

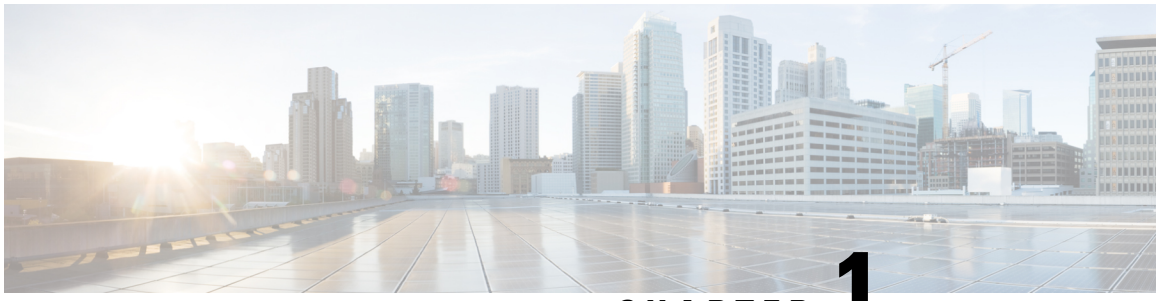
SNMP for Cisco ONS 15454 DWDM and Cisco NCS 2000 Series

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CHAPTER 1

SNMP

This document explains Simple Network Management Protocol (SNMP) as implemented by the Cisco ONS 15454 and NCS.

Note Cisco ONS 15454 M2 chassis has reached its end-of-life status. For more information, see the Retirement Notification page.

Note Unless otherwise specified, "ONS 15454" refers to both ANSI and ETSI shelf assemblies.

Note With references provided to configuration guides, see:

- For software releases 9.3 to 9.8, the Cisco ONS 15454 DWDM Configuration Guide
- For software release 10.0 and later, an appropriate guide from one of these three:
  - Cisco ONS 15454 DWDM Control Card Configuration Guide or Cisco NCS 2000 Series Control Card Configuration Guide
  - Cisco ONS 15454 DWDM Line Card Configuration Guide or Cisco NCS 2000 Series Line Card Configuration Guide
  - Cisco ONS 15454 DWDM Network Configuration Guide or Cisco NCS 2000 Series Network Configuration Guide

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SNMP Overview

SNMP is an application-layer communication protocol that allows ONS 15454 and NCS network devices to exchange management information among these systems and with other devices outside the network. Through SNMP, network administrators can manage network performance, find and solve network problems, and plan network growth. Up to 10 SNMP trap destinations and five concurrent Cisco Transport Controller (CTC) user sessions are allowed per node.

The ONS 15454 and NCS use SNMP for asynchronous event notification to a network management system (NMS). ONS and NCS SNMP implementation uses standard Internet Engineering Task Force (IETF) management information bases (MIBs) to convey node-level inventory, fault, and performance management information for generic DS-1, DS-3, SONET, and Ethernet read-only management. SNMP allows a generic SNMP manager such as HP OpenView Network Node Manager (NNM) or Open Systems Interconnection (OSI) NetExpert to be utilized for limited management functions.

The Cisco ONS 15454 and NCS supports SNMP Version 1 (SNMPv1), SNMP Version 2c (SNMPv2c), and SNMP Version 3 (SNMPv3). As compared to SNMPv1, SNMPv2c includes additional protocol operations and 64-bit performance monitoring support. SNMPv3 provides authentication, encryption, and message integrity and is more secure. This chapter describes the SNMP versions and describes the configuration parameters for the ONS 15454 and NCS.

Note In Software Release 8.0 and later, you can retrieve automatic in service (AINS) state and soak time through the SNMP and Transaction Language One (TL1) interfaces.

Note The CERENT-MSDWDM-MIB.mib, CERENT-FC-MIB.mib, and CERENT-GENERIC-PM-MIB.mib in the CiscoV2 directory support 64-bit performance monitoring counters. The SNMPv1 MIB in the CiscoV1 directory does not contain 64-bit performance monitoring counters, but supports the lower and higher word values of the corresponding 64-bit counter. The other MIB files in the CiscoV1 and CiscoV2 directories are identical in content and differ only in format.

Note In Software Release 9.60 and later, selecting the CERENT-GENERIC-MIB file in ONS 15454 M2 or ONS 15454 M6 displays trap names that are prefixed with g.

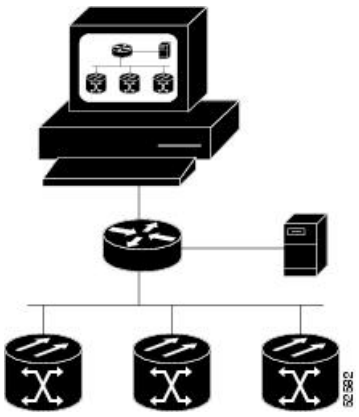
Note It is recommended that the SNMP Manager timeout value be set to 60 seconds. Under certain conditions, if this value is lower than the recommended time, the TCC card can reset. However, the response time depends on various parameters such as object being queried, complexity of what and number of hops in the node, etc.

Note The port names configured in CTC and TL1 can be up to 80 characters; however, SNMP accepts only up to 64 characters for port names.

The SNMP management interface supports the IEEE 802.3 LAG MIB.

The following figure illustrates the basic layout idea of an SNMP-managed network.

Figure 1: Basic Network Managed by SNMP

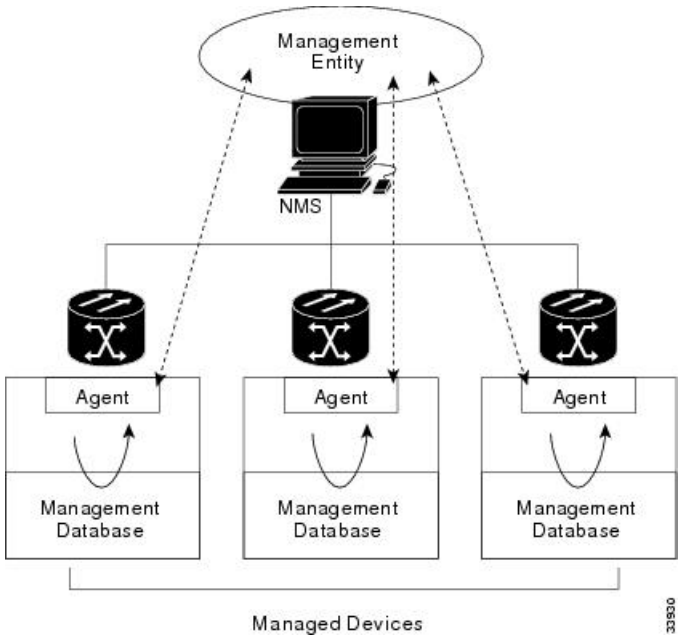


Basic SNMP Components

In general terms, an SNMP-managed network consists of a management system, agents, and managed devices.

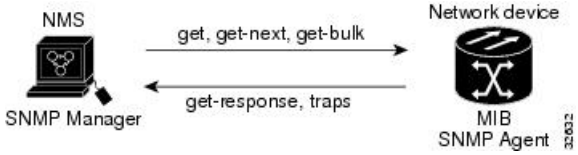
A management system executes monitoring applications and controls managed devices. Management systems execute most of the management processes and provide the bulk of memory resources used for network management. A network might be managed by one or several management systems. The following figure illustrates the relationship between the network manager, the SNMP agent, and the managed devices.

Figure 2: Example of the Primary SNMP Components



An agent (such as SNMP) residing on each managed device translates local management information data—such as performance information or event and error information—caught in software traps, into a readable form for the management system. The following figure illustrates SNMP agent get-requests that transport data to the network management software.

Figure 3: Agent Gathering Data from a MIB and Sending Traps to the Manager



The SNMP agent captures data from MIBs, which are device parameter and network data repositories, or from error or change traps.

A managed element—such as a router, access server, switch, bridge, hub, computer host, or network element (such as an ONS 15454 and NCS)—is accessed through the SNMP agent. Managed devices collect and store management information, making it available through SNMP to other management systems having the same protocol compatibility.

SNMP External Interface Requirement

Since all SNMP requests come from a third-party application, the only external interface requirement is that a third-party SNMP client application can upload RFC 3273 SNMP MIB variables in the etherStatsHighCapacityTable, etherHistoryHighCapacityTable, or mediaIndependentTable.

SNMP Version Support

The ONS 15454 and NCS support SNMPv1 and SNMPv2c traps and get requests. The ONS 15454 and NCS SNMP MIBs define alarms, traps, and status. Through SNMP, NMS applications can query a management agent for data from functional entities such as Ethernet switches and SONET multiplexers using a supported MIB.



Note ONS 15454 and NCS MIB files in the CiscoV1 and CiscoV2 directories are almost identical in content except for the difference in 64-bit performance monitoring features. The CiscoV2 directory contains three MIBs with 64-bit performance monitoring counters: CERENT-MSDWDM-MIB.mib, CERENT-FC-MIB.mib, and CERENT-GENERIC-PM-MIB.mib. The CiscoV1 directory does not contain any 64-bit counters, but it does support the lower and higher word values used in 64-bit counters. The two directories also have somewhat different formats.

SNMPv3 Support

Cisco ONS 15454 and NCS Software R9.0 and later support SNMPv3 in addition to SNMPv1 and SNMPv2c. SNMPv3 is an interoperable standards-based protocol for network management. SNMPv3 provides secure access to devices by a combination of authentication and encryption packets over the network based on the User Based Security Model (USM) and the View-Based Access Control Model (VACM).

SNMPv3 views in TL1 can be configured using a network management system.

- **User-Based Security Model**—The User-Based Security Model (USM) uses the HMAC algorithm for generating keys for authentication and privacy. SNMPv3 authenticates data based on its origin, and ensures that the data is received intact. SNMPv1 and v2 authenticate data based on the plain text community string, which is less secure when compared to the user-based authentication model.
- **View-Based Access Control Model**—The view-based access control model controls the access to the managed objects. RFC 3415 defines the following five elements that VACM comprises:
  - Groups—A set of users on whose behalf the MIB objects can be accessed. Each user belongs to a group. The group defines the access policy, notifications that users can receive, and the security model and security level for the users.
  - Security level—The access rights of a group depend on the security level of the request.
  - Contexts—Define a named subset of the object instances in the MIB. MIB objects are grouped into collections with different access policies based on the MIB contexts.
  - MIB views—Define a set of managed objects as subtrees and families. A view is a collection or family of subtrees. Each subtree is included or excluded from the view.
  - Access policy—Access is determined by the identity of the user, security level, security model, context, and the type of access (read/write). The access policy defines what SNMP objects can be accessed for reading, writing, and creating.

Access to information can be restricted based on these elements. Each view is created with different access control details. An operation is permitted or denied based on the access control details.

You can configure SNMPv3 on a node to allow SNMP get and set access to management information and configure a node to send SNMPv3 traps to trap destinations in a secure way. SNMPv3 can be configured in secure mode, non-secure mode, or disabled mode.

SNMP, when configured in secure mode, only allows SNMPv3 messages that have the authPriv security level. SNMP messages without authentication or privacy enabled are not allowed. When SNMP is configured in non-secure mode, it allows SNMPv1, SNMPv2, and SNMPv3 message types.

SNMP Message Types

The ONS 15454 and NCS SNMP agents communicate with an SNMP management application using SNMP messages. The following table describes these messages.

Table 1: ONS 15454 and NCS SNMP Message Types

Operation	Description
get-request	Retrieves a value from a specific variable.
get-next-request	Retrieves the value following the named variable; this operation is often used to retrieve variables from within a table. With this operation, an SNMP manager does not need to know the exact variable name. The SNMP manager searches sequentially to find the needed variable from within the MIB.
get-response	Replies to a get-request, get-next-request, get-bulk-request, or set-request sent by an NMS.
get-bulk-request	Fills the get-response with up to the max-repetition number of get-next interactions, similar to a get-next-request.
set-request	Provides remote network monitoring (RMON) MIB.
trap	Indicates that an event has occurred. An unsolicited message is sent by an SNMP agent to an SNMP manager.

SNMP Management Information Bases

A managed object, sometimes called a MIB object, is one of many specific characteristics of a managed device. The MIB consists of hierarchically organized object instances (variables) that are accessed by network-management protocols such as SNMP.

IETF-Standard MIBs for the ONS 15454 and NCS

The following table lists the IETF-standard MIBs implemented in the ONS 15454 and NCS SNMP agents. First compile the IETF standard MIBs and then compile the ONS 15454 and NCS proprietary MIBs.

Caution If you do not compile MIBs in the correct order, one or more might not compile correctly.

Table 2: IETF Standard MIBs Implemented in the ONS 15454 and NCS Systems

RFC Number	Module Name	Title/Comments
—	IANAifType-MIB.mib	Internet Assigned Numbers Authority (IANA) ifType Management Information Base for Network Management of TCP/IP-based Internet: MIB-II
1213	RFC1213-MIB-rfc1213.mib	Management Information Base for Version 2 of the Simple Network Management Protocol (SNMPv2)
1907	SNMPV2-MIB-rfc1907.mib	OSPF Version 2 Management Information Base
1253	RFC1253-MIB-rfc1253.mib	Definitions of Managed Objects for Bridges
1493	BRIDGE-MIB-rfc1493.mib	(This defines MIB objects for managing MAC bridges based on the IEEE 802.1D-1990 standard between Local Area Network [LAN] segments.)
2819	RMON-MIB-rfc2819.mib	Remote Network Monitoring Management Information Base
2737	ENTITY-MIB-rfc2737.mib	Entity MIB (Version 2)
2233	IF-MIB-rfc2233.mib	Interfaces Group MIB using SNMPv2
2358	EtherLike-MIB-rfc2358.mib	Definitions of Managed Objects for the Ethernet-like Interface Types
2493	PerfHist-TC-MIB-rfc2493.mib	Textual Conventions for MIB Modules Using Performance History Based on 15 Minute Intervals
2495	DS1-MIB-rfc2495.mib	Definitions of Managed Objects for the DS1, E1, DS2 and E2 Interface Types
2496	DS3-MIB-rfc2496.mib	Definitions of Managed Object for the DS3/E3 Interface Type
2558	SONET-MIB-rfc2558.mib	Definitions of Managed Objects for the SONET/SDH Interface Type
2674	P-BRIDGE-MIB-rfc2674.mib Q-BRIDGE-MIB-rfc2674.mib	Definitions of Managed Objects for Bridges with Traffic Classes, Multicast Filtering and Virtual LAN Extensions

RFC Number	Module Name	Title/Comments
3273	HC-RMON-MIB	The MIB module for managing remote monitoring device implementations, augmenting the original RMON MIB as specified in RFC 2819 and RFC 1513 and RMON-2 MIB as specified in RFC 2021
	CISCO-DOT3-OAM-MIB	A Cisco proprietary MIB defined for IEEE 802.3ah ethernet OAM.
3413	SNMP-NOTIFICATION-MIB	Defines the MIB objects that provide mechanisms to remotely configure the parameters used by an SNMP entity for generating notifications.
3413	SNMP-TARGET-MIB	Defines the MIB objects that provide mechanisms to remotely configure the parameters that are used by an SNMP entity for generating SNMP messages.
3413	SNMP-PROXY-MIB	Defines MIB objects that provide mechanisms to remotely configure the parameters used by a proxy forwarding application.
3414	SNMP-USER-BASED-SM-MIB	The management information definitions for the SNMP User-Based Security Model.
3415	SNMP-VIEW-BASED-ACM-MIB	The management information definitions for the View-Based Access Control Model for SNMP.

Proprietary ONS 15454 and NCS MIBs

Each ONS 15454 and NCS is shipped with a software CD containing applicable proprietary MIBs.

If you are using software Release 9.6 and later releases, import the latest MIB database from the Cisco ONS 15454 software CD to avoid duplicating MIB names between the CERENT-454-MIB and CERENT-GENERIC-MIB databases.

Table 3: ONS 15454 NCS Proprietary MIBs

MIB Number	Module Name
1	CERENT-GLOBAL-REGISTRY.mib
2	CERENT-TC.mib
3	CERENT-454.mib
4	CERENT-GENERIC.mib (not applicable to ONS 15454 NCS)
5	CISCO-SMI.mib

MIB Number	Module Name
6	CISCO-VOA-MIB.mib
7	CERENT-MSDWDM-MIB.mib
8	CERENT-OPTICAL-MONITOR-MIB.mib
9	CERENT-HC-RMON-MIB.mib
10	CERENT-ENVMON-MIB.mib
11	CERENT-GENERIC-PM-MIB.mib
12	BRIDGE-MIB.my
13	CERENT-454-MIB.mib
14	CERENT-ENVMON-MIB.mib
15	CERENT-FC-MIB.mib
16	CERENT-GENERIC-MIB.mib
17	CERENT-GENERIC-PM-MIB.mib
18	CERENT-GLOBAL-REGISTRY.mib
19	CERENT-HC-RMON-MIB.mib
20	CERENT-IF-EXT-MIB.mib
21	CERENT-MSDWDM-MIB.mib
22	CERENT-OPTICAL-MONITOR-MIB.mib
23	CERENT-TC.mib
24	CISCO-IGMP-SNOOPING-MIB.mib
25	CISCO-OPTICAL-MONITOR-MIB.mib
26	CISCO-OPTICAL-PATCH-MIB.mib
27	CISCO-SMI.mib
28	CISCO-VOA-MIB.mib
29	CISCO-VTP-MIB.mib
30	INET-ADDRESS-MIB.mib
31	OLD-CISCO-TCP-MIB.my
32	OLD-CISCO-TS-MIB.my
33	RFC1155-SMI.my

MIB Number	Module Name
34	RFC1213-MIB.my
35	RFC1315-MIB.my
36	BGP4-MIB.my
37	CERENT-454-MIB.mib
38	CERENT-ENVMON-MIB.mib
39	CERENT-FC-MIB.mib
40	CERENT-GENERIC-MIB.mib
41	CERENT-GENERIC-PM-MIB.mib
42	CERENT-GLOBAL-REGISTRY.mib
43	CERENT-HC-RMON-MIB.mib
44	CERENT-IF-EXT-MIB.mib
45	CERENT-MSDWDM-MIB.mib
46	CERENT-OPTICAL-MONITOR-MIB.mib
47	CERENT-TC.mib
48	CISCO-CDP-MIB.my
49	CISCO-CLASS-BASED-QOS-MIB.my
50	CISCO-CONFIG-COPY-MIB.my
51	CISCO-CONFIG-MAN-MIB.my
52	CISCO-ENTITY-ASSET-MIB.my
53	CISCO-ENTITY-EXT-MIB.my
54	CISCO-ENTITY-VENDORTYPE-OID-MI
55	CISCO-FRAME-RELAY-MIB.my
56	CISCO-FTP-CLIENT-MIB.my
57	CISCO-HSRP-EXT-MIB.my
58	CISCO-HSRP-MIB.my
59	CISCO-IGMP-SNOOPING-MIB.mib
60	CISCO-IMAGE-MIB.my
61	CISCO-IP-STAT-MIB.my

MIB Number	Module Name
62	CISCO-IPMROUTE-MIB.my
63	CISCO-MEMORY-POOL-MIB.my
64	CISCO-OPTICAL-MONITOR-MIB.mib
65	CISCO-OPTICAL-PATCH-MIB.mib
66	CISCO-PING-MIB.my
67	CISCO-PORT-QOS-MIB.my
68	CISCO-PROCESS-MIB.my
69	CISCO-PRODUCTS-MIB.my
70	CISCO-RTTMON-MIB.my
71	CISCO-SMI.mib
72	CISCO-SMI.my
73	CISCO-SYSLOG-MIB.my
74	CISCO-TC.my
75	CISCO-TCP-MIB.my
76	CISCO-VLAN-IFTABLE-RELATIONSHI
77	CISCO-VOA-MIB.mib
78	CISCO-VTP-MIB.mib
79	CISCO-VTP-MIB.my
80	ENTITY-MIB.my
81	ENTITYX.MIB
82	ETHERLIKE-MIB.my
83	HC-PerfHist-TC-MIB.my
84	HC-RMON-MIB.my
85	HCNUM-TC.my
86	IANA-RTPROTO-MIB.my
87	IANAifType-MIB.my
88	IEEE-802DOT17-RPR-MIB.my
89	IEEE8023-LAG-MIB.my

MIB Number	Module Name
90	IF-MIB.my
91	IGMP-MIB.my
92	INET-ADDRESS-MIB.my
93	IPMROUTE-STD-MIB.my
94	OSPF-MIB.my
95	PIM-MIB.my
96	RMON-MIB.my
97	RMON2-MIB.my
98	SNMP-FRAMEWORK-MIB.my
99	SNMP-NOTIFICATION-MIB.my
100	SNMP-TARGET-MIB.my
101	SNMPv2-MIB.my
102	SNMPv2-SMI.my
103	SNMPv2-TC.my
104	TCP-MIB.my
105	TOKEN-RING-RMON-MIB.my
106	UDP-MIB.my
107	BRIDGE-MIB-rfc1493.mib
108	DS1-MIB-rfc2495.mib
109	DS3-MIB-rfc2496.mib
110	ENTITY-MIB-rfc2737.mib
111	EtherLike-MIB-rfc2665.mib
112	HC-RMON-rfc3273.mib
113	HCNUM-TC.mib
114	IANAifType-MIB.mib
115	IF-MIB-rfc2233.mib
116	INET-ADDRESS-MIB.mib
117	P-BRIDGE-MIB-rfc2674.mib

MIB Number	Module Name
118	PerfHist-TC-MIB-rfc2493.mib
119	Q-BRIDGE-MIB-rfc2674.mib
120	RFC1213-MIB-rfc1213.mib
121	RFC1253-MIB-rfc1253.mib
122	RIPv2-MIB-rfc1724.mib
123	RMON-MIB-rfc2819.mib
124	RMON2-MIB-rfc2021.mib
125	RMONTOK-rfc1513.mib
126	SNMP-FRAMEWORK-MIB-rfc2571.mib
127	SNMP-MPD-MIB.mib
128	SNMP-NOTIFY-MIB-rfc3413.mib
129	SNMP-PROXY-MIB-rfc3413.mib
130	SNMP-TARGET-MIB-rfc3413.mib
131	SNMP-USER-BASED-SM-MIB-rfc3414.mib
132	SNMP-VIEW-BASED-ACM-MIB-rfc3415.mib
133	SNMPv2-MIB-rfc1907.mib
134	SONET-MIB-rfc2558.mib



Note When SNMP indicates that the wavelength is unknown, it means that the corresponding card (MXP_2.5G_10E, TXP_MR_10E, MXP_2.5G_10G, TXP_MR_10G, TXP_MR_2.5G, or TXPP_MR_2.5G) works with the first tunable wavelength. For more information about MXP and TXP cards, see the "Provisioning Transponder and Muxponder Cards" chapter in the *Cisco ONS 15454 DWDM Line Card Configuration Guide* and *Cisco NCS 2000 Series Line Card Configuration Guide*.

Generic Threshold and Performance Monitoring MIBs

A MIB called CERENT-GENERIC-PM-MIB allows network management stations (NMS) to use a single, generic MIB for accessing threshold and performance monitoring data of different interface types. The MIB is generic in the sense that it is not tied to any particular kind of interface. The MIB objects can be used to obtain threshold values, current performance monitoring (PM) counts, and historic PM statistics for each kind of monitor and any supported interval at the near end and far end.

Previously existing MIBs in the ONS 15454 and NCS system provide some of these counts. For example, SONET interface 15-minute current PM counts and historic PM statistics are available using the SONET-MIB.

DS-1 and DS-3 counts and statistics are available through the DS1-MIB and DS-3 MIB respectively. The generic MIB provides these types of information and also fetches threshold values and single-day statistics. In addition, the MIB supports optics and dense wavelength division multiplexing (DWDM) threshold and performance monitoring information.

The CERENT-GENERIC-PM-MIB is organized into three different tables:

- cerentGenericPmThresholdTable
- cerentGenericPmStatsCurrentTable
- cerentGenericPmStatsIntervalTable

The cerentGenericPmThresholdTable is used to obtain the threshold values for the monitor types. It is indexed based on the following items:

- Interface index (cerentGenericPmThresholdIndex)
- Monitor type (cerentGenericPmThresholdMonType). The syntax of cerentGenericPmThresholdMonType is type cerentMonitorType, defined in CERENT-TC.mib.
- Location (cerentGenericPmThresholdLocation). The syntax of cerentGenericPmThresholdLocation is type cerentLocation, defined in CERENT-TC.mib.
- Time period (cerentGenericPmThresholdPeriod). The syntax of cerentGenericPmThresholdPeriod is type cerentPeriod, defined in CERENT-TC.mib.

Threshold values can be provided in 64-bit and 32-bit formats. (For more information about 64-bit counters, see the HC-RMON-MIB Support, on page 36. The 64-bit values in cerentGenericPmThresholdHCValue can be used with agents that support SNMPv2. The two 32-bit values (cerentGenericPmThresholdValue and cerentGenericPmThresholdOverFlowValue) can be used by NMSs that only support SNMPv1.

Due to the 64-bit counter, the negative values for cerentGenericPmThresholdHCValue are displayed as large positive integers. If the cerentGenericPmThresholdOverFlowValue is less than zero, it indicates that the cerentGenericPmThresholdHCValue is representing a negative value.

The objects compiled in the cerentGenericPmThresholdTable are shown in the following table.

Table 4: cerentGenericPmThresholdTable

Index Objects	Information Objects
cerentGenericPmThresholdIndex	cerentGenericPmThresholdValue
cerentGenericPmThresholdMonType	cerentGenericPmThresholdOverFlowValue
cerentGenericPmThresholdLocation	cerentGenericPmThresholdHCValue
cerentGenericPmThresholdPeriod	—

The second table within the MIB, cerentGenericPmStatsCurrentTable, compiles the current performance monitoring (PM) values for the monitor types. The table is indexed based on interface index (cerentGenericPmStatsCurrentIndex), monitor type (cerentGenericPmStatsCurrentMonType), location (cerentGenericPmStatsCurrentLocation) and time period (cerentGenericPmStatsCurrentPeriod). The syntax of cerentGenericPmStatsCurrentIndex is type cerentLocation, defined in CERENT-TC.mib. The syntax of cerentGenericPmStatsCurrentMonType is type cerentMonitor, defined in CERENT-TC.mib. The syntax of cerentGenericPmStatsCurrentPeriod is type cerentPeriod, defined in CERENT-TC.mib.

The cerentGenericPmStatsCurrentTable validates the current PM value using the cerentGenericPmStatsCurrentValid object and registers the number of valid intervals with historical PM statistics in the cerentGenericPmStatsCurrentValidIntervals object.

PM values are provided in 64-bit and 32-bit formats. The 64-bit values in cerentGenericPmStatsCurrentHCValue can be used with agents that support SNMPv2. The two 32-bit values (cerentGenericPmStatsCurrentValue and cerentGenericPmStatsCurrentOverFlowValue) can be used by NMS that only support SNMPv1.

Due to the 64-bit counter, the negative values for cerentGenericPmStatsCurrentHCValue are displayed as large positive integers. If the cerentGenericPmStatsCurrentOverFlowValue is less than zero, it indicates that the cerentGenericPmStatsCurrentHCValue is representing a negative value.

The cerentGenericPmStatsCurrentTable is shown in the following table.

Table 5: 32-Bit cerentGenericPmStatsCurrentTable

Index Objects	Informational Objects
cerentGenericPmStatsCurrentIndex	cerentGenericPmStatsCurrentValue
cerentGenericPmStatsCurrentMonType	cerentGenericPmStatsCurrentOverFlowValue
cerentGenericPmStatsCurrentLocation	cerentGenericPmStatsCurrentHCValue
cerentGenericPmStatsCurrentPeriod	cerentGenericPmStatsCurrentValidData
—	cerentGenericPmStatsCurrentValidIntervals

The cerentGenericPmStatsIntervalTable obtains historic PM values for the monitor types. It validates the current PM value in the cerentGenericPmStatsIntervalValid object. This table is indexed based on interface index (cerentGenericPmStatsIntervalIndex), monitor type (cerentGenericPMStatsIntervalMonType), location (cerentGenericPmStatsIntervalLocation), and period (cerentGenericPmStatsIntervalPeriod). The syntax of cerentGenericPmStatsIntervalIndex is type cerentLocation, defined in CERENT-TC.mib. The syntax of cerentGenericPmStatsIntervalMonType is type cerentMonitor, defined in CERENT-TC.mib. The syntax of cerentGernicPmStatsIntervalPeriod is type cerentPeriod, defined in CERENT-TC.mib.

The table provides historic PM values in 64-bit and 32-bit formats. The 64-bit values contained in the cerentGenericPmStatsIntervalHCValue table can be used with SNMPv2 agents. The two 32-bit values (cerentGenericPmStatsIntervalValue and cerentGenericPmStatsIntervalOverFlowValue) can be used by SNMPv1 NMS.

Due to the 64-bit counter, the negative values for cerentGenericPmStatsIntervalHCValue are displayed as large positive integers. If the cerentGenericPmStatsIntervalOverFlowValue is less than zero, it indicates that the cerentGenericPmStatsIntervalHCValue is representing a negative value.

The cerentGenericPmStatsIntervalTable is shown in the following table.

Table 6: 32-Bit cerentGenericPmStatsIntervalTable

Index Objects	Informational Objects
cerentGenericPmStatsIntervalIndex	cerentGenericPmStatsIntervalValue
cerentGenericPmStatsIntervalMonType	cerentGenericPmStatsIntervalOverFlowValue
cerentGenericPmStatsIntervalLocation	cerentGenericPmStatsIntervalHCValue

Index Objects	Informational Objects
cerentGenericPmStatsIntervalPeriod	cerentGenericPmStatsIntervalValidData
cerentGenericPmStatsIntervalNumber	—

MIBs Supported in GE-XP, 10GE-XP, GE-XPE, 10GE-XPE Cards

A comprehensive list of supported MIBs for the GE-XP, 10GE-XP, GE-XPE, and 10GE-XPE cards can be found in the MIBs README.txt file.

You can also locate and download MIBs for Cisco platforms, Cisco IOS releases, and feature sets, using the Cisco MIB Locator at the following URL: https://software.cisco.com/download/home/286182761/type/281782939/release/11.1.3 .

The following table lists traps supported in GE-XP, 10GE-XP, GE-XPE, and 10GE-XPE cards:

Table 7: Traps Supported in GE-XP, 10GE-XP, GE-XPE, and 10GE-XPE Cards

Trap Name	Description
multicastMacAddressAliasing	Multicast mac address aliasing
multicastMacAddressTableFull	Multicast mac address table full
fastAutomaticProtectionSwitching	Fast Automatic Protection Switching
fastAutomaticProtectionSwitchingConfigMismatch	Fast automatic protection switching config mismatch

MIBs Supported in TNC, TNCE, TSC, and TSCE Cards

(Cisco ONS 15454 M2, NCS 2002, ONS 15454 M6, and NCS 2006 only)

You can locate and download MIBs for Cisco platforms, Cisco IOS releases, and feature sets, using the Cisco MIB Locator at the following URL: https://software.cisco.com/download/home/286182761/type/281782939/release/11.1.3. The following table lists the MIBs supported in the TNC and TNCE card.

Table 8: MIBs Supported in TNC and TNCE Card

MIB Number	MIB Module
1	CERENT-454-MIB.mib
2	CERENT-ENVMON-MIB.mib
3	CERENT-GENERIC-MIB.mib
4	CERENT-GENERIC-PM-MIB.mib
5	CERENT-OPTICAL-MONITOR-MIB.mib
6	CERENT-GENERIC-MIB.mib

MIB Number	MIB Module
7	CERENT-MSDWDM-MIB.mib

The following table lists the MIBs supported in the TSC and TSCE cards.

MIB Number	MIB Module
1	CERENT-454-MIB.mib
2	CERENT-GENERIC-MIB.mib

SNMP Traps

The ONS 15454, NCS uses SNMP traps to generate all alarms and events, such as raises and clears. The traps contain the following information:

- Object IDs that uniquely identify each event with information about the generating entity (the slot or port).
- Severity and service effect of the alarm (critical, major, minor, or event; service-affecting or non-service-affecting).
- Date and time stamp showing when the alarm occurred.

TL1 can provision SNMPv1 and SNMPv2 trap destinations. SNMPv3 views in TL1 can be configured using a network management system.

Generic and IETF Traps

The ONS 15454 and NCS support the generic IETF traps listed in the following table.

Trap From RFC No.	From RFC No. MIB	Description
coldStart	RFC1907-MIB	Agent up, cold start.
warmStart	RFC1907-MIB	Agent up, warm start.
authenticationFailure	RFC1907-MIB	Community string does not match.
newRoot	RFC1493/ BRIDGE-MIB	Sending agent is the new root of the spanning tree.
topologyChange	RFC1493/ BRIDGE-MIB	A port in a bridge has changed from Learning to Forwarding or Forwarding to Blocking.
entConfigChange	RFC2737/ ENTITY-MIB	The entLastChangeTime value has changed.

Trap From RFC No.	From RFC No. MIB	Description
dsx1LineStatusChange	RFC2495/ DS1-MIB	The value of an instance of dsx1LineStatus has changed. The trap can be used by an NMS to trigger polls. When the line status change results from a higher-level line status change (for example, a DS-3), no traps for the DS-1 are sent.
dsx3LineStatusChange	RFC2496/ DS3-MIB	The value of an instance of dsx3LineStatus has changed. This trap can be used by an NMS to trigger polls. When the line status change results in a lower-level line status change (for example, a DS-1), no traps for the lower-level are sent.
risingAlarm	RFC2819/ RMON-MIB	The SNMP trap that is generated when an alarm entry crosses the rising threshold and the entry generates an event that is configured for sending SNMP traps.
fallingAlarm	RFC2819/ RMON-MIB	The SNMP trap that is generated when an alarm entry crosses the falling threshold and the entry generates an event that is configured for sending SNMP traps.

Variable Trap Bindings

Each SNMP trap contains variable bindings that are used to create the MIB tables. ONS 15454 and NCS traps and variable bindings are listed in the following table. For each group (such as Group A), all traps within the group are associated with all of its variable bindings.

Table 9: Supported ONS 15454 and NCS SNMPv2 Trap Variable Bindings

Group	Trap Name(s) Associated with	Variable Binding Number	SNMPv2 Variable Bindings	Description
A	dsx1LineStatusChange (from RFC 2495)	(1)	dsx1LineStatus	This variable indicates the line status of the interface. It contains loopback, failure, received alarm and transmitted alarm information.
		(2)	dsx1LineStatusLastChange	The value of MIB II's sysUpTime object at the time this DS1 entered its current line status state. If the current state was entered prior to the last proxy-agent reinitialization, the value of this object is zero.
		(3)	cerent454NodeTime	The time that an event occurred.
		(4)	cerent454AlarmState	The alarm severity and service-affecting status. Severities are Minor, Major, and Critical. Service-affecting statuses are Service-Affecting and Non-Service Affecting.
		(5)	snmpTrapAddress	The address of the SNMP trap.

Group	Trap Name(s) Associated with	Variable Binding Number	SNMPv2 Variable Bindings	Description
B	dsx3LineStatusChange (from RFC 2496)	(1)	dsx3LineStatus	This variable indicates the line status of the interface. It contains loopback state information and failure state information.
		(2)	dsx3LineStatusLastChange	The value of MIB II's sysUpTime object at the time this DS3/E3 entered its current line status state. If the current state was entered prior to the last reinitialization of the proxy-agent, then the value is zero.
		(3)	cerent454NodeTime	The time that an event occurred.
		(4)	cerent454AlarmState	The alarm severity and service-affecting status. Severities are Minor, Major, and Critical. Service-affecting statuses are Service-Affecting and Non-Service Affecting.
		(5)	snmpTrapAddress	The address of the SNMP trap.

Group	Trap Name(s) Associated with	Variable Binding Number	SNMPv2 Variable Bindings	Description
C	coldStart (from RFC 1907)	(1)	cerent454NodeTime	The time that the event occurred.
	warmStart (from RFC 1907)	(2)	cerent454AlarmState	The alarm severity and service-affecting status. Severities are Minor, Major, and Critical. Service-affecting statuses are Service-Affecting and Non-Service Affecting.
	newRoot (from RFC)	(3)	snmpTrapAddress	The address of the SNMP trap.
	topologyChange (from RFC)	—	—	—
	entConfigChange (from RFC 2737)	—	—	—
	authenticationFailure (from RFC 1907)	—	—	—

Group	Trap Name(s) Associated with	Variable Binding Number	SNMPv2 Variable Bindings	Description
D1	risingAlarm (from RFC 2819)	(1)	alarmIndex	This variable uniquely identifies each entry in the alarm table. When an alarm in the table clears, the alarm indexes change for each alarm listed.
		(2)	alarmVariable	The object identifier of the variable being sampled.
		(3)	alarmSampleType	The method of sampling the selected variable and calculating the value to be compared against the thresholds.
		(4)	alarmValue	The value of the statistic during the last sampling period.
		(5)	alarmRisingThreshold	When the current sampled value is greater than or equal to this threshold, and the value at the last sampling interval was less than this threshold, a single event is generated. A single event is also generated if the first sample after this entry is greater than or equal to this threshold.
		(6)	cerent454NodeTime	The time that an event occurred.
		(7)	cerent454AlarmState	

Group	Trap Name(s) Associated with	Variable Binding Number	SNMPv2 Variable Bindings	Description
				The alarm severity and service-affecting status. Severities are Minor, Major, and Critical. Service-affecting statuses are Service-Affecting and Non-Service Affecting.
		(8)	snmpTrapAddress	The address of the SNMP trap.

Group	Trap Name(s) Associated with	Variable Binding Number	SNMPv2 Variable Bindings	Description
D2	fallingAlarm (from RFC 2819)	(1)	alarmIndex	This variable uniquely identifies each entry in the alarm table. When an alarm in the table clears, the alarm indexes change for each alarm listed.
		(2)	alarmVariable	The object identifier of the variable being sampled.
		(3)	alarmSampleType	The method of sampling the selected variable and calculating the value to be compared against the thresholds.
		(4)	alarmValue	The value of the statistic during the last sampling period.
		(5)	alarmFallingThreshold	When the current sampled value is less than or equal to this threshold, and the value at the last sampling interval was greater than this threshold, a single event is generated. A single is also generated if the first sample after this entry is less than or equal to this threshold.
		(6)	cerent454NodeTime	The time that an event occurred.
		(7)	cerent454AlarmState	

Group	Trap Name(s) Associated with	Variable Binding Number	SNMPv2 Variable Bindings	Description
				The alarm severity and service-affecting status. Severities are Minor, Major, and Critical. Service-affecting statuses are Service-Affecting and Non-Service Affecting.
		(8)	snmpTrapAddress	The address of the SNMP trap.

Group	Trap Name(s) Associated with	Variable Binding Number	SNMPv2 Variable Bindings	Description
E	failureDetectedExternalToTheNE (from CERENT-454-mib)	(1)	cerent454NodeTime	The time that an event occurred.
		(2)	cerent454AlarmState	The alarm severity and service-affecting status. Severities are Minor, Major, and Critical. Service-affecting statuses are Service-Affecting and Non-Service Affecting.
		(3)	cerent454AlarmObjectType	The entity that raised the alarm. The NMS should use this value to decide which table to poll for further information about the alarm.
		(4)	cerent454AlarmObjectIndex	Every alarm is raised by an object entry in a specific table. This variable is the index of objects in each table; if the alarm is interface-related, this is the index of the interface in the interface table.
		(5)	cerent454AlarmSlotNumber	The slot of the object that raised the alarm. If a slot is not relevant to the alarm, the slot number is zero.
		(6)	cerent454AlarmPortNumber	The port of the object that raised the alarm. If a port is not relevant to the alarm, the port number is zero.
		(7)	cerent454AlarmLineNumber	

Group	Trap Name(s) Associated with	Variable Binding Number	SNMPv2 Variable Bindings	Description
				The object line that raised the alarm. If a line is not relevant to the alarm, the line number is zero.
		(8)	cerent454AlarmObjectName	The TL1-style user-visible name that uniquely identifies an object in the system.
		(9)	cerent454AlarmAdditionalInfo	Additional information for the alarm object. In the current version of the MIB, this object contains provisioned description for alarms that are external to the NE. If there is no additional information, the value is zero.
		(10)	snmpTrapAddress	The address of the SNMP trap.

Group	Trap Name(s) Associated with	Variable Binding Number	SNMPv2 Variable Bindings	Description
F	performanceMonitor ThresholdCrossingAlert (from CERENT-454-mib)	(1)	cerent454NodeTime	The time that an event occurred.
			cerent454AlarmState	The alarm severity and service-affecting status. Severities are Minor, Major, and Critical. Service-affecting statuses are Service-Affecting and Non-Service Affecting.
		(3)	cerent454AlarmObjectType	The entity that raised the alarm. The NMS should use this value to decide which table to poll for further information about the alarm.
		(4)	cerent454AlarmObjectIndex	Every alarm is raised by an object entry in a specific table. This variable is the index of objects in each table; if the alarm is interface-related, this is the index of the interface in the interface table.
		(5)	cerent454AlarmSlotNumber	The slot of the object that raised the alarm. If a slot is not relevant to the alarm, the slot number is zero.
		(6)	cerent454AlarmPortNumber	The port of the object that raised the alarm. If a port is not relevant to the alarm, the port number is zero.
		(7)	cerent454AlarmLineNumber	

Group	Trap Name(s) Associated with	Variable Binding Number	SNMPv2 Variable Bindings	Description
				The object line that raised the alarm. If a line is not relevant to the alarm, the line number is zero.
		(8)	cerent454AlarmObjectName	The TL1-style user-visible name that uniquely identifies an object in the system.
		(9)	cerent454ThresholdMonitorType	This object indicates the type of metric being monitored.
		(10)	cerent454ThresholdLocation	Indicates whether the event occurred at the near or far end.
		(11)	cerent454ThresholdPeriod	Indicates the sampling interval period.
		(12)	cerent454ThresholdSetValue	The value of this object is the threshold provisioned by the NMS.
		(13)	cerent454ThresholdCurrentValue	—
		(14)	cerent454ThresholdDetectType	—
		(15)	snmpTrapAddress	The address of the SNMP trap.

Group	Trap Name(s) Associated with	Variable Binding Number	SNMPv2 Variable Bindings	Description
G	All other traps (from CERENT-454-MIB) not listed above	(1)	cerent454NodeTime	The time that an event occurred.
		(2)	cerent454AlarmState	The alarm severity and service-affecting status. Severities are Minor, Major, and Critical. Service-affecting statuses are Service-Affecting and Non-Service Affecting.
		(3)	cerent454AlarmObjectType	The entity that raised the alarm. The NMS should use this value to decide which table to poll for further information about the alarm.
		(4)	cerent454AlarmObjectIndex	Every alarm is raised by an object entry in a specific table. This variable is the index of objects in each table; if the alarm is interface-related, this is the index of the interface in the interface table.
		(5)	cerent454AlarmSlotNumber	The slot of the object that raised the alarm. If a slot is not relevant to the alarm, the slot number is zero.
		(6)	cerent454AlarmPortNumber	The port of the object that raised the alarm. If a port is not relevant to the alarm, the port number is zero.
		(7)	cerent454AlarmLineNumber	

Group	Trap Name(s) Associated with	Variable Binding Number	SNMPv2 Variable Bindings	Description
				The object line that raised the alarm. If a line is not relevant to the alarm, the line number is zero.
		(8)	cerent454AlarmObjectName	The TL1-style user-visible name that uniquely identifies an object in the system.
		(9)	snmpTrapAddress	The address of the SNMP trap.

SNMPv1/v2 Community Names

Community names are used to group SNMP trap destinations. All ONS 15454 and NCS trap destinations can be provisioned as part of SNMP communities in CTC. When community names are assigned to traps, the ONS 15454 and NCS treat the request as valid if the community name matches one that is provisioned in CTC. In this case, all agent-managed MIB variables are accessible to that request. If the community name does not match the provisioned list, SNMP drops the request.

SNMP in Multishelf Management

When using the dense wavelength division multiplexing (DWDM) multishelf management feature to subtend shelves from a node controller shelf, SNMP for the subtended shelves must be specially provisioned. All shelves within a multishelf configuration share the ID and IP address of the node controller. Thus, the only way to route SNMP messages to or from subtended shelves is by using a proxy ARP.

The cerent454MultishelfEnabled object ID (OID) can be used to determine whether the node is single shelf or multishelf.

To view the OID, use the **snmpwalk** *node IP address* **ifDescr** SNMP command in global configuration mode. This command output displays the OID as

```
node IP address ifDescr
```

where

x = Shelf number (for a multishelf node)

y = Card slot number

z = Card port number

The following example shows how to obtain the OID using the snmpwalk node IP address ifDescr SNMP command.

```
Router(config)# snmpwalk 192.0.2.1 ifDescr
RFC1213-MIB::ifDescr.1 = STRING: "motfcc0"
```

```
RFC1213-MIB::ifDescr.6 = STRING: "pdcc0"
RFC1213-MIB::ifDescr.7 = STRING: "pdcc1"
RFC1213-MIB::ifDescr.8 = STRING: "pdcc2"
RFC1213-MIB::ifDescr.9 = STRING: "pdcc3"
RFC1213-MIB::ifDescr.10 = STRING: "pdcc4"
RFC1213-MIB::ifDescr.11 = STRING: "pdcc5"
RFC1213-MIB::ifDescr.12 = STRING: "pdcc6"
RFC1213-MIB::ifDescr.13 = STRING: "pdcc7"
RFC1213-MIB::ifDescr.14 = STRING: "pdcc8"
RFC1213-MIB::ifDescr.15 = STRING: "pdcc9"
RFC1213-MIB::ifDescr.16 = STRING: "pdcc10"
RFC1213-MIB::ifDescr.17 = STRING: "pdcc11"
RFC1213-MIB::ifDescr.18 = STRING: "pdcc12"
RFC1213-MIB::ifDescr.19 = STRING: "pdcc13"
RFC1213-MIB::ifDescr.20 = STRING: "pdcc14"
RFC1213-MIB::ifDescr.21 = STRING: "pdcc15"
RFC1213-MIB::ifDescr.22 = STRING: "pdcc16"
RFC1213-MIB::ifDescr.23 = STRING: "pdcc17"
RFC1213-MIB::ifDescr.24 = STRING: "pdcc18"
RFC1213-MIB::ifDescr.25 = STRING: "pdcc19"
RFC1213-MIB::ifDescr.26 = STRING: "pdcc20"
RFC1213-MIB::ifDescr.27 = STRING: "pdcc21"
RFC1213-MIB::ifDescr.28 = STRING: "pdcc22"
RFC1213-MIB::ifDescr.29 = STRING: "pdcc23"
RFC1213-MIB::ifDescr.30 = STRING: "pdcc24"
RFC1213-MIB::ifDescr.31 = STRING: "pdcc25"
RFC1213-MIB::ifDescr.32 = STRING: "pdcc26"
RFC1213-MIB::ifDescr.33 = STRING: "pdcc27"
RFC1213-MIB::ifDescr.34 = STRING: "pdcc28"
RFC1213-MIB::ifDescr.35 = STRING: "pdcc29"
RFC1213-MIB::ifDescr.36 = STRING: "pdcc30"
RFC1213-MIB::ifDescr.37 = STRING: "pdcc31"
RFC1213-MIB::ifDescr.38 = STRING: "pdcc32"
RFC1213-MIB::ifDescr.39 = STRING: "pdcc33"
RFC1213-MIB::ifDescr.40 = STRING: "pdcc34"
RFC1213-MIB::ifDescr.41 = STRING: "pdcc35"
RFC1213-MIB::ifDescr.42 = STRING: "pdcc36"
RFC1213-MIB::ifDescr.43 = STRING: "pdcc37"
RFC1213-MIB::ifDescr.44 = STRING: "pdcc38"
RFC1213-MIB::ifDescr.45 = STRING: "pdcc39"
RFC1213-MIB::ifDescr.46 = STRING: "pdcc40"
RFC1213-MIB::ifDescr.47 = STRING: "pdcc41"
RFC1213-MIB::ifDescr.48 = STRING: "pdcc42"
RFC1213-MIB::ifDescr.49 = STRING: "pdcc43"
RFC1213-MIB::ifDescr.50 = STRING: "pdcc44"
RFC1213-MIB::ifDescr.51 = STRING: "pdcc45"
RFC1213-MIB::ifDescr.52 = STRING: "pdcc46"
RFC1213-MIB::ifDescr.53 = STRING: "pdcc47"
RFC1213-MIB::ifDescr.54 = STRING: "pdcc48"
RFC1213-MIB::ifDescr.55 = STRING: "pdcc49"
RFC1213-MIB::ifDescr.56 = STRING: "pdcc50"
RFC1213-MIB::ifDescr.57 = STRING: "pdcc51"
RFC1213-MIB::ifDescr.58 = STRING: "pdcc52"
RFC1213-MIB::ifDescr.59 = STRING: "pdcc53"
RFC1213-MIB::ifDescr.60 = STRING: "pdcc54"
RFC1213-MIB::ifDescr.61 = STRING: "pdcc55"
RFC1213-MIB::ifDescr.62 = STRING: "pdcc56"
RFC1213-MIB::ifDescr.63 = STRING: "pdcc57"
RFC1213-MIB::ifDescr.64 = STRING: "pdcc58"
RFC1213-MIB::ifDescr.65 = STRING: "pdcc59"
RFC1213-MIB::ifDescr.66 = STRING: "pdcc60"
RFC1213-MIB::ifDescr.67 = STRING: "pdcc61"
RFC1213-MIB::ifDescr.68 = STRING: "pdcc62"
RFC1213-MIB::ifDescr.69 = STRING: "pdcc63"
```

```
RFC1213-MIB::ifDescr.70 = STRING: "pdcc64"
RFC1213-MIB::ifDescr.71 = STRING: "pdcc65"
RFC1213-MIB::ifDescr.72 = STRING: "pdcc66"
RFC1213-MIB::ifDescr.73 = STRING: "pdcc67"
RFC1213-MIB::ifDescr.74 = STRING: "pdcc68"
RFC1213-MIB::ifDescr.75 = STRING: "pdcc69"
RFC1213-MIB::ifDescr.76 = STRING: "pdcc70"
RFC1213-MIB::ifDescr.77 = STRING: "pdcc71"
RFC1213-MIB::ifDescr.78 = STRING: "pdcc72"
RFC1213-MIB::ifDescr.79 = STRING: "pdcc73"
RFC1213-MIB::ifDescr.80 = STRING: "pdcc74"
RFC1213-MIB::ifDescr.81 = STRING: "pdcc75"
RFC1213-MIB::ifDescr.82 = STRING: "pdcc76"
RFC1213-MIB::ifDescr.83 = STRING: "pdcc77"
RFC1213-MIB::ifDescr.84 = STRING: "pdcc78"
RFC1213-MIB::ifDescr.85 = STRING: "pdcc79"
RFC1213-MIB::ifDescr.86 = STRING: "pdcc80"
RFC1213-MIB::ifDescr.257 = STRING: "fog_1_36"
RFC1213-MIB::ifDescr.8194 = STRING: "TenGigabitEthernet2/1"
RFC1213-MIB::ifDescr.8195 = STRING: "TenGigabitEthernet2/2"
RFC1213-MIB::ifDescr.8196 = STRING: "TenGigabitEthernet2/3"
RFC1213-MIB::ifDescr.8197 = STRING: "TenGigabitEthernet2/4"
RFC1213-MIB::ifDescr.12290 = STRING: "dwdm-cli_2/3/1"
RFC1213-MIB::ifDescr.12291 = STRING: "dwdm-cli_2/3/2"
RFC1213-MIB::ifDescr.12292 = STRING: "dwdm-trk_2/3/3"
RFC1213-MIB::ifDescr.12293 = STRING: "dwdm-trk_2/3/4"
RFC1213-MIB::ifDescr.12294 = STRING: "TenGigabitEthernet3/1"
RFC1213-MIB::ifDescr.12295 = STRING: "TenGigabitEthernet3/2"
RFC1213-MIB::ifDescr.12296 = STRING: "TenGigabitEthernet3/3"
RFC1213-MIB::ifDescr.12297 = STRING: "TenGigabitEthernet3/4"
RFC1213-MIB::ifDescr.147458 = STRING: "GigabitEthernet36/1"
RFC1213-MIB::ifDescr.147459 = STRING: "GigabitEthernet36/2"
RFC1213-MIB::ifDescr.147502 = STRING: "TenGigabitEthernet36/45"
RFC1213-MIB::ifDescr.147503 = STRING: "TenGigabitEthernet36/46"
RFC1213-MIB::ifDescr.147504 = STRING: "TenGigabitEthernet36/47"
RFC1213-MIB::ifDescr.147505 = STRING: "TenGigabitEthernet36/48"
RFC1213-MIB::ifDescr.147554 = STRING: "ds1_36/1"
RFC1213-MIB::ifDescr.147555 = STRING: "ds1_36/2"
```



Note There may be processing delays in large configurations when snmpwalk is running in the background.

LAN-connected network elements (LNEs) can be set up as gateway network elements (GNEs) or as SOCKS proxies, depending upon network security requirements. If the GNE/ENE firewall feature is required, the LNE must be set up as a GNE. If the design does not require the firewall feature but does require all-IP networking, the LNE must be set up as a SOCKS proxy.

In a GNE/ENE firewall configuration, non-connected network elements must be set up as end network elements (ENEs). With a SOCKS configuration, subtended nodes communicate with the proxy server using the IP. For procedures to provision a node or shelf as a GNE, ENE or SOCKS proxy, see the *Cisco ONS 15454 DWDM Control Card and Node Configuration Guide* and *Cisco NCS 2000 Series Control Card and Node Configuration Guide*.

SNMPv1/v2 Proxy Over Firewalls

SNMP and NMS applications have traditionally been unable to cross firewalls used for isolating security risks inside or from outside networks. CTC enables network operations centers (NOCs) to access performance

monitoring data such as RMON statistics or autonomous messages across firewalls by using an SMP proxy element installed on a firewall.

The application-level proxy transports SNMP protocol data units (PDU) between the NMS and NEs, allowing requests and responses between the NMS and NEs and forwarding NE autonomous messages to the NMS. The proxy agent requires little provisioning at the NOC and no additional provisioning at the NEs.

The firewall proxy is intended for use in a gateway network element-end network element (GNE-ENE) topology with many NEs through a single NE gateway. Up to 64 SNMP requests (such as get, getnext, or getbulk) are supported at any time behind single or multiple firewalls. The proxy interoperates with common NMS such as HP OpenView.

For security reasons, the SNMP proxy feature must be enabled at all receiving and transmitting NEs to function. For instructions to do this, see the *Cisco ONS 15454 DWDM Network Configuration Guide* and *Cisco NCS 2000 Series Network Configuration Guide*.

SNMPv3 Proxy Configuration

The GNE can act as a proxy for the ENEs and forward SNMP requests to other SNMP entities (ENEs) irrespective of the types of objects that are accessed. For this, you need to configure two sets of users, one between the GNE and NMS, and the other between the GNE and ENE. In addition to forwarding requests from the NMS to the ENE, the GNE also forwards responses and traps from the ENE to the NMS.

The proxy forwarder application is defined in RFC 3413. Each entry in the Proxy Forwarder Table consists of the following parameters:

- Proxy Type—Defines the type of message that may be forwarded based on the translation parameters defined by this entry. If the Proxy Type is read or write, the proxy entry is used for forwarding SNMP requests and their response between the NMS and the ENE. If the Proxy Type is trap, the entry is used for forwarding SNMP traps from the ENE to the NMS.
- Context Engine ID/Context Name—Specifies the ENE to which the incoming requests should be forwarded or the ENE whose traps should be forwarded to the NMS by the GNE.
- TargetParamsIn—Points to the Target Params Table that specifies the GNE user who proxies on behalf of an ENE user. When the proxy type is read or write, TargetParamsIn specifies the GNE user who receives requests from an NMS, and forwards requests to the ENE. When the proxy type is trap, TargetParamsIn specifies the GNE user who receives notifications from the ENE and forwards them to the NMS. TargetParamsIn and the contextEngineID or the contextName columns are used to determine the row in the Proxy Forwarder Table that could be used for forwarding the received message.
- Single Target Out—Refers to the Target Address Table. After you select a row in the Proxy Forwarder Table for forwarding, this object is used to get the target address and the target parameters that are used for forwarding the request. This object is used for requests with proxy types read or write, which only requires one target.
- Multiple Target Out (Tag)—Refers to a group of entries in the Target Address Table. Notifications are forwarded using this tag. The Multiple Target Out tag is only relevant when proxy type is Trap and is used to send notifications to one or more NMSs.

Remote Monitoring

The ONS 15454 and NCS incorporate RMON to allow network operators to monitor Ethernet card performance and events. The RMON thresholds are user-provisionable in CTC. Refer to the *Cisco ONS 15454 DWDM Line Card Configuration Guide* and *Cisco NCS 2000 Series Line Card Configuration Guide* for instructions.

Note Typical RMON operations, other than threshold provisioning, are invisible to the CTC user.

ONS 15454 and NCS system RMON is based on the IETF-standard MIB RFC 2819 and includes the following five groups from the standard MIB: Ethernet Statistics, History Control, Ethernet History, Alarm, and Event.

64-Bit RMON Monitoring over DCC

The ONS 15454 and NCS DCC are implemented over the IP protocol, which are not compatible with Ethernet. The system builds Ethernet equipment History and Statistics tables using HDLC statistics that are gathered over the DCC (running point-to-point protocol, or PPP). RMON DCC monitoring (for both IP and Ethernet) monitors the health of remote DCC connections.

RMON DCC contains two MIBs for DCC interfaces. They are:

- cMediaIndependentTable—standard, rfc3273; the proprietary extension of the HC-RMON MIB used for reporting statistics
- cMediaIndependentHistoryTable—proprietary MIB used to support history

Row Creation in MediaIndependentTable

The SetRequest PDU for creating a row in the mediaIndependentTable should contain all the values required to activate a row in a single set operation along with an assignment of the status variable to createRequest (2). The SetRequest PDU for entry creation must have all the object IDs (OIDs) carrying an instance value of 0. That is, all the OIDs should be of the type OID.0.

In order to create a row, the SetRequest PDU should contain the following:

- mediaIndependentDataSource and its desired value
- mediaIndependentOwner and its desired value (The size of mediaIndependentOwner is limited to 32 characters.)
- mediaIndependentStatus with a value of createRequest (2)

The mediaIndependentTable creates a row if the SetRequest PDU is valid according to the above rules. When the row is created, the SNMP agent decides the value of mediaIndependentIndex. This value is not sequentially allotted or contiguously numbered. It changes when an Ethernet interface is added or deleted. The newly created row will have mediaIndependentTable value of valid (1). If the row already exists, or if the SetRequest PDU values are insufficient or do not make sense, the SNMP agent returns an error code.

Note mediaIndependentTable entries are not preserved if the SNMP agent is restarted.

The mediaIndependentTable deletes a row if the SetRequest PDU contains a mediaIndependentStatus with a value of invalid (4). The varbind's OID instance value identifies the row for deletion. You can recreate a deleted row in the table if desired.

Row Creation in cMediaIndependentHistoryControlTable

SNMP row creation and deletion for the cMediaIndependentHistoryControlTable follows the same processes as for the MediaIndependentTable; only the variables differ.

In order to create a row, the SetRequest PDU should contain the following:

- cMediaIndependentHistoryControlDataSource and its desired value
- cMediaIndependentHistoryControlOwner and its desired value
- cMediaIndependentHistoryControlStatus with a value of createRequest (2)

HC-RMON-MIB Support

For the ONS 15454 and NCS, the implementation of the high-capacity remote monitoring information base (HC-RMON-MIB, or RFC 3273) enables 64-bit support of existing RMON tables. This support is provided with the etherStatsHighCapacityTable and the etherHistoryHighCapacityTable. An additional table, the mediaIndependentTable, and an additional object, hcRMONCapabilities, are also added for this support. All of these elements are accessible by any third-party SNMP client should have the ability to upload RFC 3273 SNMP MIB variables in the etherStatsHighCapacityTable, etherHistoryHighCapacityTable, or mediaIndependentTable.

Ethernet Statistics RMON Group

The Ethernet Statistics group contains the basic statistics monitored for each subnetwork in a single table called the etherStatsTable.

Row Creation in etherStatsTable

The SetRequest PDU for creating a row in this table should contain all the values needed to activate a row in a single set operation, and an assigned status variable to createRequest. The SetRequest PDU object ID (OID) entries must all carry an instance value, or type OID, of 0.

In order to create a row, the SetRequest PDU should contain the following:

- The etherStatsDataSource and its desired value
- The etherStatsOwner and its desired value (size of this value is limited to 32 characters)
- The etherStatsStatus with a value of createRequest (2)

The etherStatsTable creates a row if the SetRequest PDU is valid according to the above rules. When the row is created, the SNMP agent decides the value of etherStatsIndex. This value is not sequentially allotted or contiguously numbered. It changes when an Ethernet interface is added or deleted. The newly created row will have etherStatsStatus value of valid (1).

If the etherStatsTable row already exists, or if the SetRequest PDU values are insufficient or do not make sense, the SNMP agent returns an error code.

Note EtherStatsTable entries are not preserved if the SNMP agent is restarted.

Get Requests and GetNext Requests

Get requests and getNext requests for the etherStatsMulticastPkts and etherStatsBroadcastPkts columns return a value of zero because the variables are not supported by ONS 15454 and NCS Ethernet cards.

Row Deletion in etherStatsTable

To delete a row in the etherStatsTable, the SetRequest PDU should contain an etherStatsStatus “invalid” value (4). The OID marks the row for deletion. If required, a deleted row can be recreated.

64-Bit etherStatsHighCapacity Table

The Ethernet statistics group contains 64-bit statistics in the etherStatsHighCapacityTable, which provides 64-bit RMON support for the HC-RMON-MIB. The etherStatsHighCapacityTable is an extension of the etherStatsTable that adds 16 new columns for performance monitoring data in 64-bit format. There is a one-to-one relationship between the etherStatsTable and etherStatsHighCapacityTable when rows are created or deleted in either table.

History Control RMON Group

The History Control group defines sampling functions for one or more monitor interfaces in the historyControlTable. The values in this table, as specified in RFC 2819, are derived from the historyControlTable and etherHistoryTable.

History Control Table

The RMON is sampled at one of four possible intervals. Each interval or period contains specific history values (also called buckets).

The historyControlTable maximum row size is determined by multiplying the number of ports on a card by the number of sampling periods. For example, a card that contains 24 ports when multiplied by periods allows 96 rows in the table. A card that contains 14 ports when multiplied by four periods allows 56 table rows. The following table lists the four sampling periods and corresponding buckets.

Table 10: RMON History Control Periods and History Categories

Sampling Periods **(historyControlValue Variable) Total Values or Buckets**	**(historyControl Variable)**
15 minutes	32
24 hours	7
1 minute	60
60 minutes	24

Row Creation in historyControlTable

The SetRequest PDU must be able to activate a historyControlTable row in one single-set operation. In order to do this, the PDU must contain all needed values and have a status variable value of 2 (createRequest). All OIDs in the SetRequest PDU should be type OID.0 type for entry creation.

To create a SetRequest PDU for the historyControlTable, the following values are required:

- The historyControlDataSource and its desired value
- The historyControlBucketsRequested and it desired value
- The historyControlInterval and its desired value
- The historyControlOwner and its desired value
- The historyControlStatus with a value of createRequest (2)

The historyControlBucketsRequested OID value is ignored because the number of buckets allowed for each sampling period, based upon the historyControlInterval value, is already fixed. Table 12 lists these variables.

The historyControlInterval value cannot be changed from the four allowed choices. If you use another value, the SNMP agent selects the closest smaller time period from the set buckets. For example, if the set request specifies a 25-minute interval, this falls between the 15-minute (32 bucket) variable and the 60-minute (24 bucket) variable. The SNMP agent automatically selects the lower, closer value, which is 15 minutes, so it allows 32 buckets.

If the SetRequest PDU is valid, a historyControlTable row is created. If the row already exists, or if the SetRequest PDU values do not make sense or are insufficient, the SNMP agent does not create the row and returns an error code.

Get Requests and GetNext Requests

Get requests and getNext requests for the etherStatsMulticastPkts and etherStatsBroadcastPkts columns return a value of zero because the variables are not supported by ONS 15454 and NCS Ethernet cards.

Row Deletion in historyControl Table

To delete a row from the table, the SetRequest PDU should contain a historyControlStatus value of 4 (invalid). A deleted row can be recreated.

Ethernet History RMON Group

The ONS 15454 and NCS implement the etherHistoryTable as defined in RFC 2819. The group is created within the bounds of the historyControlTable and does not deviate from the RFC in its design.

64-Bit etherHistoryHighCapacityTable

64-bit Ethernet history for the HC-RMON-MIB is implemented in the etherHistoryHighCapacityTable, which is an extension of the etherHistoryTable. The etherHistoryHighCapacityTable adds four columns for 64-bit performance monitoring data. These two tables have a one-to-one relationship. Adding or deleting a row in one table will also change the other.

Alarm RMON Group

The Alarm group consists of the alarmTable, which periodically compares sampled values with configured thresholds and raises an event if a threshold is crossed. This group requires the implementation of the event group, which follows this section.

AlarmTable

The NMS uses the alarmTable to determine and provision network performance alarm thresholds.

Row Creation in alarmTable

To create a row in the alarmTable, the SetRequest PDU must be able to create the row in one single-set operation. All OIDs in the SetRequest PDU should be type OID.0 type for entry creation. The table has a maximum number of 256 rows.

To create a SetRequest PDU for the alarmTable, the following values are required:

- The alarmInterval and its desired value
- The alarmVariable and its desired value
- The alarmSampleType and its desired value
- The alarmStartupAlarm and its desired value
- The alarmOwner and its desired value
- The alarmStatus with a value of createRequest (2

If the SetRequest PDU is valid, a historyControlTable row is created. If the row already exists, or if the SetRequest PDU values do not make sense or are insufficient, the SNMP agent does not create the row and returns an error code.

In addition to the required values, the following restrictions must be met in the SetRequest PDU:

- The alarmOwner is a string of length 32 characters.
- The alarmRisingEventIndex always takes value 1.
- The alarmFallingEventIndex always takes value 2.
- The alarmStatus has only two values supported in SETs: createRequest (2) and invalid (4).
- The AlarmVariable is of the type OID.ifIndex, where ifIndex gives the interface this alarm is created on and OID is one of the OIDs supported in Table 13.

Table 11: OIDs Supported in the AlarmTable

No. Column	Name	OID	Status
1	ifInOctets	{1.3.6.1.2.1.2.2.1.10}	—
2	IfInUcastPkts	{1.3.6.1.2.1.2.2.1.11}	—
3	ifInMulticastPkts	{1.3.6.1.2.1.31.1.1.1.2}	Unsupported in E100/E1000

No. Column	Name	OID	Status
4	ifInBroadcastPkts	{1.3.6.1.2.1.31.1.1.1.3}	Unsupported in E100/E1000
5	ifInDiscards	{1.3.6.1.2.1.2.2.1.13}	Unsupported in E100/E1000
6	ifInErrors	{1.3.6.1.2.1.2.2.1.14}	—
7	ifOutOctets	{1.3.6.1.2.1.2.2.1.16}	—
8	ifOutUcastPkts	{1.3.6.1.2.1.2.2.1.17}	—
9	ifOutMulticastPkts	{1.3.6.1.2.1.31.1.1.1.4}	Unsupported in E100/E1000
10	ifOutBroadcastPkts	{1.3.6.1.2.1.31.1.1.1.5}	Unsupported in E100/E1000
11	ifOutDiscards	{1.3.6.1.2.1.2.2.1.19}	Unsupported in E100/E1000
12	Dot3StatsAlignmentErrors	{1.3.6.1.2.1.10.7.2.1.2}	—
13	Dot3StatsFCSErrors	{1.3.6.1.2.1.10.7.2.1.3}	—
14	Dot3StatsSingleCollisionFrames	{1.3.6.1.2.1.10.7.2.1.4}	—
15	Dot3StatsMultipleCollisionFrames	{1.3.6.1.2.1.10.7.2.1.5}	—
16	Dot3StatsDeferredTransmissions	{1.3.6.1.2.1.10.7.2.1.7}	—
17	Dot3StatsLateCollisions	{1.3.6.1.2.1.10.7.2.1.8}	—
18	Dot3StatsExcessiveCollisions	{13.6.1.2.1.10.7.2.1.9}	—
19	Dot3StatsFrameTooLong	{1.3.6.1.2.1.10.7.2.1.13}	—
20	Dot3StatsCarrierSenseErrors	{1.3.6.1.2.1.10.7.2.1.11}	Unsupported in E100/E1000
21	Dot3StatsSQETestErrors	{1.3.6.1.2.1.10.7.2.1.6}	Unsupported in E100/E1000
22	etherStatsUndersizePkts	{1.3.6.1.2.1.16.1.1.1.9}	—
23	etherStatsFragments	{1.3.6.1.2.1.16.1.1.1.11}	—
24	etherStatsPkts64Octets	{1.3.6.1.2.1.16.1.1.1.14}	—
25	etherStatsPkts65to127Octets	{1.3.6.1.2.1.16.1.1.1.15}	—
26	etherStatsPkts128to255Octets	{1.3.6.1.2.1.16.1.1.1.16}	—
27	etherStatsPkts256to511Octets	{1.3.6.1.2.1.16.1.1.1.17}	—

No. Column	Name	OID	Status
28	etherStatsPkts512to1023Octets	{1.3.6.1.2.1.16.1.1.1.18}	—
29	etherStatsPkts1024to1518Octets	{1.3.6.1.2.1.16.1.1.1.19}	—
30	EtherStatsBroadcastPkts	{1.3.6.1.2.1.16.1.1.1.6}	—
31	EtherStatsMulticastPkts	{1.3.6.1.2.1.16.1.1.1.7}	—
32	EtherStatsOversizePkts	{1.3.6.1.2.1.16.1.1.1.10}	—
33	EtherStatsJabbers	{1.3.6.1.2.1.16.1.1.1.12}	—
34	EtherStatsOctets	{1.3.6.1.2.1.16.1.1.1.4}	—
35	EtherStatsCollisions	{1.3.6.1.2.1.16.1.1.1.13}	—
36	EtherStatsCollisions	{1.3.6.1.2.1.16.1.1.1.8}	—
37	EtherStatsDropEvents	{1.3.6.1.2.1.16.1.1.1.3}	Unsupported in E100/E1000 and G1000

Get Requests and GetNext Requests

Get requests and getNext requests for the etherStatsMulticastPkts and etherStatsBroadcastPkts columns return a value of zero because the variables are not supported by ONS 15454 and NCS Ethernet cards.

Row Deletion in alarmTable

To delete a row from the table, the SetRequest PDU should contain an alarmStatus value of 4 (invalid). A deleted row can be recreated. Entries in this table are preserved if the SNMP agent is restarted.

Event RMON Group

The Event group controls event generation and notification. It consists of two tables: the eventTable, which is a read-only list of events to be generated, and the logTable, which is a writable set of data describing a logged event. The ONS 15454 and NCS implement the logTable as specified in RFC 2819.

Event Table

The eventTable is read-only and not provisionable. The table contains one row for rising alarms and another for falling ones. This table has the following restrictions:

- The eventType is always log-and-trap (4).
- The eventCommunity value is always a zero-length string, indicating that this event causes the trap to be despatched to all provisioned destinations.
- The eventOwner column value is always “monitor.”
- The eventStatus column value is always valid(1).

LogTable

The logTable is implemented exactly as specified in RFC 2819. The logTable is based upon data that is locally cached in a controller card. If there is a controller card protection switch, the existing logTable is cleared and a new one is started on the newly active controller card. The table contains as many rows as provided by the alarm controller.

Related Procedures for SNMP Configuration

The following section lists procedures and tasks related to SNMP configuration. For more information, see the "Turn Up a Node" chapter in the *Cisco ONS 15454 DWDM Network Configuration Guide* and *Cisco NCS 2000 Series Network Configuration Guide*.

- NTP- G29 Set Up SNMP
- NTP- G210 Provision Node for SNMPv3
- NTP- G211 Provision Node to Send SNMPv3 Traps
- NTP- G212 Manually Provision a GNE/ENE to Manage an ENE using SNMPv3
- NTP- G213 Automatically Provision a GNE to Manage an ENE using SNMPv3
- NTP- G214 Manually Provision a GNE/ENE to Send SNMPv3 Traps from an ENE using SNMPv3
- NTP- G215 Automatically Provision a GNE/ENE to Send SNMPv3 Traps from an ENE Using SNMPv3

Additional References

Related Documents

Use this document in conjunction with the other release-specific documentation listed in this table:

Link	Description
Cisco ONS Documentation Roadmap	Provides quick access to publications of Cisco ONS releases.
Cisco ONS 15454 DWDM Control Card and Node Configuration Guide	Provides background and reference material and procedures for installation and configuration of control cards and node configuration on Cisco ONS 15454 dense wavelength division multiplexing (DWDM) systems.
Cisco ONS 15454 DWDM Line Card Configuration Guide	Provides background and reference material and procedures for installation and configuration of line cards on Cisco ONS 15454 dense wavelength division multiplexing (DWDM) systems.
Cisco ONS 15454 DWDM Network Configuration Guide	Provides background and reference material, procedures for turn up, provisioning, and maintenance of Cisco ONS 15454 dense wavelength division multiplexing (DWDM) systems.

Link	Description
Cisco ONS 15454 DWDM Troubleshooting Guide	Provides general troubleshooting instructions, alarm troubleshooting instructions, and a list of error messages that apply to the Cisco ONS 15454 dense wavelength division multiplexing (DWDM) systems.
Release Notes for Cisco ONS 15454	Provides information about new features and enhancements for the Cisco ONS 15454 DWDM platforms.
Cisco ONS 15454 Hardware Installation Guide	Provides installation information of the Cisco ONS 15454 hardware.
Cisco ONS 15454 DWDM Licensing Guide	Provides information about installing and managing Cisco ONS 15454 DWDM licenses.
Cisco ONS SDH TL1 Command Guide *Cisco ONS SONET TL1 Command Guide*	Provides a comprehensive list of TL1 commands.
Installing the GBIC, SFP, SFP+, XFP, CXP, CFP, and CPAK Optical Modules in Cisco ONS Platforms	Provides information about the Pluggable Port Modules support.

Link	Description
Cisco NCS 2000 Series Documentation Roadmap	Provides quick access to publications of Cisco NCS 2000 Series releases.
Cisco NCS 2000 Series Control Card and Node Configuration Guide	Provides background and reference material and procedures for installation and configuration of control cards and node configuration on Cisco NCS 2000 Series systems.
Cisco NCS 2000 Series Line Card Configuration Guide	Provides background and reference material and procedures for installation and configuration of line cards on Cisco NCS 2000 Series systems.
Cisco NCS 2000 Series Network Configuration Guide	Provides background and reference material, procedures for turn up, provisioning, and maintenance of Cisco NCS 2000 Series systems.
Cisco NCS 2000 Series Troubleshooting Guide	Provides general troubleshooting instructions, alarm troubleshooting instructions, and a list of error messages that apply to the Cisco NCS 2000 Series systems.
Release Notes for Cisco NCS 2000 Series	Provides information about new features and enhancements for the Cisco NCS 2000 Series systems.
Cisco NCS 2000 Series Hardware Installation Guide	Provides installation information of the Cisco NCS 2000 Series hardware.
Cisco NCS 2000 Series Licensing Configuration Guide	Provides information about installing and managing NCS licenses.
Cisco NCS 2000 Series TL1 Command Guide	Provides a comprehensive list of TL1 commands.

Link	Description
Installing the GBIC, SFP, SFP+, XFP, CXP, CFP, and CPAK Optical Modules in Cisco NCS Platforms	Provides information about the Pluggable Port Modules support.

Technical Assistance

Link	Description
http://www.cisco.com/support	The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.

Short Description

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Communications, Services, and Additional Information

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- To submit a service request, visit Cisco Support.
- To discover and browse secure, validated enterprise-class apps, products, solutions and services, visit Cisco DevNet.
- To obtain general networking, training, and certification titles, visit Cisco Press.
- To find warranty information for a specific product or product family, access Cisco Warranty Finder.

Cisco Bug Search Tool

Cisco Bug Search Tool (BST) is a web-based tool that acts as a gateway to the Cisco bug tracking system that maintains a comprehensive list of defects and vulnerabilities in Cisco products and software. BST provides you with detailed defect information about your products and software.