

hp StorageWorks

SNMP reference guide for director 2/64, edge switch 2/16, and edge switch 2/32

Part Number: A6534-96026/AA-RQ7BB-TE

Second Edition (August 2002)

This guide introduces simple network management protocol (SNMP) and the associated commands to manage a network. It also explains how the Hewlett-Packard (HP) StorageWorks director 2/64, hp StorageWorks edge switch 2/16, hp StorageWorks edge switch 2/32, and ha-fabric manager (HAFM) server support SNMP management.



i n v e n t

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Printed in the U.S.A.

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About This Guide

This reference guide provides information to use simple network management protocol (SNMP) for the following Hewlett-Packard (HP) products:

- hp StorageWorks director 2/64.
- hp StorageWorks edge switch 2/16.
- hp StorageWorks edge switch 2/32.
- ha-fabric manager (HAFM) application.

Intended Audience

This publication is intended for operators, data center administrators, and customer support personnel who configure, operate, and maintain HP products using SNMP commands.

Related Documentation

In addition to this guide, HP provides corresponding information:

- *hp StorageWorks product in a SAN environment - planning guide for director 2/64, edge switch 2/16, and edge switch 2/32, A6534-96025/AA-RS2DA-TE*
- *hp StorageWorks CLI reference guide for director 2/64, edge switch 2/16, and edge switch 2/32, A6534-96027/AA-RQ7AB-TE*
- *hp StorageWorks director 2/64 installation guide, A6534-96110/AA-RSNGA-TE*
- *hp StorageWorks director 2/64 service manual, A6534-96022/AA-RS2EA-TE*
- *hp StorageWorks director 2/64 product manager user guide, A6534-96023/AA-RS2FA-TE*
- *hp StorageWorks director 2/64 release notes, A6534-96111/AV-RSNHA-TE*

- *hp StorageWorks m-series rack mount kit installation instructions, A6534-96028/AA-RQZPB-TE*
- *hp StorageWorks model A6534A/AZ torque tool caution flyer, A6534-96021/AA-RT4LA -TE*
- *hp StorageWorks universal port module kit installation instructions, A6574-96004/AA-RSS2A-TE*
- *hp StorageWorks HAFM server installation guide, A6582-96001/AA-RT4KA-TE*
- *hp StorageWorks ha-fabric manager user guide, A6534-96024/AA-RS2CA-TE*
- *hp StorageWorks ha-fabric manager release notes, A6575-96004/AV-RQZJC-TE*
- *hp StorageWorks edge switch 2/32 installation guide, A7283-96001/AA-RSTZA-TE*
- *hp StorageWorks edge switch 2/32 service manual, A7283-96002/AA-RS2GA-TE*
- *hp StorageWorks edge switch 2/32 product manager user guide, A7283-96003/AA-RS2HA-TE*
- *hp StorageWorks edge switch 2/32 release notes, A7283-96004/AV-RSU0A-TE*
- *hp StorageWorks edge switch 2/32 flexport upgrade instructions, A7290-96001/AA-RS33A-TE*
- *hp StorageWorks edge switch 2/16 installation guide, A7284-96001/AA-RSU2A-TE*
- *hp StorageWorks edge switch 2/16 service manual, A7284-96002/AA-RS2JA-TE*
- *hp StorageWorks edge switch 2/16 product manager user guide, A7284-96003/AA-RS2KA-TE*
- *hp StorageWorks edge switch 2/16 release notes, A7284-96004/AV-RSU3A-TE*
- *hp StorageWorks edge switch rack mount installation instructions, A7283-96004/AA-RT4MA-TE*
- *hp StorageWorks SFP transceiver installation instructions, A6534-96030/AA-RSS3A-TE*

Document Conventions

The conventions included in [Table 1](#) apply.

Table 1: Document Conventions

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

Symbols in Text

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



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



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

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

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

Symbols on Equipment



Any enclosed surface or area of the equipment marked with these symbols indicates the presence of electrical shock hazards. Enclosed area contains no operator serviceable parts.

WARNING: To reduce the risk of injury from electrical shock hazards, do not open this enclosure.



Any RJ-45 receptacle marked with these symbols indicates a network interface connection.

WARNING: To reduce the risk of electrical shock, fire, or damage to the equipment, do not plug telephone or telecommunications connectors into this receptacle.



Any surface or area of the equipment marked with these symbols indicates the presence of a hot surface or hot component. Contact with this surface could result in injury.

WARNING: To reduce the risk of injury from a hot component, allow the surface to cool before touching.



Power supplies or systems marked with these symbols indicate the presence of multiple sources of power.

WARNING: To reduce the risk of injury from electrical shock, remove all power cords to completely disconnect power from the power supplies and systems.



Any product or assembly marked with these symbols indicates that the component exceeds the recommended weight for one individual to handle safely.

WARNING: To reduce the risk of personal injury or damage to the equipment, observe local occupational health and safety requirements and guidelines for manually handling material.

Rack Stability



WARNING: To reduce the risk of personal injury or damage to the equipment, be sure that:

- The leveling jacks are extended to the floor.
 - The full weight of the rack rests on the leveling jacks.
 - In single rack installations, the stabilizing feet are attached to the rack.
 - In multiple rack installations, the racks are coupled.
 - Only one rack component is extended at any time. A rack may become unstable if more than one rack component is extended for any reason.
-

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- Applicable error messages
- Operating system type and revision level
- Detailed, specific questions

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Introduction to SNMP

Network management is a broad term, including workstation configuration, assignment of IP addresses, network design, architecture, network security, and topologies. All this can fall within the scope of a network manager.

Any protocol for managing networks must allow virtually all network devices and systems to communicate statistics and status information to network management stations (network managers). This communication must be independent of the primary network transmission medium and impose little effect on the efficiency of the network. Network managers must be able to obtain status information from managed devices, and make changes in the way the managed devices handle network traffic. Network managers must be able to do this without knowing anything about the managed device itself, SNMP management is one way of meeting these requirements.

SNMP Management

Simple network management protocol (SNMP) is a mechanism for network management that is complete, but simple. It is designed on the manager/agent paradigm, with the agent being resident in the managed device. Information is exchanged between agents (devices on the network being managed) and managers (devices on the network through which management is done).

There are many possible transactions between agents and managers. These transactions vary widely with the different types of devices that can be managed. With so many varied requirements for reporting and management, the list of commands a manager must be able to issue is overwhelming, and every new manageable device can increase the list. SNMP was created to allow all these things to be easily done on any growing network.

SNMP operates on a simple fetch/store concept. With SNMP the available transactions between manager and agent are limited to a handful. The manager can request information from the agent or modify variables on the agent. The agent can respond to a request by sending information, or if enabled to do so, voluntarily notify the manager of a change of status on the agent (issue a trap).

With SNMP, administrators can manage director and switch configurations, faults, performance, accounting, and security from remote SNMP management stations.

SNMP Simplified

SNMP is the only protocol that is widely available from many vendors of Transmission Control protocol/Internet protocol (TCP/IP) networks and internetworks. SNMP:

- Allows management with a simple set of commands.
- Allows new devices added to a network to be easily managed with minimal intervention.
- Is adequate for many basic network management needs.
- Is generalized for application to networks other than TCP/IP, such as IPX and OSI.
- Provides a great deal of versatility for managing a great many types of devices.
- Allows all networks to employ the same method for management.

SNMP Commands

A manager requests information from an agent by sending a single command, the Get command. The Get command also has a variation (GetNextRequest) that permits more efficient operation:

- GetRequest – Requests the value of a specified variable on the agent. This command is used to retrieve management data.
- GetNextRequest – Requests the value of the next variable after the one specified in the command. This command is used to retrieve lists and tables of management data.

An agent responds to a request by sending a single command, the GetResponse command. This command contains the requested information.

A manager changes information (variables) in the agent by sending a single command, the SetRequest command. This command is used to manipulate management data.

A trap is used by an agent to report extraordinary events. Refer to [Traps and Their Purpose on page 1-5](#).

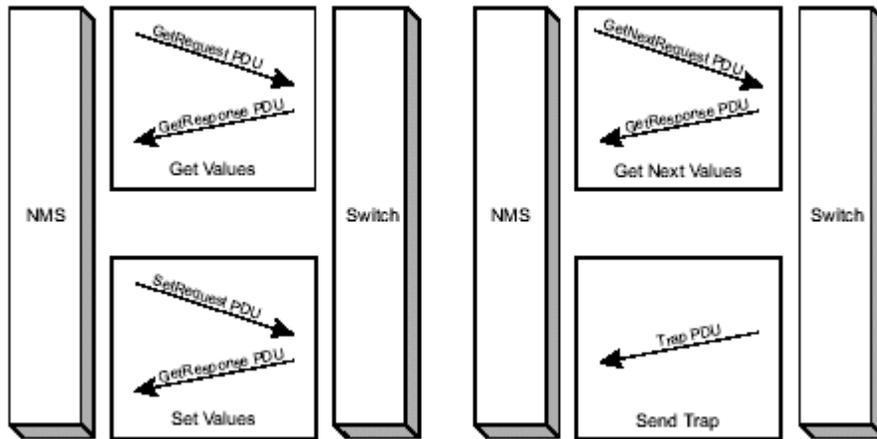


Figure 1–1: SNMP commands and responses

Why Variables Exist In a Managed Device

Variables are the means by which a director or Switch (and other devices) keep track of their performance, control their own performance, and provide access to their performance for network managers. A simple example of a variable's use is to set a port offline and turn the port back on. Some variables just hold values that indicate status (for example error counts). SNMP allows the network managers to have access to some of the same variables for network management.

For purposes of the following explanation, an object is a data variable that represents an attribute of a managed device.

How SNMP Changes Variables (Objects) in a Managed Device

An agent is the entity that interfaces to the actual object being managed ([Figure 1–2 on page 1-4](#)). The agent understands the language of SNMP and translates between the manager and the object. Objects may be retrieved and/or modified by the manager, and it is the agent's job to return the requested object's value. Within the agent is at least one, maybe several, collections of definitions called Management Information Bases (MIBs). When an agent supports a standard MIB, it agrees to provide and make available the variables listed in the MIB.

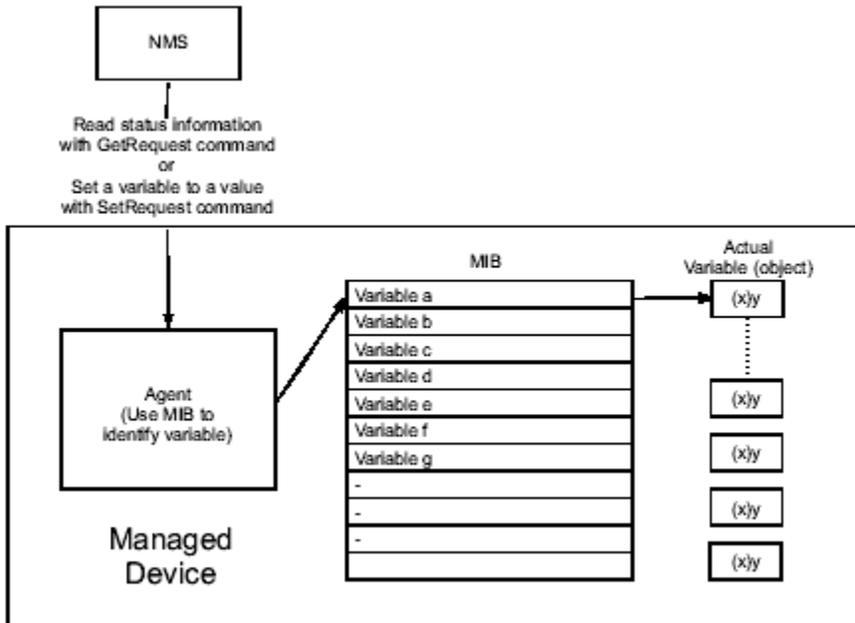


Figure 1–2: Retrieving or setting values using MIBs

Standard MIBs

Standard MIBs are those available with SNMP and designed for standard operation with a wide variety of managed devices. Chapter 2 describes the standard MIBs used by the hp StorageWorks director 2/64, hp StorageWorks edge switch 2/16, hp StorageWorks edge switch 2/32, and ha-fabric manager (HAFM) application.

Standard MIBs are:

- MIB-II (Internet MIB) as described in RFC 1157: supported by the director 2/64, edge switch 2/16, and edge switch 2/32.
- Fibre Alliance (FCMGMT) MIB, version 3.1: supported by the director 2/64, edge switch 2/16, and edge switch 2/32.
- Fibre Channel Fabric Element (FCFE), version 1.10: supported by the director 2/64, edge switch 2/16, and edge switch 2/32, and HAFM server.

Private Enterprise MIBs

Private MIBs are those provided by the manufacturer of the managed devices to allow management of device-specific items. Chapter 2 describes the private MIBs in more detail.

The private enterprise MIB is the ef6000 MIB, which is used by the director 2/64, edge switch 2/16, and edge switch 2/32 to support zoning, port binding, and threshold alerts.

Traps and Their Purpose

Traps are unsolicited status reports, or status change indicators a managed object sends to a network manager. The destination address for traps is a configuration item for each managed agent.

SNMP Support

This chapter explains how the Hewlett-Packard (HP) StorageWorks director 2/64, hp StorageWorks edge switch 2/16, hp StorageWorks edge switch 2/32, and ha-fabric manager (HAFM) server support simple network management protocol (SNMP).

SNMP Management

SNMP is a transmission control protocol/internet protocol (TCP/IP) that uses the user datagram protocol (UDP) or other protocols such as UDP/IP to exchange messages between an SNMP agent (in a managed device) and a management station residing on a network. Since SNMP does not rely on the underlying communication protocols, it can be made available over other protocols.

A MIB is a hierarchical tree of groups and variables. Operators at a network management station enter a command with supported groups and variables from the MIB. Each group is a “branch” and each variable is a “leaf” within the MIB tree. The tree begins with the **root**. The MIB for the director and switch is under the *iso* branch (refer to [Figure 2-1 on page 2-2](#)). To get to the director and switch MIB variables, you must go through the *org*, *dod*, and *internet* sub-branches.

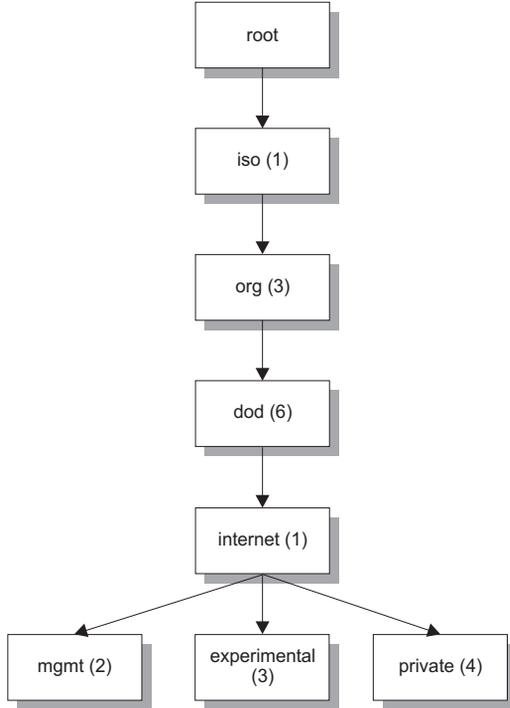


Figure 2–1: MIB tree director

NOTE: Variables are also known as “objects.”

The switch-supported groups under *internet* are *mgmt*, *experimental*, and *private* (refer to [Figure 2–2 on page 2-3](#)). For *mgmt*, see [MIB-II Support on page 2-5](#); for *experimental* refer to [Fibre Channel Fabric Element MIB Support on page 2-59](#); and for *private*, refer to the [EF-6000 Private MIB on page 2-70](#).

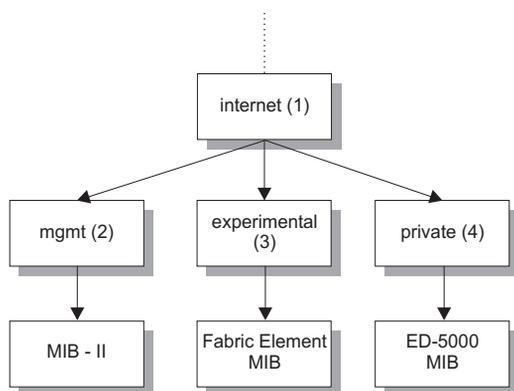


Figure 2–2: MIB Tree, experimental and private

Use the following SNMP commands with the MIB variables:

- `get`
Retrieves the value of variables at the agent.
- `set`
Sets the value of variables at the agent.
- `trap`
Notifies the management station of significant events.

Each group and variable in a MIB is assigned a object identifier. You can enter commands with variables specified as a name or a number. For example:

```
get {root, iso, org, dod, internet, mgmt, mib-2, system}
```

or

```
get {root, 1, 3, 6, 1, 2, 1, 1}
```

SNMP Support

The director and switch-resident SNMP agents:

- Support SNMPv1 manager.

- Enable access to variables in the standard MIB-II definition, the Fibre Channel Fabric Element MIB, and director or switch Private MIB. All groups and variables in the supported MIBs are read only by SNMP management stations unless noted otherwise.
- Enable the director or switch to send unsolicited trap messages to the network management station when specific events occur. The traps supported are:
 - Standard generic traps
 - Director and switch enterprise-specific traps

Configuration of the SNMP agent is accomplished through the Embedded Web Server (EWS) interface, command line interface (CLI), or Product Manager application.

SNMPv1 Transports

The director or switch SNMP agent supports UDP/IP through the Product Manager application.

Agent Configuration

Refer to the following user guides to configure the appropriate parameters for the specific managed products.

- *hp StorageWorks ha-fabric manager user guide, A6534-96024/AA-RS2CA-TE*
- *hp StorageWorks director 2/64 product manager user guide, A6534-96023/AA-RS2FA-TE*
- *hp StorageWorks edge switch 2/16 product manager user guide, A7284-96003/AA-RS2KA-TE*
- *hp StorageWorks edge switch 2/32 product manager user guide, A7283-96003/AA-RS2HA-TE*

MIB-II Support

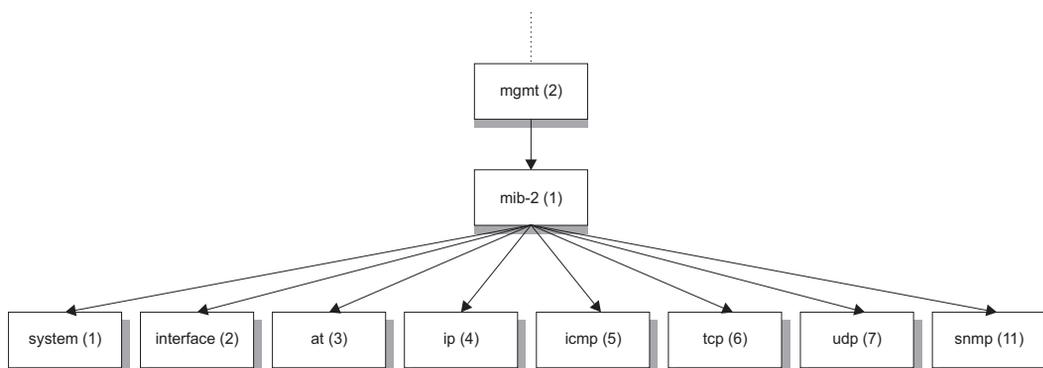


Figure 2-3: SNMP MIB-II support

The director or switch agent supports eight groups specified in MIB-II:

- System group

The variable ID is:

{iso, org, dod, internet, mgmt, mib-2, system}

- Interface group

The interface group supports three interfaces: software loopback driver, Ethernet driver, and Fibre Channel IP driver.

The variable ID is:

{iso, org, dod, internet, mgmt, mib-2, interface}

{1,3,6,1,2,1,1}

- Address translation group

The variable ID is:

{iso, org, dod, internet, mgmt, mib-2, at}

- IP group

The variable ID is:

{iso, org, dod, internet, mgmt, mib-2, ip}

- ICMP group
The variable ID is:
{ iso, org, dod, internet, mgmt, mib-2, icmp }
- TCP group
The variable ID is:
{ iso, org, dod, internet, mgmt, mib-2, tcp }
- UDP group
The variable ID is:
{ iso, org, dod, internet, mgmt, mib-2, udp }
- SNMP group
The variable ID is:
{ iso, org, dod, internet, mgmt, mib-2, SNMP }

Fibre Channel Management MIB (version 3.1)

There are six groups of objects defined in the Fibre Channel Management (FCMGMT) MIB:

- Connectivity Unit Group
- Link Table
- Port Statistics
- SNMP Trap Registration Group
- Trap Registration Table
- Fibre Channel Management Traps

A single scalar object, revisionNumber, is defined under the FCMGMT MIB base.

Table 2–1: Scalar FCMGMT Objects

Object	Provides
revisionNumber	A constant Display String value representing the revision number of the FCMGMT MIB that is supported by the HAFM server SNMP agent is returned.

HAFM Server Agent MIB Objects

The following sections define the FCMGMT MIB objects and how they are implemented in the HAFM server SNMP agent. Unless otherwise noted, all MIB objects are Read-only.

Connectivity Unit Group Objects

The Connectivity Unit Group contains information about the director or switch that are configured in the HAFM server. The group contains five simple objects and four tables; Connectivity Unit, Firmware, Port, Sensor, and Event.

Table 2–2: Connectivity Group Table (HAFM Server)

Object Type Name	Type	Product mapping	Access	Description
fcConnUnitNumber	INTEGER	The number of managed units defined to the HAFM server.	R	The number of connectivity units present on this system. May be a count of the boards in a chassis or the number of full boxes in a rack.
fcConnURL	DisplayString	http://[HAFM addr]/launch/start, where [HAFM addr] is the network address of the HAFM server. Loading this URL using a web browser launches the HAFM application.	R	<p>The top-level URL of the system. If it 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 (e.g., %USER).</p> <p>The following are the defined keywords that will be recognized and replaced with data during a launch:</p> <ul style="list-style-type: none"> • USER - replace with username • PASSWORD - replace with password • GLOBALID - replace with globalid • SERIALNO - replace with serial number <p>A management application will read this object from the MIB, provide values for any of the keywords listed above that are present in the string, and then use the URL to invoke or launch the program referenced.</p>

Connectivity Unit Table

The connectivity unit table contains general information on the connectivity units. Each row in the table contains information for a particular director or switch.

Table 2–3: ConnUnit Table (HAFM Server)

FA Mib Object Name	Type	Implementation	Access	Return When Linkdown
fcConnUnitId	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.			
	OCTET STRING(16)	An index (an array of 16 bytes) that identifies a particular unit that is managed by the given HAFM server.	R	Same
fcConnUnitGlobalId	<p>An optional global-scope identifier for this connectivity unit. It MUST be a WWN for this connectivity unit or 16 octets of value zero. WWN formats requiring fewer than 16 octets MUST be extended to 16 octets with trailing zero octets, Left justified, zero filled. If a WWN is used for connUnitId, the same WWN MUST be used for connUnitGlobalId. When a non-zero value is provided, it SHOULD be persistent across agent and unit resets. It SHOULD be globally unique. It SHOULD be one of these FC-PH/PH3 formats:</p> <p>IEEE (NAA=1) IEEE Extended (NAA=2) IEEE Registered (NAA=5). IEEE Registered extended (NAA=6).</p> <p>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</p> <p>If one or more WWNs are associated with the connUnit via other management methods, one of them SHOULD be used for connUnitGlobalId. If there is not a WWN assigned specifically to the connUnit, there is some merit, though not a requirement, to using a WWN assigned to (one of) its permanently attached FC/LAN interface(s). This cannot risk uniqueness, though. 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 will all be distinct connUnits, so the host and agent can not use the WWN of the HBA. Another example: If your hub has a built-in Ethernet port, it might be reasonable for the hub to use its MAC address (prefixed with the appropriate NAA) as its connUnitId. But if the Ethernet were a replaceable PCCard, the hub should have an independent ID.</p>			
	FcGlobalId	The units' WWN is contained in the first 8 bytes of the array. If the link between the HAFM server and the director or switch is down, the array element values are all zeros.	R	Zeros
fcConnUnitType	The type of this connectivity unit.			
	FcUnitType	director 2/64: return switch(4)	R	Same

Table 2–3: ConnUnit Table (HAFM Server) (Continued)

fcConnUnitNumPorts	Number of physical ports in the connectivity unit (internal/embedded, external).			
	Gauge(32 bits)	director 2/64, edge switch 2/16, edge switch 2/32: 9 Note: the object does not count the inaccessible ports	R	Zero
fcConnUnitState	This object reports the overall state of the connectivity unit. The meaning of all values is self-explanatory. Any of these values may occur with any of the fcConnUnitStatus values. The values are defined as: unknown(1), online(2), or offline(3).			
	INTEGER	<u>HAFM MIB</u> online: online state(2) going-offline: offline state(3) offline: offline state(3) coming-online: online state(2).	R	unknown(1)
fcConnUnitStatus	This object reports the overall status of the connectivity unit. The warning (4) value means the connectivity unit needs attention; all other values are self-explanatory. Any of these values may occur with any of the fcConnUnitState values unknown(1), unused(2), ok(3), warning(4), or failed(5).			
	INTEGER	<u>HAFM MIB</u> operational: ok(3) degraded: warning(4) failed: failed(5)	R	unknown(1)
fcConnUnitProduct	The connectivity unit vendor's product model name.			
	SnmpAdminString	The director product name.	R	Same
	The serial number for this connectivity unit.			
fcConnUnitSerialNo	SnmpAdminString	OEM serial number	R	Empty string
fcConnUnitUpTime	The number of centiseconds since the last unit initialization.			
	TimeTicks	The total time the link between the HAFM server and the managed unit has been up.	R	Zero

Table 2-3: ConnUnit Table (HAFM Server) (Continued)

fcConnUnitUrl	URL to launch a management application, if applicable. Otherwise empty string. In a standalone unit, this would be the same as the top level URL. This has the same definition as systemURL for keywords.			
	DisplayString	http://[HAFM addr]/launch/start/[product netaddr], where [HAFM addr] is the IP address of the HAFM server and [product netaddr] is the IP address of the director. The form of the director address depends upon how it was added in the HAFM application. If it was added by Name then the name must be used otherwise the IP address must be used. Loading this URL from a web browser will launch the corresponding Product Manager.	R	Same
fcConnUnitDomainId	24 bit Fibre Channel address ID of this connectivity unit. Following the fibre channel standard, the right-most bit of the right-most octet is for the least significant bit of the address value; the left-most bit of the left-most octet, if needed, is for the most significant bit of the address value. If this value is not applicable, all bits set to 1			
	OCTET STRING(3)	Switch Fibre Channel Address	R	FF.FF.FF
fcConnUnitProxyMaster	A value of 'yes' means this is the proxy master unit for a set of managed units. For example, this could be the only unit with a management card in it for a set of units. A standalone unit should return 'yes' for this object. The values are defined as follow: unknown(1), no(2), or yes(3).			
	INTEGER	yes(3)	R	Yes
fcConnUnitPrincipal	Whether this connectivity unit is the principal unit within the group of fabric elements. If this value is not applicable, return unknown. The values are defined as follow: unknown(1), no(2), yes(3).			
	INTEGER	yes(3)	R	Yes
fcConnUnitNumSensors	Number of sensors in the fcConnUnitSensorTable.			
	Gauge(32 bits)	director 2/64: Two types: power supplies and fan	R	Zero
fcConnUnitNumRevs	The number of revisions in the fcConnUnitRevsTable.			
	Gauge(32 bits)	Always return 1	R	Zero
fcConnUnitModuleId	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 would be to create a connUnit with a connUnitType of 'module' to represent a physical or logical group of connectivity units. Then the value of the group would be set to the value of connUnitId for this 'container' connUnit. connUnitModuleId should be zeros if this connUnit is not part of a module.			
	OCTET STRING(16)	Not supported, return 16 zeros	R	Not supported

Table 2-3: ConnUnit Table (HAFM Server) (Continued)

fcConnUnitName	A name for this connectivity unit. This object value should be persistent between boots.			
	A textual string of the name of the director		R/W	Empty string when reading and not settable when setting
fcConnUnitInfo	Information about this connectivity unit. This object value should be persistent between boots.			
	SnmpAdminString	A textual string of the description of the director	R/W	Empty string when reading and not settable when setting
fcConnUnitControl	<p>This object is used to control the addressed connectivity unit.</p> <ul style="list-style-type: none"> NOTE: 'ColdStart' and 'WarmStart' are as defined in MIB-2 and are not meant to be a factory reset. resetConnUnitColdStart: the addressed unit performs a 'ColdStart' reset. resetConnUnitWarmStart: the addressed unit performs a 'WarmStart' reset. offlineConnUnit: the addressed unit puts itself into an implementation dependant 'offline' state. In general, if a unit is in an offline state, it cannot be used to perform meaningful Fibre Channel work. onlineConnUnit: the addressed unit puts itself into an implementation dependant 'online' state. In general, if a unit is in an online state, it is capable of performing meaningful Fibre Channel work. NOTE: Each implementation may chose not to support SNMP Set operations for any or all of these values. For Sets specifying varbinds for instances of this object and values not supported by a given implementation, the agent will return the SNMP WrongValue PDU error code. 			
	INTEGER	1. Return unknown(1) on read operation 2. Supports: resetConnUnitWarmStart(2) offlineConnUnit(3) onlineConnUnit(4)	R/W	Not settable when setting, unknown when reading
fcConnUnitContact	Contact information for this connectivity unit. The contact information is intended to facilitate contacting someone in case of problems, questions, etc. (e.g., the a help desk internal to a company).			
	SnmpAdminString	A textual string of the contact info of the director	R/W	Empty string when reading and not settable when setting
fcConnUnitLocation	Location information for this connectivity unit:			
	SnmpAdminString	A textual string of the location of the director	R/W	Empty string when reading and not settable when setting
fcConnUnitEventFilter	This value defines the event severity that will be logged by this connectivity unit. All events of severity less than or equal to connUnitEventFilter are logged in connUnitEventTable.			
	FcEventSeverity	Default to info(8). Settable only when the new value is within 1 to 10.	R/W	Not settable, info(8) when reading

Table 2–3: ConnUnit Table (HAFM Server) (Continued)

fcConnUnitNumEvents	Number of events currently in the fcConnUnitEventTable.			
	Gauge(32bits)	Current number of events whose event severities are equal or less than the event filter value	R	Zero
fcConnUnitMaxEvents	Max number of events that can be defined in fcConnUnitEventTable.			
	Gauge(32bits)	Always 50	R	50
fcConnUnitEventCurrID	The last used event id (fcConnUnitEventIndex).			
	Gauge(32bits)	The current event index is used as the last used event id. It is wrapped to a higher number when new event occurred and restart from 1 when HAFM resets	R	Zero

Firmware Table

The firmware table contains information on the firmware revisions supported by a particular connectivity unit.

Table 2–4: Firmware Table (HAFM Server)

FA Mib Object Name	Type	Product Mapping	Access	Linkdown
fcConnUnitRevsIndex	Gauge(32 bits)	Always return 1. Each director supports only one revision component.	R	A unique value among all fcConnUnitRevsEntry with the same value of fcConnUnitRevsUnitId, in the range between 1 and fcConnUnitNumRevs [fcConnUnitRevsUnitId].
fcConnUnitRevsRevision	SnmpAdminString	The revision of the director. When link is down: return NULL	R	A vendor-specific value identifying a revision of a component of the connectivity unit.
fcConnUnitRevsDescription	SnmpAdminString	Return director Firmware Level When link is down: return NULL	R	Description of a component to which the revision corresponds.

Sensor Table

The sensor table contains information on the status of the fan and power supply components on a given director or switch.

Table 2–5: Sensor Table (HAFM Server)

FA Mib Object Name	Type	Product Mapping	Access	Description
fcConnUnit SensorIndex	Gauge(32 bits)	director 2/64: 0	R	A unique value among all fcConnUnitSensorEntry with the same value of fcConnUnitId, in the range between 1 and fcConnUnitNumSensors[fcConnUnitId].
fcConnUnit SensorName	SnmpAdminString	director 2/64: Power(5), fan(4) and fan2(). When link is down: return NULL	R	A textual identification of the sensor intended primarily for operator use.
fcConnUnit SensorStatus	INTEGER	This value is evaluated from FRU status. The active, backup and update-busy states are mapped to ok(3). The failed state is mapped to failed(5). When link is down: return unknown(1).	R	The status indicated by the sensor. The values are defined as follow: unknown(1) -- the unit cannot determine the status, other(2) -- the status does not fit any of the remaining values the ok(3) -- the sensor indicates ok, warning(4) -- the sensor indicates a warning, failed(5) B indicates the unit is non-functional-
fcConnUnit SensorInfo	SnmpAdminString	The serial number of the FRUs. Not supported if the module fails. When link is down: return NULL	R	Miscellaneous static info about the sensor such as its serial number.
fcConnUnit SensorMessage	SnmpAdminString	Textual description of the FRU status. When link is down: return NULL	R	This describes the status of the sensor as a message. It may also provide more resolution on the sensor indication, for example 'Cover temperature 1503K, above nominal operating range'
fcConnUnit Sensor Characteristic	INTEGER	Not supported and other(2) is returned When link is down: return unknown(1)	R	The characteristics monitored by this sensor. Values are defined as: unknown(1), other(2), temperature(3), pressure(4), emf(5), currentValue(6) - current is a keyword, airflow(7), frequency(8), and power(9).

Table 2–5: Sensor Table (HAFM Server) (Continued)

fcConnUnit SensorType	INTEGER	director 2/64: Power(5), fan(4) and fan(2). When link is down: return unknown(1)	R	The type of component monitored by this sensor. Unknown (1) and other (2) value meanings analogous to those for the fcConnUnitSensorStatus object; all other values are self-explanatory. Values are defined as: unknown(1), other(2), battery(3), fan(4), power-supply(5), transmitter(6), enclosure(7), board(8), and receiver(9).
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Port Table

The port table contains information on the physical ports on a given director or switch.

Table 2–6: Port Table (HAFM Server)

FA Mib Object Name	Type	Product Mapping	Access	Description
fcConnUnit PortIndex	Gauge(32 bits)	A number starting from 1 for each director. It should be continuous within that director.	R	A unique value among all fcConnUnitPortEntrys on this connectivity unit, between 1 and fcConnUnitNumPorts.
fcConnUnit PortType	INTEGER	If not installed, return not-present(3) Director F_Port(8) if device is connected to storage, E_Port(9) if director is connected to director, G_Port(10) if nothing is connected to the port When link is down: return unknown(1)	R	The port type. The values are defined as follow: unknown(1) - cannot be determined, other(2) - none of the following, not-present(3) - no port, hub-port(4) - hub port, n-port(5) - end port for fabric, nl-port(6) - end port for loop, fl-port(7) - public loop, f-port(8) - fabric port, e-port(9) - fabric expansion port, g-port(10) - generic fabric port, domain-ctl(11) - domain controller, hub-controller(12), scsi(13) - parallel SCSI port, escon(14) - end port for fabric, lan(15) - LAN port, wan(16) - WAN port.
fcConnUnit PortFCClassCap	FcPortFCClass	E or G_Port: return 1A(26) = class_two(8) + class_three(16) + class_f(2) F_Port: return 18(24) = class_two(8) + class_three(16)	R	Bit mask that specifies the classes of service capabilities of this port. If this is not applicable, return all bits set to zero.
fcConnUnit PortFCClassOp	FcPortFCClass	E or G_Port: return 1A(26) = class_two(8) + class_three(16) + class_f(2) F_Port: return 18(24) = class_two(8) + class_three(16) When link is down: return 00.00	R	Bit mask that specifies the classes of service that are currently operational. If this not applicable, return all bits set to zero.

Table 2–6: Port Table (HAFM Server) (Continued)

fcConnUnit PortState	INTEGER	HAFM MIB PDF.isInvalidAttachment() online(2) STAT_NOT_INSTALLED unknown(1) STAT_LINK_FAIL_LOL offline(3) STAT_AVAILABLE online(2) STAT_BLOCKED offline(3) STAT_UNAVAILABLE online(2) STAT_INTERNAL_DIAGS diagnostics(5) STAT_EXTERNAL_LOOP diagnostics(5) STAT_LINK_RESET online(2) STAT_LINK_FAILURE online(2) STAT_SERVICE_REQUIRED online(2) STAT_PORT_FAIL online(2) STAT_INACTIVE offline(3) In any other cases: online(2) (should not happen) The above mappings apply to the director. When link is down: return unknown(1)	R	The user selected state of the port hardware. The bypassed value (4) means the port is online but is isolated from the loop or fabric for some reason; the other values are self-explanatory. Any value for this object may co-exist with any value for the fcConnUnitPortStatus object. Values are defined as: unknown(1), online(2) - available for meaningful work, offline(3) - not available for meaningful work, bypassed(4) - no longer used (4/12/00), diagnostics(5).
fcConnUnit PortStatus	INTEGER	HAFM MIB PDF.isInvalidAttachment() warning(4) STAT_NOT_INSTALLED unknown(1) STAT_LINK_FAIL_LOL unsued(2) unknown(1) STAT_AVAILABLE ok(3) STAT_BLOCKED unknown(1)	R	An overall protocol status for the port. The warning value (4) means the port needs attention; the notParticipating value (6) means that protocol is not being processed; the initializing value (7) means the port is in the process of coming into service; the bypassed value (8) means the port was isolated from the loop or fabric; other values are self-explanatory. Any value for this object may co-exist with any value for the fcConnUnitPortState object.

Table 2–6: Port Table (HAFM Server) (Continued)

fcConnUnit PortStatus (continued)	INTEGER	<u>HAFM MIB (continued)</u> STAT_UNAVAILABLE unknown(1) STAT_INTERNAL_DIAGS unknown(1) STAT_EXTERNAL_LOOP unknown(1) STAT_LINK_RESET initializing(7) STAT_LINK_FAILURE initializing(7) STAT_SERVICE_REQUIRED unknown(1) STAT_PORT_FAIL unknown(1) STAT_INACTIVE warning(4) In any other cases: ready(3) (defined in FA2.0. - should never happen). The above mappings apply to the director 2/64. When link is down: return unknown(1)	R	Values are defined as: unknown(1), unused(2), ok (3), warning(4), failure(5),notParticipating(6), initializing(7), bypassed (8).
fcConnUnit PortTransmitterType	INTEGER	This is mapped from the port technology as: not present and serial indicate unknown(1), optical sw1g and optical sw2g indicate shortwave(4). optical lw1g and optical lw2g indicate longwave(5), copper db9 and copper amp indicate copper(6), When link is down: return unknown(1).	R	Technology of the port transceiver. Values are defined as: unknown(1), other(2), unused(3), shortwave(4) longwave(5), copper(6), scsi(7), longwaveNoOFC(8), shortwaveNoOFC(9), longwaveLED(10),
fcConnUnit PortModuleType	INTEGER	director 2/64: return smallFormFactor(9) If not installed, return gbicNotInstalled(8) When link is down: return unknown(1).	R	The module type of the port connector. Refers to the hardware implementation of the port. The embedded value (4) means 'fixed' (e.g., oneXnine). Values are defined as: unknown(1), other(2), gbic(3), embedded(4) B fixed, i.e., oneXinne, glm(5), gbicSerialId(6), gbicNoSerialId(7), gbicNotInstalled(8), smallFormFactor(9) - generically a small form factor connector.

Table 2–6: Port Table (HAFM Server) (Continued)

fcConnUnit PortWwn	FcNameId	Return the World Wide Name of the port. When link is down: return NULL	R	The World Wide Name of the port. If applicable, otherwise empty string.
fcConnUnit PortFCId	OCTET STRING (SIZE(3))	F_Port in director 2/64: Fabric address of the node containing the port, in form of [domain, rea, node] is returned E_Port in director 2/64: Right-adjusted domain returned If no fcAddress, return FF.FF.FF When link is down: return 0F.0F.0F (hex)	R	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 loop, then it is the ALPA that is connected. If this is an eport, then it will only contain the domain ID left justified, zero filled. If this port does not have a Fibre Channel address, return all bits set to 1.
fcConnUnit PortSerialNoSn	SnmpAdminString	Not supported. (empty string) When link is down: return NULL	R	The Serial Number of the unit (e.g., for a GBIC). if this is not applicable, return a zero-length string
fcConnUnit PortRevision	SnmpAdminString	Not supported. (empty string) When link is down: return NULL	R	The port revision (e.g., for a GBIC).
fcConnUnit PortVendor	SnmpAdminString	Not supported. (empty string) When link is down: return NULL	R	The port vendor (e.g., for a GBIC).
fcConnUnit PortSpeed	Gauge(32 bits)	director 2/64: 104857 for one Gig, 209714 for two Gig and zero for not established. When link is down: return NULL	R	The speed of the port in kilobytes per second.
fcConnUnit PortControl	INTEGER	1. Always return unknown(1) on read. 2. Supports: Reset, GoOffline, GoOnline 3. Linkdown: not settable When link is down: return NULL	R/W	This object controls the addressed connUnit's port. Valid commands are: resetConnUnitPort: If the addressed connUnit allows this operation to be performed to this port, the addressed port performs a vendor-specific reset operation. Examples of these operations are: the Link Reset protocol, the Loop Initialization protocol, or a re synchronization occurring between the transceiver in the addressed port to the transceiver that the port is connected to. bypassConnUnitPort: If the addressed connUnit allows this operation to be performed to this port, the addressed port performs a vendor-specific bypass operation. Examples of these operations are:

Table 2–6: Port Table (HAFM Server) (Continued)

fcConnUnit PortControl (continued)			<p>transitioning from online to offline, a request (NON-PARTICIPATING) command to the Loop Port state machine, or removal of the port from an arbitrated loop by a hub.</p> <p>unbypassConnUnitPort: If the addressed connUnit allows this operation to be performed to this port, the addressed port performs a vendor-specific unbypass operation. Examples of these operations are: the Link Failure protocol, a request (PARTICIPATING) command to the Loop Port state machine, or addition of the port to an arbitrated loop by a hub.</p> <p>offlineConnUnitPort: If the addressed connUnit allows this operation to be performed to this port, the addressed port performs a vendor-specific offline operation. Examples of these operations are: disabling a port's transceiver, the Link Failure protocol, request (NON-PARTICIPATING) command to the Loop Port state machine, or removal of the port from an arbitrated loop by a hub.</p> <p>onlineConnUnitPort: If the addressed connUnit allows this operation to be performed to this port, the addressed port performs a vendor-specific online operation. Examples of these operations are: enabling a port's transceiver, the Link Failure protocol, request (PARTICIPATING) command to the Loop Port state machine, or addition of the port from an arbitrated loop by a hub.</p> <p>resetConnUnitPortCounters: If the addressed connUnit allows this operation to be performed to this port, the addressed port statistics table counters will be set to zero. Each implementation may chose not to allow any or all of these values on a SET. On a read, if you do not support write, then return invalid. Otherwise return the last control operation attempted.</p>
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Table 2–6: Port Table (HAFM Server) (Continued)

fcConnUnit PortName	SnmpAdminString	Not settable when LD and empty string in reading. When link is down: return NULL	R/W	A string describing the addressed port.
fcConnUnit PortPhysicalNumber	Gauge(32 bits)	The internal port number starting from zero. There may be gaps between these objects for the same director, i.e., inaccessible ports are skipped. When link is down: return NULL	R	This is the internal port number this port is known by. In many implementations, this should be the same as connUnitPortIndex. Some implementations may have an internal port representation not compatible with the rules for table indices. In that case, provide the internal representation of this port in this object. This value may also be used in the fcConnUnitLinkPortNumberX or fcConnUnitLinkPortNumberY objects of the fcConnUnitLinkTable.
fcConnUnit PortProtocolCap (added from Mib3.0)	OCTET STRING (2)	director 2/64: return Fabric(2). When link is down: return NULL	R	Bit mask that specifies the driver level protocol capability of this port. If this is not applicable, return all bits set to zero. The bits have the following definition: unknown - 0, Loop - 1, Fabric - 2, SCSI - 4, TCP/IP - 8, VI - 16, FICON - 32.
fcConnUnit PortProtocolOp (added from Mib3.0)	OCTET STRING (2)	Same as above. When link is down: return NULL	R	Bit mask that specifies the driver level protocol(s) that are currently operational. If this is not applicable, return all bits set to zero. This object has the same definition as fcConnUnitPortProtocolCap.
fcConnUnit PortNodeWwn (added from Mib3.0)	FcNameId	Return director WWN. When link is down: return NULL	R	The Node World Wide Name of the port if applicable, otherwise all zeros. This should have the same value for a group of related ports. The container is defined as the largest physical entity. For example, all ports on HBAs on a host will have the same Node WWN. All ports on the same storage subsystem will have the same Node WWN.
fcConnUnit PortHWState (added from Mib3.0)	INTEGER	HAFM MIB PDF.IsInvalidAttachment active(4) STAT_NOT_INSTALLED unknown(1) STAT_LINK_FAIL_LOL offline(2) STAT_AVAILABLE active(4)	R	The hardware detected state of the port. Values are defined as: unknown(1), failed(2) - port failed diagnostics, bypassed(3) - FCAL bypass, loop only, active(4) - connected to device, loopback(5) - Port in ext loopback, txfault(6) - Transmitter fault, noMedia(7) - media not installed, linkDown(8) - waiting for activity (rx sync).

Table 2–6: Port Table (HAFM Server) (Continued)

fcConnUnit PortHWState (added from Mib3.0) (continued)		HAFM MIB STAT_BLOCKED active(4) STAT_UNAVAILABLE active(4) STAT_INTERNAL_DIAGS loopback(5) STAT_EXTERNAL_LOOP loopback(5) STAT_LINK_RESET active(4) STAT_LINK_FAILURE active(4) STAT_SERVICE_REQUIRED failed(2) STAT_PORT_FAIL failed(2) STAT_INACTIVE active(4) In any other cases: active(4) (should never happen) The above mappings apply to the director 2/64. When link is down: return unknown(1).		
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Event Table

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

Table 2–7: Event Table (HAFM Server)

FA Mlib Object Name	Type	Product Mapping	Access	Description
fcConnUnit EventIndex	Gauge(32 bits)	Return the event index defined by MIB provider which follows the definition described in the connUnitEventIndex description.	R	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. It is recommended this table be read using getNext's to retrieve the initial table. The management application should read the event table at periodic intervals and then determine if any new entries were added by comparing the last known index value with

Table 2-7: Event Table (HAFM Server) (Continued)

fcConnUnit EventIndex (continued)				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, fcConnUnitEventCurrID is 189. If the management app tries to read event index 76, and the agent's internal buffer is 100 entries max, event index 76 will no longer be 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 will cause the index value to roll over and start at one again.
fcConnUnitR EventTime	DisplayString (0..15)	Return the time when the event occurred. When link is down: return NULL.	R	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, return either a NULL string
fcConnUnitS EventTime	TimeTicks	Translated from connUnitREventTime. When link is down: return NULL.	R	This is the sysuptime timestamp when the event occurred.
fcConnUnit EventType	INTEGER	Always return status(3). When link is down: return NULL	R	The type of this event. The values are defined as follow: unknown(1), other(2), status(3), configuration(4), topology(5).
fcConnUnit EventObject	OBJECT IDENTIFIER	Only the OID of a conUnit is returned. Other information is not supported. When link is down: return NULL.	R	This is used with the fcConnUnitEventType to identify which object the event refers to. It can be the OID of a connectivity unit or of another object like fcConnUnitPortStatus[...]
fcConnUnit EventDescr	SnmpAdminString	Return the event reason code description. When link is down: return NULL.	R	The description of the event.

Link Table

The link table contains information on the Fibre Channel links that exist between a particular director or switch and a Fibre Channel device or another switch.

Table 2–8: Link Table (HAFM Server)

FA Mib Object Name	Type	Implementation	Access	Description
fcConnUnitLinkIndex	Gauge(32 bits)	Agent maintains this counter for all switches.	R	Index is used to create a unique value for each entry in the link table with the same connUnitLinkId. The value can only be reused if it is not in use and the value is the next candidate to be used. This value wraps at the highest value represented by the size of the INTEGER. This value is reset to zero when the system is Reset and the first value to be used is one.
fcConnUnitLinkNodeldX	OCTET STRING (16)	The WWN of this switch or device X.	R	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.
fcConnUnitLinkPortNumberX	Integer32	The port number of device X.	R	The port number on the unit specified by connUnitLinkNodeldX if known, otherwise -1. If the value is nonnegative then it will be equal to connUnitPortPhysicalNumber.
fcConnUnitLinkPortWwnX	OCTET STRING	The port WWN of device X. Available when the attached device to this port is in LOGIN state. Otherwise all zeroes.	R	The port WWN of the unit specified by connUnitLinkNodeldX if known, otherwise 16 octets of binary 0.
fcConnUnitLinkNodeldY	OCTET STRING (16)	The node WWN of device Y. Available when the attached device is in LOGIN state. Otherwise all zeroes.	R	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 then the value of this object MUST BE equal to its connUnitID.
fcConnUnitLinkPortNumberY	Integer32	The port number of device Y. Available for E_Ports. Unavailable for F_Ports (-1 is returned).	R	The port number on the unit specified by connUnitLinkNodeldY if known, otherwise -1. If the value is nonnegative then it will be equal to connUnitPortPhysicalNumber.
fcConnUnitLinkPortWwnY	OCTET STRING	The port WWN of device Y.	R	The port WWN on the unit specified by connUnitLinkNodeldY if known, otherwise 16 octets of binary 0.

Table 2–8: Link Table (HAFM Server) (Continued)

fcConnUnitLinkAgentAddressY	OCTET STRING (16)	16 octets of binary 0 (not supported).	R	The address of an FCMGMT MIB agent for the node identified by connUnitLinkNodeIdY, if known; otherwise 16 octets of binary 0.
fcConnUnitLinkAgentAddressTypeY	Unsigned32	Zero (not supported).	R	If connUnitLinkAgentAddressY is nonzero, it is a protocol address. ConnUnitLinkAgentAddressTypeY is the 'address family number' assigned by IANA to identify the address format. (e.g., 1 is Ipv4, 2 is Ipv6). If connUnitLinkAgentAddressY is all zeros, then this value is ignored.
fcConnUnitLinkAgentPortY	Unsigned32	Zero (not supported).	R	The IP port number for the agent. This is provided in case the agent is at a non-standard SNMP port.
fcConnUnitLinkUnitTypeY	FcUnitType	Switch(4) for E_Port. Otherwise return unknown(1).	R	Type of the FC connectivity unit as defined in connUnitType.
fcConnUnitLinkConnIdY	OCTET STRING (3)	F_Port: [domainId][areaCode] [portNumber] E_Port: [domainId] [0] [0]	R	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 loop, then it is the ALPA that is connected. If this is an eport, then it will only contain the domain ID. If not any of those, unknown or cascaded loop, return all bits set to 1.

Port Statistics

The port statistics table contains Fibre Channel port statistics for a given director or switch.

Table 2–9: Port Statistics Table (HAFM Server)

FA Mib Object Name	Type	Source for E_Port and F_Port in director 2/64	Support (Y/N)	Access	Description
fcConnUnitPortStatIndex	Gauge (32 bits)	Same as fcConnUnitPortPhysical Number	director 2/64	R	A unique value among all entries in this table, between 0 and [fcConnUnitNumPort[fcConnUnitPortUnitId]
fcConnUnitPortStatCountError	Counter64	FcConnUnitPortStatAddressErr + FcConnUnitPortStatInvalidCRC + FcConnUnitPortStatDelimiterErrs + fcConnUnitPortStatEncodingErrs +	Y Y Y N	R	A count of the errors that occurred on this port.

Table 2–9: Port Statistics Table (HAFM Server) (Continued)

fcConnUnit PortStatCount Error (continued)		frameEOErrors +	N		
		fcConnUnitPortStatFrames TooLong +	N		
		fcConnUnitPortStatFrames TooShort +	N		
		fcConnUnitPortStatInv OrderedSets +	N		
		fcConnUnitPortStatInvalid TxWords +	Y		
		fcConnUnitPortStatLinkFailures +	Y		
		fcConnUnitPortStatPSPErrs +	Y		
		fcConnUnitPortStatLoss OfSignal +	Y		
		fcConnUnitPortStatLossOfSync +	Y		
fcConnUnit PortStatCount TxObjects	Counter64	_txFrames << srTxFrames (UPM)	Y	R	The number of frames, packets, I/Os, etc. transmitted by this port. A Fibre Channel frame starts with SOF and ends with EOF. FC loop devices should not count frames passed through. This value represents the sum total for all other Tx objects.
fcConnUnit PortStatCount RxObjects	Counter64	_rxFrames << srRxFrames (UPM)	Y	R	The number of frames, packets, I/Os, etc. received by this port. A Fibre Channel frame starts with SOF and ends with EOF. FC loop devices should not count frames passed through. This value represents the sum total for all other Rx objects.
fcConnUnit PortStatCount TxElements	Counter64	_txWords*4 << srTxWords (UPM)	Y	R	The number of octets or bytes transmitted by this port. One second periodic polling of the port. 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.

Table 2–9: Port Statistics Table (HAFM Server) (Continued)

fcConnUnit PortStatCount RxElements	Counter64	_rxWords*4 << srRxWords (UPM)	Y	R	The number of octets or bytes received by this port. Through one-second periodic polling of the port, the 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.
fcConnUnit PortStatCount BBCreditZero	Counter64	Not supported	N	R	Count of transitions in/out of BBCredit zero state. The other side is not providing credit. This is a Fibre Channel stat only.
fcConnUnit PortStatCount InputBuffersFull	Counter64	Not supported	N	R	Count of occurrences when all input buffers of a port are full and outbound buffer-to-buffer credit transitioned to zero. There is no credit to provide to the other side. This is a Fibre Channel stat only.
fcConnUnit PortStatCount FBSYFrames	Counter64	Not supported	N	R	Count 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 destination port is temporarily busy. Port can only occur on SOFc1 frames (frames that establish a connection). This is a Fibre Channel stat only. This is the sum of all classes. If you cannot keep the by class counters, then keep the sum counters.
fcConnUnit PortStatCount PBSYFrames	Counter64	Not supported	N	R	Count 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 only occur on SOFc1 frames (the frames that establish a connection). This is a Fibre Channel stat only. This is the sum of all classes. If you cannot keep the by class counters, then keep the sum counters.
fcConnUnit PortStatCount FRJTFrames	Counter64	Not supported	N	R	Count of times that FRJT was returned to this port as a result of a Frame that was rejected by the fabric. This is the total for all classes and is a Fibre Channel only stat.
fcConnUnit PortStatCount PRJTFrames	Counter64	Not supported	N	R	Count of times that FRJT was returned to this port as a result of a Frame that was rejected at the destination NxPort. This is the total for all classes and is a Fibre Channel only stat.

Table 2–9: Port Statistics Table (HAFM Server) (Continued)

fcConnUnit PortStatCount Class1Rx Frames	Counter64	Not supported	N	R	Count of Class 1 Frames received at this port. This is a Fibre Channel stat only.
fcConnUnit PortStatCount Class1Tx Frames	Counter64	Not supported	N	R	Count of Class 1 Frames transmitted out this port. This is a Fibre Channel stat only.
fcConnUnit PortStatCount Class1FBSY Frames	Counter64	Not supported	N	R	Count of times that FBSY was returned to this port as a result of a Class 1 Frame that could not be delivered to the other end of the link. This occurs if either the Fabric or destination port is temporarily busy. FBSY can only occur on SOFc1 frames (frames that establish a connection). This is a Fibre Channel stat only.
fcConnUnit PortStatCount Class1PBSY Frames	Counter64	Not supported	N	R	Count of times that PBSY was returned to this port as a result of a Class 1 Frame that could not be delivered to the other end of the link. This occurs if the destination NxPort is temporarily busy. PBSY can only occur on SOFc1 frames (frames that establish a connection). This is a Fibre Channel stat only.
fcConnUnit PortStatCount Class1FRJT Frames	Counter64	Not supported	N	R	Count of times that FRJT was returned to this port as a result of a Class 1 Frame that was rejected by the fabric. This is a Fibre Channel stat only.
fcConnUnit PortStatCount Class1PRJT Frames	Counter64	Not supported	N	R	Count of times that FRJT was returned to this port as a result of a Class 1 Frame that was rejected at the destination NxPort. This is a Fibre Channel stat only.
fcConnUnit PortStatCount Class2Rx Frames	Counter64	Not supported	Y	R	Count of Class 2 Frames received at this port. This is a Fibre Channel stat only.
fcConnUnit PortStatCount Class2Tx Frames	Counter64	_c2FramesTransmitted << _fc2TxFrames	Y	R	Count of Class 2 Frames transmitted out this port. This is a Fibre Channel stat only.

Table 2–9: Port Statistics Table (HAFM Server) (Continued)

fcConnUnit PortStatCount Class2FBSY Frames	Counter64	_c2FramesBusied << _fcFxPortC2FbsyFrames (it counts for C2 + CF)(FC2)	Y	R	Count of times that FBSY was returned to this port as a result of a Class 2 Frame that could not be delivered to the other end of the link. This occurs if either the Fabric or destination port is temporarily busy. FBSY can only occur on SOFc1 frames (frames that establish a connection). This is a Fibre Channel stat only.
fcConnUnit PortStatCount Class2PBSY Frames	Counter64	Not supported	Y	R	Count of times that PBSY was returned to this port as a result of a Class 2 Frame that could not be delivered to the other end of the link. This occurs if the destination NxPort is temporarily busy. PBSY can only occur on SOFc1 frames (frames that establish a connection). This is a Fibre Channel stat only.
fcConnUnit PortStatCount Class2FRJT Frames	Counter64	_c2FramesRejected << _fcFxPortC2FrjtFrames (FC2)	Y	R	Count of times that FRJT was returned to this port as a result of a Class 2 Frame that was rejected by the fabric. This is a Fibre Channel stat only.
fcConnUnit PortStatCount Class2PRJT Frames	Counter64	Not supported	N	R	Count of times that FRJT was returned to this port as a result of a Class 2 Frame that was rejected at the destination NxPort. This is a Fibre Channel stat only.
fcConnUnit PortStatCount Class3Rx Frames	Counter64	_c3InFrames << srC3InFrames (UPM)	Y	R	Count of Class 3 Frames received at this port. This is a Fibre Channel stat only.
fcConnUnit PortStatCount Class3Tx Frames	Counter64	_c3OutFrames in director 2/64 family	Y	R	Count of Class 3 Frames transmitted out this port. This is a Fibre Channel stat only.
fcConnUnit PortStatCount Class3Discards	Counter64	_c3Discards << srC3Discards (UPM)	Y	R	Count of Class 3 Frames that were discarded upon reception at this port. There is no FBSY or FRJT generated for Class 3 Frames. They are simply discarded if they cannot be delivered. This is a Fibre Channel stat only.
fcConnUnit PortStatCount RxMulticast Objects	Counter64	Not supported	N	R	Count of Multicast Frames or Packets received at this port.

Table 2–9: Port Statistics Table (HAFM Server) (Continued)

fcConnUnit PortStatCount TxMulticast Objects	Counter64	Not supported	N	R	Count of Multicast Frames or Packets transmitted out this port.
fcConnUnit PortStatCount RxBroadcast Objects	Counter64	Not supported	N	R	Count of Broadcast Frames or Packets received at this port.
fcConnUnit PortStatCount TxBroadcast Objects	Counter64	Not supported	N	R	Count of Broadcast Frames or Packets transmitted out this port. On a Fibre Channel loop, count only OPN frames generated.
fcConnUnit PortStatCount RxLinkResets	Counter64	_linkResetIn << srLinkResetIns (UPM)	Y	R	Count of Link resets. This is the number of LRs received. This is a Fibre Channel stat only.
fcConnUnit PortStatCount TxLinkResets	Counter64	_linkResetOut << srLinkResetOuts (UPM)	Y	R	Count of Link resets. This is the number LRs transmitted. This is a Fibre Channel stat only.
fcConnUnit PortStatCount NumberLink Resets	Counter64	_linkResetIn (UPM) + _linkResetOut (UPM)	Y	R	Count of Link resets and LIPs detected at this port. The number times the reset link protocol is initiated. These are the count of the logical resets and primitives. This is a Fibre Channel stat only.
fcConnUnit PortStatCount RxOffline Sequences	Counter64	_olsIns << srOlsIns (UPM)	Y	R	Count of Offline Primitive OLS received at this port. This is a Fibre Channel stat only.
fcConnUnit PortStatCount TxOffline Sequences	Counter64	_olsOuts << srOlsOuts (UPM)	Y	R	Count of Offline Primitive OLS transmitted by this port. This is a Fibre Channel stat only.
fcConnUnit PortStatCount NumberOffline Sequences	Counter64	_olsIns (UPM) + _olsOuts (UPM)	Y	R	Count of Offline Primitive sequence received at this port. This is a Fibre Channel stat only.
fcConnUnit PortStatCount LinkFailures	Counter64	_linkFailures << srLinkFailures (UPM)	Y	R	Count of link failures. This count is part of the Link Error Status Block (LESB) (FC-PH 29.8). This is a Fibre Channel stat only.

Table 2–9: Port Statistics Table (HAFM Server) (Continued)

fcConnUnit PortStatCount InvalidCRC	Counter64	_invalidCrcs << srInvalidCrcs (UPM)	Y	R	Count of frames received with invalid CRC. This count is part of the LESB (FC-PH 29.8). Loop ports should not count CRC errors passing through when monitoring. This is a Fibre Channel stat only.
fcConnUnit PortStatCount InvalidTxWords	Counter64	_invalidTxWords << srInvalidTxWords (UPM)	Y	R	Count of invalid transmission words received at this port. This count is part of the LESB (FC-PH 29.8). This is a Fibre Channel stat only.
fcConnUnit PortStatCount Primitive Sequence ProtocolErrors	Counter64	_primitiveSequenceError << srPrimSeqProtocolError (UPM)	Y	R	Count of primitive sequence protocol errors detected at this port. This count is part of the LESB (FC-PH 29.8). This is a Fibre Channel stat only.
fcConnUnit PortStatCount LossofSignal	Counter64	_signalLosses << srSigLosses (UPM)	Y	R	Count of instances of signal loss detected at port. This count is part of the LESB (FC-PH 29.8). This is a Fibre Channel stat only.
fcConnUnit PortStatCount Lossof Synchronization	Counter64	_syncLosses << srSyncLosses (UPM)	Y	R	Count of instances of synchronization loss detected at port. This count is part of the LESB (FC-PH 29.8). This is a Fibre Channel stat only.
fcConnUnit PortStatCount InvalidOrdered Sets	Counter64	Not supported	N	R	Count of invalid ordered sets received at port. This count is part of the LESB (FC-PH 29.8). This is a Fibre Channel stat only.
fcConnUnit PortStatCount FramesToo Long	Counter64	Not supported	N	R	Count of frames received at this port where the frame length was greater than what was agreed to in FLOGI/PLOGI. This could be caused by losing the end of frame delimiter. This is a Fibre Channel stat only.
fcConnUnit PortStatCount FramesToo Short	Counter64	_framesTooShort << srFramesTooShort (UPM)	Y	R	Count of frames received at this port where the frame length was less than the minimum indicated by the frame header - normally 24 bytes, but more if the DFCTL field indicates an optional header should be present. This is a Fibre Channel stat only.
fcConnUnit PortStatCount AddressErrors	Counter64	_addressIdErrors << _fcFxPortAddressErrors (FC2)	Y	R	Count of frames received with unknown addressing. e.x. unknown SID or DID. The SID or DID is not known to the routing algorithm. This is a Fibre Channel stat only.

Table 2–9: Port Statistics Table (HAFM Server) (Continued)

fcConnUnit PortStatCount DelimiterErrors	Counter64	_delimiterErrors << srDelimiterErrors (UPM)	Y	R	Count of invalid frame delimiters received at this port. An example is a frame with a class 2 start and a class 3 end. This is a Fibre Channel stat only.
fcConnUnit PortStatCount Encoding DisparityErrors	Counter64	Not supported	N	R	Count of disparity errors received at this port. This is a Fibre Channel stat only.

Name Server Table

This table is accessed either directly if the management software has an index value or via GetNexts. The value of the indexes is not required to be contiguous. Each entry created in this table will be 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.

Table 2–10: Name Server Table (HAFM Server)

FA Mib Object Name	Type	Product Mapping	Access	Description
fcConnUnitSnsPortIndex	Counter32	An integer is returned	R	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).
fcConnUnitSnsPortIdentifier	FcAddressId	Supported	R	The Port Identifier for this entry in the SNS table.
fcConnUnitSnsPortName	FcNameId	Supported	R	The Port WWN Name for this entry in the SNS table.
fcConnUnitSnsNodeName	FcNameId	Supported	R	The Node Name for this entry in the SNS table.
fcConnUnitSnsClassOfSvc	OCTET STRING (1)	Supported	R	The Classes of Service offered by this entry in the SNS table.
fcConnUnitSnsNodeIPAddress	OCTET STRING (16)	Supported	R	The IPv6 formatted address of the Node for this entry in the SNS table.
connUnitSnsProcAssoc	OCTET STRING (8)	Supported	R	The Process Associator for this entry in the SNS table.
fcConnUnitSnsFC4Type	OCTET STRING (32)	Supported	R	The FC-4 Types supported by this entry in the SNS table.

Table 2–10: Name Server Table (HAFM Server) (Continued)

fcConnUnitSnsPortType	OCTET STRING (1)	Supported	R	The Port Type of this entry in the SNS table.
fcConnUnitSnsPortIPAddress	OCTET STRING (16)	Supported	R	The IPv6 formatted address of this entry in the SNS table.
fcConnUnitSnsFabricPortName	FcNameId	Supported	R	The Fabric Port name of this entry in the SNS table.
fcConnUnitSnsHardAddress	FcAddressId	Supported	R	The Hard ALPA of this entry in the SNS table.
fcConnUnitSnsSymbolicPortName	DisplayString (0..79)	Supported	R	The Symbolic Port Name of this entry in the SNS table.
fcConnUnitSnsSymbolicNodeName	DisplayString (0..79)	Supported	R	The Symbolic Node Name of this entry in the SNS table.

SNMP Trap Registration Group

The trap registration group allows for the control of trap generation on the HAFM server SNMP agent. The group consists of two scalar objects and a trap registration table.

Table 2–11: Trap Registration Group Table (HAFM Server)

Object Name	Type	Product Mapping	Access	Description
fcTrapMaxClients	Unsigned32	Supported.	R	The maximum number of SNMP trap recipients supported by the connectivity unit.
fcTrapClientCount	Unsigned32	Supported	R	The current number of rows in the trap table.

Trap Registration Table

This table contains a row for each trap recipient. When the SNMP agent generates a trap a copy is sent to each of the recipients in the table depending upon the severity of the trap and the setting of the trapRegFilter object.

Table 2–12: Trap Registration Table (HAFM Server)

FA Mib Object Name	Type	Product Mapping	Access	Description
fcTrapRegIp Address	IpAddress	Supported.	R	The IP address of a client registered for traps.
fcTrapRegPort	Unsigned32	Supported.	R	The UDP port to send traps to for this host. Normally this would be the standard trap port (162).
fcTrapRegFilter	FcEvent Severity	Supported. (This information not exposed in HAFM SNMP configuration dialog)	R/W	This value defines the trap severity filter for this trap host. The connUnit will send traps to this host that have a severity level less than or equal to this value.
fcTrapRegRow State	RowStatus	Supported.	R/W	Specifies the operational status of the row. A RowStatus object may take any of six defined values: active: traps may be sent as specified in this row. Management application may change the value of objects in the row when the status is active. notInService: traps are not sent using this row. notReady: the conceptual row exists in the agent, but is missing information necessary to send traps (i.e. if other objects in the row are not present or contain invalid values). This value may not be supplied by a management application. createAndGo: supplied by a management application wishing to create a new instance of a conceptual row, supplying valid values for other objects in the row, and have its status automatically set to active, making it available for use in sending traps. createAndWait: supplied by a management application wishing to create a new instance of a conceptual row but not make it available for use in sending traps at that time. destroy: supplied by a management application wishing to delete an existing conceptual row.

Fibre Channel Management Traps

The following FCMGMT MIB traps are generated from the HAFM server when the SNMP agent is active and when one or more trap recipients have been configured in the HAFM application.

Table 2–13: Trap Types (HAFM Server)

FA Mib Object Name	Type Number	Description	OID and Value	Description
fcConnUnitStatus Change	1	Generated when the switch's online status or operational status changes	.1.3.6.1.2.1.8888.1.1.3.1.6.connUnitId. connUnitStatus .1.3.6.1.2.1.8888.1.1.3.1.5.connUnitId. connUnitState	Connectivity unit status changed. Recommended severity level (for filtering): alert.
fcConnUnitDelete Trap	2	Generated when a switch is deleted from the HAFM application.	For release 6.0 and 6.1: .1.3.6.1.2.1.8888.1.1.3.1.1.connUnitId. connUnitId For release 6.2: .1.3.6.1.2.1.8888.1.1.3.1.2.connUnitId. fcConnUnitGlobalID	Connectivity unit was deleted from this agent. Recommended severity level (for filtering): warning.
fcConnUnitEvent Trap	3	Generated when a new event is generated.	.1.3.6.1.2.1.8888.1.1.7.1.1.connUnitId. eventIndexconnUnitEventIndex, .1.3.6.1.2.1.8888.1.1.7.1.5.connUnitId. eventIndexconnUnitEventType, .1.3.6.1.2.1.8888.1.1.7.1.6.connUnitId. eventIndexconnUnitEventObject, .1.3.6.1.2.1.8888.1.1.7.1.7.connUnitId. eventIndexconnUnitEventDescr	Event was generated by the connectivity unit. Recommended severity level (for filtering): info.
fcConnUnitSensio StatusChange	4	Generated when one of fans/powers status is changed.	.1.3.6.1.2.1.8888.1.1.5.1.3.unitId. sensorNumberconnUnitSensorState	Connectivity unit status changed. Recommended severity level (for filtering): alert.
fcConnUnitPort StatusChange	5	Generated when a port status is changed.	.1.3.6.1.2.1.8888.1.1.6.1.6.connUnitId. portNumber connUnitPortStatus .1.3.6.1.2.1.8888.1.1.6.1.5.connUnitId. portnumber connUnitPortState	Connectivity unit status changed. Recommended severity level (for filtering): alert.

Director and Switch Agent MIB Objects

The following sections define director or switch MIB objects and how they are implemented in the product SNMP agent.

Table 2–14: Type Definition Table (Director/Switch)

Type	Syntax	Description
FcNameId	OCTET STRING (SIZE(8))	Represents the Worldwide Name (WWN; IEEE 60-bit variety; standard part of T11 definitions for fibre channel) associated with a Fibre Channel (FC) entity.
FcGlobalId	OCTET STRING (SIZE(16))	Represents the Worldwide Name (WWN; IEEE 124-bit variety) associated with a Fibre Channel (FC) entity.
FcEventSeverity	INTEGER	The set of values which define the event severity that will be logged by this connectivity unit. Values unknown (1) through debug (9) are essentially self-explanatory; mark (10) means that all messages are logged. The values are defined as follow: unknown (1), emergency (2), alert (3), critical (4), error (5), warning (6), notify (7), info (8), debug (9), mark (10).
FcUnitType	INTEGER	Values are defined as: unknown (1) - cannot be determined, other (2) - none of the following, hub (3) - passive connectivity unit supporting loop protocol, switch (4) - active connectivity unit supporting multiple protocols, gateway (5) - unit that converts not only the interface but also the frame into another protocol. The assumption is that there is always two gateways connected together. For example, FC <-> ATM, converter (6) - unit that converts from one interface to another, For example, FC <-> SCSI, hba(7) - host bus adapter, proxyAgent (8) - software proxy-agent, storageDevice (9) - disk, cd, tape, etc, host (10) - host computer, storageSubsystem (11) - raid, library, etc, module (12) -- subcomponent of a system, swDriver (13) - software driver, storageAccessDevice (14) - Provides storage management and access for heterogeneous hosts and heterogeneous devices.
FcPortFCClass	BITS	Represents the class(es) of service represented on a given port, in a given operational context. The values are defined as follow: unknown (0), classF (1), class1(2), class2 (3), class3 (4), class4 (5), class5 (6), class6 (7).

Connectivity Unit Group Objects

The Connectivity Unit Group contains information about directors and switches that are configured in the HAFM server. The group contains five simple objects and four tables; Connectivity Unit, Firmware, Port, Sensor, and Event.

Table 2–15: Connectivity Unit Group Table (Director/Switch)

EMC MIB Object Name	Type	Product Mapping	Access	Description
fcConnUnitNumber	INTEGER	1	R	The number of connectivity units present on this system. May be a count of the boards in a chassis or full boxes in a rack.
fcConnURL	DisplayString	http://switch's IP addr (The switch's IP address is supported by PCP)	R	The top-level URL of the system. If it 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 (e.g., %USER). The following are the defined keywords that will be recognized and replaced with data during a launch: USER - replace with username PASSWORD - replace with password GLOBALID - replace with globalid SERIALNO - replace with serial number A management application will read this object from the MIB, provide values for any of the keywords listed above that are present in the string, and then use the URL to invoke or launch the program referenced.
fcConnUnitSnsMaxRows	Counter32	The number of the entries in the Name Server Table.	R	The maximum number of rows in the fcConnUnitSnsTable table.

Connectivity Group Table

The fcConnUnitTable contains general information on the system's units.

Table 2–16: fcConnUnitTable Table (Director)

EMC MIB Object Name	Type	Product Mapping	Access	Description
fcConnUnitId	OCTET STRING	switch's WWN.	R	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 fcConnUnitTable. The value assigned to a given connectivity unit should be persistent across agent and unit resets, and should be the same as fcConnUnitGlobalId if fcConnUnitGlobalId is known and stable.

Table 2–16: fcConnUnitTable Table (Director) (Continued)

fcConnUnitGlobalId	FcGlobalId	Switch's WWN (supported by PCP).	R	<p>Optional global-scope identifier for this connectivity unit. Must be a WWN for this connectivity unit or 16 octets of value zero. WWN formats requiring fewer than 16 octets MUST be extended to 16 octets with trailing zero octets. WWN is used for fcConnUnitId, must be the same for fcConnUnitGlobalId.</p> <p>When a non-zero value is provided, it should be persistent across agent and unit resets and be globally unique. It should be one of these FC-PH/PH3 formats:</p> <ul style="list-style-type: none"> IEEE (NAA=1) IEEE Extended (NAA=2) IEEE Registered (NAA=5). IEEE Registered extended (NAA=6). <p>Use of the IEEE formats allows any IEEE-registered vendor to assure global uniqueness independently. The following are IEEE WWN format references:</p> <p>http://standards.ieee.org/regauth/oui/tutorials/fibreformat.html http://standards.ieee.org/regauth/oui/tutorials/fibrecomp_id.html</p> <p>If one or more WWNs are associated with the connectivity unit via other management methods, one of them should be used for fcConnUnitGlobalId. If there is not a WWN assigned specifically to the connectivity unit, there is merit to using a WWN assigned to one of its permanently attached FC/LAN interface(s). This can not risk uniqueness, though. 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 will all be distinct connectivity units, so the host and agent cannot use the WWN of the HBA. Another example: If your hub has a built-in Ethernet port, it might be reasonable for the hub to use its LAN address (prefixed with the appropriate NAA) as its fcConnUnitId. But if the Ethernet were a replaceable PCard, the hub should have an independent ID.</p>
fcConnUnitType	FcUnitType	Switch(4)	R	Type of this connectivity unit.
fcConnUnitNumports	Unsigned32	Number of ports from PROD_CNFG.	R	Number of physical ports in the connectivity unit (internal, embedded, external).
fcConnUnitState	INTEGER	Online and coming-online indicate online state (2), offline and going-offline indicate offline state (3).	R	This object reports the overall state of the connectivity unit. The meaning of all values is self-explanatory. Any values may occur with any of the fcConnUnitStatus values. Values are defined as: unknown (1), online (2), offline (3).

Table 2–16: fcConnUnitTable Table (Director) (Continued)

fcConnUnit Status	INTEGER	Value mapped from current status of switch such that operational status indicates ok (3), degraded status indicates warning (4), failed status indicates failed (5) (supported by PCP).	R	This object reports the overall status of the connectivity unit. The warning (4) value means the connectivity unit needs attention; all other values are self-explanatory. Any of these values may occur with any fcConnUnitState values. Values are defined as: unknown (1), unused (2), ok (3), warning (4), failed (5).
fcConnUnit Product	SnmpAdmin String	OEM product name. Stored in VPD, supported by STATUSMGR.	R	The connectivity unit vendor's product model name.
fcConnUnit SerialNo	SnmpAdmin String	OEM serial number. Stored in VPD, supported by STATUSMGR.	R	The serial number identification for this connectivity unit.
fcConnUnit UpTime	TimeTicks	Supported by MCK.	R	The number of centiseconds since the last unit initialization.
fcConnUnitUrl	DisplayString	Same as fcConnURL.	R/W	URL to launch a management application, if applicable. Otherwise empty string. In a standalone unit, this would be the same as the top level URL. This has the same definition as systemURL for keywords.
fcConnUnit DomainId	OCTET STRING (SIZE (3))	FFCCXX. XX is the active domain ID of the switch.	R	24-bit Fibre Channel address ID of this connectivity unit. Following the fibre channel standard, the right-most bit of the right-most octet is for the least significant bit of the address value; the left-most bit of the left-most octet, if needed, is for the most significant bit of the address value. If this value is not applicable, all bits set to 1.
fcConnUnit ProxyMaster	INTEGER	yes (3)	R	A value of yes means this is the proxy master unit for a set of managed units. For example, this could be the only unit with a management card in it for a set of units. A standalone unit should return yes for this object. Values are defined as: unknown (1), no (2), yes (3).
fcConnUnit Principal	INTEGER	Supported by Fab_contrl subsystem	R	Whether this connectivity unit is the principal switch in a fabric. If this value is not applicable, return unknown. Values are defined as: unknown (1), no (2), yes (3).
fcConnUnit NumSensors	Unsigned32	Number of sensors.	R	Number of sensors in the fcConnUnitSensorTable.

Table 2–16: fcConnUnitTable Table (Director) (Continued)

fcConnUnit NumRevs	Unsigned32	1	R	Number of revisions in the fcConnUnitRevsTable.
fcConnUnit ModuleId	OCTET STRING (SIZE(16))	Return 16 zeros (not supported).	R	Unique ID, persistent between boots, that can be used to group a set of connectivity units together into a module. The intended use would be to create a connectivity unit with a fcConnUnitType of module to represent a physical or logical group of connectivity units. The members of the group would set the value of fcConnUnitId for this container connectivity unit. Value should be zeros if this connectivity unit is not part of a module.
fcConnUnit Name	SnmpAdmin String	Switch's configured name (supported by PCP). Writable and persistent across IPL.	R/W	Name for this connectivity unit. This object value should be persistent between boots.
fcConnUnit Info	SnmpAdmin String	A textual description of the product (supported by PCP). Writable and persistent across IPL.	R/W	Information about this connectivity unit. This object value should be persistent between boots.
fcConnUnit Control	INTEGER	Always return unknown (1) on read operation. resetConnUnitWarmStart (4), offlineConnUnit (5), and onlineConnUnit (6) supported by PCP. resetConnUnitWarmStart (4) indicates IPL on the switch is performed. resetConnUnitColdStart (3) not supported.	R/W	<p>Object used to control the addressed connectivity unit. ColdStart and WarmStart are as defined in MIB-2 and not meant to be a factory reset.</p> <p>resetConnUnitColdStart: addressed unit performs a ColdStart reset.</p> <p>resetConnUnitWarmStart: addressed unit performs a WarmStart reset.</p> <p>offlineConnUnit: addressed unit puts itself in an implementation dependant offline state. If a unit is in an offline state, it cannot be used to perform meaningful Fibre Channel work.</p> <p>onlineConnUnit: addressed unit puts itself in an implementation dependant online state. If a unit is in an online state, it is capable of performing meaningful Fibre Channel work.</p> <p>Each implementation may chose not to support SNMP Set operations for any or all of these values. For Sets specifying varbinds for instances of this object and values not supported by a given implementation, the agent returns the SNMP WrongValue PDU error code. Values are defined as: unknown (1), invalid (2), resetConnUnitColdStart (3), resetConnUnitWarmStart (4), offlineConnUnit (5), onlineConnUnit (6).</p>

Table 2–16: fcConnUnitTable Table (Director) (Continued)

fcConnUnit Contact	SnmpAdminString	Contact information for this connectivity unit (supported by PCP). Writable and persistent across IPL.	R/W	Contact information for this connectivity unit. The contact information is intended to facilitate contacting someone in case of problems, questions, etc. (e.g. the help desk internal to a company).
fcConnUnit Location	SnmpAdminString	Physical location of the switch (supported by PCP). Writable and persistent across IPL.	R/W	Location information for this connectivity unit.
fcConnUnit EventFilter	FcEventSeverity	Writable and it's set to the Default value of info(8) after IPL.	R/W	This value defines the event severity that will be logged by this connectivity unit. All events of severity less than or equal to fcConnUnitEventFilter are logged in the fcConnUnitEventTable.
fcConnUnit NumEvents	Unsigned32	Number of events in fcConnUnitEventTable. Always <= 200, the maximum size of the event table.	R	Number of events currently in the fcConnUnitEventTable.
fcConnUnit MaxEvents	Unsigned32	200.	R	Max number of events that can be recorded at any one time in the fcConnUnitEventTable.
fcConnUnit EventCurrID	Unsigned32	The current event index is used as the last used event ID.	R	The last used event id (fcConnUnitEventIndex) recorded in the fcConnUnitEventTable. When no events are presently recorded in the fcConnUnitEventTable, the value of this object MUST be zero.

Firmware Table

The firmware table lists the revisions supported by the associated connectivity units.

Table 2–17: Firmware Table (Director/Switch)

EMC MIB Object Name	Type	Product Mapping	Access	Description
fcConnUnitRevsIndex	Unsigned32	Not accessible	R	A unique value among all fcConnUnitRevsEntry with the same value of fcConnUnitId, in the range between 1 and fcConnUnitNumRevs[fcConnUnitId].
fcConnUnitRevsRevision	SnmpAdminString	XX.XX.XX (switch component revision)	R	A vendor-specific value identifying a revision of a component of the connectivity unit.
fcConnUnitRevsDescription	SnmpAdminString	Switch firmware level	R	Description of a component in the fcConnUnit to which the revision corresponds.

Sensor Table

The sensor table list the sensors supported by each connectivity unit.

Table 2–18: Sensor Table (Director/Switch)

EMC MIB Object Name	Type	Product Mapping	Access	Description
fcConnUnitSensor Index	Unsigned32	Not assessable.	R	Unique value among all fcConnUnitSensorEntry with the same value of fcConnUnitId, in the range between 1 and fcConnUnitNumSensors[fcConnUnitId].
fcConnUnitSensor Name	SnmpAdmin String	Module name of the FRU, such as FAN, PWR or THM.	R	Textual identification of the sensor intended primarily for operator use.
fcConnUnitSensor Status	INTEGER	Value is evaluated from FRU status. Active, backup, and update- busy states are mapped to ok (3), failed state is mapped to failed (5).	R	Status indicated by the sensor. Values are defined as: unknown (1) - the unit cannot determine the status, other (2) - the status does not fit any of the remaining values, ok (3) - indicates good status, warning (4) - indicates the unit needs attention, failed (5) B indicates the unit is non-functional.
fcConnUnitSensor Info	SnmpAdmin String	Serial number of the FRU. Not supported if the module fails.	R	Miscellaneous information about the sensor such as its serial number.
fcConnUnitSensor Message	SnmpAdmin String	Description of the FRU status, such as active or failed.	R	Describes the status of the sensor as a message. It may also provide more resolution on the sensor indication, for example 'Cover temperature 1503K, above nominal operating range'.
fcConnUnitSensor Type	INTEGER	Fan (4) or power-supply (5)	R	Type of component monitored by this sensor. The unknown (1) and other (2) values are analogous to those for the fcConnUnitSensorStatus object; all other values are self-explanatory. Values are defined as: unknown (1), other (2), battery (3), fan (4), powerSupply (5), transmitter (6), enclosure (7), board (8), and receiver (9).
fcConnUnitSensor Characteristic	INTEGER	Not supported. Always other (2).	R	Characteristics being monitored by this sensor. The unknown (1) and other (2) values are analogous to those for the fcConnUnitSensorStatus object; emf (5) refers to electro-magnetic field; all other values are self-explanatory. Values are defined as: unknown (1), other (2), temperature (3), pressure (4), emf (5), currentValue (6), airflow (7), frequency (8), and power (9).

Port Table

The port table provides generic information on ports for a specific fcConnUnit.

Table 2–19: Port Table (Director/Switch)

EMC MIB Object Name	Type	Product Mapping	Access	Description
fcConnUnitPort Index	INTEGER	Not accessible.	R	A unique value among all fcConnUnitPortEntries on this connectivity unit, between 1 and fcConnUnitNumPorts.
fcConnUnitPort Type	INTEGER	f_port (8) if a device is connected to the port (specified by login Server), e_port (9) if a switch is connected to the port (specified by Fabric Controller), other wise g_port (10) if nothing is connected.	R	Port type refers to the protocol active on the port and can take one of the following values: unknown (1) - cannot be determined, other (2) - none of the following, notPresent (3) - no port, hubPort (4) - hub port, nPort (5) - end port for fabric, lPort (6) - end port for loop, flPort (7) - public loop, fPort (8) - fabric port, ePort (9) - fabric expansion port, gPort (10) - generic fabric port, domainController (1) - domain controller, hubController (12) - hub controller, scsi (13) - parallel SCSI port, escon (14) - escon port, lan (15) - LAN port, wan (16) - WAN port.
fcConnUnitPort FCClassCap	FcPortFC Class	E and G_Port, return (26) = class_two(8) + class_three(16) + class_f(2) F_Port, return (24) = class_two(8) + class_three(16)	R	Bit mask that specifies the classes of service capability of this port. If this object is not applicable, the agent must return all bits set to zero.
fcConnUnitPort FCClassOp	FcPortFC Class	E_Port, return (26) = class_two(8) + class_three(16) + class_f(2), G_Port, return unknown(0), F_Port, return class_two(8) or class_three(16) or both. Class of service is decided through Login Server database.	R	Bit mask that specifies the classes of service that are currently operational at this port. If this object is not applicable, the agent must return all bits set to zero.

Table 2–19: Port Table (Director/Switch) (Continued)

fcConnUnitPort State	INTEGER	See PortStateMapping document: PortStateSD642.0.doc.	R	State of the port hardware. The bypassed value (4) means that the port is online but is currently being isolated from the loop or fabric for some reason; the other values are essentially self-explanatory. Any value for this object may co-exist with any value for the fcConnUnitPortStatus object. Values are defined as: unknown (1), online (2), offline (3), bypassed (4).
fcConnUnitPort Status	INTEGER	See PortStateMapping document: PortStateSD642.0.doc.	R	The current overall protocol status for the port. The warning value (4) means that the port needs attention; the notParticipating value (6) means that protocol is not being processed; the initializing value (7) means that the port is in the process of coming into service; the bypassed value (8) means that the port has been manually or automatically isolated from the loop or fabric; the other values are essentially self-explanatory. Any value for this object may co-exist with any value for the fcConnUnitPortState object. Values are defined as: unknown (1), unused (2), ok (3), warning (4), failure (5), notParticipating (6), initializing (7), bypassed (8).
fcConnUnitPort TransmitterType	INTEGER	Mapped from the port technology as: not present and serial indicate unknown (1), optical sw1g and optical sw2g indicate shortwave(4). optical lw1g and optical lw2g indicate longwave(5), copper db9 and copper amp indicate copper (6). (Get the value from port technology owned by UPM).	R	Technology of the port transceiver. Values are defined as: unknown (1), other (2), unused (3), shortwave (4) longwave (5), copper (6), and scsi (7), longwaveNoOFC (8), shortwaveNoOFC (9), longwaveLED (10),
fcConnUnitPort ModuleType	INTEGER	If the port is not installed, return gbicNotInstalled (8). Otherwise return smallFormFactor (9).	R	Module type of the port connector. This object refers to the hardware implementation of the port. The embedded value (4) means 'fixed' (e.g., oneXnine). Values are defined as: unknown (1), other (2), gbic (3), embedded (4), glm(5), gbicSerialId (6), gbicNoSerialId (7), gbicNotInstalled (8), smallFormFactor (9).
fcConnUnitPort Wwn	FcNameId	World Wide Name of the port (supported by PCP).	R	The World Wide Name of the port. If applicable,otherwise empty string.

Table 2–19: Port Table (Director/Switch) (Continued)

fcConnUnitPort FCId	OCTET STRING (SIZE(3))	F_Port, return fabric address of the node in form of domain, area, node (supported by Login Server) E_Port, return left-adjusted domain ID of the switch.	R	Assigned Fibre Channel ID of this port. This value is expected to be a Big Endian value of 24 bits. If this is loop, then it is the ALPA that is connected. If this is an E_Port, then it will only contain the domain ID left justified, zero filled. If this port does not have a Fibre Channel address, return all bits set to 1.
fcConnUnitPort SerialNoSn	SnmpAdmin String	Not applicable.	R	The serial number identification of the unit (e.g., for a GBIC). If this is not applicable, return a zero-length-string.
fcConnUnitPort Revision	SnmpAdmin String	Not applicable.	R	The port revision (e.g., for a GBIC).
fcConnUnitPort Vendor	SnmpAdmin String	Not applicable.	R	The port vendor (e.g., for a GBIC).
fcConnUnitPort Speed	Gauge32	Return 100000 kilobytes for 1 Gig switches and 200000 kilobytes for 2 Gig switches.	R	The speed of the port in kilobytes per second.
fcConnUnitPort Control	INTEGER	ResetConnUnitPort(3), offlineConnUnitPort(6), onlineConnUnitPort(7), and portFailure(42501) are the only set-operations are supported. Always return unknown(1) on read. (supported by PCP)	R/W	This object is used to control the addressed fcConnUnit's port. Valid commands are: Unknown (1) and invalid (2) are only used as values that are read. ResetConnUnitPort (3): If the addressed connectivity unit allows this operation to be performed on this port, the addressed port performs a vendor-specific 'reset' operation. Examples of these operations are: the Link Reset protocol, the Loop Initialization protocol, or a resynchronization occurring between the transceiver in the addressed port to the transceiver that the port is connected to. bypassConnUnitPort (4): If the addressed connectivity unit allows this operation to be performed to this port, the addressed port performs a vendor-specific 'bypass' operation. Examples of these operations are: transitioning from online to offline, a request (NON-PARTICIPATING) command to the Loop Port state machine, or removal of the port from an arbitrated loop by a hub. unbypassConnUnitPort (5): If the addressed connectivity unit allows this operation to be performed to this port, the addressed port performs a vendor-specific 'unbypass' operation. Examples of these operations are: the Link Failure protocol, a request (PARTICIPATING) command to the Loop Port state machine, or addition of the port to an arbitrated loop by a hub.

Table 2–19: Port Table (Director/Switch) (Continued)

fcConnUnitPort Control	INTEGER	ResetConnUnitPort(3), offlineConnUnitPort(6), onlineConnUnitPort(7), and portFailure(42501) are the only set-operations are supported. Always return unknown(1) on read. (supported by PCP)	R/W	<p>offlineConnUnitPort (6): If the addressed connectivity unit allows this operation to be performed to this port, the addressed port performs a vendor-specific 'offline' operation. Examples of these operations are: disabling a port's transceiver, the Link Failure protocol, request (NON-PARTICIPATING) command to the Loop Port state machine, or removal of the port from an arbitrated loop by a hub.</p> <p>onlineConnUnitPort (7): If the addressed connectivity unit allows this operation to be performed to this port, the addressed port performs a vendor-specific 'online' operation. Examples of these operations are: enabling a port's transceiver, the Link Failure protocol, request (PARTICIPATING) command to the Loop Port state machine, or addition of the port from an arbitrated loop by a hub.</p> <p>NOTE: Each implementation may chose not to support SNMP Set operations for any or all of these values. For Sets specifying varbinds for instances of this object and values not supported by a given implementation, the agent will return the SNMP WrongValue PDU error code.</p>
fcConnUnitPort Name	SnmpAdmin String	Port Name	R/W	A string describing the addressed port.
fcConnUnitPort PhysicalNumber	Unsigned32	Physical port number from 0 to Maximum port number - 1	R	This is the internal port number this port is known by. In many implementations, this should be the same as fcConnUnitPortIndex. Some implementations may have an internal port representation not compatible with the rules for table indexes. In that case, provide the internal representation of this port in this object. This value may also be used in the fcConnUnitLinkPortNumberX or fcConnUnitLinkPortNumberY objects of the fcConnUnitLinkTable.
fcConnUnitPort ProtocolCap (from Mib3.0)	OCTET STRING (SIZE (2))	Fabric(2)	R	Bit mask that specifies the driver level protocol capability of this port. If this is not applicable, return all bits set to zero. The bits have the following definition: unknown - 0, Loop - 1, Fabric - 2, SCSI - 4, TCP/IP - 8, VI - 16, FICON - 32.
fcConnUnitPort ProtocolOp (from Mib3.0)	OCTET STRING (SIZE (2))	Same as above	R	Bit mask that specifies the driver level protocol(s) that are currently operational. If this is not applicable, return all bits set to zero. This object has the same definition as fcConnUnitPortProtocolCap.

Table 2–19: Port Table (Director/Switch) (Continued)

fcConnUnitPort NodeWwn (from Mib3.0)	FcNameId	Switch WWN	R	The Node World Wide Name of the port if applicable, otherwise all zeros. This should have the same value for a group of related ports. The container is defined as the largest physical entity. For example, all ports on HBAs on a host will have the same Node WWN. All ports on the same storage subsystem will have the same Node WWN.
fcConnUnitPort HWState (from Mib3.0)	INTEGER	See PortStateMapping document: PortStateSD642.0.doc.	R	The hardware detected state of the port. The values are defined as follow: unknown (1), failed (2) -- port failed diagnostics, bypassed (3) -- FCAL bypass, loop only, active (4) -- connected to a device, loopback (5) -- Port in ext loopback, txfault (6) -- Transmitter fault, noMedia (7) -- media not installed, linkDown (8) -- waiting for activity (rx sync).

Event Table

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

Table 2–20: Event Table (Director/Switch)

EMC MIB Object Name	Type	Product Mapping	Access	Description
fcConnUnit EventIndex	Unsigned32	Event index	R	Each connectivity unit has its event buffer. As it wraps, it may write over previous events. This object is an index into the buffer. It is recommended this table be read using getNext's to retrieve the initial table. The management application should read the event table at periodic intervals and determine if any new entries were added by comparing the last known index value with the 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 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, fcConnUnitEventCurrID is 189. If the application tries to read event index 76, and the agent's internal buffer is 100 entries max, event index 76 is not 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 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 one.

Table 2–20: Event Table (Director/Switch) (Continued)

fcConnUnitR EventTime	DisplayString (SIZE (15))	Time the event occurred.	R	Real time when the event occurred, in 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, return a NULL string.
fcConnUnitS EventTime	TimeTicks	Translated from fcConnUnitR EventTime.	R	Sysuptime timestamp when the event occurred.
fcConnUnit EventSeverity	FcEvent Severity	Mapping from switch event severity level to FcEventServerity <u>SWITCH MIB</u> informational info(8) minor error(5) major critical(4) severe emergency(2)	R	Event severity level.
fcConnUnit EventType	INTEGER	Always status (3).	R	Type of this event. Values are defined as: unknown (1), other (2), status (3), configuration (4), topology (5).
fcConnUnit EventObject	OBJECT IDENTIFIER	Only the OID of the fcConnUnit is returned. Other information not supported.	R	Used with the fcConnUnitEventType to identify which object the event refers to. It can be the OID of a connectivity unit or of another object like fcConnUnitPortStatus[...]
fcConnUnit EventDescr	SnmpAdmin String	Reason code XX, XX is the event reason code.	R	Description of the event.

Link Table

The link table is intended to organize and communicate information the agent needs to assist a management application in identifying the connectivity units in the framework and how they connect in the topology. That is, the goal is to assist the management application not only to list the elements of the framework, but to map them.

With this goal, the agent should include all the information it has about any links between its own connectivity units as well as other units.

An agent should include partial information about links if it is not able to fully define them. For an entry to be considered valid, both the X (local) and the Y (remote) must have one valid value.

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

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

A connectivity unit can fill in the table as best it can. One of the methods for filling in the table would be to use the RNID ELS (ANSI document 99-422v0). This allows one to query a port for the information needed for the link table.

This table is accessed either directly (if the management software has an index value) or via GetNexts. The value of the indexes need not be contiguous. Each entry created in this table will be 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 are defined by the size of the table.

Table 2–21: Link Table (Director/Switch)

EMC MIB Object Name	Type	Product Mapping	Access	Description
fcConnUnitLinkIndex	Unsigned32	A link index.	R	This value is used to create a unique value for each entry in the link table with the same fcConnUnitId. The value can only be reused 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. This value is reset to zero when the system is reset and the first value to be used is 1.
fcConnUnitLinkNodIdX	OCTET STRING (SIZE(16))	WWN of the local fcConnUnit is returned. Available for both E and F_Ports.	R	The node WWN of the unit at one end of the link. If the node WWN is unknown and the node is a fcConnUnit in the responding agent then the value of this object must be equal to its fcConnUnitId.
fcConnUnitLinkPortNumberX	Integer32	The fcConnUnit's local port number is returned. Available for both E and F_Ports.	R	The port number on the unit specified by fcConnUnitLinkNodIdX if known, otherwise -1. If the value is non-negative then it will be equal to fcConnUnitPortPhysicalNumber.

Table 2–21: Link Table (Director/Switch) (Continued)

fcConnUnitLinkPortWwnX	OCTET STRING	Local side port WWN on the link. Available for both E and F_Ports.	R	The port WWN of the unit specified by fcConnUnitLinkNodeldX if known, otherwise 16 octets of binary 0.
fcConnUnitLinkNodeldY	OCTET STRING (SIZE(16))	The attached node WWN on the link. Available for both E and F_Ports. E_Port nodeldY can be retrieved from RNID, F_Port NodeldY is supported by FLOGI.	R	The node WWN of the unit at the other end of the link. If the node WWN is unknown and the node is a fcConnUnit in the responding SNMP agent then the value of this object MUST BE equal to its fcConnUnitId.
fcConnUnitLinkPortNumberY	Integer32	Attached port number on the link. Available only for E_Ports from ISR. For F_Port, -1 is returned.	R	The port number on the unit specified by fcConnUnitLinkNodeldY if known, otherwise -1. If the value is non-negative then it will be equal to fcConnUnitPortPhysicalNumber.
fcConnUnitLinkPortWwnY	OCTET STRING	Attached port WWN on the link. Available for F_Ports only. For E_Port, return 16 octets of binary 0.	R	The port WWN on the unit specified by fcConnUnitLinkNodeldY if known, otherwise 16 octets of binary 0.
fcConnUnitLinkAgentAddressY	OCTET STRING (SIZE(16))	Get the value from RNID, owned by Login Server.	R	The address of an FCMGMT MIB agent for the node identified by fcConnUnitLinkNodeldY, if known; otherwise 16 octets of binary 0.
fcConnUnitLinkAgentAddressTypeY	Unsigned32	Get the value from RNID, owned by Login Server.	R	If fcConnUnitLinkAgentAddressY is non-zero, then it is a protocol address. fcConnUnitLinkAgentAddressTypeY is the 'address family number' assigned by IANA to identify the address format. (e.g., 1 is Ipv4, 2 is Ipv6).
fcConnUnitLinkAgentPortY	Unsigned32	Get the value from RNID, owned by Login Server.	R	The IP port number for the agent. This is provided in case the agent is at a non-standard SNMP port.

Table 2–21: Link Table (Director/Switch) (Continued)

fcConnUnitLinkUnitTypeY	FcUnitType	E_Port, return switch (4). Otherwise return RNID type Y.	R	Type of the FC connectivity unit as defined in fcConnUnitType.
fcConnUnitLinkConnIdY	OCTET STRING (SIZE(3))	For F_Ports, return Fibre Channel Address. For E_Ports, return left adjusted domain Id of the switch.	R	Fibre Channel ID of this port. If the connectivity unit is a switch, expected to be a 24-bit Big Endian value. If this is loop, the ALPA that is connected. If this is an E_Port, then it will only contain the domain ID. If not any of those, unknown or cascaded loop, return all bits set to 1.

Port Statistics Table

There is one and only one statistics table for each individual port. For all objects in statistics table, if the object is not supported by the conn unit then the high order bit is set to 1 with all other bits set to zero. The high order bit is reserved to indicate if the object is supported or not. All objects start at a value of zero at hardware initialization and continue incrementing till end of 63 bits and then wrap to zero.

Table 2–22: Port Statistics Table (Director/Switch)

EMC MIB Object Name	Type	Product Mapping from PSCC to SWITCH.	Access	Description
fcConnUnitPortStatIndex	Unsigned32	Port number, starting from 1 to maximum number of ports.	R	Unique value among all entries in this table, between 0 and fcConnUnitNumPort[fcConnUnitPortUnitId]
fcConnUnitPortStatCountError	Counter64	This MIB object counts address ID errors, CRC errors, delimiter errors, frames too short, invalid transmission words, link failures, primitive sequence errors, signal losses, synchronization losses. Only supports low 32 bits of counter, high 32 bits are set to zero.	R	Count of the errors that have occurred on this port.
fcConnUnitPortStatCountTxObjects	Counter64	stTxFrames (64 bit counter)	R	Number of frames, packets, I/Os, etc. transmitted by this port. A Fibre Channel frame starts with SOF and ends with EOF. FC loop devices should not count frames passed through. The value represents the sum total for all other Tx objects.

Table 2–22: Port Statistics Table (Director/Switch) (Continued)

fcConnUnitPort StatCountRx Objects	Counter64	stRxFrames (64 bit counter)	R	The number of frames/packets/IOs/etc that have been received by this port. Note: A Fibre Channel frame starts with SOF and ends with EOF. FC loop devices should not count frames passed through. This value represents the sum total for all other Rx objects.
fcConnUnitPort StatCountTx Elements	Counter64	stTxOctets (64 bit counter)	R	The number of octets or bytes that have been transmitted by this port. One second periodic polling of the port. This value is saved and compared with the next polled value to compute net throughput. Note, for Fibre Channel, ordered sets are not included in the count.
fcConnUnitPort StatCountRx Elements	Counter64	stRxOctets (64 bit counter)	R	The number of octets or bytes that have been received by this port. One second periodic polling of the port. This value is saved and compared with the next polled value to compute net throughput. Note, for Fibre Channel, ordered sets are not included in the count.
fcConnUnitPort StatCount BBCreditZero	Counter64	Not supported	R	Count of transitions in/out of BBcredit zero state. The other side is not providing any credit. Note, this is a Fibre Channel stat only.
fcConnUnitPort StatCountInput BuffersFull	Counter64	Not supported	R	Count of occurrences when all input buffers of a port were full and outbound buffer-to-buffer credit transitioned to zero. There is no credit to provide to other side. Note, this is a Fibre Channel stat only.
fcConnUnitPort StatCountFBSY Frames	Counter64	Not supported	R	Count 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. Port can only occur on SOFc1 frames (the frames that establish a connection). Note, this is a Fibre Channel only stat. This is the sum of all classes. If you cannot keep the by class counters, then keep the sum counters.
fcConnUnitPort StatCountPBSY Frames	Counter64	Not supported	R	Count 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 only occur on SOFc1 frames (the frames that establish a connection). Note, this is a Fibre Channel only stat. This is the sum of all classes. If you cannot keep the by class counters, then keep the sum counters.
fcConnUnitPort StatCountFRJT Frames	Counter64	Not supported	R	Count 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 stat.

Table 2–22: Port Statistics Table (Director/Switch) (Continued)

fcConnUnitPort StatCountPRJT Frames	Counter64	Not supported	R	Count of times that FRJT was returned to this port as a result of a Frame that was rejected at the destination N_Port. Note, This is the total for all classes and is a Fibre Channel only stat.
fcConnUnitPort StatCountClass1 RxFrames	Counter64	Not supported	R	Count of Class 1 Frames received at this port. Note, this is a Fibre Channel only stat.
fcConnUnitPort StatCountClass1 TxFrames	Counter64	Not supported	R	Count of Class 1 Frames transmitted out this port. Note, this is a Fibre Channel only stat.
fcConnUnitPort StatCountClass1 FBSYFrames	Counter64	Not supported	R	Count of times that FBSY was returned to this port as a result of a Class 1 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. FBSY can only occur on SOFc1 frames (the frames that establish a connection). Note, this is a Fibre Channel only stat.
fcConnUnitPort StatCountClass1 PBSYFrames	Counter64	Not supported	R	Count of times that PBSY was returned to this port as a result of a Class 1 Frame that could not be delivered to the other end of the link. This occurs if the destination N_Port is temporarily busy. PBSY can only occur on SOFc1 frames (the frames that establish a connection). Note, this is a Fibre Channel only stat.
fcConnUnitPort StatCountClass1 FRJTFrames	Counter64	Not supported	R	Count of times that FRJT was returned to this port as a result of a Class 1 Frame that was rejected by the fabric. Note, this is a Fibre Channel only stat.
fcConnUnitPort StatCountClass1 PRJTFrames	Counter64	Not supported	R	Count of times that FRJT was returned to this port as a result of a Class 1 Frame that was rejected at the destination N_Port. Note, this is a Fibre Channel only stat.
fcConnUnitPort StatCountClass2 RxFrames	Counter64	stC2FramesIn (64 bit counter)	R	Count of Class 2 Frames received at this port. Note, this is a Fibre Channel only stat.
fcConnUnitPort StatCountClass2 TxFrames	Counter64	stC2FramesOut (64 bit counter)	R	Count of Class 2 Frames transmitted out this port. Note, this is a Fibre Channel only stat.
fcConnUnitPort StatCountClass2 FBSYFrames	Counter64	stC2FabricBusy (only supports low 32 bits of counter, high 32 bits are set to zero)	R	Count of times that FBSY was returned to this port as a result of a Class 2 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. FBSY can only occur on SOFc1 frames (the frames that establish a connection). Note, this is a Fibre Channel only stat.

Table 2–22: Port Statistics Table (Director/Switch) (Continued)

fcConnUnitPort StatCountClass2 PBSYFrames	Counter64	Not supported	R	Count of times that PBSY was returned to this port as a result of a Class 2 Frame that could not be delivered to the other end of the link. This occurs if the destination N_Port is temporarily busy. PBSY can only occur on SOFc1 frames (the frames that establish a connection). Note, this is a Fibre Channel only stat.
fcConnUnitPort StatCountClass2 FRJTFrames	Counter64	stC2FabricReject (only supports low 32 bits of counter, high 32 bits are set to zero)	R	Count of times that FRJT was returned to this port as a result of a Class 2 Frame that was rejected by the fabric. Note, this is a Fibre Channel only stat.
fcConnUnitPort StatCountClass2 PRJTFrames	Counter64	Not supported	R	Count of times that FRJT was returned to this port as a result of a Class 2 Frame that was rejected at the destination N_Port. Note, this is a Fibre Channel only stat.
fcConnUnitPort StatCountClass3 RxFrames	Counter64	stC3FramesIn (64 bit counter)	R	Count of Class 3 Frames received at this port. Note, this is a Fibre Channel only stat.
fcConnUnitPort StatCountClass3 TxFrames	Counter64	stC3FramesOut (64 bit counter)	R	Count of Class 3 Frames transmitted out this port. Note, this is a Fibre Channel only stat.
fcConnUnitPort StatCountClass3 Discards	Counter64	stC3Discards (64 bit counter)	R	Count of Class 3 Frames that were discarded upon reception at this port. There is no FBSY or FRJT generated for Class 3 Frames. They are simply discarded if they cannot be delivered. Note, this is a Fibre Channel only stat.
fcConnUnitPort StatCountRx MulticastObjects	Counter64	Not supported	R	Count of Multicast Frames or Packets received at this port.
fcConnUnitPort StatCountTx MulticastObjects	Counter64	Not supported	R	Count of Multicast Frames or Packets transmitted out this port.
fcConnUnitPort StatCountRx BroadcastObjects	Counter64	Not supported	R	Count of Broadcast Frames or Packets received at this port.
fcConnUnitPort StatCountTx BroadcastObjects	Counter64	Not supported	R	Count of Broadcast Frames or Packets transmitted out this port. On a Fibre Channel loop, count only OPN _r frames generated.
fcConnUnitPort StatCountRx LinkResets	Counter64	StLinkResetsIn (Only supports low 32 bits of counter, high 32 bits are set to zero)	R	Count of Link resets. This is the number of LRs received. Note, this is a Fibre Channel only stat.

Table 2–22: Port Statistics Table (Director/Switch) (Continued)

fcConnUnitPort StatCountTx LinkResets	Counter64	stLinkResetsOut (only supports low 32 bits of counter, high 32 bits are set to zero)	R	Count of Link resets. This is the number LRs transmitted. Note, this is a Fibre Channel only stat.
fcConnUnitPort StatCount NumberLink Resets	Counter64	stLinkResetsIn + stLinkResetsOut (only supports low 32 bits of counter, high 32 bits are set to zero)	R	Count of Link resets and LIPs detected at this port. The number times the reset link protocol is initiated. These are the count of the logical resets, a count of the number of primitives. Note, this is a Fibre Channel only stat.
fcConnUnitPort StatCountRx OfflineSequences	Counter64	stOlssIn (only supports low 32 bits of counter, high 32 bits are set to zero)	R	Count of Offline Primitive OLS received at this port. Note, this is a Fibre Channel only stat.
fcConnUnitPort StatCountTx OfflineSequences	Counter64	stOlssOut (only supports low 32 bits of counter, high 32 bits are set to zero)	R	Count of Offline Primitive OLS transmitted by this port. Note, this is a Fibre Channel only stat.
fcConnUnitPort StatCount NumberOffline Sequences	Counter64	stOlssIn + stOlssOut (only supports low 32 bits of counter, high 32 bits are set to zero)	R	Count of Offline Primitive sequence received at this port. Note, this is a Fibre Channel only stat.
fcConnUnitPort StatCountLink Failures	Counter64	stLinkFailures (only supports low 32 bits of counter, high 32 bits are set to zero)	R	Count 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 stat.
fcConnUnitPort StatCount InvalidCRC	Counter64	stInvalidCrcs (only supports low 32 bits of counter, high 32 bits are set to zero)	R	Count of frames received with 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 stat.
fcConnUnitPort StatCountInvalid TxWords	Counter64	stInvalidTxWords (only supports low 32 bits of counter, high 32 bits are set to zero)	R	Count 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 stat.
fcConnUnitPort StatCount PrimitiveSequence ProtocolErrors	Counter64	stPrimSeqProtoErrors (only supports low 32 bits of counter, high 32 bits are set to zero)	R	Count 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 stat.

Table 2–22: Port Statistics Table (Director/Switch) (Continued)

fcConnUnitPort StatCountLoss ofSignal	Counter64	stSigLosses (only supports low 32 bits of counter, high 32 bits are set to zero)	R	Count of instances of signal 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 stat.
fcConnUnitPort StatCountLoss ofSynchronization	Counter64	stSyncLosses (only supports low 32 bits of counter, high 32 bits are set to zero)	R	Count 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 stat.
fcConnUnitPort StatCountInvalid OrderedSets	Counter64	Not supported	R	Count of invalid ordered sets received at port. This count is part of the Link Error Status Block (LESB). (FC-PH 29.8). Note, this is a Fibre Channel only stat.
fcConnUnitPort StatCountFrames TooLong	Counter64	Not supported	R	Count of frames received at this port where the frame length was greater than what was agreed to in FLOGI/PLOGI. This could be caused by losing the end of frame delimiter. Note, this is a Fibre Channel only stat.
fcConnUnitPort StatCountFrames Truncated	Counter64	stFramesTooShort (only supports low 32 bits of counter, high 32 bits are set to zero)	R	Count of frames received at this port where the frame length was less than the minimum indicated by the frame header - normally 24 bytes, but it could be more if the DFCTL field indicates an optional header should have been present. Note, this is a Fibre Channel only stat
fcConnUnitPort StatCount AddressErrors	Counter64	stAddrIDErrors (only supports low 32 bits of counter, high 32 bits are set to zero)	R	Count of frames received with unknown addressing. e.g. unknown SID or DID. the SID or DID is not known to the routing algorithm. Note. this is a Fibre Channel only stat.
fcConnUnitPort StatCount DelimiterErrors	Counter64	stDelimiterErrors (only supports low 32 bits of counter, high 32 bits are set to zero)	R	Count of invalid frame delimiters received at this port. An example is a frame with a class 2 start and a class 3 at the end. Note, this is a Fibre Channel only stat.
fcConnUnitPort StatCount Encoding DisparityErrors	Counter64	Not supported	R	Count of disparity errors received at this port. Note, this is a Fibre Channel only stat.

Name Server Table

This table is accessed either directly if the management software has an index value or via GetNexts. The value of the indexes is not required to be contiguous. Each entry created in this table will be 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.

Table 2–23: Name Server Table (Director/Switch)

EMC MIB Object Name	Type	Product Mapping	Access	Description
fcConnUnitSnsPortIndex	Counter64 INTEGER	A port number, starting from 1 to maximum number of ports.	R	The physical port number of this SNS table entry. Each physical port has an SNS table with 1-n entries indexed by fcConnUnitSnsPortIdentifier (port address)
fcConnUnitSnsPortIdentifier	FcAddressId	3 bytes FcAddress in the least significant bytes.	R	The Port Identifier for this entry in the SNS table.
fcConnUnitSnsPortName	FcNameId	Port WWN Name	R	The Port WWN Name for this entry in the SNS table.
fcConnUnitSnsNodeName	FcNameId	Node Name	R	The Node Name for this entry in the SNS table.
fcConnUnitSnsClassOfSvc	OCTET STRING (SIZE (1))	Class of Service that matches the FC class service convention used in name server.	R	The Classes of Service offered by this entry in the SNS table.
fcConnUnitSnsNodeIPAddress	OCTET STRING (SIZE(16))	Node IP address	R	The IPv6 formatted address of the Node for this entry in the SNS table.
fcConnUnitSnsProcAssoc	OCTET STRING (SIZE (8))	Process Associator.	R	The Process Associator for this entry in the SNS table.
fcConnUnitSnsFC4Type	OCTET STRING (SIZE (32))	FC4 type	R	The FC-4 Types supported by this entry in the SNS table.
fcConnUnitSnsPortType	OCTET STRING (SIZE (1))	Port type	R	The Port Type of this entry in the SNS table.
fcConnUnitSnsPortIPAddress	OCTET STRING (SIZE(16))	Port IP Address	R	The IPv6 formatted address of this entry in the SNS table.
fcConnUnitSnsFabricPortName	FcNameId	Fabric Port Name	R	The Fabric Port name of this entry in the SNS table.

Table 2–23: Name Server Table (Director/Switch) (Continued)

fcConnUnitSns HardAddress	FcGlobalId	3 bytes address from name server in the least significant bytes	R	The Hard ALPA of this entry in the SNS table.
fcConnUnitSns SymbolicPortName	DisplayString (SIZE (0..79))	Symbolic port name	R	The Symbolic Port Name of this entry in the SNS table.
fcConnUnitSns SymbolicNodeName	DisplayString (SIZE (0..79))	Symbolic node name	R	The Symbolic Node Name of this entry in the SNS table.

SNMP Trap Registration Table

Table 2–24: SNMP Trap Registration Group Table (Director/Switch)

EMC MIB Object Name	Type	Product Mapping	Access	Description
fcTrapMaxClients	Unsigned32	The maximum number of SNMP trap recipients can be supported in the system.	R	The maximum number of SNMP trap recipients supported by the connectivity unit.
fcTrapClientCount	Unsigned32	The current number of trap recipients	R	The current number of rows in the trap table.

Trap Registration Table

The trapRegTable contains a row for each IP address/port number that traps will be sent.

Table 2–25: TrapRegTable Table (Director/Switch)

EMC MIB Object Name	Type	Product Mapping	Access	Description
fcTrapRegIpAddress	IpAddress	Trap recipient's IP address.	R/C	The IP address of a client registered for traps.
fcTrapRegPort	Unsigned32	UDP port.	R/C	The UDP port to send traps to for this host. Normally this would be the standard trap port (UDP/162).

Table 2–25: TrapRegTable Table (Director/Switch) (Continued)

fcTrapRegFilter	FcEventSeverity	Severity filter. Information not exposed in SNMP configuration dialog.	R/C	This value defines the trap severity filter for this trap host. The fcConnUnit will send to the designated target entity traps that have a severity level less than or equal to this value.
fcTrapRegRowState	RowStatus	Row status.	R/C	<p>Specifies the operational status of the row. A RowStatus object may take any of six defined values:</p> <ul style="list-style-type: none"> - active (1): traps may be sent as specified in this row; a management application may change the value of any objects in the row when the status is active. - notInService (2): traps will not be sent using this row. - notReady (3): the conceptual row exists in the agent, but is missing information necessary to send traps (i.e., if any of the other objects in the row are not present or contain invalid values); this value may not be supplied by a management application. - createAndGo (4): supplied by a management application wishing to create a new instance of a conceptual row, supplying valid values for the all the other objects in the row, and have its status automatically set to active, making it available for use in sending traps. - createAndWait (5): supplied by a management application wishing to create a new instance of a conceptual row but not make it available for use in sending traps at that time; and, - destroy (6): supplied by a management application wishing to delete an existing conceptual row.

Trap Type Table

Table 2–26: Trap Type Table (Director/Switch)

EMC MIB Object Name	Type Number	Product Mapping	OID and Value	Description
fcConnUnit StatusChange	1	Generated when the switch's online status or operational status changes	".1.3.6.1.2.1.8888.1.1.3.1.6" + unitldfcConnUnitStatus, ".1.3.6.1.2.1.8888.1.1.3.1.5" + unitldfcConnUnitState	The overall status of the connectivity unit has changed. Recommended severity level (for filtering): alert
fcConnUnit DeletedTrap	2	Not supported on the connUnit.	N/A	An fcConnUnit has been deleted from this agent. Recommended severity level (for filtering): warning
fcConnUnit EventTrap	3	Generated when a new event is generated.	".1.3.6.1.2.1.8888.1.1.7.1.1" + unitldfcConnUnitEventIndex, ".1.3.6.1.2.1.8888.1.1.7.1.5" + unitldfcConnUnitEventType, ".1.3.6.1.2.1.8888.1.1.7.1.6" + unitldfcConnUnitEventObject, ".1.3.6.1.2.1.8888.1.1.7.1.7" + unitldfcConnUnitEventDescr	An event has been generated by the connectivity unit. Recommended severity level (for filtering): info
fcConnUnit SensorStatus Change	4	Generated when one of fans/powers status is changed.	".1.3.6.1.2.1.8888.1.1.5.1.3" + unitld + sensor_nbrfcConnUnitSensorState	The overall status of the connectivity unit has changed. Recommended severity level (for filtering): alert
fcConnUnit PortStatus Change	5	Generated when a port state/status is changed.	".1.3.6.1.2.1.8888.1.1.6.1.6" + unitld + port_nbrfcConnUnitPortStatus, ".1.3.6.1.2.1.8888.1.1.6.1.5" + unitld + port_nbrfcConnUnitPortState	The overall status of the connectivity unit has changed. Recommended severity level (for filtering): alert

Fibre Channel Fabric Element MIB Support

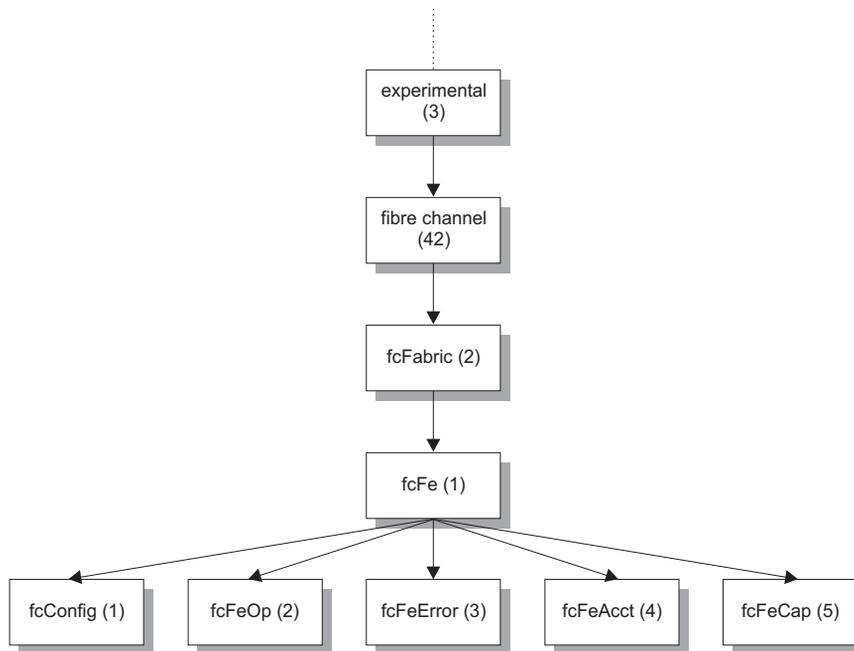


Figure 2–4: Fibre Channel Fabric Element MIB support tree

The Fibre Channel Fabric Element (FCFE) management information base (MIB) enables users on network management stations to monitor, control, and configure the director or switch remotely using functions specifically for the director or switch. Products support version 1.10 of the FCFE MIB. There are five groups of variables defined and supported by the agent:

- Configuration (FcFeConfig)
- Operation (FcFeOp)
- Error (FcFeError)
- Accounting (FcFeAcct)
- Capability (FcFeCap)

The following sections define the FCFE MIB variables and their output. All variables in the FCFE MIB except for `fcFxPortPhysAdminStatus`, which is defined under `fcFxPortPhysTable` in `fcFeOp` group, are read-only.

Error Group Table

This *Fcporterrortable* displays the number of errors detected by an FxPort since the management agent initialized, enabling you to determine the quality of the link between the FxPort and its attached NxPort.

Table 2–27: Error Group

Variable	Provides
fcFxPortErrorModuleIndex	This object identifies the module containing the FxPort for which this entry contains information. This number ranges from 1 to AS_glob.prod_cnfg_ptr->max_nbr_modules.
fcFxPortErrorFxPortIndex	This object identifies the FxPort within the module. This number ranges from 1 to the value of fcFeModulePortCapacity for the associated module. The value remains constant for the identified FxPort until the module is re-initialized. This number ranges from 1 to AS_glob.prod_cnfg_ptr->ports_per_module.
fcFxPortLinkFailures	The number of link failures detected by this FxPort.
fcFxPortSyncLosses	The number of loss of synchronization detected by the FxPort.
fcFxPortSigLosses	The number of loss of signal detected by the FxPort.
fcFxPortPrimSeqProtoErrors	The number of primitive sequence protocol errors detected by the FxPort.
fcFxPortInvalidTxWords	The number of invalid transmission word detected by the FxPort.
fcFxPortInvalidCrcs	The number of invalid CRC detected by the FxPort.
fcFxPortDelimiterErrors	The number of Delimiter Errors detected by this FxPort.
fcFxPortAddressIdErrors	The number of address identifier errors detected by this FxPort.
fcFxPortLinkResetIns	The number of Link Reset Protocols received by this FxPort from the attached NxPort.
fcFxPortLinkResetOuts	The number of Link Reset Protocols issued by this FxPort to the attached NxPort.
fcFxPortOIsIns	The number of Offline Sequences received by this FxPort.
fcFxPortOIsOuts	The number of Offline Sequences issued by this FxPort.

Accounting: Class 1

Table 2–28: Accounting: Class 1

Variable	Provides the Number of Class 1
fcFxPortC1AcctModuleIndex	This object identifies the module containing the FxPort for which this entry contains information. This number ranges from 1 to AS_glob.prod_cnfg_ptr->max_nbr_modules.
fcFxPortC1AcctFxPortIndex	This object identifies the FxPort within the module. This number ranges from 1 to the value of fcFeModulePortCapacity for the associated module. The value remains constant for the identified FxPort until the module is re-initialized. This number ranges from 1 to AS_glob.prod_cnfg_ptr->ports_per_module.
fcFxPortC1InConnections	The number of Class 1 connections successfully established in which the attached NxPort is the source of the connect-request. This value is fixed at 0.
fcFxPortC1OutConnections	The number of Class 1 connections successfully established in which the attached NxPort is the destination of the connect-request. This value is fixed at 0.
fcFxPortC1FbsyFrames	The number of F_BSY frames generated by this FxPort against Class 1 connect-request. This value is fixed at 0.
fcFxPortC1FrjtFrames	The number of F_RJT frames generated by this FxPort against Class 1 connect-request. This value is fixed at 0.
fcFxPortC1ConnTime	The cumulative time that this FxPort has been engaged in Class 1 connection. The amount of time of each connection is counted in octets from after a connect- request has been accepted until the connection is disengaged, either by an EOFdt or Link Reset. This value is fixed at 0.
fcFxPortC1InFrames	The number of Class 1 frames (other than Class 1 connect-request) received by this FxPort from its attached NxPort. This value is fixed at 0.
fcFxPortC1OutFrames	The number of Class 1 frames (other than Class 1 connect-request) delivered through this FxPort to its attached NxPort. This value is fixed at 0.
fcFxPortC1InOctets	The number of Class 1 octets (other than Class 1 connect-request) received through this FxPort to its attached NxPort. This value is fixed at 0.
fcFxPortC1OutOctets	The number of Class 1 octets (other than Class 1 connect-request) delivered through this FxPort to its attached NxPort. This value is fixed at 0.
fcFxPortC1Discards	This value is fixed at 0.

Accounting: Class 2

The *Fcfportc2accttable* displays class 2 accounting information for each FxPort in the fabric element recorded since the management agent initialized.

Table 2–29: Accounting: Class 2

Variable	Provides the Number of Class 2:
fcFxpPortC2AcctModuleIndex	This object identifies the module containing the FxPort for which this entry contains information. This number ranges from 1 to AS_glob.prod_cnfg_ptr->max_nbr_modules.
fcFxpPortC2AcctFxpPortIndex	This object identifies the FxPort within the module. This number ranges from 1 to the value of fcFeModulePortCapacity for the associated module. The value remains constant for the identified FxPort until the module is re-initialized. This number ranges from 1 to AS_glob.prod_cnfg_ptr->ports_per_module.
fcFxpPortC2InFrames	The number of Class 2 frames received by this FxPort from its attached NxPort.
fcFxpPortC2OutFrames	The number of Class 2 frames delivered through this FxPort to its attached NxPort.
fcFxpPortC2InOctets	The number of Class 2 frame octets, including the frame delimiters, received by this FxPort from its attached NxPort.
fcFxpPortC2OutOctets	The number of Class 2 frame octets, including the frame delimiters, delivered through this FxPort to its attached NxPort.
fcFxpPortC2Discards	The number of Class 2 frames discarded by this FxPort. This value is not supported. Always zero.
fcFxpPortC2FbsyFrames	The number of F_BSY frames generated by this FxPort against Class 2 frames.
fcFxpPortC2FrjtFrames	The number of F_RJT frames generated by this FxPort against Class 2 frames.

Accounting: Class 3

The *Fcfportc3accttable* displays class 3 accounting information for each FxPort in the fabric element recorded since the management agent initialized.

Table 2–30: Accounting: Class 3

Variable	Provides the Number of Class 3:
fcFxpPortC3AcctModuleIndex	This object identifies the module containing the FxPort for which this entry contains information.
fcFxpPortC3AcctFxpPortIndex	This object identifies the FxPort within the module. This number ranges from 1 to the value of fcFeModulePortCapacity for the associated module. The value remains constant for the identified FxPort until the module is re-initialized. This number ranges from 1 to AS_glob.prod_cnfg_ptr->ports_per_module.
fcFxpPortC3InFrames	The number of Class 3 frames received by this FxPort from its attached NxPort.
fcFxpPortC3OutFrames	The number of Class 3 frames delivered through this FxPort to its attached NxPort.
fcFxpPortC3InOctets	The number of Class 3 frame octets, including the frame delimiters, received by this FxPort from its attached NxPort.

Table 2–30: Accounting: Class 3 (Continued)

Variable	Provides the Number of Class 3:
fcFxC3OutOctets	The number of Class 3 frame octets, including the frame delimiters, delivered through this FxPort to its attached NxPort.
fcFxC3Discards	The number of Class 3 frames discarded by this FxPort.

Operation: FxPort Operation Table

The *Fcfxportoper* table displays the operational status and parameters of the FxPorts.

Table 2–31: FxPort Operation Table

Variable	Provides:
fcFxC3OperModuleIndex	This object identifies the module containing the FxPort for which this entry contains information. This number ranges from 1 to AS_glob.prod_cfg_ptr->max_nbr_modules.
fcFxC3OperFxPortIndex	This object identifies the FxPort within the module. This number ranges from 1 to the value of fcFeModulePortCapacity for the associated module. The value remains constant for the identified FxPort until the module is re-initialized. This number ranges from 1 to AS_glob.prod_cfg_ptr->ports_per_module.
fcFxC3PortID	The address identifier by which this FxPort is identified within the Fabric. The FxPort may assign its address identifier to its attached NxPort(s) during Fabric Login. Return a port id if the port is login into the fabric, otherwise this address is 000000 in director 2/64 1.0.
fcFxC3AttachedPortName	The port name of the attached NxPort, if applicable. If the value of this object is '0000000000000000'H, this FxPort has no NxPort attached to it. This variable has been deprecated and may be implemented for backward compatibility.
fcFxC3ConnectedPort	The address identifier of the destination FxPort with which this FxPort is currently engaged in a either a Class 1 or loop connection. If the value of this object is '000000'H, this FxPort is not engaged in a class 1 connection. This variable has been deprecated and may be implemented for backward compatibility. This address is fixed at 0x000000.
fcFxC3BbCreditAvailable	The number of buffers currently available for receiving frames from the attached port in the buffer-to-buffer flow control. The value should be less than or equal to fcFxC3BbCredit.
fcFxC3OperMode	The current operational mode of the FxPort. This value is fport(2) if the port_state_data is unavailable or the port is a fport, or unknown(1) for the other port state.
fcFxC3AdminMode	The desired operational mode of the FxPort. This value is fport(2) if the port_state_data is unavailable or the port is a fport, or unknown(1) for the other port state.

Operation: FxPort Physical Level Table

The *Fcfxportphstable* displays the physical level status and parameters for each FxPort in the fabric element.

Table 2–32: Operation: FxPort Physical Level

Variable	Provides:
fcFxPortPhysModuleIndex	This object identifies the module containing the FxPort for which this entry contains information. This number ranges from 1 to AS_glob.prod_cnfg_ptr->max_nbr_modules.
fcFxPortPhysFxPortIndex	This object identifies the FxPort within the module. This number ranges from 1 to the value of fcFeModulePortCapacity for the associated module. The value remains constant for the identified FxPort until the module is re-initialized. This number ranges from 1 to AS_glob.prod_cnfg_ptr->ports_per_module.
fcFxPortPhysAdminStatus	The desired state of the FxPort. A management station may place the FxPort in a desired state by setting this object accordingly. The testing(3) state indicates that no operational frames can be passed. When a Fabric Element initializes, all FxPort start with fcFxPortPhysAdminStatus in the offline(2) state. As the result of either explicit management action or per configuration information accessible by the Fabric Element, fcFxPortPhysAdminStatus is then changed to either the online(1) or testing(3) states, or remains in the offline state. The values are defined as follow: online(1) - place port online, offline(2) - take port offline, testing (3). This MIB variable is maintained by both the portState, ps*, defined in UPM and the PORT_BLOCKED_STATE, pstate*, defined in PCP. The psNotInstalled shows that the port is not exist. The psIntDiags and psExtLoop indicate the testing(3) state. The pstateUNBLOCKD and pstateBLOCKD indicate the online(1) and offline(2) respectively.
fcFxPortPhysOperStatus	The current operational status of the FxPort. The testing(3) indicates that no operational frames can be passed. If fcFxPortPhysAdminStatus is offline(2) then fcFxPortPhysOperStatus should be offline(2). If fcFxPortPhysAdminStatus is changed to online(1) then fcFxPortPhysOperStatus should change to online(1) if the FxPort is ready to accept Fabric Login request from the attached NxPort; it should proceed and remain in the link-failure(4) state if and only if there is a fault that prevents it from going to the online(1) state. The values are defined as follow: online(1) - Login may proceed, offline(2) - Login cannot proceed, testing(3) - port is under test, link-failure(4) - failure after online/testing.
fcFxPortPhysLastChange	The value of sysUpTime at the time the FxPort entered its current operational status. A value of zero indicates that the FxPort's operational status has not changed since the agent last restarted. This is SS_TIM_RD_TICKS(MILLISEC) * 10.
fcFxPortPhysRttov	The Receiver_Transmitter_Timeout value of the FxPort. This is used by the receiver logic to detect Loss of Synchronization. This value is fixed at 100ms.

Operation: Fabric Login Table

The *Fcflogintable* displays the service parameters for each FxPort in the fabric element that have been established from the most recent fabric login (implicit or explicit).

Table 2–33: Operation: Fabric Login

Variable	Provides:
fcFxlogiModuleIndex	This object identifies the module containing the FxPort for which this entry contains information. This number ranges from 1 to AS_glob.prod_cnfg_ptr->max_nbr_modules.
fcFxlogiFxPortIndex	This object identifies the FxPort within the module. This number ranges from 1 to the value of fcFeModulePortCapacity for the associated module. The value remains constant for the identified FxPort until the module is re-initialized. This number ranges from 1 to AS_glob.prod_cnfg_ptr->ports_per_module.
fcFxlogiNxPortIndex	The object identifies the associated NxPort in the attachment for which the entry contains information.
fcFxPortFcphVersionAgreed	The version of FC-PH that the FxPort has agreed to support from the Fabric Login.
fcFxPortNxPortBbCredit	The total number of buffers available for holding Class 1 connect-request, Class 2 or Class 3 frames to be transmitted to the attached NxPort. It is for buffer- to-buffer flow control in the direction from FxPort to NxPort. The buffer-to-buffer flow control mechanism is indicated in the respective fcFxPortBbCreditModel.
fcFxPortNxPortRxDataFieldSize	The Receive Data Field Size of the attached NxPort. This is a binary value that specifies the largest Data Field Size for an FT_1 frame that can be received by the NxPort. The value is in number of bytes and ranges from 128 to 2112 inclusive.
fcFxPortCosSuppAgreed	A variable indicating that the attached NxPort has requested the FxPort for the support of classes of services and the FxPort has granted the request.
fcFxPortIntermixSuppAgreed	A variable indicating that the attached NxPort has requested the FxPort for the support of Intermix and the FxPort has granted the request. This flag is only valid if Class 1 service is supported. The values are defined as follow: yes(1) and no(2). This is always no(2).
fcFxPortStackedConnModeAgreed	A variable indicating whether the FxPort has agreed to support stacked connect from the Fabric Login. This is only meaningful if Class 1 service has been agreed. This is always none(1).
fcFxPortClass2SeqDelivAgreed	A variable indicating whether the FxPort has agreed to support Class 2 sequential delivery from the Fabric Login. This is only meaningful if Class 2 service has been agreed. The values are defined as follow: yes(1) and no(2).
fcFxPortClass3SeqDelivAgreed	A flag indicating whether the FxPort has agreed to support Class 3 sequential delivery from the Fabric Login. This is only meaningful if Class 3 service has been agreed. The values are defined as follow: yes(1) and no(2).

Table 2–33: Operation: Fabric Login (Continued)

Variable	Provides:
fcFxpPortNxPortName	The port name of the attached NxPort, if applicable. If the value of this object is '0000000000000000'H, this FxPort has no NxPort attached to it. This is the world wide Name of the attached to NxPort. Same as fcFPortAttachedPortName.
fcFxpPortConnectedNxPort	The address identifier of the destination FxPort with which this FxPort is currently engaged in a either a Class 1 or loop connection. If the value of this object is '000000'H, this FxPort is not engaged in a connection. This is fixed at '000000'H.
fcFxpPortBbCreditModel	This object identifies the BB_Credit model used by the FxPort. The regular model refers to the Buffer-to-Buffer flow control mechanism defined in FC-PH [1] is used between the FxPort and the NxPort. For FL_Ports, the Alternate Buffer-to-Buffer flow control mechanism as defined in FC-AL [4] is used between the FL_Port and any attached NL_Ports. This is fixed at regular(1).

Configuration Group

Configuration group incorporates three scalar MIB variables, a module table, and a configuration table.

- **FcFabricName**
The Name_Identifier of the Fabric to which this Fabric Element belongs.
- **FcElementName**
The Name_Identifier of the Fabric Element.
- **FcFeModuleCapacity**
The maximum number of modules in the Fabric Element, regardless of their current state.

The module table contains the configuration parameters of a port module.

Table 2–34: Module Table

Variable	Provides:
fcFeModuleIndex	This object identifies the module within the Fabric Element for which this entry contains information. This value is never greater than fcFeModuleCapacity. This number ranges from 1 to AS_glob.prod_cnfg_ptr->max_nbr_modules.
fcFeModuleDescr	A textual description of the module. This value should include the full name and version identification of the module. It should contain printable ASCII characters. This string should be derived from VPD information stored in the FRU EEPROM.

Table 2–34: Module Table (Continued)

Variable	Provides:
fcFeModuleObjectID	The vendor's authoritative identification of the module. This value may be allocated within the SMI enterprises subtree (1.3.6.1.4.1) and provides a straight-forward and unambiguous means for determining what kind of module is being managed. For example, this object could take the value 1.3.6.1.4.1.99649.3.9 if vendor 'Neufe Inc.' was assigned the subtree 1.3.6.1.4.1.99649, and had assigned the identifier 1.3.6.1.4.1.99649.3.9 to its 'FeFiFo-16 PlugInCard'. This is a fixed object identifier assigned from the enterprise subtree (1.3.6.1.4.1.289.2.1.1.2).
fcFeModuleOperStatus	This object indicates the operational status of the module: online(1) - the module is functioning properly; offline(2) - the module is not available; testing(3) - the module is under testing; and faulty(4) - the module is defective in some way. The status is evaluated from fcFPortPhysOperStatus as following order: testing(3) - the module is under testing if all four ports on the current module are testing; faulty(4) - the module is defective if any of the ports on the current module is faulty; online(1) - the module is functioning properly if any of the ports on the current module is online or testing; offline(2) - the module is not available if any of the ports on the current module is offline.
fcFeModuleLastChange	This object contains the value of sysUpTime when the module entered its current operational status. A value of zero indicates that the operational status of the module has not changed since the agent last restarted. This is $SS_TIM_RD_TICKS(MILLISEC) * 10$
fcFeModuleFxCapacity	The number of FxPort that can be contained within the module. Within each module, the ports are uniquely numbered in the range from 1 to fcFeModuleFxCapacity inclusive. However, the numbers are not required to be contiguous. This is $AS_glob.prod_cfg_ptr->ports_per_module$
fcFeModuleName	The Name_Identifier of the module. This is the port module world wide name.

The configuration table displays the configuration parameters of the FxPorts.

Table 2–35: Configuration Table

Variable	Provides
fcFxCnfModuleIndex	This object identifies the module containing the FxPort for which this entry contains information. This number ranges from 1 to $AS_glob.prod_cfg_ptr->max_nbr_modules$.
fcFxCnfFxPortIndex	This object identifies the FxPort within the module. This number ranges from 1 to the value of fcFeModulePortCapacity for the associated module. The value remains constant for the identified FxPort until the module is re-initialized. This number ranges from 1 to $AS_glob.prod_cfg_ptr->ports_per_module$.
fcFxCnfPortName	The name identifier of this FxPort. Each FxPort has a unique port name within the address space of the Fabric. This is the WWN assigned to the port.
fcFxCnfPortFcpVersionHigh	The highest or most recent version of FC-PH that the FxPort is configured to support.
fcFxCnfPortFcpVersionLow	The lowest or earliest version of FC-PH that the FxPort is configured to support.

Table 2–35: Configuration Table (Continued)

Variable	Provides
fcFxpPortBbCredit	The total number of receive buffers available for holding Class 1 connect-request, Class 2 or 3 frames from the attached NxPort. It is for buffer-to-buffer flow control in the direction from the attached NxPort (if applicable) to FPort.
fcFxpPortRxBufSize	The largest Data_Field Size (in octets) for an FT_1 frame that can be received by the FxPort. This is fixed at 2112.
fcFxpPortRatov	The Resource_Allocation_Timeout Value configured for the FxPort. This is used as the timeout value for determining when to reuse an NxPort resource such as a Recovery_Qualifier. It represents E_D_TOV (see next object) plus twice the maximum time that a frame may be delayed within the Fabric and still be delivered.
fcFxpPortEdtov	The E_D_TOV value configured for the FxPort. The Error_Detect_Timeout Value is used as the timeout value for detecting an error condition.
fcFxpPortCosSupported	A value indicating the set of Classes of Service supported by the FxPort. This is fixed at CLASS_2 CLASS_3 (0x0C).
fcFxpPortIntermixSupported	A flag indicating whether or not the FxPort supports an Intermixed Dedicated Connection. The values are defined as follow: yes(1) and no(2). This is fixed at no(2).
fcFxpPortStackedConnMode	A value indicating the mode of Stacked Connect supported by the FxPort. This is fixed at none(1).
fcFxpPortClass2SeqDeliv	A flag indicating whether or not Class 2 Sequential Delivery is supported by the FxPort. The values are defined as follow: yes(1) and no(2). This is fixed at yes(1).
fcFxpPortClass3SeqDeliv	A flag indicating whether or not Class 3 Sequential Delivery is supported by the FxPort. The values are defined as follow: yes(1) and no(2). This is fixed at yes(1).
fcFxpPortHoldTime	The maximum time (in microseconds) that the FxPort shall hold a frame before discarding the frame if it is unable to deliver the frame. The value 0 means that the FxPort does not support this parameter. This is equal to quarter of E_D_TOV.
fcFxpPortBaudRate	The FC-0 baud rate of the FxPort.
fcFxpPortMedium	The FC-0 medium of the FxPort.
fcFxpPortTxType	The FC-0 transmitter type of the FxPort. Long distance laser is mapped to unknown(1) and long wave laser(LC version) is mapped to longWaveLaser(2).
fcFxpPortDistance	The FC-0 distance range of the FxPort transmitter.

Capability Group Table

The *Fccfportcaptable* displays the capabilities of the FxPort within the fabric element.

Table 2–36: Capability Group Table

Variable	Provides
CapModuleIndex	Module index.
FxPortIndex	Port index.
FC-PHVersionHigh	Highest or most recent version of FC-PH that the FxPort is capable of supporting.
FC-PHVersLow	Lowest or earliest version of FC-PH that the FxPort is capable of supporting.
BBCreditMax	Maximum number of receive buffers available for holding a class 1 connect-request, or class 2 or class 3 frames from the attached NxPort.
BBCreditMin	Minimum number of receive buffers available for holding a class 1 connect-request, or class 2 or class 3 frames from the attached NxPort.
RxDataFldSzMax	Maximum size in bytes of the data field in a frame that the FxPort is capable of receiving from its attached NxPort.
RxDataFldSzMin	Minimum size in bytes of the data field in a frame that the FxPort is capable of receiving from its attached NxPort.
Cos	Value indicating the set of classes of service the FxPort is capable of supporting.
Intermix	Flag indicating if the FxPort is capable of supporting the intermixing of class 2 and class 3 frames during a class 1 connection. This flag is only valid if the port is capable of supporting class 1 service. Fixed at no(2).
StackedConMode	Value indicating the mode of stacked connect request that the FxPort is capable of supporting. Fixed at none(1).
C2SeqDelivery	Flag indicating if the FxPort is capable of supporting class 2 sequential delivery.
C3SeqDelivery	Flag indicating whether or not the FxPort is capable of supporting class 3 sequential delivery.
HoldTimeMax	Maximum holding time (in microseconds) the FxPort is capable of supporting. (Not supported.)
HoldTimeMin	Minimum holding time (in microseconds) the FxPort is capable of supporting. (Not supported.)
BaudRates	Value indicating the set of baud rates the FxPort is capable of supporting.
Media	Value indicating the set of media the FxPort is capable of supporting.

EF-6000 Private MIB

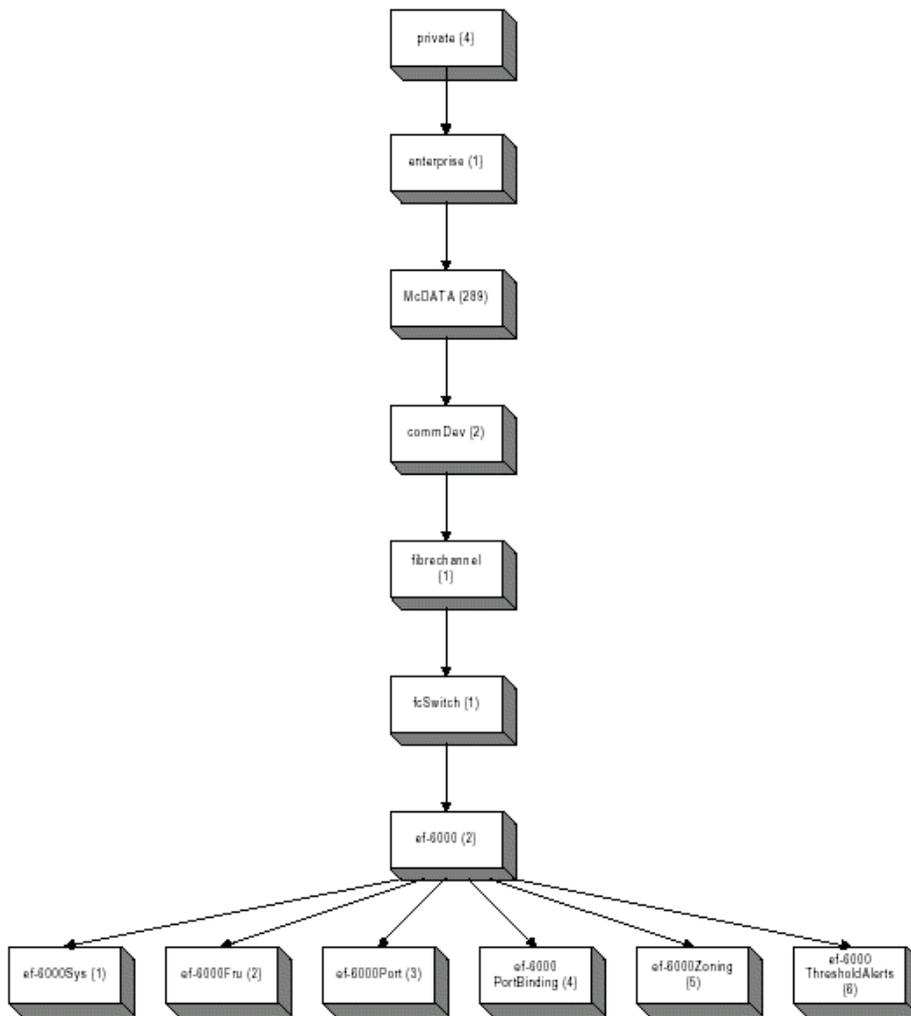


Figure 2–5: EF-6000 Private MIB support

Six groups of MIB are defined and supported in the EF-6000 Private MIB:

- System group (ef6000Sys)

- Field replaceable unit (FRU) group (ef6000Fru)
- Fibre Channel port group (ef6000Port)
- Port Binding group (ef6000PortBinding)
- Zoning group (ef6000Zoning)
- Theshold Alerts (ef6000ThresholdAlerts)

The tables that appear in the following sections define variables available in the private MIB. All variables are read-only unless noted otherwise.

System Group

Table 2–37: System Group Variables

Variable	Provides:
ef6000SysCurrentDate	Current date information.
ef6000SysBootDate	Date and time of the last IPL of the director.
ef6000SysFirmwareVersion	Current version of the firmware.
ef6000SysTypeNum	ASCII type number of the director.
ef6000SysModelNum	ASCII model number of the director.
ef6000SysMfg	ASCII manufacturer of the director.
ef6000SysPlantOfMfg	ASCII plant of manufacturer of the director.
ef6000SysEcLevel	ASCII EC level ID of the director.
ef6000SysSerialNum	ASCII OEM serial number of the director.
ef6000SysOperStatus	The current operational status of the director. The values are defined as follows: operational (1), redundant-failure (2), minor-failure (3), major-failure (4), not-operational (5).
ef6000SysState	If the <i>edOperStatus</i> of the director is operational, the director is in one of the four states: online(1), coming-online(2), offline(3), and going-offline(4).
ef6000SysAdmStatus (read-write)	The desired administrative status of the director. A management station may place the director in a desired state by setting this object accordingly. The desired administrative statuses are online(1) and offline(2). Online means setting the director to be accessible by an external Fibre Channel port, and offline means setting the director to be inaccessible.
ef6000SysConfigSpeed	Switch/director speed capability. A user-initiated option to adjust the system-wide port speed capability (either 1-gig or 2-gig).

Field Replaceable Unit (FRU) Group

Table 2–38: FRU Group Table Variables

Variable	Provides:
ef6000FruCode	Field replaceable unit. A hardware component of the product that is replaceable as an entire unit. Each module defined in this MIB has a fixed FRU code. The values are defined as follows: fru-bkplane(1) - backplane; fru-ctp(2) - control processor card; fru-sbar(3) - serial crossbar; fru-fan2(4) - center fan module; fru-fan(5) - fan module; fru-power(6) - power supply module; fru-reserved(7) - reserved (not used); fru-gsl(8) - longwave, single-mode, LC connector, 1 Gig; fru-gsml(9) - shortwave, multi-mode, LC connector, 1 Gig; fru-gxxl(10) - mixed, LC connector, 1 Gig; fru-gsfl(11) - SFO pluggable, 1Gig; fru-gsf2(12) - SFO pluggable, 2 Gig; fru-glsr(13) - longwave, single-mode, MT-RJ connector, 1 Gig; fru-gsmr(14) - shortwave, multi-mode, MT-RJ connector, 1 Gig; fru-gxxr(15) - mixed, MT-RJ connector, 1 Gig; fru-fint1(16) - FxPort, internal, 1 Gig.
ef6000FruPosition	Position of the module.
ef6000FruStatus	Operational status of the module. The active(1) state indicates that the current module is active. The backup(2) state indicates that the backup module is used. The update-busy (3) state indicates that the module is in the updating process. The failed(4) state indicates that the current module is failed.
ef6000FruPartNumber	Part number of the module.
ef6000FruSerialNumber	Serial number of the module.
ef6000FruPowerOnHours	Number of the hours that the FRU has been in operation.
ef6000FruTestDate	Final test date of the module.

Fibre Channel Port Group

This group contains information about the physical state, operational status, performance and error statistics of each Fibre Channel ports on the director or switch.

Table 2–39: Fibre Channel Port Group Table Variables

Variable	Provides
ef6000PortIndex	The fixed physical port number on the director or switch
ef6000PortPhyState	Physical state of the port.
ef6000PortOpStatus	Operational status of the port. The values are defined as follows: online(1), offline(2), testing(3), and faulty(4). The online state indicates that user frames can be passed.
ef6000PortAdmStatus (read-write)	The desired portstate. A management station may place the port in a desired state by setting this object accordingly. The testing (3) state indicates that no user frames can be passed. As the result of either explicit management action or per-configuration information accessible by the director, <i>edFcPortAdmStatus</i> is changed to the online (1) or testing (3) states, or remains in the offline state.

Table 2–39: Fibre Channel Port Group Table Variables (Continued)

Variable	Provides
ef6000PortConnector	Supported connector types of the port. The values are defined as follow: unknown(1), lc(2), mt-rj(3), mu(4)
ef6000PortDistance	A bit map to represent distance types of the Port. bit 0 unknown, bit 1-3 reserved, bit 4 long distance (l), bit 5 intermediate distance (i), bit 6 short distance (s), bit 7 very long distance.
ef6000PortType	Supported transceiver types of the port. The values are defined as follows: unknown (1), longDistance(2) -- (LL-V), longWaveLaser-LL(3) -- (LL), shortWaveLaser-OFC(4) -- (SL), shortWaveLaser-noOFC(5) -- (SN), longWaveLaser-LC(6) -- (LC).
ef6000PortMedia	A bit map to represent transmission media of the port. bit 0 single mode(sm), bit 1 reserved, bit 2 multimode 50m (m5), bit 3 multimode 62.5 (m6), bit 4-7 reserved.
ef6000PortSpeedCap	A bit map to represent the speed of optical transceiver. bit 0 - 100 Mbytes/Sec. bit 1 - reserved bit 2 - 200 Mbytes/Sec. bit 3 - reserved bit 4 - 400 Mbytes/Sec. bit 5-7 - reserved.
ef6000PortConfigSpeed	The configured port speed. The values are: 1-gig = 1, 2-gig = 2, negotiate = 3.
ef6000PortSpeed	A bit map to represent transmission speed of the port. bit 0 100 Mbytes/Sec, bit 1 reserved, bit 2 200 Mbytes/Sec, bit 3 reserved, bit 4, 400 Mbytes/Sec, bit 5-7 reserved.
ef6000PortTxWords32	The number of class 2 & class 3, 4-byte words within frames that the port has transmitted. (Primitive signals and primitive sequence are not included.)
ef6000PortRxWords32	The number of class 2 & class 3, 4-byte words within frames that the port has received. (Primitive signals and primitive sequence are not included.)
ef6000PortTxFrames32	The number of class 2 & class 3 (Fibre Channel) frames that the port has transmitted.
ef6000PortRxFrames32	The number of class 2 & class 3 (Fibre Channel) frames that the port has received.
ef6000PortTxThroughput	The Bps (bytes per second) transmission rate of the port.
ef6000PortRxThroughput	The Bps (bytes per second) reception rate of the port.
ef6000PortTxC2Words32	The number of class 2 4-byte words that the port has received. (Primitive signals and primitive sequence are not included.)
ef6000PortRxC2Words32	The number of class 2 4-byte words that the port has received. (Primitive signals and primitive sequence are not included.)
ef6000PortTxC2Frames32	The number of class 2 & class 3 (Fibre Channel) frames that the port has transmitted.

Table 2–39: Fibre Channel Port Group Table Variables (Continued)

Variable	Provides
ef6000PortRxFrames	The number of class 2 & class 3 (Fibre Channel) frames that the port has received.
ef6000PortTxThroughput	The Bps (bytes per second) transmission rate of the port.
ef6000PortRxThroughput	The Bps (bytes per second) reception rate of the port.
ef6000PortTxC2Words32	The number of class 2 4-byte words that the port has transmitted. (Primitive signals and primitive sequence are not included.)
ef6000PortRxC2Words32	The number of class 2 4-byte words that the port has received. (Primitive signals and primitive sequence are not included.)
ef6000PortTxC2Frames32	The number of Class 2 frames that the port has transmitted.
ef6000PortRxC2Frames32	The number of Class 2 frames that the port has received.
ef6000PortTxC2Octets32	The number of Class 2 Octets that the port has transmitted.
ef6000PortRxC2Octets32	The number of Class 2 Octets that the port has received.
ef6000PortTxC3Words32	The number of class 3 4-byte words that the port has transmitted. (Primitive signals and primitive sequence are not included.)
ef6000PortRxC3Words32	The number of class 3 4-byte words that the port has received. (Primitive signals and primitive sequence are not included.)
ef6000PortTxC3Frames32	The number of Class 3 frames that the port has transmitted.
ef6000PortRxC3Frames32	The number of Class 3 frames that the port has received.
ef6000PortTxC3Octets32	The number of Class 3 Octets that the port has transmitted.
ef6000PortRxC3Octets32	The number of Class 3 Octets that the port has received.
ef6000PortC3Discards32	The number of Class 3 frames that the port has discarded.
ef6000PortDiscardFrames	The number of frames that the port has discarded.
ef6000PortTxLinkResets	The number of link resets initiated by this director port.
ef6000PortRxLinkResets	The number of link resets initiated by the attached NxPort.
ef6000PortTxOLSS	The number of offline sequences initiated by this director port.
ef6000PortRxOLSS	The number of offline sequences initiated by the attached NxPort.
ef6000PortSyncLosses	The number of loss of synchronization timeout.
ef6000PortSigLosses	The number of times that a Loss of Signal is detected.

Table 2–39: Fibre Channel Port Group Table Variables (Continued)

Variable	Provides
ef6000PortProtocolErrors	The number of protocol errors detected.
ef6000PortInvalidTxWords	The number of Invalid Transmission words that the port has received.
ef6000PortLinkFailures	The number of transitions to an LFX state.
ef6000PortCrcs	The number of CRC errors detected from frames received.
ef6000PortTruncs	The number of frames shorter than the Fibre Channel minimum.
ef6000PortTxWords64	A 64 bit counter for the number of words within frames that the port has transmitted. (Primitive signals and primitive sequence are not included.)
ef6000PortRxWords64	A 64 bit counter for the number of words within frames that the port has received. (Primitive signals and primitive sequence are not included.)
ef6000PortTxFrames64	A 64 bit counter for the number of (Fibre Channel) frames that the port has transmitted.
ef6000PortRxFrames64	A 64 bit counter for the number of (Fibre Channel) frames that the port has received.
ef6000PortTxC2Words64	A 64 bit counter for the number of class 2 4-byte words that the port has transmitted. (Primitive signals and primitive sequence are not included.)
ef6000PortRxC2Words64	A 64 bit counter for the number of class 2 4-byte words that the port has received. (Primitive signals and primitive sequence are not included.)
ef6000PortTxC2Frames64	A 64 bit counter for the number of Class 2 frames that the port has transmitted.
ef6000PortRxC2Frames64	A 64 bit counter for the number of Class 2 frames that the port has received.
ef6000PortTxC2Octets64	A 64 bit counter for the number of Class 2 Octets that the port has transmitted.
ef6000PortRxC2Octets64	A 64 bit counter for the number of Class 2 Octets that the port has received.
ef6000PortTxC3Words64	A 64 bit counter for the number of class 3 4-byte words that the port has transmitted. (Primitive signals and primitive sequence are not included.)
ef6000PortRxC3Words64	A 64 bit counter for the number of class 3 4-byte words that the port has received. (Primitive signals and primitive sequence are not included.)
ef6000PortTxC3Frames64	A 64 bit counter for the number of Class 3 frames that the port has transmitted.
ef6000PortRxC3Frames64	A 64 bit counter for the number of Class 3 frames that the port has received.
ef6000PortTxC3Octets64	A 64 bit counter for the number of Class 3 Octets that the port has transmitted.
ef6000PortRxC3Octets64	A 64 bit counter for the number of Class 3 Octets that the port has received.
ef6000PortC3Discards64	A 64 bit counter for the number of Class 3 frames that the port has discarded

Port Binding Group

Table 2–40: Port Binding Group Table

Variable	Provides:
ef6000PortBindingIndex	The fixed port number on the director. It ranges from 1 to the number of physical ports that can be supported by the director.
ef6000PortBindingFlag	The flag indicates whether or not Port Binding is in effect for an individual; port. The values are: yes (1), and no (2).
ef6000PortConfiguredWWN	The authorized port WWN for attached servers and storage systems (F ports), or the authorized director WWN for attached directors (E ports).
ef6000PortAttachedWWN	The WWN of the device currently attached to the port whether it has successfully connected or is currently being rejected due to a port binding violation.

Zoning Group

Table 2–41: Zoning Group Table

Variable	Provides:
ef6000ActiveZoneSetName	The active zone set name.
ef6000ActiveZoneCount	The count of zones included in the active zone set.
ef6000DefaultZoneSetState	The state of the default zone set.
ef6000ActiveZoneSetState	The state of the default zone set.
ef6000HardwareEnforcedZoning	Indicates if zoning is hardware enforced (1=Hardzoning, 0=Nameserver zoning only).

Table 2–42: Active Zone Table

Variable	Provides:
ef6000ZoneIndex	Zone index number. This number will range from 1 to the number of zones specified by the ActiveZoneCount.
ef6000ZoneName	The name of the zone.
ef6000ZoneMemberCount	The number of members included in the zone.

Table 2–43: Active Member Table

Variable	Provides:
ef6000ZoneIndex	The index of the zone this member belongs to.
ef6000MemberIndex	Member index number. This number will range from 1 to the number of members specified by the corresponding ZoneMemberCount.
ef6000MemberType	Indicates the addressing method for this member (1=WWN, 2=Port Number).
ef6000MemberWWN	The WWN name as an 8-character string. This value is only valid if the member type is 1, otherwise it will default to 0.
ef6000MemberDomainID	The domain ID. This value is only valid if the member type is 2, otherwise it will default to 0.
ef6000MemberPortNumber	The port number. This value is only valid if the member type is 2, otherwise it will default to 0.

Threshold Alert Group

Table 2–44: Threshold Alerts Table

Variable	Provides:
ef6000TAIndex	This object is used to identify which threshold has been triggered.
ef6000TAName	The threshold alert name.
ef6000TASState	The current state of the threshold (enabled=1, disabled=2).
ef6000TAType	The type of the threshold. (throughput=1, counter=2)
ef6000TAPortType	A threshold can be set on a list of physical port numbers or on all the ports of the specified type (list=1, ePorts=2, fPorts=3, flPorts=4)
ef6000TAPortList	A bitmap that identifies which ports this threshold alert applies to (only valid when the threshold alert port type = list). The left-most bit represents port 0.
ef6000TAInterval	The number of minutes in a threshold alert interval.
ef6000TATriggerValue	If the alert type is a Throughput Threshold Alert, this is the percent of utilization (1-100) required to trigger an alert. If the alert type is a Counter Threshold Alert, this is the counter delta required to trigger an alert.
ef6000TTADirection	Specifies the throughput direction of the threshold (transmit=1, receive=2, either=3). This only applies when the alert type is Throughput Threshold Alert.

Table 2–44: Threshold Alerts Table (Continued)

Variable	Provides:
ef6000TTATriggerDuration	Specifies the amount of time during a threshold alert interval that the trigger must be exceeded before an alert is generated. This only applies when the alert type is Throughput Threshold Alert.
ef6000CTACounter	Specifies statistical counter or counter set to be monitored. This object is not supported in the current release.

Generic Traps

The following generic traps can be received from the director or switch:

- **coldStart**
Reports that the SNMP agent is reinitializing due to a power-on reset.
- **warmStart**
Reports that the agent is reinitializing due to an IML or IPL.
- **authenticationFailure**
An indication that the agent has received an improperly authenticated protocol message. By default, this trap is disabled but may be enabled using the Product Manager.

Enterprise Specific Trap

The following enterprise-specific traps can be received from the director or switch:

- **ef6000PortScn**
An *ef6000PortScn* (1) is generated whenever a Fc_Port changes its operational state. For instance, the Fc_Port goes from on-line to offline.
- **ef6000FruScn**
An *ef6000FruScn* (2) is generated whenever a FRU status changes its operational state.
- **ef6000PortBindingViolation**
An *ef6000PortBindingViolation* (3) is generated whenever the director or switch detects that a port Binding Violation occurs.

- ef6000ThresholdAlert

An *ef6000ThresholdAlert* (4) is generated whenever a threshold alert occurs.

Table 2–45: Enterprise-Specific Trap Definitions

Trap	Trap Type Enterprise	Variable
ef6000PortScn	HPTrap	{ef6000PortOpStatus}
ef6000FruScn	HPTrap	{ef6000FruStatus}
ef6000PortBindingViolation	HPTrap	{ef6000PortAttachedWWN}
ef6000ThresholdAlert	HPTrap	{ef6000PortIndex, ef6000TAIndex}

Glossary

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

access control

Method of control (with associated permissions) by which a set of devices can access other devices across a network. *See also* persistent binding and zoning.

active zone set

Single zone set that is active in a multi-switch fabric. It is created when you enable a specified zone set. This zone set is compiled by checking for undefined zones or aliases.

agent

Software that processes queries on behalf of an application and returns replies.

alarm

Simple network management protocol (SNMP) message notifying an operator of a network or device problem.

alias server

Fabric software facility that supports multicast group management.

arbitration

Process of selecting one device from a collection of devices that request service simultaneously.

audit log

Log summarizing actions (audit trail) made by the user.

backplane

The backplane provides 48 VDC power distribution and connections for all logic cards.

BB_Credit

See buffer-to-buffer credit.

beaconing

Use of light-emitting diodes on ports, port cards, field-replaceable units, directors, and switches to aid in the fault-isolation process; when enabled, active beaconing causes LEDs to flash for selected components.

BER

See bit error rate.

bidirectional

In Fibre Channel, the capability to simultaneously communicate at maximum speeds (100 Mbps) in both directions over a link.

bit error rate (BER)

Ratio of received bits that contain errors to total of all bits transmitted.

blocked port

Devices communicating with the port are prevented from logging into a director or switch; or communicating with other devices attached to the director or switch. A blocked port continuously transmits the offline sequence.

broadcast

Send a transmission to all N_Ports on a fabric. See also multicast.

broadcast frames

Data packet, also known as a broadcast packet, whose destination address specifies all computers on a network.

buffer

Storage area for data in transit. Buffers compensate for differences in processing speeds between devices. See also buffer-to-buffer credit.

buffer-to-buffer credit (BB_Credit)

See buffer-to-buffer credit. Indicates the maximum number of frames a port can transmit without receiving a receive ready signal from the receiving device.

call-home

Product feature which requires installation of HP Proactive Service software and enables the HAFM server to automatically transmit system events (failure information) to an HP customer support center. The HP support center server accepts calls from the HAFM server, logs reported events, and can notify one or more support center representatives.

Class F Fibre Channel service

Used by switches to communicate across interswitch links (ISLs) to configure, control, and coordinate a multi-switch fabric.

Class 2 Fibre Channel service

Provides a connectionless (not dedicated) service with notification of delivery or nondelivery between two N_Ports. In-order delivery of frames is not guaranteed.

Class 3 Fibre Channel service

Provides a connectionless (not dedicated) service without notification of delivery or nondelivery between two N_Ports. Also known as datagram.

community profile

Information that specifies which management objects are available to what management domain or SNMP community name.

concurrent maintenance

Ability to perform maintenance tasks, such as removal or replacement of field-replaceable units (FRUs), while normal operations continue without interruption. *See also* nondisruptive maintenance.

configuration data

Configuration data includes: identification data, port configuration data, operating parameters, SNMP configuration, and zoning configuration. A configuration backup file is required to restore configuration data if the control processor (CTP) card in a nonredundant director is removed and replaced.

connectionless

Nondedicated link. Typically used to describe a link between nodes which allows the switch to forward Class 2 or Class 3 frames as resources (ports) allow.

control processor (CTP) card

Circuit card that contains the director microprocessor. The CTP card also initializes hardware components of the system after power-on. A 10 Mbps RJ-45 twisted pair connector is located on the CTP card to connect to an Ethernet LAN and communicate with the HAFM server or a specific management station.

control unit

A device that controls the reading, writing, or displaying of data at one or more input/output units.

CRC

See cyclic redundancy check.

CTP card

See control processor card.

cyclic redundancy check (CRC)

System of error checking performed at both the sending and receiving station using the value of a particular character generated by a cyclic algorithm. When the values generated at each station are identical, data integrity is confirmed.

DASD

Acronym for direct access storage device.

datagram

See Class 3 Fibre Channel service.

default zone

Contains all attached devices that are not members of a separate zone.

destination identifier (D_ID)

Address identifier that indicates the targeted destination of a data frame.

device

Product (server or storage), connected to a managed director or switch, that is not controlled directly by the Product Manager application. *See also* node.

D_ID

See destination identifier.

director

An intelligent, redundant, high-port count Fibre Channel switching device providing any-to-any port connectivity between nodes (end devices) in a switched fabric. Directors send data frames between nodes in accordance with the address information present in the frame headers of those transmissions.

DNS name

Host or node name for a device or managed product that is translated to an internet protocol (IP) address through a domain name server.

domain ID

Number (1 through 31) that uniquely identifies a switch in a multi-switch fabric. A distinct domain ID is automatically allocated to each switch in the fabric by the principal switch.

domain name service (DNS)

See DNS name.

E_D_TOV

See error detect time-out value.

E_Port

See expansion port.

embedded web server

Administrators or operators with a browser-capable PC and Internet connection can monitor and manage a director or switch through an embedded web server interface. The interface provides a GUI similar to Product Manager applications, and supports director and switch configuration, statistics monitoring, and basic operation.

error detect time-out value (E_D_TOV)

User-specified value that defines the time a director or switch waits for an expected response before declaring an error condition.

Ethernet

A widely implemented local area network (LAN) protocol that uses a bus or star topology and serves as the basis for the IEEE 802.3 standard, which specifies the physical and software layers. Baseband LAN allows multiple station access to the transmission medium at will without prior coordination and which avoids or resolves contention.

Ethernet hub

A customer-supplied device used to LAN-connect the HAFM server and managed directors or switches.

event code

Error code that provides the operator with information concerning events that indicate degraded operation or failure of a director or switch.

event log

Record of significant events that have occurred at the director or switch, such as FRU failures, degraded operation, and port problems.

expansion port (E_Port)

Physical interface on a Fibre Channel switch within a fabric, that attaches to an expansion port (E_Port) on another Fibre Channel switch to form a multi-switch fabric.

fabric

Fibre Channel entity that interconnects node ports (N_Ports_) and is capable of routing (switching) Fibre Channel frames using the destination ID information in the Fibre Channel frame header accompanying the frames.

fabric element

An active director, switch, or node in a Fibre Channel switched fabric.

fabric port (F_Port)

Physical interface on a director or switch that connects to an N_Port through a point-to-point full duplex connection.

failover

Automatic and nondisruptive transition of functions from an active FRU that has failed to a backup FRU.

fiber

Physical media types supported by the Fibre Channel specification, such as optical fiber, copper twisted pair, and coaxial cable.

fiber optics

Branch of optical technology concerned with the transmission of light pulses through fibers made of transparent materials such as glass, fused silica, and plastic.

Fibre Channel

Integrated set of standards recognized by the American national Standards Institute (ANSI) which defines specific protocols for flexible information transfer. Logically, a point-to-point serial data channel, structured for high performance.

field-replaceable unit (FRU)

Assembly removed and replaced in its entirety when any one of its components fails.

firmware

Embedded program code that resides and executes on a director or switch.

F_Port

See fabric port.

FRU

See field-replaceable unit.

gateway address

A unique string of numbers (in the format xxx.xx.xxx.xxx) that identifies a gateway on the network.

generic port (G_Port)

Physical interface on a director or switch that can function either as a fabric port (F_Port) or an expansion port (E_Port) depending on the port type to which it connects.

G_Port

See generic port.

high-availability fabric manager (HAFM) application

Application that implements the management user interface for HP Fibre Channel switching products, and as a launching point for Product Manager applications. The application runs locally on the HAFM server or on a remote workstation.

high-availability fabric manager (HAFM) server

Notebook computer shipped with a director or switch that runs the HAFM and Product Manager applications.

HAFM application

See high-availability fabric manager application.

HAFM server

See high-availability fabric manager server.

hardware log

Record of FRU insertions and removals for a director or switch.

HBA

See host bus adapter.

heterogeneous fabric

A fabric with both HP and non-HP products.

high availability

A performance feature characterized by hardware component redundancy and hot-swappability (enabling non-disruptive maintenance). High-availability systems maximize system uptime while providing superior reliability, availability, and serviceability.

hop

Data transfer from one fabric node to another node.

homogeneous fabric

A fabric consisting of only HP products.

hop count

The number of hops a unit of information traverses in a fabric.

host bus adapter (HBA)

Logic card that provides a link between the server and storage subsystem, and that integrates the operating systems and I/O protocols to ensure interoperability.

hot-swapping

Removing and replacing a device's components while the device continues to operate normally.

hub

In Fibre Channel, a device that connects nodes into a logical loop by using a physical star topology.

IML

See initial machine load.

initial machine load (IML)

Hardware reset for a director or switch, initiated by pushing the button on a director CTP card or switch bezel.

initial program load (IPL)

Process of initializing the device and causing the operating system to start. Initiated through a menu in the Product Manager, this option performs a hardware reset on the active CTP only.

internet protocol address

Unique string of numbers (in the format xxx.xxx.xxx.xxx) that identifies a device on a network.

interoperability

Ability to communicate, execute programs, or transfer data between various functional units over a network.

interswitch link (ISL)

Physical E_Port connection between two directors or switches in a fabric.

IP address

See internet protocol address.

IPL

See initial program load.

ISL

See interswitch link.

jumper cable

Optical cable that provides physical attachment between two devices or between a device and a distribution panel. *Contrast with* trunk cable.

latency

When used in reference to a Fibre Channel switching device, latency refers to the amount of time elapsed between receipt of a data transmission at a switch's incoming F_Port (from the originating node port) to retransmission of that data at the switch's outgoing F_Port (to the destination N_Port). The amount of time it takes for data transmission to pass through a switching device.

LIN

See link incident.

link incident (LIN)

Interruption to a Fibre Channel link due to loss of light or other cause.

logical unit number (LUN)

In Fibre Channel addressing, a logical unit number is a number assigned to a storage device which, in combination with the storage device's node port's world wide name, represents a unique identifier for a logical device on a storage area network.

loopback plug

In a fiber optic environment, a type of duplex connector used to wrap the optical output signal of a device directly to the optical input.

loopback test

Test that checks attachment or control unit circuitry, without checking the mechanism itself, by returning the output of the mechanism as input.

LUN

See logical unit number.

MAC address

See Media Access Control address.

maintenance port

Connector on the director or switch where a PC running an ASCII terminal emulator can be attached or dial-up connection made for specialized maintenance support.

managed product

Hardware product that can be managed with the HAFM application. For example, the director 2/64 is a managed product. *See also* device.

management information base (MIB)

Related set of software objects (variables) containing information about a managed device and accessed via SNMP from a network management station.

Management Services application

Software application that provides back-end product-independent services to the HAFM application. Management Services runs only on the HAFM server, and cannot be downloaded to remote workstations.

management session

A management session exists when a user logs on to the HAFM application. The application can support multiple concurrent management sessions. The user must specify the network address of the HAFM server at logon time.

Media Access Control (MAC) address

Hardware address of a node (device) connected to a network.

MIB

See management information base.

multicast

Delivery of a single transmission to multiple destination N_Ports. Can be one to many or many to many. All members of the group are identified by one IP address. *See also* broadcast.

multi-switch fabric

Fibre Channel fabric created by linking more than one director or switch in a fabric.

name server

Program that translates names from one form into another. For example, the domain name service (DNS) translates domain names into IP addresses.

name server zoning

N_Port access management that allows N_Ports to communicate if and only if they belong to a common name server zone.

network address

Name or address that identifies a managed product on a transmission control protocol/internet protocol (TCP/IP) network. The network address can be either an IP address in dotted-decimal notation (containing four three-digit octets in the format xxx.xxx.xxx.xxx), or a domain name (as administered on a customer network).

nickname

Alternate name assigned to a world wide name for a node, director, or switch in a fabric.

node

In Fibre Channel terminology, node refers to an end device (server or storage device) that is or can be connected to a switched fabric.

node port (N_Port)

Physical interface within an end device which can connect to an F_Port on a switched fabric or directly to another N_Port (in point-to-point communications).

nondisruptive maintenance

Ability to service FRUs (including maintenance, installation, removal and replacement) while normal operations continue without interruption. *See also* concurrent maintenance.

N_Port

See node port.

offline sequence (OLS)

Sequence sent by the transmitting port to indicate that it is attempting to initialize a link and has detected a problem in doing so.

OLS

See offline sequence.

optical cable

Fiber, multiple fibers, or a fiber bundle in a structure built to meet optical, mechanical, and environmental specifications. *See also* jumper cable, optical cable assembly, and trunk cable.

out-of-band management

Transmission of management information using frequencies or channels (Ethernet) other than those routinely used for information transfer (Fibre Channel).

password

Unique string of characters known to the computer system and to a user who must specify it to gain full or limited access to a system and to the information stored within it.

persistent binding

A form of server-level access control that uses configuration information to bind a server to a specific Fibre Channel storage volume (or logical device) using a unit number.

port

Receptacle on a device to which a cable leading to another device can be attached.

port card

Field-replaceable hardware component that provides the port connections for fiber cables and performs specific device-dependent logic functions.

port card map

Map showing numbers assigned to each port card by card slot.

port name

Name that the user assigns to a particular port through the Product Manager.

POST

See power-on self test.

power-on self test (POST)

Series of self-tests executed each time the unit is booted or reset.

preferred domain ID

Domain ID that a director or switch is assigned by the principal switch in a switched fabric. The preferred domain ID becomes the active domain ID except when configured otherwise by the user.

principal switch

The director or switch that allocates domain IDs to itself and to all other switches in a fabric. There is always one principal switch in a fabric. If a switch is not connected to any other switches, it acts as its own principal switch.

Product Manager application

Application that implements the management user interface for a specified director 2/64, edge switch 2/16, or edge switch 2/32. When a product instance is opened from the HAFM application's Product View, the Product Manager application is invoked.

R_A_TOV

See resource allocation time-out value.

redundancy

Performance characteristic of a system or product whose integral components are backed up by identical components to which operations will automatically failover in the event of a component failure. Redundancy is a vital characteristic of virtually all high-availability (24 hours per day, seven days per week) computer systems and networks.

remote notification

A process by which a system is able to inform remote users and/or workstations of certain classes of events that occur on the system. E-mail notification and the configuration of SNMP trap recipients are two examples of remote notification programs that can be implemented on director-class switches.

remote user workstation

Workstation, such as a PC, using the HAFM and Product Manager applications that can access the HAFM server over a LAN connection.

resource allocation time-out value (R_A_TOV)

User-specified value used to time out operations that depend on the maximum possible time that a frame could be delayed in a fabric and still be delivered.

RFI

Acronym for radio frequency interface.

SAN

See storage area network.

SBAR

See serial crossbar assembly.

segmented E_Port

E_Port that has ceased to function as an E_Port within a multi-switch fabric due to an incompatibility between the fabrics that it joins. *See also* expansion port.

serial crossbar (SBAR) assembly

Responsible for Fibre Channel frame transmission from any director port to any other director port. Connections are established without software intervention.

SFP

Acronym for small form factor pluggable (a type of Fibre Channel connector). *See also* universal port module card.

simple Network management protocol (SNMP)

A protocol that specifies a mechanism for network management that is complete, yet simple. Information is exchanged between agents, which are the devices on the network being managed, and managers, which are the devices on the network through which the management is done.

SNMP

See simple network management protocol.

SNMP community

Also known as SNMP community string. An SNMP community is a cluster of managed products (in SNMP terminology, hosts) to which a server or managed product running the SNMP agent belongs.

SNMP community name

The name assigned to a given SNMP community. Queries from an SNMP management station to a device running an SNMP agent will only elicit a response if those queries are addressed with the correct SNMP community name.

storage area network (SAN)

A high-performance data communications environment that interconnects computing and storage resources so that the resources can be effectively shared and consolidated.

subnet mask

Used by a computer to determine whether another computer with which it needs to communicate is located on a local or remote network. The network mask depends upon the class of networks to which the computer is connecting. The mask indicates which digits to look at in a longer network address and allows the router to avoid handling the entire address.

switch

An intelligent but nonredundant, low-port count Fibre Channel switching device providing any-to-any port connectivity between nodes (end devices) in a switched fabric. Switches send data frames between nodes in accordance with the address information present in the frame headers of those transmissions.

switchover

Changing a backup FRU to the active state, and the active FRU to the backup state.

TCP/IP

See transmission control protocol/internet protocol.

topology

Logical and/or physical arrangement of stations on a network.

transmission control protocol/internet protocol (TCP/IP)

A suite of communication protocols used to connect host systems to the Internet. *See also* network address.

trap

Unsolicited notification of an event originating from an SNMP managed device and directed to an SNMP network management station.

trap host

SNMP management workstation that is configured to receive traps.

trunk cable

Cable consisting of multiple fiber pairs that do not directly attach to an active device. This cable usually exists between distribution panels. *See also* optical cable, *contrast with* jumper cable.

unblocked port

Devices attached to an unblocked port can login to the director or switch and communicate with devices attached to any other unblocked port.

unicast

Communication between a single sender and a single receiver over a network. Compare to *multicast* (communication between any sender and the nearest of a group of receivers).

universal port module (UPM) card

Each director 2/64 UPM card provides four 2.125 Gbps Fibre Channel connections through duplex small form factor (SFF) pluggable fiber-optic transceivers.

UPM card

See universal port module card.

vital product data (VPD)

System-level data stored by the backplane in the electrically erasable programmable read-only memory. This data includes serial numbers and identifies the manufacturer.

VPD

See vital product data.

world wide name (WWN)

Eight-byte address that uniquely identifies a switch, or a node (end device) on global networks.

WWN

See world wide name.

zone

Set of devices that can access one another. All connected devices may be configured into one or more zones. Devices in the same zone can see each other. Those devices that occupy different zones cannot.

zone member

Specification of a device to be included in a zone. A zone member can be identified by the port number of the director or switch to which it is attached or by its world wide name. In multi-switch fabrics, identification of end-devices/nodes by world wide name is preferable.

zone set

See zone.

zoning

Grouping of several devices by function or by location. All devices connected to a connectivity product, such as the director or switch, may be configured into one or more zones. *See also* zone.

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