EM316LNXNM-OT

Network Manager with Linux

Optical Communications Systems®

Fiber Driver Optical Multi-Service Platform

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For EM316LNXNM v4.7 fdr 35 built Mar 21 2012 - 09:40:18

User Guide

EMPOWERING THE OPTICAL EDGE™

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Chapter 1. Support and Safety

...company and industry references

1.1. Customer Support

Before contacting customer support, look for release notes, software updates, technical specifications, and frequently asked questions (FAQ) online at the MRV support website: http://service.mrv.com/.

The website includes information regarding software updates, technical specifications, frequently asked questions (FAQ), and contact information. Contact help online by sending email to mailto:support@mrv.com or through the website request link at http://service.mrv.com/support/contact.

	MRV Americas (US, Canada, Latin America)	+1-800-435-7997
		+1-978-952-4888
	MRV Europe	+49-6105-2070
	MRV International	+972-4-993-6200

Include the following important information when opening a support case:

1. Site ID or company name
2. Contact information
3. Model or product name
4. Serial number
5. Top assembly revision (see label on device)
6. Brief problem or question including a description of the host network environment
7. Attenuation data for applicable high-speed fiber links
8. Urgency of the issue

1.2. User Guides and Related Documents

Download Fiber Driver product documents from:

- http://service.mrv.com/support/tech_docs/10
- ftp://ftp.mrv.com/pub/doc/manuals/Fiber Driver/

Release Notes are produced as needed for specific product revisions. MRV reserves the right to change products and documents without notice. The user assumes sole responsibility for application and use of products and information supplied.

1.3. FCC Notice

This equipment generates, uses, and can radiate radio frequency energy. This equipment is tested and complies with the limits for a Class A digital device in Part 15 of the FCC rules. These limits and product manuals provide protective guidelines to avoid communication interference for operation in a commercial environment. Users must correct interference when operating this equipment in a residential area. Use only shielded and grounded cables to ensure compliance with FCC rules. Changes and modifications not expressly approved by the manufacturer can void users' authority to operate the equipment.

1.4. Regulatory Compliance

Contact an MRV representative for additional details regarding specific MRV products.

Fiber Driver Chassis: FCC Part 15 (Class A); IC (Class A); EMC Directive: Emission (Class A) and Immunity; LVD Directive: Electrical Safety; CE Marking; TUV CUE Mark (Canada, USA, EU); GOST; RoHS Directive, REACH SVHC Directive, WEEE Directive: Wheelie Bin Mark; ETSI, NEBS, C-Tick

Media Cross Connect Chassis: FCC Part 15 (Class A); IC (Class A); EMC Directive: Emission (Class A) and Immunity; LVD Directive: Electrical Safety; CE Marking; TUV CUE Mark (Canada, USA, EU); RoHS Directive, REACH SVHC Directive, WEEE Directive: Wheelie Bin Mark; ETSI

Fiber Driver Modules: FCC Part 15 (Class A); IC (Class A); EMC Directive: Emission (Class A) and Immunity; LVD Directive: Electrical Safety; RoHS Directive, REACH SVHC Directive, WEEE Directive: Wheelie Bin Mark; ETSI, EN 60825-1:2007 (Safety of Laser Products)

Media Cross Connect Blades: FCC Part 15 (Class A); IC (Class A); EMC Directive: Emission (Class A) and Immunity; LVD Directive: Electrical Safety; RoHS Directive, REACH SVHC Directive, WEEE Directive: Wheelie Bin Mark

Optical and Copper Transceivers: FCC Part 15 (Class A); IC (Class A); EMC Directive: Emission (Class A) and Immunity; LVD Directive: Electrical Safety; CE Marking; TUV; UL, CSA, RoHS Directive, REACH SVHC Directive, WEEE Directive, ETSI, NEBS, EN 60825-1 (Safety of Laser Products), 21 CFR 1040.10 (except deviations noted in Laser Notice #50, 6/24/2007)

Certified System QMI-SAI Global CERT – 0025916	As a leading supplier of network equipment to carriers, service providers, and enterprise customers worldwide, the Quality Management System of MRV Chatsworth Product Division has been registered to ISO 9001.
ISO 14001	MRV Communications, Chatsworth Product Division has established, implemented, and properly maintains an environmental management system in accordance with the requirements of ISO 14001.
TÜV C NRTL US	The TUV CUE Marking is applied to the equipment certified by TUV Product Service. CUE is the acronym for TUV's 3-in-1 certification service, combining electrical safety certification for three of the most sought-after markets in the world: C=Canada (SCC), U=United States (NTRL), and E=Europe (EU Directives).
	The Wheelie Bin symbol refers to the WEEE Directive. Do not dispose of this equipment as unsorted municipal waste. Dispose of the equipment and its components as specified by all national laws and regulations.

Preserve, protect, and improve the quality of the environment, protect human health, and use natural resources prudently and rationally.

1.5. International Regulations

European Union

This equipment conforms with the provisions of EMC Directive 2004/108/EC (Class A) and Low Voltage Directive 2006/95/EC in the application of harmonized standards.

The "CE" marking of the CE Marking Directive is applied to MRV products.

Contact MRV's EU authorized representative (international@mrv.com) for routing information to return EU equipment for WEEE collection.

Canada

This Class A digital apparatus complies with Canadian ICES-003.

Cet appareil numerique de la classe A est conforme a la norme NMB-003 du Canada.

Australia and New Zealand

N2079	The C-tick mark is applied to equipment certified for compliance with EMC standards for Australia and New Zealand.

China

China RoHS Disclosure **中国 RoHS 声明**

Component Name 部件名称	Pollution Control Logo 污染控制标志	Hazardous Substance Name 有毒有害物质或元素					
		Lead 铅 (Pb)	Mercury 汞 (Hg)	Cadmium 镉 (Cd)	Hexavalent Chromium 六价铬 Cr (VI)	Polybrominated Biphenyls 多溴联苯 (PBB)	Polybrominated Diphenyl Ethers 多溴二苯醚 (PBDE)
Fiber Driver Chassis, Modules and Accessories 光纤驱动器机箱, 组件和附件	50	X	O	O	O	O	O
Pluggable Optics 插入式光学器件	20	X	O	O	O	O	O
Power Supplies 电源	50	X	O	O	O	O	O

O: Indicates that this hazardous substance contained in all of the homogeneous materials for this component is below the limit requirement in SJ/T11363-2006.

O: 表示该有毒有害物质在该部件所有均质材料中的含量均在 SJ/T11363-2006 标准规定的限量要求以下。

X: Indicates that this hazardous substance contained in at least one of the homogeneous materials used in this component is above the limit in ST/T11363-2006. Contain lead in solder.

X: 表示该有毒有害物质至少在该部件的某一均质材料中的含量超出 SJ/T11363-2006 标准规定的限量要求，焊锡中含铅。

Table of Hazardous Substances Name and Concentration **有毒有害物质名称及含量的标识格式**

1.6. General Safety

	One person must not lift heavy devices alone. Lift with legs and a straight back to prevent injury. Use both hands, grasping underneath the lower edge only. Do not lift from the chassis power supply handles, interface processors, or plastic panels on the front of the chassis.
	Do not stack unsecured equipment that can cause damage or injury when falling.
	Stabilize the equipment and rack while mounting or servicing components by: • Mounting devices from the bottom of an empty rack. • Mounting the heaviest rack devices at the bottom of the rack. • Installing rack stabilizing equipment before mounting or servicing rack devices.
	While operating, secure all modules, cover empty slots, and plug lasers outputs.
	Proposition 65: Some MRV products may contain chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm.
	Operate devices only in areas within the recommended ambient temperature range. Provide at least 3 inch (7.6 cm) of clearance around the ventilation openings for proper air flow.
	Only trained and qualified service personnel (IEC 60950-1) should install or service this equipment.

1.7. Electrical Safety

	Provide proper grounding to avoid ESD damage to components during service and operation. Use antistatic carriers to transport exposed electronic devices. Use protective clothing, grounding straps, antistatic furniture and surfaces, and any recommended devices.
	Use only shielded and grounded cables to comply with FCC rules.
	Electrical equipment relies on building installation safety devices for short-circuit, over-current, and earth (ground) fault protection. Ensure that these devices are properly rated to protect the equipment. Use a listed or certified fuse or circuit breaker on all current-carrying conductors.
	Install the equipment near the power source. The power cord plug must be always accessible as the main disconnecting device. Unplug the power cord before working on a system without an on/off switch.
	Disconnect all power sources before servicing equipment. Connect power cords to equipment before applying the power source.
	The equipment is not intended for direct copper connection to a public switched telephone network or telecommunication network (EU) connection ports.
	Install MRV equipment in accordance with applicable building and electrical codes such as: NFPA NEC 70, CEC, Part 1, CSA C22.1, IEC 60364, BS7671, etc.

1.8. Laser Safety

	Do not open laser devices for service. Removing the cover may cause exposure to harmful laser beams. Return defective laser devices to the vendor for service.
	Un-terminated connectors or fiber cable ends may emit invisible laser radiation. To avoid eye injury, do not view them within 100 mm or directly with optical instruments such as eye loupes, magnifiers, or microscopes. The amplified laser output can dramatically increase eye hazard.
	This equipment is intended for use with Class 1 pluggable (SFP, SFP+, XFP, QSFP, GBIC) fiber optic transceivers with a label indicating the following specifications: 1. Classification as a Class 1 Laser product 2. Compliance with Food and Drugs Administration Center for Radiological Health (FDA CDRH) performance standards, 21 CFR 1040.10 (except deviations noted in Laser Notice #50, 6/24/2007) 3. Certification from Nationally Recognized Testing Laboratory (NRTL), CSA, or TUV
	Some fiber optics modules (EM316EDFA) may contain Class 1M levels of invisible laser radiation. Class 1M equipment must be installed in a restricted location that is accessible only to authorized personnel with laser safety training.
	WARNING: Laser products labeled as Class 1M may have internal laser diodes containing Class 3B lasers.
	Caution: use of controls, adjustments, or procedures not specified by the manufacturer my result in hazardous radiation exposure.
	

1.9. Aggregated Power

Access to the fiber ends and connections constitutes potential risks with live laser transmissions. Although individual components may produce output within Class 1 parameters, some devices combine signals that collectively exceed Class 1 hazard level of 10 dBm. Measure all risk potentials for both skin and retinal hazards when working with equipment such as Fiber Driver WDM add/drop and multiplex/de-multiplex devices.

IEC 60825-2, D.5.1 - Aggregated Wavelengths on a Fiber (excerpt)
When more than one wavelength is combined on the same fiber as in a WDM system, then the hazard level depends on aggregated power levels. Hazards are cumulative for common wavelengths used in optical communications.

Refer to the IEC document quoted above for more information on laser safety.

1.10. Input Thresholds

Receiver inputs are sensitive to power levels, particularly on small pluggable transceivers. Observe component thresholds for optimal operation, to avoid damage, and to maintain warranty support.

Chapter 2. Network Managers

...introduction to the Linux-based network managers

2.1. The EM316LNXNM Modules

The EM316LNXNM network managers control either the Fiber Driver (FD) or the Media Cross Connect (MCC) network platforms. The EM316LNXNM models are specifically configured for each product line, as shown below.

EM316LNXNM-OT	Fiber Driver manager (two SFP sockets and embedded MegaVisionJ GUI)
EM316LNXNM-MCC	MCC manager (no SFP sockets and embedded PathFinder GUI)

The MCC configuration is bundled and distributed as an integral part of each MCC chassis. The Fiber Driver configuration is ordered as a separate module to allow for many unmanaged and remotely managed CO/CPE applications. Default settings may work for many applications, but management allows customization to optimize installations or to use the powerful features of the MRV network devices. Examples and figures may show either module configuration, but management features are consistent between the modules except as stated.

2.2. Features

EM316LNXNM modules provide powerful and extensive tools for managing Fiber Driver and MCC systems. The management module firmware is based on a Linux kernel for security and extensibility.

- Local and remote administration interface for Fiber Driver and MCC platforms
- Linux-based onboard software for extensible, open-source configuration
- Serial port and IP network interface access with Telnet or SSH terminal services
- Native command line interface (CLI) and SNMP support
- Field upgrade support to expand software features with limited downtime
- Extensive management tools and environment controls for users, groups, and administration
- Custom graphical user interface (GUI) support with MegaVision
- PathFinder graphical user interface (GUI) support (MCC only)
- Application programming interface (API) for automated and scripted administration (MCC only)
- Additional SFP interface sockets for more network expansion (Fiber Driver only)
- Cluster Discovery Protocol for groups of managed systems (Fiber Driver only)
- Synchronization of commands with devices (**`flush`**) and software (**`sync`**)

2.3. Management Environments

The NM module provides a command line interface (CLI) management environment that is accessible locally through the RS-232 serial console port or remotely through the RJ-45 Ethernet port using SSH or Telnet protocols. The CLI environment and some of the available CLI commands are addressed in dedicated manual sections. Refer to EM316LNXNM command line help for specific command syntax and usage not included in this document.

The EM316LNXNM module also provides Simple Network Management Protocol (SNMP) support that allows control through any industry standard network management system (NMS). To maximize the graphical remote management control of MRV modules, MRV offers MegaVision® Pro. It is a powerful NMS with unique graphical user interfaces (GUI) for managed MRV network components including Fiber Driver and MCC. A limited version of MegaVision called “Configurator” is available for trial through http://www.mrv.com. Refer to MegaVision Pro documentation for more information on the benefits and options for graphical management.

The firmware of the EM316LNXNM module includes a graphical network manager: MegaVisionJ for Fiber Driver and PathFinder for MCC. Each graphical user interface (GUI) is accessible through a Java-enabled HTTP browser at the IP address configured on the module. The embedded GUI provides access to all the necessary management features available for one managed system only.

An Application Programming Interface (API) is available for customized automation and software control of managed systems. Refer to MRV technical support for details not included in this document.

Chapter 3. Module Installation

...unpacking and installing hardware

3.1. The EM316LNXNM Network Manager

The FD NM (EM316LNXNM-OT) is a standard Fiber Driver module that occupies one slot in a Fiber Driver chassis. It is not bundled with any chassis because network management is optional for some Fiber Driver platform solutions.

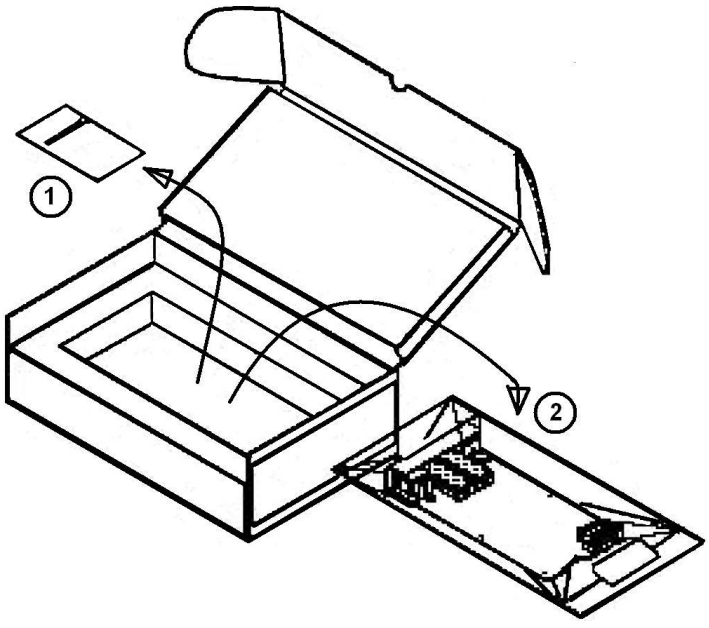
The appropriate MCC network manager model is bundled as part of each MCC modular chassis, but it is also available as a replacement or spare.

3.2. Unpacking the NM Module

This information is primarily for the FD NM that is sold independently, but the general information below can also apply to the spare MCC NM. Follow the steps below as illustrated in the figure.

1. Open the cardboard box.
2. Remove the static bag containing the device.
3. Check for additional accessories in the box that may move beneath the module tray during transit.

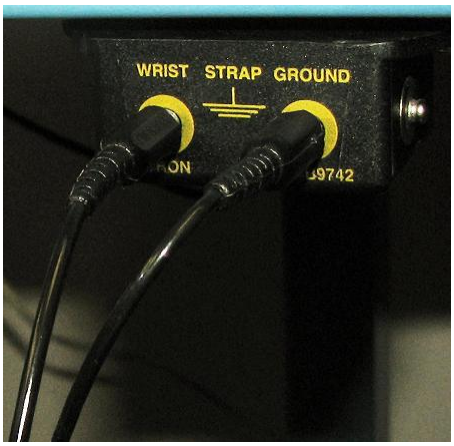
Contact your authorized MRV dealer or representative if any contents are missing or damaged during shipment. The EM316LNXNNM-OT package includes a power cable and a serial data cable. If returnibng the unit becomes necessary, repackage all contents in the original container.

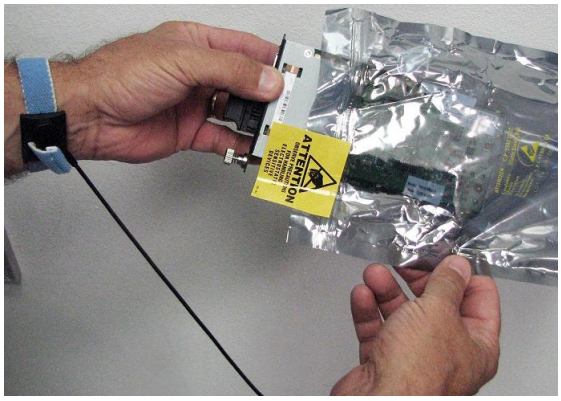


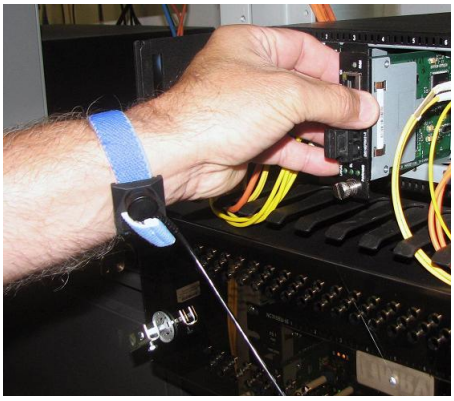
Unpacking a module

3.3. Module Handling and ESD

MRV delivers electronic devices in antistatic packaging to limit electrical damage during shipping. Avoid electrostatic discharge when unpacking and handling all electronic equipment. Use grounding straps and antistatic surfaces to minimize equipment damage. Some of these safety devices are pictured below.







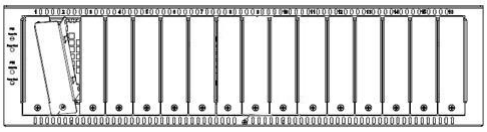
3.4. NM Module Installation

Fiber Driver modules including the FD NM are hot-swappable in a powered Fiber Driver chassis. A #1 Phillips and a 5.0 flat-tip screwdriver may be useful when working with Fiber Driver chassis and components.

If it does become necessary to handle the MCC NM, refer to the guidelines described below for the Fiber Driver NM with allowances for the illustrated Fiber Driver chassis examples.

Follow all guidelines to eliminate static electricity while handling the module and other electronic devices. Follow all safety suggestions in this manual and guidelines for all related equipment.

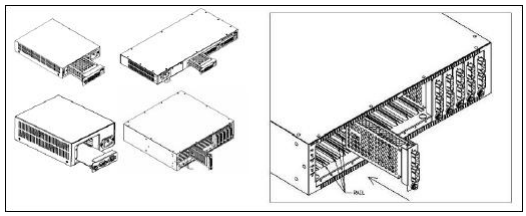
Step 1 Remove the blank panel or old module from the target chassis slot. Unfasten the mounting screws with a 6-inch Phillips screwdriver, or disengage any thumb screws by hand.



Remove the required blank panels

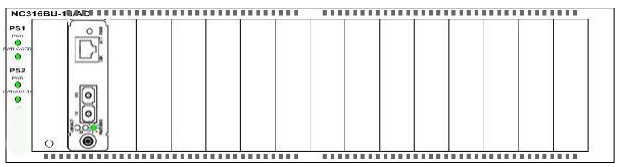
To comply with FCC regulations and for optimal cooling air flow, a cover panel or a module must cover every chassis slot. To limit external signals, no chassis slot should remain open when the unit is operational. Secure modules and panels with appropriate screws for grounding and further compliance.

Step 2 Install the module into a Fiber Driver chassis by aligning the edge of the circuit board with the rail of the chassis. Tighten the thumbscrew by hand, and do not over-tighten.



Module installation (not all chassis are shown)

Handle modules by the edges to avoid damaging any components. Follow ESD precautions in this manual and electrical component guidelines. Push the module securely into the chassis slot your thumbs. Do not use excessive force, but make sure the module connector is fully inserted in the chassis. Secure the module by hand using the thumbscrew.



Fiber Driver module installed in a powered chassis

3.5. Fiber Optic Transceivers Care

Optical devices use a variety of cables, connectors, transceivers, and other components that require special handling care.

Follow all ESD precautions listed at the front of this manual.

3.5.1. Cleaning Fibers

Fiber optic components and cables are very sensitive to dirt, dust, and mishandling, especially in high-speed networks. Dirty or mistreated fiber may cause errors and degradation of signal quality that affect network performance or module functionality.

3.5.1.1. Cleaning Supplies

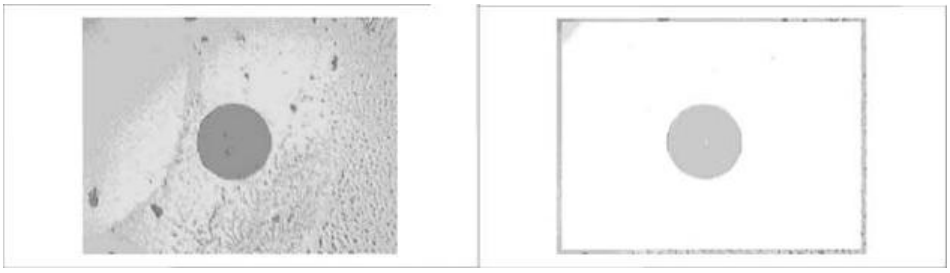
1. Optical cleaner cartridge 2. Can of compressed air	 Cleaning cartridge

3.5.1.2. Cleaning Procedure

Follow the procedure below to clean optical transceivers before each cable installation.

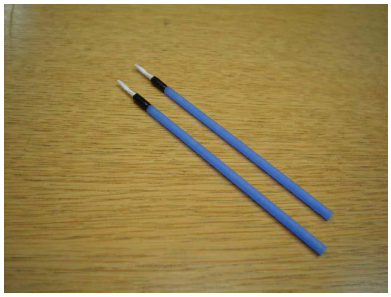
1. Blow a stream of compressed air on the fiber ends while the caps are in place.
2. Remove the caps, and blow the ends of the fibers again.
3. Follow the cartridge instructions to clean the ends of the fibers.

Fiber Inspection



Contaminated fiber and clean fiber through a scope

3.5.2. Working with Fiber Optic Transceivers

The pluggable optics modules used in the EM316xx products are extremely portable, and consequently may be easily mistreated. If optical transceivers have not been protected against dust, remove the dust caps and clean them with 1.25 millimeter cleaners.	 Optical transceiver cleaners

3.5.2.1. Cleaning Fiber Optic Transceivers

Use the 1.25mm cleaners shown above and the steps below to clean optical transceivers.

1. Insert the 1.25mm cleaner into the optical transceivers
2. Turn ¼ turn
3. Remove the 1.25mm cleaner and discard
4. Repeat the process

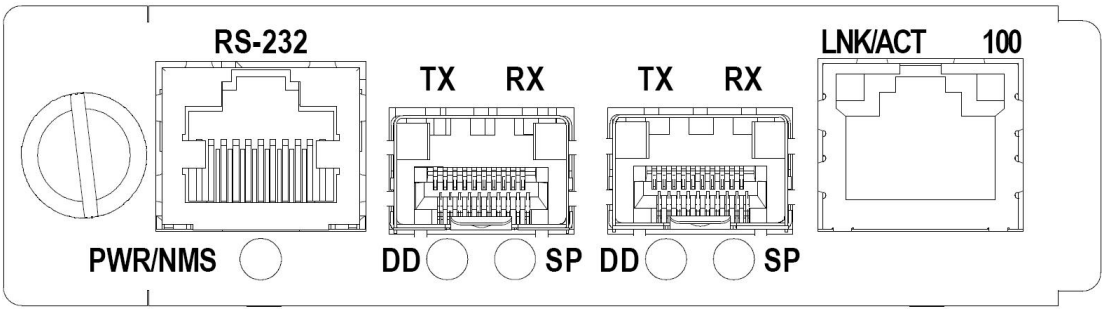
Install optical cables with as little fiber stress as possible. Stretching or bending optical fibers can damage them and affect performance.

Chapter 4. EM316LNXNM Hardware

...network manager ports and LEDs

4.1. The EM316LNXNM Front Panels

The EM316LNXNM-OT front panel designed for Fiber Driver is shown below:



The EM316LNXNM-MCC designed for the MCC system is similar, but it has no SFP sockets.

Serial, Ethernet, and SFP ports are described in this section along with optical maintenance. The SFP port descriptions apply to the EM316LNXNM-OT module only.

4.2. Access Ports and Connectors

There are two RJ port connectors built into the EM316LNXNM front panel for serial and Ethernet access. The RS-232 port connects to a PC serial port for direct "out-of-band" secure access to the command line interface (CLI). The serial interface configuration is discussed later in this section. The Ethernet port opposite the serial port connects to an IP network for CLI and SNMP control.

The EM316LNXNM-OT includes two SFP sockets in addition to the two RJ ports. An SFP transceiver may be installed in each of these sockets for addition network connections. Refer to the transceiver documentation for connection information not covered in this document or appendices.

4.3. LED Legend

LED indicators built into the front panel of the EM316LNXNM module display operational status.

LED Label	Functional Description
PWR/NMS	Lights amber while booting and green when the module is operating
DD *	Lights green when the installed SFP Digital Diagnostics report good status or amber for error codes
SP *	Lights green when the installed SFP detects signal precence
LNK/ACT	Lights green when an Ethernet link is detected, and blinks for activity
100	Lights green for Ethernet link at 100 Mbps or amber for 10 Mbps

* SFP ports and the associated LEDs are on the EM316LNXNM-OT module only.

4.4. Command Line Interface (CLI) Setup

The EM316LNXNM may be controlled through SNMP tools or through a command line interface (CLI). This manual deals primarily with the CLI, which may be accessed through either a serial or network connection.

4.4.1. Local Serial Console Setup

The EM316LNXNM RS-232 interface is used for secure "out-of-band" communications to the CLI. Use this serial interface for configuring the module to eliminate error sources from the network. Another advantage of the serial interface is "out-of-band" management that is enitrely secure and does not compete with network traffic.

Connect one end of a serial cable (included parts listed below) to a terminal (or a PC terminal emulator) and the other end to the EM316LNXNM serial port.

Table 4.1. RS-232 Serial Cables (current and previous versions)

Cable Assembly	Part Number
Adapter Cable (current)	2012001-001R
Cable and adapter (previous)	151-3028 REV-F AI 04/04 and 350-0308 REV. B MRG/20028-2

Configure the terminal serial parameters with the following values:

- 38400 baud
- 8 data bits
- 1 stop bit
- no parity
- no flow control

4.4.2. Remote IP Setup

Besides local serial access, the EM316LNXNM also provides an Ethernet interface for remote administration. SFP transceivers may be installed in the EM316LNXNM-OT for additional network interfaces.

The factory default IP configuration for the RJ-45 Ethernet port is shown below:

IP Address - 192.168.14.201

Netmask - 255.255.255.0

The IP address and netmask above may be written as 192.168.14.201/24 (24-bit netmask).

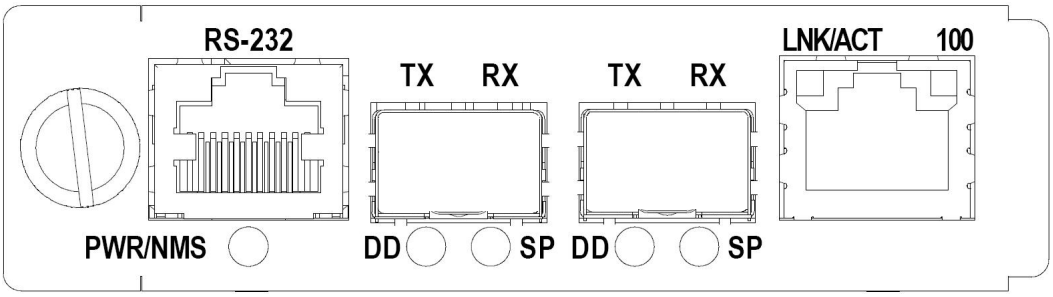
Without a gateway, the EM316LNXNM cannot respond to either CLI (Telnet/SSH) or SNMP requests beyond the subnet. For wider management access, consult your network administrator for an IP gateway within your subnet.

The EM316LNXNM supports SSH and Telnet. Use SSH (secure shell) from the network to the EM316LNXNM IP address to open a secure command line interface (CLI). Telnet services are disabled by default on the EM316LNXNM, but they may be enabled for additional CLI access.

Chapter 5. Management Basics

...getting started with the EM316LNXNM-OT manager for Fiber Driver

This chapter includes only Fiber Driver management features that are not specific to any device. Later chapters may introduce commands for specific Fiber Driver devices. Use the latest product revisions to ensure support for all features.



The EM316LNXNM (LNXNM) network management module provides monitoring and configuration access to a chassis and all installed manageable components. The EM316LNXNM-MCC module is integrated into the Media Cross Connect (MCC) chassis. Installing the EM316LNXNM-OT in any slot of a powered Fiber Driver multi-slot chassis is recommended for most applications. This chapter uses Fiber Driver examples to introduce the LNXNM basic concepts and commands that apply to both product platforms except where noted otherwise.

While the factory default device configurations may address some applications, network management is a powerful tool for proactive Fiber Driver administration and reduced operating expenses. The LNXNM provides monitoring and configuration access locally or remotely through the serial or Ethernet ports.

The LNXNM provides a command line interface (CLI) that is accessible either through a local serial console or from the IP network using SSH or Telnet. This section includes common CLI commands and management concepts. The display examples may vary slightly between LNXNM firmware versions. Refer to the CLI help commands in this chapter for complete command lists, options, and syntax.

The network management module also provides Simple Network Management Protocol (SNMP) support to allow control through any industry standard network management system (NMS). MRV's MegaVision Pro is a general purpose network management system with unique graphical support for MRV products including Fiber Driver. A limited version of MegaVision called "Configurator" is available for trial through the MRV website. Refer to ftp://ftp.mrv.com/pub/software/megavision/ for the latest MegaVision software, documentation, and more product details. ResourceFinder is the powerful graphical system designed for MCC management in any application. MegaVisionJ is a compact graphical manager that is built into the EM316LNXNM-OT firmware to manage only a single chassis system. Access this interface from any standard Java-enabled web browser with an IP route to the LNXNM. Some GUI management windows are included later in this manual.

5.1. System Response Time

The EM316LNXNM-OT is part of a distributed architecture that uses polling, which can impact the response time of the system. The resulting command latencies should be considered during initial installation and testing as well as during operation.

The command process begins by sending a command to the LNXNM through the command line, API, or graphical interfaces.

There is a time lag before the requested action executes in the target line card. Use the **`flush`** command to complete outstanding action requests before continuing with dependent actions, especially in automated management.

There is another delay before the LNXNM reads the updated information back from the device to display the updates in the user interfaces such as the **`show`** command in the CLI. The Command latency depends on the type and quantity of modules managed in the chassis. LNXNM statistics collection from the modules for presentation to the user may take several seconds. The delay may be longer when collecting information from remotely managed Fiber Driver CPE modules. Use the **`sync`** command to complete all requested actions and allow the LNXNM to finish polling before continuing with dependent actions. The **`sync`** requires more processing time than **`flush`**, so it is most useful when managing through a manual interface such as the CLI or API.

Avoid rapidly plugging managed devices in and out to allow time for the EM316LNXNM-OT software to register modules, pluggable transceivers, and cables. Otherwise unexpected configuration and synchronization conflicts may result.

5.2. Command Line Console Setup

The LNXNM front panel includes an RS-232 serial port and an RJ-45 Ethernet port for management access, as described below. The Fiber Driver EM316LNXNM-OT model has two SFP ports for additional network access options.

5.2.1. Serial Console Connection

Use the serial connection for the initial system configuration and for secure "out-of-band" management. Connect the LNXNM RS-232 port to the PC or terminal with the serial cable (shown below) and power up the chassis.

Adapter Cable (current)	2012001-001R
Cable and adapter (previous)	151-3028 REV-F AI 04/04 and 350-0308 REV. B MRG/20028-2

Terminal Parameters:	• 38400 baud • 8 data bits • 1 stop bit	• no parity • no flow control

5.2.2. Network Console Connection

The EM316LNXNM-OT has an RJ-45 Ethernet port that is typically used to connect to a local area network (LAN). Use a standard Ethernet Cat-5e cable to connect between the LNXNM RJ-45 network port and a network switch or hub.

The LNXNM Fiber Driver model also includes two SFP ports on the front panel. MSA-compliant pluggable transceivers may be installed for additional network access options. Contact MRV sales or visit http://www.mrv.com for current SFP availability.

The factory default IP address is 192.168.14.201 with netmask 255.255.255.0, sometimes written as 192.168.14.201/24 to show the 24 bits masked for subnetting.

From the network, connect to the LNXNM IP address using Telnet or SSH (secure shell) to open the command line interface (CLI). Telnet services are disabled by default on the LNXNM, but they may be enabled for additional CLI access.

5.3. LED Legend

LED indicators built into the front panel of the EM316LNXNM module display operational status.

PWR/NMS	Lights amber while booting and green when the module is operating
DD *	Lights green when the installed SFP Digital Diagnostics report good status or amber for error codes
SP *	Lights green when the installed SFP detects signal precence
LNK/ACT	Lights green when an Ethernet link is detected, and blinks for activity
100	Lights green for Ethernet link at 100 Mbps or amber for 10 Mbps

* SFP ports and the associated LEDs are on the EM316LNXNM-OT module only.

5.4. Command Line Interface (CLI)

The LNXNM provides command line interface (CLI), SNMP, and graphical administration options for a Fiber Driver chassis and compatible modules. This section introduces the CLI for the Linux-based network management (LNXNM) module with some useful commands for the EM316LNXNM-OT.

5.4.1. EM316LNXNM-OT Boot and Login

The box below shows the NM boot banner. *Do not interrupt this boot process.*

```
U-Boot 1.0.3.2 (Mar  5 2009 - 11:55:56)

CPU:   MPC875ZPnn at 133 MHz: 8 kB I-Cache 8 kB D-Cache FEC1 FEC2
BOARD: MRV NM2 v3
DRAM:  (64 MB SDRAM) 64 MB
FLASH: 16.5 MB
Net:   FEC ETHERNET
Hit any key to stop autoboot:  0
Detecting flash layout:
.. no magic header
Detected extended flash layout!
### JFFS2 loading 'uImage.initrd' to 0x800000
Scanning JFFS2 FS: . done.
         ################################################################
         ###                    lines omitted                         ####
         ################################################################
   Verifying Checksum ... OK
   Uncompressing Multi-File Image ... OK
   Flash version 2
   Image version 2 ... OK
   Loading Ramdisk to 0373e000, end 03f71b15 (833b15)... OK

Welcome to MRV EM316LNXNM

FPGA 5c.18 Already Loaded.
Starting up, please wait

MRV EM316LNXNM

login:
```

Use the default user "admin" with password "admin" to login, as shown below.

```
login: admin
Password:
EM316LNXNM v4.7 fdr 17 (Aug 2 2011 - 14:02:31).
U-Boot 1.0.3.4 (Sep  1 2010 - 01:58:56).
Linux kernel v2.6.32.1-mrv (#1 Mon Dec 14 15:13:11 PST 2009).
EM316LNXNM (firmware 5c.1c) (00:20:1a:02:83:c8).
Copyright (c) MRV Corp. 1993-2010
You are a SUPER user!
fiberdriver#
```

5.4.2. Command Syntax

To execute a command at the command prompt, type the command followed by the parameters required in the syntax. Use online help to display the syntax for a command by entering the commnand followed by a "?". Using an incorrect number of parameters displays an error message with correct command syntax. <Up> and <Down> arrow keys display the history of commands entered during the current CLI session. The <Enter> key completes and executes each command entered.

The <Backspace> and <Delete> keys allow editing of entered commands before they are executed. Depending on the terminal type, <Delete> may act as a backspace rather than deleting the character at the cursor.

There are also several special keystrokes.

Table 5.1. Special CLI Keystrokes

Key	Function
<Enter>	Enter the command
<Up>	Previous command - in the history of commands
<Down>	Next command - in the history of commands
<^C> (Ctrl+C)	Cancel command
?	Context sensitive list of available commands and on-line help
!	Begin a comment. Any text after this to the end of the line is ignored
<Tab>	Command completion (see below)
<Tab><Tab>	Command completion (see below)

The <Tab> key completes partially entered commands. It searches the available CLI command list for commands that begin with the text entered so far on the command line. For a single match, the full command is completed and displayed. For multiple matches, the system beeps and displays as much text as is shared by all the commands that match the text entered. More text may be entered to narrow the command match selections, or you may press <Tab> again to list all the commands that match beginning of the command entered so far.

For example, suppose that the command line interface consisted only of the commands "**telnet**" and "**terminal**". If you type "**t**<Tab><Tab>", the system displays two commands: "**telnet**" and "**terminal**".

```
fiberdriver# t<Tab><Tab>
telnet  terminal
fiberdriver# t
```

If you continue by typing "**el**<Tab>", then the system would complete the command "telnet".

Similarly, a command may be abbreviated by typing enough characters to make it unique. Using the example above, you could type "**tel *192.168.2.237***", and the CLI would execute "**telnet *192.168.2.237***" because no other command begins with "tel".

The CLI maintains a history list of commands that have been entered by the user. To move backward through this list, use <Up> key. To move forward, use <Down> key.

If you enter a command incorrectly, a message is displayed indicating the type of error that occurred. For example, typing a nonexistent command gives the following message:

```
fiberdriver# pn
% Unknown command 'pn'
fiberdriver#
```

If the command exists but the number of parameters is incorrect, the following message is displayed:

```
fiberdriver# ping
% Command incomplete.
fiberdriver#
```

Use the '?' command (entered alone on the command line) to display a list of available commands.

To see current state of the chassis, slot, and port, use the **show** command. To make changes to the configuration, enter the configuration context by typing "configure terminal".

After entering a command, there may be a delay of several seconds before the action displays in the "**show**" command.

5.4.2.1. Command Truncation

As with many operating environments, the CLI recognizes partial commands and arguments if enough of the character string is typed to make the word unique.

For example, **show version** may be shortened to **sho ver**.

If the truncated entry is not unique or does not match any valid CLI command string, an appropriate message is displayed.

5.4.2.2. Command History

A history of commands is maintained for each CLI login session. The "up-arrow" key moves backwards through the list from the most recent commands to the more distant ones. The "down-arrow" key moves forward through the list towards the most recent. A recovered command may be edited when it is visible on the command line.

The **show history** command displays the entire saved history of commands.

5.4.2.3. Command Argument Completion

When entering commands, specify all the parameters listed in the command syntax. The wrong number of command parameters may cause the command to fail, or worse, the command may cause unexpected results. Extra command line arguments are ignored while unspecified arguments retain previous attribute values. It is good practice to verify the expected command results using the **show** command. If results are not as expected, revert to default values or try the command again.

The box below shows an example command with all arguments specified:

```
fiberdriver(config)# aaa remote-server host 1 1.2.3.4 mySecret 1 2 3
fiberdriver(config)# show aaa remote-server hosts
aaa remote-server host 1 1.2.3.4 mySecret 1 2 3
```

The next box below shows the same command with too few arguments specified, which results in the final parameters keeping the values 1, 2, and 3 from the previous command.

```
fiberdriver(config)# aaa remote-server host 1 1.2.3.4 myNewSecret
fiberdriver(config)# show aaa remote-server hosts
aaa remote-server host 1 1.2.3.4 myNewSecret 1 2 3
```

5.4.2.4. Command Argument By Name

The unique descriptive name assigned to a chassis, slot, or port in the system may be used in place of the numbered hardware designation in most commands. Refer to the **description** command sections to set up a unique device name. These names can be used to make administration clearer with names that reflect location or function.

5.4.3. CLI Navigation

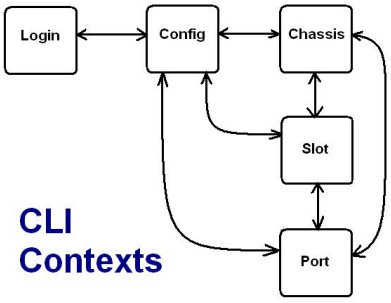
The CLI operates in five states that affect or determine the command availability and behavior. The CLI provides an organized system layout that the user follows with navigation tools to address actions toward specific system components.

At login, the CLI has a fixed set of available commands. This state alone determines the working "context" for the CLI command environment. This environment is referred to simply as the "login context".

There are also four configuration states: Config, Chassis, Slot, and Port. The Config (Configuration) state also has a fixed set of available commands, so the CLI environment is referred to as the "config context".

The available commands and resulting actions in the other three CLI states (Chassis, Slot, and Port) depend partially on the specific hardware component being accessed. These three states are roughly hierarchical, corresponding to the hardware represented; a chassis contains slots which contain ports. The CLI environment is in a similar operating state for chassis, for slots, or for ports, but the specific characteristics of each hardware component also affects the available commands. The hardware state (chassis, slot, or port) along with these individual component characteristics determines the command "context".

The default system prompt displays the active command context. The box below shows the state model and a command sequence traversing through the CLI environment Notice how the prompt changes with each navigation command.




```
fiberdriver# configure terminal
fiberdriver(config)# chassis 1
fiberdriver(chassis/1)# slot 1.2
fiberdriver(slot/1.2)# port 1.2.2
fiberdriver(port/1.2.2)# next
fiberdriver(port/1.2.3)# previous
fiberdriver(port/1.2.2)# up
fiberdriver(slot/1.2)# up
fiberdriver(chassis/1)# exit
fiberdriver(config)# exit
fiberdriver#
```

Enter the Config context with the **`configure terminal`** command. Return to the Login context with the **`exit`** command.

```
fiberdriver(config)# port 1.2.2
fiberdriver(port/1.2.2)# chassis 1
fiberdriver(chassis/1)#
```

The three hardware contexts follow a partly hierarchical structure that mirrors the physical device relationships. The chassis contains slots (modules) which in turn contain ports. Operations on the larger component often affect the components contained in the larger target device.

The **`next`** command is a short-cut for navigating to the following slot or port context. The **`previous`** command navigates in the reverse direction. The **`up`** navigates either from the port to the slot context or from the slot to the chassis context. Notice how the port value in the prompt changes in the box below.

```
fiberdriver(port/1.2.2)# next
fiberdriver(port/1.2.3)# previous
fiberdriver(port/1.2.3)# up
fiberdriver(slot/1.2)# up
fiberdriver(chassis/1)#
```

5.5. Login Context Commands and Examples

Commands in the Login context are generally for system status monitoring. Use the **"?"** and **"list"** commands at the **fiberdriver#** prompt to display the list of command line options.

5.5.1. "?" and "list"

? displays the commands available in the current context of the CLI. The box below shows the login context commands:

```
fiberdriver# ?
  configure  Enter configuration context
  cp         Copy files
  echo       Display text for scripting
  erase      Erase configuration or NVRAM
  exit       Exit current context and go down to previous context
  flush      Wait for changes to be flushed to hardware
  list       Print command list
  logout     Logout of the system
  ls         List files
  more       Display file
  mv         Rename files
  no         Negate a command
  pager      Pause scrolling when screen is full
  ping       Send ICMP echo messages to test network connectivity
  quit       Exit current context and go down to previous context
  restart    Reboot the NM card
  rm         Remove files
  scp        Use SCP to transfer files (small config files only)
  show       Show running system information
  sleep      Pause CLI for scripting
  source     Read CLI commands from file
  ssh        Open a SSH connection
  sync       Wait for changes to be flushed to hardware / display
  telnet     Open a TELNET connection
  terminal   Set current terminal parameters
  tftp       TFTP commands
  upgrade    Upgrade software
  who        Find out who is connected to the system
  whoami     Who am I?
  write      Write running configuration to memory or terminal
fiberdriver#
```

For more detailed syntax help, type **list <command>** to display all options for the specified command. If no command is specified, then it displays every valid command for the current context.

The "?" character may also be used on the command line after a valid command in the box above. The display shows the valid parameters that may be used following the specified command. If the given parameter does not complete the command line, then another "?" may be used to display the list of valid options for the next parameter on the command line.

5.5.2. "show"

The **show** command displays information about the target system component. Use the command line "?" (help character) to display command line syntax and parameters for the show command.

```
fiberdriver# show?
  show - Show running system information
fiberdriver# show ?
  C.S.P               - Display info for port P of slot S in chassis C
  NAME                - Display info for an element with the given name
  C                   - Show info for a chassis
  C.S                 - Show info for a slot
  aaa                 - Show AAA (RADIUS/TACACS+) configuration
  chassis             - Show chassis list
  config              - Show administrative configuration for a location
  cos                 - Show CoS configuration
  defaults            - Show default configuration for a location
  digital-diagnostics - Show Digital Diagnostics summary
  discovery           - L2 Discovery Protocol
  dscp                - Dscp Map
  firmware            - Show firmware info
  flows               - Show flow configuration
  groups              - Show group configuration
  history             - Display the session command history
  inventory           - Show information about every object in the system
  ip                  - Show administrative IP status
  license             - Displays licensing information about this system
  log                 - Show logging configuration and log entries
  map                 - Display port map
  mapping-types       - Show mapping-type info
  memory              - Show memory usage
  ntp                 - Show NTP configuration
  ntp-server          - NTP server configuration
  packages            - Show installed packages and versions
  permissions         - Show your permissions
  plugins             - Show Pluggable Optics (SFP/GBIC/XFP) summary
  ports               - Show port list
  proc                - Process information
  redundancy          - Show redundancy info
  rm                  - Remotely manageable module version information
  running-config      - Current operating configuration
  slot                - Show slot list
  slots               - Show slot list
  snmp-server         - Show SNMP server configuration
  startup-config      - Contents of startup configuration
  statistics          - Show port info
  sys                 - Show system information
  table               - Display a system table
  terminal            - Show local terminal information
  tftp                - Show tftp information
  unmapped            - Show unmapped ports
  user-class          - User class (debug, super, etc)
  users               - User accounts
  version             - Displays software version
  vid-map             - Show VID map
  warranty            - Displays information about the warranty for this system
fiberdriver#
```

The following examples use the **show** command with some possible command line parameters.

5.5.3. "show version"

The show version command displays revision levels for the management system components:

```
fiberdriver# show version
EM316LNXNM v4.7 fdr 17 (Aug 2 2011 - 14:02:31).
U-Boot 1.0.3.4 (Sep  1 2010 - 01:58:56).
Linux kernel v2.6.32.1-mrv (#1 Mon Dec 14 15:13:11 PST 2009).
EM316LNXNM (firmware 5c.1c) (00:20:1a:02:83:c8).
Copyright (c) MRV Corp. 1993-2010
fiberdriver#
```

5.5.4. "show chassis"

The following box displays the configuration of a chassis:

```
fiberdriver# show chassis
Chassis  Model       Name      Number Of Slots  Temp(C)  Serian Num
=======  ==========  ========= ===============  =======  ==========
1        NC316BU-16  Chassis 1 16               20       xxxxxxxxxx

fiberdriver#
```

5.5.5. "show slots"

The following example displays information about modules in the slots in a chassis:

```
fiberdriver# show slots
Slot  Model           Name                        Mac Address        Serial Num
====  ==============  ==========================  =================  ============
1.1   EM316LNXNM-OT   EM316LNXNM-OT at 1.1        00:20:1a:02:48:28  N/A
1.2   EM316T1E1-XY    Dual-converter-with-2-CPEs  N/A                030309EM1YAG
1.3   EM316-GSWXY-4   GSWXY FD Module             00:20:1a:12:12:34  032309EM1ZLM
1.5   EM316GSW-XY     EM316GSW-XY at 1.5          00:02:1a:08:08:08  N/A
1.7   EM316O3C/S1     EM316O3C at 1.7             N/A                N/A

fiberdriver#
```

5.5.6. "show ports"

The following example displays information about the available ports in a chassis:

```
fiberdriver# show ports
Port    Enable   Link           LIN      Speed     DDiags  WL(nm)  Name
======  =======  =============  =======  ========  ======  ======  =============
1.1.1   N/A      N/A            N/A      N/A       N/A     N/A     RS232 at 1.1.
1.1.2   enable   no Signal      N/A      100 Mbps  N/A     N/A     SFP at 1.1.2
1.1.3   enable   no Signal      N/A      100 Mbps  N/A     N/A     SFP at 1.1.3
1.1.4   enable   link           N/A      100 Mbps  N/A     N/A     RJ-45 at 1.1.
1.2.1   enable   no Signal      enable   N/A       N/A     N/A     RJ48 at 1.2.1
1.2.2   enable   no Signal      enable   100 Mbps  Alarm   850     SFP at 1.2.2
1.2.3   enable   no Signal      enable   100 Mbps  Alarm   850     SFP at 1.2.3
1.2.4   enable   no Signal      enable   N/A       N/A     N/A     T1port4
1.3.1   enable   no Signal      disable  10 Mbps   N/A     N/A     RJ-45 at 1.3.
1.3.2   enable   signal Detect  disable  1 Gbps    Ok      850     GSWXY port 2
1.3.3   enable   signal Detect  disable  1 Gbps    Ok      850     SFP at 1.3.3
1.3.4   enable   no Signal      disable  10 Mbps   N/A     N/A     RJ-45 at 1.3.
1.5.1   enable   no Signal      N/A      10 Mbps   N/A     N/A     RJ-45 at 1.5.
1.5.2   enable   signal Detect  N/A      1 Gbps    Ok      850     SFP at 1.5.2
1.5.3   enable   signal Detect  N/A      1 Gbps    Ok      850     SFP at 1.5.3
1.5.4   enable   no Signal      N/A      10 Mbps   N/A     N/A     RJ-45 at 1.5.
1.7.1   N/A      no Signal      N/A      N/A       N/A     N/A     2BNC at 1.7.1
1.7.2   N/A      no Signal      N/A      N/A       N/A     N/A     S1_DSC_SM at

fiberdriver#
```

5.5.7. "show log"

The show log command displays log settings for the management system components:

```
fiberdriver# show log
 Running Level: warning
 Nvram Level: disabled
 Trap Level: warning
 Remote Server: 0.0.0.0
 Remote Level: notice
 Debug Messages: disabled
fiberdriver#
```

5.5.8. "show groups" and "show users"

Management access is controlled through group and user permissions. Display the current system groups and users with the commands shown below.

```
fiberdriver# show groups
System group configuration:
group all write 1
group all write 2

Your configured permissions:
Read/Write Chassis: 1, 2
        (From Group 'all')

fiberdriver#
```

```
fiberdriver# show users
username admin password encrypted $1$kQ2rIq/$Ob8wFa2EW134TnN7wJ/ class super
username admin groups all
username debug password encrypted $1$NUIVuN/$sN7tmW5aoZG8ggT.I30 class debug
username debug groups all
fiberdriver#
```

5.5.9. "show running-config"

The show running-config command displays the currently active system parameters for the management system.

```
fiberdriver# show running-config
Building configuration...

Current configuration:
!
! Configuration saved on 2011/08/15 12:05:55
!
!
! Configuration written by admin!
!
! EM316LNXNM v4.7 fdr 17 (Aug 2 2011 - 14:02:31).
! U-Boot 1.0.3.4 (Sep  1 2010 - 01:58:56).
! Linux kernel v2.6.32.1-mrv (#1 Mon Dec 14 15:13:11 PST 2009).
! EM316LNXNM (firmware 5c.1c) (00:20:1a:02:83:c8).
! Copyright (c) MRV Corp. 1993-2010
!
ip interface 192.168.14.201/24
snmp-server community write encrypted $1$wZCHI9/$6H3mce5Y15iLhtdpoXBoa1
snmp-server community read encrypted $1$hZyZkA1$xiJTxyGDfVb1bcAYyW9Wi1
snmp-server sys name fiberdriver
ip interface dhcp
chassis 1 type NC316BU-16 rev 1
chassis 2 type VIRTUAL16
slot 1.1 type EM316LNXNM-OT rev 4
slot 1.2 type EM316-10G-XY rev 1
slot 1.3 type EM316E3 rev 8
slot 1.4 type EM316F rev 12
slot 2.2 type EM316EFRM rev 6
port 1.1.1 type RS232
port 1.1.2 type SFP
port 1.1.3 type SFP
port 1.1.4 type RJ-45
port 1.2.1 type SFP
port 1.2.2 type XFP
port 1.2.3 type XFP
username admin password encrypted $1$kQ2rIq/$Ob8wFa2EW134TnN7wJ/ class super
username admin groups all
username debug password encrypted $1$NUIVuN/$sN7t87lmWZG8ggT.I30 class debug
username debug groups all
group all write 1
group all write 2
fiberdriver#
```

5.5.10. "show startup-config"

The show startup-config command displays the contents of the startup-config file, which are applied when the system boots. Default values are applied to any parameters not specified in this file.

```
fiberdriver# show startup-config
!
! Configuration saved on 2005/01/01 00:22:42
!
!
! Configuration written by admin!
!
! EM316LNXNM v4.0 fdr 58 (Jul 25 2007 - 09:34:25).
! U-Boot 1.0.1 (Jan 25 2005 - 11:08:25).
! Linux kernel v2.4.26 (#1 Wed Dec 13 10:36:44 PST 2006).
! EM316LNXNM (firmware 5c.13) (00:20:1a:02:48:28).
! Copyright (c) MRV Corp. 1993-2007.
!
ip interface 192.168.14.201/24
username admin password encrypted $1$kQ2rIq/$Ob8wFa2EWXC4TnN7wJ/ class super
username admin group all
username debug password encrypted $1$NUIVuN/$sN7t87lmWZG8ggT.I30 class debug
username debug group all
group all write 2
group all write 1
snmp-server community read encrypted $1$hZyZkA1$xiJTxyGDfVb1bcAYyW9Wi1
snmp-server community write encrypted $1$wZCHI9/$6H3mce5Y15iLhtdpoXBoa1
ip interface dhcp
snmp-server sys name fiberdriver
chassis 1 type NC316BU-16 rev 1
chassis 2 type VIRTUAL16
slot 1.1 type EM316LNXNM rev 4
slot 1.2 type EM316O3C rev 5
slot 1.3 type EM316E3 rev 8
slot 1.4 type EM316F rev 12
slot 2.2 type EM316EFRM rev 6
fiberdriver#
```

5.5.11. "show defaults"

The show defaults command displays the startup-config parameters for the specified system component.

```
fiberdriver# show defaults?
  NAME     - Display info for an element with the given name
  defaults - Show default configuration for a location
fiberdriver# show defaults ?
  C     - Chassis
  C.S   - Slot
  C.S.P - Port
  NAME  - Element
fiberdriver# show defaults 1
chassis 1
 ! temperature-limit 45
 ! temperature-min 5
 ! gen-trap link
 ! gen-trap chassis
 ! gen-trap loopback
 ! gen-trap slot-change
 ! gen-trap port
 ! gen-trap module-specific
 ! loopback-timeout 0
 ! description "Chassis 1"
 ! gen-trap lin
 ! gen-trap port-change
 ! gen-trap port-diags
 ! gen-trap switchover
fiberdriver#
```

5.5.12. "show config"

The "show config" command displays the operating parameters for the specified system component.

```
fiberdriver# show config?
  NAME   - Display info for an element with the given name
  config - Show administrative configuration for a location
fiberdriver# show config ?
  C     - Chassis
  C.S   - Slot
  C.S.P - Port
  NAME  - Element
fiberdriver# show config 1
chassis 1
 ! Configured parameters that override defaults:
 ! Configured parameters that match defaults:
 ! Parameters that will follow defaults:
 ! temperature-limit 45
 ! temperature-min 5
 ! gen-trap link
 ! gen-trap chassis
 ! gen-trap loopback
 ! gen-trap slot-change
 ! gen-trap port
 ! gen-trap module-specific
 ! loopback-timeout 0
 ! description "Chassis 1"
 ! gen-trap lin
 ! gen-trap port-change
 ! gen-trap port-diags
 ! gen-trap switchover
fiberdriver#
```

5.5.13. Displaying and Saving System Parameters

Use the write terminal command to display the current operating parameters.

Use the write file command to save the current parameters to the configuration file.

These commands display no output besides the prompt.

5.5.14. EM316LNXNM Hot-Swapping

Hot-swap settings are stored on each EM316LNXNM module. Stored startup values are read by the EM316LNXNM when the module restarts.

The EM316LNXNM may be removed from the chassis during operation and replaced with a spare that is configured the same as the original. Data flow may be affected while the manager is not available, but normal Fiber Driver operation resumes when the EM316LNXNM reboots in the system.

Not all line cards or settings support EM316LNXNM hot-swap. Modules that do not support hot-swap are reconfigured according to the "`startup-config`" file when the NM is booted, which can intertupt traffic. Settings that do not support EM316LNXNM hot-swap are reloaded from "`startup-config`". For example, port, slot, and chassis names cannot be read from the hardware, so the EM316LNXNM software uses these values as stored in the configuration file. To minimize impact from hot-swapping modules, it is very important to save changes made to the running configuration.

5.5.15. "flush" and "sync"

The **`flush`** command forces the system to wait for all previous commands to execute on the target device. This command assures that the target devices are in the desired operating state. This command is useful with automated management before any command that requires a known system state.

```
fiberdriver# flush
```

The **`sync`** command forces the system to wait for all previous commands to execute on the target device AND for the EM316LNXNM-OT to poll the system to update any changes in the status tables. This command assures that the target devices are in the desired operating state AND that the user interfaces correctly report the current status including changes. This command is useful with manual management before any command that reads system status and manageable parameters.

```
fiberdriver# sync
```

5.5.16. Network Testing: "ping"

The system's ping tool can be used to check the IP connectivity between the EM316LNXNM and any external device. Ping is an ICMP/IP utility that sends an echo request from one host to another and expects a reply from the remote host. The reply requests are answered if there is a logical network connection between the device and the destination. If there are no responses, either there is no connection or the IP configuration is not configured correctly on the device or at least one of the sending and receiving devices. If there are some responses and some timeouts, then there is likely an intermittent cabling problem.

User the **`ping`** command to verify network connectivity between IP devices. Type the destination IP address in dotted decimal notation (e.g. 192.168.1.1).

Use <^C> (Ctrl+C) to stop the ping command in the EM316LNXNM CLI.

```
fiberdriver# ping 192.168.1.1
Press Ctrl-C to terminate.
PING 192.168.1.1 (192.168.1.1): 56 data bytes
64 bytes from 192.168.1.1: icmp_seq=0 ttl=20 time=5.5 ms
64 bytes from 192.168.1.1: icmp_seq=1 ttl=20 time=1.0 ms
64 bytes from 192.168.1.1: icmp_seq=2 ttl=20 time=1.0 ms
64 bytes from 192.168.1.1: icmp_seq=3 ttl=20 time=1.0 ms
64 bytes from 192.168.1.1: icmp_seq=4 ttl=20 time=1.0 ms
64 bytes from 192.168.1.1: icmp_seq=5 ttl=20 time=1.0 ms
64 bytes from 192.168.1.1: icmp_seq=6 ttl=20 time=1.0 ms
64 bytes from 192.168.1.1: icmp_seq=7 ttl=20 time=1.1 ms <^C> (Ctrl+C)

--- 192.168.1.1 ping statistics ---
8 packets transmitted, 8 packets received, 0% packet loss
round-trip min/avg/max = 1.0/1.5/5.5 ms
fiberdriver#
```

5.5.17. IP Access

The EM316LNXNM-OT supports standard IP access tools for remote network monitoring and administration. HTTP, Telnet, and SSH operate as server and client services to connect a remote user with the Fiber Driver system manager. To use each protocol for management access, first verify that the server is enabled on the LNXNM to accept the connection request from the remote client.

The server setup commands are similar for each service. Configuring the LNXNM IP address, mask, and gateway is always the first step before using any network service. Set these parameters in the Configuration context with the IP commands shown below.

```
fiberdriver(config)# ip?
  ip - IP configuration
fiberdriver(config)# ip ?
  default-gateway - Set default gateway
  gratuitous-arp  - Send broadcast gratutitous ARP when IP address changes or network
 comes up
  interface       - System interface configuration
  ssh-server      - Enable ssh server
  tables          - iptables configuration
  telnet-server   - Enable TELNET server
  web-server      - Enable web server
fiberdriver(config)#
```

Enable and disable the Telnet server with the commands:

```
fiberdriver# ip telnet-server

fiberdriver# no ip telnet-server
```

Enable and disable the SSH server with the commands:

```
fiberdriver# ip ssh-server

fiberdriver# no ip ssh-server
```

Enable and disable the HTTP (web) server with the commands:

```
fiberdriver# ip web-server

fiberdriver# no ip web-server
```

Use the **`write file`** command to apply the current configuration each time the EM316LNXNM-OT restarts.

When the IP parameters are configured and the server is enabled, then the EM316LNXNM-OT is ready to receive connection requests from corresponding remote clients.

The EM316LNXNM-OT also supports outward (client) Telnet and SSH connections. Telnet and SSH connections originating at the LNXNM require IP configuration, but servers may be disabled.

5.5.17.1. Server Ports

Telnet, SSH, and HTTP use ports 23, 22, and 80 by default. These default ports may be changed with the following commands:

```
fiberdriver# ip telnet-server port <1-65535>

fiberdriver# ip ssh-server port <1-65535>

fiberdriver# ip web-server port <1-65535>
```

5.5.17.2. Remote CLI: "Telnet"

Contact the EM316LNXNM-OT from a network workstation with the TCP/IP terminal interface "Telnet" client.

The CLI operates and appears the same as using the serial interface. For security, the Telnet server is disabled by default. Refer to the following section for more secure management access through secure shell (SSH).

Use the **`open`** command to open a user CLI session.

Use the **`quit`** command to exit the CLI and close the Telnet connection.

5.5.17.3. Secure Remote CLI: "SSH"

Contact the EM316LNXNM-OT from a network workstation with the TCP/IP terminal interface "SSH" client for secure management.

The CLI operates and appears the same as using the serial interface.

5.5.17.4. Graphical Web Access

The EM316LNXNM-OT includes an HTTP server for direct graphical management of a single Fiber Driver system. The HTTP (web) server is enabled by default.

Use a web browser (Internet Explorer, Firefox, etc.) from a network client to access the graphical HTTP server on the target Fiber Driver manager. Use the EM316LNXNM-OT IP address configured above in the address line to open the administration starting page.

5.5.18. Upload/Download: "tftp"

Trivial File Transfer Protocol (TFTP) transfers files to or from the network management (NM) module. The EM316LNXNM firmware includes a TFTP client that must be configured with an external TFTP server to send or receive files. The **tftp** command is available in the Login context of the CLI.

The **tftp** tool is intended for moving revision (*.rev), source (*.src), and configuration files. Once used, these files should be removed from LNXNM storage because onboard capacity is limited. Use the **ls** command to view the current files stored.

Use the **upgrade** command for firmware revision images. Files such as uImage.initrd that are too large can cause problems.

5.5.19. Configuration Scripts: "scp"

SCP copies files to or from the system with the security of authentication and encryption. SCP establishes an SSH connection to either send or receive files. SCP transfers can initiate only from the LNXNM. SCP transfers can't be initiated by an SCP client running on an external host. Use the "**scp**" command to start a file transfer.

To copy a file to the local system from a remote host (with IP Address 192.168.1.1, for example):

```
fiberdriver# scp localfile from user@192.168.1.1:remotefile
Password:
remotefile                                    100% 1759     0.0KB/s   00:00
fiberdriver#
```

To copy a file from the local system to a remote host (with IP Address 192.168.1.1, for example):

```
fiberdriver# scp localfile to user@192.168.1.1:remotefile
The authenticity of host '192.168.1.1 (192.168.1.1)' can't be established.
RSA key fingerprint is 1f:e6:7f:7b:c2:56:2c:74:42:11:c7:a3:a6:f6:d0:05.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '192.168.1.1' (RSA) to the list of known hosts.
user@192.168.1.1's password:
localfile                                     100% 1759     0.0KB/s   00:00
fiberdriver#
```

The **scp** tool is intended for moving revision (*.rev), source (*.src), and configuration files. Once used, these files should be removed from LNXNM storage because onboard capacity is limited. Use the **ls** command to view the current files stored.

Use the **upgrade** command for firmware revision images. Files such as uImage.initrd that are too large can cause problems.

5.5.20. Custom Scripts

Write CLI scripts using any text editor and then, using TFTP or SCP, transfer the files to the device to run them. Provide an external TFTP or SCP server. For improved security, the EM316LNXNM system does not include an onboard TFTP or SCP server. However, it does provide TFTP and SCP clients.

5.5.20.1. Moving Files

Using the "**`sys tftp-host-ip`** ***`10.1.1.1`***" command, set up the IP address of the external TFTP server. The "**`tftp get`**" and "**`upgrade`**" commands use the address (***`10.1.1.1`***) if it is not specified in the command itself.

Use the "**`tftp get script.txt`**" command to transfer the script file to the device. If the command does not specify a TFTP server using "**`sys tftp-host-ip`**", or if you wish to use a different server than the one specified by **`tftp-host-ip`**, use the "**`tftp get`** ***`10.1.1.2`*** **`script.txt`**" command.

```
fiberdriver# con t
fiberdriver(config)# sys tftp-host-ip 10.1.1.1
fiberdriver(config)# exit
fiberdriver# tftp get script.txt
Fetching script.txt from 10.1.1.1...
Copying...
fiberdriver#
```

Alternately, use the steps described in "SCP">.

Unix-like commands **`ls`**, **`mv`**, and **`rm`** are available to operate on those files.

```
fiberdriver# ls
...
-rw-rw----    1 admin    config         12 Mar 29 11:58 script.txt
...
fiberdriver# mv script.txt script2.txt
fiberdriver# ls
...
-rw-rw----    1 admin    config         12 Mar 29 11:58 script2.txt
...
fiberdriver# rm script2.txt
fiberdriver# ls
-rw-------    1 root     config        668 Sep  2  2005 ssh_host_dsa_key
-rw-r--r--    1 root     config        606 Sep  2  2005 ssh_host_dsa_key.pub
-rw-------    1 root     config        531 Sep  2  2005 ssh_host_key
-rw-------    1 root     config        335 Sep  2  2005 ssh_host_key.pub
-rw-------    1 root     config        883 Sep  2  2005 ssh_host_rsa_key
-rw-r--r--    1 root     config        226 Sep  2  2005 ssh_host_rsa_key.pub
-rw-r-----    1 root     config       1734 Mar 29 09:30 startup-config
-rw-r-----    1 root     config       1708 Mar 20 13:19 startup-config.sav
fiberdriver#
```

5.5.20.2. Executing Scripts (source)

Use the "**ls**" command to verify that the script is loaded in the LNXNM. Type "**source script.txt**" to execute the CLI commands in the named script file.

Example `script.txt`:

```
port 1.1.1
description port 1
```

Loading and running `script.txt`:

```
fiberdriver# tftp get script.txt
Fetching script.txt from 10.1.1.19...
Copying...
fiberdriver# show 1.1.1
Port: 1.1.1
Name: RS232 at 1.1.1

Enable: enable

Connector: cu Db9

fiberdriver# source script.txt
fiberdriver# show 1.1.1
Port: 1.1.1
Name: port 1

Enable: enable

Connector: cu Db9

fiberdriver#
```

5.5.20.3. Restoring a Saved Configuration

Beginning with EM316LNXNM-OT v4.5, the "**source**" command does not process script command lines that reset default values. Previous versions simply processed each script line sequentially. Contact customer support if scripts behave differently after upgrading EM316LNXNM-OT versions.

To return a module configuration to a specific saved state, follow the steps below.

Save Configuration

1. Use the "**write file**" command to save the module configuration
2. Note the module hardware settings (necessary for most recent Fiber Driver products)

Restore Configuration

1. Set module hardware to the setting when the configuration was saved (recent Fiber Driver modules)
2. Use the "**default all**" command to configure default settings (hardware-dependent in recent Fiber Driver modules)
3. Use the "**sync**" command to wait for all defaults to reset
4. Use the "**source [config-file]**" command to restore the non-default system configuration

5.5.21. LNXNM Firmware Upgrades

Use the "**`write file`**" command to make sure that the "`startup-config`" file is current and matches the running configuration.

Backup the "`startup-config`" file by using the "**`tftp put A.B.C.D startup-config remote-file-name`**" command, where *`A.B.C.D`* is the address of your external TFTP server. A backup makes it easier to go back to the previous software version if you have problems with the new software. See "Firmware: Upgrade" for more information.

When the system software is working properly, upgrade process is simplest with a TFTP server on a PC. Setup the external TFTP server and use **`upgrade`** command to update the EM316LNXNM software. This "upgrade" command may run for a minute or more. If not specified, the **`upgrade`** command retreives the file "`uImage.initrd`" by default. If security is important, then use **`upgrade scp`**, where "scp" means 'Secure Copy'.

```
fiberdriver# upgrade 169.254.192.116 uImage.initrd
Fetching uImage.initrd from 169.254.192.116...
```

Use SCP to upgrade the system with the command:

```
fiberdriver# upgrade scp user@10.1.120.16 filename
fetching filename ...
Password:
filename                                    100% 4978KB 551.0KB/s   00:08

Erasing Flash: Erased!

Writing image: Software updated!
all done!
fiberdriver#
```

SSH uses RSA keys, which the system may not know at the time of executing an SSH command. Therefore, the system may ask you to acknowledge the authenticity of any host being contacted the first time. Also, the Linux NM does *not* have a DNS client, so you must use an actual IP Address (e.g. *`192.168.1.1`*) for SSH remote hosts.

To restart the system, use one of the following commands:

- To re-start the LNXNM and all line cards, reload firmware and configuration settings as show below.

```
fiberdriver# restart cold
Waiting for processes..ok
Restarting system
```

- To re-start the LNXNM but not reload firmware or configuration settings:

```
fiberdriver# restart warm
Waiting for processes..ok
Restarting system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login:
```

- To re-start the LNXNM and reload firmware only, but not reload configuration:

```
fiberdriver# restart upgrade
Waiting for processes..ok
Restarting system
```

If the EM316LNXNM does not start after an upgrade process, the normal boot process can be interrupted to download a valid "uImage.initrd" file from a TFTP server. See the "Recovering from a failed 'upgrade' command" section in the Troubleshooting chapter.

5.5.22. LNXNM Firmware Downgrades

Before *upgrading* the system software, always make a backup of the current `"startup-config"` file. This backup may be used to *downgrade* the EM316LNXNM to this previous version of software, if necessary.

To back up the current `startup-config` file:

```
fiberdriver# write file
Building configuration file...
OK, saved to startup-config
fiberdriver# tftp put 10.1.1.15 startup-config saved-startup-config
putting startup-config ...
TFTP finished!
fiberdriver#
```

See "Firmware: Upgrade" for more information.

Procedure 5.1. Downgrading LNXNM software

Configure the TFTP server with the required files. Required files should include current LNXNM software (`uImage.initrd`), old LNXNM software (`old-uImage.initrd`), and old startup-config file (`old-startup-config`).

1. **Load the current version of software**

   Skip this step if you are already running the current version of the software.

```
fiberdriver# upgrade
Erasing Flash: Erased!

Writing image: Software updated!
all done!
fiberdriver#
```

2. **Restore the previous version of `"startup-config"`**

   To be sure that your `"startup-config"` file contains commands compatible with the older version of software, restore the `"startup-config"` file with the working copy before upgrading. Use the "**`tftp get`**" command:

```
fiberdriver# tftp get 10.1.1.15 old-startup-config startup-config
Fetching old-startup-config from 10.1.1.15...
Copying...
fiberdriver#
```

   Do not execute "**`write file`**" after restoring the `"startup-config"` from `old-startup-config`. That command would overwrite the newly restored `"startup-config"`.

3. **Load old version of software**

   Follow the same steps used in the "Firmware: Upgrade" section to downgrade your NM card to the desired version of software.

```
fiberdriver# upgrade 10.1.1.15 old-uImage.initrd
fetching old-uImage.initrd ...

Erasing Flash: Erased!

Writing image: Software updated!
all done!
fiberdriver#
```

4. **Reboot!**

   Use the "**`restart upgrade`**" command to reset the NM card and reload the operating software without interrupting module (or blade) function. Note that "restart upgrade" is equivalent to LNXNM hot-swap.

```
fiberdriver# restart upgrade
Waiting for processes..ok
Restarting system
```

Chapter 6. Configuration Context

...LNXNM envirnonment setup in the CLI

The configuration context is used to set up system and environment parameters. For a list of commands available in this (or any) context, type '?' after the command prompt.

```
fiberdriver(config)# ?
  aaa             Remote authentication/authorization/accounting
  chassis         Configure a chassis
  default         Restore parameter(s) to defaults
  echo            Display text for scripting
  end             End current context and go down to initial command context
  exit            Exit current context and go down to previous context
  firmware        Onboard firmware manipulation
  flush           Wait for changes to be flushed to hardware
  foreach         Execute a command on a set of objects
  group           Group configuration
  ip              IP Configuration
  list            Print command list
  log             Logging configuration
  logout          Logout of the system
  map             Configure port map
  no              Negate a command
  ntp             Enable NTP
  ntp-server      NTP server configuration
  pager           Pause scrolling when screen is full
  port            Configure a port
  quit            Exit current context and go down to previous context
  scp             Use SCP to transfer files (small config files only)
  show            Show running system information
  sleep           Pause CLI for scripting
  slot            Configure a slot
  snmp-server     SNMP server configuration
  sync            Wait for changes to be flushed to hardware / display
  sys             System configuration
  terminal        Set current terminal parameters
  username        User account management
  who             Find out who is connected to the system
  whoami          Who am I?
  write           Write running configuration to memory or terminal
fiberdriver(config)#
```

Use the **`list`** commnand to display all the complete commands available.

The "?" character may also be used on the command line after a valid command in the box above. The display shows the valid parameters that may be used following the specified command. If the given parameter does not complete the command line, then another "?" may be used to display the list of valid options for the next parameter on the command line.

6.1. Storage of Configuration Parameters

The device has a Non-Volatile RAM (NVRAM) to store configuration parameters. The "`startup-config`" file contains device configuration parameters. This file is simple text, readable with any text editor. It contains a list of the CLI commands required to bring the box from the known default condition to the desired running condition.

The manager does not automatically save the current running configuration. Use the "**`write file`**" command to save current parameters to the "`startup-config`" file and use them when the system restarts.

6.2. Restoring Default Parameters

Use the default command to discard changes applied to the module configuration. The example below illustrates returning the entire module to the original factory defaults. Use the "?" after the default command or refer to EM316LNXNM-OT documentation for parameters to reapply only selected default values including individual port settings.

```
fiberdriver(config)# default?
  default  Restore parameter(s) to defaults
fiberdriver(config)# default ?
  C            Chassis
  C.S          Slot
  C.S.P        Port
  aaa          Remote authentication/authorization/accounting
  ip           IP Configuration
  log          Logging configuration
  ntp          Restore ntp to its default state
  snmp-server  SNMP server configuration
  sys          System configuration
fiberdriver(config)# default 1
Restored defaults for 1.
Removed configuration for 1.

fiberdriver(config)#
```

6.3. Configuring System Parameters

Enter "configuration" mode, as shown below, to configure the system parameters. The prompt changes to reflect the current command context.

```
fiberdriver# configure terminal
```

Commands are completed with the -CR- or -Enter- key, which does not display or print.

Change the SUPER user password using the 'username' command.

```
fiberdriver(config)# username admin password -new password-
```

Set IP address and netmask information using the following command:

```
fiberdriver(config)# ip interface 192.168.88.114/24
```

The IP address (192.168.88.114) and netmask (255.255.255.0) above are examples only. Use IP parameters appropriate for your network.

Set specific gateway information using the following command:

```
fiberdriver(config)# ip default gateway 192.168.88.1
```

The new IP information configured does not load until restarting the system or using the command:

```
fiberdriver(config)# ip interface update
```

Use the following command to save the configuration into permanent (non-volatile) storage:

```
fiberdriver(config)# write file
fiberdriver(config)# exit
```

The system does not automatically save configurations to permanent storage. Use the write file command to save a configuration before restarting the system. Now the IP configuration is complete.

The default SNMPv1 and SNMPv2c community names are "**public**" for read and "**private**" for write. You can reset the SNMP community strings using the "**snmp-server community**" command. SNMPv3 configuration information is provided later in this manual.

```
fiberdriver(config)# snmp-server community read readsecret
fiberdriver(config)# snmp-server community write writesecret
fiberdriver(config)#
```

Use the "**description**" command to change names of the chassis, slot, and port. Use the **show** command to verify the change. Chassis names are limited to nine characters.

6.4. Dynamic IP (DHCP)

The EM316LNXNM-OT supports Dynamic Host Control Protocol (DHCP) for convenient IP configuration. The DHCP client automatically requests IP configuration values from a local DHCP server. These values are applied when the LNXNM boots, and may change if the IP connection resets.

The box below shows the syntax help for the **`ip`** command in the config context.

```
fiberdriver(config)# ip ?
  default-gateway - Set default gateway
  gratuitous-arp  - Send broadcast gratutitous ARP when IP address changes or network
 comes up
  interface       - System interface configuration
  ssh-server      - Enable ssh server
  tables          - iptables configuration
  telnet-server   - Enable TELNET server
  web-server      - Enable web server
fiberdriver(config)# ip interface ?
  A.B.C.D   - IP address
  A.B.C.D/M - IP address/prefix length
  dhcp      - Enable DHCP
  update    - Apply administrative interface configuration to operational
  vlan-id   - Set 802.1q VLAN ID (0 to disable). Will not take effect until next cold-
restart
fiberdriver(config)# ip interface dhcp ?
  <cr>
  >    - Redirect output to a file
  >>   - Append output to file
fiberdriver(config)#
```

Use the **`ip interface dhcp`** command to enable automatic IP addressing.

```
fiberdriver# ip interface dhcp
```

Use the **`no ip interface dhcp`** command to disable automatic IP addressing.

```
fiberdriver# no ip interface dhcp
```

Use the **`show ip interface`** command to display the IP network settings.

```
fiberdriver# show ip interface
Desired IP Interface Configuration:
 DHCP enabled
 Internet Address: 192.168.72.72
 Netmask: 255.255.255.0
 Broadcast: 192.168.72.255
 Default Gateway: 192.168.73.73
 802.1q VLAN ID: unconfigured

Actual IP Interface Configuration:
 DHCP enabled, lease time: 1209600 seconds, server ID: 192.168.11.21
 Internet Address: 192.168.12.105
 Netmask: 255.255.255.0
 Broadcast: 192.168.12.255
 Default Gateway: 192.168.12.1
 802.1q VLAN ID: unconfigured

fiberdriver#
```

With DHCP enabled, changes applied to IP parameters display in the "Desired" section at the top of the display. DHCP manages the "Actual" IP interface configuration until it is disabled. Desired IP interface configuration is applied when DHCP is disabled.

For IP parameter configurations not discussed in this manual, consult the local network administrator. Misconfigured IP parameters can interrupt network communication and services.

6.5. Configuring the Prompt

The default login prompt for the EM316LNXNM is:

```
fiberdriver#
```

There are two ways to change the EM316LNXNM prompt string:

1. CLI command

2. SNMP sysName SNMP object (OID .1.3.6.1.2.1.1.5) - see SNMP section

From the CLI configuration prompt, use the command below to change the CLI prompt string:

```
fiberdriver(config)# snmp-server sys name someprompt
someprompt(config)#
```

The prompt cannot include the characters "#", "$", "(", or ")". The CLI prompt maximum length is 40 characters. Additional characters in the new prompt string are ignored. The SNMP sysName string limit is 255 characters, but only the first 40 characters are displayed.

The command "**`default snmp-server sys name`**" returns the prompt to the default, as shown below:

```
OLD-PROMPT(config)# default snmp-server sys name
fiberdriver(config)#
```

6.6. Editing the Login Banner

Unless changed, you will see the following banner when you login to the LNXNM:

```
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login:
```

The box above shows the default EM316LNXNM login banner. The banner may be changed, and can contain up to 256 characters including newline. There are two ways to change the LNXNM Banner: by single command or interactively.

Single Command

Use the command below from the configuration prompt to change the EM316LNXNM prompt. STRING is the new banner text to apply. If you want to insert a tab Use the "**\t**" sequence to insert a tab within the string. Use the "**\n**" sequence to insert a newline within the string.

```
fiberdriver(config)# sys login-banner STRING
fiberdriver(config)#
```

For example, "**sys login-bannner First Line \n Second Line**" displays the following on login:

```
First Line
Second Line login:
```

Interactive Changes

Use the command command below from the configuration prompt to enter the EM316LNXNM prompt editor. Next, type the exact banner text you wish to use. Start a new line with the <Enter> key. End the banner entry with a new line containing only "**.**" followed by <Enter>, or a new line with only <^D> (Ctrl+D).

```
fiberdriver(config)# sys login-banner
Enter banner (. or ^D alone on a new line to end):
> This is my login banner.
> This is the second line of my login banner.
> .
done!
fiberdriver(config)#
```

Removing the LNXNM banner

Use the "**`no sys login-banner`**" command from the configuration prompt to delete the banner. Only "`login:`" displays when the EM316LNXNM session starts.

Returning the LNXNM banner to default

From the configuration prompt, use the command "**`default sys login-banner`**." The default banner string is at the beginning of this section.

Displaying the current LNXNM banner

Use the "**`show sys login-banner`**" command from the configuration prompt to display the literal banner text, as shown below:

```
fiberdriver(config)# show sys login-banner
Login Banner: \nMRV EM316LNXNM\n\n
fiberdriver(config)#
```

The following characters may be used in the banner editor: **`0-9, A-Z, a-z, <Tab>,`** or one of "**`!"#$%&'()*+,-./:;<=>?@[\]^_`{|}~`**". All other characters are converted to "?".

6.7. Users, Classes, Groups, and Access

User accounts include a username, a password, and an access class that determines the commands available to each user. The three access classes and general permissions are:

Class	Permissions
Super	Full access to all commands
Normal	Access to non-sensitive show/config commands
View	Access to non-sensitive show commands

"Non-sensitive" commands cannot have a fatal impact on managing the system and cannot reveal sensitive information such as passwords and community strings.

"Super" access allows users to add, remove, or change access to user accounts.

Change the active user in a CLI session by using logging out and logging back into the CLI with the other username and password.

A Super class user does not need to know the password of a user to change or delete the account. If a Normal or View user forgets his password, a Super user can set a new password for the user by using the "**`user password`**" command. Passwords must have *strong* security. (See "Password Strength" below.) The factory default Super user account is "admin" with the default password "admin", which is the only exception to the password strength rules.

Remember the super user password when it changes, and safely record it in a secure location.

6.7.1. Adding and Removing Users

Create separate users and groups for better administrative security. Each user account includes a username, a password, and an access class. The only factory default user account is "admin", with password "admin" and class "Super".

Other users may be added and managed from any account in the "Super" class. The account access class determines the commands available to each user.

Use the "**username**" command to create a user:

```
fiberdriver(config)# username jsmith password goodfella2 class normal
```

Use the "**no username**" command to remove a user:

```
fiberdriver(config)# no username jsmith
```

The CLI help display below gives the command description. The "list" command shows all the command line options.

```
fiberdriver(config)# username?
  username - User account management
fiberdriver(config)# username ?
  NAME - User name
fiberdriver(config)# list username
  username NAME
  username NAME class (debug|view|normal|super)
  username NAME group NAME
  username NAME groups WORD
  username NAME password
  username NAME password PASS
  username NAME password PASS class (debug|view|normal|super)
  username NAME password class (debug|view|normal|super)
  username NAME password encrypted PASS
  username NAME password encrypted PASS class (debug|view|normal|super)
fiberdriver(config)#
```

Use the "?" after any portion of an incomplete command to display the options for the next argument on the command line.

User name rules:

- must be 1 to 32 characters long
- must start with the following characters: a-z or _
- must only contain the following characters: a-z, 0-9, -, or _

Group name rules:

- must be 1 to 16 characters long
- must start with the following characters: a-z or _
- must only contain (except for the one exception below) the following characters: a-z, 0-9, -, or _
- may end with the following character: $

There must always be at least one SUPER class user configured in the system. If there is only one SUPER class user on the system, it cannot be deleted. Even the built-in "admin" user may be deleted if another SUPER user is added first.

The example below adds a new user "david2" with the password "david2pw".

```
fiberdriver(config)# username david2 password david2pw
fiberdriver(config)#
fiberdriver(config)#
fiberdriver(config)# show users
username admin password encrypted $1$kQ2rIq/$Ob8wFa235XC4TnN7wJ/ class super
username admin groups all
username david2 password encrypted $1$ER4TU/7.$m/4mcdXwlOjM/LVEHW.
fiberdriver(config)#
```

The system does not automatically save configurations to permanent storage. Use the write file command to save a configuration before restarting the system. Unsaved changes are lost, including new user accounts!

6.7.2. Password Strength

Descriptive error messages give helpful information when a password does not meet the system requirements. Passwords created must meet be:

- at least 6 characters long
- at least one alphabetic character
- at least one non-alphabetic character

The commands below remove and re-apply the password strength restrictions above.

```
fiberdriver(config)# no sys password-strength-checking
fiberdriver(config)#
fiberdriver(config)# sys password-strength-checking
```

6.7.3. Protecting Passwords

The most recent commands entered in a CLI session may be viewed by using "**show history**". If passwords are typed as part of a command line, then these passwords are visible in the command history log. Log out of CLI sessions after password changes are made to clear the command history.

```
fiberdriver(config)# username foouser password foouser1 class super
fiberdriver(config)# show history
configure terminal
username foouser password foouser1 class super
fiberdriver(config)# logout
```

Another way to hide displayed passwords is by using commands that prompt for separate password input. When the passwords are entered interactively as in the example beloow, the system does not display or save them in the command history.

```
fiberdriver(config)# username foouser password
Password:            — Password not echoed to screen
Again:               — Password not echoed to screen
fiberdriver(config)# username foouser class super
fiberdriver(config)# show history
configure terminal
username foouser password
username foouser class super
fiberdriver(config)#
```

Some CLI commands (like the ones listed below) inlcude passwords in their syntax. Most of these commands have alternative syntax that prompt for passwords interactively and hide them from the display and history.

- fiberdriver(config)# **snmp-server community read**
- fiberdriver(config)# **snmp-server community write**
- fiberdriver(config)# **snmp-server user *foouser***
- fiberdriver(config)# **username *foouser***
- fiberdriver(config)# **username *foouser* password**

6.7.4. Groups

Limiting the privileges of users increases system security and integrity. User classes provides a very general measure of security. Groups provide more specific control over two types of user permissions:

1. *Port/Slot/Chassis Control*

   ...which Fiber Driver components can each set of users manage

2. *Login Access*

   ...which user interfaces each set of users is allowed to login through:
   - console
   - telnet
   - ssh
   - api
   - gui

   These interface permissions may be granted all together using the keyword "all", or they may be denied together using the keyword "none".

The default group "all" has full access to all system resources.

6.7.5. Port/Slot/Chassis Control

The CLI controls user access to Fiber Driver components through group permissions. Each group is assigned read, read/write, or no access to each manageable component in the system. A user can be a member of any or all the available groups. The one factory default group, called "**all**", has read/write access to all possible ports. The "**admin**" username is assigned to group "**all**", so this user can access and change the configuration of any port on the system.

To add a user to a group (from "configuration" context):

```
fiberdriver(config)# username USERNAME group GROUPNAME
fiberdriver(config)#
```

To remove a user from a group:

```
fiberdriver(config)# no username USERNAME group GROUPNAME
fiberdriver(config)#
```

To configure the READ port membership of a group:

```
fiberdriver(config)# group GROUPNAME read 1.1.1
fiberdriver(config)#
```

To remove that access privilege:

```
fiberdriver(config)# no group GROUPNAME read 1.1.1
fiberdriver(config)#
```

Similar commands exist for read/write access rights. Use "**write**" instead of "**read**" in the above commands. The system checks chassis, slot, and port access rights on each command. If a user has permission to manage a system component through a "chassis", "slot", or "port" access configuration, then the user can access the component. Read and read/write access rights are stored separately. Each port, slot, or chassis read or write access must be allowed through a specific component access right.

For example, consider the following sequence of commands:

```
fiberdriver(config)# username guest group read-group
fiberdriver(config)# username guest group guest-group
fiberdriver(config)# username admin group write-group
fiberdriver(config)# group read-group read 1
fiberdriver(config)# group guest-group write 1.1
fiberdriver(config)# group guest-group write 1.2.1
fiberdriver(config)# group write-group write 1
fiberdriver(config)#
```

This will allow "admin" full read/write access to every port on the chassis. User "guest" will be able to read every port on the chassis, and will also be able to configure ports on slot 1.1, and will be able to configure port 1.2.1, but will not be able to configure any other port.

6.7.6. Login Access

User groups may be used to restrict access to the various interfaces to the management system. There are five interfaces supported by the EM316LNXNM manager:

- Console
- SSH
- Telnet
- API
- GUI

A group may be granted or denied permission to use each of these management interfaces. By default, new groups (and users) have no access restrictions. For convenience, all these access permissions may be granted or denied together with the two key words below:

- any
- none

The screen shot below shows the CLI help ("?") display for a group called "b":

```
fiberdriver(config)# group b access ?
 any  Enable access via any service
 api  Enable api service access
 console Enable console service access
 gui  Enable pathfinder service access
 none  Remove access via any services
 ssh  Enable ssh service access
 telnet  Enable telnet service access
fiberdriver(config)#
```

Group permissions may be added or removed by any SUPER user. Each user account is denied access to an interface only if no associated group allows that access. If a user belongs to two groups and one of those groups allows API access, for example, then the user can access management through the API.

The commands below add, remove, and reset access privileges for the specified "GROUP":

group GROUP access (any|none|console|telnet|ssh|api)
no group GROUP access (any|console|telnet|ssh|api)
default group GROUP access

Each interface access may be restricted to some or all groups. If a group with SUPER class members is assigned no ("none") access, those SUPER class members are granted FULL ("any") access to all interfaces. This exception protects agains possibly locking out SUPER class control from the system, but it may be opposite from the intended effect for any SUPER class users in a fully restricted group. Note a SUPER class user may be restricted from SOME interfaces, but not from ALL interfaces.

6.7.7. Access by Address

The Linux kernel in the network manager (NM) supports the standard **iptables** command. Access to the NM may be granted or denied based on IPv4 or MAC addresses through packet filtering and network address translation (NAT).

The **ip tables** command is complex with many command line arguments. The command syntax options are listed below. Refer to online documentation (e.g. http://www.netfilter.org) for more information.

- **ip tables -[AD] chain rule-specification [options]**
- **ip tables -I chain [rulenum] rule-specification [options]**
- **ip tables -R chain rulenum rule-specification [options]**
- **ip tables -D chain rulenum [options]**
- **ip tables -[LFZ] [chain] [options]**
- **ip tables -N chain**
- **ip tables -X [chain]**
- **ip tables -P chain target [options]**
- **ip tables -E old-chain-name new-chain-name**

By default, access is open to all IP and MAC addresses.

To return **iptables** to the default configuration, type **default ip tables**.

To display the **iptables** configuration, type **show ip tables**.

6.7.8. Forcing User Logouts

Super class users can force logout of a user currently logged into the system. There are two situations to address.

First, a particular connection may be locked or another user may require access from that location. A Super user can end the session of the user currently connected at that point without affecting other connections. Use the "**who**" command to find the process identification (PID) number for the command argument.

Disconnect a specific session or sessions:

```
sys disconnect pid PID
```

Second, a rogue user may be logged into the system through multiple connections. All connections belonging to this user can be terminated by a Super user.

Disconnect a user's session(s):

```
sys disconnect user USER
```

Disconnecting a specified user's sessions can be also be limited to an access interface type listed below:

COMMAND	FUNCTION
sys disconnect user USER api	Disconnect user from all API sessions
sys disconnect user USER console	Disconnect user from serial console
sys disconnect user USER ssh	Disconnect user from all ssh sessions
sys disconnect user USER telnet	Disconnect user from all telnet sessions
sys disconnect user USER gui	Disconnect user from all gui sessions

6.8. EM316LNXNM Reboot

There are three commands to reboot the EM316LNXNM:

- "**`restart upgrade`**"
- "**`restart warm`**"
- "**`restart cold`**"

The "**`restart warm`**" command restarts the current version of the software. The EM316LNXNM will not reconfigure line cards that support hot-swap.

The "**`restart upgrade`**" simulates unplugging and re-plugging the EM316LNXNM in the chassis. It reloads the software from flash memory, but it does not reconfigure modules that support hot-swap. Ensure that the running configuration and the "`startup-config`" remain synchronized after the restart is completed by running "**`write file`**" before using the "**`restart upgrade`**".

The "**`restart cold`**" simulates a power cycle to the entire chassis. The EM316LNXNM reloads its software from flash, and it reconfigures all modules according to `startup-config`. Use this command to ensure that the configuration in "`startup-config`" is applied to the hardware.

6.9. Configuration Backup and Restoration

Once the device is configured with proper parameters, backup the configuration file on a remote tftp-server. Use "**`tftp put`**" to make a copy of the "`startup-config`" file on a remote tftp-server. If necessary, restore the "`startup-config`" on the same EM316LNXNM or a replacement card. Use "**`tftp get`**" to copy "`startup-config`" from the external tftp-server on to the EM316LNXNM. Use a different chassis (even a 1-slot chassis) to restore EM316LNXNM system settings to avoid the risk of disturbing the traffic flow in the target chassis.

Make sure that the right "`startup-config`" is programmed into the replacement EM316LNXNM. Then, unplug the old EM316LNXNM from the live chassis and replace it with the new EM316LNXNM (hot-swap). The swap will not disturb the traffic flow through the other modules in the chassis.

6.10. Module Replacement and Type-Locking

By default, there are no restrictions between slots in a system chassis for slot devices (modules or blades) that are supported by the chassis. Once configured for a specific application, use the following command to restrict each slot in the Fiber Driver chassis to allow only the currently installed device type.

```
fiberdriver# configure terminal
fiberdriver(config)# sys lock-types
fiberdriver(config)#
```

Once locked by the command above, each system slot will initialize only the associated device type. To return to the default state, unlock all slots in the chassis with the command below:

```
fiberdriver# configure terminal
fiberdriver(config)# no sys lock-types
fiberdriver(config)#
```

To unlock only one slot in the chassis and install any supported device into that slot, use the command below in the target slot context:

```
fiberdriver(slot/1.s)# clear-type
fiberdriver(slot/1.s)#
```

When removing and inserting slot devices in a chassis, the LNXNM uses the following initialization rules:

- With type-locking enabled, a slot device may be replaced only with the same device type; the system rejects any other device type in the same slot. The "**`clear-type`**" command releases the slot as if it was not previously occupied. The "**`no sys lock-types`**" command releases all the slot type restrictions.
- When type-locking is disabled, a slot device may be replaced with any supported device type. The system discards any previous module configuration, and it initializes the new card to its default settings.
- When replacing a slot device with the same type in the same slot, the LNXNM manager initializes the new device with the current saved configuration for that slot. Type-locking does not matter, in this case.
- If a slot has never been occupied, then the LNXNM initializes a newly installed module to its default settings. If type-locking is enabled, the slot restricts future replacement devices to the installed type.

Configuration commands for hardware that is not yet installed allows setup of slot devices before plugging them in. Any configuration may be entered, but options that are not supported by the new device are dropped. Only the applicable commands are used to initialize the new device.

The running configuration may also include information for devices that have been removed from the system. Saving this information is very useful when replacing the old device with the same model. If the previous module configuration is no longer needed in a slot, the administrator can remove the slot entries from the **`show running-config`** display by using the "**`clear-type`**" command in the target slot context.

6.11. Restoring Parameters (Restart / Hot-Swap)

When the managed system is booted, the management module (EM316LNXNM) reads the 'startup-config' file into its memory area called the configuration storage layer (CSL). These stored parameters form the starting point for the running configuration of the application modules in the system.

Next, the EM316LNXNM sequentially interacts with each manageable application module installed in the system.

If the module was not previously configured, then the EM316LNXNM writes the corresponding CSL values into the module configuration. This module is marked as 'configured' for the next boot sequence and the stored parameters will take precedence over the CSL values. The EM316LNXNM then looks for the next installed module until all the manageable modules in the chassis are configured.

If the module was previously configured, then the EM316LNXNM tries to read the operating parameter values from the module. The EM316LNXNM stores configuration values successfully read from each module into the CSL, overwriting the corresponding values read from the 'startup-config' file.. If a value is not readable, then the EM316LNXNM uses the value already stored in the CSL without overwriting the values in the module. The EM316LNXNM then looks for the next installed module until all the manageable modules in the chassis are configured.

The above process is very reliable, but an operational anomaly could cause the EM316LNXNM to read a previously configured module as unconfigured. Such a reading anomaly would cause the EM316LNXNM to overwrite the module configuration with the CSL values. This theoretical situation is suggested only as a reminder to back up system configurations and to document critical parameter values.

6.12. Message Logging

The EM316LNXNM can display log messages on a CLI terminal, send syslog messages, and send SNMP traps in response to certain conditions detected by the system. The default parameters configure these message logging options for the most common applications.

To change the default setting for displaying log messages to a CLI user, use the "**log level running**" command shown below.

```
fiberdriver(config)# log level running info
fiberdriver(config)# show log
 Running Level: info
 Nvram Level: disabled
 Trap Level: warning
 Email Level: disabled
 Remote Server: 0.0.0.0
 Remote Level: memo
fiberdriver(config)#
```

To specify the remote syslog server address, use the "**log remote-server**" command. To change the remote syslog message level, use the "**log level remote**" command.

```
fiberdriver(config)# log remote-server 192.168.11.20
fiberdriver(config)# log level remote info
fiberdriver(config)# show log
 Running Level: info
 Nvram Level: disabled
 Trap Level: warning
 Email Level: disabled
 Remote Server: 192.168.11.20
 Remote Level: info
```

To stop sending messages to the remote syslog server, use the "**no log remote-server**" command or the "**no log level remote**" command.

```
fiberdriver(config)# no log remote-server
fiberdriver(config)# no log level remote
fiberdriver(config)# show log
 Running Level: info
 Nvram Level: disabled
 Trap Level: warning
 Email Level: disabled
 Remote Server: 0.0.0.0
 Remote Level: disabled
fiberdriver(config)#
```

An event can trigger an SNMP trap to one or more remote SNMP managers. A network administrator can receive immediate notification of these events through a manager GUI like MegaVision™. Specify the SNMP trap manager address with the "**snmp-server host**" command. Change the default setting for trap message level with the "**log level trap**" command.

```
fiberdriver(config)# snmp-server host 169.254.1.100
fiberdriver(config)# snmp-server host 169.254.1.101
fiberdriver(config)# show snmp-server hosts
snmp-server host 169.254.1.100 public warning
snmp-server host 169.254.1.101 public warning

fiberdriver(config)# log level trap error
fiberdriver(config)# show log
 Running Level: info
 Nvram Level: disabled
 Trap Level: error
 Email Level: disabled
 Remote Server: 0.0.0.0
 Remote Level: memo
fiberdriver(config)#
```

The LNXNM can also use onboard NVRAM to store log messages. Change the log message storage from default to NVRAM with the **log level nvram** command. To preserve the limited space, use the NVRAM logs only as needed for troubleshooting. The manager deletes the oldest messages to make room for new messages. To reduce NVRAM usage, set thresholds to log only messages above desired importance level from "fatal" down to "memo". For best operation, disable the log with the **no log level nvram** command when all problems are resolved.

```
fiberdriver(config)# log level nvram error
fiberdriver(config)# show log
 Running Level: info
 Nvram Level: error
 Trap Level: error
 Email Level: disabled
 Remote Server: 0.0.0.0
 Remote Level: memo
fiberdriver(config)#
```

6.13. Audit Logging

The audit log is a history of changes made in the Fiber Driver system by users. Each change creates an entry that includes the log level, a time stamp, the OID of the object changed, the ID of the user, and the new value of the changed object. All audit log messages have a level of "info".

The audit log messages may be displayed on the monitor (running log) or routed to syslog. An example of a typical audit log message is shown below:

```
 fdrd[119]|kern|   info|Oct 15 15:25:10 1.2.3: cli user admin
set nbsCmmcPortName to newName
```

SNMPv1 and SNMPv2 messages do not include a user name because they use only community strings for identification.

Toggle the audit log on and off with the following commands in the Config context:

```
fiberdriver(config)# sys audit-log
```

```
fiberdriver(config)# no sys audit-log
```

The syslog must be configured to receive "info" level messages to record the audit log messages.

Chapter 7. Managing Fiber Driver Devices

...managing the Fiber Driver components: chassis, slots, and ports

The EM316LNXNM-OT provides management access to Fiber Driver hardware components: chassis, slots, and ports. Factory configurations may work for some applications, but network management is highly recommended. Many applications require interactive configuration access provided by the LNXNM module. Fiber Driver network management provides proactive administration and reduced operating expenses.

The LNXNM provides a command line interface (CLI) that is accessible either through the secure serial port or the Ethernet port. The Ethernet port supports SSH or Telnet connections. SSH provides greater administrative security. The Telnet server is disabled by default to improve security.

7.1. Hardware Contexts

Hardware contexts (chassis, slot, and port) are dependent on the modular components installed in the managed Fiber Driver system. Refer to device-specific documents for individual command details. Use the '?' command line help key to display available options in any context. The hardware contexts are arranged hierarchically under the configuration context for CLI navigation, as described earlier.

7.1.1. Chassis Context

Commands typed at the chassis context prompt without a specified target apply to the entire managed chassis system. In some cases, a command may also apply to all slots and ports included within the chassis. Display the commands available in this context by typing '?' at the prompt, as shown in the example below.

```
fiberdriver(chassis/1)# ?
  chassis            Configure a chassis
  clear-counters     Clear counters for all ports in this chassis
  default            Restore parameter(s) to defaults
  description        Set chassis name
  echo               Display text for scripting
  end                End current context and go down to initial command context
  exit               Exit current context and go down to previous context
  gen-trap           Enable trap generation for the chassis
  list               Print command list
  logout             Logout of the system
  loopback-timeout   Adjust loopback timeout
  map                Configure port map for entire current context
  next               Configure next element
  no                 Negate a command
  pager              Pause scrolling when screen is full
  port               Configure a port
  previous           Configure previous element
  quit               Exit current context and go down to previous context
  show               Show running system information
  sleep              Pause CLI for scripting
  slot               Configure a slot
  sync               Wait for changes to be flushed to hardware / display
  temperature-limit  Adjust high-temperature limit (deg. C)
  temperature-min    Adjust low-temperature limit (deg. C)
  who                Find out who is connected to the system
  whoami             Who am I?
  write              Write running configuration to memory or terminal
fiberdriver(chassis/1)#
```

7.1.2. Slot Context

Commnads typed at the slot context prompt without a specified target apply only to the slot specified in the prompt. In some cases, a command may also apply to all ports included within the module. Display commands available in this context by typing '?' at the prompt.

Slot context command options can vary depending on the module addressed. The example display below shows commands available for a Fiber Driver module.

```
fiberdriver(slot/1.4)# ?
  chassis      Configure a chassis
  clear-type   Clear Type, if locking types
  default      Restore parameter(s) to defaults
  description  Set slot name
  echo         Display text for scripting
  end          End current context and go down to initial command context
  exit         Exit current context and go down to previous context
  list         Print command list
  logout       Logout of the system
  next         Configure next element
  no           Negate a command
  pager        Pause scrolling when screen is full
  port         Configure a port
  previous     Configure previous element
  quit         Exit current context and go down to previous context
  show         Show running system information
  sleep        Pause CLI for scripting
  slot         Configure a slot
  sync         Wait for changes to be flushed to hardware / display
  up           Configure parent element
  who          Find out who is connected to the system
  whoami       Who am I?
  write        Write running configuration to memory or terminal
fiberdriver(slot/1.4)#
```

7.1.3. Port Context

Commnads typed at the port context prompt without a specified target apply only to the individual port specified in the prompt. Display commands available in this context by typing '?' at the prompt.

Port context command options can vary depending on the slot and port type addressed. The example below shows commands available for one type of port.

```
fiberdriver(port/1.4.1)# ?
  chassis      Configure a chassis
  default      Restore parameter(s) to defaults
  description  Set port name
  echo         Display text for scripting
  end          End current context and go down to initial command context
  exit         Exit current context and go down to previous context
  list         Print command list
  logout       Logout of the system
  next         Configure next element
  no           Negate a command
  pager        Pause scrolling when screen is full
  port         Configure a port
  previous     Configure previous element
  quit         Exit current context and go down to previous context
  rm-chassis   Set remote chassis connectivity information
  rm-port      Set remote port connectivity information
  rm-slot      Set remote slot connectivity information
  show         Show running system information
  sleep        Pause CLI for scripting
  slot         Configure a slot
  sync         Wait for changes to be flushed to hardware / display
  up           Configure parent element
  who          Find out who is connected to the system
  whoami       Who am I?
  write        Write running configuration to memory or terminal
fiberdriver(port/1.4.1)#
```

7.1.4. Device Descriptions

The "**description**" command sets a descriptive name for a chassis, slot, or port. Use the "**show**" command to verify device changes. For example, the following command changes the device name from "chassis 1" to "myFDchass":

```
fiberdriver# configure terminal
fiberdriver(config)# chassis 1
fiberdriver(chassis/1)# description myFDchass
fiberdriver(chassis/1)# show
        Model: NC316BU-16
         Name: myFDchass
      Temp(C): 25
  Temp Min(C): 5
Temp Limit(C): 55
fiberdriver(chassis/1)#
```

After entering a command, there may be a delay of several seconds before the action displays in the "**show**" command.

The next command changes a slot description:

```
fiberdriver(config)# slot 1.1
fiberdriver(slot/1.1)# description myslot1.1
fiberdriver(slot/1.1)# exit
fiberdriver(config)#
```

The next command changes a port description:

```
fiberdriver(config)# port 1.1.1
fiberdriver(port/1.1.1)# description myport1.1.1
fiberdriver(port/1.1.1)# exit
fiberdriver(config)#
```

Chassis names are restricted to nine (9) characters.

Slot and port names are restricted to fifty (50) characters.

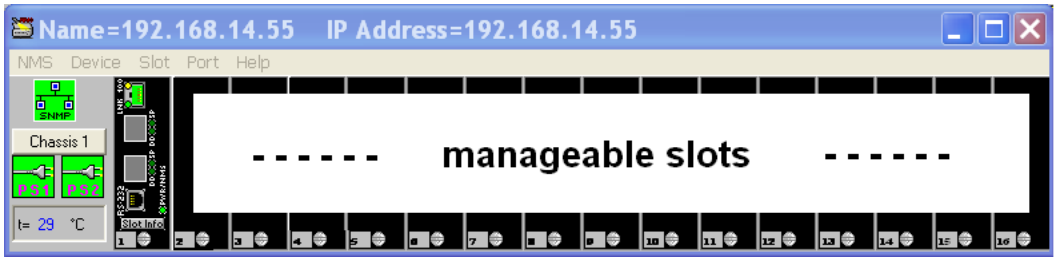
Device descriptions must be unique within the managed system. Duplicate names produce an error message.

Device descriptions cannot "look like" device hardware descriptors (e.g. "1", "1.3", or "1.4.12"). Any name with the form (integer)[.(integer)[.(integer)]] produces an error message, even if an integer is out of range for a chassis, slot, or port in the system.

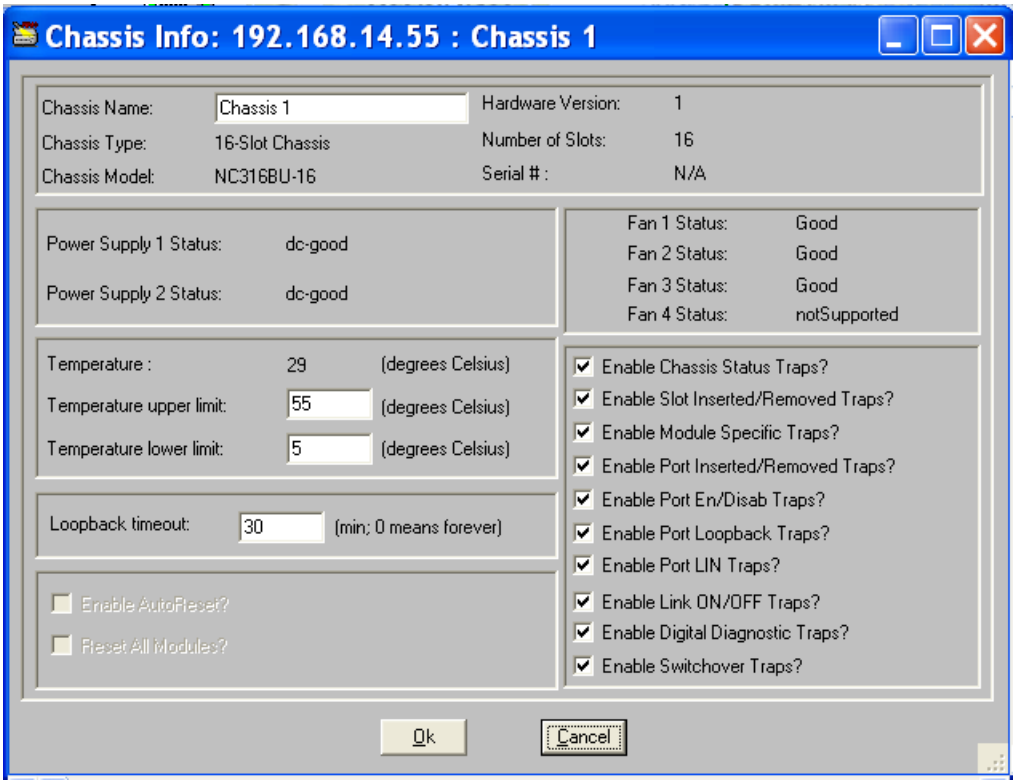
7.2. MegaVision Graphical Management

MegaVision is a general purpose graphical user interface (GUI) for network management with special graphical extensions for MRV networking devices including Fiber Driver. There are several MegaVision variants including a free download (Configurator), an embedded version in the EM316LNXNM-OT firmware, and the full network version (MegaVision Pro). The GUI is extensive and powerful; visit ftp://ftp.mrv.com/pub/software/megavision for information and downloads. Contact MRV sales or support for purchasing and technical questions.

MegaVision presents the administrative controls with a realistic representation of the device. Each Fiber Driver system is controlled by a window that looks like the target physical device. Open the desired network node by double-clicking the icon from the main map window of the MegaVision interface. If the node is a Fiber Driver system, a control window representing the specific chassis model appears. The example below shows the MegaVision control windows for a generic Fiber Driver chassis with a EM316LNXNM-OT in slot 1. There is no restriction between specific slots and hosted devices, so the manager can operate from any available slot in the chassis.

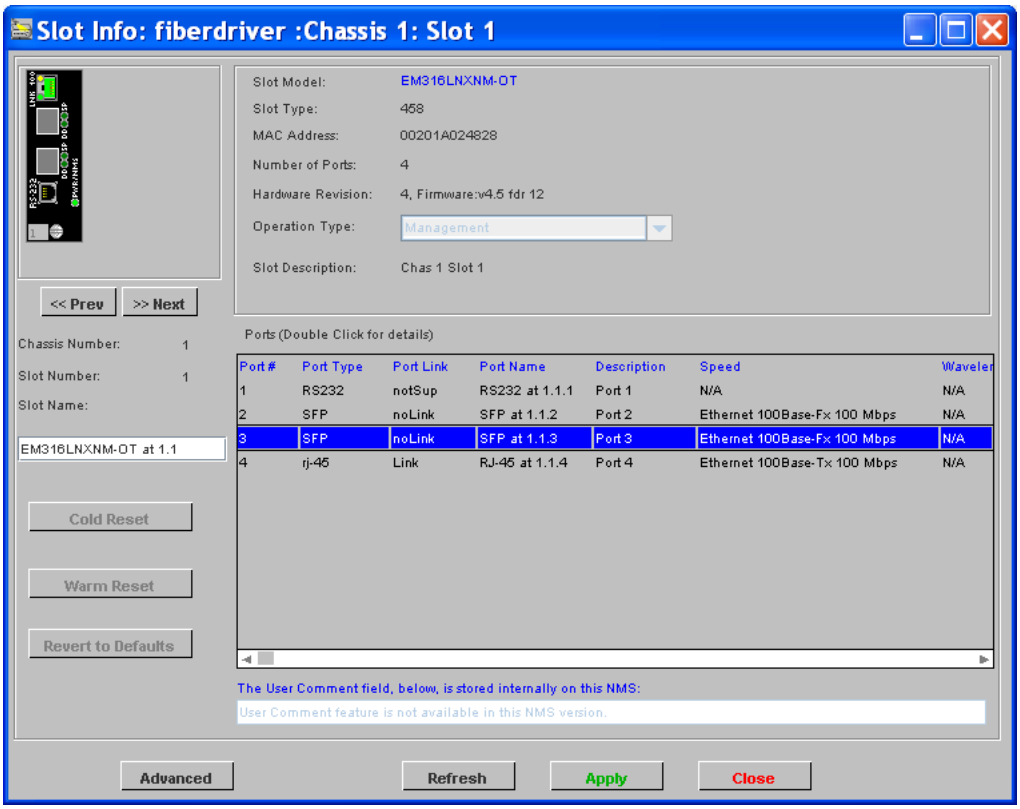


Display chassis details below by clicking the "Chassis 1" button at the left edge of the window.



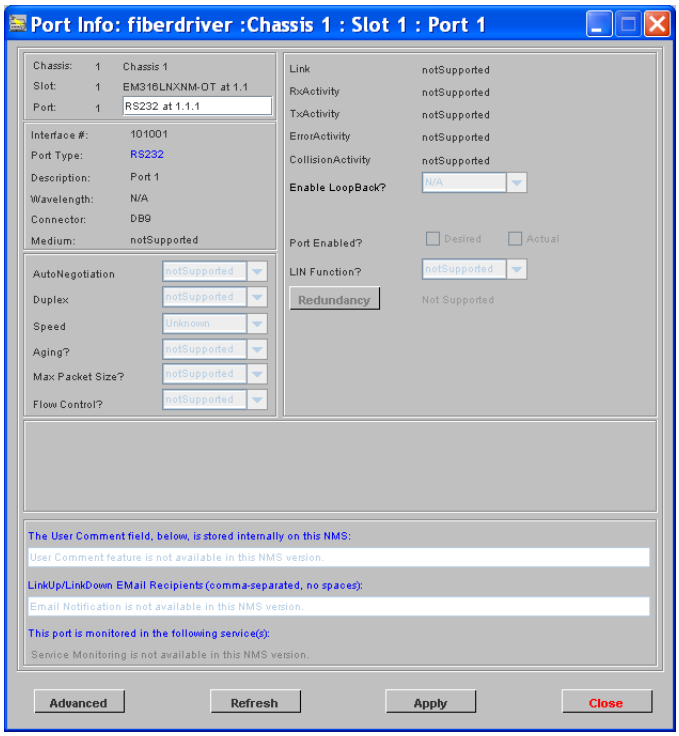
In the example above, the EM316LNXNM-OT resides in the first chassis slot. Open the slot and port management windows by clicking on the corresponding parts of the image in the chassis control window.

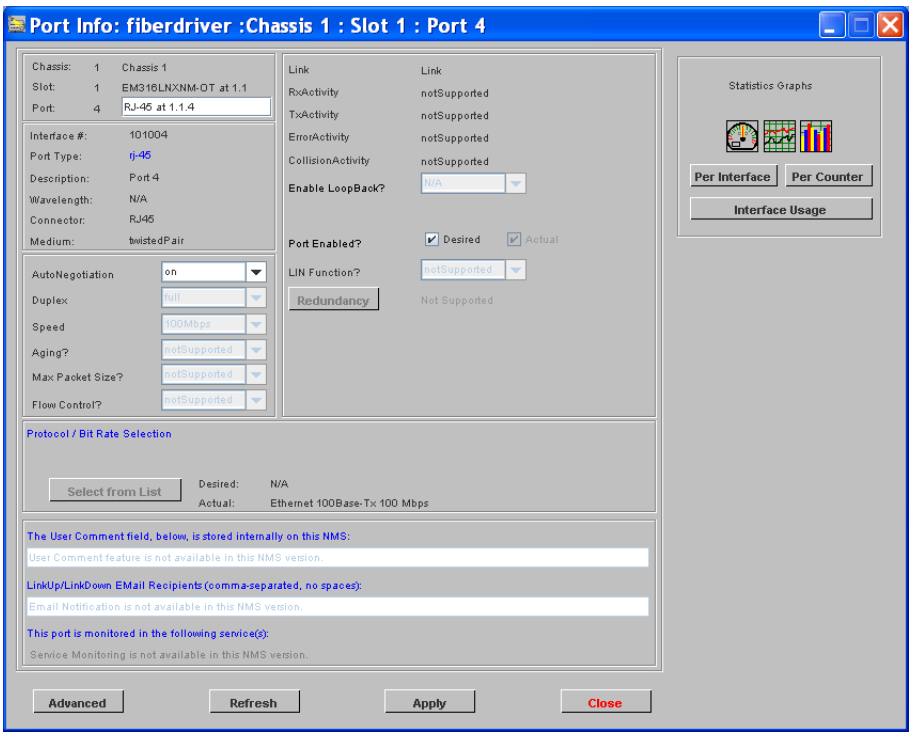
Click on the module front panel or the 'slot info' button to open a module control window like the example shown below. The module control window provides access to slot-level manager commands. The example below shows the EM316LNXNM-OT module itself.



Open the port-level management windows by clicking on the picture of the port in the chassis control window. The parameters, options, and data presented in the window is specific to the port selected. Port operational statistics are reported, and specific port capabilities may be accessed from this window.

The port window examples below show the serial and Ethernet ports on an EM316LNXNM-OT module.





Chapter 8. Foreach

...apply a command sequentially to a list of target components

The "**foreach**" command applies a command sequentially to each component in a specified set of components. If a specified target component does not support the desired command, an error message is generated and the command is applied to the next specified component. Each specified target component that does not support the desired command generates an error message, and the system applies the command to the next specified component. Ports on the network manager module also generate errors.

The component set is designated by individual components or ranges for chassis, slot, and port. The "*" wildcard character may be used to match any existing component ordinal within the command "**LOC**" syntax. The command syntax is described in more detail below.

The "**foreach**" command is available in the configuration context, as show below in the interactive CLI help display:

```
fiberdriver# configure terminal
fiberdriver(config)# foreach?
  foreach - Execute a command on a set of objects
fiberdriver(config)# foreach ?
  LOC - Range of locations, Ex. 1.2-4,9.* or 1.*.3,4, etc.
fiberdriver(config)#
```

The box below shows an example of the **foreach** command:

```
fiberdriver(config)# foreach 1.*.* shutdown
Executing 'shutdown' for '1.1.1'
Executing 'shutdown' for '1.1.2'
Executing 'shutdown' for '1.2.1'
Executing 'shutdown' for '1.2.2'
Executing 'shutdown' for '1.3.1'
Executing 'shutdown' for '1.3.2'
Executing 'shutdown' for '1.4.1'
Executing 'shutdown' for '1.4.2'
Executing 'shutdown' for '1.5.1'
Executing 'shutdown' for '1.5.2'
Executing 'shutdown' for '1.6.1'
Executing 'shutdown' for '1.6.2'
Executing 'shutdown' for '1.7.1'
Executing 'shutdown' for '1.7.2'
Executing 'shutdown' for '1.8.1'
Executing 'shutdown' for '1.8.2'
Ignoring NM port '1.9.1'
Ignoring NM port '1.9.2'
fiberdriver(config)#
```

Notice that the latest version of the **foreach** command ignores ports on the network manager.

The syntax of the **foreach** command is:

```
fiberdriver(config)# foreach LOC command string
```

...where *C*, *S*, and *P* are one of the following:

- "*N*" - single number, matches one number only.

  "Single Number" is the easiest implementation of the "**foreach**" command. For example, "**foreach 1.2.3 *command string***" executes "*command string*" on port 3 of slot 2 in chassis 1.

- "*" - wildcard, matches anything.

  The wildcard character (*) repeats the "**foreach**" command on all sub-components. For example, "**foreach 1.2.* *command string***" executes "*command string*" on all ports of slot 2 in chassis 1. "**foreach 1.*.* *command string***" executes "*command string*" on all ports of all slots in chassis 1.

- "*S-E*" - range that matches from *S* to *E* inclusive.

  The range syntax allows for the inclusion of a continuous span of components. For example, "**foreach 1.2.1-5 *command string***" executes "*command string*" on ports 1, 2, 3, 4, and 5 of slot 2 in chassis 1.

- ", - combine ranges or numbers: *S-E,N,N*

  Include non-sequential components in the "**foreach**" command by specifiying multiple comma-separated ranges. For example, "**foreach 1.2.1-5,10-15 *command string***" executes "*command string*" on ports 1, 2, 3, 4, 5, 10, 11, 12, 13, 14, and 15 of slot 2 in chassis 1.

...and the command string for iteration follows the range of components.

The command string appears as if typed in the context of a specific component. Context sensitive command line completion (<Tab> or question mark help) is not available in the **foreach** command string. An error message displays for each designated component that does not exist or if the command does not apply to that component.

Chapter 9. Network Time Protocol

...synchronizing the system clock with an external reference

9.1. NTP Introduction

Network Time Protocol (NTP) synchronizes the clocks of computer systems communicating in packet-switched, variable-latency data networks. NTP uses UDP port 123 for its transport layer. NTP avoids large time jumps, reversals, and other discontinuities by adjusting the clock incrementally. It makes backward time adjustments by slowing the system clock until the time is correct.

9.2. NTP Server Hosts

NTP requires at least one "upstream" server to synchronize the local time. Add an NTP server host to the EM316LNXNM with the "**ntp-server host *A.B.C.D***" command from the main configuration context. "*A.B.C.D*" represents the IP address of the added NTP server.

```
fiberdriver# configure terminal
fiberdriver(config)# ntp-server host A.B.C.D
fiberdriver(config)#
```

Use one of the many public servers that offer NTP if you do not have any local NTP servers. Avoid using more than five servers.

Check that the NTP servers are added correctly with the "**show ntp-server hosts**" command from the main configuration context.

```
fiberdriver(config)# show ntp-server hosts
ntp-server host 192.168.14.98
ntp-server host 192.168.14.106
ntp-server host 10.1.1.8
fiberdriver(config)#
```

9.3. Enabling/Disabling NTP

NTP is disabled by default. After adding the NTP server hosts and verifying them, enable NTP from the main configuration context with the "**ntp**" command. Add the server hosts before enabling NTP so that the system can set the time most accurately when NTP starts up.

```
fiberdriver(config)# ntp
fiberdriver(config)#
```

Disable NTP at any time with the "**no ntp**" command from the main configuration context. The EM316LNXNM clock may gradually gain or lose accuracy without synchronization.

```
fiberdriver(config)# no ntp
fiberdriver(config)#
```

To change the time, use the "**sys rdate**" or "**sys date**" commands.

To return NTP to the default state, use the "**default ntp**" command from the main configuration context.

```
fiberdriver(config)# default ntp
fiberdriver(config)#
```

9.4. Displaying NTP Status

After some NTP server hosts are set and NTP is enabled, use the "**show ntp**" command from the main configuration context to display the NTP settings.

```
fiberdriver(config)# show ntp
NTP configuration:
Enable: yes
NTP servers:
ntp-server host 192.168.14.98
ntp-server host 192.168.14.106
ntp-server host 10.1.1.8
remote           local      st poll reach   delay      offset   disp
=================================================================
=10.1.1.8        192.168.14.140  16   64    0 0.00000  0.000000 0.00000
=192.168.14.98   192.168.14.140   3   64    1 0.00090  0.001953 2.81735
=192.168.14.106  192.168.14.140  16   64    0 0.00000  0.000000 0.00000
fiberdriver(config)#
```

9.5. NTP with "sys rdate" and "sys date"

If the system time is not synchronized with the configured NTP servers, NTP attempts to drift the system time back to the proper time with incremental changes. The further the time is away from the NTP time, the longer the correction will take.

If NTP sees a time offset of more than 1000 seconds (about 17 minutes), it will *not* drift. The user must manually force the clock within 1000 seconds of the NTP time using commands like "**sys rdate**" or "**sys date**".

When NTP first starts up, it tries once to set the time to the NTP time even if the offset is beyond 1000 seconds. Disable and re-enable NTP to force an NTP time synchronization.

```
fiberdriver(config)# no ntp
fiberdriver(config)# ntp
fiberdriver(config)#
```

At least one NTP server *must* be configured and reachable for NTP to reset successfully and synchronize the EM316LNXNM clock.

Chapter 10. Authentication, Authorization, and Accounting

...users, groups, and policies to secure network administration

Authentication, Authorization, and Accounting (AAA) in a Media Cross Connect includes two server options:

- TACACS+
- Radius

The commands **`TACACS+`** and **`Radius`** control each server type, respetively. Each of these server commands uses the same command line options. The commands and options to secure the Fiber Driver system are described in this section.

Authentication maintains user credentials to access the system. Each user must provide a user name and password. When the remote server authenticates the credentials, the user can access the system.

Authorization maintains specific access rights to the system for each user. The remote server provides the class level to the system. The class level can be VIEW, NORMAL, or SUPER for each user account. The user class provides general access to features associated with the assigned level. Specific elements access rights may be set only on the local system level.

On the local system level, port authorization works in two ways: If the user is specified locally, that user's group assignments are transferred to the remote user for element access. If user is not specified locally, element access is set to a special user named "remote" that transfers its group assignments to the remote user. If neither the accessing user nor the special "remote" user are not present on the system, then the user receives no group assignments.

Accounting is a series of records sent from the system to the remote server to keep track of activities on the system. The system records only when users receive access into the system and when they log out of the system.

General Notes

The system allows up to five ordered servers to be contacted. If the first server does not respond or denies access, then the second, third, fourth, and fifth servers are contacted in order until a server permits access. If no server responds, AAA duties return to the local Fiber Driver EM316LNXNM-OT.

Authentication and accounting are independent processes in the system. Either process may be activated without the other.

10.1. CLI Interface

AAA may be managed through the command line interface (CLI). This section describes the useful commands for both Radius and TACACS+.

10.1.1. Display AAA Status

Use the command **`show aaa`** to display the current AAA status on the system. Use the command **`show aaa remote-server hosts`** to display only the AAA remote hosts.

```
fiberdriver(config)# show aaa
AAA configuration:
 Remote AAA Authentication: enabled
 Remote AAA Accounting: enabled
 Remote AAA Protocol: Radius
AAA remote hosts:
aaa remote-server host 1 192.168.14.12 sharedsecret 0 3 0
aaa remote-server host 2 192.168.14.102 sharedsecret2 0 3 0
```

10.1.2. Choosing a Protocol

Use the command **`aaa protocol`** to select either Radius or TACACS+ security protocols. Radius is the default selection. Once the protocol is selected, all remote server hosts switch to the new protocol. When switching between different AAA environments, delete all previous remote server hosts. (See the "Configuring a Remote Server" section).

The TACACS+ protocol has two variations. The first variation is TACACS+ ASCII, which works with TACACS+ servers that support ASCII (i.e. Cisco Secure ACS Express). The second variation is TACACS + PAP, which works with TACACS+ servers that support PAP (i.e. Tac-Plus UNIX Daemon).

Use the following commands to configure the correct AAA protocol:

- **`aaa protocol radius`**
- **`aaa protocol tacacs-ascii`**
- **`aaa protocol tacacs-pap`**

10.1.3. Configuring a Remote Server

Setting up an AAA remote server is done using the "aaa remote-server host" command. The setup parameters for a server are listed below:

- Server Priority (1-5, where 1 is the highest)
- IP Address
- Shared Secret
- Remote Server Port (Optional)
- Wait Time (Optional)
- Retries (Optional)

Typical configuration of a remote server:

```
fiberdriver(config)# aaa remote-server host 1 192.168.14.12 sharedsecret
```

Once an AAA remote server has been declared, operational parameters (specific to that server) may be individually set (revised) using the "aaa remote-server X" commands listed below.

Set the AAA protocol port (default=0 means the normal port for the chosen AAA protocol):

```
fiberdriver(config)# aaa remote-server <1-5> port <0-65535>
```

Set the number of seconds to timeout a server response (default=3):

```
fiberdriver(config)# aaa remote-server <1-5> timeout <0-10>
```

Set the number of server connection retry attempts (default=0):

```
fiberdriver(config)# aaa remote-server <1-5> retries <0-10>
```

The following parameters apply to a TACACS+ AAA remote server:

Set the primary service name (default=ppp):

```
fiberdriver(config)# aaa remote-server <1-5> service NAME
```

Set the sub-protocol for the primary service (default=lcp):

```
fiberdriver(config)# aaa remote-server <1-5> protocol PROTOCOL
```

Set the minimum privilege level corresponding to the SUPER access class (default=5):

```
fiberdriver(config)# aaa remote-server <1-5> priv-super <2-15>
```

Set the minimum privilege level corresponding to the NORMAL access class (default=3):

```
fiberdriver(config)# aaa remote-server <1-5> priv-normal <1-14>
```

Set the minimum privilege level corresponding to the VIEW access class (default=1):

```
fiberdriver(config)# aaa remote-server <1-5> priv-view <0-13>
```

The following commands restore the named parameter to its default value for the given remote server (1-5):

```
fiberdriver(config)# default aaa remote-server <1-5> port
fiberdriver(config)# default aaa remote-server <1-5> timeout
fiberdriver(config)# default aaa remote-server <1-5> retries
fiberdriver(config)# default aaa remote-server <1-5> server
fiberdriver(config)# default aaa remote-server <1-5> protocol
fiberdriver(config)# default aaa remote-server <1-5> priv-super
fiberdriver(config)# default aaa remote-server <1-5> priv-normal
fiberdriver(config)# default aaa remote-server <1-5> priv-view
```

The following command restores all parameters to their default values for the given remote server (1-5):

```
fiberdriver(config)# default aaa remote-server <1-5>
```

To delete a remote server, use the **`no aaa remote-server host X`** command where X is the desired host you wish to remove. For example, delete the remote server host above with the following command:

```
fiberdriver(config)# no aaa remote-server host 1
```

10.1.4. Configuring Authentication

By default, authentication is disabled. To turn on authentication, use the command **`aaa authentication`**. To turn off authentication, use the command **`no aaa authentication`**.

10.1.5. Configuring Accounting

By default, accounting is disabled. To turn on accounting, use the command **`aaa accounting`**. To turn off accounting, use the command **`no aaa accounting`**.

10.1.6. Configuring General Remote User Access

As stated in the Authorization section, a remotely authenticated user that is not recognized locally is treated as the special user "$remote$". This special user is used only to assign group permissions for all users in groups without a local user. The user "$remote$" is included in each new Fiber Driver system. This user is added to group "all", which has access to the entire chassis. The user may not be added in upgrades from a previous version.

Use the command **`show users`** to see the permissions of each user. Use the standard user commands from the "Users, Classes, and Logging In and Out" section to setup the group permission.

```
fiberdriver(config)# show users
username $remote$ groups all
username admin password encrypted $1$kQ2rIq/$Ob8wFa2EW135XC4TnN7wJ/ class debug
username admin groups all
```

10.2. TACACS+

There are three required parameters to use a TACACS+ server:

- Username
- Password
- Priv-Lvl

A user's privilege level (Priv-Lvl) is an integer value that determines the access class. The system compares it against the minimum value configured for each of the three access classes on the given server. The system applies the highest access class that is not more than the user's Priv-Lvl. The default access class minimum level values are as follows:

- 1 = VIEW User
- 3 = NORMAL User
- 5 = SUPER User

The system denies access if the user's Priv-Lvl is less than the configured 'VIEW User' value.

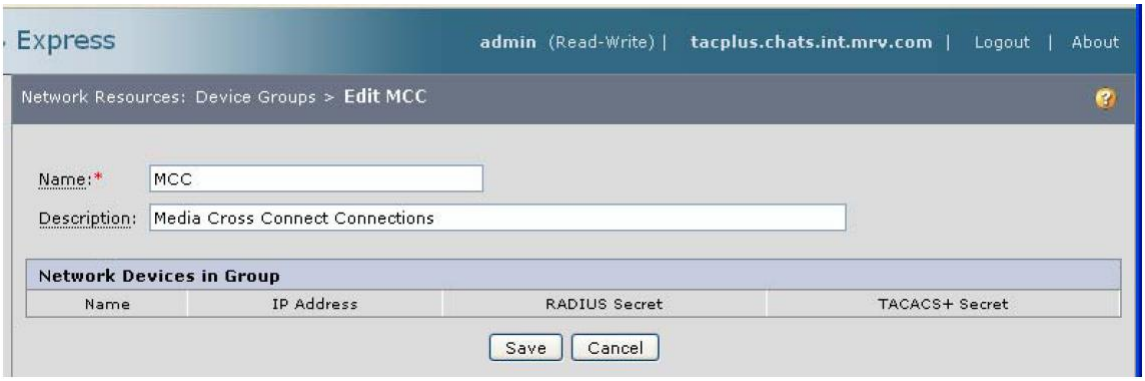
It is always a good practice to verify AAA server functionality before signing the administrator out of the server configuration to reduce possible authentication issues.

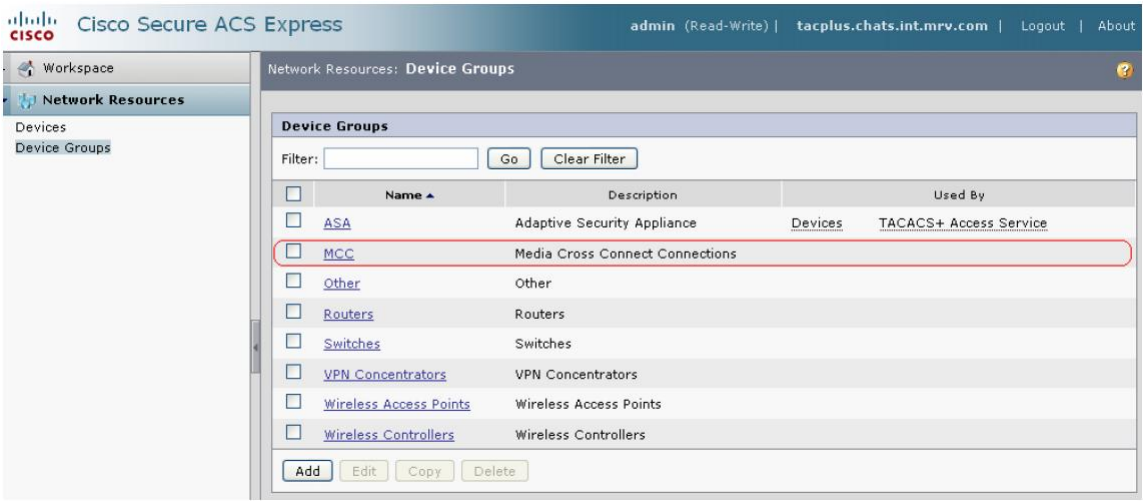
The following examples show how to configure a TACACS+ server.

10.2.1. Cisco Secure ACS Express

Add a Device Group (Network Resources -> Device Groups)

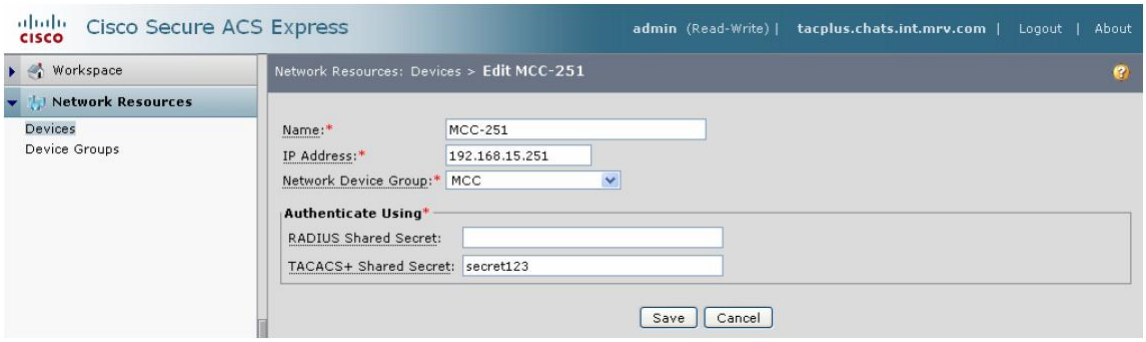
The following example shows a new Media Cross Connect (MCC) device.

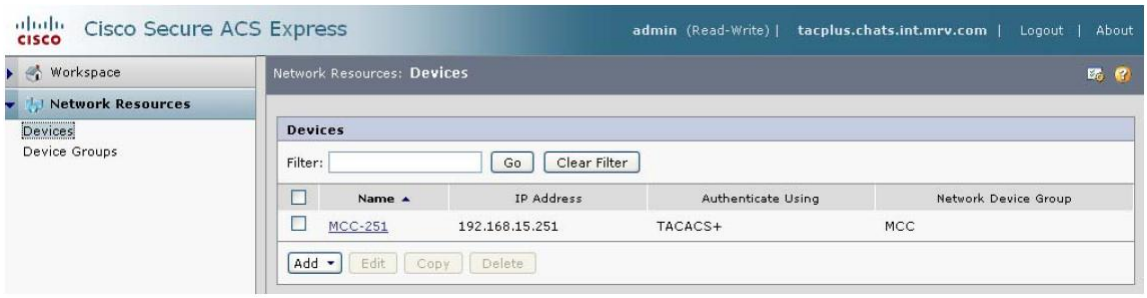




Add a Device (Network Resources -> Devices)

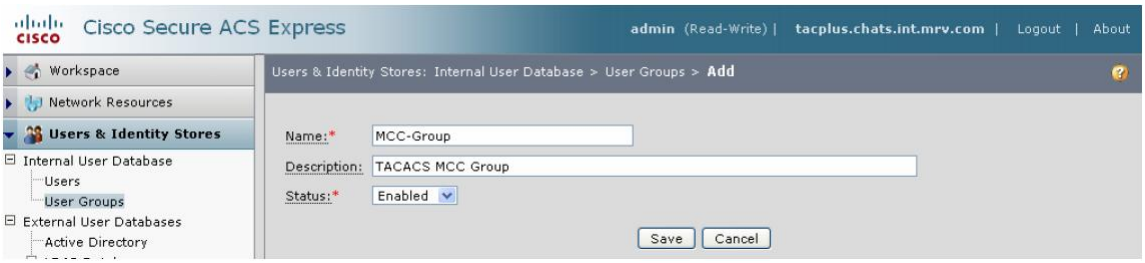
- Attach the device to the Device Group from the previous step
- Enter the IP address of the new Fiber Driver device
- Select a secure shared secret for configuring the AAA remote server host on the new device

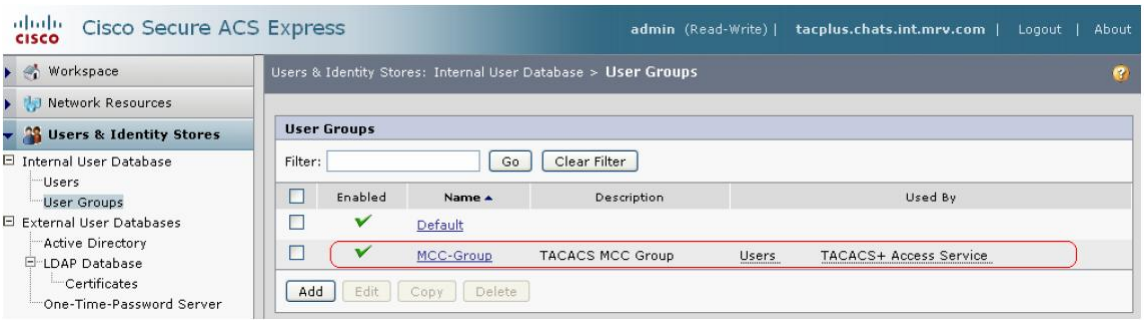




Add a User Group (Users & Identity Stores -> User Groups)

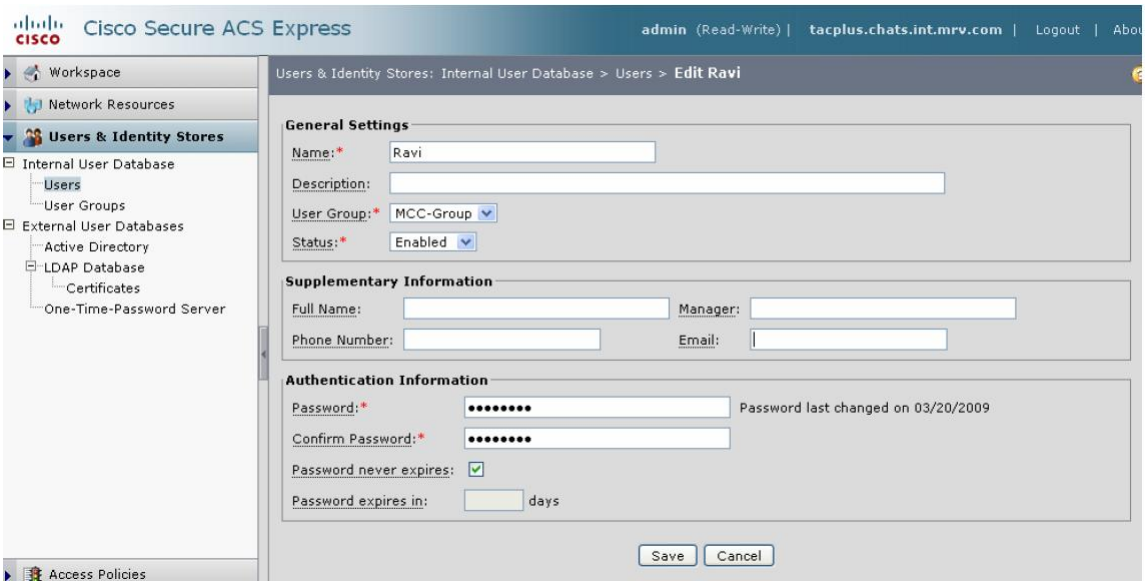
- Set "Status" to enabled

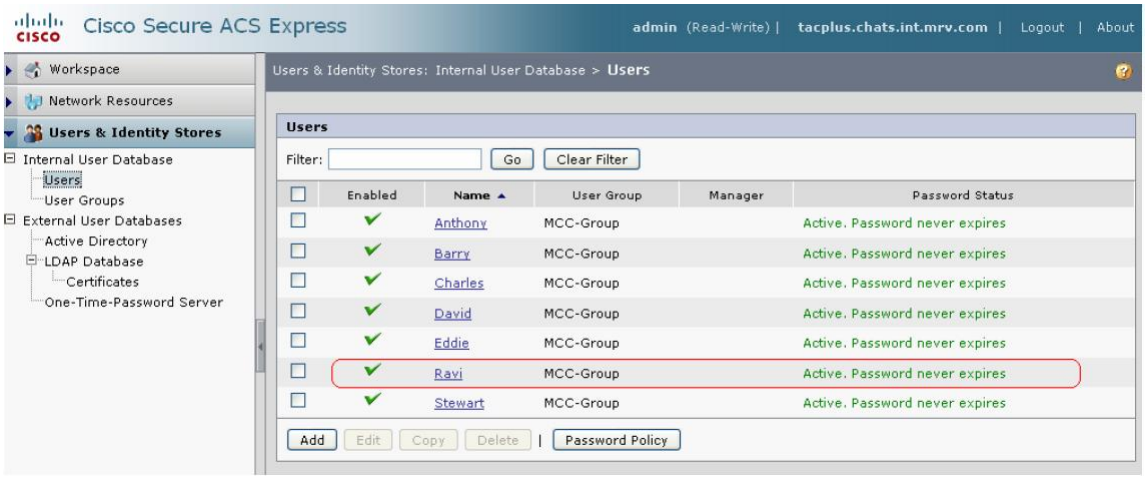




Add Users (User & Identity Stores -> Users)

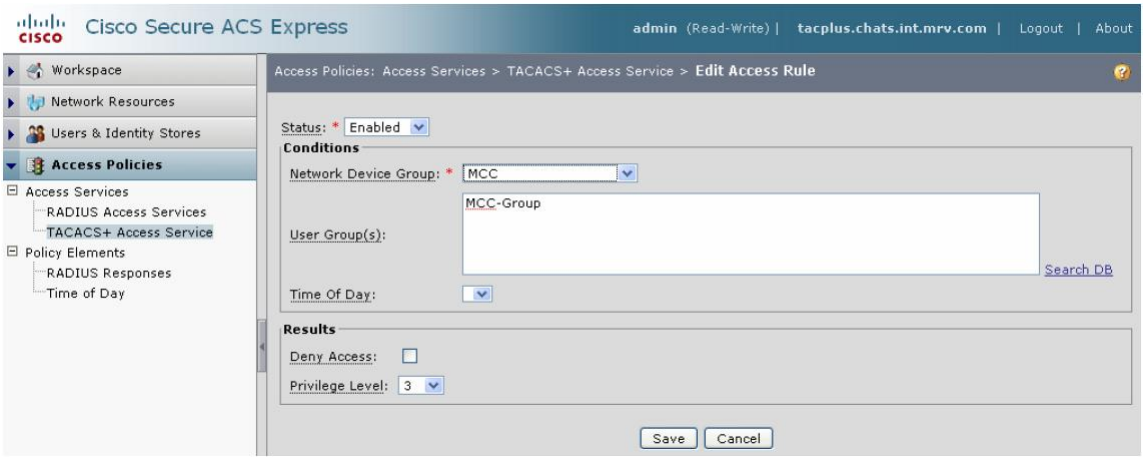
- Make sure to attach the user to the user group created in the last step





Add TACACS+ Access Service (Access Policies -> TACACS+ Access Service)

- Set "Status" to enabled
- Attach the network device group created above
- Attach the user group created above
- Set the privilege level for all the users attached to the group



10.2.2. Tac-Plus Daemon

Edit the configuration file typically located at "/etc/tac-plus/tacacs.conf".

The example below shows a typical entry in the configuration file for an MCC device. There are two required parameters:

- IP Address
- Shared Secret

```
host = 192.168.14.12
{
   key=secret123
}
```

The example below shows a typical addition of a user into the configuration file. There are two required parameters and one optional parameter:

- Username
- Password
- Priv-Lvl (Optional)

```
user = Abigail
{
   default service = permit
   pap = cleartext mypassword
   service = ppp protocol = lcp
   {
      priv-lvl = 3
   }
}
```

10.3. Radius

An MRV specific dictionary file should be used with the desired Radius server. MRV provides a dictionary for the following Radius servers:

- FreeRADIUS
- Steel-Belted
- Livingston
- Cistron

The RADIUS server requires three parameters:

- Username
- Password
- User Class Level

The user class level is defined by three different attributes. The recommended class attribute is to use the MRV specific version which is MRV-Security-Level.

If using the MRV-Security-Level attribute (dictionary.mrv: Vendor code 33, Attribute 8):

- "View" – The user class level is set to VIEW.
- "Normal" – The user class level is set to NORMAL.
- "Super" – The user class level is set to SUPER.

If using the Cisco-AVPair attribute:

- "Class=View" – The user class level is set to VIEW.
- "Class=Normal" – The user class level is set to NORMAL.
- "Class=Super" – The user class level is set to SUPER.

If using the Service-Type attribute:

- "Login-User" - The user class level is set to NORMAL.
- "Administrative-User" - The user class level is set to SUPER.

If no attribute is specified, the user class level is set to VIEW. Avoid using more than one attribute for each user. If the server configuration requires it, a set of rules determines the final user class. If both MRV-Security-Level and Cisco-AVPair attributes are used, MRV-Security-Level takes precedence. These two attributes are considered part of the explicit class. If the Service-Type attribute is used along with an explicit class, then the highest class level is taken.

The following examples show how to setup a Radius server.

10.3.1. FreeRADIUS Server

Add the dictionary file ("dictionary.mrv") supplied for Fiber Driver to the location where the FreeRADIUS server looks for dictionaries. Typically this directory is "/etc/raddb" or "/usr/share/FreeRADIUS".

Edit the file "dictionary" in the same dictionary directory. Include the text "$INCLUDE dictionary.mrv" so the MRV dictionary file is loaded when FreeRADIUS is started.

```
$INCLUDE dictionary.mikrotik
$INCLUDE dictionary.mrv
$INCLUDE dictionary.navini
```

Edit the host configuration file that is typically located at "/etc/FreeRADIUS/clients.conf". Add the host to this file with the following attributes:

- IP Address
- Secret
- Short Name (Optional)

```
client 192.168.14.12 {
   secret            = secret123
   shortname         = media-cross-connect
}
```

Edit the user configuration file that is typically located at "/etc/FreeRADIUS/users". Add the desired users by using the following parameters:

- Username
- Password
- MRV-Security-Level

```
Boris   User-Password       = "password"
        MRV-Security-Level = Normal
```

10.3.2. Steel-Belted Radius Server

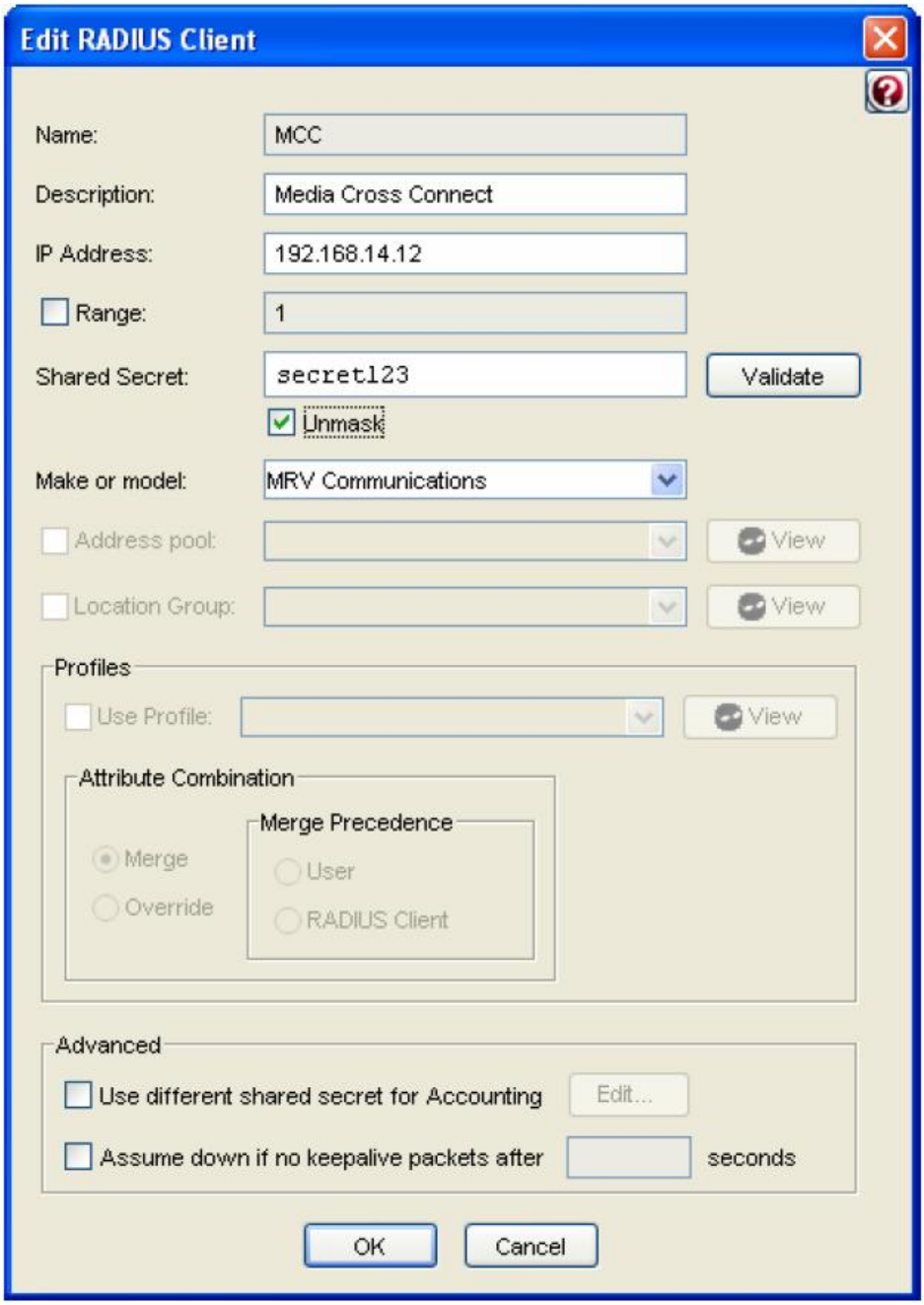
Add the dictionary file ("mrv.dct") supplied with the Fiber Driver to the location where the SBR server looks for dictionaries. Edit the main dictionary file to include the MRV dictionary. Include the text "@mrv.dct" to load the MRV dictionary file when the SBR server starts.

```
@marc.dct
@mrv.dct
@nautica.dct
```

Edit the vendor information file to include the MRV dictionary. Typically, this file is named "vendor.ini".

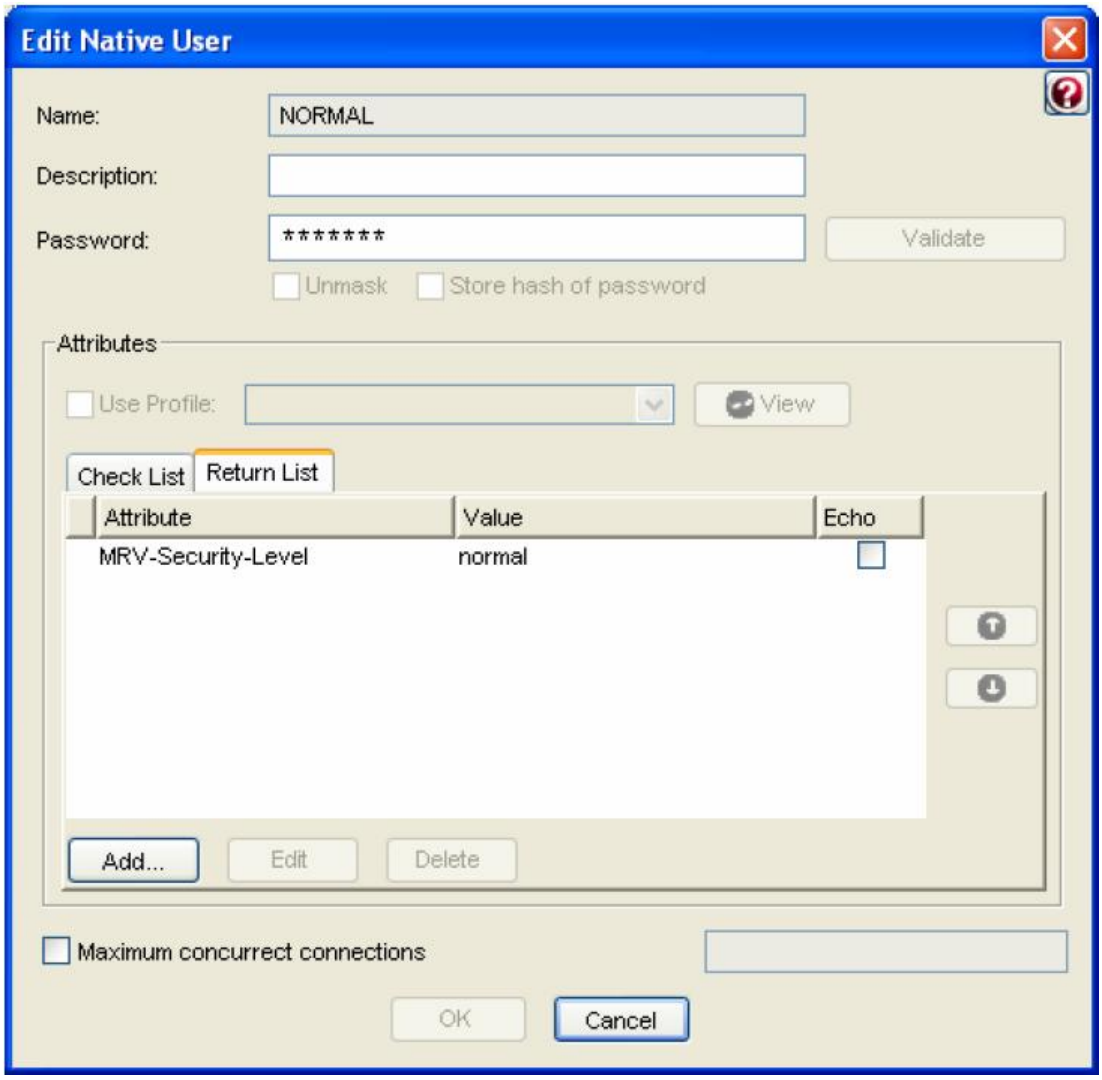
```
vendor-product        = Meru Networks
dictionary            = radius
ignore-ports          = no
port-number-usage     = per-port-type
help-id               =

vendor-product        = MRV Communications
dictionary            = Mrv
ignore-ports          = no
port-number-usage     = per-port-type
help-id               = 2000

vendor-product        = Netscreen Technologies
dictionary            = Netscreen
ignore-ports          = no
port-number-usage     = per-port-type
help-id               = 2000
```

Login to the SBR server and add the Fiber Driver device as a Radius client. Select "MRV Communications" as the "Make or model" of the Radius client. Add the IP address and shared secret for the Fiber Driver device.



When configuring users, add the attribute "MRV-Security-Level" as an item in the return list. This attribute uses the following values:

- "view" – Set the user as a VIEW level user.
- "normal" – Set the user as a NORMAL level user.
- "super" – Set the user as a SUPER level user.



10.4. Upgrading From a Non AAA Capable Software Version

If upgrading from a release without AAA functionality (v1.2 build 36b, v1.2 build 36f), first remove the files "ssh_config" and "sshd_config" and then save the configuration.

```
fiberdriver# rm ssh_config
fiberdriver# rm sshd_config
fiberdriver# write f
```

After removing these files, you may upgrade your software safely.

There is no way to update sshd_config. The file copied from "/defaults/sshd_config" is always overridden by a user-edited version stored in "/config". Delete "/config/sshd_config" every time you switch back and forth between AAA enabled software and regular software, and before you boot any new AAA capable software.

Chapter 11. Fiber Driver Applications

...reference for building managed optical solutions with the EM316LNXNM-OT.

11.1. Building an Optical Service Channel

There are two features included on the EM316LNXNM-OT for cluster support: Discovery Protocol and Loop Management Protocol (LMP). Both protocols work with networks connected to the SFP ports on the EM316LNXNM-OT. The RJ-45 port does not currently support management clustering.

11.1.1. Discovery Protocol

Discovery is a simple layer 2 protocol used to discover other NM cards on the same Optical Service Channel (OSC) network. Each NM card multicasts layer 2 frames to announce its presence to other NM cards connected via OSC ports. To see the list of discovered NM cards, use the "**`show discovery hosts`**" command:

```
fiberdriver# show discovery hosts
MAC Address                 Distance  IP Address
==========================  ========  ============
00:20:1a:02:0b:19           3         169.254.1.20
00:20:1a:02:13:f1           6         169.254.1.9
00:20:1a:02:13:f2           1         169.254.1.8
00:20:1a:02:13:f6           4         169.254.1.10
00:20:1a:02:26:db           7         169.254.1.6
00:20:1a:02:48:28           5         169.254.1.3
00:20:1a:02:49:f9           2         169.254.1.2
00:20:1a:02:53:8f           0         169.254.1.7
fiberdriver#
```

Discovery is enabled by default.

Disable the discovery protocol using the "**`no sys discovery`**" command:

```
fiberdriver# configure terminal
fiberdriver(config)# no sys discovery
fiberdriver(config)#
```

The discovery protocol only discovers cards connected to the SFP ports. The copper RJ-45 Ethernet network interface does not support discovery frames.

11.1.2. Link Management Protocol

LMP is a ring management protocol. It is disabled by default. LMP, which is similar to Rapid Spanning tree, breaks loops in the network to prevent broadcast storms.

To enable LMP:

```
fiberdriver# configure terminal
fiberdriver(config)# sys lmp
fiberdriver(config)#
```

To disable LMP:

```
fiberdriver# configure terminal
fiberdriver(config)# no sys lmp
fiberdriver(config)#
```

LMP only breaks rings on segments connected through the OSC (SFP) ports. LMP frames are not sent or recieved through the RJ45 Ethernet network interface.

Since LMP only functions on the OSC (SFP) ports, segment loops involving the RJ45 port are not detected. Avoid segment loops when configuring RJ45 Ethernet connections.

Chapter 12. SNMP Management

...introduction to SNMP setup

To ensure proper operation specific to your network configuration and to provide SNMP access, some environment-specific parameters must be configured through the CLI. A brief review of CLI setup is included below for convenience.

12.1. CLI Setup - Remote IP

The factory default IP address is 192.168.14.201/24 (netmask 255.255.255.0).

1. Edit the system IP configuration to match your IP network with the "**`ip interface`**" command.
2. Set the default gateway address using the "**`ip default-gateway`**" command. This address must be an interface on a local subnet device that can route IP packets to non-local IP networks. For example:
3. Use the "**`show ip interface`**" command to confirm that the default gateway IP address is set.

IP information configured using the previous commands will only take effect after using the "**`ip interface update`**" command or the system is restarted.

The manager does not automatically save the current running configuration. Use the "**`write file`**" command to save current parameters to the "`startup-config`" file and use them when the system restarts.

12.2. SNMPv1 Setup

1. Set up the SNMP community strings for read and write access using the commands shown below. For security reasons, the "**show**" commands do not display the community strings. Community strings are encrypted in the "**show running-config**" command for security.

```
fiberdriver(config)# snmp-server community read readSecret
fiberdriver(config)# snmp-server community write writeSecret
fiberdriver(config)#
```

2. Configure the trap receiver table. Add the IP addresses of each network manager station that should receive traps from the EM316LNXNM.

```
fiberdriver(config)# snmp-server host 169.254.192.117
fiberdriver(config)# show snmp-server hosts
snmp-server host 169.254.192.117 public warning
fiberdriver(config)#
```

3. SNMP traps are sent to address listed in the trap receiver table. Each receiving device must include management capabilities to interpret SNMP traps. MRV recommends MegaVision, which includes special support for graphical management of MRV products. In MegaVision, open the trap receiver table with the "System-->IP/SNMP Configuration" menu selection. SNMP traps are sent to all SNMP capable managers (such as MegaVision™), whose IP addresses are entered into the traps table on the LNXNM through the "System —> IP/SNMP Configuration" windows in MegaVision™.

Some example traps from the EM316LNXNM are listed below:

- Chassis temperature outside pre-determined safe operational limits
- Power supply failure
- Fan failure (certain chassis)
- Hardware or software malfunctions
- Informational occurrences (module specific)
- Change in link status (link up, link down)
- Change in loopback condition (on or off) -- Fiber Driver only
- Change in slot inventory (module removed or inserted)
- Change in port inventory (pluggable port removed or inserted)

See the appendix sections for a complete trap list.

Completely disable trap generation by removing all IP addresses from the SNMP trap table:

```
fiberdriver(config)# no snmp-server host
fiberdriver(config)#
```

Selectively disable specific traps with the "**no gen-trap**" command, found in the chassis 1 config context:

```
fiberdriver(chassis/1)# no gen-trap chassis
fiberdriver(chassis/1)# no gen-trap lin
fiberdriver(chassis/1)# no gen-trap link
fiberdriver(chassis/1)# no gen-trap loopback
fiberdriver(chassis/1)# show
        Model: EM316-16BU
         Name: EM316-16
      Temp(C): 23
  Temp Min(C): 5
Temp Limit(C): 40

PS1: DC Bad
PS2: AC Good

Fan1: good  Fan3: good
Fan2: good  Fan4: not Installed

Chassis Traps: off  Slot Change Traps: on   Module Specific Traps: on
   Port Traps: on          Link Traps: off         Loopback Traps: off
    LIN Traps: off  Port Change Traps: on        Port Diags Traps: on

Number Of Slots: 16

Slot  Model          Name
====  =============  ============================
1.3   EM316-LNXNM12  Slot 1 (EM316-LNXNM12 at 1.3)
fiberdriver(chassis/1)#
```

12.3. SNMPv3 Setup

You can create an SNMPv3 user with "auth" and "priv" level security. A new user created will use the already existing "initial" group and existing "internet" and "restricted" views, based on the security level selected.

Use "snmp-server user" commands to create the users.

You can use MegaVision™ SNMPv3 features to communicate with the device. The passwords used in user creation must be at least 8 characters long. SNMPv3 passwords are stored encrypted. The EM316LNXNM MAC address (which is unique for every NM) is used to encrypt the passwords. For this reason, it is required to recreate the SNMPv3 passwords when a configuration file containing SNMPv3 passwords is moved form one NM to another NM.

Example: The following commands create some SNMPv3 users.

```
fiberdriver(config)# snmp-server user fdrNoAuth
fiberdriver(config)# snmp-server user fdrMd5Auth auth md5 open-sesame
fiberdriver(config)# snmp-server user fdrMd5Priv auth md5 open-sesame priv
des close-sesame
fiberdriver(config)# snmp-server user fdrShaAuth auth sha open-sesame
fiberdriver(config)# snmp-server user fdrShaPriv auth sha open-sesame priv
des close-sesame
fiberdriver(config)#
```

In the above commands, "*open-sesame*" and "*close-sesame*" are passwords and usernames start with "fdr". This section assumes familiarity with SNMPv3 concepts.

12.4. SNMP Disable

Security conscious users can selectively enable or disable SNMP v1/v2c/v3 agents using either of the following commands:

- "**snmp-server (v1|v2c|v3)**"
- "**no snmp-server (v1|v2c|v3)**"

12.5. Trap Filtering

Traps can be filtered by chassis, slot, or port with the **trap** command.

Enable all traps for the target device with the **trap** command. Use a trap name as an argument to enable only a specific trap.

```
fiberdriver(chassis/1)# trap?
  trap - Enable trap generation
fiberdriver(chassis/1)# trap ?
  <cr> - Enable all available traps for this location
  >    - Redirect output to a file
  >>   - Append output to file
  NAME - Enable generation of a specific trap
fiberdriver(chassis/1)#
```

Disable all traps for the device with the **no trap** command. Use a trap name as an argument to disable only a specific trap.

```
fiberdriver(chassis/1)# no trap
  trap - Disable trap generation
fiberdriver(chassis/1)# no trap ?
  <cr> - Disable all available traps for this location
  >    - Redirect output to a file
  >>   - Append output to file
  NAME - Disable generation of a specific trap
fiberdriver(chassis/1)#
```

Specific trap names are listed in the MIB file. For example, the **no trap nbsCmmcTrapPortEnabled** command disables the "PortEnabled" trap. For easier CLI configuration, start by issuing a **show traps** command. All traps for that element display along with the emit status. Copy the name listed and issue a **(no) trap NAME** command to toggle the trap.

```
fiberdriver(chassis/1)# show traps
Name                                        Emit
==========================================  ====
NBS-CMMC-MIB::nbsCmmcTrapPowerSupplyFailure   yes
NBS-CMMC-MIB::nbsCmmcTrapPowerSupplyRestored  yes
NBS-CMMC-MIB::nbsCmmcTrapFanFailure           yes
NBS-CMMC-MIB::nbsCmmcTrapFanRestored          yes
NBS-CMMC-MIB::nbsCmmcTrapChassisTooHot        yes
NBS-CMMC-MIB::nbsCmmcTrapChassisTooCold       yes
NBS-CMMC-MIB::nbsCmmcTrapChassisTempOk        yes
fiberdriver(chassis/1)# no trap NBS-CMMC-MIB::nbsCmmcTrapFanFailure
fiberdriver(chassis/1)# show traps
Name                                        Emit
==========================================  ====
NBS-CMMC-MIB::nbsCmmcTrapPowerSupplyFailure   yes
NBS-CMMC-MIB::nbsCmmcTrapPowerSupplyRestored  yes
NBS-CMMC-MIB::nbsCmmcTrapFanFailure           no
NBS-CMMC-MIB::nbsCmmcTrapFanRestored          yes
NBS-CMMC-MIB::nbsCmmcTrapChassisTooHot        yes
NBS-CMMC-MIB::nbsCmmcTrapChassisTooCold       yes
NBS-CMMC-MIB::nbsCmmcTrapChassisTempOk        yes
fiberdriver(chassis/1)#
```

12.6. SNMP Ports

To avoid resource conflicts, SNMP administrators can change the SNMP (UDP) ports for sending and receiving traps.

The following CLI commands control UCP port usage:

CLI Command	Description	Default
snmp-server port X	UDP/IP port for the agent to listen for SNMP traffic	161
snmp-server trap-port X	UDP/IP port for the agent to send SNMP traps	162

Value changes do not affect the working environment for management until the system is restarted. Be sure to properly configure connecting devices with the new contact information or communication with the EM316LNXNM manager will not be re-established.

The example below shows the port change using the CLI:

```
fiberdriverconfig)# snmp-server port 150
fiberdriverconfig)# snmp-server trap-port 140

fiberdriverconfig)# show snmp-server
Administrative configuration:
 Snmp V1: disabled
 Snmp V2c: disabled
 Snmp V3: disabled
 Power Supply Traps: enabled
 Module Traps: enabled
 Snmp Port desired: 150
 Trap Port desired: 140
 SysContact:
 SysName:
 SysLocation:
Current operating configuration:
 Snmp Port: 161
 Trap Port: 162
fiberdriverconfig)#
```

The "Current operating configuration" values update after the changes are saved and the system is restarted as shown below:

```
fiberdriverconfig)# write file
fiberdriverconfig)# exit
fiberdriver# restart warm
```

Refer to SNMP documentation or customer support for help changing SNMP ports.

12.7. Message Logging

A trap issues an SNMP trap to one or more remote SNMP managers, which allows a network administrator to receive immediate error notification from SNMP management software like MegaVision™. To specify an SNMP trap manager address, use the "**snmp-server host**" command. To change the default setting for trap message level, use the "**log level trap**" command.

```
fiberdriver(config)# snmp-server host 169.254.1.100
fiberdriver(config)# snmp-server host 169.254.1.101
fiberdriver(config)# show snmp-server hosts
snmp-server host 169.254.1.100 public warning
snmp-server host 169.254.1.101 public warning

fiberdriver(config)# log level trap error
fiberdriver(config)# show log
 Running Level: info
 Nvram Level: disabled
 Trap Level: error
 Email Level: disabled
 Remote Server: 0.0.0.0
 Remote Level: memo
fiberdriver(config)#
```

You can't choose "**info**" or "**memo**" level for traps, since the lowest priority trap is of type warning.

12.8. Dynamic SNMP Information (MetaMIB)

The MetaMIB is an extension to the MIB architecture used by the Fiber Driver. Instead of relying on static objects, the MetaMIB dynamically builds objects for the system.

12.8.1. Usage

The Meta-MIB is not included in the standard MIB `"cmmc.mib"` file. Extended MIB information is in the file named `"nbs-meta.mib"`. The Meta-MIB requires that the MIB search path always includes the standard MIB.

The MetaMIB is divided into two portions. The first portion inlcudes the available features covered by the MetaMIB. The second portion includes MetaMIB usage on the Fiber Driver in use.

12.8.2. Features Table

MetaMIB Object	Description
metaMibFeatureTableSize	Returns how many MetaMIB features are available.
metaMibFeatureID.X	Returns the ID of MetaMIB feature X.
metaMibFeatureFamily.X	Returns what family MetaMIB feature X is a part of.
metaMibFeatureName.X	Returns what name MetaMIB feature X uses.
metaMibFeatureDesc.X	Returns the full description of MetaMIB feature X.
metaMibFeatureUnits.X	Returns the type of unit MetaMIB feature X uses. (optional)
metaMibFeatureType.X	Returns the MetaMIB feature type: • Enumeration • String • Octet String • Integer • Float

In the table above there is a variable X which refers to a specific feature. When traversing the metaMibFeature* table, you can tie together a features attributes by using the .X notation. For example to get feature #10’s name and description, use metaMibFeatureName.10 and metaMibFeatureDesc.10.

12.8.3. Dynamic Element Parameters

MetaMIB Object	Description
metaMibVariableTableSize	Returns how many MetaMIB objects currently in use on the Fiber Driver
metaMibVariableIfIndex.X.Y	Returns the interface index: X
metaMibVariableID.X.Y	Returns the MetaMIB object ID (Y) used in the features table for this variable object
metaMibVariableCaps.X.Y	Returns a list of comma separated strings that indicate the type of values this variable supports. Ranges and string lengths are expressed as a two item list: MIN, MAX. A zero length string indicates that this variable is read-only.
metaMibVariableDefault.X.Y	Returns the default value of this variable.
metaMibVariableJumper.X.Y	Returns the jumper settings of this variable. If the object does not have a jumper for this feature: • It will report 'N/A' if metaMibVariableType is string. • It will be zero length otherwise. When read, a zero length string is valid if Type is string. Note this is not used by the Media Cross Connect.
metaMibVariableOper.X.Y	Returns the current operational value for this variable. If the object cannot report the current operational value: • It will report 'N/A' if metaMibVariableType is string. • It will be zero length otherwise. • If Caps reports non-zero length, this variable is write-only due to hardware limitations. When read, a zero length string is valid if Type is string.
metaMibVariableAdmin.X.Y	Returns the current administrative value of this variable. If the Administrative value cannot be set for this variable, Caps is zero-length and it reports a zero length string. Writing zero length values is rejected unless Type is string and Caps permits it. When read, a zero length string is valid if Type is string.
metaMibVariableStatus.X.Y	Returns any messages relating to this variable.

In the preceeding table, X is the interface index of a port in the form CSSPPP. C is the chassis number, SS is the 2-digit slot number (00-10), and PPP is the 3-digit port number (000-100). To target a slot, the PPP field should be empty. To target a chassis, both the SS and the PPP fields should be empty. For example, index notation for port 1.2.3 is 102003 and slot 1.2 is 102000.

In the preceeding table, Y is the element's feature ID. For example, if the MetaMIB object ends with 102003.12 then the port 1.2.3 has feature ID #12.

12.8.4. Example MetaMIB Session - get

First, do an SNMP walk on the entire Fiber Driver system being used. From there, find the object that you wish to configure. For simplicity, use the “metaMibFeatureOID” of your target object to find the ID for configuration. For example, to find the equalization value on an SFP-SATA-SAS-HT SFP, search for “metaMibFeatureOID” that is set to 1.1.0.

Below is a truncated version of an SNMP walk on a chassis focusing on the equalization feature; other features are ignored.

```
$  snmpwalk -c public -v 1 -m ./nbs-meta.mib 192.168.14.201 metaMib
NBS-META-MIB::metaMibFeatureTableSize.0 = INTEGER: 24
NBS-META-MIB::metaMibFeatureID.11 = Gauge32: 11
NBS-META-MIB::metaMibFeatureFamily.11 = STRING: SATA/SAS Cu SFP
NBS-META-MIB::metaMibFeatureName.11 = STRING: Equalization
NBS-META-MIB::metaMibFeatureDesc.11 = STRING: Input Equalization
NBS-META-MIB::metaMibFeatureUnits.11 = STRING:
NBS-META-MIB::metaMibFeatureType.11 = INTEGER: enum(1)
NBS-META-MIB::metaMibVariableTableSize.0 = INTEGER: 8
NBS-META-MIB::metaMibVariableIfIndex.104001.11 = Gauge32: 104001
NBS-META-MIB::metaMibVariableID.104001.11 = Gauge32: 11
NBS-META-MIB::metaMibVariableCaps.104001.11 = STRING: disabled,low,medium,high
NBS-META-MIB::metaMibVariableDefault.104001.11 = STRING: disabled
NBS-META-MIB::metaMibVariableJumper.104001.11 = STRING:
NBS-META-MIB::metaMibVariableOper.104001.11 = STRING:
NBS-META-MIB::metaMibVariableAdmin.104001.11 = STRING: disabled
NBS-META-MIB::metaMibVariableStatus.104001.11 = STRING:
```

To get specific information on a port, use the relevant MIB object (in the current example, we can use #11) on a port with the desired feature. For example to just get the administrative status of equalization on port 1.4.1 use the example below.

```
$  snmpget -c public -v 1 -m ./nbs-meta.mib 192.168.14.201
  metaMibVariableAdmin.104001.11
NBS-META-MIB::metaMibVariableAdmin.104001.11 = STRING: disabled
```

12.8.5. Example MetaMIB Session - set

It is suggested to follow the steps in the previous section to figure out what objects are available to be changed on the system. After figuring out which object to configure, use the MetaMIB object “metaMibVariableAdmin” to change the value.

For example using the equalization object from the previous section, we can change the value from “disabled” to “medium”. We know “medium” is an available option by looking at what was returned from “metaMibVariableCaps.104001.11” and “metaMibFeatureType.11”. The values returned were “disabled, low, medium and high” and “enum” respectively. This means the MetaMIB object is an enumeration with the available options: disabled, low, medium and high.

```
$  snmpset -c private -v 1 -m ./nbs-meta.mib 192.168.14.201
  metaMibVariableAdmin.104001.11 s medium
NBS-META-MIB::metaMibVariableAdmin.104001.11 = STRING: medium
```

Appendix

1. Equivalent EM316NM Commands

This guide gives some EM316LNXNM command equivalents for some EM316NM commands. It is not intented as a comprehensive list of equivalent commands.

The manager does not automatically save the current running configuration. Use the "**`write file`**" command to save current parameters to the "`startup-config`" file and use them when the system restarts.

Hints:

- Use '?' and <Tab> keys for context sensitive command line help.
- Make configuration changes in the "configure" context.
- To enter the configure context, type "**`configure terminal`**" command at the "`fiberdriver#`" prompt.

```
fiberdriver# configure terminal
fiberdriver(config)#
```

- The command prompt indicates the current command context.

Table 3. Command Map Table

EM316NM CLI command	EM316LNXNM CLI command
`set-ip`	**`ip interface`**, **`ip interface update`**
`get-ip`	**`show ip`**
`set-gatew`	**`ip default-gateway`**, **`ip interface update`**
`get-gatew`	**`show ip`**
`set-passwd`	**`username`** ***`username`*** **`password`**
`set-comm`	**`snmp-server community`**
`get-comm`	**`show snmp-server`**
`set-tftp-srvr`	**`sys tftp-host-ip`**
`get-tftp-srvr`	**`show sys`**

2. EM316LNXNM Command Reference

2.1. Initial Command Context

Table 4. Initial Command Context Table

Command	Description
configure terminal	Configuration from vty interface
cp *FROM TO*	Copy files
echo	Display text for scripting
echo *LINE*	Display text for scripting
erase nvram all	Erase all files in NVRAM (including ssh keys, upgrade files, NVRAM log, and startup config)
erase nvram log	NVRAM log records
erase package *PACKAGE*	Remove a package
erase startup-config	Erase startup configuration
exit	Exit current context and go down to previous context
flush	Wait for changes to be flushed to hardware
list	Print command list
list *MATCH*	Print command list
logout	Logout of the system
ls	List files
more *FILE*	Display file
mv *FROM TO*	Rename files
[no] pager	Pause scrolling when screen is full
ping *WORD*	Send ICMP echo messages to test network connectivity
quit	Exit current context and go down to previous context
restart cold	Cold reset the NM card and reconfigure all line cards from NVRAM
restart upgrade	Reload software but preserve running configuration. Recommend using "write file" before this
restart warm	Warm reset the NM card
rm *FILE*	Remove files
scp *LOCAL* from *REMOTE*	Copy remote to local
scp *LOCAL* to *REMOTE*	Copy local to remote
show C	Display info for chassis C
show C dump	Dump machine readable status

Command	Description
show C.S	Display info for slot S in chassis C
show C.S dump	Dump machine readable status
show C.S.P	Display info for port P of slot S in chassis C
show C.S.P dump	Dump machine readable status
show C.S.P plugin	Show Pluggable Optics (SFP/GBIC/XFP) data
show *NAME*	Show running system information
show *NAME* plugin	Show Pluggable Optics (SFP/GBIC/XFP) data
show aaa	Show AAA (RADIUS/TACACS+) configuration
show aaa remote-server hosts	Show remote AAA servers
show chassis	Show chassis list
show chassis all	Show list of all chassis (deprecated, use 'show chassis')
show config C	Chassis
show config C all	Show configuration for this location and all of its children
show config C.S	Slot
show config C.S all	Show configuration for this location and all of its children
show config C.S.P	Port
show config C.S.P all	Show configuration for this location and all of its children
show config *NAME*	Show administrative configuration for a location
show config *NAME* all	Show configuration for this location and all of its children
show cos prio	Show CoS priority configuration
show cos prio C	Show CoS priority for all slots in this chassis
show cos prio C.S	Show CoS priority for this slot
show defaults C	Chassis
show defaults C all	Show defaults for this location and all of its children
show defaults C.S	Slot
show defaults C.S all	Show defaults for this location and all of its children
show defaults C.S.P	Port
show defaults C.S.P all	Show defaults for this location and all of its children
show defaults *NAME*	Show default configuration for a location
show defaults *NAME* all	Show defaults for this location and all of its children
show digital-diagnostics	Show Digital Diagnostics summary

Command	Description
show digital-diagnostics C	For all ports in this chassis
show digital-diagnostics C.S	For all ports in this slot
show digital-diagnostics C.S.P	For a specific port
show digital-diagnostics *NAME*	Show Digital Diagnostics summary
show discovery hosts	List of hosts found by L2 Discovery Protocol
show dscp map	For all slots
show dscp map C	For all slots in a chassis
show dscp map C.S	For a slot
show firmware	Show firmware info
show firmware areas	Show firmware non-volatile areas
show firmware areas C	Show firmware non-volatile area for chassis
show firmware areas C.S	Show firmware non-volatile area for slot
show firmware sessions	Show firmware download sessions
show flows	Show flow configuration
show flows C	Show flow configuration for all slots in this chassis
show flows C.S	Show flow configuration for this slot
show groups	Show group configuration
show history	Display the session command history
show hw-config	Show hardware configuration settings (e.g. jumper/DIP switches)
show hw-config C.S	For a slot
show inventory	Show information about every object in the system
show inventory tsv	Inventory in a tab-separated format
show ip	Show administrative IP status
show ip interface	Show system IP interface configuration
show ip interface vlan-id	Show VLAN 802.1q configuration
show ip tables	Show ip tables configuration
show license	Displays licensing information about this system
show log	Show logging configuration and log entries
show log nvram	NVRAM log
show log nvram <*1-99999*>	NVRAM log
show log nvram all	Show all NVRAM log entries
show log remote-server hosts	Show remote syslog servers
show log running	Running log
show log running <*1-99999*>	Running log
show log running all	Show all running log entries
show map	Display port map

Command	Description
show map C	Enter chassis location
show map C dump actual	Show actual (operating) state
show map C dump desired	Show desired (administrative) state
show map C names	Map list with full port names
show map C simple	Map list without graphics
show map C.S	Enter slot location
show map C.S dump actual	Show actual (operating) state
show map C.S dump desired	Show desired (administrative) state
show map C.S names	Map list with full port names
show map C.S simple	Map list without graphics
show map C.S.P	Enter port location
show map C.S.P dump actual	Show actual (operating) state
show map C.S.P dump desired	Show desired (administrative) state
show map C.S.P names	Map list with full port names
show map C.S.P simple	Map list without graphics
show map names	Map list with full port names
show map simple	Map list without graphics
show mapping-types	Show mapping-type info
show mapping-types C	Show mapping-type info
show mapping-types C.S	(no description yet)
show mapping-types C.S.P	(no description yet)
show memory	Show memory usage
show ntp	Show NTP configuration
show ntp-server hosts	Show NTP servers
show packages	Show installed packages and versions
show permissions	Show your permissions
show permissions chassis	Show your chassis permissions
show permissions port	Show your port permissions
show permissions slot	Show your slot permissions
show plugins	Show Pluggable Optics (SFP/GBIC/XFP) summary
show ports	Show port list
show proc cpu	CPU utilization and memory statistics
show redundancy C	Show chassis redundancy info
show redundancy C.S	Show slot redundancy info
show redundancy *NAME*	Show redundancy info
show rm slots	Show s/w versions of rm slots
show running-config	Current operating configuration

Command	Description
show slot all	Show list of all slots (deprecated, use 'show slots')
show slots	Show slot list
show snmp-server	Show SNMP server configuration
show snmp-server hosts	Show trap recipients
show snmp-server users	SNMPv3 user list
show startup-config	Contents of startup configuration
show statistics	Show port info
show sys	Show system information
show sys date	Show the system clock
show sys login-banner	Show login banner
show sys uptime	Show system up-time
show table chassis dump	Dump in machine readable format
show table metamib feature dump	Dump in machine readable format
show table metamib variable dump	Dump in machine readable format
show table port dump	Dump in machine readable format
show table protocol	Display protocol table
show table protocol dump	Dump in machine readable format
show table slot dump	Dump in machine readable format
show tech-support	Generate informational report for technical support
show terminal	Show local terminal information
show unmapped	Show unmapped ports
show unmapped C	Enter slot location
show unmapped C.S	Enter port location
show unmapped C.S.P	Show unmapped ports
show user-class	User class (debug, super, etc)
show users	User accounts
show version	Displays software version
show vid-map	Show VID map
show vid-map C	Show VID map for all slots in this chassis
show vid-map C.S	Show VID map for this slot
show warranty	Displays information about the warranty for this system
sleep *<0-10>*	Pause CLI for scripting
source *FILE*	Read CLI commands from file
ssh *HOST*	Open a SSH connection
sync	Wait for changes to be flushed to hardware / display
telnet *WORD*	Open a TELNET connection

Command	Description
telnet *WORD PORT*	Open a TELNET connection
[no] terminal echo-commands	Echo commands when sourcing scripts
no terminal length	Disable pager (use 'terminal length 24' for default)
terminal length *<0-512>*	Set number of lines on a screen
[no] terminal progress	Show progress indicator while waiting for commands to complete
[no] terminal show-timestamps	Show time stamps for log messages displayed on the CLI
terminal width *<0-512>*	Set number of columns on a screen
tftp get *A.B.C.D REMOTE*	Get file
tftp get *A.B.C.D REMOTE LOCAL*	Get file
tftp get *REMOTE*	Get file
tftp get *REMOTE LOCAL*	Get file
tftp put *A.B.C.D LOCAL*	Put file
tftp put *A.B.C.D LOCAL REMOTE*	Put file
tftp put *LOCAL*	Put file
tftp put *LOCAL REMOTE*	Put file
upgrade	Upgrade software
upgrade *A.B.C.D*	Upgrade software
upgrade *A.B.C.D FNAME*	Upgrade software
upgrade scp *HOST FNAME*	Upgrade software using SCP
who	Show user sessions
whoami	Who am I?
write file	Write configuration to the startup-config file
write terminal	Write to terminal

2.2. Main Configuration Context

Table 5. Main Configuration Context Table

Command	Description
default C	Chassis
default C all	Restore defaults for this location and all of its children
default C.S	Slot
default C.S all	Restore defaults for this location and all of its children
default C.S.P	Port
default C.S.P all	Restore defaults for this location and all of its children
default *NAME*	<NO DOC STRING>
default *NAME* all	Restore defaults for this location and all of its children
[default|no] aaa accounting	Enable remote accounting
[default|no] aaa authentication	Enable remote authentication
default aaa protocol	Select AAA protocol
aaa protocol radius	Use Radius
aaa protocol tacacs-ascii	Use TACACS+ ASCII password authentication
aaa protocol tacacs-pap	Use TACACS+ PAP password authentication
default aaa remote-server *<1-5>*	Restore most remote AAA server parameters
default aaa remote-server *<1-5>* port	Restore remote AAA server port to its default value
aaa remote-server *<1-5>* port *<0-65535>*	Configure remote AAA server port
default aaa remote-server *<1-5>* priv-normal	Restore (min) privilege level for normal access to its default value
aaa remote-server *<1-5>* priv-normal *<1-14>*	Configure TACACS+ (min) privilege level for normal access
default aaa remote-server *<1-5>* priv-super	Restore (min) privilege level for super access to its default value
aaa remote-server *<1-5>* priv-super *<2-15>*	Configure TACACS+ (min) privilege level for super access
default aaa remote-server *<1-5>* priv-view	Restore (min) privilege level for view access to its default value
aaa remote-server *<1-5>* priv-view *<0-13>*	Configure TACACS+ (min) privilege level for view access
default aaa remote-server *<1-5>* protocol	Restore primary service sub-protocol to its default value

Command	Description
aaa remote-server *<1-5>* protocol *PROTOCOL*	Configure TACACS+ sub-protocol for primary service
default aaa remote-server *<1-5>* retries	Restore connection retry count to its default value
aaa remote-server *<1-5>* retries *<0-10>*	Configure remote AAA server retries
default aaa remote-server *<1-5>* service	Restore primary user service name to its default value
aaa remote-server *<1-5>* service *SERVICE*	Configure TACACS+ primary service name
default aaa remote-server *<1-5>* timeout	Restore response timeout to its default value
aaa remote-server *<1-5>* timeout *<0-10>*	Configure remote AAA server response timeout
no aaa remote-server host *<1-5>*	Remove remote AAA server
aaa remote-server host *<1-5>* *A.B.C.D SECRET*	Configure remote AAA server
aaa remote-server host *<1-5>* *A.B.C.D SECRET <0-65535>*	Configure remote AAA server
aaa remote-server host *<1-5>* *A.B.C.D SECRET <0-65535> <1-10>*	Configure remote AAA server
aaa remote-server host *<1-5>* *A.B.C.D SECRET <0-65535> <1-10> <0-10>*	Configure remote AAA server
aaa remote-server host *<1-5>* *A.B.C.D* encrypted *SECRET*	Encrypted Remote AAA server shared secret
aaa remote-server host *<1-5>* *A.B.C.D* encrypted *SECRET <0-65535> <1-10> <0-10>*	Encrypted Remote AAA server shared secret
chassis C	A chassis location
chassis *NAME*	Configure a chassis
chassis *NAME* type *TYPE*	Specify a specific chassis type (This command is only available in the startup-config file)
chassis *NAME* type *TYPE* rev *<0-255>*	Specify a specific chassis revision (This command is only available in the startup-config file)
echo	Display text for scripting
echo *LINE*	Display text for scripting
end	End current context and go down to initial command context
exit	Exit current context and go down to previous context
firmware download *FILE* C	Download firmware file to chassis non-volatile area

Command	Description
firmware download *FILE* C.S	Download firmware file to slot non-volatile area
firmware download *FILE* all	All cards that are compatible with the firmware
firmware download abort C	Abort current download on chassis
firmware download abort C.S	Abort current download on slot
firmware reload C	Swap/reload firmware in non-volatile area for chassis
firmware reload C.S	Swap/reload firmware in non-volatile area for slot
firmware swap-primary C	Swap/reload firmware in non-volatile area for chassis
firmware swap-primary C.S	Swap/reload firmware in non-volatile area for slot
flush	Wait for changes to be flushed to hardware
foreach *LOC COMMAND*	Execute a command on a set of objects
no group *GROUP*	Group configuration
default group *GROUP* access	Restore default service access for a group
[no] group *GROUP* access any	Enable access via any service
[no] group *GROUP* access api	Enable api service access
[no] group *GROUP* access console	Enable console service access
group *GROUP* access none	Remove access via any services
[no] group *GROUP* access ssh	Enable ssh service access
[no] group *GROUP* access telnet	Enable telnet service access
[no] group *GROUP* read C	Enable control for a chassis
[no] group *GROUP* read C.S	Enable control for a slot
[no] group *GROUP* read C.S.P	Enable control for a port
[no] group *GROUP* write C	Enable control for a chassis
[no] group *GROUP* write C.S	Enable control for a slot
[no] group *GROUP* write C.S.P	Enable control for a port
[default|no] ip default-gateway	Clear default gateway
ip default-gateway *A.B.C.D*	Set the default gateway
[default|no] ip gratuitous-arp	Send broadcast gratuitous ARP when IP address changes or network comes up
no ip interface	System interface configuration
ip interface *A.B.C.D*	System interface configuration
ip interface *A.B.C.D/M*	System interface configuration
[default|no] ip interface dhcp	Enable DHCP
ip interface update	Apply administrative interface configuration to operational
[default|no] ip interface vlan-id	Disable VLAN 802.1q support. Will not take effect until next cold-restart

Command	Description
ip interface vlan-id *<0-4095>*	Set 802.1q VLAN ID (0 to disable). Will not take effect until next cold-restart
[default|no] ip scp-server	Configure SCP server
[default|no] ip ssh-server	Configure SSH server
default ip ssh-server port	Set the listening port for ssh traffic to its default state
ip ssh-server port *<1-65535>*	Set the listening port for ssh traffic
[default|no] ip tables	Remove all ip tables
ip tables *LINE*	ip tables configuration
[default|no] ip telnet-server	Configure TELNET server
default ip telnet-server port	Set the listening port for TELNET traffic to its default state
ip telnet-server port *<1-65535>*	Set the listening port for TELNET traffic
[default|no] ip web-server	Configure web server
default ip web-server port	Set the listening port for web traffic to its default state
ip web-server port *<1-65535>*	Set the listening port for web traffic
list	Print command list
list *MATCH*	Print command list
[default|no] log level nvram	Disable flash logging
log level nvram alarm	Set log threshold to alarm - similar to LOG_WARNING (4)
log level nvram error	Set log threshold to LOG_ERR (3)
log level nvram fatal	Set log threshold to LOG_EMERG (0)
log level nvram info	Set log threshold to LOG_INFO (6)
log level nvram memo	Set log threshold to LOG_DEBUG (7)
log level nvram warning	Set log threshold to LOG_WARNING (4)
[default|no] log level running	Disable display log
log level running alarm	Set log threshold to alarm - similar to LOG_WARNING (4)
log level running error	Set log threshold to LOG_ERR (3)
log level running fatal	Set log threshold to LOG_EMERG (0)
log level running info	Set log threshold to LOG_INFO (6)
log level running memo	Set log threshold to LOG_DEBUG (7)
log level running warning	Set log threshold to LOG_WARNING (4)
[default|no] log level trap	Disable sending SNMP Traps
log level trap alarm	Set log threshold to alarm - similar to LOG_WARNING (4)
log level trap error	Set log threshold to LOG_ERR (3)
log level trap fatal	Set log threshold to LOG_EMERG (0)

Command	Description
log level trap warning	Set log threshold to LOG_WARNING (4)
no log remote-server host *<1-5>*	Remove remote syslog server
log remote-server host *<1-5>* *A.B.C.D*	Setup remote syslog server
log remote-server host *<1-5>* *A.B.C.D <0-65535>*	Setup remote syslog server
log remote-server host *<1-5>* *A.B.C.D <0-65535>* alert	Set log threshold to LOG_ALERT (1)
log remote-server host *<1-5>* *A.B.C.D <0-65535>* crit	Set log threshold to LOG_CRIT (2)
log remote-server host *<1-5>* *A.B.C.D <0-65535>* debug	Set log threshold to LOG_DEBUG (7)
log remote-server host *<1-5>* *A.B.C.D <0-65535>* emerg	Set log threshold to LOG_EMERG (0)
log remote-server host *<1-5>* *A.B.C.D <0-65535>* error	Set log threshold to LOG_ERR (3)
log remote-server host *<1-5>* *A.B.C.D <0-65535>* info	Set log threshold to LOG_INFO (6)
log remote-server host *<1-5>* *A.B.C.D <0-65535>* notice	Set log threshold to LOG_NOTICE (5)
log remote-server host *<1-5>* *A.B.C.D <0-65535>* warning	Set log threshold to LOG_WARNING (4)
log send alarm *LINE*	Send with alarm level
log send error *LINE*	Send with error level
log send fatal *LINE*	Send with fatal level
log send info *LINE*	Send with info level
log send memo *LINE*	Send with memo level
log send warning *LINE*	Send with warning level
default log size nvram	Restore nvram to its default state
log size nvram *<4-65535>*	Configure flash log threshold
logout	Logout of the system
map C clear-all	Clear all related mappings
map C repeater	Set to 'repeater' setting (1 <-> 2, etc.)
map C to-self	Map to itself (and clear other mappings)
map C.S clear-all	Clear all related mappings
map C.S repeater	Set to 'repeater' setting (1 <-> 2, etc.)
map C.S to-self	Map to itself (and clear other mappings)
map C.S.P also-to C.S.P	Enter port location
map C.S.P also-to *NAME*	Map to a port (in addition to this port's existing destinations)
map C.S.P clear-all	Clear all related mappings

Command	Description
map C.S.P not-to C.S.P	Enter port location
map C.S.P not-to *NAME*	Remove the source port from that destination port
map C.S.P only-to C.S.P	Enter port location
map C.S.P only-to *NAME*	Map to a port (and clear all other mappings for both ports)
map C.S.P repeater	Set to 'repeater' setting (1 <-> 2, etc.)
map C.S.P to-self	Map to itself (and clear other mappings)
map C.S.P with C.S.P	Enter port location
map C.S.P with *NAME*	Map a port pair (and clear any other mapping)
map *NAME* also-to C.S.P	Enter port location
map *NAME* also-to *NAME*	Map to a port (in addition to this port's existing destinations)
map *NAME* clear-all	Clear all related mappings
map *NAME* not-to C.S.P	Enter port location
map *NAME* not-to *NAME*	Remove the source port from that destination port
map *NAME* only-to C.S.P	Enter port location
map *NAME* only-to *NAME*	Map to a port (and clear all other mappings for both ports)
map *NAME* repeater	Set to 'repeater' setting (1 <-> 2, etc.)
map *NAME* to-self	Map to itself (and clear other mappings)
map *NAME* with C.S.P	Enter port location
map *NAME* with *NAME*	Map a port pair (and clear any other mapping)
[default|no] ntp	Enable NTP
[no] ntp-server host *A.B.C.D*	Add an NTP server
[no] pager	Pause scrolling when screen is full
port C.S.P	A port location
port *NAME*	Configure a port
port *NAME* type *TYPE*	Specify a specific port type (This command is only available in the startup-config file)
quit	Exit current context and go down to previous context
scp *LOCAL* from *REMOTE*	Copy remote to local
scp *LOCAL* to *REMOTE*	Copy local to remote
show C	Display info for chassis C
show C dump	Dump machine readable status
show C.S	Display info for slot S in chassis C
show C.S dump	Dump machine readable status
show C.S.P	Display info for port P of slot S in chassis C
show C.S.P dump	Dump machine readable status

Command	Description
show C.S.P plugin	Show Pluggable Optics (SFP/GBIC/XFP) data
show *NAME*	Show running system information
show *NAME* plugin	Show Pluggable Optics (SFP/GBIC/XFP) data
show aaa	Show AAA (RADIUS/TACACS+) configuration
show aaa remote-server hosts	Show remote AAA servers
show chassis	Show chassis list
show chassis all	Show list of all chassis (deprecated, use 'show chassis')
show config C	Chassis
show config C all	Show configuration for this location and all of its children
show config C.S	Slot
show config C.S all	Show configuration for this location and all of its children
show config C.S.P	Port
show config C.S.P all	Show configuration for this location and all of its children
show config *NAME*	Show administrative configuration for a location
show config *NAME* all	Show configuration for this location and all of its children
show cos prio	Show CoS priority configuration
show cos prio C	Show CoS priority for all slots in this chassis
show cos prio C.S	Show CoS priority for this slot
show defaults C	Chassis
show defaults C all	Show defaults for this location and all of its children
show defaults C.S	Slot
show defaults C.S all	Show defaults for this location and all of its children
show defaults C.S.P	Port
show defaults C.S.P all	Show defaults for this location and all of its children
show defaults *NAME*	Show default configuration for a location
show defaults *NAME* all	Show defaults for this location and all of its children
show digital-diagnostics	Show Digital Diagnostics summary
show digital-diagnostics C	For all ports in this chassis
show digital-diagnostics C.S	For all ports in this slot
show digital-diagnostics C.S.P	For a specific port
show digital-diagnostics *NAME*	Show Digital Diagnostics summary

Command	Description
show discovery hosts	List of hosts found by L2 Discovery Protocol
show dscp map	For all slots
show dscp map C	For all slots in a chassis
show dscp map C.S	For a slot
show firmware	Show firmware info
show firmware areas	Show firmware non-volatile areas
show firmware areas C	Show firmware non-volatile area for chassis
show firmware areas C.S	Show firmware non-volatile area for slot
show firmware sessions	Show firmware download sessions
show flows	Show flow configuration
show flows C	Show flow configuration for all slots in this chassis
show flows C.S	Show flow configuration for this slot
show groups	Show group configuration
show history	Display the session command history
show hw-config	Show hardware configuration settings (e.g. jumper/DIP switches)
show hw-config C.S	For a slot
show inventory	Show information about every object in the system
show inventory tsv	Inventory in a tab-separated format
show ip	Show administrative IP status
show ip interface	Show system IP interface configuration
show ip interface vlan-id	Show VLAN 802.1q configuration
show ip tables	Show ip tables configuration
show log	Show logging configuration and log entries
show log nvram	NVRAM log
show log nvram *<1-99999>*	NVRAM log
show log nvram all	Show all NVRAM log entries
show log remote-server hosts	Show remote syslog servers
show log running	Running log
show log running *<1-99999>*	Running log
show log running all	Show all running log entries
show map	Display port map
show map C	Enter chassis location
show map C dump actual	Show actual (operating) state
show map C dump desired	Show desired (administrative) state
show map C names	Map list with full port names
show map C simple	Map list without graphics

Command	Description
show map C.S	Enter slot location
show map C.S dump actual	Show actual (operating) state
show map C.S dump desired	Show desired (administrative) state
show map C.S names	Map list with full port names
show map C.S simple	Map list without graphics
show map C.S.P	Enter port location
show map C.S.P dump actual	Show actual (operating) state
show map C.S.P dump desired	Show desired (administrative) state
show map C.S.P names	Map list with full port names
show map C.S.P simple	Map list without graphics
show map names	Map list with full port names
show map simple	Map list without graphics
show mapping-types	Show mapping-type info
show mapping-types C	Show mapping-type info
show mapping-types C.S	(no description yet)
show mapping-types C.S.P	(no description yet)
show memory	Show memory usage
show ntp	Show NTP configuration
show ntp-server hosts	Show NTP servers
show packages	Show installed packages and versions
show permissions	Show your permissions
show permissions chassis	Show your chassis permissions
show permissions port	Show your port permissions
show permissions slot	Show your slot permissions
show plugins	Show Pluggable Optics (SFP/GBIC/XFP) summary
show ports	Show port list
show proc cpu	CPU utilization and memory statistics
show redundancy C	Show chassis redundancy info
show redundancy C.S	Show slot redundancy info
show redundancy *NAME*	Show redundancy info
show rm slots	Show s/w versions of rm slots
show running-config	Current operating configuration
show slot all	Show list of all slots (deprecated, use 'show slots')
show slots	Show slot list
show snmp-server	Show SNMP server configuration
show snmp-server hosts	Show trap recipients
show snmp-server users	SNMPv3 user list

Command	Description
show statistics	Show port info
show sys	Show system information
show sys date	Show the system clock
show sys login-banner	Show login banner
show table chassis dump	Dump in machine readable format
show table metamib feature dump	Dump in machine readable format
show table metamib variable dump	Dump in machine readable format
show table port dump	Dump in machine readable format
show table protocol	Display protocol table
show table protocol dump	Dump in machine readable format
show table slot dump	Dump in machine readable format
show terminal	Show local terminal information
show unmapped	Show unmapped ports
show unmapped C	Enter slot location
show unmapped C.S	Enter port location
show unmapped C.S.P	Show unmapped ports
show user-class	User class (debug, super, etc)
show users	User accounts
show vid-map	Show VID map
show vid-map C	Show VID map for all slots in this chassis
show vid-map C.S	Show VID map for this slot
sleep *<0-10>*	Pause CLI for scripting
slot C.S	A slot location
slot *NAME*	Configure a slot
slot *NAME* type *TYPE*	Specify a specific slot type (This command is only available in the startup-config file)
slot *NAME* type *TYPE* rev *<0-255>*	Specify a specific slot revision (This command is only available in the startup-config file)
snmp-server community read	Set read community string
snmp-server community read *WORD*	Set read community string
snmp-server community read encrypted *WORD*	Encrypted
snmp-server community write	Set write community string
snmp-server community write *WORD*	Set write community string
snmp-server community write encrypted *WORD*	Encrypted
[no] snmp-server host *A.B.C.D*	Add trap recipient
snmp-server host *A.B.C.D COMMUNITY*	Add trap recipient

Command	Description
snmp-server host *A.B.C.D COMMUNITY* alarm	Set host trap threshold to alarm - similar to LOG_WARNING (4)
snmp-server host *A.B.C.D COMMUNITY* alarm *<1-65535>*	Set host trap threshold to alarm - similar to LOG_WARNING (4)
snmp-server host *A.B.C.D COMMUNITY* error	Set host trap threshold to LOG_ERR (3)
snmp-server host *A.B.C.D COMMUNITY* error *<1-65535>*	Set host trap threshold to LOG_ERR (3)
snmp-server host *A.B.C.D COMMUNITY* fatal	Set host trap threshold to LOG_EMERG (0)
snmp-server host *A.B.C.D COMMUNITY* fatal *<1-65535>*	Set host trap threshold to LOG_EMERG (0)
snmp-server host *A.B.C.D COMMUNITY* warning	Set host trap threshold to LOG_WARNING (4)
snmp-server host *A.B.C.D COMMUNITY* warning *<1-65535>*	Set host trap threshold to LOG_WARNING (4)
default snmp-server port	Port that the SNMP server listens on
snmp-server port *<1-65535>*	Port that the SNMP server listens on
[default|no] snmp-server sys contact	Clear SNMP sysContact
snmp-server sys contact *LINE*	Set SNMP sysContact
[default|no] snmp-server sys location	Clear SNMP sysLocation
snmp-server sys location *LINE*	Set SNMP sysLocation
[default|no] snmp-server sys name	Clear SNMP sysName and restore prompt to default
snmp-server sys name *LINE*	Set SNMP sysName (and prompt)
[default|no] snmp-server traps module	Enable module traps
[default|no] snmp-server traps power-supply	Enable power supply traps
[no] snmp-server user *USERNAME*	Configure SNMPv3 users
snmp-server user *USERNAME* auth md5	MD5 authentication hash
snmp-server user *USERNAME* auth md5 *AUTHPASS*	MD5 authentication hash
snmp-server user *USERNAME* auth md5 *AUTHPASS* priv des *PRIVPASS*	DES encryption
snmp-server user *USERNAME* auth md5 priv des	DES encryption
snmp-server user *USERNAME* auth sha	SHA authentication hash
snmp-server user *USERNAME* auth sha *AUTHPASS*	SHA authentication hash

Command	Description
snmp-server user *USERNAME* auth sha *AUTHPASS* priv des *PRIVPASS*	DES encryption
snmp-server user *USERNAME* auth sha priv des	DES encryption
snmp-server user *USERNAME* encrypted auth md5 *AUTHPASS*	MD5 authentication hash
snmp-server user *USERNAME* encrypted auth md5 *AUTHPASS* priv des *PRIVPASS*	DES encryption
snmp-server user *USERNAME* encrypted auth sha *AUTHPASS*	SHA authentication hash
snmp-server user *USERNAME* encrypted auth sha *AUTHPASS* priv des *PRIVPASS*	DES encryption
[default|no] snmp-server v1	Enable SNMPv1
[default|no] snmp-server v2c	Enable SNMPv2c
[default|no] snmp-server v3	Enable SNMPv3
sync	Wait for changes to be flushed to hardware / display
[default|no] sys api-agent	Enable API agent
[default|no] sys audit-log	Enable the audit log
sys clear-counters	Clear counters system wide
sys date *DATESTR*	Set the system clock
sys disconnect pid *PID*	Disconnect a specific session(s)
sys disconnect user *USER*	Disconnect a user's session(s)
sys disconnect user *USER* api	Disconnect user from all API sessions
sys disconnect user *USER* console	Disconnect user from serial console
sys disconnect user *USER* gui	Disconnect user from all gui sessions
sys disconnect user *USER* ssh	Disconnect user from all ssh sessions
sys disconnect user *USER* telnet	Disconnect user from all telnet sessions
[default|no] sys discovery	Enable L2 Discovery Protocol
[default|no] sys gui-server	Configure the GUI server
default sys gui-server port	Set the GUI server port to its default state
sys gui-server port *<1-65534>*	Set the GUI server port
[default|no] sys idle-timeout	Disable CLI idle timeout
sys idle-timeout *<0-400000>*	Set CLI idle timeout (in minutes)
[default|no] sys lmp	Enable loop management protocol
[default|no] sys lock-types	Enable Type-Locking
[default|no] sys login-banner	Set login-banner
sys login-banner *STRING*	Set login-banner

Command	Description
[default|no] sys password-strength-check	Enable password strength checking
default sys prompt	Restore prompt (and SNMP sysName) to default
sys prompt *LINE*	Change prompt (and SNMP sysName)
sys rdate	Set the system clock from an rdate server
sys rdate *A.B.C.D*	Set the system clock from an rdate server
[default|no] sys rdate-server	Set rdate server address (only used for 'sys rdate')
sys rdate-server *A.B.C.D*	Set rdate server address (only used for 'sys rdate')
sys serial baudrate 19200	Set to 19200 baud
sys serial baudrate 38400	Set to 38400 baud
sys serial baudrate 9600	Set to 9600 baud
[default|no] sys serial terminal-type	Clear serial port terminal type (will auto-detect)
sys serial terminal-type *LINE*	Set serial port terminal type
[default|no] sys tftp-host-ip	Set TFTP host address
sys tftp-host-ip *A.B.C.D*	Set TFTP host address
[default|no] sys timezone	Use UTC/GMT
sys timezone *TIMEZONE*	Timezone
[no] terminal echo-commands	Echo commands when sourcing scripts
[no] terminal progress	Show progress indicator while waiting for commands to complete
[no] terminal show-timestamps	Show time stamps for log messages displayed on the CLI
[no] username *NAME*	User account management
username *NAME* class debug	has access to low-level (dangerous) debug commands
username *NAME* class normal	has access to view and change settings based on group membership
username *NAME* class super	has access to configure the system
username *NAME* class view	has read-only access to system
[no] username *NAME* group *NAME*	Add a single group
no username *NAME* groups	Remove all groups
username *NAME* groups *WORD*	Enter full group list
username *NAME* password	Set password
username *NAME* password *PASS*	Set password
username *NAME* password *PASS* class debug	has access to low-level (dangerous) debug commands
username *NAME* password *PASS* class normal	has access to view and change settings based on group membership

Command	Description
username *NAME* password *PASS* class super	has access to configure the system
username *NAME* password *PASS* class view	has read-only access to system
username *NAME* password class debug	has access to low-level (dangerous) debug commands
username *NAME* password class normal	has access to view and change settings based on group membership
username *NAME* password class super	has access to configure the system
username *NAME* password class view	has read-only access to system
username *NAME* password encrypted *PASS*	Encrypted password
username *NAME* password encrypted *PASS* class debug	has access to low-level (dangerous) debug commands
username *NAME* password encrypted *PASS* class normal	has access to view and change settings based on group membership
username *NAME* password encrypted *PASS* class super	has access to configure the system
username *NAME* password encrypted *PASS* class view	has read-only access to system
who	Show user sessions
whoami	Who am I?
write file	Write configuration to the startup-config file
write terminal	Write to terminal

2.3. Chassis Configuration Context

Table 6. Chassis Configuration Context Table

Command	Description
default all	Restore defaults for this location and all of its children
chassis C	A chassis location
chassis *NAME*	Configure a chassis
clear-counters	Clear counters for all ports in this chassis
default description	Restore description to its default state
description *LINE*	Set chassis name
echo	Display text for scripting
echo *LINE*	Display text for scripting
end	End current context and go down to initial command context
exit	Exit current context and go down to previous context
firmware download *FILE*	Start/abort firmware download into hardware non-volatile area
firmware download abort	Abort current download
firmware reload	Reload firmware from primary non-volatile area
firmware swap-primary	Swap between primary and backup firmware
flush	Wait for changes to be flushed to hardware
[default|no] gen-trap chassis	Enable chassis traps
[default|no] gen-trap lin	Enable LIN traps
[default|no] gen-trap link	Enable link traps
[default|no] gen-trap loopback	Enable loopback traps
[default|no] gen-trap module-specific	Enable module specific traps
[default|no] gen-trap port	Enable port traps
[default|no] gen-trap port-change	Enable port change traps
[default|no] gen-trap port-diags	Enable digital diagnostic traps
[default|no] gen-trap slot-change	Enable slot change traps
[default|no] gen-trap switchover	Enable active/standby switchover change traps
list	Print command list
list *MATCH*	Print command list
logout	Logout of the system
default loopback-timeout	Adjust loopback timeout
loopback-timeout *<0-2147483647>*	Adjust loopback timeout
map clear-all	Clear all related mappings

Command	Description
map repeater	Set to 'repeater' setting (1 <-> 2, etc.)
map to-self	Map to itself (and clear other mappings)
default me	Restore defaults for this location only
next	Configure next element
[no] pager	Pause scrolling when screen is full
port C.S.P	A port location
port *NAME*	Configure a port
port S.P	A port in this chassis
previous	Configure previous element
quit	Exit current context and go down to previous context
show	Show running system information
show config	Show administrative configuration for this object
show config all	Show administrative configuration for this object and all of its children
show defaults	Show default configuration for this object
show defaults all	Show default configuration for this object and all of its children
show digital-diagnostics	Show Digital Diagnostics summary
show dump	Dump machine readable status
show firmware	Show onboard non-volatile areas
show firmware sessions	Show firmware download sessions
show hw-config	Show hardware configuration settings (e.g. jumper/DIP switches)
show map	Display port map
show map dump actual	Show actual (operating) state
show map dump desired	Show desired (administrative) state
show map names	Map list with full port names
show map simple	Map list without graphics
show mapping-types	Show mapping-type info
show redundancy	Show slot redundancy info
show running-config	Current operating configuration
show traps	Show trap filter configuration
show unmapped	Show only unmapped ports
sleep *<0-10>*	Pause CLI for scripting
slot C.S	A slot location
slot *NAME*	Configure a slot
slot S	A slot on this chassis

Command	Description
sync	Wait for changes to be flushed to hardware / display
default temperature-limit	Adjust high-temperature limit (deg. C)
temperature-limit <-100-100>	(no description yet)
default temperature-min	Adjust low-temperature limit (deg. C)
temperature-min <-100-100>	(no description yet)
[default|no] trap	Enable trap generation
[no] trap *NAME*	Enable trap generation
who	Show user sessions
whoami	Who am I?
write file	Write configuration to the startup-config file
write terminal	Write to terminal

2.4. Slot Configuration Context

Table 7. Slot Configuration Context Table

Command	Description
default acc-control tagged	Specify control for tagged frames
acc-control tagged deny-all	Discard all tagged frames
acc-control tagged deny-list *LINE*	Discard only specific tagged frames
acc-control tagged permit-all	Pass all tagged frames
acc-control tagged permit-list *LINE*	Pass only specific tagged frames
default acc-control untag	Specify control for untagged frames
acc-control untag deny	Discard all untagged frames
acc-control untag permit	Pass all untagged frames
default aging-timer	Restore Switch Aging Timer in seconds to default setting
aging-timer *<1-86400>*	Configure Switch Aging Timer in seconds
default all	Restore defaults for this location and all of its children
chassis C	A chassis location
chassis *NAME*	Configure a chassis
clear-counters	Clear counters for all ports in this slot
clear-type	Clear Type, if locking types
[default|no] cos	specify frame priority classification
cos both-tag-dscp	prioritize per DSCP value (has precedence) or VLAN priority
cos dscp-only	prioritize per DSCP value
default cos prio	Return CoS priority configuration to defaults
cos prio *<0-7>* high	Configure high CoS priority
cos prio *<0-7>* low	Configure low CoS priority
cos prio *<0-7>* medium	Configure medium CoS priority
cos prio *<0-7>* normal	Configure normal CoS priority
cos tag-only	Prioritize per VLAN priority
default description	Restore description to its default state
description *LINE*	Set slot name
default dscp	Return DSCP configuration to defaults
default dscp egress-mode	Specify remarking mode on egress
dscp egress-mode af-mode	Assured forward remarking
dscp egress-mode cs-mode	Class selector remarking
[default|no] dscp ingress af	Assured forwarding
	Code point values other than af, cs, ef, zero

Command	Description
[default|no] dscp ingress all-other	
[default|no] dscp ingress cs	Class selector
[default|no] dscp ingress ef	Expedited forwarding
[default|no] dscp ingress zero-dscp	Zero code point
no dscp map <*0-63*>	Remove a DSCP map
dscp map <*0-63*> active	DSCP row active
dscp map <*0-63*> high active	DSCP row active
dscp map <*0-63*> high notInService	DSCP row configured, not active
dscp map <*0-63*> low active	DSCP row active
dscp map <*0-63*> low notInService	DSCP row configured, not active
dscp map <*0-63*> medium active	DSCP row active
dscp map <*0-63*> medium notInService	DSCP row configured, not active
dscp map <*0-63*> normal active	DSCP row active
dscp map <*0-63*> normal notInService	DSCP row configured, not active
dscp map <*0-63*> notInService	DSCP row configured, not active
[default|no] dscp remark	DSCP Remarking
echo	Display text for scripting
echo *LINE*	Display text for scripting
end	End current context and go down to initial command context
exit	Exit current context and go down to previous context
firmware download *FILE*	Start/abort firmware download into hardware non-volatile area
firmware download abort	Abort current download
firmware reload	Reload firmware from primary non-volatile area
firmware swap-primary	Swap between primary and backup firmware
default flow	Return flow configuration to defaults
no flow <*1-4095*> <*0-8*>	Remove flow
flow <*1-4095*> <*0-8*> <*0-1000000*> active	Flow row active
flow <*1-4095*> <*0-8*> <*0-1000000*> notInService	Flow row configured, not active
flow <*1-4095*> <*0-8*> active	Flow row active
flow <*1-4095*> <*0-8*> clear	clear counters for this flow
flow <*1-4095*> <*0-8*> notInService	Flow row configured, not active

Command	Description
flush	Wait for changes to be flushed to hardware
default homing	Adjust homing setting
homing dualcos	Dual Central Offices
homing singleco	Single Central Office
[default|no] iometrix	Process Iometrix cNode Level 1 frames received
[default|no] ip default-gateway	Clear default gateway
ip default-gateway *A.B.C.D*	Set default gateway
no ip interface	Slot interface configuration
ip interface *A.B.C.D*	Slot interface configuration
ip interface *A.B.C.D/M*	Slot interface configuration
lga start interval *<10-86400>*	Monitoring duration (Perf/Mon) or interval (Loss/ Gain
lga stop	Stop Loss Gain Analysis
[default|no] link-aggregation	aggregate both trunks into the active path
link-aggregation on-dmac	select trunk based on destination MAC address
link-aggregation on-ip	select trunk based on IP information
link-aggregation on-random	select trunk randomly
link-aggregation on-xor-all	select trunk based on MAC addresses and IP info
link-aggregation on-xor-sd	select trunk based on both MAC addresses
default link-toggle-action	Start or stop link toggle of group members
link-toggle-action start	(no description yet)
link-toggle-action stop	(no description yet)
default link-toggle-cycles	Configure number of link toggle cycles
link-toggle-cycles *<0-4294967294>*	Configure number of link toggle cycles
default link-toggle-down-rate	Adjust link toggle down rate (microseconds), for group members
link-toggle-down-rate *<0-4294967294>*	Adjust link toggle down rate (microseconds), for group members
link-toggle-members *WORD*	Configure ports as a part of a link toggle group
default link-toggle-trap-start-	Restore link-toggle-trap-start-emit to its default state
link-toggle-trap-start- emit-not	(no description yet)
link-toggle-trap-start- emit-yes	(no description yet)
default link-toggle-trap-stop-e	Restore link-toggle-trap-stop-emit to its default state
link-toggle-trap-stop-e emit-not	(no description yet)
link-toggle-trap-stop-e emit-yes	(no description yet)
default link-toggle-up-rate	Adjust link toggle up rate (microseconds), for group members

Command	Description
link-toggle-up-rate *<0-4294967294>*	Adjust link toggle up rate (microseconds), for group members
list	Print command list
list *MATCH*	Print command list
logout	Logout of the system
default management-vid	define VLAN id reserved exclusively to management
management-vid *<1-4095>*	define VLAN id reserved exclusively to management
map clear-all	Clear all related mappings
map repeater	Set to 'repeater' setting (1 <-> 2, etc.)
map to-self	Map to itself (and clear other mappings)
[default|no] maps heartbeat	Start MAPS heartbeat
default maps rx-timer	Specify MAPS RX heartbeat timer
maps rx-timer *<15-30>*	Specify MAPS RX heartbeat timer
default maps tx-timer	Specify MAPS TX heartbeat timer
maps tx-timer *<1-10>*	Specify MAPS TX heartbeat timer
default maps vid	Specify VLAN ID for MAPS packets
maps vid *<1-4095>*	Specify VLAN ID for MAPS packets
default maps-mode	Restore maps-mode to its default state
maps-mode master	(no description yet)
maps-mode slave	(no description yet)
default me	Restore defaults for this location only
default mgmt-vid	Restore mgmt-vid to its default state
mgmt-vid *<0-4095>*	(no description yet)
next	Configure next element
operation-type add-drop-mux	(no description yet)
operation-type booster-agc	Optical Amplifier booster, gain mode
operation-type booster-apc	Optical Amplifier booster, output power mode
operation-type co	Central Office
operation-type co-dual-active	Active Central Office
operation-type co-dual-inactive	Inactive Central Office
operation-type converter	Media Converter
operation-type cpe	Customer Premise Equipment
operation-type fast-repeater	Fast Ethernet Repeater
operation-type gigabit-repeater	Gigabit Ethernet Repeater
operation-type inline-agc	Optical Amplifier inline, gain mode
operation-type inline-apc	Optical Amplifier inline, output power mode
operation-type management	Management Card

Command	Description
operation-type midstage-agc	(no description yet)
operation-type midstage-apc	(no description yet)
operation-type monitor	Monitor
operation-type multi-co10g	(no description yet)
operation-type multi-co1g	(no description yet)
operation-type multicast	Configure flooding limit for multicast frames (Kfps)
operation-type multiplexer	Multiplexer
operation-type multiplexer4x10g	(no description yet)
operation-type opt-attenuator	(no description yet)
operation-type optical-switch	Optical Switch
operation-type packet-mux	(no description yet)
operation-type phys-layer-switch	Physical Layer Switch
operation-type preamp-agc	Optical Amplifier preamplifier, gain mode
operation-type preamp-apc	Optical Amplifier preamplifier, output power mode
operation-type preamp-appc	(no description yet)
operation-type redundant	Self Healing Link
operation-type remote	Remote Management Card
operation-type repeater	Repeater
operation-type repeater40g	(no description yet)
operation-type splitter-combiner	Splitter/combiner
operation-type switch	Switch
operation-type variable-gain	(no description yet)
[no] pager	Pause scrolling when screen is full
pm start direction co-to-cpe interval <*60-604800*>	Monitoring duration (Perf/Mon) or interval (Loss/Gain
pm start direction cpe-rx interval <*60-604800*>	Monitoring duration (Perf/Mon) or interval (Loss/Gain
pm start direction cpe-to-co interval <*60-604800*>	Monitoring duration (Perf/Mon) or interval (Loss/Gain
pm start direction cpe-tx interval <*60-604800*>	Monitoring duration (Perf/Mon) or interval (Loss/Gain
pm stop	Stop Performance Monitoring
port C.S.P	A port location
port *NAME*	Configure a port
port P	A port on this slot
port S.P	A port on this chassis
previous	Configure previous element

Command	Description
quit	Exit current context and go down to previous context
[default|no] redundancy	Enable slot redundancy
reset cold	Full slot reset
reset warm	Slot software reset
show	Show running system information
show access	Show EUSM access control vid list
show attenuation	Display port attenuation settings
show config	Show administrative configuration for this object
show config all	Show administrative configuration for this object and all of its children
show cos prio	Show CoS priority configuration
show defaults	Show default configuration for this object
show defaults all	Show default configuration for this object and all of its children
show digital-diagnostics	Show Digital Diagnostics summary
show dscp map	DSCP Map
show dump	Dump machine readable status
show eusm	Show EUSM slot info
show firmware	Show onboard non-volatile areas
show firmware sessions	Show firmware download sessions
show flows	Show flow configuration
show hw-config	Show hardware configuration settings (e.g. jumper/DIP switches)
show lga statistics	Show Loss Gain Analysis statistics info
show map	Display port map
show map dump actual	Show actual (operating) state
show map dump desired	Show desired (administrative) state
show map names	Map list with full port names
show map simple	Map list without graphics
show mapping-types	Show mapping-type info
show maps	MAPS information
show mgmt-vid	Display vlan mgmt vid setting
show oam	OAM remote management information
show pattern	Pattern Generator/Checker information
show pm statistics	Show Performance Monitoring statistics info
show redundancy	Show slot redundancy info
show running-config	Current operating configuration
show sniffer	Show slot all ports sniffer status

Command	Description
show statistics	Show port info
show traps	Show trap filter configuration
show unmapped	Show only unmapped ports
show vid-map	Show VID map for the current slot
sleep *<0-10>*	Pause CLI for scripting
slot C.S	A slot location
slot *NAME*	Configure a slot
slot S	A slot on this chassis
default storm-control broadcast	Configure flooding limit for broadcast frames (Kfps)
storm-control broadcast *<0-255>*	Configure flooding limit for broadcast frames (Kfps)
default storm-control multicast	Configure flooding limit for multicast frames (Kfps)
storm-control multicast *<0-255>*	Configure flooding limit for multicast frames (Kfps)
default storm-control unicast	Configure flooding limit for unicast frames (Kfps)
storm-control unicast *<0-255>*	Configure flooding limit for unicast frames (Kfps)
sync	Wait for changes to be flushed to hardware / display
default toggle-rate	Adjust toggling rate (microseconds), Value will be rounded to the closest HW value
toggle-rate *<1-2147483647>*	Adjust toggling rate (microseconds), Value will be rounded to the closest HW value
[default|no] trap	Enable trap generation
[no] trap *NAME*	Enable trap generation
up	Configure parent element
default user-oam-1	Restore User OAM Channel 1 to default setting
user-oam-1 discard	Set User OAM Channel 1 to "discard"
user-oam-1 notSupported	Set User OAM Channel 1 to "notSupported"
user-oam-1 passthru	Set User OAM Channel 1 to "passthru"
default user-oam-2	Restore User OAM Channel 2 to default setting
user-oam-2 discard	Set User OAM Channel 2 to "discard"
user-oam-2 notSupported	Set User OAM Channel 2 to "notSupported"
user-oam-2 passthru	Set User OAM Channel 2 to "passthru"
default user-port-limit	define bandwidth (Kbps) for user-port traffic
user-port-limit *<0-1000000>*	define bandwidth (Kbps) for user-port traffic
default vid-map	Return VID map configuration to defaults
no vid-map *<0-4095>*	Remove VID map
vid-map *<0-4095>* *<0-4095>* active	VID row active

Command	Description
vid-map *<0-4095>* *<0-4095>* notInService	VID row configured, not active
vid-map *<0-4095>* active	VID row active
vid-map *<0-4095>* notInService	VID row configured, not active
who	Show user sessions
whoami	Who am I?
write file	Write configuration to the startup-config file
write terminal	Write to terminal

2.5. Port Configuration Context

Table 8. Port Configuration Context Table

Command	Description
default acc-control tagged	Specify control for tagged frames
acc-control tagged deny-all	Discard all tagged frames
acc-control tagged deny-list *LINE*	Discard only specific tagged frames
acc-control tagged permit-all	Pass all tagged frames
acc-control tagged permit-list *LINE*	Pass only specific tagged frames
default acc-control untag	Specify control for untagged frames
acc-control untag deny	Discard all untagged frames
acc-control untag permit	Pass all untagged frames
[default|no] aging	Enable aging
default all	Restore defaults for this location and all of its children
default amplifier gain	AGC mode gain in dB
amplifier gain *GAIN*	AGC mode gain in dB
default amplifier output-power	APC mode output power
amplifier output-power <-2147483647-2147483647	(no description yet)
default attenuation	Attenuation in dB
attenuation *ATTEN*	Set attenuation in dB
default attenuation rx	(no description yet)
attenuation rx *ATTEN*	0.0-15.0
default attenuation tx	(no description yet)
attenuation tx *ATTEN*	0.0-15.0
[default|no] auto-neg-adv	Adjust auto-negotiation advertisement
[no] auto-neg-adv 10	Advertise 10Base-T
[no] auto-neg-adv 10 full	Advertise full duplex only for this speed
[no] auto-neg-adv 10 half	Advertise half duplex only for this speed
[no] auto-neg-adv 100	Advertise 100Base-Tx
[no] auto-neg-adv 100 full	Advertise full duplex only for this speed
[no] auto-neg-adv 100 half	Advertise half duplex only for this speed
[no] auto-neg-adv 1000	Advertise 1000Base-T
[no] auto-neg-adv 1000 full	Advertise full duplex only for this speed
[no] auto-neg-adv 1000 half	Advertise half duplex only for this speed
auto-neg-adv all	Advertise all capabilities
[no] auto-neg-adv flow-control	Advertise flow control

Command	Description
[no] auto-neg-adv full	Advertise full duplex only for all speeds
[no] auto-neg-adv half	Advertise half duplex only for all speeds
auto-neg-adv hex *WORD*	Advertise using hex format (see MIB descr. for help)
default auto-neg-wait	Set the number of seconds a port should auto-negotiate before deciding a link is down
auto-neg-wait *<1-254>*	Set the number of seconds a port should auto-negotiate before deciding a link is down
[default|no] auto-negotiation	Enable auto-negotiation
default cable-len	Adjust the expected maximum length cable that will be attached this port
cable-len 133	Set to 0-133 feet
cable-len 266	Set to 134-266 feet
cable-len 399	Set to 267-399 feet
cable-len 533	Set to 400-533 feet
cable-len 655	Set to 534-655 feet
cable-len long-haul	(no description yet)
cable-len short-haul	(no description yet)
cable-test	Test copper user cable for opens/shorts/impedance problems
chassis C	A chassis location
chassis *NAME*	Configure a chassis
clear-counters	Clear counters for this port
[default|no] de-emphasis	Enable Output De-emphasis
de-emphasis 0	Set Output De-emphasis to "0"
de-emphasis 2	Set Output De-emphasis to "2"
de-emphasis 4	Set Output De-emphasis to "4"
de-emphasis 6	Set Output De-emphasis to "6"
default description	Restore description to its default state
description *LINE*	Set port name
default duplex	Adjust port duplex setting
duplex full	Set to full duplex
duplex half	Set to half duplex
echo	Display text for scripting
echo *LINE*	Display text for scripting
default egress-tag-action	Restore egress-tag-action to its default state
egress-tag-action add	Add outer VLAN tag to egress frames; define VLAN id and priority
egress-tag-action retain	(no description yet)

Command	Description
egress-tag-action strip	Remove outer VLAN tag (if any) from egress frames
end	End current context and go down to initial command context
[default|no] equalization	Disable Input Equalization
equalization high	Set Input Equalization to "high"
equalization low	Set Input Equalization to "low"
equalization medium	Set Input Equalization to "medium"
default error-select	Select type of error to monitor
error-select bpv-exz	(no description yet)
error-select cv-exz	(no description yet)
error-select prbs	(no description yet)
exit	Exit current context and go down to previous context
[default|no] fiber-auto-neg	Enable Fiber Auto-Negotiation state on line side of RJ45 port
[default|no] fiber-mode	Enable Set RJ45 port to work with fiber port on its line side
default fiber-speed	Restore Fiber Speed on line side of RJ45 port to default setting
fiber-speed 100	Set Fiber Speed on line side of RJ45 port to "100"
fiber-speed 1000	Set Fiber Speed on line side of RJ45 port to "1000"
[default|no] flow-control	Enable Flow Control
default flow-control receive	Adjust port flow control token reception
flow-control receive comply	Obey received FC tokens
flow-control receive drop	Drop received FC tokens
flow-control receive passthru	Ignore received FC tokens, but relay them to outbound port
[default|no] flow-control send	Enable transmission of FC tokens
flush	Wait for changes to be flushed to hardware
default ingress-tag-action	Restore ingress-tag-action to its default state
ingress-tag-action add	Add outer VLAN tag to egress frames; define VLAN id and priority
ingress-tag-action retain	(no description yet)
ingress-tag-action strip	Remove outer VLAN tag (if any) from egress frames
lga start interval *<10-86400>*	(no description yet)
lga stop	Stop Loss Gain Analysis
[default|no] lin	Enable LIN
[default|no] link-match	Enable link match mode

Command	Description
default link-threshhold rx-power high	Restore Link Threshold Rx Power High to default setting
link-threshhold rx-power high *WORD*	Configure Link Threshold Rx Power High
default link-threshhold rx-power low	Restore Link Threshold Rx Power Low to default setting
link-threshhold rx-power low *WORD*	Configure Link Threshold Rx Power Low
default link-threshhold tx-bias high	Restore Link Threshold Tx Bias High to default setting
link-threshhold tx-bias high *WORD*	Configure Link Threshold Tx Bias High
default link-threshhold tx-bias low	Restore Link Threshold Tx Bias Low to default setting
link-threshhold tx-bias low *WORD*	Configure Link Threshold Tx Bias Low
default link-threshhold tx-power high	Restore Link Threshold Tx Power High to default setting
link-threshhold tx-power high *WORD*	Configure Link Threshold Tx Power High
default link-threshhold tx-power low	Restore Link Threshold Tx Power Low to default setting
link-threshhold tx-power low *WORD*	Configure Link Threshold Tx Power Low
list	Print command list
list *MATCH*	Print command list
local	Configure local device
logout	Logout of the system
[no] loopback	Enable Loopback
loopback all	Return all ingress frames
loopback all swap	DA-SA swap
[no] loopback internal	Internal loopback
loopback mac	MAC for loopback
loopback off	Disable loopback
loopback on-both vid *<1-4095>* mac *WORD*	MAC for loopback
loopback on-both vid *<1-4095>* mac *WORD* swap	DA-SA swap
loopback on-da mac *WORD*	MAC for loopback
loopback on-da mac *WORD* swap	DA-SA swap
loopback on-vid vid *<1-4095>*	VLAN id
loopback on-vid vid *<1-4095>* swap	DA-SA swap
map also-to C.S.P	Enter port location
map also-to *NAME*	Map to a port (in addition to this port's existing destinations)
map clear-all	Clear all related mappings

Command	Description
map not-to C.S.P	Enter port location
map not-to *NAME*	Remove the source port from that destination port
map only-to C.S.P	Enter port location
map only-to *NAME*	Map to a port (and clear all other mappings for both ports)
map repeater	Set to 'repeater' setting (1 <-> 2, etc.)
map to-self	Map to itself (and clear other mappings)
map with C.S.P	(no description yet)
map with *CSSPPP*	Connect to ...
map with *LINE*	Connect to ...
map with *NAME*	Connect to ...
map with *PORT*	Connect to ...
default mapping-type	Adjust mapping type of the port, to define mapping restrictions
mapping-type destination	This port would only be able to be mapped from other ports
mapping-type inter-chas-link	This port would only be used for inter-chassis links
mapping-type open	This port would be available for all types of mappings
mapping-type source	This port would only be able to map to other ports
mapping-type source-helper	This port would only be able to map to source ports
mapping-type unavailable	This port will not be able to be mapped
default mdi-pinout	Adjust MDI/MDI-X
mdi-pinout auto-sense	Autodetect MDI/MDI-X
mdi-pinout mdi	MDI
mdi-pinout mdix	MDI-X
default me	Restore defaults for this location only
next	Configure next element
default nominal-bit-rate	Set port custom bit-rate
nominal-bit-rate <*0-4294967294*>	Set port custom bit-rate
[default|no] oam	enable OAM management
[no] pager	Pause scrolling when screen is full
default path-transmitters	Restore The transmitter on each port in a data path to default setting
path-transmitters disable-all	Set The transmitter on each port in a data path to "disable-all"
path-transmitters enable-all	Set The transmitter on each port in a data path to "enable-all"

Command	Description
default pattern-check duration	Restore duration to its default state
pattern-check duration *<0-4294967294>*	(no description yet)
pattern-check start allOnes	(no description yet)
pattern-check start alternatingOnes	(no description yet)
pattern-check start cjt	(no description yet)
pattern-check start cr	(no description yet)
pattern-check start cs	(no description yet)
pattern-check start none	(no description yet)
pattern-check start prbs15	(no description yet)
pattern-check start prbs23	(no description yet)
pattern-check start prbs31	(no description yet)
pattern-check start prbs7	(no description yet)
pattern-check start prbs9	(no description yet)
pattern-check stop	(no description yet)
default pattern-check update-freq	Restore update-freq to its default state
pattern-check update-freq *<0-4294967294>*	(no description yet)
default pattern-gen duration	Restore duration to its default state
pattern-gen duration *<0-4294967294>*	(no description yet)
pattern-gen start allOnes	(no description yet)
pattern-gen start alternatingOnes	(no description yet)
pattern-gen start cjt	(no description yet)
pattern-gen start cr	(no description yet)
pattern-gen start cs	(no description yet)
pattern-gen start none	(no description yet)
pattern-gen start prbs15	(no description yet)
pattern-gen start prbs23	(no description yet)
pattern-gen start prbs31	(no description yet)
pattern-gen start prbs7	(no description yet)
pattern-gen start prbs9	(no description yet)
pattern-gen stop	(no description yet)
pm start size *<1-9600>* duration *<60-604800>*	(no description yet)
pm stop	Stop Performance Monitoring
port C.S.P	A port location
port *NAME*	Configure a port

Command	Description
port P	A port on this slot
port S.P	A port on this chassis
default preamble-len	Adjust transmitted preamble length setting
preamble-len standard	Always send standard 8 byte preamble
preamble-len variable	Allow transmission of preambles longer than 8 bytes
[default|no] preferred	Select whether channel is preferred
previous	Configure previous element
default priority	Adjust Port Priority
priority <*0-7*>	Adjust Port Priority
[default|no] protocol	Disable protocol
protocol digitalvideo hdtv	HDTV (1.485 GHz)
protocol digitalvideo hdtv-15	HDTV-15 (1.485 GHz)
protocol digitalvideo sdi270	SDI270 (270 MHz)
protocol digitalvideo sdi270-15	SDI270-15 (270 MHz)
protocol digitalvideo sdi540	SDI540 (540 MHz)
protocol digitalvideo sdi540-15	SDI540-15 (540 MHz)
protocol e-carrier e1	E1 (2.048 Mbps)
protocol e-carrier e1-ami	E1 AMI (2.048 Mbps)
protocol e-carrier e1-hdb3	E1 HDB3 (2.048 Mbps)
protocol e-carrier e3	E3 (34.368 Mbps)
protocol e-carrier e3-hdb3	E3 HDB3 (34.368 Mbps)
protocol ethernet 10/100/1000	10/100/1000 (10-1000 Mbps)
protocol ethernet 1000base-t	1000Base-T (1 Gbps)
protocol ethernet 1000base-t/x	1000Base-T/X (1 Gbps)
protocol ethernet 1000base-x	1000Base-X (1 Gbps)
protocol ethernet 100base-fx	100Base-Fx (100 Mbps)
protocol ethernet 100base-tx	100Base-Tx (100 Mbps)
protocol ethernet 10base-fl	10Base-FL (10 Mbps)
protocol ethernet 10base-t	10Base-T (10 Mbps)
protocol ethernet 10g-lan	10G-LAN (10.3125 Gbps)
protocol ethernet 10g-wan	10G-WAN (9.9533 Gbps)
protocol ethernet 10glan-fec237	10GLAN-FEC237 (11.0957 Gbps)
protocol ethernet 10glan-fec238	10GLAN-FEC238 (11.0491 Gbps)
protocol ethernet 10gwan-fec237	10GWAN-FEC237 (10.709 Gbps)
protocol ethernet 10gwan-fec238	10GWAN-FEC238 (10.6642 Gbps)
protocol ethernet 40g	40G (10.3125 Gbps)
protocol ethernet quarter-10ge	Quarter 10GE (3.125 Gbps)

Command	Description
protocol fddi	FDDI (125 Mbps)
protocol fibrechannel 1/2/4/8g	1/2/4/8G (1-8.5 Gbps)
protocol fibrechannel 1/2/4g-repeater	1/2/4g-repeater (1-4 Gbps)
protocol fibrechannel 1/2/4g-retimer	1/2/4g-retimer (1-4 Gbps)
protocol fibrechannel 1/2/4gfc	1/2/4GFC (1-4 Gbps)
protocol fibrechannel 1/2gfc	1/2GFC (1-2 Gbps)
protocol fibrechannel 10g	10G (10.5187 Gbps)
protocol fibrechannel 10g-fec237	10G-FEC237 (11.318 Gbps)
protocol fibrechannel 10g-fec238	10G-FEC238 (11.27 Gbps)
protocol fibrechannel 1gfc	1GFC (1.063 Gbps)
protocol fibrechannel 2gfc	2GFC (2.125 Gbps)
protocol fibrechannel 2xgfc	2xGFC (2/4/8.. Gbps)
protocol fibrechannel 4gfc	4GFC (4.25 Gbps)
protocol fibrechannel 8gfc	8GFC (8.5 Gbps)
protocol ibm escon	ESCON (200 MHz)
protocol ibm ficon	FICON (200 MHz)
protocol infiniband 10g	10G (10 Gbps)
protocol infiniband 2.5g	2.5G (2.5 Gbps)
protocol infiniband 5g	5G (5 Gbps)
protocol otn otu3	OTU3 (10.7543 Gbps)
protocol ppp	PPP
protocol sdh stm64	STM64 (9.9533 Gbps)
protocol sdh stm64-fec237	STM64-FEC237 (10.709 Gbps)
protocol sdh stm64-fec238	STM64-FEC238 (10.6642 Gbps)
protocol slip	SLIP
protocol sonet oc1	OC1 (51.84 Mbps)
protocol sonet oc1/3/12/24/48	OC1/3/12/24/48 (51-2488 Mbps)
protocol sonet oc12	OC12 (622.08 Mbps)
protocol sonet oc192	OC192 (9.9533 Gbps)
protocol sonet oc192-fec237	OC192-FEC237 (10.709 Gbps)
protocol sonet oc192-fec238	OC192-FEC238 (10.6642 Gbps)
protocol sonet oc24	OC24 (1.244 Gbps)
protocol sonet oc3	OC3 (155.52 Mbps)
protocol sonet oc48	OC48 (2.488 Gbps)
protocol sonet oc48/fec	OC48/FEC (2.666 Gbps)
protocol sonet sts1	STS1 (51.54 Mbps)

Command	Description
protocol t-carrier ds3	DS3 (44.736 Mbps)
protocol t-carrier t1	T1 (1.544 Mbps)
protocol t-carrier t1-ami	T1 AMI (1.544 Mbps)
protocol t-carrier t1-b8zs	T1 B8ZS (1.544 Mbps)
protocol t-carrier t3	T3 (44.736 Mbps)
protocol t-carrier t3-b3zs	T3 B3ZS (44.736 Mbps)
protocol telcobus	TelcoBus (77 MHz)
protocol transparent	Transparent
protocol user-defined	User defined
default pump-pwr	Restore pump-pwr to its default state
pump-pwr *<0-4294967294>*	(no description yet)
quit	Exit current context and go down to previous context
default redundant-tx-mode	Adjust redundant trunk transmit mode
redundant-tx-mode 1+1	Enable both trunk transmitters
redundant-tx-mode 1:1	Only enable trunk transmitter connected to the active Rx port on far end
remote	Configure remotely attached device
default rm-chassis	Set remote chassis connectivity information
rm-chassis *<0-4294967294>*	Set remote chassis connectivity information
default rm-port	Set remote port connectivity information
rm-port *<0-4294967294>*	Set remote port connectivity information
default rm-slot	Set remote slot connectivity information
rm-slot *<0-4294967294>*	Set remote slot connectivity information
select-link active	Attempt to make this port active
select-link standby	Attempt to make this port standby
[default|no] sgmii	Set SGMII-PHY mode
show	Show running system information
show attenuation	Display port attenuation setting
show channels	Show channels detected by OSA
show config	Show administrative configuration for this object
show config all	Show administrative configuration for this object and all of its children
show defaults	Show default configuration for this object
show defaults all	Show default configuration for this object and all of its children
show digital-diagnostics	Show Digital Diagnostics summary
show dump	Dump machine readable status
show eusm	Show EUSM port info

Command	Description
show lga	Display loss_gain settings and stats
show map	Display port map
show map dump actual	Show actual (operating) state
show map dump desired	Show desired (administrative) state
show map names	Map list with full port names
show map simple	Map list without graphics
show mapping-types	Show mapping-type info
show oam	OAM remote management information
show pattern	Pattern Generator/Checker information
show plugin	Show Pluggable Optics (SFP/GBIC/XFP) data for this port
show pm	Display perf_mon settings and stats
show running-config	Current operating configuration
show statistics	Show statistics for this port
show thresholds	Show thresholds detected by OSA
show traffic-gen-10	Display traffic-gen-10 settings
show traps	Show trap filter configuration
show tunable-channel	Display tunable channel settings and allowable range
show vid-list	Display vid-list setting
show vlan	Show port VLAN-tagging info
[default|no] shutdown	Disable the port
[default|no] shutdown-unmapped	Enable or Disable the port when it is not mapped from another port
sleep *<0-10>*	Pause CLI for scripting
slot C.S	A slot location
slot *NAME*	Configure a slot
slot S	A slot on this chassis
[default|no] sniff-from	Disable sniffer
sniff-from *PORT*	Set sniffer from port
[default|no] sniffer	Enable sniffer
default speed	Adjust port speed
speed 10	Set to 10Mbps
speed 10-gig	Set to 10-Gigabit
speed 100	Set to 100Mbps
speed 1000	Set to 1-Gigabit
default swing	Restore Peak-to-peak Swing Amplification to default setting
swing *<1-6>*	Configure Output Swing

Command	Description
swing high	Set Peak-to-peak Swing Amplification to "high"
swing normal	Set Peak-to-peak Swing Amplification to "normal"
sync	Wait for changes to be flushed to hardware / display
[default|no] termination	Set port termination
termination 100-ohms	Set to 100 ohms
termination 120-ohms	Set to 120 ohms
termination 75-ohms	Set to 75 ohms
default threshold	Adjust threshold setting
threshold <-2147483647-2147483647	(no description yet)
threshold osnr max *<21-60> MAX*	Maximum, rising above will generate a trap
threshold osnr min *<21-60> MIN*	Minimum, dropping below will generate a trap
threshold rx-power max *<21-60> MAX*	Maximum, rising above will generate a trap
threshold rx-power min *<21-60> MIN*	Minimum, dropping below will generate a trap
threshold-action *<0-4294967294>*	Adjust threshold action setting
[default|no] toggle-mode	Enable toggle-mode
traffic-gen action start	Start traffic generation
traffic-gen action stop	Stop traffic generation
default traffic-gen all	(no description yet)
default traffic-gen da	Egress bytes 0-5 (random, fixed, incrementing)
traffic-gen da fixed *WORD*	Specify fixed destination address
traffic-gen da increment *WORD*	Destination address is incremented starting with specified address
traffic-gen da random	Destination address is randomly selected
default traffic-gen frame-count	Frame count (fixed, continuous)
traffic-gen frame-count continuous	Specify continuous traffic generation
traffic-gen frame-count fixed *<1-4294967294>*	Specify fixed frame count
default traffic-gen frame-size	Frame size for fixed. Interpreted as mask for random
traffic-gen frame-size fixed *<64-9600>*	Specify fixed frame size
traffic-gen frame-size random *<64-9600>*	Frame size is randomly selected
default traffic-gen inter-packet-gap	IPG (bytes)--controls amount of traffic
traffic-gen inter-packet-gap *<12-134217727>*	IPG (bytes)--controls amount of traffic
traffic-gen load *LOAD*	Set traffic-gen load
default traffic-gen pattern	Egress bytes 16-17, replicates (random, fixed)

Command	Description
traffic-gen pattern fixed *WORD*	Specify fixed pattern
traffic-gen pattern random	Pattern is randomly selected
default traffic-gen sa	Egress bytes 6-11 (random, fixed, incrementing)
traffic-gen sa fixed *WORD*	Specify fixed source address
traffic-gen sa increment *WORD*	Source address is incremented starting with specified address
traffic-gen sa random	Source address is randomly selected
default traffic-gen tag	Egress bytes 12-15 (random, fixed, incrementing)
traffic-gen tag fixed *WORD*	Specify fixed tag
traffic-gen tag increment *WORD*	Tag is incremented starting with specified data
traffic-gen tag random	Tag is randomly selected
traffic-gen-10 action start	(no description yet)
traffic-gen-10 action stop	(no description yet)
default traffic-gen-10 all	(no description yet)
default traffic-gen-10 da	Egress bytes 0-5 (random, fixed, incrementing)
traffic-gen-10 da fixed *WORD*	(no description yet)
traffic-gen-10 da increment *WORD*	(no description yet)
traffic-gen-10 da random	(no description yet)
default traffic-gen-10 frame-count	Frame count (fixed, continuous)
traffic-gen-10 frame-count continuous	(no description yet)
traffic-gen-10 frame-count fixed *<1-4294967294>*	(no description yet)
default traffic-gen-10 frame-size	Frame size for fixed. Interpreted as mask for random
traffic-gen-10 frame-size fixed *<64-9600>*	(no description yet)
traffic-gen-10 frame-size random *<64-9600>*	(no description yet)
default traffic-gen-10 headers	(no description yet)
traffic-gen-10 headers *STRING* [OFFSET]	(no description yet)
default traffic-gen-10 inter-packet-gap	IPG (bytes)--controls amount of traffic
traffic-gen-10 inter-packet-gap *<12-134217727>*	IPG (bytes)--controls amount of traffic
traffic-gen-10 load *LOAD*	Set traffic-gen-10 load
default traffic-gen-10 pattern	Egress bytes 16-17, replicates (random, fixed)
traffic-gen-10 pattern fixed *WORD*	(no description yet)
traffic-gen-10 pattern random	(no description yet)

Command	Description
default traffic-gen-10 sa	Egress bytes 6-11 (random, fixed, incrementing)
traffic-gen-10 sa fixed *WORD*	(no description yet)
traffic-gen-10 sa increment *WORD*	(no description yet)
traffic-gen-10 sa random	(no description yet)
default traffic-gen-10 tag	Egress bytes 12-15 (random, fixed, incrementing)
traffic-gen-10 tag fixed *WORD*	(no description yet)
traffic-gen-10 tag increment *WORD*	(no description yet)
traffic-gen-10 tag random	(no description yet)
[default|no] trap	Enable trap generation
[no] trap *NAME*	Enable trap generation
tunable-channel *CHANNEL*	Set tunable channel
tunable-channel *FREQ GHz*	Set tunable channel
tunable-channel *FREQ* Hz	Hertz
tunable-channel *FREQ MHz*	Set tunable channel
tunable-channel *FREQ PHz*	Set tunable channel
tunable-channel *FREQ THz*	Set tunable channel
up	Configure parent element
default vid	VLAN id
vid *<0-4095>*	VLAN id
[default|no] vid-list	Set forwarding vids
vid-list *LINE*	Set forwarding vids
default vlan-tag	Add/remove outer VLAN tag in egress frames
vlan-tag add vid *<0-4095>* priority *<0-7>*	Adjust Port Priority
vlan-tag ignore	Leave VLAN tag(s) in egress frames unchanged
vlan-tag strip	Remove outer VLAN tag (if any) from egress frames
who	Show user sessions
whoami	Who am I?
write file	Write configuration to the startup-config file
write terminal	Write to terminal
no zone	Clear port zone (This command is only available in the startup-config file)
zone C.S.P	Port location (This command is only available in the startup-config file)

3. MetaMIB Reference

3.1. Fiber Config On RJ45 Port

3.1.1. Fiber Auto-Neg

Fiber Auto-Negotiation state on line side of RJ45 port

Type: Enum (`disabled, enabled`)

Access: `Read/write`

CLI command: `fiber-auto-neg`

Default: `disabled`

3.1.2. Fiber Mode

Set RJ45 port to work with fiber port on its line side

Type: Enum (`disabled, enabled`)

Access: `Read/write`

CLI command: `fiber-mode`

Default: `disabled`

3.1.3. Fiber Speed (in Mbps)

Fiber Speed on line side of RJ45 port

Type: Enum (`100, 1000`)

Access: `Read/write`

CLI command: `fiber-speed`

Default: `1000`

3.2. Hd Pmc Port Config

3.2.1. Path Transmitters

The transmitter on each port in a data path

Type: Enum (`disable-all, enable-all`)

Access: `Read/write`

CLI command: `path-transmitters`

3.3. PS Info

3.3.1. PS 1 Info

Power Supply 1 Information

Type: String

Access: `Read only`

CLI command: `ps-monitor-1`

3.3.2. PS 2 Info

Power Supply 2 Information

Type: String

Access: `Read only`

CLI command: `ps-monitor-2`

3.4. Port De-emphasis

3.4.1. De-emphasis (in dB)

Output De-emphasis

Type: Enum (`0, 2, 4, 6`)

Access: `Read/write`

CLI command: `de-emphasis`

3.5. Port Equal Config

3.5.1. Equal-config

Equal Config

Type:	Enum (`disabled, adaptive, manual`)
Access:	`Read/write`
CLI command:	`equal-config`
Default:	`adaptive`

3.6. Port Equalization

3.6.1. Equalization (in level)

Input Equalization

Type:	Integer (Range: `1 to 15`)
Access:	`Read/write`
CLI command:	`equalization`
Default:	`2`

3.7. Port Swing

3.7.1. Swing (in level)

Output Swing

Type:	Integer (Range: `1 to 6`)
Access:	`Read/write`
CLI command:	`swing`
Default:	`3`

3.8. SATA/SAS Cu SFP

3.8.1. De-emphasis

Output De-emphasis

Type: Enum (`disabled, enabled`)

Access: `Read/write`

CLI command: `de-emphasis`

Default: `disabled`

3.8.2. Equalization

Input Equalization

Type: Enum (`disabled, low, medium, high`)

Access: `Read/write`

CLI command: `equalization`

Default: `disabled`

3.8.3. Swing

Peak-to-peak Swing Amplification

Type: Enum (`normal, high`)

Access: `Read/write`

CLI command: `swing`

Default: `normal`

3.9. SFP/XFP Link Threshhold

3.9.1. Rx Power high (in dB)

Link Threshold Rx Power High

Type: Float

Access: `Read/write`

CLI command: `link-threshhold rx-power high`

Default: `Inf`

3.9.2. Rx Power low (in dB)

Link Threshold Rx Power Low

Type: Float

Access: `Read/write`

CLI command: `link-threshhold rx-power low`

Default: `-Inf`

3.9.3. Tx Bias high (in mA)

Link Threshold Tx Bias High

Type: Float

Access: `Read/write`

CLI command: `link-threshhold tx-bias high`

Default: `Inf`

3.9.4. Tx Bias low (in mA)

Link Threshold Tx Bias Low

Type: Float

Access: `Read/write`

CLI command: `link-threshhold tx-bias low`

Default: `-Inf`

3.9.5. Tx Power high (in dB)

Link Threshold Tx Power High

Type: Float

Access: `Read/write`

CLI command: `link-threshhold tx-power high`

Default: `Inf`

3.9.6. Tx Power low (in dB)

Link Threshold Tx Power Low

Type: Float

Access: `Read/write`

CLI command: `link-threshhold tx-power low`

Default: `-Inf`

3.10. Switch Parameter

3.10.1. Aging Timer (in Seconds)

Switch Aging Timer in seconds

Type:	Integer (Range: `1 to 86400`)
Access:	`Read/write`
CLI command:	`aging-timer`
Default:	`300`

3.11. User OAM Channel

3.11.1. User OAM 1

User OAM Channel 1

Type: Enum (`notSupported, discard, passthru`)

Access: `Read/write`

CLI command: `user-oam-1`

Default: `discard`

3.11.2. User OAM 2

User OAM Channel 2

Type: Enum (`notSupported, discard, passthru`)

Access: `Read/write`

CLI command: `user-oam-2`

Default: `discard`

3.12. Voltage Monitor

3.12.1. Blade Voltage (in Volts)

Blade Voltage Monitoring

Type: Float

Access: `Read only`

CLI command: `volt-monitor`

3.12.2. Voltage Backplane & Slot 2 (in Volts)

Slot 2 Voltage Monitoring

Type: Float

Access: `Read only`

CLI command: `volt-monitor-2`

3.12.3. Voltage NM (in Volts)

Slot 5 Voltage Monitoring

Type: Float

Access: `Read only`

CLI command: `volt-monitor-5`

3.12.4. Voltage Slot 1 (in Volts)

Slot 1 Voltage Monitoring

Type: Float

Access: `Read only`

CLI command: `volt-monitor-1`

3.12.5. Voltage Slot 3 (in Volts)

Slot 3 Voltage Monitoring

Type: Float

Access: `Read only`

CLI command: `volt-monitor-3`

3.12.6. Voltage Slot 4 (in Volts)

Slot 4 Voltage Monitoring

Type: Float

Access: `Read only`

CLI command: `volt-monitor-4`

4. LNXNM Troubleshooting

4.1. SNMP Problems

If your SNMP manager has trouble communicating with the SNMP agent in the EM316LNXNM, check your SNMP configuration parameters.

Your network administrator can help determine if your IP configuration (IP address and netmask) is correct. If the SNMP management workstation is on a different network, make sure that you define an appropriate default gateway IP address.

Change the SNMP v1 community string configuration by using the **`snmp-server community read/write`** command. Please note that community string information can not be displayed using any **`show`** command. The community strings are encrypted, even in **`write terminal`** output.

If you are not receiving any traps, check that you entered the network management workstation address in the trap receiver table correctly. Display the table using the **`show snmp-server hosts`** command. Check that both the IP address and the SNMP v1 community string are correct.

Check that you have a working network connection.

Test the connection to the network management station by pinging it. If the network's physical topology has changed recently (e.g. a network management station has been moved from one segment to another), you may have to wait for the entries in the ARP cache to time out.

4.2. Hot-swap issues

If the LNXNM is hot-swapped, the configuration in the LNXNM database and the settings in the hardware may not match. For some devices, the hot-swap feature only works correctly when all changes are written to flash with the "**`write file`**" command *before* a hot-swap or a warm reset. To make sure that the hardware configuration matches the software database, use the "**`restart cold`**" command or power-cycle the box.

Always save changes with "**`write file`**" before a hot-swap.

4.3. Serial Port Connection is stuck at "=>" Prompt

If you see the "`=>`" prompt again when you press "enter" key and nothing else seems to work, the system is halted at the boot ROM prompt. Get out of this prompt by using the "**`reset`**" command or power-cycle. When it starts to boot again, "`Hit any key to stop autoboot:`" should appear and you will see a count down. Let the count down finish, and let the boot ROM attempt to load the firmware. You should eventually get the login prompt. If the symptom persists, and the prompt remains at "`=>`" even after rebooting, the system failed to boot correctly and the unit must be repaired or replaced. Alternately, see the "Recovering from a failed 'upgrade' command" section below.

4.4. Changing console serial port speed

The LNXNM serial console starts by default at 38400 baud. If no local terminal can use 38400 baud, then it is possible to change the LNXNM serial speed setting. You must connect at 38400 initially (somehow) to follow the procedure below.

1. Save all important work and configuration settings, and restart the LNXNM manager.
2. At the prompt **`Hit any key to stop autoboot:"`**, press any keyboard key to enter the u-boot environment.

   (This environment is supported ONLY for the specific commands and procedures described in this document for the current release.)
3. At the "`=>`" prompt, type **`set baudrate 9600`** and <ENTER>.

   The baud rate 9600 shown above is an example. Any of the following values may be used:
   - 9600
   - 19200
   - 38400
   - 57600
   - 115200

   If prompted, hit <ENTER> to change the baud rate of the LNXNM serial port.

   When the port speed changes, your current session will stop working! (continue procedure...)
4. Set your local terminal to the serial speed selected above and restart your terminal application or session.
5. Use the <ENTER> key to verify connection with the returned prompt.

   At the prompt, type **`saveenv`** to set the new serial port speed as the default.
6. Restart the LNXNM with the command **`boot`**, and do not interrupt the startup process.
7. The LNXNM firmware should start, and evenually give the module login banner and prompt.

Contact customer support for help with this procedure.

4.5. All usernames and passwords fail to login

This procedure requires connection through the local RS-232 console CLI. Some user settings may be lost through this procedure. Before following the procedure listed below, make sure that it is safe to interrupt operation.

1. Power-cycle the EM316LNXNM by one of the following methods:
   - Remove, pause, and reinsert the management card
   - Cycle power to the chassis
   - Cold reset the manager module

2. After the "`Hit any key to stop autoboot:`" message displays but during the count down, hit any key to enter the boot ROM user interface.

3. At the "`=>`" prompt, enter the following command to set the "**`runlevel`**" parameter to "S":

```
=> setenv runlevel S
=> run bfl
```

4. The "**`run bfl`**" ("boot from flash") command initiates a Linux shell with a "`sh-3.2#`" prompt. The commands entered in the following session use common Linux shell rules. Enter the command below exactly as listed:

```
sh-3.2# mv /config/startup-config /config/old-startup-config
```

   This command changes the "`startup-config`" file name so that the failed configuration is not automatically used in the boot process.

   The "**`reboot -f`**" command below restarts the LNXNM with the factory default configuration:

```
sh-3.2# reboot -f
```

   Once the login prompt appears, login with the factory default username and password combination: "*`admin`*/*`admin`*".

5. After a successful login, examine the "`old-startup-config`" file to see if you can salvage any data from it. Use any known good data in "**`source old-startup-config`**" to create a new "`old-startup-config`" file and some of the old configuration.

   Sourcing the old configuration file (`old-startup-config`) resets the "admin" user password to the failed one saved in the old file! Since this password may be unknown, assign a known password to the "admin" user with the "**`username admin password`** ***`new-password`***" command immediately following the "**`source`**" command used to retore the old configuration.

6. Immediately use the "**`write file`**" command to save the new configuration and password back to the "`startup-config`" file BEFORE signing out.

4.6. Recovering from a failed "upgrade" command

Before restarting the LNXNM, attempt "**upgrade**" again. Make sure that there are no network disruptions. The next attempt may succeed. However, if there is no login prompt, try the following procedure that may help if the application software in the flash memory is corrupted and you are not able to login. The most frequent cause for flash corruption is ESD (ElectroStatic Discharge).

You must have a RS-232 console connection to the LNXNM for this procedure. You will have to power-cycle LNXNM during this procedure. Make sure it is safe to interrupt operation.

1. Power-cycle the LNXNM, either by removing and reinserting the management card or by cycling power to the chassis. Make sure it is safe to do so.

2. After the "`Hit any key to stop autoboot:`" message displays but during the count down, hit any key to enter the boot ROM user interface.

   In the following commands set the IP address information appropriate for your specific network. Set "**serverip**" to the IP address of the TFTP server hosting the "`uImage.initrd`" file.

```
=> setenv ipaddr 10.1.125.127
=> setenv netmask 255.255.0.0
=> setenv serverip 10.1.1.13
=> setenv gatewayip 10.1.1.1
=> saveenv
=> run bnet
```

3. After the "**run bnet**" ("boot from network") command, the LNXNM fetches the software from the TFTP server and then boots the LNXNM image. The login prompt displays when it is ready for login. At this point, the software is *not* stored in the flash memory of the LNXNM. Follow the procedure to upgrade the LNXNM as described in this manual. Otherwise, boot from network again as described above each time the LNXNM is rebooted.

4.7. "System resources low, access denied" message appears while trying to log in

The system is dangerously low on memory without enough resources to allow another user access to the system. Log out of other sessions to free up resources. Use the "**sys idle-timeout**" command to automatically time out idle sessions after a specified length of time.

4.8. System state does not match "show" command display

Use the **sync** command to force completion of all outstanding commands and the EM316LNXNM-OT to poll all devices and update system status tables.

5. LNXNM Quick Setup Reference

Use this appendix only as a reference to configure IP and the serial console. Consider all precautions in the complete EM316LNXNM User Guide when using this reference. Use the serial console when configuring network parameters to avoid lost communications during configuration.

Connect the installed LNXNM to a PC terminal with a RS-232 serial cable listed below.

Type	Part Number
Adapter Cable (current version)	2012001-001R
Cable and adapter (previous version)	151-3028 REV-F AI 04/04 and 350-0308 REV. B MRG/20028-2

The LNXNM has at least one Ethernet port, which is typically used to connect to a Local Area Network (LAN). The factory default IP address is "192.168.14.201/24" (netmask 255.255.255.0). The EM316LNXNM-OT for Fiber Driver also has SFP ports that can be used to connect to an IP network.

The LNXNM modules have an RS-232 interface for serial communications to a local administrative terminal. The serial parameters for the RS-232 interface are:

- 38400 Baud
- 8 Data Bits
- 1 Stop Bit
- No Parity
- No Flow Control

5.1. First Login

The default account username is **admin** with the password **admin**. A successful login is shown below:

```
MRV Communications

mcc login: admin
Password:
EM316LNXNM v4.7 fdr 17 (Aug 2 2011 - 14:02:31).
U-Boot 1.0.3.2 (Mar 27 2008 - 10:19:12).
Linux kernel v2.6.26.5-svn12741 (#1 Fri May 29 17:18:36 PDT 2009).
EM316LNXNM (firmware 5c.1c) (00:20:1a:02:82:62).
Copyright (c) MRV Corp. 1993-2009
You are a SUPER user!

fiberdriver#
```

5.2. Basic LNXNM Setup

Type **`configure terminal`** to enter the "configuration" context. As shown below, the prompt changes to show the current context.

```
fiberdriver# configure terminal
fiberdriver(config)#
```

Change the admin account password using the "**`username`**" command. Some password strength restrictions apply.

```
fiberdriver(config)# username admin password new-password
fiberdriver(config)#
```

Set the IP address and IP netmask information using the "**`ip interface`**" command. The IP address (169.254.88.200) and netmask (16) shown below are for example only. Use IP values appropriate for your network.

```
fiberdriver(config)# ip interface 169.254.88.200/16
fiberdriver(config)#
```

Set your gateway information using the "**`ip default-gateway`**" command. Again, the address 169.254.88.1 shown below is for example only.

```
fiberdriver(config)# ip default-gateway 169.254.88.1
fiberdriver(config)# ip interface update
```

The IP configuration is complete with the above included "**`ip interface update`**" command.

Use the "**`write file`**" command to save the current configuration to permanent storage in the "startup-config" file. *If not saved, the new configuration is lost when the system restarts.*

```
fiberdriver(config)# write file
fiberdriver(config)#
```

Exit the "configuration" context with the "**`exit`**" command:

```
fiberdriver(config)# exit
fiberdriver(config)#
```

The default SNMP community names are "**`public`**" for read and "**`private`**" for write. Refer to the SNMP chapter to customize SNMP access to the LNXNM.

Refer to the complete LNXNM User Guide for details.

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