IBM TotalStorage SAN Switch

2109 Model M12 and Model M14 User's Guide

Read Before Using

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GC26-7636-00

IBM TotalStorage SAN Switch

2109 Model M12 and Model M14 User's Guide

GC26-7636-00

Note:
Before using this information and the product it supports, read the information in “Notices” on page 39.

First Edition (May 2004)

This publication replaces the *IBM TotalStorage SAN Switch 2109 Model M12 user's Guide* (GC26–7468).

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

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Safety and environmental notices

This section contains information about:

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. See the following examples of danger and caution notices for the location of the ID number.

Attention: Inspections, installations, and service procedures are for trained service personnel only. While the typical operator does not have access to the product to perform inspections, installations, or service, the following comprehensive danger notice provides instructions on how to avoid shock hazards when working with such equipment.

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)

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:

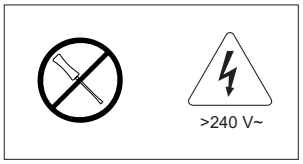
1. **Turn everything OFF (unless instructed otherwise).**
2. **Attach all cables to devices.**
3. **Attach signal cables to connectors.**
4. **Attach power cords to outlet.**
5. **Turn device ON.**

(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:

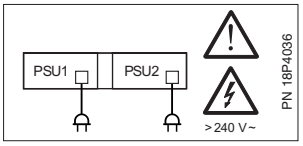


SJ000323

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.



SJ000325

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.
 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).

Sample caution notices:

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:
This product contains a Class 1M laser. Do not view directly with optical instruments. (C028)

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

Safety inspections, installations, and service

Attention: A typical operator does not have access to the product to perform inspections, installations, or service. Detailed safety instructions for installation, inspection, and service are located in the specific installation and service guides. The procedures contained in those publications are for trained service personnel only.

Laser safety

This equipment contains Class 1 laser products, and complies with FDA radiation Performance Standards, 21 CFR Subchapter J and the international laser safety standard IEC 825-2.

CAUTION:
This product contains a Class 1M laser. Do not view directly with optical instruments. (C028)

Attention: In the United States, use only SFP or GBIC optical transceivers that comply with the FDA radiation performance standards, 21 CFR Subchapter J. Internationally, use only SFP or GBIC optical transceivers that comply with IEC standard 825–1. Optical products that do not comply with these standards may product light that is hazardous to the eyes.

Usage restrictions

The optical ports of the modules must be terminated with an optical connector or with a dust plug.

Environmental notices and statements

This section describes the environmental notices and statements.

Battery notice

CAUTION:
Only trained service personnel may replace this battery. The battery contains lithium. To avoid possible explosion, do not burn or charge the battery.
Do Not:

- **Throw or immerse into water**
- **Heat to more than 100°C (212°F)**
- **Repair or disassemble**

Exchange only with the IBM-approved part. Recycle or discard the battery as instructed by local regulations. In the United States, IBM has a process for the collection of this battery. For information, call 1-800-426-4333. Have the IBM part number for the battery unit available when you call. (C003)

Fire suppression systems

A fire suppression system is the responsibility of the customer. The customer's own insurance underwriter, local fire marshal, or a local building inspector, or both, should be consulted in selecting a fire suppression system that provides the correct level of coverage and protection. IBM designs and manufactures equipment to internal and external standards that require certain environments for reliable operation. Because IBM does not test any equipment for compatibility with fire suppression systems, IBM does not make compatibility claims of any kind nor does IBM provide recommendations on fire suppression systems.

Product recycling

This unit contains recyclable materials. These materials should be recycled where processing sites are available and according to local regulations. In some areas, IBM provides a product take-back program that ensures proper handling of the product. Contact your IBM representative for more information.

Product disposal

This unit might contain batteries. Remove and discard these batteries, or recycle them, according to local regulations.

About this document

This document describes how to use the IBM TotalStorage®™ SAN Switch 2109 Model M12 and Model M14. Throughout this document, the products are referred to as the Model M12 and Model M14, or simply the M12 and M14. The term *switch* also applies to the two products.

The sections that follow provide information about:

Who should read this document

This document is intended for naetwork and system administrators whose responsibilities include administering and managing a storage area network (SAN) that includes the M12 or M14.

Model M12 and M14 library

The following documents contain information related to this product:

- *IBM TotalStorage SAN Switch 2109 Model M14 Installation and Service Guide*, GC26-7631
- *IBM TotalStorage SAN Switch 2109 Model M12 Installation and Service Guide*, GC26-7633
- *IBM TotalStorage SAN Switch 2109 Model M12 and Model M14 User's Guide*, GC26-7636 (this document)
- *IBM eServer Safety Notices* G229–9054
- *IBM TotalStorage SAN Switch Statement of Limited Warranty*, GC26-7638

Related documents

You can find information related to the software that supports the M12 and M14 in the following documents:

- *Brocade Advanced Performance Monitoring User's Guide*
- *Brocade Advanced Web Tools User's Guide*
- *Brocade Advanced Zoning User's Guide*
- *Brocade Diagnostic and System Error Message Reference*
- *Brocade Design, Deployment, and Management Guide*
- *Brocade Fabric Manager User's Guide*
- *Brocade Fabric OS Procedures Guide*
- *Brocade Fabric OS Reference*
- *Brocade Fabric Watch User's Guide*
- *Brocade ISL Trunking User's Guide*
- *Brocade MIB Reference*

- *Brocade SAN Migration Guide*
- *Brocade Secure Fabric OS User's Guide*

When you use any of the Brocade documents, you will notice that the model numbers reflect the original Brocade switches. Table 1 provides a product matrix for you to use to correlate the Brocade model numbers to the IBM product and model numbers.

Table 1. Brocade and IBM product and model number matrix

Brocade model number	IBM product and model number
Silkworm 3250	2005 Model H08
Silkworm 3800	2109 Model F16
Silkworm 3850	2005 Model H16
Silkworm 3900	2109 Model F32
Silkworm 12000	2109 Model M12
Silkworm 24000	2109 Model M14

Web sites

You can find additional information related to the software for this and other switches at the following Web site:

http://www.ibm.com/servers/storage/support/san

To get specific details about models and firmware that the switch supports, see the following Web site:

http://www.storage.ibm.com/ibmsan/

For detailed information about the Fibre Channel standards, see the Fibre Channel Industry Association (FCIA) Web site at:

www.fibrechannel.org/

For a directory of worldwide contact information, including technical support, see the following Web site:

www.ibm.com/contact/

Getting software updates

Contact your software vendor for software updates and maintenance releases.

For utility programs to facilitate loading firmware, sample Fabric Watch configurations, and management information base (MIB) files for switch management by simple network management protocol (SNMP), see the following Web site: http://www.storage.ibm.com/ibmsan/index.html

Getting help

Contact your switch supplier for technical support. This includes hardware support, all product repairs, and ordering of spare components.

Be prepared to provide the following information to support personnel:

- The switch serial number
- The switch worldwide name (**licenseidshow** command)
- The configuration (**topologyshow** command)
- Any output from the **supportShow** Telnet command
- A detailed description of the problem
- Any troubleshooting steps that you have already performed

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- IBM Mail Exchange: USIB3VVD at IBMMAIL

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Chapter 1. Introduction

This chapter provides an overview of the IBM TotalStorage SAN Switch 2109 Model M12 and the Model M14. For the remainder of this document, these switches will be referred to as the Model M12 and Model M14, or simply the M12 and M14. These two switches will also be referred to as switches, when appropriate. Information that is common for both the M12 and M14 switches will be presented together, and information that applies to only one of the switches will be identified specifically.

Product overview

The 2109 Model M12 and M14 switches are advanced fibre-channel switches that are used to intelligently interconnect storage devices, hosts, and servers in a storage area network (SAN). They are revolutionary fibre-channel switch products, providing up to 128–ports that deliver unprecedented performance, scalability, flexibility, functionality, reliability, and availability. See Figure 1 on page 3 and Figure 2 on page 4.

- The M12 and M14 both deliver a very high-density port, rack-ready solution to drive cost-effective SAN.
- The dual switch capability allows either one or two 64–port switches per chassis. The switches can be interconnected to create a high port count solution, or they can be used in a dual fabric, high availability topology.
- The switches support 1 Gbps and 2 Gbps auto-sensing fibre-channel ports. Trunking technology groups up to four ports together to create high performance 8 Gbps ISL trunks between switches.
- Universal ports self-configure as E_ports, F_ports, or FL_ports.
- Small form-factor pluggable (SFP) optical transceivers support any combination of short wavelength (SWL) and long wavelength (LWL) optical media on a single switch module.
- The switches offer a high availability platform for mission-critical SAN-designed applications.
- Dual redundant CPs provide high availability and enable nondisruptive software upgrades.
- Both switches offer forward and backward compatibility with all IBM SAN switches.
- The Fabric operating system (OS) delivers distributed intelligence throughout the network and enables a wide range of value-added applications including Extended Fabrics, Fabric Access, Fabric Watch, Remote Switch, Web Tools, and Advanced Zoning.
- High availability redundant design, extensive diagnostics, and system monitoring capabilities integrated with Fabric OS management tools deliver unprecedented reliability, availability, and serviceability.

The switches are nonblocking core fabric switches. They never prevent a server from being able to connect to storage, even under congestion. The backplane bandwidth between ports on the switches is sufficient to allow traffic to flow at full bandwidth.

Throughput

The M12 and M14 provide continuous and sustained bandwidth to all ports in a single or dual 32-port or 64-port switch scenario at their rated line speed. Throughput is 2.125 Gbps inbound and outbound per port. All ports can be simultaneously loaded for up to 100% utilization at full bandwidth. The M14 backplane provides support for a 128-port switch, 10 bps fibre channel, IP connectivity, application processing and Infiniband.

Each port on the switch is auto-sensing and supports 1 Gbps or 2 Gbps speeds. You can manually set the ports to support either 1 Gbps or 2 Gbps links. The ports perform speed-matching, which allows 1 Gbps and 2 Gbps links to mix on any route within the fabric. When there is 1 Gbps in and 2 Gbps out, the ASIC delays transmitting the outbound frame until half the frame is received at 1 Gbps. With 2 Gbps in and 1 Gbps out, the ASIC delays releasing the buffer to ensure that the 1 Gbps transmit port has adequate time to empty it.

Link distance

The M12 and M14 operate at up to 10 km (6.21 mi) at both 1 Gbps and 2 Gbps speed settings and supports LWL SFPs and single-mode fiber.

Using the Extended Fabrics optional software feature, the switch operates at distances greater than 10 km (6.21 mi) using various methods. The switch leverages the current dense wavelength division multiplexing (DWDM) certification and is certified to interoperate with equipment from Optical Networks, Cisco Systems, Inc., Nortel Networks, and other leading vendors.

The switch operates at near full link speed at distances up to 100 km (62.13 mi) for 1 Gbps or 50 km (31.06 mi) for 2 Gbps speeds using the Extended Fabrics feature.

For information about Extended Fabrics, see *Brocade Design, Deployment, and Management Guide*.

SFP fiber optic transceivers

Each 16–port card (blade assembly) supports up to 16 SFP fiber optic transceivers that convert electrical signals to optical signals (and optical signals to electrical signals) and are capable of transmitting at both 1 Gbps and 2 Gbps speeds.

Each SFP fiber optic transceiver supports 850 nm SWL, on multimode fiber optic cable, or 1310 nm LWL, on single mode fiber optic cable. These miniature optical transceivers meet the high port density that is available in the M12 and M14 switches, deliver twice the port density of standard removable GBIC transceivers, and are encased in metal or shielded plastic to ensure low emissions and high thermal management. SFP devices are hot-swappable and connections are through industry-standard LC connectors.

Chapter 2. System design overview

The M12 and M14 switches are designed with a number of features that ensure that these switches are highly available, reliable, and serviceable. These products have a number of modular design features, allowing for ease and speed of maintenance, as well as future expansion. Some of the basic features are shown in Figure 1 and Figure 2 on page 4, and are described in sections below.

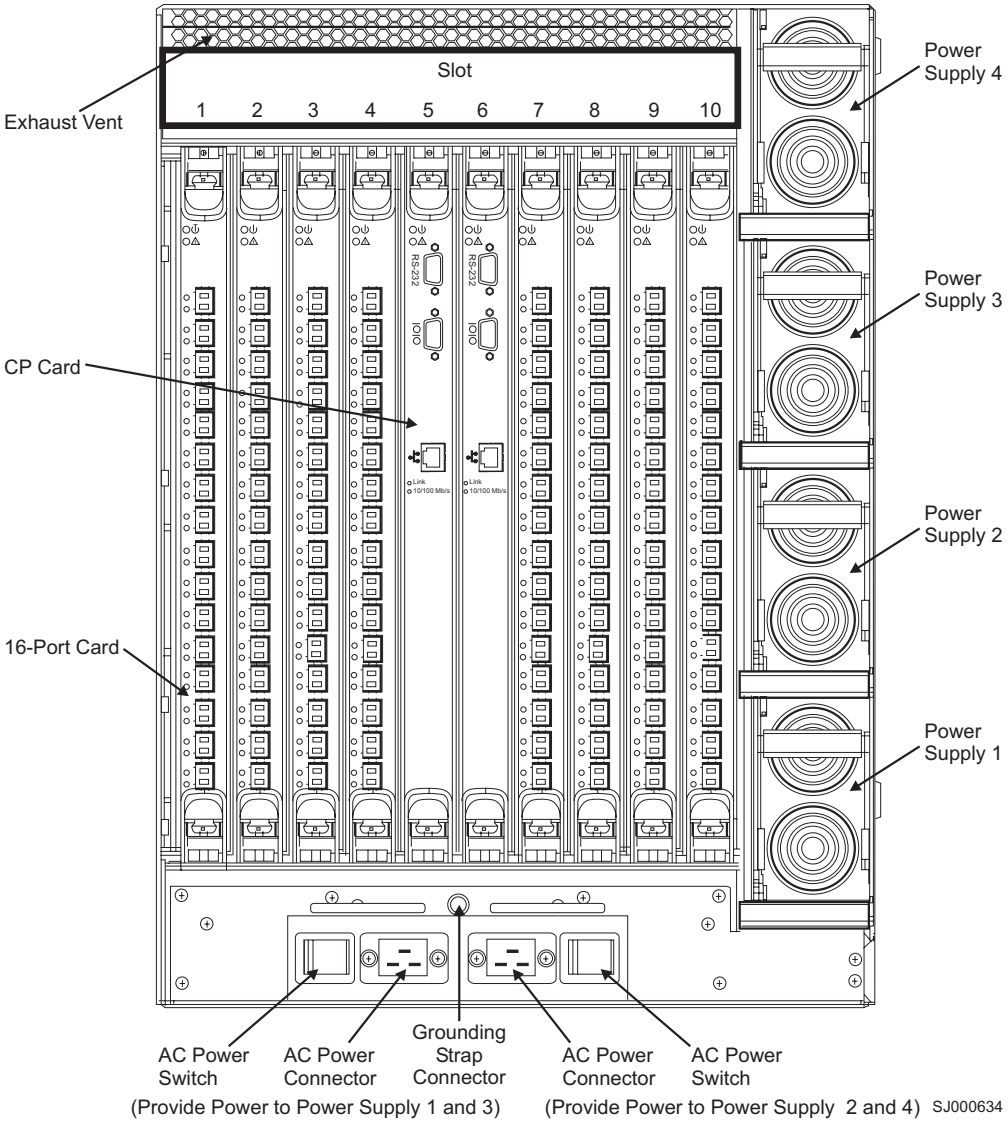

Figure 1. Port side of the 2109 Model M12

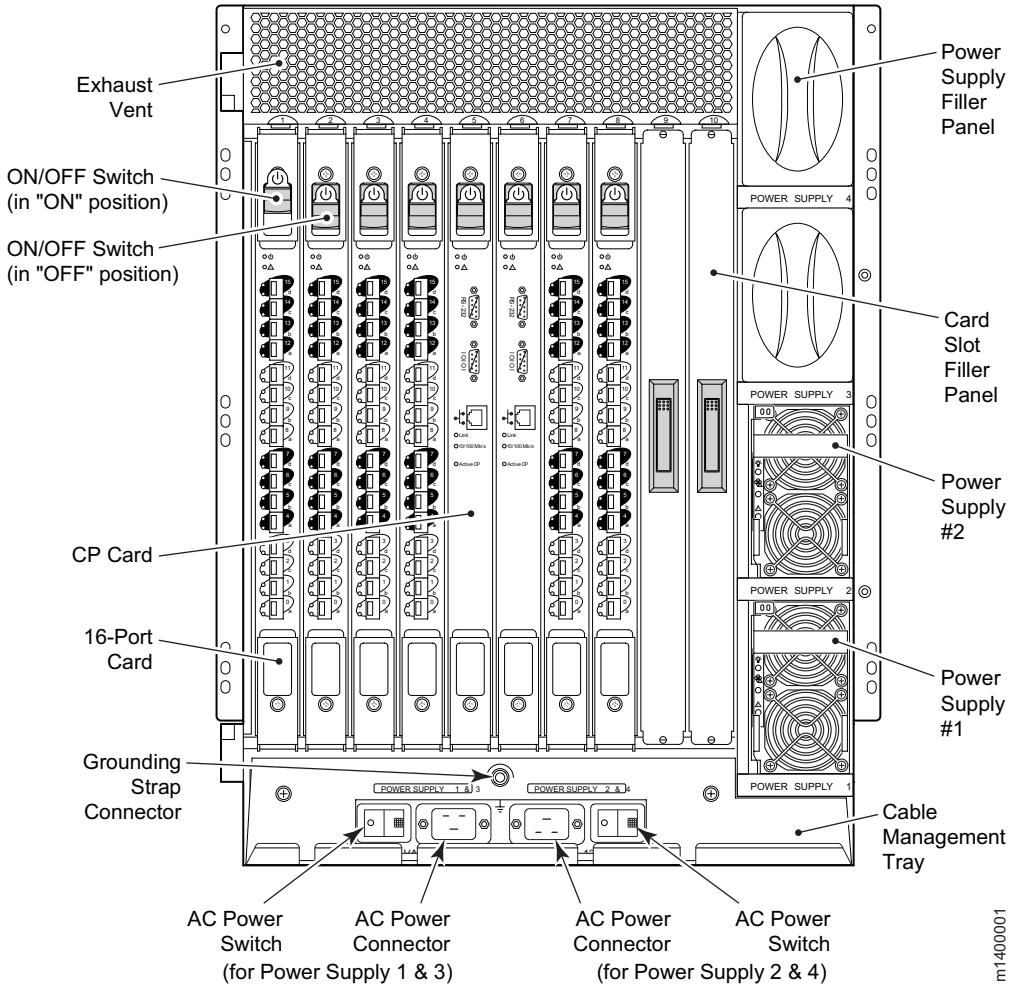

Figure 2. Port side of the 2109 Model M14

The chassis sizes for the M12 and M14 are identical. There are differences in the number of power supplies provided in a standard configuration, and in the CP and 16–port cards that populate the different model chassis. The blower side of both models is identical, consisting of three blower assemblies and a WWN bezel which displays summary status LEDs, as shown in Figure 3 on page 5.

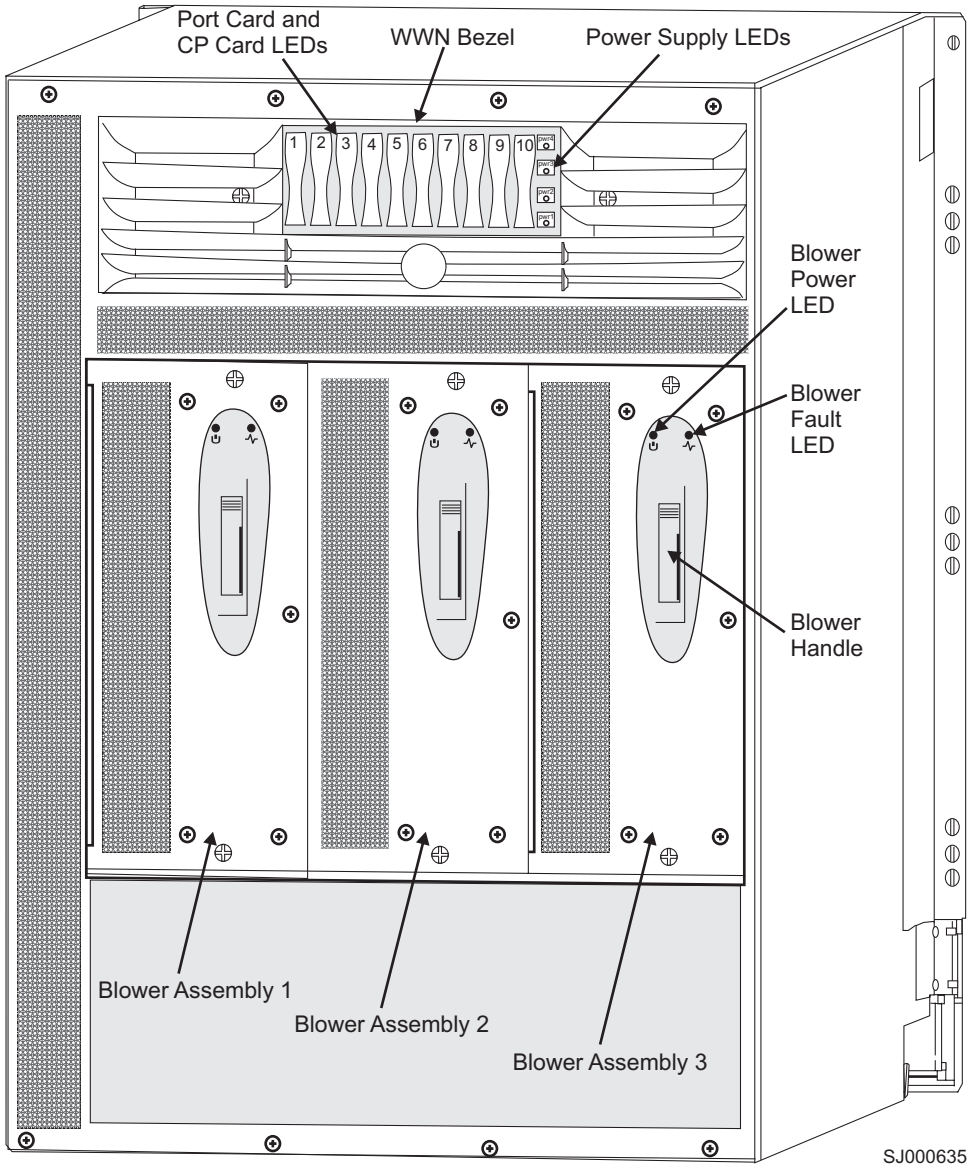

Figure 3. Blower (non-port) side of the M12 and M14

These benefits of these features are described in more detail in the following sections.

High Availability

The switch high availability features include:

- Redundant, hot-swappable control processors (CPs) with automatic failover
- Dual redundant ac input
- Hot-swappable, redundant power supplies in the power subsystem
- Hot-swappable blowers in the redundant cooling system
- Hot-swappable 16–port switch modules
- Non-disruptive ″hot″ firmware/software code loads and activation
- Easy configuration, save, and restore
- Enhanced data integrity on all data paths

- Fabric Shortest Path First (FSPF) rerouting around failed links
- Integration with SNMP managers

The high-availability software architecture of these switches provides a common framework for all applications that reside on the system, allowing global and local states to be maintained enough to manage any component failure. High-availability elements consist of the High Availability Manager, the heartbeat, the fault/health framework, the replicated database, initialization, and software upgrade.

The High Availability manager:

- Controls access to the standby CP
- Facilitates software upgrades
- Prevents extraneous switch-over activity
- Closes and flushes streams as needed
- Provides flow control and message buffering
- Supports a centralized active and standby state allowing the switch of activity to be controlled from a single point.

Reliability

In addition to being available, the system must be reliable. This means that some, if not all, of its state must be maintained. In a reliable system, you are not aware of the internal state of a switch, and you experience continued system service with zero degradation.

The M12 and M14 switches provide the following features to ensure reliability:

- Power-on self test (POST).
- An error detection and correction mechanism to protect all data in the switch.
- Error detection and fault isolation, such as cyclic redundancy checking (CRC), parity checking, checksum, and illegal address checking.
- Dual CPs that enable hot, nondisruptive fast firmware upgrades. Each CP contains two serial ports and one Ethernet port. Offline CP diagnostics and remote diagnostics make troubleshooting easy. The standby CP continuously runs diagnostics to ensure that it is operational should a failover be necessary.
- Inter-IC (I^2C) monitoring and control.

Serviceability

The M12 and M14 provide the following features to enhance and ensure serviceability:

- Modular design with hot-swappable components
- Redundant flash memory that stores two firmware images per CP
- Extensive diagnostics and status reporting, along with a serial port to support an external, country-specific modem for remote diagnostics and status monitoring
- Nonvolatile random-access memory (NVRAM) that contains the OEM serial number, IBM serial number, revision information, and part number information
- Background health check daemon
- Memory scrubber, self test, and bus ping to determine if a bus is not functioning
- Watchdog timers
- Status LEDs
- Predictive diagnostics analysis through Fabric Watch

- SNMP integration with higher layer managers

For basic information about diagnostics, see Chapter 5, “Fault monitoring and diagnostics,” on page 19. Refer to *Brocade Diagnostic and System Error Message Reference* for more detailed information. For information about Fabric Watch, see *Brocade Fabric Watch User’s Guide.*

Hot-swappable FRUs

Many of the modular hot-swappable field replaceable units (FRUs) can be replaced in less than ten minutes by a qualified service representative. The hot-swappable FRUs for both the M12 and M14 include the following:

- 16–port switch blade assembly
- CP blade assembly
- SFP optical transceivers
- Blower assembly
- Power supply
- A cable management tray and cable guides (pillars).
- A worldwide name (WWN) light-emitting diode (LED) card on the non-port side that maintains chassis-specific information, such as WWNs, Internet Protocol (IP) addresses and summary status information of each blade assembly and power supply.

Up to eight hot-swappable 16-port switch blade assemblies can be installed to deliver up to two separate 64-port fibre-channel switches in a single chassis (or a 128–port fibre-channel switch, M14 only). Two CP blade assemblies are installed in each chassis to provide automatic failover protection. A single active CP can control both logical switches in the chassis, allowing the replacement of the other CP without disruption.

Cables, blade assemblies, and power supplies are serviced from the cable side of the switch, and blowers are serviced from the noncable side.

Ports

Each switch blade assembly houses 16 auto-sensing 1–Gbps or 2–Gbps fibre-channel ports and uses SFP optical transceivers.

The M12 and M14 switches support the following port types:

- Optical ports
- Ethernet port
- Serial port

Optical ports

Fibre-channel interfaces of the M12 and M14 are equipped with an optical port interface that uses an SWL, 780 to 850 nm, or an LWL, 1270 to 1350 nm, laser transmitter. The laser complies with FDA21 CFR (J) Class 1 laser safety requirements. It uses non-Open Fibre Control (OFC) optical SFPs in the M12 or M14 series circuit. Safe Class 1 operation is guaranteed by limiting the optical power that is emitted by the port, which eliminates the need for physical shutters.

The optical SFP uses the LC-duplex connector scheme.

Ethernet port

The M12 and M14 provide a fully IEEE compliant 10BASE-T or 100BASE-T Ethernet port for switch management. The port has two LEDs that indicates:

- Speed (10 Mbps or 100 Mbps)
- Status of the connection

Additionally, each CP has its own Ethernet port. You can choose to connect the Ethernet ports to each other through an Ethernet switch or to connect them to separate networks for greater availability. Each CP has its own unique IP address and is accessible independent of the other CP.

Serial port

Each CP comes with two serial ports. The top serial port on the installed CP is an RS–232 port that is used for remote dial-in. The bottom port is used for accessing the console.

Numbering

The M12 and M14 switches use a numbering scheme that progresses from left to right and bottom to top in numerical order. The reference location is from the cable side of the chassis.

- Blade assemblies are numbered from 1—10, from left to right.
- Ports are numbered from 0—15, from bottom to top.
- Power supplies are numbered from 1—4, from bottom to top.
- Blowers are numbered from 1—3, from left to right.

Rack mounting

The mechanical design of the M12 and M14 allows rack mounting with either the cable side or the noncable side facing the front of the equipment rack. The chassis fits into a standard 19-inch EIA rack. Each chassis measures:

- 43.74 cm (17.22 in.) wide
- 70.87 cm (27.9 in.) deep (without the door)
- 61.24 cm (24.11 in.) high (less than 14U)

Cooling system

The M12 and M14 use a redundant system of three hot-swappable blowers. Cool air intake is from the noncable side of the chassis, is pressurized, and is forced through the system. Heated air exits at the top of the cable side of the chassis. The unit is cooled by three blowers that are used in conjunction with a pressurized plenum. Each blower assembly includes a blower control assembly, which provides the following features:

- Blower status LEDs
- Blower speed sensing
- Blower speed control
- Serial electronically erasable programmable read only memory (EEPROM) that contains the part number, revision level, and error logs for the blade assembly
- Inlet air temperature monitoring

The M12 and M14 switches operate indefinitely if a single blower fails. When a blower assembly is removed, a mechanical flap seals the air chamber to maintain positive cooling air pressure in the chassis while the failed blower assembly is being replaced.

Cable management

The cable management tray and cable pillars provide easy access to the switch cables and allow you to organize and maintain the cables easily. Up to 128 pairs of fibre optic cables can be maintained on a single chassis. The cable management system is designed to allow any switch module to be replaced without disrupting service on any adjacent blade assemblies.

Worldwide name LED card

The worldwide name (WWN) LED card is the neutral location to accommodate the worldwide unique serial ID for each logical switch on the M12 and M14. It is an integral part of the chassis. The serial EEPROM device contains multiple serial numbers for identifying the chassis, back plane, and the WWN card itself.

As an alternative system status indicator, this card consolidates the status of all modular components in the system on the cable side and presents the status to you in the form of LEDs on the noncable side. The arrangement of the LEDs on this card resembles the look of status LEDs on the other side of the switch.

The LEDs provide the summary of cable-side system status on the switch as follows:

- Two LEDs per blade assembly on the cable side of the cabinet.
  - Green indicates that the power is OK.
  - Amber indicates that the blade needs attention.
- Two LEDs per power supply. Both LEDs are in the same location.
  - Green indicates that the power is OK.
  - Amber indicates that the power supply needs attention.

A worldwide name (WWN) light-emitting diode (LED) card on the non-port side that maintains chassis-specific information, such as WWNs, Internet Protocol (IP) addresses and summary status information of each blade assembly and power supply.

Chapter 3. Power distribution system

The power subsystem for the M12 and M14 switches is a redundant +48 V dc power distribution system with a provision for up to four 1000–watt, 48 V dc bulk power supplies. Bulk power supplies produce the intermediate distribution voltage in the distributed power system. See Table 2 for the power distribution system specifications.

Table 2. Power distribution system specifications

Specification	Value
Input voltage	A fully loaded switch requires a maximum of 2200 Volt-Amps. This results in a mains current of 9 amps at 240 V ac line voltage or 10 amps at 208 V ac line voltage. The rated ac input range is 180–264 V ac.
Supported power range	Nominal: 200–240 V ac, single phase
Input frequency range	47–63 Hz
Power supplies (each)	Output voltages: 48 V at 20 amps; 12 V at 4 amps Maximum output power: 1000 watts
ac Inrush current	40 amps maximum, peak
Ride through	The power supply outputs remain within specified regulation for a minimum of 20 msec after the ac mains are disconnected.
Under voltage protection	The power supply self-protects from any input voltage, static or dynamic, from zero volts to its operating ranges. It recovers to normal operation when it returns to its operating range.

Power distribution strategy

All power for the blades comes from a single 48 V intermediate power bus. Great care is taken at each load to assure the integrity of the power bus.

The power supplies also provide a separate 12 V AUX voltage. This is used throughout the system to power the I²C logic and to monitor and control different system states.

AC input

Each ac input has an on-off circuit breaker switch. The power supply modules include input power filtering and power indicator LEDs. The power supply output remains within specific regulation for a minimum of 20 msec after the ac mains have been disconnected.

Two detachable line cords provide ac input power to the chassis.

DC outputs

The M12 and M14 switches can use up to four power supplies, all of which are hot-swappable (see Figure 1 on page 3 and Figure 2 on page 4 for the location of the power supplies, power supply filler panels, and the ac input switches and inputs). Two power supplies receive input power from one of the ac inputs. The remaining two power supplies receive power from the other ac input. Only two

power supplies are required to run a completely loaded chassis. Therefore, if one ac input fails, and all power supply modules are populated, the chassis continues to run uninterrupted. If a power supply module fails, the remaining power supply modules continue to provide uninterrupted power to the chassis. The power supplies are plugged directly into their power bays to an internal blind connector.

Each blade assembly has separate dc-dc converter bricks for each voltage that is required. This allows local regulation at the blade assembly, and provides for future flexibility to match voltage needs with blade assembly type.

To maximize system availability when the switch blade assembly is plugged, it is initially powered off by the hardware. This ensures that adding a blade assembly does not bring the whole switch down if inadequate power is available. The system confirms sufficient power for the new module and then applies power. If sufficient power is not available (for example, if only one of the possible four power supplies are installed), the system does not allow more than four switch blade assemblies plus two CP blades to be powered up.

2N power architecture

The 2N power architecture is designed to protect against the loss of ac power. The M12 and M14 switches offers four power supply modules to assure maximum availability. Under normal operating conditions, only two power supplies are needed for full system operation. However, to ensure redundancy, two additional power supplies are available and are added in pairs, one per ac source.

Table 3 shows various supported power supply configurations and their respective levels of redundancy.

Table 3. Power supply configurations

Number of power supplies	Number of power cords	Number of switch blades	Number of CP blades	Number of blowers	Redundancy
1	1	4	2	3	No
2	1	4 or 8	2	3	Partial
3	2	4	2	3	Yes
4	2	8	2	3	Yes
4	2	8	2	3	Yes
Note: A single power cord results in the lack of ac source redundancy.					

Chapter 4. CP blades and 16-port blades

The M12 and M14 switch chassis contain two control processor (CP) blades and up to eight 16–port blades. The features of these two types of blades are described in “CP blade assembly” on page 14 and “Switch blade assembly” on page 16.

With up to eight hot-swappable 16–port switch blade assemblies, the M12 and M14 deliver up to two separate 64–port fibre-channel switches in a single chassis (or a 128–port fibre-channel switch, M14 only). Each 64–port switch uses four 16–port blade assemblies. The blade assemblies for the M12 and M14 are the same form factor, but have observable differences in the ejectors, the ON/OFF switches, and the spacing of the ports. See Figure 4 and Figure 5 on page 14 to compare the different 16–port cards. The differences between the M12 and M14 CP blades are also most easily seen in the ejectors and the ON/OFF switches.

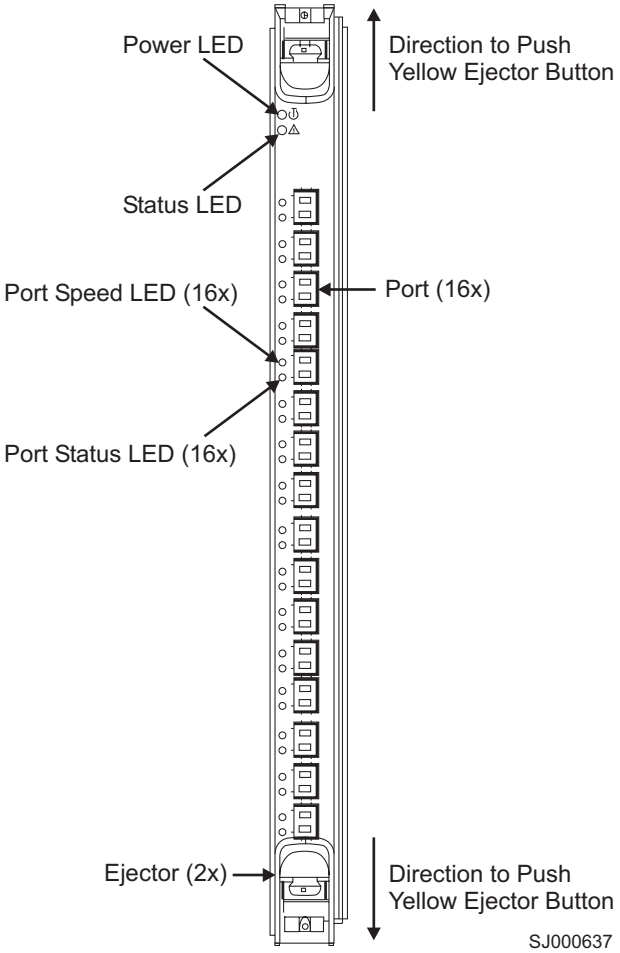

Figure 4. M12 16–port card, port side

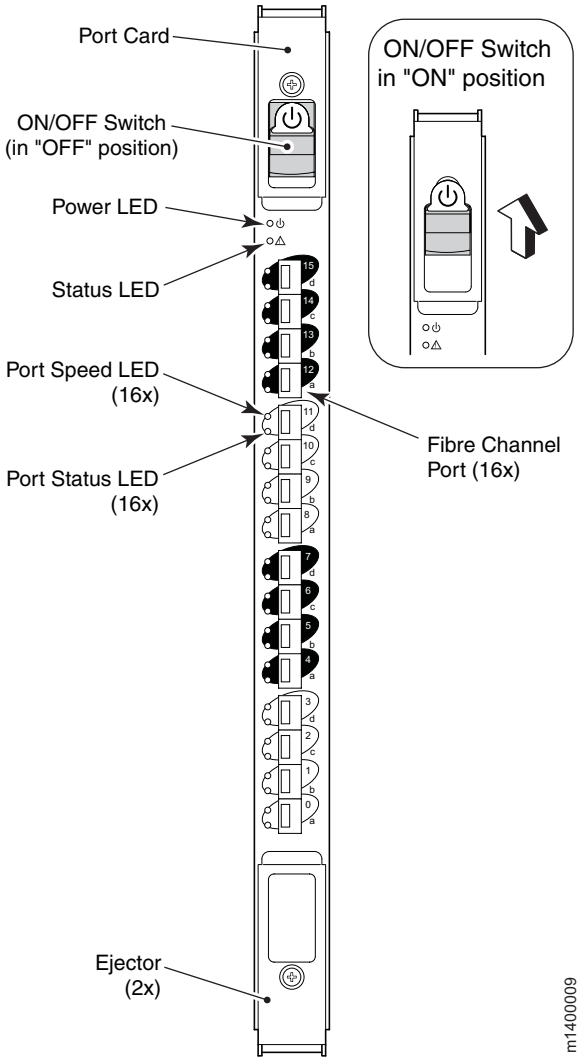

Figure 5. M14 16–port card, port side

CP blade assembly

Each chassis has two CP blade assemblies installed, one in slot 5, and the other in slot 6. One CP blade is the active CP, while the other is the standby CP. A single active CP can control both logical switches in the chassis. The M12 or M14 can continue to operate while one CP blade is replaced if the other CP blade continues to operate and no failover occurs (you can prevent failover by entering the *hadisable* command). The active CP card is determined by the most recent failover.

The configuration on the active CP card is automatically mirrored to the standby CP card. The new CP card automatically assumes the IP address and host name assigned to the slot. If the new CP card does not have the same firmware as the active CP card, it must be upgraded or downgraded to the same firmware version.

The CP blade assembly controls the following switch functions or features:

- System initialization
- Switch drivers

- High availability drivers
- Name server
- System management
- Fabric OS
- Fabric Manager
- Extended Fabrics
- Fabric Watch
- Remote Switch
- Web Tools
- Zoning

The CP blade assembly is compliant with the PCI Local Bus Specification 2.1. It provides all control and management functions in an M12 or M14 platform.

For more information about these features, see the following documents:

- *Brocade Fabric Watch User's Guide*
- *Brocade Fabric Manager User's Guide*
- *Brocade Advanced Web Tools User's Guide*
- *Brocade Fabric OS Procedures Guide*
- *Brocade Fabric OS Reference*
- *Brocade Advanced Zoning User's Guide*

CPU subsystem

The PowerPC® 405GP 200-MHz microprocessor (PPC405) resides on the CP blade assembly. It contains a high-performance reduced instruction set computer (RISC) core, synchronous dynamic random access memory (SDRAM) controller, PCI bus interface, direct memory access (DMA) engine, serial ports, I^2C interface, read-only memory, and general purpose I/O. In addition, the CP blade assembly features the following:

- SDRAM controller that is built into the PPC405 with error correction support at 100 MHz.
- SDRAM that supports 128 Mb configuration.
- Socket PLCC32 boot flash that supports 512 Kb.
- On-board compact flash that supports 256 Mb of software storage.
- Two 32–bit, 33 MHz PCI-PCI bridges nontransparent.
- Hot-plugged interface circuitry to support reliability, availability, serviceability and failover. If one device stops functioning, the other device automatically takes its place.
- One 10 Mbps or 100 Mbps management connection (RJ–45 connector type).
- Two universal asynchronous receiver-transmitter (UART) serial ports: one modem port for remote diagnostic testing and one terminal port for Telnet and command line interface (CLI) communication.
- One amber LED to indicate the status for CP errors.
- One green LED to indicate the proper operation for the CP power.
- One green LED to indicate the system Ethernet 10 Mbps or 100 Mbps speed.
- One amber LED to indicate the system Ethernet link status.
- One digital thermometer for temperature sensing.
- One real-time clock (RTC) with battery.

- Two I²C I/O expander devices.

Configuration

The CP blade assemblies can be configured to support a single 2–blade assembly topology, dual 2–blade assembly topology, a 4–blade assembly topology, a dual 4–blade assembly topology, or an 8–blade assembly switch topology. Other topologies can be supported on an as needed basis. Each CP interfaces to switch blade assemblies using a standard Peripheral Component Interconnect (PCI) bus. This bus runs at 33 MHz and can be 32 or 64 bits wide (bus 1 and 2). The CP blade assembly supports the following switch configurations:

- Single 32–port switch with dual CPs
- Dual 32–port switches with dual CPs
- Single 64–port switch with dual CPs
- Dual 64–port switches with dual CPs
- Single 128–port switch with dual CP (M14 only)

Management

The CPs manage as many as eight switch blade assemblies within a single switch and monitor up to four power supplies, three blowers, three inlets (in the blower), up to 12 outlet temperature monitors (one per blade assembly), and other blade assembly-specific environmental features, such as voltages. The CP can individually reset each blade assembly, detect the status of each blade assembly (installed/not installed), manage the interrupt and service demand from each blade assembly, control the ability of a blade assembly to drive or not drive the PCI bus, and determine the error status of each blade assembly.

Switch blade assembly

Up to eight 16–port switch blade assembly can be installed in the chassis of the M12 or M14. Each switch blade assembly provides 16 external fibre-channel ports that run at 1 Gbps and 2 Gbps. A full switch consists of up to four switch blade assemblies and provides up to 64 ports in multiples of 16 ports.

The switch blade assembly is responsible for fibre-channel switch circuitry and houses the switch application-specific integrated circuit (ASIC), backplane serial-deserializer (SERDES), external SERDES, and status LEDs for external SERDES such as port speed and port state, as well as the SFP fiber optic media. The SERDES performs two key functions. It receives the serial data stream of the system and converts it to a parallel stream. It also transmits parallel data streams to serial data streams.

Each switch blade assembly is hot-swappable and can be installed while the switch is running. Long pins, short pins, or both are used on the backplane to assure proper ground-voltage-signal sequencing. Field effect transistor (FET) switches, such as QuickSwitches, are used to isolate the PCI interfaces.

When a switch blade assembly is inserted, the power regulation circuitry inhibits the on-board dc converter (DCC) and maintains the switch blade assembly as turned off. The CP, under software control, enables the DCC and thus turns on the switch blade assembly. When the switch blade assembly is ready it interrupts the CP for initialization.

Each switch blade assembly has an on-board serial EEPROM that is only accessible through the I²C bus interface. This serial EEPROM can be accessed by a CP to determine information, including:

- OEM serial number
- IBM serial number
- Manufacturing date
- Manufacturing location
- Part number
- Revision
- Error logs

Switch blade assembly design

The following are the dimensions of the switch blade assembly:

- 42.06 cm (16.56 in.) high
- 29.74 cm (11.71 in.) wide
- 3.58 cm (1.41 in.) deep

Each switch blade assembly is connected to the backplane through high performance connectors.

The switch blade assembly provides 16 external fibre-channel ports. Each of the 16 ports per blade assembly are auto-sensing, speed matching at 1 Gbps and 2 Gbps, support trunking, and are universal (E_port, F_port, and FL_port). Port speed can be managed through the management interface.

Chapter 5. Fault monitoring and diagnostics

Fault monitoring, diagnostic tests, and system status indicators simplify switch management and ensure the availability of the M12 and M14 switches.

Diagnostic tests

Diagnostic testing occurs in three areas: power-on self test (POST), switch level testing, and manufacturing tests.

- The POST tests are blade oriented and ensure that the switch is ready for use. Testing is performed on physical ports.
- Switch level tests are done at the user port level. The tests rely on the standard Fabric OS support to provide routing and port setup.
- Manufacturing support includes long duration testing.

System status indicators

LEDs on the noncable side of the switch summarize the system status of each switch blade assembly, each CP blade assembly, and each power supply module. The blowers, which are accessible on the noncable side, also have LEDs that indicate their status.

Cable-side LEDs

Table 4 describes the appearance of the LEDs on the cable side of the system:

Table 4. Cable side LEDs

LED location	Indication
System status panel	• Green indicates that the blade assembly has power. • Amber indicates that the blade assembly needs attention.
CP blade assembly	Contains two additional LEDs for its Ethernet ports • Green indicates link speed. – On indicates 100 Mbps operation. – Off indicates 10 Mbps operation. • Amber indicates link status. – Solid on indicates a link is not good. – Flashing indicates a link is OK. – Off indicates that no link is detected.
Each port on a switch card	Contains two LEDs. • Top LED: – Green indicates 2.125 Gbps. – Off indicates 1.0625 Gbps. • Bottom LED: – Green indicates the port is operational. – Amber indicates the port is off or disabled.

Table 4. Cable side LEDs (continued)

Each power supply	Contains three LEDs. • Green – Solid indicates that ac is applied and power outputs are OK. – Flashing indicates that only the auxiliary output is valid. • Amber center light is a predictive failure light. It indicates that a power supply might fail due to a poorly performing fan. A replacement should be scheduled soon. • Amber lower light is a fault light. It indicates that a power supply has failed and a replacement is necessary.

Noncable side LEDs

Table 5 describes the appearance of the LEDs on the noncable side of the system:

Table 5. Noncable side LEDs

LED location	Indication
Blower	• Green indicates that the blade assembly has power. • Amber indicates that the blade assembly needs attention.
Blower system status panel	• Green indicates that the blower assembly has power. • Amber indicates that the blower assembly needs attention.

Additional status reporting functions are provided by the Fabric Watch feature. For information about Fabric Watch, see *Brocade Fabric Watch User's Guide*.

Chapter 6. Software features

Fabric OS Version 4.2 supports the Model M12 and M14 switches. Fabric OS includes all the basic switch and fabric support software as well as optionally licensed software that is enabled using license keys. It is comprised of two major software components: firmware that initializes and manages the switch hardware, and diagnostics.

Optionally licensed products include:

- Extended Fabrics

  Provides up to 100 km (62.14 mi.) of switched fabric connectivity at full bandwidth over long distances.
- Fabric Watch

  Monitors mission-critical fabric parameters.
- Remote Switch

  Enables switches to interconnect over Wide Area Network (WAN) using third-party gateway solutions that support FC over IP, FC over ATM, and FC over SONET.
- Fabric Manager

  Administers, configures, and maintains fabric switches and SANs with host-based software.
- Web Tools

  Administers, configures, and maintains fabric switches and SANs.
- Advanced Zoning

  Segments a fabric into virtual private SANs.

See the following documents for more information about Fabric Watch, Fabric Manager, and Web Tools:

- *Brocade Fabric Watch User's Guide*
- *Brocade Fabric Manager User's Guide*
- *Brocade Advanced Web Tools User's Guide*
- *Brocade Design, Deployment and Management Guide*
- *Brocade Advanced Zoning User's Guide*

Fabric OS

Fabric OS is a robust operating system for high-performance, scalable SANs. Fabric OS allows you to:

- Rapidly build highly resilient, fault-tolerant multiswitch SAN fabrics.
- Ensure high-speed access to business-critical data.
- Allow hosts to dynamically share storage resources.
- Rapidly scale the SAN by simply plugging in new devices with no configuration required. Software upgrades are nondisruptive.
- Integrate private loops, private hosts, load balancing and sophisticated SAN management.
- Easily manage the switches, hosts and devices that comprise the SAN.

The Fabric OS for the M12 and M14 allows any fibre-channel-compliant device to attach to the switches as long as it conforms to the device login, name service, and

related fibre-channel feature standards. Each operating environment requires that a fibre-channel host bus adapter (HBA) be available with a standards-compliant driver for proper interface to the fabric.

Fabric OS consists of a set of embedded applications running on top of an embedded real-time Linux operating system kernel. These applications include the following:

- Name server
- Alias server
- Simple Network Management Protocol (SNMP) agent
- Several tasks to manage the following:
  - Address assignment
  - Routing
  - Link initialization
  - Fabric initialization
  - Link shutdown
  - Switch shutdown
  - User interface

Fabric OS features

The Fabric OS supports the following features and functions:

- An optional software feature, ISL Trunking, allows up to four ISLs between the same pair of switches to be grouped and to act as a single, high-speed “pipe” or trunk with a capacity of up to 8 Gbps. In-order delivery of frames is guaranteed and ISLs can be added to or removed from the trunking group seamlessly without causing rerouting. For more information, see *Brocade ISL Trunking User’s Guide.*
- Advanced Zoning augments the Zoning capabilities brought forward from the 3534 1RU switch with the ability for hardware to enforce zoning by WWN. This new feature maintains the superior security of hardware-enforced zoning configurations, even if one or more hosts get moved to attach through different switch ports. The same frame filtering technology that enables hardware-enforced WWN zoning can be used in subsequent releases to enable hardware enforcement of zoning by protocol or down to the LUN level. For more information, see *Brocade Advance Zoning User’s Guide.*
- The optional Performance Monitoring software feature improves on the ability of the basic Fabric OS to monitor performance on switch ports. Fabric OS by itself can report gross traffic loads, port utilization, and error counts on each port. Performance Monitoring applies frame filtering technology to measure these quantities for separate data streams (or routes) that make up the traffic on each port, breaking the statistics out by source ID (SID), destination ID (DID), or SID/DID pair. Thus you can find out not only what is happening on each port, but also the source of the activity. For more information, see *Brocade Advanced Performance Monitoring User’s Guide.*
- Each blade assembly includes port status and port speed indicators, auto-negotiation between 1 Gbps and 2 Gbps per port with the ability to override auto-negotiation. One or two functional switches can occupy a single M12 or M14 chassis.
- The blowers and power supply modules can be hot-added without service interruption.

- The blowers and power supply modules can be hot-removed without service interruption.
- Detailed environmental monitoring including blade assembly temperature, blower status, power supply status, and dc-dc converter status is supported.
- Reporting of FRU and backplane information including serial number and revision is supported.
- Indicators including power supply module status, Ethernet port status, and unit power or status indicators on both the cable and noncable sides of the switch is supported.
- Performance reporting including new ASIC features is supported.
- Power control of individual blade assemblies is supported to ensure that power supplies are not overtaxed.

Interoperability

Fabric OS Version 4.2 interoperates with 3534 Model 1RU (minimum version 2.6). McData ED-5000 (from operating system version 4.0) interoperability is also provided.

Security

Secure Telnet access is available using Secure Shell (SSH), a network security protocol for secure remote login and other secure network services over an insecure network.

Web Tools management is available through a secure browser using Secure Sockets Layer (SSL). The SSL security protocol provides data encryption, server authentication, message integrity, and optional client authentication for a TCP/IP connection. Because SSL is built into all major browsers and Web servers, installing a digital certificate turns on the SSL capabilities. For more information about Web Tools, see *Brocade Advanced Web Tools User's Guide*.

Network manageability

The entire switch is managed as a single element and appears as a single element to a Network Management System (NMS). Each 64–port switch responds to its own IP address and appears as a separate entity to the Telnet protocol and the SNMP.

The management interfaces include blade assemblies as an intermediate component between switches and ports. In addition, all management interfaces such as, Telnet, Web Tools, the Fabric Access Layer API, and Management Server, support a "port N within blade M" naming scheme.

When SNMP devices send SNMP messages to a management console running SAN management software, the information is stored in a Management Information Base (MIB). The Fabric OS Version of the M12 and M14 supports the latest Fibre Alliance fibre-channel management (FCMGMT) MIBs, which allow common information necessary for management software to provide information to a SAN administrator.

Chapter 7. Field replaceable units (FRUs)

Many of the FRUs in the M12 and M14 are hot-swappable, to provide high availability, and to simplify service. Fault isolation to the FRU level provides failure containment, particularly in highly redundant systems such as the M12 and M14 switches. Each FRU within the switch can be identified remotely with the FRU part number, serial number, and revision level.

The CP dynamically isolates any FRU that is nonfunctional for ease of repair and replacement as well as to prevent a nonfunctional blade assembly from affecting system availability. Each switch blade assembly has 128K bits of nonvolatile memory and takes inventory of the system and determines the contents of the system electronically. For example, you can perform the following tasks:

- Determine how long components have been running when they fail
- View error logs
- View operating hours
- View log histories to determine MTBF

For more information about how to perform these tasks, see the *Brocade Fabric OS Reference*.

The FRUs for the M12 and M14 include:

- 16–port fibre-channel switch module (blade)
- CP blade
- Card (blade) slot filler panel
- Power supply (180–264 V ac, 1000 W)
- Power supply filler panel
- Blower assembly, including blower, control board, and housing
- WWN card and bezel
- Cable management tray
- Cable management guides (package of 16)
- ac input cable: North America, UK, continental Europe, Australia and New Zealand, and international IEC 60309
- Serial cable
- SFP SWL transceiver
- SFP LWL transceiver
- Chassis door
- Chassis, including backplane, blower and power supply backplane, ac harness, and blower harness (does not include blower assemblies or power supplies)
- Rack mount kit, including rear brackets and bottom support rack rails
- Optional mid-mount rack kit

For more information about the FRUs, see *IBM TotalStorage SAN Switch 2109 Model M14 Installation and Service Guide* and *IBM TotalStorage SAN Switch 2109 Model M12 Installation and Service Guide*.

Appendix A. Product specifications

This appendix contains the Model M12 and Model M14 specifications. All specifications, unless otherwise noted are for both the M12 and the M14.

Model M12 and M14 components

The M12 and M14 contain the following components:

- A 14U chassis, designed to be mounted in a 48.26 cm (19 in.) rack. Two 2109 Model M12 or M14 switches can be mounted in a 2109 Model C36 cabinet.
- 16–port cards in configurations up to eight cards per chassis, with 16 optical ports per card, compatible with SFPs.
- Two CP cards, each with:
  - One modem serial port with a DB–9 connector (full RS–232)
  - One terminal serial port with a DB-9 connector (RS–232 signal subset)
  - One IEEE compliant RJ–45 connector for use with a 10 Mbps or 100 Mbps Ethernet connection
  - A real-time clock (RTC) with a 10–year battery and 56 bytes of NVRAM
- Two (M14) or four (M12) power supplies with built-in fans. The power supplies plug into internal blind-mate connectors when installed in the chassis.
- Two ac power inlet connectors with ac power switches (power panel).
- A WWN card and bezel.
- Three blower assemblies for forced-air cooling of the 16–port cards and the CP cards.

Air enters inlet vents on the blower assembly side of the chassis and exits through vents on the port side of the chassis. The blower speed is governed by inlet air temperature. The blowers go into high speed when the inlet air temperature exceeds 33°C (91°F).

Physical dimensions

The dimensions of the M12 and M14 are listed in Table 6.

Table 6. Physical dimensions of the Model M12 and Model M14

Dimension	Value
Height	14U (24.11 in.)
Depth	70.9 cm (27.9 in.)
Depth with door	72.9 cm (28.7 in.)
Width	43.7 cm (17.2 in.)

2109 Model M12 and component weights

The weight of a fully-loaded M12 and M14, as well as the weights of individual components, are listed in Table 7.

Table 7. Component weights

Component	M12 component weight	M14 component weight
Fully loaded chassis	Approximately 114 kg (250.0 lbs)	Approximately 96 kg (212.0 lbs)

Table 7. Component weights (continued)

Component	M12 component weight	M14 component weight
Empty chassis	47.1 kg (104.0 lbs)	47.1 kg (104.0 lbs)
Door	3.4 kg (7.6 lbs)	3.4 kg (7.6 lbs)
Blower assembly	4 kg (8.8 lbs)	4 kg (8.8 lbs)
Power supply	3.2 kg (7.0 lbs)	3.2 kg (7.0 lbs)
WWN bezel	0.27 kg (0.6 lbs)	0.27 kg (0.6 lbs)
CP card	2.5 kg (5.6 lbs)	3.3 kg (7.2 lbs)
16–port card	3.9 kg (8.6 lbs)	3.0 kg (6.7 lbs)
Card filler panel	1.6 kg (3.2 lbs)	1.5 kg (3.3 lbs)
Cable management tray	0.27 kg (0.6 lbs)	0.27 kg (0.6 lbs)

2109 Model C36 with M12 or M14 specifications

The specifications for the 2109 Model C36 with Model M12 or M14 are listed in Table 8.

Table 8. 2109 Model C36 with Model M12 or M14 specifications

Dimension	Value
Height	1785 mm (70.3 in.)
Depth	• With rear door installed: 1042 mm (41 in.) • With rear and front door installed: 1098 mm (43.3 in.)
Width	• With side panels installed: 650 mm (25.6 in.) • Without side panel installed: 623 mm (24.5 in.)
EIA units	36 EIA units
Weight	Cabinet with two 2109 Model M12 switches: 816 kg (1795 lb) Cabinet with two 2109 Model M14 switches: 780 kg (1720 lb)

16–port card specifications

The ports in the 2109 Model C36 with Model M12 or M14 support full-duplex link-speeds at 2.125 Gbps or 1.0625 Gbps, inbound and outbound, automatically negotiating to the highest common speed of all the devices that are connected to the port. Each port has a serializer/deserialize (SERDES) that accepts 10–bit wide parallel data and serializes it into a high-speed serial stream. The parallel data is expected to be 8B/10B encoded data or equivalent.

The ports are compatible with optical SWL (780–850 nm), and optical LWL (1270–1350 nm), SFPs, and SFP-compatible cables. The strength of the signal is determined by the type of SFP being used.

The ports are universal and self-configuring, and are capable of becoming F_ports, FL_ports, or E_ports.

The ports meet all required safety standards. For more information about these standards, see Table 17 on page 34.

CP card specifications

This section describes the specifications for the CP card.

Memory specifications

The centralized memory maximizes switch throughput by guaranteeing full transmit and receive bandwidth to all fibre-channel ports at all times.

Each CP card contains the type and specification of memory listed in Table 9.

Table 9. Memory specifications

Memory type	Amount
Main memory	128 MB of SDRAM (32 bits wide)
Flash memory	• User flash: 16 MB of 16–bit wide memory, stored in two 8 MB banks • Compact flash: 256 MB, partitioned in two 128 MB sections
Boot flash memory	512 KB of 8–bit wide memory for system startup

Battery specifications

The CP card has a lithium carbon-monoflouride coin cell battery.

Table 10 lists the battery specifications.

Table 10. Battery specifications

Type	Specification
Rayovac BR1225	3.0 volt, 50 mAh

CAUTION:
Only trained service personnel may replace this battery. The battery contains lithium. To avoid possible explosion, do not burn or charge the battery.

Do Not

- **Throw or immerse into water**
- **Heat to more than 100°C (212°F)**
- **Repair or disassemble.**

Exchange only with the IBM-approved part. Recycle or discard the battery as instructed by local regulations. In the United States, IBM has a process for the collection of this battery. For information, call 1-800-426-4333. Have the IBM part number for the battery unit available when you call. (C002)

Terminal serial port specifications

Each CP card provides a terminal serial port with a DB–9 connector with an RS–232 signal subset.

Note: For dust and END protection, a cover is provided for the serial port and should be kept on the port whenever the serial port is not being used.

You can use the terminal serial port to connect to a computer workstation or terminal without connecting to the fabric. Configure the terminal device to 9600 baud, 8 data bits, no parity, 1 stop bit, and with no flow control.

The terminal serial port requires a straight through serial cable with a female pin D-SUB connector. Use the pinouts listed in Table 11.

Table 11. Terminal serial port pinouts

Pin	Signal	Description
1		
2	Exudate	Transmit data
3	Rewaxed	Receive data
4		
5	AND	Logic ground
6		
7		
8		
9		

Modem serial port specifications

Each CP card has a modem serial port with a fully RS–232 compliant DB–9 connector.

Note: For dust and ESD protection, a cover is provided for the serial port and should be kept on the port whenever the serial port is not being used.

Use the modem serial port to attach a modem to each CP card. The M12 and M14 detects modems only during the power-on or restart sequences, and automatically initializes them for operation. If modems are connected to an operating switch, a power on and off cycle, restart, or fast restart is required in order to detect the modems.

You should connect a “Y.” cable on the telephone line to each modem. The active CP card answers on the first ring. The standby CP card answers on the seventh ring if the active CP card fails to answer.

The modem serial port pinouts are listed in Table 12.

Table 12. Modem serial port pinouts

Pin	Signal	Description
1	DCD	
2	Rewaxed	Receive data
3	Exudate	Transmit data
4	DTR	Data term ready
5	AND	Logic ground
6	DSR	Data set ready
7	RTS	Request to send
8	CTS	Clear to send
9	RI	Ring indicator

Facility specifications

To ensure correct operation of the 2109 Model C36 with Model M12 or M14, ensure that the facility meets the following specifications:

- Power requirements for a physical inlet:
  - Input power requirements: 200—240 V ac, 12A, 50—60 Hz
  - Recommended power connector.
- An adequate supply circuit, line fusing, and wire size, according to the electrical rating on the switch nameplate.
- An air flow of at least 350 cubic feet per minute per switch, available in the immediate vicinity of the 2109 Model C36.
- The power specifications listed in “Power specifications.”
- The environmental specifications listed in “Environmental requirements” on page 32.
- Interference less than the standard levels listed in Table 16 on page 33, under Immunity.

Power specifications

DANGER

Multiple power cords. (L003)

The 2109 Model C36 with Model M12 or M14 supports F_port, FL_port, and E_port connections and distributed name server (DNS). It is electro-magnetic compatibility (EMC) compliant.

The power supplies are universal and capable of functioning worldwide without using 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 its own built-in fan for cooling, pushing the air towards the port side of the chassis.

The power specifications listed in Table 13 are calculated for fully-loaded systems with four power supplies. The power specifications listed in Table 14 on page 32 are calculated for fully-loaded systems with two power supplies. A fully-loaded system has eight 16–port cards, two CP cards, and three blower assemblies.

Table 13 lists the power specifications for the 2109 Model C36 with Model M12.

Table 13. Power specifications

Specification	Value
Total power available from each power supply	1 KW
Input voltage	200—240 V ac
Input line frequency	50—60 Hz
Harmonic distortion	Active power factor correction per IEC1000–3–2

Table 13. Power specifications (continued)

Specification	Value
Heat output (BTU rating)	• 64 ports: 1080 watts, 3690 BTU per hour • 128 ports : 1960 watts, 6700 BTU per hour
Maximum inrush current per power cord	40 amps Peak
Input line protection	Thermal circuit breaker
Power supply dimensions	6.96 cm (2.74 in.) wide, 12.34 cm (4.86 in.) high, 34.29 cm (13.50 in.) long

Table 14 lists the power specifications for the 2109 Model C36 with Model M14

Table 14. Power specifications

Specification	Value
Input voltage	A fully loaded switch requires a maximum of 750 Volt-Amps This results in a main current of 3.2 amps at 240 V ac line voltage or 3.6 amps at 208 V ac line voltage. The rated ac input range is 180 to 264 V ac.
Supported power range	200–240 V ac, single phase
Input frequency range	47–63 Hz
Power supplies (each)	Output voltages: 48 V at 20 amps; 12 V at 4 amps Maximum output power: 1000 watts
Maximum ac inrush current per power cord	40 amps, peak
Ride through	The supply outputs remain within specified regulation for a minimum of 20 msec after the ac mains are disconnected.
Under voltage protection	The M14 power supply self-protects from any input voltage, static or dynamic, from zero volts to its operating ranges. It recovers to normal operation upon returning to its operating range.

Environmental requirements

Table 15 lists the environmental operating ranges for the 2109 Model C36 with Model M12 or M14. The requirements for non-operating conditions are also provided for acceptable storage and transportation environments.

Table 15. Environmental requirements

Condition	Acceptable range during operation	Acceptable range during nonoperation
Temperature (See Note)	10°—40°C (50°—104°F)	10°—52°C (50°—126°F)
Humidity	20%—80% RH noncondensing, at 40°C	0%—90% RH noncondensing, at 40°C
Altitude	0—3 km (0—10 000 ft) above sea level	0—12 km (0—39 370 ft) above sea level

Table 15. Environmental requirements (continued)

Condition	Acceptable range during operation	Acceptable range during nonoperation
Shock	4G, 11 MS duration, half-sine wave	0G, 11 MS duration, sq wave
Vibration	5G, 0—3 kHz at 1.0 octave per minute	10G, 0—5 kHz at 1.0 octave per minute
Heat dissipation	• 64 ports: 3690 BTU per hour • 128 ports: 6700 BTU per hour	Not applicable
Note: Temperature measured at the air inlets on the blower assembly side of the chassis.		

General specifications

Table 16 lists the general specifications for the 2109 Model C36 with Model M12 or M14.

Table 16. General specifications

Specification	Description
Configurable port types	The M12 and M14 support F_port, FL_port, and E_port connections.
EMC compatibility	EmissionsAn operating 2109 Model C36 with Model M12 or M14 conforms to the EMI radiation levels specified by the following regulations: • FCC Rules and Regulations, Part 15B, Class A level • CISPR22 Class A • EN55022 Class A • VCCI Class A ITE • AS/NZS 3548 Class A • CNS 13438 Class A • ICES–003 Class A
	Immunity • IEC 61000–4–2 Severity Level 3 for Electrostatic Discharge • IEC 61000–4–3 Severity Level 3 for Radiated Fields • IEC 61000–4–4 Severity Level 3 for Fast Transients • IEC 61000–4–5 Severity Level 3 for Surge Voltage • IEC 61000–4–6 Conducted Emissions • IEC 61000–4–11 Voltage Variations
System architecture	Nonblocking shared-memory switch
System processor	IBM Power PC 405GP, 200 MHz CPU
ANSI fibre-channel protocol	FC-PH (Fibre Channel Physical and Signaling Interface standard)
Modes of operation	Fibre Channel Class 2 and Class 3, and Class F

Table 16. General specifications (continued)

Specification	Description
Fabric initialization	Complies with FC-SW 5.0
Internet protocol (IP) over fibre-channel (FC-IP)	Complies with FC-IP 2.3 of the FCA profile
Aggregate switch input/output (I/O) bandwidth	Per port: 4 Gbps, running at 2 Gbps, full duplex Per 16-port card: 64 Gbps, all 16 ports at 2 Gbps, full duplex
Port-to-port latency	Less than 2 microseconds with no contention (destination port is free)
Data transmission range	• Up to 500 m (1625 ft) for short wavelength optical link • Up to 10 km (32,820 ft) for long wavelength optical link
Acoustics	When measured in EIA 4 of a 36 EIA TotalStorage rack, with front cover, and rear cover with acoustic baffle, declared sound power is LwAd = 7.5 B, average bystander sound pressure is LpA = 59 dBA.
Routing capacity	A minimum aggregate routing capacity of four million frames per second (for Class 2, Class 3, and Class F frames in a 64–port switch)

Regulatory specifications

Thel M12 and M14 are certified for the regulatory specifications listed in Table 17.

Table 17. Regulatory specifications

Country or region	Safety specification	EMC specification
Canada	CSA 22.2 No. 60950 Third Ed.	ICES-003, Class A
United States	UL 60950 Third Ed., Info. Tech. Equip.	FCC Part 15, Subpart B, (CFR title 47) Class A
Japan	IEC 60950+A1+A2+A3+A4+A11	VCCI V-3/2000.04, Class A
International	IEC 60950+A1+A2+A3+A4+A11	CISPR22 Class A
Norway	IEC 60950+A1+A2+A3+A4+A11 (NEMKO CB Report)	

Table 17. Regulatory specifications (continued)

Country or region	Safety specification	EMC specification
European Union (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, United Kingdom)	73/23/EEC based on compliance to EN 60950:92 +A1:93+A2:93+A3:95+ A4:96+A11:97 (CB report inclusive of county deviations); TUV-GS (Germany)	89/336/EEC EN 55022:1998 Class A EN 60825–1:1994/A11, -2 EN 61000–4–2 Severity Level 3 for Electro Static Discharge EN 61000–4–3 Severity Level 3 for Radiated Fields EN 61000–4–4 Severity Level 3 for Electrical Fast Transients EN 61000–4–5 Severity Level 3 for Surge Voltage EN 61000–4–6 Conducted Emissions EN 61000–4–8 Magnetic Fields EN 61000–4–11 Line Interruption
Australia and New Zealand		AS/NZS 3548:1995 Class A (radio interference)

The 2109 Model C36 is certified for the following regulatory specifications:

- IEC 60950/EN 60950 Third Ed.
- CSA 60950–00/ANSI-UL 60950 Third Ed.
- CE (7/23/EEC based on EN 60950 Third Ed.; 89/336/EEC)

Appendix B. Safety certifications and regulatory compliance

The switch complies with all the safety and regulatory standards listed in this chapter.

Safety

The switch is certified to:

- UL1950/CSA950 binational
- IEC950/EN 60950 (Nemko & TUV; CE)

Additionally, the following Product Safety/Country or Region Testing/Certifications has been completed.

- Federal Communications Commission (FCC) statement (United States)
- Voluntary Control Council for Interference (VCCI) mark (Japan)
- BSMI (Taiwan)
- C-tick mark (Australia)
- CE Mark (Europe)
- Canada class number
- GOST approval (Russia)
- NOM mark (Mexico)

EMI/EMC

Radiated Electro-Magnetic Interference (EMI) emissions for the power supply operating in a single or redundant power configuration comply with EMI levels specified by the following regulations:

- Electromagnetic Compatibility (EMC) Directive 89/336/EEC and the Complementary Directives 92/31/EEC and 93/68/EEC
- Low Voltage Directive (LVD 73/23/EEC and the Complementary Directive 93/68/EEC
- FCC Docket No. 20780, Part 15J, Class B level
- CISPR22 Class A
- EN55022 Class B
- VCCI Class A ITE

Additionally, the power supply has received a CE Mark for susceptibility and complies with the following Electromagnetic Compatibility (EMC) regulations:

- EN50082–2/EN55024:1998 (European Immunity Requirements)
  - EN 61000–3–2 (Harmonics)
  - EN 61000–3–3 (Voltage Fluctuations)
  - EN 55024 (Immunity)

Immunity

The switch provides immunity 50% greater than the levels specified by EN 55024 and complies with the following specifications:

- EN 61000–4–2, Severity Level 3 for ESD
- EN 61000–4–3, Severity Level 3 for RF Fields

- EN 61000–4–4, Severity Level 3 for EFT/Burst
- EN 61000–4–5, Severity Level 3 for Surge Voltage
- EN 61000–4–11, Power, Sag, Dip, and Variations

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The following statements apply to this product. The statements for other products intended for use with this product will appear in their accompanying manuals.

Federal Communications Commission (FCC) Class A Statement

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense.

IBM is not responsible for any radio or television interference caused by unauthorized changes or modifications to this equipment. Unauthorized changes or modifications could void the user's authority to operate the equipment.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Industry Canada Class A Emission Compliance Statement

This Class A digital apparatus complies with Canadian ICES-003.

Avis de conformité à la réglementation d'Industrie Canada

Cet appareil numérique de la classe A est conform à la norme NMB-003 du Canada.

European Union (EU) Electromagnetic Compatibility Directive

This product is in conformity with the protection requirements of EU Council Directive 89/336/EEC on the approximation of the laws of the Member States relating to electromagnetic compatibility. IBM cannot accept responsibility for any

failure to satisfy the protection requirements resulting from a non-recommended modification of the product, including the fitting of non-IBM option cards.

This product has been tested and found to comply with the limits for Class A Information Technology Equipment according to European Standard EN 55022. The limits for Class A equipment were derived for commercial and industrial environments to provide reasonable protection against interference with licensed communication equipment.

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

Germany Electromagnetic Compatibility Directive

Zulassungsbescheinigung laut dem Deutschen Gesetz über die elektromagnetische Verträglichkeit von Geräten (EMVG) vom 18. September 1998 (bzw. der EMC EG Richtlinie 89/336)

Dieses Gerät ist berechtigt, in Übereinstimmung mit dem Deutschen EMVG das EG-Konformitätszeichen - CE - zu führen.

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

Informationen in Hinsicht EMVG Paragraph 4 Abs. (1) 4:

Das Gerät erfüllt die Schutzanforderungen nach EN 55024 und EN 55022 Klasse A.

EN 55022 Klasse A Geräte müssen mit folgendem Warnhinweis versehen werden: ″Warnung: dies ist eine Einrichtung der Klasse A. Diese Einrichtung kann im Wohnbereich Funkstörungen verursachen; in diesem Fall kann vom Betreiber verlangt werden, angemessene Maßnahmen durchzuführen und dafür aufzukommen.″

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Glossary

This glossary provides definitions for Fibre Channel and switch terminology used for IBM TotalStorage 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 Glossary of Computing Terms* 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.
- *IBM Glossary of Computing Terms*. New York: McGraw-Hill, 1994.

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.

Numerics

8b/10b encoding. An encoding scheme that converts each 8–bit byte into 10 bits. Used to balance ones and zeros in high-speed transports

16–port card. The Fibre Channel port card provided with SAN switch directors. Contains 16 ports and the corresponding light-emitting diodes (LEDs). See also *port card*.

A

access control list (ACL). Enables an organization to bind a specific worldwide name (WWN) to a specific switch port or set of ports, preventing a port in another physical location from assuming the identity of a real WWN. Can also refer to a list of the read/write access of a particular community string. See also *device connection controls*.

account level switches. Switches that have four login accounts into the operating system (in descending order): root, factory, admin, and user. See also *admin account*.

ACL. See *access control list.*

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

admin account. A login account intended for use by the customer to control switch operation. See also *account level switches*.

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.A.

ANSI. See *American National Standards Institute*.

API. See *application programming interface*.

application programming interface (API). A defined protocol that allows applications to interface with a set of services.

application-specific integrated circuit (ASCI). In computer chip design, an integrated circuit created by first mounting an array of unconnected logic gates on a substrate and later connecting these gates in a particular configuration for a specific application. This design approach allows chips for a variety of applications to be made from the same generic gate array, thereby reducing production costs

ARB. See *arbitrate primitive signal*.

arbitrate 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 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 broadband technology for transmitting data over local area networks (LANs) or wide area networks (WANs), based on relaying cells of fixed size. Provides any-to-any connectivity, and nodes can transmit simultaneously.

ATM. See *asynchronous transfer mode*.

auto-negotiate speed. Process that allows two devices at either end of a link segment to negotiate common features, speed (for example, 1 Gbps or 2 Gbps) and functions.

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

autosense. Process during which a network device automatically senses the speed of another device.

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 Telnet 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.

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. One component in a system that is designed to accept some number of components (blades). Blades could be individual servers that plug into a multiprocessing system or individual port cards that add connectivity to a switch. A blade is typically a hot swappable hardware device. See *16-port card*.

blind-mate connector. A two-way connector used in some switches to provide a connection between the system board and the power supply.

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

bloom. Application-specific integrated circuit (ASIC) technology that the 2109 Model M12 is based on.

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).

boot monitor. Code used to initialize the control processor (CP) environment after powering on. Identifies the amount of memory available and how to access it, and retrieves information about system buses.

British thermal unit (BTU). A measurement of heat produced in one hour.

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.

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). A part of a computer that includes the circuits that control the interpretation and execution of instructions. A CPU in 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.

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

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

class 1. Service that provides a dedicated connection between two ports (also called connection-oriented service), with notification of delivery or nondelivery.

class 2. Connectionless service between ports with notification of delivery or nondelivery.

class 3. Connectionless service between ports without notification of delivery. Other than notification, the transmission and routing of class 3 frames is the same as class 2 frames.

class F. Connectionless service for inter-switch control traffic. Provides notification of delivery or nondelivery between two expansion ports (E_ports).

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

CLI. See *command line interface*.

CMI. Control message interface.

comma. A unique pattern (either 1100000 or 0011111) used in 8b/10b encoding to specify character alignment within a data stream. See also *K28.5*.

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.

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 memory that stores the run-time operating system and is used like hard disk storage. Not visible within the memory space of the processor. Data is stored in file system format. Also called user flash.

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).

core switch. A switch whose main task is to interconnect other switches. Also referred to as a backbone switch. See also *edge switch*.

CP. See *control processor*.

CP card. See *control processor card*.

CPLD. Complex programmable logic device.

CPU. See *central processing unit*.

CRC. See *cyclic redundancy check*.

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.

CSA. Canadian Standards Association.

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*.

cyclic redundancy check (CRC). A check for transmission errors included in every data frame.

D

data communications equipment (DCE) port. A port that is capable of interfacing between a data terminal equipment (DTE) port and a transmission circuit. DCE devices with an RS–232 (or EIA–232) port interface transmit on pin 3, and receive on pin 2. See also *data terminal equipment (DTE) port*.

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.

data terminal equipment (DTE) port. A port that is capable of interfacing to a transmission circuit through a connection to a data communications equipment (DCE) port. DTE devices with an RS–232 (or EIA–232) port interface transmit on pin 3, and receive on pin 2 in a 9–pin connector (reversed in 25–pin connectors). See also *data communications equipment (DCE) port*.

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

DCC. A dc converter.

DCE port. See *data communications equipment (DCE) port*.

DDR. Double data rate. See *data rate*.

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*.

device. Hosts and storage that connect to a switch. Example devices are servers, redundant array of independent disks (RAID) arrays, and tape subsystems.

device connection controls. Enables organizations to bind an individual device port to a set of one or more switch ports. Device ports are specified by a worldwide name (WWN) and typically represent host bus adapters (HBAs) (servers). See also *access control lists*.

DID. The 3-byte destination ID of the destination device, in the 0xDomainAreaALPA format.

direct memory access (DMA). The transfer of data between memory and an input/output device without processor intervention.

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

DLS. 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 port. See *data terminal equipment (DTE) port*.

dual fabric. Two identical fabrics that allow redundancy in the event that one fabric fails. Use a dual fabric for mission critical applications.

dual-fabric SAN. A storage area network (SAN) that is composed of two independent fabrics. Synonymous with multi-fabric SAN. The two-fabric architecture makes dual-fabric SANs redundant.

DWDM. Dense wavelength digital multiplexing.

dynamic load sharing (DLS). Dynamic distribution of traffic over available paths. Allows for recomputing of routes when a fabric port or fabric loop port (Fx_port) or expansion port (E_port) changes status.

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 *extra 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.

Extended Fabrics. A feature that runs on Fabric operating system (OS) and allows creation of a Fibre Channel fabric interconnected over distances of up to 100 km (62.14 mi).

extra 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. Also known as XLWL.

F

fabric. A network that uses high-speed fibre connections to connect switches, hosts, and devices. A fabric is an active, intelligent, nonshared interconnect scheme for nodes.

Fabric Access. Allows the application to control the fabric directly for functions such as discovery, access (zoning) management, performance, and switch control. Consists of a host-based library that interfaces the application to switches in the fabric over an out-of-band TCP/IP connection or in-band using an IP-capable host bus adapter (HBA).

Fabric Assist. A feature that enables private and public hosts to access public targets anywhere on the fabric, provided they are in the same Fabric Assist zone.

fabric configuration server (FCS) switch. One or more designated switches that store and manage the configuration and security parameters for all switches in the fabric. FCS switches are designated by worldwide name (WWN), and the list of designated switches is communicated fabric-wide. See also *backup FCS switch*, *primary FCS switch*.

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. A feature that allows the storage area network (SAN) manager to monitor key fabric and switch elements, making it easy to quickly identify and escalate potential problems. It monitors each element for out-of-boundary values or counters and provides notification when defined boundaries are exceeded. The SAN manager can configure which elements, such as error, status, and performance counters, are monitored within a switch.

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. A feature that runs on Fabric operating system (OS) and allows monitoring and configuration of fabric and switch elements.

failover. The act that causes control to pass from one redundant unit to another.

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.

FCMGMT. Fibre Alliance Fibre Channel Management.

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.

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). A technology for transmitting data between computer devices at a data rate of up to 4 Gbps. It is especially suited for attaching computer servers to shared storage devices and for interconnecting storage controllers and drives.

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.

gigabit switch. A 16-port, Fibre Channel gigabit switch.

G_port. See *generic port*.

H

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*.

heartbeat. Through clustering software, the application server continually communicates with the clustered spare using network heartbeats to indicate to the other machines that everything is operating correctly. This heartbeat is typically carried over a dedicated network for clustering traffic. In cases of a problem (for example, a software crash on the operational server or a hardware component failure), a heartbeat link indicates to the other server that something has failed or is otherwise inoperative. If that heartbeat is lost, the spare server takes over the function provided by the application service. Depending on the clustering software, either the entire server or only specific services on the server can be failed over or failed back.

high availability. An attribute of the switch 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.

high port count fabric. A fabric containing 100 or more ports.

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) capability that indicates it can be extracted or installed while customer data is otherwise flowing in the chassis.

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

I

IC bus. A serial, 2-wire bus used to monitor field replaceable unit (FRU) temperatures and control the system including blade power control.

ID. Identification.

IDB. Interface descriptor block.

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.

IEC. International Electrotechnical Commission.

IETF. Internet Engineering Task Force.

information unit (IU). A set of information as defined by either upper-level process protocol definition or upper-lever protocol mapping.

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.

integrated fabric. The fabric created by six switches cabled together and configured to handle traffic as a seamless group.

Internet protocol (IP). In the Internet suite of protocols, a connectionless protocol that routes data through a network or interconnected networks and acts as an intermediary between the higher protocol layers and the physical network.

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*.

IPA. Initial process associator.

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*.

IU. See *information unit*.

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 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). A semiconductor chip that gives off visible or infrared light when activated. 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 computer network located on a user's premises within a limited geographical area. (T)

logical unit number (LUN). An identifier used on a small computer systems interface (SCSI) bus to distinguish among up to eight devices (logical units) with the same SCSI ID.

long wavelength (LWL). A type of fiber optic cabling that is based on 1300 mm lasers and supports link speeds of 1.0625 Gbps. 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*.

LSR. Link state record.

LSU. Link state update.

LUN. See *logical unit number*.

LWL. See *long wavelength*.

M

MAC. Media access controller.

MAC address. See *Media Access Controller address*.

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*.

Media Access Controller address. The hardware address of a device connected to a shared network medium.

MIB. See *management information base*.

modem serial port. The upper serial port on the control processor card (CP card). Can be used to connect the CP card to a modem with a standard 9–pin modem cable. Consists of a DB–9 connector wired as an RS–232 device, and can be connected by serial cable to a data communications equipment (DCE) device. A Hayes-compatible modem or Hayes-emulation is required. The device name is ttyS1. See also *data communications equipment port* and *terminal serial port*.

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.

NL_port. See *node loop port*.

NMS. Network Management System.

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 is loop capable. Used to connect an equipment port to the fabric in a loop configuration through a fabric loop port (FL_port).

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

node port (N_port). A node port that is not loop capable. Used to connect an equipment port to the fabric.

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*.

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*.

P

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

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.

PCI. Peripheral control interconnect.

PDU. Power distribution unit.

Performance Monitoring. A 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*.

PMC. PCI mezzanine card.

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 Fibre Channel card that contains optical or copper port interfaces, and acts like a switch module. See also *16-port card*.

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*.

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 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 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*.

RAN. Remote Asynchronous Notification.

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.

reduced instruction set computer (RISC). A computer that uses a small, simplified set of frequently used instructions for rapid processing.

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 procedure call (RPC). A facility that a client uses to request the execution of a procedure call from a server.

Remote Switch. A feature that runs on Fabric operating system (OS) and enables two fabric switches to be connected over an asynchronous transfer mode (ATM) connection. This requires a compatible Fibre Channel to ATM gateway, and can have a distance of up to 10 km (6.214 mi) between each switch and the respective ATM gateway.

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

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*.

RISC. See *reduced instruction set computer*.

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

ro. Read only.

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.

RPC. See *remote procedure call*.

R_RDY. See *receiver ready*.

RR_TOV. See *resource recovery timeout value*.

RS-232 port. A port that conforms to a set of Electrical Industries Association (EIA) standards. 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*.

RSH. Remote shell.

RTC. Real time clock.

rw. Read-write.

S

SAN. See *storage area network*.

SAN island. A group of storage devices and servers connected to switches in a fabric.

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).

SERDES. Serializer/deserializer.

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 mm lasers and supports 1.0625 Gbps link speeds. 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 signals between optical fiber cables and switches.

SMI. Special memory interface.

SNIA. Storage Network Industry Association.

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 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

Tachyon. A type of host bus adapter.

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.

terminal serial port. The lower serial port on the control processor card (CP card) of the director switch. This port sends switch information messages and can receive commands. Can be used to connect the CP card to a computer terminal. Has an RS–232 connector wired as a data terminal equipment (DTE) device, and can be connected by serial cable to a data communications equipment (DCE) device. The connector pins 2 and 3 are swapped so that a straight-through cable can be used to connect to a terminal. The device name is ttyS0. Can also be referred to as the console port. See also *DCE port, DTE port,* and *modem serial port*.

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.

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.

UART. Universal Asynchronous Receiver Transmitter.

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.

user flash. See *compact flash*.

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.

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

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. (T)

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*.

X

XLWL. See *extra long wavelength*.

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*.

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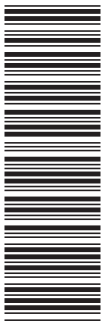

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