hp StorageWorks

fabric OS procedures version 3.0.x/4.0.x user guide

Part Number: AA–RS23A–TE

First Edition (October 2002)

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

This guide describes configuring switches, working with the management server, and working with diagnostics and displaying switch status information.

i n v e n t

Fabric OS Procedures Version 3.0.x/4.0.x User Guide
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About this Guide

This guide provides information to help you:

- Set up switch configurations
- Work with the Management Server database
- Set up heterogeneous fabrics
- Understand diagnostics and switch status information
- Contact technical support for additional assistance

Intended Audience

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

- *HP StorageWorks*™ Fibre Channel SAN switches
- Fabric Operating System (FOS) V3.0.x or later

Related Documentation

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

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

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

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

Document Conventions

The conventions included in Table 1 apply.

Table 1: Document Conventions

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

Symbols in Text

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

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

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

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

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

Getting Help

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

HP Technical Support

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

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

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

Be sure to have the following information available before calling:

- Technical support registration number (if applicable)

- Product serial numbers

- Product model names and numbers

- Applicable error messages

- Operating system type and revision level

- Detailed, specific questions

HP Storage Website

The HP storage website has the latest information on this product, as well as the latest drivers. Access the HP storage website at: http://thenew.hp.com/country/us/eng/prodserv/storage.html. From this website, select the appropriate product or solution.

HP Authorized Reseller

For the name of your nearest HP Authorized Reseller:

- In the United States, call 1-800-345-1518.

- In Canada, call 1-800-263-5868.

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

1

Setting the Initial Configuration

This chapter provides information on initial configuration tasks for a switch.

Physically Connecting to the Switch

Refer to the specific hardware manual for your switch for instructions on physically connecting to the switch.

The tasks required when initially connecting to the switch include:

- Connecting to the switch using a serial connection. Refer to the hardware manual for your specific switch for instructions.

- Setting the IP address or addresses.

- Once the IP addresses are set, you can use several access methods to manage the switch, including Telnet, Web Tools, Fabric Manager, or through a third-party application using the API.

Configuring the IP Address for the
HP StorageWorks Core Switch 2/64

For the HP StorageWorks Core Switch 2/64 (Core Switch 2/64), there are a number of Ethernet IP addresses and Fibre Channel IP addresses to set. Each of the Control Processors (slot 5 and 6) has an Ethernet and Fibre Channel IP, as well as having a Hostname and Gateway IP address. Each of the logical switches (slots 1 through 4 and 7 through 10) has an Ethernet and Fibre Channel IP and Subnet mask. The backplane IPs are static and cannot be changed. There is also one Fibre Channel IP for each logical switch.

1. Log in to the switch as the admin user. See "Logging into a Switch," on page 1–3.

2. At the command line, enter the following command:

   ```
   ipAddrSet
   ```

An interactive session is opened.

3. Choose the logical switch or CP that you want to configure. Enter the value that corresponds to that logical region:

    — Enter 0 to configure logical switch 0 (slots 1 though 4)

    — Enter 1 to configure logical switch 1 (slots 7 though 10)

    — Enter 2 to configure control processor 1 (slot 5)

    — Enter 3 to configure control processor 2 (slot 6)

4. If you are configuring a logical switch, enter the following information when prompted:

    — Ethernet IP Address

    — Ethernet Subnet mask

    — Fibre Channel IP address

    — Fibre Channel Subnet mask

5. If you are configuring a control processor, enter the following information when prompted:

    — Ethernet IP Address

    — Ethernet Subnet mask

    — Hostname

    — Gateway IP Address

6. Once you have configured a logical switch or control processor, the `ipaddrset` command verifies the data you entered, and exits.

7. Rerun this command to configure all logical switches and control processors.

Configuring the IP Address for the StorageWorks 2 Gb SAN switch

The switch is shipped with a default IP address of `10.77.77.77`. To change the default IP Address and configure the Fibre Channel IP address of the switch:

1. Log in to the switch as the admin user.

2. At the command line, enter the following command:

   ```
   ipAddrSet
   ```

   An interactive session is opened and you are prompted for configuration values. Press **Enter** without entering a value to skip over a prompt and leave the parameter value as is.

3. At the Ethernet IP Address prompt, enter the new IP address for the Ethernet port on the switch. Press **Enter** to continue.

4. At the Ethernet Subnet mask prompt, enter the address of the subnet mask, if applicable. Press **Enter** to continue.

5. At the Fibre Channel IP address prompt, enter the Fibre Channel IP address for the switch. Press **Enter** to continue.

6. At the Fibre Channel Subnet mask prompt, enter the address of the subnet mask, if applicable. Press **Enter** to continue.

7. At the Gateway Address prompt, enter the IP address of the gateway system if applicable. Press **Enter** to continue.

   The configuration is then committed to the switch firmware. You are then prompted whether to make the IP address changes active now or at the next reboot.

8. Enter **y** at the prompt to have the IP address changes take effect immediately.

Logging into a Switch

To log into a switch:

1. Open a telnet or rlogin connection to the switch. The login prompt is displayed if the telnet connection successfully found the switch in the network.

   NOTE: The switch must be connected to your IP network through the RJ-45 Ethernet port to enable connection through telnet. Refer to the hardware manual of your switch for more information about connecting the switch to your IP network.

2. At the login prompt, enter your user ID. For example:

   ```
   login: admin
   ```

   The password prompt is displayed if the user exists.

3. Enter the admin password:

   ```
   password: xxxxxx
   ```

The default password is `password`.

If the login was successful, a prompt is displayed showing the switch name and user ID you are logged in as. For example:

```
switch55:admin>
```

Enabling Licensed Features

Licensed features such as Zoning, QuickLoop, ISL Trunking, and Extended Fabric are already loaded onto the switch firmware, but must be enabled with a license key. Once you have purchased these features, you are provided with a key to unlock the features in the firmware.

To enter a license key:

1. Log in to the switch as the admin user.

2. At the command line, enter the following command:

   ```
   licenseAdd "aaaBbbCcc"
   ```

   where `aaaBbbCcc` is the license key for a particular feature.

   NOTE: License keys are case sensitive.

Displaying the Installed Feature Licenses

To display what features have been enabled on a switch:

1. Log in to the switch as the admin user.

2. At the command line, enter the following command:

   ```
   licenseShow
   ```

   This command displays the license keys that have been entered for the switch and the features enabled by those licenses.

   For example:

   ```
   switch:admin> licenseShow
   cQebzbRdScRfc0iK:
        Zoning license
   AybbzQQ9edTzcc0X:
        Fabric license
   ```

Changing the Admin Password in V3.0.x

For security reasons, the first time you log into the Fabric OS you are requested to change the system password.

To change the admin password:

1. Log in to the switch as the admin user.

2. Enter the following:

    ```
    passwd "admin"
    ```

3. At the New username prompt, enter a new name for the admin user or press return without changing the value to leave it as is. You can change the name of the admin user without changing the password.

4. At the New password prompt, enter the new password. The new password must be from 6 to 40 characters in length and must include a capital and lowercase letter and a number.

5. At the Re-enter new password prompt, enter the new password exactly as entered to the previous prompt.

6. Press **Enter** to commit the configuration to the firmware.

Changing the Admin Password in V4.0.x

For security reasons, the first time you log into the Fabric OS you are requested to change the system passwords. There are four user levels: root, factory, admin, and user. Most of the administration of an StorageWorks SAN switch should be done from the admin user level.

To change the admin password:

1. Log in to the switch as the admin user.

2. Enter the following:

    ```
    passwd
    ```

3. At the New password prompt, enter the new password. The new password must be from 6 to 8 characters in length and must include a capital and lowercase letter and a number.

4. At the Re-enter new password prompt, enter the new password exactly as entered to the previous prompt.

5. Press **Enter** to commit the configuration to the firmware.

Verifying the Switch Operation

To verify that your switch is operating correctly, display information about the switch and port status.

To display information about the switch and port status:

1. Log in to the switch as the admin user.

2. At the command line, enter the following command:

   ```
   switchshow
   ```

   This command displays a switch summary and a port summary.

   The following example shows a StorageWorks 2 Gb SAN switch:

   ```
   switch:admin> switchshow
   switchName:     Switch
   switchType:     16.2
   switchState:    Testing
   switchRole:     Disabled
   switchDomain:   1 (unconfirmed)
   switchId:       fffc01
   switchWwn:      10:00:00:60:69:c0:06:71
   switchBeacon:   OFF
   port  0: id 1G No_Light    Disabled
   port  1: id 1G No_Light    Disabled
   port  2: id 1G No_Light    Disabled
   port  3: id 1G No_Light    Disabled
   port  4: id 1G No_Light    Disabled
   port  5: id 1G No_Light    Disabled
   port  6: id 1G No_Light    Disabled
   port  7: id 1G No_Light    Disabled
   switch:admin>
   ```

   The following example shows a Core Switch 2/64:

```
switch12k:admin> switchshow

switchName:san94
switchType:10.1
switchState:Online
switchRole:Subordinate
switchDomain:2
switchId:fffc02
switchWwn:10:00:00:60:69:50:02:8f
switchBeacon:OFF
blade7: Beacon: OFF

Area Slot Port SFP Speed State
=====================================
 0    7    0   id   N2   Online    E-Port  10:00:00:60:69:00:54:e8 "san94"
(downstream)
 1    7    1   id   N2   Online    E-Port  10:00:00:60:69:00:54:e8 "san94"
 2    7    2   id   N2   Online    E-Port  10:00:00:60:69:00:54:e8 "san94"
 3    7    3   id   N2   Online    E-Port  10:00:00:60:69:00:54:e8 "san94"
 4    7    4   id   N1   Online    E-Port  10:00:00:60:69:12:34:e2 "san180"
 5    7    5   id   1G   No_Light
 6    7    6   --   1G   No_Module
 7    7    7   --   1G   No_Module
 8    7    8   --   1G   No_Module
 9    7    9   id   N2   Online    F-Port  21:00:00:e0:8b:04:1a:76
10    7   10   id   N2   Online    E-Port  10:00:00:60:69:00:54:e8 "san94"
11    7   11   id   N2   Online    E-Port  10:00:00:60:69:00:54:e8 "san94"
12    7   12   --   1G   No_Module
13    7   13   --   1G   No_Module
14    7   14   id   N1   Online    E-Port  10:00:00:60:69:10:9b:06 "san176"
(upstream)
15    7   15   id   N2   Online    F-Port  10:00:00:00:c9:27:2e:69
```

Verifying Fabric Connectivity

To verify that you have fabric-wide switch connectivity, display a summary of information about the fabric, as follows:

1. Log in to the switch as the admin user.

2. At the command line, enter the following command:

   `fabricshow`

   This command displays a summary of all the switches in the fabric.

   For example:

```
switch:admin> fabricShow
Switch ID    Worldwide Name            Enet IP Addr    FC IP Addr      Name
-------------------------------------------------------------------------------
 3: fffc43 10:00:00:60:69:10:60:1f  192.168.64.187  0.0.0.0          "sw187"
 2: fffc42 10:00:00:60:69:00:05:91  192.168.64.60   192.168.65.60    "sw60"
 1: fffc41 10:00:00:60:69:00:02:0b  192.168.64.180  192.168.65.180 >"sw180"
 0: fffc40 10:00:00:60:69:00:06:56  192.168.64.59   192.168.65.59    "sw5"
The Fabric has 4 switches

Group ID    Token
----------------
0: fffb01 40:05:00:00:10:00:00:60:69:00:00:15
```

Verifying Fabric Wide Device Connectivity

To display the fabric-wide device count from a switch:

1. Log in to the switch as the admin user.

2. At the command line, enter the following command:

   `nsAllShow`

   This command displays 24-bit Fibre Channel addresses of all devices in the fabric. For example:

```
switch:admin> nsAllShow
     12 Nx_Ports in the Fabric
     011200 0118e2 0118e4 0118e8 0118ef 021200
     0214e2 0214e4 0214e8 0214ef
```

Creating a Backup of Critical Switch Information

HP recommends that you make a hard copy backup of all key configuration data, including license key information, and store it in a safe and secure place for emergency reference.

Print out and store in a secure location information from the following commands:

- `licenseshow`
- `configshow`
- `ipaddrshow` - select option 4 to display all configured addresses.

NOTE: Depending on the security procedures of your company, you may want to keep a record of the user levels and passwords for all switches in the fabric. This is sensitive information and access to such information should be limited.

2

Basic Configuration Procedures

This chapter provides information on basic configuration tasks for a switch.

Displaying the Firmware Version

To display the firmware version:

1. Log in to the switch as the admin user.

2. At the command line, enter the following command:

   ```
   version
   ```

   This command displays the Kernel version, Fabric OS release number, and other information about the firmware.

   The following example shows the firmware version information on a StorageWorks 2 Gb SAN switch:

   ```
   Switch:admin> version
   Kernel:     5.3.1
   Fabric OS:  v3.0.2
   Made on:    Fri Jan 25 10:01:42 PST 2002
   Flash:      Thu Jan 31 08:12:49 PST 2002
   BootProm:   Tue Oct 30 10:24:38 PST 2001
   Switch:admin>
   ```

   The following example shows the firmware version information on a Core Switch 2/64:

   ```
   switch12k:admin> version
   Kernel:     2.4.2
   Fabric OS:  v4.0.0
   Made on:    Fri Feb 1 23:02:08 2002
   Flash:      Fri Feb 1 18:03:35 2002
   BootProm:   3.1.13b
   switch12k:admin>
   ```

Setting the Switch Date and Time

All switches maintain current date and time in non-volatile memory. Date and time are used for logging events. Switch operation does not depend on the date and time; a switch with an incorrect date and time value still functions properly.

To set the date and time of a switch:

1. Log in to the switch as the admin user.

2. At the command line, enter the following command:

   ```
   date "MMDDhhmmYY"
   ```

   where:

   MM is the month, valid values are 01-12.

   DD is the date, valid values are 01-31.

   hh is the hour, valid values are 00-23.

   mm is minutes, valid values are 00-59.

   YY is the year, valid values are 00-99.

   NOTE: Year values greater than 69 are interpreted as 1970-1999, year values less than 70 are interpreted as 2000-2069. The date function does not support daylight saving time or time zones.

Displaying the System Configuration Settings

To display the system configuration settings:

1. Log in to the switch as the admin user.

2. At the command line, enter the following command:

   ```
   configShow
   ```

   The system configuration settings are displayed. Note that system configuration parameters vary depending on switch model and configuration.

Backing Up the System Configuration Settings

To upload a backup copy of the configuration settings to a host computer:

1. Verify that the FTP service is running on the host workstation.

2. Log in to the switch as the admin user.

3. At the command line, enter the following command:

   ```
   configupload
   ```

   The command becomes interactive and you are prompted for the required information.

   NOTE: In V3.0.x you can use FTP or RSHD. In V4.0.x you can only use FTP.

   For example using V4.0.x:

   ```
   switch:admin> configupload
   Server Name or IP Address [host]: 192.168.15.42
   User Name [None]: user21
   File Name [config.txt]: config-switch.txt
   Password: xxxxxx
   upload complete
   switch:admin>
   ```

Restoring the System Config Settings

To restore the system configuration settings from a backup:

1. Verify that the FTP service is running on the host workstation.

2. Log in to the switch as the admin user.

3. Shut down the switch by entering the following command:

   ```
   switchdisable
   ```

4. At the command line, enter the following command:

   ```
   configdownload
   ```

   The command becomes interactive and you are prompted for the required information.

   NOTE: In V3.0.x you can use FTP or RSHD. In V4.0.x you can only use FTP.

For example using V4.0.x:

```
switch:admin> configdownload
Server Name or IP Address [host]: 192.168.15.42
User Name [None]: user21
File Name [config.txt]: config-file.txt
Password: xxxxxx
download complete
switch:admin>
```

5. Reboot the switch by entering the following command:

```
reboot
```

Upgrading the Firmware Level in V3.0.x

To upgrade or restore the switch firmware:

1. Verify that the RSHD service (on UNIX and Windows machines) or the FTP service (on a Windows machine) is running on the host workstation.

2. Log in to the switch as the admin user.

3. At the command line, enter the following command:

```
firmwareDownload
```

The command becomes interactive and you are prompted for the required information.

NOTE: In V3.0.x you can use FTP or RSHD. In V4.0.x you can only use FTP.

For example using V3.0.x:

```
Switch:admin> firmwaredownload
Server Name or IP Address [jsmith]: fjones
User Name [jsmith]: fjones
File Name [~jsmith/v3.0.1]: ~fjones/v3.0.2
Protocol (RSHD or FTP) [rshd]:
3869708+301460+1119124, csum 6edc
...............................
...............................
writing flash 0 ...............................
writing flash 1 ...............................
download complete
Switch:admin>
```

4. Reboot the switch by entering the following command:

```
reboot
```

Disabling a Switch

To disable a switch:

1. Log in to the switch as the admin user.

2. At the command line, enter the following command:

   ```
   switchDisable
   ```

   All Fibre Channel ports on the switch are taken offline. If the switch was part of a fabric, the remaining switches reconfigure.

Enabling a Switch

To enable a switch:

1. Log in to the switch as the admin user.

2. At the command line, enter the following command:

   ```
   switchEnable
   ```

   All Fibre Channel ports that passed the POST test are enabled. If the switch was part of a fabric, it rejoins the fabric.

Disabling a Port

To disable a port:

1. Log in to the switch as the admin user.

2. At the command line, enter the following command:

   ```
   portDisable [slotnumber/]portnumber
   ```

   where `slotnumber` and `portnumber` are the slot and port number of the port you want to disable. If the port is connected to another switch the fabric may reconfigure. If the port is connected to one or more devices, these devices are no longer available to the fabric.

Enabling a Port

To enable a port:

1. Log in to the switch as the admin user.

2. At the command line, enter the following command:

    ```
    portEnable [slotnumber/]portnumber
    ```

    where `slotnumber` and `portnumber` are the slot and port number of the port you want to enable. If the port is connected to another switch the fabric may reconfigure. If the port is connected to one or more devices, these devices become available to the fabric.

Changing a Switch Name

To change the name of a switch:

1. Log in to the switch as the admin user.

2. At the command line, enter the following command:

    ```
    switchName "new_name"
    ```

    where `new_name` is the new name for the switch. Switch names can be up to 19 characters long, must begin with a letter, and can contain letters, numbers, or the underscore character. For example:

    ```
    switch:admin> switchname "sw10"
    Committing configuration...
    Done.
    sw10:admin>
    ```

Setting the Switch Status Policy

There are seven parameters that determine the status of a switch:

*   Number of faulty ports

*   Missing GBICs

*   Power supply status

*   Temperature in enclosure

*   Fan speed

*   Port status

- sgroup ISL status

Each parameter is configurable so that a specific threshold must be reached before that parameter changes the overall status of a switch to MARGINAL or DOWN. Only one parameter needs to pass the MARGINAL or DOWN threshold to change the overall status of the switch.

Viewing the Policy Threshold Values

To view the switch status policy threshold values:

1. Log in to the switch as the admin user.

2. At the command line, enter the following command:

   `switchStatusPolicyShow`

Configuring the Policy Threshold Values

To set the switch status policy threshold values:

1. Log in to the switch as the admin user.

2. At the command line, enter the following command:

   `switchStatusPolicySet`

   The current switch status policy parameter values are displayed.

3. You are prompted to enter values for each parameter's DOWN and MARGINAL thresholds:

   — Enter the number of faulty ports required to change the switch status to DOWN and press **Enter**.

   — Enter the number of faulty ports required to change the switch status to MARGINAL and press **Enter**.

   — Enter the number of missing GBICs required to change the switch status to DOWN and press **Enter**.

   — Enter the number of missing GBICs required to change the switch status to MARGINAL and press **Enter**.

   — Enter the number of bad Power Supply warnings required to change the switch status to DOWN and press **Enter**.

   — Enter the number of bad Power Supply warnings required to change the switch status to MARGINAL and press **Enter**.

— Enter the number of temperature warnings required to change the switch status to DOWN and press **Enter**.

— Enter the number of temperature warnings required to change the switch status to MARGINAL and press **Enter**.

— Enter the number of fan speed warnings required to change the switch status to DOWN and press **Enter**.

— Enter the number of fan speed warnings required to change the switch status to MARGINAL and press **Enter**.

— Enter the number of port down warnings required to change the switch status to DOWN and press **Enter**.

— Enter the number of port down warnings required to change the switch status to MARGINAL and press **Enter**.

— Enter the number of ISLstatus down warnings required to change the switch status to DOWN and press **Enter**.

— Enter the number of ISLstatus down warnings required to change the switch status to MARGINAL and press **Enter**.

4. Verify the threshold settings you have configured for each parameter. Enter the following command to view your current switch status policy configuration:

   ```
   switchStatusPolicyShow
   ```

NOTE: By setting the DOWN and MARGINAL value for a parameter to 0,0, that parameter is ignored in setting the overall status for the switch.

Track Changes Feature

Enabling the Track Changes Feature

To enable the track changes feature:

1. Log in to the switch as the admin user.

2. At the command line, enter the following command:

   ```
   trackChangesSet 1
   ```

   A prompt is displayed verifying that the track changes feature is on. The output from the track changes feature is dumped to the error log for the switch. Use the `errdump` command or `errshow` command to view the error log.

Trackable changes are:

— Successful login

— Unsuccessful login

— Logout

— Config file change from task

— Track-changes on

— Track-changes off

Items in the error log created from the Track changes feature are labeled `Error TRACK`. For example:

```
Error 08
--------
0x102cf710 (tShell): May  2 16:12:10
    Error TRACK-LOGIN, 4, Successful login
```

Displaying whether Track Changes is Enabled

To display the status of the track changes feature:

1. Log in to the switch as the admin user.

2. At the command line, enter the following command:

   `trackChangesShow`

   The status of the track changes feature is displayed as either on or off. This also displays whether the track changes feature is configured to send SNMP traps. For example:

```
switch:admin> trackchangesshow
Track changes status: ON
Track changes generate SNMP-TRAP: YES
```

Configuring the In-order Delivery Option

In a stable fabric, frames are always delivered in order, even when the traffic between switches is shared among multiple paths. However, when topology changes occur in the fabric (for instance, a link goes down), traffic is rerouted around the failure. When topology changes occur, some frames may be delivered out of order.

The default behavior enables out-of-order delivery of frames during fabric topology changes. This enables fast rerouting after a fabric topology change.

Forcing In-order Delivery of Frames

To force in-order delivery of frames during fabric topology changes:

1. Log in to the switch as the admin user.

2. At the command line, enter the following command:

   ```
   iodset
   ```

   NOTE: This command can cause a delay in the establishment of a new path when a topology change occurs, and should be used with care.

Disabling In-order Delivery of Frames

To disable In-Order Delivery of frames during fabric topology changes:

1. Log in to the switch as the admin user.

2. At the command line, enter the following command:

   ```
   iodreset
   ```

Displaying Help Information for a Telnet Command

To display help information about a telnet command:

1. Log in to the switch as the admin user.

2. At the command line, enter the following command:

   ```
   help command
   ```

   where `command` is the command name you would like help with.

Reading Hexadecimal Port Diagrams

Many of the commands return port diagrams in hexadecimal format. For example:

```
switch:admin> bcastShow
Group    Member Ports    Member ISL Ports    Static ISL Ports
------------------------------------------------------------
256      0x00012083      0x00002080          0x00000000
```

To read the hexadecimal port diagrams, you must convert them into binary notation. Each hexadecimal value represents four binary values. Each hexadecimal value is converted into a group of four binary values that represent four ports as follows:

Hex value = Binary value

0 = 0000	1 = 0001	2 = 0010	3 = 0011
4 = 0100	5 = 0101	6 = 0110	7 = 0111
8 = 1000	9 = 1001	A = 1010	B = 1011
C = 1100	D = 1101	E = 1110	F = 1111

Once the hexadecimal is converted into a binary bit map, each bit represents a port, where a value of 1 means yes and a value of 0 means no. The bit map is read from right to left, that is, the least significant bit represents port 0.

For example, if the member port value is displayed in hex as:

```
0x00012083
```

This corresponds to a binary bit map of the member ports as follows:

```
0000 0000 0000 0001 0010 0000 1000 0011
```

This bit map displays the member ports as port 0, 1, 7, 13, and 16. Each switch has a hidden internal port (in the example above port 16), which is always a member of a broadcast group.

3

Operating the Core Switch 2/64

This chapter provides information on working with the Core Switch 2/64. For detailed information about the Core Switch 2/64, refer to the *HP StorageWorks Core Switch 2/64 Version 4.0.x Installation Guide*.

Selecting Ports for the Core Switch 2/64

In previous versions of the Fabric OS (v2.0.x and v3.0.x), the primary method for identifying a port within the fabric was the `"domain,port"` combination. For example, to add port 1 on domain 5 to a zone:

```
switch:admin> zoneadd "bluezone", "5,1"
```

This method of selecting ports cannot be used with the HP StorageWorks Core Switch 2/64 because of the addition of slots and the high port count. It was replaced in Fabric OS V4.0.x by two methods to specify a particular port: the slot/port method and the port area number method.

Slot/Port Method

To select a specific port, you must identify both the slot number and port number you are working with.

When specifying a particular slot and port for a command, the slot number operand must followed by the slash (/) and then a value for the port number. For example, to enable port 4 on a switch blade in slot 2, you would specify the following:

```
portEnable 2/4
```

The Core Switch 2/64 provides ten slots. Slot numbers 5 and 6 are control processor cards, and slots 1 through 4 and 7 through 10 are switch cards. On each switch card, there are 16 ports counted from the bottom 0 to 15. A particular port must be represented by both slot number (1 though 10) and port number (0 through 15).

NOTE: No spaces are allowed between the slot number, the slash (/), and the port number.

Port Area Number Method

Some commands such as the zoning commands require you to specify ports using the Area Number method. In the Fabric OS V4.0.x each port on a particular domain is given a unique Area ID.

The StorageWorks Core switch chassis contains two logical switches. The Area IDs for both logical 64-port switches range from 0-63. Both logical switch 0 and 1 have a port that is referenced with Area ID 0.

An Area ID for each port is unique inside each logical switch (that is, each assigned domain ID). These are two of the three parts of a 24-bit Fibre Channel Address ID: 8-bit domain ID, 8-bit Area ID, 8-bit Port ID.

Use the **switchshow** command to display all ports on the current (logical) switch and their corresponding Area IDs.

Upgrading the Firmware Level in V4.0.x

This process is specific to the Core Switch 2/64. The Core Switch 2/64 has 4 IP addresses: 1 for each switch (switch 0 and 1) and 1 for each of the 2 CPs (CP0 in slot 5 and CP1 in slot 6). When upgrading the firmware in the Core Switch 2/64, you must load the new firmware to both the Active CP and Standby CP using the following procedure.

Use these steps to upgrade Core Switch 2/64 firmware.

IMPORTANT: It is highly recommended that the same firmware version is running on both CP cards (CP0 in slot 5 and CP1 in slot 6).

1. Verify that both CP cards are running the same software version. At the command line, enter:

   ```
   version
   ```

2. Verify that the FTP service is running on the host workstation.

3. To prevent fabric disruption, first download the new firmware to the standby CP card. Locate the standby CP card as follows:

   a. Establish a telnet connection using the switch IP address.

   b. Type the haShow command at the prompt. For example:

   ```
   switch: admin> haShow
   Local CP (Slot 6, CP1) : Active
   ```

```
Remote CP (Slot 5, CP0) : Standby
HA Enabled, Heartbeat Up
```

4. Log in to the standby CP card with the username, `admin`.

5. Use these steps to download the new firmware to the standby CP card.

    a. At the command line, enter:

        `firmwareDownload`

    b. Enter the appropriate information at the on-screen prompts, as follows:

        — Server Name or IP Address

        — User Name

        — File Name

        — Password

        — Overwrite the whole firmware [Y]: Y

        — Do Auto-Commit after reboot [Y]: Y

        — Reboot system after download [N]: Y

        NOTE: Rebooting the CP card disconnects the telnet session. If Auto-Commit is selected, restore the old firmware version using the `firmwareRestore` command. This command is useful during SAN testing.

    c. Establish an Ethernet connection. Enter the following command at the prompt:

        `haShow`

    d. Using the switch IP address, enter the following command at the prompt:

        `haFailover`

        IMPORTANT: The haFailover command causes the active CP card to fail over to the standby CP card. The standby CP card is now the active CP card, running the new firmware. In turn, the active CP card reboots, and is now the standby CP card, running the previous version of the firmware.

    e. Due to the fail over, the active CP card reboots, and the telnet connection terminates. Reconnect to the switch via telnet.

    f. Verify that the standby CP card rebooted successfully, and is running the new firmware. Enter the `haShow` command at the prompt, for example,

---

```
switch: admin> haShow

Local CP (Slot 6, CP1) : Active

Remote CP (Slot 5, CP0) : Standby

HA Enabled, Heartbeat Up
```

NOTE: CP0 is ready for the firmware download procedure when the prompt shows CP0 as the "Standby " CP card.

6. Download the new firmware to the standby CP card as follows:

    a. Start a telnet session with the standby CP card (now CP0).

    b. Enter the `firmwareDownload` command at the prompt. Make sure to select both the reboot and firmwareCommit options.

    IMPORTANT: It is not necessary to execute the `haFailover` command at this time, since the two CP cards are equivalent. It makes no difference which CP card is active and which is standby.

NOTE: For more information on any of the commands used in this procedure, refer to the *HP StorageWorks Fabric OS Version 3.0.x/4.0.x Reference Guide,* which contains detailed information on commands and command syntax.

Determining the Area ID of a Port

To determine the Area ID of a particular port:

1. Log in to the switch as the admin user.

2. At the command line, enter the following command:

    ```
    switchshow
    ```

    This command displays all ports on the current (logical) switch and their corresponding Area IDs.

Disabling a Blade

To disable a blade:

1. Log in to the switch as the admin user.

2. At the command line, enter the following command:

    ```
    slotoff slotnumber
    ```

where `slotnumber` is the blade you want to disable.

Enabling a Blade

This procedure enables a blade that is powered, but has been disabled.

1. Log in to the switch as the admin user.

2. At the command line, enter the following command:

   `sloton slotnumber`

   where `slotnumber` is the blade you want to enable.

Powering On a Blade

To power on a blade:

1. Log in to the switch as the admin user.

2. At the command line, enter the following command:

   `slotpoweron slotnumber`

   where `slotnumber` is the blade you want to power on.

Powering Off a Blade

This procedure powers off a blade unit. Note: you must use the `slotoff slotnumber` command to disable the blade, before powering off.

1. Log in to the switch as the admin user.

2. At the command line, enter the following command:

   `slotpoweroff slotnumber`

   where `slotnumber` is the blade you want to power off.

Displaying the Status of All Slots in the Chassis

To display the status of slots in the chassis:

1. Log in to the switch as the admin user.

2. At the command line, enter the following command:

   `slotshow`

   This command displays the current status of each slot in the system. The format of the display includes a header and four fields for each slot. The **slotshow** command fields and their possible values are:

   - `Slot` displays the physical slot number

   - `Blade Type` displays the blade type. Values include:

     — `SW BLADE` indicates the blade is a switch

     — `CP BLADE` indicates the blade is a control processor

     — `UNKNOWN` indicates the blade is not present or its type field is not recognized

   - `ID` displays the hardware ID of the blade type.

   - Status displays the status of the blade. Values include:

     — `VACANT` means the slot is empty

     — `INSERTED, NOT POWERED ON` indicates the blade is present in the slot but is turned off

     — `DIAG RUNNING POST1`. The blade is present, powered on, and running the post initialization power on self-tests

     — `DIAG RUNNING POST2`. The blade is present, powered on, and running the POST (power on self-tests)

     — `ENABLED`. The blade is on and enabled

     — `DISABLED`. The blade is powered on but disabled

     — `FAULTY`. The blade is faulty because an error was detected

     — `UNKNOWN`. The blade is inserted but its state cannot be determined

Setting the Blade Beacon Mode

When beaconing mode is enabled, the port LEDs will flash amber in a running pattern from port 0 through port 15 and back again. The pattern continues until the user turns it off. This can be used to signal the user to a failing unit.

To enable the blade beacon mode:

1. Log in to the switch as the admin user.

2. At the command line, enter the following command:

   `bladebeacon slotnumber, mode`

   where `slotnumber` is the blade where you want to enable beacon mode, and `mode` is 1 to turn on beaconing, or 0 to turn off beaconing.

Displaying Information on Switch FRUs

To view switch FRU information for a switch:

1. Log in to the switch as the admin user.

2. At the command line, enter the following command:

   `chassisshow`

   This command displays the Field Replaceable Unit (FRU) header content for each object in the chassis. This command returns information for each FRU including:

   — Object ID and object number. Valid values include the following: CHASSIS, FAN, POWER SUPPLY, SW BLADE (switch), CP BLADE (control processor), WWN, or UNKNOWN. The object number refers to the slot number for blades, and unit number for everything else.

   — FRU header version number.

   — The object's power consumption, positive for power supplies, negative for consumers.

   — HP part number (up to 14 characters).

   — HP serial number (up to 12 characters).

   — The date the FRU was manufactured.

   — The date the FRU header was last updated.

   — The cumulative time, in days, that the FRU has been powered on.

   — The current time, in days, since the FRU was last powered on.

   — The externally supplied ID (up to 10 characters).

   — The externally supplied part number (up to 20 characters).

   — The externally supplied serial number (up to 20 characters).

   — The externally supplied revision number (up to 4 characters).

4

Working with the Management Server

This chapter provides information on working with the Management Server platform database.

The Management Server allows a Storage Area Network (SAN) management application to retrieve and administer the fabric and interconnect elements such as switches, servers, and storage devices. It is located at the Fibre Channel well-known address, FFFFFAh.

NOTE: Management Server Platform service is available only with Fabric OS V2.3 and later. If the Management Server Platform service is started on a fabric with any switches of 2.2.x or earlier, the fabric will be segmented.

Configuring Access to the Management Server

An Access Control List (ACL) of WWN addresses determines which systems have access to the Management Server database. If the list is empty (default), the Management Server is accessible to all systems connected in-band to the fabric. For a more secured access, an administrator may specify WWNs in the ACL. These WWNs are usually associated with the management applications. If any WWNs are entered into the ACL then access to the Management Server is restricted to only those WWNs listed in the ACL.

Displaying the Access Control List

To display the Management Server ACL:

1. Log in to the switch as the admin user.

2. At the command line, enter the following command:

    ```
    msConfigure
    ```

3. At the prompt enter 1 to display the access list.

A list of WWNs that have access to the Management Server are displayed. For example:

```
MS Access List consists of (3):
 20:01:00:60:69:00:60:10
 20:02:00:60:69:00:60:10
 20:03:00:60:69:00:60:10
```

Adding a WWN to the Access Control List

To add a WWN to the ACL:

1. Log in to the switch as the admin user.

2. At the command line, enter the following command:

   ```
   msConfigure
   ```

3. At the prompt enter 2 to add a member based on its Port/Node WWN.

4. At the prompt enter the WWN of the member you would like to add to the ACL. For example:

   ```
   20:02:00:60:69:00:60:03
   ```

   Once the action is complete the main menu is displayed.

5. At the prompt enter 1 to verify the WWN you entered was added to the ACL.

6. Once you have verified that the WWN was added correctly, enter 0 at the prompt to end the session.

7. The following prompt is displayed:

   ```
   Update the FLASH?  (yes, y, no, n): [yes]
   ```

8. Press **Enter** to update the flash and end the session.

Deleting a WWN from the Access Control List

To delete a WWN from the ACL:

1. Log in to the switch as the admin user.

2. At the command line, enter the following command:

   ```
   msConfigure
   ```

3. At the prompt enter 3 to delete a member based on its Port/Node WWN.

4. At the prompt enter the WWN of the member you would like to delete from the ACL. For example:

   ```
   20:02:00:60:69:00:60:03
   ```

    Once the action is complete the main menu displays.

5. At the prompt enter 1 to verify the WWN you entered was deleted from the ACL.

6. Once you have verified that the WWN was deleted correctly, enter **0** at the prompt to end the session.

7. The following prompt is displayed:

   ```
   Update the FLASH?  (yes, y, no, n): [yes]
   ```

8. Press **Enter** to update the flash and end the session.

Displaying the Management Server Database

To view the contents of the Management Server Platform Database:

1. Log in to the switch as the admin user.

2. At the command line, enter the following command:

   ```
   msPlatShow
   ```

   The contents of the Management Server Database are displayed. For example:

   ```
   switch:admin> msPlatShow
   ----------------------------------------------------------
   Platform Name: [9] "first obj"
   Platform Type: 5 : GATEWAY
   Number of Associated M.A.: 1
     [35] "http://java.sun.com/products/plugin"
   Number of Associated Node Names: 1
   Associated Node Names:
     10:00:00:60:69:20:15:71
   ----------------------------------------------------------
   Platform Name: [10] "second obj"
   Platform Type: 7 : HOST_BUS_ADAPTER
   Number of Associated M.A.: 1
   Associated Management Addresses:
     [30] "http://java.sun.com/products/1"
   Number of Associated Node Names: 2
   Associated Node Names:
     10:00:00:60:69:20:15:75
   ```

Clearing the Management Server Database

To clear the Management Server Platform Database:

1. Log in to the switch as the admin user.

2. At the command line, enter the following command:

   ```
   msPlclearDB
   ```

   The following message is displayed:

   ```
   Fabric-wise Platform DB Delete operation in progress...
   done ...
   ```

Displaying the Fabric Capability for MS Support

To display the capability of a fabric for Management Server support:

1. Log in to the switch as the admin user.

2. At the command line, enter the following command:

   ```
   msCapabilityShow
   ```

   The name, WWN, and specific Management Server capability are displayed for
   each switch in the fabric.

   ```
   switch:admin> msCapabilityShow
                               Platform
   Switch WWN                  Service Capable  Capability  Name
   =======================     ===============  ==========  =======
   10:00:00:60:69:04:01:94         Yes          0x0000008f  "switch55"
   10:00:00:60:69:10:53:48         Yes          0x0000000b  "switch53"
   10:00:00:60:69:10:54:c8         Yes          0x0000000b  "switch52"
   10:00:00:60:69:02:39:70         Yes          0x0000000b  "switch54"
   10:00:00:60:69:20:10:52         Yes          0x0000000b  "switch43"
   10:00:00:60:69:20:10:2b         No           0x00000009  "switch62"
   10:00:00:60:69:10:53:3c         Yes          0x0000000b  "switch51"
   10:00:00:60:69:04:11:17         Yes          0x0000008f  "switch57"

           Capability Bit Definitions:
                   Bit 0: Basic Configuration Service Supported.
                   Bit 1: Platform Management Service Supported.
                   Bit 2: Topology Discovery Service Supported.
                   Bit 3: Unzoned Name Server Service Supported.
                   Bit 4: M.S. Fabric Zone Service Supported.
                   Bit 5: Fabric Lock Service Supported.
                   Bit 6: Timer Service Supported.
                   Bit 7: RSCN Small Payload Supported.
                   Others: Reserved.
   WARNING! Platform Management Service CAN NOT BE activated for this
   ```

```
Fabric!!!
Done.
```

3. Verify that all the switches in the fabric are capable of Management Server support.

NOTE: In the example above, the fabric does not support Platform Management Service because switch `switch62` is firmware version 2.2. For more information, refer to the `msPlCapabilityShow` command in the *HP StorageWorks Fabric OS Version 3.0.x/4.0.x Reference Guide*.

Activating the Platform Management Service

To activate the Platform Management Service for a fabric:

1. Log in to the switch as the admin user.

2. At the command line, enter the following command:

   ```
   msPlMgmtActivate
   ```

   The following prompt is displayed:

   ```
   Committing configuration...done.
   Request Fabric to activate Platform Management services....
   Done.
   ```

Deactivating the Platform Management Service

To deactivate the Platform Management Service for a fabric:

1. Log in to the switch as the admin user.

2. At the command line, enter the following command:

   ```
   msPlMgmtDeactivate
   ```

3. At the following prompt, enter **Y**, and press **Enter**:

   ```
   This will erase all Platform entries. Are you sure?  (yes, y, no,
   n): [no] y
   Committing configuration...done.
   Request Fabric to Deactivate Platform Management services....
   Done.
   ```

5

Diagnostics and Status

This chapter provides information on diagnostics and displaying port and switch status information.

Diagnostics Overview

The purpose of the diagnostic subsystem is to evaluate the integrity of the system hardware. Diagnostics can be invoked in either of two ways:

- Manually (through the Fabric OS command line)
- During the Power On Self Test (POST)

During these test activities the error messages generated are sent to the console, error logs, and possibly to non-volatile storage. Each of these destinations may adjust the output format slightly to suit the purpose of the output media.

Manual Operation

During manual operation of diagnostics, the switch or blade typically needs to be in an offline state so as not to affect the fabric that the switch is placed in. There are exceptions to this policy. If a diagnostic needs the switch offline and finds that the switch is active, it will not run, and exit without harm to the fabric. Manual tests are useful in fault isolation, and various stress test environments. There is no single test that will give a comprehensive indication of the hardware status. They need to be run in concert to achieve this goal.

POST

POST tests give a quick indication of hardware readiness when new hardware is installed. These tests do not require user input to function. These tests typically operate within a couple of minutes, and support minimal validation due to the restriction on test duration. Their purpose is to give a basic health check before new

hardware is allowed to join a fabric. These tests are divided into two groups: POST1 and POST2. POST1 validates the hardware interconnect of the switch/blade, and POST2 validates the ability of the switch/blade to pass data frames between the ports.

Diagnostic Command Set

The diagnostic command set can be divided into two categories. These are control commands and test commands. The control commands act to support or evaluate the diagnostic operations independent of performing an actual test of hardware circuitry. The test commands test the hardware circuitry and report anomalies when found. There are two basic modes in which diagnostics can be manually run. They are normal interactive mode and burn-in mode. Burn-in mode has additional control commands for its operation.

Diagnostics are also executed in the POST operation, but do not require user command input. They are automatically activated when FRUs are brought on line.

During all three modes of diagnostic operation, the same tests are executed. For example, the `spinSilk` command executed from the command line is the same SpinSilk executed in POST.

Diagnostic test commands:

- `portRegTest`
- `sramRetentionTest`
- `spinSilk`
- `spinFab`
- `crossPortTest`
- `portLoopbackTest`
- `backPort`
- `centralMemoryTest`
- `cmemRetentionTest`
- `cmiTest`
- `camTest`
- `turboramTest`
- `statsTest`
- `portLEDtest`

- `filterTest`
- `bladeDiag`
- `bladeDiagShort`

Diagnostic control commands

- `diagEnablePost`
- `diagDisablePost`
- `diagModeShow`
- `statsClear`
- `diagShow`
- `diagStatus`
- `diagReset`
- `diagCommandShow`
- `diagHelp`
- `forceError`
- `forcePortError`

Interactive Diagnostic Commands

When diagnostics are executed manually (from the telnet command line), many commands require the switch/blade to be in an offline state. This ensures that the activity of the diagnostic does not interfere or disturb normal fabric traffic. If the switch/blade is not in an offline state (switchDisable, bladeDisable), the diagnostic command will not run and display an error message. No one diagnostic can give a complete assessment of the viability of the hardware. The diagnostic commands must be used together to get an overall picture of the health of the switch or blade. If an area of the hardware is suspected of having a fault, then a set of diagnostic commands can be used to isolate and validate the functionality of the hardware.

A series of tests have been captured and structured to allow hardware validation and fault isolation. These have been captured in the `bladeDiag` and `bladeDiagShort` commands. These commands run a set of tests in certain combinations and in various modes to allow a trained user to evaluate the integrity of the hardware, and enable insight as to where a hardware fault is originating.

Displaying the Error Log of a Switch

There are two ways to display the error log of a switch:

- Display the error log one page at a time
- Display the error log all at once

To display the switch error log one page at a time:

1. Log in to the switch as the admin user.

2. At the command line, enter the following command:

   ErrShow

To display the switch error log all at once:

1. Log in to the switch as the admin user.

2. At the command line, enter the following command:

   ErrDump

Displaying the Switch Status

The switch status can be either Healthy/OK, Marginal/Warning, or Down. The overall status of a switch is determined by the status of several individual components within the switch. For more information on how the overall switch status is determined, refer to the switchStatusPolicySet command in the *HP StorageWorks Fabric OS Version 3.0.x/4.0.x Reference Guide*.

To display the overall status of a switch:

1. Log in to the switch as the admin user.

2. At the command line, enter the following command:

   switchStatusShow

   The status of the switch should be Healthy/OK. If the status is Marginal/Warning or Down, the components contributing to this status are displayed.

Displaying Information About a Switch

To display switch information:

1. Log in to the switch as the admin user.

2. At the command line, enter the following command:

   `switchShow`

   This command displays the following information for a switch:

   — switchName - the switch's name.

   — switchType - The switch's model and firmware version numbers.

   — switchState - The switch's state: Online, Offline, Testing, or Faulty.

   — switchRole - The switch's role: Principal, Subordinate, or Disabled.

   — switchDomain - The switch's domain ID.

   — switchId - The switch's embedded port D_ID.

   — switchWwn - The switch's World Wide Name.

   — switchBeacon - The switch's beaconing state: either ON or OFF.

   This command also displays the following information for ports on the specified switch:

   — Module type - The GBIC type if a GBIC is present.

   — Port speed - The speed of the Port (1G, 2G, N1, N2, or AN). The speed can be fixed, negotiated, or auto negotiated.

   — Port state - The port status.

   — Comment - Displays information about the port. May be blank or including WWN for F_port or E_port, Trunking state, upstream or downstream status.

   For more information, refer to the `switchShow` command in the *HP StorageWorks Fabric OS Version 3.0.x/4.0.x Reference Guide*.

Displaying the Uptime Of The Switch

To display the uptime for a switch:

1. Log in to the switch as the admin user.

2. At the command line, enter the following command:

   `uptime`

   This command displays the length of time the system has been in operation, the total cumulative amount of "up time" since the system was first powered-on, the date and time of the last reboot, and the reason for the last reboot.

The reason for the last switch reboot is also recorded in the error log.

Displaying the Status of a Port

There are two types of statistics you can view for a port:

- Software statistics
- Hardware statistics

Displaying Software Statistics for a Port

Software statistics for a port include information such as port state, number of interrupts, number of link failures, number of loss of synchronization warnings, and number of loss of signal warnings.

To display the software statistics for a port:

1. Log in to the switch as the admin user.

2. At the command line, enter the following command:

   `portShow slotnumber/portnumber`

   where `slotnumber` and `portnumber` are the port location you want to view. A table of software statistics for the port is displayed.

   NOTE: For more information on the `portShow` command, refer to the *HP StorageWorks Fabric OS Version 3.0.x/4.0.x Reference Guide*.

Displaying Hardware Statistics for a Port

Hardware statistics for a port include information such as number of frames received, number of frames sent, number of encoding errors received, and number of class 2 and 3 frames received.

To display the hardware statistics for a port:

1. Log in to the switch as the admin user.

2. At the command line, enter the following command:

   `portStatsShow slotnumber/portnumber`

   where `slotnumber` and `portnumber` are the port location you want to view. A table of hardware statistics for the port is displayed.

   NOTE: For more information on the `portStatsShow` command, refer to the *HP StorageWorks Fabric OS Version 3.0.x/4.0.x Reference Guide*.

Displaying a Summary of Port Errors

This command displays a summary of port errors for all the ports in a single switch.

To display a summary of port errors for a switch:

1. Log in to the switch as the admin user.

2. At the command line, enter the following command:

   `portErrshow`

   The display contains one output line per port. The following table explains the types of errors counted:

   NOTE: For more information on the `portErrShow` command, refer to the *HP StorageWorks Fabric OS Version 3.0.x/4.0.x Reference Guide*.

Table 5–1: Error Summary Description

Error Type	Description
frames tx	Frames transmitted.
frames rx	Frames received.
enc in	Encoding errors inside frames.
crc err	Frames with CRC errors.
too shrt	Frames shorter than minimum.

Table 5–1: Error Summary Description (Continued)

`too long`	Frames longer than maximum.
`bad eof`	Frames with bad end-of-frame delimiters.
`enc out`	Encoding error outside of frames.
`disc c3`	Class 3 frames discarded.
`link fail`	Link failures (LF1 or LF2 states).
`loss sync`	Loss of synchronization.
`loss sig`	Loss of signal.
`frjt`	Frames rejected with F_RJT.
`fbsy`	Frames busied with F_BSY.

Displaying the Fan Status

To display the fan status of a switch:

1. Log in to the switch as the admin user.

2. At the command line, enter the following command:

   `fanShow`

   The possible values for fan status are shown in Table 5–2.

Table 5–2: Fan Status Values

Fan Status Value	Description
`OK`	Fan is functioning correctly
`absent`	Fan is not present.
`below minimum`	Fan is present but rotating too slowly or stopped.

Displaying Power Supply Status

To display the power supply status of a switch:

1. Log in to the switch as the admin user.

2. At the command line, enter the following command:

   `psShow`

The possible values for power supply status are shown in Table 5–3.

Table 5–3: Power Supply Status Values

Power Supply Status Values	Description
OK	Power supply present and functioning correctly.
absent	Power supply not present.
faulty	Power supply present but faulty (no power cable, power switch turned off, fuse blown, or other internal error).

After the status line, a power supply identification line may be shown. If present, this line contains manufacture date, part numbers, serial numbers, and other identification information.

Displaying the Temperature Status

To display the temperature status of a switch:

1. Log in to the switch as the admin user.

2. At the command line, enter the following command:

   tempShow

   This command displays current temperature readings from each of the five temperature sensors located on the main printed circuit board of the switch. The sensors are located, approximately, one in each corner and one at the center of the PCB.

Running Diagnostic Tests on the Switch Hardware

There are several diagnostic tests you can run on a switch. These tests are generally run during the POST, each time a switch is booted up.

- camtest
- centralMemoryTest
- cmemRetentionTest
- cmiTest
- crossPortTest

- portLoopbackTest
- sramRetentionTest
- turboRamTest
- statsTest
- spinSilk

Glossary

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

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

See also port card.

8b/10b Encoding
An encoding scheme that converts each 8-bit byte into 10 bits. Used to balance ones and zeros in high-speed transports.

Access Control List
Enables an organization to bind a specific WWN to a specific switch port or set of ports, preventing a port in another physical location from assuming the identity of a real WWN. May also refer to a list of the Read/Write access of a particular community string.

See also device connection controls.

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

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

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

Admin Account
A login account intended for use by the customer to control switch operation.

See also account level switches.

AL_PA

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

Alias

An alternate name for an element or group of elements in the fabric. Aliases can be used to simplify the entry of port numbers and WWNs when creating zones.

Alias Address Identifier

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

See also alias.

Alias AL_PA

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

See also AL_PA.

Alias Server

A fabric software facility that supports multicast group management.

ANSI

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

API

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

Arbitrated Loop

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

See also topology.

Arbitrating State

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

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

ASIC
Application Specific Integrated Circuit.

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

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

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

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

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

See also FCS switch, primary FCS switch.

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

See also throughput.

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

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

Beacon

When all the port LEDs on a switch are set to flash from one side of the switch to the other, to enable identification of an individual switch in a large fabric. A switch can be set to beacon by telnet command or through Web Tools.

Beaconing

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

See also Beacon.

Beginning Running Disparity

The disparity at the transmitter or receiver when the special character associated with an ordered set is encoded or decoded.

See also disparity.

BER

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

See also error.

Bit Synchronization

See BER.

Blade

See 16-port card.

Blind-mate Connector

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

Block

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

Blower Assembly

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

Boot Flash

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

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

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

See also multicast, unicast.

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

See also BB_Credit.

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

See also fabric, ISL.

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

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

See also link.

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

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

Class 3

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

Class F

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

Class of Service

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

CLI

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

CLS

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

Comma

A unique pattern (either 1100000 or 0011111) used in 8b/10b encoding to specify character alignment within a data stream.

See also K28.5.

Community (SNMP)

A relationship between a group of SNMP managers and an SNMP agent, in which authentication, access control, and proxy characteristics are defined.

See also SNMP.

Compact Flash

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

Configuration

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

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

May also refer to a set of zones.

See also zone configuration.

Connection Initiator

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

Connection Recipient

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

Control Panel

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

Core Switch

A switch whose main task is to interconnect other switches.

See also SAN switch.

CP Card

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

CRC

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

Credit

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

See also BB_Credit, EE_Credit.

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

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

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

See also fill word, LPSM.

Cut-through
A switching technique that allows the route for a frame to be selected as soon as the destination address is received.

See also route.

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

See also frame, ordered set, transmission word.

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

See also RS-232 port.

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

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

See also DTE port, RS-232 port.

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

See also enabled zone configuration, zone configuration.

Device Connection Controls
Enables organizations to bind an individual device port to a set of one or more switch ports. Device ports are specified by a WWN and typically represent HBAs (servers).

See also access control lists.

Device
A disk, a RAID, or an HBA.

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

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

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

DTE port
A data terminal equipment port capable of interfacing to a transmission circuit through a connection to a DCE (data communications equipment) port. DTE devices with an RS-232 (or EIA-232) port interface transmit on pin 3, and receive on pin 2 in a 9-pin connector (reversed in 25-pin connectors).

See also DCE port, RS-232 port.

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

E_D_TOV

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

See also R_A_TOV, RR_TOV.

E_Port

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

See also ISL.

EE_Credit

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

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

EIA Rack

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

ELWL

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

Also known as XLWL.

Enabled Zone Configuration

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

See also defined zone configuration, zone configuration.

End-to-end Flow Control

Governs flow of class 1 and 2 frames between N_Ports.

See also EE_Credit.

Entry Fabric

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

Error

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

See also loop failure.

ESD

Electrostatic Discharge.

Exchange

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

Extended Fabric

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

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

F_Port

Fabric Port. A port that is able to transmit under fabric protocol and interface over links. Can be used to connect an N_Port to a switch.

See also FL_Port, Fx_Port.

Fabric

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

See also topology, SAN, cascade.

Fabric Access

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

Fabric Access allows the application to control the fabric directly for functions such as discovery, access (zoning), management, performance, and switch control. Consists of a host-based library that interfaces the application to switches in the fabric over an out-of-band TCP/IP connection or in-band using an IP-capable Host Bus Adapter (HBA).

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

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

See also QuickLoop.

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

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

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

Fabric OS
The proprietary operating system on HP StorageWorks switches.

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

Allows the SAN manager to monitor key fabric and switch elements, making it easy to quickly identify and escalate potential problems. It monitors each element for out-of-boundary values or counters and provides notification when defined boundaries are exceeded. The SAN manager can configure which elements, such as error, status, and performance counters, are monitored within an HP switch.

See also Fabric Manager.

Factory Account

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

See also account level switches.

Failover

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

FAN

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

FC-AL-3

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

FC-FLA

The Fibre Channel Fabric Loop Attach standard defined by ANSI.

FCIA

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

FCP

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

FC-PH-1, 2, 3

The Fibre Channel Physical and Signaling Interface standards defined by ANSI.

FC-PI

The Fibre Channel Physical Interface standard defined by ANSI.

FC-PLDA

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

FCS switch

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

See also backup FCS switch, primary FCS switch.

FC-SW-2

The second generation of the Fibre Channel Switch Fabric standard defined by ANSI. Specifies tools and algorithms for the interconnection and initialization of Fibre Channel switches in order to create a multi-switch Fibre Channel fabric.

Fibre Channel Transport

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

See also FSP.

FIFO

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

Fill Word

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

Firmware Download

Loading firmware down from a server into a switch.

Firmware

The basic operating system provided with the hardware.

FL_Port

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

See also F_Port, Fx_Port.

Flash Partition

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

Flash

Programmable NVRAM memory that maintains its contents.

FLOGI

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

See also PLOGI.

Frame

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

See also Data Word.

FRU

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

FS_ACC

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

FS_IU

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

FS_REQ

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

FS_RJT

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

FS

Fibre Channel Service. A service that is defined by Fibre Channel standards and exists at a well-known address. For example, the Simple Name Server is a Fibre Channel service.

See also FSP.

FSPF

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

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

See also FS.

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

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

See also half-duplex.

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

See also F_Port, FL_Port.

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

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

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

See also SFP.

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

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

Half-duplex

A mode of communication that allows a port to either transmit or receive frames at any time, but not simultaneously (with the exception of link control frames, which can be transmitted at any time).

See also full-duplex.

Hard Address

The AL_PA that an NL_Port attempts to acquire during loop initialization.

Hardware Translative Mode

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

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

HBA

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

High Availability

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

Host

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

See also workstation.

Hot Pluggable

A FRU capability that indicates it may be extracted or installed while customer data is otherwise flowing in the chassis.

Hub

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

IBTA

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

Idle

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

Infiniband

See IBTA.

Initiator

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

See also Target.

Integrated Fabric

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

IOD

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

IPA

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

Isolated E_Port

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

See also E_Port.

ISL

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

See also E_Port, cascade, ISL trunking.

ISL Trunking
An HP feature that enables distribution of traffic over the combined bandwidth of up to four ISLs (between adjacent switches), while preserving in-order delivery. A set of trunked ISLs is called a trunking group; each port employed in a trunking group is called a trunking port.

See also Master Port.

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

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

See also RAID.

K28.5
A special 10-bit character used to indicate the beginning of a transmission word that performs Fibre Channel control and signaling functions. The first seven bits of the character are the comma pattern.

See also comma.

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

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

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

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

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

See also Non-participating Mode, Participating Mode.

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

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

Link Services
A protocol for link-related actions.

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

See also Circuit.

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

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

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

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

See also BB_Credit.

Loop Circuit
A temporary bidirectional communication path established between L_Ports.

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

See also error.

Loop Initialization

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

Loop_ID

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

Looplet

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

LPSM

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

LWL

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

See also SWL.

Master Port

As relates to trunking, the port that determines the routing paths for all traffic flowing through the trunking group. One of the ports in the first ISL in the trunking group is designated as the master port for that group.

See also ISL Trunking.

Media

See transceiver.

MIB

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

Modem Serial Port

The upper serial port on the CP Card of the StorageWorks Core switch. Can be used to connect the CP Card to a modem with a standard 9-pin modem cable. Consists of a DB-9 connector wired as a RS-232 device, and can be connected by serial cable to a DCE device. A Hayes-compatible modem or Hayes-emulation is required. The device name is ttyS1.

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

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

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

See also broadcast, unicast.

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

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

See also NL_Port, Nx_Port.

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

Name Server
Frequently used to indicate Simple Name Server.

See also SNS.

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

Negotiate
See auto-negotiate speed and autosense.

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

See also N_Port, Nx_Port.

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

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

Non-participating Mode
A mode in which an L_Port in a loop is inactive and cannot arbitrate or send frames, but can retransmit any received transmissions. This mode is entered if there are more than 127 devices in a loop and an AL_PA cannot be acquired.

See also L_Port, Participating Mode.

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

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

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

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

OPN
Open Primitive Signal.

Ordered Set
A transmission word that uses 8B/10B mapping and begins with the K28.5 character. Ordered sets occur outside of frames, and include the following items:

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

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

Packet
A set of information transmitted across a network.

See also Frame.

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

See also L_Port, Non-participating Mode.

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

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

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

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

Also known as phantom AL_PA.

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

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

See also FLOGI.

Point-to-point
A Fibre Channel topology that employs direct links between each pair of communicating entities.

See also topology.

Port Cage

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

Port Card

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

See also 16-port card.

Port Module

A collection of ports in a switch.

Port_Name

The unique identifier assigned to a Fibre Channel port. Communicated during login and port discovery.

POST

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

Primary FCS Switch

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

See also backup FCS switch, FCS switch.

Private Device

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

Private Loop

An arbitrated loop that does not include a participating FL_Port.

Private NL_Port

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

Protocol

A defined method and a set of standards for communication.

PSU

Power Supply Unit.

Public Device
A device that supports arbitrated loop protocol, can interpret 8-bit addresses, and can log into the fabric.

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

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

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

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

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

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

The QuickLoop/Fabric Assist feature also allows:

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

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

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

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

See also E_D_TOV, RR_TOV.

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

RAID
Redundant Array of Independent Disks. A collection of disk drives that appear as a single volume to the server and are fault tolerant through mirroring or parity checking.

See also JBOD.

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

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

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

See also service rate.

RLS Probing
Read link status of the AL_PAs.

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

See also account level switches.

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

See also FSPF.

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

RR_TOV

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

See also E_D_TOV, R_A_TOV.

RS-232 port

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

See also DCE port, DTE port.

RSCN

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

RX_ID

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

SAN

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

See also fabric.

SAN Switch

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

See also core switch.

SCSI

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

SDRAM

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

See also flash.

Sequence

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

Service Rate

The rate at which an entity can service requests.

See also request rate.

SFF

Small Form Factor.

SFP Cable

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

SFP

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

See also GBIC.

SID/DID

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

Single Mode

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

See also multimode, LWL, ELWL, and XLWL.

SI

Sequence Initiative.

SNMP

Simple Network Management Protocol. An internet management protocol that uses either IP for network-level functions and UDP for transport-level functions, or TCP/IP for both. Can be made available over other protocols, such as UDP/IP, because it does not rely on the underlying communication protocols.

See also Community (SNMP).

SNMPv1

The original SNMP, now labeled v1.

SNS

Simple Name Server. A switch service that stores names, addresses, and attributes for up to 15 minutes, and provides them as required to other devices in the fabric. SNS is defined by Fibre Channel standards and exists at a well-known address. May also be referred to as directory service.

See also FS.

StorageWorks SAN switch

The brand name for the HP family of switches.

Switch Name

The arbitrary name assigned to a switch.

Switch Port

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

Switch

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

SWL

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

See also LWL.

Tachyon

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

Target

A storage device on a Fibre Channel network.

See also Initiator.

Tenancy

The time from when a port wins arbitration in a loop until the same port returns to the monitoring state. Also referred to as loop tenancy.

Terminal Serial Port
May also be referred to as the console port. The lower serial port on the CP Card of the StorageWorks Core switch. This port sends switch information messages and can receive commands. Can be used to connect the CP Card to a computer terminal. Has an RS-232 connector wired as a DTE device, and can be connected by serial cable to a DCE device. The connector pins two and three are swapped so that a straight-through cable can be used to connect to a terminal. The device name is ttyS0.

See also DCE port, modem serial port.

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

See also bandwidth.

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

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

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

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

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

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

Transmission Word
A group of four transmission characters.

See also data word.

Trap (SNMP)

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

See also SNMP.

Trunking

See ISL Trunking.

Tunneling

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

U_Port

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

UDP

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

ULP_TOV

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

ULP

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

Unicast

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

See also broadcast, multicast.

user account

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

See also account level switches.

VC

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

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

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

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

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

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

Also known as ELWL.

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

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

See also Zoning.

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

See also alias.

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

See also defined zone configuration, enabled zone configuration.

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

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

See also zone configuration.

Zone Set
See zone configuration.

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

See also zone.

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