HP StorageWorks
XPath OS 7.4.x MIB reference guide

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XPath OS 7.4.x MIB reference guide

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About this guide

This guide provides information about:

- Understanding HP SNMP
- MIB-II
- FibreAlliance MIB objects
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- MIB OIDs and their matching object names

NOTE: FICON is not supported on HP B-Series Fibre Channel switches. The FICON information in this document is included for reference only.

Intended audience

This guide is intended for system administrators and technicians who are experienced with the following:

- HP StorageWorks Fibre Channel Storage Area Network (SAN) switches
- XPath Operating System (OS) 7.4.x or earlier

Related documentation

Documentation, including white papers and best practices documents, is available on the HP web site:

http://www.hp.com/country/us/eng/prodserv/storage.html

To access current Fabric OS related documents:

1. Locate the **IT storage products** section of the web page.
2. Under **Networked storage**, click the **SAN Infrastructure** subsection.
3. From the **SAN Infrastructure** web page, locate the **SAN Infrastucture products** section.
4. Click **Multi-protocol Routers and Gateways**.
5. To access XPath OS 7.4.x documents (such as this document), click **B-Series Multi-Protocol Router**. The **HP StorageWorks B-Series Multi-Protocol Router** overview page displays.
6. Go to the **Product Information section**, located on the right side of the web page.
7. Click **Technical documentation**.
8. Follow the onscreen instructions to download XPath OS 7.4.x documents.

Document conventions and symbols

Table 1 Document conventions

Convention	Element
Medium blue text: Figure 1	Cross-reference links and e-mail addresses
Medium blue, underlined text (http://www.hp.com)	Web site addresses
Bold font	• Key names • Text typed into a GUI element, such as into a box • GUI elements that are clicked or selected, such as menu and list items, buttons, and check boxes
Italics font	Text emphasis
`Monospace font`	• File and directory names • System output • Code • Text typed at the command-line
`Monospace, italic font`	• Code variables • Command-line variables
`Monospace, bold font`	Emphasis of file and directory names, system output, code, and text typed at the command line

⚠ **WARNING!** Indicates that failure to follow directions could result in bodily harm or death.

△ **CAUTION:** Indicates that failure to follow directions could result in damage to equipment or data.

IMPORTANT: Provides clarifying information or specific instructions.

NOTE: Provides additional information.

Rack stability

⚠ **WARNING!** To reduce the risk of personal injury or damage to equipment:

- Extend leveling jacks to the floor.
- Ensure that the full weight of the rack rests on the leveling jacks.
- Install stabilizing feet on the rack.
- In multiple-rack installations, secure racks together.
- Extend only one rack component at a time. Racks may become unstable if more than one component is extended.

HP technical support

Telephone numbers for worldwide technical support are listed on the HP support web site: http://www.hp.com/support/.

Collect the following information 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

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

HP strongly recommends that customers sign up online using the Subscriber's choice web site: http://www.hp.com/go/e-updates.

- Subscribing to this service provides you with e-mail updates on the latest product enhancements, newest versions of drivers, and firmware documentation updates as well as instant access to numerous other product resources.
- After signing up, you can quickly locate your products by selecting **Business support** and then **Storage** under Product Category.

HP-authorized reseller

For the name of your nearest HP-authorized reseller:

- In the United States, call 1-800-282-6672.
- Elsewhere, visit the HP web site: http://www.hp.com. Then click **Contact HP** to find locations and telephone numbers.

Helpful web sites

For other product information, see the following HP web sites:

- http://www.hp.com
- http://www.hp.com/go/storage
- http://www.hp.com/support/
- http://www.docs.hp.com

1 Understanding HP SNMP

Simple Network Management Protocol (SNMP) is a common method for monitoring and managing network devices. The protocol promotes interoperability, as cooperating systems must adhere to a common framework and language. Understanding the components of SNMP make it possible to use any SNMP tool to view, browse, and manipulate HP StorageWorks switch variables as well as set up an enterprise-level management process. Every HP StorageWorks switch supports SNMP.

This chapter discusses the following:

NOTE: HP XPath OS 7.1.0 supports a subset of the HP Fabric OS MIBs.

Understanding SNMP basics

Every HP StorageWorks switch carries an agent and management information base (MIB), as shown in Figure 1. The agent accesses information about a device and makes it available to a network management station.

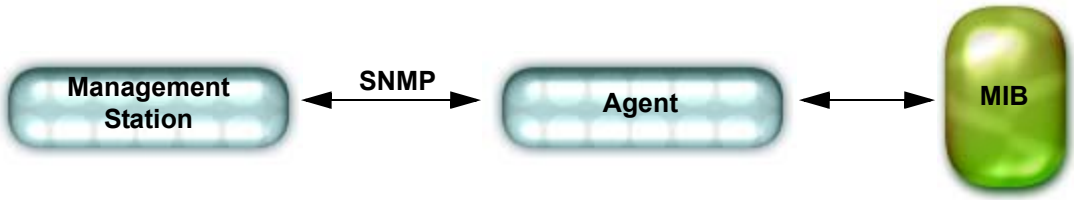

Figure 1 SNMP structure

When active, the management station inspects (`get`) or alters (`set`) variables when it queries an agent. The `get`, `getnext`, and `set` commands are sent from the management station, and the agent replies once the value is obtained or altered (see Figure 2). Agents use variables to report such data as the number of bytes and packets in and out of the device, or the number of broadcast messages sent and received. These variables are also known as *managed objects*. All managed objects are contained in the MIB.

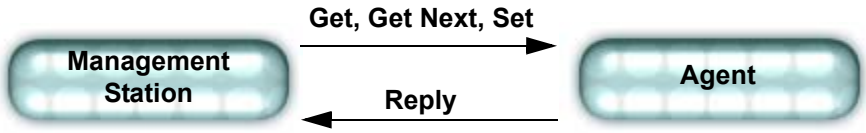

Figure 2 SNMP query

When passive, the management station receives an unsolicited message (trap; see Figure 3) from the switch agent if an unusual event occurs. See "Loading HP MIBs" on page 11 for more information.

Figure 3 SNMP trap

The agent can receive queries from one or more management stations and can send traps to up to 6 management stations with XPath OS. Figure 4 shows the structure of a Fibre Channel SAN.

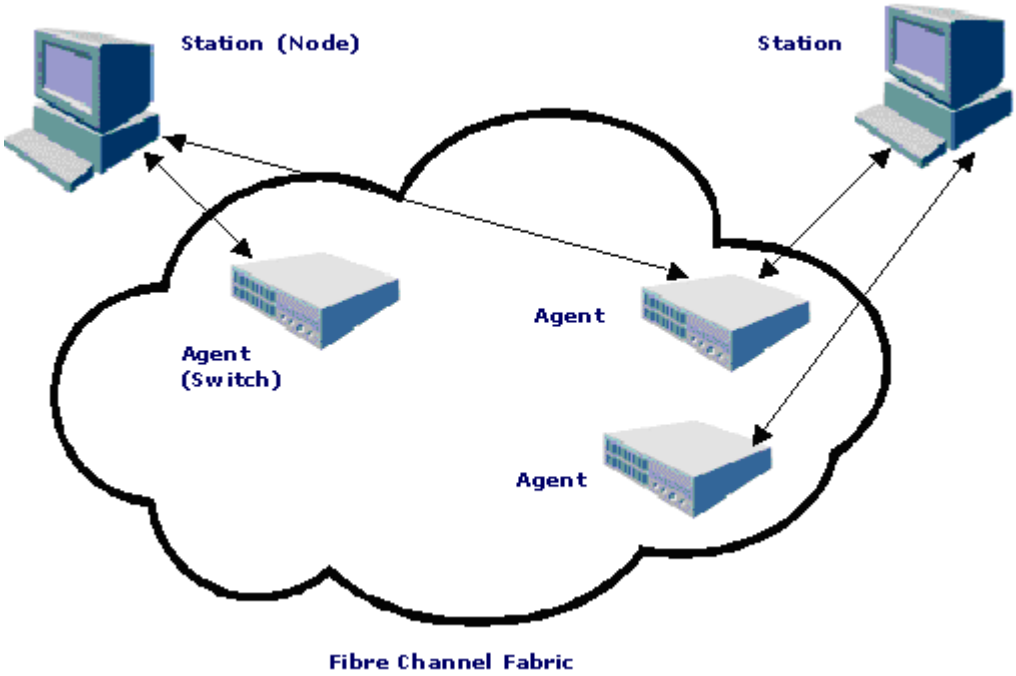

Figure 4 Fibre Channel SAN

Understanding MIBs

The MIB structure can be represented by a tree hierarchy. The root splits into three main *branches*:

- International Organization for Standardization (ISO)
- Consultative Committee for International Telegraph and Telephone (CCITT)
- Joint ISO/CCITT.

These branches and their *leaves* have short text strings and integers to identify them. Text strings describe *object names*, while integers allow software to create compact, encoded representations of the names.

Each MIB variable is assigned an *object identifier* (OID). The OID is the sequence of numeric labels on the nodes along a path from the root to the object. For example, as shown in Figure 5, the HP SW.MIB OID is 1.3.6.1.4.1.1588, the corresponding name is `iso.org.dod.internet.private.enterprise.bsci`. The other branches are part of the standard MIBs, and the portions relevant to configuring SNMP on an HP StorageWorks switch are referenced in the remainder of this document.

NOTE: XPath OS supports a subset of the MIB-II and FibreAlliance MIB, not the HP SW MIB.

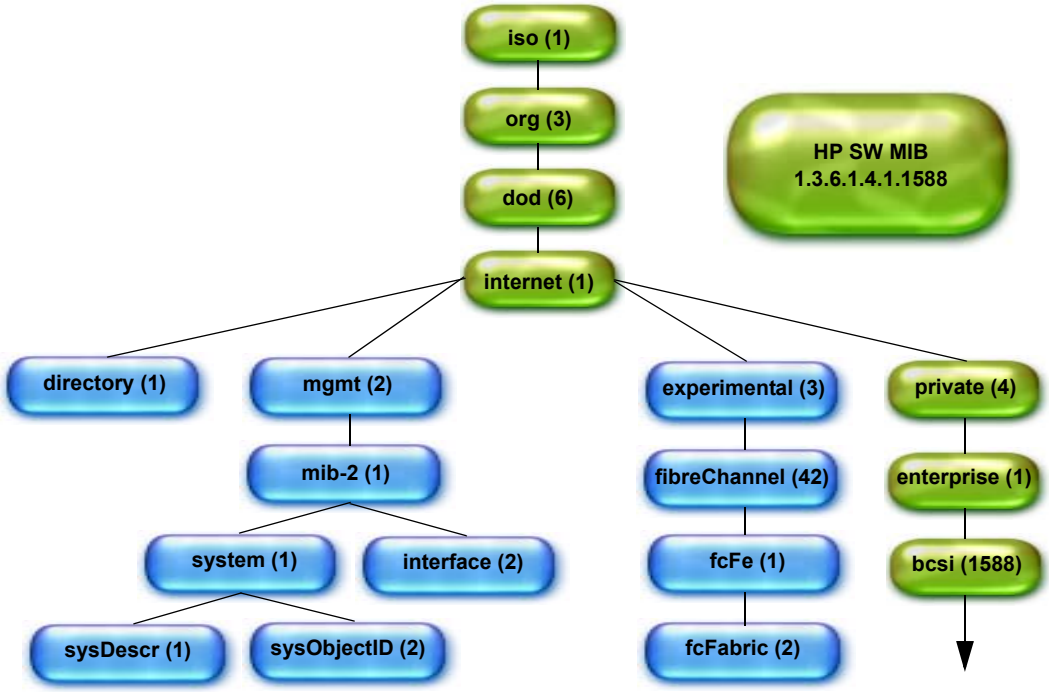

Figure 5 HP MIB tree location

Use a MIB browser to access the MIB variables; all MIB browsers perform queries and load MIBs. The standard is FibreAlliance (FA) MIB. See "Loading HP MIBs" next, for more information.

Once loaded, the MAX-ACCESS variable in the MIB represents a concept of *access levels* between the agent and management station. This allows for the following states:

- not-accessible — You cannot read or write to this variable
- read-create — Specifies a tabular object that can be read, modified, or created as a new row in a table.
- read-only — The community is *public* and the variable is used only to monitor information.
- read-write — The community is *private* and you can read or modify this variable.

Loading HP MIBs

The HP MIB is a set of variables that are private extensions to the Internet standard MIB-II. The MIB-II standard is documented in Request for Comment (RFC) 1213, *Management Information Base for Network Management of TCP/IP-based Internets: MIB-II*. To find specific MIB information, examine the HP proprietary FA MIB structure and the standard RFC MIBs supported by HP.

MIB loading order

Many MIBs use definitions that are defined in other MIBs. These definitions are listed in the IMPORTS sections near the top of the MIB. When loading the HP MIBs, see Figure 6 to ensure any MIB dependencies are loading in the correct order.

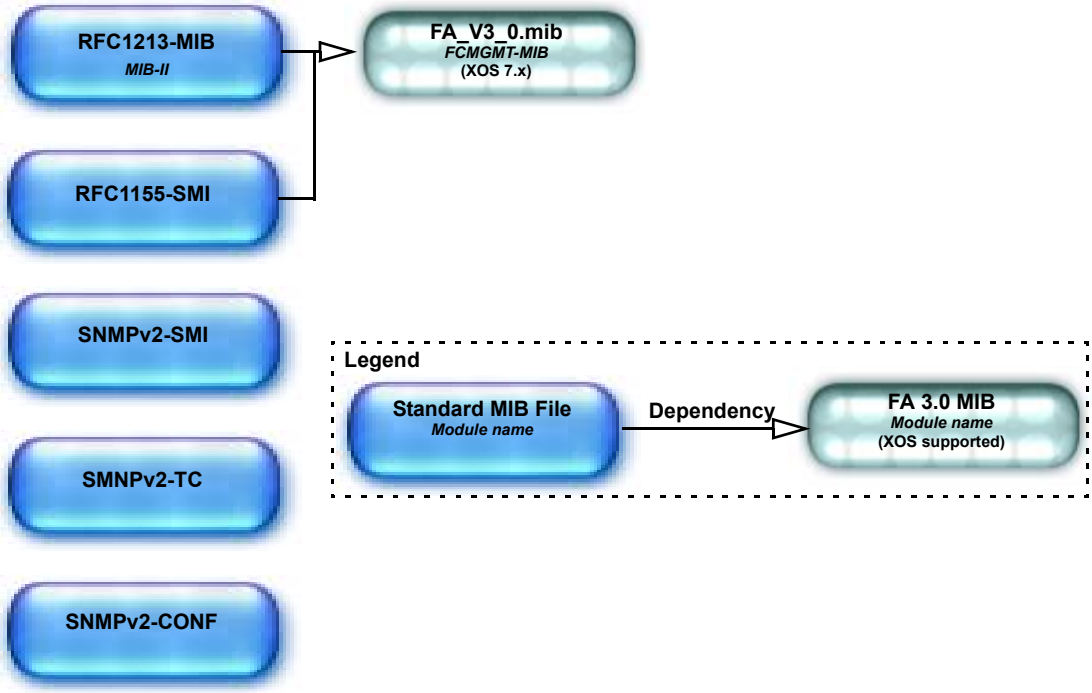

Figure 6 HP SNMP MIB dependencies and advised installation order

2 MIB-II (RFC1213-MIB)

This chapter provides descriptions and other information specific to MIB-II, including the following information:

Overview of MIB-II

The descriptions of each of the Management Information Base (MIB) variables in this chapter come directly from MIB-II itself. The notes that follow the descriptions is typically HP-specific information.

MIB-II object hierarchy

Figure 7 shows the organization and structure of MIB-II.

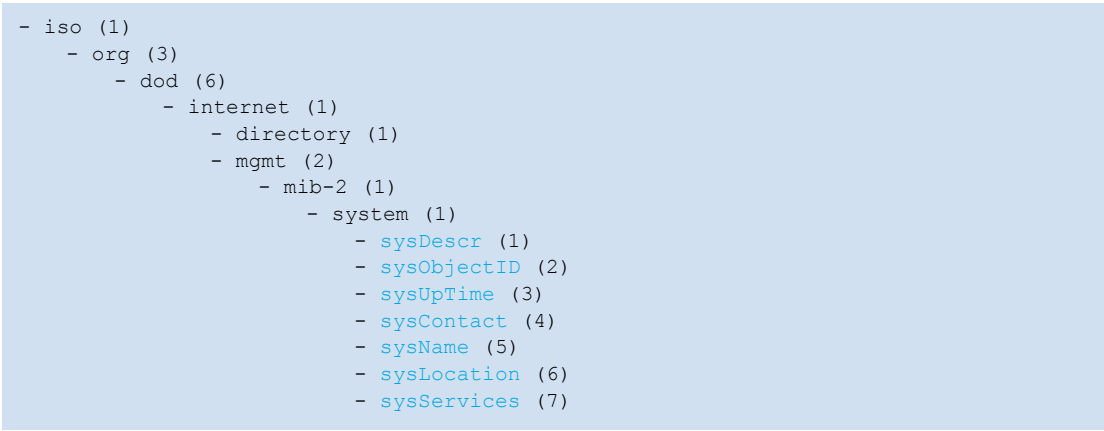

Figure 7 MIB-EE overall hierarchy

Textual conventions

Table 2 lists the textual conventions used for MIB-II.

Table 2 MIB-EE textual conventions

Type Definition	Value
DisplayString	Octet string of size 0 to 255
PhysAddress	Octet string

Objects and types imported to MIB-II

The following objects and types are imported from RFC1155-SMI:

- mgmt
- NetworkAddress
- IpAddress
- Counter
- Gauge
- TimeTicks

System group

All systems must implement the System group. If an agent is not configured to have a value for any of the System group variables, a string of length 0 is returned.

sysDescr

OID	1.3.6.1.2.1.1.1
Description	A textual description of the entity. This value should include the full name and version of the hardware type, software operating system, and networking software, in printable ASCII characters only.
Note	The default value is Fibre Channel Switch. Set this value using the `agtCfgSet` command.

sysObjectID

OID	1.3.6.1.2.1.1.2
Description	The vendor's authoritative identification of the network management subsystem contained in the entity. This value is allocated within the SMI enterprises subtree (1.3.6.1.4.1). It provides an easy and unambiguous way to determine what kind of object is being managed. For example, if vendor ABC, Inc. is assigned the subtree 1.3.6.1.4.1.4242, it could assign the identifier 1.3.6.1.4.1.4242.1.1 to its ABC Router.
Note	The default value is iso.org.dod.internet.private.enterprises.bcsi.commDev.fibrechannel.fcSwitch.sw.

sysUpTime

OID	1.3.6.1.2.1.1.3
Description	The time (in hundredths of a second) since the network management portion of the system was last reinitialized.

sysContact

OID	1.3.6.1.2.1.1.4
Description	The textual identification of the contact person for this managed node, together with information on how to contact this person.
Note	The default value is Field Support. Set this value using the `agtCfgSet` command.

sysName

OID	1.3.6.1.2.1.1.5
Description	An administratively assigned name for this managed node. By convention, this is the node's fully qualified domain name.
Note	The default value is preassigned name of the switch. The length of the sysName object should be equal or less than 19 characters.

sysLocation

OID	1.3.6.1.2.1.1.6
Description	The physical location of this node (for example, telephone closet, third floor).
Note	The default value is End User Premise. Set this value using the `agtcfgset` command.

sysServices

OID 1.3.6.1.2.1.1.7

Description A value that indicates the set of services that this entity primarily offers.

The value is a sum initially set to 0. For each layer L in the range 1 through 7 for which this node performs transactions, 2 raised to the power (L - 1) is added to the sum.

For example, a node that primarily performs routing functions has a value of 4 (2^{3-1}). In contrast, a node that is a host and offers application services has a value of 72 ($2^{4-1} + 2^{7-1}$).

Note that in the context of the Internet suite of protocols, values should be calculated accordingly:

Layer 1	Physical, such as repeaters
Layer 2	Datalink/subnetwork, such as bridges
Layer 3	Internet, such as IP gateways
Layer 4	End-to-end, such as IP hosts
Layer 5	Session (OSI only)
Layer 6	Presentation (OSI only)
Layer 7	Applications, such as mail relays

Note For systems including OSI protocols, Layers 5 and 6 might also be counted. The return value is always 72.

3 FibreAlliance MIB objects

This chapter provides information specific to FibreAlliance MIB (FCMGMT-MIB) object types, including the following:

Overview of FibreAlliance MIB

The descriptions of each of the MIB variables in this chapter come directly from the FCMGMT-MIB itself. The notes that follow the descriptions are typically HP-specific information.

The object types in FCMGMT-MIB are organized into the following groups:

- Connectivity
- Events
- Revision Number
- Statistic Set
- Service Set

Descriptions of these begin with the "Connectivity group" on page 22.

FCMGMT-MIB system organization of MIB objects

Figure 8 through Figure 15 show the organization and structure of FCMGMT-MIB. In these figures, the grayed-out objects are not supported and are not documented in this guide.

```
- iso (1)
    - org (3)
        - dod (6)
            - internet (1)
                - experimental (3)
                    - fcmgmt (94)
                        - connSet (1)
                            - uNumber (1)
                            - systemURL (2)
                            - connUnitTable (6)
                            - connUnitRevsTable (7)
                            - connUnitSensorTable (8)
                            - connUnitPortTable (10)
                            - connUnitEventTable (11)
                            - connUnitLinkTable (12)
                        - trapReg (2)
                        - trapMaxClients (1)
                            - trapClientCount (2)
                        - trapRegTable (3)
                            - trapRegIpAddress (1)
                            - trapRegPort (2)
                            - trapRegFilter (3)
                            - trapRegRowState (4)
                        - connUnitServiceSet (5)
                            - connUnitServiceScalars (1)
                                - connUnitSnsMaxEntry (1)
                            - connUnitServiceTables (2)
                                - connUnitSnsTable (1)
```

Figure 8 FCMGMT-MIB overall hierarchy

```
- connSet (1.3.6.1.3.94.1)
    - connUnitTable (6)
        - connUnitEntry (1)
            - connUnitId (1)
            - connUnitGlobalId (2)
            - connUnitType (3)
            - connUnitNumports (4)
            - connUnitState (5)
            - connUnitStatus (6)
            - connUnitProduct (7)
            - connUnitSn (8)
            - connUnitUpTime (9)
            - connUnitUrl (10)
            - connUnitDomainId (11)
            - connUnitProxyMaster (12)
            - connUnitPrincipal (13)
            - connUnitNumSensors (14)
            - connUnitStatusChangeTime (15)
            - connUnitConfigurationChangeTime (16)
            - connUnitNumRevs (17)
            - connUnitNumZones (18)
            - connUnitModuleId (19)
            - connUnitName (20)
            - connUnitInfo (21)
            - connUnitControl (22)
            - connUnitContact (23)
            - connUnitLocation (24)
            - connUnitEventFilter (25)
            - connUnitNumEvents (26)
            - connUnitMaxEvents (27)
            - connUnitEventCurrID (28)
```

Figure 9 connSet hierarchy

```
- connUnitPortTable (10)
    - connUnitPortEntry (1)
        - connUnitPortUnitId (1)
        - connUnitPortIndex (2)
        - connUnitPortType (3)
        - connUnitPortFCClassCap (4)
        - connUnitPortFCClassOp (5)
        - connUnitPortState (6)
        - connUnitPortStatus (7)
        - connUnitPortTransmitterType (8)
        - connUnitPortModuleType (9)
        - connUnitPortWwn (10)
        - connUnitPortFCId (11)
        - connUnitPortSn (12)
        - connUnitPortRevision (13)
        - connUnitPortVendor (14)
        - connUnitPortSpeed (15)
        - connUnitPortControl(16)
        - connUnitPortName (17)
        - connUnitPortPhysicalNumber (18)
        - connUnitPortStatObject (19)
        - connUnitPortProtocolCap (20)
        - connUnitPortProtocolOp (21)
        - connUnitPortNodeWwn (22)
        - connUnitPortHWState (23)
```

Figure 10 connUnitPortTable hierarchy

```
- connUnitEventTable (11)
    - connUnitEventEntry (1)
        - connUnitEventUnitId (1)
        - connUnitEventIndex (2)
        - connUnitEventId (3)
        - connUnitREventTime (4)
        - connUnitSEventTime (5)
        - connUnitEventSeverity (6)
        - connUnitEventType(7)
        - connUnitEventObject(8)
        - connUnitEventDescr (9)
```

Figure 11 connUnitEventTable hierarchy

```
- connUnitLinkTable (1)
    - connUnitLinkEntry (1)
        - connUnitLinkUnitId (1)
        - connUnitLinkIndex (2)
        - connUnitLinkNodeIdX (3)
        - connUnitLinkPortNumberX (4)
        - connUnitLinkPortWwnX (5)
        - connUnitLinkNodeIdY (6)
        - connUnitLinkPortNumberY (7)
        - connUnitLinkPortWwnY (8)
        - connUnitLinkAgentAddressY (9)
        - connUnitLinkAgentAddressTypeY (10)
        - connUnitLinkAgentPortY (11)
        - connUnitLinkUnitTypeY (12)
        - connUnitLinkConnIdY (13)
        - connUnitLinkCurrIndex (14)
```

Figure 12 connUnitLinkTable hierarchy

```
- trapReg (1.3.6.1.3.94.2)
    - trapMaxClients (1)
    - trapClientCount (2)
    - trapRegTable (3)
        - trapRegEntry (1)
            - trapRegIpAddress (1)
            - trapRegPort (2)
            - trapRegFilter (3)
            - trapRegRowState (4)
```

Figure 13 trapReg hierarchy

```
- connUnitServiceTables (1.3.6.1.3.94.5.2)
    - connUnitSnsTable (1)
        - connUnitSnsEntry (1)
            - connUnitSnsId (1)
            - connUnitSnsPortIndex (2)
            - connUnitSnsPortIdentifier (3)
            - connUnitSnsPortName (4)
            - connUnitSnsNodeName (5)
            - connUnitSnsClassOfSvc (6)
            - connUnitSnsNodeIPAddress (7)
            - connUnitSnsProcAssoc (8)
            - connUnitSnsFC4Type (9)
            - connUnitSnsPortType (10)
            - connUnitSnsPortIPAddress (11)
            - connUnitSnsFabricPortName (12)
            - connUnitSnsHardAddress (13)
            - connUnitSnsSymbolicPortName (14)
            - connUnitSnsSymbolicNodeName (15)
```

Figure 14 connUnitServiceTables hierarchy

```
- connUnitPortStatTable (1.3.6.1.3.94.4.5)
    - connUnitPortStatEntry (1)
        - connUnitPortStatUnitId (1)
        - connUnitPortStatIndex (2)
        - connUnitPortStatCountError (3)
        - connUnitPortStatCountTxObjects (4)
        - connUnitPortStatCountRxObjects (5)
        - connUnitPortStatCountTxElements (6)
        - connUnitPortStatCountRxElements (7)
        - connUnitPortStatCountBBCreditZero (8)
        - connUnitPortStatCountInputBuffersFull (9)
        - connUnitPortStatCountFBSYFrames (10)
        - connUnitPortStatCountPBSYFrames (11)
        - connUnitPortStatCountFRJTFrames (12)
        - connUnitPortStatCountPRJTFrames (13)
        - connUnitPortStatCountClass1RxFrames (14)
        - connUnitPortStatCountClass1TxFrames (15)
        - connUnitPortStatCountClass1FBSYFrames (16)
        - connUnitPortStatCountClass1PBSYFrames (17)
        - connUnitPortStatCountClass1FRJTFrames (18)
        - connUnitPortStatCountClass1PRJTFrames (19)
        - connUnitPortStatCountClass2RxFrames (20)
        - connUnitPortStatCountClass2TxFrames (21)
        - connUnitPortStatCountClass2FBSYFrames (22)
        - connUnitPortStatCountClass2PBSYFrames (23)
        - connUnitPortStatCountClass2FRJTFrames (24)
        - connUnitPortStatCountClass2PRJTFrames (25)
        - connUnitPortStatCountClass3RxFrames (26)
        - connUnitPortStatCountClass3TxFrames (27)
        - connUnitPortStatCountClass3Discards (28)
        - connUnitPortStatCountRxMulticastObjects (29)
        - connUnitPortStatCountTxMulticastObjects (30)
        - connUnitPortStatCountRxBroadcastObjects (31)
        - connUnitPortStatCountTxBroadcastObjects (32)
        - connUnitPortStatCountRxLinkResets (33)
        - connUnitPortStatCountTxLinkResets (34)
        - connUnitPortStatCountNumberLinkResets (35)
        - connUnitPortStatCountRxOfflineSequences (36)
        - connUnitPortStatCountTxOfflineSequences (37)
        - connUnitPortStatCountNumberOfflineSequences (38)
        - connUnitPortStatCountLinkFailures (39)
        - connUnitPortStatCountInvalidCRC (40)
        - connUnitPortStatCountInvalidTxWords (42)
        - connUnitPortStatCountPrimitiveSequenceProtocolErrors (43)
        - connUnitPortStatCountLossofSignal (44)
        - connUnitPortStatCountLossofSynchronization (45)
        - connUnitPortStatCountInvalidOrderedSets (46)
        - connUnitPortStatCountFramesTooLong (47)
        - connUnitPortStatCountFramesTruncated (48)
        - connUnitPortStatCountAddressErrors (49)
        - connUnitPortStatCountDelimiterErrors (50)
        - connUnitPortStatCountEncodingDisparityErrors (51)
```

Figure 15 connUnitPortStatTable hierarchy

Definitions for FCMGMT-MIB

The definitions in Table 3 are used for FCMGMT-MIB.

Table 3 FCMGMT-MIB Definitions

Type definition	Value	Description
FcNameId	Octet string of size 8	The Port Name for this entry in the SNS table.
FcGlobalId	Octet string of size 16	An optional global scope identifier for this connectivity unit. It must be a WWN for this connectivity unit or 16 octets of value zero.

Table 3 FCMGMT-MIB Definitions (continued)

Type definition	Value	Description
FcAddressId	Octet string of size 3	The Port Identifier for this entry in the SNS table.
FcEventSeverity	Integer	1 (unknown): Unknown status. 2 (emergency): Emergency status. 3 (alert): Alert status. 4 (critical): Critical status. 5 (error): Error status. 6 (warning): Warning status. 7 (notify): Notification status. 8 (info): Informational status. 9 (debug): Debug status. 10 (mark): All messages logged.
FcUnitType	Integer	1 (unknown): Unknown unit type. 2 (other): None of 3–14. 3 (hub): Passive connectivity unit supporting loop protocol. 4 (switch): Active connectivity unit supporting multiple protocols. 5 (gateway): Unit that not only converts the interface, but also encapsulates the frame into another protocol. The assumption is that there are always two gateways connected together, for example, FC to ATM. 6 (converter): Unit that converts from one interface to another, for example, FC to SCSI. 7 (hba): Host bus adapter. 8 (proxy-agent): Software proxy agent. 9 (storage-device): Disk, CD, tape, and so on. 10 (host): Host computer. 11 (storage-subsystem): RAID, library, and so on. 12 (module): Subcomponent of a system. 13 (swdriver): Software driver. 14 (storage-access-device): Provides storage management and access for heterogeneous hosts and heterogeneous devices.

Connectivity group

All systems must implement the Connectivity group.

uNumber

OID 1.3.6.1.3.94.1.1

Description The number of connectivity units on this system (represented by this agent). Can be a count of the boards in a chassis or the number of full boxes in a rack.

Note The connectivity unit is mapped to a switch. The uNumber is always set to 1.

systemURL

OID 1.3.6.1.3.94.1.2

Description The top-level URL of the system. If systemURL does not exist, the value is an empty string. The URL format is implementation dependent and can have keywords embedded that are preceded by a percent sign (for example, %USER).

The following defined keywords are recognized and replaced with data during a launch:

- USER: Replace with a user name.
- PASSWORD: Replace with a password.
- GLOBALID: Replace with a global ID.
- SERIALNO: Replace with a serial number.

Note Provides the virtual IP address of the switch as a URL (for example, http://10.114.63.74/).

Connectivity unit table

The connectivity unit table contains general information about a system's units.

connUnitTable

OID 1.3.6.1.3.94.1.6

Description A list of units under a single SNMP agent. The number of entries is given by the value of uNumber. The value is 1 for a standalone system.

connUnitRevsTable

OID 1.3.6.1.3.94.1.7

Description Table of the revisions supported by connectivity units managed by this agent.

Note The connUnitRevsUnitId displays the WWN value for the local switch.

The connUnitRevsRevId displays the switch type (for example, 38.2) and software version (for example, 7.4.0).

connUnitEntry

OID 1.3.6.1.3.94.1.6.1

Description A connectivity unit entry containing objects for a particular unit.

Index connUnitId

connUnitId

OID 1.3.6.1.3.94.1.6.1.1

Description The unique identification for this connectivity unit among those within this proxy domain. The value must be unique within the proxy domain because it is the index variable for connUnitTable. The value assigned to a given connectivity unit should be persistent across agent and unit resets. It should be the same as connUnitGlobalId, if connUnitGlobalId is known and stable.

Note The HP implementation maps the switch WWN to the top eight octets of this variable and sets the remaining lower eight octets to 0.

To specify a particular instance of any columnar variable in connUnitEntry (such as connUnitType), specify the instance identifier as a 16-octet value, as follows:

```
connUnitType.10.0.0.60.69.4.11.19.0.0.0.0.0.0.0.0
```

The object instance identifier consists of 16 octets, each representing the byte value, from high byte to low byte, of this 128-bit integer.

connUnitGlobalId

OID 1.3.6.1.3.94.1.6.1.2

Description An optional global-scope identifier for this connectivity unit. It must be a WWN or 16 octets of value 0.

The following characteristics are required:

- WWN formats requiring fewer than 16 octets must be extended to 16 octets using trailing 0s.
- If a WWN is used for connUnitId, the same WWN must be used for connUnitGlobalId.

When a nonzero value is provided, HP strongly recommends the following characteristics:

- It should be persistent across agent and unit resets.
- It should be globally unique.
- It should be one of the following FC-PH/PH3 formats:
  - IEEE (NAA=1)
  - IEEE Extended (NAA=2)
  - IEEE Registered (NAA=5)
  - IEEE Registered Extended (NAA=6)

Use of the IEEE formats allows any IEEE-registered vendor to assure global uniqueness independently. The following are some references on IEEE WWN formats:

```
http://standards.ieee.org/regauth/oui/tutorials/fibreformat.html
http://standards.ieee.org/regauth/oui/tutorials/fibrecomp_id.html
```

If one or more WWNs are associated with connUnit through other management methods, one of them should be used for connUnitGlobalId.

If a WWN is not assigned specifically to connUnit, there is some merit, although no requirement, to using a WWN assigned to (one of) its permanently attached FC/LAN interfaces, without endangering uniqueness.

As a counterexample, if your agent runs in a host and the host has an HBA, it is quite possible that agent, host, and HBA are all distinct connUnits and so the host and agent cannot use the WWN of the HBA.

Example If your hub has a built-in Ethernet port, the hub could use its LAN address (prefixed with the appropriate NAA) as its connUnitId. However, if the Ethernet is a replaceable PCCard, the hub should have an independent ID.

Note The HP implementation maps the switch WWN to the top eight octets of this variable and sets the remaining lower eight octets to 0.

For example, if the HP switch WWN is 10:0:0:60:69:10:02:18, then SNMP GET on connUnitGlobalId.10.0.0.60.69.10.02.18.0.0.0.0.0.0.0.0 and returns 10 00 00 60 69 10 02 18 00 00 00 00 00 00 00 00

connUnitType

OID 1.3.6.1.3.94.1.6.1.3

Description The type of this connectivity unit.

Note This is set to switch (4).

connUnitNumports

OID 1.3.6.1.3.94.1.6.1.4

Description Number of physical ports (between 0 and the maximum number of system-supported ports) in the connectivity unit (internal/embedded, external).

connUnitState

OID 1.3.6.1.3.94.1.6.1.5

Description Overall state of the connectivity unit. Possible values are:

1 (unknown)
2 (online)
3 (offline)

Note connUnitState is mapped as follows:

switchState(ONLINE)	2 (online)
switchState(not ONLINE)	3 (offline, testing, faulty)

connUnitStatus

OID 1.3.6.1.3.94.1.6.1.6

Description Overall status of the connectivity unit. Possible values are:

1 (unknown)
2 (unused)
3 (ok)
4 (warning)
5 (failed)

If the value is 4 (warning), the unit needs attention.

Note The switchStatus maps directly as follows:

connUnitStatus	**switchStatus**
1 (unknown)	Unknown
2 (unused)	Unmonitored
3 (ok)	Healthy/okay
4 (warning)	Marginal/warning
5 (failed)	Down/failed

connUnitProduct

OID 1.3.6.1.3.94.1.6.1.7

Description The connectivity unit vendor's product model name. Always returns `AP7420`.

Note This is the same as for sysDescr (set for as many as 79 bytes).

connUnitSn

OID 1.3.6.1.3.94.1.6.1.8

Description The serial number for this connectivity unit.

connUnitUpTime

OID 1.3.6.1.3.94.1.6.1.9

Description The number of centiseconds since the last unit initialization.

Note This is set when connUnitTable is initialized.

connUnitUrl

OID 1.3.6.1.3.94.1.6.1.10

Description The URL to use to launch a management application, if applicable. Otherwise, this is an empty string. In a standalone unit, this is the same as the top-level URL. This has the same definition as systemURL for keywords.

Note Provides the virtual IP address of the switch as a URL (for example: http://10.114.63.74/).

connUnitDomainId

OID 1.3.6.1.3.94.1.6.1.11

Description The 24-bit Fibre Channel address ID of this connectivity unit, right-justified, using leading 0s, if required. If this value is not applicable, all bits are set to 1.

Note This is set to the switch domain ID (as per FC-SW).

connUnitProxyMaster

OID 1.3.6.1.3.94.1.6.1.12

Description A value of 3 (yes) means that this is the proxy master unit for a set of managed units. Possible values are:

1 (unknown)
2 (no)
3 (yes)

Example This could be the only unit with a management card in it for a set of units. A standalone unit returns 3 (yes) for this object.

Note This is set to 3 (yes).

connUnitPrincipal

OID 1.3.6.1.3.94.1.6.1.13

Description Indicates whether this connectivity unit is the principal unit within the group of fabric elements. If this variable is not applicable, the value is 1 (unknown). Possible values are:

1 (unknown)
2 (no)
3 (yes)

Note If the switch is principal, this is set to 3 (yes); otherwise, it is set to 2 (no).

connUnitNumRevs

OID 1.3.6.1.3.94.1.6.1.17

Description The number of revisions in the connUnitRevsTable.

Note Always returns a value of 1.

connUnitModuleId

OID 1.3.6.1.3.94.1.6.1.19

Description This is a unique ID, persistent between boots, that can be used to group a set of connUnits together into a module. The intended use is to create a connUnit with a connUnitType of `module` to represent a physical or logical group of connectivity units. As a result, the value of the group is set to the value of connUnitId for this container connUnit.

The connUnitModuleId should be 0s if this connUnit is not part of a module.

Note This is set to the WWN of the switch.

connUnitName

OID 1.3.6.1.3.94.1.6.1.20

Description A display string containing a name for this connectivity unit. This object value should be persistent between boots.

Note This is set to switchName/sysName. The length of the connUnitName object should be equal to or less than 19 characters.

connUnitInfo

OID 1.3.6.1.3.94.1.6.1.21

Description A display string containing information about this connectivity unit. This object value should be persistent between boots.

Note This is set to sysDescr and read-write.

connUnitControl

OID 1.3.6.1.3.94.1.6.1.22

Description Controls the addressed connUnit. Each implementation can allow all or none of the following possible values on a SET:

1 (unknown)	Default value upon rebooting.
2 (invalid)	Not applicable.
3 (resetConnUnitColdStart)	Reboot. Performs a switch reboot.
4 (resetConnUnitWarmStart	Fastboot. The addressed unit performs a warm start reset.
5 (offlineConnUnit)	Disable switch. The addressed unit puts itself into an implementation-dependent offline state.
6 (onlineConnUnit)	Enable switch. The addressed unit puts itself into an implementation-dependent online state.

Cold start and warm start are as defined in MIB-II and are not meant to be a factory reset.

Note This always returns 2 (invalid) and cannot be set.

connUnitContact

OID 1.3.6.1.3.94.1.6.1.23

Description Contact information for this connectivity unit.

Note This is the same as sysContact.

connUnitLocation

OID 1.3.6.1.3.94.1.6.1.24

Description Location information for this connectivity unit.

Note This displays the same value as sysLocation.

connUnitEventFilter

OID 1.3.6.1.3.94.1.6.1.25

Description This value defines the event severity logged by this connectivity unit. All events of severity less than or equal to connUnitEventFilter are logged in connUnitEventTable.

Note Returns warning.

connUnitNumEvents

OID	1.3.6.1.3.94.1.6.1.26
Description	Number of events currently in the connUnitEventTable.
Note	Returns the number of events currently in the buffer (between 1and 999).

connUnitMaxEvents

OID	1.3.6.1.3.94.1.6.1.27
Description	Maximum number of events that can be defined in connUnitEventTable.
Note	The maximum number of events is 1000.

connUnitEventCurrID

OID	1.3.6.1.3.94.1.6.1.28
Description	The last-used event ID (connUnitEventId).
Note	The value of this object is a running counter. Hence, you may see the value beyond 1000 wherein 1000 is the maximum event count. The counter then begins again at 1.

Connectivity unit port table

connUnitPortTable

OID	1.3.6.1.3.94.1.10
Description	Generic information on ports for a specific connUnit.

connUnitPortEntry

OID	1.3.6.1.3.94.1.10.1
Description	Each entry contains the information for a specific port.
Index	connUnitPortUnitId connUnitPortIndex

connUnitPortUnitId

OID	1.3.6.1.3.94.1.10.1.1
Description	The connUnitId of the connectivity unit that contains this port.
Note	Displays the switch WWN.

connUnitPortIndex

OID	1.3.6.1.3.94.1.10.1.2
Description	Number of physical ports (between 1 and *maximum number of system-supported ports*) in the connectivity unit (internal/embedded, external).
Note	A unique value, between 1 and connUnitNumports, identifying the connUnitPortEntry.

connUnitPortType

OID 1.3.6.1.3.94.1.10.1.3

Description The port type. Possible values are:

1 (unknown)	
2 (other)	
3 (not-present)	
4 (hub-port)	
5 (n-port)	End port for fabric.
6 (l-port)	End port for loop.
7 (fl-port)	Public loop.
8 (f-port)	Fabric port.
9 (e-port)	Fabric expansion port.
10 (g-port)	Generic fabric port.
11 (domain-ctl)	Domain controller.
12 (hub-controller)	
13 (scsi)	Parallel SCSI port.
14 (escon)	
15 (lan)	
16 (wan)	
17 (ac)	AC power line.
18 (dc)	DC power line.
19 (ssa)	Serial storage architecture.

Note connUnitPortType is mapped as follows:

U_Port = 10 (g-port)
F_Port = 8 (f-port)
FL_Port = 7 (fl-port)
E_Port = 9 (e-port)

Ex_Port, Loopback, iSCSI and VE_Ports return the value 2 (other).

connUnitPortFCClassCap

OID 1.3.6.1.3.94.1.10.1.4

Description Bit mask that specifies the class-of-service capability of this port. If this is not applicable, all bits are set to 0.

The bits have the following definitions:

0	unknown
1	class-f
2	class-one
4	class-two
8	class-three
16	class-four
32	class-five
64	class-six

connUnitPortFCClassOp

OID 1.3.6.1.3.94.1.10.1.5

Description Bit mask that specifies the classes of service currently operating. If this is not applicable, all bits are set to 0. This object has the same definition as connUnitPortFCClassCap.

Note For an F_Port or FL_Port, this value is 0x0C. For a G_Port or E_Port, this value is 0x0D. For an iSCSI port this value is 0x008.

connUnitPortState

OID 1.3.6.1.3.94.1.10.1.6

Description The state of the port hardware. Possible values are:

1 (unavailable)	Do not use.
2 (online)	Available.
3 (offline)	Not available.
4 (bypassed)	No longer used.
5 (diagnostics)	Map to your testing.

Note For an E_Port, F_Port, or FL_Port, the value is 2 (online). For a U_Port, the value is 3 (offline) (disabled, testing, or faulted).

connUnitPortStatus

OID 1.3.6.1.3.94.1.10.1.7

Description An overall protocol status for the port. If the value of connUnitPortStatus is not online, then it is reported as unknown. Possible values are:

1 (unknown)	Unknown status.
2 (unused)	Device cannot report this status.
3 (ready)	FCAL Loop or FCPH Link reset protocol initialization has completed.
4 (warning)	Do not use.
5 (failure)	Do not use.
6 (notparticipating)	Loop not participating and does not have a loop address.
7 (initializing)	Protocol is proceeding.
8 (bypass)	Do not use.
9 (ols)	FCP offline status.

Note For an E_Port, F_Port, or FL_ Port, the value is 3 (ready).

connUnitPortTransmitterType

OID 1.3.6.1.3.94.1.10.1.8

Description The technology of the port transceiver. Possible values are:

1 (unknown)
2 (other)
3 (unused)
4 (shortwave)
5 (longwave)
6 (copper)
7 (scsi)
8 (longwaveNoOFC)
9 (shortwaveNoOFC)
10 (longwaveLED)
11 (ssa)

Note For an external FC_Port, this value should be 4 (shortwave), 6 (copper), or 8 (longwaveNoOFC).

connUnitPortModuleType

OID 1.3.6.1.3.94.1.10.1.9

Description The module type of the port connector. Possible values are:

1 (unknown)
2 (other)
3 (gbic)
4 (embedded)
5 (glm)
6 (gbicSerialId)
7 (gbicNoSerialId)
8 (gbicNotInstalled)
9 (smallFormFactor)

Note For an external FC_Port with GBIC, this value should be 6 (gbicSerialId).

connUnitPortWwn

OID 1.3.6.1.3.94.1.10.1.10

Description The World Wide Name of the port, if applicable; otherwise, an empty string.

This is in IEEE Extended format; the extension contains the internal port number of each port.

Note The internal port number is 1 less than the port index. For example, if the switch has WWN 10:00:00:60:69:10:02:18, then port numbers 0 and 6 have WWN 20:00:00:60:69:10:02:18 and 20:06:00:60:69:10:02:18, respectively; however, the embedded port has WWN 10:00:00:60:69:10:02:18, the same as the switch.

connUnitPortFCId

OID 1.3.6.1.3.94.1.10.1.11

Description This is the assigned Fibre Channel ID of this port. This value is expected to be a Big Endian value of 24 bits. If this is a loop, then it is the ALPA that is connected. If this is an E_Port, then it contains only the domain ID, left justified and zero filled. If this port does not have a Fibre Channel address, all bits are set to 1.

Note It displays the following value for all the ports: domainID PortNumber 00(For example:64 01 00)

connUnitPortSn

OID 1.3.6.1.3.94.1.10.1.12

Description The serial number of the unit (for example, for an SFP). If this is not applicable, returns an empty string.

Note If the SFP has a serial ID, the return value is the SFP part number; otherwise, it returns a value of unknown.

connUnitPortRevision

OID 1.3.6.1.3.94.1.10.1.13

Description The port revision (for example, for an SFP).

Note If the SFP has a serial ID, this returns the SFP revision number; otherwise, it returns a value of unknown.

connUnitPortVendor

OID 1.3.6.1.3.94.1.10.1.14

Description The port vendor (for example, for an SFP).

Note If the SFP has a serial ID, this returns the SFP vendor name; otherwise, it returns a value of unknown.

connUnitPortSpeed

OID 1.3.6.1.3.94.1.10.1.15

Description The speed of the port, in kilobytes per second.

Note The valid values for an HP StorageWorks MP Router are 2,097,152 and 1,048,576 KB/sec.

connUnitPortControl

OID 1.3.6.1.3.94.1.10.1.16

Description This object is used to control the addressed connUnit's port.

Note Each implementation may choose not to allow any or all of these values on a SET. Currently, this variable returns the value invalid (2).

connUnitPortName

OID 1.3.6.1.3.94.1.10.1.17

Description A string describing the addressed port.

Note This object can be set for HP StorageWorks switches.

connUnitPortPhysicalNumber

OID 1.3.6.1.3.94.1.10.1.18

Description This is the internal port number by which this port is known. In many implementations, this should be the same as connUnitPortIndex. Some implementations might have an internal port representation that is not compatible with the rules for table indices; in that case, provide the internal representation of this port in this object. This value can also be used in the connUnitLinkPortNumberX or connUnitLinkPortNumberY objects of the connUnitLinkTable.

Note The internal port numbers for the MP Routers are 0 through *maximum number of ports*.

connUnitPortProtocolCap

OID 1.3.6.1.3.94.1.10.1.20

Description This is the bit mask that specifies the driver-level protocol capability of this port. If this is not applicable, all bits are set to 0. The return value is 0x 7F.

The bits have the following definitions:

0 = unknown
1 = Loop
2 = Fabric
4 = SCSI
8 = TCP/IP
16 = VI
32 = FICON

connUnitPortProtocolOp

OID 1.3.6.1.3.94.1.10.1.21

Description This is the bit mask that specifies the currently active driver-level protocols. If this is not applicable, all bits are set to 0. The return value is 07F.

The bits have the following definitions:

0 = unknown
1 = Loop
2 = Fabric
4 = SCSI
8 = TCP/IP
16 = VI
32 = FICON

connUnitPortNodeWwn

OID 1.3.6.1.3.94.1.10.1.22

Description The node World Wide Name of the port, if applicable; otherwise, an empty string. All related ports in a group should have the same node WWN value. The container is defined as the largest physical entity.

Example All ports on HBAs on a host have the same node WWN. All ports on the same storage subsystem have the same node WWN. This is in IEEE Extended format and the extension contains the internal port number of each port.

Note The internal port number is 1 less than the port index.

For example, if the switch has WWN 10:00:00:60:69:10:02:18, then port numbers 0 and 6 have WWN 20:00:00:60:69:10:02:18 and 20:06:00:60:69:10:02:18, respectively. However, the embedded port has WWN 10:00:00:60:69:10:02:18, the same as the switch.

connUnitPortHWState

OID 1.3.6.1.3.94.1.10.1.23

Description The state of the port as detected by the hardware. Possible values are:

1 (unknown)	Unknown state.
2 (failed)	Port failed diagnostics (port_flt_state).
3 (bypassed)	FCAL bypass, loop only (not used).
4 (active)	Connected to a device (light and sync are present).
5 (loopback)	Port in ext loopback (loopback state).
6 (txfault)	Transmitter fault (bad SFP).
7 (noMedia)	Media not installed (SFP removed).
8 (linkDown)	Waiting for activity: rx sync (light with no sync).

Note For loopback ports this returns a value of 5 (loopback).

For all ports that are online state this returns a value of 4 (active).

For all ports that are disabled state this returns a value of 8 (linkdown).

For all ports that are in diagnostic mode this returns a value of 2 (failed).

For all ports that are in No_Light or No_Module state this returns a value of 7 (noMedia).

Connectivity unit event table

connUnitEventTable

OID 1.3.6.1.3.94.1.11

Description The table of connectivity unit events. Errors, warnings, and information should be reported in this table.

connUnitEventEntry

OID 1.3.6.1.3.94.1.11.1

Description Each entry contains information on a specific event for the given connectivity unit.

connUnitEventUnitId

OID 1.3.6.1.3.94.1.11.1.1

Description The connUnitId of the connectivity unit that contains events in this event table.

Note This displays the WWN value of the local switch for all the events.

connUnitEventIndex

OID 1.3.6.1.3.94.1.11.1.2

Description Each connectivity unit has its own event buffer. As it wraps, it may write over previous events. This object is an index into the buffer. HP recommends that this table be read using `getNext` commands to retrieve the initial table.

The management application should read the event table at periodic intervals and then determine whether any new entries were added by comparing the last known index value with the current highest index value. The management application should then update its copy of the event table. If the read interval is too long, it is possible that there may be events that may not be contained in the agent's internal event buffer.

For example, an agent may read events 50-75. At the next read interval, connUnitEventCurrID is 189. If the management application tries to read event index 76, and the agent's internal buffer is 100 entries maximum, event index 76 is no longer available.

The index value is an incrementing integer starting from one every time there is a table reset. On table reset, all contents are emptied and all indices are set to zero. When an event is added to the table, the event is assigned the next higher integer value than the last item entered into the table. If the index value reaches its maximum value, the next item entered causes the index value to roll over and start at 1 again

connUnitEventId

OID 1.3.6.1.3.94.1.11.1.3

Description The internal event ID. Incremented for each event, ranging between 0 and connUnitMaxEvents. Not used as table index to simplify the agent implementation. When this reaches the end of the range specified by connUnitMaxEvents, the Id rolls over to start at zero. This value is set back to zero at reset. The relationship of this value to the index is that internal event id may represent a smaller number than a 32-bit integer (for example, max 100 entries) and would only have a value range up to connUnitMaxEvents.

connUnitREventTime

OID 1.3.6.1.3.94.1.11.1.4

Description This is the real time when the event occurred. It has the following format:

`DDMMYYYY HHMMSS`

`DD` = day number

`MM` = month number

`YYYY` = year number

`HH` = hour number

`MM` = minute number

`SS` = seconds number

If not applicable, a NULL string is returned.

Note An example of the return value is: 12212004 084704

connUnitSEventTime

OID 1.3.6.1.3.94.1.11.1.5

Description This is the sysuptime timestamp when the event occurred.

Note Currently, the value of this MIB object remains the same for all entries in the connUnitEventTable.

connUnitEventSeverity

OID 1.3.6.1.3.94.1.11.1.6

Description The event severity level.

connUnitEventType

OID 1.3.6.1.3.94.1.11.1.7

Description The type of this event.

Note The value other(2) is displayed for all the events.

connUnitEventObject

OID 1.3.6.1.3.94.1.11.1.8

Description This is used with the connUnitEventType to identify which object the event refers to. It can be the OID of a connectivity unit or of another object like connUnitPortStatus.

Note The value null is displayed for all the events.

connUnitEventDescr

OID 1.3.6.1.3.94.1.11.1.9

Description The description of the event.

Connectivity Unit Link Table

The connectivity unit link table organizes and communicates information from the agent to assist a management application to discover the connectivity units in the framework and the topology of their interconnect. The connectivity unit link table also maps the elements of the framework.

The agent should include all information about links from its own connectivity units to others, including links among its own units. It also should include partial information about links if it is not able to fully define them in accordance with the following structure; however, the information must include either a nonzero connUnitNodeId or a nonzero connUnitPortWwn for each end of the link.

If the agent discovers links that do not directly attach to members of its agency and its discovery algorithm gives some assurance that the links are recently valid, it can include these links.

Link information entered by administrative action can be included even if not validated directly if the link has at least one endpoint in this agency; it should not be included otherwise.

A connectivity unit should fill in the link table as best it can. One method is to use the RNID ELS command (ANSI document 99-422v0), which queries a port for the information needed.

This link table is accessed either directly, if the management software has an index value, or by using the `getnext` command. The values of the indexes need not be contiguous. Each entry created in this table is assigned an index. This relationship is kept persistent until the entry is removed from the table or the system is reset. The total number of entries is defined by the size of the table.

For an entry to be considered valid, both the X (local unit) and the Y (remote unit) need to have one valid value.

connUnitLinkTable

OID 1.3.6.1.3.94.1.12

Description A list of links known to this agent from this connectivity unit to other connectivity units. X is the switch data; Y is the other end of the link.

connUnitLinkEntry

OID 1.3.6.1.3.94.1.12.1

Description An entry describing one link to another.

Index connUnitLinkUnitId
connUnitLinkIndex

connUnitLinkUnitId

OID 1.3.6.1.3.94.1.12.1.1

Description The connUnitId of the connectivity unit that contains this link table.

Note connUnitLinkUnitId is set to the WWN of the local switch.

connUnitLinkIndex

OID 1.3.6.1.3.94.1.12.1.2

Description This index is used to create a unique value for each entry with the same connUnitLinkUnitId in the link table. The value can be reused only if it is not currently in use and the value is the next candidate to be used. This value is allowed to wrap at the highest value represented by the number of bits. It is reset to 0 when the system is reset; the first value used is 1.

Note — Indexes 1 through *maximum number of ports* is reserved for ISL.

Indexes *maximum number of ports* + 1 and above are reserved for end devices and are calculated based on portID of the end devices.

For F_ports, FL_ports, and iSCSI ports it displays the hexadecimal equivalent of the PID. For example:

```
connUnitLinkIndex.16.0.0.5.30.21.158.0.0.0.0.0.0.0.0.6556160
```

Converts to a PID of:

```
6556160
```

connUnitLinkNodeIdX

OID — 1.3.6.1.3.94.1.12.1.3

Description — The node WWN of the unit at one end of the link. If the node WWN is unknown and the node is a connUnit in the responding agent, then the value of this object must be equal to its connUnitId.

Note — connUnitLinkNodeIdX is set to the WWN of the local switch.

connUnitLinkPortNumberX

OID — 1.3.6.1.3.94.1.12.1.4

Description — The port number on the unit specified by connUnitLinkNodeIdX, if known; otherwise, -1. If the value is nonnegative, then it is equal to connUnitPortPhysicalNumber.

Note — For an ISL, the value is the physical port number of the E_Port. For a device, the value is the physical port number to which the device is connected.

connUnitLinkPortWwnX

OID — 1.3.6.1.3.94.1.12.1.5

Description — The port WWN of the unit specified by connUnitLinkNodeIdX, if known; otherwise, 16 octets of binary 0.

Note — connUnitLinkPortWwnX is set to the WWN of the port to which the device is connected.

connUnitLinkNodeIdY

OID — 1.3.6.1.3.94.1.12.1.6

Description — The node WWN of the unit at the other end of the link. If the node WWN is unknown and the node is a connUnit in the responding SNMP agency, the value of this object must be equal to its connUnitId.

Note — For an ISL, the value is the WWN of the remote switch. For a device, the value is the node name of the device.

connUnitLinkPortNumberY

OID — 1.3.6.1.3.94.1.12.1.7

Description — The port number on the unit specified by connUnitLinkNodeIdY, if known; otherwise, -1. If the value is nonnegative, then it is equal to connUnitPortPhysicalNumber.

Note — For an ISL, the value is the physical port number of the remote port. For a device, the value is -1.

connUnitLinkPortWwnY

OID 1.3.6.1.3.94.1.12.1.8

Description The port WWN on the unit specified by connUnitLinkNodeIdY, if known; otherwise, 16 octets of binary 0.

Note For an ISL, the value is the WWN of the remote port. For a device, the value is the port name.

connUnitLinkAgentAddressY

OID 1.3.6.1.3.94.1.12.1.9

Description The address of an FCMGMT MIB agent for the node identified by connUnitLinkNodeIdY, if known; otherwise, 16 octets of binary 0.

Note This displays (zero-length) for devices and hosts.

connUnitLinkAgentAddressTypeY

OID 1.3.6.1.3.94.1.12.1.10

Description If connUnitLinkAgentAddressY is nonzero, it is a protocol address. ConnUnitLinkAgentAddressTypeY is the address family number assigned by IANA to identify the address format (for example, 1 is Ipv4; 2 is Ipv6).

Note This displays 1 for the devices connected to an E_Port and Ex_Port.
This displays 0 for the devices and hosts connected to an F_Port, FL_Port, and iSCSI port.

connUnitLinkAgentPortY

OID 1.3.6.1.3.94.1.12.1.11

Description The IP port number for the agent. This is provided in case the agent is at a non-standard SNMP port.

Note This displays 161 for the devices connected to an E_Port and Ex_Port.
This displays 0 for the devices and hosts connected to an F_Port, FL_Port, and iSCSI port.

connUnitLinkUnitTypeY

OID 1.3.6.1.3.94.1.12.1.12

Description The type of the Fibre Channel connectivity unit as defined in connUnitType:

- ISL: Switch device.
- End devices: End device types based on an FCP Inquiry.

Note HP does not support hubs.

connUnitLinkConnIdY

OID 1.3.6.1.3.94.1.12.1.13

Description This is the Fibre Channel ID of this port. If the connectivity unit is a switch, this is expected to be a Big Endian value of 24 bits. If this is a loop, it is the ALPA that is connected. If this is an E_Port, it contains only the domain ID. If this is not any of these, it is unknown or a cascaded loop; all bits are set to 1.

Note For an ISL, the value is the Port ID of the remote port. For a device, the value is the Port ID of the remote port.

This displays DomainId port number `00` for devices connected to E_Port and Ex_Port.

This displays the PID value for devices and hosts connected to F_Port and FL_Port.

This displays `00 00 00` for devices connected to VE_Port.

This displays `FFFFFF` for devices connected to iSCSI port.

connUnitLinkCurrIndex

OID 1.3.6.1.3.94.1.12.1.14

Description The most recently used link index.

trapMaxClients

OID 1.3.6.1.3.94.2.1

Description The maximum number of SNMP trap recipients supported by the connectivity unit.

Note The maximum number of SNMP trap recipients supported is 6.

trapClientCount

OID 1.3.6.1.3.94.2.2

Description The current number of rows in the trap table.

trapRegTable

OID 1.3.6.1.3.94.2.3

Description A table containing a row for each IP address/port number that traps are sent to.

trapRegEntry

OID 1.3.6.1.3.94.2.3.1

Description A row for each IP address/port number that traps are sent to.

trapRegIpAddress

OID 1.3.6.1.3.94.2.3.1.1

Description The IP address of a client registered for traps.

trapRegPort

OID 1.3.6.1.3.94.2.3.1.2

Description The UDP port to send traps to for this host. Normally this would be the standard trap port (162). This object is an index and must be specified to create a row in this table.

Note This MIB object always returns the value 162.

trapRegFilter

OID 1.3.6.1.3.94.2.3.1.3

Description This value defines the trap severity filter for this trap host. The connUnit sends traps to this host that have a severity level less than or equal to this value. The default value of this object is warning.

Note This MIB object is implemented as a read-only variable instead of a read-write variable, as defined in the MIB.

trapRegRowState

OID 1.3.6.1.3.94.2.3.1.4

Description Specifies the state of the row.

Note This MIB object is implemented as a read-only variable instead of a read-write variable, as defined in the MIB. It returns the row-active(3) for all the trap entries.

Statistics group

Port types are aggregated into a port type class, such as fabric ports.

Each individual port has only one statistics table. For all objects in the statistics table, if the object is not supported by the conn unit, the high-order bit is set to 1, with all other bits set to 0 (for example, the last 8 bytes of the returned value might be 80 00 00 00 00 00 00 00).

The high-order bit is reserved to indicate whether the object is supported. All objects start at a value of 0 at hardware initialization and continue incrementing until they reach 63 bits; then the value wraps to 0.

This is the case for all Class 1 frames; HP does not support them.

connUnitPortStatTable

OID 1.3.6.1.3.94.4.5

Description A list of statistics for the fabric port.

connUnitPortStatEntry

OID 1.3.6.1.3.94.4.5.1

Description An entry describing port statistics.

Index connUnitPortStatUnitId
connUnitPortStatIndex

connUnitPortStatUnitId

OID 1.3.6.1.3.94.4.5.1.1

Description The connUnitId of the connectivity unit that contains this port stat table.

connUnitPortStatIndex

OID 1.3.6.1.3.94.4.5.1.2

Description A unique value among all entries in this table, between 0 and connUnitNumports[connUnitPortUnitId].

connUnitPortStatCountTxObjects

OID 1.3.6.1.3.94.4.5.1.4

Description The number of frames, packets, I/Os, and so on transmitted by this port.

Note A Fibre Channel frame starts with SOF and ends with EOF. Fibre Channel loop devices should not count frames passed through. The value represents the sum total for all other transmitted objects.

connUnitPortStatCountRxObjects

OID 1.3.6.1.3.94.4.5.1.5

Description The number of frames, packets, I/Os, and so on received by this port.

Note A Fibre Channel frame starts with SOF and ends with EOF. Fibre Channel loop devices should not count frames passed through. The value represents the sum total for all other received objects.

connUnitPortStatCountTxElements

OID 1.3.6.1.3.94.4.5.1.6

Description The number of octets or bytes transmitted by this port. The port is polled every second. This value is saved and compared with the next polled value to compute net throughput.

For Fibre Channel, ordered sets are not included in the count.

connUnitPortStatCountRxElements

OID 1.3.6.1.3.94.4.5.1.7

Description The number of octets or bytes received by this port. The port is polled every second. This value is saved and compared with the next polled value to compute net throughput.

For Fibre Channel, ordered sets are not included in the count.

connUnitPortStatCountBBCreditZero

OID 1.3.6.1.3.94.4.5.1.8

Description The number of transitions in and out of BB credit zero state. The other side is not providing any credit.

Note This is a Fibre Channel stat only.

connUnitPortStatCountInputBuffersFull

OID 1.3.6.1.3.94.4.5.1.9

Description The number of occurrences when all input buffers of a port were full and outbound BB credit transitioned to 0. There is no credit to provide to the other side.

Note This is a Fibre Channel-only statistic.

connUnitPortStatCountFBSYFrames

OID 1.3.6.1.3.94.4.5.1.10

Description The number of times that FBSY was returned to this port as a result of a frame that could not be delivered to the other end of the link. This occurs if either the fabric or the destination port is temporarily busy. The port can occur only on SOFc1 frames (the frames that establish a connection).

Note This is a Fibre Channel-only statistic; the sum of all classes. If you cannot keep the by-class counters, then keep the sum counters.

connUnitPortStatCountPBSYFrames

OID 1.3.6.1.3.94.4.5.1.11

Description The number of times that PBSY was returned to this port as a result of a frame that could not be delivered to the other end of the link.This occurs if the destination port is temporarily busy. PBSY can occur only on SOFc1 frames (the frames that establish a connection).

Note This is a Fibre Channel-only statistic. This is the sum of all classes. If you cannot keep the by-class counters, then keep the sum counters.

connUnitPortStatCountFRJTFrames

OID 1.3.6.1.3.94.4.5.1.12

Description The number of times that FRJT was returned to this port as a result of a frame that was rejected by the fabric.

Note This is the total for all classes and is a Fibre Channel-only statistic.

connUnitPortStatCountClass2RxFrames

OID 1.3.6.1.3.94.4.5.1.20

Description The number of Class 2 frames received at this port.

Note This is a Fibre Channel-only statistic.

connUnitPortStatCountClass3RxFrames

OID 1.3.6.1.3.94.4.5.1.26

Description The number of Class 3 frames received at this port.

Note This is a Fibre Channel-only statistic.

connUnitPortStatCountClass3TxFrames

OID 1.3.6.1.3.94.4.5.1.27

Description The number of Class 3 frames transmitted out of this port.

Note This is a Fibre Channel-only statistic.

connUnitPortStatCountLinkFailures

OID 1.3.6.1.3.94.4.5.1.39

Description The number of link failures. This count is part of the Link Error Status Block (LESB) (FC-PH 29.8).

Note This is a Fibre Channel-only statistic.

connUnitPortStatCountInvalidCRC

OID 1.3.6.1.3.94.4.5.1.40

Description The number of frames received with an invalid CRC. This count is part of the Link Error Status Block (LESB). (FC-PH 29.8) Loop ports should not count CRC errors passing through when monitoring.

Note This is a Fibre Channel-only statistic.

connUnitPortStatCountInvalidTxWords

OID 1.3.6.1.3.94.4.5.1.41

Description The number of invalid transmission words received at this port. This count is part of the Link Error Status Block (LESB) (FC-PH 29.8).

Note This is a Fibre Channel-only statistic.

connUnitPortStatCountPrimitiveSequenceProtocolErrors

OID 1.3.6.1.3.94.4.5.1.42

Description The number of primitive sequence protocol errors detected at this port. This count is part of the Link Error Status Block (LESB) (FC-PH 29.8).

Note This is a Fibre Channel-only statistic.

connUnitPortStatCountLossofSynchronization

OID 1.3.6.1.3.94.4.5.1.44

Description The number of instances of synchronization loss detected at port. This count is part of the Link Error Status Block (LESB) (FC-PH 29.8).

Note This is a Fibre Channel-only statistic.

Unsupported Variables

For the following variables, the MSB bit is set to 1 to indicate these variables are not supported. For example these return the following value: 80 00 00 00 00 00 00 00.

- connUnitPortStatCountClass1RxFrames
- connUnitPortStatCountClass1TxFrames
- connUnitPortStatCountClass1FBSYFrames

- connUnitPortStatCountClass1PBSYFrames
- connUnitPortStatCountClass1FRJTFrames
- connUnitPortStatCountClass1PRJTFrames
- connUnitPortStatCountClass2FBSYFrames
- connUnitPortStatCountClass2PBSYFrames
- connUnitPortStatCountClass2FRJTFrames
- connUnitPortStatCountClass2PRJTFrames
- connUnitPortStatCountNumberLinkResets
- connUnitPortStatCountNumberOfflineSequences

Service group

All systems must implement the Service group. The Service group contains the following subgroups:

- Connectivity Unit Service Scalars group
- Connectivity Unit Service Tables group

Connectivity Unit Service Scalars group

All systems must implement the Connectivity Unit Service Scalars group.

connUnitSnsMaxEntry

OID 1.3.6.1.3.94.5.1.1

Description The maximum number of entries in the table.

connectivity Unit Service Tables group

All systems must implement the Connectivity Unit Service Tables group.

connUnitSnsTable

OID 1.3.6.1.3.94.5.2.1

Description This table contains an entry for each object registered with this port in the switch.

connUnitSnsEntry

OID 1.3.6.1.3.94.5.2.1.1

Description The Simple Name Server table for the port represented by connUnitSnsPortIndex.

Index connUnitSnsId
connUnitSnsPortIndex
connUnitSnsPortIdentifier

connUnitSnsId

OID 1.3.6.1.3.94.5.2.1.1.1

Description The connUnitId of the connectivity unit that contains this Name Server table.

connUnitSnsPortIndex

OID 1.3.6.1.3.94.5.2.1.1.2

Description The physical port number of this SNS table entry. Each physical port has an SNS table with 1-n entries, indexed by connUnitSnsPortIdentifier (port address).

connUnitSnsPortIdentifier

OID 1.3.6.1.3.94.5.2.1.1.3

Description The port identifier for this entry in the SNS table.

connUnitSnsPortName

OID 1.3.6.1.3.94.5.2.1.1.4

Description The port name for this entry in the SNS table.

connUnitSnsNodeName

OID 1.3.6.1.3.94.5.2.1.1.5

Description The node name for this entry in the SNS table.

connUnitSnsClassOfSvc

OID 1.3.6.1.3.94.5.2.1.1.6

Description The classes of service offered by this entry in the SNS table.

connUnitSnsNodeIPAddress

OID 1.3.6.1.3.94.5.2.1.1.7

Description The IPv6-formatted address of the node for this entry in the SNS table.

connUnitSnsProcAssoc

OID 1.3.6.1.3.94.5.2.1.1.8

Description The process associator for this entry in the SNS table.

connUnitSnsFC4Type

OID 1.3.6.1.3.94.5.2.1.1.9

Description The FC-4 types supported by this entry in the SNS table.

connUnitSnsPortType

OID 1.3.6.1.3.94.5.2.1.1.10

Description The port type of this entry in the SNS table.

connUnitSnsPortIPAddress

OID 1.3.6.1.3.94.5.2.1.1.11

Description The IPv6-formatted address of this entry in the SNS table.

connUnitSnsFabricPortName

OID 1.3.6.1.3.94.5.2.1.1.12

Description The fabric port name of this entry in the SNS table.

connUnitSnsHardAddress

OID 1.3.6.1.3.94.5.2.1.1.13

Description The hard address of this entry in the SNS table.

connUnitSnsSymbolicPortName

OID 1.3.6.1.3.94.5.2.1.1.14

Description The symbolic port name of this entry in the SNS table.

connUnitSnsSymbolicNodeName

OID 1.3.6.1.3.94.5.2.1.1.15

Description The symbolic node name of this entry in the SNS table.

Revision number scalar

revisionNumber

OID 1.3.6.1.3.94.3

Description This is the revision number for this MIB. The following is the format of the revision value:

0 = High-order major revision number
1 = Low-order major revision number
2 = High-order minor revision number
3 = Low-order minor revision number

The value is stored as an ASCII value, as follows:

0 = 0
1 = 3
2 = 0
3 = 0

This defines a revision of 03.00.

Note This is set to 0300.

Unsupported tables

HP does not support the following:

- Connectivity Unit Port Statistics Hub table
- Connectivity Unit Port Statistics SCSI table
- Connectivity Unit Port Statistics LAN/WAN table

The connUnitSensorTable is not supported in this release.

Connectivity unit traps

NOTE: The connUnitDeletedTrap is not supported in this release.

connUnitStatusChange

Enterprise fcmgmt

Variables connUnitStatus, connUnitState

Description The overall status of the connectivity unit has changed.

Recommended severity level (for filtering): alert.

Note Generated when connUnitStatus changes. See connUnitStatus for an explanation as to how the value is calculated.

connUnitEventTrap

Enterprise fcmgmt

Variables connUnitEventId, connUnitEventType, connUnitEventObject, connUnitEventDescr

Description The connUnitEventSeverity is sent as the fifth trap binding for the connUnitEventTrap.

Recommended severity level (for filtering): info.

connUnitSensorStatusChange

Enterprise	fcmgmt
Variables	connUnitSensorStatus
Description	The overall status of the connectivity unit has changed.

connUnitPortStatusChange

Enterprise	fcmgmt
Variables	connUnitPortStatus, connUnitPortState
Description	The overall status of the connectivity unit has changed. Recommended severity level (for filtering): alert.

A MIB object groupings

This appendix provides a function-based list of MIB objects, showing the correlation of various switch objects to MIB objects, including the following:

Switch variables

MIB variables that help you monitor or modify the status/state of switches are in section "Connectivity unit table" on page 23.

Port variables

MIB variables that help you monitor or modify ports are in the following tables or groups:

- Variables for State and Status: "Connectivity unit port table" on page 28
- Variables for Statistics and Measurement: "Statistics group" on page 40

ISL and end device variables

MIB variables that help you monitor or modify ISL and end-devices are in the following tables or groups:

- ISL Variables: "Connectivity Unit Link Table" on page 36
- End Device Variables: "Connectivity Unit Link Table" on page 36

B MIB OIDs and their matching object names

The matrix in Table 4 allows you to identify a MIB object name related its related OID; the table also cross-references the page on which the MIB appears.

Table 4 MIB object name and OID matrix

MIB object name	OID	Page number
iso	1	page 13
org	1.3	page 13
dod	1.3.6	page 13
internet	1.3.6.1	page 13
directory	1.3.6.1.1	page 13
mgmt	1.3.6.1.2	page 13
mib-2	1.3.6.1.2.1	page 13
system	1.3.6.1.2.1.1	page 13
sysDescr	1.3.6.1.2.1.1.1	page 14
sysObjectID	1.3.6.1.2.1.1.2	page 14
sysUpTime	1.3.6.1.2.1.1.3	page 14
sysContact	1.3.6.1.2.1.1.4	page 14
sysName	1.3.6.1.2.1.1.5	page 14
sysLocation	1.3.6.1.2.1.1.6	page 14
sysServices	1.3.6.1.2.1.1.7	page 15
fcmgmt	1.3.6.1.3.94	page 18
connSet	1.3.6.1.3.94.1	page 18
uNumber	1.3.6.1.3.94.1.1	page 22
systemURL	1.3.6.1.3.94.1.2	page 23
connUnitTable	1.3.6.1.3.94.1.6	page 23
connUnitRevsTable	1.3.6.1.3.94.1.7	page 23
connUnitEntry	1.3.6.1.3.94.1.6.1	page 23
connUnitId	1.3.6.1.3.94.1.6.1.1	page 23
connUnitGlobalId	1.3.6.1.3.94.1.6.1.2	page 24
connUnitType	1.3.6.1.3.94.1.6.1.3	page 24
connUnitNumports	1.3.6.1.3.94.1.6.1.4	page 24
connUnitState	1.3.6.1.3.94.1.6.1.5	page 25
connUnitStatus	1.3.6.1.3.94.1.6.1.6	page 25
connUnitProduct	1.3.6.1.3.94.1.6.1.7	page 25
connUnitSn	1.3.6.1.3.94.1.6.1.8	page 25
connUnitUpTime	1.3.6.1.3.94.1.6.1.9	page 25
connUnitUrl	1.3.6.1.3.94.1.6.1.10	page 26

Table 4 MIB object name and OID matrix (continued)

MIB object name	OID	Page number
connUnitDomainId	1.3.6.1.3.94.1.6.1.11	page 26
connUnitProxyMaster	1.3.6.1.3.94.1.6.1.12	page 26
connUnitPrincipal	1.3.6.1.3.94.1.6.1.13	page 26
connUnitNumRevs	1.3.6.1.3.94.1.6.1.17	page 26
connUnitModuleId	1.3.6.1.3.94.1.6.1.19	page 26
connUnitName	1.3.6.1.3.94.1.6.1.20	page 27
connUnitInfo	1.3.6.1.3.94.1.6.1.21	page 27
connUnitControl	1.3.6.1.3.94.1.6.1.22	page 27
connUnitContact	1.3.6.1.3.94.1.6.1.23	page 27
connUnitLocation	1.3.6.1.3.94.1.6.1.24	page 27
connUnitEventFilter	1.3.6.1.3.94.1.6.1.25	page 27
connUnitNumEvents	1.3.6.1.3.94.1.6.1.26	page 28
connUnitMaxEvents	1.3.6.1.3.94.1.6.1.27	page 28
connUnitEventCurrID	1.3.6.1.3.94.1.6.1.28	page 28
connUnitPortTable	1.3.6.1.3.94.1.10	page 28
connUnitPortEntry	1.3.6.1.3.94.1.10.1	page 28
connUnitPortUnitId	1.3.6.1.3.94.1.10.1.1	page 28
connUnitPortIndex	1.3.6.1.3.94.1.10.1.2	page 28
connUnitPortType	1.3.6.1.3.94.1.10.1.3	page 29
connUnitPortFCClassCap	1.3.6.1.3.94.1.10.1.4	page 29
connUnitPortFCClassOp	1.3.6.1.3.94.1.10.1.5	page 29
connUnitPortState	1.3.6.1.3.94.1.10.1.6	page 30
connUnitPortStatus	1.3.6.1.3.94.1.10.1.7	page 30
connUnitPortTransmitterType	1.3.6.1.3.94.1.10.1.8	page 30
connUnitPortModuleType	1.3.6.1.3.94.1.10.1.9	page 31
connUnitPortWwn	1.3.6.1.3.94.1.10.1.10	page 31
connUnitPortFCId	1.3.6.1.3.94.1.10.1.11	page 31
connUnitPortSn	1.3.6.1.3.94.1.10.1.12	page 31
connUnitPortRevision	1.3.6.1.3.94.1.10.1.13	page 31
connUnitPortVendor	1.3.6.1.3.94.1.10.1.14	page 32
connUnitPortSpeed	1.3.6.1.3.94.1.10.1.15	page 32
connUnitPortControl	1.3.6.1.3.94.1.10.1.16	page 32
connUnitPortName	1.3.6.1.3.94.1.10.1.17	page 32
connUnitPortPhysicalNumber	1.3.6.1.3.94.1.10.1.18	page 32
connUnitPortProtocolCap	1.3.6.1.3.94.1.10.1.20	page 32
connUnitPortProtocolOp	1.3.6.1.3.94.1.10.1.21	page 33
connUnitPortNodeWwn	1.3.6.1.3.94.1.10.1.22	page 33

Table 4 MIB object name and OID matrix (continued)

MIB object name	OID	Page number
connUnitPortHWState	1.3.6.1.3.94.1.10.1.23	page 33
connUnitLinkTable	1.3.6.1.3.94.1.12	page 36
connUnitLinkEntry	1.3.6.1.3.94.1.12.1	page 36
connUnitLinkUnitId	1.3.6.1.3.94.1.12.1.1	page 36
connUnitLinkIndex	1.3.6.1.3.94.1.12.1.2	page 36
connUnitLinkNodeIdX	1.3.6.1.3.94.1.12.1.3	page 37
connUnitLinkPortNumberX	1.3.6.1.3.94.1.12.1.4	page 37
connUnitLinkPortWwnX	1.3.6.1.3.94.1.12.1.5	page 37
connUnitLinkNodeIdY	1.3.6.1.3.94.1.12.1.6	page 37
connUnitLinkPortNumberY	1.3.6.1.3.94.1.12.1.7	page 37
connUnitLinkPortWwnY	1.3.6.1.3.94.1.12.1.8	page 38
connUnitLinkAgentAddressY	1.3.6.1.3.94.1.12.1.9	page 38
connUnitLinkAgentAddressTypeY	1.3.6.1.3.94.1.12.1.10	page 38
connUnitLinkAgentPortY	1.3.6.1.3.94.1.12.1.11	page 38
connUnitLinkUnitTypeY	1.3.6.1.3.94.1.12.1.12	page 38
connUnitLinkConnIdY	1.3.6.1.3.94.1.12.1.13	page 38
connUnitLinkCurrIndex	1.3.6.1.3.94.1.12.1.14	page 39
trapMaxClients	1.3.6.1.3.94.2.1	page 39
trapClientCount	1.3.6.1.3.94.2.2	page 39
trapRegTable	1.3.6.1.3.94.2.3	page 39
trapRegEntry	1.3.6.1.3.94.2.3.1	page 39
trapRegIpAddress	1.3.6.1.3.94.2.3.1.1	page 39
trapRegPort	1.3.6.1.3.94.2.3.1.2	page 39
trapRegFilter	1.3.6.1.3.94.2.3.1.3	page 39
trapRegRowState	1.3.6.1.3.94.2.3.1.4	page 39
revisionNumber	1.3.6.1.3.94.3	page 45
connUnitPortStatTable	1.3.6.1.3.94.4.5	page 40
connUnitPortStatEntry	1.3.6.1.3.94.4.5.1	page 40
connUnitPortStatUnitId	1.3.6.1.3.94.4.5.1.1	page 40
connUnitPortStatIndex	1.3.6.1.3.94.4.5.1.2	page 40
connUnitPortStatCountTxObjects	1.3.6.1.3.94.4.5.1.4	page 40
connUnitPortStatCountRxObjects	1.3.6.1.3.94.4.5.1.5	page 40
connUnitPortStatCountTxElements	1.3.6.1.3.94.4.5.1.6	page 40
connUnitPortStatCountRxElements	1.3.6.1.3.94.4.5.1.7	page 41
connUnitPortStatCountBBCreditZero	1.3.6.1.3.94.4.5.1.8	page 41
connUnitPortStatCountInputBuffersFull	1.3.6.1.3.94.4.5.1.9	page 41
connUnitPortStatCountFBSYFrames	1.3.6.1.3.94.4.5.1.10	page 41

Table 4 MIB object name and OID matrix (continued)

MIB object name	OID	Page number
connUnitPortCountPBSYFrames	1.3.6.1.3.94.4.5.1.11	page 41
connUnitPortStatCountFRJTFrames	1.3.6.1.3.94.4.5.1.12	page 41
connUnitPortStatCountClass2RxFrames	1.3.6.1.3.94.4.5.1.20	page 41
connUnitPortStatCountClass3RxFrames	1.3.6.1.3.94.4.5.1.26	page 42
connUnitPortStatCountClass3TxFrames	1.3.6.1.3.94.4.5.1.27	page 42
connUnitPortStatCountLinkFailures	1.3.6.1.3.94.4.5.1.39	page 42
connUnitPortStatCountInvalidCRC	1.3.6.1.3.94.4.5.1.40	page 42
connUnitPortStatCountInvalidTxWords	1.3.6.1.3.94.4.5.1.41	page 42
connUnitPortStatCountPrimitiveSequence ProtocolErrors	1.3.6.1.3.94.4.5.1.42	page 42
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Glossary

alias

A logical grouping of elements in a fabric. An alias is a collection of port numbers and connected devices; it is used to simplify the entry of port numbers and WWNs when creating zones.

ANSI

American National Standards Institute.

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.

block

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

cascade

Two or more interconnected Fibre Channel switches. HP StorageWorks 1 GB and later switches can be cascaded up to 239 switches, with a recommended maximum of seven interswitch links (no path longer than eight switches). *See also* fabric, ISL.

circuit

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

CLI

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

client

An entity that, using its common transport (CT), makes requests of a server.

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.

configuration

1. A set of parameters that can be modified to fine-tune the operation of a switch. Use the `configShow` command to view the current configuration of your switch.

2. In HP Zoning, a zoning element that contains a set of zones. The Configuration is the highest-level zoning element and is used to enable or disable a set of zones on the fabric.

disparity

The proportion of 1s and 0s in an encoded character. *Neutral disparity* means an equal number of each, *positive disparity* means a majority of 1s, and *negative disparity* means a majority of 0s.

domain ID

A unique identifier for all switches in a fabric, used in routing frames. Usually assigned by the principal switch, but can be assigned manually. The domain ID for an HP StorageWorks switch can be any integer between 1 and 239.

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.

ELS

Extended link service. ELSs are sent to the destination N_Port to perform the requested function or service. ELS is a Fibre Channel standard that is sometimes called a *Fibre Channel Physical (FC_PH) ELS*.

embedded port

An embedded port (or domain controller) communicates and gets updates from the embedded ports of other switches. The well-known address is *fffcdd*, where *dd* = domain number.

EOF

End of frame. A group of ordered sets used to mark the end of a frame.

error

In the Fibre Channel industry, a missing or corrupted frame, timeout, loss of synchronization, or loss of signal (link errors).

F_Port

Fabric port. A port that is able to transmit under fabric protocol and interface over links. Can be used to connect an N_Port to a switch. *See also* FL_Port, Fx_Port.

fabric

A Fibre Channel network containing two or more switches in addition to hosts and devices. Also called a *switched fabric*. *See also* cascade, SAN, topology.

Fabric Manager

Optional, licensed HP software. Fabric Manager is a GUI that allows for fabric-wide administration and management. Switches can be treated as groups and actions such as firmware downloads can be performed simultaneously.

Fabric Mode

One of two possible modes for an L_Port, in which the L_Port is connected to another port that is not loop capable, using fabric protocol.

fabric name

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

fabric port count

The number of ports available for connection by nodes in a fabric.

fabric services

Codes that describe the communication to and from any well-known address.

fabric topology

The arrangement of switches that form a fabric.

Fabric Watch

Optional, licensed HP software. Fabric Watch can be accessed through either the command line or Advanced Web Tools, and it provides the ability to set thresholds for monitoring fabric conditions.

failover

Describes the HP StorageWorks Core Switch 2/64 process of one CP passing active status to another CP. A failover is nondisruptive.

FCA

Flow-control acknowledgement (DLSW).

FCP

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

Fibre Channel

A protocol used to transmit data between servers, switches, and storage devices. It is a high-speed, serial, bidirectional, topology-independent, multi-protocol, and highly scalable interconnection between computers, peripherals, and networks.

FICON

A protocol used on IBM mainframes.

FIFO

First in, first out. A storage method that retrieves the item stored for the longest time.

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

Programmable nonvolatile RAM (NVRAM); memory that maintains its contents without power.

frame

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

FRU

Field-replaceable unit. A component that can be replaced onsite.

FTP

File Transfer Protocol.

FTS

Fiber Transport Services.

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 an F_Port. A port is defined as a G_Port when it is not yet connected or has not yet assumed a specific function in the fabric.

gateway

Hardware that connects incompatible networks by providing 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.

Gb/sec

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

GB/sec

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

GLM

Gigabit Link Module. A semitransparent transceiver that incorporates serializing and deserializing functions.

HA

High availability. The High availability features in HP StorageWorks switches are designed to provide maximum reliability and nondisruptive replacement of key hardware and software modules.

hard address

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

HBA

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

header

A Fibre Channel frame has a header and a payload. The header contains control and addressing information associated with the frame.

host

A computer system that provides end users with services like computation and storage access.

HTTP

Hypertext Transfer Protocol. The standard TCP/IP transfer protocol used on the World Wide Web.

interswitch link

See ISL.

IOCTL

I/O control.

IP

Internet Protocol. The addressing part of TCP.

iSCSI

Internet Small Computer Systems Interface. A protocol that defines the processes for transferring block storage applications over TCP/IP networks by encapsulating SCSI commands into TCP and transporting them over the network via IP.

ISL

Interswitch link. A Fibre Channel link from the E_Port of one switch to the E_Port of another. *See also* cascade, E_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.

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 either Fabric Mode or Loop Mode.

latency

The time required to transmit a frame. Together, latency and bandwidth define the speed and capacity of a link or system.

LED

Light-emitting diode. A device that indicates the status of elements on a switch.

login server

The unit that responds to login requests.

LPE

Loop port enable. A primitive sequence transmitted by an L_Port to enable one or all L_Ports that have been bypassed with the LPB. It is used only in arbitrated loops.

LPSM

Loop Port State Machine. Logic that monitors and performs the tasks required for initialization and access to the loop. It is maintained by an L_Port to track behavior through different phases of loop operations. Alternatively, the logical entity that performs arbitrated-loop protocols and defines the behavior of L_Ports when they require access to an arbitrated loop.

MB/sec

Megabytes per second.

Mb/sec

Megabits per second.

MIA

Media interface adapter. A device that converts optical connections to copper ones, and vice-versa.

MIB

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

MTBF

Mean time between failures. The average time a component works without failure. The average is calculated by dividing the number of failures by the hours under observation.

N_Port

Node port. A port on a node that can connect to a Fibre Channel port or to another N_Port in a point-to-point connection. *See also* NL_Port, Nx_Port.

Name Server

Simple Name Server (SNS). 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. Also called a *directory service*.

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.

Nx_Port

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

OFC

Open fiber control. A method used to enable and disable laser signaling for higher-intensity laser transceivers.

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, which mark frame boundaries and describe frame contents.
- Primitive signals, which indicate events.
- Primitive sequences, which indicate or initiate port states.

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

originator

The Nx_Port that originated an exchange.

oversubscription

A situation in which more nodes could potentially contend for a resource than the resource could simultaneously support (typically an ISL). Oversubscription could be a desirable attribute in fabric topology, as long as it does not produce unacceptable levels of congestion.

packet

A set of information transmitted across a network. *See also* frame.

parallel

The simultaneous transmission of data bits over multiple lines.

Performance Monitoring

An HP StorageWorks switch feature that monitors port traffic and includes frame counters, SCSI read monitors, SCSI write monitors, and other types of monitors.

persistent error log

Error messages of a high enough level (by default, Panic or Critical) are saved to flash memory on the switch instead of to RAM. These messages are saved over reboots and power cycles, constituting the persistent error log. Note that each CP on a HP StorageWorks Core Switch 2/64 has its own unique persistent error log.

PLOGI

Port login. The port-to-port login process by which initiators establish sessions with targets. *See also* frame.

point to point

A Fibre Channel topology that employs direct links between each pair of communicating entities. *See also* topology.

port

In an HP StorageWorks switch environment, an SFP or GBIC receptacle on a switch to which an optical cable for another device is attached.

port address

In Fibre Channel technology, the port address is defined in hexadecimal. In the HP Fabric OS, a port address can be defined by a domain and port number combination or by area number. In an ESCON Director, an address used to specify port connectivity parameters and to assign link addresses for attached channels and control units.

port card

A hardware component that provides a platform for field-replaceable, hot-swappable ports.

port log

A record of all activity on a switch, kept in volatile memory.

port log dump

A view of what happens on a switch, from the switch's point of view. The `portLogDump` command is used to read the port log.

port name

A user-defined alphanumeric name for a port.

port swapping

Port swapping is the ability to redirect a failed port to another port. This feature is available in Fabric OS v4.1.0 and later.

port_name

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

primitive sequence

An ordered set that is transmitted repeatedly and continuously. Primitive sequences are transmitted to indicate specific conditions within or conditions encountered by the receiver logic of an FC_Port.

principal switch

The first switch to boot up in a fabric. Ensures unique domain IDs among roles.

private NL_Port

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

protocol

A defined method and set of standards for communication. Determines the type of error-checking, the data-compression method, how sending devices indicate an end of message, and how receiving devices indicate receipt of a message.

PSU

Power supply unit.

public loop

An arbitrated loop that includes a participating FL_Port and can contain both public and private NL_Ports.

public NL_Port

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

radius

The greatest distance between any edge switch and the center of a fabric. A low-radius network is better than a high-radius network.

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.

receiver

A device that performs detection and signal processing.

redundancy

Multiple instances of a component to maintain high availability (HA).

remote switch

An optional product for long-distance fabrics, requiring a Fibre Channel-to-ATM or SONET gateway.

repeater

A circuit that uses a recovered clock to regenerate and transmit an outbound signal.

route

In a fabric, the communication path between two switches. Might also apply to the specific path taken by an individual frame, from source to destination.

routing

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

RW

Read/write. Refers to access rights.

SAN

Storage area network. A network of systems and storage devices that communicate using Fibre Channel protocols. *See also* fabric.

SAN architecture

The overall design of a storage network solution, which includes one or more related fabrics, each of which has a topology.

SAN port count

The number of ports available for connection by nodes in the entire SAN.

scalability

One of the properties of a SAN; the size to which a SAN topology can grow port and switch counts with ease.

SCN

State change notification. Used for internal state change notifications, not external changes. This is the switch logging that the port is online or is an Fx_port, not what is sent from the switch to the Nx_Ports.

SCSI

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

Secure Fabric OS

A separately sold HP feature that provides advanced, centralized security for a fabric.

security policy

Rules that determine how security is implemented in a fabric. Security policies can be customized through HP Secure Fabric OS or HP Fabric Manager.

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

serial
The transmission of data bits in sequential order over a single line.

server
A computer that processes end-user applications or requests.

SFP
Small-form-factor pluggable. A transceiver used on 2 GB/sec switches that replaces the GBIC.

SFP cable
A cable specifically designed for use with an SFP. Not compatible with GBICs.

Simple Name Server (SNS)
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. Also called *directory service* or *name server*.

SMI
Structure of management information. A notation for setting or retrieving SNMP management variables.

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

SNS
See Simple Name Server (SNS).

SoIP
SCSI-over-IP.

special character
A 10-bit character that does not have a corresponding 8-bit value, but is still considered valid. The special character is used to indicate that a particular transmission word is an ordered set. This is the only type of character to have five 1s or 0s in a row.

SPOF
Single point of failure. Any component in a SAN whose malfunction could bring down the entire SAN.

switch
A fabric device providing bandwidth and high-speed routing of data through link-level addressing.

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. *See also* E_Port, F_Port, FL_Port.

syslog
Syslog daemon. Used to forward error messages.

TCP/IP

Transmission Control Protocol/Internet Protocol.

telnet

A virtual terminal emulation used with TCP/IP. Telnet is sometimes used as a synonym for the HP Fabric OS CLI.

topology

In Fibre Channel technology, the configuration of the Fibre Channel network and the resulting communication paths allowed. There are three possible topologies:

- Point to point, which is a direct link between two communication ports.
- Switched fabric, in which multiple N_Ports are linked to a switch by F_Ports.
- Arbitrated loop, in which multiple NL_Ports are connected in a loop.

track changes

An HP Fabric OS feature that can be enabled to report specific activities (for example, logins, logouts, and configuration task changes). The output from the track-changes feature is dumped to the error log for the switch.

trap (SNMP)

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

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.

well-known address

In Fibre Channel technology, a logical address defined by Fibre Channel standards as assigned to a specific function and stored on the switch.

WWN

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

zone

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

zoning

A feature in fabric switches or hubs that allows segmentation of a node by physical port, name, or address.

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