Sun StorEdge™ SAN Foundation Software 4.2 Configuration Guide

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Preface

The *Sun StorEdge SAN Foundation Software 4.2 Configuration Guide* is for system administrators who need instructions for configuring the Sun StorEdge™ SAN Foundation software (SFS) in a storage area network (SAN) or direct-attach environment.

By the time you read this book, you should have already completed the hardware and software installation for your SAN with the help of the *Sun StorEdge SAN Foundation Software 4.2 Installation Guide*.

Using UNIX Commands

This document may not contain information on basic UNIX® commands and procedures such as shutting down the system, booting the system, and configuring devices.

See one or more of the following for this information:
- *Solaris Handbook for Sun Peripherals*
- AnswerBook2™ online documentation for the Solaris™ operating environment
- Other software documentation that you received with your system

Typographic Conventions

TABLE P-1

Typeface	Meaning	Examples
AaBbCc123	The names of commands, files, and directories; on-screen computer output	Edit your `.login` file. Use `ls -a` to list all files. `% You have mail.`
AaBbCc123	What you type, when contrasted with on-screen computer output	`% `**`su`** `Password:`
AaBbCc123	Book titles, new words or terms, words to be emphasized	Read Chapter 6 in the *User's Guide*. These are called *class* options. You *must* be superuser to do this.
	Command-line variable; replace with a real name or value	To delete a file, type `rm` *filename*.

Shell Prompts

TABLE P-2

Shell	Prompt
C shell	*machine_name*%
C shell superuser	*machine_name*#
Bourne shell and Korn shell	$
Bourne shell and Korn shell superuser	#

Related Documentation

TABLE P-3   Sun StorEdge SAN Foundation Release Related Documentation

Product	Application	Title	Part Number
Sun StorEdge SAN 4.2 Foundation Release	Documentation information	*Sun StorEdge SAN Foundation Software 4.2 Guide to Documentation*	817-1576

Getting Help

If you need help installing or using this product, contact your service provider. If you have a support contract with Sun, call 1-800-USA-4SUN, or go to:

`http://www.sun.com/service/contacting/index.html`

Accessing Sun Documentation Online

A broad selection of Sun system documentation is located at:

`http://www.sun.com/products-n-solutions/hardware/docs`

A complete set of Solaris documentation and many other titles are located at:

`http://docs.sun.com`

Features and Guidelines

By now, you should have completed the SFS hardware and software installation. The *Sun StorEdge SAN Foundation Software 4.2 Release Notes* identifies hardware on the Sun price list that you can include in your network and lists features and functionality that Sun supports. This section gives related guidelines for creating a SAN with the SFS and contains the following topics:

- "Fabric Bootability" on page 1
- "SNIA and FCSM Packages" on page 2
- "Zones and Ports" on page 5
- "Guidelines" on page 7

Fabric Bootability

The 2 Gb HBAs that support the SFS can now boot from fabric devices as well as non-fabric devices. Fabric topologies with Fibre Channel switches provide higher speed, more connections, and port isolation. A Fibre Channel port can be configured in a loop or fabric topology.

As Sun deprecates loop support with its Fibre Channel switches, some current bootable configurations will not work in the future. With support for fabric bootability, however, you can still boot off devices on your SAN as you use the new switches. For fabric bootability instructions, see the Dump and Restore section of the chapter on bootability in the *Sun StorEdge SAN Foundation Software 4.2 Installation Guide.*

SNIA and FCSM Packages

The SAN Foundation release includes the Storage Networking Industry Association (SNIA) Fibre Channel host bus adapter (HBA) library. Some of these interfaces are provided through the Fibre Channel Switch Management (FCSM) driver. The SNIA library uses the FCSM driver to send Fibre Channel Common Transport (CT) requests to Fibre Channel switches. This allows client applications to get detailed information about the SAN topology and switch configurations.

The SNIA HBA application programming interfaces (APIs) enable you to manage Fibre Channel HBAs in your SAN. You can use the interfaces to access detailed information about the HBAs on a host and switches and storage devices connected to the SAN to comply with industry standards. Specifically, SNIA and FCSM enable you to integrate the Sun StorEdge Enterprise Storage Manager Topology Reporter (ESM) and other third-party SAN management tools with the Sun StorEdge SAN Foundation software required for devices that Sun supports.

The SNIA HBA API is divided into two functional components. The first is a Common Library, to which applications are linked. The second is one or more Vendor Specific Libraries (VSLs), which the Common Library dynamically loads to manage individual vendor HBAs.

Man pages for the common SNIA API are included in the Sun StorEdge SAN Foundation software. The formal specification (FC-MI) is available at `http://www.t11.org`. TABLE 1-1 outlines which APIs are included in the vendor library for this release:

TABLE 1-1   Supported and Unsupported SNIA Interfaces

SNIA API	Sun StorEdge SAN Foundation Software Support
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

TABLE 1-1 Supported and Unsupported SNIA Interfaces *(Continued)*

SNIA API	Sun StorEdge SAN Foundation Software Support
HBA_GetPortAttributesbyWWN	Yes
HBA_SendCTPassThru	Yes
HBA_SendCTPassThruV2	No
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	No
HBA_RegisterForAdapterEvents	No

TABLE 1-1   Supported and Unsupported SNIA Interfaces *(Continued)*

SNIA API	Sun StorEdge SAN Foundation Software Support
HBA_RegisterForAdapterAddEvents	No
HBA_RegisterForAdapterPortEvents	No
HBA_RegisterForAdapterPortStatEvents	No
HBA_RegisterForTargetEvents	No
HBA_RegisterForAdapterLinkEvents	No
HBA_RegisterForAdapterTargetEvents	No
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

SNIA packages are now part of the Sun StorEdge SAN Foundation software stack.
See the *Sun StorEdge SAN Foundation Software 4.2 Installation Guide* and *Sun StorEdge
SAN Foundation Software 4.2 Release Notes* for more information on the location of the
packages and how to install them. The package names are:

- SNIA common library: SUNWcfclr, SUNWcfcl, SUNWcfclx
- SAN Foundation Vendor Library: SUNWfchbr, SUNWfchba, SUNWfchbx
- FCSM driver: SUNWfcsm, SUNWfcsmx
- SAN Foundation software: SUNWsan, SUNWcfpl, SUNWcfplx

Zones and Ports

Understanding zoning and port usage is fundamental to understanding the use of configuration rules with the supported hardware. This section explains the use of zones and ports in preparation of the next section, which covers the configuration rules. Topics covered include:

- "Zone Types" on page 5
- "Port Types" on page 6

Zone Types

Zoning is a function of the switch that allows segregation of devices by ports or World Wide Names (WWNs). You can create zones for a variety of reasons, such as security, simplicity, performance, or dedication of resources. Previous releases supported hard zones, segmented loop (SL) zones and name server (NS) zones. The current release now supports industry-standard port-based and WWN-based NS zones. See your third-party vendor documentation for more information. The two types of NS zones discussed most frequently in this documentation include:

- Port-based NS zones
- WWN-based NS zones

Name Server Zones

NS zones use fabric protocols to communicate with Fibre Channel devices. NS zones contain F, FL, G, GL, and E ports for fabric devices. Each NS zone defines which ports or devices receive NS information. GL ports are not supported for Sun devices in this release. The Sun StorEdge T3 and T3+ arrays with firmware levels 1.18.01 and 2.0.03 support loop (TL) port connections. The Sun StorEdge T3+ array with firmware levels 2.0.03 supports fabric connections. FL ports are supported for Sun StorEdge L180/L700 tape libraries.

Segmented Loop Zones

The current SAN 4.0 release does not support Segmented Loop (SL) zones or ports. If you have a SAN that requires SL connectivity to private loop devices, you can connect a new switch from the SAN 4.x release to the same host as an old switch from previous releases. The two SANs must, however, each have separate directories on the host for their respective management tools.

Port Types

TABLE 1-2 Switch Port Types

Port Type	Description	Supported Devices
TL Ports	Translated loop	storage devices connected to the Sun switch only
FL Ports	Public loop	Sun StorEdge L180/L700 tape libraries
F Ports	Point-to-point fabric	host bus adapters, storage devices
E Ports	Inter-switch port	cascaded switches acting as ISLs, which are configured initially in fabric port mode
G Ports	General ports	automatically configure to F or E ports to support hosts or switches
GL Ports	General loop ports	N/A

Guidelines

This section covers guidelines for the following topics:

- "Cascading Guidelines" on page 7
- "FCIP Guidelines" on page 8
- "Multipathing Guidelines" on page 8

Cascading Guidelines

- Hub-to-switch connectivity is not supported in a fabric.
- Cascading requires connection of E ports from switch to switch with either a shortwave or longwave GigBit Interface Converter (GBIC) or Small Form Factor Pluggable (SFP) 2-Gbyte transceiver. The use of shortwave SFPs allows a higher port count in a local configuration. The use of longwave SFPs and long haul fiber optics allows users to reach geographically separated storage and servers, perhaps for disaster recovery purposes.
- You can have a maximum of eight switches cascaded in a linear series. In other words, you can have seven inter-switch links between switches. Two of the ISLs can be long-wave connections. Check with your switch vendor for specific ISL count limitations because not all switches support a cascade of eight.
- Long-wave and short-wave ISLs can be used to cascade switches. The maximum distance for a single ISL hop is 10 km. Check with your third-party vendor documentation for details.
- If 1- and 2-Gbyte switches are used together, a maximum of 16 switches can be connected together.
- If only 2-Gbyte switches are used, a maximum of 64 switches can be connected together.
- Any number of ISL hops can be used between two switches. ISL hops do not include the connections between hosts and switches or between switches and storage.

FCIP Guidelines

FCIP devices are supported for use with Network File System (NFS) software, Network Attached Storage (NAS) devices and Sun StorEdge Network Data Replicator (SNDR), or Sun StorEdge Availability Suite 3.1 remote mirror software.

TABLE 1-3   FCIP (NFS/NAS and SNDR)

Feature	Supported
Cascading	Yes, with Fabric NS zones only
Zone type	Fabric NS zone (with the HBA configured as an F port point-to-point connection)
Maximum number of device ports per zone	4[*]

[*] With the Sun StorEdge PCI Dual Fibre Channel Network Adapter+, only physical port 2 can be used for FCIP. With the Sun StorEdge cPCI Dual Fibre Channel Network Adapter, only physical port 1 can be used for FCIP.

The following restrictions apply:

- Promiscuous mode is not supported. The `snoop` (1M) utility cannot be used.
- Multicasting is supported through broadcasting only.
- Assign the IP address of the FCIP port to a subnet different from that of the Ethernets on the same system.
- Network cards using FCIP can not be used as routers. The `/etc/notrouter` file must be present on the host.
- When using FCIP, storage devices and hosts should be in separate zones. The storage device should have one path to one zone and another path to another zone for failover and redundancy. The host can have more than one path to a specified zone, and it should have at least one path to each zone so that it can see the respective storage.
- Failover is not possible with FCIP or FC tape.

Multipathing Guidelines

Before you configure port-based zones to storage devices, you might want to set up volumes, or LUNs, for those devices. If you want high availability, you should also enable multipathing capability for load balancing of I/O traffic between hosts and arrays in the SAN. The multipathing driver described in this section is called the STMS and runs in the Solaris operating environment. See the *Sun StorEdge Traffic Manager Software Installation and Configuration Guide* for details about the component. If you are using another multipathing application, see the documentation for it.

Note – STMS is disabled on SCSI devices but not boot devices. Multipathing is not supported on tape drives or tape libraries

Adding and Removing SAN Devices

By now, you should have identified features and guidelines for connecting devices and hosts to the switches. This chapter helps you with setting up the devices in the zones on your switches. If you have not already done so, configure your ports and zones according to the instructions in your vendor-specific documentation.

This section covers addition of the supported storage devices, such as the Sun StorEdge T3+ array and Sun StorEdge 39x0, 69x0, and 99x0 series, to a SAN. Topics include:

■ "Special Considerations" on page 12
■ "Adding and Removing Devices" on page 13

Special Considerations

This section covers:

- "Port Choices" on page 12
- "Multipathing" on page 12

Port Choices

When configuring an array, the host port is connected to an F port and the array is connected to an F or TL port on the switch. The TL port, or translation loop port, represents eight-bit addressing devices as 24-bit addressing devices and vice versa.

TABLE 2-1   Port Types and For Storage Devices

Port Type	Storage Device
loop	Sun StorEdge T3 array
loop or fabric	Sun StorEdge t3+ array
fabric	Sun StorEdge 69x0 array
loop or fabric	Sun StorEdge 99x0 array
loop	STK 9840b tape drive
loop or fabric	STK 9940b tape drive
loop	STK 9840 tape drive
loop, public loop	Sun StorEdge L180/L700 tape libaries

Although you may connect a Sun StorEdge T3 array with a TL port, the host bus adapter recognizes it as a fabric device. Sun StorEdge T3+ arrays and the Sun StorEdge 39x0, 69x0, and 99x0 series should be connected with F ports as a 24-bit addressing device for fabric connectivity. The STK 9840b tape drive require F ports when connected to 2 Gbyte switches. Sun StorEdge L5500/L6000 libraries are not connected to the SAN.

Multipathing

You can connect arrays and other storage devices to the SAN with or without multipathing capability. The multipathing driver discussed in this book is called the Sun StorEdge Traffic Manager software (STMS) and runs on the Solaris operating

environment. The Sun StorEdge Traffic Manager software (STMS) is an associated application that is bundled with the SFS. For detailed information about the STMS or other multipathing utilities, see the *Sun StorEdge Traffic Manager Software Installation and Configuration Guide* or other third-party manuals.

Adding and Removing Devices

This section covers:

- "Adding a Storage Device" on page 13
- "Removing a Storage Device" on page 16

Adding a Storage Device

- If the STMS is not enabled, read the section "Creating and Removing Individual Device Nodes Without Multipathing Enabled" on page 18. See "Creating and Removing Multiple Device Nodes Without Multipathing Enabled" on page 25 for specific information.

- If the STMS is enabled, read the section "Creating and Removing Individual Device Nodes With Multipathing Enabled" on page 29. See "Creating and Removing Multiple Device Nodes With Multipathing Enabled" on page 41 for specific information.

Note – If you use the `format` command when the STMS is enabled, as shown in FIGURE 2-1, you see only one instance of a device identifier for each LUN. Without the STMS, you see one identifier for each path. The `format` command is shown in FIGURE 2-1 but is not further described in the manual because it is an established utility.

▼ To Add a Storage Device

1. **Plug the storage device into the system.**

2. **Create the LUN or LUNs desired.**

3. **Apply LUN masking for HBA control.**

4. **Create port-based or WWN zones on the switch.**

5. **If necessary, configure all paths to the storage device using the** `cfgadm -c configure` **command on all the host bus adapters that have a path to the storage device.**

   The `cfgadm -c configure` command creates device nodes. This step is necessary if the storage device is connected in an NS zone and is accessed by a host port connected to a switch F port.

6. **Run the** `fsck` **or** `newfs` **commands on the device.**

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

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

Public Loop Device(s)

Do you want multipathing support for high availability?

yes   no

Do you want Sun multipathing support?

yes   no

Enable the STMS software.   Use VERITAS Vx/DMP
See the STMS documentation.   See your third-party
documentation.   documentation.

The host does not automatically detect the fabric device.
See page 18.

Use the `cfgadm` utility to detect and configure fabric devices on the host.
See page 18 or page 20 for
two of several examples.

Use the `format` utility to verify the host detects the device if the Sun StorEdge
Traffic Manager is not enabled. See the format(1M) man

Use the `luxadm` utility to check the device paths.
See the luxadm(1M) man
page.

Is the STMS enabled?

yes   no

Use `luxadm` to check the online and standby paths.   Use `luxadm` to check all the paths.
See CODE EXAMPLE 3-6.   See CODE EXAMPLE 3-2.
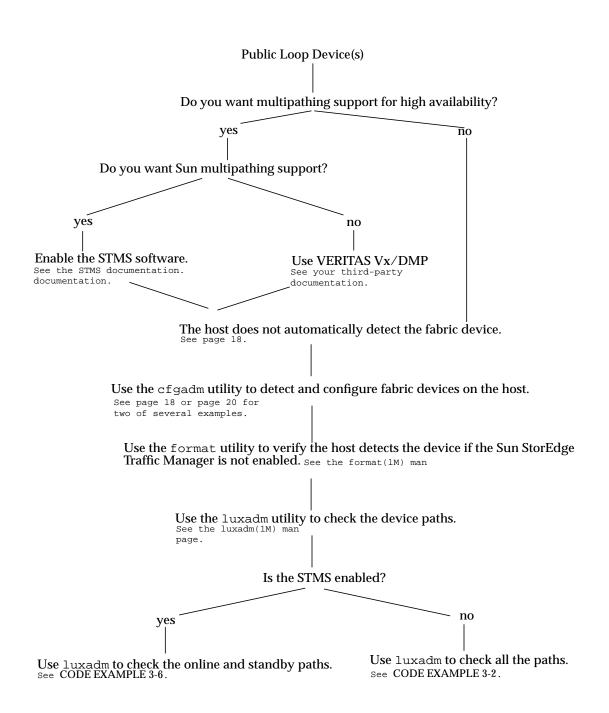
FIGURE 2-1   Decision Tree For Adding Public Devices

Removing a Storage Device

- If the STMS is not enabled, read the section "Creating and Removing Individual Device Nodes With Multipathing Enabled" on page 29. See "To Unconfigure a Fabric Device" on page 24 for specific information.
- If the STMS is enabled, read the section "Creating and Removing Individual Device Nodes With Multipathing Enabled" on page 29. See "To Unconfigure a Fabric Device Associated With Multipathing Enabled Devices" on page 35 for specific information.
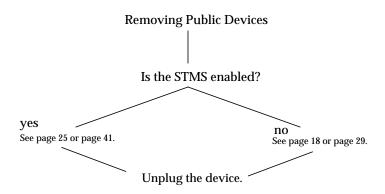

Removing Public Devices

Is the STMS enabled?

yes
See page 25 or page 41.

no
See page 18 or page 29.

Unplug the device.

FIGURE 2-2   Decision Tree For Removing Public Devices

▼ To Remove a Storage Device

1. **Stop all LUN activity to the storage device.**

2. **Unmount any file systems currently using the storage device's LUNs.**

3. **Deport any volume manager disk groups.**

4. **Unconfigure paths to the storage device using the** `cfgadm -c unconfigure` **command.**

   This step is necessary if the storage device is connected in an NS zone and is accessed by a host port connected to an F port on the switch.

Public Device Node Recognition

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

This chapter provides generic instructions for adding and removing all supported devices in this release. This chapter includes:

- "Creating and Removing Individual Device Nodes Without Multipathing Enabled" on page 18
- "Creating and Removing Multiple Device Nodes Without Multipathing Enabled" on page 25
- "Creating and Removing Individual Device Nodes With Multipathing Enabled" on page 29
- "Creating and Removing Multiple Device Nodes With Multipathing Enabled" on page 41

There are a variety of ways in which you can ensure the host recognizes storage devices you add on your SAN. The decision trees in FIGURE 2-1 and FIGURE 2-2 help guide you through the process.

Note – You can connect a Sun StorEdge T3 array as an FC-AL device to a switch, but the Sun StorEdge host bus adapters supported in the SAN Foundation release recognize the array as a fabric device.

The scope of this chapter is limited to the operations required from the perspective of the Solaris operating environment. 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.

Creating and Removing Individual Device Nodes Without Multipathing Enabled

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

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 devices attached to the fabric-connected host port are not configured by default, thus those devices are not available to the host using the Solaris operating environment. Use the cfgadm(1M) configure and 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 how to detect fabric devices that are visible on a host and to configure and make them available to a host using the Solaris operating environment.

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

This section contains the following topics:

- "To Detect Fabric Devices Visible on a Host" on page 18
- "Ensuring LUN Level Information Is Visible" on page 20
- "To Configure a Fabric Device Without Multipathing Enabled On the Host" on page 20
- "To Unconfigure a Fabric Device" on page 24
- "To Configure All Fabric Devices on a Fabric-Connected Host Port" on page 25
- "To Unconfigure All Fabric Devices on a Fabric-Connected Host Port" on page 27

▼ To Detect Fabric Devices Visible on a Host

This procedure uses Fibre Channel host ports c0 and c1, and the devices attached to them, to provide an example of detecting fabric devices. This procedure also shows the device configuration information that is displayed with the cfgadm(1M) command.

> **Note –** If you do not install the proper software patches and packages for this release, Fibre Channel devices do not display in the cfgadm(1M) command output. 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 operating environment.

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 Fibre Channel host ports. Also use the `cfgadm -al` command to display information about Fibre Channel 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 operating environment. The Ap_Id devices with port WWNs under `c1` represent private-loop devices that are configured through the `c1` host port.

To identify which device nodes represent the same storage device on your own system, log in to your Sun StorEdge T3 array and use `port list` to list the WWNs of the array controllers attached to your SAN.

Ensuring LUN Level Information Is Visible

If you issue the `cfgadm -al -o show_FCP_dev` *<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. Use the `modinfo` command to check if the drivers are loaded. After you load the drivers, the LUN level information is visible in the `cfgadm` output. Also, issue the `format` command to confirm the disks and LUNs are visible.

▼ To Configure a Fabric Device Without Multipathing Enabled On the Host

This 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.**

Only devices on a fabric-connected host port can 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.

Use the `show_FCP_dev` option to display FCP SCSI LUN information for multi-LUN SCSI devices. From CODE EXAMPLE 3-1, the physical devices connected through ap_id c2::50020f2300006107 and ap_id c2::50020f2300005f24 have two LUNs configured respectively.

CODE EXAMPLE 3-1   show_FCP_dev Output Showing Two LUNs

```
# cfgadm -al -o show_FCP_dev 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
```

The device is now available on the host using the Solaris operating environment. CODE EXAMPLE 3-2 is an example of the `luxadm(1M)` output. Notice that four devices are listed under Paths:

```
/dev/rdsk/c0t50020F2300006077d3s2
/dev/rdsk/c0t50020F2300006077d2s2
/dev/rdsk/c0t50020F2300006077d1s2
/dev/rdsk/c0t50020F2300006077d0s2
```

```
The paths represent each SCSI LUN in the physical device
represented by c0::50020f2300006077.
```

CODE EXAMPLE 3-2   `luxadm` Output For Four Devices and a Single Array

```
# luxadm display 50020f2300006077
DEVICE PROPERTIES for disk: 50020f2300006077
 Status(Port A):       O.K.
 Vendor:               SUN
Product ID:            T300
 WWN(Node):            50020f2000006077
 WWN(Port A):          50020f2300006077
 Revision:             0117
 Serial Num:           Unsupported
 Unformatted capacity: 558448.000 MBytes
Write Cache:           Enabled
Read Cache:            Enabled
 Minimum prefetch:     0x0
 Maximum prefetch:     0x0
Device Type:           Disk device
 Path(s):
 /dev/rdsk/c0t50020F2300006077d3s2
```

```
/devices/pci@1f,2000/pci@1/SUNW,qlc@4/fp@0,0/ssd@w50020f23000060
77,3:c,raw
DEVICE PROPERTIES for disk: 50020f2300006077
  Status(Port A):        O.K.
  Vendor:                SUN
  Product ID:            T300
WWN(Node):               50020f2000006077
  WWN(Port A):           50020f2300006077
  Revision:              0117
  Serial Num:            Unsupported
Unformatted capacity: 558448.000 MBytes
  Write Cache:           Enabled
Read Cache:              Enabled
  Minimum prefetch:   0x0
  Maximum prefetch:   0x0
Device Type:           Disk device
Path(s):
/dev/rdsk/c0t50020F2300006077d2s2
/devices/pci@1f,2000/pci@1/SUNW,qlc@4/fp@0,0/ssd@w50020f23000060
77,2:c,raw
 DEVICE PROPERTIES for disk: 50020f2300006077
  Status(Port A):        O.K.
Vendor:                  SUN
Product ID:              T300
WWN(Node):               50020f2000006077
WWN(Port A):             50020f2300006077
Revision:                0117
Serial Num:              Unsupported
Unformatted capacity: 558448.000 MBytes
Write Cache:             Enabled
Read Cache:              Enabled
Minimum prefetch:     0x0
Maximum prefetch:     0x0
Device Type:           Disk device
Path(s):
/dev/rdsk/c0t50020F2300006077d1s2
/devices/pci@1f,2000/pci@1/SUNW,qlc@4/fp@0,0/ssd@w50020f23000060
77,1:c,raw
DEVICE PROPERTIES for disk: 50020f2300006077
  Status(Port B):        O.K.
Vendor:                  SUN
  Product ID:            T300
WWN(Node):               50020f2000006077
  WWN(Port B):           50020f2300006077
```

CODE EXAMPLE 3-2   `luxadm` Output For Four Devices and a Single Array *(Continued)*

```
Revision:              0117
Serial Num:            Unsupported
Unformatted capacity: 558448.000 MBytes
Write Cache:           Enabled
Read Cache:            Enabled
Minimum prefetch:    0x0
Maximum prefetch:    0x0
Device Type:          Disk device
 Path(s):
/dev/rdsk/c0t50020F2300006077d0s2
/devices/pci@1f,2000/pci@1/SUNW,qlc@4/fp@0,0/ssd@w50020f23000060
77,0:c,raw
```

▼ To Unconfigure a Fabric Device

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

Note – 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 operating environment for unmounting instructions. If the device is under any volume manager's control, see the documentation for your volume manager for maintaining the fabric device

---

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
c0::50020f2300005f24 disk         connected    configured   unknown
c0::50020f2300006107 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
```

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
c0::50020f2300005f24 disk         connected    configured    unknown
c0::50020f2300006107 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
```

Creating and Removing Multiple Device Nodes Without Multipathing Enabled

Procedures for creating and removing multiple devices are similar to those described in "Creating and Removing Individual Device Nodes Without Multipathing Enabled" on page 18. This section explains the finer differences. Make sure you first identify the devices visible to the host with the procedure "To Detect Fabric Devices Visible on a Host" on page 18. This section covers:

- "To Configure All Fabric Devices on a Fabric-Connected Host Port" on page 25
- "To Unconfigure All Fabric Devices on a Fabric-Connected Host Port" on page 27

▼ To Configure All Fabric Devices on a Fabric-Connected Host Port

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
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 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, and 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
c0                    fc-fabric    connected    configured   unknown
c0::50020f2300006077 disk         connected    configured   unknown
c0::50020f23000063a9 disk         connected    configured   unknown
c0::50020f2300005f24 disk         connected    configured   unknown
c0::50020f2300006107 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
```

The `show_FCP_dev` option displays FCP SCSI LUN information for multiple LUN SCSI devices. From the example in CODE EXAMPLE 3-3, the physical devices represented by c0::50020f2300006077 and c0::50020f2300006107 have four LUNs configured respectively. The physical devices represented by c0::50020f23000063a9 and c0::50020f2300005f24 have two LUNs configured respectively.

CODE EXAMPLE 3-3   `show_FCP_dev` Output For Multiple LUNs and Two Devices

```
# cfgadm -al -o show_FCP_dev 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
```

▼ 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
c0::50020f2300005f24 disk         connected    configured   unknown
c0::50020f2300006107 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
```

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

Note – 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 for maintaining the fabric device.

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

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

---

4. **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
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 of `c0` and all the fabric devices attached to it are displayed as unconfigured.

Creating and Removing Individual Device Nodes With Multipathing Enabled

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

The devices that are attached to fabric-connected HBA ports are not configured by default. These devices are thus not available to the host using the Solaris operating environment when a host port is initially connected to a fabric. The procedures in this section illustrate steps to detect fabric devices that are visible on a host and to configure them as Sun StorEdge Traffic Manager devices to make them available to the host using the Solaris operating environment.

The device information that you supply, and that which 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.)

This section contains the following procedures:

- "To Detect Fabric Devices Visible to a Host" on page 30
- "Ensuring LUN Level Information Is Visible" on page 31

▼ To Detect Fabric Devices Visible to a Host

This procedure shows Fibre Channel host ports c0, c1, and c2 and the devices attached to them. It illustrates fabric device detection and device configuration using the cfgadm(1M) command.

Note – If the proper cfgadm support for Fibre Channel devices is not installed, Fibre Channel devices do not display in the cfgadm(1M) command output. In the following examples, only failover path attachment points (Ap_Ids) are listed. The Ap_Ids displayed on your system depend on your system configuration.

---

1. **Become superuser.**

2. **Display 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
c2                 fc-fabric    connected    unconfigured unknown
```

An Ap_Id on a fabric-connected host port is a path to a Sun StorEdge Traffic Manager device. In this example, c0 and c2 represent fabric-connected host ports. Also, 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 are managed by a host using the Solaris operating environment.

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
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
```

Note – The `cfgadm -l` command displays information about Fibre Channel host ports. Also use the `cfgadm -al` command to display information about Fibre Channel 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 available to hosts using the Solaris operating environment. The Ap_Id devices with port WWNs under `c1` represent private-loop devices that are configured through the `c1` host port.

In the previous example, host ports `c0` and `c2` are connected to the two ports of a Sun StorEdge T3 enterprise array that has two port WWNs associated with it: Ap_Ids `50020f2300006077` and `50020f2300006107`.

If your storage device is a Sun StorEdge T3 array and you want to identify which device nodes represent the same storage device on your own system, log in to the array and use `port list` to list the WWNs of the array controllers attached to your SAN.

Ensuring LUN Level Information Is Visible

If you issue the `cfgadm -al -o show_FCP_dev` *<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. Use the `modinfo` command to check if the drivers are loaded. After you load the drivers, the LUN level information is visible in the `cfgadm` output.

▼ To Configure Fabric-Connected Device Nodes With Multipathing Enabled Devices

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

Note – Whether the STMS is enabled or not, the `cfgadm -c unconfigure` command for Fabric devices is identical, but the result is different. When the Sun Storage Traffic Manager software is enabled, the host using the Solaris operating environment creates device-node and path information that includes STMS information. The devices are still listed as `fc-fabric` devices, but the specific Ap_Ids are marked as `unconfigured` in the Occupant column.

---

1. **Become superuser.**

2. **Identify the port WWN of the device to be configured as a Sun StorEdge Traffic Manager device.**

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

   CODE EXAMPLE 3-4   `cfgadm` Listing of fabric and Private-Loop 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
   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
   ```

   In CODE EXAMPLE 3-4, 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 STMS.

3. **Configure the fabric device and make Sun StorEdge Traffic Manager 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
c0                    fc-fabric    connected   configured    unknown
c0::50020f2300006077 disk          connected   configured    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
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`.

After completing the configure operation without an error, STMS enabled devices are created on the host using the Solaris operating environment. If the physical device represented by `c0::50020f2300006077` and `c2::50020f2300006107` has multiple SCSI LUNs configured, each LUN is configured as a Sun StorEdge Traffic Manager device. CODE EXAMPLE 3-5 shows that two LUNs are configured through `c0::50020f2300006077` and `c2::50020f2300006107`. Each `ap_id` is associated with a path to those Sun StorEdge Traffic Manager devices.

CODE EXAMPLE 3-5 `show_FCP_dev` Output For Two LUNs On a Device

```
# cfgadm -al -o show_FCP_dev 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
```

In CODE EXAMPLE 3-6, notice that two STMS enabled devices

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

are created for the device represented by c0::50020f2300006077 and
c2::50020f2300006107.

CODE EXAMPLE 3-6   luxadm(1M) Output For Multiple Device Nodes With the STMS
Enabled

```
# luxadm display 50020f2300006077
DEVICE PROPERTIES for disk: 50020f2300006077
  Status(Port A):      O.K.
  Status(Port B):      O.K.
  Vendor:              SUN
  Product ID:          T300
  WWN(Node):           50020f2000006077
  WWN(Port A):         50020f2300006077
  WWN(Port B):         50020f2300006107
  Revision:            0117
  Serial Num:          Unsupported
  Unformatted capacity: 558448.000 MBytes
  Write Cache:         Enabled
  Read Cache:          Enabled
    Minimum prefetch:  0x0
    Maximum prefetch:  0x0
  Device Type:         Disk device
  Path(s):
  /dev/rdsk/c6t60020F20000061073AC8B52D000B74A3d0s2
  /devices/scsi_vhci/ssd@g60020f20000061073ac8b52d000b74a3:c,raw
   Controller        /devices/pci@1f,2000/pci@1/SUNW,qlc@4/fp@0,0
     Device Address    50020f2300006107,1
     Class             secondary
     State             STANDBY
   Controller        /devices/pci@1f,2000/pci@1/SUNW,qlc@5/fp@0,0
     Device Address    50020f2300006077,1
     Class             primary
     State             ONLINE

 DEVICE PROPERTIES for disk: 50020f2300006077
   Status(Port A):      O.K.
   Status(Port B):      O.K.
   Vendor:              SUN
   Product ID:          T300
   WWN(Node):           50020f2000006107
```

WWN(Port A):	50020f2300006107
WWN(Port B):	50020f2300006077
Revision:	0117
Serial Num:	Unsupported
Unformatted capacity:	558448.000 MBytes
Write Cache:	Enabled
Read Cache:	Enabled
Minimum prefetch:	0x0
Maximum prefetch:	0x0
Device Type:	Disk device
Path(s):	
/dev/rdsk/c6t60020F20000061073AC8B4C50004ED3Ad0s2	
/devices/scsi_vhci/ssd@g60020f20000061073ac8b4c50004ed3a:c,raw	
Controller	/devices/pci@1f,2000/pci@1/SUNW,qlc@4/fp@0,0
Device Address	50020f2300006107,0
Class	primary
State	ONLINE
Controller	/devices/pci@1f,2000/pci@1/SUNW,qlc@5/fp@0,0
Device Address	50020f2300006077,0
Class	secondary
State	STANDBY

Note – The luxadm (1M) output on device 50020f2300006107 shows the same information as the previous display.

▼ To Unconfigure a Fabric Device Associated With Multipathing Enabled Devices

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

Note – Whether the STMS is enabled or not, the cfgadm -c unconfigure command for Fabric devices is identical, but the result is different. When the Sun Storage Traffic Manager software is enabled, the host using the Solaris operating environment creates device-node and path information that includes STMS information. The devices are still listed as fc-fabric devices, but the specific Ap_Ids are marked as unconfigured in the Occupant column.

---

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
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
```

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

Note – 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.

---

3. **Unconfigure fabric devices associated with the Sun StorEdge Traffic Manager
   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`, etc. As an alternative, you can remove an entire set of paths from the
host, as in the example `cfgadm -c unconfigure c0.`

---

4. **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
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     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 StorEdge Traffic Manager devices associated with the Ap_Ids `c0::50020f2300006077` and `c2::50020f2300006107` are no longer available to the host using the Solaris operating environment. The two Sun StorEdge Traffic Manager devices,

`/dev/rdsk/c6t60020F20000061073AC8B52D000B74A3d0s2`

and

`/dev/rdsk/c6t60020F20000061073AC8B4C50004ED3Ad0s2`

are removed from the host.

▼ To Unconfigure One Path to a Multipathed Device

In "To Unconfigure a Fabric Device Associated With Multipathing Enabled Devices" on page 35, a storage device is connected to the host using the Solaris operating environment by two Ap_Ids, `c0::50020f2300006077` and `c2::50020f2300006107`. For the STMS enabled host, each Ap_Id is associated with the path to a Sun StorEdge Traffic Manager device that represents the physical storage device. This procedure shows how to unconfigure a device associated with `c2::50020f2300006107` and leave the other Ap_Id, `50020f2300006077`, configured.

1. **Become superuser.**

2. **Identify the Ap_Id of the Sun StorEdge Traffic Manager device to be unconfigured.**

   An Ap_Id on a fabric-connected host port is a path to a Sun StorEdge Traffic Manager device. Only devices on a fabric-connected host port can be unconfigured through the `cfgadm unconfigure` command.

   CODE EXAMPLE 3-7   `cfgadm` Listing of Port WWNs For Physical Devices To Unconfigure

   ```
   # 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
   ```

   In CODE EXAMPLE 3-7, `c0::50020f2300006077` and `c2::50020f2300006107` Ap_Ids represent different port WWNs for the same device.

3. **Unconfigure the Ap_Id associated with Sun StorEdge Traffic Manager device.**

   Note – If the Ap_Id represents the last configured path to the Sun StorEdge Traffic Manager device, stop all activity to the path and unmount any file systems on it. If the multipathed 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 multipathed device.

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

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

The Sun StorEdge Traffic Manager devices associated with that Ap_Id are still available to a host using the Solaris operating environment 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.

CODE EXAMPLE 3-8 shows example output you would see for the Sun StorEdge Traffic Manager devices if you use the `luxadm(1M)` command after performing this procedure. Although the path represented by `c2::50020f2300006107` is no longer listed, the path represented by `c0::50020f2300006077` is displayed for Sun StorEdge Traffic Manager devices

```
/dev/rdsk/c6t60020F20000061073AC8B52D000B74A3d0s2
```

and

```
/dev/rdsk/c6t60020F20000061073AC8B4C50004ED3Ad0s2.
```

CODE EXAMPLE 3-8   `luxadm` (1M) Output For Two Device Nodes With a Single Path Available With the Sun StorEdge Traffic Manager Software Enabled

```
# luxadm display 50020f2300006077
DEVICE PROPERTIES for disk: 50020f2300006077
  Status(Port A):      O.K.
  Vendor:              SUN
  Product ID:          T300
  WWN(Node):           50020f2000006077
  WWN(Port A):         50020f2300006077
  Revision:            0117
  Serial Num:          Unsupported
  Unformatted capacity: 558448.000 MBytes
  Write Cache:         Enabled
```

`luxadm` (1M) Output For Two Device Nodes With a Single Path
Available With the Sun StorEdge Traffic Manager Software Enabled

```
      Read Cache:          Enabled
        Minimum prefetch:  0x0
        Maximum prefetch:  0x0
      Device Type:         Disk device
      Path(s):
    /dev/rdsk/c6t60020F20000061073AC8B52D000B74A3d0s2
    /devices/scsi_vhci/ssd@g60020f20000061073ac8b52d000b74a3:c,raw
     Controller        /devices/pci@1f,2000/pci@1/SUNW,qlc@5/fp@0,0
        Device Address    50020f2300006077,1
        Class             primary
        State             ONLINE

 DEVICE PROPERTIES for disk: 50020f2300006077
    Status(Port B):      O.K.
    Vendor:              SUN
    Product ID:          T300
    WWN(Node):           50020f2000006077
    WWN(Port B):         50020f2300006077
    Revision:            0117
    Serial Num:          Unsupported
    Unformatted capacity: 558448.000 MBytes
    Write Cache:         Enabled
    Read Cache:          Enabled
      Minimum prefetch:  0x0
      Maximum prefetch:  0x0
    Device Type:         Disk device
    Path(s):
    /dev/rdsk/c6t60020F20000061073AC8B4C50004ED3Ad0s2
    /devices/scsi_vhci/ssd@g60020f20000061073ac8b4c50004ed3a:c,raw
     Controller        /devices/pci@1f,2000/pci@1/SUNW,qlc@5/fp@0,0
        Device Address    50020f2300006077,0
        Class             secondary
        State             ONLINE
```

Creating and Removing Multiple Device Nodes With Multipathing Enabled

The procedures for creating and removing multiple device nodes is similar to those in the section "Creating and Removing Individual Device Nodes With Multipathing Enabled" on page 29. This section explains the finer differences. Make sure you have first identified the the fabric devices by using the procedure "To Detect Fabric Devices Visible to a Host" on page 30 before you configure or remove device nodes. This section covers:

- "To Configure All Fabric-Connected Devices With Multipathing Enabled" on page 41
- "To Unconfigure All Fabric-Connected Devices With Multipathing Enabled" on page 46

▼ To Configure All Fabric-Connected Devices With Multipathing Enabled

In this example, an Ap_Id on a fabric-connected host port is a path to a Sun StorEdge Traffic Manager 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 a Sun StorEdge Traffic Manager device that has already been configured through another Ap_Id results in an additional path to the previously configured device. Note that a new Solaris device is not created in this case. A Solaris device is created only the first time an Ap_Id to a corresponding Sun StorEdge Traffic Manager 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. The luxadm output in
CODE EXAMPLE 3-9 shows the Solaris device associated with this path. One path is
configured.

CODE EXAMPLE 3-9   luxadm (1M) Output for Multiple Device Nodes Associated With
One Device Path and STMS Enabled

```
# luxadm display 50020f2300006077
DEVICE PROPERTIES for disk: 50020f2300006077
  Status(Port A):      O.K.
  Vendor:              SUN
  Product ID:          T300
  WWN(Node):           50020f2000006077
  WWN(Port A):         50020f2300006077
  Revision:            0117
  Serial Num:          Unsupported
  Unformatted capacity: 558448.000 MBytes
  Write Cache:         Enabled
  Read Cache:          Enabled
    Minimum prefetch:  0x0
    Maximum prefetch:  0x0
  Device Type:         Disk device
  Path(s):
  /dev/rdsk/c6t60020F20000061073AC8B52D000B74A3d0s2
  /devices/scsi_vhci/ssd@g60020f20000061073ac8b52d000b74a3:c,raw
   Controller        /devices/pci@1f,2000/pci@1/SUNW,qlc@5/fp@0,0
     Device Address    50020f2300006077,1
```

```
      Class                 primary
      State                 ONLINE


 DEVICE PROPERTIES for disk: 50020f2300006077
   Status(Port B):       O.K.
   Vendor:               SUN
   Product ID:           T300
   WWN(Node):            50020f2000006077
   WWN(Port B):          50020f2300006077
   Revision:             0117
   Serial Num:           Unsupported
   Unformatted capacity: 558448.000 MBytes
   Write Cache:          Enabled
   Read Cache:           Enabled
     Minimum prefetch:   0x0
     Maximum prefetch:   0x0
   Device Type:          Disk device
   Path(s):
   /dev/rdsk/c6t60020F20000061073AC8B4C50004ED3Ad0s2
   /devices/scsi_vhci/ssd@g60020f20000061073ac8b4c50004ed3a:c,raw
    Controller         /devices/pci@1f,2000/pci@1/SUNW,qlc@5/fp@0,0
      Device Address     50020f2300006077,0
      Class              secondary
      State              ONLINE
```

3. Configure the unconfigured devices on the selected port.

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

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

4. 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_FCP_dev` option displays FCP SCSI LUN information for multiple LUN SCSI devices. In CODE EXAMPLE 3-10, the physical devices connected through by `c2::50020f2300006107` and `c2::50020f2300005f24` have two LUNs configured respectively.

CODE EXAMPLE 3-10 `show_FCP_dev` Output For Multiple LUNs and Multiple Physical Devices

```
# cfgadm -al -o show_FCP_dev 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
```

In CODE EXAMPLE 3-11, notice that two STMS enabled devices

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

are created for the device represented by c0::50020f2300006077 and
c2::50020f2300006107.

CODE EXAMPLE 3-11 luxadm(1M) Output For Multiple Device Nodes With the STMS
Enabled

```
# luxadm display 50020f2300006077
DEVICE PROPERTIES for disk: 50020f2300006077
  Status(Port A):       O.K.
  Status(Port B):       O.K.
  Vendor:               SUN
  Product ID:           T300
  WWN(Node):            50020f2000006077
  WWN(Port A):          50020f2300006077
  WWN(Port B):          50020f2300006107
  Revision:             0117
  Serial Num:           Unsupported
  Unformatted capacity: 558448.000 MBytes
  Write Cache:          Enabled
  Read Cache:           Enabled
    Minimum prefetch:   0x0
    Maximum prefetch:   0x0
  Device Type:          Disk device
  Path(s):
  /dev/rdsk/c6t60020F20000061073AC8B52D000B74A3d0s2
  /devices/scsi_vhci/ssd@g60020f20000061073ac8b52d000b74a3:c,raw
    Controller        /devices/pci@1f,2000/pci@1/SUNW,qlc@4/fp@0,0
      Device Address    50020f2300006107,1
      Class             secondary
      State             STANDBY
    Controller        /devices/pci@1f,2000/pci@1/SUNW,qlc@5/fp@0,0
      Device Address    50020f2300006077,1
      Class             primary
      State             ONLINE

 DEVICE PROPERTIES for disk: 50020f2300006077
  Status(Port A):       O.K.
  Status(Port B):       O.K.
  Vendor:               SUN
  Product ID:           T300
  WWN(Node):            50020f2000006107
  WWN(Port A):          50020f2300006107
  WWN(Port B):          50020f2300006077
  Revision:             0117
  Serial Num:           Unsupported
```

```
Unformatted capacity: 558448.000 MBytes
Write Cache:          Enabled
Read Cache:           Enabled
  Minimum prefetch:   0x0
  Maximum prefetch:   0x0
Device Type:          Disk device
Path(s):
/dev/rdsk/c6t60020F20000061073AC8B4C50004ED3Ad0s2
/devices/scsi_vhci/ssd@g60020f20000061073ac8b4c50004ed3a:c,raw
Controller        /devices/pci@1f,2000/pci@1/SUNW,qlc@4/fp@0,0
  Device Address      50020f2300006107,0
  Class               primary
  State               ONLINE
Controller        /devices/pci@1f,2000/pci@1/SUNW,qlc@5/fp@0,0
  Device Address      50020f2300006077,0
  Class               secondary
  State               STANDBY
```

Note – The luxadm (1M) output on device 50020f2300006107 shows the same
information as the previous display.

▼ To Unconfigure All Fabric-Connected Devices With Multipathing Enabled

Note – Whether or not the Sun StorEdge Traffic Manager multipathing software is
enabled, the cfgadm -c unconfigure command for fabric devices is identical,
but the result of the operation is different. When the STMS is enabled, the host using
the Solaris operating environment removes Sun StorEdge Traffic Manager-related
path or device-node information.

An Ap_Id on a fabric-connected host port is a path to a Sun StorEdge Traffic
Manager device.

When a Sun StorEdge Traffic Manager device has multiple Ap_Ids connected to it,
the device is still available to the host using the Solaris operating environment after
you unconfigure an Ap_Id. After you unconfigure the last Ap_Id, no additional
paths remain and the Sun StorEdge Manager device is unavailable to the host using
the Solaris operating environment.

1. **Become superuser.**

2. **Identify the 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
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
```

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 and it can be time-consuming if the number of devices on c2 is large.

---

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

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

FCIP Management

In order to configure FCIP, you should have already ensured the hosts recognize the switch and all attached devices. This chapter covers host recognition of FCIP devices and implementation of IP over Fibre Channel in a SAN. The FCIP driver is based on RFC 2625 and it allows IP traffic to run over Fibre Channel. Configuration of FCIP depends on the instance of the fabric port (fp) driver for the Fibre Channel adapter ports. This chapter contains the following topics:

- "Loading FCIP" on page 49
- "FCIP Invocation, Configuration and Usage" on page 54

Loading FCIP

Configuration of FCIP depends on the instance of fp, or host bus adapter ports. If multiple host bus adapters are present, plumb manually after identifying the fp instance on which IP should be plumbed. The following two procedures determine fp instances.

- "Determining Fibre Channel Adpater Port Instances" on page 49
- "To Plumb an FCIP Instance" on page 52

Determining Fibre Channel Adpater Port Instances

There are two basic ways to determine Fibre Channel adapter port instances to which IP can be plumbed. The first way, which is a short procedure, requires that you know the WWN of the card. In the second way, which is a longer procedure, you do not know the WWN but you do know the physical location of the card. The procedures include:

■ "To Determine All Fibre Channel Adapter Port Instances To Which IP Can Be Plumbed With a WWN" on page 50
■ "To Determine an FP Instance for a Known HBA Port Physical Device Path" on page 51

▼ To Determine All Fibre Channel Adapter Port Instances To Which IP Can Be Plumbed With a WWN

1. Become superuser.

2. Determine the fp driver instances in your system.

In the example below, there are four instances (0-3) of fp present in the system.

```
# prtconf -v | grep fp

fp (driver not attached)
fp, instance #0
fp (driver not attached)
fp, instance #1
fp (driver not attached)
fp, instance #2
fp (driver not attached)
fp, instance #3
```

3. Manually load FCIP to the desired fp instances.

Use the ifconfig fcip*interface* plumb command, where *interface* is a variable for the desired fp instance number. For example:

```
# ifconfig fcip0 plumb
```

If the command succeeds, the following message appears on the console and messages file:

```
Sep 13 15:52:30 bytownite ip: ip: joining multicasts failed (7) on
fcip1 - will use link layer broadcasts for multicast
```

If no other error message is displayed, manual plumbing has succeeded. Repeat this step for the other fp instances identified in Step 2.

Note – Additional options can be provided to the `ifconfig` command too. See `ifconfig`(1M) for more information. Currently, FCIP can be plumbed on only one port on Fibre Channel adapters with multiple ports. See "FCIP Guidelines" on page 8 for details. An error occurs if a plumb operation is attempted on other ports.

▼ To Determine an FP Instance for a Known HBA Port Physical Device Path

Use this procedure when there is no cable connected to the HBA port. Otherwise, you can use the shorter procedure "To Plumb an FCIP Instance" on page 52.

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

   You need this information to perform the calculation in Step 2.

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

2. **Determine the `fp` instance number.**

   a. **Use an editor to search for the `fp` driver binding name in the `/etc/path_to_inst` file.**

      Entries have `fp` on the line.

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

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

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

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

         Using the array with an HBA in PCI adapter slot five and PCI slot one of the I/O board, add one 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.**

         CODE EXAMPLE 4-1 shows a single Fibre Channel network adapter device path. TABLE 4-1 defines the significance of the device path. The instance number for this device path is 7.

   CODE EXAMPLE 4-1   PCI Single Fibre Channel Network Adapter Device Path

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

TABLE 4-1 PCI Single Fibre Channel Network Adapter `/etc/path_to_inst` Device Path Entry

Entry Item	Entry Value
Physical Name	pci@b,2000/SUNW,qlc@2/fp@0.0
Instance Number	7
Driver Binding Name	fp

3. **Manually plumb the fp instance.**

   Use the `ifconfig <`*interface*`> plumb` command. In this example, *interface* is `fcip7`.

   ```
   # ifconfig fcip7 plumb
   ```

   If no error message is displayed, manual plumbing has succeeded. Repeat this step for the other `fp` instances identified in Step 2.

▼ To Plumb an FCIP Instance

Use this procedure to load and plumb FCIP.

1. **Each FP instance on the system has an entry in** `/dev/fc`**. If HBAs have been removed, some stale links might exist.**

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

   ```
   # 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 FCIP communications.**

   In the example for this procedure, the destination HBAs have port IDs 610100 and 620d02. The originating HBA's port ID is 62e00.

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 1:**

   ```
   # ls -l /dev/fc/fporiginating-hba-link
   ```

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

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

4. **Search the physical path identified in Step 3.**

   You must remove the leading ../../devices from the pathname output. For example

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

6. **Use the instance number from Step 5 to load FCIP and plumb the FCIP interface.**

   In this example, the instance is 0.

   ```
   # ifconfig fcip0 plumb
   ```

FCIP Invocation, Configuration and Usage

Immediately after installation, start FCIP manually with the `ifconfig` command. On subsequent reboots, the FCIP network interface starts automatically. This section covers:

- "To Start a Network Interface Manually" on page 54
- "To Configure the Host for Automatic Plumbing Upon Reboot" on page 55
- "FCIP Usage" on page 55

▼ To Start a Network Interface Manually

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

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

   For example, to enable an FCIP interface associated with fp instance 0 and an IP address of 192.9.201.10, enter:

   ```
   # 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)` manpage. Ask your network administrator for an appropriate IP address and netmask information.

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 ff000000
   fcip0: flags=1001843<UP,BROADCAST,RUNNING,MULTICAST,MULTI_BCAST,IPv4> mtu 1500
   index 2
   inet 192.9.201.10 netmask ffffff00 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 ffffff00 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, FCIP network *interface* fcip0 has a file named `/etc/hostname.fcip0`.

1. **Manually create a** `/etc/hostname.`*interface* **file with a text editor so it contains a single line that identifies the host name or interface IP address.**

2. **Use a text editor to make any additional entries to the** `/etc/inet/hosts` **file.**

   The Solaris 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, other network interfaces attached to the system, and any other network interface that the machine must know about.

   CODE EXAMPLE 4-2   `sun1` machine `/etc/inet/hosts`

   ```
   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 the uncommented entries has the word** `files` **before any other nameservice.**

   The `/etc/nsswitch.conf` specifies which name service to use for a particular machine.

   CODE EXAMPLE 4-3   `sun1` machine `/etc/nsswitch.conf` File

   ```
   hosts:     files nis
   ```

FCIP Usage

Any standard network commands can be used after FCIP is attached. There are not any usage differences when these commands (`telnet`, `ping`, or `ftp`) are used in an Ethernet setup.

Dynamic Reconfiguration On the SAN

When you want to change an existing SAN configuration, Dynamic Reconfiguration (DR) adjusts your system configuration. DR is straight forward with FC-AL devices, and only slightly more complicated for fabric devices.

With previously configured FC-AL devices, DR happens automatically upon addition or removal of devices to a host I/O port. With the STMS enabled, the Solaris operating environment host configures the devices as Sun StorEdge Traffic Manager devices. However, DR is more complex with fabric devices. This section covers:

- "DR and Fabric Devices" on page 57
- "To Remove a Fabric Device Before DR" on page 58
- "To Maintain a Fabric Device Configuration With DR" on page 58
- "To Reconfigure Fabric Devices With DR" on page 58
- "To Reconfigure the Sun Enterprise 10000 Server With a Fabric Connection" on page 58

DR and Fabric Devices

Previously configured fabric devices are not automatically reconfigured. Fabric device configurations are not persistent when you remove a system component on which switch-connected host ports reside, and then add that system component back to a host through DR operations. The discussion of on-demand node creation in these sections applies to fabric devices, such as a host port connected to an F port on a switch and an array connected to an F port or TL port on a switch.

▼ To Remove a Fabric Device Before DR

● **Unconfigure the fabric devices that were configured through host ports on the system component with on-demand node creation.**

   ■ If the STMS is not enabled, see "To Unconfigure a Fabric Device" on page 24.
   ■ If the STMS is enabled, see "To Unconfigure a Fabric Device Associated With Multipathing Enabled Devices" on page 35.

▼ To Maintain a Fabric Device Configuration With DR

1. **Reconfigure the device through on-demand node creation.**

2. **Perform DR operations according to the instructions in the documentation for the host.**

▼ To Reconfigure Fabric Devices With DR

1. **Add the system component and make it available to the host.**

2. **Reconfigure the device(s) through on-demand node creation.**

   ■ If the STMS is not enabled, see "To Configure a Fabric Device Without Multipathing Enabled On the Host" on page 20.
   ■ If the STMS is enabled, see "To Configure Fabric-Connected Device Nodes With Multipathing Enabled Devices" on page 32.

▼ To Reconfigure the Sun Enterprise 10000 Server With a Fabric Connection

The following procedure gives the sequence of operations for a Sun Enterprise 10000 server board with a fabric connection.

1. **Unconfigure the fabric devices on fabric-connected host ports on the board to be detached.**

2. **Start the DR detach operations for the board.**

   See the *Sun Enterprise 10000 Dynamic Reconfiguration Configuration Guide.*

3. **Start the DR attach operations when the board is ready.**

   See the *Sun Enterprise 10000 Dynamic Reconfiguration Configuration Guide.*

4. Configure any fabric devices on the attached boards.

See the sections in Chapter 3 that explain how to recognize the storage devices on the host. On the newly attached board, the devices could be the same or completely new devices.

Glossary

This glossary defines SAN teminology used in this book.

A

AL_PA Arbitrated Loop Physical Address. An AL_PA is an eight-bit value used to identify a device attached to a Fibre Channel arbitrated loop.

Ap_Id Attachment Point Identifier. The port identifier for either a host or a storage device connected to a switch. For example, `c0` identifies the host port and `c0::50020f23000063a9` identifies an array.

B

Bridge ports (B port) When a G port (generic port) is attached to some switches, it is a bridge port (B port). The B port connects an arbitrated loop device (switch) to a multiswitch fabric. Director B ports are not assigned a domain ID and do not participate in fabric path selection processes.

C

Cascade

Broadcast Zone   Zone type used to filter broadcast traffic away from end nodes that cannot use or interpret it. A port will broadcast to all ports in the same Broadcast Zone(s) in which the port is defined. Broadcast zoning is primarily used for doing IP over Fibre Channel or when mixing IP and SCSI traffic on the switch.

Cascade   Connection of two or more switches together to increase the number of available ports or to allow for increased distances between components of the SAN.

E

Expansion ports (E port)   Port used to connect FC-SW2 compliant switches to one another.

F

Fabric ports (F port)   Fabric port on a Fibre Channel switch. Switch ports used to connect to the fabric capable storage devices, such as the Sun StorEdge T3+ array or Sun StorEdge 39x0, 69x0 and 99x0 series, tape drives and host bus adapters.

Fabric   One or more switches in a Fibre Channel network. It is also common to refer to something as a "fabric device" or being in "fabric mode."

Fabric Loop ports (FL port)   A port that is able to transmit under fabric protocol and also has arbitrated loop capabilities.

FC-SW-2   The second generation of the Fibre Channel Switch Fabric Standard defined by ANSI.

G

Generic port (G port) A port that can operate as either an E port or F port. A port is defined as a G port when it is not yet connected or has not yet assumed a specific function in the fabric.

I

Initiator Each host bus adapter port connection that provides a path to a storage device.

Interswitch Link (ISL) A segment or cable connecting two cascaded switches. Does not include cables from host to the switch or from storage devices to the switch.

N

N port A Fibre Channel port that supports point-to-point or fabric connections.

Name Server Zones (NS zones) A set of name server (NS) ports that can contain F , FL , G , GL and E ports. The ports receive name server information (port number, type, address, WWN, etc). NS zones can be port-based or WWN-based.

P

Private Loop Fibre Channel Arbitrated Loop (FC-AL) with 8-bit addressing that supports up to 126 device connections with no fabric attachment (F and FL ports). Private loops are closed systems incapable of seeing outside the loop.

Public Loop Arbitrated loop that supports fabric login and services. Provides 24-bit Fibre Channel addressing and up to 16 million node connections fabric wide. Uses name server (NS) ports.

S

Segmented Loop ports (SL ports)
A port connected to a private loop device. SL ports make a switch behave like a hub, but with the advantage of better performance and the ability to segment the private loop into SL Zones for ease of administration and isolation of resources. Ports in SL zones do not communicate with ports in NS zones. Supports the Sun StorEdge A5200, A3500FC arrays and FC tape devices. SL zones contain SL ports only. SL ports are are not supported in the SAN 4.x release but were in earlier releases.

Segmented Loop Zones (SL zones)
A set of SL ports on the switch that behave as a single private loop. This grouping behaves like a hub, but with the advantage of better performance and the ability to segment the private loop into SL zones for ease of administration and isolation of resources. SL zones are are not supported in the SAN 4.x release but were in earlier releases.

T

Transfer or Trunk ports (T ports)
Switch ports from the SAN 3.0 release used to connect to other switches in a cascade. T ports are used to attach a port on one switch to a port on another switch. Replaced by E ports in SAN 4.0 release.

Translative Loop ports (TL ports)
Ports on the switch that allow private-to-public and public-to-private loop connectivity. TL ports present private devices to a fabric as if they were public so they can communicate with the off-loop devices, such as public devices connected to F ports and FL ports and private devices on other TL port loops. Supports the Sun StorEdge T3 arrays. Hosts recognize arrays that use TL ports as fabric devices.

Z

Zone
A set of ports or WWNs and their connected devices that have been grouped together to control information exchange.

Zoning Function of the switch that allows segregation of devices. Zoning is done for a variety of reasons, such as security, simplicity, performance, or dedication of resources.

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