` and `c0::50020f2300006107` each have four LUNs configured. The physical devices represented by `c0::50020f23000063a9` and `c0::50020f2300005f24` each have two LUNs configured.

```
# cfgadm -al -o show_SCSI_LUN c0
```

Ap_Id	Type	Receptacle	Occupant	Condition
c0	fc-fabric	connected	configured	unknown
c0::50020f2300006077,0	disk	connected	configured	unknown
c0::50020f2300006077,1	disk	connected	configured	unknown
c0::50020f2300006077,2	disk	connected	configured	unknown
c0::50020f2300006077,3	disk	connected	configured	unknown
c0::50020f23000063a9,0	disk	connected	configured	unknown
c0::50020f23000063a9,1	disk	connected	configured	unknown
c0::50020f2300005f24,0	disk	connected	configured	unknown
c0::50020f2300005f24,1	disk	connected	configured	unknown
c0::50020f2300006107,0	disk	connected	configured	unknown
c0::50020f2300006107,1	disk	connected	configured	unknown
c0::50020f2300006107,2	disk	connected	configured	unknown
c0::50020f2300006107,3	disk	connected	configured	unknown

## Configuring Device Nodes With Solaris Multipathing Software Enabled

This section describes how to perform fabric device configuration steps on a host that has the multipathing software enabled.

The devices attached to the fabric-connected host port are not configured by default and so are not available to the host using the Solaris 10 OS. Use the `cfgadm configure` and `cfgadm unconfigure` commands to manage device node creation for fabric devices. See the `cfgadm_fp(1M)` man page for additional information. The procedures in this section illustrate steps to detect fabric devices that are visible on a host and to configure them as multipathing devices to make them available to the host using the Solaris 10 OS.

The device information that you supply, and that is displayed by the `cfgadm(1M)` command, depends on your system configuration. For more information on the `cfgadm` command, see the `cfgadm_fp(1M)` and `cfgadm(1M)` man pages.

## ▼ To Configure Individual Devices With Sun StorageTek Traffic Manager Software

This sample procedure uses fabric-connected host ports `c0` and `c2` to configure fabric devices as multipath devices on a host that has the Sun StorageTek Traffic Manager software enabled.

The `cfgadm -c configure` command for fabric devices is the same regardless of whether multipathing is enabled.

- 1 Become superuser.
- 2 Identify the port WWN of the device to be configured as the Sun StorageTek Traffic Manager software device.

Look for devices on a fabric-connected host port marked as `fc-fabric`. These devices are the devices you can configure with the `cfgadm -c configure` command.

```
# cfgadm -al
```

Ap_Id	Type	Receptacle	Occupant	Condition
<code>c0</code>	<code>fc-fabric</code>	<code>connected</code>	<code>unconfigured</code>	<code>unknown</code>
<code>c0::50020f2300006077</code>	<code>disk</code>	<code>connected</code>	<code>unconfigured</code>	<code>unknown</code>
<code>c0::50020f23000063a9</code>	<code>disk</code>	<code>connected</code>	<code>unconfigured</code>	<code>unknown</code>
<code>c1</code>	<code>fc-private</code>	<code>connected</code>	<code>configured</code>	<code>unknown</code>
<code>c1::220203708b69c32b</code>	<code>disk</code>	<code>connected</code>	<code>configured</code>	<code>unknown</code>
<code>c1::220203708ba7d832</code>	<code>disk</code>	<code>connected</code>	<code>configured</code>	<code>unknown</code>
<code>c1::220203708b8d45f2</code>	<code>disk</code>	<code>connected</code>	<code>configured</code>	<code>unknown</code>
<code>c1::220203708b9b20b2</code>	<code>disk</code>	<code>connected</code>	<code>configured</code>	<code>unknown</code>
<code>c2</code>	<code>fc-fabric</code>	<code>connected</code>	<code>unconfigured</code>	<code>unknown</code>
<code>c2::50020f2300005f24</code>	<code>disk</code>	<code>connected</code>	<code>unconfigured</code>	<code>unknown</code>
<code>c2::50020f2300006107</code>	<code>disk</code>	<code>connected</code>	<code>unconfigured</code>	<code>unknown</code>

In the above example, the `c0::50020f2300006077` and `c2::50020f2300006107` `Ap_Ids` represent the same storage device with different port WWNs for the storage device controllers. The `c0` and `c2` host ports are enabled for use by the Sun StorageTek Traffic Manager software.

- 3 Configure the fabric device and make the devices available to the host.

```
# cfgadm -c configure c0::50020f2300006077 c2::50020f2300006107
```

- 4 Verify that the selected devices are configured.

```
# cfgadm -al
```

Ap_Id	Type	Receptacle	Occupant	Condition
<code>c0</code>	<code>fc-fabric</code>	<code>connected</code>	<code>configured</code>	<code>unknown</code>
<code>c0::50020f2300006077</code>	<code>disk</code>	<code>connected</code>	<code>configured</code>	<code>unknown</code>
<code>c0::50020f23000063a9</code>	<code>disk</code>	<code>connected</code>	<code>unconfigured</code>	<code>unknown</code>
<code>c1</code>	<code>fc-private</code>	<code>connected</code>	<code>configured</code>	<code>unknown</code>
<code>c1::220203708b69c32b</code>	<code>disk</code>	<code>connected</code>	<code>configured</code>	<code>unknown</code>
<code>c1::220203708ba7d832</code>	<code>disk</code>	<code>connected</code>	<code>configured</code>	<code>unknown</code>

```

c1::220203708b8d45f2 disk      connected  configured  unknown
c1::220203708b9b20b2 disk      connected  configured  unknown
c2                fc-fabric  connected  configured  unknown
c2::50020f2300005f24 disk      connected  unconfigured unknown
c2::50020f2300006107 disk      connected  configured  unknown

```

Notice that the Occupant column of `c0` and `c0::50020f2300006077` specifies `configured`, which indicates that the `c0` port has at least one configured occupant and that the `c0::50020f2300006077` device is configured. The same change has been made in `c2` and `c2::50020f2300006107`.

When the configure operation has been completed without an error, multipathing-enabled devices are created on the host. If the physical device represented by `c0::50020f2300006077` and `c2::50020f2300006107` has multiple SCSI LUNs configured, each LUN is configured as a Sun StorageTek Traffic Manager software device. The example below shows that two LUNs are configured through `c0::50020f2300006077` and `c2::50020f2300006107`. Each `Ap_Id` is associated with a path to those Sun StorageTek Traffic Manager software devices.

```

# cfmadm -al -o show_SCSI_LUN c0::50020f2300006077\ c2::50020f2300006107
Ap_Id      Type      Receptacle  Occupant    Condition
c0::50020f2300006077,0 disk      connected   configured  unknown
c0::50020f2300006077,1 disk      connected   configured  unknown
c2::50020f2300006107,0 disk      connected   configured  unknown
c2::50020f2300006107,1 disk      connected   configured  unknown

```

The example above shows that the following two multipathing-enabled devices are created for the device represented by `c0::50020f2300006077` and `c2::50020f2300006107`:

## ▼ To Configure Multiple Devices With Multipathing

Before you configure or remove device nodes, be sure to first identify the fabric devices by using the procedure [“Ensuring That LUN Level Information Is Visible” on page 73](#).

In this example, an `Ap_Id` on a fabric-connected host port is a path to the Sun StorageTek Traffic Manager software device. For example, all devices with a path through `c2` are to be configured, but none through `c0` are to be configured. `c2` is an attachment point from the host to the fabric, whereas `c2::50020f2300006107` is an attachment point from the storage to the fabric. A host detects all the storage devices in a fabric for which it is configured.

Configuring an `Ap_Id` on the device that has already been configured through another `Ap_Id` results in an additional path to the previously configured device. A new device node is not created in this case. The device node is created only the first time an `Ap_Id` to the corresponding device is configured.

### 1 Become superuser.

**2 Identify the fabric-connected host port to be configured.**

```
# cfgadm -al
Ap_Id          Type          Receptacle  Occupant  Condition
c0             fc-fabric    connected   configured unknown
c0::50020f2300006077 disk         connected   configured unknown
c0::50020f23000063a9 disk         connected   configured unknown
c1             fc-private   connected   configured unknown
c1::220203708b69c32b disk         connected   configured unknown
c1::220203708ba7d832 disk         connected   configured unknown
c1::220203708b8d45f2 disk         connected   configured unknown
c1::220203708b9b20b2 disk         connected   configured unknown
c2             fc-fabric    connected   unconfigured unknown
c2::50020f2300005f24 disk         connected   unconfigured unknown
c2::50020f2300006107 disk         connected   unconfigured unknown
```

Devices represented by Ap\_Ids `c0::50020f2300006077` and `c2::50020f2300006107` are two paths to the same physical device, with `c0::50020f2300006077` already configured. Configure the unconfigured devices on the selected port. This operation repeats the `configure` command of an individual device for all the devices on `c2`. This can be time-consuming if the number of devices on `c2` is large.

```
# cfgadm -c configure c2
```

**3 Verify that all devices on c2 are configured.**

```
# cfgadm -al
Ap_Id          Type          Receptacle  Occupant  Condition
c0             fc-fabric    connected   configured unknown
c0::50020f2300006077 disk         connected   configured unknown
c0::50020f23000063a9 disk         connected   configured unknown
c1             fc-private   connected   configured unknown
c1::220203708b69c32b disk         connected   configured unknown
c1::220203708ba7d832 disk         connected   configured unknown
c1::220203708b8d45f2 disk         connected   configured unknown
c1::220203708b9b20b2 disk         connected   configured unknown
c2             fc-fabric    connected   configured unknown
c2::50020f2300005f24 disk         connected   configured unknown
c2::50020f2300006107 disk         connected   configured unknown
```

Notice that the `Occupant` column of `c2` and all of the devices under `c2` is marked as `configured`.

The `show_SCSI_LUN` command displays FCP SCSI LUN information for multiple LUN SCSI devices. The following code example shows that the physical devices connected through by `c2::50020f2300006107` and `c2::50020f2300005f24` each have two LUNs configured.

```
# cfgadm -al -o show_SCSI_LUN c2
Ap_Id          Type          Receptacle  Occupant  Condition
c2             fc-fabric    connected   configured unknown
c2::50020f2300005f24,0 disk         connected   configured unknown
```

```

c2::50020f2300005f24,1 disk    connected    configured    unknown
c2::50020f2300006107,0 disk    connected    configured    unknown
c2::50020f2300006107,1 disk    connected    configured    unknown

```

## Unconfiguring Fabric Devices

This section provides information about unconfiguring the Sun StorageTek Traffic Manager software.

### Unconfiguring a Fabric Device

Before you unconfigure a fabric device, stop all activity to the device and unmount any file systems on the fabric device. See the administration documentation for the Solaris 10 OS for unmounting instructions. If the device is under any volume manager's control, see the documentation for your volume manager before unconfiguring the device.

#### ▼ To Unconfigure a Fabric Device

This procedure describes how to unconfigure a fabric device that is attached to the fabric-connected host port `c0`.

##### 1 Become superuser.

##### 2 Identify the device to be unconfigured.

Only devices on a fabric-connected host port can be unconfigured.

```
# cfgadm -al
```

Ap_Id	Type	Receptacle	Occupant	Condition
c0	fc-fabric	connected	configured	unknown
c0::50020f2300006077	disk	connected	configured	unknown
c0::50020f23000063a9	disk	connected	configured	unknown
c1	fc-private	connected	configured	unknown
c1::220203708b69c32b	disk	connected	configured	unknown
c1::220203708ba7d832	disk	connected	configured	unknown

##### 3 Unconfigure the fabric device.

```
# cfgadm -c unconfigure c0::50020f2300006077
```

##### 4 Verify that the selected fabric device is unconfigured.

```
# cfgadm -al
```

Ap_Id	Type	Receptacle	Occupant	Condition
c0	fc-fabric	connected	configured	unknown
c0::50020f2300006077	disk	connected	unconfigured	unknown

```

c0::50020f23000063a9 disk      connected  configured  unknown
c1                          fc-private connected  configured  unknown
c1::220203708b69c32b disk    connected  configured  unknown
c1::220203708ba7d832 disk    connected  configured  unknown

```

## ▼ To Unconfigure All Fabric Devices on a Fabric-Connected Host Port

This procedure describes how to unconfigure all configured fabric devices that are attached to a fabric-connected host port.

- 1 Become superuser.
- 2 Identify the fabric devices to be unconfigured.

Only devices on a fabric-connected host port can be unconfigured.

```

# cfgadm -al
Ap_Id          Type          Receptacle  Occupant    Condition
c0             fc-fabric    connected   configured  unknown
c0::50020f2300006077 disk          connected   configured  unknown
c0::50020f23000063a9 disk          connected   configured  unknown
c1             fc-private   connected   configured  unknown
c1::220203708b69c32b disk          connected   configured  unknown
c1::220203708ba7d832 disk          connected   configured  unknown

```

- 3 Stop all activity to each fabric device on the selected port and unmount any file systems on each fabric device.

If the device is under any volume manager's control, see the documentation for your volume manager before unconfiguring the device.

```
# cfgadm -c unconfigure c0
```

- 4 Unconfigure all of the configured fabric devices on a selected port.

---

**Note** – This operation repeats the unconfigure operation of an individual device for all the devices on c0. This process can be time-consuming if the number of devices on c0 is large.

---

- 5 Verify that all the devices on c0 are unconfigured.

```

# cfgadm -al
Ap_Id          Type          Receptacle  Occupant    Condition
c0             fc-fabric    connected   unconfigured unknown
c0::50020f2300006077 disk          connected   unconfigured unknown
c0::50020f23000063a9 disk          connected   unconfigured unknown
c1             fc-private   connected   configured  unknown
c1::220203708b69c32b disk          connected   configured  unknown
c1::220203708ba7d832 disk          connected   configured  unknown

```

Notice that the Occupant column of `c0` and all the fabric devices attached to it are displayed as unconfigured.

## ▼ To Unconfigure a Fabric Device Associated With Sun StorageTek Traffic Manager Multipathing-Enabled Devices

This procedure shows fabric-connected host ports `c0` and `c2` to illustrate how to unconfigure fabric devices associated with Sun StorageTek Traffic Manager software devices.

- 1 **Become superuser.**
- 2 **Identify the port WWN of the fabric device to be unconfigured.**

```
# cfgadm -aL
Ap_Id                Type      Receptacle  Occupant  Condition
c0                   fc-fabric connected   configured unknown
c0::50020f2300006077 disk      connected   configured unknown
c0::50020f23000063a9 disk      connected   configured unknown
c1                   fc-private connected   configured unknown
c1::220203708b69c32b disk      connected   configured unknown
c1::220203708ba7d832 disk      connected   configured unknown
c2                   fc-fabric connected   configured unknown
c2::50020f2300005f24 disk      connected   configured unknown
c2::50020f2300006107 disk      connected   configured unknown
```

In this example, the `c0::50020f2300006077` and `c2::50020f2300006107` Ap\_Ids represent different port WWNs for the same device associated with a Sun StorageTek Traffic Manager software device. The `c0` and `c2` host ports are enabled for use by the Sun StorageTek Traffic Manager software.

- 3 **Stop all device activity to each fabric device on the selected port and unmount any file systems on each fabric device.**

If the device is under any volume manager's control, see the documentation for your volume manager for maintaining the fabric device.

- 4 **Unconfigure fabric devices associated with the device.**

Only devices on a fabric-connected host port can be unconfigured through the `cfgadm -c unconfigure` command.

```
# cfgadm -c unconfigure c0::50020f2300006077 c2::50020f2300006107
```

---

**Note** – You can remove a device from up to eight paths individually, as in the example command `cfgadm -c unconfigure c0::1111, c1::2222, c3::3333`, and so on. As an alternative, you can remove an entire set of paths from the host, as in the example `cfgadm -c unconfigure c0`.

---

## 5 Verify that the selected devices are unconfigured.

```
# cfgadm -al
Ap_Id                Type      Receptacle  Occupant  Condition
c0                   fc-fabric connected   configured unknown
c0::50020f2300006077 disk      connected   unconfigured unknown
c0::50020f23000063a9 disk      connected   configured  unknown
c1                   fc-private connected   configured  unknown
c1::220203708b69c32b disk      connected   configured  unknown
c1::220203708ba7d832 disk      connected   configured  unknown
c2                   fc-fabric connected   configured  unknown
c2::50020f2300005f24 disk      connected   configured  unknown
c2::50020f2300006107 disk      connected   unconfigured unknown
```

Notice that the Ap\_Ids `c0::50020f2300006077` and `c2::50020f2300006107` are unconfigured. The Occupant column of `c0` and `c2` still displays those ports as configured because they have other configured occupants.

The Sun StorageTek Traffic Manager software devices associated with the Ap\_Ids `c0::50020f2300006077` and `c2::50020f2300006107` are no longer available to the host using the Solaris 10 OS. The following two devices are removed from the host:

```
/dev/rdisk/c6t60020F20000061073AC8B52D000B74A3d0s2
/dev/rdisk/c6t60020F20000061073AC8B4C50004ED3Ad0s2
```

## ▼ To Unconfigure One Path to a Multipathing Device

In contrast to the procedure in the preceding section, this procedure shows how to unconfigure one device associated with `c2::50020f2300006107` and leave the other device, `50020f2300006077`, configured. Only devices on a fabric-connected host port can be unconfigured through the `cfgadm unconfigure` command.

### 1 Become superuser.

### 2 Identify the Ap\_Id of the Sun StorageTek Traffic Manager software device to be unconfigured.

```
# cfgadm -al
Ap_Id                Type      Receptacle  Occupant  Condition
c0                   fc-fabric connected   configured  unknown
c0::50020f2300006077 disk      connected   configured  unknown
c0::50020f23000063a9 disk      connected   configured  unknown
c1                   fc-private connected   configured  unknown
c1::220203708b69c32b disk      connected   configured  unknown
c1::220203708ba7d832 disk      connected   configured  unknown
c2                   fc-fabric connected   configured  unknown
c2::50020f2300005f24 disk      connected   configured  unknown
c2::50020f2300006107 disk      connected   configured  unknown
```

In this example, `c0::50020f2300006077` and `c2::50020f2300006107` Ap\_Ids represent different port WWNs for the same device.

### 3 Unconfigure the Ap\_Id associated with the device.

**Note** – If the Ap\_Id represents the last configured path to the device, stop all activity to the path and unmount any file systems on it. If the multipathing device is under any volume manager’s control, see the documentation for your volume manager for maintaining the fabric device.

In the example that follows, the path represented as `c2::50020f2300006107` is unconfigured, and `c0::50020f2300006077` remains configured to show how you can unconfigure just one of multiple paths for a multipathing device.

```
# cfgadm -c unconfigure c2::50020f2300006107
```

### 4 Verify that the selected path `c2::50020f2300006107` is unconfigured.

```
# cfgadm-a1
```

Ap_Id	Type	Receptacle	Occupant	Condition
c0	fc-fabric	connected	configured	unknown
c0::50020f2300006077	disk	connected	configured	unknown
c0::50020f23000063a9	disk	connected	configured	unknown
c1	fc-private	connected	configured	unknown
c1::220203708b69c32b	disk	connected	configured	unknown
c1::220203708ba7d832	disk	connected	configured	unknown
c2	fc-fabric	connected	configured	unknown
c2::50020f2300005f24	disk	connected	configured	unknown
c2::50020f2300006107	disk	connected	unconfigured	unknown

The devices associated with that Ap\_Id are still available to a host using the Solaris 10 OS through the other path, represented by `c0::50020f2300006077`. A device can be connected to multiple Ap\_Ids and an Ap\_Id can be connected to multiple devices.

```
/dev/rdsk/c6t60020F20000061073AC8B52D000B74A3d0s2
and
/dev/rdsk/c6t60020F20000061073AC8B4C50004ED3Ad0s2
```

## ▼ To Unconfigure All Fabric-Connected Devices With Multipathing Enabled

An Ap\_Id on a fabric-connected host port is a path to the Sun StorageTek Traffic Manager software device.

When a Sun StorageTek Traffic Manager software device has multiple Ap\_Ids connected to it, the device is still available to the host using the Solaris 10 OS after you unconfigure an Ap\_Id. After you unconfigure the last Ap\_Id, no additional paths remain and the device is unavailable to the host using the Solaris 10 OS. Only devices on a fabric-connected host port can be unconfigured.

### 1 Become superuser.

**2 Identify the devices to be unconfigured.**

```
# cfgadm -al
Ap_Id                Type      Receptacle  Occupant  Condition
c0                   fc-fabric connected   configured unknown
c0::50020f2300006077 disk      connected   configured unknown
c0::50020f23000063a9 disk      connected   configured unknown
c1                   fc-private connected   configured unknown
c1::220203708b69c32b disk      connected   configured unknown
c1::220203708b9b20b2 disk      connected   configured unknown
c2                   fc-fabric connected   configured unknown
c2::50020f2300005f24 disk      connected   configured unknown
```

**3 Unconfigure all of the configured devices on the selected port.**

```
# cfgadm -c unconfigure c2
```

---

**Note** – This operation repeats the unconfigure command of an individual device for all devices on c2. This process can be time-consuming if the number of devices on c2 is large.

---

**4 Verify that all devices on c2 are unconfigured.**

```
# cfgadm -al
Ap_Id                Type      Receptacle  Occupant  Condition
c0                   fc-fabric connected   configured unknown
c0::50020f2300006077 disk      connected   configured unknown
c1                   fc-private connected   configured unknown
c1::220203708b69c32b disk      connected   configured unknown
c1::220203708ba7d832 disk      connected   configured unknown
c2                   fc-fabric connected   unconfigured unknown
c2::50020f2300005f24 disk      connected   unconfigured unknown
c2::50020f2300006107 disk      connected   unconfigured unknown
```

Notice that the Occupant column lists c2 and all the devices attached to c2 as unconfigured.

# Supported FC-HBA API

---

This appendix contains the list of supported and unsupported FC-HBA Interfaces. For further information regarding the API, refer to the Sun StorageTek Traffic Manager multipathing “Software Features” on page 12.

## Supported Fibre Channel HBA API

TABLE B-1 Supported and Unsupported FC-HBA Interfaces

FC - HBA	Sun StorageTek Traffic Manager Software Supported
HBA_GetVersion	Yes
HBA_LoadLibrary	Yes
HBA_FreeLibrary	Yes
HBA_GetNumberOfAdapters	Yes
HBA_GetAdapterName	Yes
HBA_OpenAdapter	Yes
HBA_CloseAdapter	Yes
HBA_GetAdapterAttributes	Yes
HBA_GetAdapterPortAttributes	Yes
HBA_GetDiscoveredPortAttributes	Yes
HBA_GetPortAttributesbyWWN	Yes
HBA_SendCTPassThru	Yes
HBA_SendCTPassThruV2	Yes

TABLE B-1 Supported and Unsupported FC-HBA Interfaces (Continued)

FC-HBA	Sun StorageTek Traffic Manager Software Supported
HBA_RefreshInformation	Yes
HBA_GetFcpTargetMapping	Yes
HBA_SendScsiInquiry	Yes
HBA_SendReportLuns	Yes
HBA_SendReadCapacity	Yes
HBA_GetPortStatistics	Yes
HBA_ResetStatistics	No
HBA_GetFcpPersistentBinding	No
HBA_GetEventBuffer	No
HBA_SetRNIDMgmtInfo	Yes
HBA_GetRNIDMgmtInfo	Yes
HBA_SendRNID	Yes
HBA_SendRNIDV2	Yes
HBA_ScsiInquiryV2	Yes
HBA_ScsiReportLUNsv2	Yes
HBA_ScsiReadCapacityV2	Yes
HBA_OpenAdapterByWWN	Yes
HBA_RefreshAdapterConfiguration	Yes
HBA_GetVendorLibraryAttributes	Yes
HBA_GetFcpTargetMappingV2	Yes
HBA_SendRPL	No
HBA_SendRPS	No
HBA_SendSRL	No
HBA_SendLIRR	No
HBA_SendRLS	Yes
HBA_RemoveCallback	Yes
HBA_RegisterForAdapterEvents	Yes
HBA_RegisterForAdapterAddEvents	Yes

TABLE B-1 Supported and Unsupported FC-HBA Interfaces (Continued)

FC-HBA	Sun StorageTek Traffic Manager Software Supported
HBA_RegisterForAdapterPortEvents	Yes
HBA_RegisterForAdapterPortStatEvents	No
HBA_RegisterForTargetEvents	Yes
HBA_RegisterForAdapterLinkEvents	No
HBA_RegisterForAdapterTargetEvents	Yes
HBA_GetFC4Statistics	No
HBA_GetFCPStatistics	No
HBA_GetBindingCapability	No
HBA_GetBindingSupport	No
HBA_SetBindingSupport	No
HBA_SetPersistentBindingV2	No
HBA_GetPersistentBindingV2	No
HBA_RemovePersistentBinding	No
HBA_RemoveAllPersistentBindings	No



# Multipathing Troubleshooting

---

This appendix provides solutions to potential problems that might occur while running the Sun StorageTek Traffic Manager software.

This appendix contains the following sections:

- “System Fails to Boot During `stmsboot`” on page 91
- “System Crashes During `stmsboot`” on page 92

## System Fails to Boot During `stmsboot`

During the reboot following `stmsboot enable (-e)`, `stmsboot disable (-d)`, or `stmsboot update (-u)` operations if the system fails to boot but lets you enter single user mode, perform the following to recover.

### ▼ To Recover From Single User Mode

- 1 Type the root password and enter single user mode.
- 2 Restart the `mpxio-upgrade` service.

```
# svcadm restart svc:/platform/sun4u/mpxio-upgrade:default
```

If this command is not successful, follow the instructions in the next section to recover your original configuration.

## System Crashes During `stmsboot`

During the reboot following `stmsboot enable (-e)`, `stmsboot disable (-d)`, or `stmsboot update (-u)` operations, if your system hangs, panics, or fails to boot, follow the instructions below to recover your original configuration.

### ▼ To Recover from a System Crash

**1 Boot the system from another disk, CD, DVD, or over the network.**

**2 Run the `fsck your-root-device` command where *your-root-device* is your original root device.**

```
# fsck your-root-device
```

**3 Mount your original root device.**

```
# mount your-root-device /mnt
```

**4 Restore your original `fp.conf` file by performing one of the following steps:**

■ **If you ran `stmsboot -e` or `-d`:**

```
# cp /mnt/etc/mpxio/fp.conf /mnt/kernel/drv/fp.conf
```

The `/mnt/etc/mpxio/fp.conf` file is a copy of your original `fp.conf` file that the `stmsboot` command saved prior to updating your `fp.conf` file.

■ **If you ran the `stmsboot -u` command, and you modified the `fp.conf` file prior to running the `stmsboot` command, undo the changes you made to this file by editing the**

**`/mnt/kernel/drv/fp.conf` file.**

**5 Undo any other changes you made to the multipathing configuration prior to running the `stmsboot` command.**

For example, if you modified the `scsi_vhci.conf` file, undo the changes you made to this file by editing the `/mnt/kernel/drv/scsi_vhci.conf` file.

If you modified the device settings of your storage arrays, restore their original settings.

**6 Restore your original `/etc/vfstab` file:**

```
# cp /mnt/etc/mpxio/vfstab /mnt/etc/vfstab
```

The `/mnt/etc/mpxio/vfstab` file is a copy your original `/etc/vfstab` file that the `stmsboot` command saved prior to updating your `vfstab` file. A `/mnt/etc/mpxio/vfstab` file will not exist if the `stmsboot` command has not modified your `vfstab` file.

**7 If the system is running on a Solaris 10 Update 4 (or later) x86 based system, perform the following steps:**

**a. Restore your original /boot/solaris/bootenv.rc file.**

```
# cp /mnt/etc/mpxio/bootenv.rc /mnt/boot/solaris/bootenv.rc
```

The /mnt/etc/mpxio/bootenv.rc file is a copy your original /boot/solaris/bootenv.rc file that the stmsboot command saved prior to updating your bootenv.rc file. A /mnt/etc/mpxio/bootenv.rc file will not exist if the stmsboot command has not modified your bootenv.rc file.

**b. Update the boot archive.**

```
# bootadm update-archive -R /mnt
```

**8 Disable the mpxio-upgrade service:**

```
# /usr/sbin/svccfg -f /mnt/etc/mpxio/svccfg_recover
```

**9 Unmount the device.**

```
# umount /mnt
```

**10 Reboot the system.**



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