hp StorageWorks
quickloop fabric assist

Product Version: Version 3.0.x

First Edition (February 2003)

Part Number: AA-RTS1A-TE

This document provides an overview of QuickLoop Fabric Assist concepts, instructions for installing QuickLoop Fabric Assist and zoning, and information about configuring and using QuickLoop Fabric Assist.

hp invent

contents

This user guide provides information to help you:

■　Installing the optionally-licensed QuickLoop software.

■　Configure the QuickLoop software.

■　Contact technical support for additional assistance.

Intended Audience

This book is intended for use by System Administrators who are experienced with the following:

■　StorageWorks Fibre Channel SAN Switches.

■　Fabric Operating System V3.0 or later.

Prerequisites

Before you install or configure the software, make sure you consider the items in the Document Conventions section that follow.

Conventions

Conventions consist of the following:

- Document Conventions
- Text Symbols
- Text Symbols

Document Conventions

The document conventions included in Table 1 apply in most cases.

Table 1: Document Conventions

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

Text Symbols

The following 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.

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

Equipment Symbols

The following equipment symbols may be found on hardware for which this guide pertains. They have the following meanings.

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

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

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

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

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

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

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

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

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

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

Rack Stability

Rack stability protects personnel and equipment.

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

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

Getting Help

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

HP Technical Support

In North America, call 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 technical support at the nearest location. Telephone numbers for worldwide technical support are listed on the HP website under support: http://www.hp.com/country/us/eng/support.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 website 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 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, see the HP website for locations and telephone numbers: http://www.hp.com.

Introducing QuickLoop

1

This chapter provides the following information:

■ QuickLoop Overview on page 11

■ QuickLoop Basics on page 12

■ Address Translation on page 12

■ Combining QuickLoop and Zoning on page 13

QuickLoop Overview

QuickLoop is an optional-licensed product that allows arbitrated loops to be attached to a fabric. Without modifying their drivers, private targets on the arbitrated loops can be accessed by public or private hosts elsewhere on the fabric.

Note: Fabric Assist mode is not supported in this Version 3.0 release; however, it will be supported in a future release.

Devices attached to QuickLoop communicate with all other devices attached to the same QuickLoop. However, private devices attached to QuickLoop communicate only with devices within the same QuickLoop. Public devices in an arbitrated loop mode are considered private devices when connected to QuickLoop ports.

When a zoning license is also purchased, the set of storage devices visible to specific hosts can be carefully administered.

The QuickLoop and zoning combination allows a private host to fully participate in a Storage Area Network (SAN).

QuickLoop Basics

QuickLoop is a unique Fibre Channel topology that combines arbitrated loop and fabric topologies. An arbitrated loop supports communication between devices that are not fabric-aware. Such devices are called private devices, and arbitrated loops are sometimes called private loops.

QuickLoop allows a SAN Switch 8-EL/16-EL to emulate a hub environment, while offering the additional benefit of connectivity to a fabric.

A QuickLoop consists of multiple private arbitrated looplets (a set of devices connected to a single port) that are connected by a fabric. All devices in a QuickLoop share a single AL_PA bit-map and behave as if they are in one loop. This allows private devices to communicate with other devices over the fabric, provided they are in the same QuickLoop.

A particular QuickLoop can be configured to consist of selected devices or looplets connected to the ports of one switch, or to a cascaded switch pair.

QuickLoop provides a possible migration path starting with deploying a single private loop and later deploying a fabric-based SAN. In this scenario, QuickLoop-enabled switches can be used to replace hubs when the SAN is first deployed and has only private devices attached. Then, as the SAN grows, fabric switches can be added without any detrimental effect to the QuickLoop-enabled switches.

Address Translation

Address translation is transparent and requires no actions on the part of the user. It is achieved through hardware translative mode (also known as phantom mode), in which a device not physically located in a looplet is made addressable by a unique AL_PA in that looplet.

Two hardware translative modes are available to a QuickLoop-enabled switch:

- **Standard translative mode**—Allows public hosts to communicate with private target devices across the fabric. Standard translative mode is available as an integral part of Fabric OS, and does not require QuickLoop.

- **QuickLoop mode**—Allows private hosts to communicate with private target devices across the fabric when configured in the same QuickLoop. Also allows a private host to communicate with a public target in the same QuickLoop.

Individual ports within a switch may be set by configuration commands to one of the above two modes offering a mixed mode configuration.

The switch automatically determines and sets the appropriate mode, based on factory defaults and configurations currently in effect.

Combining QuickLoop and Zoning

QuickLoop can be used in conjunction with Zoning.

Zoning allows the zoning of fabrics and QuickLoops. This feature enhances the management of a Fibre Channel Arbitrated Loop (FC-AL) in a legacy environment.

In QuickLoop zoning, devices within a QuickLoop can be partitioned within that QuickLoop to form QuickLoop zones; this means that a QuickLoop zone is a subset of QuickLoop and can include only devices in QuickLoop.

Fabric zones and QuickLoop zones are independent of each other; both types of zones can co-exist in the same zone configuration. Hosts in a QuickLoop can see only targets contained within a QuickLoop.

Purchasing a zoning license adds the following features:

■   Devices from multiple QuickLoops can be added to the definition for a fabric zone. Even an identical AL_PA from two different QuickLoops could be configured under a fabric zone. Zoning can correctly direct traffic to the different devices.

■   Additional control over access to QuickLoop devices. Fabric devices in a zoned fabric can only access the QuickLoop (and fabric) devices that are in the same zone.

■   Zones can be created within QuickLoops. Zoning can be used to partition QuickLoops. This creates QuickLoop zones (as opposed to fabric zones), whose members are identified by either physical port number or AL_PA.

For more information about using Zoning and QuickLoop in conjunction, see the *Zoning User Guide.*

Installing a QuickLoop

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This chapter provides the following information:

- Installation Overview on page 15
- Installing a QuickLoop Using Telnet on page 16
- Installing a QuickLoop Using Web Tools on page 17

Installation Overview

Installation of aQuickLoop involves the installation of a license on each switch that you want to enable for a QuickLoop. A license may have been installed on the switch at the factory. If not, contact your switch supplier to obtain a license key.

QuickLoops require a Compaq StorageWorks Fibre Channel SAN Switch with Fabric Operating System Version 3.0 or later installed. You can install a QuickLoop license either through telnet or through Web Tools.

Installing a QuickLoop Using Telnet

1. Log onto the switch by telnet (see the user guide provided with the hardware for details), using an account that has administrative privileges.

2. If you want to determine whether a QuickLoop license is already installed on the switch, type `licenseShow` on the telnet command line. A list displays of all the licenses currently installed on the switch. For example:

```
admin> licenseShow

1A1AaAaaaAAAA1a:
Release v3.0
Web license
Zoning license
Compaq QuickLoop license
```

If the QuickLoop license is not included in the list, or is incorrect, continue with step 3 and 4.

3. Enter the following on the command line:

```
licenseAdd "key"
```

where "*key*" is the license key provided to you, surrounded by 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 on the command line:

```
licenseShow
```

If the QuickLoop license is listed, the feature is installed and immediately available. If the license is not listed, repeat steps 3 and 4.

Installing a QuickLoop Using Web Tools

If a Web Tools license is installed, you can install a QuickLoop as follows:

1. Launch a web browser, enter the switch name or IP address in the **Location/Address** section of the browser, and press <Enter>. Web Tools launches, displaying the Fabric View.

2. Click the **Admin** button on the relevant switch panel. The logon window displays.

3. Enter a logon name and password with administrative privileges and press **Enter**. The Administration View displays.

4. Select the **License Admin** tab.

5. Enter the license key in the **License Key:** field

6. Click **Add** button. The QuickLoop features are available as soon as the license key is added.

For more information about Web Tools installation, see the *Web Tools User Guide*, Version 3.0.

Using Quick Loop

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This chapter provides the following information:

Note: For information about creating zones within a QuickLoop, see the *Zoning User Guide, Version 3.0.*

Overview

You can enable or disable QuickLoop for either the entire switch or for individual ports. When QuickLoop is disabled on an individual port, that port returns to Fabric mode. When QuickLoop is enabled on a port, the port is added to the same QuickLoop to which the switch belongs.

A QuickLoop is either "single switch," where all looplets are located on a single switch, or "dual switch," where looplets are located on either of two partnered switches. However, any switch can be in only one QuickLoop. A QuickLoop includes all or some of the ports on a switch or cascaded switch pair, and can have several private hosts. Public hosts in an arbitrated loop mode are considered private devices when connected to QuickLoop ports.

A switch can be configured to operate in any of the following modes:

- **QuickLoop mode**—All ports on the switch, except for E_Ports or loopback ports, are enabled for QuickLoop and participate in a logical Private Loop Direct Attach (PLDA). Upon request, this can be set as the manufacturing default. This mode can also be set by the telnet command `qlEnable`.

- **Fabric mode**—No ports are QuickLoop-enabled (none participate in any logical PLDAs), and all ports operate as FC-FLA compliant devices. This mode can be set by the telnet command `qlDisable`.

- **Mixed mode**—Each port is set to QuickLoop on an individual basis. The port's operating mode can be reset during operation. Ports set to QuickLoop become looplets of the QuickLoop to which the switch belongs. Particular ports can be taken in and out of the QuickLoop by the telnet commands `qlPortDisable` and `qlPortEnable`.

Note: These modes cannot be configured by Simple Network Management Protocol (SNMP).

A switch has a default mode, which depends on the switch model. When powered up, all the ports of the switch will be set to the default mode.

Administering QuickLoop

You can manage QuickLoops using telnet commands or Web Tools (an optional-licensed product).

Web Tools

You can view and modify the QuickLoop settings through the QuickLoop **Admin** tab on the Switch Admin interface view available through Web Tools. For detailed information about installing and using Web Tools for the QuickLoop feature, refer to the *Web Tools User Guide*.

Telnet Commands

The telnet commands for QuickLoop become available through the shell *admin* account when the basic QuickLoop license key is installed.

To use a QuickLoop telnet command, log into the relevant switch with administrative privileges, enter the command along with any required operands, and press **Enter**.

For a description of all the telnet commands provided for managing QuickLoop, refer to the *Fabric Operating System Reference Guide*.

QuickLoop Topology

QuickLoop topologies have the following characteristics:

■ A QuickLoop can include up to two switches and can support up to 126 AL_PA devices.

■ Each switch can only be included in one QuickLoop.

■ A QuickLoop can include either all of, or a subset of, the ports on an individual switch.

■ Multiple non-overlapping QuickLoops can exist in a fabric of multiple switches.

■ Switches with QuickLoops enabled can exist in the same fabric as non-QuickLoop enabled switches.

■ A device attached to a QuickLoop can communicate with all other devices attached to the same QuickLoop.

■ A private device in a QuickLoop can only communicate with devices in the same QuickLoop. Existing PLDA capable host drivers need no modification to perform I/O operations with storage devices.

■ Public devices that are arbitrated loop capable are treated as private devices when connected to QuickLoop ports (their fabric login, or "FLOGI," is not valid).

■ Legacy devices may be used in a QuickLoop and may be attached to a fabric and operate as if in a PLDA environment.

■ A QuickLoop can be enabled or disabled for either the entire switch or for individual ports. When QuickLoop is disabled on an individual port, that port returns to Fabric mode.

■ Each looplet in a QuickLoop has its own unshared bandwidth and can support transfer rates up to 100 MB/s.

- Multiple devices communicate simultaneously between at least 4 separate switch ports, at full bandwidth within multiple looplets located in the same QuickLoop. These simultaneous conversations cannot involve overlapping looplets.

- If a looplet error is detected, QuickLoop automatically takes that looplet out of service. If the error condition is cleared, the looplet is automatically reinstated.

QuickLoop Implementation

QuickLoop is implemented by a combination of hardware and software components and requires no actions on the part of the user once it is installed and configured. The hardware components are responsible for the transport of frames among looplets and across switches, and the software components are responsible for QuickLoop initialization and error handling.

Terminology

The terms and concepts introduced in this section are fundamental to understanding the use of QuickLoop mode with switches. Refer to the Glossary for aditional terms.

Note: The following two port types are on host or storage devices, not on switches.

N_port

(Node port) An equipment port that is not loop capable. Used to connect the equipment to the fabric.

NL_port

An equipment port that is loop capable. Used to connect an equipment port to the fabric in a loop configuration through the FL_Port on a switch.

There are 8, 16 or 32 physical ports on varying models of a Compaq StorageWorks Fibre Channel SAN Switch; certain models constrain the type of port the switch can support. Each port can be independently configured as one of the following types.

- F_Port—A fabric port that is not in loop mode. Able to transmit under fabric protocol, and interface over links. N_Ports on equipment connect to F_Ports on switches.

- FL_Port—A fabric port on a switch that is in loop mode. Used to connect loop capable NL_Ports to the switch in a loop configuration.

- E_Port—Expansion port. A port is designated an E_Port when it is used as an interswitch expansion port to connect to the E_Port of another switch, to build a larger switch fabric, or to build a two-switch QuickLoop configuration.

  Sometimes, a single fabric loop device is attached to a port. In this case, the port would function as an FL_port. The attached device possesses either an N_port (if the device is fabric-capable) or an NL_port, in which case the device would be connected to the fabric in a loop configuration through an FL_Port on a switch. In this latter case a looplet is created.

- looplet—A set of devices connected in a loop to a port that is itself a member of an arbitrated loop. By contrast, a single device rather than a loop might be connected to a port.

  Each device in a private loop must have a unique physical address. The devices in a QuickLoop are assigned a unique phantom AL_PA.

- AL_PA—Arbitrated loop physical address. A one-byte value used to identify a device in an arbitrated loop.

  During implementation and operation of switches in a QuickLoop, messages are transmitted by devices as they come online. These messages, called Loop Initialization primitives (LIPs), are in addition to normal data traffic.

Dual-switch QuickLoop

In a dual-switch QuickLoop, the initialization process is driven by one of the switches, called the QuickLoop master. The role of the QuickLoop master is dynamically assigned at each instance of QuickLoop initialization, according to the following criteria:

- If one switch receives LIPs from its looplets and the other does not, the switch that receives the LIPs is the QuickLoop master.

- If both switches receive LIPs from their respective looplets, the switch with the lower domain ID is the QuickLoop master.

QuickLoop Initialization

QuickLoop initialization includes two passes:

- Pass 1: Sequential looplet initialization—Allows each device in a looplet to obtain a unique AL_PA.

- Pass 2: Full QuickLoop initialization—Brings QuickLoop up to operation.

Note: If Zoning is in use, the looplets that are initialized depend upon the zoning configuration.

Pass 1: Sequential Looplet Initialization

This pass allows each device in the QuickLoop to obtain a unique AL_PA in a single AL_PA bit-map. Only those looplets from which LIPs were received are initialized, using the loop initialization procedure described in the FC-AL standard. The AL_PAs of devices in looplets from which no LIPs are received are preserved during initialization.

Pass 2: Full Initialization

This pass sets up the QuickLoop as a single logical PLDA. This is accomplished by making all assigned AL_PAs addressable by any device in the QuickLoop, regardless of whether the destination device and source device are in the same physical looplet. If the destination and source devices are not in the same physical looplet, the hidden FL_Port in the source device looplet acts on behalf of the destination device, and the fabric provides the transport service.

Sample Configurations

The following examples illustrate possible configurations of one or two switches to form a QuickLoop. For the details of setting these sample configurations using telnet commands, refer to *Fabric OS Reference Guide*.

The QuickLoop configuration examples are:

- Configuration 1: Emulating a Hub on page 25—A simple configuration in which a QuickLoop-enabled switch is used as a hub emulator or concentrator.

- Configuration 2: Dual-switch QuickLoop on page 26—A dual-switch configuration in which two switches are cascaded by a local fiber connection to make up a QuickLoop.

- Configuration 3: Long Wave Laser Connection on page 27—A dual-switch configuration in which two switches up to 10 kilometers apart are connected to make up a QuickLoop.

- ■ Configuration 4: Mixed QuickLoop Mode and Fabric Mode on page 28—A mixed-mode configuration in which only some of the ports of two cascaded switches are enabled for QuickLoop.

In each of these examples, the dotted line represents the logical QuickLoop or the ports that form the QuickLoop.

A QuickLoop zone is a subset of a QuickLoop. For examples that illustrate using QuickLoop zones, see the *Zoning User Guide.*

Configuration 1: Emulating a Hub

Figure 1 shows multiple hosts and devices connected to a QuickLoop-enabled switch. The switch serves as a concentrator, similar to a hub except the switch offers throughput performance on each looplet of 200MB/s.
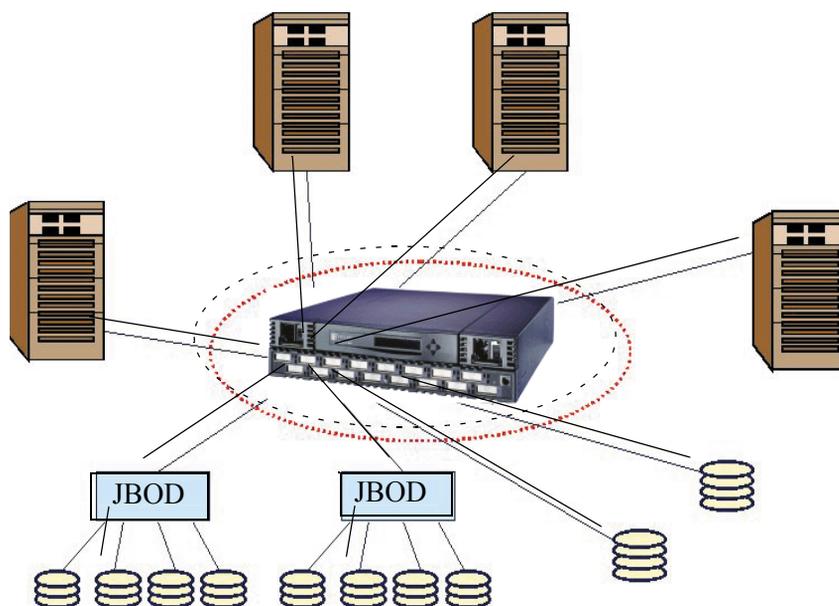
Figure 1: QuickLoop-enabled switch used as concentrator

Configuration 2: Dual-switch QuickLoop

Figure 2 shows two switches cascaded by a local fiber connection between E_ports into a single logical PLDA. The ports configured on both switches in QuickLoop share a single AL_PA bit-map. Neither switch can participate in a different QuickLoop. The QuickLoop can be further subdivided into one or more QuickLoop zones.
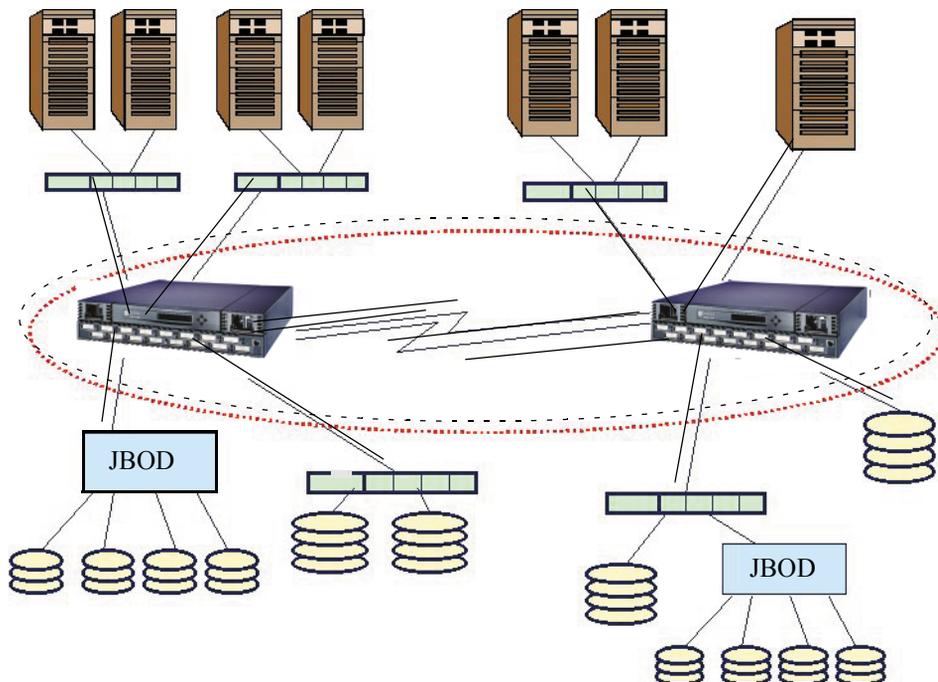
Figure 2: QuickLoop configured as dual-switch

Configuration 3: Long Wave Laser Connection

Figure 3 shows two switches cascaded by a long wave laser into a single logical PLDA. Both switches operate in QuickLoop mode and connect devices at distances of up to 10 kilometers.
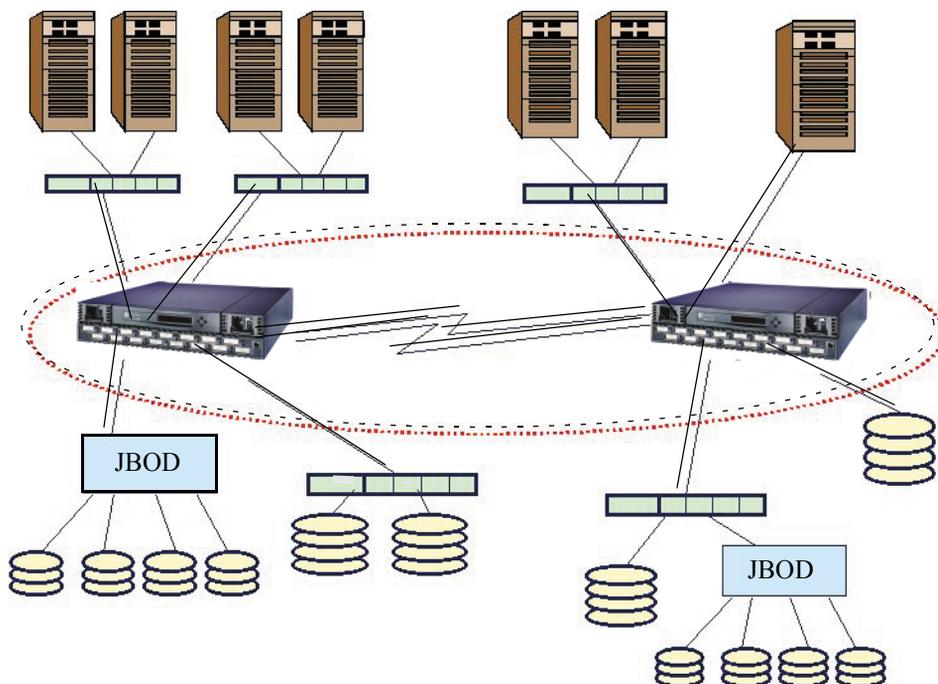
Figure 3: QuickLoop configured as long-distance QuickLoop

Configuration 4: Mixed QuickLoop Mode and Fabric Mode

Figure 4 shows a sample configuration of a mixed mode environment, with ports set on an individual basis to either QuickLoop mode or Fabric mode. In this example, a fabric is formed from two cascaded switches, Compaq 1 and Compaq 2.

■ The ports to which the looplets within the QuickLoop are attached, ports (1,14), (1,15), (2,0), and (2,1), are all QuickLoop-enabled FL_Ports.

■ Private target device **a** and public target device **f** are attached to FL_Ports (1,0) and (2,14).

■ Public host **G** is attached to an F_Port, (1,1).

■ Because it is in the same QuickLoop, private host **J** can access the private target devices **b** and **c** even though they are attached to a different switch.
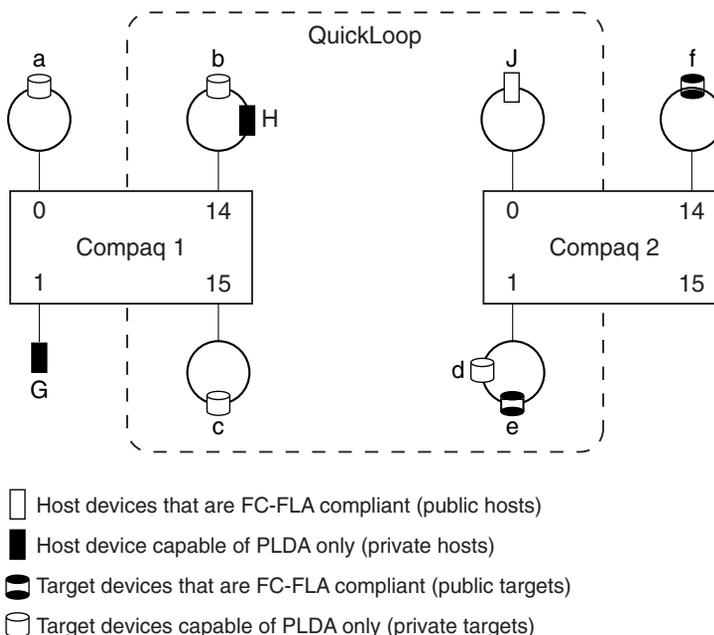
CXO7793A

Figure 4: QuickLoop configuration in mixed mode

Table 1 lists the methods that the hosts in this example would use to communicate with the targets.

Table 1: Configuration Access Methods

a	b	c	d	e	f
Fabric[1] (standard translative) mode	Fabric[1] (standard translative) mode	Fabric[1] (standard translative) mode	Fabric[1] (standard translative) mode	Fabric[1] (standard translative) mode	Fabric (FLA)
No Access[2]	PLDA	QuickLoop mode	QuickLoop mode	QuickLoop mode	No Access[2]
No Access	QuickLoop mode	QuickLoop mode	QuickLoop mode	QuickLoop mode	No Access

1. A public host accesses a device on Compaq QuickLoop by translative mode (phantom), in the same way it accesses a private device attached to an FL_Port.

2. Devices connected to Compaq QuickLoop lose their public functions. FLOGIs sent by these devices are dropped, forcing them back to a private loop attachment.

Error Handling

QuickLoop isolates faulty switches or ports by excluding them from the initialization process. This minimizes of the impact of a faulty looplet or switch on normal QuickLoop operations, and is particularly important for QuickLoops that contain multiple looplets distributed across two switches.

Switch Level Errors

Switch level errors affect dual-switch QuickLoops, and include the following conditions:

■ No switch with the configured partner switch's WWN can be found in the fabric.

■ No response is received from the partner switch during the initial handshake.

■ Inconsistent responses are received from the partner switch.

■ Responses are not received in time during QuickLoop initialization.

If one of the above errors is detected on a switch, the partner reinitializes to form a separate QuickLoop containing only the devices on the partner switch, creating two QuickLoops. If the error condition is removed, the QuickLoops are reinitialized to form a single QuickLoop. If the recovery procedure fails, the switches remain in the single switch QuickLoops, and the procedure is executed again after a time-out period.

Port Level Errors

The following conditions are considered faulty in regards to the related looplet:

■ Any physical level errors occur, such as loss of synchronization or laser fault.

■ The frequency of LIPs received from a port exceeds a threshold.

■ A port fails to become the Loop Initialization Master within a time-out period after LIPs are either received from or sent to the port.

■ A port does not receive a loop initialization sequence back within a time-out period after the sequence is sent.

If an error is detected on a looplet, the QuickLoop is reinitialized with the looplet excluded. The error condition is monitored, and if the condition is removed, the looplet is re-included into the QuickLoop.

The looplet error recovery procedure includes the following steps:

1. LIPs are issued to the looplet, and it is determined whether the hidden FL_Port enters OPEN-INIT and becomes the Loop Initialization Master.

2. The rest of the standard Loop Initialization Sequences are completed, and it is determined whether the looplet can be fully initialized within a time-out period.

3. The looplet is kept idle and it is determined whether it remains stable.

If the procedure fails at any of the above steps, the looplet remains isolated from the QuickLoop, and the procedure is executed again after the time-out period. If all the steps are successfully completed, the looplet is reinstated into the QuickLoop by full initialization.

Using QuickLoop Fabric Assist Mode

4

This chapter provides the following information:

- Overview on page on 31
- Characteristics and Configuration Guidelines on page on 32
- Fault Isolation and Security on page on 33
- How Fabric Assist Mode Works on page on 34
- Sample Fabric Assist Mode Zone Configurations on page on 38

Overview

This chapter provides detailed information for using QuickLoop Fabric Assist mode. Throughout this chapter, QuickLoop Fabric Assist mode will be referred to as *Fabric Assist mode*. A zone created under QuickLoop Fabric Assist mode will be referred to as a *Fabric Assist mode zone*.

You can manage Fabric Assist mode through telnet commands or through Web Tools (an optionally licensed product).

The example Fabric Assist mode zone configurations given later in this chapter use the telnet commands to better reveal the underlying parameters. For detailed syntax of these telnet commands, see the next chapter.

Characteristics and Configuration Guidelines

A Fabric Assist mode zone has the following characteristics:

■ Only one Fabric Assist host, an initiator, per Fabric Assist zone is allowed.

■ A Fabric Assist host must be alone on a port; Fabric Assist hosts cannot be located on a hub.

■ Each Fabric Assist mode zone is managed independently, which means multiple private hosts that share storage are not required to participate on the same arbitrated loop. Because each loop is managed separately, loops are isolated from each other.

■ A Fabric Assist mode zone consists of a single private host and at least one target (public or private). The targets can be located anywhere in the fabric.

■ The private host is not constrained by topology restrictions typically imposed by hub or switching hub solutions. A private host has the capability to communicate with a private or public storage device that is located anywhere in the fabric, through the configuration in the Fabric Assist mode zone for the private host.

■ Fabric Assist mode allows private hosts to share storage with public hosts. For example a storage array can be shared between NT and private HP/UX hosts.

■ Private host Loop Initialization Primitives (LIPs) do not interact with public storage devices.

■ With Fabric Assist mode, private hosts can access a combination of public or private (FC-AL) storage devices. A storage device may be simultaneously accessible by either private hosts with Fabric Assist or public hosts with standard zoning.

■ Each switch can support up to 125 distinct devices assigned to private hosts connected to that switch. The target limit per switch is 125. If you try to zone more than 125 targets with Fabric Assist hosts on one switch, the switch will be unable to allocate a phantom for itself and will be unable to probe private targets. This means the private targets will not be listed in the name server database, and public hosts will not be able to talk to these private targets.

■ A storage device (public or private target) can be configured into multiple Fabric Assist zones.

■ Each virtual loop has a separate AL_PA (Arbitrated Loop Physical Address) domain. Each storage device is assigned a phantom AL_PA on a Fabric Assist zone. (The same device may be accessed by a different phantom AL_PA from the private host of a different Fabric Assist zone.)

- A fabric can have virtually unlimited number of Fabric Assist host loops.

- A Fabric Assist zone is defined by listing zone members by World Wide Name (WWN) or by fabric port number. If defined with a `fazoneCreate` telnet command, the private host is identified with "H{ }" notation in its WWN or fabric port designation. If the private host WWN is used, a Fabric Assist zone is automatically configured when that comes online anywhere in the fabric.

- A Fabric Assist mode private host may or may not be registered in the Name Server, allowing the user to monitor its status. This depends on whether or not the private host responds to the switch's PLOGI request.

- Fabric Assist mode supports all Zoning features such as Zoning Configurations, Zone Aliases to specify common elements, and fabric-wide distribution.

- A Fabric Assist zone may be grouped with other zones and placed within various configurations. The Fabric Assist zone telnet commands are described in Using QuickLoop Fabric Assist Mode, Chapter 4.

If legacy private hosts or private storage devices have difficulty with U_Port initialization, use the portCfgLport command to configure the port as a loop-only port.

Fault Isolation and Security

The components of the Fabric Assist mode zone can be specified as either a port address (hard zoning) or as a WWN (soft zoning). If you specify a WWN, the Name Service guarantees that the associated device is automatically configured into the zone wherever it is found in the Fabric. Currently, hard zoning is more secure than soft zoning.

The creation of separate Fabric Assist mode zones for each host provides superior fault isolation over emulated loop environments.

How Fabric Assist Mode Works

There are significant implications about the implementation of Fabric Assist zones, especially considerations of LIPs, and the interaction with QuickLoop zones.

The standard QuickLoop implementation imposes the following limitations:

■   A QuickLoop is confined to at most two switches in a fabric.

■   There can only be 29 private hosts supported in a QuickLoop.

■   Even though a target device can be public, it is forced to perform as a private loop device in a QuickLoop. This prohibits the public target from using fabric functions such as Extended Fabrics.

Fabric Assist mode zoning supports operations between private initiators and public targets without imposing these limitations. The initiator and target can exist anywhere in the fabric. A public target remains public, with full fabric functionality.

In order to support this, prior to loop initialization, phantom translation tables are set up in the switch that is connected to a private initiator. These tables represent phantom targets on the private initiator's loop. The switch creates a phantom table entry for each target zoned with the private host. Upon completion of the initialization process, the private host will "see" a valid AL_PA for each target that it has been zoned with. As the initiator communicates with each phantom, the phantom translation process transforms the frame into a public frame, and transmits it to the fabric.

Zone Configuration Limits

The number of public targets that may be zoned with a single private host depends on the number of phantom nodes that may be created on the private host's loop. The number of phantoms that may be created are limited only by the number of entries within the phantom tables of the switch, and the total number of available AL_PAs.

The switch's phantom translation table may contain a maximum of 125 unique phantom translations. The existing translative process utilizes the same phantom translation tables, thus reducing the maximum number of Fabric Assist targets that may exist if this feature is used.

Each private looplet has its own allocation of 126 AL_PAs. Therefore each private host may be zoned with all 125 public targets.

LIP Propagation and Private Targets

LIPs of the private host loop are not propagated back to the loop's Fabric Assist targets. A Registered State Change Notification (RSCN) will be generated, and thus public targets that have registered for SCN will be notified of any configuration changes. If the host re-LIPs without causing a configuration change, then no RSCN will be generated.

Private targets will not register for SCN, and without LIP propagation, they rely on higher-level protocols for error recovery. This is similar to QuickLoop Translative Mode, where the private loop targets zoned with public hosts are not re-LIPed due to changes in the status of the public host.

Specifying private targets inside a Fabric Assist zone does not affect normal operation of the other public members of the Fabric Assist zone. A phantom AL_PA for the private host is added to the private target's loop when the first ELS command is sent from the private host. Private hosts LIP only when phantoms are added.

Private targets can not be on the same switch as the private host in which they are Fabric Assist zoned. If Fabric Assist zoning with a private target is required than the private target must be connected to another switch within the fabric. Public targets that will be Fabric Assist zoned may be connected anywhere including the same switch as the private host.

If LIP propagation to the target loop is required, then the private targets that need to be accessed by a private host should be placed within a QuickLoop instead of a Fabric Assist mode zone.

Fabric Assist Mode Hosts and QuickLoop Zoning

Fabric Assist hosts may not be on a switch that is running QuickLoop. If any port of a switch is configured to be a QuickLoop port, then you can not connect a Fabric Assist host to the switch. A switch with a Fabric Assist host, will not allow any of its ports to be configured as a QuickLoop port.

Preferred Phantom AL_PA Assignment

When "cfg" is enabled, phantoms for all online zoned targets are created on the private host's loop and is re-LIPed so that it can see any newly added phantoms. As additional targets join the fabric, within the Fabric Assist zone (fazone), a phantom is created on the private host's loop, which is triggered off the Registered State Change Notification (RSCN). A target can be zoned with more than one private host, and may have a unique phantom created on each host's loop.

Refer to Figure 1 for an example of the preferred AL_PA process.

A preferred phantom AL_PA assignment can have the following characteristics:

■ A private Fabric Assist host 0x01 has two phantoms created on its loop. One for each target for which it is zoned.

■ A private format frame sent from 0x01 to 0x02 translates into a public format frame and then routed to the public device located at port 12.

■ Adding a new target that is already zoned with the private host causes a new phantom to be created, and the host's loop is reLIPed. The target on port 8 is be reLIPed.

■ A private host loop is not reLIPed when a phantom is removed.

AL_PA Assignment Rules

The following rules are applied when AL_PA assignments are made:

■ Loop targets that have an AL_PA value are assigned the same AL_PA as their phantom AL_PA.

■ N_Port targets are assigned the first available AL_PA on the host's loop.

■ Phantoms are kept persistent for a device as long as the switch where these phantoms are created is operational.

■ When a switch reboots, the phantom addresses for the targets may change, which means they are not persistent across reboots or fastboots.

■ When a new "cfg" is enabled, the phantom addresses for the targets may change.

■ Some private hosts have firmware that requires their targets to have specific AL_PA values.

■ Preferred AL_PA assignments (see Figure 1) may be identified at the time of zone creation.

■ Preferred AL_PAs are identified by using additional syntax, such as:

```
fazoneCreate "fazone_2", "H{1,4}; 1,1[0x88]; 1,5; 1,12[0xCC];
50:05:07:61:00:5b:50[0x08]; 50:05:07:61:00:5b:52;
50:05:07:61:00:5b:54"
```

Preferred AL_PAs are added, within square brackets [ ], to the definition of a domain, port, or WWN target. For example, a Fabric Assist zone defined with the following members:
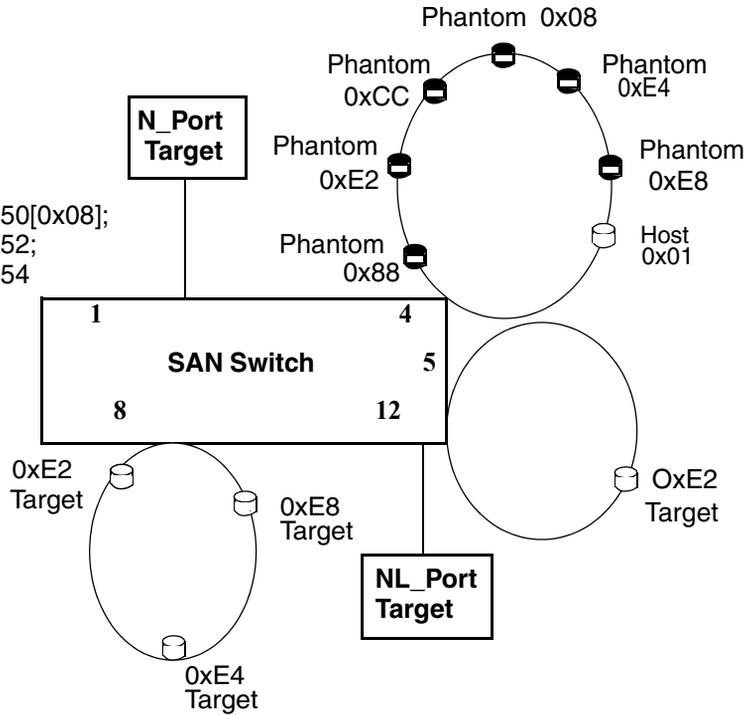
```
"H{1,1};2,12[0xe2];2,14[0xe8]; 10:00:00:60:69:00:00:8a[0xef]"
```

contains whatever devices are connected to switch 2, ports 12 and 14, and the device with a WWN of "10:00:00:60:69:00:00:8a", and the node name or port name in which the fabric is connected.

■ The target connected to switch 2, port 12 is assigned an AL_PA values of 0xE2

■ The target connected to port switch 2, port 14 is assigned an AL_PA value of 0xE8

■ The AL_PA assigned to the target identified by the WWN is assigned a value of 0xEF

Preferred ALPAs

Phantom 0x08

Phantom 0xCC

Phantom 0xE4

N_Port Target

Phantom 0xE2

Phantom 0xE8

H{1,4};
1,1[0x88];
1,5;
1,12[0xCC];
50:05:07:61:00:5b:50[0x08];
50:05:07:61:00:5b:52;
50:05:07:61:00:5b:54

Phantom 0x88

Host 0x01

1

4

SAN Switch

5

8

12

0xE2 Target

0xE8 Target

OxE2 Target

NL_Port Target

0xE4 Target

Figure 1: Example of preferred AL_PA process

# Sample Fabric Assist Mode Zone Configurations

This section details two example Fabric Assist mode zone configurations:

- Configuration 1: Single Fabric Assist Mode Zone on page on 38
- Configuration 2: Two Fabric Assist Mode Zones in a Fabric on page on 40

Configuration 1: Single Fabric Assist Mode Zone

Figure 2 shows a Fabric Assist mode zone created in a fabric consisting of the devices attached to four SAN switches.

For the details of setting up this example configuration using telnet commands, refer to Telnet Commands for Configuration 1 on page on 40.
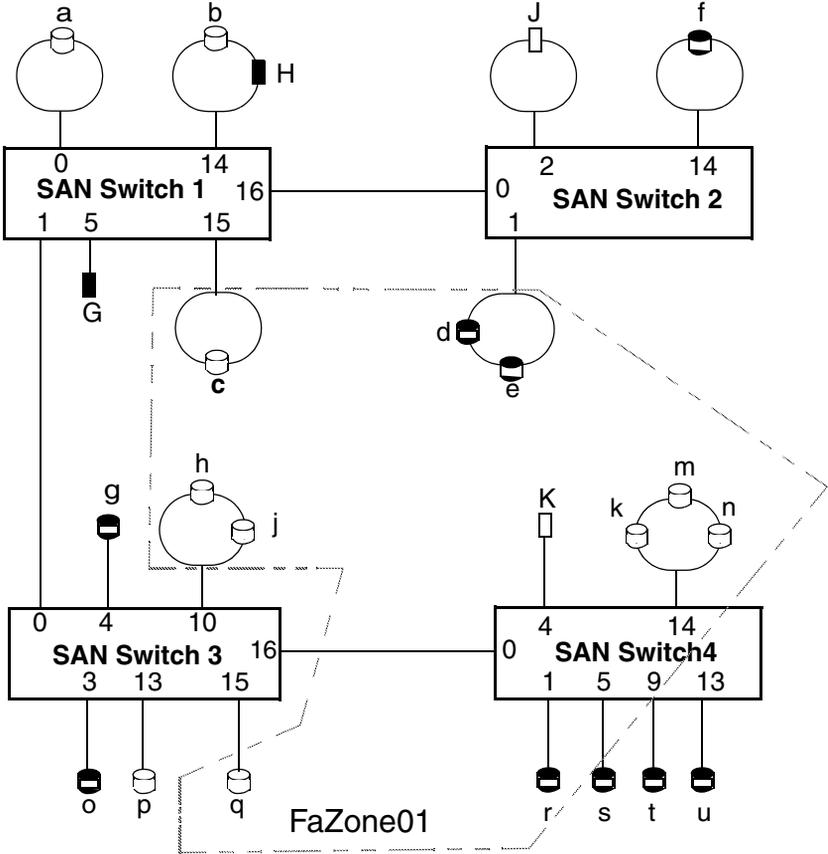
Legend:

▮ Host devices that are FC-FLA compliant (public hosts)

◻ Host device capable of PLDA only (private hosts)

⬤ Target devices that are FC-FLA compliant (public targets)

⊖ Target devices capable of PLDA only (private targets)

Figure 2: Fabric Assist Mode Zone Configuration Example

In the example shown in Figure 2, a fabric is formed from four switches, SAN Switch1 through SAN Switch4. This Fabric Assist zone is named **FaZone0** in which a private host can access public and private target devices. Upon execution of the telnet command shown in the following section is executed:

- Private host **K**, connected to port (4,4), is zoned with the private targets **c**, **h**, **j**, **k**, **m**, **n** and **q**, and the public targets **d**, **e** and **r**.

- The port numbers for the private targets are (1,15), (3,10), (3,15), and (4,14). The port numbers for the public targets are (2,1) and (4,1).

Telnet Commands for Configuration 1

1. Log onto the shell *admin* account on any switch in the fabric. The following prompt will be displayed:

   ```
   SilkW04:admin>
   ```

   Note: The switch listed in the prompt varies with particular switches.

2. Issue the command:

   ```
   fazoneCreate "FaZone01", "1,15; 3,10; 3,15; 4,14; H{4,4}; 2,1; 4,1"
   ```

3. Create the zone as part of or added to a configuration. For example:
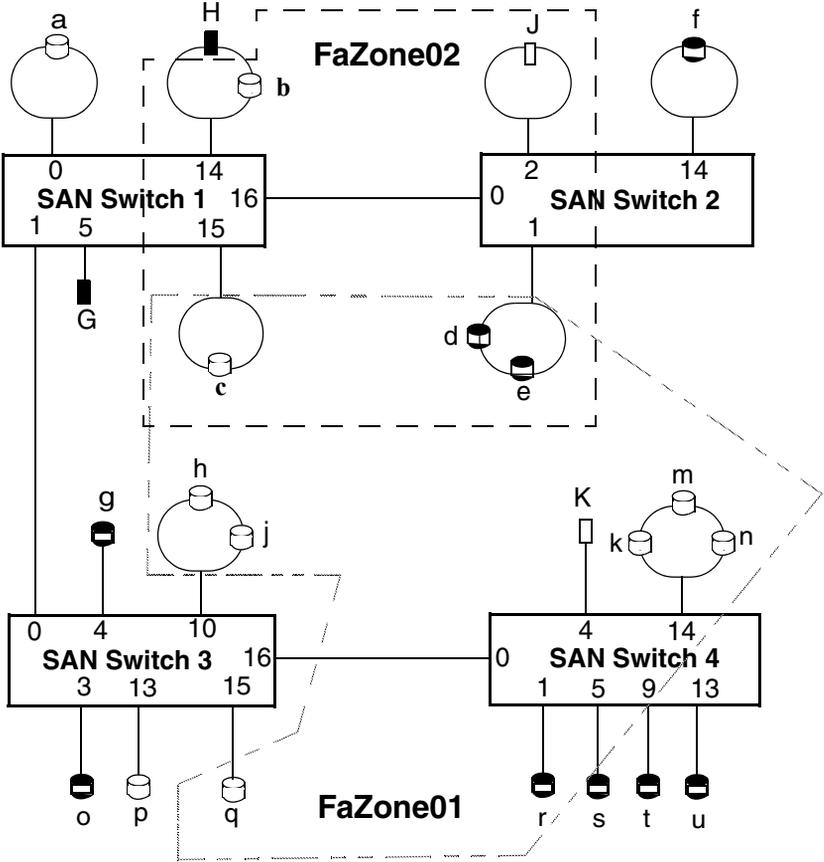
   ```
   cfgCreate "USA" "FaZone01"
   cfgSave
      Updating flash...
   cfgEnable "USA"
      zone "FaZone01" is in effect
   ```

The Fabric Assist zone **FaZone01** is now part of the effective configuration.

Configuration 2: Two Fabric Assist Mode Zones in a Fabric

Figure 3 shows a second Fabric Assist mode zone created in a the same fabric as Configuration 1.

For the details of setting up this example configuration using telnet commands, refer to Telnet Commands for Configuration 2 on page on 42.

Figure 3: Configuration with two Fabric Assist mode zones

In the example shown in Figure 3, second Fabric Assist zone within the fabric has been created. When the telnet command given in the following section is executed:

■   Private host **J**, connected to port (2,2), can access private targets **b** and **c**, and public targets **d** and **e**.

Private host **J** cannot see private target **b** unless **b** is zoned using its WWN.

■   The port numbers for the private targets are (1,14) and (1,15).

Port (1,14) must be zoned using **b's** WWN, not a port number.

■   The port number for the public target is (2,1).

■   Public target devices **d** and **e** are now fully fabric functional and are seen by both host **J** and host **K**.

Telnet Commands for Configuration 2

1. Log onto the shell *admin* account on any switch in the fabric. Issue the command:

    ```
    fazoneCreate "FaZone02", "H{2,2}; WWN (target b); 1,15; 2,1"
    ```

2. Add the the new zone. For example:

    ```
    cfgAdd "USA" "FaZone02"
    cfgSave
        Updating flash...
    cfgEnable "USA"
        zone "FaZone02" is in effect
    ```

The Fabric Assist zone **FaZone02**, is now part of the effective configuration.

Fabric Assist Mode Telnet Commands

5

This chapter provides information about the telnet commands available for managing Fabric Assist mode and is organized as follows:

■ Overview on page 43

■ Telnet Commands on page 45

Overview

The telnet commands allow management of Fabric Assist mode. These commands become available through the shell *admin* account when the Zoning license key is installed. To use a telnet command, log into the relevant switch with administrative privileges, enter the command along with any required operands, and press **Enter**.

Note: Fabric Assist mode can be accessed simultaneously from different connections, by telnet or the web. If this happens, changes from one connection might not be updated to the other, and some may be lost. If "Committing configuration..." displays during a telnet session, the configuration may have been modified from another connection.

The telnet commands for administering Fabric Assist mode zones and hosts operating in Fabric Assist mode are summarized in Table 1.

Table 1:   Fabric Assist Mode Telnet Commands

Command	Description	Go to
fazoneAdd	Adds member(s) to an existing Fabric Assist mode zone.	fazoneAdd on page 45
fazoneCreate	Creates a Fabric Assist mode zone.	fazoneCreate on page 47
fazoneDelete	Deletes an existing Fabric Assist mode zone.	fazoneDelete on page 51
fazoneRemove	Removes members from an existing Fabric Assist mode zone.	fazoneRemove on page 52
faShow	Shows the port ID of each private Fabric Assist mode host on the switch and the list of each zoned target port ID on the fabric, with its assigned phantom AL_PA value.	fazoneShow on page 54
faStatsShow	Displays a set of statistics for each Fabric Assist mode host on the switch.	faStatsShow on page 55

Telnet Commands

fazoneAdd

Add a member to a Fabric Assist zone.

Synopsis

fazoneAdd "fazoneName","fazoneMember; fazoneMember"

Availability

admin

Description

This command adds one or more members to an existing Fabric Assist zone. fazoneName is the name of an existing Fabric Assist zone. fazoneMemberList is a semi-colon separated list of one or more:

- Physical fabric port numbers
- WWNs
- Zone alias names
- Exactly one Fabric Assist host member

Note: This command does not change the defined configuration (which you can view using the cfgShow command) until the cfgSave command is issued. For the change to become effective, an appropriate Fabric Assist zone configuration must be enabled using the cfgEnable command. For the change to be preserved across switch reboots, it must be saved to non-volatile memory using the cfgSave command.

Operands

The following operands are required:

"fazoneName"	A name for the Fabric Assist zone in quotation marks.
"fazoneMember"	A list of Fabric Assist Zone members. The list must be enclosed in quotation marks, and each member must be separated by a semi-colon.

Examples

To add aliases for some disk arrays to "Blue_fazone" insert the following command string:

```
sw5:admin> fazoneAdd "Blue_fazone", "array3; array4; array5"
```

To add a Fabric Assist host member to "Blue_fazone" insert the following command string:

```
sw5:admin> fazoneAdd "Blue_fazone", "H{5,6}"
```

See Also

```
fazoneCreate
```

```
fazoneDelete
```

```
fazoneRemove
```

```
fazoneShow
```

fazoneCreate

Create a Fabric Assist zone.

Synopsis

    fazoneCreate "fazoneName","fazoneMemberList"

Availability

admin

Description

This command creates a new Fabric Assist zone. The variable "`fazoneName`" is a name for the new Fabric Assist zone. The name cannot have been previously used for any other Fabric Assist zone object. The variable "`fazoneMemberList`" is a semi-colon separated list of one or more:

■ Physical fabric port numbers

■ WWNs

■ Fabric Assist zone alias names

■ Exactly one Fabric Assist host member

A Fabric Assist zone name is a C language-style name. It is a name beginning with a letter and followed by any number of letters, digits and underscore characters. Names are case sensitive, for example "`faZone_1`" and "`fazone_1`" are different Fabric Assist zones. White space is ignored.

The Fabric Assist zone member list has at least one member (empty lists are not allowed). The members are described by a semi-colon separated list of member definitions. Physical fabric port numbers are specified as a pair of decimal numbers "`s,p`" where "`s`" is the domain ID of the switch, and "`p`" is the port number on that switch. For example, "`2,12`" specifies port 12 on switch domain ID 2.

When a Fabric Assist zone member is specified by physical fabric port number, then any and all devices connected to that port are in the Fabric Assist zone. If this port is an arbitrated loop, then all devices on the loop are in the Fabric Assist zone.

WWNs are specified as eight hex numbers separated by colons, for example "10:00:00:60:69:00:00:8a". Zoning has no knowledge of the fields within a WWN; the eight bytes are simply compared with the Node and Port Names presented by a device in a login frame (FLOGI or PLOGI).

When a Fabric Assist zone member is specified by Node Name, then all ports on that device are in the Fabric Assist zone. When a Fabric Assist zone member is specified by Port Name, only that single device port is in the Fabric Assist zone. Zone alias names have the same format as Fabric Assist zone names and are created with the aliCreate command. The alias must resolve to a list of one or more physical fabric port numbers, WWNs, or a Fabric Assist host.

A Fabric Assist host member is defined by wrapping the physical fabric port or a physical device (a WWN) between "H{" and "}". For example, "H{5,6}" or "H{10:00:00:60:69:00:00:8a}" is a Fabric Assist host. The type of Fabric Assist zone members used to define a Fabric Assist zone may be mixed and matched.

For example, a Fabric Assist zone defined with the following members "2,12; 2,14; 10:00:00:60:69:00:00:8a" would contain devices connected to switch 2, ports 12 and 14, and the device with a WWN of "10:00:00:60:69:00:00:8a" (either Node Name or Port Name - whichever port in the fabric it is connected to.)

Each target listed within the fazone definition is assigned an ALPA when the private hosts performs loop initialization. When the private host communicates with this assigned ALPA, the private loop frame is translated into a public format and then delivered to the target's location within the fabric.

Loop devices that are zoned with the private host are assigned the same ALPA claimed during their own loop initialization, provided that it is still available on the private host's loop. Other public devices zoned with the private host is assigned the lowest available ALPA during the private host's loop initialization.

However, if the ALPA by which the fazoned target is identified, does not conform to the default ALPA assignment process, then a preferred ALPA is assigned to each target within the fazone definition. The identified preferred ALPA is the ALPA value that is assigned to the target during the privates host's loop initialization, provided that it is not claimed by the private host or another preferred ALPA assignment.

To assign a preferred ALPA, add the definition of the target (Domain, Port or WWN) and the preferred ALPA within square brackets [ ]. For example, a fazone defined with the following members:

    "H{1,1}; 2,12[0xe2]; 2,14[0xe8];10:00:00:60:69:00:00:8a[0xef}"

would contain all devices connected to switch 2, ports 12 and 14, and the device with a WWN of "`10:00:00:60:69:00:00:8a`" (either Node Name or Port Name), depending on the port in the ALPA, the assigned target identified by the WWN is assigned a value of 0xEF.

Preferred ALPA assignments given to a Domain Port that is not a public N-Port device are ignored, and the fazone is created without error.

Note: This command changes the defined configuration. Use the **cfgShow** command to review changes. For the change to become effective, and appropriate fazone configuration must be enabled using the **cfgEnable** command. To preserve the change across switch reboots, it must be saved to non-volatile memory using the **cfgSave** command.

Operands

The following operands are required:

"`fazoneName`"	A name for the Fabric Assist zone in quotes. This operand is required.
"`fazoneMemberList`"	Specify a list of members. The member list must be enclosed in quotation marks. Each member must be separated by a semi-colon(;). This operand is required.

Example

To create three Fabric Assist zones using a mixture of port numbers and Fabric Assist zone aliases input the following command string:

```
sw5:admin> fazoneCreate "Red_fazone", "H{1,0}; loop1"

sw5:admin> fazoneCreate "Blue_fazone", "H{1,1}; array1; 1,2;
array2"

sw5:admin> fazoneCreate "Green_fazone", "1,0; loop1; H{1,2};
array2"

sw5:admin> fazoneCreate "Yellow_fazone",
"1,0[0xe2];loop1;H{1,2;array2[0x02]"
```

See Also

```
fazoneAdd; fazoneDelete; fazoneRemove; fazoneShow;
faShow
```

fazoneDelete

Delete a Fabric Assist mode zone.

Note: This command does not change the defined configuration (which you can view using the **cfgShow** command) until the **cfgSave** command is issued. For the change to become effective, an appropriate Fabric Assist zone configuration must be enabled using the **cfgEnable** command. For the change to be preserved across switch reboots, it must be saved to non-volatile memory using the cfgSave command.

Synopsis

```
fazoneDelete "fazoneName"
```

Availability

Administrator

Description

Use this command to delete an existing Fabric Assist mode zone on a fabric.

Operands

The following operand is required:

`"fazoneName"`	Name for the zone to be deleted, in quotes.

Example

The following entry deletes a Fabric Assist mode zone:

```
sw5:admin> fazoneDelete "FaZone02"
```

See Also

```
fazoneCreate
faShow
faStatsShow
```

fazoneRemove

Remove members from a Fabric Assist mode zone.

Synopsis

```
fazoneRemove "fazoneName", "fazoneMember;
fazoneMember"
```

Availability

admin

Description

This command removes one or more members from an existing Fabric Assist zone. **fazoneName** is the name of an existing Fabric Assist zone. **fazoneMemberList** is a semi-colon separated list of one or more:

■ Physical Fabric port numbers

■ WWNs

■ Fabric Assist alias names

■ Exactly one Fabric Assist host member

The member list is found by an exact string match. Order is important when removing multiple members of a Fabric Assist zone. For example, if a Fabric Assist zone contains "array2; array3; array4" then removing "array4; array3" fails, but removing "array3; array4" succeeds.

If issuing this command results in all members being removed, the Fabric Assist zone is deleted.

Note: This command does not change the defined configuration (which you can view using the cfgShow command) until the cfgSave command is issued. For the change to become effective, an appropriate Fabric Assist zone configuration must be enabled using the cfgEnable command. For the change to be preserved across switch reboots, it must be saved to non-volatile memory using the cfgSave command.

Operands

The following operands are required:

`"fazoneName"`	A name for the Fabric Assist zone in quotes.
`"fazoneMemberList"`	A semi-colon separated list of members in quotes.

Example

To remove "array2" from "Blue_fazone" insert the following command string:

```
sw5:admin> fazoneRemove "Blue_fazone", "array2"
```

See Also

```
fazoneAdd
fazoneCreate
fazoneDelete
fazoneShow
```

fazoneShow

Reports Fabric Assist mode hosts and zones attached to a switch.

Synopsis

faShow

Availability

Administrator

Description

The **faShow** command displays the port ID of each private Fabric Assist mode host on the switch, along with a listing of each zoned target port ID and assigned phantom AL_PA value. If this call is made prior to any Fabric Assist mode host loop going online, then the message is displayed indicating that no Fabric Assist mode hosts exist on this switch.

This command works only when invoked on a switch that contains an active Fabric Assist mode private host loop. Issuing this command on a switch without a Fabric Assist mode private host loop causes a message to be displayed indicating that no Fabric Assist mode hosts exist on the switch.

Operands

None.

Example

To display the port ID of each Fabric Assist mode host on switch sw5 entere the following command string:

```
sw5:admin> faShow
```

See Also

faCreate
faStatsShow

faStatsShow

Reports statistics on Fabric Assist mode hosts attached to a switch.

Synopsis

```
faStatsShow
```

Availability

Administrator

Description

The command displays a set of statistics for each Fabric Assist mode host on the switch. The total number of times that the private host loop was re-initialized due to Fabric Assist mode zoning is displayed. The last target port ID that was responsible for the latest Fabric Assist mode initialization is also indicated.

Operands

None.

Example

To display the statistics of each Fabric Assist mode host on switch sw5 enter the following command string:

```
sw5:admin> faStatsShow
```

See Also

```
faCreate
faShow
```

glossary

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

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.

Address Identifier
A 24-bit or 8-bit value used to identify the source or destination of a frame.

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

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

Alias AL_PA
An AL_PA value recognized by an L_Port in addition to the AL_PA assigned to the port. See also *AL_PA*.

Alias Server
A fabric software facility that supports multicast group management.

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

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

ASIC
Application Specific Integrated Circuit.

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

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

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

BB_Credit
Buffer-to-buffer credit; the number of frames that can be transmitted to a directly connected recipient or within an arbitrated loop. Determined by the number of receive buffers available. See also *Buffer-to-buffer Flow Control*, *EE_Credit*.

Beginning Run 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.*

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

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

Broadcast
The transmission of data from a single source to all devices in the fabric, regardless of zoning. 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. The recommended number of interswitch links is seven. See also *Fabric*, *ISL*.

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

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

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 connection-less frame switching service between two ports, with notification of delivery or nondelivery.

Class 3
Service that provides a connection-less frame switching service between two ports, without notification of delivery or nondelivery of data. Can also be used to provide a multicast connection between the originator and recipients, with notification of delivery or nondelivery.

Class 4
Connection-oriented service that provides a virtual circuit between two ports, with notification of delivery or nondelivery. Allows fractional parts of the bandwidth to be used in a virtual circuit.

Class 6
Connection-oriented service that provides a multicast connection between the multicast originator and recipients, with notification of delivery or nondelivery.

Class F
Connection-less 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.

CLS
Close Primitive Signal. The protocol used by a port in an arbitrated loop to close a circuit.

Code Balance
The ratio of one bit to the total number of transmitted bits.

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

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

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

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

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

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

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

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 (loop port state machine). See also *Fill Word*.

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*.

Defined Zone Configuration
The set of all zone objects defined in the fabric. May include multiple zone configurations. See also *Enabled Configuration*, *Zone Configuration*.

Disparity

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

DLS

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

Domain ID

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

E_D_TOV

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

Enabled Zone Configuration

The currently enabled configuration of zones. Only one configuration can be enabled at a time. See also *Defined Configuration*, *Zone Configuration*.

End-to-end Flow Control

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

Error

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

Exchange

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

F_Port
Fabric Port; a port that is able to transmit under fabric protocol and interface over links. Can be used to connect an N_Port to a switch. See also *FL_Port*, *Fx_Port*.

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

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

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

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

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

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

FC-PH-1, 2, 3
The Fibre Channel Physical and Signalling 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.

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*.

Fill Word

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

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*.

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.

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 specific 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*.

FSP

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

FSPF

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

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

Full-duplex
A mode of communication that allows the same port to simultaneously transmit and receive frames. 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
A device such as a switch that connects different subnets together. A switch can be used as a gateway from the Ethernet to the Fibre Channel. Set the gateway address on one switch to the Fibre Channel IP address of another switch to enable the other switch to forward IP traffic to the ethernet port on the second switch.

GBIC
Gigabit Interface Converter; a removable serial transceiver module that allows gigabaud physical-level transport for Fibre Channel and gigabit ethernet. Also known as Optical Transceiver.

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.

Hub

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

Idle

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

IN_ID

Initial Identifier. The field in the CT_HDR where the port ID of the client originator of a Fibre Channel Services request.

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 Compaq StorageWorks Fibre Channel SAN Switch IS/32 or IS/64, or SAN Switches 16-EL/8-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.

ISL

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

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

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

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*.

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.

Link Services
A protocol for link-related actions.

Link
As applies to Fibre Channel, a physical connection between two ports, consisting of both transmit and receive fibres. 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. Communicated through PLOGI, PDISC link services, or FLOGI.

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.

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*.

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

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

Multicast
The transmission of data from a single source to multiple specified N_Ports (as opposed to all the ports on the network). See also *Broadcast*, *Unicast*.

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

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

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. The protocol used by a port that has won arbitration in an arbitrated loop to establish a circuit.

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. The Compaq switches use the FSPF protocol.

Phantom Address

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

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

Phantom Device

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

PLOGI

Port Login; the port-to-port login process by which initiators establish sessions with targets. 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_Name
The unique identifier assigned to a Fibre Channel port. Communicated during login and port discovery.

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

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

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

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

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

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

Public Device
A device that can log into the fabric and support 20-bit addresses (or has 20-bit phantom addresses created for it by the switch). See also *Phantom Addresses*

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

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

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

R_A_TOV
Resource Allocation Time-out Value; the maximum time a frame can be delayed in the fabric and still be delivered. See also *E_D_TOV*, *RR_TOV*.

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 Loop Initialization Primitive (LIP) before logging out a SCSI initiator. See also *E_D_TOV*, *R_A_TOV*.

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

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

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

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

Service Rate
The rate at which an entity can service requests. See also *Request Rate*.

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

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 protocol, 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*.

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*.

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.

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.

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

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

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

Transmission Word
A group of four transmission characters.

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

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*.

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

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

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

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

Zone Configuration

A specified set of zones. Enabling a configuration enables all zones in that configuration. See also *Defined Configuration*, *Enabled Configuration*.

Zone

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

Zoning

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

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