



Brocade® Distributed Fabrics

User's Guide

Version 2.6

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Contents

About This Guide	v
Related Publications	v
Getting Help	vi
Getting Software Updates	vi

Section I Brocade Remote Switch

Chapter 1 Introducing the Brocade Remote Switch

Chapter 2 Installing the Brocade Remote Switch

Installing a Brocade Remote Switch using Telnet	2-1
Installing a Brocade Remote Switch using Brocade Web Tools	2-2

Chapter 3 Using a Brocade Remote Switch

Overview	3-1
Configuring a Brocade Remote Switch Fabric	3-1
Other Considerations	3-3

Section II Brocade Extended Fabrics

Chapter 4 Introducing Brocade Extended Fabrics

Chapter 5 Installing Brocade Extended Fabrics

Installing Brocade Extended Fabrics through Telnet	5-1
Installing Brocade Extended Fabrics using Brocade Web Tools	5-2

Chapter 6	Using Brocade Extended Fabrics	
	Configuring Brocade Extended Fabrics	6-1
	Accessing Brocade Extended Fabrics through the Telnet Interface . .	6-2

Glossary

Index

Preface

Brocade Distributed Fabrics are optionally licensed products, and requires a valid license key to function. It is supported for the SilkWorm 2000 series of switches, using the Brocade Fabric Operating System, version 2.2 or later.

About This Guide

This guide provides the following information:

Chapter 1

Introducing Brocade Distributed Fabrics

Overview of Brocade Distributed Fabrics.

Chapter 2

Installing Brocade Distributed Fabrics

Instructions for installing Brocade Distributed Fabrics.

Chapter 3

Using Brocade Distributed Fabrics

Instructions for configuring and using Brocade Distributed Fabrics.

Glossary

Definitions for the terms used in this document and in related Brocade documentation.

Index

Topics indexed alphabetically.

Related Publications

Related product information can be found in the following Brocade publications:

- *Brocade Fabric OS v2.2 Release Notes*
- *Brocade Fabric OS Procedures Guide*
- *Brocade Fabric OS Reference*
- *Brocade MIB Reference*
- *Brocade ISL Trunking User's Guide*
- *Brocade Advanced Performance Monitoring User's Guide*
- *Brocade Web Tools User's Guide*
- *Brocade Zoning User's Guide*

- *Brocade QuickLoop User's Guide*
- *Brocade Fabric Watch User's Guide*
- *Brocade Distributed Fabrics User's Guide*
- *Brocade SES User's Guide*

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

Contact your switch supplier for technical support. This includes software support, hardware support, product repairs, and ordering spare components. Be prepared to provide the following information to support personnel:

- Switch serial number
- Switch worldwide name
- Fabric and SAN topology configuration
- Output from the `supportShow telnet` command
- Detailed description of the problem
- Troubleshooting steps already performed

Getting Software Updates

Contact your switch supplier for software updates and maintenance releases.

Utility programs to facilitate loading firmware from the listed operating systems, in addition to MIB files for switch management by SNMP, can be accessed on the Brocade website through the following steps:

1. Launch your web browser and enter <http://partner.brocade.com>.
2. Enter your Brocade Partner login and password, and click **Login**.
3. Scroll down to **Technical Support** in the left navigation bar.
4. Click **MIBs and RSH Utilities** for MIB files.

Click **Firmware** for firmware download.

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

- UNIX
- Windows NT
- Windows 98
- Windows 95

Brocade Remote Switch

This section provides the following information:

- Chapter 1, Introducing Brocade Remote Switch
- Chapter 2, Installing Brocade Remote Switch
- Chapter 3, Using Brocade Remote Switch

Introducing the Brocade Remote Switch

Brocade Remote Switch is an optionally licensed product that runs on SilkWorm 2000 series switches with Brocade Fabric OS version 2.2 or later.

The Brocade Remote Switch feature, in conjunction with a compatible fibre channel to asynchronous transfer mode (ATM) gateway, enables two SilkWorm 2000 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. Brocade Remote Switch supports a maximum of two switches in a fabric.

Brocade 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 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 (Brocade Web Tools, telnet, SNMP, and SES) 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.

1 Introducing the Brocade Remote Switch

Installing the Brocade Remote Switch

A Brocade Remote Switch fabric requires two Silkworm 2000 series switches with Fabric OS version 2.2 or later installed, with the switches configured the same.

Installing a Brocade Remote Switch involves 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 Brocade Remote Switch license either through telnet or through Brocade Web Tools.

Installing a Brocade Remote Switch using Telnet

To install a Brocade Remote Switch using Telnet:

1. Log onto the switch by using the `telnet` command (refer to the *Fabric OS Reference* for details), using an account that has administrative privileges.
2. To determine whether a Remote Switch license is already installed on the switch, type the `licenseShow` command on the telnet command line.

A list displays of all the licenses currently installed on the switch.

Example:

```
admin> licenseShow

1A1AaAaaaAAAA1a:
Release v2.2
Web license
Zoning license
SES license
QuickLoop license
Remote 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. 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 a Brocade Remote Switch using Brocade Web Tools

To install a Brocade Remote Switch using Brocade Web Tools:

1. Launch the web browser.
2. Enter the switch name or IP address in the Location/Address field, and press Enter.
Brocade Web Tools launches, displaying the Fabric View.
3. Click the Admin button on the relevant switch panel.
The login window is displayed.
4. Enter a login 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 Brocade Remote Switch feature is available as soon as the license key is added.

Using a Brocade Remote Switch

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

This chapter provides the following information:

- *Overview* on page 3-1
- *Configuring a Brocade Remote Switch Fabric* on page 3-1
- *Other Considerations* on page 3-3

Overview

The Brocade 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 Brocade Remote Switch fabric, transfers them across a WAN using ATM protocol, and passes them to the other side of the Brocade 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. 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 SilkWorm 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 SilkWorm E_Port to the ATM network.

Configuring a Brocade Remote Switch Fabric

A Brocade Remote Switch fabric requires two Brocade SilkWorm 2000 series switches, with identical configurations. A separate Brocade Remote Switch license is required for each switch.

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 Brocade 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 the *Fabric OS* manual.
- **Data field size**
Some network-bridge devices may not support the default data field size that is used by the Brocade Switch. By default the Brocade SilkWorm Switch is configured to send a frame size of 2,112 bytes. A smaller frame size can be negotiated between an N_Port device that is logging into a Brocade SilkWorm F_Port Switch.

```
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]
Data field size: (256..2112) [2112] 2048
```

Note: All switches that participating in the Remote Switch environment must have their data field size configured to the supported frame size 2,048 bytes. The data field size may be configured smaller than 2,048 bytes, but a performance penalty may be incurred.

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

```
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]
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
```

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

Other Considerations

Fibre channel frames may range from 256 to 2,112 bytes in size and may be larger in size than those allowed by the bridged network protocol. The network-bridge should break the fibre channel frames up into smaller pieces at the local end of the network and tunnel them across. The pieces are then reassembled at the remote end of the bridged network into complete fibre channel frames and are transmitted out the remote fibre channel interface.

3 Using a Brocade Remote Switch

Brocade Extended Fabrics



This section provides the following information:

- Chapter 4, Introducing Brocade Extended Fabrics
- Chapter 5, Installing Brocade Extended Fabrics
- Chapter 6, Using Brocade Extended Fabrics



Introducing Brocade Extended Fabrics

Brocade Extended Fabrics uses fibre channel technology to create a fabric that can be interconnected at a distance of up to 100 kilometers. Brocade Extended Fabrics can increase the allowable distance between two switches or between a switch and an ATM gateway used in a Brocade Remote Switch configuration. It is an optionally licensed product that runs on SilkWorm 2000 series switches with Brocade Fabric OS version 2.2 or later

Note: The Brocade Extended Fabric license is only required on the edge port connector switch.

Brocade Extended Fabrics optimizes the internal buffering algorithm for SilkWorm 2000 series 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/second for switches interconnected at 100 kilometers, 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 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 Brocade Extended Fabrics, every switch in the fabric must be configured as long distance extended fabric capable.

4 Introducing Brocade Extended Fabrics

Installing Brocade Extended Fabrics

Installing Brocade Extended Fabrics requires the installation of a license on only the edge port connector switch in the fabric. If a license was not installed into the switch at the factory, contact your switch supplier to obtain a license key.

Brocade Extended Fabrics 2.2 requires a Silkworm 2000 series switch with Brocade Fabric OS version 2.2 installed.

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

Installing Brocade Extended Fabrics through Telnet

To install Brocade Extended Fabrics using telnet:

1. Log on to the switch by entering the `telnet` command (refer to the *Fabric OS User's Guide* for details), using an account that has administrative privileges.
2. If you want to determine whether a Brocade 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:
Release v2.2
Web license
Zoning license
SES license
QuickLoop license
Extended Fabric license
```

If the Brocade Extended Fabrics license is not included in the list, or is incorrect, continue with step [3]. If it is correctly listed, the license 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 Brocade Extended Fabrics license is listed, the feature is installed and immediately available. If the license is not listed, repeat step [3].

Installing Brocade Extended Fabrics using Brocade Web Tools

1. Launch the web browser.
2. Enter the switch name or IP address in the Location/Address field, and press Enter.
Brocade Web Tools is launched, displaying the Fabric View.
3. Click the Admin button on the relevant switch panel.
The login window is displayed.
4. Enter a login name and password with administrative privileges and press Enter.
The Administration View is displayed.
5. Select the License Admin tab.
6. Enter the license key in the License Key field, and click Add License.
The Brocade Extended Fabrics feature is available as soon as the license key is added.

Using Brocade Extended Fabrics

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

This chapter provides the following information:

- *Configuring Brocade Extended Fabrics* on page 6-1
- *Accessing Brocade Extended Fabrics through the Telnet Interface* on page 6-2

Configuring Brocade Extended Fabrics

In order to employ Brocade Extended Fabrics, each switch in the fabric must be configured to support a long distance extended fabric. This consists of specifying the long distance level for each port in the switch, and then specifying the same level for each ports neighboring port (the second port in a two-port pair). If incorrectly set, the fabric will segment until the configurations in each segment match.

To set the long distance fabric mode bit:

1. Log into the switch by entering the `telnet` command.
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	Effect
-------	--------

- | | |
|---|---|
| 0 | Reconfigures port as a regular 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. |

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, and 12-15. 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. Since 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 Brocade Extended Fabrics through the Telnet Interface

The configuration of a port to support long distance links by using the `portCfgLongDistance` telnet command is described in the following section.

portCfgLong Distance

Configure a port to support long distance links.

Synopsis

```
portCfgLongDistance port_number <long_distance_level>
```

Availability

admin. The Brocade 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 10 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 regular 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 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: 0-7 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

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 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 set the long distance fabric mode bit (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 kilometer 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.
AL_PA	Arbitrated loop physical address. A unique 8-bit value assigned during loop initialization to a port in an arbitrated loop.
alias	An alternate name for an element or group of elements in the fabric. Aliases can be used to simplify the entry of port numbers and WWNs when creating zones.
alias address identifier	An address identifier recognized by a port in addition to its standard identifier. An alias address identifier may be shared by multiple ports. See also <i>alias</i> .
alias AL_PA	An AL_PA value recognized by an L_Port in addition to the AL_PA assigned to the port. See also <i>AL_PA</i> .
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. A 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 <i>topology</i> .
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.
authentication	The process of verifying that an entity (such as a switch) in a fabric is what it claims to be. See also <i>digital certificate</i> , <i>switch-to-switch authentication</i> .
AW_TOV	Arbitration wait time-out value. The minimum time an arbitrating L_Port waits for a response before beginning loop initialization.
backup FCS switch	Backup fabric configuration server switch. The switch or switches assigned as backup in case the primary FCS switch fails. See also <i>FCS switch</i> , <i>primary FCS switch</i> .
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 link or system. See also <i>throughput</i> .
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 <i>buffer-to-buffer flow control</i> , <i>EE_Credit</i> .

beacon	When all the port LEDs on a switch are set to flash from one side of the switch to the other, to enable identification of an individual switch in a large fabric. A switch can be set to beacon by telnet command or through Brocade Web Tools.
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 <i>disparity</i> .
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 <i>error</i> .
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 <i>multicast</i> , <i>unicast</i> .
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 <i>BB_Credit</i> .
CA	Certificate authority. A trusted organization that issues digital certificates. See also <i>digital certificate</i> .
cascade	Two or more interconnected fibre channel switches. SilkWorm 2000 and later switches can be cascaded up to 239 switches, with a recommended maximum of seven interswitch links (no path longer than eight switches). See also <i>fabric</i> , <i>ISL</i> .
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 <i>link</i> .
Class 1	The class of frame switching service for a dedicated connection between two communicating ports (also called connection-oriented service), with acknowledgement of delivery or nondelivery of frames.
Class 2	A connectionless class of frame switching service that includes acknowledgement of delivery or nondelivery of frames.
Class 3	A connectionless class of frame switching service that does not include acknowledgement of delivery or nondelivery of frames. Can be used to provide a multicast connection between the frame originator and recipients, with acknowledgement of delivery or nondelivery of frames.
Class F	The class of frame switching service for a direct connection between two switches, allowing communication of control traffic between the E_Ports, with notification of delivery or nondelivery of data.
class of service	A specified set of delivery characteristics and attributes for frame delivery.
CLI	Command line interface. Interface that depends entirely on the use of commands, such as through telnet or SNMP, and does not involve a GUI.
comma	A unique pattern (either 1100000 or 0011111) used in 8B/10B encoding to specify character alignment within a data stream. See also <i>K28.5</i> .
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 <i>SNMP</i> .

CRC	Cyclic redundancy check. A check for transmission errors that is 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 <i>BB_Credit</i> , <i>EE_Credit</i> .
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 <i>route</i> .
data word	A type of transmission word that occurs within frames. The frame header, data field, and CRC all consist of data words. See also <i>frame</i> , <i>ordered set</i> , <i>transmission word</i> .
defined zone configuration	The set of all zone objects defined in the fabric. May include multiple zone configurations. See also <i>enabled zone configuration</i> , <i>zone configuration</i> .
digital certificate	An electronic document issued by a CA (certificate authority) to an entity, and containing the public key and identity of the entity. Entities in a secure fabric are authenticated based on these certificates. See also <i>authentication</i> , <i>CA</i> , <i>public key</i> .
disparity	The proportion 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	Unique identifier for all switches in a fabric, used in routing frames. Usually automatically assigned by the principal switch, but can be assigned manually. The domain ID for a SilkWorm switch can be any integer 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 <i>R_A_TOV</i> , <i>RR_TOV</i> .
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 <i>ISL</i> .
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 <i>BB_Credit</i> , <i>end-to-end flow control</i> .
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 <i>defined zone configuration</i> , <i>zone configuration</i> .
end-to-end flow control	Governs flow of class 1 and 2 frames between N_Ports. See also <i>EE_Credit</i> .
error	As applies to fibre channel, a missing or corrupted frame, time-out, loss of synchronization, or loss of signal (link errors). See also <i>loop failure</i> .
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 <i>FL_Port</i> , <i>Fx_Port</i> .
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 <i>cascade</i> , <i>SAN</i> , <i>topology</i> .
fabric name	The unique identifier assigned to a fabric and communicated during login and port discovery.
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.
FCS switch	Fabric configuration server switch. One or more designated SilkWorm switches that store and manage the configuration and security parameters for all switches in the fabric. FCS switches are designated by WWN, and the list of designated switches is communicated fabric-wide. See also <i>backup FCS switch</i> , <i>primary FCS switch</i> .
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 <i>FSP</i> .
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 <i>F_Port</i> , <i>Fx_Port</i> .
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 <i>PLOGI</i> .
frame	The fibre channel structure used to transmit data between ports. Consists of a start-of-frame delimiter, header, any optional headers, data payload, cyclic redundancy check (CRC), and 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 <i>FSP</i> .
FSP	Fibre channel service protocol. The common protocol for all fabric services, transparent to the fabric type or topology. See also <i>FS</i> .
FSPF	Fabric shortest path first. Brocade's 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 <i>half-duplex</i> .
Fx_Port	A fabric port that can operate as either an F_Port or FL_Port. See also <i>F_Port</i> , <i>FL_Port</i> .
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.
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 <i>full-duplex</i> .
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: <ul style="list-style-type: none"> • 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.
initiator	A server or workstation on a fibre channel network that initiates communications with storage devices. See also <i>target</i> .
Integrated Fabric	The fabric created by a SilkWorm 6400, 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 <i>cascade</i> , <i>E_Port</i> .

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 <i>E_Port</i> .
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 <i>RAID</i> .
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 <i>comma</i> .
key	A string of data (usually a number) shared between two entities and used to control a cryptographic algorithm. Usually selected from a large pool of possible keys to make unauthorized identification of the key difficult. See also <i>key pair</i> .
key pair	In public key cryptography, a pair of keys consisting of an entity's public and private key. The public key can be publicized, but the private key must be kept secret. See also <i>public key cryptography</i> .
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: <ul style="list-style-type: none"> • 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 <i>non-participating mode</i> , <i>participating mode</i> .
latency	The period of time required to transmit a frame, from the time it is sent until it arrives. Together, latency and bandwidth define the speed and capacity of a link or system.
LED	Light emitting diode. Used to indicate status of elements on switch.
link	As applies to fibre channel, a physical connection between two ports, consisting of both transmit and receive fibres. See also <i>circuit</i> .
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.
looplest	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 1300nm lasers and supports link speeds of 1.0625 Gbps. May also refer to the type of GBIC or SFP. See also <i>SWL</i> .
MIB	Management information base. An SNMP structure to help with device management, providing configuration and device information.
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 <i>broadcast, unicast</i> .
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 <i>NL_Port, Nx_Port</i> .
name server	Frequently used to indicate Simple Name Server. See also <i>SNS</i> .
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 <i>N_Port, Nx_Port</i> .
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 <i>L_Port, participating mode</i> .
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: <ul style="list-style-type: none"> • 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 <i>frame</i> .
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 <i>L_Port, non-participating mode</i> .
path selection	The selection of a transmission path through the fabric. Brocade switches use the FSPF protocol. See also <i>FSPF</i> .
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.
PKI	Public key infrastructure. An infrastructure that is based on public key cryptography and CA (certificate authority), and uses digital certificates. See also <i>CA, digital certificate, public key cryptography</i> .

PKI certification utility	Public key infrastructure certification utility. A utility that makes it possible to collect certificate requests from switches and load certificates to switches. See also <i>digital certificate, PKI</i> .
PLOGI	Port login. The port-to-port login process by which initiators establish sessions with targets. See also <i>FLOGI</i> .
point-to-point	A fibre channel topology that employs direct links between each pair of communicating entities. See also <i>topology</i> .
Port_Name	The unique identifier assigned to a fibre channel port. Communicated during login and port discovery.
POST	Power on self-test. A series of tests run by a switch after it is turned on.
primary FCS switch	Primary fabric configuration server switch. The switch that actively manages the configuration and security parameters for all switches in the fabric. See also <i>backup FCS switch, FCS switch</i> .
private device	A device that supports arbitrated loop protocol and can interpret 8-bit addresses, but cannot log into the fabric.
private key	The secret half of a key pair. See also <i>key, key pair</i> .
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 set of standards for communication.
public device	A device that supports arbitrated loop protocol, can interpret 8-bit addresses, and can log into the fabric.
public key	The public half of a key pair. See also <i>key, key pair</i> .
public key cryptography	A type of cryptography which uses a key pair, with the two keys in the pair called at different points in the algorithm. The sender uses the recipient's public key to encrypt the message, and the recipient uses the recipient's private key to decrypt it. See also <i>key pair, PKI</i> .
public loop	An arbitrated loop that includes a participating FL_Port, and may contain both public and private NL_Ports.
public NL_Port	An NL_Port that logs into the fabric, can function within either a public or a private loop, and can communicate with either private or public NL_Ports.
quad	A group of four adjacent ports that share a common pool of frame buffers.
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 <i>E_D_TOV, RR_TOV</i> .
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 <i>JBOD</i> .
request rate	The rate at which requests arrive at a servicing entity. See also <i>service rate</i> .
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 <i>FSPF</i> .

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 <i>E_D_TOV</i> , <i>R_A_TOV</i> .
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 <i>fabric</i> .
sectelnet	A protocol similar to Telnet but with encrypted passwords for increased security.
security policy	A set of rules that determine how security is implemented in a fabric. Security policies can be customized.
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 <i>request rate</i> .
SI	Sequence initiative.
SilkWorm	The brand name for the Brocade family of switches.
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 <i>community (SNMP)</i> .
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 <i>FS</i> .
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.
switch-to-switch authentication	The process of authenticating both switches in a switch-to-switch connection using digital certificates. See also <i>authentication</i> , <i>digital certificate</i> .
SWL	Short wavelength. A type of fiber optic cabling that is based on 850nm lasers and supports 1.0625 Gbps link speeds. May also refer to the type of GBIC or SFP. See also <i>LWL</i> .
target	A storage device on a fibre channel network. See also <i>initiator</i> .
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 <i>bandwidth</i> .

topology	As applies to fibre channel, the configuration of the fibre channel network and the resulting communication paths allowed. There are three possible topologies: <ul style="list-style-type: none"> • 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 <i>SNMP</i> .
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 <i>broadcast, multicast</i> .
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. 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 <i>defined zone configuration, enabled zone configuration</i> .

Index

A

ATM gateway 3-1

B

BB credit 3-2
buffers, frame 6-1

C

class F frames 3-2
configuring ports for long distance 6-1

D

data field size 3-2

E

E_D_TOV 3-2

F

Fibre Channel Association viii
frame buffers 6-1
frame transfer with Brocade Remote Switch 3-1

I

installation 2-1, 5-1
 of Brocade Extended Fabrics by telnet 5-1
 of Brocade Extended Fabrics by the web 5-2
 of Brocade Remote Switch by telnet 2-1
 of Brocade Remote Switch by the web 2-2

K

key, license 2-1, 5-1

L

license key 2-1, 5-1
line speed performance 4-1
long distance fabric mode bit, setting 6-1

P

performance, Brocade Extended Fabrics 4-1
port levels 6-1
portCfgLongDistance telnet command 6-2

Q

quads, definition of 6-1

R

R_A_TOV 3-2
requirements
 Brocade Extended Fabrics 4-1
 Brocade Remote Switch 1-1

S

- segmentation of fabric 6-1
- support, technical viii
- supportShow telnet command viii

T

- technical support viii
- telnet
 - accessing Brocade Extended Fabrics by 6-2
 - accessing Brocade Remote Switch by 3-3
 - installing Brocade Extended Fabrics by 5-1
 - installing Brocade Remote Switch by 2-1
- telnet commands
 - portCfgLongDistance command 6-2
 - supportShow viii
- timeout values 3-2

W

- web
 - installing Brocade Extended Fabrics by 5-2
 - installing Brocade Remote Switch by 2-2