hp StorageWorks

advanced performance monitoring version 3.0.x/4.0.x user guide

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This user guide provides an overview of and installation instructions for Advanced Performance Monitoring. In addition, this guide provides information on configuring and using the Advanced Performance Monitoring telnet commands.

hp invent

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About this Guide

This guide provides information to help you:

- Understand and install Advanced Performance Monitoring

- Configure and use the Advanced Performance Monitoring telnet commands

- 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

Introducing Advanced Performance Monitoring

This chapter provides the following information:

- Overview on page 1–1
- Performance Monitoring with Telnet Commands on page 1–3
- Performance Monitoring with Web Tools on page 1–4

Overview

Advanced Performance Monitoring is a comprehensive tool for monitoring the performance of networked storage resources. This tool helps reduce total cost of ownership and over-provisioning while enabling SAN performance tuning, reporting of service level agreements, and greater administrator productivity.

Advanced Performance Monitoring provides SAN performance management through an end-to-end monitoring system that provides:

- Increased end-to-end visibility into the fabric
- More accurate reporting for service level agreements and charged access applications
- Improved performance tuning and resource optimization
- Shortened troubleshooting time
- Better capacity planning
- Increased productivity with preformatted and customizable screens and reports

Advanced Performance Monitoring is an optionally licensed product that runs on HP StorageWorks Core Switch 2/64 (Core Switch 2/64) series and StorageWorks 2 Gb SAN switches (StorageWorks SAN Switch 2/16, 2/8 EL, and 2/16 EL). If you have a fabric that includes StorageWorks 1 Gb SAN switches, you can take advantage of the

end-to-end performance monitoring features by installing a Core Switch 2/64 series or StorageWorks 2 Gb SAN switch anywhere in the path between the Source ID and the Destination ID.

You can administer performance monitoring through either telnet commands or Web Tools.

Terminology Used in this Document

Table 1–1 shows the terminology used in this book.

Table 1–1: Terminology

Term	Definition
AL_PA	Arbitrated Loop Physical Address. An 8-bit value used to uniquely identify an individual port within a loop. A loop may have one or multiple AL_PAs.
SID	3-byte Source ID of the originator device, in the "0xDomainAreaALPA" (0xDDAAPP) format.
DID	3-byte Destination ID of the destination device, in the "0xDomainAreaALPA" (0xDDAAPP) format.
CRC	Cyclic redundancy check; an error detection method. The CRC is 32-bits in the frame, after the data field, and before the EOF (end of frame).
FILTER	A pattern of values in the frame header to be matched for the Fibre Channel frames being transmitted and received by the port.
MASK	A field made up of hexadecimal values that are used to include or exclude portions of a frame header for a possible match.

Features

The Advanced Performance Monitoring product:

- Measures the bandwidth consumed by individual routes (host-target pairs)

- Provides device performance measurements by port, AL_PA, and LUN

- Reports CRC error measurement statistics

- Measures Trunking performance

- Compares IP versus SCSI traffic on each port

- Includes a wide range of predefined reports
- Allows you to create customized user-defined reports

Performance Monitoring with Telnet Commands

Telnet commands provide three different types of performance monitoring:

- AL_PA monitoring
- End-to-end monitoring
- Filter-based monitoring

Refer to Chapter 3 for detailed information on how to use the telnet commands through a command line interface to monitor performance.

AL_PA Error Performance Monitoring

AL_PA error performance monitoring provides information regarding the number of CRC errors in Fibre Channel frames in a loop configuration. AL_PA error performance monitoring collects CRC error counts for each AL_PA attached to a specific port.

End-to-end Monitoring

End-to-end monitoring provides information regarding performance between the source (SID) and destination (DID) on a fabric or a loop. SIDs and DIDs are in World Wide Name (WWN) format and are available from other switch commands. Up to eight SID-DID pairs can be specified per port. For each of the SID-DID pairs, the following information is available:

- CRC error count on the frames for the SID-DID pair
- Fibre Channel words that have been transmitted through the port for the SID-DID pair
- Fibre Channel words that have been received by the port for the SID-DID pair

Filter-based Monitoring

Filter-based monitoring provides information about a filter's hit count. All user-defined filters are matched for all Fibre Channel (FC) frames being transmitted from a port.

A filter consists of a set of elements in the following format:

{*offset, value 0[, value 1, ..., value 3*]}

      A   B
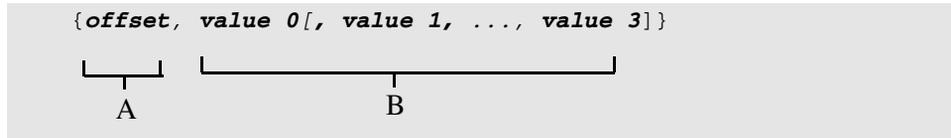
In the previous example, **offset** (A) is the byte offset value in the header of the FC frame and **value 0[, value 1, ..., value 3]** (B) is a user-defined value, or a set of user-defined values. At least one value must be specified (**value 0**), but you can specify up to four values.

For a filter to be matched, all the elements specified in the filter must provide a match.

For an element to produce a match, the value at offset (A) in the frame being transmitted must match at least one of the user-defined values (B).

The range of offsets that can be matched using filters is 0 to 63. Examples of FC Frame statistics that can be measured using filters are:

- SCSI Read, Write, or Read/Write commands
- IP versus SCSI traffic comparison

Performance Monitoring with Web Tools

You can monitor performance using Web Tools. The enhanced Advanced Performance Monitoring features in Web Tools provide:

- Predefined reports for AL_PA error, end-to-end, and filter-based performance monitoring
- User-definable reports
- Performance canvas for application level or fabric level views
- Configuration editor (save, copy, edit, and remove multiple configurations)
- Persistent graphs across reboots (saves parameter data across reboots)
- Print capabilities

For more information on using the Web Tools to administer Advanced Performance Monitoring, see Chapter 3.

2

Installing Advanced
Performance Monitoring

This chapter provides the following information:

- Overview on page 2–1
- Installing through Telnet on page 2–1
- Installing through Telnet on page 2–1

Overview

To enable Advanced Performance Monitoring, you must install a license on each switch that will use this feature. Contact your switch supplier to obtain a license.

NOTE: A license may have already been installed on the switch at the factory.

You can install a Advanced Performance Monitoring license through telnet commands or through Web Tools.

Version 3.0.x of Advanced Performance Monitoring requires a StorageWorks 2 Gb SAN switch (StorageWorks SAN Switch 2/16, 2/8 EL, and 2/16 EL) with Fabric OS 3.0.x or above installed.

Advanced Performance Monitoring V4.0.x requires a Core Switch 2/64 series switch with Fabric OS 4.0.x or above installed.

Installing through Telnet

1. Log onto the switch using telnet (refer to the *HP StorageWorks Fabric Operating System Procedures Version 3.0.x/4.0.x User Guide* for details), using an account with administrative privileges.

2. Type `licenseShow` on the telnet command line to determine whether an Advanced Performance Monitoring license is already installed on the switch. A list of all the licenses currently installed on the switch displays.

Example:

```
admin> licenseShow
1A1AaAaaaAAA1a:
     Zoning license
1A1AaAaaaAAA2a:
     Web license
```

If the Advanced Performance Monitoring license is not included in the list, continue with step 3.

3. Enter the following on the command line:

   licenseAdd "*key***"**

   where "*key*" is the license key exactly as provided by your switch supplier, surrounded by double quotes. The license key is case-sensitive and must be entered exactly as given.

4. Verify the license was successfully added by entering licenseShow on the command line.

   Example:

```
admin> licenseShow
1A1AaAaaaAAA1a:
     Zoning license
1A1AaAaaaAAA2a:
     Web license
1A1AaAaaaAAA3a:
     Performance Monitor license
```

   The Advanced Performance Monitoring features are available as soon as the license is added.

Installing through Web Tools

You can install the Advanced Performance Monitoring license through Web Tools by performing the following steps:

1. Launch a web browser, enter the switch name or IP address in the **Location/Address** field of the browser, and press **Enter**.

   Web Tools launches, displaying the Fabric View as shown in Figure 2–1.
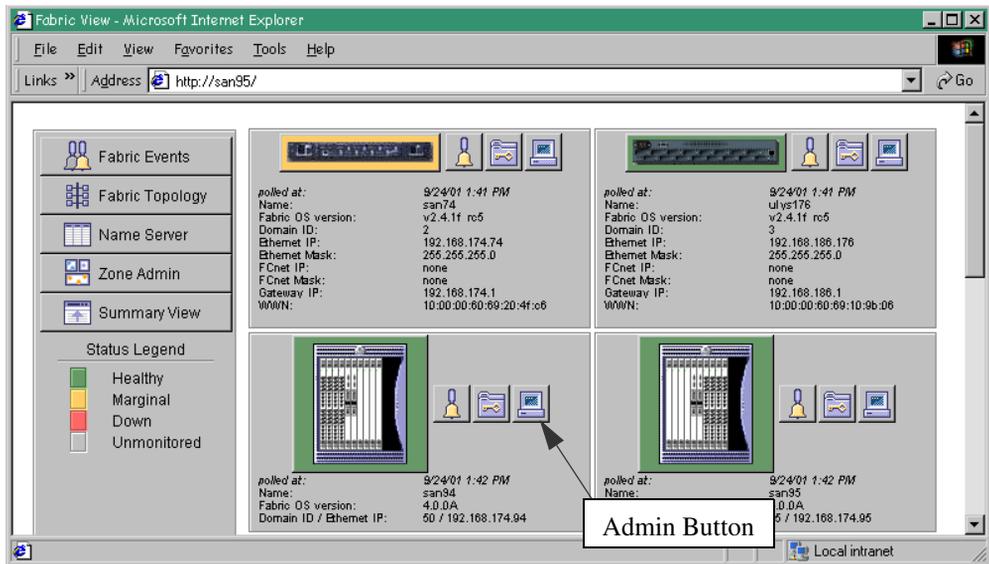
Figure 2–1: Fabric view

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

   The logon window displays, as shown in Figure 2–2.
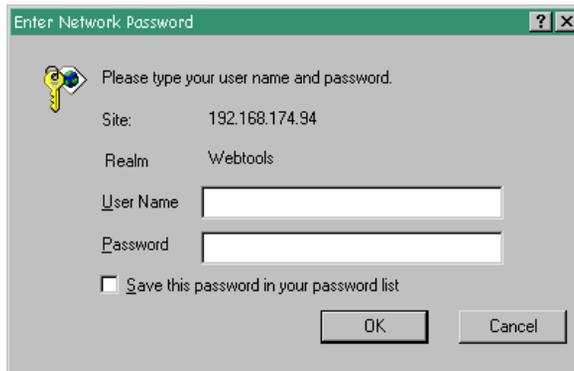
Figure 2–2: Login window

3. Enter a user name and password with administrative privileges and press **Enter**. The administrator account user name and default password is "admin" and "password".

The Administration View displays. (See Figure 2–3 on page 2–4.)

4. Select the **License Admin** tab. Figure 2–3 shows a typical **License Admin** tab screen.
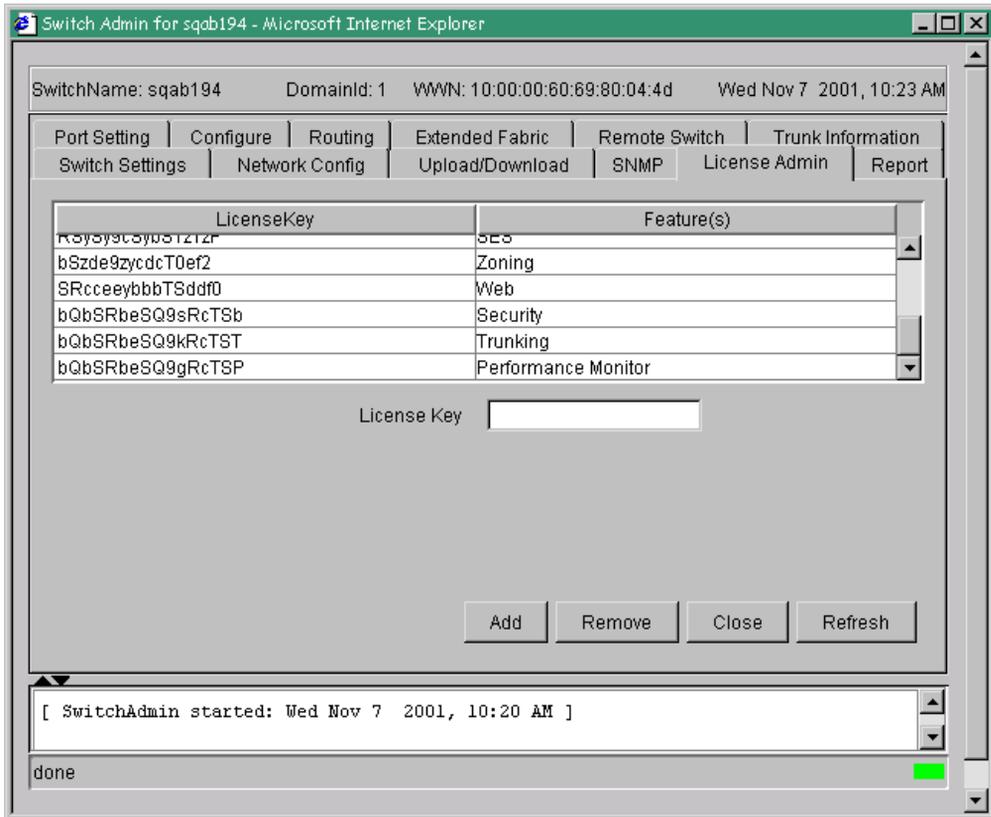
Figure 2–3: License Admin tab

5. Enter the license key in the **License Key** field exactly as provided by your switch supplier, and click **Add**.

The Advanced Performance Monitoring features are available as soon as the license is added.

For more information about Web Tools, refer to the *HP StorageWorks Web Tools Version 3.0.x/4.0.x User Guide*.

3

Using Advanced Performance Monitoring

This chapter provides the following information:

- Overview on page 3–1
- Using Web Tools on page 3–2
    - — Predefined Performance Graphs on page 3–5
    - — User-defined Graphs on page 3–6
    - — Performance Graph Formats on page 3–7
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- Telnet Commands on page 3–11
    - — AL_PA Error Performance Monitoring on page 3–12
    - — End-to-end Performance Monitoring on page 3–13
    - — Filter-based Performance Monitoring on page 3–20
    - — Saving and Restoring Monitor Configuration on page 3–25

Overview

You can administer Advanced Performance Monitoring through telnet commands or through Web Tools. This chapter provides a brief description of performance monitoring through Web Tools. It also describes how to fully administer Advanced Performance Monitoring through telnet commands.

For additional information about performance monitoring through Web Tools, refer to the *HP StorageWorks Web Tools Version 3.0.x/4.0.x User Guide*.

Using Web Tools

Accessing Performance Monitor through Web Tools

Switch performance can be monitored from the Switch View of Web Tools. To access Performance Monitor, click the **Perf** icon in Switch View. You can access Performance Monitor through Web Tools by performing the following steps:

1. Launch Web Tools. The Fabric View displays.

2. Click on the **Switch** icon of the switch you want to monitor. This will launch the Switch View, see Figure 3–1.
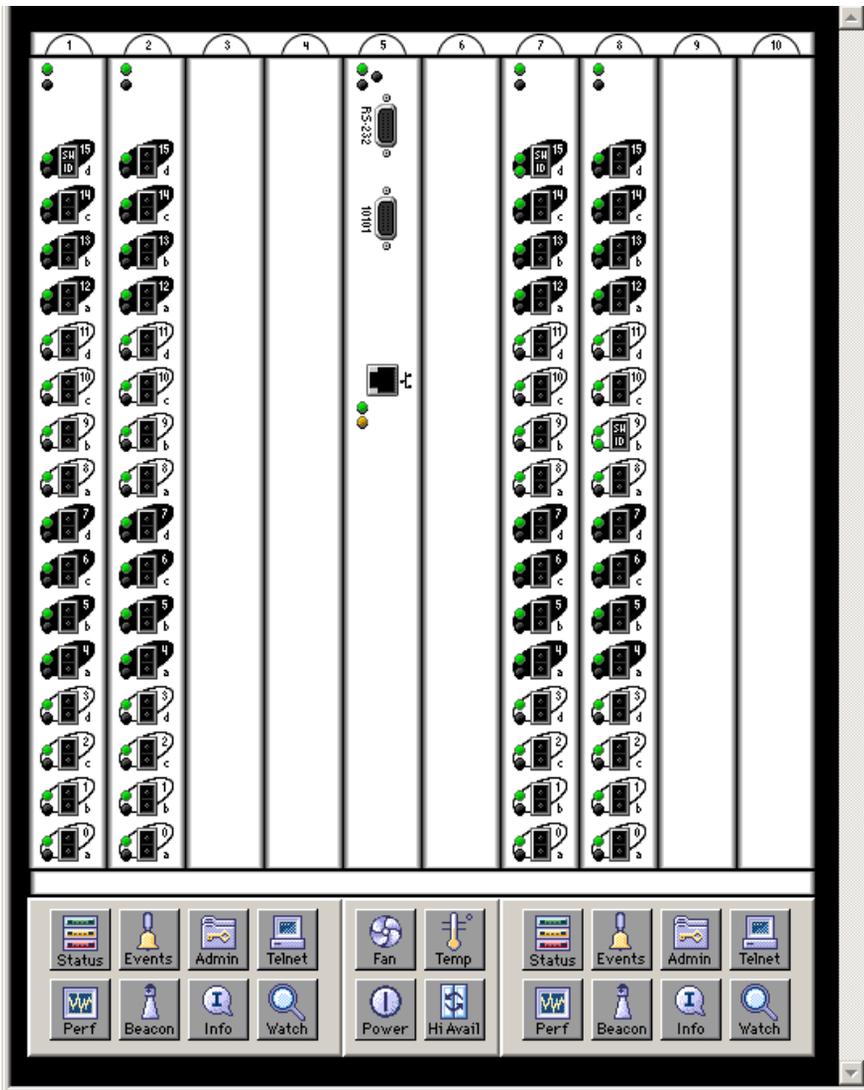
Figure 3–1: Switch View in Web Tools

3. Click on the **Perf** icon in the Switch View, launching the Performance Monitor window.

Figure 3–2 shows the Performance Monitor window.
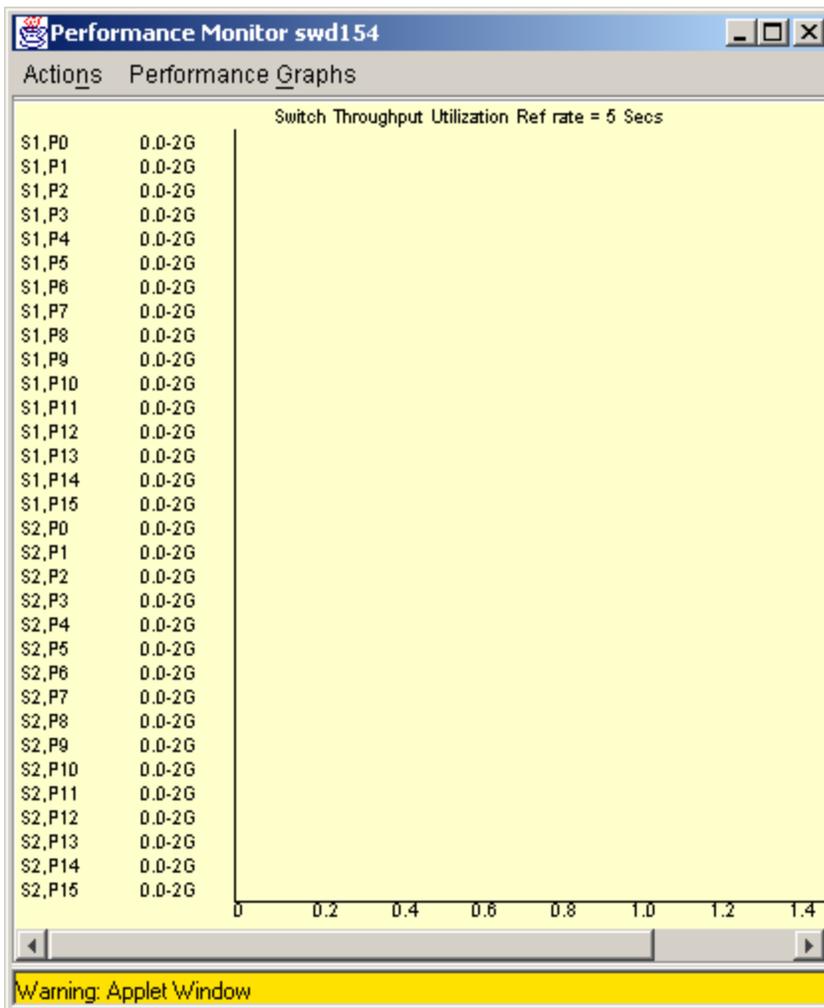
Figure 3–2: Performance Monitor window

Predefined Performance Graphs

Predefined graphs are provided to simplify performance monitoring. A wide range of end-to-end fabric, logical unit number (LUN), device, and port metrics are included. Table 3–1 lists the predefined performance graphs available with both basic and advanced performance monitoring.

Table 3–1: Predefined Performance Graphs

Basic Monitoring	Description
Port Throughput	Displays the performance of a port based in four-byte frames received and transmitted.
Switch Aggregate Throughput	Displays the aggregate performance of all ports of a switch.
Switch Throughput Utilization	Displays the port throughput at the time the sample is taken.
Port Error	Displays a line of CRC errors for a given port.
Switch Percent Utilization	Displays the percentage of usage of a chosen switch at the time the sample is taken.
Port Snapshot Error	Displays the CRC error count between sampling periods for all the ports on a switch.
Advanced Monitoring[1]	**Description**
SID/DID Performance	Displays the traffic between an SID (or WWN) and a DID (or WWN) pair on the switch being managed.
SCSI vs. IP Traffic	Displays percentage of SCSI versus IP frame traffic on each individual port.
AL_PA Errors	Displays CRC errors for a given port and a given AL_PA.
SCSI Commands by port and LUN (R, W, R/W)	Displays the total number of Read/Write commands on a given port to a specific LUN.

1. These graphs are available only when a Advanced Performance Monitoring license is installed.

Figure 3–3 shows how to access the list of predefined Advanced Performance Monitoring graphs in Web Tools.
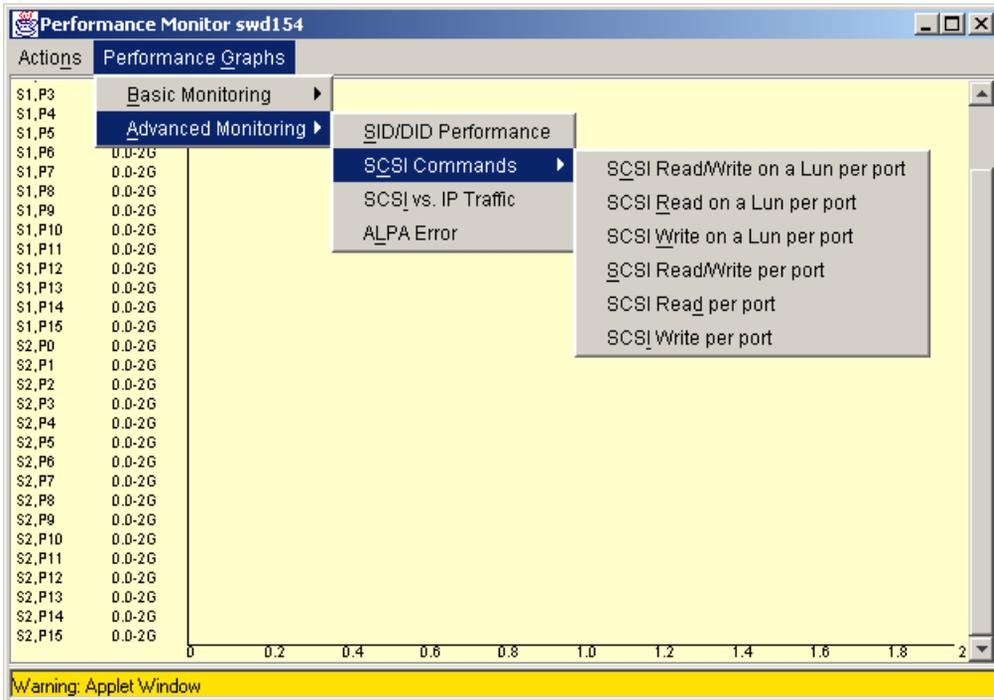
Figure 3–3: Accessing predefined performance graphs

User-defined Graphs

The predefined graphs can be modified based on parameter fields such as SID/DID, LUN, AL_PA, and port. These new user-defined graphs can be added and saved to canvas configurations. Figure 3–4 shows a list of user-defined graphs defined in a canvas.

Please select a Graph that you wish to edit:

Port Throughput,Port=5

SCSI Read/Write on a Lun per port,Port=3,Lun=0023002056000067

SID/DID Performance,Port=3,Sid=20:00:00:20:37:30:d0:73,Did=20:00:00:20:37:30:b4:7b

SCSI Read/Write on a Lun per port,Port=4,Lun=0045000060000000

SID/DID Performance,Port=3,Sid=668210,Did=69121B

Save	Edit	Add	Remove	Cancel
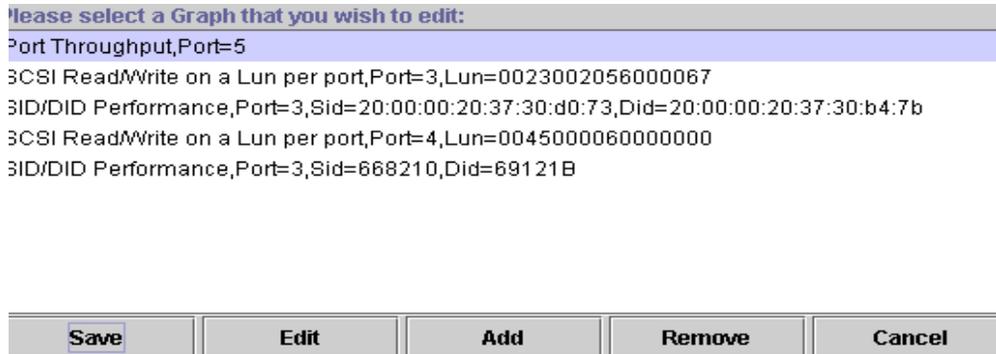
Figure 3–4: User-defined graphs

Performance Graph Formats

Performance graphs can be displayed as vertical bar charts, horizontal bar charts, and line charts, as shown in Figure 3–5.
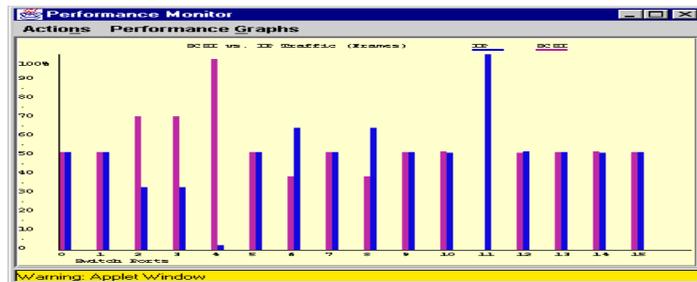
Vertical Bar Charts
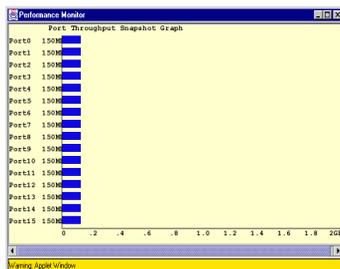
Horizontal Bar Charts
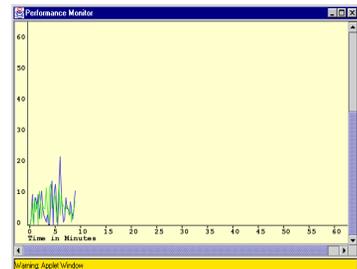
Line Charts

Figure 3–5: Types of performance graphs

In addition to the charts, the Advanced Performance Monitoring Resource Usage Display (shown in Figure 3–6) shows which filter slots have been used for each port, and which are available. The color-coded interface makes troubleshooting easier.

Figure 3–6: Advanced Performance Monitoring resource usage display

Performance Graph Canvas

Use the enhanced performance monitoring in Web Tools to set up a canvas of performance graphs. The canvas can hold up to eight graphs per window, as shown in Figure 3–7.
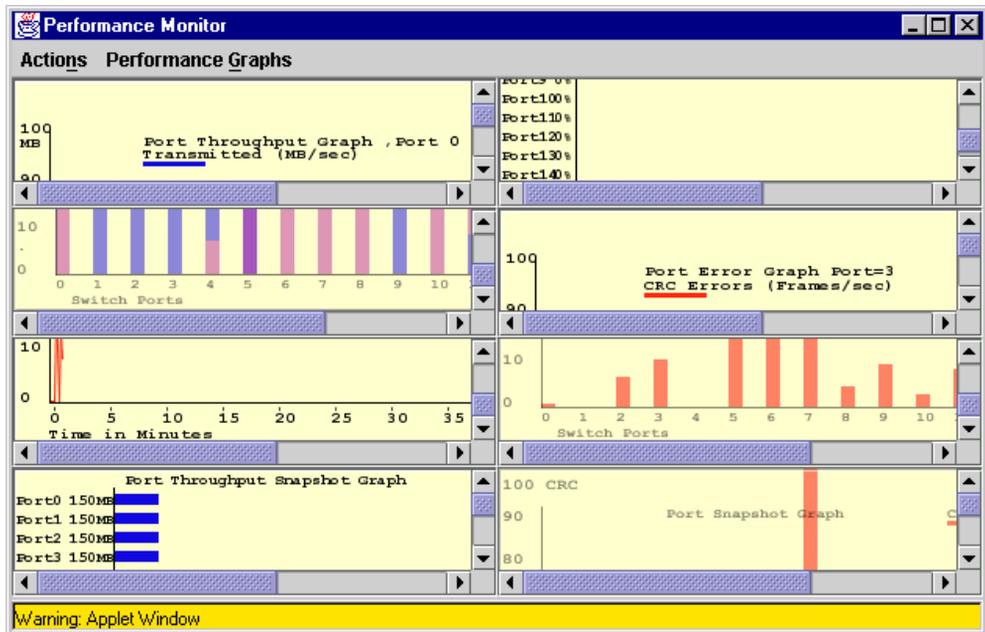
Figure 3–7: Canvas of eight performance monitoring graphs

Multiple canvasses can be created for different users or different scenarios.

Adding Graphs to a Canvas

You can add graphs to a canvas by using the Performance Graphs menu on the Performance Monitor window. Select the graph you wish to add to the canvas from either the Basic or Advanced Monitoring submenus. For a description of each of the graphs available, refer to Table 3–1.

You can then use the Actions menu on the Performance Monitor window to:

- Save current canvas configuration

- Display canvas configuration

- Display current canvas configuration

- Print all graphs

For a detailed description of the options available in the Actions menu, refer to the *HP StorageWorks Web Tools Version 3.0.x/4.0.x User Guide*.

Saving Canvas Configurations

You can save up to 20 individual canvases, each with up to 8 graphs each. Save each canvas with a name and an optional brief description. To save a current canvas configuration, select the **Actions** menu on the Performance Monitor window. Select the **Save Current Canvas Configuration** option. Figure 3–8 shows an example of saved canvases.
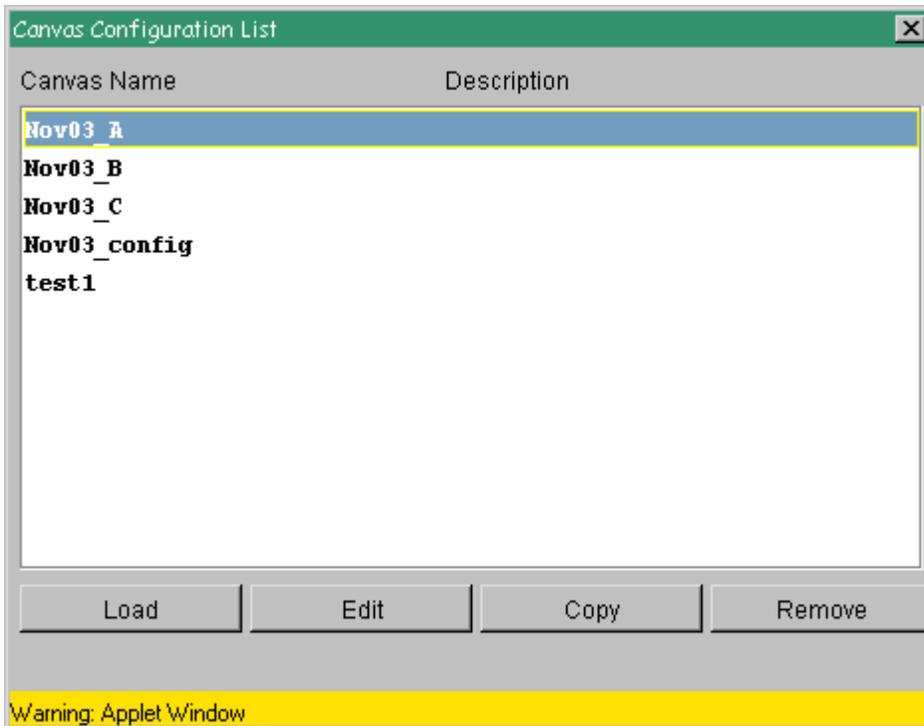
Figure 3–8: Saved canvas configurations

Printing All Graphs on a Configuration

You can print all the graphs on a selected canvas. Select the **Print All Graphs** option from the Actions menu on the Performance Monitor window. Select print options such as printer choice, print to file, and number of pages to print.

Telnet Commands

The telnet commands for Advanced Performance Monitoring become available through the shell "admin" account when the Advanced Performance Monitoring license key is installed. To use a telnet command, log into the relevant switch with administrative privileges, enter the command along with any required arguments, and press **Enter**.

Using telnet commands, you can track the following:

- Number of CRC errors for AL_PA devices

- Number of words received and transmitted in Fibre Channel frames with a defined SID/DID pair

- Number of CRC errors in Fibre Channel frames with a defined SID/DID pair

- Number of times a particular filter pattern in a frame is received by a port

For a description of all the telnet commands provided for performance monitoring, refer to the *HP StorageWorks Fabric OS Version 3.0.x/4.0.x Reference Guide.*

Port Addressing and Area Numbering

Port addressing and Area Numbering is different for the Core Switch 2/64 than with the StorageWorks 1 Gb SAN switch and StorageWorks 2 Gb SAN switch families of 8-port and 16-port switches. The concept of area numbering is new for the Core Switch 2/64. The area number is used in the same way a port number is used for the StorageWorks 1 Gb SAN switch series and SAN Switch 2/16, 2/8-EL, and 2/16-EL switches.

The physical ports on the 16-port cards are numbered 0 through 15 from bottom to top and up to four 16-port cards can comprise a logical switch. Therefore, it is necessary to relate a physical port number to a card to uniquely identify that port.

NOTE: You must specify the slot ID when using port-oriented commands so that a port can be uniquely identified. You must include the area number when specifying zoning configurations by port number. For a detailed description of the syntax differences between Fabric OS v3.x and Fabric OS v4.0.x, refer to the *HP StorageWorks Fabric OS Version 3.0.x/4.0.x Reference Guide*.

NOTE: The examples in this chapter use the Version 4.0.x syntax. Refer to the *HP StorageWorks Fabric OS Version 3.0.x/4.0.x Reference Guide* for the Fabric OS Version 3.0.x syntax examples.

AL_PA Error Performance Monitoring

AL_PA error performance monitoring tracks and displays the number of CRC errors that have occurred on frames sent to each AL_PA on a specific port. AL_PA-based error performance monitoring does not require explicit configuration. The switch hardware and firmware automatically monitor CRC errors for all valid AL_PAs.

Displaying the CRC Error Count

Use the `perfShowAlpaCrc` command to display the CRC error count for all AL_PA devices or a single AL_PA on a specific port. The port must be an active L_Port.

Example 1. This command displays the CRC error count for all AL_PA devices on slot 1, port 3:

```
sw1:admin> perfShowAlpaCrc 1/3

AL_PA    CRC count
-------------------
0x01     2
0x02     0
0x04     1
```

Example 2. The following command displays the CRC error count for AL_PA 0x01 on slot 1, port 3:

```
sw1:admin> perfShowAlpaCrc 1/3, 0x01

The CRC count at ALPA 0x1 on port 3 is 0x000000002.
```

Clearing the CRC Error Count

Use the `perfClrAlpaCrc` command to clear the CRC error count for AL_PA devices on a specific port. You can clear the error counts for all the AL_PA devices on a port or for a specific AL_PA.

Example 1. The following command clears the CRC error count for all AL_PA devices on slot 1, port 3:

```
sw1:admin> perfClrAlpaCrc 1/3
No ALPA value is specified. This will clear all ALPA CRC
counts on port 3. Do you want to continue? [y|n]y
Please wait ...
All alpa CRC counts are cleared on port 3.
```

Example 2. The following command clears the CRC error count for AL_PA 1 on slot 1, port 3:

```
admin> perfClrAlpaCrc 1/3, 0x01
CRC error count at ALPA 0x1 on port 3 is cleared.
```

End-to-end Performance Monitoring

End-to-end performance monitoring counts the number of words and CRC errors in Fibre Channel frames for a specified Source ID (SID) and Destination ID (DID) pair. An end-to-end performance monitor counts the number of:

- Words in frames received at the port (RX_COUNT)
- Words in frames transmitted from the port (TX_COUNT)
- CRC errors in frames received at the port (CRC_COUNT)

To enable end-to-end performance monitoring, you must configure an end-to-end monitor on a port, specifying the SID-DID pair. The monitor counts only those frames with matching SID and DID.

Each SID or DID has three fields, listed in the following order:

- Domain ID (DD)
- Area ID (AA)
- AL_PA (PP)

For example, the SID 0x118a0f has Domain ID 0x11, Area ID 0x8a, and AL_PA 0x0f. (The prefix "0x" denotes a hexadecimal number.)

Adding End-to-end Monitors

Use the `perfAddEEMonitor` command to add an end-to-end monitor to a port. With this command, you specify the port, the SID, and the DID that you want to monitor. Depending on the application, you can select any port along the routing path for monitoring.

Example. Figure 3–9 shows two devices: Host A, which is connected to slot 1, port 2 on switch 1, and Dev B, which is connected to slot 12, port 15 on switch 2.
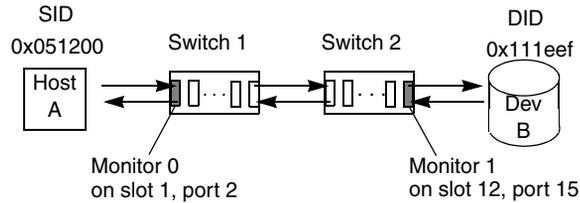
Figure 3–9: Setting end-to-end monitors on a port

To monitor the traffic from Host A to Dev B, add a monitor to slot 1, port 2, specifying 0x051200 as the SID and 0x111eef as the DID. To monitor the traffic from Dev B to Host A, add a monitor to slot 12, port 15, specifying 0x111eef as the SID and 0x051200 as the DID. Use the following commands:

```
sw1:admin> perfAddEEMonitor 1/2, "0x051200" "0x111eef"
End-to-End monitor number 0 added.

-------------------------------------------------------

sw2:admin> perfAddEEMonitor 12/15, "0x111eef" "0x051200"
End-to-End monitor number 1 added.
```

Monitor 0 counts the frames that have an SID of 0x051200 and a DID of 0x111eef. For monitor 0, RX_COUNT is the number of words from Host A to Dev B, CRC_COUNT is the number of frames from Host A to Dev B with CRC errors, and TX_COUNT is the number of words from Dev B to Host A.

Monitor 1 counts the frames that have an SID of 0x111eef and a DID of 0x051200. For monitor 1, RX_COUNT is the number of words from Dev B to Host A, CRC_COUNT is the number of frames from Dev B to Host A with CRC errors, and TX_COUNT is the number of words from Host A to Dev B.

NOTE: End-to-end performance monitoring monitors traffic on the receiving port respective to the SID only. In Figure 3–9, if you add a monitor to port 2 specifying Dev B as the SID and Host A as the DID, no counters are incremented.

```
Valid:     perfAddEEMonitor 1/2, "0x051200" "0x111eef"

Not valid: perfAddEEMonitor 1/2, "0x111eef" "0x051200"
```

Figure 3–10 shows several switches and the proper ports on which to add performance monitors for a specified SID-DID pair.
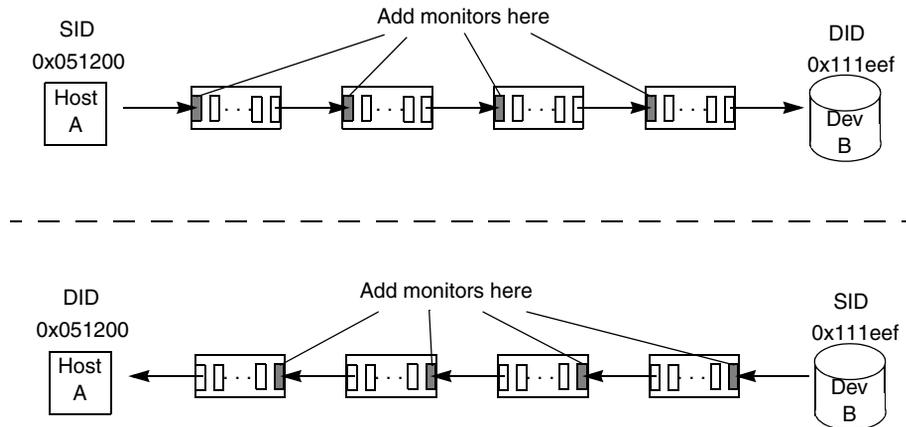
Figure 3–10: Proper placement of end-to-end performance monitors

Setting a Mask for End-to-end Monitors

End-to-end monitors count the number of words in Fibre Channel frames that match a specific SID/DID pair. If you want to match only part of the SID or DID, you can set a mask on the port to compare only certain parts of the SID or DID. With no mask set, the frame must match the entire SID and DID to trigger the monitor. By setting a mask, you can choose to have the frame match only one or two of the three fields (Domain ID, Area ID, AL_PA) to trigger the monitor.

NOTE: You can set only one mask per port. The mask is applied to all of the end-to-end monitors on a port. If you subsequently create new monitors on the port, the mask is applied to these new monitors as well. All of the counters are reset when you set the mask.

The mask is specified in the form "*dd*:*aa*:*pp*" where *dd* is the Domain ID mask, *aa* is the Area ID mask, and *pp* is the AL_PA mask. The values for *dd*, *aa*, and *pp* are either **ff** (the field must match) or **00** (the field is ignored).

Use the perfSetPortEEMask command to set a mask for end-to-end monitors. This command sets the mask for all end-to-end monitors of a port.

The perfSetPortEEMask command sets a mask for the Domain ID, Area ID, and AL_PA of the SIDs and DIDs for frames transmitted from and received by the port. Figure 3–11 shows the mask positions in the command.
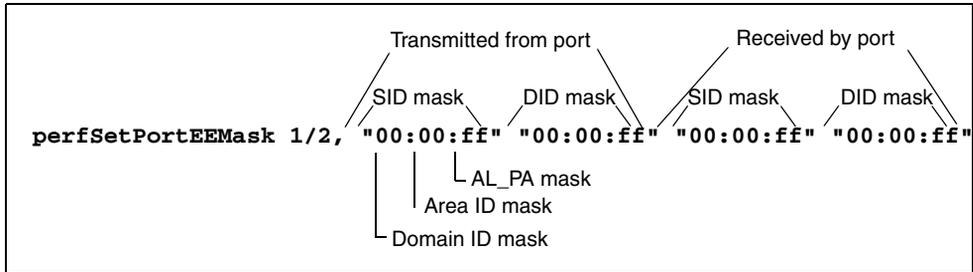
Figure 3–11: Mask positions for end-to-end monitors

In Figure 3–11, a mask ("ff") is set on slot 1, port 2 to compare the AL_PA fields on the SID and DID in all frames (transmitted and received) on port 2. The Domain ID and Area ID fields in all frames are ignored, as no mask is set on these fields.

For example, if you set the following monitor on a port:

```
perfAddEEMonitor 3/2, "0x051200" "0x111eef"
```

then the frame SID must be "0x051200" and the frame DID must be "0x111eef" to trigger the monitor.

If you set the mask shown in Figure 3–11, then the frame SID and DID must match only the AL_PA portion of the specified SID-DID pair. That is, frames with SID of "0x*nnnn*00" and DID of "0x*nnnn*ef" trigger the monitor, where *nnnn* is any number.

Each port can have only one EE mask. The mask is applied to all end-to-end monitors on the port. You cannot specify individual masks for each monitor on the port. If you define a new end-to-end monitor on a port after you have created a mask for that port, the mask is automatically applied to the new monitor.

The default EE mask value upon power-on is "ff:ff:ff" for everything—SID and DID on all transmitted and received frames.

Example. The following commands add an end-to-end monitor to port 2, and then set a mask on the SID and DID Domain ID of frames transmitted from slot 4, port 2. After the mask is set, monitor 0 counts the number of words in incoming Fibre Channel frames that have an SID of 0x05*nnnn* and DID of 0x11*nnnn*, where *nnnn* is any number.

```
sw1:admin> perfAddEEMonitor 4/2, "0x051200" "0x111eef"
End-to-End monitor number 0 added.

sw1:admin> perfSetPortEEMask 4/2, "00:00:00" "00:00:00"
"ff:00:00" "ff:00:00"
The EE mask on port 34 is set and EE Monitors are reset.
```

Displaying the End-to-end Mask of a Port

Use the `perfShowPortEEMask` command to display the current end-to-end mask of a port.

The end-to-end mask has 12 fields, with each field having a value of **on** or **off**.

Example. The following commands set an end-to-end mask on slot 2, port 11 and display the mask:

```
sw1:admin> perfSetPortEEMask 2/11, "00:00:ff" "00:00:ff"
"00:00:ff" "00:00:ff"
The EE mask on port 26 is set and EE counters are reset.

sw1:admin> perfShowPortEEMask 2/11
The EE mask on port 26 is set by application TELNET

TxSID Domain:   off
TxSID Area:     off
TxSID ALPA:     on
TxDID Domain:   off
TxDID Area:     off
TxDID ALPA:     on
RxSID Domain:   off
RxSID Area:     off
RxSID ALPA:     on
RxDID Domain:   off
RxDID Area:     off
RxDID ALPA:     on
```

Displaying End-to-end Monitors

Use the `perfShowEEMonitor` command to display all the end-to-end monitors defined on a port. You can display cumulative counters or a rolling table of counters at specified intervals. This command displays the following information on all end-to-end monitors:

- Monitor number (KEY)
- SID
- DID
- CRC error count (CRC_COUNT)
- Number of Fibre Channel words transmitted (TX_COUNT)
- Number of Fibre Channel words received (RX_COUNT)
- Creator application (OWNER_APP)
- IP address of the creator, if known (OWNER_IP_ADDR)

If you specify an interval number in the perfShowEEMonitor command, the command displays a rolling table of CRC error, Tx, and Rx counters on a per-interval basis for all the valid monitors on the port. The counter values are the number of bytes, in decimal format.

If you omit the interval number, the command displays the cumulative transmit counter (TX_COUNT), receive counter (RX_COUNT), and CRC error counter. These cumulative counters are 64-bit values in hexadecimal format.

NOTE: The minimum interval value that can be specified is 5 seconds.

Example 1. The following command displays all of the end-to-end monitors on slot 1, port 3 at an interval of every 6 seconds. (In this example, there are three monitors on port 3, numbered 0, 1, and 2.)

```
sw1:admin> perfShowEEMonitor 1/3, 6
perfShowEEMonitor 3, 6: Tx/Rx are # of bytes and crc is
# of crc errors

      0                1                2
------------    ------------    ------------
crc  Tx   Rx   crc  Tx   Rx   crc  Tx   Rx
===========    ===========    ===========
 0    0    0    0    0    0    0    0    0
 0   53m  4.9m  0   53m  4.9m  0   53m  4.9m
 0   53m  4.4m  0   53m  4.4m  0   53m  4.4m
 0   53m  4.8m  0   53m  4.8m  0   53m  4.8m
 0   53m  4.6m  0   53m  4.6m  0   53m  4.6m
 0   53m  5.0m  0   53m  5.0m  0   53m  5.0m
 0   52m  4.6m  0   52m  4.6m  0   52m  4.6m
```

NOTE: In the example above, "m" stands for megabytes. You may also see "g" which stands for gigabytes, or "k" which stands for kilobytes.

Example 2. The following command displays the cumulative counters on all end-to-end monitors defined on slot 1, port 3. The KEY column contains the monitor number.

```
switch:admin> perfShowEEMonitor 1/3

There are 3 end-to-end monitor(s) defined on port 3.

KEY  SID        DID        OWNER_APP  OWNER_IP_ADDR   TX_COUNT
 ...

----------------------------------------------------------------------------
-...
 0   0xb1300    0xb23ef    TELNET        N/A           0x00000004d0ba9915
 ...
 1   0xb1200    0xb22ef    TELNET        N/A           0x00000004d0baa754
 ...
 2   0x58e0f    0x1182ef   WEB_TOOLS  192.168.169.40   0x00000004d0bade54
 ...
```

Deleting End-to-end Monitors

Use the perfDelEEMonitor command to delete an end-to-end monitor on a port. Indicate which monitor to delete by specifying the monitor number that was returned by a previous perfDelEEMonitor command.

Example. The following command deletes the end-to-end monitor number 0 on slot 4, port 2:

```
sw1:admin> perfDelEEMonitor 4/2, 0
End-to-End monitor number 0 deleted
```

Clearing End-to-end Monitor Counters

To clear all of the end-to-end monitor counters on a port, use the perfSetPortEEMask command to reset all of the end-to-end monitor counters on that port.

NOTE: The perfSetPortEEMask command also sets the end-to-end mask, so if you do not want to change the mask, you must respecify the current mask settings. You can view the current mask settings using the perfShowPortEEMask command.

To clear the counters for a single end-to-end monitor, delete the monitor using the perfDelEEMonitor command, and then add the monitor again, using the perfAddEEMonitor command.

Filter-based Performance Monitoring

Filter-based monitoring counts the number of times a frame with a particular pattern in its header is received by a port. Filter-based monitoring is achieved by configuring a filter for a particular purpose. The filter can be a standard filter (for example, a read command filter that counts the number of read commands that have been received by the port) or a user-defined filter that you customize for your particular use.

The maximum number of filters is eight per port, in any combination of standard filters and user-defined filters.

Adding Standard Filter-Based Monitors

This section describes how to add standard filter-based monitors to a port. Use the telnet commands listed in Table 3–2 to define filter-based monitors on a port.

Table 3–2: Telnet Commands to Add Filter-based Monitors

Telnet command	Description
perfAddReadMonitor	Count the number of SCSI Read commands
perfAddWriteMonitor	Count the number of SCSI Write commands
perfAddRWMonitor	Count the number of SCSI Read and Write commands
perfAddSCSIMonitor	Count the number of SCSI traffic frames
perfAddIPMonitor	Count the number of IP traffic frames

Example. These commands add several filter-based monitors to slot 1, port 2 and display the results.

```
sw1:admin> perfAddReadMonitor 1/2
SCSI Read filter monitor #0 added

sw1:admin> perfAddWriteMonitor 1/2
SCSI Write filter monitor #1 added

sw1:admin> perfAddRWMonitor 1/2
SCSI Read/Write filter monitor #2 added

sw1:admin> perfAddSCSIMonitor 1/2
SCSI traffic frame monitor #3 added

sw1:admin> perfAddIPMonitor 1/2
IP traffic frame monitor #4 added

sw1:admin> perfShowFilterMonitor 1/2
There are 5 filter-based monitors defined on port 2.

KEY    ALIAS     OWNER_APP        OWNER_IP_ADDR      FRAME_COUNT
-------------------------------------------------------------------
-
0  SCSI Read  TELNET                 N/A      0x0000000000000000
1  SCSI Write TELNET                 N/A      0x0000000000000000
2  SCSI R/W   TELNET                 N/A      0x0000000000000000
3  SCSI Frame TELNET                 N/A      0x0000000000000000
4  IP Frame   TELNET                 N/A      0x0000000000000000
```

Adding User-Defined Filter-Based Monitors

In addition to the standard filters (read, write, read/write, and frame count), you can create custom filters to qualify frames for statistics gathering to fit your own special needs.

To define a custom filter, use the perfAddUserMonitor telnet command. With this command, you must specify a series of *offsets*, *masks*, and *values*. The following actions are performed. For all incoming frames, the switch:

- locates the byte found in the frame at the specified *offset*

- applies the *mask* to the byte found in the frame

- compares the value with the given *values* in the perfAddUserMonitor command

- increments the filter counter if a match is found

You can specify up to six different offsets for each port, and up to four values to compare against each offset.

If more than one offset is required to properly define a filter, the bytes found at each offset must match one of the given values for the filter to increment its counter. If one or more of the given offsets does not match any of the given values, the counter does not increment.

The value of the offset must be between 0 and 63, in decimal format. Byte 0 indicates the first byte of the Start of Frame (SOF), byte 4 is the first byte of the frame header, and byte 28 is the first byte of the payload. Thus only the SOF, frame header, and first 36 bytes of payload may be selected as part of a filter definition.

Offset 0 is a special case, which can be used to monitor the first 4 bytes of the frame (SOF). When the *offset* is 0, the *values* are from 0–7, indicating the following:

0	SOFf
1	SOFc1
2	SOFi1
3	SOFn1
4	SOFi2
5	SOFn2
6	SOFi3
7	SOFn3

The hardware can manage only a limited number of unique offsets and values. If the switch does not have enough resources to create a given filter, then other filters may have to be deleted to free up resources.

Example 1. This command adds a filter-based monitor to count all FCP and IP frames received from domain 0x02 for port 2 on slot 4.

```
sw1:admin> perfAddUserMonitor 4/2, "12, 0xff, 0x05,
          0x08; 9, 0xff, 0x02" "FCP/IP"
User monitor #5 added
```

The FCP and IP protocols are selected by monitoring offset 12, mask 0xff and matching values of 0x05 or 0x08. Domain 2 is selected by monitoring offset 9, mask 0xff, and matching a value of 0x02.

The monitor counter is incremented for all incoming frames where byte 9 is 0x02 and byte 12 is 0x05 or 0x08.

Example 2. The following command adds a special case filter-based monitor for SOFi3 on slot 1, port 2.

```
sw1:admin> perfAddUserMonitor 1/2, "0, 0xff, 6"
User Monitor #6 added
```

Displaying Filter-Based Monitors

Use the `perfShowFilterMonitor` command to display all the filter-based monitors of a port. You can display a cumulative count of the traffic detected by the monitors, or you can display a snapshot of the traffic at specified intervals.

NOTE: Intervals must be specified in multiples of 5 seconds, for example, 5, 10, 15, 20, 25, etc., because registers are scanned every 5 seconds.

This command displays all the filter-based monitors defined on the specified port. It displays all the valid monitor numbers and user-defined aliases on the specified port.

Example 1. The following command displays filter monitor traffic on slot 1, port 2 at an interval of once every 6 seconds. In the command output, "#CMDs" refers to the read, write, and read-write counters, and "#Frames" refers to SCSI frame, IP frame, and user-defined counters.

```
sw1:admin> perfShowFilterMonitor 1/2, 6
    0        1        2        3        4        5        6
  #CMDs    #CMDs    #CMDs    #Frames  #Frames  #Frames  #CMDs
-------------------------------------------------------------
    0        0        0        0        0        0        0
   26k      187      681      682      682      494      187
   26k      177      711      710      710      534      176
   26k      184      734      734      734      550      184
   26k      182      649      649      649      467      182
   26k      188      754      755      755      567      184
```

Example 2. The following command displays the cumulative frame count of all filter-based monitors defined on slot 1, port 2. The KEY column lists the monitor numbers.

```
sw1:admin> perfShowFilterMonitor 1/2
There are 7 filter-based monitors defined on port 2.
KEY    ALIAS     OWNER_APP       OWNER_IP_ADDR     FRAME_COUNT
----------------------------------------------------------------
-
0   SCSI Read  TELNET                  N/A       0x0000000000002208
1   SCSI Write TELNET                  N/A       0x000000000000464a
2   SCSI R/W   TELNET                  N/A       0x000000000000fd8c
3   SCSI Frame WEB_TOOLS        192.168.169.40 0x00000000002c2229
4   IP Frame   WEB_TOOLS        192.168.169.40 0x0000000000000492
5   FCP/IP     WEB_TOOLS        192.168.169.40 0x0000000000000009
6   SCSI_RD    WEB_TOOLS         192.168.161.140  0x00000000000
0023a
```

Deleting Filter-Based Monitors

To delete a filter-based monitor, first list the valid monitor numbers using the perfShowFilterMonitor command, then use the perfShowFilterMonitor command to delete a specific monitor. If you do not specify which monitor number to delete, you will be asked if you want to delete all entries.

Example. The following commands display the monitors on slot 1, port 4 (the monitor numbers are listed in the KEY column), and then delete monitor number 1 on slot 1, port 4.

```
sw1:admin> perfShowFilterMonitor 1/4
There are 4 filter-based monitors defined on port 4.
KEY    ALIAS     OWNER_APP       OWNER_IP_ADDR     FRAME_COUNT
----------------------------------------------------------------
-
0   SCSI Read  TELNET                  N/A       0x0000000000002208
1   SCSI Write TELNET                  N/A       0x000000000000464a
2   SCSI R/W   TELNET                  N/A       0x000000000000fd8c
3   SCSI Frame WEB_TOOLS        192.168.169.40 0x00000000002c2229

sw1:admin> perfDelFilterMonitor 1/4, 1
The specified filter-based monitor is deleted.
```

Clearing Filter-Based Monitor Counters

To clear a filter-based monitor counter, delete the monitor using the `perfDelFilterMonitor` command, and then add the monitor again, using the appropriate command:

- `perfAddReadMonitor`
- `perfAddWriteMonitor`
- `perfAddRWMonitor`
- `perfAddSCSIMonitor`
- `perfAddIPMonitor`
- `perfAddUserMonitor`

Saving and Restoring Monitor Configuration

You can use the `perfCfgSave` command to save the current end-to-end and filter monitor configuration settings into flash memory. This command enables the performance monitoring configuration to be saved over power cycles. You can use the `perfCfgRestore` command to restore the saved monitor configuration from flash memory.

For example, if you power cycle the switch, and you want to use the same end-to-end and filter monitoring configuration that was in effect prior to the power cycle, do the following:

1. Use the `perfCfgSave` command to save the monitor configuration settings.

2. Power cycle the switch.

3. Use the `perfCfgRestore` command to restore the saved monitor configuration.

Example 1.

```
sw1:admin> perfCfgSave
This will overwrite previously saved Performance Monitoring
settings in FLASH ROM.  Do you want to continue? [y|n]y
Please wait ...
Committing configuration...done.
Performance monitoring configuration saved in FLASH ROM.

sw1:admin> perfCfgRestore
This will overwrite current Performance Monitoring
settings in RAM.  Do you want to continue? [y|n]y
Please wait ...
Performance monitoring configuration restored from FLASH ROM.
```

Use the perfCfgClear command to clear the previously saved performance monitoring configuration settings from flash memory.

Example 2.

```
sw1:admin> perfCfgClear
This will clear Performance Monitoring settings in FLASH ROM.
The RAM settings won't change.  Do you want to continue? [y|n]y
Please wait ...
Committing configuration...done.
Performance Monitoring configuration cleared from FLASH.
```

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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