hp StorageWorks

ISL trunking version 3.0.x/4.0.x user guide

Part Number: AA–RTSAA–TE

First Edition (October 2002)

Product Version: V3.0.x/V4.0.x

This user guide provides an overview of the ISL Trunking feature. This guide also includes information about how to install and how to use the ISL Trunking feature.

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ISL Trunking Version 3.0.x/4.0.x User Guide
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About this Guide

This guide provides information to help you:

- Become familiar with, install, and use the ISL Trunking feature

- Contact technical support for additional assistance

Intended Audience

This book is intended for use by system administrators who are experienced with the following:

- *HP StorageWorks*™ Fibre Channel SAN switches

- Fabric Operating System V3.0.x or later

Related Documentation

For a list of related documents included with this product, see the Related Documents section of the Release Notes that came with your switch.

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

http://www.compaq.com/storage/productindexdisk.html

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

Document Conventions

The conventions included in Table 1 apply.

Table 1: Document Conventions

Element	Convention
Cross-reference links	Blue text: Figure 1
Key names, menu items, buttons, and dialog box titles	**Bold**
File names, application names, and text emphasis	*Italics*
User input, command names, system responses (output and messages)	`Monospace font` `COMMAND NAMES` are uppercase unless they are case sensitive
Variables	*`Monospace, italic font`*
Website addresses	Sans serif font (http://thenew.hp.com)

Symbols in Text

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

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

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

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

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

Getting Help

If you still have a question after reading this guide, contact an HP authorized service provider or access our website: http://thenew.hp.com.

HP Technical Support

In North America, call HP technical support at 1-800-652-6672, available 24 hours a day, 7 days a week.

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

Outside North America, call HP technical support at the nearest location. Telephone numbers for worldwide technical support are listed on the HP website: http://thenew.hp.com/country/us/eng/contact_us.html.

Be sure to have the following information available 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 Website

The HP storage website has the latest information on this product, as well as the latest drivers. Access the HP storage website at: http://thenew.hp.com/country/us/eng/prodserv/storage.html.
From this website, 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.
- In Canada, call 1-800-263-5868.

- Elsewhere, access the HP website at:
  http://thenew.hp.com/country/us/eng/contact_us.html for locations and telephone numbers.

1

Introducing ISL Trunking

This chapter provides the following information:

- Overview on page 1–1
- Advantages of ISL Trunking on page 1–2
- Trunking Groups, Ports, and Masters on page 1–4

Overview

Interswitch Link (ISL) Trunking is an optionally licensed product available on the HP StorageWorks 2 Gb SAN switches running Fabric OS V3.0.x, and the HP StorageWorks Core Switch 2/64 series switches running Fabric OS V4.0.x. ISL Trunking is managed using telnet commands or the Advanced Web Tools interface. ISL Trunking simplifies network design and reduces the cost of storage management by optimizing bandwidth use and enabling load sharing of traffic at the frame-level.

The ISL Trunking feature connects up to four ISLs, between two switches through an Expansion Port (E_Port), to merge logically into one link. With ISL Trunking, high speed links ensure that server-to-storage performance is efficient and shared under heavy network loads. When using ISL Trunking to aggregate bandwidth of up to four ports, the speed of the ISLs between switches in a fabric is quadrupled. For example, at 2 Gbps speeds, ISL Trunking delivers ISL throughput of up to 8 Gbps.

The primary task of ISL Trunking is to route data between switches that aggregate connections to servers and storage. ISL Trunking also supports high-bandwidth, large-scale SANs which include core switches that interconnect with other switches.

For a list of frequently asked questions about the ISL Trunking feature, see "Frequently Asked Questions about ISL Trunking" on page 3–5.

Advantages of ISL Trunking

The ISL Trunking feature enhances switch-to-switch performance in SANs while simplifying management and improving reliability. Advantages of the ISL Trunking feature include:

- Combining up to four ISLs into a single logical ISL

- Load sharing traffic across all ISLs in a trunk

- Maintaining in-order delivery of frames

- Avoiding rerouting if one of the ISLs between two switches fails; however, rerouting occurs when a trunk master is down

- Simplifying management by implementing fewer ISLs

Routing without the ISL Trunking Feature

Before the ISL Trunking feature was introduced, device-level load sharing was done through Fibre Channel networks that created ISLs and operated with the Fibre Channel Shortest Path First (FSPF) routing protocol. The protocol established and communicated the shortest paths for data to be carried from source to destination. Load sharing multiple ISLs to connect two switches was established by a round robin algorithm that assigned the next available ISL as part of the link to connect a Host Bus Adapter (HBA) and storage. Depending on the fabric event sequences, multiple HBAs shared an individual ISL. This type of load sharing sometimes caused the fabric to have congested input/output traffic over the ISLs connecting two switches.

Although FSPF compliant switches ensure fixed routing paths, and guarantee that all frames are delivered in order, congestion occurs if the aggregation of the stream exceeds the capacity of one of the ISLs in the path.

For example, Figure 1–1 shows four untrunked ISLs with a maximum capacity of 2 Gbps each, for a maximum throughput of 8 Gbps. Due to traffic that is not trunked, the throughput of the four ISLs is: 1 Gbps + 1.5 Gbps +.5 Gbps + 1 Gbps + 1 Gbps, giving a total of only 5 Gbps, because two 2 Gbps data streams are competing for the same path.

Figure 1–1: Routing without the ISL Trunking feature

Routing with the ISL Trunking Feature

ISL Trunking ensures that all links are used efficiently, eliminating congestion on one link, while distributing the load of the links. This feature is designed to significantly reduce traffic congestion. As shown in Figure 1–2, four ISLs are combined into a single logical ISL with a total capacity of 8 Gbps.

The ISL Trunking feature improves the Fabric Shortest Path First (FSPF) concept by preventing the loss of a link in a route. With trunking, a link failure merely reduces the available bandwidth of the logical ISL trunk. In other words, a failure does not completely "break the pipe," but simply makes the pipe thinner. As a result, data traffic is much less likely to be affected by link failures and the bandwidth automatically increases when repaired.

The ISL Trunking feature distributes workload across all ISLs in a trunk. Each incoming frame is sent across the first available ISL. As a result, transient workload peaks for one system or application are much less likely to impact the performance of other parts of the SAN fabric. Because the full bandwidth of each physical link is available, bandwidth is efficiently allocated.

In Figure 1–2, four ISLs provide 8 Gbps of total throughput. With the implementation of ISL Trunking, bandwidth is shared across the trunked ISLs, permitting a total throughput of 2 Gbps + 1.5 Gbps + 0.5 Gbps + 1 Gbps + 2 Gbps, or 7 Gbps. Because the trunk aggregates the four individual paths into one and preserves in-order delivery of frames, the total throughput is increased compared to a non-trunked group of ISLs.

Figure 1–2: Routing with the ISL Trunking Feature

Trunking Groups, Ports, and Masters

ISL Trunking dynamically performs load sharing, at the frame level, across a set of available links between two adjacent switches to establish a trunking group. Ports that belong to a trunking group are called trunking ports. One port is used to assign traffic for the group and is referred to as the trunking master.

Trunking Groups

A trunking group is a set of links that distribute frames across a set of available paths linking two adjacent switches. When two, three, or four adjacent ISLs are used to connect two switches, the switches automatically group the ISLs into a single logical ISL. A trunking group is identified by the trunking master that represents the entire group. Non-master trunking ports from a trunking group are referred to as slave links that help the trunking master direct traffic across ISLs, allowing efficient and shared in-order communication. Failure of a slave port has minimal impact on the traffic flow of the trunk.

Trunking Ports

Trunking ports are grouped by four adjacent ports that share a common pool of frame buffers on a quad. When connecting two switches in a fabric with ISLs, consider leaving other ports open on the quad for future trunk growth.

Trunking ports in a trunking group must meet the following criteria:

- Ports must be configured as E_ports, which are used to connect to other switches. E_Ports communicate in Class F frames to distribute information about the different servers and to set up circuits that pass frames to the appropriate nodes over the fabric.

- Ports must reside in the same contiguous four-port group on a four-port boundary. For example: 0-3, 4-7, 8-11, 12-15.

- Set ports to run at the 2G speed. The port speed can be set to auto-negotiation speed.

- The cable difference between all ports in a trunking group must be less than 400 meters, and should be kept to 30 meters or less within a trunk to ensure optimal performance and bandwidth use.

NOTE: Short Wave Length (SWL) and Long Wave Length (LWL) fiber optics can be intermixed within a trunking group.

Trunking Masters

Only one of the trunking ports is used to set up all routing paths for an entire trunking group, this port is called the trunking master port. The trunking master implicitly defines the trunking group. All ports with the same master are considered to be part of the same group. Each trunking group includes a single trunking master and from one to three trunking slave links. The first ISL found in any trunking group is assigned as the trunking master. There can be several trunks, each with one master port, between two adjacent switches; however, there is only one designated principal (master) ISL between the switches. After a trunking group is fully established, all data packets intended for transmission across the trunk are dynamically distributed at the frame level across the ISLs in the trunking group, while preserving in-order delivery.

NOTE: When a master trunking link goes offline or fails, and there are at least two remaining active trunking ports, the remaining slave links go offline and regroup with a new master.

2

Installing ISL Trunking

Overview

Installing the ISL Trunking feature involves activating a license for each switch you want to enable for trunking. After the license is activated, ISL Trunking is automatically invoked as ISLs are added between two 2 Gbps switches. A license may have been installed in the switch at the factory. To see whether or not an ISL Trunking license is installed, perform the steps in the "Installing ISL Trunking through Telnet" section below. If an ISL Trunking license has not been installed, contact your switch supplier to obtain a license key.

IMPORTANT: ISL Trunking is only supported between two 2 Gbps switches. It is not supported between a 1 Gbps switch and a 2 Gbps switch. Refer to the *HP StorageWorks SAN Design Reference Guide* for addtional information.

NOTE: With this feature, you must obtain a license key for each switch using the ISL Trunking feature.

The ISL Trunking feature requires two HP StorageWorks switches which may be any mix of the following:

- SAN Switch 2/16

- SAN Switch 2/8 EL

- FC Entry Switch 8B

- FC Switch 8B

- SAN Switch 2/16 EL

- FC Switch 16B

- Core Switch 2/64

Installing ISL Trunking through Telnet

To use telnet to log on to the ISL Trunking feature, do the following:

1. Log onto the switch via telnet with an account that has administrative privileges (refer to *HP StorageWorks Fabric OS Version 3.0.x/4.0.x Reference Guide* for details).

2. Type `licenseShow` at the telnet command line to determine whether a Fabric Watch license is already installed on the switch. A list displays all the licenses currently installed on the switch.

   Example:

   ```
   admin> licenseShow

    1A1AaAaaaAAAA1a:
    Web license
   Zoning license
   Trunking license
   ```

   If the Trunking license is not included in the list, or is incorrect, continue with step 3.

3. Enter the following:

   ```
   licenseAdd "key"
   ```

   where "`key`" is the license key provided to you, enclosed in double quotes. The license key is case sensitive and must be entered exactly as given.

4. Verify the license was added by entering the following:

   ```
   licenseShow
   ```

   If the ISL Trunking license is listed, the feature is installed and immediately available.

   If the license is not listed, repeat step 3.

5. Disable the switch by entering:

   ```
   switchdisable
   ```

6. Enable the switch by entering:

   ```
   switchenable
   ```

Installing ISL Trunking through Advanced Web Tools

To enter the ISL Trunking license key using the Web Tool user interface, do the following:

1. Launch the web browser, enter the switch name or IP address in the **Location/Address** field, and press **Enter**.

   Advanced Web Tools launches, displaying the Fabric View.

2. Click **Admin View** on the relevant switch panel.

   The logon window displays.

3. Enter a logon name and password with administrative privileges and press **Enter**.

   The **Switch Admin View** displays.

4. Select the **License Admin** tab, enter the license key in the **License Key** field, and click **Add**.

   The Trunking feature is available as soon as the license key is added.

5. Select the **Switch Settings** tab, then disable the switch by selecting **Disable**.

6. Enable the switch by selecting **Enable** from the **Switch Setting** tab.

3

Using ISL Trunking

This chapter provides the following information:

Overview

The ISL Trunking feature is easy to manage. Some of the administrative tasks include:

- Enabling or disabling ISL Trunking
- Enabling and disabling ports of a switch
- Setting the speed of a port
- Debugging an ISL Trunking link failure

Administering ISL Trunking

ISL Trunking optimizes the use of ISLs and reduces the SAN administration effort. Given two SANs of equivalent functionality, the SAN that is easier to manage has the advantage. Because ISLs are managed as a group, instead of individually, the ISL Trunking feature minimizes the effort of managing a SAN.

The ISL Trunking feature can be administered using telnet commands, or through Advanced Web Tools.

Telnet is a standard IP networking function allowing you to log in to a machine through a telnet interface from any host server attached on Ethernet. Typically, you log in to a telnet interface and execute commands.

Advanced Web Tools is a software utility allowing you to manage and monitor your fabric through a Web browser interface and Java plug-in. Using Advanced Web Tools, you can view all switches in the SAN.

ISL Trunking Telnet Commands

Table 3–1 lists the telnet commands used to manage the ISL Trunking feature when running Fabric OS V3.0.x.

Table 3–1:   ISL Trunking Telnet Commands with Fabric OS V3.0.x

Telnet Command	Description	Example

`portCfgTrunkport`	Used to configure a port to enable or disable a port for ISL Trunking.	To enable port 5 for ISL Trunking, enter:
		
		`portCfgTrunkport 5, 1`
		
		To disable port 5 for ISL Trunking, enter:
		
		`portCfgTrunkport 5, 0`

`switchCfgTrunk`	Used to enable or disable ISL Trunking on all ports of a switch.	To enable ISL Trunking on all ports of a switch, enter:
		
		`switchCfgTrunk 1`
		
		To disable ISL Trunking on all ports of a switch, enter:
		
		`switchCfgTrunk 0`

`trunkDebug`	Used to debug a trunk link failure.	To debug ports 1 and 2, enter: `trunkDebug 1, 2`
`trunkshow`	Used to display ISL Trunking membership information.	To display ISL Trunking membership information about users, enter: `trunkshow`
`portCfgSpeed`	Used to set the port speed to run at 2GB.	To set the port speed to 2GB, enter: `portCfgSpeed x y 2` where '`x`' is the slot number and 'y' is the port number.
`switchCfgSpeed`	Used to set the switch speed to auto negotiate.	To set the switch to auto negotiate, enter: `switchCfgSpeed 0`

Table 3–2 lists the telnet commands used to manage the ISL Trunking feature when running Fabric OS V4.0.x. For detailed information on how to use these Fabric OS V4.0.x commands, refer to the *HP StorageWorks Fabric OS Version 3.0.x/4.0.x Reference Guide*.

Table 3–2: ISL Trunking Telnet Commands for Fabric OS V4.0.x

Telnet Command	Description	Example
portCfgTrunkport	Used to enable or disable a port for ISL Trunking.	To enable a port, the following syntax is used: portCfgTrunkPort <slot#> <port#> For example, to enable port 15 on a blade for the ISL Trunking feature, enter: portCfgTrunkPort 2 15 1 To disable port 15, enter: portCfgTrunkPort 2 15 0
switchCfgTrunk	Used to enable or disable trunking on all ports of a switch.	To enable ISL Trunking on all ports of a switch, enter: switchCfgTrunk 1 To disable ISL Trunking on all ports of a switch, enter: switchCfgTrunk 0
portCfgSpeed	Used to set the port speed to run at 2 GB.	To set the port speed to 2GB enter: portCfgSpeed x y 2 where 'x' is the slot number and 'y' is the port number.
switchCfgSpeed	Used to set the switch speed to auto negotiate.	To set the switch to auto negotiate enter: switchCfgSpeed 0
trunkshow	Used to display ISL Trunking membership information.	To display ISL Trunking membership information about users, enter: trunkshow

Using Advanced Web Tools for ISL Trunking

Use Advanced Web Tools to view and modify ISL Trunking options through the **Trunk Information** tab and the **Port Settings** tab on the Switch Administration interface. For information on how to install and use Web Tools for the ISL Trunking feature, refer to the *HP StorageWorks Web Tools Version 3.0.x/4.0.x User Guide*.

Use the Advanced Web Tools **Trunk Information** tab to view a summary of trunk groups and associated master and member ports. Table 3–3 describes the headings displayed from the **Trunk Information** tab, applicable to both Fabric OS V3.0.x and V4.0.x.

Table 3–3: Trunk Information Tab Description for V3.0.x and 4.0.x

Trunk Information Tab	Description
Trunk Group	A number list of trunk groups displays.
Master Port	The associated master port for the group displays.
Member Ports	Shows the member ports associated with the group, separated by a comma.

Table 3–4 describes the headings and the tasks performed using the Advanced Web Tools **Port Setting** tab when running Fabric OS V3.0.x.

Table 3–4: Port Setting Tab Features for V3.0.x

Port Setting Tab Features	Description
Port Number	Each port is assigned a number. The port numbers are displayed under this heading.
Trunking Enabled Disable	Used to enable or disable ISL Trunking on a per port basis.
Port Enabled Disable	Used to enable or disable a port.
Port Speed	Used to set the speed of the port to 2 Gbps. Ports must operate at 2 Gbps. Setting the speed to 1 Gbps prevents a port from participating in a trunk.

Table 3–5 describes the headings and tasks performed using the Advanced Web Tools **Port Setting** tab when Fabric OS V4.0.x is running.

Table 3–5: Port Setting Tab Features for V4.0.x

Port Setting Tab Features	Description
Port Number	Each port is assigned a number. The port numbers display under this heading.
Trunking Enabled	Used to enable ISL Trunking on a per port basis.
Port Enabled	Used to enable a port.
Current Speed	Used to set the speed of the port to 2 Gbps.
Port State	Used to get port status, such as: online, offline, and no light.
Change Port	Used to change the port speed from 1G to 2G, or to the auto negotiate option.

Frequently Asked Questions about ISL Trunking

Table 3–6 lists Frequently Asked Questions about the ISL Trunking feature:

Table 3–6: Frequently Asked Questions about ISL Trunking

Frequently Asked Questions	Answers
Is the ISL Trunking feature automatically configured?	Yes. ISL Trunking does not require software installation. The ISL Trunking feature is automatically invoked when ISLs are added between any two HP 2 Gbps switches.
Does ISL Trunking replace Dense Wavelength Digital Multiplexing (DWDM)?	No. DWDM is a ring, and if a failure occurs it reroutes the allocated wavelength over alternate routes, and therefore changes the effected cable lengths.
What happens if an ISL in the trunk slave port fails?	If one of the trunk slave ports fails, the logical ISL stays up; however, its capacity is reduced by 2 Gbps, and no route failure or re-routing of traffic occurs.

Table 3–6: Frequently Asked Questions about ISL Trunking (Continued)

Frequently Asked Questions	Answers
What happens if a trunk master fails?	If a trunk master fails, the logical ISL goes down, and FSPF perceives a momentary route failure. The trunk immediately re-forms without the failed ISL, and traffic resumes over the re-formed trunk with capacity reduced by 2 Gbps. A new master port is assigned to form a logical ISL for routing.
Are trunks automatically established when the trunking feature is enabled?	Yes. When two, three, or four adjacent ISLs are connected to two switches, the switches automatically group the ISLs into a single logical ISL, or "trunk."
Is it possible to have more than one trunk between a pair of switches?	Yes.
When using a pair of switches, is there a limit on the number of trunks I can have on one switch?	No.
Is there a limit on the number of trunks I can have between a pair of switches?	No. ISL Trunking 4.0 supports up to 16 routing paths. The maximum number of trunks between two adjacent switches are 64/4, or 16 trunks, and all ports are used as E-ports.
Is it possible to trunk between a switch and an edge devices host or storage?	No.
Should port statistics be the same across all participating ISLs within a trunk?	Not necessarily, it depends on the payload variations at the frame level. While optimal bandwidth use is the goal of the ISL Trunking feature, traffic might not be distributed exactly the same across all ISLs within a trunk.
Is a Trunking Master same as the Principal ISL?	Not necessarily. A Trunking Master might be a Principal ISL; however, a Principal ISL can also exist when trunking is not enabled. Whereas a Trunking Master applies only when the trunking feature is enabled.

Table 3–6: Frequently Asked Questions about ISL Trunking (Continued)

Frequently Asked Questions	Answers
What is a Trunking Slave?	Non-master Trunking Ports from a Trunking Group are called Slaves. The failure of any slave port has minimal impact on the traffic flow of a trunk.
What is a Trunking Link?	The components that comprise a trunk are referred to as trunking links. A link consists of the two trunking ports and the connecting components: a small form factor pluggable (SFP) and a cable. A trunking link is analogous to an ISL.

Glossary

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

16-port card
The Fibre Channel port card provided with the StorageWorks Core switch. Contains 16 Fibre Channel ports and the corresponding LEDs indicating port status and speed.

See also port card.

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.

Access Control List
Enables an organization to bind a specific 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. May also refer to a list of the Read/Write access of a particular community string.

See also device connection controls.

Account Level Switches
Refers to switches that have four login accounts into the operating system (in descending order): root, factory, admin, and user.

See also root account, factory account, admin account, and user account.

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.

AL_PA

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

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 WWNs when creating zones.

Alias Address Identifier

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

See also alias.

Alias AL_PA

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

See also AL_PA.

Alias Server

A fabric software facility that supports multicast group management.

ANSI

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

API

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

Arbitrated Loop

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

See also topology.

Arbitrating State

The state in which a port has become the loop master. This state is only available from the Open state.

Area Number
A number assigned to each potential port location in the StorageWorks Core switch. Used to distinguish StorageWorks Core switch ports that have the same port number but are on different port Blades.

ASIC
Application Specific Integrated Circuit.

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

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

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

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

Backup FCS Switch
Backup fabric configuration server switch. The switch or switches assigned as backup in case the primary FCS switch fails.

See also FCS switch, primary FCS switch.

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

See also throughput.

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

See also Buffer-to-buffer Flow Control, EE_Credit.

Beacon

When all the port 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.

Beaconing

The state of the switches LEDs when the switch is set to Beacon.

See also Beacon.

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

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

See also error.

Bit Synchronization

See BER.

Blade

See 16-port card.

Blind-mate Connector

A two-way connector used in some switches to provide a connection between the motherboard and the power supply.

Block

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

Blower Assembly

A fan that prevents a switch (or individual elements within a switch) from overheating.

Boot Flash

Flash memory that stores the boot code and boot parameters. The processor executes its first instructions from boot flash. Data is cached in RAM.

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

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

See also multicast, unicast.

Buffer-to-buffer Flow Control
Management of the frame transmission rate in either a point-to-point topology or in an arbitrated loop.

See also BB_Credit.

Cascade
Two or more interconnected Fibre Channel switches. StorageWorks 1 Gb SAN switches (running Fabric OS V2) and later can be cascaded up to 239 switches, with a recommended maximum of seven interswitch links (no path longer than eight switches).

See also fabric, ISL.

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

Circuit
An established communication path between two ports. Consists of two virtual circuits capable of transmitting in opposite directions.

See also link.

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

Class 2
Service that provides multiplex and connectionless frame switching service between two ports, with notification of delivery or nondelivery.

Class 3

Service that provides a connectionless frame switching service between two ports, without notification of delivery or nondelivery of data. This service can also be used to provide a multicast connection between the originator and recipients, with notification of delivery or nondelivery.

Class F

Connectionless service for control traffic between switches, with notification of delivery or nondelivery of data between the E_Ports.

Class of Service

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

CLI

Command line interface. Interface that depends entirely on the use of commands, such as through telnet or SNMP, and does not involve a Graphic User Interface (GUI).

CLS

Close Primitive Signal. Only in an Arbitrated Loop; sent by an L_Port that is currently communicating on the loop, to close communication to an other L_Port.

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.

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.

Compact Flash

Flash memory that stores the run-time operating system and is used like hard disk storage. Not visible within the processor's memory space. Data is stored in file system format.

Configuration

How a system is set up. May refer to hardware or software.

- Hardware: The number, type, and arrangement of components that make up a system or network.
- Software: The set of parameters that guide switch operation. May include general system parameters, IP address information, domain ID, and other information. Modifiable by any login with administrative privileges.

May also refer to a set of zones.

See also zone configuration.

Connection Initiator

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

Connection Recipient

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

Control Panel

Refers to the left-side panel of Web Tools, which accesses fabric-wide functions such as Zoning and Events.

Core Switch

A switch whose main task is to interconnect other switches.

See also SAN switch.

CP Card

Control Processor Card. The central processing unit of the StorageWorks Core switch, which contains two CP Card slots to provide redundancy. Provides Ethernet, serial, and modem ports with the corresponding LEDs.

CRC

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

Credit

As applies to Fibre Channel, the number of receive buffers available for transmission of frames between ports.

See also BB_Credit, EE_Credit.

CT_HDR
Common Transport Header. A header that conforms to the Fibre Channel Common Transport (FC_CT) protocol.

CT_IU
Common Transport Information Unit. An information unit that conforms to the Fibre Channel Common Transport (FC_CT) protocol.

Current Fill Word
The fill word currently selected by the LPSM.

See also fill word, LPSM.

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.

Data Word
Type of transmission word that occurs within frames. The frame header, data field, and CRC all consist of data words.

See also frame, ordered set, transmission word.

DB-9 connector
A 9-pin version of the RS-232C port interface. May be either the male of female interface.

See also RS-232 port.

dBm
Logarithmic unit of power used in electronics. Indicates signal strength in decibels above the reference level, which is 1 milliwatt for dBm. An increase of 10 dBm or represents a 10-fold increase in power.

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

See also DTE port, RS-232 port.

Defined Zone Configuration
The set of all zone objects defined in the fabric. May include multiple zone configurations.

See also enabled zone configuration, zone configuration.

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 WWN and typically represent HBAs (servers).

See also access control lists.

Device
A disk, a RAID, or an HBA.

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

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

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

DTE port
A data terminal equipment port capable of interfacing to a transmission circuit through a connection to a DCE (data communications equipment) 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 DCE port, RS-232 port.

DWDM
Dense Wavelength Multiplexing. A means to concurrently transmit more than one stream of data through a single fiber by modulating each stream of data onto a different wavelength of light.

E_D_TOV

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

See also R_A_TOV, RR_TOV.

E_Port

Expansion Port. A type of switch port that can be connected to an E_Port on another switch to create an ISL.

See also ISL.

EE_Credit

End-to-end Credit. The number of receive buffers allocated by a recipient port to an originating port. Used by Class 1 and 2 services to manage the exchange of frames across the fabric between source and destination.

See also End-to-end Flow Control, BB_Credit.

EIA Rack

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

ELWL

Extra Long Wave Length. Laser light with a periodic length greater than 1300 nm (e.g., 1420 or 1550). ELWL lasers are used to transmit Fibre Channel data over distances greater than 10 Km.

Also known as XLWL.

Enabled Zone Configuration

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

See also defined zone configuration, zone configuration.

End-to-end Flow Control

Governs flow of class 1 and 2 frames between N_Ports.

See also EE_Credit.

Entry Fabric

Basic HP license that allows one E_Port per switch. Not supported by StorageWorks Core switches.

Error

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

See also loop failure.

ESD

Electrostatic Discharge.

Exchange

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

Extended Fabric

An HP product that runs on Fabric OS and allows creation of a Fibre Channel fabric interconnected over distances of up to 100 kilometers.

Extended Fabric is a means of allowing the implementation and management of SANs over extended distances. This is achieved by adjusting the Buffer-to-Buffer Credits to guaranteed allocation of buffers to specific ports.

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.

See also FL_Port, Fx_Port.

Fabric

A Fibre Channel network containing two or more interconnected switches in addition to hosts and devices. May also be referred to as a switched fabric.

See also topology, SAN, cascade.

Fabric Access

An HP product that consists of a set of APIs that allow third party applications to interface with Fabric OS.

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
An HP feature that enables private and public hosts to access public targets anywhere on the fabric, provided they are in the same Fabric Assist zone. This feature is available only when both QuickLoop and Zoning are installed on the switch.

Fabric Assist is a means of allowing private hosts to communicate with public targets across a switched fabric. Fabric Assist also allows private hosts to communicate with private targets that are not resident on the same switch across a switched fabric.

See also QuickLoop.

Fabric Configuration Server
One or more designated HP switches that store and manage the configuration parameters for all other switches in the fabric. These switches are designated by WWN, and the list of designated switches is known fabric-wide.

Fabric Manager
An HP product that works in conjunction with Web Tools to provide a graphical user interface for managing switch groups (such as the SAN Switch Integrated/32) as a single unit, instead of as separate switches. Fabric Manager is installed on and run from a computer workstation.

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

Fabric OS
The proprietary operating system on HP StorageWorks switches.

Fabric Watch
An HP product that runs on Fabric OS and allows monitoring and configuration of fabric and switch elements.

Allows the 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 an HP switch.

See also Fabric Manager.

Factory Account
A login used during manufacturing to initialize and test a switch and is not intended for customer use.

See also account level switches.

Failover
The act that causes control to pass from one redundant unit to another. In the StorageWorks Core switch one may failover from the currently Active Control Processor (CP) to the Standby CP.

FAN
Fabric access notification. Retains the AL_PA and fabric address when loop re-initializes (if the switch supports FAN).

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

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

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

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

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.

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

FCS switch
Fabric configuration server switch. One or more designated HP switches that store and manage the configuration parameters for all switches in the fabric. FCS switches are designated by WWN, and the list of designated switches is communicated fabric-wide.

See also backup FCS switch, primary FCS 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 multi-switch Fibre Channel fabric.

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

See also FSP.

FIFO
First In, First Out. May also refer to a data buffer that follows the first in, first out rule.

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

Firmware Download
Loading firmware down from a server into a switch.

Firmware
The basic operating system provided with the hardware.

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

See also F_Port, Fx_Port.

Flash Partition
Two redundant usable areas, called "partitions," into which firmware can be downloaded in the StorageWorks Core switch.

Flash
Programmable NVRAM memory that maintains its contents.

FLOGI

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

See also PLOGI.

Frame

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

See also Data Word.

FRU

Field Replaceable Unit. A component that can be replaced on site.

FS_ACC

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

FS_IU

Fibre Channel Services Information Unit. An information unit that has been defined by a Fibre Channel service.

FS_REQ

Fibre Channel Services Request. A request for a Fibre Channel services function, or notification of a fabric condition or event.

FS_RJT

Fibre Channel Services Reject. An indication that a request for Fibre Channel services could not be processed.

FS

Fibre Channel Service. 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 FSP.

FSPF

Fabric Shortest Path First. HP routing protocol for Fibre Channel switches.

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

See also FS.

Full Fabric
The HP license that allows multiple E_Ports on a switch, making it possible to create multiple ISL links.

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

See also half-duplex.

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

See also F_Port, FL_Port.

G_Port
Generic Port. A port that can operate as either an E_Port or F_Port. A port is defined as a G_Port when it is not yet connected or has not yet assumed a specific function in the fabric.

Gateway
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.

GBIC
Gigabit interface converter. A removable serial transceiver module that allows gigabaud physical-level transport for Fibre Channel and gigabit Ethernet. Typically refers only to the SC-form factor transceivers.

See also SFP.

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

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

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 AL_PA that an NL_Port attempts to acquire during loop initialization.

Hardware Translative Mode

A method for achieving address translation. The following two hardware translative modes are available to a QuickLoop-enabled switch:

- Standard Translative Mode: Allows public devices to communicate with private devices that are directly connected to the fabric.
- QuickLoop Mode: Allows initiator devices to communicate with private or public devices that are not in the same loop.

HBA

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

High Availability

An attribute of equipment that identifies it as being capable of conducting customer operations well in excess of 99% of the time. Typically High Availability is identified by the number of nines in that percentage. "Five Nines" means the equipment is rated as being capable of conducting customer operations 99.999% of the time without failure.

Host

A computer that accesses storage devices over the fabric. May also be referred to as a server.

See also workstation.

Hot Pluggable

A FRU capability that indicates it may 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.

IBTA

The InfiniBand Trade Association (IBTA). The IBTA is an industry consortium of more than 200 companies working together to develop a new common I/O specification designed to bring greater scalability and performance to server I/O. InfiniBand defines a new channel based, switched-fabric technology for server-to-server and server-to-I/O interconnection that is expected to improve scalability and performance over existing PCI Bus technologies.

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.

Infiniband

See IBTA.

Initiator

A server or workstation on a Fibre Channel network that initiates communications with storage devices.

See also Target.

Integrated Fabric

The fabric created by a SAN Switch Integrated/32 and SAN Switch Integrated/64, consisting of six SAN Switch 16-EL switches cabled together and configured to handle traffic as a seamless group.

IOD

In-order Delivery. A parameter that, when set, guarantees that frames are either delivered in order or dropped.

IPA

Initial Process Associator. An identifier associated with a process at an N_Port.

Isolated E_Port

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

See also E_Port.

ISL

Interswitch Link. a Fibre Channel link from the E_Port of one switch to the E_Port of another.

See also E_Port, cascade, ISL trunking.

ISL Trunking
An HP feature that enables distribution of traffic over the combined bandwidth of up to four 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.

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

JBOD
Just a Bunch Of Disks. Indicates a number of disks connected in a single chassis to one or more controllers.

See also RAID.

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
lash memory that stores the bootable kernel code and is visible within the processor's memory space. Data is stored as raw bits.

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

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

- *Fabric mode.* Connected to a port that is not loop capable, and using fabric protocol.

- *Loop mode.* In an arbitrated loop and using loop protocol. An L_Port in loop mode can also be in participating mode or non-participating mode.

See also Non-participating Mode, Participating Mode.

Latency

The period of time required to transmit a frame, from the time it is sent until it arrives. Together, latency and bandwidth define the speed and capacity of a link or system.

LED

Light Emitting Diode. Used on HP switches to indicate the status of various switch elements.

Link Services

A protocol for link-related actions.

Link

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

See also Circuit.

LIP

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

LIS_HOLD_TIME

Loop Initialization Sequence Hold Time. The maximum period of time for a node to forward a loop initialization sequence**.**

LM_TOV

Loop Master Time-out Value. The minimum time that the loop master waits for a loop initialization sequence to return.

Login BB_Credit

The number of receive buffers a receiving L_Port has available when a circuit is first established.

See also BB_Credit.

Loop Circuit

A temporary bidirectional communication path established between L_Ports.

Loop Failure

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

See also error.

Loop Initialization
The logical procedure used by an L_Port to discover its environment. Can be used to assign AL_PA addresses, detect loop failure, or reset a node.

Loop_ID
A hex value representing one of the 127 possible AL_PA values in an arbitrated loop.

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

LPSM
Loop Port State Machine. The logical entity that performs arbitrated loop protocols and defines the behavior of L_Ports when they require access to an arbitrated loop.

LWL
Long Wavelength. A type of fiber optic cabling that is based on 1300-mm lasers and supports link speeds of 1.0625 Gbps. May also refer to the type of GBIC or SFP.

See also SWL.

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 ISL in the trunking group is designated as the master port for that group.

See also ISL Trunking.

Media
See transceiver.

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

Modem Serial Port
The upper serial port on the CP Card of the StorageWorks Core switch. 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 a RS-232 device, and can be connected by serial cable to a DCE device. A Hayes-compatible modem or Hayes-emulation is required. The device name is ttyS1.

See also DB-9 connector, DCE port, terminal serial port.

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

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

See also broadcast, unicast.

Multimode
A fiber optic cabling specification that allows up to 500 meters between devices for 1 Gb, or 300 meters between devices for 2 Gb.

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.

See also NL_Port, Nx_Port.

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

Name Server
Frequently used to indicate Simple Name Server.

See also SNS.

Native Address Identifier
A unique, 64-bit address is assigned to each port, and is referred to as its World-Wide Name (WWN). If a port connects to an arbitrated loop, it will also be assigned a dynamic 8-bit address, referred to as its arbitrated loop physical address, or AL_PA. If it connects to a fabric, it will be assigned a dynamic 24-bit address, referred to as its Native Address Identifier.

Negotiate
See auto-negotiate speed and autosense.

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

See also N_Port, Nx_Port.

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

Node
A Fibre Channel device that contains an N_Port or NL_Port.

Non-participating Mode
A mode in which an 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 AL_PA cannot be acquired.

See also L_Port, Participating Mode.

Nx_Port
A node port that can operate as either an N_Port or NL_Port.

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

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

Open State
The state in which a port can establish a circuit with another port. A port must be in the Open state before it can arbitrate.

OPN
Open Primitive Signal.

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 the following items:

- *Frame delimiters.* Mark frame boundaries and describe frame contents.
- *Primitive signals.* Indicate events.
- *Primitive sequences.* Indicate or initiate port states.

Ordered sets are used to differentiate Fibre Channel control information from data frames and to manage the transport of frames.

Packet

A set of information transmitted across a network.

See also Frame.

Participating Mode

A mode in which an L_Port in a loop has a valid AL_PA and can arbitrate, send frames, and retransmit received transmissions.

See also L_Port, Non-participating Mode.

Path Selection

The selection of a transmission path through the fabric. HP StorageWorks switches use the FSPF protocol.

Performance Monitor

Comprehensive HP tool for monitoring the performance of networked storage resources.

Performance Monitoring

An HP product that provides error and performance information to the administrator and end user for use in storage management.

Phantom Address

An AL_PA value that is assigned to an device that is not physically in the loop.

Also known as phantom AL_PA.

Phantom Device

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

PLOGI

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

See also FLOGI.

Point-to-point

A Fibre Channel topology that employs direct links between each pair of communicating entities.

See also topology.

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

Port Card
A Fibre Channel card that contains optical or copper port interfaces, and acts like a switch module.

See also 16-port card.

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

Primary FCS Switch
Primary fabric configuration server switch. The switch that actively manages the configuration parameters for all switches in the fabric.

See also backup FCS switch, FCS switch.

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

Private Loop
An arbitrated loop that does not include a participating FL_Port.

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

Protocol
A defined method and a set of standards for communication.

PSU
Power Supply Unit.

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 FL_Port, and may contain both public and private NL_Ports.

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

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

QuickLoop
An HP StorageWorks product that makes it possible to allow private devices within loops to communicate with public and private devices across the fabric through the creation of a larger loop.

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

A means of allowing private hosts to communicate with private targets across a switched fabric.

The QuickLoop/Fabric Assist feature also allows:

- private hosts to communicate with public targets across a switched fabric.
- private hosts to communicate with private targets that are not resident on the same switch across a switched fabric.

See also Fabric Access, fabric assist, and translative mode.

QuickLoop Zoning
Protects devices from disruption by unrelated devices during critical processes; for example, during a tape backup session.

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

See also E_D_TOV, RR_TOV.

R_RDY
Receiver ready. A primitive signal indicating that the port is ready to receive a frame.

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.

See also JBOD.

Remote Fabric
A fabric that spans across WANs by using protocol translation (a process also known as tunneling) such as Fibre Channel over ATM or Fibre Channel over IP.

Remote Switch
Bridges two switches into a SAN as large as 3000KM or more through protocol encapsulation in ATM networks via the Computer Network Technologies (CNT) UltraNet Open Systems Gateway.

Request Rate
The rate at which requests arrive at a servicing entity.

See also service rate.

RLS Probing
Read link status of the AL_PAs.

Root Account
A login used for debugging purposes by HP engineers and is not intended for customer use.

See also account level switches.

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

See also FSPF.

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

RR_TOV

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

See also E_D_TOV, R_A_TOV.

RS-232 port

A port that conforms to a set of Electrical Industries Association (EIA) standards. Used to connect DTE and DCE devices for communication between computers, terminals, and modems.

See also DCE port, DTE port.

RSCN

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

RX_ID

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

SAN

Storage Area Network. A network of systems and storage devices that communicate using Fibre Channel protocols.

See also fabric.

SAN Switch

A switch whose main task is to connect nodes into the fabric.

See also core switch.

SCSI

Small Computer Systems Interface. A parallel bus architecture and protocol for transmitting large data blocks to a distance of 15 - 25 meters.

SDRAM

Synchronous Dynamic Random Access Memory. The main memory for the switch. Used for volatile storage during switch operation.

See also flash.

Sequence

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

Service Rate

The rate at which an entity can service requests.

See also request rate.

SFF

Small Form Factor.

SFP Cable

The latest innovation in high-speed copper cabling for Fibre Channel and InfiniBand. It incorporates the SFP module directly onto the cable assembly, eliminating the need for a separate SFP copper module and an HSSDC2 cable assembly.

SFP

Small form factor pluggable. A transceiver used on 2 Gbps switches that replaces the GBIC. Refers to the LC-form factor transceiver.

See also GBIC.

SID/DID

Source identifier/Destination identifier. S_ID is a 3-byte field in the frame header that is used to indicate the address identifier of the N_Port from which the frame was sent.

Single Mode

The fiber optic cabling standard that, when used in conjunction with a 1300 nm laser light, can transfer data up to 10 km between devices. When used in conjunction with a 1550 nm laser light, single mode cabling can transfer data over 10 km.

See also multimode, LWL, ELWL, and XLWL.

SI

Sequence Initiative.

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).

SNMPv1

The original SNMP, now labeled v1.

SNS
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. May also be referred to as directory service.

See also FS.

StorageWorks SAN switch
The brand name for the HP family of switches.

Switch Name
The arbitrary name assigned to a switch.

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

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

SWL
Short Wavelength. A type of fiber optic cabling that is based on 850-mm lasers and supports 1.0625-Gbps link speeds. May also refer to the type of GBIC or SFP.

See also LWL.

Tachyon
A chip developed by Hewlett-Packard, and used in various devices. This chip has FC-0 through FC-2 on one chip.

Target
A storage device on a Fibre Channel network.

See also Initiator.

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
May also be referred to as the console port. The lower serial port on the CP Card of the StorageWorks Core 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 DTE device, and can be connected by serial cable to a DCE device. The connector pins two and three are swapped so that a straight-through cable can be used to connect to a terminal. The device name is ttyS0.

See also DCE port, modem serial port.

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

See also bandwidth.

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

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

Transceiver
Device that converts one form of signaling to another for transmission and reception; in fiber optics, it refers to optical and electrical.

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

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

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

Transmission Word
A group of four transmission characters.

See also data word.

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

See also SNMP.

Trunking
See ISL Trunking.

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

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

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

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

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

Unicast
The transmission of data from a single source to a single destination.

See also broadcast, multicast.

user account
A login intended for use by the customer to monitor, but not control, switch operation.

See also account level switches.

VC
Virtual circuit. A one-way path between N_Ports that allows fractional bandwidth.

Web Tools

An HP product that runs on Fabric OS and provides a graphical interface to allow monitoring and management of individual switches or entire fabrics from a standard workstation running a browser.

Well-known Address

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

Workstation

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

WWN

World-Wide Name. An identifier that is unique worldwide. Each entity in a fabric has a separate WWN.

XLWL

Xtra Long Wave Length. Laser light with a periodic length greater than 1300 nm (e.g., 1420 or 1550). XLWL lasers are used to transmit Fibre Channel data over distances greater than 10 Km.

Also known as ELWL.

Xmitted Close State

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

Zone

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

A name assigned to a device or group of devices in a zone. Aliases can greatly simplify the zone administrative process.

See also alias.

Zone Configuration

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

See also defined zone configuration, enabled zone configuration.

Zone Member

A port, node, WWN, or alias, which is part of a zone.

Zone Schemes

The level of zoning granularity selected. For example, zoning may be done by switch/port, WWN, AL_PA, or a mixture.

See also zone configuration.

Zone Set

See zone configuration.

Zoning

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

See also zone.

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