

hp StorageWorks

SAN switch 2/32 version 4.0.x installation guide

Part Number: AA-RTQVA-TE

First Edition (November 2002)

Product Version: V4.0.x

This installation guide provides procedures for setting up, configuring, and managing the SAN switch 2/32.



i n v e n t

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About this Guide

This installation guide provides information to help you set up and configure the hp StorageWorks SAN Switch 2/32.

Intended Audience

This book is intended for use by customers who purchased the SAN Switch 2/32, and for authorized service providers who are experienced with the following:

- Configuration aspects of customer Storage Area Network (SAN) fabric
- Customer host environments such as HPUX, hp OpenVMS, hp Tru64 UNIX, Windows 2000, Windows NT, and IBM AIX
- Web Tools Graphical User Interface (GUI), for configuring the switch via a supported Web browser

Related Documentation

For a list of related documents included with this product, see the Related Documents section of the *hp StorageWorks SAN Switch 2/32 Release Notes*.

For the latest information, documentation and firmware releases, please visit the following hp StorageWorks website:

<http://www.q.c.com/storage/productindexdisk.html>

For information about Fibre Channel standards, visit the Fibre Channel Industry Association website, located at <http://www.fibrechannel.com>.

Document Conventions

The conventions included in Table 1 apply in most cases.

Table 1: Document Conventions

Element	Convention
Key names, menu items, buttons, and dialog box titles	Bold
File names and application names	<i>Italics</i>
User input, command names, system responses (output and messages)	Monospace font COMMAND NAMES are uppercase unless they are case sensitive
Variables	<i>Monospace, italic font</i>
Website addresses	Sans serif font (http://www.hp.com)

Symbols in Text

These symbols may be found in the text of this guide. They have the following meanings.



WARNING: Text set off in this manner indicates that failure to follow directions in the warning could result in bodily harm or loss of life.



CAUTION: Text set off in this manner indicates that failure to follow directions could result in damage to equipment or data.

IMPORTANT: Text set off in this manner presents clarifying information or specific instructions.

NOTE: Text set off in this manner presents commentary, sidelights, or interesting points of information.

Symbols on Equipment



Any enclosed surface or area of the equipment marked with these symbols indicates the presence of electrical shock hazards. Enclosed area contains no operator serviceable parts.

WARNING: To reduce the risk of injury from electrical shock hazards, do not open this enclosure.



Any RJ-45 receptacle marked with these symbols indicates a network interface connection.

WARNING: To reduce the risk of electrical shock, fire, or damage to the equipment, do not plug telephone or telecommunications connectors into this receptacle.



Any surface or area of the equipment marked with these symbols indicates the presence of a hot surface or hot component. Contact with this surface could result in injury.

WARNING: To reduce the risk of injury from a hot component, allow the surface to cool before touching.



Power supplies or systems marked with these symbols indicate the presence of multiple sources of power.

WARNING: To reduce the risk of injury from electrical shock, remove all power cords to completely disconnect power from the power supplies and systems.



Any product or assembly marked with these symbols indicates that the component exceeds the recommended weight for one individual to handle safely.

WARNING: To reduce the risk of personal injury or damage to the equipment, observe local occupational health and safety requirements and guidelines for manually handling material.

Rack Stability



WARNING: To reduce the risk of personal injury or damage to the equipment, be sure that:

- The leveling jacks are extended to the floor.
 - The full weight of the rack rests on the leveling jacks.
 - In single rack installations, the stabilizing feet are attached to the rack.
 - In multiple rack installations, the racks are coupled.
 - Only one rack component is extended at any time. A rack may become unstable if more than one rack component is extended for any reason.
-

Getting Help

If you still have a question after reading this guide, contact service representatives or visit our website.

Technical Support

There are no customer serviceable parts in the SAN Switch 2/32. For the most current technical support information, visit the HP website at:

<http://www.hp.com/support>.

Be sure to have the following information available before requesting assistance:

- Technical support registration number (if applicable)
- Product serial numbers, please reference “Locating SAN Switch 2/32 Serial Numbers,” in Chapter 2
- Product model names and numbers
- Applicable error messages
- Operating system type and revision level
- Detailed, specific questions.

Warranty Options

Increased warranty options are available, including 1- and 3-year on-site, next-day, same-day, and 24 x 7 hardware and phone support; critical support; and business connectivity support. For more information on warranty and support options, please visit one of the following websites at:

<http://www.hp.com/hps/tech/storage/supp>

http://www.compaq.com/services/CarePAQ/us/install/cp_storage.html

http://www.compaq.com/services/CarePAQ/us/hardware/cp_storage.html

Additional Licenses

For information on obtaining license keys visit the HP website at <http://www.hp.com/support>.

hp Website

The HP website has the latest information on this product, as well as the latest drivers. Access the HP website at <http://www.hp.com/support>. From this website, select the appropriate product or solution.

hp Authorized Reseller

See the HP website for reseller locations and telephone numbers.

Overview

The hp StorageWorks SAN Switch 2/32 is a high-performance, 32-port, 2 gigabit (Gb) Fibre Channel switch used to interconnect storage devices, hosts, and servers in a Storage Area Network (SAN). It integrates Fabric Operating System (FOS) firmware V4.0.2x or higher, and is compatible with the hp StorageWorks switch product family. The SAN Switch 2/32 operates in a fabric containing multiple switches, or as the only switch in the fabric.

This chapter provides the following information:

- SAN Switch 2/32 features
- Firmware and hardware summaries
- Optional hardware kits
- Optional software kits

SAN Switch 2/32 Features

Read the following sections for feature-specific information.

Firmware

The SAN Switch 2/32 operates using FOS firmware version 4.0.2x or higher. The firmware supports:

- High-speed data traffic using Interswitch Link (ISL) trunking technology
- Automatic rerouting through the Fabric Shortest Path First (FSPF) algorithm
- Application Programming Interface (API), a protocol that allows applications to interface with switch services

- Zoning functionality, provides a means to allocate storage controllers to groups of computers. Allows you to create logical subsets of the fabric to accommodate closed user groups or to create functional user groups within a fabric
- Per port statistics help technicians diagnose and isolate problem ports without disrupting switch operations
- Error detections and fault isolation, automatically disables failing ports and restarts when the problem is resolved
- Industry standard Management Information Base (MIB) support
- Automatic self-discovery, discovers and registers host server and storage devices
- Web Tools provides a Graphical User Interface (GUI) to allow management of a SAN from a browser, such as Internet Explorer or Netscape

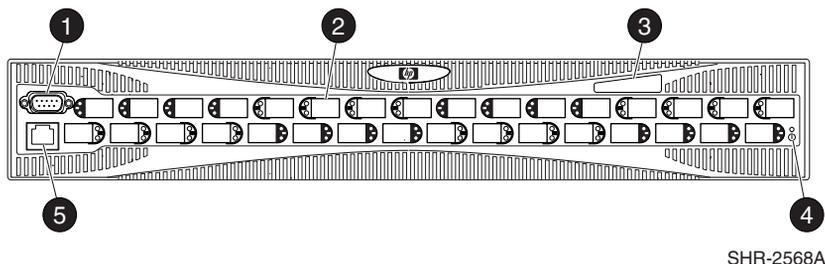
Hardware

The SAN Switch 2/32 consists of the following components:

- Air-cooled 1.5U chassis that can be set up as a stand-alone unit or mounted in a standard Electronic Industries Association (EIA) 19-inch rack
- 32 Fibre Channel ports
- One RS-232 Serial port, designed to connect to a DTE port
- One 10/100 Mb/s Ethernet port with an RJ-45 connector
- Two redundant power supplies, with AC switches and built-in fans
- Three redundant fan assemblies, hot-swappable if replaced one at a time
- A field-replaceable motherboard assembly enclosed in a grounded EMI cage
- Slide Rack Mount Kit
- The following LED indicators:
 - Switch Power/Status LED on the port side of the switch
 - Port Readiness LED on the non-port side of the switch
 - Port Status LED and Port Speed LED for each port
 - Power LED on each power supply
 - Fan Failure LED on each fan assembly

Port Side of the SAN Switch 2/32

Figure 1–1 shows the port side of the SAN Switch 2/32.



- | | | | | |
|---------------|--------------------------------|--------------------|----------------|-----------------|
| ❶ Serial port | ❷ Fibre Channel port (1 of 32) | ❸ IP address label | ❹ Power switch | ❺ Ethernet port |
|---------------|--------------------------------|--------------------|----------------|-----------------|

Figure 1–1: SAN Switch 2/32 - port side

Optical Ports

The Fibre Channel ports are numbered from left to right, with ports 0–15 in the lower row, and ports 16–31 in the upper row. The ports provide the following functionality:

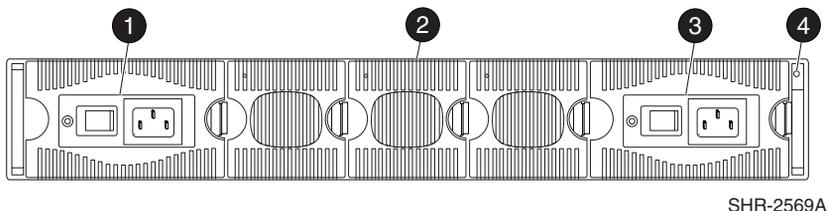
- Automatic negotiation to highest common speed of all devices connected to port
- Port interfaces compatible with Small Form Factor Pluggable (SFP) transceivers, both Short Wavelength (SWL) and Long Wavelength (LWL)
- Universal and self-configuring: capable of becoming an F_Port (fabric enabled), FL_Port (fabric loop enabled), or E_Port (expansion port).

The ports are color-coded into groups of four to indicate which ports can be used in the same Interswitch Link (ISL) trunking group.

NOTE: ISL Trunking is an integrated software component that enables ISL trunking groups between adjacent switches. For more information about trunking, refer to the *hp StorageWorks ISL Trunking Version 3.0.x/4.0.x User Guide*.

Fan Assembly Side of the SAN Switch 2/32

Figure 1–2 shows the fan assembly side of the SAN Switch 2/32. The fan assembly side houses the fans with corresponding LEDs, power supplies, and the port readiness LED.



- ❶ Power supply
- ❷ Fan assembly (1 Of 3)
- ❸ Power supply
- ❹ Port readiness LED

Figure 1–2: Fan assembly side of the SAN Switch 2/32

Optional Hardware Kits

HP provides the following optional hardware kits in support of the SAN Switch 2/32.

Table 1–1: SAN Switch 2/32 Orderable Hardware

Accessory	Part Number
Short wavelength SFP	A6515A* or 300834-B21**
Long wavelength SFP, 10 km	A6516A* or 300835-B21**
2m LC-to-LC Fibre Channel (fc) cable	C7524A*
2m LC-to-LC multi-mode fc cable	221692-B21**
16m LC-to-LC fc cable	C7525A*
5m LC-to-LC multi-mode fc cable	221692-B22**
50m LC-to-LC fc cable	C7526A*
15m LC-to-LC multi-mode fc cable	221692-B23**
200m LC-to-LC fc cable	C7527A*
30m LC-to-LC multi-mode fc cable	221692-B26**
50m LC-to-LC multi-mode fc cable	221692-B27**

Table 1–1: SAN Switch 2/32 Orderable Hardware (Continued)

Accessory	Part Number
2m LC-to-SC fc cable	C7529A*
2m LC-to-SC multi-mode fc cable	221691-B21**
16m LC-to-SC fc cable	C7530A*
5m LC-to-SC multi-mode fc cable	221691-B21**
15m LC-to-SC multi-mode fc cable	221691-B23**
30m LC-to-SC multi-mode fc cable	221691-B26**
50m LC-to-SC multi-mode fc cable	221691-B27**
SC female to SC female adapter	C7534A*
2m LC male to SC male adapter kit	C7534A*

* premerger HP part number

** premerger Compaq part number

Installing the SAN Switch 2/32

This chapter covers the following topics:

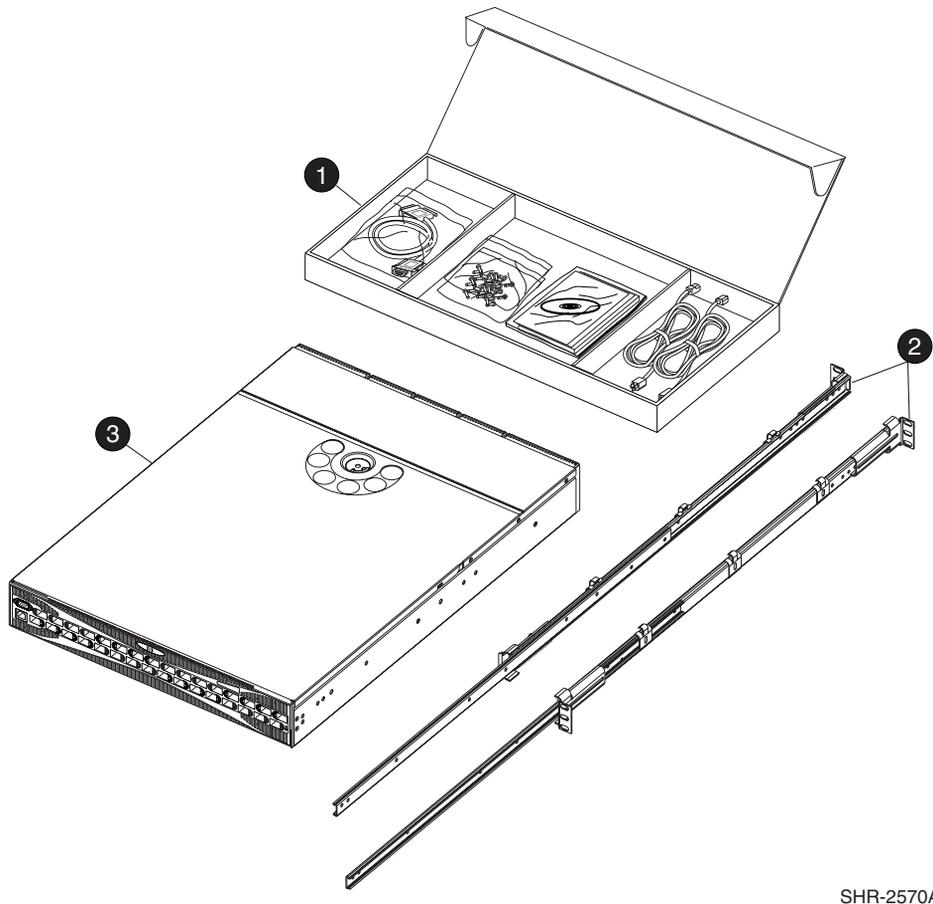
- Carton contents
- Installation and safety guidelines
- Installing the switch as a stand-alone unit or in an HP 9000 Series Rack
- Configuring network addressing
- Connecting to the LAN
- Connecting an SFP module

Unpack and Verify Carton Contents

Unpack and inspect the SAN Switch 2/32 carton contents as follows.

1. Inspect the shipping container for possible damage caused during transit.
2. Unpack the shipping cartons.
3. Verify that the carton contains the items shown in Figure 2–1 and Table 2–1.

NOTE: If any items are damaged or missing, please contact HP or an HP authorized reseller.



SHR-2570A

Figure 2–1: Shipping carton contents

Table 2–1: Shipping Carton Contents

Number	Item
1	<p>One hp StorageWorks SAN Switch 2/32 product accessories box containing:</p> <ul style="list-style-type: none"> • One RS-232 Serial cable (convertible to an RJ-45 connector, by removing the adapter on the end of the cable.) • Rack Mount hardware pouch: <ul style="list-style-type: none"> • Power cord clips (6) • 3-hole bar nuts (4) • 10-32 x 3/8" Black Phillips head screws (12) • 8-32 x 3/16" Phillips head screws (10) • Square alignment washers (8) • Right and left rear rack mount brackets (2), use if installing so that port side slides from the rear of the rack • Right and left front mount brackets (2), use if installing so that power supply end slides out from the front of the rack. • Documentation, Release Notes, license, warranty, and CD • Two country specific AC power cords • Two Power Distribution Unit (PDU) power cords (not shown in Figure 2–1) • Four rubber mounting feet for standalone installations on a table or lab bench
2	<p>Slide assembly, includes one inner and one outer slide rail, with the following items preinstalled:</p> <ul style="list-style-type: none"> • L-bracket, slide mount, 3-hole (4) • Nut, Hex, Locking, 8-32 (4 nuts in each slide assembly, for a total of 8) • 8-32 x 3/8 inch, zinc slotted screw (requiring a torque of 15 inch-pounds) (8)
3	hp StorageWorks SAN Switch 2/32

Locating SAN Switch 2/32 Serial Numbers

Before contacting HP for technical support or service, obtain the three serial numbers located on the bottom of the switch. Each serial number provides specific logistical information, identifying the device's manufacturing location.

Installation and Safety Guidelines

Read the following sections for installation guidelines. Install the SAN Switch 2/32 in one of the following ways:

- As a stand-alone unit on a flat surface, or
- In an Electronics Industries Association (EIA) cabinet (like the HP 9000 Series Rack), using the Slide Rack Mount Kit provided with the switch, see Slide Rack Mount Kit contents outlined in Table 2-1

Selecting an Operating Location

To ensure correct operation of the switch, the location where the switch is in use must meet the following requirements:

- Adequate supply circuit, line fusing, and wire size, as specified by the electrical rating on the switch nameplate.
- An air flow of at least 300 cubic feet per minute, available in the immediate vicinity of the switch.
- If installing the switch in the HP 9000 Series, or comparable EIA rack:
 - All equipment installed in the rack should have a reliable branch circuit ground connection, and should not rely on a connection to a branch circuit, such as a power strip.
 - The rack should be balanced and the installed equipment within the rack's weight limits. Ensure the rack is mechanically secured to insure stability in the event of an earthquake.

Cooling Requirements

Cooling air is drawn into the switch chassis by the fans mounted on the rear of the chassis. The air is expelled through vents in the front (port side) of the chassis, next to the HP logo. HP recommends installing the switch so that air intake and exhaust for all components in the rack is flowing in the same, “front-to-back” direction.

IMPORTANT: HP highly recommends mounting the switch in a cabinet or rack so that the fans reside in the front of the cabinet, and the ports (cables) reside in the rear of the cabinet.

Follow these guidelines to ensure proper air flow, and prevent component overheating:

- To ensure adequate cooling, install the switch with the non-port side, which contains the air intake vents, facing the cool-air aisle
- Verify a minimum of 47 cubic feet/minute (79.8 cubic meters/hour) of air flow is available to the air intake vents on the non-port side of the switch
- Verify that the ambient air temperature does not exceed 40° Celsius (104° Fahrenheit) while the switch is operating



CAUTION: Do not block air vents. The switch uses ambient air for cooling.

Power Requirements

Two AC power cords connect to the switch on either side of the rear panel. The AC power source must meet these requirements:

- Primary AC Input 100–240 VAC (switch auto-senses input voltage), 47–63 Hz
- Correctly wired primary outlet, with circuit protected by a circuit breaker and grounded in accordance with local electrical codes
- Adequate supply circuit, line fusing, and wire size, as specified by the electrical rating on the switch nameplate
- Voltage capability of 85–264 VAC
- Input voltage frequency of 47–63 Hz
- Power capability of 75 W maximum

The switch has a universal power supply capable of functioning worldwide without voltage jumpers or switches. The power supply is auto ranging in terms of accommodating input voltages and line frequencies.

Setting Up the Switch as a Stand-alone Unit

Use these procedures for setting up the switch as a stand-alone unit. The following items are required for this setup:

- SAN Switch 2/32
 - AC power cords and cables supplied with the switch
 - Rubber mounting feet supplied with the switch
1. Place the SAN Switch 2/32 on a flat, sturdy surface like a table or lab bench.
 2. Apply the rubber feet as follows.
 - a. Clean the four depressions that are at each corner of the bottom of the switch to ensure they are free of dust.
 - b. Place a rubber foot in each depression, with the adhesive side against the chassis, and press into place.



CAUTION: Installing the rubber feet on the switch is recommended to help prevent the switch from accidentally sliding off the table or bench.

3. Connect the power cables to the SAN Switch 2/32 power connectors and to a power outlet. Ensure the power cable is routed so that it is not exposed to stress.
4. Turn on the power to the switch (flip the AC switch to “1”). The switch automatically runs a Power On Self-Test (POST).



CAUTION: Do not connect the switch to the network until the IP address is correctly set. For instructions on how to set the IP address, see “Configuring SAN Switch 2/32 Network Addressing,” later in this chapter.

Installing the SAN Switch 2/32 in an HP Series 9000 or EIA Cabinet

Read the following sections for complete installation instructions. Before you begin, obtain the following tools:

- #2 Phillips screwdriver, with torque capability
- Torque screwdriver
- Slotted blade screwdriver, 1/4 in, with torque capability

Rack Mount Checklist

Verify that the rack and the area around the rack meets the following requirements:

- The cabinet must be a standard EIA cabinet.
- Plan a cabinet space that is 1.5 rack units high (2.6 inches; 6.7 cm), 19 inches (48.3 cm) wide, and at least 23 inches (68.6 cm) deep.
- Ground all equipment in the cabinet through a reliable branch circuit connection, and maintain ground at all times. Do not rely on a secondary connection to a branch circuit, such as a power strip.
- Ensure that airflow and temperature requirements are met on an ongoing basis, particularly if the switch is installed in a closed or multi-rack assembly.
- Verify that the additional weight of the switch does not exceed the cabinet's weight limits or unbalance the cabinet in any way.
- Secure the cabinet to insure stability in case of unexpected movement.

NOTE: This procedure is written with the assumption that the non-port side of the switch, which contains the air intake vents, is installed facing the cool-air aisle.

Installing the Slide Rail Assemblies to the Switch

The SAN Switch 2/32 Rack Mount Kit consists of two slide rail assemblies consisting of an inner slide rail attached to an outer slide rail. Read the following sections for complete instructions on first separating, then installing the Slide Rail Assemblies.

Separating the Inner Slide Rail Assembly from the Outer Slide Rail Assembly

Separate the two inner (smaller) slide rails from the two outer (larger) slide rails as follows.

1. Holding one slide rail assembly horizontally, pull the inner slide rails out of the outer slide rail until the lock release lever engages.
2. Press the lock release lever located on the inner slide rails. The inner slide rail separates from the outer slide rail.
3. Repeat steps 1 and 2 to separate the second slide rail assembly.
4. Put the outer slide rails aside. Follow the steps in the next section, “Attaching the Inner Slide Rails to the Switch.”

Attaching the Inner Slide Rails to the Switch

Use the following steps to secure each inner slide rail to the switch chassis.

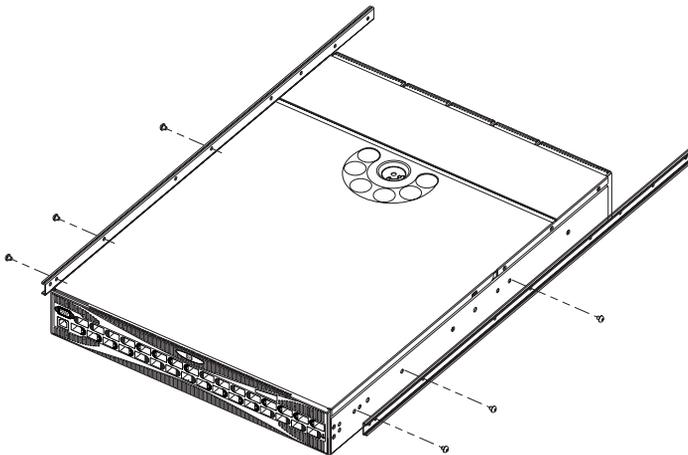


CAUTION: It is important to install the inner slide rails using the Phillips head, 8-32 x 3/16 in screws supplied in the Rack Mount Kit. Installing screws longer than 3/16 in can damage the switch.

1. Position the inner slide rails with the flat side against the switch, oriented in one of the following two ways:

IMPORTANT: HP recommends installing the SAN Switch 2/32 so that the port side of the switch slides out the rear of the rack (as described in step 1a below). In this way, the switch faces the aisle where exhaust air is released. Air intake and exhaust for all components in the rack should flow in the same direction.

- a. To allow the port side of the switch to slide out the rear of the rack:
Orient the inner slide rail with the end containing the lock release lever towards the power supply end of the switch.
 - b. To allow the power supply side of the switch to slide out the front of the rack:
Orient the inner slide rail with the end containing the lock release lever towards the port end of the switch.
2. Locate three Phillips head, 8-32 x 3/16" screws provided in the Rack Mount Kit. Secure the inner slide rail to the switch, see Figure 2-2.
 3. Tighten the screws and torque to 15 inch-pounds.



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Figure 2-2: Securing the inner slide rails to the switch

4. Repeat steps 1 and 2 to attach the second inner slide rail to the switch. Make sure to orient the second inner slide rail in the same way you positioned the first (based on 1a or 1b above).

Attaching the Rear or Front Rack Mount Brackets

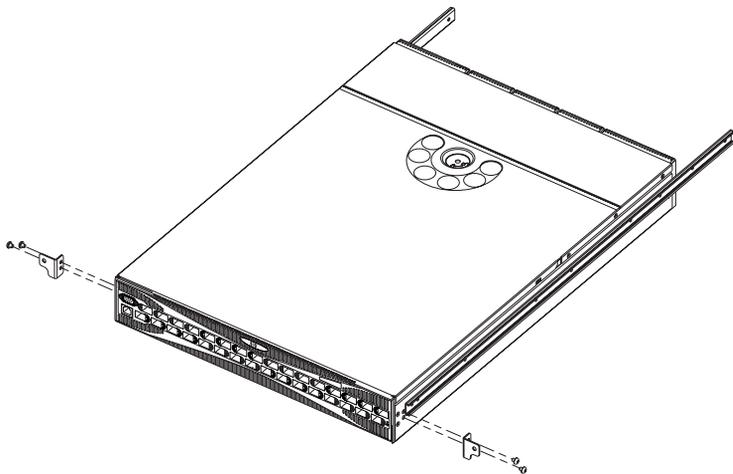
The Rack Mount Kit supplied with the SAN switch 2/32 contains two rear rack mount brackets and two front rack mount brackets. Install these rack mount brackets to prevent the switch from accidentally sliding out of the rack, as follows.

IMPORTANT: HP recommends installing the SAN Switch 2/32 so that the port side of the switch slides out the back of the rack. (For example, the switch should face the aisle where exhaust air is released. Air intake and exhaust for all components in the rack should flow in the same direction.)

For Rear Rack Access

Use these steps to attach the rear rack mount brackets to the switch. The rear rack mount brackets act as “stops” to prevent the switch from sliding out the rear of the rack. Use these steps if you installed the inner slide rails to the switch using the procedure outlined in “Attaching the Inner Slide Rails to the Switch,” step 1a.

1. Align the right rack mount bracket with the two screw holes at the port end of the switch.
2. Locate two Phillips head 8-32 x 3/16 in screws, contained in the Rack Mount Kit. Secure the right mount bracket to the switch, see Figure 2–3.



SHR-2576A

Figure 2–3: Attaching the rear rack mount brackets

3. Tighten the screws and torque to 15 inch-pounds.

4. Repeat steps 1 through 3 to install the left mount bracket on the left side of the switch, see Figure 2–3.

For Front Rack Access

Use these steps to attach the front rack mount brackets to the switch. The front rack mount brackets act as “stops” to prevent the switch from sliding out the front of the rack. Use these steps if you installed the inner slide rails to the switch using the procedure outlined in “Attaching the Inner Slide Rails to the Switch,” step 1b.

1. Align the right rack mount bracket with the two screw holes at the end of the inner rails on the right, power supply end of the switch.
2. Locate two slotted head Phillips head 8-32 x 3/8 in screws and two lock nuts contained in the Rack Mount Kit accessory pouch.
3. Secure the right mount bracket to the end of the inner slide rail using the screws and lock nuts.
4. Tighten the screws and torque to 15 inch-pounds.
5. Repeat steps 1 through 4 to install the left mount bracket onto the second inner slide rail.

Attaching the Outer Slide Rails to the HP 9000 Series Rack

Use the following steps to install the outer slide rails in the HP 9000 Series Rack.

NOTE: This procedure requires two technicians to properly align the outer slide rails in the HP 9000 Series Rack.

Obtain the following items, located in the Rack Mount Kit:

- Four 3-hole bar nuts
- Eight Phillips head 8-32 x 3/8-inch screws
- Eight square alignment washers
- # 2 Phillips screwdriver with torque capability

IMPORTANT: Before starting this procedure, verify that two of the slide mount L-brackets are preinstalled at the end of each outer slide rail, see Figure 2–4. The L-brackets are necessary to attach the outer rails to the rack.

1. Determine the appropriate placement for the switch inside the rack. The HP 9000 Series Rack's rails are divided into Units (Us). Each U is marked with a small, round hole and three square openings for mounting equipment.

NOTE: The SAN Switch 2/32 requires 1.5 Units of rack space.

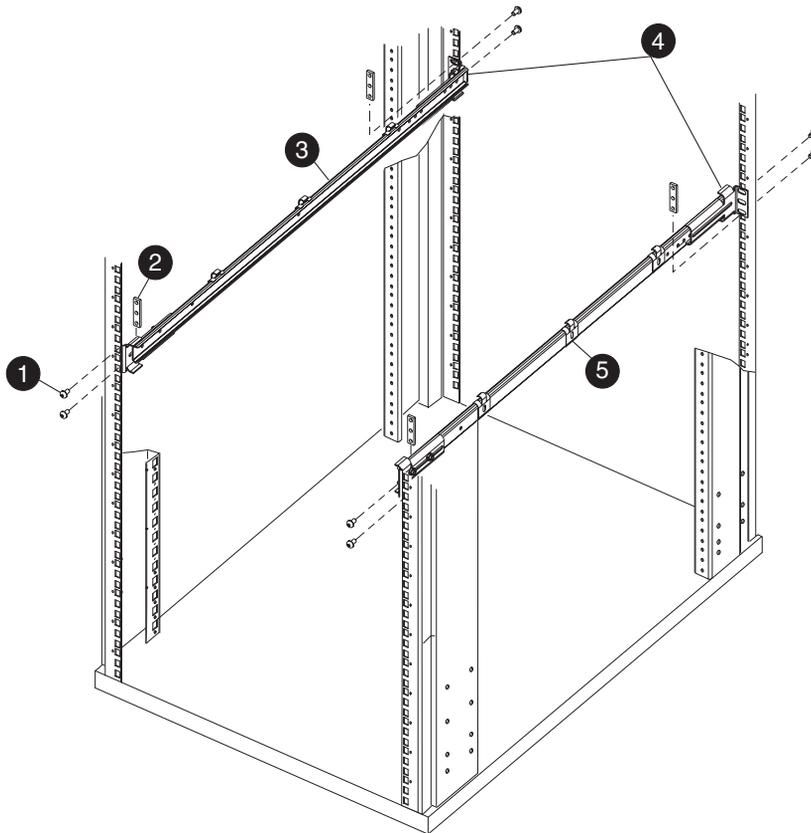
2. Locate the small, round marker hole on the rack's rails, that coincides with the location selected in step 1. Each marker hole delineates the beginning of one U.
3. Insert one square alignment washer on each of the eight 10-32 x 3/8 in Phillips head screws.

NOTE: The square alignment washers are mandatory for proper switch alignment.

4. Adjust the outer slide rail's length to fit the length of the rack.
5. Position one of the outer slide rails in the rack, as described below:
 - a. To allow the switch's port end to slide out the back of the rack, orient with the closed end of the outer slide rail towards the front of the rack.
 - b. To allow the power supply end to slide out the front of the rack, orient the closed end of the outer slide rail towards the back of the rack.
6. Holding the outer slide rail in place, insert one 3-hole bar nut in between the rack's rail and the L-bracket at the end of the outer slide rail, see Figure 2–4.

IMPORTANT: Position the square alignment washers onto the Phillips head 10-32 x 3/8 in screws, as described in step 3. The square alignment washers are mandatory for proper switch alignment.

7. Secure each L-bracket and 3-hole bar nut to the rack's rails with two Phillips head 10-32 x 3/8 in screws (and attached square alignment washers), see Figure 2-4.



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- | | |
|--------------------------------------|----------------------------|
| ❶ Phillips head 10-32 x 3/8 in screw | ❷ L-Brackets |
| ❸ 3-hole bar nut | ❹ Power cord clip (1 of 6) |
| ❺ Outer slide rail | |

Figure 2-4: Attaching the outer slide rails to the HP 9000 Series rack

NOTE: Remember to position the 3-hole bar nut behind the L-bracket.

8. Tighten the screws, and torque to 25 inch-pounds.
9. Repeat steps 5 through 7 to secure the other end of the outer slide rail.
10. Repeat steps 3 through 7 to install the second outer slide rail.

Finalizing the Rack Mounting Procedure

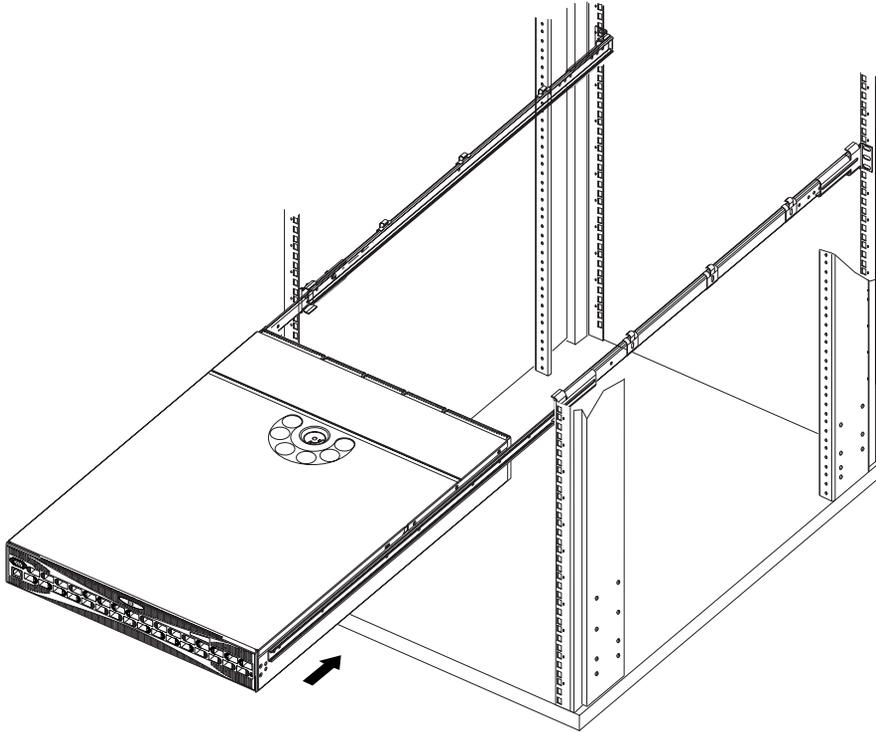
Read this section to finalize the rack mount procedure.

Positioning the Switch in the HP 9000 Series Rack

Follow these steps to install the switch in the rack.

IMPORTANT: If installing more than one SAN Switch 2/32 directly on top of one another (in a 3U space) you must mount the slide rails attached to the switch using the set of holes on the top of the switch, and the bottom using the set of holes on the bottom of the switch.

1. Depending on the type of install (front or rear access), slide the outer slide rails all the way toward the front or back of the rack.
2. Carefully lift the switch into the rear of the rack, inserting the inner slide rails (attached to the switch) into the outer slide rails (attached to the rack), see Figure 2–5.
3. Slide the switch in the rack, see Figure 2–5.



SHR-2577A

Figure 2–5: Sliding the SAN Switch 2/32 in an HP 9000 Series rack

4. To verify proper alignment, slide the switch in and out of the rack.

Securing the Rack Mount Brackets

Secure the Rack Mount Brackets (installed earlier, see “Attaching the Rear or Front Mount Brackets”) to the rack rails, as follows.

1. Locate two Phillips head 10-32 x 3/8” screws in the Rack Mount Kit accessory pouch.
2. Secure each rack mount bracket to the rack rails. Tighten the screws, and torque to 25 inch-pounds.

Installing the Switch in the Optional HP System/e Rack

This section provides instructions for installing the SAN Switch 2/32 in the *optional* HP System/e rack. The following hardware is required to install the HP System/e Rack Mount Kit:

- Rails, rear mounting brackets
- Rail mounting hardware, shown next:



(6) #8-32 x 5/16 Phillips pan-head screw with captive star lock washer



(6) #8 Flat washer



(6) M5 Torx head screw with captive lock washer



(2) Rubber washer

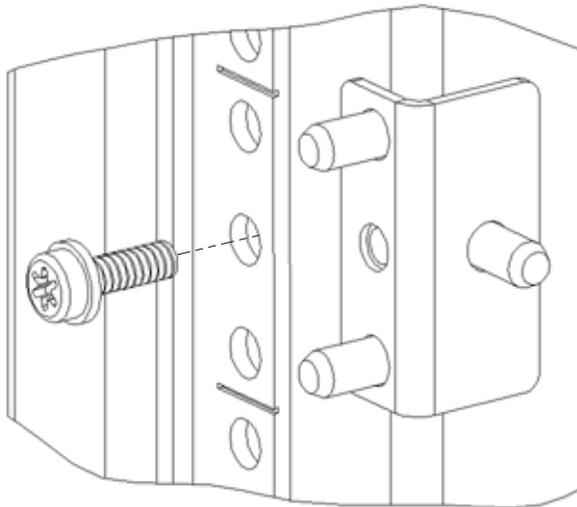


(4) M5 U-type Tinnerman clip

IMPORTANT: For proper airflow, the SFP media side of the SAN Switch 2/32 faces the rear of the rack. This mounting allows air to enter from the front of the rack and to exhaust at the rear of the rack, similar to other rack-mounted equipment. This prevents switch overheating, which may cause it to fail.

Use these steps to install the switch in the HP System/e rack.

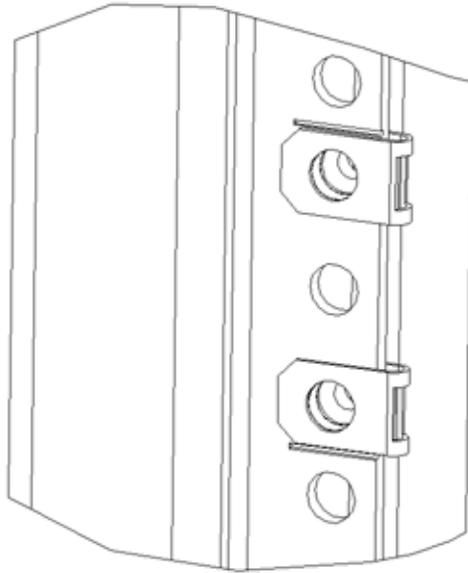
1. Verify that all required hardware is available.
2. Choose a mounting location in the rack for the switch.
3. Install each of the two mounting brackets with (1) M5 Torx head screw with captive lock washers as shown in Figure 2–6.



SHR-2581A

Figure 2–6: Installing the mounting brackets

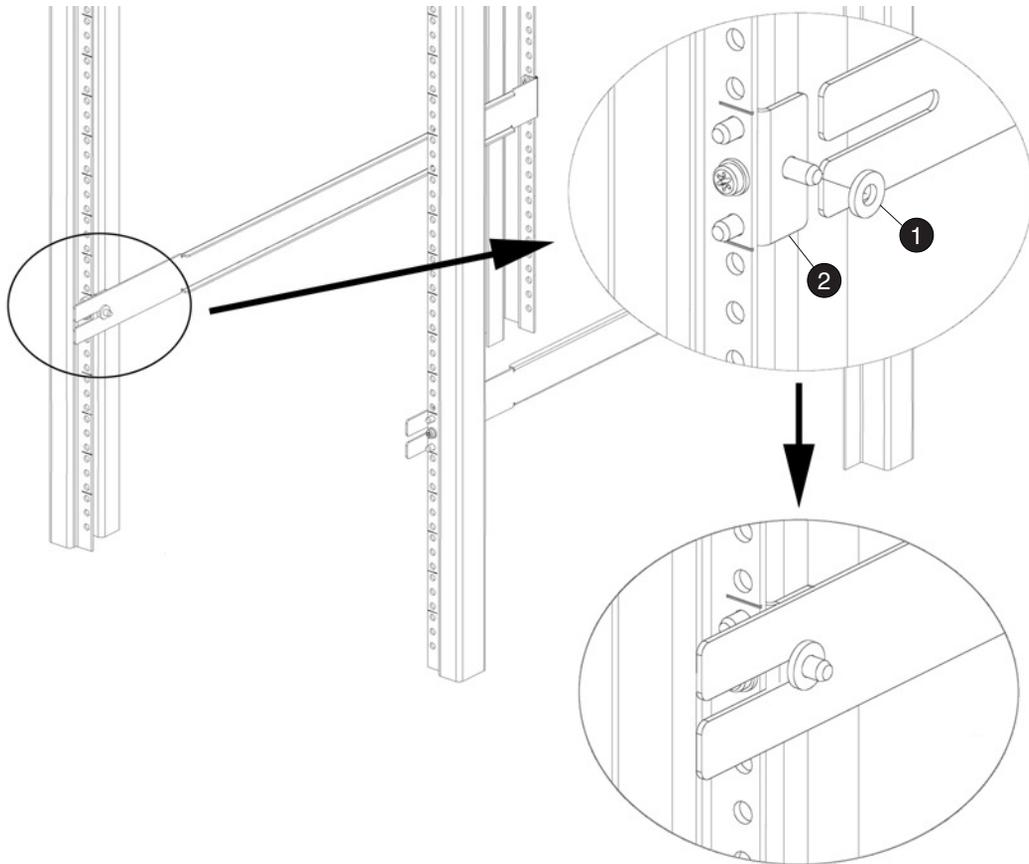
4. Install (2) M5 U-type Tinnerman clips for each of the front columns of the rack in the top and bottom positions of the three-hole EIA pattern as shown in Figure 2–7.



SHR-2582A

Figure 2–7: Installing the tinnerman clips

5. Assemble the outer rails by completing the following steps:
 - a. As an aid in assembly, two rubber washers have been included to help keep the rear slotted portion of the outer rail flush against the rear rail-tray brackets. Install them as shown in Figure 2–8.
 - b. Insert the alignment pins attached to the outer rail front flange into the center opening in the rack.



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- ❶ Rubber washer (1 of 2) ❷ Rear rail tray bracket (1 of 2)

Figure 2–8: Installing the rubber washers

6. Install one M5 Torx screw in the upper hole location of the right rail. Then, install one M5 Torx screw in the lower location of the left rail. See Figure 2–9.

NOTE: Do not install the upper left and the lower right screws until step 9.

7. Assemble the two inner rails (one on each side) to the switch using (6) #8-32 x 5/16 Phillips pan-head screws, and #8 flat washer as shown in Figure 2-9.

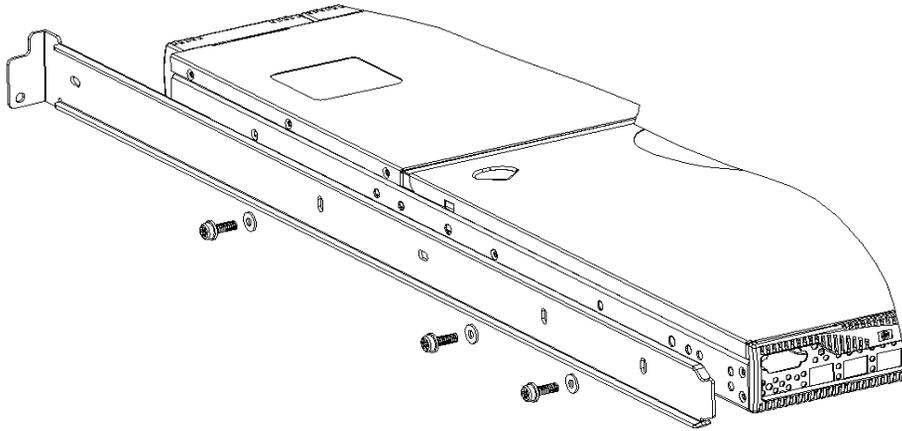


Figure 2-9: Assembling the inner rails



CAUTION: Do not use any other screws other than the six that are provided. Use of any longer lengths can cause damage to internal components of the switch. Before tightening screws, make sure that the rails are centered to the overall height of the switch.

8. Insert the switch with the attached inner rails into the outer rails.
9. Install the two remaining M5 Torx screws to complete the installation.
10. Go to the next section, “Connecting AC Power” for steps on applying power to the switch.

NOTE: Do not connect the switch to the network until the IP address is correctly set. For instructions on how to set the IP address, see “Configuring SAN Switch 2/32 Network Addressing,” later in this chapter.

Connecting AC Power

Use these steps to power on the SAN Switch 2/32.



CAUTION: Do not plug the power cords into the power source until the switch is completely installed in the rack.

1. Connect the SAN Switch 2/32 power cords to the power connectors on the switch, see Figure 2–10.

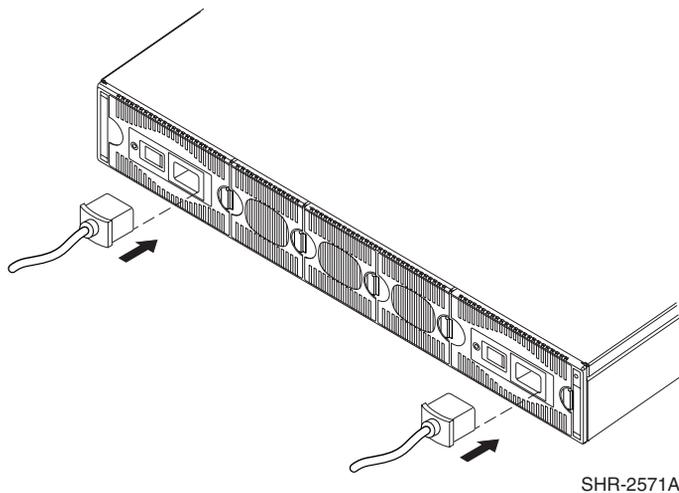


Figure 2–10: Connecting the power cords

2. Attach the remaining ends of the power cords to power outlets.
3. Turn on the power switch (the 1 position indicates power on, the O position indicates power off). The switch automatically runs POST.



CAUTION: Do not connect the switch to the network until the IP address is correctly set. For instructions on setting the IP address, see “Configuring SAN Switch 2/32 Network Addressing,” later in this chapter.

Power On Self-Test

Each time the switch is powered on, rebooted, or reset, the switch automatically runs POST. During POST, the port status LEDs flash, verifying that the switch is operating properly. POST completes in approximately six minutes, with total boot time approximately seven minutes.

POST runs through the following test cycles:

- Preliminary POST diagnostics
- Initialization of operating system
- Initialization of hardware
- Diagnostic tests are run on a number of functions, including circuitry, port functionality, memory, parity, statistics counters, and serialization

For example, if the switch prompt does not display when POST completes, POST was unsuccessful. Contact your authorized HP switch supplier for more information.

To determine whether POST completed without errors, verify that all LEDs return to a normal state after POST is complete. If one or more LEDs do not return to a normal state (and this is not due to the switch being set to beacon), see “Interpreting LED Activity,” in Chapter 3.

NOTE: For more information about beaconing, refer to the *hp StorageWorks Fabric OS Procedures Version 3.0.x/4.0.x User Guide*.

Checking POST Results

Check the success/fail results of the diagnostic tests run during POST via LED activity, the error log, or CLI using the `errShow` command. For more information about error messages, refer to the *hp StorageWorks Fabric OS Version 3.0.x/4.0.x Reference Guide*.

Configuring SAN Switch 2/32 Network Addressing

Read the following sections for information on how to configure the SAN Switch 2/32 addressing scheme.

For instructions about configuring the switch to operate in a fabric containing switches from other vendors, refer to the *hp StorageWorks Fabric OS Version 3.0.x/4.0.x Procedures Guide*.

For detailed information about the commands used in this procedure, refer to the *hp StorageWorks Fabric OS Version 3.0.x/4.0.x Reference Guide*.

Requirements

The following items are required for configuring and connecting the SAN Switch 2/32 in a network and fabric:

- An unused IP address and corresponding subnet mask and gateway address from your Network Administrator
- SAN Switch 2/32 installed and connected to a power source
- A local workstation (desktop or notebook computer) with:
 - Microsoft Windows 98, Windows 2000, Windows Millennium Edition, or Windows NT 4.0 operating system.
 - RS-232 Serial communication software (for example, ProComm Plus or HyperTerminal)
- Serial cable provided with the switch
- Ethernet cable
- SFP transceivers and compatible cables, as required
- Access to an FTP server for backing up the switch configuration

Setting Network Addresses via a Serial Connection

Use the following steps to verify or change the SAN Switch 2/32 IP address, subnet mask, or gateway address.

IMPORTANT: During first time setup, you must replace the factory IP, Subnetmask and Gateway addresses with addresses provided by your Network Administrator.

1. Remove the shipping plug from the SAN Switch 2/32 Serial port.
2. Connect the Serial cable to the SAN Switch 2/32 Serial port, see Figure 2–11.

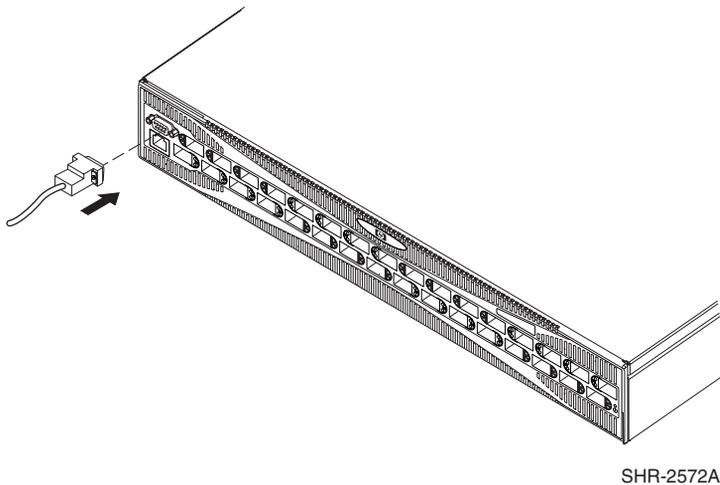


Figure 2–11: Connecting the Serial cable

3. Connect the other end of the Serial cable to an RS-232 Serial port on the workstation. If no RS-232 Serial port is available on the workstation, the adapter on the end of the Serial cable can be removed to use the RJ-45 connector to create a Serial connection.
4. Verify that the switch power is on and POST is completed. See the “Power-on Self Test” section, earlier in this chapter.
5. Power on the workstation and establish a connection to the switch using a terminal emulator application (such as Hyperterminal).

NOTE: These steps show instructions specific to Hyperterminal. If using a different application, consult the specific application’s documentation.

6. Using Hyperterminal (or similar application) configure the Port Settings as follows:

- Bits per second: 9600
- Databits: 8
- Parity: None
- Stop bits: 1
- Flow control: None

To configure Port Settings in a UNIX environment, type:

```
tip /dev/ttyb -9600
```

7. Log onto the switch (with administrative privileges). The default administrative logon is `admin` and the default password is `password`.

a. Enter the following at the prompt:

```
ipAddrSet
```

b. Enter the following information at the corresponding prompts, as in the example below:

Example

```
switch:admin> ipaddrset
Ethernet IP Address [10.77.77.77]:10.32.53.47
Ethernet Subnetmask [255.0.0.0]:255.255.240.0
Fibre Channel IP Address [0.0.0.0]:
Fibre Channel Subnetmask [0.0.0.0]:
Gateway IP Address [0.0.0.0]:10.32.48.1
Set IP address now? [y = set now, n = next
reboot]:y
IP address being changed...
Committing configuration...Done.
switch:admin>
```

c. To verify that the IP address was entered correctly, type:

```
ipAddrShow
```

d. Once the IP address is verified as correct, remove the Serial cable, and replace the shipping plug in the Serial port.



CAUTION: The Serial port is intended only for use during the initial setting of the IP address and for service purposes. Using the Serial port during normal switch operation or for regular maintenance is not recommended.

8. Record the IP address on the label affixed to the SAN Switch 2/32.

Connecting the SAN Switch 2/32 to the LAN

Use the following steps to connect the SAN Switch 2/32 to the Ethernet Local Area Network (LAN) segment.

1. Remove the shipping plug from the SAN Switch 2/32 Ethernet port.
2. Connect one end of an Ethernet cable to the SAN switch 2/32 Ethernet port, see Figure 2–12.

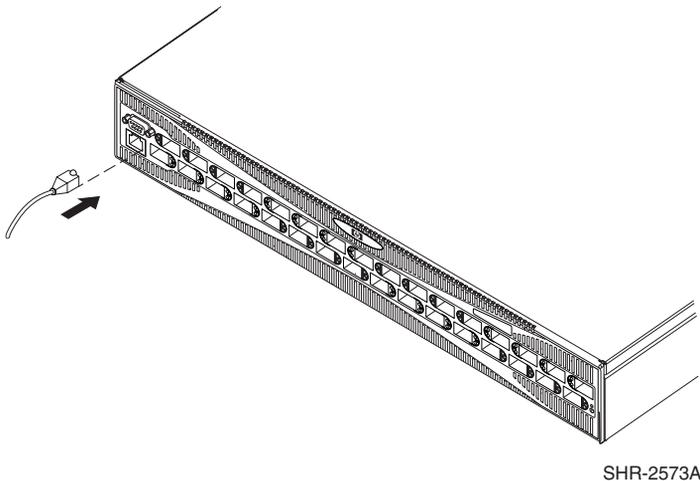


Figure 2–12: Connecting the Ethernet cable

3. Connect the other end of the Ethernet cable to the workstation or to an Ethernet network containing the workstation.

NOTE: You can now access the switch remotely (and from multiple connections), using telnet or the Web Tools application. Verify that the switch is not accessed from any other connections during the remaining steps.

4. Log on to the switch with administrative privileges by telnet. The default administrative logon is `admin` and the default password is `password`.

Core Switch PID Format Summary

A Core PID format is one of several addressing formats used in Fibre Channel. The parameter is used by the routing and zoning services in Fibre Channel fabrics to identify ports in the network.

The PID format is analogous to specifying the physical switch and port a device is attached to in data networks. It is not analogous to an IP address. PIDs are assigned by a Fibre Channel switch when a device logs into the fabric. An example PID might look like this, 011F00.

Many scenarios cause a device to receive a new PID. For example, unplugging the device from one port and plugging it into a different port will cause this. (This might happen when cabling around a bad port, or when moving equipment around.) Another example is changing the domain ID of a switch, which might be necessary when merging fabrics, or changing compatibility mode settings.

IMPORTANT: All switches running Fabric OS version 4.0.x or higher are shipped with the Core Switch PID Format enabled, so it is not necessary to change the Core Switch PID format on these switches. For example, the hp StorageWorks SAN Switch 2/32 and hp StorageWorks Core Switch 2/64 always use Core Switch PID format 1. This parameter is always 1 and cannot be changed.

Important Information on Checking the Core Switch PID Format

Updating the Core Switch PID Format is necessary when upgrading an existing SAN to support larger port-count switches. When a switch with more than 16 ports is introduced into an existing fabric, this parameter needs to be set on all switches in the fabric.

For example, all SAN Switch 2/32 units ship with the Core Switch PID format set to 1. Before connecting to the SAN, you *must verify* that the Core Switch PID formats of all switches already running in the SAN are also set to 1.

NOTE: If the Core PID format is set to 0 in switches already running in the SAN, you must follow the procedures in Appendix B, “Updating the Core Switch PID Format” to change the parameter to 1. If the Core Switch PID format is not changed to 1 to match the SAN Switch 2/32’s value, then the switches residing in the SAN will fail to communicate with one another.

For detailed recommendations and instructions on updating the Core Switch PID, please refer to Appendix B in this guide, “Updating the Core Switch PID Format.”

Optional Configuration Settings

The following sections describe how to modify domain IDs and status policies.

Modifying Domain IDs

Optional. Modify the domain IDs if desired, as follows.

NOTE: The default domain ID is 1. If the default domain ID is already in use when the switch is connected to the fabric, the domain ID for the new switch is automatically reset to a unique value. The domain IDs that are currently in use can be determined using the telnet command **fabricShow**.

1. Disable the switch by entering the following:

```
switchDisable
```

2. Enter the following:

```
configure
```

3. Enter **y** after the **Fabric parameters** prompt.

```
Fabric parameters (y, n)
```

4. Enter a unique domain ID (such as the domain ID used by the previous switch, if still available).

```
Domain: (1..239) [1] 3
```

5. Complete the remaining prompts (or press **CTRL+D** to accept the remaining settings without completing all the prompts).

6. Re-enable the switch by entering the following:

```
switchEnable
```

Specifying Custom Status Policies

Optional If desired, specify any custom status policies for the fabric as follows.

1. Enter the following at the prompt.

```
switchStatusPolicySet
```

2. Specify the desired status policies. To completely deactivate the alarm for a particular condition, enter **0** at the prompt for that condition.

IMPORTANT: Configure each port to match the topology of each host or target before connecting to the device. The default port configuration is fabric, not private loop. The switch does not auto-sense topology.

Connecting the SAN Switch 2/32 to the Fabric

Use these steps to connect the SFPs and cables to SAN Switch 2/32 ports as required.

NOTE: The ports and cables used in trunking groups must meet specific requirements. For a list of these requirements, refer to the *hp StorageWorks ISL Trunking Version 3.0.x/4.0.x User Guide*.

1. Remove the shipping plug from the appropriate ports.
2. Position the SFP so that the key (the tab near the cable-end of the SFP) is on top.
3. Insert the SFP into the port until it is firmly seated and the latching mechanism clicks.

NOTE: The SFP is keyed so that it can only be inserted with the correct orientation into the port. If the SFP does not slide in easily, check the orientation.

4. Connect the cables to the SFPs as appropriate to the fabric topology, by positioning each cable so that the key (the ridge on one side of the cable connector) is aligned with the slot in the SFP, see Figure 2–13.

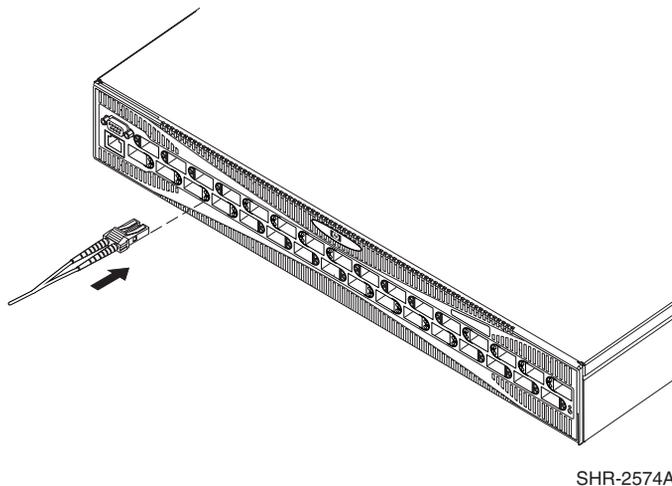


Figure 2–13: Inserting a cable into an SFP

NOTE: The cable is keyed so that it can only be inserted correctly into the SFP. If the cable does not slide in easily, check the orientation.

Verifying Operation

After making the appropriate connections, as outlined in this chapter, use these steps to verify that the switch is running properly.

1. Access your browser.
2. At the URL address window, type **http://your switch IP address**.
3. If connected properly, the name of your switch appears (in green) at the prompt, indicating Healthy/OK.

IMPORTANT: Backing up the configuration is strongly recommended. This ensures that a complete configuration is available if required for a replacement switch. For instructions on how to back up the configuration, refer to Chapter 4, “Backing Up Configuration Data and Upgrading Firmware.” Or, for more detailed information and commands, refer to the *hp StorageWorks Fabric OS Version 3.0.x/4.0.x Procedures User Guide*.

Installing Multiple Switches into an Existing SAN

Use these steps to set up more than one SAN Switch 2/32 in an existing SAN.

1. Connect the appropriate components as outlined in the installation section of this chapter.
2. Connect the power cord to the AC connector on the switch. The switch performs POST.

If a malfunction occurs during POST, error messages are written to the switch error log and can be viewed by a telnet or terminal session when the POST session completes.

If the malfunction prohibits the switch from completing the boot process (fatal error), the switch stops the boot process. If the switch does not fully boot, the switch prompt will not be displayed when the Serial port is connected.

3. Connect the Serial cable, provided in the package contents, between a host computer and the Serial port of the switch. See the “Setting Network Addresses via a Serial Connection,” earlier in this chapter, to make a Serial connection through a workstation and to set the IP address.
4. Set the switch Domain Address using the `configure` command to the next unused domain in the SAN. The default domain setting is 1.

NOTE: If a switch boot failure occurs, the switch must be taken offline for repair or replacement. Contact your HP Technical Support for assistance.

5. Power off the new switch and connect one Fibre Channel cable from the SAN to the new switch.

Recommendations for Cable Management

HP recommends following these cable management guidelines:

- Plan cable management before installing the switch in a rack
- Leave at least one meter of slack for each port cable (this provides room to remove and replace the switch)
- If using ISL Trunking:
 - Group cables by trunking groups.
 - The cables used in trunking groups must meet specific requirements. For a list of these requirements, refer to the *hp StorageWorks ISL Trunking Version 3.0.x/4.0.x User Guide*.
- Label the fiber optic cables and record the devices to which they are connected
- Keep LEDs visible by routing port cables and other cables directly downwards or otherwise away from the LEDs
- Do not use tie wraps on fiber optic cables, because they are easily overtightened and can damage the optic fibers

NOTE: The minimum bend radius for a 50 micron cable is 2 inches under full tensile load, and 1.2 inches with no tensile load.

Managing the SAN Switch 2/32

This chapter covers the following topics:

- Interpreting LED activity
- Management overview
- Optional management features
- Running basic switch operations using telnet
- Diagnostic tests

Interpreting LED Activity

SAN Switch 2/32 status is determined through the LED activity on the switch. There are three possible LED states: no light, a steady light, and a flashing light. The lights may be any of the following colors:

- Green
- Orange (may be referred to as “amber” in related documentation)
- Yellow (appears when both green and orange LED elements are lit)

Refer to in this chapter to for a list of LEDs and their meanings.

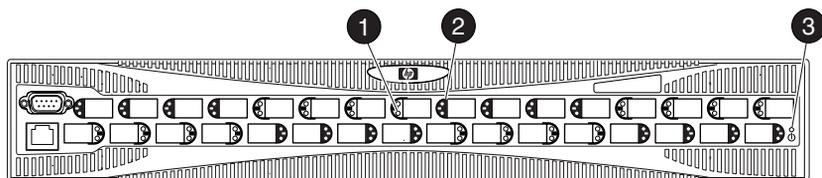
NOTE: Any errors related to LED activity are listed in the error log. For information about the error log, refer to the *hp StorageWorks Fabric OS Version 3.0.x/4.0.x Procedures Guide*.

LEDs on the Port Side of the Switch

The port side of switch contains the following LEDs, see Figure 3–1:

- One Switch Power/Status LED on right side
- One Port Status LED next to each Fibre Channel port (lower LED)
- One Port Speed LED next to each Fibre Channel port (upper LED)

NOTE: The port LEDs for the upper ports (ports 16–31) are to the left of the ports. The Port LEDs for the lower ports (ports 0–15) are to the right of the ports.



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- ❶ Port status LEDs (lower LED)
- ❷ Port speed LEDs (upper LED)
- ❸ Status LED

Figure 3–1: LEDs on port side of SAN Switch 2/32

Table 3–1 describes the LEDs on the port side of the switch.

Table 3–1: Port Side LED Patterns During Normal Operation

LED Name and Location	Color of LED	Status of Hardware	Recommended Action
Switch Power/Status LED On far right when viewing switch from Port Side	No light	Switch is off, or boot is not complete, or boot failed.	Verify switch is on and has completed booting.
	Steady green	Switch is on and functioning.	No action required.
	Flashing green (on 1 second; off 1 second)	One or both of the following are true: <ul style="list-style-type: none"> • One or more environmental ranges are exceeded. • Error log contains one or more port diagnostic error messages. 	<ol style="list-style-type: none"> 1. Check environmental conditions, error log, Port Status LEDs, transceivers, cables, and loopback plugs. 2. Correct error condition. 3. Clear error log. 4. Rerun diagnostics to verify fix.

Table 3–1: Port Side LED Patterns During Normal Operation (Continued)

LED Name and Location	Color of LED	Status of Hardware	Recommended Action
Port Status LED Lower LED next to each port	No light	No signal or light carrier (media or cable) detected.	Check transceiver and cable.
	Steady green	Port is online (connected to external device) but has no traffic.	No action required.
	Slow-flashing green (on 1 second; off 1 second)	Port is online but segmented, indicating a loopback cable or incompatible switch.	Verify correct device is connected to port, and switch and port settings are correct.
	Fast-flashing green (on 1/4 second; off 1/4 second)	Port is in internal loopback (diagnostic).	No action required.
	Flickering green	Port is online, with traffic flowing through port.	No action required.
	Steady orange	Port is receiving light or signal carrier, but is not yet online.	No action required.
	Slow-flashing orange (on 1 second; off 1 second)	Port is disabled (result of diagnostics or <code>portdisable</code> command). If all ports are slow-flashing orange, the switch may be disabled.	Enable port (can use <code>portenable</code> command; refer to <i>Fabric OS Reference Guide</i> for more information). If all ports are slow-flashing orange, enable the switch (<code>switchenable</code> command).
	Fast-flashing orange (on 1/4 second; off 1/4 second)	Port is faulty.	<ol style="list-style-type: none"> 1. Check transceiver and cable or loopback plugs for correct insertion. 2. Check and clear error log.
	Alternating green and orange	Port is bypassed.	Check configuration of Fibre Channel loop.

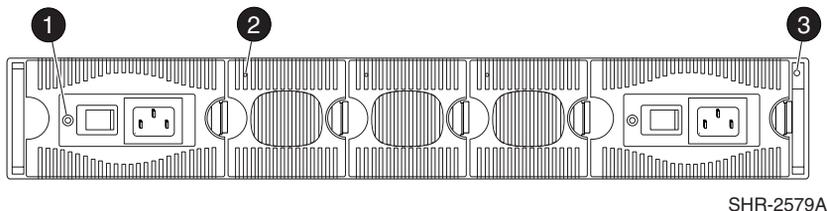
Table 3–1: Port Side LED Patterns During Normal Operation (Continued)

LED Name and Location	Color of LED	Status of Hardware	Recommended Action
Port Speed LED Upper LED next to each port	No light	Port is transmitting/receiving at 1 Gbit/sec.	No action required.
	Steady green	Port is transmitting/receiving at 2 Gbit/sec.	No action required.

LEDs on the Non-Port Side of the SAN Switch 2/32

The non-port side of the switch contains the following LEDs, see Figure 3–2:

- One Port Readiness LED on right side
- One Power Supply LED next to the AC power switch on each power supply
- One Fan Failure LED at the top of each fan assembly (inside the bezel)



- ❶ Power supply LED
- ❷ Fan failure LED
- ❸ Port readiness LED

Figure 3–2: LEDs on non-port side of SAN Switch 2/32

Table 3–2 describes the LEDs on the non-port side of the switch.

Table 3–2: Non-Port Side LED Patterns During Normal Operation

LED Name, Location	Color of LED	Status of Hardware	Recommended Action
Port Readiness LED On far right when viewing switch from non-port Side	No light	Switch is off, or boot is not complete, or boot failed.	Verify switch is on and has completed booting.
	Steady green	Switch is on and all ports are ready for use.	No action required.
	Steady yellow	One or more ports are offline.	Verify switch has completed booting and is not disabled. If light is still yellow, check error log and Port Status LEDs.
	Slow-flashing yellow (on 1 second; off 1 second)	One or both of the following are true: <ul style="list-style-type: none"> • One or more environmental ranges are exceeded. • Error log contains one or more port diagnostic error messages. 	<ol style="list-style-type: none"> 1. Check environmental conditions, error log, Port Status LEDs, transceivers, cables, and loopback plugs. 2. Correct error condition. 3. Clear error log. 4. Rerun diagnostics to verify fix.
Power Supply Power LED On each power supply (left corner)	No light	Power supply is not providing power.	Verify power supply is on and seated, and power cord is connected to a functioning power source.
	Steady green	Power supply is providing power.	No action required.
Fan Failure LED On each fan assembly (left corner)	No light	Fan assembly is either healthy or is not receiving power.	Verify power supply is on and power cord is connected to a functioning power source.
	Flashing orange (on 1 second; off 1 second)	Fan assembly has failed.	Replace fan assembly.

Management Overview

You can use the management functions built into the SAN Switch 2/32 to monitor the fabric topology, port status, physical status, and other information to aid in performance analysis and system debugging.

You can manage the switch using any of the management options listed in Table 3–3.

NOTE: For information about upgrading the version of Fabric OS installed on the switch, refer to the *hp StorageWorks Fabric OS Version 3.0.x/4.0.x Procedures Guide*.

Table 3–3: Management Options for the SAN Switch 2/32

Management Tool	Out-of-band Support	In-band Support
Command Line Interface (CLI) Runs up to two admin sessions and four user sessions simultaneously. For more information, refer to the <i>hp StorageWorks Fabric OS Version 3.0.x/4.0.x Procedures Guide</i> and the <i>hp StorageWorks Fabric OS Version 3.0.x/4.0.x Reference Guide</i> .	Ethernet or serial connection	IP over Fibre Channel *
Fabric Manager (option) For information refer to the <i>hp StorageWorks Fabric Manager Version 3.0.x/4.0.x User's Guide</i> .	Ethernet	IP over Fibre Channel *
Advanced Web Tools For information refer to the <i>hp StorageWorks Web Tools Version 3.0.x/4.0.x User Guide</i> .	Ethernet or serial connection	IP over Fibre Channel *
Standard SNMP applications For information refer to the <i>hp StorageWorks MIB Version 3.0.x/4.0.x Reference Guide</i> .	Ethernet or serial connection	IP over Fibre Channel *
Management server For more information, refer to the <i>hp StorageWorks Fabric OS Version 3.0.x/4.0.x Procedures Guide</i> and the <i>hp StorageWorks Fabric OS Version 3.0.x/4.0.x Reference Guide</i> .	Ethernet or serial connection	Native inband interface (over HBA only)

* Requirements for running IP over Fibre Channel:

- Must be run on both HBA and switch.
- Must be supported by both HBA and HBA driver.

For the hp StorageWorks SAN Switch 2/32 power pak (P/N 311026-B21)

This unit ships with software components loaded into the firmware and enabled. You do not have to retrieve a license key to enable the components. These include:

- Advanced Performance Monitor (APM)
- Extended Fabrics
- Fabric Watch
- ISL Trunking
- Remote Switch
- Advanced Zoning

Review the following sections for feature descriptions.

Advanced Performance Monitoring

The Advanced Performance Monitoring feature provides SAN performance management through an end-to-end monitoring system. Advantages to integrating APM into your SAN include,

- Increased end-to-end fabric visibility
- More accurate reporting for service level agreements and charged access applications

For more information refer to the *hp StorageWorks Advanced Performance Monitoring Version 3.0.x/4.0.x User Guide*, provided on the SAN Switch 2/32 Software CD.

Extended Fabrics

The Extended Fabrics feature increases the maximum bandwidth between two switches (at extended distances). Advantages to integrating Extended Fabrics into your SAN include,

- Provides the highest possible performance of data transfer between switches
- Provides maximum buffering between E_Ports connected over an extended distance

For information refer to the *hp StorageWorks Extended Fabric Version 3.0.x/4.0.x User Guide*, provided on the SAN Switch 2/32 Software CD.

Fabric Watch

The Fabric Watch feature allows you to monitor the performance and status of hp StorageWorks SAN switches. Advantages to integrating Fabric Watch into your SAN include,

- Real-time alerts to potential problems within the SAN
- Monitoring of fabric events (like reconfiguration and zone changes), physical switch conditions, and individual port status

For more information refer to the *hp StorageWorks Fabric Watch Version 3.0.x/4.0.x User Guide*, provided on the SAN Switch 2/32 Software CD.

ISL Trunking

The ISL Trunking feature allows up to four ISLs to merge logically into a single link. Advantages to integrating ISL Trunking into your SAN include,

- Load shares traffic across all ISLs in a trunk.
- Simplifies management by implementing fewer ISLs

For information refer to the *hp StorageWorks ISL Trunking Version 3.0.x/4.0.x User Guide*, provided on the SAN Switch 2/32 Software CD.

Remote Switch

Remote Switch functions with the aid of a “bridging device” or network-bridge. The network-bridge supports both a Fibre Channel physical interface as well as a secondary non-Fibre Channel physical interface such as IP or ATM. Switches can be cascaded together to form a fabric that, from the viewpoint of the connected hosts and storage devices, interact the same as locally connected switches.

For more information refer to the *hp StorageWorks Remote Switch Version 3.0.x/4.0.x User Guide*, provided on the SAN Switch 2/32 Software CD.

Advanced Zoning

The Advanced Zoning feature allows partitioning of the SAN into logical groupings of devices. Use Advanced Zoning to create logical subsets of the fabric to accommodate closed user groups, or to create functional areas within the fabric. For example, include selected devices within a zone for the exclusive use of zone members, or create separate test areas within the fabric.

For more information refer to the *hp StorageWorks Zoning Version 3.0.x/4.0.x User Guide*, provided on the SAN Switch 2/32 Software CD.

Optional Management Feature – Fabric Manager

Fabric Manager provides a GUI that allows the administrator to monitor and manage an entire fabric from a standard workstation. Use Fabric Manager to manage fabrics containing integrated fabrics, in addition to individual switches. Contact your HP Sales Representative for purchasing information.

Displaying the Optional Feature Licenses

Use these steps to display optional features installed on your switch.

1. Login to the switch as the admin user.
2. At the command line enter the following command:

```
licenseShow
```

This command displays the license keys that have been entered for the switch and the features enabled by those licenses.

Running Basic Switch Operations Using Telnet

Read the following sections to run common switch operations via telnet.

Logging into the SAN Switch 2/32

Use these steps to log into the SAN Switch 2/32.

1. Open a telnet connection to the switch. The login prompt is displayed if the telnet connection successfully found the switch in the network.

NOTE: The switch must be connected to your IP network through the RS-232 port to enable connection through telnet.

2. At the login prompt, enter the user ID you are logging in as. For example:

```
login: admin
```

The password prompt is displayed if the user exists.

3. Enter the password for the user:

```
password: xxxxxx
```

The default password is password.

4. If the login was successful a prompt is displayed showing the switch name and user ID you are logged in as. For example:

```
switch55>admin:
```

Changing the Admin Password and User ID

Use these steps to change the Admin user ID and password. For security reasons, the first time you log into the Fabric OS you are requested to change the admin user ID and system password.

NOTE: Previous switches did not require a password to access the management via the serial line. With V4.0.0 and higher, a password is required to use the serial line, similar to using the admin level telnet or admin level web tools.

1. Login to the switch as the admin user.
2. At the command line, enter the following command:

```
Password admin
```

An interactive session is opened and you are prompted for configuration values.

3. At the New username prompt, enter a new name for the admin user. You can change the name of the admin user without changing the password. Press Enter to leave the name as is.
4. At the Old Password prompt, enter the old password.
5. At the New password prompt, enter the new password. The new password must be from 8 to 40 characters in length.
6. At the new password prompt, enter the new password exactly as entered to the previous prompt.
7. Press Enter to commit the configuration to the firmware.

IMPORTANT: Save your passwords in a safe place. It is nearly impossible to access a switch without knowing the switch password.

Configuring the IP and Fibre Channel Address

The SAN Switch 2/32 is shipped with a default IP address of 10.77.77.77. Use these steps to change the default IP Address and configure the Fibre Channel IP address of the switch.

1. Login to the switch as the admin user.

2. At the command line enter the following command:

```
ipAddrSet
```

An interactive session is opened and you are prompted for configuration values. Press Enter to skip over a prompt and leave the parameter value as is.

3. At the Ethernet IP Address prompt, enter the new IP address for the ethernet port on the switch. Press Enter.
4. At the Ethernet Subnetmask prompt, enter the address of the subnetmask, if applicable. Press Enter.
5. At the Fibre Channel IP address prompt, enter the Fibre Channel IP address for the switch. Press Enter.
6. At the Fibre Channel Subnetmask prompt, enter the address of the subnetmask, if applicable. Press Enter.
7. At the Gateway Address prompt, enter the IP address of the gateway system if applicable. Press Enter.

The configuration is then committed to the switch firmware.

8. You are then prompted whether to make the IP address changes active now or at the next reboot. Enter *y* at the prompt to have the IP address changes take effect immediately.

Displaying Devices within the Fabric

To verify that you have fabric wide connectivity when you install a new switch, display the fabric wide device count from the newly installed switch. Use these steps to display the fabric.

1. Login to the switch as the admin user.
2. At the command line enter the following command:

```
nsAllShow
```

This command displays all the connected devices in the fabric.

Checking the Firmware Version

Use these steps to display the SAN Switch 2/32 firmware version.

1. Login to the switch as the admin user.

2. At the command line enter the following command:

```
version
```

This command displays the Kernel version, and Fabric OS release number.

Setting the Switch Date and Time

All switches maintain current date and time in non-volatile memory. Date and time are used for logging events. Switch operation does not depend on the date and time; a switch with an incorrect date and time value still functions properly.

Uses these steps to set the date and time of a switch.

1. Login to the switch as the admin user.
2. At the command line, enter the following command:

```
date "MMDDhhmmYY"
```

where:

- MM is the month, valid values are 01–12.
- DD is the date, valid values are 01–31.
- hh is the hour, valid values are 00–23.
- mm is minutes, valid values are 00–59.
- YY is the year, valid values are 00–99.

NOTE: Year values greater than 69 are interpreted as 1970-1999, year values less than 70 are interpreted as 2000-2069. The date function does not support daylight saving time or time zones.

Displaying Switch Configuration Settings

Use these steps to display the system configuration settings.

1. Login to the switch as the admin user.
2. At the command line enter the following command:

```
configShow
```

The system configuration settings display.

SAN Switch 2/32 Diagnostics

Read the following sections for information on using POST and diagnostic tests.

Interpreting POST Results

Each time the switch is powered on or reset, the switch automatically performs POST, a one-minute system check during which the port status LEDs flash different colors.

To determine whether POST completed without errors, verify that all LEDs return to a normal state after POST is complete. If one or more LEDs do not return to a normal state, and this is not due to the switch being set to beacon, refer to the *hp StorageWorks Fabric OS Version 3.0.x/4.0.x Procedures User Guide*.

NOTE: If the switch prompt does not display when POST completes, POST was not successfully completed and the switch should be returned to your switch supplier for repair.

Any errors detected during POST are written to the system log, accessible through the `errShow` command. For more information about error messages, refer to the *hp StorageWorks Fabric OS Version 3.0.x/4.0.x Procedures User Guide*.

Additional Diagnostic Tests

The SAN Switch 2/32 uses diagnostic tests to help troubleshoot hardware and firmware. The diagnostic tests provided on the switch include tests of internal connections and circuitry, fixed media, and any SFP modules and fiber optic cables in use. The tests are implemented by command, either through a telnet session or through a terminal set up for a Serial connection to the switch. Some tests require the ports to be connected by external cables, to allow diagnostics to verify the serializer/deserializer interface, and to verify the attached SFP and cable.

All diagnostic tests are run at link speeds of both 1 Gbps and 2 Gbps. For information about the specific diagnostic tests and how to run them, refer to the *hp StorageWorks Fabric OS Version 3.0.x/4.0.x Procedures User Guide*.

NOTE: The transmit and receive speed of the links may be temporarily locked to a specific speed during diagnostic testing.

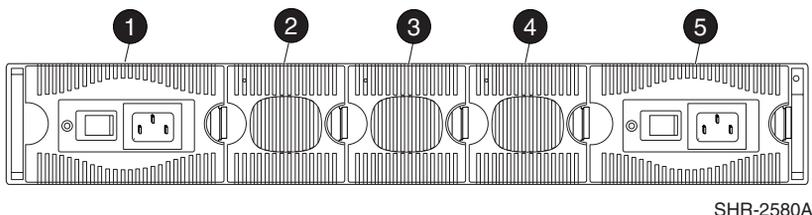
Field Replaceable Units

You can replace the power supplies, fan assemblies, and motherboard in the field without the use of special tools. The power supplies and fan assemblies are keyed to ensure correct orientation during installation. Replacement instructions are provided with all replacement units ordered.

NOTE: The SAN Switch 2/32 uses two AC power cords. To remove all power from the switch, disconnect both power cords before servicing.

Power Supplies

The two power supplies are hot-swappable if replaced one at a time. They are identical and fit into either power supply slot, see Figure 3–3.



- | | |
|------------------------------------|------------------------------------|
| ❶ Power supply #2 | ❸ Fan assembly containing fans 3,4 |
| ❷ Fan assembly containing fans 5,6 | ❹ Fan assembly containing fans 1,2 |
| | ❺ Power supply #1 |

Figure 3–3: Power supplies and fan assemblies locations

The Fabric OS identifies the power supplies as follows (viewing the switch from the non-port side):

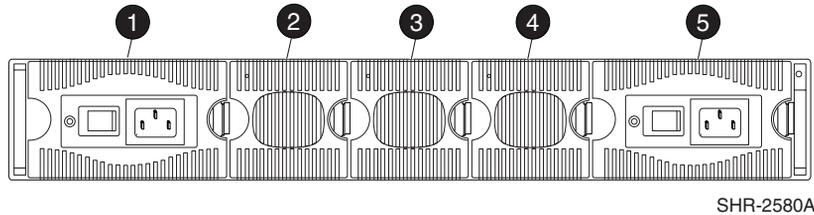
- Power supply #1 is on the right when viewing the switch from the non-port side.
- Power supply #2 is on the left when viewing the switch from the non-port side.

To determine whether a power supply requires replacing:

- Check the Power Supply LED next to the AC switch
- Enter the `ps show` command
- In Web Tools, click the Power Status icon

Fan Assemblies

The three fan assemblies are hot-swappable if replaced one at a time. The fan assemblies are identical and fit into any fan assembly slot, see Figure 3–4.



- | | |
|------------------------------------|------------------------------------|
| ❶ Power supply #2 | ❸ Fan assembly containing fans 3,4 |
| ❷ Fan assembly containing fans 5,6 | ❹ Fan assembly containing fans 1,2 |
| | ❺ Power supply #1 |

Figure 3–4: Power supplies and fan assemblies locations

Each fan assembly contains two fans, identified by Fabric OS as follows (viewing the switch from the non-port side assembly on the right contains fans #1 and #2.

- The fan assembly in the center contains fans #3 and #4.
- The fan assembly on the left contains fans #5 and #6.

Any of the following methods can be used to determine whether a fan assembly requires replacing:

- Check the Fan Failure LED on the face of the fan assembly
- Enter the `fanshow` command
- In Web Tools, click the Fan Status icon

Motherboard Assembly

The switch must be powered off and removed from the fabric (and possibly from the cabinet) to replace the motherboard assembly. To determine whether the motherboard assembly requires replacing, first check the Switch Power/Status and Port Status LEDs. Next, run diagnostics (refer to the *hp StorageWorks Fabric OS Version 3.0.x/4.0.x Procedures Guide*). If the motherboard assembly appears to require replacing, contact your switch supplier.

Backing Up Configuration Data and Upgrading Firmware

This chapter covers the following topics:

- Backing up system configuration settings
- Restoring configuration settings
- Upgrading or restoring the switch firmware

Backing Up System Configuration Settings

HP strongly recommends saving the configuration after the initial configuration changes and periodically thereafter.

FTP must be used on Windows workstations to backup the system configuration. The FTP server must be running before an upload can occur. Use the RSHD service or FTP on a UNIX machine.

NOTE: The two supplied utilities, RSHD.EXE and CAT.EXE currently do not support uploads for Windows, only downloads. These utilities are available from the support web site: <http://www.hp.com/support>.

Use these steps to upload a backup copy of the configuration settings to a host computer.

1. Verify that the RSHD service (on a UNIX machine) or the FTP service (on a Windows or UNIX machine) is running on the host workstation.
2. Login to the switch as the admin user.

3. At the command line enter the following command:

```
configUpload "hostIPAddr", "user",  
"path_filename", "password"
```

For example, *hostIPAddr* is the IP address of the host computer, *user* is the User ID used to log into this computer, *path_filename* is the path location and filename of the configuration file, and *password* is the password for the user ID specified.

If only *configupload* is entered the system prompt you for each parameter, as follows:

Example:

```
switch:admin> configupload  
Server Name or IP Address [host]: 123.45.678.901  
User Name [user]: kelev  
File Name [config.txt]: switch1  
Protocol (RSHD or FTP) [rshd]: ftp  
Password:  
upload complete
```

Restoring the System Configuration Settings

Use these steps to restore the system configuration settings from a backup.

1. Verify that the RSHD service or the FTP service is running on the host workstation.
2. Login to the switch as the admin user.
3. Shut down the switch by entering the following command:

```
switchDisable
```

4. At the command line, enter the following command:

```
configdownload hostIPAddr, user, path_filename, password
```

For example, *hostIPAddr* is the IP address of the host computer, *user* is the User ID used to log into this computer, *path_filename* is the path location and filename of the configuration file, and *password* is the password for the user ID specified.

The password operand is only required if you are using FTP.

5. Reboot the switch, type:

```
fastBoot
```

Upgrading or Restoring Switch Firmware

The SAN Switch 2/32 ships with preloaded firmware. In most cases there is no need to update the firmware on the new switch. The firmware version can be determined by using:

- The `version` Telnet command
- The Switch Management Application page in Web Tools

Use these steps to upgrade or restore the switch firmware.

1. Verify that the RSHD service or the FTP service is running on the host workstation.
2. Login to the switch as the admin user.
3. Enter the following command:

```
firmwareDownload hostIPaddr, user, path_filename, password
```

For example, where *hostIPaddr* is the IP address of the host computer, *user* is the User ID used to log into this computer, *path_filename* is the path location and filename of the new firmware file, and *password* is the password for the user ID specified.

The password operand is only required if you are using FTP.

4. Reboot the switch by entering the following command:

```
fastBoot
```

Downloading Firmware from the hp Website

To download the firmware from the hp website, go to <http://www.hp.com/support>. The hp Storageworks SAN Switch software CD contains the switch firmware, loaders, and downloading instructions.

Technical Specifications

This appendix covers the following topics:

- Dimensions
- Power supply specifications
- Environmental requirements
- Memory specifications
- Serial port specifications

Dimensions

Table A-1 lists SAN Switch 2/32 dimensions.

Table A-1: Physical Specifications

Dimension	Value
Height	2.58 in (65.5 mm)
Depth	23.06 in (585.6 mm)
Width	16.87 in (42.86 cm)
Weight (with both power supplies installed)	35.8 lb (16.2 kg)

Power Supply Specifications

Table A-2 lists lists the acceptable environmental ranges for both operating and non-operating (such as during transportation or storage) conditions.

Table A-2: Power Supply Specifications

Specification	Value
Outlet	Correctly wired and earth-grounded
Maximum output	300 W, with internal fans operating
Maximum system power consumption	190–220 Watts (with some variation depending on transceiver vendor)
Input voltage	100–240 VAC (nominal 80% efficiency) auto-ranging
Input line frequency	47–63 Hz

Table A–2: Power Supply Specifications (Continued)

Specification	Value
Harmonic distortion	Active power factor correction per EN61000-3-2
BTU rating at 80% efficiency	$220 \text{ Watts} / 0.8 \times 3.412 \text{ BTU/Hr/Watts} = 938 \text{ BTU/hr}$
Inrush current	Maximum of 15 amps for periods longer than 300 microseconds, at 50 degrees Celsius, hot or cold start
Input line protection	Fused in both hot and neutral lines, using independent fuses

Environmental Requirements

Table A–3 lists the environmental ranges that are acceptable when the SAN switch 2/32 is operating, and the acceptable ranges when the switch is not operating (such as when transporting, or storing).

Table A–3: Environmental Requirements

Condition	Acceptable Range
Temperature (operating)	10 °C to 40 °C
Temperature (non-operating)	-25 °C to 70 °C
Humidity (operating)	20% to 85% RH non condensing, at 40 °C, with maximum gradient with 10% per hour
Humidity (non-operating)	10% to 850% RH non-condensing, at 70°C
Altitude (operating)	0 to 3 km above sea level
Altitude (non-operating)	0 to 12 km above sea level
Shock (operating)	80 G, 2.4 ms, half sine
Shock (non-operating)	20 G, 11 ms, half sine wave

Table A-3: Environmental Requirements (Continued)

Vibration (operating)	0.5 G, 5-500 Hz
Vibration (non-operating)	2.0 G, 5-500 Hz
Air flow (operating)	25 cubic feet/minute (42.5 cubic meters/hour)
Air flow (non-operating)	None required

Memory Specifications

The SAN Switch 2/32 utilizes the following memory.

- Main memory (SDRAM): 128 MB
- Flash Memory: 32 MB
- Boot Flash: 512 KB
- Compact Flash: 256 MB

The centralized memory maximizes the overall switch throughput by guaranteeing full transmit and receive bandwidth to all Fibre Channel ports at all times.

Serial Port Specifications

The Serial port can be used to connect to a computer workstation to configure the switch IP address without connecting to the fabric. The Serial port's parameters are 9600 baud, 8 data bits, no parity, 1 stop bit, and no flow control.

The port requires a straight Serial cable with a female 9-pin subminiature-D connector. Only pins 2, 3, and 5 are supported; if pin 7 is used, the signal must always be driven high, using the pinouts listed in Table A-4.

Table A-4: Serial Port Connectors

PIN	Signal	Description
1		
2	TxDATA	Transmit Data
3	RxDATA	Receive Data
4		
5	GND	Logic Ground
6		
7		
8		
9		

NOTE: For dust and ESD (electrostatic discharge) protection, a cover is provided for the Serial port and should be kept on the port whenever the Serial port is not in use.

Updating the Core Switch PID Format

This Appendix provides detailed information for changing the Core Switch PID format. The SAN Switch 2/32 units ship with the Core Switch PID format set to 1. Before connecting to the SAN, you *must verify* that the Core Switch PID formats of all switches already running in the SAN are also set to 1. If the Core Switch PID format is not changed to 1 to match the SAN Switch 2/32's value, then the switches residing in the SAN will fail to communicate with one another.

IMPORTANT: All switches running Fabric OS version 4.0.x or higher are shipped with the Core Switch PID Format enabled, so it is not necessary to change the Core Switch PID format on these switches. For example, the hp StorageWorks SAN Switch 2/32 and hp StorageWorks Core Switch 2/64 always use Core Switch PID format 1. This parameter is always 1 and cannot be changed.

HP Recommendations on Changing the Core Switch PID Format

Proactively setting the core PID format on all new fabrics before they enter production will prevent the need to update those fabrics in the future. This is strongly recommended as a step in the deployment of all new fabrics. There is no difference in the behavior of a fabric with either PID format; changing to the new format during deployment will merely save administrative effort later on.

HP strongly recommends against using drivers that bind by PID. There are several routine maintenance procedures which may result in a device receiving a new PID; the core PID format update is just one example of such a procedure. Examples include but are not limited to:

- Changing “Compatibility Mode” settings
- Changing switch domain IDs
- Merging fabrics
- Relocating devices to new ports or new switches (that is, for Add, Move, Change type operations)

- Using hot spare switch ports to deal with failures
- In every case where devices bind by PID, any such procedure will become difficult or impossible to execute without downtime.

IMPORTANT: HP always recommends redundant fabrics and multi-pathing software for uptime-sensitive environments. If a redundant SAN architecture is in place, the Core PID update can take place without application downtime. To ensure maximum ease of administration, this parameter can and should be proactively set on a fabric before it ever enters production, whether or not an upgrade to larger switches is planned.

How to Check the Current Core PID Setting for Switches Running Firmware Lower than V4.0.0

To view a switch's current Core Switch PID format, connect directly to a switch in your SAN and complete the following steps via a telnet session or the serial cable supplied.

1. Type `configShow` and press Enter.
2. About 15 lines down (press Enter to display more information on the page), locate the following line:

```
fabric.ops.mode.pidFormat: 0
```

NOTE: The [0] value shown above indicates the Core Switch PID parameter set on this particular switch.

If necessary, proceed to the next section for detailed procedures on changing the Core Switch PID format to 1.

Updating the Core Switch PID Format Online

In order for the switches already running in the SAN to interoperate properly with the SAN Switch 2/32, all of them must use a Core Switch PID format setting of **1**. If the Core Switch PID format assigned to switches already running in the SAN is **0**, then you must use these steps to update the value to **1**.

IMPORTANT: The online update process is only intended for use in uptime-critical dual-fabric environments, with multi-pathing software. If dual-fabrics are not in place, there are a number of routine maintenance scenarios which require scheduled downtime, the core PID migration process being only one example. High-uptime environments should always use a redundant fabric SAN architecture.

Complete these steps to update the Core Switch PID format while the SAN is running online.

1. Backup all data. Verify backups.

2. If the multi-pathing software cannot automatically switchover between fabrics seamlessly enough for the users of the SAN, use the software's administrative tools to manually disassociate, or mark offline all storage devices on the first fabric to be updated. (This is the best practice in cases where any doubt exists about the multi-pathing software's behavior, but is more labor intensive.)
3. Verify that I/O continues over the other fabric.
4. Disable all switches one at a time in the fabric to be updated.
5. Verify that I/O continues over the other fabric after each switch disable.
6. Change the PID format on each switch in the fabric, as follows:
 - a. Telnet into each switch in the fabric.
 - b. Type `switchDisable`, and press Enter.
 - c. Type `configure` and press Enter.
 - d. Type `y` at the Fabric parameters prompt, (yes, y, no, n): `[no] y`.
 - e. To view the Core Switch PID setting, press Enter until you reach the Core Switch PID format line, similar to the following.

```
Core Switch PID Format: (0..1) [0]
```

NOTE: The [0] value shown above indicates the Core Switch PID parameter set on this particular switch.

- f. Type **1** to update the Core Switch PID format.
 - g. Continue to press Enter until you completed the configure section and have returned to the admin prompt.
7. One at a time, re-enable the switches in the updated fabric. In a core/edge network, enable the core switches first.
8. Once the fabric has re-converged, type `cfgEnable myZoningCfg` (where `myZoningCfg` is the name of your zone configuration). Press Enter to update zoning.

NOTE: This does not change the definition of zones in the fabric, but causes the lowest tables in the zoning database to update with the new Core Switch PID format.

9. Repeat steps 3 through 6 for all fabrics in the SAN.

10. For any devices manually bound by PID, update their bindings. This may involve changing them to the new PIDs, or may (preferably) involve changing to WWN binding.
11. For any devices automatically bound by PID, two options exist:
 - a. Execute a custom procedure to rebuild its device tree online. Examples are given in this Appendix.
 - b. Reboot the device to rebuild the device tree. Some operating systems require a special command to do this. E.g. “boot -r” in Solaris.
12. For devices that do not bind by PID, or have had their PID binding updated, mark online or re-associate the disk devices with the multi-pathing software and resume I/O over the updated fabric.

Updating the Core Switch PID Format Offline

Complete these steps to update the Core Switch PID format while the SAN is running offline.

1. Backup all data. Verify backups.
2. Shut down all hosts and storage devices attached to the SAN.
3. Disable all switches in the fabric requiring the update.
4. Change the PID format on each switch in the fabric, as follows.
 - a. Telnet into each switch in the fabric.
 - b. Type `switchDisable`, and press Enter.
 - c. Type `configure` and press Enter.
 - d. Type `y` at the Fabric parameters prompt, (yes, y, no, n): `[no] y`.
 - e. To view the Core Switch PID setting, press Enter until you reach the Core Switch PID format line, similar to the following.

```
Core Switch PID Format: (0..1) [0]
```

NOTE: The [0] value shown above indicates the Core Switch PID parameter set on this particular switch.

- f. Type `1` to update the Core Switch PID format.
- g. Continue to press Enter until you completed the configure section and have returned to the admin prompt.

5. One at a time, re-enable the switches in the updated fabric. In a core/edge network, enable the core switches first.
6. Once the fabric re-converges, type `cfgEnable myZoningCfg`, (where `myZoningCfg` is the name of your zone configuration). Press Enter to update zoning.

NOTE: This does not change the definition of zones in the fabric, but causes the lowest tables in the zoning database to update with the new Core Switch PID format.

7. Repeat steps 3 through 6 for all fabrics in the SAN.
8. Bring the devices online in the order appropriate to the SAN. This usually involves starting up the storage arrays first, and the hosts last.
9. For any devices manually bound by PID, bring the device back online, but do not start applications. Update their bindings and reboot again if necessary. This may involve changing them to the new PIDs, or may (preferably) involve changing to WWN binding.
10. For any devices automatically bound by PID, reboot the device to rebuild the device tree. (Some operating systems require a special command to do this. E.g. “boot -r” in Solaris.)
11. For devices that do not bind by PID or have had their PID binding updated, bring them back up and resume I/O.
12. Verify that all I/O has resumed correctly.

NOTE: Migrating from manual PID binding (e.g. persistent binding on an HBA) to manual WWN binding and/or upgrading drivers to versions that do not bind by PID can often be done before setting the core PID format. This can be advantageous, as it prevents the update process from having as many variables.

IMPORTANT: Once the switch PID format is set, it is stored in the flash memory of the switch and it is NOT necessary to set it again during subsequent firmware upgrades.

HP/UX Procedure for Updating the Core Switch PID Format

Use these procedures for updating the Core Switch PID format in an HP/UX environment.

1. Backup all data. Verify backups.
2. If you are not using multi-pathing software, stop all I/O going to all volumes connected through the switch/fabric to be updated.

3. If you are not using multi-pathing software, unmount the volumes from their mount points using `umount`. The proper usage would be `umount <mount point>`. For example:

```
umount /mnt/jbod
```

4. If you are using multi-pathing software, use that software to remove one fabric's devices from its configuration.
5. Deactivate the appropriate volume groups using `vgchange`. The proper usage would be `vgchange -a n <path to volume group>`. For example:

```
vgchange -a n /dev/jbod
```

6. Make a backup copy of the volume group directory using `tar` from within `/dev`. For example:

```
tar -cf /tmp/jbod.tar jbod
```

7. Export the volume group using `vgexport`. The proper usage would be `vgexport -m <map file> <path to volume group>`. For example:

```
vgexport -m /tmp/jbod_map /dev/jbod
```

8. Login into each switch in the fabric
9. Issue the command `switchDisable`.
10. Issue the command `configure` and change the Core Switch PID Format to 1.
11. Issue the command `switchEnable`. Enable the core switches first, then the edge switches.
12. Once you have done this to all switches in the fabric and verified that it has re-converged properly, issue the command `cfgEnable` [effective zone configuration] on one of the switches in that fabric. For example:

```
cfgEnable my_zones
```

13. Clean the `lvmtab` file by using the command `vgscan`.
14. Change to `/dev` and untar the file that was tared in step 4. For example:

```
tar -xf /tmp/jbod.tar
```

15. Import the volume groups using `vgimport`. The proper usage would be `vgimport -m <map file> <path to volume group> <physical volume path>`. For example:

```
vgimport -m /tmp/jbod_map /dev/jbod /dev/dsk/c64t8d0  
/dev/dsk/c64t9d0
```

16. Activate the volume groups using `vgchange`. The proper usage would be `vgchange -a y <path to the volume group>`. For example:

```
vgexport -a y /dev/jbod
```

17. If you are not using multi-pathing software, mount all devices again and restart I/O. For example, `mount /mnt/jbod`
18. If you are using multi-pathing software, re-enable the affected path. The preceding steps do not “clean up” the results from `ioscan`. When viewing the output of `ioscan`, notice that the original entry is still there, but now has a status of `NO_HW`.

```
# ioscan -funC disk
Class      I   H/W Path                Driver S/W State   H/W Type           Description
-----
disk       0   0/0/1/1.2.0             adisk CLAIMED      DEVICE             SEAGATE ST39204LC
           /dev/dsk/clt2d0 /dev/rdisk/clt2d0
disk       1   0/0/2/1.2.0             adisk CLAIMED      DEVICE             HP        DVD-ROM 304
           /dev/dsk/c3t2d0 /dev/rdisk/c3t2d0
disk       319 0/4/0/0.1.2.255.14.8.0  adisk CLAIMED      DEVICE             SEAGATE ST336605FC
           /dev/dsk/c64t8d0 /dev/rdisk/c64t8d0
disk       320 0/4/0/0.1.18.255.14.8.0 adisk NO_HW         DEVICE             SEAGATE ST336605FC
           /dev/dsk/c65t8d0 /dev/rdisk/c65t8d0
```

Figure B–1: ioscan output

19. To remove the original (outdated) entry, use the command `rmsf` (remove special file). For example:

```
rmsf -a -v /dev/dsk/c65t8d0
```

20. Validate that the entry has been removed by using the command `ioscan -funC disk`. Notice in the figure below that the `NO_HW` entry is no longer listed.

```
het46 (HP-50001)> ioscan -funC disk
Class      I   H/W Path                Driver S/W State   H/W Type           Description
-----
disk       0   0/0/1/1.2.0             adisk CLAIMED      DEVICE             SEAGATE ST39204LC
           /dev/dsk/clt2d0 /dev/rdisk/clt2d0
disk       1   0/0/2/1.2.0             adisk CLAIMED      DEVICE             HP        DVD-ROM 304
           /dev/dsk/c3t2d0 /dev/rdisk/c3t2d0
disk       319 0/4/0/0.1.2.255.14.8.0  adisk CLAIMED      DEVICE             SEAGATE ST336605FC
           /dev/dsk/c64t8d0 /dev/rdisk/c64t8d0
```

Figure B–2: ioscan func disk command output

21. Repeat for all fabrics.

AIX Procedure for Updating the Core Switch PID Format

Use these procedures for updating the Core Switch PID format in an AIX environment.

1. Backup all data. Verify backups.
2. If you are not using multi-pathing software, stop all I/O going to all volumes connected through the switch or fabric to be updated.
3. If you are not using multi-pathing software, varyoff the volume groups. Type,
`varyoffvg datavg`
4. If you are not using multi-pathing software, unmount the volumes from their mount points using `umount`. For example,
`umount /mnt/jbod`
5. If you are using multi-pathing software, use that software to remove one fabric's devices from its configuration.
6. Remove the device entries for the fabric you are migrating. For example, if the HBA for that fabric is `fcs0`, execute the command:
`rmdev -Rdl fcs0`
7. Login into each switch in the fabric.
8. Issue the `switchDisable` command.
9. Issue the `configure` command. Change the Core Switch PID Format to 1.
10. Issue the `configenable`, (`effective_zone_configuration`) command.
For example:
`configenable my_config`
11. Issue the `switchEnable` command. Enable the core switches first, then the edge switches.
12. Rebuild the device entries for the affected fabric using the `cfgmgr` command.
For example:
`cfgmgr -v`
This command may take several minutes to complete.

13. If you are not using multi-pathing software, vary on the disk volume groups. The proper usage would be `varyonvg <volume_group_name>`. For example,

```
varyonvg datavg
```

14. If you are not using multi-pathing software, mount all devices again and restart I/O. For example,

```
mount /mnt/jbod
```

15. If you are using multi-pathing software, re-enable the affected path.

16. Repeat for all fabrics.

Regulatory Compliance Notices

FCC EMC Statement (USA)

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense. The end user of this product should be aware that any changes or modifications made to this equipment without the approval of Hewlett-Packard could result in the product not meeting the Class A limits, in which case the FCC could void the user's authority to operate the equipment.

Regulatory Series Number: NA2106

EMC Statement (Canada)

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la Classe A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

EMC Statement (European Union)

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

Germany Noise Declaration

Schalldruckpegel $L_p = 46.1$ dB(A) Am Arbeitsplatz (operator position) Normaler Betrieb (normal operation) Nach ISO 7779:1999 (Typprüfung)

VCCI EMC Statement (Japan)

この装置は、情報処理装置等電波障害自主規制協議会（VCCI）の基準に基づくクラスA情報技術装置です。この装置を家庭環境で使用すると電波妨害を引き起こすことがあります。この場合には使用者が適切な対策を講ずるよう要求されることがあります。

BSMI EMC Statement (Taiwan)

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

RRL EMC Statement (Korea)

사용자 안내문 : A 급기기

이 기기는 업무용으로 전자파 적합등록을 받은 기기 이오니, 판매자 또는 사용자는 이점을 주의하시기 바라며, 만약 잘못 구입하셨을 때에는 구입한 곳에서 비업무용으로 교환하시기 바랍니다.

Laser Safety

A. Certification and Classification Information

When equipped with native Fibre Channel adapters, this product contains a laser internal to the small form factor pluggable (SFP) transceiver modules.

In the USA, the SFP module is certified as a Class 1 Laser product, conforming to the requirements contained in Department Of Health and Human Services (DHHS) regulation 21 CFR, Subchapter J. The certification is indicated by a label on the metal SFP housing.

Outside the USA, the SFP is certified as a Class 1 Laser product conforming to requirements contained in IEC 825-1:1993 and EN60825-1:1994, including Amendment 11:1996.

The SFP includes the following certifications:

- UL Recognized Component (USA)
- CSA Certified Component (Canada)
- TUV Certified Component (European Union)
- CB Certificate (Worldwide)

B. Product Information

Each communications port consists of a transmitter and receiver optical subassembly. The transmitter subassembly contains internally a semiconductor laser diode in the wavelength of either 850 nanometers (shortwave laser) or 1310 nanometers (longwave laser).

Class 1 Laser products are not considered hazardous.



WARNING: There are no user maintenance operations, service operations, or adjustments to be performed on the SFP module.

C. Usage Restrictions

Failure to comply with these usage restrictions may result in incorrect operation of the system and points of access may emit laser radiation above the Class 1 limits established by the IEC and U.S. DHHS.

Battery Replacement Notice

Your switch is equipped with a lithium manganese dioxide, a vanadium pentoxide, or an alkaline internal battery or battery pack. There is a danger of explosion and risk of personal injury if the battery is incorrectly replaced or mistreated. Unless specific replacement instructions are provided as part of this guide, replacement is to be done by an HP authorized service provider using the HP spare designated for this product. For more information about battery replacement or proper disposal, contact your HP authorized reseller or your authorized service provider.



WARNING: Your switch contains an internal lithium manganese dioxide, a vanadium pentoxide, or an alkaline battery. There is risk of fire and burns if the battery is not handled properly. To reduce the risk of personal injury:

- **Do not attempt to recharge the battery.**
 - **Do not expose to temperatures higher than 140°F (60°C).**
 - **Do not disassemble, crush, puncture, short external contacts, or dispose of in fire or water.**
-

Batteries, battery packs, and accumulators should not be disposed of with the general household waste. In order to forward them to recycling or proper disposal, please use the public collection system or return them to HP, your authorized HP partners, or their agents.

Glossary

This glossary defines terms used in this guide or related to this product and is not a comprehensive glossary of computer terms.

AL_PA

Arbitrated Loop Physical Address; a unique 8-bit value assigned during loop initialization to a port in an arbitrated loop.

Alias Address Identifier

An address identifier recognized by a port in addition to its standard identifier. An alias address identifier may be shared by multiple ports.

Alias AL_PA

An AL_PA value recognized by an L_Port in addition to the AL_PA assigned to the port.

Alias Server

A fabric software facility that supports multicast group management.

API

Application Programming Interface; defined protocol that allows applications to interface with a set of services.

Arbitrated Loop

A shared 100 MBps or 200 MBps Fibre Channel transport structured as a loop. Can support up to 126 devices and one fabric attachment. See also *Topology*.

ASIC

Application Specific Integrated Circuit.

ATM

Asynchronous Transfer Mode; a transport used for transmitting data over LANs or WANs that transmit fixed-length units of data. Provides any-to-any connectivity, and allows nodes to transmit simultaneously.

AW_TOV

Arbitration Wait Time-out Value; the minimum time an arbitrating L_Port waits for a response before beginning loop initialization.

Bandwidth

The total transmission capacity of a cable, link, or system. Usually measured in bps (bits per second). May also refer to the range of transmission frequencies available to a network. See also *Throughput*.

BB_Credit

Buffer-to-buffer credit; the number of frames that can be transmitted to a directly connected recipient or within an arbitrated loop. Determined by the number of receive buffers available.

BER

Bit Error Rate; the rate at which bits are expected to be received in error. Expressed as the ratio of error bits to total bits transmitted. See also *Error*.

Block

As applies to Fibre Channel, upper-level application data that is transferred in a single sequence.

Bridge

Hardware that connects incompatible networks by providing translation for both hardware and software. For example, an ATM gateway can connect a Fibre Channel link to an ATM connection.

Broadcast

The transmission of data from a single source to all devices in the fabric, regardless of zoning.

Buffer-to-buffer Flow Control

Management of the frame transmission rate in either a point-to-point topology or in an arbitrated loop. See also *BB_Credit*.

Cascade

Two or more interconnected Fibre Channel switches. The recommended number of interswitch links is seven. See also *Fabric, ISL*.

Chassis

The metal frame in which the switch and switch components are mounted.

Circuit

An established communication path between two ports. Consists of two virtual circuits capable of transmitting in opposite directions. See also *Link*.

Command Line

Interface that depends entirely on the use of commands, such as through telnet or SNMP, and does not involve a GUI.

Community (SNMP)

A relationship between a group of SNMP managers and an SNMP agent, in which authentication, access control, and proxy characteristics are defined. See also *SNMP*.

Connection Initiator

A port that has originated a Class 1 dedicated connection and received a response from the recipient.

Connection Recipient

A port that has received a Class 1 dedicated connection request and transmitted a response to the originator.

CRC

Cyclic Redundancy Check; a check for transmission errors included in every data frame.

Credit

As applies to Fibre Channel, the number of receive buffers available for transmission of frames between ports. See also *BB_Credit*, *EE_Credit*.

Disparity

The relationship of ones and zeros in an encoded character. “Neutral disparity” means an equal number of each, “positive disparity” means a majority of ones, and “negative disparity” means a majority of zeros.

DLS

Dynamic Load Sharing; dynamic distribution of traffic over available paths. Allows for recomputing of routes when an Fx_Port or E_Port changes status.

Domain ID

As applies to SAN switches, a unique number between 1 and 239 that identifies the switch to the fabric and is used in routing frames. Usually automatically assigned by the switch, but can be manually assigned.

E_D_TOV

Error Detect Time-out Value; the minimum amount of time a target waits for a sequence to complete before initiating recovery. Can also be defined as the maximum time allowed for a round-trip transmission before an error condition is declared.

E_Port

Expansion Port; a type of switch port that can be connected to an E_Port on another switch to create an ISL. See also *ISL*.

EE_Credit

End-to-end Credit; the number of receive buffers allocated by a recipient port to an originating port. Used by Class 1 and 2 services to manage the exchange of frames across the fabric between source and destination. See also *End-to-end Flow Control*, *BB_Credit*.

EIA Rack

A storage rack that meets the standards set by the Electronics Industry Association.

Enabled Zone Configuration

The currently enabled configuration of zones. Only one configuration can be enabled at a time.

End-to-end Flow Control

Governs flow of class 1 and 2 frames between N_Ports. See also *EE_Credit*.

Error

As applies to Fibre Channel, a missing or corrupted frame, time-out, loss of synchronization, or loss of signal (link errors).

Exchange

The highest level Fibre Channel mechanism used for communication between N_Ports. Composed of one or more related sequences, and can work in either one or both directions.

F_Port

Fabric Port; a port that is able to transmit under fabric protocol and interface over links. Can be used to connect an N_Port to a switch.

Fabric Name

The unique identifier assigned to a fabric and communicated during login and port discovery.

Fabric

A Fibre Channel network containing two or more switches in addition to hosts and devices. May also be referred to as a switched fabric. See also *Topology*, *SAN*, *Cascade*.

FC-AL-3

The Fibre Channel Arbitrated Loop standard defined by ANSI. Defined on top of the FC-PH standards.

FC-FLA

The Fibre Channel Fabric Loop Attach standard defined by ANSI.

FCIA

Fibre Channel Industry Association. An international organization of Fibre Channel industry professionals. Among other things, provides oversight of ANSI and industry developed standards.

FCP

Fibre Channel Protocol; mapping of protocols onto the Fibre Channel standard protocols. For example, SCSI FCP maps SCSI-3 onto Fibre Channel.

Fibre Channel Transport

A protocol service that supports communication between Fibre Channel service providers.

FL_Port

Fabric Loop Port; a port that is able to transmit under fabric protocol and also has arbitrated loop capabilities. Can be used to connect an NL_Port to a switch.

FLOGI

Fabric Login; the process by which an N_Port determines whether a fabric is present, and if so, exchanges service parameters with it.

Frame

The Fibre Channel structure used to transmit data between ports. Consists of a start-of-frame delimiter, header, any optional headers, the data payload, a cyclic redundancy check (CRC), and an end-of-frame delimiter. There are two types of frames: Link control frames (transmission acknowledgements, etc.) and data frames.

FS_ACC

Fibre Channel Services Accept. The information unit used to indicate acceptance of a request for a Fibre Channel service.

FSP

Fibre Channel Service Protocol; the common protocol for all fabric services, transparent to the fabric type or topology.

FSPF

Fabric Shortest Path First; the routing protocol for Fibre Channel switches.

Full Fabric

The licensing that allows multiple E_Ports on a switch, making it possible to create multiple ISL links.

Full-duplex

A mode of communication that allows the same port to simultaneously transmit and receive frames.

Fx_Port

A fabric port that can operate as either an F_Port or FL_Port.

G_Port

Generic 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.

Gateway

A device such as a switch that connects different subnets together. A switch can be used as a gateway from the Ethernet to the Fibre Channel. Set the gateway address on one switch to the Fibre Channel IP address of another switch to enable the other switch to forward IP traffic to the Ethernet port on the second switch.

Gbps

Gigabits per second (1,062,500,000 bits/second).

GBps

GigaBytes per second (1,062,500,000 bytes/second).

HBA

Host Bus Adapter; the interface card between a server or workstation bus and the Fibre Channel network.

Hub

A Fibre Channel wiring concentrator that collapses a loop topology into a physical star topology. Nodes are automatically added to the loop when active and removed when inactive.

Idle

Continuous transmission of an ordered set over a Fibre Channel link when no data is being transmitted, to keep the link active and maintain bit, byte, and word synchronization.

ISL

Interswitch Link; a Fibre Channel link from the E_Port of one switch to the E_Port of another. See also *E_Port, Cascade*.

Isolated E_Port

An E_Port that is online but not operational due to overlapping domain IDs or nonidentical parameters (such as E_D_TOVs).

IU

Information Unit; a set of information as defined by either upper-level process protocol definition or upper-level protocol mapping.

L_Port

Loop Port; a node port (NL_Port) or fabric port (FL_Port) that has arbitrated loop capabilities. An L_Port can be in one of two modes:

- *Fabric mode* Connected to a port that is not loop capable, and using fabric protocol.
- *Loop mode* In an arbitrated loop and using loop protocol. An L_Port in loop mode can also be in participating mode or non-participating mode.

Latency

The period of time required to transmit a frame, from the time it is sent until it arrives.

Link Services

A protocol for link-related actions.

Link

As applies to Fibre Channel, a physical connection between two ports, consisting of both transmit and receive fibres.

LIP

Loop Initialization Primitive; the signal used to begin initialization in a loop. Indicates either loop failure or resetting of a node.

Looplet

A set of devices connected in a loop to a port that is a member of another loop.

MIB

Management Information Base; an SNMP structure to help with device management, providing configuration and device information.

Monitoring State

The state in which a port is monitoring the flow of information for data relevant to the port.

Multicast

The transmission of data from a single source to multiple specified N_Ports (as opposed to all the ports on the network).

Multimode

A fiber optic cabling specification that allows up to 500 meters between devices.

N_Port

Node Port; a port on a node that can connect to a Fibre Channel port or to another N_Port in a point-to-point connection.

NAA

Network Address Authority. An identifier that indicates the format of a network address.

Name Server

Frequently used to indicate Simple Name Server.

NL_Port

Node Loop Port; a node port that has arbitrated loop capabilities. Used to connect an equipment port to the fabric in a loop configuration through an FL_Port.

Node Name

The unique identifier for a node, communicated during login and port discovery.

Node

A Fibre Channel device that contains an N_Port or NL_Port.

Open Originator

The L_Port that wins arbitration in an arbitrated loop and sends an OPN ordered set to the destination port, then enters the Open state.

Open Recipient

The L_Port that receives the OPN ordered set from the open originator, and then enters the Open state.

Phantom Address

An AL_PA value that is assigned to an device that is not physically in the loop. Also known as phantom AL_PA.

A twenty-bit public address created for an 8-bit loop device to allow public devices to access it.

Phantom Device

A device that is not physically in an arbitrated loop, but is logically included through the use of a phantom address.

PLOGI

Port Login; the port-to-port login process by which initiators establish sessions with targets.

Point-to-point

A Fibre Channel topology that employs direct links between each pair of communicating entities. See also *Topology*.

Port Cage

The metal casing extending out of the optical port on the switch, and in which the SFP can be inserted.

Port_Name

The unique identifier assigned to a Fibre Channel port. Communicated during login and port discovery.

POST

Power On Self-Test; a series of tests run by a switch after it is turned on.

Private Device

A device that supports arbitrated loop protocol and can interpret 8-bit addresses, but cannot log into the fabric.

Private Loop

An arbitrated loop that does not include a participating FL_Port.

Private NL_Port

An NL_Port that communicates only with other private NL_Ports in the same loop and does not log into the fabric.

Protocol

A defined method and a set of standards for communication.

Public NL_Port

An NL_Port that logs into the fabric, can function within either a public or a private loop, and can communicate with either private or public NL_Ports.

Public Device

A device that can log into the fabric and support 20-bit addresses (or has 20-bit phantom addresses created for it by the switch).

Public Loop

An arbitrated loop that includes a participating FL_Port, and may contain both public and private NL_Ports.

QuickLoop

A feature that makes it possible to allow private devices within loops to communicate with public and private devices across the fabric through the creation of a larger loop.

May also refer to the arbitrated loop created using this software. A QuickLoop can contain a number of devices or looplets; all devices in the same QuickLoop share a single AL_PA space.

R_A_TOV

Resource Allocation Time-out Value; the maximum time a frame can be delayed in the fabric and still be delivered.

Route

As applies to a fabric, the communication path between two switches. May also apply to the specific path taken by an individual frame, from source to destination.

Routing

The assignment of frames to specific switch ports, according to frame destination.

RR_TOV

Resource Recovery Time-out Value; the minimum time a target device in a loop waits after a LIP before logging out a SCSI initiator.

RSCN

Registered State Change Notification; a switch function that allows notification of fabric changes to be sent from the switch to specified nodes.

RX_ID

Responder Exchange Identifier. A 2-byte field in the frame header used by the responder of the Exchange to identify frames as being part of a particular exchange.

SAN

Storage Area Network; a network of systems and storage devices that communicate using Fibre Channel protocols. See also *Fabric*.

Sequence

A group of related frames transmitted in the same direction between two N_Ports.

Service Rate

The rate at which an entity can service requests.

Single Mode

The fiber optic cabling standard that corresponds to distances of up to 10 km between devices.

SNMP

Simple Network Management Protocol. An internet management protocol that uses either IP for network-level functions and UDP for transport-level functions, or TCP/IP for both. Can be made available over other protocols, such as UDP/IP, because it does not rely on the underlying communication protocols.

Switch Name

The arbitrary name assigned to a switch.

Switch Port

A port on a switch. Switch ports can be E_Ports, F_Ports, or FL_Ports.

Switch

Hardware that routes frames according to Fibre Channel protocol and is controlled by software.

Target

A storage device on a Fibre Channel network.

Tenancy

The time from when a port wins arbitration in a loop until the same port returns to the monitoring state. Also referred to as loop tenancy.

Throughput

The rate of data flow achieved within a cable, link, or system. Usually measured in bps (bits per second).

Topology

As applies to Fibre Channel, the configuration of the Fibre Channel network and the resulting communication paths allowed. There are three possible topologies:

- Point to point - A direct link between two communication ports.
- Switched fabric - Multiple N_Ports linked to a switch by F_Ports.
- Arbitrated loop - Multiple NL_Ports connected in a loop.

Transfer State

The state in which a port can establish circuits with multiple ports without reentering the arbitration cycle for each circuit. This state can only be accessed by an L_Port in the Open state.

Translative Mode

A mode in which private devices can communicate with public devices across the fabric.

Transmission Character

A 10-bit character encoded according to the rules of the 8B/10B algorithm.

Transmission Word

A group of four transmission characters.

Trap (SNMP)

The message sent by an SNMP agent to inform the SNMP management station of a critical error.

Tunneling

A technique for enabling two networks to communicate when the source and destination hosts are both on the same type of network, but are connected by a different type of network.

U_Port

Universal Port; a switch port that can operate as a G_Port, E_Port, F_Port, or FL_Port. A port is defined as a U_Port when it is not connected or has not yet assumed a specific function in the fabric.

UDP

User Datagram Protocol; a protocol that runs on top of IP and provides port multiplexing for upper-level protocols.

ULP_TOV

Upper-level Time-out Value; the minimum time that a SCSI ULP process waits for SCSI status before initiating ULP recovery.

ULP

Upper-level Protocol; the protocol that runs on top of Fibre Channel. Typical upper-level protocols are SCSI, IP, HIPPI, and IPI.

Well-known Address

As pertaining to Fibre Channel, a logical address defined by the Fibre Channel standards as assigned to a specific function, and stored on the switch.

Workstation

A computer used to access and manage the fabric. May also be referred to as a management station or host.

WWN

Worldwide Name; an identifier that is unique worldwide. Each entity in a fabric has a separate WWN.

Xmitted Close State

The state in which an L_Port cannot send messages, but can retransmit messages within the loop. A port in the XMITTED CLOSE state cannot attempt to arbitrate.

Zone Configuration

A specified set of zones. Enabling a configuration enables all zones in that configuration.

Zone

A set of devices and hosts attached to the same fabric and configured as being in the same zone. Devices and hosts within the same zone have access permission to others in the zone, but are not visible to any outside the zone.

Zoning

A feature that runs on Fabric OS and allows partitioning of the fabric into logical groupings of devices. Devices in a zone can only access and be accessed by devices in the same zone.

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