user's guide
version 2.2

hp
i n v e n t

Distributed Fabrics

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Notice

Warranty

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

Trademarks

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Brocade Extended Fabrics, Brocade Fabric Manager, Brocade Fabric OS, Brocade Fabric Watch, Brocade QuickLoop, Brocade Remote Switch, Brocade Web Tools, and Brocade Zoning are hereafter referred to as Extended Fabrics, Fabric Manager, Fabric OS, Fabric Watch, QuickLoop, Remote Switch, Web Tools, and Zoning respectively.

Safety notices

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

Format conventions

variable	Indicates that you must supply a value.
output	Denotes text displayed on the screen.
[ ]	Indicates that the enclosed element is optional and may be left out.
{ }	Indicates that you must specify one of the listed options.
|	Separates alternatives.
. . .	Indicates a repetition of the preceding parameter.

Tip   Denotes ideas for enhanced product usage.

Note   Denotes significant concepts or operating instructions.

CAUTION   Denotes a hazard that can cause hardware or software damage.

⚠ **WARNING**   Denotes a hazard that can cause personal injury or death.

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Revision History

July 2001   First release.

PREFACE

This document covers the installation, setup or configuration, and use of the Remote Switch and Extended Fabrics products.

Remote Switch, in conjunction with a compatible fibre channel to an asynchronous transfer mode (ATM) gateway, enables two fabric switches to be connected over an ATM connection, with a distance of up to 10 km between each switch and the respective ATM gateway. Extended Fabrics allows you to use fibre channel technology to create a fabric interconnected at up to 100 km. For example, you can use Extended Fabrics to increase the allowable distance between two switches, or between a switch and an ATM gateway in a Remote Switch configuration.

About This Guide

This guide describes the Remote Switch and Extended Fabric features, and is organized as follows:

Chapter 1
Introducing Remote Switch

Provides an overview of Remote Switch.

Chapter 2
Installing Remote Switch

Provides instructions for installing a Remote Switch.

Chapter 3
Using Remote Switch

Provides information for using Remote Switch.

Chapter 4 Introducing Extended Fabrics	Provides an overview of Extended Fabrics.
Chapter 5 Installing Extended Fabrics	Provides instructions for installing Extended Fabrics.
Chapter 6 Using Extended Fabrics	Provides information for using Extended Fabrics.

Related Publications

Related product information can be found in the following publications. Those publications with part numbers are provided as printed copies with your product. The HP Surestore FC Switch 6164 Documentation CD contains all publications listed in the table below and is also provided with your product.

Title	Part Number
HP Surestore FC Switch 6164 Documentation CD	A7326-11011
HP Surestore FC Switch 6164 Installation and Reference Guide	A7326-90902
HP Surestore FC Switch 6164 Quick Start Guide	A7326-90901
Fabric OS Reference Manual, version 2.4	Available only on CD
Fabric Watch User's Guide, version 2.2	Available only on CD
MIB Reference Manual, version 2.3	Available only on CD
QuickLoop User's Guide, version 2.3	Available only on CD
Web Tools User's Guide, version 2.3	Available only on CD
Zoning User's Guide, version 2.2	Available only on CD

Information about fibre channel standards and the fibre channel industry in general can be found on the Fibre Channel Industry Association web site, located at:

http://www.fibrechannel.com

Getting Help

For support information, visit the HP web site located at:

http://www.hp.com

Getting Software Updates

Firmware and software updates are found on the HP web site at:

http://www.hp.com

New switch firmware can be installed from the following host operating systems:

- UNIX
- Windows NT
- Windows 2000
- Windows 98
- Windows 95

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INTRODUCING REMOTE SWITCH

The Remote Switch feature, in conjunction with a compatible fibre channel to asynchronous transfer mode (ATM) gateway, enables two fabric switches to be connected over an ATM connection, with a distance of up to 10 km 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 the following features:

- **Any-to-any connectivity** - A host connected on either 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 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.

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INSTALLING REMOTE SWITCH

A Remote Switch fabric requires two switches with Fabric OS version a2.4.1 or later installed; both the switches must have the same configuration and a separate license for each switch. The switch licenses are applied by your HP Account Support Engineer (ASE) or Customer Engineer (CE). You can also install a license through telnet or Web Tools. Should any license keys be needed to access features not already licensed on your FC 6164 switch, they can be obtained through the following web site:

http://www.hp.com/support/fc6164

Installing Through Telnet

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

2. If you want to determine whether a Remote Switch license is already installed on the switch, type licenseShow on the Telnet command line.

   A list displays all licenses currently installed on the switch.

Example: ```
admin> licenseShow

1A1AaAaaaAAAA1a:
Release v2.2
Web license
Zoning license
SES license
QuickLoop license
```

If the Remote Switch license is not included in the list or is incorrect, continue with Step 3.

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

Installing Through Web Tools

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

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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*.

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.

To transfer frames across a WAN using ATM protocol, 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. When 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 re-assembled back into complete fibre channel frames and transmitted through the remote fibre channel interface.

To accomplish this task, the gateway provides an E_Port interface that links to the switch E_Port. When 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.

Setting Up A Remote Switch Fabric

A Remote Switch fabric requires two switches, with identical configurations.

In addition to the normal switch configuration options, you must configure these parameters:

- **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, see the *Fabric OS User's Guide*.

- **Data field size** - All switches participating in the Remote Switch fabric must have the data field size configured to the 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 can 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.

Accessing Through the Telnet Interface

You can use the Telnet command `configure` to accomplish the following:

- Set the R_A_TOV and E_D_TOV values.

- Set the data field size.

- Set the Class F frame suppression flag.

You must disable the switch 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 is accepted for R_A_TOV.

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INTRODUCING EXTENDED FABRICS

Extended Fabrics allows you to use fibre channel technology to create a fabric interconnected at a distance of up to 100 kilometers. You can use Extended Fabrics to increase the allowable distance between two switches, or between a switch and an ATM gateway in a Remote Switch configuration.

Extended Fabrics optimizes the internal buffering algorithm for switches. It provides maximum buffering between E_Ports connected over an extended distance through buffer reconfiguration that results in line speed performance of up to 95 MB per second for switches interconnected at 100 km, thus providing the highest possible performance for transfers between switches. The fibre channel connection extensions are provided by Extended Distance GBICs, fibre channel repeaters, or Wave Division Multiplexing (WDM) devices.

Note Performance can 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, you must configure every switch in the fabric as long-distance extended fabric capable.

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INSTALLING EXTENDED FABRICS

Extended Fabrics requires a switch with Fabric OS version a2.4.1 installed and a license for each switch in the fabric. An Extended Fabrics license is installed on each switch by your HP Account Support Engineer (ASE) or Customer Engineer (CE). This license is installed through either Telnet or Web Tools as described in this chapter. Should any license keys be needed to access features not already licensed on your FC 6164 switch, they can be obtained through the following web site:

http://www.hp.com/support/fc6164

Installing Through Telnet

1. Log on to the switch by Telnet (see the user's guide provided with the hardware for details), using an account that has administrative privileges.

2. If you want to determine whether an 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.

Example: `admin> licenseShow`

```
1A1AaAaaaAAAA1a:
Web license
Zoning license
QuickLoop license
Fabric license
Fabric Watch license
```

If the Extended Fabrics license is not included in the list, or is incorrect, continue with Step 3. If the licence is correctly listed, it is already installed.

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

Installing Through Web Tools

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

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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, see the *Web Tools User's Guide*.

Configuring Extended Fabrics

To use Extended Fabrics, you must configure each switch in the fabric to support a long-distance extended fabric. This task consists of specifying the long-distance level for each port in the switch, and then specifying the same level for each port's neighboring port (the second port in a two-port pair). If incorrectly set, the fabric segments until the configurations in each segment match.

To set the long-distance fabric mode bit:

1. Log into the switch by Telnet.

2. Enter the `switchDisable` command.

3. Enter the `configure` command.

4. Enter "1" on the following line:

    ```
    Long Distance Fabric [0]:
    ```

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 km links.

- *Level 1* Distances up to 50 km. A total of 27 full-size frame buffers are reserved for the port.

- *Level 2* Distances up to 100 km. A total of 60 full-size frame buffers are reserved for the port.

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 to 3, 4 to 7, 8 to11, and 12 to15. Certain buffers are dedicated for each port, but others are shared among the ports. In extended fabric mode, one port is given an increase of dedicated buffers from this pool. Because the total number of frame buffers in a quad is limited, only one port in the quad can be configured for use in an extended fabric at any one time. When one port is configured as a long-distance port, the remaining ports in the quad must be configured as regular switch ports (Level 0).

Accessing Through the Telnet Interface

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

Synopsis   portCfgLongDistance port_number <long_distance_level>

Availability   Administrator. The 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 km. You can use the port 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.

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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 the port as a regular switch port. The number of buffers reserved for the port supports links up to 10 km.
1	Level one long-distance, up to 50 km. A total of 27 full-size frame buffers are reserved for the port.
2	Level two long-distance, up to 100 km. 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 Lx, 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 to7 or 0 to15.

The following operand is optional:

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

Limitations   A group of four adjacent ports that share a common pool of frame buffers (for example, ports 0 to 3 or 4 to 7) are called a "quad." Because the total number of frame buffers in a quad is limited, if one of the ports in the quad is configured as a 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 (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 km link:

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

See Also   configure
portShow
switchShow

GLOSSARY

This glossary provides definitions for fibre channel and switch terminology.

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

AL_PA   Arbitrated Loop Physical Address. An 8-bit value used to uniquely identify an individual port within a loop. A loop can have one or multiple AL_PAs.

Arbitrated Loop   Afibre channel transport structured as a loop. Allows communication between ports without using a switch. Requires successful arbitration by a port before a circuit is established. Supports up to 126 devices and one fabric attachment.

ATM   Asynchronous Transfer Mode. A broadband technology for transmitting data over LANs or WANs, based on relaying cells of a fixed size. Provides any-to-any connectivity, and nodes can transmit simultaneously.

Class F   Connectionless service for interswitch control traffic. Provides notification of delivery or nondelivery between two E_Ports.

Class 2   Connectionless service between ports with notification of delivery or non delivery.

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

Community (SNMP)   A relationship between an SNMP agent and a set of SNMP managers that defines authentication, access control, and proxy characteristics.

Credit	When applied to a switch, the maximum number of receive buffers provided by an F_Port or FL_Port to its attached N_Port or NL_Port, respectively, such that the N_Port or NL_Port can transmit frames without over-running the F_Port or FL_Port.
Defined Configuration	The complete set of all zone objects that are defined in the fabric. The defined configuration can include multiple zone configurations.
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 Timeout Value. The time that the switch waits for an expected response before declaring an error condition. Adjustable in 1-microsecond increments from 2 to 10 seconds.
Effective Configuration	The particular zone configuration that is currently in effect. Only one configuration can be in effect at a time. The effective configuration is built each time a zone configuration is enabled.
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.
Fabric	A network that uses high-speed fibre connections to connect switches, hosts, and devices. A fabric is an active, intelligent, nonshared interconnect scheme for nodes.
FC-AL	The Fibre Channel Arbitrated Loop standard. Defined on top of the FC-PH standard. Defines the arbitration on a loop where several FC nodes share a common medium.
FC-PH	Fibre Channel Physical and Signalling standard.
FLA	Fabric Loop Attach.
FLOGI	Fabric login. The process by which a device gains access to the fabric.
F_Port	A fabric port that is not loop capable. Used to connect an N_Port to a switch.
FL_Port	A fabric port that is loop capable. Used to connect NL_Ports to the switch in a loop configuration.

FSPF	Fibre-Channel Shortest Path First. A routing protocol used by fibre channel switches.
G_Port	A generic port that can operate as either an E_Port or an F_Port. A port is defined as a G_Port when it is not yet connected, or has not yet assumed a specific function in the fabric.
Gateway	Hardware that connects incompatible networks by providing the necessary translation for both hardware and software.
GBIC	Gigabit Interface Converter. A removable serial transceiver module designed to provide gigabaud capability for fibre channel (FC) and other products that use the same physical layer.
Hardware Translative Mode	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 across the fabric. • QuickLoop Mode: Allows private devices to communicate with other private devices across the fabric.
ISL	Interswitch Link. A fibre link between two switches.
Isolated E_Port	A port that is online but not operational between switches due to overlapping domain ID or nonidentical parameters such as E_D_TOVs.
LIP	Loop initialization primitive.
L_Port	A loop capable fabric port or node.
Multicast	Used when multiple copies of data need to be sent to multiple designated destinations.
N_Port	A node port that is not loop capable. Used to connect an equipment port to the fabric.
NL_Port	A node port that is loop capable. Used to connect an equipment port to the fabric in a loop configuration through an FL_Port.
PLDA	Private Loop Direct Attach. A subset of fibre channel standards for the operation of peripheral devices.

POST	Power on self-test. A series of self-tests that run each time the unit is booted or reset.
R_A_TOV	Resource Allocation Timeout Value. Used to time out operations that depend on the maximum possible time that a frame can be delayed in a fabric and still be delivered. This value is adjustable in 1-microsecond increments from 10 to 120 seconds.
SNMP	Simple Network Management Protocol. A TCP/IP protocol that generally uses the User Datagram Protocol (UDP) to exchange messages between a management information base and a management client residing on a network. Since SNMP does not rely on the underlying communication protocols, it can be made available over other protocols, such as UDP/IP.
SNMPv1	The original standard for SNMP, now labeled v1.
Tachyon	A type of host bus adapter.
Trap (SNMP)	A mechanism for SNMP agents to notify the SNMP management station of significant events.
Tunneling	A technique for enabling two networks to communicate when the source and destination hosts are on the same type of network but are connected by a different type of network.
Unicast	A routing method that provides one or more optimal paths between any two switches in the fabric.
U_Port	Universal port. A generic switch port that can operate as either an 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.
WWN	Worldwide name. A unique local and global identifier for a device on a network.

Zone　　　　　　　　A set of hosts and devices attached to the same fabric and designated as belonging to the same zone. Any device connected to the fabric can be configured into one or more zones.

Zone alias　　　　　An alias for a set of port numbers or WWNs. Zone aliases can be used to simplify the entry of port numbers and WWNs. For example, "host" could be used as an alias for a WWN of 110:00:00:60:69:00:00:8a.

Zone configuration　A set of zones designated as belonging to the same zone configuration. When a zone configuration is in effect, all valid zones in that configuration are also in effect.

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