IBM System Storage SAN64B-2

Installation, Service, and User's Guide

Service information: 2005 / B64

Read Before Using

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GC26-7899-00

IBM System Storage SAN64B-2

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Note:
Before using this information and the product it supports, read the information in "Notices" on page 59.

First Edition (May 2006)

Order publications through your IBM representative or the IBM branch office serving your locality.

Read this first

Getting help

For the latest version of your product documentation, visit the web at http://www.elink.ibmlink.ibm.com/public/applications/publications/cgibin/pbi.cgi. Search by form number or title.

For more information about IBM® SAN products, see the following Web site: http://www.ibm.com/servers/storage/san/

For support information for this product and other SAN products, see the following Web site: http://www.ibm.com/servers/storage/support/san

You can also contact IBM within the United States at 1-800-IBMSERV (1-800-426-7378). For support outside the United States, you can find the service number at: http://www.ibm.com/planetwide/.

Visit www.ibm.com/contact for the contact information for your country or region.

For detailed information about the Fibre Channel standards, see the Fibre Channel Industry Association (FCIA) Web site at: www.fibrechannel.org/

For information about storage industry standards, see the Storage Networking Industry Association (SNIA) Web site at: http://www.snia.org/

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Contents

Figures

Tables

Safety and environmental notices

This section contains information about:

- “Safety notices and labels”
- “Rack safety” on page xvii
- “Environmental notices” on page xix

Safety notices and labels

When using this product, observe the danger, caution, and attention notices contained in this guide. The notices are accompanied by symbols that represent the severity of the safety condition. The danger and caution notices are listed in numerical order based on their IDs, which are displayed in parentheses, for example (D004), at the end of each notice. Use this ID to locate the translation of these danger and caution notices in the *IBM eServer™ Safety Notices* (G229–9054) publication, which is on the CD-ROM that accompanies this product.

The following sections define each type of safety notice and provide examples.

The following types of notices and statements are used in IBM documents. They are listed below in order of increasing severity of potential hazards. Follow the links for more detailed descriptions and examples of the danger, caution, and attention notices in the sections that follow.

- **Note:** These notices provide important tips, guidance, or advice.
- **“Attention notices” on page xvi:** These notices indicate potential damage to programs, devices, or data.
- **“Caution notices” on page xv:** These statements indicate situations that can be potentially hazardous to you.
- **“Danger notices”:** These statements indicate situations that can be potentially lethal or extremely hazardous to you. Safety labels are also attached directly to products to warn of these situations.
- In addition to these notices, “Labels” on page xv may be attached to the product to warn of potential hazards.

Danger notices

A danger notice calls attention to a situation that is potentially lethal or extremely hazardous to people. A lightning bolt symbol accompanies a danger notice to represent a dangerous electrical condition. A sample danger notice follows.

DANGER

An electrical outlet that is not correctly wired could place hazardous voltage on metal parts of the system or the devices that attach to the system. It is the responsibility of the customer to ensure that the outlet is correctly wired and grounded to prevent an electrical shock. (D004)

A comprehensive danger notice provides instructions on how to avoid shock hazards when servicing equipment. Unless instructed otherwise, follow the procedures in the following danger notice.

DANGER

Electrical voltage and current from power, telephone, and communication cables are hazardous.

To avoid a shock hazard:

- **Do not connect or disconnect any cables or perform installation, maintenance, or reconfiguration of this product during an electrical storm.**
- **Connect all power cords to a properly wired and grounded electrical outlet. Ensure outlet supplies proper voltage and phase rotation according to the system rating plate.**
- **Connect any equipment that will be attached to this product to properly wired outlets.**
- **When possible, use one hand only to connect or disconnect signal cables.**
- **Never turn on any equipment when there is evidence of fire, water, or structural damage.**
- **Disconnect the attached power cords, telecommunications systems, networks, and modems before you open the device covers, unless instructed otherwise in the installation and configuration procedures.**
- **Connect and disconnect cables as described below when installing, moving, or opening covers on this product or attached devices.**

To Disconnect:

1. **Turn everything OFF (unless instructed otherwise).**
2. **Remove power cords from the outlet.**
3. **Remove signal cables from connectors.**
4. **Remove all cables from devices.**

To Connect:

1. **Turn everything OFF (unless instructed otherwise).**
2. **Attach all cables to devices.**
3. **Attach signal cables to connectors.**
4. **Attach power cords to outlet.**
5. **Turn device ON.**

(D005)

Labels

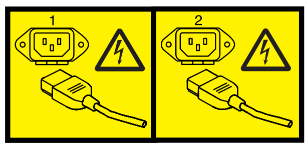
As an added precaution, safety labels are often installed directly on products or product components to warn of potential hazards.

The actual product safety labels may differ from these sample safety labels:

DANGER

Hazardous voltage, current, or energy levels are present inside any component that has this label attached. (L001)

Do not service, there are no serviceable parts.



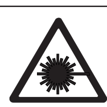
DANGER

Multiple power cords (L003)

To remove all power to the device, disconnect all power cords.

Caution notices

A caution notice calls attention to a situation that is potentially hazardous to people because of some existing condition. A caution notice can be accompanied by different symbols, as in the examples below:

If the symbol is...	It means....
	A hazardous electrical condition with less severity than electrical danger.
	A generally hazardous condition not represented by other safety symbols.
	A specification of product weight that requires safe lifting practices. The weight range of the product is listed below the graphic, and the wording of the caution varies, depending on the weight of the device.
	A potential hazard of pinching the hand or other body parts between parts.
	A hazardous condition due to moving parts nearby.
 Class I	A hazardous condition due to the use of a laser in the product. Laser symbols are always accompanied by the classification of the laser as defined by the U. S. Department of Health and Human Services (for example, Class I, Class II, and so forth).

Read and comply with the following caution notices before installing or servicing this device.

CAUTION:
This product is equipped with a 3–wire (two conductors and ground) power cable and plug. Use this power cable with a properly grounded electrical outlet to avoid electrical shock. (C018)

CAUTION:
Data processing environments can contain equipment transmitting on system links with laser modules that operate at greater than Class 1 power levels. For this reason, never look into the end of an optical fiber cable or open receptacle. (C027)

Attention notices

An attention notice indicates the possibility of damage to a program, device, or system, or to data. An exclamation point symbol may accompany an attention notice, but is not required. A sample attention notice follows:

Attention: Do not bend a fibre cable to a radius less than 5 cm (2 in.); you can damage the cable. Tie wraps are not recommended for optical cables because they can be easily overtightened, causing damage to the cable.

Rack safety

Rack installation

DANGER

- **Always lower the leveling pads on the rack cabinet.**
- **Always install stabilizer brackets on the rack cabinet.**
- **To avoid hazardous conditions due to uneven mechanical loading, always install the heaviest devices in the bottom of the rack cabinet. Always install servers and optional devices starting from the bottom of the rack cabinets.**
- **Rack-mounted devices are not to be used as a shelf or work space. Do not place any object on top of rack-mounted devices.**
- **Each rack cabinet might have more than one power cord. Be sure to disconnect all power cords in the rack cabinet before servicing any device in the rack cabinet.**
- **Connect all devices installed in a rack cabinet to power devices installed in the same rack cabinet. Do not plug a power cord from a device installed in one rack cabinet into a power device installed in a different rack cabinet.**

CAUTION:

- **Do not install a unit in a rack where the internal rack ambient temperatures will exceed the manufacturer's recommended ambient temperature for all your rack-mounted devices.**
- **Do not install a unit in a rack where the air flow is compromised. Ensure that air flow is not blocked or reduced on any side, front, or back of a unit used for air flow through the unit.**
- **Consideration should be given to the connection of the equipment to the supply circuit so that overloading of the circuits does not compromise the supply wiring or overcurrent protection.**
- **To provide the correct power connection to a rack, refer to the rating labels located on the equipment in the rack to determine the total power requirement of the supply circuit.**
- *(For sliding drawers.)* **Do not pull out or install any drawer or feature if the rack stabilizer brackets are not attached to the rack. Do not pull out more than one drawer at a time. The rack may become unstable if you pull out more than one drawer at a time.**
- *(For fixed drawers.)* **This drawer is a fixed drawer and should not be moved for servicing unless specified by manufacturer. Attempting to move the drawer partially or completely out of the rack may cause the rack to become unstable or cause the drawer to fall out of the rack.**

(R001)

Rack relocation (19″ rack)

CAUTION:
Removing components from the upper positions in the rack cabinet improves rack stability during relocation. Follow these general guidelines whenever you relocate a populated rack cabinet within a room or building:

- **Reduce the weight of the rack cabinet by removing equipment starting at the top of the rack cabinet. When possible, restore the rack cabinet to the configuration of the rack cabinet as you received it. If this configuration is not known, you must do the following:**
  - **Remove all devices in the 32U position and above.**
  - **Ensure that the heaviest devices are installed in the bottom of the rack cabinet.**
  - **Ensure that there are no empty U-levels between devices installed in the rack cabinet below the 32U level.**
  - **If the rack cabinet you are relocating is part of a suite of rack cabinets, detach the rack cabinet from the suite.**
  - **Inspect the route that you plan to take when moving the rack to eliminate potential hazards.**
  - **Verify that the route that you choose can support the weight of the loaded rack cabinet. Refer to the documentation that came with your rack cabinet for the weight of a loaded rack cabinet.**
  - **Verify that all door openings are at least 760 x 2030 mm (30 x 80 in.).**
  - **Ensure that all devices, shelves, drawers, doors, and cables are secure.**
  - **Ensure that the four leveling pads are raised to their highest position.**
  - **Ensure that there is no stabilizer bracket installed on the rack cabinet during movement.**
  - **Do not use a ramp inclined at more than ten degrees.**
  - **Once the rack cabinet is in the new location, do the following:**
    - **Lower the four leveling pads.**
    - **Install stabilizer brackets on the rack cabinet.**
    - **If you removed any devices from the rack cabinet, repopulate the rack cabinet from the lowest position to the highest position.**
  - **If a long distance relocation is required, restore the rack cabinet to the configuration of the rack cabinet as you received it. Pack the rack cabinet in the original packaging material, or equivalent. Also, lower the leveling pads to raise the casters off of the pallet and bolt the rack cabinet to the pallet.**

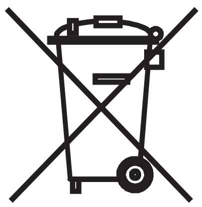
(R002)

Environmental notices

Use the environmental statements and warning in this section to guide you when using this product and in properly disposing of the product and its components.

Product recycling and disposal

This unit must be recycled or discarded according to applicable local and national regulations. IBM encourages owners of information technology (IT) equipment to responsibly recycle their equipment when it is no longer needed. IBM offers a variety of product return programs and services in several countries to assist equipment owners in recycling their IT products. Information on IBM product recycling offerings can be found on IBM's Internet site at http://www.ibm.com/ibm/environment/products/prp.shtml



Note: This mark applies only to countries within the European Union (EU) and Norway.

Appliances are labeled in accordance with European Directive 2002/96/EC concerning waste electrical and electronic equipment (WEEE). The Directive determines the framework for the return and recycling of used appliances as applicable throughout the European Union. This label is applied to various products to indicate that the product is not to be thrown away, but rather reclaimed upon end of life per this Directive.

注意: このマークは EU 諸国およびノルウェーにおいてのみ適用されます。

この機器には、EU 諸国に対する廃電気電子機器指令 2002/96/EC(WEEE) のラベルが貼られています。この指令は、EU 諸国に適用する使用済み機器の回収とリサイクルの骨子を定めています。このラベルは、使用済みになった時に指令に従って適正な処理をする必要があることを知らせるために種々の製品に貼られています。

Remarque : Cette marque s'applique uniquement aux pays de l'Union Européenne et à la Norvège.

L'étiquette du système respecte la Directive européenne 2002/96/EC en matière de Déchets des Equipements Electriques et Electroniques (DEEE), qui détermine les dispositions de retour et de recyclage applicables aux systèmes utilisés à travers l'Union européenne. Conformément à la directive, ladite étiquette précise que le produit sur lequel elle est apposée ne doit pas être jeté mais être récupéré en fin de vie.

In accordance with the European WEEE Directive, electrical and electronic equipment (EEE) is to be collected separately and to be reused, recycled, or recovered at end of life. Users of EEE with the WEEE marking per Annex IV of the WEEE Directive, as shown above, must not dispose of end of life EEE as unsorted municipal waste, but use the collection framework available to customers for the return, recycling and recovery of WEEE. Customer participation is important to minimize any potential effects of EEE on the environment and human health due to the potential presence of hazardous substances in EEE. For proper collection and treatment, contact your local IBM representative.

Battery return program

This product may contain sealed lead acid, nickel cadmium, nickel metal hydride, lithium, or lithium ion battery. Consult your user manual or service manual for specific battery information. The battery must be recycled or disposed of properly. Recycling facilities may not be available in your area. For information on disposal of batteries outside the United States, go to http://www.ibm.com/ibm/environment/products/batteryrecycle.shtml or contact your local waste disposal facility.

In the United States, IBM has established a return process for reuse, recycling, or proper disposal of used IBM sealed lead acid, nickel cadmium, nickel metal hydride, and other battery packs from IBM equipment. For information on proper disposal of these batteries, contact IBM at 1-800-426-4333. Please have the IBM part number listed on the battery available prior to your call.

For Taiwan:

廢電池請回收

Cable warning

WARNING: Handling the cord on this product or cords associated with accessories sold with this product, will expose you to lead, a chemical known to the State of California to cause cancer and birth defects or other reproductive harm. *Wash hands after handling*

About this document

This document describes how to install, service, and use the IBM System Storage™ SAN64B-2 SAN switch. Throughout this document, the product is referred to as the SAN64B-2, or simply the *switch*.

The sections that follow provide information about:

- "Who should read this document"
- "Product documents"
- "Brocade documents"
- "Getting help" on page iii
- "How to send your comments" on page iii

Who should read this document

This document is intended for clients and service personnel who are responsible for installing, servicing, and using the switch.

Product documents

The following documents contain information related to this product:

- *IBM System Storage SAN64B-2 Installation, Service, and User's Guide*, GC26-7899-00 (this document)
- *IBM eServer Safety Notices*, G229–9054
- *IBM System Storage SAN b-type 2005 Statement of Limited Warranty*, GC26-7754

Brocade documents

IBM b-type switches use software licensed from Brocade Communications Systems, Inc. You can find information related to the software that supports the director in the following documents on the CD-ROM supplied with this product:

Brocade Fabric OS

- *Brocade Fabric OS Administrator's Guide*
- *Brocade Fabric OS Command Reference Manual*
- *Brocade Fabric OS MIB Reference Manual*
- *Brocade Fabric OS System Error Message Reference Manual*

Brocade Fabric OS optional features

- *Brocade Fabric Watch Administrator's Guide*
- *Brocade Secure Fabric OS User's Guide*
- *Brocade Web Tools Administrator's Guide*
- *Brocade Secure Fabric OS Administrator's Guide*

IBM and Brocade product matrix

When you use any of the Brocade documents, you will notice that the model numbers reflect the original Brocade switches. Table 1 on page xxii provides a product matrix for you to use to correlate the Brocade model numbers to the IBM product names and machine types and model numbers. Note that a number of these products are no longer marketed by IBM or Brocade.

Table 1. Brocade and IBM product and model number matrix

Brocade product name	IBM product name	IBM machine type and model number
SilkWorm AP7420	SAN16B-R multiprotocol router	2109 Model A16
SilkWorm 200E	SAN16B-2	2005 Models B16 and 16B
SilkWorm 3250	SAN Switch H08	2005 Model H08
SilkWorm 3800	SAN Switch F16	2109 Model F16
SilkWorm 3850	SAN Switch H16	2005 Model H16
SilkWorm 3900	SAN Switch F32	2109 Model F32
SilkWorm 4100	SAN32B-2	2005 Models B32 and 32B
SilkWorm 4900	SAN64B-2	2005 Model B64
SilkWorm 7500	SAN18B-R	2005 Model R18
SilkWorm 12000	SAN Switch M12	2109 Model M12
SilkWorm 24000	SAN Switch M14	2109 Model M14
SilkWorm 48000	SAN256B Director	2109 Model M48

Chapter 1. Introducing the SAN64B-2 switch

The IBM System Storage SAN64B-2 switch introduces 4 gigabit throughput capability to mid-range and enterprise storage area networks (SANs), providing improved performance to support storage networking demands with higher throughput and enhanced port density. The switch is a 2U Fibre Channel switch with 64 fixed Fibre Channel SFP ports that supports link speeds up to 1, 2, or 4 Gbit/sec. Its high availability features include two hot-pluggable redundant power supplies and three redundant hot-pluggable fan units. The power supplies and fan assemblies are customer replaceable units (CRUs). This switch includes Fabric OS and features full forward- and backward-compatibility with all IBM System Storage and System Storage SAN switch models. The switch can operate in a fabric containing multiple switches, or operate independently. The base functionality includes Web Tools, Advanced Zoning, and Fabric Watch.

This chapter provides the following information:

- "Features and functions of the switch"
- "Switch characteristics" on page 2
- "Supported (optional) features" on page 5

Features and functions of the switch

The switch provides the following features and functions:

- 4 gigabit per second port-to-port throughput with auto-sensing capability for connecting to existing 1, 2, and 4 gigabit host servers, storage, and switches
- 2U form factor for enhanced port density and space utilization
- High availability features:
  - 3 hot-pluggable redundant fans
  - 2 hot-pluggable redundant power supplies
  - automatic path routing
- Scalability from mid-range to very large enterprise SAN fabric environments
- 64 non-blocking ports with full duplex throughput at 1, 2, or 4 gigabit(s) per second link speeds
- Support for 2– and 4–gigabit short wave and long wave small form-factor pluggable (SFP) optical transceivers
- Open Fibre Channel Protocol (FCP) support
- One RS–232 serial port (DB–9 connector)
- One 10/100 MB/sec Ethernet port with an RJ–45 connector
- Light-emitting diodes (LEDs) that indicate:
  - Power status
  - System status
  - Ethernet status
  - Ethernet speed
  - Port status and port speed for each port
  - Power supply status for each power supply
  - Fan status for each fan
- Web browser interface compatible with any Java-enabled browser provides configuration monitoring and diagnostics using the Internet or intranet

- Ports scalable by default from numbers 0 through 64, with 0 through 31 enabled. Additional port activation can be purchased in increments of 16 ports.
- Auto Fabric discovery allows external host and storage systems to discover other supported SAN-enabled systems that are connected to the fabric
- Base features include: Advanced Zoning, Web Tools, Full Fabric, and Fabric Watch
- Optional features include: Additional Port Activation, Advanced Security, Extended Fabrics, Remote Switch, enhanced Inter-Switch Link (ISL) Trunking, and Performance Monitoring

Switch characteristics

The following sections describe the physical characteristics of the switch.

Port side of the switch

Figure 1 on page 3 shows the port side of the switch. The serial port, Ethernet port, and the Fibre Channel ports are all located on this side of the switch. All LEDs except the fan and power supply LEDs are also located on the port side of the switch. These LEDs display the system status, power status, port status, and port speed. See "Interpreting LED activity" on page 27 for a complete description of the locations and interpretations of these LEDs. The switch ID pull-out tab is also located on the port side of the switch, directly below the serial and Ethernet ports. The switch serial number and corresponding bar code are attached to this tab.

The switch enclosure has forced-air cooling, with the fans pushing the air from the non-port side of the chassis through the enclosure, and exhausting through the holes on the port side.

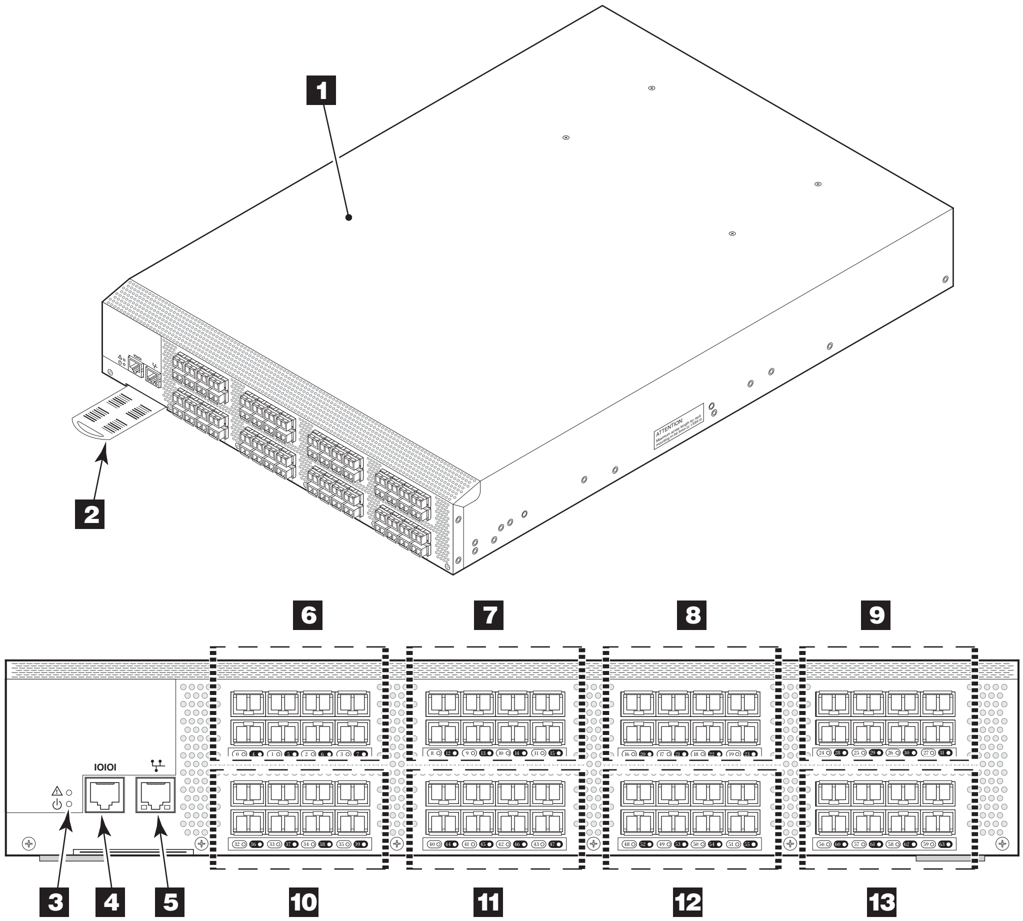


Figure 1. Port side of the switch

1	SAN64B-2	6	FC ports 0-7	10	FC ports 32-39
2	Switch ID pull-out tab	7	FC ports 8-15	11	FC ports 40-47
3	System Status LED (top) System Power LED (bottom)	8	FC ports 16-23	12	FC ports 48-55
4	Console port	9	FC ports 24-31	13	FC ports 56-63
5	Ethernet port				

The Fibre Channel ports are numbered from left to right, in eight-port groups (see Figure 1), and are also numbered on the faceplate between the Fibre Channel port status and port speed LEDs, in the pattern shown in Figure 2.

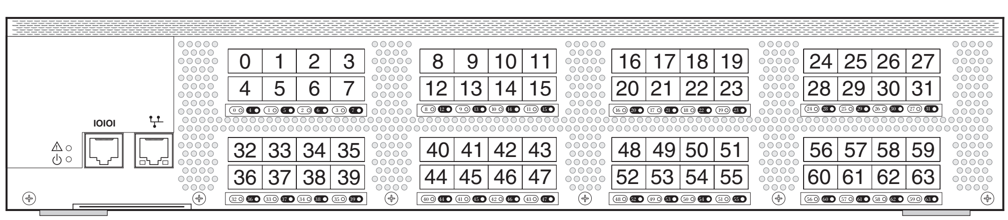


Figure 2. Fibre Channel port numbering in the switch

Note: ISL Trunking is optional software that allows you to create trunking groups of ISLs between adjacent switches. For more information about trunking, refer to the *Brocade Fabric OS Features Guide*.

Nonport side of the switch

The nonport side of the switch (see Figure 3) contains the two redundant, hot-pluggable power supplies. Each power supply has a built-in fan for cooling. The switch also has three redundant, hot-pluggable fan assemblies for cooling the entire switch. These fans have two speeds, which are set automatically and cannot be modified. They default to high speed upon boot, then switch to low speed as Fabric OS comes online, returning to high speed only as required.

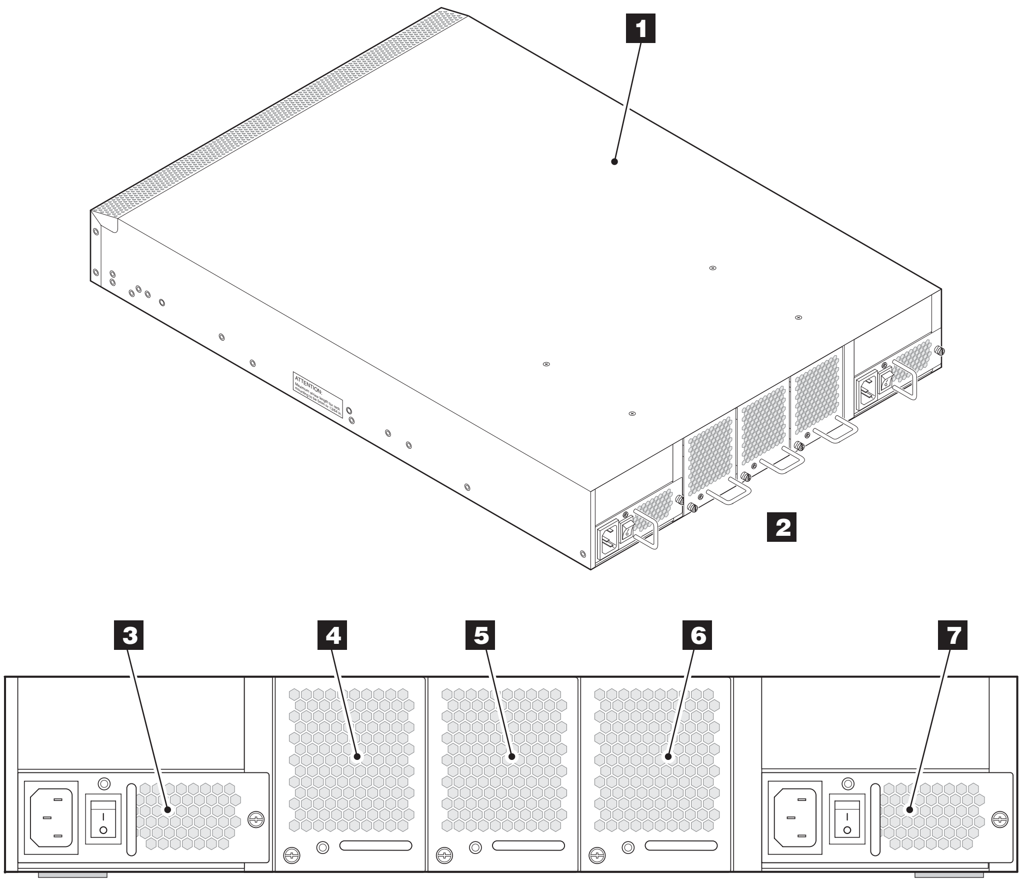


Figure 3. Nonport side of the switch

- **1** SAN64B-2
- **2** Nonport side of switch
- **3** Power supply 2
- **4** Fan assembly 3
- **5** Fan assembly 2
- **6** Fan assembly 1
- **7** Power supply 1

Supported (optional) features

The switch supports the following optional software, which can be activated with the purchase of the corresponding license key.

- “Additional Port Activation”
- “Remote Switch Activation”
- “Extended Fabric Activation”
- “Advanced Security Activation”
- “Performance Bundle (Performance Monitoring and ISL Trunking)”

Additional Port Activation

The base switch model provides the first thirty-two ports enabled. Additional Port Activation enables an upgrade to 48 and/or 64 ports. Customers can optionally purchase port activation in sixteen port increments, providing forty-eight or sixty-four active ports. Port activation features do not include fiber optic transceivers. Enabling ports on the switch is nondisruptive. For detailed information on enabling additional ports, see the *Brocade Fabric OS Administrator’s Guide*.

Remote Switch Activation

Remote Switch Activation extends the distance of SAN fabric by enabling two Fibre Channel switches to interconnect with a pair of CNT’s Open System Gateways across an asynchronous transfer mode (ATM) WAN.

Extended Fabric Activation

Extended Fabric Activation extends SAN fabrics beyond the Fibre Channel standard 10 km by optimizing the internal switch buffers to maintain performance on ISL at distances up to 70 kilometers.

Advanced Security Activation

Advanced Security Activation is designed to enable policy-based security mechanisms integrated within Fabric Operating System Versions 2.6, 3.1, and 4.1. To enable advanced security capabilities, all switches within the IBM SAN Switches Fabric must be configured with their respective Fabric OS version (2.6, 3.1, and 4.1) before activating the Advanced Security feature license key. When activated across the IBM SAN Switch Fabric, the Advanced Security Activation feature offers the following comprehensive security capabilities:

- Centralized security management (trusted switches)
- Fabric-wide security policies to control access
- Port-level access control
- Switch-level access control
- Management access controls (Telnet, SNMP, HTTP, API)
- Encryption of management data such as passwords
- Strong and non-reputable authentication between switches

Performance Bundle (Performance Monitoring and ISL Trunking)

Performance Bundle Activation adds support for ISL-Trunking with up to four links and up to eight Gbps bandwidth; and performance monitoring tools for measuring end-to-end activities.

Trunking Groups and ASIC Groups

The switch provides 8-port trunk groups. The trunking octet groups are in the following ranges: 0-7, 8-15, 16-23, 24-31, 32-39, 40-47, 48-55, and 56-63.

There are 16 user ports per ASIC on the switch. They are divided as follows: port numbers 0-15, 16-31, 32-47, and 48-63. The distinction between trunk groups and ASIC groups is important for Trunking over long distance, where the ASIC restrictions determine the number of and length of the long distance links.

Trunking over long distances

Table 2 summarizes the trunking over long distances available on the switch.

Table 2. Trunking over long distances

Distance	**Number of 2G ports** **Number of Trunked Ports**	**Number of 4G ports** **Number of Trunked Ports**
LE - 10 km	64 eight 8-port trunks	64 eight 8-port trunks
L0.5 - 25 km	64 eight 8-port trunks	48 one 8-port trunk per ASIC one 4-port trunk per ASIC
L1 - 50 km	48 one 8-port trunk per ASIC one 4-port trunk per ASIC	20 one 5-port trunk per ASIC
L2 - 100 km	20 one 5-port trunk per ASIC	8 one 2-port trunk per Condor ASIC
LD – 200 km	8 one 2-port trunk per ASIC	0
LD - 250 km	8 one 2-port trunk per ASIC	0
LD - 500 km	0	0

Maximum number of long distance ports

Table 3 lists the maximum number of long distance ports for the switch. There are 16 ports per ASIC on the switch. They are divided as follows: port numbers 0-15, 16-31, 32-47, and 48-63.

Table 3. Maximum number of long distance ports

Speed and distance	**Maximum number of long distance ports** **ASIC restrictions**
1G-100 km ports	48 12 per ASIC
1G-250 km ports	16 4 per ASIC
1G-500 km ports	8 2 per ASIC
2G-100 km ports	20 5 per ASIC
2G-250 km ports	8 2 per ASIC

Table 3. Maximum number of long distance ports (continued)

Speed and distance	Maximum number of long distance ports ASIC restrictions
4G-125 km ports	8 2 per ASIC

Chapter 2. Installing and configuring the switch

Attention: Due to the acoustic characteristics of this product, it should be installed in a location that is generally unattended.

You can install the switch in either of two ways:

- As a stand-alone unit on a flat surface
- In an Electronic Industries Association (EIA) cabinet using a slide-rail rack mount kit, which is provided with the switch. When you mount the switch into a slide-rail rack, you can mount the chassis to slide from either the port side or the non-port side.

This chapter provides the following information:

Items included with the switch

The following items are included with the standard shipment of the switch . When you open the packaging, verify that these items are included in the package and that no damage occurred during shipping.

- One SAN64B-2 switch, composed of:
  - One cabinet-mountable 2U chassis designed to be mounted in a 19 in. rack, with forced-air cooling that flows from the non-port side of the switch to the port side
  - 64 Fibre Channel ports, compatible with small form factor pluggable (SFP) transceivers, short wavelength (SWL), long wavelength (LWL) and extended long wavelength (ELWL) SFP transceivers.
  - One IEEE-compliant RJ–45 connector for use with 10/100 Mbps Ethernet for switch management
  - LEDs as described in “Interpreting LED activity” on page 27
  - Two hot–pluggable power supplies
  - Three hot–pluggable fan assemblies containing two fans each.
- An accessory kit that contains the following items:
  - Two grounded 6 ft. (1.83 m.) power cords
  - One RJ-45 serial cable, 10 ft (approximately 3 m) long
  - One RJ-45 connector for serial port
  - One RJ-45 to DB9 adaptor
  - Rubber mounting feet, required for setting up the switch as a stand-alone unit
  - One slide-rail rack mount kit, with instructions
  - Up to 64 SFP transceivers
  - SAN64B-2 Installation, Service, and User’s Guide (this document).
  - IBM documentation CD

Installation and safety considerations

Use this section to prepare your site for a safe and successful installation.

Attention: Although the switch has been designed for customer installation and replacement procedures, you must first ensure that the rack into which the switch is to be installed is also customer accessible. If it is not, then only trained personnel can install and service these switches in such a rack.

Attention: Read the "Safety and environmental notices" on page xiii before attempting any installation or maintenance procedures.

Facility requirements

Attention: Due to the acoustic characteristics of this product, it should be installed in a location that is generally unattended.

To ensure correct operation of the switch, the facility where the switch is in use must meet the requirements listed in Table 4.

Table 4. Facility requirements

Type	Requirements
Thermal	• A minimum air flow of 79.8 cu m/hr (47 cu ft/min) available in the immediate vicinity • Ambient air temperature not exceeding 40°C (104°F) • Install the switch with the nonport side, which contains the air intake vents, facing the cool-air aisle.
Cabinet (when rack-mounted)	• A minimum of two EIA units high (8.6 cm or 3.4 in.), 42.8 cm (16.8 in.) wide and at least 61 cm (24 in.) 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-cabinet assembly. • Verify that the additional weight of the switch does not exceed the cabinet's weight limits or unbalance the cabinet in any way. • Cabinet must be secured to insure stability in case of unexpected movement, such as an earthquake

Electrical requirements

For successful installation and operation of the switch, ensure that the following electrical requirements are met.

- Primary ac input 100-240 V ac (the switch autosenses 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

See “Power supply specifications” on page 55 for details.

Environmental requirements and considerations

To ensure proper operation, the switch must not be subjected to environmental conditions beyond those for which it was tested. The ranges specified in Table 5 list the acceptable environment for both operating and non-operating conditions.

Table 5. Environmental requirements

Condition	Acceptable range during operation	Acceptable range during non-operation
Temperature	0° to + 40°C (32° to 104°F)	-25° to 70°C (-13° to 158°F)
Humidity	20% to 85% RH non-condensing, at 40°C (104°F), with maximum gradient of 10% per hour	10% to 85% RH non-condensing, at 70°C (158°F)
Altitude	0 to 3 km (10,000 ft) above sea level	0 to 12 km (40,000 ft) above sea level
Shock	20 G, 6 ms duration, half-sine wave	15 G, 12–18 ms duration, trapezoid
Vibration	0.5 G, 5–500 Hz	2.0 G, 5–500 Hz
Air flow	54.02 cubic meters per hour (42.5 cubic feet per minute)	None required

Installing a stand-alone switch

To install the switch as a stand-alone unit, use the following procedure:

1. Unpack the switch and verify that all items listed in “Items included with the switch” on page 9 are present and undamaged.
2. Clean the four corner depressions on the bottom of the switch enclosure, place an adhesive rubber foot in each one, and firmly press into place. Applying the rubber feet onto the switch helps prevent the switch from sliding off the supporting surface.
3. Place the switch on a flat, sturdy surface.
4. Provide power to the switch as described in “Powering up the switch and logging in” on page 19.

Attention: Do not connect the switch to the network until the IP address is correctly set. For instructions on how to cable and configure the switch, and how to set the IP address, see “Cabling and configuring the switch” on page 18.

Installing a switch into an EIA cabinet

Attention: Refer to "Rack safety" on page xvii for danger and caution notices related to rack and cabinet installations.

You can install the rack mount kit in either of two ways:

- To allow the port side of the switch to slide out of the exhaust-air side of the cabinet. In this installation, the port side of the switch is flush with the edge of the cabinet.
- To allow the non-port side of the switch to slide out the cool-air side of the cabinet. In this installation, the port side of the switch is set 3 in. (7.62 cm.) back from the edge of the cabinet, allowing a more gradual bend in the fiber optic cables.

Time required

Approximately 30 minutes

Items required

You need the following items to install the switch in a slide-rail rack:

- Straight slot screwdriver
- Rack space: 1.5 EIA units of rack space, 48.26 cm (19 in.) wide, and 60.96 cm (24 in.) deep
- Two power cables that are provided with the switch
- Two power outlets
- Rack mount kit

Attention: Use the exact screws specified in the procedure for use with the switch chassis. Using screws longer than 3/16 in. can damage the switch. The different types of screws are listed in Table 6 on page 13.

Note: Make sure that you tighten all screws used in this procedure.

Installation instructions

To install the switch in a slide-rail rack that meets EIA standards, use the following procedure.

Note: These procedures use parts that are included in the rack-mount kit. These parts are listed in Table 6 on page 13. The installation procedure cross-references the items in this table. Be sure to use the referenced parts when you perform each step.

Before you start the rack-mount installation process, locate the rack-mount slides and the mounting bracket that are provided in the shipping container.

Figure 4 on page 13 shows the rack assembly. The number keys, such as **1**, refer to the items listed in Table 6 on page 13.

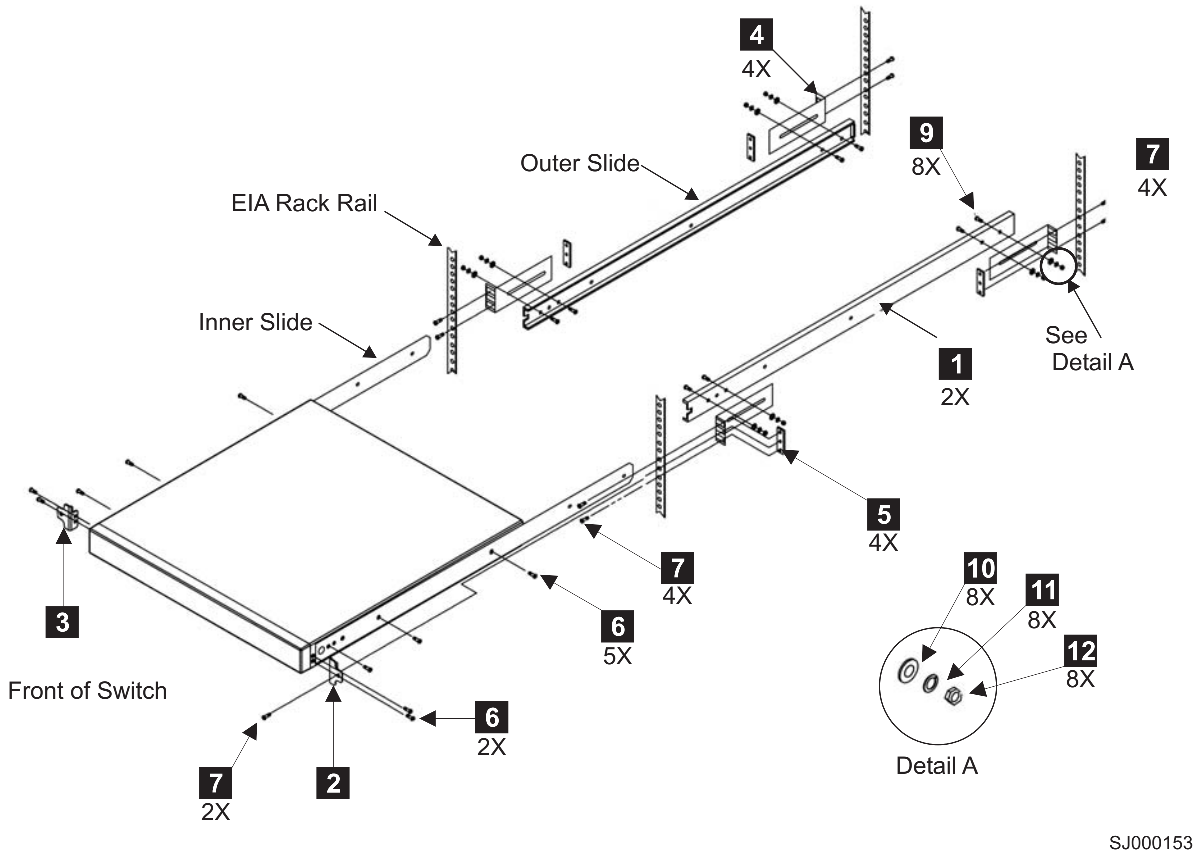


Figure 4. Rack assembly

1. Unpack the rack-mount kit and verify that all ordered items and parts are present and undamaged. See Table 6 for a list of parts and the quantities supplied.

Table 6. Parts supplied with the rack-mount kit

Item	Description	Quantity
1	Rack mount slide (inner and outer slide)	2
2	Right rack mount bracket (optional bracket for front of switch)	1
3	Left rack mount bracket (optional bracket for front of switch)	1
4	Rack mounting bracket (3-hole)	4
5	Nut clip, M5	11
6	Screw, 8-32 x 3/16 in., zinc	11
7	Screw, M5 x 12	11
8	Bracket to slide rack kit (contains items 9 - 12)	1
9	Screw, 8-32 x 3/8 in., zinc	5
10	Washer, flat, No. 8	5
11	Washer, lock, No. 8	5
12	Nut, hex, 8-32	5

2. Separate the inner and outer slides.
   a. Open one of the slides until the lock engages.
   b. Press the lock release lever (**1** in Figure 5) and remove the inner rail from the outer rail.

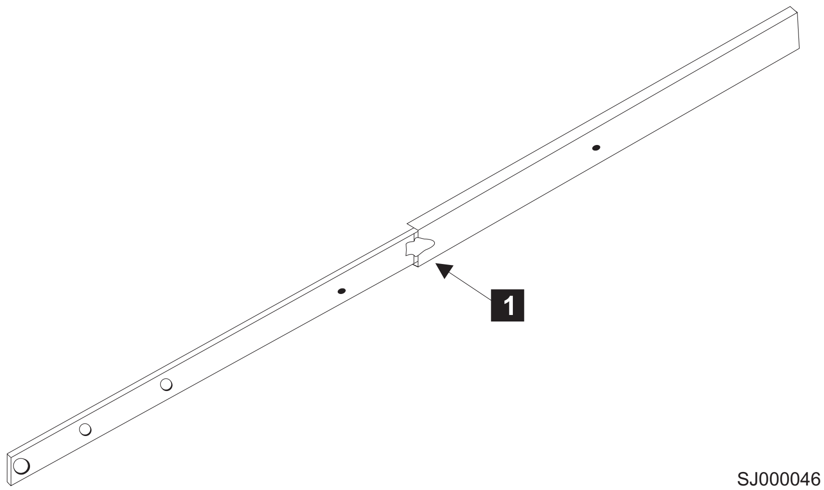


Figure 5. Separating the inner and outer rails.

   c. Repeat step 2a and step 2b for the other rail.

   Note: For racks with flush-mount doors, such as the 9306 Netfinity® racks, do not install the ears. Instead, use the rack-mount slides by attaching the switch to the set of mounting holes, which are offset 3 inches into the rack.

3. Install the inner (smaller) slide on the switch chassis, as Figure 4 on page 13 shows.

   Attention: If you use screws longer than 3/16 in., you can damage the switch.

   a. Position the flat side of the inner rail along one side of the switch. Align the holes in the rail with the threaded holes in the side of the switch chassis. The chamfered end of the inner rail should face toward the rear of the switch (away from the ports) as shown in Figure 6 on page 15.
   b. Attach the inner rail by using three of the 8-32 x 3/16 in. zinc screws (**6** in Table 6 on page 13).

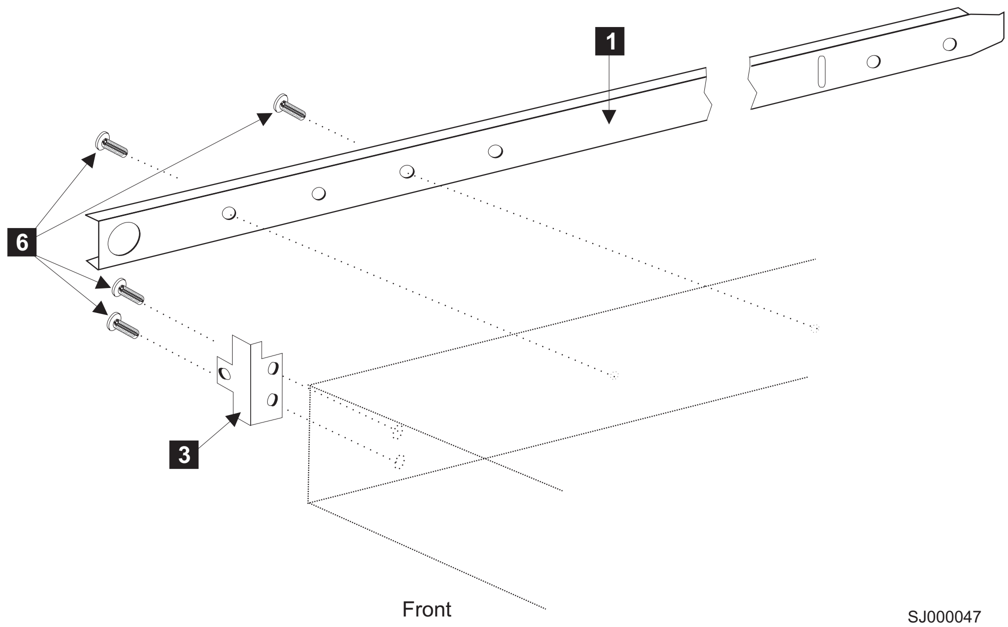


Figure 6. Mounting the moving portion of the slide and mounting brackets to the switch

   c. Repeat step 3a on page 14 and step 3b on page 14 for the second inner rail on the other side of the switch chassis.

4. Optional step: If desired, install the right rack mount bracket **2** (see Figure 4 on page 13) and the left rack mount bracket **3** on the switch chassis. Use these brackets to secure the switch to the rack as shown in Figure 6.

   Attention: Do not use screws longer than 3/16 in.; they can damage the switch.

   a. Position the left rack mount bracket at the left front corner of the switch chassis. Align the two holes in the bracket with the two threaded holes in the switch chassis.
   b. Attach the bracket by using two of the 8-32 x 3/16 in. zinc screws (see **6** in Figure 4 on page 13)
   c. Repeat step 4a and step 4b for the right rack mount bracket on the right front corner of the switch chassis.

5. Attach all four of the 3-hole rack mounting brackets **4** in Figure 7 on page 16.

   a. Position a 3-hole rack mounting bracket **4** at the end of one of the outer slides.
   b. Attach the bracket by using the 8-32 x 3/8 in. zinc screws **9**. Ensure that the screw heads are inside the slides.
   c. Place one each of the following items on the outer end of the screw in the order listed:
      1) Washer, flat No. 8 **10**
      2) Washer, lock No. 8 **11**
      3) Nut, hex, 8-32 **12**
   d. Repeat steps 5a through 5c for the three remaining rail ends.

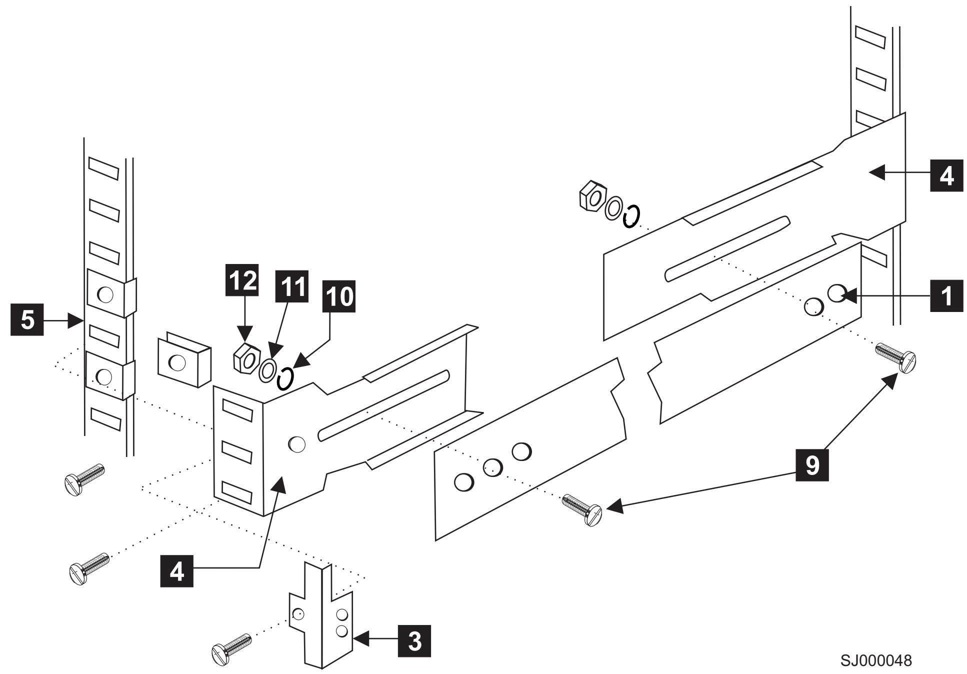
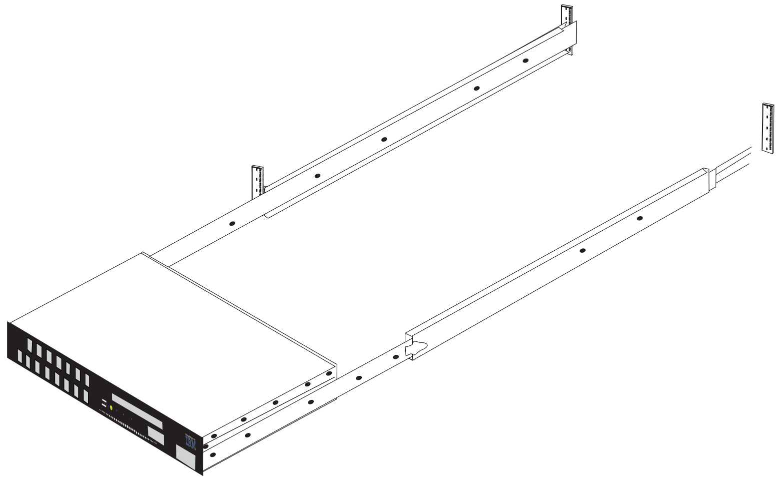


Figure 7. Mounting the fixed portion of the rail and the locking ears to the rack

6. Install the outer (larger) slides in the rack, as shown in Figure 7.
   a. At the desired height, install the five M5 nut clips **5**. Put three M5 nut clips in the front of the rack and two in the back. The middle clip in the front of the rack is for the locking ears.

      Note: Some rack mount kits might use 10-32 nut clips in place of the M5 nut clips for the locking ears.
   b. Attach the slides by using four M5 x 12 screws **7** (see Figure 4 on page 13).
   c. Repeat step 6a and step 6b for the other rail.
7. Install the switch in the rack.
   a. Position the switch in front of the rack. Insert the switch into the rack by sliding the inner slides that are mounted on the switch into the outer slides that are mounted on the rack. See Figure 8 on page 17.



SJ000049

Figure 8. Inserting slides into the rack rails

b. Check the alignment of the slides by sliding the switch in and out of the rack. Any difficulty moving the switch indicates lateral stress or misalignment. If this situation occurs, adjust the slide positions until the movement is smooth.

8. Optional step: If the right and left rack mount brackets are installed on the front corners of the switch, attach both brackets to the cabinet rack by using M5 x 12 screws **7**. See step 4 on page 15 and Figure 4 on page 13. The screws should pass through the front of each bracket and the slide rail.

   Note: Some rack mount kits might use 10-32 nut clips in place of the M5 nut clips for the locking ears.

9. Continue with initial setup of the switch by following the procedures in "Cabling and configuring the switch" on page 18.

DANGER

An electrical outlet that is not correctly wired could place hazardous voltage on metal parts of the system or the devices that attach to the system. It is the responsibility of the customer to ensure that the outlet is correctly wired and grounded to prevent an electrical shock. (D004)

Note: Do not connect the switch to the network until you perform one of the following steps:

- Set the internet protocol (IP) address.
- Verify that the default IP address does not conflict with the existing IP addresses in the same network.

Cabling and configuring the switch

You must configure the switch to ensure correct operation within a network and fabric. For instructions about how to configure the switch to operate in a fabric that contains switches from other vendors, refer to the *Brocade Fabric OS Procedures Guide*.

For more information about the commands used in this procedure, refer to the *Brocade Fabric OS Reference Manual*.

Recommendations for cable management

Attention: The minimum bend radius for a 50 micron cable is 51 mm (2 in.) under full tensile load and 30.5 mm (1.2 in.) with no tensile load. Because they are easily overtightened, tie wraps are not recommended for optical cables.

Cables can be organized and managed in a variety of ways: for example, using cable channels on the sides of the cabinet or patch panels to minimize cable management. A list of recommendations follows:

- Plan for rack space required for cable management before installing the switch.
- Leave at least 1 meter (3.28 ft) of slack for each port cable. This provides room to remove and replace the switch, allows for inadvertent movement of the rack, and helps prevent the cables from being bent to less than the minimum bend radius.
- If you are using Brocade ISL Trunking, consider grouping cables by trunking groups. The cables used in trunking groups must meet specific requirements, as described in the *Brocade Fabric OS Administrator's Guide*.
- For easier maintenance, label the fiber optic cables and record the devices to which they are connected.
- Keep LEDs visible by routing port cables and other cables away from the LEDs.
- Do not use tie wraps on fiber optic cables, because wraps are easily overtightened and can damage the optic fibers.

Items required for installation

The following items are required for configuring and connecting the switch for use in a network and fabric:

- SAN64B-2 switch installed and connected to a power source
- Workstation with an installed terminal emulator, such as HyperTerminal
- Available IP address and corresponding subnet mask and gateway address
- Serial cable (provided)
- Ethernet cable
- SFP transceivers and compatible fibre cables, as required
- Access to an FTP server for backing up the switch configuration (optional)

Configuring the switch

Follow the steps described in the next sections to configure your switch.

1. "Creating a serial connection" on page 19
2. "Powering up the switch and logging in" on page 19
3. "Setting the IP address" on page 20
4. "Creating an Ethernet connection and logging in" on page 20
5. "Modifying the domain ID (optional)" on page 20

6. “Installing the SFP transceivers” on page 21
7. “Connecting the cables” on page 21

Creating a serial connection

Before you can begin configuring the switch, you must create a connection by way of the serial port. To create a serial connection to the switch, perform the following steps:

1. Using the provided serial cable, connect an RJ-45 serial port on the workstation to the serial port on the switch.
2. Disable any serial communication programs running on the workstation.

   Note: If the serial port on the workstation is RS-232, use the adapter on the end of the serial cable and insert the RS-232 connector into the serial port on the workstation.
3. Open a terminal emulator application (such as HyperTerminal on a PC or TERM in a UNIX® environment) and configure the application as follows:
   - In a Windows® 2000, 2003, ME, or XP environment:

Bits per second	9600
Databits	8
Parity	None
Stop bits	1
Flow control	None
   - In a UNIX environment, type the following string at the prompt:

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

Powering up the switch and logging in

After you create the serial connection using the steps in “Creating a serial connection,” provide power to the switch by completing the steps below.

Note: Power is supplied to the switch as soon as the first power supply is connected and powered on, you should then see POST messages.

1. Connect the power cords to both power supplies and power sources.

   Attention: Ensure that the power cables are routed so that they are not pinched or exposed to stress when the switch is moved on the slide-rails. Ensure that the cords have a minimum service loop of six inches available at the connection to the switch.

   To protect against ac failure, connect the power cords to outlets on separate circuits.

   The power supply LED lights up green, and the switch begins running POST. The POST should complete and the switch will complete the boot process in about three minutes.

   Note: The status LEDs may display amber or flash during boot, POST or other diagnostic tests. This is normal and does not indicate a problem unless the LEDs do not indicate a healthy state after all boot processes and diagnostic tests are complete.
2. Flip the power supply switches to “I”)

   The power supply LEDs light up green, and the switch begins running POST. The switch requires a minimum of three minutes to boot and complete the POST process.

3. After POST is complete, verify that the System Status and Power Status LEDs are green (see “Interpreting LED activity” on page 27 for more details).
4. Using a serial connection, when the terminal emulator application stops reporting information, press **Enter** to display the login prompt.
5. Log in using the administrative account. The logon is `admin` and the default password is `password`. You can create up to two simultaneous admin sessions and four user sessions. For details, refer to the *Brocade Fabric OS Administrator’s Guide* and the *Brocade Fabric OS Command Reference Manual*.

Setting the IP address

Replace the default IP address and related information with the information provided by your network administrator. By default, the IP address is set to 10.77.77.77.

1. Type **ipAddrSet** at the terminal emulator application prompt, as shown in the following example:
2. Type the requested information as prompted. In this example, the items in **bold** are the new values that were entered.

Table 7. Example of changing an IP address

```
switch:admin> ipAddrSet
Ethernet IP Address [192.168.1.1]:10.32.53.47
Ethernet Subnetmask [255.255.255.0]: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>
```

3. Optionally, verify that the address was correctly set by entering the **ipAddrShow** command at the prompt.
4. Record the IP address on the pull-out tab below the serial and Ethernet ports on the port side of the switch.
5. If the serial port is no longer required, log out of the serial console, remove the serial cable, and replace the plug in the serial port.

Note: Any time the serial port is not in use, install the protective plug to keep foreign material out of the port.

Creating an Ethernet connection and logging in

Create an Ethernet connection to the switch by performing the following steps:

1. Connect an Ethernet cable to the Ethernet port and to the workstation or to an Ethernet network that contains the workstation. After this connection is made, the switch can be accessed remotely by command line or by using Advanced Web Tools. Ensure that the switch is not being modified from any other connections during the remaining steps.
2. Log in to the switch with Telnet using the admin account.

Modifying the domain ID (optional)

If desired, you can modify the domain ID. The default domain ID is domain 1. If the switch is not powered on until after it is connected to the fabric and the default domain ID is already in use, the domain ID for the new switch is automatically reset to a unique value. If the switch is connected to the fabric after it has been powered on and the default domain ID is already in use, the fabric will segment.

To find the domain IDs that are currently in use, run the **fabricShow** command on another switch in the fabric.

To modify the domain ID, perform the following steps:

1. Disable the switch by typing **switchDisable**.
2. Type **configure**. This prompts sequential displays; type a new value or press **Enter** to accept each default value.
3. At the Fabric Parameters prompt, type **y** and press **Enter**, as the following example shows:

   ```
   Fabric parameters (yes, y, no, n): [no] y
   ```
4. Enter a unique domain ID, such as the domain ID used by the previous switch, if still available, as the following example shows:

   ```
   Domain: (1..239) [1] 3
   ```
5. Complete the remaining prompts or press **Ctrl+D** to accept the remaining default settings without going through each prompt.
6. Re-enable the switch by entering the **switchEnable** command.
7. Optionally, specify any custom status policies:
   - Enter the **switchStatusPolicySet** command at the prompt. This command sets the policy parameters that determine the overall switch status.
   - Customize the status policies as desired. To deactivate the alarm for a condition, type **0** at the prompt for that condition.

Installing the SFP transceivers

If your switch came without SFP transceivers installed, or if the transceivers have been removed, use the following procedure to install them into the Fibre Channel ports. See “Installing an SFP” on page 38 for more detailed instructions.

The ports selected for use in trunking groups must meet specific requirements. For a list of these requirements, refer to the *Brocade Fabric OS Administrator’s Guide*.

To install SFP transceivers, perform the following steps:

1. Remove the protective plugs from the ports to be used.
2. Position a transceiver so that it is oriented correctly and insert it into a port until the latching mechanism clicks. The transceivers are keyed to ensure correct orientation. If a transceiver does not install easily, ensure that it is correctly oriented.
3. Repeat for the remaining ports, as required.

Connecting the cables

See “Installing fiber-optic cables” on page 40 for more detailed instructions with illustrations.

Attention: The minimum bend radius for a 50-micron cable is 2 inches under full tensile load, and 1.2 inches with no tensile load. Because they are easily overtightened, tie wraps are not recommended for optical cables.

Connect the cables to the transceivers:

1. Remove the plugs from the end of the cable and from the SFP.
2. The cable connectors are keyed to ensure correct orientation. Orient a cable connector so that the key (ridge on one side of connector) aligns with the slot in the transceiver and insert cable into transceiver until latching mechanism clicks.

If a cable does not install easily, ensure it is correctly oriented. For instructions specific to cable type, refer to the cable manufacturer's documentation.

3. Repeat for the remaining cables and transceivers, as required.

The cables used in trunking groups must meet specific requirements. For a list of these requirements, refer to the *Brocade Fabric OS Administrator's Guide*.

Verifying the configuration

After you complete the configuration, use the LEDs and commands to verify that the configuration has been accepted:

1. Check the LEDs to verify that all components are functional. For information about LED patterns, refer to "Interpreting LED activity" on page 27.
2. Verify the correct operation of the switch by entering the **switchShow** command from the workstation. This command provides information about the switch and port status.
3. Verify the correct operation of the switch in the fabric by entering the **fabricShow** command from the workstation. This command provides general information about the fabric.

Backing up the configuration

Back up regularly to ensure that a recent configuration is available for downloading to a replacement switch, if required. For specific instructions about how to back up the configuration, refer to the *Brocade Fabric OS Administrator's Guide*.

Back up the switch configuration to an FTP server by entering the **configUpload** command and following the prompts. This command uploads the switch configuration to the server, making it available for downloading to a replacement switch, if necessary.

The **switchShow**, **fabricShow**, and **configUpload** commands are described in detail in the *Brocade Fabric OS Command Reference Manual*.

Setting the switch date and time

The date and time switch settings 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. You can synchronize the local time of the principal or primary fabric configuration server (FCS) switch to that of an external Network Time Protocol (NTP) server.

To set the date and time of a switch:

1. Log in to the switch as admin.
2. Type the **date** command at the command line using the following syntax:

   ```
   date "MMDDhhmm[CC]YY"
   ```

   The values represent the following:

   - MM is the month (01-12)
   - DD is the date (01-31)
   - hh is the hour (00-23)
   - mm is minutes (00-59)
   - CC is the century (19-20)
   - YY is the year (00-99)

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 Savings Time or time zones, so changes will have to be reset manually.

Table 8. Example of setting switch date and time

```
switch:admin> date
Fri May 5 21:50:00 UTC 1989
switch:admin>
switch:admin> date "0624165203"
Tue Jun 24 16:52:30 UTC 2003
switch:admin>
```

Synchronizing local time with an external source

Use this procedure to synchronize the local time of the principal or primary FCS switch with that of an external NTP server:

1. Log in as admin.
2. Enter the **tsClockServer** [*ipaddr*] command.

The *ipaddr* variable represents the IP address of the NTP server that the switch can access. This argument is optional; by default, its value is "LOCL".

Table 9. Example of synchronizing local time with an external source

```
switch:admin> tsClockServer
LOCL
switch:admin> tsclockserver 132.163.135.131
switch:admin>
```

Correcting the time zone of a switch

If the time of your switch(es) is off by hours (and not minutes), use the following procedure on all switches to set the time zone:

1. Log in as admin.
2. Enter the **tsTimeZone** command as follows:

   `tstimezone [houroffset [, minuteoffset]]`

   - For Pacific Standard Time, enter tsTimeZone -8,0
   - For Central Standard Time, enter tsTimeZone -6,0
   - For Eastern Standard Time, enter tsTimeZone -5,0

   The default time zone for switches is Universal Time Conversion (UTC), which is eight hours ahead of Pacific Standard Time. Additional time zone conversions are listed later in this section. The parameters listed do not apply if the time zone of the switch(es) has already been changed from the default (eight hours ahead of PT). Refer to the **tsTimeZone** command in the *Brocade Fabric OS Command Reference Manual* for more detailed information about the command parameters.
3. Repeat steps 1 and 2 on all switches for which the time zone needs to be set. This needs to be done only once, because the value is stored in nonvolatile memory.

For U.S. time zones, use Table 10 on page 24 to determine the correct parameter for the **tsTimeZone** command.

Table 10. tsTimeZone command parameter selection

Local Time	tsTimeZone parameter (difference from UTC)
Atlantic Standard	-4,0
Atlantic Daylight	-3,0
Eastern Standard	-5,0
Eastern Daylight	-4,0
Central Standard	-6,0
Central Daylight	-5,0
Mountain Standard	-7,0
Mountain Daylight	-6,0
Pacific Standard	-8,0
Pacific Daylight	-7,0
Alaskan Standard	-9,0
Alaskan Daylight	-8,0
Hawaiian Standard	-10,0

Viewing, adding, and removing license keys (optional)

Depending on what has been ordered, certain licenses are factory-installed on the switch. Feature licenses might be included as a paperpack item in the switch shipping carton. This paperpack will provide you with keys to unlock the features. You can also purchase licenses separately from IBM.

Attention: Retain this paperpack in a safe place. The transaction keys in the paperpack are required for activation of optional features on the switch. Once a feature is activated, its activation key is associated with a specfic product WWN and serial number.

To determine which licenses are currently enabled, enter the **licenseshow** command. You need the WWN for the switch to obtain and activate licenses; you can get the WWN by using the **switchshow** command. Refer to the following sections for information about viewing the current licenses, adding a license, or removing a license. For more information on the following procedures, see the *Brocade Fabric OS Administrator's Guide* and the *Brocade Fabric OS Command Reference Manual*.

Viewing current license keys

To view the licenses that are currently enabled on the switch, complete the following steps.

1. Log in as `admin`.
2. Enter the **licenseshow** command. A list of the enabled licenses and their features is displayed, as in the following example.

Table 11. Viewing current licenses

```
APswitch:admin> licenseshow
License Key: bQebzeRdScRfc0iK
             Web license
License Key: SybbzQQ9edTzcd0X
             Zoning license
APswitch:admin>
```

Adding a license key

Licenses for additional functionality may be purchased as feature codes through IBM. Contact your IBM representative for more information. You will need to supply IBM with the WWN to obtain a transaction key, which is sent in a paperpack. To obtain the license key, follow the instructions included in the paperpack. The transaction key and the switch wwn or product serial number are required to obtain the license key.

To add a license to the switch, complete the following steps.

1. Log in as `admin`.
2. Enter the **switchshow** command to obtain the WWN of your switch.

   The license key is a string of approximately 16 uppercase and lowercase letters and digits. Case is significant. The key is an encrypted form of the system WWN and the products licensed to run on this system.
3. Enter the **licenseadd** command, followed by the license key enclosed in quotation marks, as shown in the following example.

   ```
   APswitch:admin> licenseadd "aBcDeFGh12345K"
   License key aBcDeFGh12345 added
   ```

   Enter the license key into the system exactly as issued. If you enter it incorrectly, the license might be accepted, but it will not function.
4. After entering the license key, use the **licenseshow** command to verify that it is valid. If a licensed product is not displayed, the license is invalid.

   Note: After you enter a license, the licensed product is available immediately; the system does not need to be rebooted.

Removing a license key

To remove a license from the switch, complete the following steps.

1. Log in as `admin`.
2. Enter the **licenseremove** command, followed by the license key enclosed in quotation marks, as in the following example.

   ```
   APswitch:admin> licenseremove "bQebzbRdScRfc0iK"
   removing license key "bQebzbRdScRfc0iK"
   ```
3. Save the license key information in case you want to reinstall it in the future.
4. After removing the license key, the switch must be rebooted.
5. Use the **licenseshow** command to verify that the license key has been removed.

Chapter 3. Operating the switch

This chapter provides the following information:

- “Powering the switch on and off”
- “Interpreting LED activity”
- “POST and boot specifications” on page 33
- “Interpreting POST results” on page 34

Powering the switch on and off

See Chapter 2, “Installing and configuring the switch,” on page 9 for initial setup instructions before powering the switch on for the first time. Once the switch has been properly configured, follow these instructions to power the switch on and off.

Powering on the switch

Ensure that at least one power cable is connected to one ac receptacle on the SAN64B-2 and to a power source. Set the ac power switch(es) on the power supply to “**I**” See Figure 3 on page 4 for the location of each power supply. Power is supplied to the switch as soon as the first power supply is connected and powered on. Both power supplies must be turned on and plugged into separate circuits to ensure redundant power to the switch. The switch runs POST (power-on self-test) by default each time you power on, reset, or reboot. A boot and POST requires a minimum of 3 minutes.

Powering off the switch

To power off the switch, power off both power supplies by setting each ac power switch to "**0**". All devices are returned to their initial state the next time the switch is powered on.

Interpreting LED activity

System activity and status can be determined through the activity of the LEDs on the switch. LEDs are located on both the port side and the nonport side of the switch. The LEDs on the nonport side are the fan status and power supply status LEDs; all other LEDs are located on the port side of the switch.

There are possible six LED states: no light, a steady light, a flickering light (steady with random flashes), a flashing light, a slow flashing light (flashing in 2 second intervals) and a fast flashing light (flashing in half second intervals). The steady lights, flickering lights and flashing lights can be green or amber.

Sometimes the LEDs flash either of these colors during boot, POST, or other diagnostic tests. This is normal and does not indicate a problem unless all boot processes and diagnostic tests are complete, and the LEDs continue to indicate a problem status.

LEDs on the port side of the switch

The port side of the switch has the following LEDs (see Figure 9 on page 28):

- System Status, located to the left of the Console port (top LED)
- Power Status, located to the left of the Console port, directly below the System Status LED

- Ethernet Link, located to the lower right of the Ethernet port
- Ethernet Speed, located to the lower left of the Ethernet port
- Port Status LEDs 0 and 4 are located at the top left of the port side of the switch, and to the right of the System Status and System Power LEDs. Ports 0-7 are located to the right of the Port Status LEDs. Port Status LEDs 32 and 36 are located at the bottom left of the port side of the switch and to the right of the System Status and System Power LEDs. FC Ports 32-39 are located at the bottom left of the port side of the switch and to the right of the System Status and System Power LEDs.

Note: The pairs of port LEDs for all 32 ports are arrayed below the lower row of ports. The pairs of port LEDs are located in the array in the same relative positions as the ports. The port number of the associated Fibre Channel port appears between the Port Status and Port Speed LEDs.

Figure 9 shows the location of the LEDs on the port side of the switch.

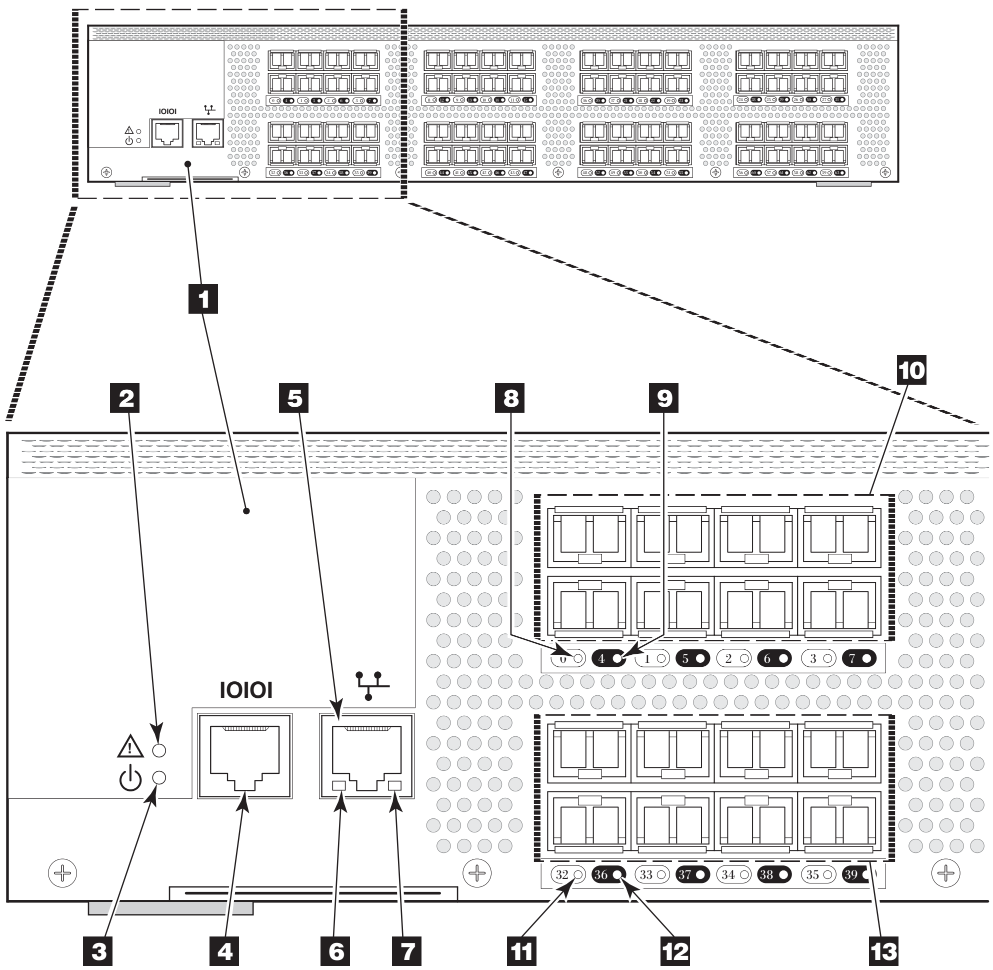


Figure 9. LEDs on the port side of the switch

See “Port side LED patterns and recommended actions” on page 29 for details about how to interpret the activity of these LEDs, and possible actions to take.

1	SAN64B-2	8	Port 0 Status LED
2	System Status LED	9	Port 4 Status LED

3	System Power LED	**10**	Port 0 through 7
4	Console port	**11**	Port 32 Status LED
5	Ethernet port	**12**	Port 36 Status LED
6	Ethernet speed LED	**13**	FC ports 32-39
7	Ethernet link LED		

Port side LED patterns and recommended actions

Table 12, Table 13 on page 30, and Table 14 on page 31 summarize LED location, color, and meaning of the LEDs on the port side of the switch, as well as any recommended user response.

System and power LED patterns

The system and power LED patterns are shown in Table 12.

Table 12. System LED patterns during normal operation

LED name, location	LED color	Status of Hardware	Recommended action
Power Status (bottom LED to the left of the console port)	No light	System is off or there is an internal power supply failure.	Verify that the system is on. If the system is on, the unit is faulty. Contact IBM Support.
	Steady green	System is on and power supplies are functioning properly	No action required.
System Status (top LED to the left of the console port)	No light	System is off , boot is not complete, or boot failed.	Verify that the system is on and has completed booting.
	Steady green	System is on and power supplies are functioning properly.	No action required.
	Steady amber (for more than five seconds)	Boot failed, the system is faulty. This LED displays steady amber during POST. This is normal and does not indicate a fault	Perform the following steps: 1. Connect a serial cable to the system. 2. Reboot the system. 3. Check the failure indicated on the system console. 4. Contact IBM Support.
	Flashing amber/ green	Attention is required. A number of variables can cause this status including a single power supply failure, a fan failure, or one or more environmental ranges has been exceeded.	Check the management interface and the error log for details on the cause of status. Contact IBM Support, if required.

Ethernet LED patterns

Each Ethernet port has two LEDs, the Link LED, and the Speed LED (see 28 for the Ethernet port and Ethernet LED locations). Table 13 describes the location, color, and meaning for the Ethernet LED activity.

Table 13. Ethernet LED patterns

LED name, location	LED color	Status of hardware	Recommended action
Ethernet link (LED to the right of the port)	No light	There is no link.	Verify that the Ethernet cable is connected correctly.
	Amber	Link is valid.	No action required.
	Flashing amber/ no light	Traffic.	No action required.
Ethernet Speed (LED to the left of the port)	No light	Port speed is 10 Mb/sec	No action required.
	Steady green	Port speed is 100 Mb/sec.	

Port LED patterns

In addition to the switch system LEDs, each port has two LEDs: a port speed and a port status indicator. These LEDs are located below both rows of ports, and each set is labeled with the port number. Table 14 shows the LED location, color, and meaning for these port LEDs.

Table 14. Port LED patterns during normal operation

LED name, location	LED color	Status of hardware	Recommended action
Port Status (below the ports on the left)	No light	No light or signal carrier (transceiver or cable) detected.	Check transceiver and cable.
	Steady green	Port is online (connected to external device) but has no traffic.	
	Slow-flashing green (on one second, off one second)	Port is online but segmented, indicating a loopback cable or incompatible switch.	No action required.
	Fast-flashing green (on 1/4 second, off 1/4 second)	Port is in internal loopback (diagnostic).	No action required.
	Flickering green (steady with random flashes)	Port is online with traffic flowing through port.	No action required.
	Steady amber	Port is receiving light or signal carrier but is not yet online.	No action required.
	Slow-flashing amber (on one second, off one second)	Port is disabled as the result of diagnostics or **portDisable** command. If all ports are slow-flashing amber, the switch could be disabled.	Enable the port using the **portEnable** command. See the *Brocade Fabric OS Command Reference Manual* for more information. If all ports are slow-flashing amber, enable the switch using the **switchEnable** command.
	Fast-flashing amber (on 1/4 second, off 1/4 second)	Port is faulty.	Perform the following steps (See the *Brocade Fabric OS Command Reference Manual* for more information for the telnet commands): 1. Check the Port Status LED, error log, SFP, and cable or loopback plug. 2. Clear the error log. 3. Rerun the diagnostics to verify that the error condition is fixed.
Port Speed (below the ports on the right)	No light	Port is transmitting/receiving at 1 Gb/sec.	No action required.
	Steady green	Port is transmitting/receiving at 2 Gb/sec.	No action required.

LEDs on the nonport side of the switch

The nonport side of the switch has the following LEDs:

- Power supply status LED for each of the two power supplies, located above the power switch on each power supply
- Fan status LED for each of the three fan assemblies, located near the top left corner of each fan assembly

Figure 10 shows the location of the LEDs on the nonport side of the switch.

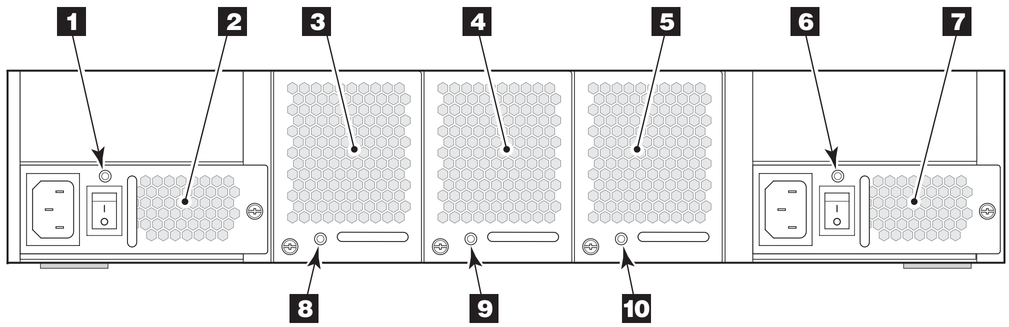


Figure 10. LEDs on the nonport side of the switch

See “Nonport side LED patterns and recommended actions” for details about how to interpret the activity of these LEDs, and possible actions to take.

1	Power supply 2 Status LED	6	Power supply 1 Status LED
2	Power supply 2	7	Power supply 1
3	Fan assembly 3	8	Fan assembly 3 Status LED
4	Fan assembly 2	9	Fan assembly 2 Status LED
5	Fan assembly 1	10	Fan assembly 1 Status LED

Nonport side LED patterns and recommended actions

LEDs for the power supply and fan assemblies on the nonport side of the switch have three possible displays during normal operation:

- No light
- Steady green
- Steady amber

Power supply and fan LED patterns

The power supply and fan LED patterns, as well as recommended user responses are shown in Table 15 on page 33.

Table 15. Nonport side LED patterns during normal operation

LED name, location	LED color	Status of Hardware	Recommended action
Power Supply Status (LED directly above power switch)	No light	Power supply is not receiving power, or is off.	Verify that the power supply is on and seated and the power cord is connected to a functioning power source.
	Steady green	Power supply is operating normally.	No action required.
	Steady amber	Power supply fault for one of the following reasons: • power cable is disconnected • power supply is off • the power supply has failed	Try the following: • check the power cable connection • verify that the power supply is powered on • replace the power supply FRU
Fan Status (near top left corner of fan assembly)	No light	Fan assembly is not receiving power.	Verify that system is powered on. If power to system is on, then the CRU is faulty and should be replaced
	Steady green	Fan assembly is operating normally.	No action required.
	Steady amber (for more than five seconds)	Fan fault for one of the following reasons: • one or more of the fans in the fan assembly has failed • the fan FRU was disabled by the user **Note:** When the switch is first powered on, the fan status LED will show amber until POST has completed.	Verify that the fan FRU is enabled. If the fan FRU is enabled, the FRU is faulty and should be replaced.

POST and boot specifications

When the switch is turned on or rebooted, the switch performs POST. Total boot time with POST is a minimum of 3 minutes.

POST can be omitted after subsequent reboots by using the **fastboot** command. For more information about this command, refer to the *Brocade Fabric OS Command Reference Manual*.

POST

The success/failure results of the diagnostic tests that run during POST can be monitored through the error log or the command line interface.

POST includes the following steps:

1. Preliminary POST diagnostics are run.
2. Operating system is initialized.
3. Hardware is initialized.
4. Diagnostic tests are run on several functions, including circuitry, port functionality, memory, statistics counters, and serialization.

Boot

Boot completes in a minimum of 3 minutes if POST is run. In addition to POST, boot includes the following steps after POST is complete:

1. Universal port configuration is performed.
2. Links are initialized.
3. Fabric is analyzed, and if any ports are connected to other switches, the switch participates in a fabric configuration.
4. Switch obtains a domain ID and assigns port addresses.
5. Unicast routing tables are constructed.
6. Normal port operation is enabled.

Interpreting POST results

POST is a system check that is performed each time the switch is powered on, rebooted, or reset. During POST, the LEDs flash amber and green. Any errors that occur during POST are listed in the error log.

To determine whether POST completed successfully and whether or not any errors were detected:

1. Verify that the switch LEDs indicate that all components are healthy. See the tables in “Port side LED patterns and recommended actions” on page 29 and “Nonport side LED patterns and recommended actions” on page 32 for descriptions and interpretation of LED patterns. If one or more LEDs do not display a healthy state:
   a. Verify that the LEDs on the switch are not set to `beacon`; use the **switchShow** command. For information about how to turn beaconing on and off, refer to the *Brocade Fabric OS Administrator’s Guide*.
   b. Follow the recommended action for the observed LED behavior, as listed in the tables in “Port side LED patterns and recommended actions” on page 29 and “Nonport side LED patterns and recommended actions” on page 32.
2. Verify that the switch prompt displays on the terminal of a computer workstation connected to the switch. If there is no switch prompt when POST completes, press **Enter**. If the switch prompt still does not display, open another Telnet session or access the switch through another management tool. If this is not successful, the switch did not successfully complete POST. Contact IBM Service for repair.
3. Review the switch system log for errors. Any errors detected during POST are written to the system log, which is accessible through the **errShow** command.

For information about all referenced commands, and on accessing the error log, refer to *Brocade Fabric OS Administrator’s Guide*. For information about error messages, refer to the *Brocade Fabric OS System Error Message Reference Manual*.

Chapter 4. Monitoring and maintaining the switch

The switch does not require any regular physical maintenance and is designed for high availability and to minimize the chance of failure. The power supplies and fan assemblies are hot-swappable CRUs that further enhances high availability, and minimizes disruption of normal operation of the switch. After you have installed and configured your switch, you can monitor the health of the fabric as well as maintain the health of the switch. This chapter provides the following information:

Management features of the switch

Using any of the management tools built into the switch listed in Table 16, you can monitor fabric topology, port status, physical status, and other information used for performance analysis and system debugging.

When running IP over Fibre Channel, these management tools must be run on both HBA and switch and must be supported by both HBA and HBA driver.*Brocade Fabric OS Administrator's Guide*

Table 16. Management options for the SAN64B-2

Management tool	**Out-of-band support**	**In-band support**
Command line interface Up to two admin sessions and four user sessions simultaneously. For more information, see the *Brocade Fabric OS Administrator's Guide* and the *Brocade Fabric OS Command Reference Manual*	Ethernet or serial connection	IP over Fibre Channel
Fabric Manager	Ethernet connection	IP over Fibre Channel
Brocade Advanced Web Tools For information, see the *Brocade Web Tools Administrator's Guide*	Ethernet connection	IP over Fibre Channel
Standard SNMP applications For information, see the *Brocade Fabric OS MIB Reference Manual*	Ethernet connection	IP over Fibre Channel
Management server For information, see the *Brocade Fabric OS Administrator's Guide* and the *Brocade Fabric OS Command Reference Manual*.	Ethernet connection	Native in-band interface (over HBA only)

Diagnostic tests

In addition to POST, Fabric OS includes diagnostic tests to help troubleshoot the hardware and the firmware. This includes tests of internal connections and circuitry, fixed media, and the transceivers and 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, transceiver, and cable. Some tests require loop back plugs.

All diagnostic tests are run at link speeds of 1 Gb/sec, 2 Gb/sec, and 4 Gb/sec.

Attention: Diagnostic tests can temporarily lock the transmit and receive speed of the links during diagnostic testing.

For information about specific diagnostic tests, refer to the *Brocade Fabric OS Administrator's Guide*.

Maintaining the switch

The switch was designed to minimize the chance of failure, and does not require any regular physical maintenance. Periodically monitor the switch environment to ensure that the environmental conditions, described in "System general specifications" on page 56, are met. This helps prevent failure of the switch due to distress or abuse. In addition to running diagnostic tests and using various management tools, you can monitor the condition of the switch through the LEDs. See the tables in "Port side LED patterns and recommended actions" on page 29 and "Nonport side LED patterns and recommended actions" on page 32 for descriptions and interpretation of LED patterns, and recommended user interventions.

Installing, removing, and testing SFPs

Note: For a listing of SFPs compatible with this product:

- Go to the IBM SAN b-type family web page http://www.ibm.com/servers/storage/san/b_type
- Click the **Product details** link under the individual product name
- On the **Product details** tab, click the **Interoperability** link.

If your switch did not come with installed SFP modules (transceivers), or you are replacing older ones, follow the instructions in "Installing an SFP" on page 38 to install the SFPs. If you need to verify that an installed SFP is operating correctly, follow the instructions in "Testing an SFP" on page 44. Follow the instructions in "Removing SFP modules" on page 41 to replace faulty SFPs, or to remove SFPs that are no longer needed in the switch.

SFPs are supplied by several different manufacturers and have different designs. Some SFPs have plastic tabs, as shown in Figure 11 on page 37, and others have wire bales, as shown in Figure 12 on page 37. Follow the instructions appropriate to the type of SFP you are installing.

Note: The illustrations of the SFPs and cable connectors in this section are not oriented in the same direction that they are installed in the switch.

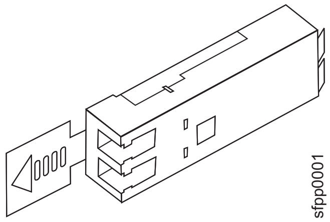


Figure 11. SFP plastic tab variety

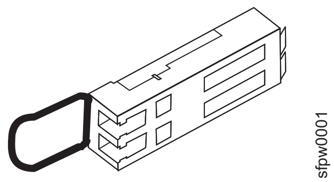


Figure 12. SFP wire bale variety

Installing an SFP

If your switch did not come with installed SFPs, or you are replacing older ones, follow the instructions below to install your SFPs.

Note: SFPs are keyed so that they can be inserted only in the correct orientation. The ports in the top row the switch are oriented in one direction, and the lower row of ports are oriented in the opposite direction. If a transceiver does not install easily, ensure that it is oriented and aligned correctly, and that the port is not blocked by a protective cap or other object.

1. Remove the protective cap (if any) from the switch port. Save the cap for future use.
2. Remove the SFP from its static-protective package.
3. Remove the protective cap from the SFP module, as shown in Figure 13 and Figure 14. Save the cap for future use.

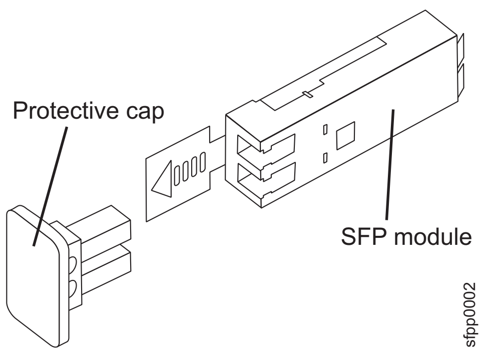


Figure 13. Removing the protective cap from a plastic tab type SFP

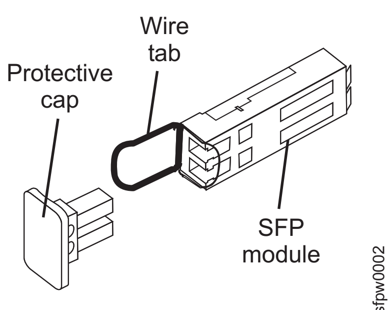


Figure 14. Removing the protective cap from a wire bale type SFP

4. Hold the SFP correctly oriented towards the port as shown in Figure 15 on page 39 and Figure 16 on page 40 (for wire bale type SFPs, make sure the bale is open, in the unlocked position, as shown in **1** of Figure 16 on page 40). Slide the SFP into the port until you feel it click into place. For the top row of ports, SFPs will be oriented as shown. To install SFPs in the bottom row of ports, orient the SFPs with the plastic tab or wire bale on the top.

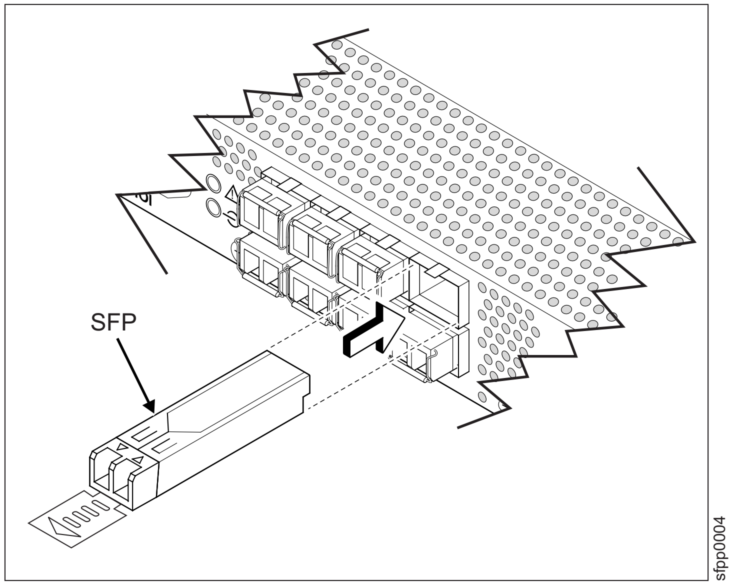


Figure 15. Installing a plastic tab type SFP

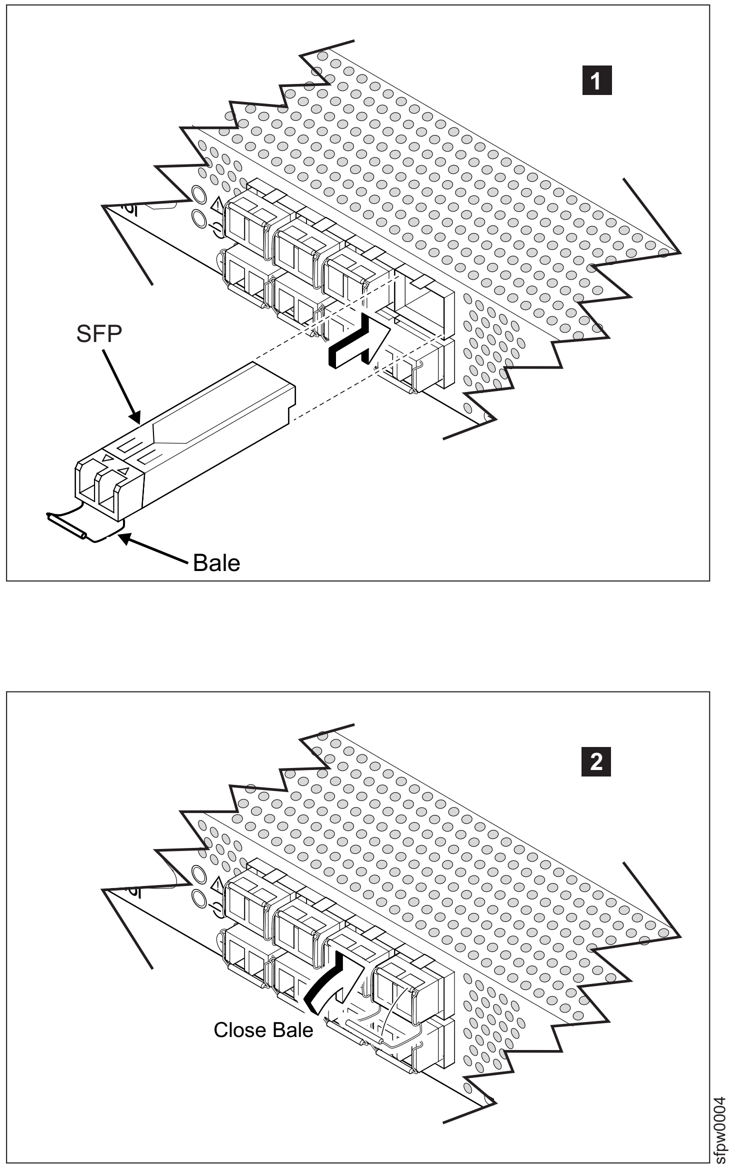


Figure 16. Installing a wire bale type SFP

5. For SFPs with wire bales, close the bale to lock it in place (see as shown in 2 in Figure 16.
6. Repeat this procedure for the remaining SFPs and ports, as required. For the top row of ports, SFPs will be oriented as shown in Figure 15 on page 39 and Figure 16. To install SFPs in the bottom row of ports, orient the SFPs with the plastic tab or wire bale on the top.

Installing fiber-optic cables

To connect fiber-optic cables to SFP modules, follow the steps below.

Note: Fiber-optic cable connectors are keyed to ensure that they are inserted in the SFPs correctly. If a cable does not install easily, ensure that it is oriented and aligned correctly, and that the SFP or cable end is not blocked by a protective cap or other object.

1. Remove the protective caps from the end of the fiber-optic cable. See Figure 17. Remove the protective cap (if any) from the SFP. Save the caps for future use.

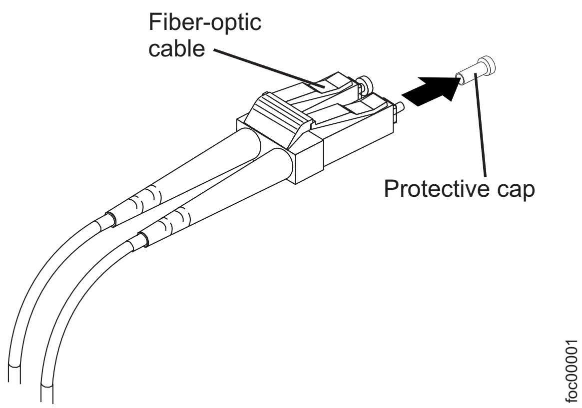


Figure 17. Removing the caps from fiber-optic cables

2. Holding the cable by its connector, align the cable end with the SFP module, and push it into the SFP (see Figure 18) until the connector clicks in place.

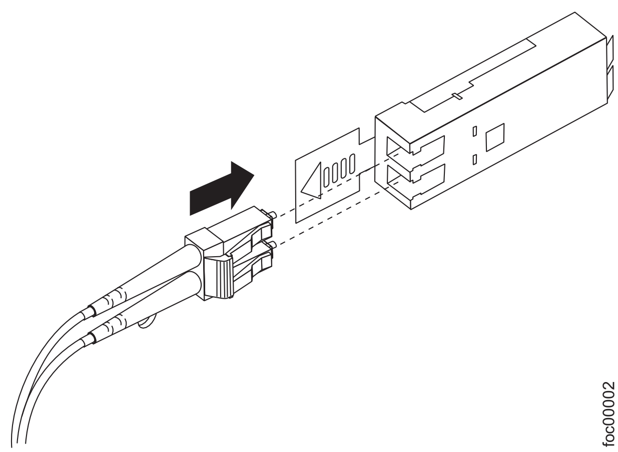


Figure 18. Inserting a fiber-optic cable into an SFP module

Removing SFP modules

In some cases you might need to remove an SFP module, either because it is no longer needed or because you must replace it. If fiber-optic cables are installed, they must be removed before you can remove the SFP module.

Note: In the illustrations below, the SFPs and cables are shown outside of the switch's ports for clarity, and are not oriented in the direction that they are installed in the switch.

Removing fiber-optic cables

Follow the steps below to remove a fiber optic cable.

1. Press down and hold the lever (see Figure 19 on page 42) to release the latches.

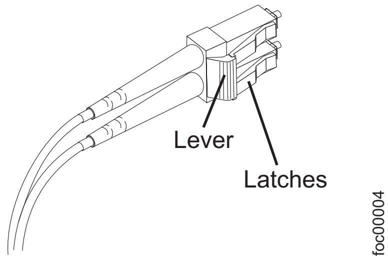


Figure 19. Fiber-optic cable lever and latches

2. Carefully pull on the connector to remove the cable from the SFP module, as shown in Figure 20.

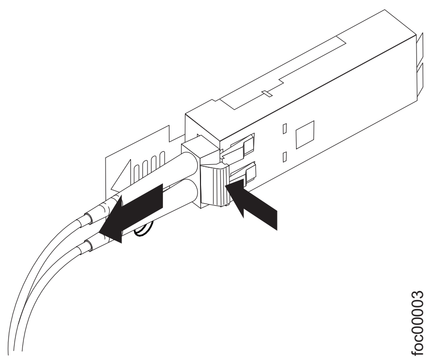


Figure 20. Removing a fiber-optic cable

3. Replace the protective caps on the cable ends.
4. If you are leaving the SFP in place, replace the protective cap on the SFP.

Removing a plastic tab type SFP

Follow the steps below to remove a plastic tab type SFP.

1. Pull the plastic tab outward 10° from the SFP to unlock it (see Figure 21).

   Note: If there is not enough room because of an adjacent cable and SFP, you may need to temporarily remove that cable.

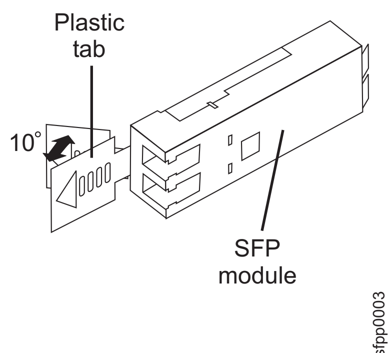


Figure 21. Unlocking the SFP module latch, plastic tab type

2. Using the plastic tab, pull the SFP from the port (see Figure 22 on page 43).

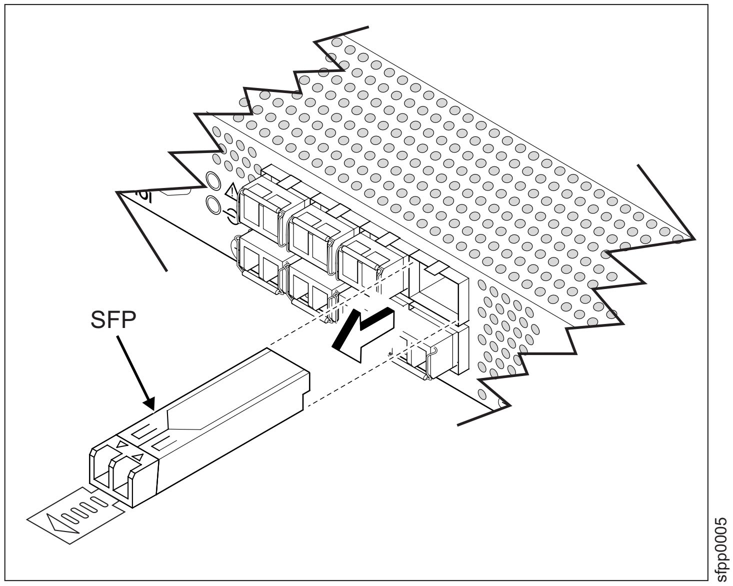


Figure 22. Removing an SFP module, plastic tab type

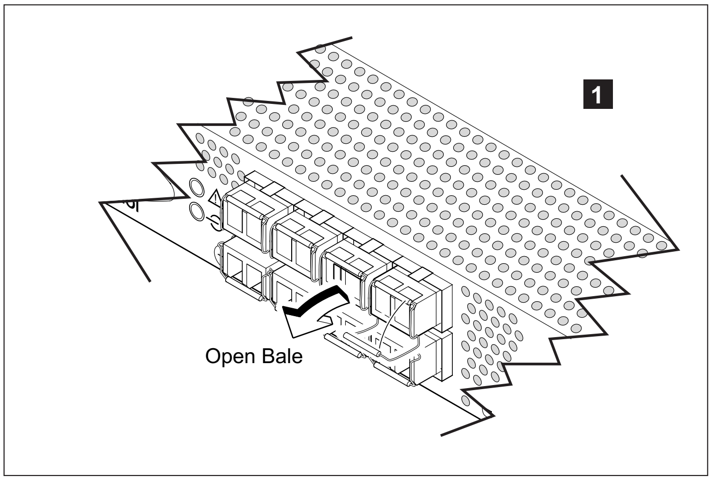
3. Replace the protective cover on the SFP module.
4. Place the SFP module into a static-protective package.
5. Replace the protective cover on the switch port.
6. Repeat this procedure for any additional SFPs, as required.

Removing a wire bale type SFP

Follow the steps below to remove a wire bale type SFP.

1. Unlock the bale (wire handle) by pulling it outwards 90° to release the transceiver (see **1** in Figure 23 on page 44).

   Note: If there is not enough room because of an adjacent cable and SFP, you may need to temporarily remove that cable.



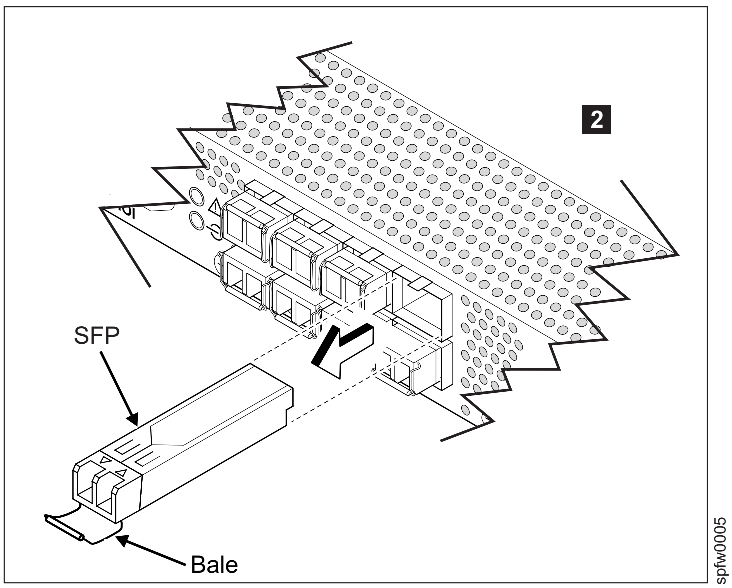


Figure 23. Unlocking the SFP module latch, wire bale type

2. Grasping it by the bale, gently but firmly pull the transceiver out of the port (see **2** in Figure 23).
3. Replace the protective cover on the SFP module.
4. Place the SFP module into a static-protective package.
5. Replace the protective cover on the switch port.
6. Repeat this procedure for any additional SFPs, as required.

Testing an SFP

Use the following procedure to determine if an SFP is faulty and needs to be replaced.

The **crossPortTest** command verifies the intended functional operation of the switch by sending frames from port M's transmitter and looping them back through the loopback plugs into port N's receiver with **-lb_mode** set to 1.

-nframes Specifies the number of frames to transmit on the test port.

-lb_mode =1 (with loopback plugs)

1. Remove the fiber cable from two SFPs on different port quad.
2. Insert the loopback plugs into the SFPs
3. Login as ″admin″ on the switch
4. Enter admin password ″xxxxxxxx″. Press **Enter**
5. Type the command ″**crossPortTest -nframes 5000 -lb_mode 1**″. Press **Enter**
6. If the test passes, both the switch and the SFPs are good. They do not need to be replaced.
7. If one of the ports has failed, swap the SFPs including the loopback plugs, and run the test again.
8. Type the command ″**crossPortTest** -nframes 5000 -lb_mode 1″. Press **Enter**
9. If the problem moves with the SFP, the SFP is faulty. Replace the SFP.
10. If the problem remains on the same port, verify that the port and switch configurations are correct before replacing the switch.

Table 17. Example of running a functional test of the port with loopback plug:

```
SW1 login: admin
Password:
SW1:admin> crossPortTest   -nframes   5000   -lb_mode   1

Running crossporttest .............
Test Complete: crossporttest Pass 5000 of 5000
Duration 0 hr, 1 min & 43 sec (0:1:43:765).
passed.
SW1:admin>
```

Removing and replacing power supplies

The switch has two power supplies, as shown in Figure 24 on page 46. The two power supplies are hot-swappable if replaced one at a time. They are identical and fit into either power supply slot. The Fabric OS identifies the power supplies from left to right on the nonport side as PS2 (on the left) and PS1 (on the right).

Attention: Because the cooling system relies on pressurized air, do not leave either of the power supply slots empty longer than two minutes while the switch is operating. If a power supply fails, leave it in the switch until it can be replaced. Maintain both power supplies in operational condition to provide redundancy.

CAUTION:
Disassembling any part of the power supply voids the part warranty and regulatory certifications. Servicing of the power supply is to be performed trained service personnel only. (C032)

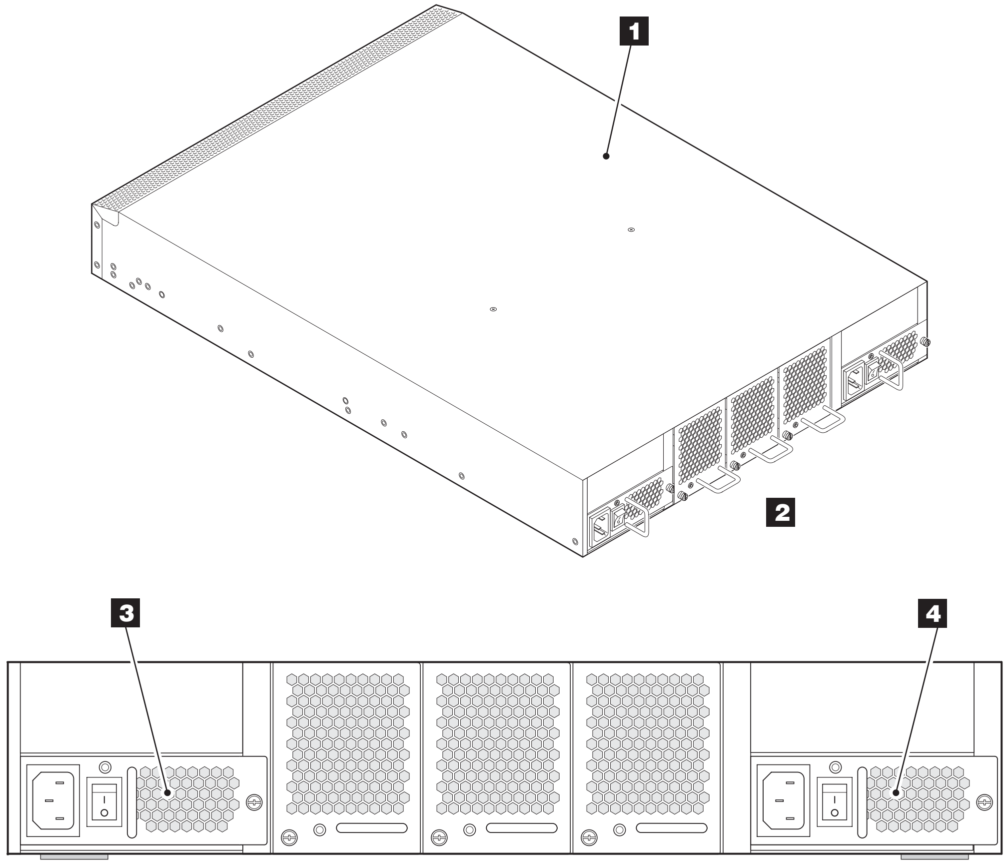


Figure 24. Two power supplies, located on the nonport side of the switch

1	SAN64B-2	3	Power supply 2
2	Nonport side	4	Power supply 1

Any of the following methods can be used to determine whether a power supply requires replacing:

- Check the power supply status LED above the On/Off switch (see Figure 25 on page 47.
- Type the **psShow** command at the command prompt to display power supply status as shown in the example below:

```
switch:admin> psshow
Power Supply #1 is OK
V10415, QW2M0000269 , 60-0000849-01,X4, DPSN-210BB A, S4, QW2M0000
Power Supply #2 is OK
V10415, LX2M000020 , 60-0000849-01,X4, DPSN-210BB A, S3, LX2M0000
```

- In Advanced Web Tools, click the **Power Status** icon.

Time required

Less than two minutes.

Items required

- New power supply
- Phillips #1 screwdriver

Removing a power supply

Perform the following steps to remove a power supply from the switch.

1. If the switch is to continue operating during the replacement, verify that the other power supply (the one not being replaced) has been powered on for at least four seconds and has a green LED.
2. If the power supply you are replacing is not already off, press the ac power switch on the circle symbol **0** to power it off. See Figure 25 for the location of the ac power switch.

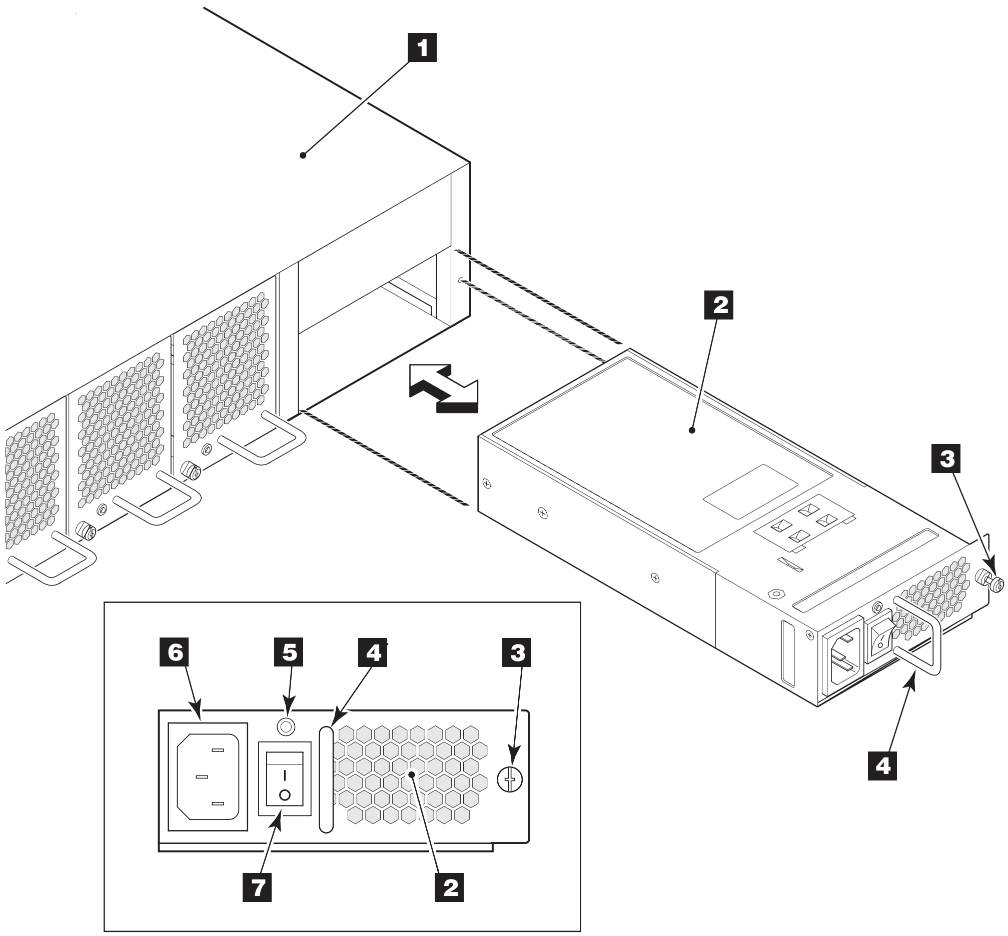


Figure 25. Power supply removal and replacement

1	SAN64B-2	**5**	Status LED
2	Power supply	**6**	AC power receptacle
3	Captive screw	**7**	AC power switch
4	Handle		

3. Unplug the power cord from the power supply that you are replacing.
4. Using a Phillips #1 screwdriver, unscrew the captive screw on the power supply.
5. Remove the power supply from the chassis by pulling the handle on the power supply out, away from the chassis.

Installing a power supply

Perform the following steps to install a power supply.

1. Orient the power supply as shown in Figure 25 on page 47, with the ac power switch on the left.
2. Gently push the power supply into the switch chassis until it is firmly in place.

   Attention: Do not force the installation. If the power supply does not slide in easily, ensure that it is correctly oriented before continuing.
3. Using a Phillips #1 screwdriver, secure the power supply to the chassis by tightening the captive screw.
4. Plug the power cord in to the power supply, then press the ac power switch on the vertical line symbol **I** to turn it on.
5. Verify that the LED on the new power supply displays a steady green light while the switch is operating. If the LED is not green, ensure that the power supply is firmly installed.
6. Optionally, type the **psShow** command at the command line prompt to display power supply status. The Fabric OS identifies the power supplies in switch from left to right as PS2 and PS1.

Removing and replacing fan assemblies

The switch has three fan assemblies, as shown in Figure 26 on page 49. The three fan assemblies are hot-swappable if replaced one at a time. They are identical and fit into any fan assembly slot. The Fabric OS identifies the fan assemblies from left to right as Fan 3, Fan 2, and Fan 1.

Attention: Because the cooling system relies on pressurized air, do not leave any of the fan assembly slots empty longer than two minutes while the switch is operating. If a fan assembly fails, leave it in the switch until it can be replaced. Maintain all three fan assemblies in operational condition to provide redundancy.

CAUTION:
Disassembling any part of the fan assembly voids the part warranty and regulatory certifications. Servicing of the fan assembly is to be performed trained service personnel only. (C032)

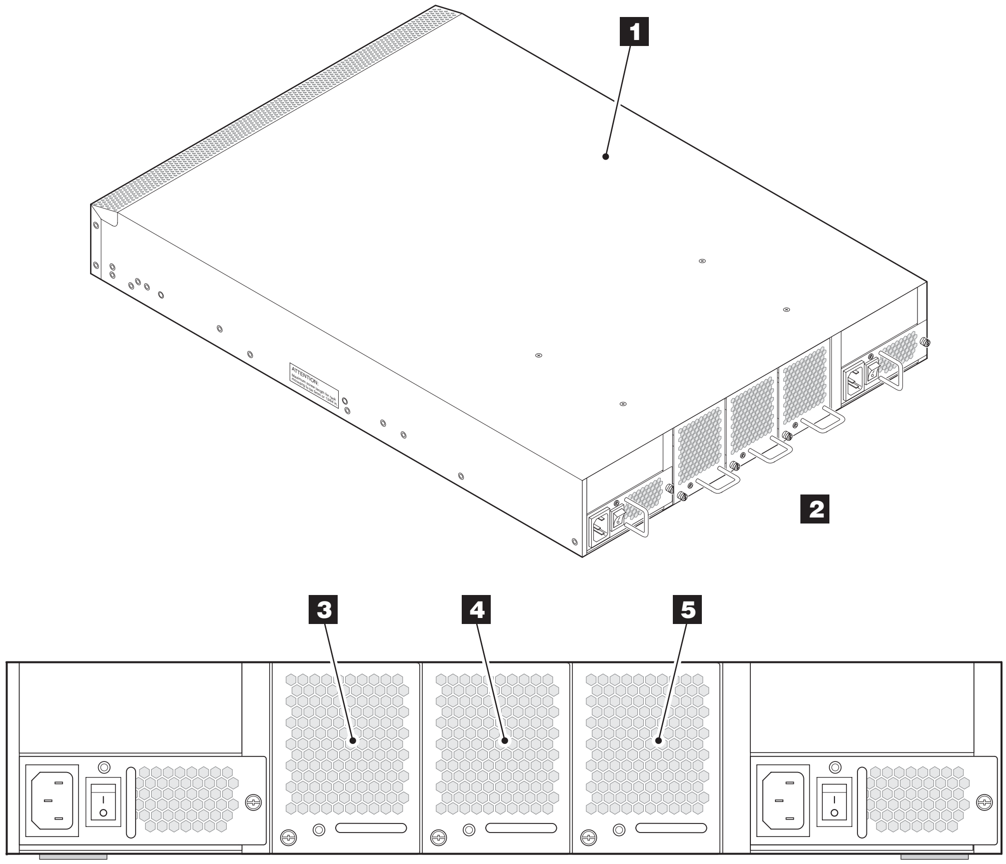


Figure 26. Three fan assemblies, located on the nonport side of the switch

1	SAN64B-2	4	Fan assembly 2
2	Nonport side	5	Fan assembly 1
3	Fan assembly 3		

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

- Check the fan status LED on the face of the fan assembly (see Figure 26).
- Type the **fanShow** command at the command prompt to display the fan status as shown in the example below.

```
switch:admin> fanshow
Fan 1 sensor 1 is OK, speed is 5625 RPM
Fan 1 sensor 2 is OK, speed is 5578 RPM
Fan 2 sensor 1 is OK, speed is 5720 RPM
Fan 2 sensor 2 is OK, speed is 6026 RPM
Fan 3 sensor 1 is OK, speed is 5921 RPM
Fan 3 sensor 2 is OK, speed is 5818 RPM
```

- In Advanced Web Tools, click the Fan Status icon.

Time required

Less than two minutes.

Items required

- New fan assembly
- Phillips #1 screwdriver

Procedure

Perform the following steps to remove and replace a fan assembly from the switch.

1. Using a Phillips #1 screwdriver, unscrew the captive screw on the fan assembly you are replacing.
2. Remove the fan assembly you are replacing from the chassis by pulling the handle out, away from the chassis.
3. Orient the new fan assembly as shown in Figure 27, with the captive screw on the right.

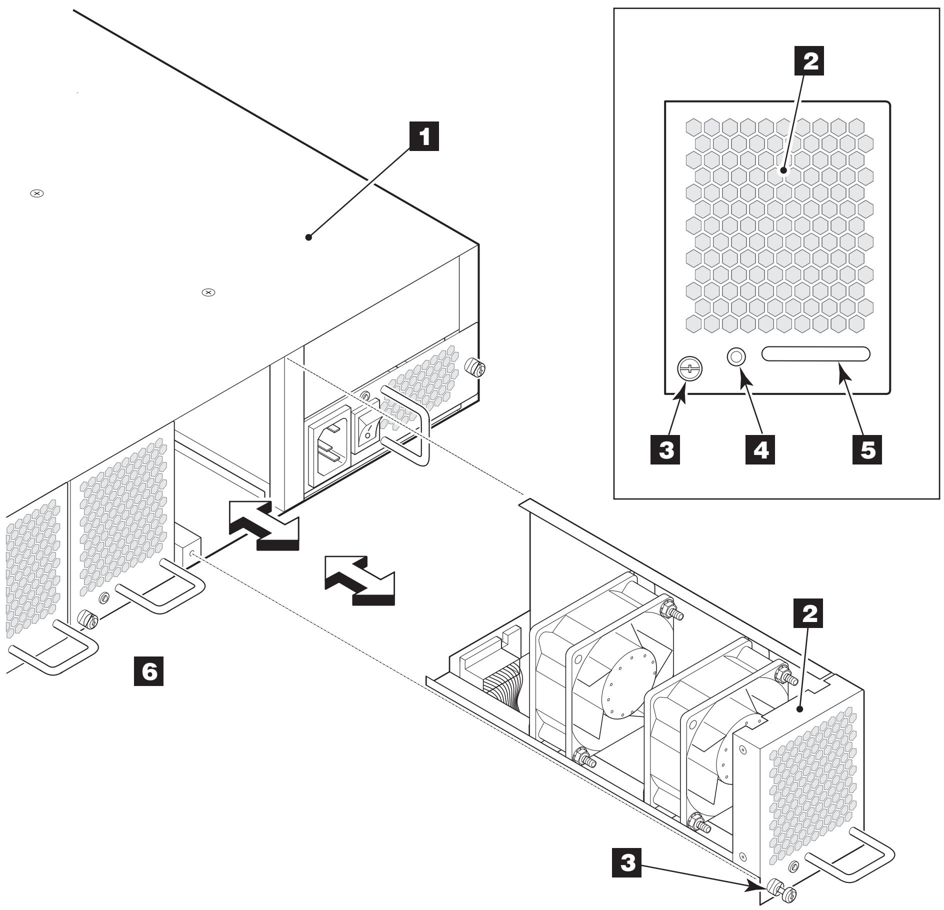


Figure 27. Removing and replacing a fan assembly

1	SAN64B-2	4	Status LED
2	Fan assembly unit	5	Handle
3	Captive screw	6	Non-port side

4. Gently push the new fan assembly into the switch chassis until it is firmly in place.

   Attention: Do not force the installation. If the fan assembly does not slide in easily, ensure that it is correctly oriented before continuing.
5. Using a Phillips #1 screwdriver, secure the fan assembly to the chassis by tightening the captive screw.
6. Verify that the fan status LED is not lit in a steady amber color for more than five seconds, which indicates a fault.
7. Optionally, type the **fanShow** command at the command line to display the fan status. The Fabric OS identifies the fan assemblies in a switch from left to right as Fan 3, Fan 2, and Fan 1.

Replacing the switch

If any of the internal circuitry fails within the switch, the entire unit must be replaced. Contact IBM technical support for assistance with ordering the replacement. Within the United States call 1-800-IBMSERV (1-800-426-7378). For support outside the United States, you can find the service number at: http://www.ibm.com/planetwide/.

Once you have received the replacement switch, follow the steps below and the instructions included within the CRU package.

Attention: Before installing, removing, or replacing any component, read and follow the "Safety notices and labels" on page xiii.

Time required

Approximately 45 minutes

Items required

- Replacement switch

DANGER

Hazardous voltage, current, or energy levels are present inside any component that has this label attached. (L001)

Do not service, there are no serviceable parts.

Procedure

Follow these steps and the links to more detailed instructions to replace the switch.

Removing the switch

1. Verify that the replacement switch is the correct part number (23R1852).
2. Verify that you know where the configuration backup file is stored for restoring the configuration once the switch replacement has been completed.
3. If you have not done so already, turn off the power to the switch by setting both ac power switches to "**0**"
4. Unplug the power cords from the two power supplies. If desired for better access, unplug the other end of the power cords from the power sources. Set the power cords aside for use with the replacement switch.

5. If you have not done so already, label each cable to simplify reconnecting the cables to the correct ports. Make a written record of the cable configurations if needed.
6. From the port side of the switch, remove each cable one at a time from its SFP (See “Removing fiber-optic cables” on page 41).
7. From the port side of the switch, remove each SFP. (See “Removing SFP modules” on page 41 for detailed instructions, if needed.) Set the SFPs aside for later installation in the new switch.
8. Remove the switch from the rack. Verify and remove any mounting hardware or screws that prevent the switch from being removed from the cabinet. If the switch is installed on sliding rails, press the release mechanism on the rails to allow full removal of the switch and inner rails.
9. Remove the rail hardware from the switch. Set it aside for attachment to the new switch, making notes as necessary for the correct placement of parts. (Refer to “Installing a switch into an EIA cabinet” on page 12 for illustrations and complete rack mount instructions.)
10. Set the switch aside for later return to IBM, following the instructions included with the replacement switch.

Installing the CRU switch

Follow these steps to install the replacement for the switch you removed earlier.

1. Follow any instructions included with the CRU related to attaching labels, if any.
2. Attach the rail hardware to the new switch. Refer to your notes or “Installing a switch into an EIA cabinet” on page 12, as needed.
3. Slide the switch into the rails attached to the cabinet.
4. Attach any screws or hardware that you removed earlier to allow removal of the original switch.
5. Install the SFPs and connect the Fibre Channel cables, using the labels and notes you made during the removal steps.
6. Provide power to the switch. (Follow the instructions in “Powering up the switch and logging in” on page 19.) The switch will take several minutes to complete POST.
7. Create a serial connection to the switch. (Follow the instructions in “Creating a serial connection” on page 19.)
8. Set the switch IP address. (Follow the instructions in “Setting the IP address” on page 20.)
9. Connect the Ethernet cable to the Ethernet management port. (See **5** in Figure 1 on page 3.)
10. Verify that the ftp server where the backup configuration file is stored is accessible to the switch.
11. Use the **configdownload** command to restore the configuration saved for the original chassis. (Refer to the *Maintaining Configurations* chapter in the *Brocade Fabric OS Administrator’s Guide* for details.)

Once you have completed the replacement procedures, follow the instructions included in the CRU shipment to return the faulty switch to IBM.

Changing the switch serial number

Attention: This procedure is to be used only if a switch has failed and it is being replaced by a new switch.

In the event of a hardware failure, the replacement switch should be configured to display the serial number of the original failed switch, in order to maintain continuity in the IBM service system. Once you have installed the replacement switch, follow the steps below to change the serial number displayed through the switch or fabric management program.

Note: This serial number change procedure requires the user to login as ″root″.

1. Login as ″root″ on the switch.
2. Enter the root password ″xxxxxxxx″. Press **Enter**.
3. Type the command ″**fruinfoset chassis 1**″. Press **Enter**.
4. ID: (none). Press **Enter**.
5. PN: (none). Press **Enter**.
6. SN: (none) > type ″**switch Serial Number**″. Press **Enter**.
7. RV: (none). Press **Enter**.
8. Chassis SN: (FAxxXxxxxxx). Press **Enter**.

   To verify that the serial number has been entered correctly, follow these steps:
9. Type the command ″**fruinfoset chassis 1**″. Press **Enter**.
10. ID: (none). Press **Enter**.
11. PN: (none). Press **Enter**.
12. SN: (none) > Verify ″switch Serial Number″ entered. Press **Enter**.
13. RV: (none). Press **Enter**.
14. Chassis SN: (FA0xxXxxxxxx). Press **Enter**.

If the serial number displayed is not correct, repeat the above steps, beginning with 3.

Appendix. Product specifications

This appendix contains the following information:

Weight and physical dimensions

Table 18 lists the weight and physical dimensions of the SAN64B-2.

Table 18. Switch specifications

Dimension	Value
Height	2U or 8.6 cm (3.4 in.)
Width	42.8 cm (16.8 in.)
Depth	61 cm (24 in.)
Weight (with two power supplies, three fan assemblies installed and no SFPs installed)	13.7 kg (30.2 lb.)

Power supply specifications

The power supplies are universal and capable of functioning worldwide without voltage jumpers or switches. They meet IEC 61000-4-5 surge voltage requirements and are autoranging in terms of accommodating input voltages and line frequencies. Each power supply has a built-in fan for cooling, pushing air towards the port side of the switch.

Table 19 lists the power supply specifications for the switch.

Table 19. SAN64B-2 power supply specifications

Specification	Values
Inlet	IEC320/C14
System power draw from ac line	225 Watts Nominal, 245 Watts Maximum
Input voltage range	90-264 Vac, 47-63 HZ
Harmonic distortion	Active power factor correction
BTU rating	836 BTU/hr
Inrush current	Maximum of 15A for period of 10-150mS
Input line protection	Both ac lines are fused
Maximum output of one power supply	300 Watts
Nominal system power draw from power supplies	175 Watts

System general specifications

Attention: Due to the acoustic characteristics of this product, it should be installed in a location that is generally unattended.

Table 20 lists the system specifications for the SAN64B-2.

Table 20. General specifications

Specification	Descriptions
Configurable port types	F_Port, FL_Port, and E_Port
System architecture	Nonblocking shared-memory switch
System processor	PowerPC® 440GP, 400 MHz CPU
ANSI Fibre-channel protocol	FC-PH (Fibre Channel Physical and Signalling Interface standard)
Modes of operation	Fibre Channel Class 2 and Class 3
Fabric initialization	Complies with FC-SW–3 rev 6.6
FC-IP (IP over Fibre Channel)	Complies with FC-IP 2.3 of FCA profile
Aggregate switch I/O bandwidth	512 Gbps if all 64 ports running at 4 Gbps, full duplex
Port-to-port latency	Less than 2 microseconds with no contention (destination port is free)

Data transmission ranges

Table 21 provides the data transmission ranges for different cable types and port speeds.

Table 21. Laser data transmission ranges

Port speed	Cable size (microns)	Short wavelength (SWL)	Long wavelength (LWL)	Extended long wavelength (ELWL)
1 Gbps	50	500 m (1,640 ft)	N/A	N/A
	62.5	300 m (984 ft)	N/A	N/A
	9	N/A	10 km (6.2 mi)	80 km (50 mi)
2 Gbps	50	300 m (984 ft)	N/A	N/A
	62.5	150 m (492 ft)	N/A	N/A
	9	N/A	10 km (6.2 miles)	80 km (50 mi)
4 Gbps	50	150 m (492 ft)	N/A	N/A
	62.5	70 m (230 ft)	N/A	N/A
	9	N/A	10 km (6.2 mi)	N/A

Up to 500 km at 1 Gbps is supported when using a long distance transport system such as dense wavelength division multiplexing (DWDM).

Memory specifications

The SAN64B-2 has three types of memory devices.

Table 22. Memory specifications

Memory type	Installed Memory
Main memory (DDR SDRAM)	256 MB
Boot flash	4 MB
Compact flash	512 MB

Fibre Channel port specifications

The Fibre Channel ports in the SAN64B-2 are compatible with SWL, LWL, and ELWL SFP transceivers. The strength of the signal is determined by the type of transceiver in use.

The ports meet all required safety standards.

The ports are capable of operating at 1-, 2-, or 4-Gbit/sec and are able to auto-negotiate to the maximum link speed.

Serial port specifications

The serial port is located on the port side of the switch. The switch uses an RJ-45 connector for serial port. An RJ-45 to DB9 adaptor cable is also provided with the switch.

Note: To protect the serial port from damage, keep the cover on the port when not in use.

The serial port can be used to connect to a workstation to configure the switch IP address before connecting the switch to a fabric or IP network. The serial port's parameters are fixed at 9600 baud, 8 data bits, and no parity, with flow control set to None.

Table 23 lists the pinouts for the serial cable.

Table 23. Serial cable pinouts

PIN	Signal	Description
1	Not supported	N/A
2	Not supported	N/A
3	UART1_TXD	Transmit data
4	GND	Logic ground
5	GND	Logic ground
6	UART1_RXD	Receive data
7	Not supported	N/A
8	Not supported	N/A

Parts list (CRUs)

The parts in listed Table 24 can be replaced by a customer. Refer to Chapter 3, “Operating the switch,” on page 27 for information on interpreting LED patterns and diagnostics and troubleshooting procedures to determine the status of components. Refer to Figure 1 on page 3 and Figure 3 on page 4 for the location of the parts listed below. Part numbers are subject to change, particularly for SFP transceivers.

For a listing of SFPs compatible with this product:

- Go to the IBM SAN b-type family web page http://www.ibm.com/servers/storage/san/b_type
- Click the **Product details** link under the individual product name
- On the **Product details** tab, click the **Interoperability** link.

Table 24. CRU part numbers

Part number	Description
23R1852	Switch assembly
23R1810	Power supply
23R1818	Fan assembly
	4GB SW transceiver (SFP)
	4GB, 4km LW transceiver (SFP)
	4GB, 10km LW transceiver (SFP)
	35km extended distance LW transceiver (SFP)

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Verantwortlich für die Konformitätserklärung nach Paragraph 5 des EMVG ist die: IBM Deutschland Informationssysteme GmbH 70548 Stuttgart.

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Glossary

This glossary provides definitions for Fibre Channel and switch terminology used for IBM System Storage and SAN switches and related products. It also provides additional definitions of technical terms and abbreviations. If you do not find the term you are looking for, see the *IBM Terminology* located at http://www.ibm.com/ibm/terminology/

This glossary includes terms and definitions from:

- *Information Technology Vocabulary* by Subcommittee 1, Joint Technical Committee 1, of the International Organization for Standardization and the International Electrotechnical Commission (ISO/IEC JTC1/SC1). Definitions are identified by the symbol (I) after the definition; definitions taken from draft international standards, committee drafts, and working papers by ISO/IEC JTC1/SC1 are identified by the symbol (T) after the definition, indicating that final agreement has not yet been reached among the participating National Bodies of SC1.

The following cross-reference conventions are used in this glossary:

See Refers you to (a) a term that is the expanded form of an abbreviation or acronym, or (b) a synonym or more preferred term.

See also
Refers you to a related term.

A

access control list (ACL). In computer security, a list associated with an object that identifies all the subjects that can access the object and their access rights. For example, an access control list is a list that is associated with a file that identifies the users who can access the file and that identified the user's access rights to that file.

ACL. See *access control list.*

address identifier. A 24–bit or 8–bit value used to identify the source or destination of a frame.

alias. An alternate name for an element or group of elements in the fabric. Aliases can be used to simplify the entry of port numbers and worldwide names (WWNs) when creating zones.

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

alias AL_PA. An arbitrated loop physical address (AL_PA) value recognized by a loop port (L_port) in addition to the AL_PA assigned to the port. See also *arbitrated loop physical address*.

alias server. A fabric software facility that supports multicast group management.

AL_PA. See *arbitrated loop physical address*.

American National Standards Institute (ANSI). The governing body for Fibre Channel standards in the U.S.

ANSI. See *American National Standards Institute*.

API. See *application programming interface*.

application programming interface (API). An interface that allows an application program that is written in a high-level language to use specific data or functions of the operating system or another program.

application-specific integrated circuit (ASIC). A computer chip designed for a particular application.

ARB. See *arbitrative primitive signal*.

arbitrative primitive signal (ARB). A primitive signal that is transmitted as the fill word by a loop port (L_port) to indicate that the L_port is arbitrating to access to the loop. Applies only to the arbitrated loop topology.

arbitrated loop. A shared 100 MBps Fibre Channel transport structured as a loop and supporting up to 126 devices and one fabric attachment. A port must successfully arbitrate before a circuit can be established.

arbitrated loop physical address (AL_PA). An 8–bit value used to uniquely identify an individual port within a loop. A loop can have one or multiple AL_PAs.

arbitration. A method of gaining orderly access to a shared-loop topology.

arbitration wait timeout value (AW_TOV). The minimum time an arbitrating loop port (L_port) waits for a response before beginning loop initialization.

area number. A number that is assigned to each potential port location in the switch. Used to distinguish ports that have the same port number but are on different port cards.

ASIC. See *application-specific integrated circuit*.

asynchronous transfer mode (ATM). A method of transmission in which the sending and receiving of data is controlled by control characters such as a start bit and a stop bit, instead of by a timing sequence.

ATM. See *asynchronous transfer mode*.

autonegotiation. A universal mechanism to exchange network capabilities between two Ethernet nodes. The exchange takes place at power-up (or link reset) time. It automatically establishes a link that takes advantage of the highest common denominator of the mutual capabilities of the two Ethernet nodes. The universal mechanism negotiates capabilities that include link speed, PHY types, and full duplex or half duplex.

autoranging. A power supply that accommodates different input voltages and line frequencies.

AW_TOV. See *arbitration wait timeout value*.

B

backup FCS switch. The switch or switches assigned as backup in case the primary fabric configuration server (FCS) switch fails. See also *fabric configuration server switch* and *primary FCS switch*.

bandwidth. (1) The total transmission capacity of a cable, link, or system. Usually measured in bits per second (bps). (2) The range of transmission frequencies available to a network. See also *throughput*.

basic input/output system (BIOS). Code that controls basic hardware operations, such as interactions with diskette drives, hard disk drives, and the keyboard.

BB_credit. See *buffer-to-buffer credit*.

beacon. When all the port light-emitting diodes (LEDs) on a switch are set to flash from one side of the switch to the other, to enable identification of an individual switch in a large fabric. A switch can be set to beacon by a CLI command or through Web Tools.

beginning running disparity. The disparity at the transmitter or receiver when the special character associated with an ordered set is encoded or decoded. See also *disparity*.

BER. See *bit error rate*.

BIOS. See *basic input/output system*.

BISR. Built-in self-repair.

BIST. Built-in self-test.

bit error rate (BER). 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*.

blade. A component that provides application-specific services and components. A blade is typically a hot swappable hardware device.

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

boot code. Software that initialized the system environment during the early phase of the boot-up process. For example, boot code might determine the amount of available memory and how to access it.

boot flash. Flash memory that stores the boot code and boot parameters. The processor runs its first instructions from boot flash. Data is cached in random access memory (RAM).

British thermal unit (Btu). The amount of heat required to raise a pound of water by 1 degree Fahrenheit.

broadcast. The transmission of data from a single source to all devices in the fabric, regardless of zoning. See also *multicast* and *unicast*.

Btu. See *British thermal unit*.

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. See also *buffer-to-buffer flow control*.

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 *buffer-to-buffer credit*.

C

CAM. Content addressable memory.

cache. A buffer that contains frequently accessed instructions and data; it is used to reduce access time.

cascade. Two or more interconnected Fibre Channel switches that can build large fabrics. Switches can be cascaded up to 239 switches, with a recommended maximum of seven inter-switch links (no path longer than eight switches). See also *fabric* and *inter-switch link*.

central processing unit (CPU). The part of a computer that includes the circuits that control the interpretation and running of instructions. A CPU is the circuitry and storage that executes instructions. Traditionally, the complete processing unit was often regarded as the CPU, whereas today the CPU is often a microchip. In either case, the centrality of a processor or processing unit depends on the configuration of the system or network in which it is used.

Challenge Handshake Authentication Protocol (CHAP). (1) An authentication protocol that protects against eavesdropping by encrypting the user name and password. (2) Allows remote servers and clients to securely exchange authentication credentials.

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

CIM. See *Common Information Model*

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

class 1 service. The class of frame-switching service for a dedicated connection between two communicating ports (also called ″connection-oriented service″). Includes acknowledgement of frame delivery or nondelivery.

class 2 service. A connectionless class of frame-switching service that includes acknowledgement of frame delivery or nondelivery.

class 3 service. A connectionless class of frame-switching service that does not include acknowledgement of frame delivery or nondelivery. Can be used to provide a multicast connection between the frame originator and recipients, with acknowledgement of frame delivery or nondelivery.

class 4 service. A connection-oriented service that allows fractional parts of the bandwidth to be used in a virtual circuit.

class 6 service. A connection-oriented multicast service geared toward video broadcasts between a central server and clients.

class F service. The class of frame-switching service for a direct connection between two switches, allowing communication of control traffic between the E_Ports. Includes acknowledgement of data delivery or nondelivery.

class of service. A specified set of delivery characteristics and attributes for frame delivery.

CLI. See *command line interface*.

client. A system or process that is dependent on another system or process (usually called the server) to provide it with access to data, services, programs, or resources.

comma. A unique pattern (either 1100000 or 0011111) used in 8b/10b encoding to specify character alignment within a data stream.

command line interface (CLI). Interface that depends entirely on the use of commands, such as through Telnet or simple network management protocol (SNMP), and does not involve a graphical user interface.

Common Information Model (CIM). An implementation-neutral, object-oriented schema for describing network management information. The Distributed Management Task Force (DMTF) develops and maintains CIM specifications.

community (SNMP). A relationship between a simple network management protocol (SNMP) agent and a set of SNMP managers that defines authentication, access control, and proxy characteristics.

compact flash. Flash (temporary) memory that is used in a manner similar to hard disk storage. It is connected to a bridging component that connects to the PCI bus of the processor. Not visible within the processor's memory space.

control processor (CP). The central processing unit that provides all control and management functions in a switch.

control processor card (CP card). The central processing unit of the director/switch, which contains two control processor (CP) card slots to provide redundancy. Provides Ethernet, serial, and modem ports with the corresponding light-emitting diodes (LEDs).

CP. See *control processor*.

CP card. See *control processor card*.

CPU. See *central processing unit*.

credit. When applied to a switch, the maximum number of receive buffers provided by a fabric port (F_port) or fabric loop port (FL_port) to its attached node port (N_port) or node loop port (NL_port), respectively, such that the N_port or NL_port can transmit frames without over-running the F_port or FL_port.

CRU. See *customer replaceable unit*

CSA. Canadian Standards Association.

customer replaceable unit (CRU). An assembly that is replaced in its entirety by a customer when any one of its components fails. In contrast, a field replaceable unit (FRU) can only be replaced by a qualified service representative.

cut-through. A switching technique that allows the route for a frame to be selected as soon as the destination address is received. See also *route*.

D

data rate. The rate at which data is transmitted or received from a device. Interactive applications tend to require a high data rate, while batch applications can usually tolerate lower data rates.

DB-9 connector. A 9–pin version of the RS–232C port interface.

dc. Direct current.

defined zone configuration. The complete set of all zone objects that are defined in the fabric. The defined configuration can include multiple zone configurations. See also *enabled zone configuration* and *zone configuration*.

DHCP. Dynamic Host Configuration Protocol.

disparity. The proportion 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. See *dynamic load sharing*.

DMA. See *direct memory access*.

DNS. Distributed name server.

domain_ID. Unique identifier for the switch in a fabric. Usually automatically assigned by the switch, but can also be assigned manually. Can be any value between 1–239.

DRAM. See *dynamic random access memory*.

DTE. Data terminal equipment. Usually refers to a terminal.

DWDM. Dense wavelength division multiplexing. Allows more wavelengths to use the same fiber.

dynamic random access memory (DRAM). A storage in which the cells require repetitive application of control signals to retain stored data.

E

edge fabric. A single fabric that uses two or more switches as a core to interconnect multiple edge switches. Synonymous with dual-core fabric. See also *resilient core*.

edge switch. A switch whose main task is to connect nodes into the fabric. See also *core switch*.

E_D_TOV. See *error detect timeout value*.

EE_credit. See *end-to-end credit*.

effective zone configuration. The particular zone configuration that is currently in effect. Only one configuration can be in effect at once. The effective configuration is built each time a zone configuration is enabled.

EIA. Electronic Industries Alliance.

EIA rack. A storage rack that meets the standards set by the Electronics Industries Alliance (EIA).

electromagnetic compatibility (EMC). The design and test of products to meet legal and corporate specifications dealing with the emissions and susceptibility to frequencies in the radio spectrum. Electromagnetic compatibility is the ability of various electronic equipment to operate properly in the intended electromagnetic environment.

electromagnetic interference (EMI). Waves of electromagnetic radiation, including but not limited to radio frequencies, generated by the flow of electric current.

electrostatic discharge (ESD). The flow of current that results when objects having a static charge come into close enough proximity to discharge.

ELP. Extended link parameters.

ELWL. See *extended long wavelength*.

EMC. See *electromagnetic compatibility*.

EMI. See *electromagnetic interference*.

enabled zone configuration. The currently enabled configuration of zones. Only one configuration can be enabled at a time. See also *defined zone configuration* and *zone configuration*.

end port. A port on an edge switch that connects a device to the fabric.

end-to-end credit (EE_credit). The number of receive buffers allocated by a recipient port to an originating port. Used by class 1 and class 2 services to manage the exchange of frames across the fabric between source and destination. See also *end-to-end flow control* and *buffer-to-buffer credit*.

end-to-end flow control. Governs flow of class 1 and class 2 frames between node ports (N_ports). See also *end-to-end credit.*

E_port. See *expansion port*.

error. As applies to fibre channel, a missing or corrupted frame, timeout, loss of synchronization, or loss of signal (link errors). See also *loop failure*.

error detect timeout value (E_D_TOV). The time that the switch waits for an expected response before declaring an error condition. Adjustable in 1 microsecond increments from 2—10 seconds.

ESD. See *electrostatic discharge*.

exchange. The highest level Fibre Channel mechanism used for communication between node ports (N_ports). Composed of one or more related sequences, and can work in either one or both directions.

expansion port (E_port). A port is designated an expansion port (E_port) when it is used as an inter-switch expansion port to connect to the E_port of another switch, to build a larger switch fabric.

exended long wavelength (ELWL). Laser light with a periodic length greater than 1300 nm (for example, 1420 or 1550). ELWL lasers are used to transmit Fibre Channel data over distances greater than 10 km. Can also refer to the type of GBIC or SFP.

F

fabric. A collection of Fibre Channel switches and devices, such as hosts and storage. Also referred to as a ″switched fabric.″

fabric login (FLOGI). The process by which a device gains access to the fabric.

fabric loop port (FL_port). A fabric port that is loop capable. Used to connect node loop ports (NL_ports) to the switch in a loop configuration.

Fabric Manager. An optionally licensed software feature. Fabric Manager is a GUI that allows for fabric-wide administration and management. Switches can be treated as groups, and actions such as firmware downloads can be performed simultaneously.

fabric mode. One of the modes for a loop port (L_port). An L_port is in fabric mode when it is connected to a port that is not loop capable and is using fabric protocol. See also *loop port* and *loop mode*.

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

Fabric OS. An operating system made up of two software components: the firmware that initializes and manages the switch hardware, and diagnostics.

fabric port (F_port). A port that is able to transmit under fabric protocol and interface over links. Can be used to connect a node port (N_port) to a switch. See also *fabric loop port* and *Fx_port*.

Fabric Watch. An optionally licensed software feature. Fabric Watch can be accessed through either the command line or Advanced Web Tools, and it provides the ability to set thresholds for monitoring fabric conditions.

failover. The process of passing control from one redundant unit to another, in a nondisruptive manner.

FAN. Fabric address notification.

FC. See *fibre channel*.

FCA. See *Fibre Channel arbitrated loop*.

FC-AL. See *Fibre Channel arbitrated loop*.

FC-AL-3. The Fibre Channel Arbitrated Loop standard defined by ANSI. Defined on top of the FC-PH standards.

FCC. Federal Communications Commission.

FC-FLA. The Fibre Channel Fabric Loop Attach standard defined by ANSI.

FCP. See *Fibre Channel protocol*.

FC-PDLA. The Fibre Channel Private Loop Direct Attach standard defined by ANSI. Applies to the operation of peripheral devices on a private loop.

FC-PH-1,2,3. The Fibre Channel Physical and Signaling Interface standards defined by ANSI. (first, second, and third generations)

FC-PI. The Fibre Channel Physical Interface standard defined by ANSI.

FCS switch. See *fabric configuration server switch.*

FC-SW-2. The second generation of the Fibre Channel Switch Fabric standard defined by ANSI. Specifies tools and algorithms for the interconnection and initialization of Fibre Channel switches in order to create a multiswitch Fibre Channel fabric.

Fibre Channel (FC). The primary protocol used for building SANs to transmit data between servers, switches, and storage devices. Unlike IP and Ethernet, Fibre Channel was designed to support the needs of storage devices of all types. It is a high-speed, serial, bidirectional, topology-independent, multiprotocol, and highly scalable interconnection between computers, peripherals, and networks.

Fibre Channel arbitrated loop (FC-AL). A standard defined on top of the FC-PH standard. It defines the arbitration on a loop where several FC nodes share a common medium.

Fibre Channel protocol (FCP). The protocol for transmitting commands, data, and status using Fibre Channel FC-FS exchanges and information units. Fibre Channel is a high-speed serial architecture that allows either optical or electrical connections at data rates from 265 Mbps up to 4–Gbps.

Fibre Channel service (FS). A service that is defined by Fibre Channel standards and exists at a well-known address. For example, the Simple Name Server is a Fibre Channel service. See also *Fibre Channel service protocol*.

Fibre Channel service protocol (FSP). The common protocol for all fabric services, transparent to the fabric type or topology. See also *Fibre Channel service*.

Fibre Channel shortest path first (FSPF). A routing protocol used by Fibre Channel switches.

Fibre Channel transport. A protocol service that supports communication between Fibre Channel service providers. See also *Fibre Channel service protocol*.

field replaceable unit (FRU). An assembly that is replaced in its entirety by a service representative when any one of its components fails. In some cases, a field replaceable unit can contain other field replaceable units.

File Transfer protocol (FTP). In Transmission Control protocol/Internet protocol (TCP/IP), an application protocol used for transferring files to and from host computers.

fill word. An IDLE or ARB ordered set that is transmitted during breaks between data frames to keep the Fibre Channel link active.

firmware. The basic operating system provided with the hardware.

FLA. Fabric loop attach.

flash partition. Two redundant usable areas, called *partitions* into which firmware can be downloaded in the director/switch.

FLOGI. See *fabric login*.

FL_port. See *fabric loop port*.

F_port. See *fabric port*.

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, and so on) and data frames.

frame delimiter. A part of an ordered set that marks frame boundaries and describes frame contents. See also *ordered set*.

FRU. See *field replaceable unit*.

FS. See *Fibre Channel service*.

FSP. See *Fibre Channel service protocol*.

FSPF. See *Fibre Channel shortest path first*.

FTP. See *File Transfer protocol*.

full duplex. A mode of communication that allows the same port to simultaneously transmit and receive frames. See also *half duplex*.

Fx_port. A fabric port that can operate as either a fabric port (F_port) or fabric loop port (FL_port). See also *fabric port* and *fabric loop port*.

G

gateway. Hardware that connects incompatible networks by providing the necessary translation for both hardware and software.

GBIC. See *gigabit interface converter*.

Gbps. Gigabits per second.

GBps. Gigabytes per second.

generic port (G_port). A generic port that can operate as either an expansion port (E_port) or a fabric port (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.

gigabit interface converter (GBIC). A removable serial transceiver module designed to provide gigabaud capability for fibre channel (FC) and other products that use the same physical layer.

G_port. See *generic port*.

H

HA. See *high availability*.

half duplex. A mode of communication that allows a port to either transmit or receive frames at any time, but not simultaneously (with the exception of link control frames, which can be transmitted at any time). See also *full duplex*.

hard address. The arbitrated loop physical address (AL_PA) that a node loop port (NL_port) attempts to acquire during loop initialization.

hardware translative mode. Method for achieving address translation. The two hardware translative modes that are available to a QuickLoop-enabled switch are standard translative mode and QuickLoop mode. See also *standard translative mode* and *QuickLoop mode*.

HBA. See *host bus adapter*.

high availability. An attribute of equipment that identifies it as being capable of operating well in excess of 99 percent of the time. High Availability is typically identified by the number of nines in that percentage. For example, a switch that is rated at five nines would be capable of operating 99.999 percent of the time without failure.

host. A computer that is connected to a network and provides an access point to that network. The host can be a client, a server, or both a client and server simultaneously.

host bus adapter (HBA). The interface card between a server or workstation bus and the Fibre Channel network.

hot-pluggable. A field replaceable unit (FRU) that can be removed or installed without turning the system off. Also called ″hot swappable.″

hot swappable. See *hot-pluggable*.

HTTP. See *Hypertext Transfer Protocol.*

hub. A Fibre Channel device that connects nodes into a logical loop by using a physical star topology. Hubs will automatically recognize an active node and insert the node into the loop. A node that fails or is powered off is automatically removed from the loop.

Hypertext Transfer Protocol (HTTP). In the Internet suite of protocols, the protocol that is used to transfer and display hypertext and XML documents on the Web.

I

ID. Identification.

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.

in-band. Transmission of management protocol over the Fibre Channel.

initiator. A server or workstation on a Fibre Channel network that initiates communications with storage devices. See also *target*.

in-order delivery (IOD). A parameter that, when set, guarantees that frames are either delivered in order or dropped.

Internet protocol (IP). A protocol that routes data through a network or interconnected networks. Internet Protocol (IP) acts as an intermediary between the higher protocol layers and the physical network.

inter-switch link (ISL). A Fibre Channel link that connects two switches (a link from the expansion port (E_port) of one switch to the E_port of another).

IOD. See *in-order delivery*.

IP. See *internet protocol*.

ISL. See *inter-switch link*.

ISL Trunking. A feature that enables distribution of traffic over the combined bandwidth of up to four inter-switch links (ISLs) (between adjacent switches), while preserving in-order delivery. A set of trunked ISLs is called a *trunking group*; each port employed in a trunking group is called a *trunking port*. See also *master port*.

isolated E_port. An expansion port (E_port) that is online but not operational between switches due to overlapping domain ID or nonidentical parameters such as error delay timeout values (E_D_TOVs). See also *expansion port*.

J

JBOD. Just a bunch of disks.

K

K28.5. A special 10–bit character used to indicate the beginning of a transmission word that performs fibre channel control and signaling functions. The first seven bits of the character are the comma pattern. See also *comma*.

kernel flash. Flash memory that stores the bootable kernel code and is visible within the memory space of the processor. Data is stored as raw bits.

key. A string of data (usually a numeric value) shared between two entities and used to control a cryptographic algorithm. Usually selected from a large pool of possible keys to make unauthorized identification of the key difficult. See also *key pair.*

key pair. In public key cryptography, a pair of keys consisting of a public and private key of an entity. The public key can be publicized, but the private key must be kept secret.

L

LAN. See *local area network*.

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

LED. See *light-emitting diode*.

light-emitting diode (LED). An electronic component that gives off visible or infrared light when electricity is passed through it. It is used to indicate the status of elements on a switch.

link. As applies to fibre channel, a physical connection between two ports, consisting of both transmit and receive fibers. See also *circuit*.

link services. A protocol for link-related services.

LIP. See *loop initialization primitive*.

LM_TOV. See *loop master timeout value*.

local area network (LAN). A network that connects several devices into a limited area (such as a single building or campus) and that can be connected to a larger network.

logical unit number (LUN). An identifier used on a SCSI bus to distinguish among devices (logical units) with the same SCSI ID.

long wavelength (LWL). A type of fiber optic cabling that is based on 1300 nm lasers. Can also refer to the type of GBIC or SFP. See also *short wavelength*.

loop. A configuration of devices that are connected to the fabric by way of a fabric loop port (FL_port) interface card.

loop circuit. A temporary bidirectional communication path established between loop ports (L_ports).

loop failure. Loss of signal within a loop for any period of time, or loss of synchronization for longer than the timeout value.

loop_ID. A hexadecimal value representing one of the 127 possible arbitrated loop physical address (AL_PA) values in an arbitrated loop.

loop initialization. The logical procedure used by a loop port (L_port) to discover its environment. Can be used to assign arbitrated loop physical address (AL_PA) addresses, detect loop failure, or reset a node.

loop initialization primitive (LIP). 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.

loop master timeout value (LM_TOV). The minimum time that the loop master waits for a loop initialization sequence to return.

loop mode. One of the modes for a loop port (L_port). An L_port is in loop mode when it is in an arbitrated loop and is using loop protocol. An L_port in loop mode can also be in participating mode or nonparticipating mode. See also *loop port*, *fabric mode*, *participating mode*, and *nonparticipating mode*.

loop port (L_port). A node port (NL_port) or fabric port (FL_port) that has arbitrated loop capabilities. An L_port can be either in fabric mode or loop mode. See also *fabric mode* , *loop mode, nonparticipating mode,* and *participating mode.*

loop port state machine (LPSM). The logical entity that performs arbitrated loop protocols and defines the behavior of loop ports (L_ports) when they require access to an arbitrated loop.

L_port. See *loop port*.

LPSM. See *loop port state machine*.

LSAN. Logical storage area network. An LSAN enables device and storage connectivity that spans two or more fabrics.

LSR. Link state record.

LSU. Link state update.

LUN. See *logical unit number*.

LWL. See *long wavelength*.

M

management information base (MIB). A simple network management protocol (SNMP) structure to help with device management, providing configuration and device information.

master port. As relates to trunking, the port that determines the routing paths for all traffic flowing through the trunking group. One of the ports in the first inter-switch link (ISL) in the trunking group is designated as the master port for that group. See also *ISL Trunking*.

MIB. See *management information base*.

multicast. The transmission of data from a single source to multiple specified node ports (N_ports), as opposed to all the ports on the network. See also *broadcast* and *unicast*.

multimode. A fiber optic cabling specification that allows up to 500 m (1640.5 ft) between devices.

N

name server. Frequently used to indicate Simple Name Server. See also *simple name server*.

NEMA. National Electrical Manufacturers Association.

network time protocol (NTP). An Internet standard protocol that provides synchronization of computer clock times in a network with times provided by radio or atomic clocks on the Internet.

NL_port. See *node loop port*.

node. A Fibre Channel device that contains a node port (N_port) or node loop port (NL_port).

node loop port (NL_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 port (N_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.

nonparticipating mode. A mode in which a loop port (L_port) in a loop is inactive and cannot arbitrate or send frames, but can retransmit any received transmissions. This mode is entered if there are more than 127 devices in a loop and an arbitrated loop physical address (AL_PA) cannot be acquired. See also *participating mode*.

nonvolatile random access memory (NVRAM). Random access memory (storage) that retains its contents after the electrical power to the machine is shut off. A specific part of NVRAM is set aside for use by the system ROS for the boot device list.

N_port. See *node port*.

NTP. See *network time protocol*

NVRAM. See *nonvolatile random access memory*.

Nx_port. A node port that can operate as either a node port (N_port) or node loop port (NL_port). See also *node port* and *node loop port*.

O

operating system (OS). A collection of system programs that control the overall operation of a computer system.

ordered set. A transmission word that uses 8b/10b mapping and begins with the K28.5 character. Ordered sets occur outside of frames, and include frame delimiters, primitive signals, and primitive sequences. Ordered sets are used to differentiate Fibre Channel control information from data frames and to manage the transport of frames. See also *frame delimiter*, *primitive signal*, and *primitive sequence.*

OS. See *operating system*.

out-of-band. Transmission of management protocol outside of the Fibre Channel network, usually over Ethernet.

P

packet. A set of information transmitted across a network. See also *frame*.

parallel. The simultaneous transmission of data bits over multiple lines.

participating mode. A mode in which a loop port (L_port) in a loop has a valid arbitrated loop physical address (AL_PA) and can arbitrate, send frames, and retransmit received transmissions. See also *nonparticipating mode*.

path selection. The selection of a transmission path through the fabric. Switches use the Fibre Channel shortest path first (FSPF) protocol.

PDU. Power distribution unit.

Performance Monitoring. A software feature that provides error and performance information to the administrator and user for use in storage management.

phantom address. An arbitrated loop physical address (AL_PA) value that is assigned to a device that is not physically in the loop. Also known as phantom AL_PA.

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

PLDA. See *private loop direct attach*.

PLOGI. See *port login*.

P/N. Part number.

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 gigabit interface converter (GBIC) or small form-factor pluggable (SFP) can be inserted.

port card. A hardware component that provides a platform for field-replaceable, hot swappable ports.

port login (PLOGI). The port-to-port login process by which initiators establish sessions with targets. See also *fabric login*.

port module. A collection of ports in a switch.

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

POST. See *power-on self-test*.

PPP. Point-to-Point Protocol.

power-on self-test (POST). A series of diagnostics that are automatically run by a device when the power is turned on.

primary FCS switch. Primary fabric configuration server switch. The switch that actively manages the configuration and security parameters for all switches in the fabric. See also *backup FCS switch* and *FCS switch*.

primitive sequence. A part of an ordered set that indicates or initiates port states. See also *ordered set*.

primitive signal. A part of an ordered set that indicates events. See also *ordered set*.

principal switch. The switch that assumes the responsibility to assign domain IDs. The role of principal switch is negotiated after a “build fabric” event.

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 fabric loop port (FL_port).

private key. The secret half of a key pair.

private loop direct attach (PLDA). A subset of fibre channel standards for the operation of peripheral devices.

private NL_port. A node loop port (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 device. A device that supports arbitrated loop protocol, can interpret 8–bit addresses, and can log into the fabric.

public loop. An arbitrated loop that includes a participating fabric loop port (FL_port), and can contain both public and private node loop ports (NL_ports).

public NL_port. A node loop port (NL_port) that logs into the fabric, can function within either a public or private loop, and can communicate with either private or public NL_ports.

Q

quad. A group of four adjacent ports that share a common pool of frame buffers.

QuickLoop. (1) A software 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. (2) 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 arbitrated loop physical address (AL_PA) space.

QuickLoop mode. A hardware translative mode that allows private devices to communicate with other private devices across the fabric. See also *hardware translative mode* and *standard translative mode*.

R

RAID. See *redundant array of independent disks*.

RAM. See *random access memory*.

random access memory (RAM). A temporary storage location in which the central processing unit (CPU) stores and executes its processes.

R_A_TOV. See *resource allocation timeout value*.

read only memory (ROM). Memory in which stored data cannot be changed by the user except under special conditions.

receiver ready (R_RDY). A primitive signal indicating that the port is ready to receive a frame.

redundant array of independent disks (RAID). A collection of disk drives that appear as a single volume to the server and are fault tolerant through mirroring or parity checking.

registered state change notification (RSCN). A switch function that allows notification of fabric changes to be sent from the switch to specified nodes.

remote fabric. A fabric that spans across wide area networks (WANs) by using protocol translation (a process also known as tunneling) such as fibre channel over asynchronous transfer mode (ATM) or fibre channel over Internet protocol (IP).

remote switch. A optional feature for long distance fabrics, requireing a Fibre Channel to ATM or SONET gateway.

request rate. The rate at which requests arrive at a servicing entity. See also *service rate*.

resilience. A fabric’s ability to adapt to or tolerate a failure of a component within the fabric.

resilient core. A single fabric that uses two or more switches as a core to interconnect multiple edge switches. Synonymous with dual-core fabric.

resource allocation timeout value (R_A_TOV). Used to time out operations that depend on the maximum possible time that a frame can be delayed in a fabric and still be delivered. This value is adjustable in one microsecond increments from 10—120 seconds.

resource recover timeout value (RR_TOV). The minimum time a target device in a loop waits after a loop initialization primitive (LIP) before logging out a small computer systems interface (SCSI) initiator. See also *error detect timeout value* and *resource allocation timeout value*.

RLS probing. Read link status of the arbitrated loop physical addresses (AL_PAs).

ROM. See *read only memory*.

route. As applies to a fabric, the communication path between two switches. Can also apply to the specific path taken by an individual frame, from source to destination. See also *Fibre Channel shortest path first*.

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

R_RDY. See *receiver ready*.

RR_TOV. See *resource recovery timeout value*.

RS-232 port. An older standard for a port that has been replaced by EIA/TIA-232-E. Used to connect data terminal equipment (DTE) and data communications equipment (DCE) devices for communication between components, terminals, and modems. See also *DB–9 connector*, *DCE port,* and *DTE port*.

RSCN. See *registered state change notification*.

rw. Read-write.

S

SAN. See *storage area network*.

SC. Standard connector.

SCSI. See *small computer systems interface*.

SCSI Enclosure Services (SES). A subset of the small computer systems interface (SCSI) protocol used to monitor temperature, power, and fan status for enclosure devices.

SDRAM. See *synchronous dynamic random access memory*.

Secure Fabric OS. An optionally-licensed software product that runs on top of the Fabric OS and provides customizable security restrictions through local and remote management channels on a switch.

secure sockets layer (SSL). A security protocol that provides communication privacy. SSL enables client/server applications to communicate in a way that is designed to prevent eavesdropping, tampering, and message forgery.

sequence. A group of related frames transmitted in the same direction between two node ports (N_ports).

service rate. The rate at which an entity can service requests. See also *request rate*.

SES. See *SCSI Enclosure Services*.

SFP. See *small form-factor pluggable*.

short wavelength (SWL). A type of fiber optic cabling that is based on 850 nm lasers. Can also refer to the type of gigabit interface converter (GBIC) or small form-factor pluggable (SFP). See also *long wavelength*.

SID. The 3–byte source ID of the originator device, in the 0xDomainAreaALPA format.

SID-DID. Source identifier-destination identifier.

SIMMS. Single in-line modules.

simple name server (SNS). A switch service that stores names, addresses, and attributes for up to 15 minutes, and provides them as required to other devices in the fabric. SNS is defined by Fibre Channel standards and exists at a well-known address. Can also be referred to as directory service. See also *Fibre Channel service*.

simple network management protocol (SNMP). In the Internet suite of protocols, a network management protocol that is used to monitor routers and attached networks. SNMP is an application layer protocol. Information on devices managed is defined and stored in the application's Management Information Base (MIB).

single mode. The fiber optic cabling standard that corresponds to distances of up to 10 km (6.214 mi) between devices.

small computer systems interface (SCSI). A parallel bus architecture and a protocol for transmitting large data blocks up to a distance of 15—25 m (49—82 ft).

small form-factor pluggable (SFP). An optical transceiver used to convert optical and electrical signals between optical fiber cables and switches.

SNMP. See *simple network management protocol*.

SNMPv1. The original standard for SNMP, now labeled v1.

SNS. See *simple name server*.

SOF. Start-of-frame.

SSL. See *secure sockets layer*.

standard translative mode. A hardware translative mode that allows public devices to communicate with private devices across the fabric. See also *hardware translative mode* and *QuickLoop mode*.

storage. A device used to store data, such as a disk or tape.

storage area network (SAN). A network of systems and storage devices that communicate using Fibre Channel protocols. See also *fabric*.

subordinate switch. All switches in the fabric other than the principal switch. See also *principal switch*.

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

switch name. The arbitrary name assigned to a switch.

switch port. A port on a switch. Switch ports can be expansion ports (E_ports), fabric ports (F_ports), or fabric loop ports (FL_ports).

SWL. See *short wavelength*.

synchronous dynamic random access memory (SDRAM). The main memory for the switch. Used for volatile storage during switch operation.

T

target. A storage device on a Fibre Channel network. See also *initiator*.

TCP. See *transmission control protocol*.

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 bits per second (bps). See also *bandwidth*.

topology. As applies to fibre channel, the configuration of the Fibre Channel network and the resulting communication paths allowed.

transceiver. A device that converts one form of signaling to another for transmission and reception; in fiber optic applications, optical and electrical signals are converted.

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 control protocol (TCP). A communications protocol used in the Internet and in any network that follows the Internet Engineering Task Force (IETF) standards for Internet protocol.

transmission word. A group of four transmission characters.

trap (SNMP). The message sent by a simple network management protocol (SNMP) agent to inform the SNMP management station of a critical error. See also *simple network management protocol*.

tunneling. A technique for enabling two networks to treat a transport network as though it were a single communication link or local area network (LAN).

Tx. Transmitted.

U

U. Unit of measure for rack-mounted equipment.

UDP. See *user datagram protocol*.

ULP. See *upper-level protocol*.

ULP_TOV. See *upper-level timeout value*.

unicast. The transmission of data from a single source to a single destination. See also *broadcast* and *multicast*.

universal port (U_port). A switch port that can operate as a generic port (G_port), expansion port (E_port), fabric port (F_port), or fabric loop port (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.

U_port. See *universal port*.

upper-level protocol (ULP). The protocol that runs on top of Fibre Channel. Typical upper-level protocols are small computer system interface (SCSI), Internet protocol (IP), HIPPI, and IPI.

upper-level timeout value (ULP_TOV). The minimum time that a small computer system interface (SCSI) upper-level protocol (ULP) process waits for SCSI status before initiating ULP recovery.

user datagram protocol (UDP). A protocol that runs on top of Internet protocol (IP) and provides port multiplexing for upper-level protocols.

V

VC. See *virtual circuit*.

VCCI. Voluntary Control Council for Interference

virtual circuit (VC). A one-way path between node ports (N_ports) that allows fractional bandwidth.

W

WAN. See *wide area network*.

WDM. Wave division multiplexing. Allows multiple wavelengths to be combined or filtered on a single cable.

well-known address. As it pertains to fibre channel, a logical address defined by the Fibre Channel standards as assigned to a specific function, and stored on the switch.

wide area network (WAN). A network that provides communication services to a geographic area larger than that served by a local area network or a metropolitan network, and that can use or provide public communications facilities.

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

worldwide name (WWN). Uniquely identifies a switch on local and global networks.

World Wide Web (WWW). A network of servers that contain programs and files. Many of the files contain hypertext links to other documents available through the network.

WWN. See *worldwide name*.

WWW. See *World Wide Web*.

Z

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. See also *zoning*.

zone alias. An alias for a set of port numbers or worldwide names (WWNs). Zone aliases can be used to simplify the entry of port numbers and WWNs. For example, “host” could be used as an alias for a WWN of 110:00:00:60:69:00:00:8a.

zone configuration. A set of zones designated as belonging to the same zone configuration. When a zone configuration is in effect, all valid zones in that configuration are also in effect.

zone member. A port, node, worldwide name (WWN), or alias, which is part of a zone.

zone scheme. The level of zoning granularity selected. For example, zoning can be done by switch or port, worldwide name (WWN), arbitrated loop physical address (AL_PA), or a mixture. See also *zone configuration*.

zone set. See *zone configuration*.

Zoning. A feature that runs on Fabric operating system (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. See also *zone*.

Index

A

B

C

D

E

F

G

H

I

W

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