user's guide
version 3.0

distributed fabrics

www.hp.com

Notice

Warranty

If you have any questions about the warranty for this product, contact your dealer or local Hewlett-Packard sales representative.

Trademarks

Safety notices

Any servicing, adjustment, maintenance, or repair must be performed only by authorized service-trained personnel.

Contents

Preface

Remote Switch and Extended Fabrics are licensed options and each product requires a valid license key to function. Each license is supported for the HP Brocade 2400/2800 and FC 6164 switches using Fabric OS version a2.4.1 or later, and the HP Surestore FC 1Gb/2Gb Entry Switch 8B, FC 1Gb/2Gb Switch 8B, and FC 1Gb/2Gb Switch 16B using Fabric OS version 3.0.1b or later.

Remote Switch, in conjunction with a compatible Fibre Channel to asynchronous transfer mode (ATM) gateway, enables two HP Brocade 2400/2800, FC 6164, FC Entry Switch 8B, FC Switch 8B, or FC 16B fabric switches to be connected over the ATM network infrastructure. Extended Fabrics allows the use of Fibre Channel technology to create a fabric interconnected at up to 100 kilometers.

About This Guide

This guide describes the Remote Switch and Distributed Fabrics features and is organized as follows:

Section I - Remote Switch

Chapter 1 Introducing Remote Switch	Provides an overview of Remote Switch.
Chapter 2 Installing Remote Switch	Provides instructions for installing a Remote Switch license for customers who purchase the license.
Chapter 3 Using Remote Switch	Provides information for using Remote Switch.

Section II - Extended Fabrics

Chapter 4 Introducing Extended Fabrics	Provides an overview of Extended Fabrics.
Chapter 5 Installing Extended Fabrics	Provides instructions for installing a Extended Fabrics license for customers who purchase the license.
Chapter 6 Using Extended Fabrics	Provides information for using Remote Switch.

Related Publications

Related product information can be found in the following publications.

Provided with the FC Entry Switch 8B and FC Switch 8B:

- *HP Surestore FC 1Gb/2Gb Entry Switch 8B and FC 1Gb/2Gb Switch 8B Getting Started Guide* (A7346-90902)
- HP Surestore FC 1Gb/2Gb Entry Switch 8B and FC 1Gb/2Gb Switch 8B Documentation CD (A7346-11001)

Provided on the FC Entry Switch 8B and FC Switch 8B Documentation CD, and at the HP Web site at http://www.hp.com/support/fc8B:

- *HP Surestore FC 1Gb/2Gb Entry Switch 8B and FC 1Gb/2Gb Switch 8B Getting Started Guide* (A7346-90902)
- *HP Surestore FC 1Gb/2Gb Entry Switch 8B and FC 1Gb/2Gb Switch 8B Installation and Reference Guide*
- *Fabric OS Reference Manual*, version 3.0
- *Fabric OS Procedures Guide*, version 3.0
- *Fabric OS Version 3.0.1b Release Notes*
- *Fabric Watch User's Guide*, version 3.0
- *QuickLoop User's Guide*, version 3.0
- *Web Tools User's Guide*, version 3.0
- *Distributed Fabrics User's Guide*, version 3.0
- *Zoning User's Guide*, version 3.0
- *MIB Reference Manual*, version 3.0
- *ISL Trunking User's Guide*, version 3.0
- *Advanced Performance Monitoring User's Guide*, version 3.0
- *Merging Heterogeneous Fabrics Instructions*

Provided with the FC 16B:

- *HP Surestore FC 1Gb/2Gb Switch 16B Quick Start Guide* (A7340-96002)
- HP Surestore FC 1Gb/2Gb Switch 16B Documentation CD (A7340-11001)

Provided on the FC 1Gb/2Gb Switch 16B Documentation CD and at the HP Web site at http://www.hp.com/support/fc16B:

- *HP Surestore FC 1Gb/2Gb Switch 16B Quick Start Guide* (A7340-96002)
- *HP Surestore FC 1Gb/2Gb Switch 16B Installation and Reference Guide*
- *Fabric OS Reference Manual*, version 3.0
- *Fabric OS Procedures Guide*, version 3.0
- *Fabric OS Version 3.0.1 Release Notes*
- *Fabric Watch User's Guide*, version 3.0
- *QuickLoop User's Guide*, version 3.0
- *Web Tools User's Guide*, version 3.0
- *Distributed Fabrics User's Guide*, version 3.0
- *Zoning User's Guide*, version 3.0
- *MIB Reference Manual*, version 3.0
- *ISL Trunking User's Guide*, version 3.0
- *Advanced Performance Monitoring User's Guide*, version 3.0
- *Merging Heterogeneous Fabrics Instructions*

Information about Fibre Channel standards and Fibre Channel in general can be found on the Fibre Channel Industry Association Web site, located at http://www.fibrechannel.com.

Getting Help

For information for the FC Entry Switch 8B and FC Switch 8B, visit the HP Web site at http://www.hp.com/support/fc8B. For the most current technical support information for the FC 16B, visit the HP Web site at http://www.hp.com/support/fc16B. This includes hardware and software support, all repairs, and spare components.

Be prepared to provide the following information to the support personnel:

- Switch serial number
- Switch world wide name
- Output from the `supportShow` telnet command
- Detailed description of the problem
- Topology configuration
- Troubleshooting steps already performed

Getting Software Updates

For information on obtaining software updates contact your HP account representative or technical support.

Introducing Remote Switch

Remote Switch is an optionally licensed product that runs on HP Brocade 2400/2800 and FC 6164 switches with Fabric OS version a2.4.1 or later, or on FC Entry Switch 8B, FC Switch 8B, and FC 16B switches with Fabric OS version 3.0.1b or later.

The Remote Switch feature, in conjunction with a compatible Fibre Channel to asynchronous transfer mode (ATM) gateway, enables two HP Brocade 2400/2800, FC 6164, FC Entry Switch 8B, FC Switch 8B, or FC 16B fabric switches to be connected over an ATM connection, with a distance of up to 10 kilometers between each switch and the respective ATM gateway. The two switches are cascaded together to form a fabric that, from the viewpoint of the connected hosts and storage devices, interact the same as locally connected switches. The performance limitations depend only on the type of ATM connection used. Remote Switch supports a maximum of two switches in a fabric.

Remote Switch provides:

- Any-to-any connectivity
  A host connected on the local or remote switch can communicate with storage devices at either location.

- Coordinated fabric services
  The Remote Switch fabric configuration fully supports all fabric services, the same as a centralized fabric configuration. These services include Distributed Name Services, Registered State Change Notifications, and Alias Services.

- Distributed management
  Access to the management facilities (Web Tools, telnet, and SNMP) is available from either the local or the remote switch. Interconnect for switch management is routed through the Fibre Channel connection; no additional network connection is required between sites.

- Ability to support multiple interswitch links (ISLs)
  Sites requiring redundant configurations can connect multiple E_Ports to remote sites by using multiple gateways. Standard Fabric OS routing facilities automatically maximize throughput by using the E_Ports to load share traffic during normal operation, with automatic failover and failback during interruption on the WAN connection.

Installing Remote Switch

A Remote Switch fabric requires two switches that are HP Brocade 2400/2800 or FC 6164 switches with Fabric OS version a2.4.1 or later, or FC Entry Switch 8B, FC Switch 8B, or FC 16B switches with Fabric OS version 3.0.1b or later installed, with the switches configured the same.

Installing a Remote Switch requires the installation of a separate license on each of the two switches. Licenses may have been installed on the switches at the factory. If not, contact your switch supplier to obtain a license key.

You can install a Remote Switch license either through telnet or through Web Tools.

Installing the Remote Switch Using Telnet

To install a Remote Switch using Telnet:

1. Log on to the switch by telnet (refer to the *Fabric OS Procedures Guide* for details), using an account that has administrative privileges.

2. To determine whether a Remote Switch 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

     cQebzbRdScRfcOiK:
         Web license
         Zoning license
     AybbzQQ9edTzccOX:
         Fabric license
    ```

    If a Remote Switch license is correctly listed the feature is installed and immediately available. Skip steps [3] and [4].

3. Enter the following on the command line:

    ```
    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. Also, a special Remote Switch license needs to be installed.

4. Verify the license was added by entering the following on the command line:

    ```
    licenseShow
    ```

    If the Remote Switch license is listed, the feature is installed and immediately available. If the license is not listed, repeat step [3].

Installing the Remote Switch Using Web Tools

To install Remote Switch using Webtools:

1. Launch the Web browser.

2. Enter the switch name or IP address in the **Location/Address** field, and press Enter.

   Web Tools launches, displaying the Fabric View.

3. Click the **Admin** button on the relevant switch panel.

   The logon window displays.

4. Enter a logon name and password with administrative privileges and press Enter.

   The Administration View displays.

5. Select the License Admin tab.

6. Enter the license key in the **License Key:** field, and click **Add License**.

   The Remote Switch feature is available as soon as the license key is added.

Using Remote Switch

You can configure switches for use with Remote Switch through telnet or through Web Tools. For information about using Web Tools to configure a switch, see the *Web Tools User's Guide*.

This chapter provides the following information:

Overview

The Remote Switch feature operates in conjunction with a Fibre Channel to ATM gateway. The gateway provides both a Fibre Channel physical interface functioning as an E_Port and an ATM physical interface.

The gateway accepts Fibre Channel frames from one side of a Remote Switch fabric, transfers them across a WAN using ATM protocol, and passes them to the other side of the Remote Switch fabric.

In order to transfer frames across a WAN using ATM protocol, the Fibre Channel frames (from 256 to 2112 bytes) must be broken into smaller pieces (53 byte ATM cells) at the local end of the ATM network. Once they are broken into smaller pieces, they are tunnelled inside ATM cells to be transmitted across the ATM network. At the remote end of the ATM network, these pieces are reassembled back into complete Fibre Channel frames and transmitted through the remote Fibre Channel interface.

To accomplish this, the gateway provides an E_Port interface that links to the switch E_Port. Once the link between the two E_Ports is negotiated, the gateway E_Port moves to pass-through mode and passes Fibre Channel traffic from the switch E_Port to the ATM network.

Configuring a Remote Switch Fabric

A Remote Switch fabric requires two HP Brocade 2400/2800, FC 6164, FC Entry Switch 8B, FC Switch 8B, or FC 16B switches with identical configurations. A separate extended fabric license is not required to operate the switch at distances much greater than 100 kilometers. This can be achieved when the switch operates over ATM. Performance is limited to the ATM link - 1.55 to 155 Mb/s. Other FC-ATM devices such as ADVA DiskLink do not require a remote switch. The DiskLink does not perform e_port connections, but rather imports devices from a remote SAN and appears as an n_port device in the local SAN.

In addition to normal switch configuration options, the following parameters must be configured:

- Timeout values
  The Resource Allocation Timeout Value (R_A_TOV) and Error Detect Timeout Value (E_D_TOV) must be increased, as appropriate, for all switches participating in the Remote Switch fabric. This provides for the possible increase in transit time caused by the introduction of WAN links into the fabric. For more information about timeout values, refer to *Fabric OS Reference Manual*.

- Data field size
  All switches participating in the Remote Switch fabric must have the data field size configured to a maximum of 2048 bytes to accommodate the maximum field size supported by the ATM gateway. Data field sizes smaller than 2048 bytes can be set, but they may cause significant performance degradation.

- Class F frame suppression
  All switches participating in the Remote Switch fabric must have the Class F frame suppression flag set. Class F frames are automatically converted to Class 2 frames.

- BB credit
  The setting for BB credit must be the same on both switches.

To set the BB_Credit on a switch that is running with a Remote Fabric license:

1. Use the `configure` command. This will select the BB_Credit that will be used.

2. Say "Y" to the fabric parameters, and the second option is BB_credit. You may then set the parameters to any allowed value.

Note: Currently the parameter values are set at 1-16, but the values will soon be changed to allow any value from 1-27. The parameters will then become the BB_Credit that is offered to all F_Ports, and any E_Ports that are using the Remote Fabric feature. E_ports that are not remote fabric E_Ports will not be affected.

Note: You must set the same BB_Credit value to all switches in the fabric. Switches with a different value will segment.

Accessing the Switch Using Telnet

The telnet command `configure` is used to set the following:

- R_A_TOV and E_D_TOV values.

- Data field size.

- Class F frame suppression flag.

The switch must be disabled prior to entering the `configure` command.

Example:
```
switch:admin> configure

Configure. . .

        Fabric parameters (yes, y, no, n): [no] yes
```

```
Domain:  (1. .239) [2]
BB credit:  (1. .16)  [16]
R_A_TOV:  (4000. .120000)  [10000]
E_D_TOV:  (1000. .5000)  [2000]5000
Data field size:  (256. .2112)  [2112]  2048
Non-SCSI Tachyon Mode:  (0. .1)  [0]
Disable Device Probing:  (0. .1)  [0]
Suppress Class F Traffic:  (0. .1)  [0]  1
```

In this example, the default value was accepted for R_A_TOV.

Note: The switch must be disabled prior to entering the configure command.

Introducing Extended Fabrics

Extended Fabrics uses Fibre Channel technology to create a fabric interconnected at a distance of up to 100 kilometers. Extended Fabrics can increase the allowable distance between two switches or between a switch and an ATM gateway used in a Remote Switch configuration. It is an optionally licensed product that runs on HP Brocade 2400/2800 and FC 6164 switches with Fabric OS version a2.4.1or later, or on FC Entry Switch 8B, FC Switch 8B, and FC 16B switches with Fabric OS version 3.0.1b or later.

Extended Fabrics optimizes the internal buffering algorithm for these switches. It provides maximum buffering between E_Ports connected over an extended distance through buffer reconfiguration that results in line speed performance of close to full Fibre Channel speed for switches interconnected at 100 kilometers, thus providing the highest possible performance for transfers between switches. The Fibre Channel connection extensions can be provided by Extended Distance GBICs, Fibre Channel repeaters, or Wave Division Multiplexing (WDM) devices.

Note: Performance may vary depending on the condition of the fiber optic connections between the switches. Losses due to splicing, connectors, tight bends, and other degradation can affect the performance over the link and the maximum distance possible.

To enable Extended Fabrics, an Extended Fabrics license has to be installed. If a fabric is created with FC Entry Switch 8B, FC Switch 8B, or FC 16B switches, the long distance extended fabric configuration has to be set only for the edge ports of the long distance link. The edge port connector switch automatically works with the rest of the switches in the fabric. There is no need for any fabric wide configuration change.

Note: To enable Extended Fabrics in a fabric created with HP Brocade 2400/2800 or FC 6164 switches, each switch in the fabric must be configured individually.

Installing Extended Fabrics

The installation of Extended Fabrics involves the installation of a license on each switch in the fabric. A license may have been installed in the switch at the factory. If not, contact your switch supplier to obtain a license key.

Extended Fabrics licenses are installed using either telnet commands or Web Tools.

Installing Extended Fabrics through Telnet

To install Extended Fabrics using telnet:

1. Log on to the switch by telnet (refer to the *Fabric OS Procedures Guide* for details), using an account that has administrative privileges.

2. To determine whether a Extended Fabrics 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:
           Web license
    1AAAaAaaaAAAA1a:
           Zoning license
    1ABAaAaaaAAAA1a:
           QuickLoop licens
    1ACAaAaaaAAAA1a:
           Fabric license
    1ADAaAaaaAAAA1a:
           Fabric Watch license
    ```

    If an Extended Fabrics license is not included in the list, or is incorrect, continue with step [3]. If an Extended Fabrics license is correctly listed, the feature is installed and immediately available. Skip steps [3] and [4].

3. Enter the following on the command line:

    ```
    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 that the license was added by entering the following on the command line:

    ```
    licenseShow
    ```

    If the Extended Fabrics license is listed, the feature is installed and immediately available. If the license is not listed, repeat step [3].

Installing Extended Fabrics using Web Tools

To install Extended Fabrics using Web Tools:

1. Launch the Web browser.

2. Enter the switch name or IP address in the **Location/Address** field, and press Enter.

   Web Tools launches, displaying the Fabric View.

3. Click the **Admin** button on the relevant switch panel.

   The logon window displays.

4. Enter a logon name and password with administrative privileges and press Enter.

   The Administration View displays.

5. Select the License Admin tab.

6. Enter the license key in the **License Key:** field, and click **Add License**.

   The Extended Fabrics feature is available as soon as the license key is added.

Using Extended Fabrics

You can configure ports to support long distance links through telnet or through *Web Tools*. For information about using Web Tools to configure ports, refer to the *Web Tools User's Guide*.

This chapter provides the following information:

- *Supported Configurations* on page 6-1
- *Configuring Extended Fabrics* on page 6-3
- *Setting the Extended Fabric Port Configuration* on page 6-5

Supported Configurations

An Extended Fabric can be created either with the HP Brocade 2400/2800 and FC 6164 switches running Fabric OS version a2.4.1 or later, or FC Entry Switch 8B, FC Switch 8B, and FC 16B switches running Fabric OS version 3.0.1b or later. An Extended Fabric can consist of:

- HP Brocade 2400/2800 and FC 6164 switches only
- FC Entry Switch 8B, FC Switch 8B, and FC 16B switches only
- A combination of HP Brocade 2400/2800, FC 6164, FC Entry Switch 8B, FC Switch 8B, and FC 16B switches.

  Note: In a combination configuration, the long distance ISL that connects the fabrics must be installed between port switches of the same types. For example:

  - HP Brocade 2400/2800 to HP Brocade 2400/2800 (as shown in Figure 6-1) or
  - FC 16B to FC 16B (as shown in Figure 6-2)

An Extended Fabric does not work if the long distance ISL is installed between non-matching switches.
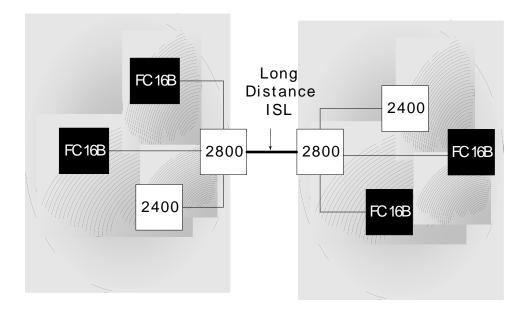
Figure 6-1   Mixed Extended Fabric with HP Brocade 2800 switches
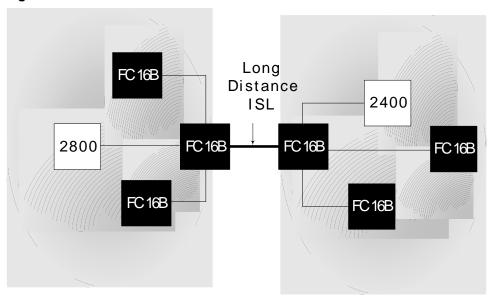

Figure 6-2   Mixed Extended Fabric with FC 16B series switches.

Configuring Extended Fabrics

In order to employ Extended Fabrics the following two parameters need to be set:

*   Switch configuration to enable long distance
*   Port configuration to select the long distance mode

In the HP Brocade 2400/2800 switches in Figure 6-1, or in FC 6164 switches, each switch within the fabric must have the switch configuration turned on.

To set the long distance fabric mode bit:

1. Log into the switch by telnet.
2. Enter the `switchDisable` command at the telnet command line.
3. Enter the `configure` command at the telnet command line.
4. Select "yes,y" at Fabric parameters line.
5. Enter "1" on the following telnet command line:

    `Long Distance Fabric [0]:`

To set the port configuration:

1. View the `portCfgLongDistance` command

There are three possible levels for a port:

*   *Level 0* Reconfigures the port as a regular switch port. The number of buffers reserved for the port supports up to 10 kilometers links.
*   *Level 1* Distances up to 50 kilometers will support 1gb/second and 2 gb/second (HP Brocade 2400/2800 or FC 6164; and FC Entry Switch 8B, FC Switch 8B, or FC 16B switches).
*   *Level 2* Distances up to 100 kilometers will support 1gb/second and 2 gb/second (HP Brocade 2400/2800 or FC 6164; and FC Entry Switch 8B, FC Switch 8B, or FC 16B switches).

In the FC Entry Switch 8B, FC Switch 8B, or FC 16B switches, as shown in Figure 6-2, only the linking switches need to have the switch configuration turned on.

To set the long distance fabric mode bit:

1. Leave as default [0]

To set the port configuration:

There are three possible levels for a port:

*   *Level 0* Reconfigures the port as a regular switch port. The number of buffers reserved for the port supports up to 10 kilometers links.
*   *Level 1* Distances up to 50 kilometers will support 1gb/second and 2 gb/second (HP Brocade 2400/2800 or FC 6164; and FC Entry Switch 8B, FC Switch 8B, or FC 16B switches).
*   *Level 2* Distances up to 100 kilometers will support 1gb/second and 2 gb/second (HP Brocade 2400/2800 or FC 6164; and FC Entry Switch 8B, FC Switch 8B, or FC 16B switches).

Ports are grouped into quads, each of which consists of four adjacent ports that share a common pool of frame buffers. The possible quad groupings are ports:

- 0 – 3
- 4 – 7
- 8 – 11
- 12 – 15

Certain buffers are dedicated for each port, and others are shared among the ports. In extended fabric mode, one port is given an increase of dedicated buffers from this pool.

L0 = Represents an Extended Fabric mode of 10 kilometers.

L1 = Represents an Extended Fabric mode of 50 kilometers.

L2 = Represents an Extended Fabric mode of 100 kilometers.

Fx = F_Port or FL_Port that is used when connected to devices.

E = E_Port that is used for interswitch connectivity.

Because the total number of frame buffers in a quad is limited, the following Extended Fabric port matrix introduces a combination of long distance ports that are available:

	Speed	Port 0	Port 1	Port 2	Port 3
v2.0 and v3.0	1 Gbps	L2	L1	Fx	X
v2.0 and v3.0	1 Gbps	L2	Fx	Fx	Fx
v2.0 and v3.0	1 Gbps	L1/E/Fx	L1/E/Fx	L1/E/Fx	L1/E/Fx
v3.0	2 Gbps	L2	X	X	X
v3.0	2 Gbps	L1	L1	X	X
v3.0	2 Gbps	L1	E	E	X
v3.0	2 Gbps	L1	E	Fx	X
v3.0	2 Gbps	L1	Fx	Fx	Fx
v3.0	2 Gbps	Fx	Fx	Fx	Fx

Setting the Extended Fabric Port Configuration

You can configure a port to support long distance links by using the
portCfgLongDistance telnet command.

**portCfgLong
Distance**

Configures a port to support long distance links.

Synopsis

portCfgLongDistance port_number <long_distance_level>

Availability

Administrator. An Extended Fabrics license key is required to see this command.

Description

Use this command to specify the allocation of enough full size frame buffers on a
particular port to support a long distance link of up to 100 kilometers. The port can be used
as either an Fx_Port or an E_Port. The configuration is saved in the non-volatile memory
and is persistent across switch reboot or power cycle.

When this command is invoked without the optional operand, you are prompted to enter
the long distance level number. The level value must be one of the following:

Level	Effect
0	Reconfigures port as a normal switch port. The number of buffers reserved for the port supports links up to 10 kilometers.
1	Level one long distance, up to 50 kilometers. A total of 27 full size frame buffers are reserved for the port.
2	Level two long distance, up to 100 kilometers. A total of 60 full size frame buffers are reserved for the port.

You can cancel the configuration update by entering CTRL+D.

When a port is configured to be a long distance port, the output of portShow and
switchShow displays the long distance level. In the portShow output, the long
distance level is indicated as "medium for level 1 long distance, and "long" for level 2
long distance. In the switchShow output, the format is L*x*, where *x* is the long distance
level number, except for level 0, which is not displayed in switchShow.

Operands

The following operand is **required**:

port_number   Number of port to be configured: 0-7 or 0-15.

The following operand is **optional**:

long_distance_level 0 = reconfigure port to be regular switch port
                     1 = level one long distance (up to 50 kilometers)
                     2 = level two long distance (up to 100 kilometers)

Limitations

When the linking switch is an HP Brocade 2400/2800 or FC 6164 switch then all switches
on both ends need to be configured for long distances. A group of four adjacent ports that
share a common pool of frame buffers (for example, ports 0 – 3 or 4 – 7) are called a
"quad". Since the total number of frame buffers in a quad is limited, if one of the ports in
the quad is configured as an L2 long distance port, none of the remaining ports in the quad
can be a long distance port; they must all be level 0 ports. In order to have a long distance
port take effect, all switches in the fabric must be configured to run in long distance fabric
mode (in other words, the long distance fabric mode bit must be "on", or set to 1).

Otherwise, the fabric will be segmented. In fact, a long distance port cannot be configured in a switch unless the long distance fabric mode is on for that switch.

For the same reason, if all ports are reconfigured back to non-long distance ports, the long distance fabric mode must be set to "off" for that switch.

Example   The following example shows the configuration of switch port 3 to support a 100 kilometers link:

```
sw5:admin> portCfgLongDistance 3
Please enter the long distance level -- : (0..2) [0] 2
Committing configuration...done.
```

See Also   configure

portShow

switchShow

Glossary

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.
Advanced Performance Monitoring	A software product that provides error and performance information to the administrator and end user for use in storage management.
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.
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 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 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*.
Block	As applies to Fibre Channel, upper-level application data that is transferred in a single sequence.
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. For HP switches, a maximum of seven hops is recommended (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. 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.
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*.
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*.
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.
Distributed Fabrics	The combined user's guides for the software products Extended Fabrics and Remote Switch. "Distributed Fabrics" is not a software product. See also *Extended Fabrics*, *Remote Switch*.
DLS	Dynamic Load Sharing; dynamic distribution of traffic over available paths. Allows for recomputing of routes when an Fx_Port or E_Port changes status.
Domain ID	Unique identifier for the switch in a fabric. Usually automatically assigned by the switch, but can also be assigned manually. Can be any value between 1 and 239.
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.
Extended Fabrics	Software product that runs on Fabric OS and allows creation of a Fibre Channel fabric interconnected over distances of up to 100 kilometers. See also *Distributed Fabrics*.
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 switches in addition to hosts and devices. May also be referred to as a switched fabric. See also *Topology*, *SAN*, *Cascade*.
Fabric Assist	A feature that enables private and public hosts to access public targets anywhere on the fabric, provided they are in the same Fabric Assist zone. This feature is available only when both QuickLoop and Zoning are installed on the switch.

Fabric Manager	A software product that works in conjunction with Web Tools to provide a graphical user interface for managing switch groups 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	Operating system on HP Brocade switches.
Fabric Watch	A software product that runs on Fabric OS and allows monitoring and configuration of fabric and switch elements.
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.
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.
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*.
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.
FRU	Field-replaceable Unit; a component that can be replaced on site.
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. Routing protocol for Fibre Channel switches.
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.
GBIC	Gigabit Interface Converter; a removable serial transceiver module that allows gigabaud physical-level transport for Fibre Channel and gigabit ethernet. 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.
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.
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 the HP FC 6164, consisting of six Silkworm 2250 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.
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	An HP Brocade switch 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*.
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.

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*.
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	As applies to Fibre Channel, a physical connection between two ports, consisting of both transmit and receive fibres. See also *Circuit*.
Link Services	A protocol for link-related actions.
LIP	Loop Initialization Primitive; the signal used to begin initialization in a loop. Indicates either loop failure or resetting of a node.
LM_TOV	Loop Master Time-out Value; the minimum time that the loop master waits for a loop initialization sequence to return.
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 1300mm 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. The MIB types provided with HP Brocade switches are described in the *MIB Reference Manual*.
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*.
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	A Fibre Channel device that contains an N_Port or NL_Port.
Node Name	The unique identifier for a node, communicated during login and port discovery.
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.
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.
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_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 NL_Port	An NL_Port that communicates only with other private NL_Ports in the same loop and does not log into the fabric.

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.
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 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.
QuickLoop	A software 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.
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*.
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 Switch	A software product that runs on Fabric OS and enables two switches to be connected over an ATM (asynchronous transfer mode) connection. This requires a compatible Fibre Channel to ATM gateway, and can have a distance of up to 10 kilometers between each switch and the respective ATM gateway. See also *Distributed Fabrics*.
Request Rate	The rate at which requests arrive at a servicing entity. See also *Service Rate*.
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*.
RSCN	Registered State Change Notification; a switch function that allows notification of fabric changes to be sent from the switch to specified nodes.
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*.
SFP	Small Form Factor Pluggable; optical transceiver used to convert signals between optical fiber cables and switches.

SI	Sequence Initiative.
Single Mode	The fiber optic cabling standard that corresponds to distances of up to 10 km between devices.
SNMP	Simple Network Management Protocol. An internet management protocol that uses either IP for network-level functions and UDP for transport-level functions, or TCP/IP for both. Can be made available over other protocols, such as UDP/IP, because it does not rely on the underlying communication protocols. See also *Community (SNMP)*.
SNS	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	Hardware that routes frames according to Fibre Channel protocol and is controlled by software.
Switch Name	The arbitrary name assigned to a switch.
Switch Port	A port on a switch. Switch ports can be E_Ports, F_Ports, or FL_Ports.
SWL	Short Wavelength; a type of fiber optic cabling that is based on 850mm 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.
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*.
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	Upper-level Protocol; the protocol that runs on top of Fibre Channel. Typical upper-level protocols are SCSI, IP, HIPPI, and IPI.
ULP_TOV	Upper-level Time-out Value; the minimum time that a SCSI ULP process waits for SCSI status before initiating ULP recovery.
Unicast	The transmission of data from a single source to a single destination. See also *Broadcast*, *Multicast*.
Web Tools	A software 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.
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.
Zone	A set of devices and hosts attached to the same fabric and configured as being in the same zone. See also *Zoning*. Devices and hosts within the same zone have access permission to others in the zone, but are not visible to any outside the zone.
Zone Configuration	A specified set of zones. Enabling a configuration enables all zones in that configuration. See also *Defined Configuration*, *Enabled Configuration*.
Zoning	A software 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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