HP StorageWorks

Fabric OS 4.x features overview

Fabric OS 4.x features overview

Contents

Figures

Tables

About this guide

This guide provides information about:

- Standard features that come with the Fabric Operating System (Fabric OS)

- Optional features that require a license from HP

Intended audience

This guide is intended for system administrators and technicians who are experienced with the following:

- HP StorageWorks Fibre Channel Storage Area Network (SAN) switches
- Fabric OS 4.x

Related documentation

Documentation, including white papers and best practices documents, is available at the following HP web site:

http://www.hp.com/country/us/eng/prodserv/storage.html

To access 4.x related documents:

1. Locate the **Networked storage** section of the web page.

2. Under **Networked storage**, go to the **By type** subsection.

3. Click **SAN infrastructure**. The SAN infrastructure page displays.

4. Locate the **Fibre Channel Switches** section.

   Locate the **B-Series Fabric** subsection, and then go to the appropriate subsection, such as **Enterprise Class** for the HP StorageWorks SAN Director 2/128.

   To access version 4.x documents (such as this document), select the appropriate product, for example **SAN Director 2/128 & SAN Director 2/128 power pack** or **Core Switch 2/64 & Core Switch 2/64 power pack**.

   The switch overview page displays.

5. Go to the **Product Information** section, located on the far right side of the web page.

6. Click **Technical documents**.

7. Follow the onscreen instructions to download the applicable documents.

Document conventions and symbols

Table 1 lists the document conventions used in this manual.

Table 1 Document conventions

Convention	Element
Medium blue text: Figure 1	Cross-reference links and e-mail addresses
Medium blue, underlined text (http://www.hp.com)	Web site addresses
Bold font	• Key names • Text typed into a GUI element, such as into a box • GUI elements that are clicked or selected, such as menu and list items, buttons, and check boxes
Italics font	Text emphasis
`Monospace font`	• File and directory names • System output • Code • Text typed at the command-line
`Monospace, italic font`	• Code variables • Command-line variables
`Monospace, bold font`	Emphasis of file and directory names, system output, code, and text typed at the command-line

⚠ **WARNING!**   Indicates that failure to follow directions could result in bodily harm or death.

△ **CAUTION:**   Indicates that failure to follow directions could result in damage to equipment or data.

IMPORTANT: Provides clarifying information or specific instructions.

NOTE: Provides additional information.

TIP: Provides helpful hints and shortcuts.

HP technical support

Telephone numbers for worldwide technical support are listed on the following HP web site: http://www.hp.com/support/. From this web site, select the country of origin.

NOTE: For continuous quality improvement, calls may be recorded or monitored.

Obtain the following information before calling:

- Technical support registration number (if applicable)
- Product serial numbers
- Product model names and numbers
- Applicable error messages
- Operating system type and revision level
- Detailed, specific questions

HP Storage web site

The HP web site has the latest information on this product, as well as the latest drivers. Access storage at: http://www.hp.com/country/us/eng/prodserv/storage.html. From this web site, select the appropriate product or solution.

HP-authorized reseller

For the name of your nearest HP-authorized reseller:

- In the United States, call 1-800-345-1518.

- Elsewhere, visit http://www.hp.com and click **Contact HP** to find locations and telephone numbers.

1 Standard features

This chapter describes standard features that come with Fabric OS. These features include the following:

Configurable accounts

Fabric OS provides two different levels of authorization—called *roles*—for using the system:

- admin

- user

The system provides default user and admin accounts. You can create up to 15 additional accounts per logical switch and designate their roles as either admin or user. Table 2 describes these roles.

Table 2 Roles for admin and user

Role	Usage	Maximum simultaneous login sessions per switch
admin	Administrative (such as installing a port upgrade license)	2
user	Nonadministrative (such as monitoring the system)	4

High availability features

The HP StorageWorks switch hardware and the Fabric OS firmware both support high availability (HA). The HA features include redundancy, hot-swapping, and nondisruptive operations. Table 3 summarizes the HA features available on various HP StorageWorks models.

Table 3 HP StorageWorks HA features

Feature	SAN Director 2/128	Core Switch 2/64	SAN Switch 4/32	SAN Switch 2/32	SAN Switch 2/16V and 2/16N	SAN Switch 2/8V
Redundant AC cables	Yes	Yes	Yes	Yes	Yes	
Redundant, hot-swappable power supplies	Yes	Yes	Yes	Yes		
Redundant, hot-swappable fans	Yes	Yes	Yes	Yes		
Hot-swappable port cards	Yes	Yes				
Hot-swappable control processor (CP) cards	Yes	Yes				
Hot-swappable World Wide Name (WWN) card	Yes	Yes				
Nondisruptive CP failover	Yes	Yes				

Table 3 HP StorageWorks HA features (continued)

Feature	SAN Director 2/128	Core Switch 2/64	SAN Switch 4/32	SAN Switch 2/32	SAN Switch 2/16V and 2/16N	SAN Switch 2/8V
Background CP health monitor	Yes	Yes				
Nondisruptive firmware download	Yes	Yes	Yes	Yes	Yes	Yes
Nondisruptive code activation	Yes	Yes	Yes	Yes	Yes	Yes

Secure protocols

Fabric OS supports the secure protocols listed in Table 4.

Table 4 Secure protocol support

Protocol	Description
SSL	secure sockets layer—Provides support for secure operations through GUIs, such as Advanced Web Tools. Fabric OS uses SSL to provide support for HTTPS, which in turn provides support for GUIs. By default, SSL includes support for SSLv3, 128-bit encryption. To enable SSL, a certificate must be generated and installed to each switch.
HTTPS	Hypertext Transfer Protocol over SSL—Provides support for secure operations through GUIs, such as Advanced Web Tools.

Table 4 Secure protocol support (continued)

Protocol	Description
scp	secure file copy—Provides support for secure configuration maintenance, such as configuration upload and download. **NOTE:** Firmware download does not use scp.
SNMPv3	Simple Network Management Protocol, version 3—Provides support for the Simple Network Management Protocol (SNMP), which allows you to monitor and manage network devices. (See "SNMP security" on page 14 for more information.) **NOTE:** SNMPv1 is also supported.

Requirements

Table 5 describes additional software or certificates that you must obtain to run secure protocols.

Table 5 Requirements needed to run secure protocols

Protocol	Host side	Switch side
Secure telnet	Secure telnet client	License for HP Secure Fabric OS
SSH	SSH client	None
HTTPS	Certificate Authority	Switch IP certificate for SSL
scp	SSH daemon, scp server	None
SNMPv3, SNMPv1	None	None

Security scenarios

Security protocols are designed with the four main scenarios described in Table 6.

Table 6   Main security scenarios

Fabric	Traffic management	Configuration via policy	Comments
Nonsecure	Nonsecure	No	Does not require a special setup.
Nonsecure	Secure/ nonsecure	No	Allows secure fabric management without the use of Secure Fabric OS. SSL certificates must be installed.
Secure	Secure	Yes	Fabric OS 4.4.x (and later) switches provide support for encrypted protocols. Fabric OS 3.2.x switches support telnet and secure telnet only. Switches running earlier Fabric OS versions can be part of the secure fabric, but they do not support secure management. You must enable secure management on each participating switch. You can disable nonsecure management on nonparticipating switches. If you use SSL, then you must install certificates.
Secure	Nonsecure/ secure	Yes	The following lists conditions under which you must use nonsecure traffic management: • The fabric contains switches running Fabric OS 3.2.x. • Software tools that do not support secure protocols are present; for example, Fabric Manager 4.x. • The fabric contains switches running Fabric OS versions earlier than 4.4.x. (Nonsecure management is enabled by default.)

SNMP security

Using SNMP components, you can program tools to view, browse, and manipulate HP switch variables and set up enterprise-level management processes.

Every HP B-series switch carries an SNMP agent and management information base (MIB). The SNMP agent accesses MIB information about a device and makes it available to a network manager station. You can manipulate information of your choice by *trapping* MIB elements using the Fabric OS CLI (CLI), Advanced Web Tools or Fabric Manager.

The SNMP access control list (ACL) provides a way for the administrator to restrict SNMP get/set operations to certain hosts/IP addresses. You can use ACLs for enhanced management security in a SAN.

For details on the HP B-series MIB files, naming conventions, loading instructions, and for information about using HP's SNMP agent, refer to the *HP StorageWorks Fabric OS 4.x MIB reference guide.*

RADIUS AAA service

For large enterprises, Fabric OS supports Remote Authentication Dial-In User Server (RADIUS) authentication, authorization, and accounting (AAA) service. When configured for RADIUS, the switch becomes a Network Access Server (NAS) that acts as a RADIUS client. In this configuration, authentication records are stored in the RADIUS host server database. Login and logout account name, assigned role, and time accounting records are also stored on the RADIUS server.

Director CP card management

The HP StorageWorks SAN Director 2/128 CP card allows you to create the following configurations:

- Two domains; the default configuration is one domain

- The following combinations of Core Switch 2/64 and SAN Director 2/128 port cards:

  - One domain of 128 ports—SAN Director 2/128 port cards only

  - Two domains, 64 ports per domain—SAN Director 2/128 port cards only

  - Two domains—SAN Director 2/128 port cards on one domain and Core Switch 2/64 port cards in the other

Routing policies

All HP StorageWorks models support *port-based* routing, in which the routing path chosen for an incoming frame is based only on the incoming port and the destination domain. To optimize port-based routing, you can enable the Dynamic Load Sharing feature (DLS) to balance the load across the available output ports within a domain.

The SAN Switch 4/32 model allows you to tune routing performance with these additional routing policies:

- *Device-based* routing, in which the choice of routing path is based on the Fibre Channel addresses of the source device (S_ID) and the destination device (D_ID), improving path utilization for better performance

- *Exchange-based* routing, in which the choice of routing path is based on the S_ID, D_ID, and Fibre Channel originator exchange ID (OXID), optimizing path utilization for the best performance

Device-based and exchange-based routing require DLS; when these policies are in effect, you cannot disable the DLS feature.

Using port-based routing, you can assign a *static route*, in which the path chosen for traffic never changes. In contrast, device-based and exchange-based routing policies always employ *dynamic path selection*.

Message logging

Standard features allow you to display system, port, and specific hardware messages. You can set up system logging mapping (`syslogd`), and you can specify that the system automatically offload diagnostic messages to a server.

The HP StorageWorks Core Switch 2/64 and SAN Director 2/128 models provide a unique error log on each CP.

Fabric OS also maintains a separate, internal port log of all port activity. You can use this log to troubleshoot device connections.

Fabric OS CLI

The Fabric OS CLI lets you monitor and manage entire fabrics, individual switches, and ports from a standard workstation. Using the CLI, you can access the entire suite of Fabric OS features and capabilities across an entire fabric from a single access point.

A switch-level password for each account controls access (see "Configurable accounts" on page 9 for more information). You can perform all configuration and management tasks using the admin or user role. CLI commands are based on the account role and activated license keys.

Distributed Management Server

The HP Fabric OS Distributed Management Server allows a SAN management application to retrieve information and administer interconnected switches, servers, and storage devices. The management server assists in the autodiscovery of switch-based fabrics and their associated topologies.

A client of the management server can find basic information about the switches in the fabric and use this information to construct topology relationships. The management server also allows you to obtain certain switch attributes and, in some cases, modify them. For example, you can register logical names identifying switches with the management server.

The management server provides several advantages for managing a Fibre Channel fabric:

- Applications can access the management server through an external Fibre Channel node at the well-known address FFFFFAh. As a result, applications have access to information about the entire fabric with minimal knowledge of the existing configuration.

- The system replicates the management server on every HP StorageWorks switch within a fabric (Fabric OS 2.3.0 and later).

- The management server provides an unzoned view of the overall fabric configuration.

   This view exposes the internal configuration of a fabric for management purposes; the view contains interconnect information about switches and devices connected to the fabric. Under normal circumstances, a device (typically an FCP initiator) queries the Name Server for storage devices within its member zones. Because this limited view is not always sufficient, the management server provides the application with a list of the entire Name Server database.

NOTE: The management server includes a platform service, which you must enable (see the *HP StorageWorks Fabric OS 4.x procedures user guide* for more information.) The platform service is available only with Fabric OS 2.3.0 and later. If you start the management server platform service on a fabric that contains any switches running earlier Fabric OS versions, the management services will not be enabled.

Advanced Web Tools

Advanced Web Tools is a GUI that enables administrators to monitor and manage single or small fabrics, switches, and ports from a standard workstation.

Advanced Web Tools provides the administrative control point for Advanced Fabric Services, including the following:

- Advanced Zoning

- ISL Trunking

- Advanced Performance Monitoring

- Fabric Watch.

Advanced Web Tools also provides an interface to telnet commands to perform special switch functions and diagnostics that are available only through the telnet interface.

Advanced Zoning

Advanced Zoning allows you to partition a SAN into logical groupings of devices that have access to each other. These groupings are called *zones*.

Through the use of zoning, you can customize environments and optimize resources. You can configure devices connected to a fabric into one or more zones.

After you enable zoning, devices that you have not explicitly defined in a zone are isolated and other devices in the fabric cannot access them.

NOTE: You can enable zoning in most storage units in the switch fabric and on the host.

Zone functions

You can use zones for the following purposes:

- To create logical subsets of a fabric in order to accommodate specialized environments, such as closed user groups or functional areas within the fabric. For example, you can identify selected devices within a zone for the exclusive use of zone members, or you can define a zone to create separate test or maintenance areas within the fabric.

- To logically consolidate equipment for efficiency or to facilitate time-sensitive functions. For example, you can create a temporary zone to back up nonmember devices.

- To limit communication of individual objects. Zone objects can communicate only with other objects in the same zone. For example, consider Figure 1 on page 18, which shows the following:

  - Three zones, named Red, Green, and Blue, have been configured.

  - Server 1 can communicate only with the Loop 1 devices.

  - Server 2 can communicate only with the RAID and Blue zone devices.

  - Server 3 can communicate with the RAID device and the Loop1 devices.

  - The Loop 2 JBODs are not assigned to a zone; no other zoned fabric device can access them.
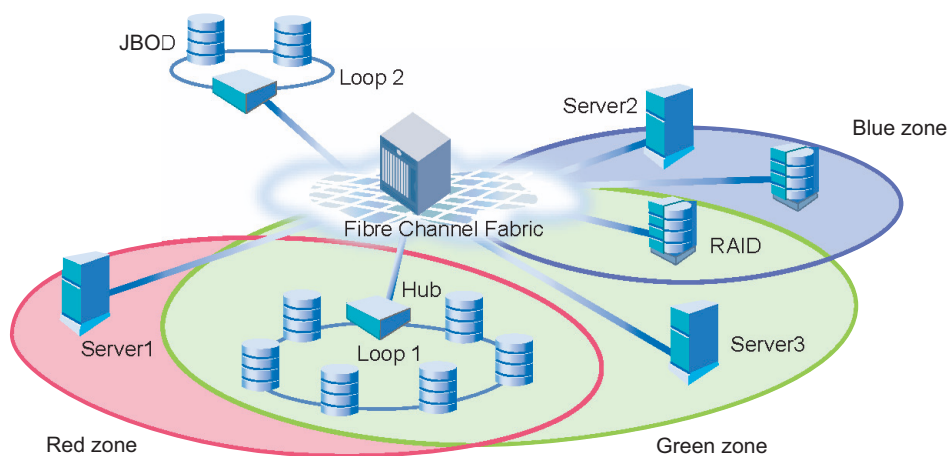
Figure 1 Zoning example

Zone characteristics

Zones have the following qualities:

- They can be configured dynamically and can vary in size, depending on the number of fabric-connected devices.

- They can be disabled at any time. When zoning is disabled, devices can freely access other devices in the fabric.

- Their configurations persist across reboots and power cycles. For example, if two switches are connected in a fabric, they can become isolated (due to an ISL failure for instance); however, when rejoined, they maintain the same fabric configuration unless one of the switches has had a configuration change.

TIP: Use the Advanced Web Tools wizard to simplify zone administration.

2 Optional features

This chapter describes the following optional features that you can use to manage HP StorageWorks switches:

Fabric Manager

Fabric Manager is a complete SAN management tool for HP-based SANs. You can use Fabric Manager to complete the following activities:

- Configure multiple switches simultaneously from one location

- View the status of multiple devices in one window

- Perform SAN-level maintenance without having to access each switch in your fabric or SAN

Fabric Manager is tightly integrated with additional SAN management products, including Advanced Web Tools and Fabric Watch. You can use it with other SAN and storage resource management applications to drill down into single or multiple HP fabrics.

Fabric Manager performs the following tasks in multiple SANs:

- Manages multiple HP switch elements across multiple fabrics

- Discovers and collects SAN data, and provides multiple views of that data (including topology maps and detailed views in a tabular format)

- Displays the status of critical fabric elements and key discovery data at varying levels of detail, such as high-level *At-A-Glance* views

- Provides detailed tables that display information about switches, ports, devices, and events

Fabric Manager includes the following advanced features for additional management capabilities:

- Fabric, switch, and port naming

- Data storage (persistent files)

- Change management

- License key management

- HBA management

- Scalable firmware download

- Call home support

- End-to-end performance monitoring

- Secure Fabric OS management

Fabric Watch

Fabric Watch is a SAN health monitor for HP StorageWorks switches running Fabric OS 2.2 or later. It enables each switch to constantly watch its SAN fabric for potential faults and to automatically alert you to problems long before they become costly failures.

Fabric Watch tracks a variety of SAN fabric elements, events, and counters. Monitoring fabric-wide events, ports, (gigabit interface converters (GBICs), and environmental parameters enables early fault detection and isolation as well as performance measurement. You can select custom fabric elements and alert thresholds or choose from a selection of preconfigured settings. You can also easily integrate Fabric Watch with enterprise systems management solutions.

By implementing Fabric Watch, you can rapidly improve SAN availability and performance without installing new software or system administration tools.

Fabric Access

Fabric Access is an application programming interface (API) that enables software applications to interact with HP StorageWorks switches. It gives third-party software the ability to retrieve detailed information about fabrics, such as properties, statistics, and states of fabric elements. Fabric Access also gives applications the ability to control and configure many fabric functions and properties, including zoning.

Secure Fabric OS

Secure Fabric OS provides customizable security restrictions through local and remote management channels on an HP StorageWorks fabric. Secure Fabric OS allows you to perform the following activities:

- Create policies to customize fabric management access

- Specify which switches and devices can join a fabric

- View statistics related to attempted policy violations

- Manage the fabric-wide Secure Fabric OS parameters through a single switch

- Create temporary passwords specific to a login account and switch

- Enable and disable Secure Fabric OS as desired

Secure Fabric OS uses digital certificates based on PKI or Diffie-Hellman with Challenge-Handshake Authentication Protocol (DH-CHAP) shared secrets to provide switch-to-switch authentication.

Ports on Demand

The Ports on Demand feature is available on the SAN Switch 4/32 model.

Ports on Demand enables you to scale your fabric as necessary. You can buy a switch with a subset of the ports activated. If you need more ports in your fabric, you can upgrade by purchasing a license key. Contact your authorized HP representative to purchase a license key.

Extended Fabrics

The Extended Fabrics feature extends the distance that interswitch links (ISLs) can reach.

As the distance between switches and the link speed increase, additional *buffer-to-buffer credits* are required to maintain maximum performance. The number of credits reserved for a port depends on the switch model and the extended ISL mode for which it is configured.

The following HP StorageWorks models each contain a *port group* called a *quad*:

- HP StorageWorks SAN Switch 2/8V

- HP StorageWorks SAN Switch 2/16V and 2/16N

- HP StorageWorks SAN Switch 2/32

- HP StorageWorks Core Switch 2/64

- HP StorageWorks SAN Director 2/128

A quad port group contains four ports and shares a common pool of credits.

Because the number of credits available for use within each port group is limited, configuring ports for extended links on these models might cause other ports to become disabled if there are not enough buffer credits available.

For the HP StorageWorks SAN Switch 4/32 model, each port group contains eight ports, and buffer credits are shared among all ports on the switch. This design is called *buffer-limited* port technology. This technology allows all ports to remain operational, even when extended links are in use.

A buffer-limited port can come online with fewer buffer credits allocated than its configuration specifies. This type of allocation allows the port to operate at a reduced bandwidth instead of being disabled for lack of buffers. Buffer-limited operation is persistent across switch reboots or power cycles.

NOTE: Long-distance connections can participate in trunking if the ISL Trunking license is installed. For more information, refer to the next section, "ISL Trunking."

ISL Trunking

The ISL Trunking feature allows ISLs between two HP StorageWorks models to merge logically into a group link. ISL Trunking reduces or eliminates situations that require static traffic routes and individual ISL management to achieve optimal performance.

Trunking optimizes fabric performance by distributing traffic across the shared bandwidth of all the ISLs in a trunking group. This distribution allows traffic to flow through any available link in a group rather than restricting it to a specific, potentially, congested link.

Additional advantages

The following lists additional ISL Trunking advantages:

- Allows a simplified fabric design and management, lowered cost of ownership, and increased data availability.

- Distributes traffic dynamically and in order at the frame level. This distribution scheme allows the fabric to achieve greater performance with fewer ISLs.

- Is compatible with both short wavelength (SWL) and long wavelength (LWL) fiber optic cables and transceivers.

- Is easily managed using either Fabric OS CLI commands or Advanced Web Tools. These tools allow you to enable and disable trunking and set trunk port speeds for entire switches or for individual ports.

Each switch that participates in trunking requires an ISL Trunking license. Trunking is enabled automatically when the ISL Trunking license is activated and ports are reinitialized.

Improved throughput

Figure 2 illustrates how trunking can result in more throughput by distributing data over four ISLs with no congestion. In a fabric that does not have trunking capability, some paths would be congested and other paths underutilized.
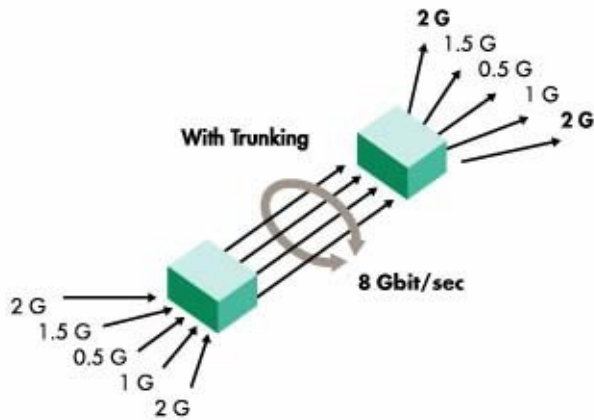
Figure 2 Distribution of traffic over an ISL Trunking group

Trunks operate best when the cable length of each trunked link is roughly equal to the others in the trunk. The difference between cable lengths for participating links should be no more than 30 meters.

Advanced features

Connections between HP StorageWorks SAN Switch 4/32 models support these advanced features:

- Up to eight ports in one trunk group

- ISL Trunking over longer distances than other models

- Dynamic trunk master reassignment if a trunk master is disabled (on other platforms, all ports on a trunk must be disabled temporarily to reassign a master)

- 4 Gb/s trunk links

📝 **NOTE:** The maximum number of ports per trunk and trunks per switch depends on the HP StorageWorks model.

Advanced Performance Monitoring

Advanced Performance Monitoring (APM) allows you to monitor the performance of networked storage resources. This product helps reduce overprovisioning and enables SAN performance tuning.

Advanced Performance Monitoring provides SAN performance monitoring through an end-to-end monitoring system that provides the following:

- Increased end-to-end visibility into the fabric

- More accurate reporting for service-level agreements and charged access applications

- Shortened troubleshooting time

- Better capacity planning

- Increased productivity through preformatted and customized screens and reports

You can administer APM through the Fabric OS CLI, Advanced Web Tools, or Fabric Manager.

Using APM, you can perform the following activities:

- Measure the bandwidth consumed by individual routes (host-target pairs)

- Provide device performance measurements by port, Arbitrated Loop Physical Address (AL_PA), and Logical Unit Number (LUN)

- Report cyclic redundancy check (CRC) error measurement statistics

- Measure HP ISL trunking performance and resource usage.

NOTE: ISL monitoring is set up on E_ports automatically in Fabric OS 4.4.x and later.

- Compare IP versus SCSI traffic on each port

- Produce a wide range of predefined reports

- Create customized user-defined reports

- Provide a performance history for each port

- Use the Fabric Manager application (version 4.4 or later) to store performance data persistently off the switch and maintain historical data for the performance of the switches in your fabric

Glossary

alias　　　　　　A logical grouping of elements in a fabric. An alias is a collection of port numbers and connected devices, used to simplify the entry of port numbers and WWNs when creating zones.

buffer-to-buffer flow control　　Management of the frame transmission rate in either a point-to-point topology or in an arbitrated loop.

bypass circuitry　　Circuits that automatically remove a device from the data path when valid signals are dropped.

CA　　　　　　Certificate authority. A trusted organization that issues digital certificates. *See also* digital certificate.

cascade　　　　Two or more interconnected Fibre Channel switches. Up to 239 HP StorageWorks switches can be cascaded, with a recommended maximum of seven interswitch links (no path longer than eight switches). *See also* fabric, ISL.

CHAP　　　　　Challenge-Handshake Authentication Protocol. Allows remote servers and clients to securely exchange authentication credentials. Both the server and client are configured with the same shared secret.

CLI　　　　　　Command line interface. An interface that depends entirely on the use of commands, such as through telnet or SNMP, and does not involve a GUI.

client　　　　　An entity that, using its common transport (CT), makes requests of a server.

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

configuration　　1. A set of parameters that can be modified to fine-tune the operation of a switch. Use the `configshow` command to view the current configuration of your switch.

　　　　　　　　2. In HP zoning, a zoning element that contains a set of zones. The configuration is the highest-level zoning element and is used to enable or disable a set of zones on the fabric. *See also* zone configuration.

CP　　　　　　Control processor.

credit

As it applies to Fibre Channel technology, the number of receive buffers available to transmit frames between ports.

deskew

Related to the HP Trunking feature. The time difference between traffic traveling over each ISL other than the shortest ISL in the group and traffic traveling over that shortest ISL. The deskew number corresponds to nanoseconds divided by 10. The firmware automatically sets the minimum deskew value of the shortest ISL to 15.

DH-CHAP

Diffie-Hellman Challenge-Handshake Authentication Protocol. An implementation of CHAP using Diffie-Hellman encryption. *See also* CHAP.

digital certificate

An electronic document issued by a CA (certificate authority) to an entity, containing the public key and identity of the entity. Entities in a secure fabric are authenticated based on these certificates.

director

An HP StorageWorks Core Switch 2/64 or SAN Director 2/128 switch.

DLS

Dynamic load-sharing. Dynamic distribution of traffic over available paths. Allows for recomputing of routes when an Fx_Port or E_Port changes status.

domain ID

A unique identifier for all switches in a fabric, used in routing frames. Usually automatically assigned by the principal switch but can be assigned manually. The domain ID for an HP StorageWorks switch can be any integer between 1 and 239.

embedded port

An embedded port (or domain controller) communicates and get updates from other switches' embedded ports. The well-known address is *fffcdd*, where *dd* = domain number.

enabled zone configuration

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

E_Port

Expansion port. A standard Fibre Channel mechanism that enables switches to network with each other, creating an ISL. *See also* ISL.

Ethernet

Popular protocols for LANs.

EX_Port

A type of E_Port that connects an FC router to an edge fabric. EX_Ports limit the scope of fabric services scope but provide device connectivity using FC-NAT.

fabric

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

Fabric Manager

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

Fabric Watch	An optionally licensed HP software product. Fabric Watch can be accessed through either the command line or Advanced Web Tools, and it provides the ability to set thresholds for monitoring fabric conditions.
failover	Describes the HP StorageWorks Core Switch 2/64 process of one CP passing active status to another CP. A failover is nondisruptive.
FCS	Fibre Channel switch; alternatively, Fabric Configuration Server.
FCS switch	Relates to the HP Secure Fabric OS feature. One or more designated switches that store and manage security parameters and configuration data for all switches in the fabric. They also act as a set of backup switches to the primary FCS switch.
FFFFFA	Well-known Fibre Channel address for a management server.
Fibre Channel	The primary protocol used for building SANs to transmit data between servers, switches, and storage devices. Unlike IP and Ethernet, Fibre Channel was designed to support the needs of storage devices of all types. It is a high-speed, serial, bidirectional, topology-independent, multiprotocol, and highly scalable interconnection between computers, peripherals, and networks.
Fibre Channel transport	A protocol service that supports communication between Fibre Channel service providers.
F_Port	Fabric port. A port that is able to transmit under fabric protocol and interface over links. Can be used to connect an N_Port to a switch.
frame	The Fibre Channel structure used to transmit data between ports. Consists of a start-of-frame delimiter, header, optional headers, data payload, cyclic redundancy check (CRC), and end-of-frame delimiter. There are two types of frames: link control frames (transmission acknowledgements and so forth) and data frames.
FTP	File Transfer Protocol.
gateway	Hardware that connects incompatible networks by providing translation for both hardware and software. For example, an ATM gateway can be used to connect a Fibre Channel link to an ATM connection.
Gb/s	Gigabits per second (1,062,500,000 bits/second).
GB/s	Gigabytes per second (1,062,500,000 bytes/second).
GUI	A graphic user interface, such as Advanced Web Tools and Fabric Manager.
HA	High availability. A set of features in HP StorageWorks switches that is designed to provide maximum reliability and nondisruptive replacement of key hardware and software modules.

host	A computer system that provides end users with services like computation and storage access.
hot swappable	A hot swappable component can be replaced under power.
HTTP	Hypertext Transfer Protocol. The standard TCP/IP transfer protocol used on the World Wide Web.
ID_ID	Insistent domain ID. A parameter of the `configure` command in the Fabric OS.
in-band	Transmission of management protocol over the Fibre Channel.
initiator	A server or workstation on a Fibre Channel network that initiates communications with storage devices.
interswitch link	*See* ISL.
IOD	In-order delivery. A parameter that, when set, guarantees that frames are either delivered in order or dropped.
IP	Internet Protocol. The addressing part of TCP.
ISL	Interswitch link. A Fibre Channel link from the E_Port of one switch to the E_Port of another. *See also* cascade, E_Port.
ISP	Internet service provider.
LAN	Local area network. A network in which transmissions typically take place over fewer than 5 kilometers (3.4 miles).
latency	The time required to transmit a frame. Together, latency and bandwidth define the speed and capacity of a link or system.
login server	The unit that responds to login requests.
L_Port	Loop port. A node port (NL_Port) or fabric port (FL_Port) that has arbitrated-loop capabilities. An L_Port can be in either Fabric Mode or Loop Mode.
MIB	Management Information Base. An SNMP structure to help with device management, providing configuration and device information.
Name Server	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. Also referred to as *directory service*.
N_Port	Node port. A port on a node that can connect to a Fibre Channel port or to another N_Port in a point-to-point connection.

NS	Name Server. The service provided by a fabric switch that stores names, addresses, and attributes related to Fibre Channel objects. Can cache information for up to 15 minutes. Also known as *Simple Name Server* or as a *directory service*. *See also* Simple Name Server.
out-of-band	Transmission of management protocol outside of the Fibre Channel network, usually over Ethernet.
oversubscription	A situation in which more nodes could potentially contend for a resource than the resource could simultaneously support (typically an ISL). Oversubscription could be a desirable attribute in fabric topology, as long as it does not produce unacceptable levels of congestion.
Performance Monitoring	An HP StorageWorks switch feature that monitors port traffic and includes frame counters, SCSI read monitors, SCSI write monitors, and other types of monitors.
PKI	Public key infrastructure. An infrastructure that is based on public key cryptography and CA (certificate authority) and that uses digital certificates.
PKI certification utility	Public key infrastructure certification utility. A utility that makes it possible to collect certificate requests from switches and to load certificates to switches. *See also* digital certificate, PKI.
port	In an HP StorageWorks switch environment, an SFP or GBIC receptacle on a switch to which an optic cable for another device is attached.
port address	In Fibre Channel technology, the port address is defined in hexadecimal. In the Fabric OS, a port address can be defined by a domain and port number combination or by area number. In an ESCON Director, an address used to specify port connectivity parameters and to assign link addresses for attached channels and control units.
port card	A hardware component that provides a platform for field-replaceable, hot swappable ports.
port log	A record of all activity on a switch, kept in volatile memory.
port name	A user-defined alphanumeric name for a port.
port_name	The unique identifier assigned to a Fibre Channel port. Communicated during login and port discovery.
port swapping	Port swapping is the ability to redirect a failed port to another port. This feature is available in Fabric OS 4.1.0 and higher.
POST	Power-on self-test. A series of tests run by a switch after it is turned on.
PPP	Point-to-Point Protocol.

primary FCS switch	Relates to the Secure Fabric OS feature. The primary fabric configuration server switch actively manages security and configurations for all switches in the fabric.
principal switch	The first switch to boot up in a fabric. Ensures unique domain IDs among roles.
protocol	A defined method and set of standards for communication. Determines the type of error-checking, the data-compression method, how sending devices indicate an end of message, and how receiving devices indicate receipt of a message.
QLA	A type of Fibre Channel controller.
QoS	Quality of service.
quad	A group of four adjacent ports that share a common pool of frame buffers.
queue	A mechanism for each AL_PA address that allows for collecting frames prior to sending them to the loop.
QuickLoop	An HP software product that allows multiple ports on a switch to create a logical loop. Devices connected via QuickLoop appear to each other as if they are on the same arbitrated loop.
QuickLoop Mode	Allows initiator devices to communicate with private or public devices that are not in the same loop.
radius	The greatest "distance" between any edge switch and the center of a fabric. A low-radius network is better than a high-radius network.
RAID	Redundant array of independent disks. A collection of disk drives that appear as a single volume to the server and are fault tolerant through mirroring or parity checking.
redundancy	Having multiple occurrences of a component to maintain high availability (HA).
remote switch	An optional product for long-distance fabrics, requiring a Fibre Channel-to-ATM or SONET gateway.
route	As it applies to a fabric, the communication path between two switches. Might also apply to the specific path taken by an individual frame, from source to destination.
routing	The assignment of frames to specific switch ports, according to frame destination.
SAN	Storage area network. A network of systems and storage devices that communicate using Fibre Channel protocols. *See also* fabric.
scalability	One of the properties of a SAN that indicates the size to which a SAN topology can grow port and switch counts with ease.
sectelnet	A protocol similar to telnet but with encrypted passwords for increased security.

Secure Fabric OS An optionally licensed HP feature that provides advanced, centralized security for a fabric.

security policy Rules that determine how security is implemented in a fabric. Security policies can be customized through HP Secure Fabric OS or HP Fabric Manager.

S_ID Source ID. Refers to the native port address (24 bit address).

Simple Name Server 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. Also referred to as *directory service* or *name server*.

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

SNS *See* Simple Name Server.

soft zone A zone consisting of zone members that are made visible to each other through client service requests. Typically, soft zones contain zone members that are visible to devices using Name Server exposure of zone members. The fabric does not enforce a soft zone. Note that well-known addresses are implicitly included in every zone.

SSH Secure shell. Used starting in Fabric OS 4.1 to support encrypted telnet sessions to the switch. SSH encrypts all messages, including the client sending the password at login.

SSL Secure sockets layer.

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

switch A fabric device providing bandwidth and high-speed routing of data via link-level addressing.

switch name The arbitrary name assigned to a switch.

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

switch-to-switch authentication The process of authenticating both switches in a switch-to-switch connection using digital certificates.

syslog Syslog daemon. Used to forward error messages.

TCP/IP Transmission Control Protocol Internet Protocol.

telnet	A virtual terminal emulation used with TCP/IP. "Telnet" is sometimes used as a synonym for the Fabric OS CLI.
trap (SNMP)	The message sent by an SNMP agent to inform the SNMP management station of a critical error. *See also* SNMP.
trunking	In Fibre Channel technology, a feature that enables distribution of traffic over the combined bandwidth of up to four ISLs between adjacent switches, while preserving in-order delivery.
trunking ports	The ports in a set of trunked ISLs.
WAN	Wide area network.
well-known address	As it pertains to Fibre Channel technology, a logical address defined by Fibre Channel standards as assigned to a specific function and stored on the switch.
workstation	A computer used to access and manage the fabric. Also referred to as a *management station* or *host*.
WWN	World Wide Name. An identifier that is unique worldwide. Each entity in a fabric has a separate WWN.
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 to others in the zone but are not visible to any outside the zone.
zone configuration	A specified set of zones. Enabling a configuration enables all zones in that configuration.
zoning	A feature in fabric switches or hubs that allows segmentation of a node by physical port, name, or address.

Index

Figures

Tables