CHAPTER 2

NE- and CTM-Specific Details

This chapter provides specific details about each of the NEs that CTM supports. It also provides details specific to CTM.

Note In this document, the terms *network element* (NE) and *managed element* (ME) are interchangeable.

The following sections include NE- and CTM-specific details:

- 2.1 NE-Specific Details, page 2-1
- 2.2 CTM-Specific Details, page 2-27

2.1 NE-Specific Details

2.1.1 Cisco 7600

See the *Release Notes for Cisco Transport Manager Release 8.0* for the Cisco IOS images that CTM R8.0 supports on the Cisco 7600 Edge Router.

2.1.2 CRS-1

See the *Release Notes for Cisco Transport Manager Release 8.0* for the Carrier Routing System 1 (CRS-1) software releases that CTM R8.0 supports.

CRS-1 model types include the following:

- CRS-1/8
- CRS-1/16
- Multichassis

Note In CTM, numbering for all of the managed entities (such as rack, shelf, slots, subslots, cards, and ports) starts from 0 (for example, rack.0, slot.0, port.0, card.0, and so on). However, according to the TeleManagement Forum (TMF) standards, numbering for any managed entity must start from 1, not from 0. Therefore, for CTM GateWay/CORBA, numbering for all managed entities is incremented by 1. For example, card.0 is shown as card#1, port.1 is shown as port#2, and so on.

2.1.2.1 Racks

Depending on the hardware type, a CRS-1 can have a single rack or many racks, which include single-fabric racks and line card racks.

2.1.2.2 Slots

The CRS-1/8 has eight slots; the CRS-1/16 has 16 slots. One slot can contain multiple cards and some cards can have more than one slot.

2.1.2.3 Subslots

The CRS-1 supports shared-port adapters (SPAs). A container for a slot contains all the SPAs; a slot might have multiple SPAs. The container is modeled as the subslot in the CRS-1.

2.1.2.4 Equipment

Cards are included as CRS-1 equipment. Cards can be physical layer interface module (PLIM) controllers, SP modules, route processors, fabric cards, shared-port adapters, and so on.

2.1.2.5 Topological Links

Topological link creation and deletion operations are supported between CRS-1 and ONS 15454 NEs.

2.1.2.6 Autodiscovery

The automatic discovery (autodiscovery) of CRS-1 NEs is not supported in CTM GateWay/CORBA R8.0, but is supported in CTM R8.0.

2.1.2.7 CTPs

The CRS-1 supports CTPs associated with the ports of DWDM PLIM cards (OC-768c/STM-256 DWDM PLIM and 10 GE DWDM PLIM controllers).

The CRS-1 supports the following layer rates:

- LR_Physical_10_Gigabit_ITU = 107
- LR_Physical_40_Gigabit_ITU = 152

2.1.2.8 PTPs

The CRS-1 supports PTPs associated to POS, POS/SDH, and GE ports of line cards. The CRS-1 supports the following additional PTP layer rates:

- LR_Physical_10_Gigabit_ITU = 107
- LR_Physical_40_Gigabit_ITU = 152

The CRS-1 PTP structure contains the names and values shown in the following table as additional information.

Table 2-1 CRS-1 Additional Information Values

PTP Additional Info Key	PTP Additional Info Value
ADMINSTATE	Admin state string as defined in the IOX common interface table.
IPADDRESS	IP address as string.
IPMASK	Mask as string.
IPMTU	String representing the integers from 68 to 65535.
CDPENABLED	Either enabled or disabled.
DESCRIPTION	Description string.
OPERSTATUS	Integer describing operational status. Values are: • 1—Active • 2—Loading • 3—Failed • 4—Diagnostic

2.1.3 ONS 15216

Some NEs in the ONS 15216 family do not provide any management interface. These NEs are considered passive and all data is entered by a user from the CTM client. After data has been entered, CTM reports these NEs. Other ONS 15216 NEs provide a management interface; these NEs are considered active.

See the *Release Notes for Cisco Transport Manager Release 8.0* for the passive and active ONS 15216 software releases that CTM R8.0 supports.

Note CTM does not support ONS 15216 single-shelf NEs (they are not removable equipment) except for the ONS 15216 DCU, which contains a chassis and a removable module.

2.1.3.1 PTPs

CTM reports PTPs for ONS 15216 NEs only if a topological link originates from or terminates on an ONS 15216 NE.

2.1.3.2 Topological Links

Topological links are unidirectional for ONS 15216 NEs. Inter-NE links are available between all NEs in the ONS 15216 family. CTM supports links between an ONS 15216 and the following NEs at compatible layer rates:

- ONS 15216
- ONS 15310 CL and ONS 15310 MA
- ONS 15327 (Physical, SONET/SDH, and OCH)

- ONS 15454 (Physical, SONET/SDH, and OCH)
- ONS 15600 (Physical, SONET/SDH, and OCH)

2.1.4 ONS 15302

See the *Release Notes for Cisco Transport Manager Release 8.0* for the ONS 15302 software releases that CTM R8.0 supports.

2.1.4.1 Slots

The ONS 15302 is a single-shelf NE with four slots. Slot 4 is the only slot that contains a removable card. Cards in slots 1, 2, and 3 cannot be removed.

2.1.4.2 PTPs

The ONS 15302 supports PTPs associated to WAN, SDH, and PDH ports.

2.1.5 ONS 15305 and ONS 15305 CTC

See the *Release Notes for Cisco Transport Manager Release 8.0* for the ONS 15305 software releases that CTM R8.0 supports.

Note The NEs with R3.0 are called ONS 15305 CTC.

2.1.5.1 Slots

The ONS 15305 and ONS 15305 CTC are single-shelf NEs with four slots.

2.1.5.2 PTPs

The ONS 15305 and ONS 15305 CTC support PTPs associated to WAN, SDH, and PDH ports.

2.1.6 ONS 15310 CL

See the *Release Notes for Cisco Transport Manager Release 8.0* for the ONS 15310 CL software releases that CTM R8.0 supports.

2.1.6.1 Slots

The ONS 15310 CL is a single-shelf NE with two slots. Slot 1 is the expansion slot and can contain the provisionable data card. Slot 2 is a nonreplicable unit and contains the Control Timing and Cross-Connect (CTX)-CL controller.

2.1.6.2 Equipment

All cards for the ONS 15310 CL R5.0 and later display administration and service states. For previous software releases, these states are not applicable (N/A). The following tables show the attribute values for these two states.

2.1.6.2.1 Equipment Administration State

The attribute name is ACTUAL_EQUIPMENT_SERVICE_STATE and is displayed in getAdditionalInfo for the equipment. The attribute values for the administration state are listed in Table 2-2. The attribute values for the service state are listed in Table 2-3 and Table 2-4.

Table 2-2 Equipment Administration State (ONS 15310 CL)

Attribute Value	Meaning
In Service	Places the entity In Service.
Auto in Service	Places the entity in Auto in Service. The circuit is out of service until it receives a valid signal for the duration of the soak period, at which time the circuit state changes to In Service. During the soak period, alarms and loopbacks are suppressed but traffic is carried.
Out of Service–Maintenance	Removes the entity from service for maintenance. Alarms are no longer generated.
Out of Service	Removes the entity from service and disables it. Alarms are no longer generated and traffic is not passed.

2.1.6.2.2 Equipment Service State

The attribute name is ACTUAL_EQUIPMENT_SERVICE_STATE and is displayed in getAdditionalInfo for the equipment. The attribute value for the service state is the same as that displayed in CTM.

Table 2-3 Equipment Service State–Primary (ONS 15310 CL)

Primary States (PST-PSTQ)	
Attribute Value	**Meaning**
In Service–Normal (IS_NR)	The entity is fully operational and performs as provisioned.
Out of Service–Management (OOS_MA)	The entity has been administratively removed from service.
Out of Service–Autonomous (OOS_AU)	The entity is not operational due to an autonomous event.
Out of Service–Autonomous and Management (OOS_AUMA)	The entity is not operational due to an autonomous event and has been administratively removed from service.

Table 2-4 Equipment Service State–Secondary (ONS 15310 CL)

Secondary States (SST)	
Attribute Value	**Meaning**
Unassigned (UAS)	The entity is not provisioned in the database.
Unequipped (UEQ)	The entity is physically not present. That is, it is physically removed (the slot is empty). It may or may not be assigned (provisioned).

Table 2-4 Equipment Service State–Secondary (ONS 15310 CL) (continued)

Secondary States (SST)	
Attribute Value	**Meaning**
Mismatch of Equipment and Attributes (MEA)	Improper equipment is installed. For example, the card plugged in is not compatible with the card provisioned or it is not compatible with the slot.
Automatic In-Service (AINS)	The entity is in a delay transition (to IS) state. The transition to IS is pending the correction of off-normal conditions on the entity.
Maintenance (MT)	The entity has been manually removed from service for maintenance. It is still capable of performing its provisioned functions. Traffic is still carried.
Disabled (DSBLD)	The entity is manually removed from service and cannot perform its provisioned functions. All of its provisioned services are explicitly disrupted. No traffic is passed.
Loopback (LPBK)	Loopback command is in effect (any loopback type).

2.1.6.3 Topological Links

All topological links are unidirectional or bidirectional for ONS 15310 CL NEs.

2.1.6.4 CTX Cards

The CTX card is an electrical card and consists of 21 DS-1 ports, three DS3/EC1 ports, and two OC-3/OC-12 optical ports.

2.1.6.5 PTPs

All PTPs are bidirectional for the ONS 15310 CL. The ports are always in channelized mode. PTPs support In Service and Out of Service–Maintenance values for the service state attribute.

2.1.6.6 CTPs

All CTPs are in channelized mode for the ONS 15310 CL.

2.1.6.7 SNCs

CTX cards perform synchronous transport signal (STS) and VT1.5 switching. The subnetwork connection (SNC) name cannot exceed 48 characters. The NE enforces the SNC name character limit.

2.1.6.8 Autodiscovery

The ONS 15310 CL supports automatic discovery of connected elements. CTM can connect to one node and retrieve information about all connected nodes. The first time CTM connects to a node, it retrieves only the IP address of the connected node; CTM does not retrieve the node name, even though CTM has to report this element to the user. Because the IP address is unique, CTM uses the NE IP address as the name of the newly discovered element. An Object Creation Event is generated for this managed element with the IP address as the name. Later, CTM connects to this element and retrieves all information, including the actual name, and an Attribute Value Change (AVC) event is generated for the managed element name.

Note It is recommended that the NMS listen to the AVC event for the managed element name and invoke managedElementManager::ManagedElementManager_I::getManagedElement.

2.1.7 ONS 15310 MA

See the *Release Notes for Cisco Transport Manager Release 8.0* for the ONS 15310 MA software releases that CTM R8.0 supports.

2.1.7.1 Slots

The ONS 15310 MA consists of two CTX slots and four Expansion (EXP) input/output (I/O) slots.

2.1.7.2 Topological Links

All topological links are unidirectional or bidirectional for ONS 15310 MA NEs.

2.1.7.3 CTX Cards

The CTX card is an electrical card and consists of 21 DS-1 ports and three DS-3/EC-1 ports. Two optical interfaces are supported using SFP technology. OC-3/STM-1 and OC-12/STM-4 are available.

- DS1_28_DS3_EC1_3_LINE_CARD— The electrical ports consist of 28 DS1 and 3 DS3 or EC1 ports.
- DS1_84_DS3_EC1_3_LINE_CARD—The electrical ports consist of 84 DS1 and 3 DS3 or EC1 ports.

2.1.7.4 PTPs

All PTPs are bidirectional for the ONS 15310MA. The ports are always in channelized mode. PTPs support In Service and Out of Service-Maintenance values for the service state attribute.

2.1.7.5 CTPs

All CTPs are in channelized mode for the ONS 15310 MA.

2.1.7.6 SNCs

CTX cards perform STS and VT1.5 switching. The SNC name cannot exceed 48 characters. The NE enforces the SNC name character limit.

2.1.7.7 Auto Discovery

The ONS 15310 MA supports automatic discovery of connected elements. CTM can connect to one node and retrieve information about all connected nodes. The first time CTM connects to a node, it retrieves only the IP address of the connected node; CTM does not retrieve the node name, even though CTM has to report this element to the user. Because the IP address is unique, CTM initializes the name of the

newly discovered element with its IP address. An Object Creation Event is generated for this managed element with the IP address as the name. Later, CTM connects to this element and retrieves all information, including the actual name, and an AVC event is generated for the managed element name.

Note It is recommended that the NMS listen to the AVC event for the managed element name and invoke managedElementManager::ManagedElementManager_I::getManagedElement.

2.1.8 ONS 15327

See the *Release Notes for Cisco Transport Manager Release 8.0* for the ONS 15327 software releases that CTM R8.0 supports.

2.1.8.1 Slots

ONS 15327 is a single-shelf NE with eight slots. The Mechanical Interface Card (MIC) A card must occupy slot 8 and the MIC B card must occupy slot 7. If an integrated Cross-Connect, Timing, and Control (XTC) card is required, it must occupy slot 5 or slot 6.

2.1.8.2 Equipment

All the cards in ONS 15327 R5.0 and later display administration and service states. For earlier software releases, these states are not applicable and CTM displays them as "N/A."

2.1.8.2.1 Equipment Administration State

The attribute name is ACTUAL_EQUIPMENT_SERVICE_STATE and is displayed in getAdditionalInfo for the equipment. The attribute values for the administration state are listed in Table 2-5. The attribute values for the service state are listed in Table 2-6 and Table 2-7.

Table 2-5 Equipment Administration State (ONS 15327)

Attribute Value	Meaning
In Service	Places the entity In Service.
Auto in Service	Places the entity in Auto in Service. The circuit is out of service until it receives a valid signal for the duration of the soak period, at which time the circuit state changes to In Service. During the soak period, alarms and loopbacks are suppressed but traffic is carried.
Out of Service–Maintenance	Removes the entity from service for maintenance. Alarms are no longer generated.
Out of Service	Removes the entity from service and disables it. Alarms are no longer generated and traffic is not passed.

2.1.8.2.2 Equipment Service State

The attribute name is ACTUAL_EQUIPMENT_SERVICE_STATE and is displayed in getAdditionalInfo for the equipment. The attribute value for the service state is the same as that displayed in CTM.

Table 2-6 Equipment Service State–Primary (ONS 15327)

Primary States (PST-PSTQ)	
Attribute Value	**Meaning**
In Service–Normal (IS_NR)	The entity is fully operational and performs as provisioned.
Out of Service–Management (OOS_MA)	The entity has been administratively removed from service.
Out of Service–Autonomous (OOS_AU)	The entity is not operational due to an autonomous event.
Out of Service–Autonomous and Management (OOS_AUMA)	The entity is not operational due to an autonomous event and has been administratively removed from service.

Table 2-7 Equipment Service State–Secondary (ONS 15327)

Secondary States (SST)	
Attribute Value	**Meaning**
Unassigned (UAS)	The entity is not provisioned in the database.
Unequipped (UEQ)	The entity is physically not present. That is, it is physically removed (empty slot). It may or may not be assigned (provisioned).
Mismatch of Equipment and Attributes (MEA)	Improper equipment is installed. For example, the card plugged in is not compatible with the card provisioned or it is not compatible for the slot.
Automatic In-Service (AINS)	The entity is in a delay transition (to IS) state. The transition to IS is pending the correction of off-normal conditions on the entity.
Maintenance (MT)	The entity has been manually removed from service for maintenance. It is still capable of performing its provisioned functions. Traffic is still carried.
Disabled (DSBLD)	The entity is manually removed from service and cannot perform its provisioned functions. All of its provisioned services are explicitly disrupted. No traffic is passed.
Loopback (LPBK)	Loopback command is in effect (any loopback type).

2.1.8.3 Topological Links

All topological links are unidirectional or bidirectional for the ONS 15327 NEs.

2.1.8.4 XTC Cards

The XTC-14 card has 14 digital signal level 1 (DS-1) ports numbered 1 through 14. Only VT1.5 SNCs can be created on these ports. The XTC-28-3 card has 28 DS-1 ports numbered 1 through 28 and 3 DS-3 ports numbered 29 through 31. VT1.5 SNCs can be created on DS-1 ports, and STS-1 SNCs can be created on DS-3 ports.

2.1.8.5 PTPs

All PTPs are bidirectional for the ONS 15327. The ports are always in channelized mode. PTPs support In Service, Out of Service, Out of Service–Maintenance, and Auto in Service values for the service state attribute.

2.1.8.6 CTPs

All CTPs are in channelized mode for the ONS 15327. Alarm monitoring cannot be turned on or off for CTPs.

2.1.8.7 SNCs

XTC cards perform synchronous transport signal (STS) and VT1.5 switching. The XTC cards support the total rearrangement of 192 bidirectional STSs from the four high-speed slots (1 to 4), plus 12 bidirectional STSs for XTC module low-speed electrical interfaces. The XTC VT1.5 matrix supports the grooming of 336 bidirectional VT1.5 circuits.

The SNC name cannot exceed 48 characters.

2.1.8.8 Autodiscovery

ONS 15327 autodiscovery is identical to ONS 15454 SONET autodiscovery, described in 2.1.10 ONS 15454 SONET, page 2-13.

2.1.9 ONS 15454 SDH

See the *Release Notes for Cisco Transport Manager Release 8.0* for the ONS 15454 SDH software releases that CTM R8.0 supports.

2.1.9.1 Shelves

All supported ONS 15454 SDH NEs have exactly one shelf each, with the exception of ONS 15454 SDH multishelf termination point (MSTP) R8.0, which can have up to eight shelves per NE.

2.1.9.2 Slots

The ONS 15454 SDH NE has one shelf view supplemented with the top subrack Electrical Facility Connection Assembly (EFCA) shelf and bottom subrack chassis. The main shelf has 17 slots numbered 1 to 17 and contains cards that carry traffic. The EFCA shelf has 12 additional slots numbered 18 to 29 and contains Front Mount Electrical Connection (FMEC) modules, the ALM/PWR/MIC (A/P/M) module, and the CRFT/TMG/MIC (C/T/M) module. The Timing Communications and Control-International (TCC-I) modules must be in slot 7 or slot 11, the A/P/M module must be in slot 23, and the C/T/M module must be in slot 24.

2.1.9.3 Equipment

All cards in ONS 15454 SDH R5.0 and later display administration and service states. For earlier software releases, these states are not applicable and CTM displays them as “N/A.”

2.1.9.3.1 Equipment Administration State

The attribute name is ACTUAL_EQUIPMENT_SERVICE_STATE and is displayed in getAdditionalInfo for the equipment. The attribute values for the administration state are listed in Table 2-8. The attribute values for the service state are listed in Table 2-9 and Table 2-10.

Table 2-8 Equipment Administration State (ONS 15454 SDH)

Attribute Value	Meaning
In Service	Places the entity In Service.
Auto in Service	Places the entity in Auto in Service. The circuit is out of service until it receives a valid signal for the duration of the soak period, at which time the circuit state changes to In Service. During the soak period, alarms and loopbacks are suppressed but traffic is carried.
Out of Service–Maintenance	Removes the entity from service for maintenance. Alarms are no longer generated.
Out of Service	Removes the entity from service and disables it. Alarms are no longer generated and traffic is not passed.

2.1.9.3.2 Equipment Service State

The attribute name is ACTUAL_EQUIPMENT_SERVICE_STATE and is displayed in getAdditionalInfo for the equipment. The attribute value for the service state is the same as that displayed in CTM.

Table 2-9 Equipment Service State–Primary (ONS 15454 SDH)

Primary States (PST-PSTQ)	
Attribute Value	**Meaning**
In Service–Normal (IS_NR)	The entity is fully operational and performs as provisioned.
Out of Service–Management (OOS_MA)	The entity has been administratively removed from service.
Out of Service–Autonomous (OOS_AU)	The entity is not operational due to an autonomous event.
Out of Service–Autonomous and Management (OOS_AUMA)	The entity is not operational due to an autonomous event and has been administratively removed from service.

Table 2-10 Equipment Service State–Secondary (ONS 15454 SDH)

Secondary States (SST)	
Attribute Value	**Meaning**
Unassigned (UAS)	The entity is not provisioned in the database.
Unequipped (UEQ)	The entity is physically not present. That is, it is physically removed (empty slot). It may or may not be assigned (provisioned).
Mismatch of Equipment and Attributes (MEA)	Improper equipment is installed. For example, the card plugged in is not compatible with the card provisioned or it is not compatible for the slot.
Automatic In-Service (AINS)	The entity is in a delay transition (to IS) state. The transition to IS is pending on the correction of off-normal conditions on the entity.
MT (Maintenance)	The entity has been manually removed from service for maintenance. It is still capable of performing its provisioned functions. Traffic is still carried.
DSBLD (Disabled)	The entity is manually removed from service and cannot perform its provisioned functions. All of its provisioned services are explicitly disrupted. No traffic is passed.
LPBK (Loopback)	Loopback command is in effect (any loopback type).

2.1.9.4 Topological Links

Topological links are either unidirectional or bidirectional for ONS 15454 SDH NEs.

2.1.9.5 PTPs

All PTPs are bidirectional for the ONS 15454 SDH, except for PTPs on DWDM cards (optical amplifiers, optical multiplexers, optical demultiplexers, and optical add/drop multiplexers). The ports are always in channelized mode. PTPs support IN_SERVICE, OUT_OF_SERVICE, OUT_OF_SERVICE_MAINTENANCE, and AUTO_IN_SERVICE values for the service state attribute.

2.1.9.6 CTPs

All CTPs are in channelized mode for the ONS 15454 SDH. Alarm monitoring cannot be turned on or off for CTPs.

2.1.9.7 SNCs

One node supports a maximum of 192 VC4 SNCs. The SNC name cannot exceed 48 characters. The NE enforces the SNC name character limit.

2.1.9.8 Equipment Protection

1:*N* equipment protection is supported for E1, E1-42, and DS3i cards. You must install protect cards (E1-*n*, E1-42, DS3i-*n*) in slot 3 or slot 15 on the same side of the shelf as the protected cards. Protect cards must match the cards they protect. For example, an E1-*n* card protects only E1 or E1-*n* cards. You must create the protection group explicitly. Installing E1-*n*, E1-42, or DS3i-*n* cards in slot 3 or slot 15 does not automatically protect other E1, E1-42, or DS3i cards. 1:*N* equipment protection is always revertive.

1:1 equipment protection is supported for E1, E1-42, E3, STM-1E-12, and DS3i cards. Install the protect card in an odd-numbered slot and install the working card in an adjacent even-numbered slot. For example, install the protect card in slot 1 and install the working card in slot 2.

Note In this document, “card” and “equipment” strings are used interchangeably to refer to equipment.

2.1.9.9 Facility Protection

Facility protection is available for STM-*n* PTPs. Protect ports must match the working ports. For example, port 1 of an STM-1 (OC-3) card is protected only by port 1 on another STM-1 (OC-3) card.

2.1.9.10 Autodiscovery

The ONS 15454 SDH supports automatic discovery of connected elements such as the ONS 15454 SONET autodiscovery described in 2.1.10 ONS 15454 SONET, page 2-13.

2.1.10 ONS 15454 SONET

See the *Release Notes for Cisco Transport Manager Release 8.0* for the ONS 15454 SONET software releases that CTM R8.0 supports.

2.1.10.1 Shelves

All supported ONS 15454 SONET NEs have exactly one shelf each, with the exception of the ONS 15454 SONET MSTP R8.0, which can have up to eight shelves per NE.

2.1.10.2 Slots

Each ONS 15454 SONET shelf has 17 slots. The Timing Communications and Control Plus (TCC+) card must occupy slot 7 or slot 11. For more information, refer to the Cisco ONS 15454 SONET user documentation.

2.1.10.3 Equipment

All the cards in ONS 15454 SONET R5.0 and later display administration and service states. For earlier software releases, these states are not applicable and CTM displays them as "N/A." The following tables show the attribute values for these two states.

2.1.10.3.1 Equipment Administration State

The attribute name is ACTUAL_EQUIPMENT_SERVICE_STATE and is displayed in getAdditionalInfo for the equipment. The attribute values for the administration state are listed in Table 2-11. The attribute values for the service state are listed in Table 2-12 and Table 2-13.

Table 2-11 Equipment Administration State (ONS 15454 SONET)

Attribute Value	Meaning
In Service	Places the entity In Service.
Auto in Service	Places the entity in Auto in Service. The circuit is out of service until it receives a valid signal for the duration of the soak period, at which time the circuit state changes to In Service. During the soak period, alarms and loopbacks are suppressed but traffic is carried.
Out of Service–Maintenance	Removes the entity from service for maintenance. Alarms are no longer generated.
Out of Service	Removes the entity from service and disables it. Alarms are no longer generated and traffic is not passed.

2.1.10.3.2 Equipment Service State

The attribute name is ACTUAL_EQUIPMENT_SERVICE_STATE and is displayed in getAdditionalInfo for the equipment. The attribute value for the service state is the same as that displayed in CTM.

Table 2-12 Equipment Service State–Primary (ONS 15454 SONET)

Primary States (PST-PSTQ)	
Attribute Value	**Meaning**
In Service–Normal (IS_NR)	The entity is fully operational and performs as provisioned.
Out of Service–Management (OOS_MA)	The entity has been administratively removed from service.
Out of Service–Autonomous (OOS_AU)	The entity is not operational due to an autonomous event.
Out of Service–Autonomous and Management (OOS_AUMA)	The entity is not operational due to an autonomous event and has been administratively removed from service.

Table 2-13 Equipment Service State–Secondary (ONS 15454 SONET)

Secondary States (SST)	
Attribute Value	**Meaning**
UAS (Unassigned)	The entity is not provisioned in the database.
UEQ (Unequipped)	The entity is physically not present. That is, it is physically removed (empty slot). It may or may not be assigned (provisioned).
MEA (Mismatch of Equipment and Attributes)	Improper equipment is installed. For example, the card plugged in is not compatible with the card provisioned or it is not compatible for the slot.
AINS (Automatic In-Service)	The entity is in a delay transition (to IS) state. The transition to IS is pending on the correction of off-normal conditions on the entity.
MT (Maintenance)	The entity has been manually removed from service for maintenance. It is still capable of performing its provisioned functions. Traffic is still carried.
DSBLD (Disabled)	The entity is manually removed from service and cannot perform its provisioned functions. All of its provisioned services are explicitly disrupted. No traffic is passed.
LPBK (Loopback)	Loopback command is in effect (any loopback type).

2.1.10.4 Topological Links

Topological links are either unidirectional or bidirectional for ONS 15454 SONET NEs.

2.1.10.5 PTPs

All PTPs are bidirectional for the ONS 15454 SONET, except for PTPs on DWDM cards (optical amplifiers, optical multiplexers, optical demultiplexers, and optical add/drop multiplexers). The ports are always in channelized mode. PTPs support IN_SERVICE, OUT_OF_SERVICE, OUT_OF_SERVICE_MAINTENANCE, and AUTO_IN_SERVICE values for the service state attribute.

2.1.10.6 CTPs

All CTPs are in channelized mode for the ONS 15454 SONET. Alarm monitoring cannot be turned on or off for CTPs.

2.1.10.7 SNCs

One node supports a maximum of 144 bidirectional STS SNCs with an XC or Cross-Connect Virtual Tributary (XCVT) card installed or 576 bidirectional STS SNCs with a 10 Gigabit Cross-Connect (XC10G) card installed. If an XCVT or XC10G card is present, you can create a maximum of 336 bidirectional VT1.5 SNCs.

In NE release 3.0.3, the name of the SNC cannot exceed 32 characters. For NE release 3.2.1 or later, the name cannot exceed 48 characters. The NE enforces the SNC name character limit.

2.1.10.8 Equipment Protection

1:*N* equipment protection is supported for DS-1, DS-3, DS3I, and DS3E cards. You must install protect cards (DS1N, DS3N, DS3IN, and DS3NE) in slot 3 or slot 15 on the same side of the shelf as the protected cards. Protect cards must match the cards they protect. For example, a DS1N protects only DS1 or DS1N cards. You must create the protection group explicitly. Installing DS1N or DS3N cards in slot 3 or slot 15 does not automatically protect other DS-1 or DS-3 cards. 1:*N* equipment protection is always revertive.

1:1 equipment protection is supported for DS-1, DS-3, DS3I, DS3E, EC-1, and DS3XM cards. Install the protect card in an odd-numbered slot and install the working card in an adjacent even-numbered slot. For example, install the protect card in slot 1 and install the working card in slot 2.

2.1.10.9 Facility Protection

Facility protection is available for OC-*n* PTPs. Protect ports must match the working ports. For example, port 1 on an OC-3 card is protected only by port 1 on another OC-3 card.

2.1.10.10 Autodiscovery

The ONS 15454 SONET supports automatic discovery of connected elements. CTM can connect to one node and retrieve information about all connected nodes. The first time CTM connects to a node, it retrieves only the IP address of the connected node; CTM does not retrieve the node name. However, CTM has to report this element to the users. Because the IP address is unique, CTM initializes the name of the newly discovered element with the IP address. An Object Creation Event is generated for this managed element with the IP address as the name. Later, CTM connects to this element and retrieves all information, including the actual name, and an attribute value change (AVC) event is generated for the managed element name. The NMS should listen to the AVC event for the managed element name and invoke managedElementManager::ManagedElementManager_I::getManagedElement.

2.1.11 ONS 15501

See the *Release Notes for Cisco Transport Manager Release 8.0* for the ONS 15501 software releases that CTM R8.0 supports.

2.1.11.1 Slots

The ONS 15501 is a single-shelf system with no slots.

2.1.11.2 PTPs

All PTPs are unidirectional for ONS 15501 NEs. PTPs do not support the service state attribute. Only the In-Port and Out-Port interfaces are reported as PTPs.

2.1.11.3 CTPs

CTPs for the ONS 15501 are not supported in this release of CTM GateWay/CORBA.

2.1.11.4 SNCs

SNCs for the ONS 15501 are not supported in this release of CTM GateWay/CORBA.

2.1.11.5 Equipment

The ONS 15501 has no removable equipment. The chassis is reported as equipment present under the shelf equipment holder.

2.1.11.6 Topological Links

All topological links are unidirectional for ONS 15501 NEs.

2.1.12 ONS 15530

See the *Release Notes for Cisco Transport Manager Release 8.0* for the ONS 15530 software releases that CTM R8.0 supports.

2.1.12.1 Slots

The ONS 15530 is a single-shelf NE with 13 slots. The ONS 15530 is a dual-CPU system with integrated switch fabric. The processor cards occupy slots 6 and 7. Slot 1 contains the multiplexer/demultiplexer motherboards, which are populated with optical multiplexer/demultiplexer modules. The remaining slots can contain:

- 10-port Enterprise System Connection (ESCON) module
- 1-port 10-Gigabit Ethernet (10GE) International Telecommunication Union (ITU) grid dense wavelength division multiplexing (DWDM)
- 1-port 10GE SR module
- 1-port transparent transponder module
- Optical Supervisory Channel (OSC) module consisting of two pluggable daughter modules for redundancy

2.1.12.2 PTPs

PTPs are both unidirectional and bidirectional for the ONS 15530. PTPs do not support the service state attribute.

The following interfaces are reported as PTPs:

- Transparent—Client-side transparent interface.
- Wavepatch—Passive optical interface on the transponder/trunk card that is patched to the filter interface on the multiplexer/demultiplexer card.
- Filter—Passive optical interface that passes a single wavelength on the multiplexer/demultiplexer card. It is patched to the wavepatch interface on the transponder trunk card.
- WDM—Passive external WDM interface on the multiplexer/demultiplexer card that carries multiple wavelengths, including the ones that have been added or dropped by the card. It can be used for internode or intermultiplexer/demultiplexer patching.
- Thru—Passive external WDM interface on the multiplexer/demultiplexer card that carries multiple wavelengths, including the ones that have been added but excluding the ones that have been dropped by the card. It can be used for internode or intermultiplexer/demultiplexer patching.
- Filterband—Passive special external WDM interface on the 16 wavelength multiplexer/demultiplexer card that passes through a special band of wavelengths. It is patched to the corresponding filter group interface on the other multiplexer/demultiplexer card.
- Filter group—Passive special external WDM interface on the 16 wavelength multiplexer/demultiplexer card that drops a special band of wavelengths.
- Wave—Optical lambda interface on the multiplexer/demultiplexer motherboard. Converts uncolored to one ITU grid wavelength.
- Oscfilter—Passive optical interface that passes OSC wavelengths on the multiplexer/demultiplexer card. It is patched to the wave interface on the transponder card.
- FastEthernet—Interface on the CPU card for Ethernet connectivity.
- EsconPhy—Physical ports on ESCON transceivers plugged into the ESCON line card.
- WaveEthernetPhy
- EthernetDcc
- TenGigEthernetPhy—Interface on the 10GE transceiver.
- VoaFilterIn
- voaFilterOut
- voaBypassIn
- voaBypassOut
- voaIn
- voaOut

2.1.12.3 CTPs

CTPs for the ONS 15530 are not supported in this release of CTM GateWay/CORBA.

2.1.12.4 SNCs

SNCs for the ONS 15530 are not supported in this release of CTM GateWay/CORBA.

2.1.12.5 Equipment Protection

1:1 equipment protection is supported for the CPU card.

2.1.12.6 Equipment

The ONS 15530 reports all field-replaceable units (FRUs) as equipment. In addition, the chassis is reported as equipment present under the shelf equipment holder.

2.1.12.7 Topological Links

Topological links can be either unidirectional or bidirectional for ONS 15530 NEs. CTM reports both inter-NE and intra-NE links for the ONS 15530.

2.1.12.8 PTP Layer Rates

The ONS 15530 supports the following additional PTP layer rates:

- LR_Ten_Gigabit_Ethernet (TenGigabit Ethernet)
- LR_SYSPLEX_ISC_COMP (sysplexIscCompatibility)
- LR_SYSPLEX_ISC_PEER (sysplexIscPeer)
- LR_SYSPLEX_TIMER_ETR (sysplexTimerEtr)
- LR_SYSPLEX_TIMER_CLO (sysplexTimerClo)

2.1.13 ONS 15540

See the *Release Notes for Cisco Transport Manager Release 8.0* for the ONS 15540 ESP and ESPx software releases that CTM R8.0 supports.

2.1.13.1 Slots

The ONS 15540 is a single-shelf NE with 13 slots. The ONS 15540 is a dual-CPU system where the processor cards occupy slots 7 and 8. Slots 1 and 2 contain the multiplexer/demultiplexer motherboards, which are populated with optical multiplexer/demultiplexer modules. The remaining slots contain the line card motherboards, which are populated with transponder modules.

2.1.13.2 PTPs

All PTPs are bidirectional for the ONS 15540. PTPs do not support the service state attribute.

Wavepatch interfaces on the transponder card and filter interfaces on multiplexer/demultiplexer cards are reported as PTPs even though the cards are not externally visible from the fixed optical backplane. Wave interfaces on the transponder cards are reported as PTPs even though they are internal interfaces, because alarms are generated on these interfaces and CTPs are not supported.

The following interfaces are reported as PTPs:

- Transparent—Client-side transparent interface.
- Wavepatch—Passive optical interface on the transponder card that is patched to the filter interface on the multiplexer/demultiplexer card.
- Filter—Passive optical interface that passes a single wavelength on the multiplexer/demultiplexer card. It is patched to the wavepatch interface on the transponder card.

- WDM—Passive external WDM interface on the multiplexer/demultiplexer card that carries multiple wavelengths, including the ones added or dropped by the card. It can be used for internode or intermultiplexer/demultiplexer patching.
- Thru—Passive external WDM interface on the multiplexer/demultiplexer card that carries multiple wavelengths, including the added ones but excluding the wavelengths dropped by the card. It can be used for internode or intermultiplexer/demultiplexer patching.
- Filterband—Passive special external WDM interface on the 16 wavelength multiplexer/demultiplexer card that passes through a special band of wavelengths. It is patched to the corresponding filter group interface on the other multiplexer/demultiplexer card.
- Filter group—Passive special external WDM interface on the 16 wavelength multiplexer/demultiplexer card that drops a special band of wavelengths.
- Wave—Optical lambda interface on the multiplexer/demultiplexer motherboard. Converts uncolored to one ITU grid wavelength.
- Oscfilter—Passive optical interface that passes OSC wavelengths on the multiplexer/demultiplexer card. It is patched to the wave interface on the transponder card.
- FastEthernet—Interface on the CPU card for Ethernet connectivity.
- TenGigEthernetPhy—Interface on the 10GE transceiver.
- WavePassThru—External interface on the POM dummy module for 10GE configurations.

2.1.13.3 CTPs

CTPs for the ONS 15540 are not supported in this release of CTM GateWay/CORBA.

2.1.13.4 SNCs

SNCs for the ONS 15540 are not supported in this release of CTM GateWay/CORBA.

The NMS should listen to the AVC event for the managed element name and invoke managedElementManager::ManagedElementManager_I::getManagedElement.

2.1.13.5 Equipment Protection

1:1 equipment protection is supported for CPU card.

2.1.13.6 Equipment

The ONS 15540 reports all the FRUs as equipment. The chassis is also reported as equipment present under the shelf equipment holder.

2.1.13.7 Topological Links

Topological links can be unidirectional or bidirectional for ONS 15540 NEs. CTM reports both inter-NE and intra-NE links for the ONS 15540.

2.1.13.8 PTP Layer Rates

The ONS 15540 supports these additional layer rates:

- LR_Ten_Gigabit_Ethernet (TenGigabit Ethernet)
- LR_SYSPLEX_ISC_COMP (sysplexIscCompatibility)
- LR_SYSPLEX_ISC_PEER (sysplexIscPeer)
- LR_SYSPLEX_TIMER_ETR (sysplexTimerEtr)
- LR_SYSPLEX_TIMER_CLO (sysplexTimerClo)

2.1.14 ONS 15600 SONET

See the *Release Notes for Cisco Transport Manager Release 8.0* for the ONS 15600 SONET software releases that CTM R8.0 supports.

2.1.14.1 Slots

The ONS 15600 SONET is a single-shelf NE with 14 slots. The Timing and Shelf Control (TSC) card must occupy slot 5 or slot 10. The Core Cross-Connect (CXC) cards are always 1+1 redundant in slots 6/7 and 8/9. Each CXC card occupies two slots. Slots 1 to 4 and 11 to 14 are reserved for optical I/O cards. Single Shelf Cross-Connect (SSXC) cards replace CXC cards from release 5.0 of the NE. However, due to a known caveat (CSCse87505), CTM and CTC display SSXC cards as CXC.

2.1.14.2 Equipment

All the cards in the ONS 15600 SONET R5.0 and later display administration and service states. For earlier software releases, these states are not applicable and CTM displays them as “N/A.”

2.1.14.2.1 Equipment Administration State

The attribute name is ACTUAL_EQUIPMENT_SERVICE_STATE and is displayed in getAdditionalInfo for the equipment. The attribute values for the administration state are listed in Table 2-14. The attribute values for the service state are listed in Table 2-15 and Table 2-16.

Table 2-14 Equipment Administration State (ONS 15600 SONET)

Attribute Value	Meaning
In Service	Places the entity In Service.
Auto in Service	Places the entity in Auto in Service. The circuit is out of service until it receives a valid signal for the duration of the soak period, at which time the circuit state changes to In Service. During the soak period, alarms and loopbacks are suppressed but traffic is carried.
Out of Service–Maintenance	Removes the entity from service for maintenance. Alarms are no longer generated.
Out of Service	Removes the entity from service and disables it. Alarms are no longer generated and traffic is not passed.

2.1.14.2.2 Equipment Service State

The attribute name is ACTUAL_EQUIPMENT_SERVICE_STATE and is displayed in getAdditionalInfo for the equipment. The attribute value for the service state is the same as that displayed in CTM.

Table 2-15 Equipment Service State–Primary (ONS 15600 SONET)

Primary States (PST-PSTQ)	
Attribute Value	**Meaning**
In Service–Normal (IS_NR)	The entity is fully operational and performs as provisioned.
Out of Service–Management (OOS_MA)	The entity has been administratively removed from service.
Out of Service–Autonomous (OOS_AU)	The entity is not operational due to an autonomous event.
Out of Service–Autonomous and Management (OOS_AUMA)	The entity is not operational due to an autonomous event and has been administratively removed from service.

Table 2-16 Equipment Service State–Secondary (ONS 15600 SONET)

Secondary States (SST)	
Attribute Value	**Meaning**
Unassigned (UAS)	The entity is not provisioned in the database.
Unequipped (UEQ)	The entity is physically not present. That is, it is physically removed (empty slot). It may or may not be assigned (provisioned).
Mismatch of Equipment and Attributes (MEA)	Improper equipment is installed. For example, the card plugged in is not compatible with the card provisioned or it is not compatible for the slot.
Automatic In-Service (AINS)	The entity is in a delay transition (to IS) state. The transition to IS is pending on the correction of off-normal conditions on the entity.
Maintenance (MT)	The entity has been manually removed from service for maintenance. It is still capable of performing its provisioned functions. Traffic is still carried.
Disabled (DSBLD)	The entity is manually removed from service and cannot perform its provisioned functions. All of its provisioned services are explicitly disrupted. No traffic is passed.
Loopback (LPBK)	Loopback command is in effect (any loopback type).

2.1.14.3 Topological Links

Topological links are either unidirectional or bidirectional for ONS 15600 SONET NEs.

2.1.14.4 PTPs

All PTPs are bidirectional for the ONS 15600 SONET. These ports are always in channelized mode. PTPs support In Service and Out of Service–Maintenance values for the service state attribute.

2.1.14.5 CTPs

All CTPs are in channelized mode for the ONS 15600 SONET. Alarm monitoring cannot be turned on or off for CTPs.

2.1.14.6 SNCs

One ONS 15600 SONET NE supports a maximum of 1536 STS SNCs.

2.1.14.7 Protection

The ONS 15600 SONET supports 1+1 protection to create redundancy for optical ports. Protect ports must match the working ports. For example, port 1 on an OC-48 card can be protected only by port 1 on another OC-48 card.

2.1.14.8 Autodiscovery

The ONS 15600 SONET supports automatic discovery of connected elements. CTM can connect to one node and retrieve information about all connected nodes. The first time CTM connects to a node, it retrieves only the IP address of the connected node; CTM does not retrieve the node name, even though CTM has to report this element to the user. Because the IP address is unique, CTM uses the NE IP address as the name of the newly discovered element. An Object Creation Event is generated for this managed element with the IP address as the name. Later, CTM connects to this element and retrieves all information, including the actual name, and an AVC event is generated for the managed element name.

Note It is recommended that the NMS listen to the AVC event for the managed element name and invoke managedElementManager::ManagedElementManager_I::getManagedElement.

2.1.15 ONS 15600 SDH

See the *Release Notes for Cisco Transport Manager Release 8.0* for the ONS 15600 SDH software releases that CTM R8.0 supports.

2.1.15.1 Slots

The ONS 15600 SDH is a single-shelf NE with 14 slots. The TSC card must occupy slot 5 or slot 10. The CXC cards are always 1+1 redundant in slots 6/7 and 8/9. Each CXC card occupies two slots. Slots 1 to 4 and 11 to 14 are reserved for optical I/O cards. For more information, refer to the Cisco ONS 15600 SDH user documentation.

2.1.15.2 Topological Links

Topological links are either unidirectional or bidirectional for ONS 15600 SDH NEs.

2.1.15.3 PTPs

All PTPs are bidirectional for the ONS 15600 SDH. These ports are always in channelized mode. PTPs support In Service and Out of Service–Maintenance values for the service state attribute.

2.1.15.4 CTPs

All CTPs are in channelized mode for the ONS 15600 SDH. Alarm monitoring cannot be turned on or off for CTPs.

2.1.15.5 SNCs

One ONS 15600 SDH NE supports a maximum of 1536 VC4 SNCs.

2.1.15.6 Protection

The ONS 15600 SDH supports 1+1 protection to create redundancy for optical ports. Protect ports must match the working ports. For example, port 1 on an STM-16 card can be protected only by port 1 on another STM-16 card.

2.1.15.7 Autodiscovery

The ONS 15600 SDH supports automatic discovery of connected elements. CTM can connect to one node and retrieve information about all connected nodes. The first time CTM connects to a node, it retrieves only the IP address of the connected node; CTM does not retrieve the node name, even though CTM has to report this element to the user. Because the IP address is unique, CTM uses the NE IP address as the name of the newly discovered element. An Object Creation Event is generated for this managed element with the IP address as the name. Later, CTM connects to this element and retrieves all information, including the actual name, and an AVC event is generated for the managed element name.

Note It is recommended that the NMS listen to the AVC event for the managed element name and invoke managedElementManager::ManagedElementManager_I::getManagedElement.

2.1.16 ONS 15800 and ONS 15801

See the *Release Notes for Cisco Transport Manager Release 8.0* for the ONS 15800 and ONS 15801 software releases that CTM R8.0 supports.

2.1.16.1 Racks

Each ONS 15800 or ONS 15801 can have from one to ten racks.

2.1.16.2 Shelves

Each ONS 15800 or ONS 15801 has three shelves per rack.

2.1.16.3 Slots

Each ONS 15800 has 17 slots per shelf. Each ONS 15801 has 15 slots per shelf.

2.1.16.4 Topological Links

All topological links are unidirectional for ONS 15800 and ONS 15801 NEs.

2.1.16.5 PTPs

All PTPs are unidirectional for ONS 15800 and ONS 15801 equipment. There are four types of PTPs:

- Source east-to-west
- Source west-to-east
- Sink east-to-west
- Sink west-to-east

A topological link starts in a source PTP and ends in a sink PTP. PTPs bordering the same link have the same direction (east-to-west or west-to-east).

Links can be established between PTPs supported by following boards:

- Source PTPs—TPA-R, RBA, RBA-10G, RBA-10G-E
- Sink PTPs—PRE-L

Each board can delimit only a link.

2.1.17 ONS 15808

See the *Release Notes for Cisco Transport Manager Release 8.0* for the ONS 15808 software releases that CTM R8.0 supports.

2.1.17.1 Racks

Each ONS 15808 can have from one to ten racks.

2.1.17.2 Shelves

Each ONS 15808 has three shelves per rack.

2.1.17.3 Slots

Each ONS 15808 has 15 slots per shelf.

2.1.17.4 Topological Links

All topological links are unidirectional for the ONS 15808 NEs.

2.1.17.5 PTPs

All PTPs are unidirectional for ONS 15808 equipment. There are four types of PTPs:

- Source east-to-west
- Source west-to-east
- Sink east-to-west
- Sink west-to-east

A topological link starts in a source PTP and ends in a sink PTP. PTPs bordering the same link have the same direction (east-to-west or west-to-east).

Each terminal site supports up to two links with opposite directions; all other sites support up to four links—two east-to-west and two west-to-east. Links can be established between PTPs supported by the following boards:

- BCS-LH
- BCS-ELH

Each board can delimit two links through a source PTP and a sink PTP, with opposite directions.

2.1.18 MGX 8880/8850/8830

See the *Release Notes for Cisco Transport Manager Release 8.0* for the MGX software releases that CTM R8.0 supports.

2.1.18.1 Racks

The MGX 8880/8850/8830 is a single-rack NE.

2.1.18.2 Shelves

Each MGX 8880/8850/8830 NE has one shelf per rack.

2.1.18.3 Slots

The MGX 8880/8850 is a single-shelf NE with 32 slots. Slots 7 and 8 are reserved for the controller (PXM45 or PXM1E) front card. Slots 15/31 and 16/32 are reserved for the short reach (SR) ME front cards.

The MGX 8830 is a single-shelf NE with 14 slots. Slots 1 and 2 are reserved for the controller (PXM1E) front card. Slots 13/14 are reserved for SRME front cards.

2.1.18.4 Subslots

The MGX 8880/8850/8830 slot is divided into subslots or bays. The full-height cards (AXSM, VXSM, PXM, RPM, and PXM1E) have two subslots; the half-height cards (VISM, MPSM, and SRME) have one subslot. The subslots contain the back card for the corresponding front card.

2.1.18.5 PTPs

All PTPs are bidirectional for MGX 8880/8850/8830 NEs. PTPs do not support the service state attribute but do support the layer rate attribute.

2.1.19 MDS 9000

The MDS 9000 is a passive storage NE that does not contain any equipment. CTM reports PTPs for the MDS 9000 only if a topological link originates from or terminates on the MDS 9000. There are no alarms reported for the MDS 9000.

2.1.20 Unmanaged NEs

Unmanaged NEs are other vendor MEs in CTM. There is no equipment for these NEs. CTM reports PTPs for unmanaged NEs only if a topological link originates from or terminates on the unmanaged NE. There are no reported alarms on unmanaged NEs.

2.1.21 XR 12000

See the *Release Notes for Cisco Transport Manager Release 8.0* for the XR 12000 software releases that CTM R8.0 supports.

CTM supports the following types of XR 12000 chassis:

- XR 12006
- XR 12008
- XR 12010
- XR 12012
- XR 12016
- XR 12404
- XR 12406
- XR 12410
- XR 12416

Note In CTM, numbering for all of the managed entities (such as rack, shelf, slots, subslots, cards, and ports) starts from 0 (for example, rack.0, slot.0, port.0, card.0, and so on). However, according to the TMF standards, numbering for any managed entity must start from 1, not from 0. Therefore, for CTM GateWay/CORBA, numbering for all managed entities is incremented by 1. For example, card.0 is shown as card#1, port.1 is shown as port#2, and so on.

2.1.21.1 Racks

The XR 12000 is a single-rack NE.

2.1.21.2 Shelves

Each XR 12000 has one shelf per rack.

2.1.21.3 Slots

The number of slots in an XR 12000 rack is determined by the type of XR 12000 chassis.

2.1.21.4 Subslots

The XR 12000 has SPA support. A container for a slot contains all the SPAs; a slot might have multiple SPAs. The container is modeled as the subslot in an XR 12000.

2.1.21.5 Topological Links

Topological links are not supported for the XR 12000 in CTM GateWay/CORBA R8.0.

2.1.21.6 Autodiscovery

Automatic discovery (autodiscovery) of the XR 12000 is not supported in GateWay/CORBA R8.0.

2.1.21.7 PTPs

The XR 12000 supports PTPs associated to POS, POS/SDH, and GE ports of line cards. The XR 12000 PTP structure contains the names and values shown in the following table as additional information.

Table 2-17 XR 12000 Additional Information Values

PTP Additional Information–Name	PTP Additional Information–Value
ADMINSTATE	Administration state string as defined in the IOX common interface table.
IPADDRESS	IP address as string.
IPMASK	Mask as string.
IPMTU	String representing integer value from 68 to 65535.
OPERSTATUS	Integer describing operational status. Values are: • 1—Active • 2—Loading • 3—Failed • 4—Diagnostic
DESCRIPTION	Description string.

2.2 CTM-Specific Details

2.2.1 Layer Rate

Note The type of layer rate is a “short” number. Layer rates numbered 0 to 91 are TMF-defined, and layer rates numbered 92 and above are CTM-defined.

CTM R8.0 supports the following layer rates:

- 0 = Not used
- 1 = LR_Not_Applicable—The layer is not relevant
- 2 = LR_T1_and_DS1_1_5M, 1.5Mbit/s async/PDH signal
- 3 = LR_T2_and_DS2_6M, 6Mbit/s async/PDH signal
- 4 = LR_T3_and_DS3_45M, 45Mbit/s async/PDH signal
- 5 = LR_E1_2M, 2Mbit/s PDH signal

- 6 = LR_E2_8M, 8Mbit/s PDH signal
- 7 = LR_E3_34M, 34Mbit/s PDH signal
- 8 = LR_E4_140M
- 9 = LR_E5_565M
- 10 = LR_VT1_5_and_TU11_VC11
- 11 = LR_VT2_and_TU12_VC12
- 12 = LR_VT6_and_TU2_VC2
- 13 = LR_Low_Order_TU3_VC3
- 14 = LR_STS1_and_AU3_High_Order_VC3
- 15 = LR_STS3c_and_AU4_VC4
- 16 = LR_STS12c_and_VC4_4c
- 17 = LR_STS48c_and_VC4_16c
- 18 = LR_STS192c_and_VC4_64c
- 19 = LR_Section_OC1_STS1_and_RS_STM0
- 20 = LR_Section_OC3_STS3_and_RS_STM1
- 21 = LR_Section_OC12_STS12_and_RS_STM4
- 22 = LR_Section_OC48_STS48_and_RS_STM16
- 23 = LR_Section_OC192_STS192_and_RS_STM64
- 24 = LR_Line_OC1_STS1_and_MS_STM0
- 25 = LR_Line_OC3_STS3_and_MS_STM1
- 26 = LR_Line_OC12_STS12_and_MS_STM4
- 27 = LR_Line_OC48_STS48_and_MS_STM16
- 28 = LR_Line_OC192_STS192_and_MS_STM64
- 29 to 39 = Not used
- 40 = LR_Optical_Channel—For WDM wavelengths
- 41 = LR_Optical_Multiplex_Section—For WDM wavelength bands
- 42 = LR_Optical_Transmission_Section—For WDM entire optical signal
- 43 = LR_ATM_NI—For ATM network interfaces (UNI and NNI)
- 44 = LR_ATM_VP—For ATM virtual paths
- 45 = LR_ATM_VC—For ATM virtual channels
- 46 = LR_PHYSICAL_ELECTRICAL
- 47 = LR_PHYSICAL_OPTICAL
- 48 = LR_PHYSICAL_MEDIALESS—Specifies physical media for technologies such as radio
- 49 = LR_OPTICAL_SECTION—Represents the wavelength termination for a non-DWDM system
- 50 = LR_DIGITAL_SIGNAL_RATE—Raw binary electrical signal of unspecified rate
- 51 = LR_Async_FOTS_150M—Legacy async optical signal
- 52 = LR_Async_FOTS_417M—Legacy async optical signal
- 53 = LR_Async_FOTS_560M—Legacy async optical signal

- 54 = LR_Async_FOTS_565M—Legacy async optical signal
- 55 = LR_Async_FOTS_1130M—Legacy async optical signal
- 56 = LR_Async_FOTS_1G7—Legacy async optical signal
- 57 = LR_Async_FOTS_1G8—Legacy async optical signal
- 58 = LR_D1_Video—Video-capable port
- 59 = LR_ESCON—IBM protocol for mainframes
- 60 = LR_ETR—IBM protocol for mainframes
- 61 = LR_Fast_Ethernet—Fast Ethernet (legacy)
- 62 = LR_FC_12_133M—Fibre Channel protocol
- 63 = LR_FC_25_266M—Fibre Channel protocol
- 64 = LR_FC_50_531M—Fibre Channel protocol
- 65 = LR_FC_100_1063M—Fibre Channel protocol
- 66 = LR_FDDI
- 67 = LR_FICON—IBM protocol for mainframes
- 68 = LR_Gigabit_Ethernet—Gigabit Ethernet
- 69 = LR_DS0_64K—DS0 CTP layer rate
- 70 = LR_ISDN_BRI—ISDN Basic Rate Interface PTP layer rate
- 71 = LR_POTS—POTS PTP layer rate
- 72 = LR_DSR_OC1_STM0
- 73 = LR_DSR_OC3_STM1
- 74 = LR_DSR_OC12_STM4
- 75 = LR_DSR_OC24_STM8
- 76 = LR_DSR_OC48_and_STM16
- 77 = LR_DSR_OC192_and_STM64
- 78 = LR_DSR_OC768_and_STM256
- 79 = LR_DSR_1_5M
- 80 = LR_DSR_2M
- 81 = LR_DSR_6M
- 82 = LR_DSR_8M
- 83 = LR_DSR_34M
- 84 = LR_DSR_45M
- 85 = LR_DSR_140M
- 86 = LR_DSR_565M
- 87 = LR_DSR_Gigabit_Ethernet
- 88 = LR_Section_OC24_STS24_and_RS_STM8
- 89 = LR_Line_OC24_STS24_and_MS_STM8
- 90 = LR_Section_OC768_STS768_and_RS_STM256
- 91 = LR_Line_OC768_STS768_and_MS_STM256

- 92 to 97 = Not used
- 98 = LR_STS6c_and_VC4_2c
- 99 = LR_STS9c_and_VC4_3c
- 100 = LR_STS24c_and_VC4_8c
- 101 = Not used
- 102 = LR_SYSPLEX_ISC_COMP
- 103 = LR_SYSPLEX_ISC_PEER
- 104 = LR_SYSPLEX_TIMER_ETR
- 105 = LR_SYSPLEX_TIMER_CLO
- 106 = LR_Ten_Gigabit_Ethernet
- 107 = LR_Physical_10_Gigabit_ITU—WDM in physical layer
- 108 = LR_Physical_2_5_Gigabit_ITU—WDM in physical layer
- 109 = LR_OCH_10_Gigabit_ITU—WDM in Optical Channel layer
- 110 = LR_OCH_2_5_Gigabit_ITU—WDM in Optical Channel layer
- 111 = LR_FC_200_2125M—Fibre Channel protocol (FC1) layer
- 112 = LR_FICON_1G—FICON 1 Gbps
- 113 = LR_FICON_2G—FICON 2 Gbps
- 114 = LR_STS18c_and_VC4_6c
- 115 = LR_STS36c_and_VC4_12c
- 116 = LR_Optical_Transport_Path
- 117 = LR_Optical_Transport_Section
- 118 = LR_Optical_Transport_FEC
- 119 = LR_POS_100M
- 120 = LR_POS_Gigabit
- 121 = LR_8b10b_2_5_Gigabit
- 122 = LR_COS_100M
- 123 = LR_COS_Gigabit
- 124 = LR_GFP_Multirate
- 125 = LR_Optical_Transport_EFEC
- 126 = LR_Optical_Transport_OTUk
- 127 to 132 = Not used
- 133 = LR_FC_10G
- 134 = LR_FC_4G
- 135 to 136 = Not used
- 137 = LR_FICON_4G
- 138 to 142 = Not used
- 143 = LR_OCH_ISC3_PEER_1G
- 144 = LR_OCH_ISC3_PEER_2G

- 145 = Not used
- 146 = LR_OCH_HDVT
- 147 = Not used
- 148 = LR_DV_6000
- 149 = LR_PASS_THROUGH
- 150 = LR_RPR_IEEE_802_17
- 151 = LR_STS96c_and_VC4_32c
- 152 = LR_Physical_40_Gigabit_ITU
- 10001 = LR_OCH_Transport_Unit—For OchTrail tunnel SNCs

2.2.2 Inventory

The ONS 15310, ONS 15327, ONS 15501, ONS 15530, ONS 15540, ONS 15600 SONET, and ONS 15600 SDH are single-shelf NEs. However, in future they may be expanded to multishelf, multibay NEs. Considering this, CTM reports the following:

- Rack = 1 and shelf = 1 for ONS 15310, ONS 15327, ONS 15501, ONS 15530, ONS 15540, ONS 15600 SONET, and ONS 15600 SDH inventory. This implementation allows CTM to accommodate future changes quickly.
- ONS 15454 MSTP NEs support up to eight shelves per NE. The shelf ID identifies a specific shelf on the NE. The rack ID remains 1 for all the shelves.
- For the ONS 15454 SDH, the EFCA shelf and the main shelf are considered to be a single logical shelf with slots numbering from 1 to 29.
- Rack = 1 and shelf = 1 for ONS 15216 NEs.
- For the ONS 15216 DCU, CTM reports the DCU chassis as the shelf. CTM reports two slots as equipment holders contained by the shelf. Any DCM module is reported as equipment under the slot.
- For the ONS 15216 FlexLayer, CTM reports the FlexLayer chassis as the shelf. CTM reports four slots as equipment holders contained by the shelf. Any provisioned module is reported as equipment under the slot.
- For the remaining ONS 15216 NEs, CTM reports only one type of equipment under the shelf. The equipment name is the same as the NE name.

For some supported NEs, equipment does not fit in the normal EquipmentHolders (rack, shelf, slot, and so on) and does not have provisioning functions. For inventory purposes, CTM defines a special EquipmentHolder named AdditionalHolder to hold this equipment.

- For the ONS 15454 SONET R3.4 and later, the Alarm Interface Extension (AIE) is reported in AdditionalHolder 1 (if installed). The Alarm Extension Panel (AEP) is reported in AdditionalHolder 2.
- For the ONS 15454 SDH R3.4 and later, the AIE (if installed) is reported in AdditionalHolder 1.
- For the ONS 15600 R5.0 and later, pluggable port modules (PPMs) and pluggable I/O modules (PIMs) on ASAP cards are reported as subslots and port holders, respectively.
- For the ONS 15600 SDH R8.0, PPMs and PIMs on ASAP cards are reported as subslots and port holders, respectively.
- The CRS-1 contains one or more racks and the shelf number is set to 1.
- For the XR 12000, CTM reports rack = 1 and shelf = 1.

- For the CRS-1 and XR 12000:
  - The router processor (RP) card, switch fabric card, clock scheduler card, and power supply cards are reported under the slot holder.
  - The PLIM and LC SP modules are reported under the sub_slot holder.
  - For the SPA cards, the SPA jacket card is reported in the subslot holder and the SPA line card is reported in a specially defined holder called spa_holder.
- For unmanaged NEs, CTM reports only ManagedElement. CTM does not report any equipment holder or equipment.
- For storage NEs, CTM reports only ManagedElement. CTM does not report any equipment holder or equipment.

MGX 8880/8850/8830 NEs are single-shelf NEs. However, in the future, they may be expanded to multishelf, multibay NEs. Considering this, CTM reports the following:

- Rack = 1 and shelf = 1 for the MGX 8880/8850/8830 inventory. This implementation allows CTM to accommodate future changes quickly
- CTM reports MGX slots and peripheral holder as equipment holders contained by the shelf. Any provisioned card is reported as equipment under the slot, and any provisioned peripheral is reported as equipment under the peripheral holder.
- CTM reports MGX slots with a provisioned card as equipment holders. CTM does not report empty slots as equipment holders.

2.2.3 Interfaces

Note Unless specified otherwise, all get*XXX* methods are synchronous.

Note CTM supports all the ONS 15xxx-series NEs. However, methods supported for one NE type might not be supported for another NE type. In this case, CTM returns a NOT_IMPLEMENTED ProcessingFailureException for the unsupported method.

Note CTM supports TMF-defined and Cisco-proprietary application programming interfaces (APIs) and data structures. The Cisco-proprietary APIs and data structures are subject to change in future releases of CTM to accommodate the introduction of new features or the maintenance of TMF compliance. This is especially true if the TMF were to define the same method with different behavior.

In such cases, the affected API name is changed without changing the behavior. The renamed API retains the signature and behavior of the original API.

A standard deprecation period of one CTM release is allowed on the obsolete APIs and data structure. However, Cisco is willing to consider exceptions that minimize the business impact to customers.

Note The following methods are proprietary.

In addition to implementing TMF-defined interfaces, CTM defines the following new methods on different interfaces:

- managedElementManager::ManagedElementManager_I::getAllSNCs
- managedElementManager::ManagedElementManager_I::getAssociatedTopologicalLinks
- managedElementManager::ManagedElementManager_I::getAllSrcPTPsForSNCProvisioning
- managedElementManager::ManagedElementManager_I::getAllSrcCTPsForSNCProvisioning
- managedElementManager::ManagedElementManager_I::getAllDestPTPsForSNCProvisioning
- managedElementManager::ManagedElementManager_I::getAllDestCTPsForSNCProvisioning
- managedElementManager::ManagedElementManager_I::getAllSrcFTPsForSNCProvisioning
- managedElementManager::ManagedElementManager_I::getAllDestFTPsForSNCProvisioning
- managedElementMgr::ManagedElementMgr_I::forceNEResync
- managedElementManager::ManagedElementMgr_I::getAllTopologicalLinksForME
- multiLayerSubnetwork::MultiLayerSubnetworkMgr_I::getCTPsAndTopologicalLink
- multiLayerSubnetwork::MultiLayerSubnetworkMgr_I::createAndActivateSNCFromUserLabel
- multiLayerSubnetwork::MultiLayerSubnetworkMgr_I::addDrops
- performance::PerformanceManagementMgr_I::getCTMHistoryPMData
- performance::PerformanceManagementMgr_I::deleteHistoryPMDataFile
- performance::PerformanceManagementMgr_I::getTPHistoryPMData
- performance::PerformanceManagementMgr_I::getMEPMcapabilities
- protection::ProtectionMgr_I::createProtectionGroup
- protection::ProtectionMgr_I::deleteProtectionGroup
- protection::ProtectionMgr_I::getAssociatedProtectionGroup
- emsMgr::EMSMgr_I::createTopologicalLink
- emsMgr::EMSMgr_I::deleteTopologicalLink
- emsMgr::EMSMgr_I::modifyTopologicalLink
- emsSessionFactory::EmsSessionFactory_I::getEmsPublicKey
- emsMgr::EMSMgr_I::createTopologicalLinkWithYCableProtection
- All methods defined in 3.15 L2 Topology and ML VLAN for ML-Series Ethernet Cards, page 3-317
- All methods defined in 3.16 E-Series VLAN Interfaces, page 3-344
- multiLayerSubnetwork::MultiLayerSubnetworkMgr_I::getVCATSNC
- multiLayerSubnetwork::MultiLayerSubnetworkMgr_I::getAllVCATSNCs
- multiLayerSubnetwork::MultiLayerSubnetworkMgr_I::getAllVCATSNCNames
- multiLayerSubnetwork::MultiLayerSubnetworkMgr_I::getAllVCATMemberSNCs
- multiLayerSubnetwork::MultiLayerSubnetworkMgr_I::getAllVCATMemberSNCNames
- multiLayerSubnetwork::MultiLayerSubnetworkMgr_I::createVCAT
- multiLayerSubnetwork::MultiLayerSubnetworkMgr_I::deleteVCAT
- multiLayerSubnetwork::MultiLayerSubnetworkMgr_I::addMemberSNCsToVCAT

- multiLayerSubnetwork::MultiLayerSubnetworkMgr_I::deleteMemberSNCsFromVCAT
- multiLayerSubnetwork::MultiLayerSubnetworkMgr_I::deleteAllMemberSNCFromVCAT
- managedElementManager::ManagedElementManager_I::getAllRolls
- managedElementManager::ManagedElementManager_I::getAllRollNames
- managedElementManager::ManagedElementManager_I::getRoll
- managedElementManager::ManagedElementManager_I::rollSNCsForPTP
- managedElementManager::ManagedElementManager_I::getAllPTPsForRollProvisioning
- managedElementManager::ManagedElementManager_I::getAllCTPsForRollProvisioning
- multiLayerSubnetwork::MultiLayerSubnetworkMgr_I::createRoll
- multiLayerSubnetwork::MultiLayerSubnetworkMgr_I::deleteRoll
- multiLayerSubnetwork::MultiLayerSubnetworkMgr_I::cancelRoll
- multiLayerSubnetwork::MultiLayerSubnetworkMgr_I::completeRoll
- multiLayerSubnetwork::MultiLayerSubnetworkMgr_I::finishRoll
- multiLayerSubnetwork::MultiLayerSubnetworkMgr_I::getAllFromCTPsForRollProvisioning
- multiLayerSubnetwork::MultiLayerSubnetworkMgr_I::getAllRolls
- multiLayerSubnetwork::MultiLayerSubnetworkMgr_I::getAllRollNames
- multiLayerSubnetwork::MultiLayerSubnetworkMgr_I::getAllAssociatedRollsForSNC
- multiLayerSubnetwork::MultiLayerSubnetworkMgr_I::getAssociatedSNCForRoll
- softwareAndDataManager::SoftwareAndDataMgr_I::activateSoftwareOnME
- softwareAndDataManager::SoftwareAndDataMgr_I::revertSoftwareOnME
- softwareAndDataManager::SoftwareAndDataMgr_I::restoreME
- softwareAndDataManager::SoftwareAndDataMgr_I::getMERestoreStatus
- softwareAndDataManager::SoftwareAndDataMgr_I::abortMERestore
- softwareAndDataManager::SoftwareAndDataMgr_I::getAllSupportedMESoftwareVersions
- softwareAndDataManager::SoftwareAndDataMgr_I::downloadMESoftware
- softwareAndDataManager::SoftwareAndDataMgr_I::addSupportedMESoftwareVersion
- softwareAndDataManager::SoftwareAndDataMgr_I::getSWDownloadStatus
- managedElementManager::ManagedElementMgr_I::setMEAdminState
- multiLayerSubnetwork::MultiLayerSubnetworkMgr_I::addManagedElement
- multiLayerSubnetwork::MultiLayerSubnetworkMgr_I::deleteManagedElement
- emsMgr::EMSMgr_I::addMultiLayerSubnetwork
- emsMgr::EMSMgr_I::deleteMultiLayerSubnetwork
- emsMgr::EMSMgr_I::getAllSupportedMEModels
- multiLayerSubnetwork::MultiLayerSubnetworkMgr_I::createAndActivateSNCFromUserLabel

2.2.4 Object Details

2.2.4.1 Multilayer Subnetwork

A subnetwork is a collection of managed elements that reflects network connectivity, in most cases. There are two ways to create a new subnetwork through the CTM client:

- In the Domain Explorer window, choose **File > Add Network Element(s)**. Choose **<SELF>** as the GNE ID and **<System Default>** as the subnetwork ID. CTM creates a new subnetwork and assigns a name to the new subnetwork object. The naming convention is Subnetwork-<*ID*>, where *ID* = 00000001, 00000002, *n*.
- Create a subnetwork object from the CTM client by choosing **File > Subnetwork Explorer**. In the Subnetwork Explorer window, select a network partition and choose **File > Add New Subnetwork**. Enter the subnetwork name.

There are four ways to add NEs to subnetworks:

- Use the CTM client to specify a subnetwork for the new NE. If the new NE is a GNE and you choose **<System Default>** as the subnetwork ID, the new subnetwork is created as described in the first bullet above.
- If the new NE is not a GNE, choose an existing subnetwork as the subnetwork ID. CTM adds this NE to the subnetwork.
- If the new NE is connected to an existing NE on the network, CTM discovers the NE and automatically adds it to the existing NE's subnetwork. No user action is required.
- Use the CTM client to move the NE from one subnetwork to another subnetwork.

SNC creation is limited within a MultiLayerSubnetwork scope. For example, assume Subnetwork-00000001 contains two NEs, A and B, that are connected to each other with an autodiscovered link. Subnetwork-00000002 contains two NEs, C and D, that are connected to each other with an autodiscovered link. There is also a manually routable link between NEs B and C. To create an SNC between NEs A and D, you must move NEs C and D into Subnetwork-00000001, or move NEs A and B into Subnetwork-00000002.

CTM R8.0 includes a feature to automatically group NEs in subnetworks. This feature is enabled by default. If a routable link is created between two NEs in different subnetworks and CTM decides to merge the two subnetworks, the result is reflected in CTM GateWay/CORBA. In this instance the two subnetworks are automatically merged when this feature is enabled in CTM.

2.2.4.2 SNCs

SNCs are supported only for ONS 15310, ONS 15327, ONS 15454 SONET, ONS 15454 SDH, ONS 15600 SONET, and ONS 15600 SDH NEs. CTM does not support SNC in pending state. However, CTM SNC has a proprietary deleting state.

2.2.4.3 AVC Events

In certain situations, CTM cannot provide the list of changed object attributes. In this case, CTM generates an AVC event with an empty attribute list. The NMS must retrieve the object details by making an explicit get call.

2.2.4.4 Managed Element and Object Creation Event

You can use the CTM client to add new managed elements. If the name of the new element is incorrect, an Object Creation event is generated with the incorrect name. Later, when CTM connects to the actual NE, it retrieves the correct name. CTM generates an AVC event to notify the NMS.

2.2.4.5 Source of Object Attributes Reported by CTM

This section lists the attributes of objects that CTM GateWay/CORBA reports. Each attribute is a constant value or is retrieved from the cache or from the NE. The term *cache* refers to "in-memory" and includes the CTM database repository and configuration files. CTM relies on notifications from the NE to update the value of these attributes.

2.2.4.5.1 MultiLayerSubnetwork_T

The following table lists the MultiLayerSubnetwork_T attributes and where they are reported.

Table 2-18 MultiLayerSubnetwork_T

Attribute	Reported from...
name	cache
nativeEMSName	cache
subnetworkType	cache

2.2.4.5.2 EMS_T

The following table lists the EMS_T attributes and where they are reported.

Table 2-19 EMS_T

Attribute	Reported from...
name	cache
nativeEMSName	cache
emsVersion	constant value
type	constant value

2.2.4.5.3 Equipment_T

The following table lists the Equipment_T attributes and where they are reported.

Note For NE-specific details, see 3.6.1 equipment::EquipmentInventoryMgr_I::getAllEquipment, page 3-52.

Table 2-20 Equipment_T

Attribute	Reported from...
name	cache
nativeEMSName	cache

Table 2-20 Equipment_T (continued)

Attribute	Reported from...
expectedEquipmentObjectType	cache
installedEquipmentObjectType	cache
installedPartNumber	cache
installedVersion	cache
installedSerialNumber	cache
additionalInfo (only CLEI[1] code is reported)	cache

1. CLEI = Common Language Equipment Identifier.

2.2.4.5.4 EquipmentHolder_T

The following table lists the EquipmentHolder_T attributes and where they are reported.

Note For NE-specific details, see 3.6.1 equipment::EquipmentInventoryMgr_I::getAllEquipment, page 3-52.

Table 2-21 EquipmentHolder_T

Attribute	Reported from...
name	cache
nativeEMSName	cache
holderType	cache
expectedOrInstalledEquipment	cache
acceptableEquipmentTypeList	cache
holderState	cache

2.2.4.5.5 TerminationPoint_T

The following table lists the TerminationPoint_T attributes and where they are reported.

Note For NE-specific details, see 3.6.3 equipment::EquipmentInventoryMgr_I::getAllSupportedPTPs, page 3-66.

Table 2-22 TerminationPoint_T

Attribute	Reported from...
name	cache
type	cache
connectionState	constant value
direction	constant value

Table 2-22 TerminationPoint_T (continued)

Attribute		Reported from...
transmissionParameters	AlarmReporting (PTP only)	cache
	ServiceState (PTP only)	cache
	AdminState (PTP only)	cache
	LineCode (PTP only)	cache
	FrameFormat (PTP only)	cache
	SDH_SONET_SS_BITS (OC-*n* PTP only)	cache
	EnableSyncMsg (OC-*n* PTP only)	cache
	TrailTraceActualTx (CTP only)	cache
	TrailTraceExpectedRx (CTP, FTP only)	cache
	TrailTraceMonitor (CTP, FTP only)	cache
	IPPMMonitor (CTP only)	cache

2.2.4.5.6 SubnetworkConnection_T

The following table lists the SubnetworkConnection_T attributes and where they are reported.

Note For NE-specific details, see 3.8.2 managedElementManager::ManagedElementManager_I::getAllSNCs, page 3-88.

Table 2-23 SubnetworkConnection_T

Attribute		Reported from...
Name		cache
NativeEMSName		cache
SncState		cache
Direction		cache
Rate		cache
StaticProtectionLevel		cache
aEnd, zEnd	tpName	cache
	transmissionParams	See 2.2.4.5.5 TerminationPoint_T, page 2-37

2.2.4.5.7 ManagedElement_T

The following table lists the ManagedElement_T attributes and where they are reported.

Note For NE-specific details, see 3.8.3 managedElementManager::ManagedElementManager_I::getAllManagedElements, page 3-90.

Table 2-24 ManagedElement_T

Attribute	Reported from...
name	cache
nativeEMSName	cache
location	cache
version	cache
productName	cache
communicationState	cache
supportedRates	cache
additionalInfo (IP address)	cache

2.2.4.5.8 TopologicalLink_T

The following table lists the TopologicalLink_T attributes and where they are reported.

Note For NE-specific details, see 3.3.5 emsMgr::EMSMgr_I::getAllTopLevelTopologicalLinks, page 3-21.

Table 2-25 TopologicalLink_T

Attribute	Reported from...
name	cache
nativeEMSName	cache
direction	cache
rate	cache
aEndTP	cache
zEndTP	cache

2.2.4.5.9 ProtectionGroup_T

The following table lists the ProtectionGroup_T attributes and where they are reported.

Note For NE-specific details, see 3.12.2 protection::ProtectionMgr_I::getAllProtectionGroups, page 3-306.

Table 2-26 ProtectionGroup_T

Attribute	Reported from...
name	cache
nativeEMSName	cache
protectionGroupType	cache
protectionSchemeState	constant value

Table 2-26 ProtectionGroup_T (continued)

Attribute	Reported from...
reversionMode	cache
rate	cache
pgTPList	cache
pgpParameters[1]	cache
additionalInfo[2]	cache

1. CTM supports only wtrTime.
2. CTM supports only BIDIRECTIONAL for 1_PLUS_1 PGP.

2.2.4.5.10 ServerTrailLink_T

The following table lists the ServerTrailLink_T attributes and where they are reported.

Table 2-27 ServerTrailLink_T

Attribute	Reported from...
name	cache
userLabel	cache
nativeEMSName	cache
owner	cache
count	cache
cost	cache
direction	cache
rate	cache
protectionType	cache
aEndTP	cache
zEndTP	cache
additionalInfo	cache
srlgGroupListValue	cache

2.2.5 Naming Conventions

The following sections describe naming conventions for objects that CTM reports.

2.2.5.1 Multilayer Subnetwork

The name is defined by the user in the CTM client. If the user does not specify a name, CTM assigns a default name.

2.2.5.2 Managed Element

The name is reported by the ManagedElement.

2.2.5.3 Physical Termination Point

The PTP name represents the position of the PTP with respect to the equipment. For example, port number 4 on equipment in slot 15 is reported as /rack=1/shelf=1/slot=15/port=4.

For multishelf NEs, the rack and shelf number must be included in the PTP name. For example, port number 4 on equipment in slot 15 on shelf number 2 and rack number 3 is reported as /rack=3/shelf=2/slot=15/port=4.

This PTP naming convention is used to represent the front Ethernet ports for the ONS 15454 SONET and ONS 15454 SDH ML-series cards. The back Ethernet ports are reported as FTPs.

For class of service (CoS) data on data cards, the PTP name specifies the interface (POS/FastEthernet/GigabitEthernet), direction (input/output), and CoS level (0-7).

For example, CoS data with POS interface, input direction, and CoS level 3 for slot 1, port 1 in the NE is reported as rack=1/shelf=1/slot=1/port=1:POS/Input/3.

Similarly, CoS data with Fast Ethernet interface, output direction, and CoS level 5 for slot 1, port 1 in the NE is reported as /rack=1/shelf=1/slot=1/port=1:FastEthernet/Output/5.

For the ONS 15600 SONET, the ASAP card on slot 3, port 1 on PPM 3 and PIM 2 is reported as /rack=1/shelf=1/slot=3/sub_slot=2/ppm_holder=3/port=1.

Similarly for the ONS 15310, ONS 15454 SONET, and ONS 15454 SDH, a port on PPM 2 is reported as /rack=1/shelf=1/slot=2/ppm_holder=2/port=1.

For the ONS 15501, ONS 15530, and ONS 15540, the PTP name represents the position of the PTP with respect to the equipment. It also specifies the CLI name, because more than one interface type could have the same physical position. Numbering for equipmentHolders and ports starts from 0 in the NE. However, the TMF convention is to start numbering from 1 for equipmentHolders and ports. Therefore, CTM does translation when reporting PTP names.

For example, wavepatch0/0/0 (which is present in slot 0, subslot 0 in the NE) is reported as /rack=1/shelf=1/slot=1/subslot=1/port=1:wavepatch0/0/0.

Transparent0/0/0 port (which is present in slot 0, subslot 0 in the NE) is reported as /rack=1/shelf=1/slot=1/subslot=1/port=1:transparent0/0/0.

Some PTPs, such as wdm0/0, do not have an associated port number. In these cases, the port number is set to 1.

Wdm0/0 (which is present in slot 0 and subslot 0 in the NE) is reported as /rack=1/shelf=1/slot=1/subslot=1/port=1:wdm0/0.

Wave0 interface (which is present in slot 0 in the NE) is reported as /rack=1/shelf=1/slot=1/port=1:wave0 (since the subslot does not apply to this port, it is skipped).

The In-Port on the chassis is reported as rack=1/shelf=1/port=1:In-Port.

For the ONS 15800, ONS 15801, and ONS 15808, the PTP name represents the position of the PTP with respect to the equipment, where the physical location is composed of rack/shelf/slot. It also specifies the direction, since there can be more than one PTP with the same physical position:

```
/rack=1/shelf=1/slot=13:0
```

Subslot and port are not significant for ONS 158xx equipment. The direction can assume the following values:

- 2 = Source east-to-west
- 3 = Source west-to-east
- 4 = Sink east-to-west
- 5 = Sink west-to-east

For the CRS-1 and XR 12000, the PTP name represents the position of the PTP with respect to the equipment. For example, PTPs of 3-port GE line cards in slot 3 are reported as:

```
/rack=1/shelf=1/slot=3/sub_slot=0/port=0
/rack=1/shelf=1/slot=3/sub_slot=0/port=1
/rack=1/shelf=1/slot=3/sub_slot=0/port=2
```

For unmanaged NEs, the PTP nativeName is a free-format string.

For the MGX 8880/8850/8830, the PTP name represents the position of the PTP with respect to the equipment. For example, port number 4 on equipment in slot 10 and bay 1 is reported as /rack=1/shelf=1/slot=10/subslot=1/port=4.

2.2.5.4 Connection Termination Point

Naming conventions for SONET, SDH, and plesiochronous digital hierarchy (PDH) CTP are defined by TMF 814 in a document named *objectNaming.html*. CTM follows these rules.

For OC-*n* or STM-*n* cards on the ONS 15327 R3.3 or later, ONS 15454 SONET R3.2.1 or later, and ONS 15454 SDH R3.3 or later, CTM supports STS6c, STS9c, and STS24c layer rates. On the ONS 15327 R5.0 or later, ONS 15454 SONET R5.0 or later, and ONS 15454 SDH R5.0 or later, CTM supports STS18c and STS36c layer rates. These are not conventional SONET/SDH rates; therefore, the TMF document does not cover their naming. The following table shows the CTM CTPs for STS6c, STS9c, STS24c, STS18c, and STS36c layer rates.

Table 2-28 CTPs for STS6c, STS9c, STS18c, STS24c, and STS36c

Possible PTP	Layer Rate	CTP Tuple	Comments
OC12	sts6c_vc4_2c	/sts6c_vc4_2c=1, 2	CTP is on the edge of sts6c, STS#1 and STS#7.
		/sts6c_vc4_2c=1-r=[1..5]	CTP is not on the edge of sts6c. For example, if CTP is on STS#4, the name is /sts6c_vc4_2c=1-r=3.
	sts9c_vc4_3c	/sts9c_vc4_3c=1	CTP is on the edge of sts9c, STS#1.
		/sts9c_vc4_3c=1-r=[1..3]	CTP is not on the edge of sts9c. For example, if CTP is on STS#4, the name is /sts9c_vc4_3c=1-r=3.

Table 2-28 CTPs for STS6c, STS9c, STS18c, STS24c, and STS36c (continued)

Possible PTP	Layer Rate	CTP Tuple	Comments
OC48	sts6c_vc4_2c	/sts6c_vc4_2c=[1..8]	CTP is on the edge of sts6c, STS#1, STS#7… STS#43.
		/sts6c_vc4_2c=[1..7]-r=[1..5]	CTP is not on the edge of sts6c. For example, if CTP is on STS#10, the name is /sts6c_vc4_2c=2-r=3.
	sts9c_vc4_3c	/sts9c_vc4_3c=[1..5]	CTP is on the edge of sts9c, STS#1, STS#10… STS#37.
		/sts9c_vc4_3c=[1..5]-r=[1..8]	CTP is not on the edge of sts9c. For example, if CTP is on STS#16, the name is /sts9c_vc4_3c=2-r=6.
	sts24c_vc4_8c	/sts24c_vc4_8c=1, 2	CTP is on the edge of sts24c, STS#1, STS#25.
		/sts24c_vc4_8c=1-r=[1..23]	CTP is not on the edge of sts24c. For example, if CTP is on STS#10, the name is /sts24c_vc4_8c=1-r=9.
	sts18c_vc4_6c	/sts18c_vc4_6c=1, 2	CTP is on the edge of sts18c, STS#1, STS#19.
		/sts18c_vc4_6c=1-r=[1..17]	CTP is not on the edge of sts18c. For example, if CTP is on STS#10, the name is /sts18c_vc4_6c=1-r=9.
	sts36c_vc4_12c	/sts36c_vc4_12c=1	CTP is on the edge of sts36c, STS#1.
		/sts36c_vc4_12c=1-r=[1..35]	CTP is not on the edge of sts36c. For example, if CTP is on STS#10, the name is /sts36c_vc4_12c=1-r=9.
OC192	sts6c_vc4_2c	/sts6c_vc4_2c=[1..32]	CTP is on the edge of sts6c, STS#1, STS#7… STS#187.
		/sts6c_vc4_2c=[1..31]-r=[1..5]	CTP is not on the edge of sts6c. For example, if CTP is on STS#4, the name is /sts6c_vc4_2c=1-r=3.
	sts9c_vc4_3c	/sts9c_vc4_3c=[1..21]	CTP is on the edge of sts9c, STS#1, STS#10… STS#181.
		/sts9c_vc4_3c=[1..20]-r=[1..8]	CTP is not on the edge of sts9c. For example, if CTP is on STS#52, the name is /sts9c_vc4_3c=6-r=6.
	sts18c_vc4_6c	/sts18c_vc4_6c=1,10	CTP is on the edge of sts18c, STS#1, STS#19.
		/sts18c_vc4_6c=1-r=[1..17]	CTP is not on the edge of sts18c. For example, if CTP is on STS#10, the name is /sts18c_vc4_6c=1-r=9.
	sts24c_vc4_8c	/sts24c_vc4_8c=[1..8]	CTP is on the edge of sts24c, STS#1, STS#25… STS#169.
		/sts24c_vc4_8c=[1..7]-r=[1..23]	CTP is not on the edge of sts24c. For example, if CTP is on STS#61, the name is /sts24c_vc4_8c=3-r=12.
	sts36c_vc4_12c	/sts36c_vc4_12c=1,5	CTP is on the edge of sts36c, STS#1, STS#37.
		/sts36c_vc4_12c=1-r=[1..35]	CTP is not on the edge of sts36c. For example, if CTP is on STS#10, the name is /sts36c_vc4_12c=1-r=9.
STM4	sts6c_vc4_2c	/sts6c_vc4_2c=1,2	CTP is on the edge of vc4_2c, VC4#1, and VC4#3.
		/sts6c_vc4_2c=1-r=1	CTP is on VC4#2.
	sts9c_vc4_3c	/sts9c_vc4_3c=1	CTP is on the edge of vc4_3c, VC4#1.
		/sts9c_vc4_3c=1-r=1	CTP is on VC4#2.

Table 2-28 CTPs for STS6c, STS9c, STS18c, STS24c, and STS36c (continued)

Possible PTP	Layer Rate	CTP Tuple	Comments
STM16	sts6c_vc4_2c	/sts6c_vc4_2c=[1..8]	CTP is on the edge of vc4_2c, VC4#1, VC4#3… VC4#15.
		/sts6c_vc4_2c=[1..7]-r=1	CTP is not on the edge of vc4_2c. For example, if CTP is on VC4#4, the name is /sts6c_vc4_2c=2-r=1.
	sts9c_vc4_3c	/sts9c_vc4_3c=[1..5]	CTP is on the edge of vc4_3c, VC4#1, VC4#4… VC4#13.
		/sts9c_vc4_3c=[1..5]-r=[1..2]	CTP is not on the edge of vc4_3c. For example, if CTP is on VC4#6, the name is /sts9c_vc4_3c=2-r=2.
	sts18c_vc4_6c	/sts18c_vc4_6c=1,2	CTP is on the edge of vc4_6c, VC4#1, VC4#7.
		/sts18c_vc4_6c=1-r=[1..5]	CTP is not on the edge of vc4_6c. For example, if CTP is on VC4#3, the name is /sts18c_vc4_6c=1-r=2.
	sts24c_vc4_8c	/sts24c_vc4_8c=1,2	CTP is on the edge of vc4_8c, VC4#1, VC4#9.
		/sts24c_vc4_8c=1-r=[1..7]	CTP is not on the edge of vc4_8c. For example, if CTP is on VC4#4, the name is /sts24c_vc4_8c=1-r=3.
	sts36c_vc4_12c	/sts36c_vc4_12c=1	CTP is on the edge of vc4_12c, VC4#1.
		/sts36c_vc4_12c=1-r=[1..11]	CTP is not on the edge of vc4_12c. For example, if CTP is on VC4#10, the name is /sts36c_vc4_12c=1-r=9.
STM64	sts6c_vc4_2c	/sts6c_vc4_2c=[1..32]	CTP is on the edge of vc4_2c, VC4#1, VC4#3… VC4#63.
		/sts6c_vc4_2c=[1..31]-r=1	CTP is not on the edge of vc4_2c. For example, if CTP is on VC4#20, the name is /sts6c_vc4_2c=10-r=1.
	sts9c_vc4_3c	/sts9c_vc4_3c=[1..21]	CTP is on the edge of vc4_3c, VC4#1, VC4#4… VC4#61.
		/sts9c_vc4_3c=[1..21]-r=[1..3]	CTP is not on the edge of vc4_3c. For example, if CTP is on VC4#6, the name is /sts9c_vc4_3c=2-r=2.
	sts18c_vc4_6c	/sts18c_vc4_6c=1,9	CTP is on the edge of vc4_6c, VC4#1, VC4#7.
		/sts18c_vc4_6c=1-r=[1..5]	CTP is not on the edge of vc4_6c. For example, if CTP is on VC4#3, the name is /sts18c_vc4_6c=1-r=2.
	sts24c_vc4_8c	/sts24c_vc4_8c=[1..8]	CTP is on the edge of vc4_8c, VC4#1, VC4#9… VC4#57.
		/sts24c_vc4_8c=[1..7]-r=[1..7]	CTP is not on the edge of vc4_8c. For example, if CTP is on VC4#28, the name is /sts24c_vc4_8c=4-r=3.
	sts36c_vc4_12c	/sts36c_vc4_12c=1,4	CTP is on the edge of vc4_12c, VC4#1.
		/sts36c_vc4_12c=1-r=[1..11]	CTP is not on the edge of vc4_12c. For example, if CTP is on VC4#10, the name is /sts36c_vc4_12c=1-r=9.

Note The number after '-r' is the difference between the STS/VC4# and the previous edge STS/VC4#.

In addition, the following CTP name support has been added:

Possible PTP	Layer Rate	CTP Tuple
STM1	vt2_tu12	/sts3c_au4-*j*=1/vt2_tu12-*k*=[1..3]-*l*=[1..7]-*m*=[1..3] The qualifier strings represent the following values: • *j*—AUG index • *k*—TUG-3 or AU-3 index • *l*—TUG-2 index • *m*—TU-12 or TU-11 index

For CTPs used for WDM SNCs (optical channel network connection [OCHNC], optical channel client connection [OCHCC], and OCH trail tunnels), use the naming conventions defined in TMF: /frequency=*nnn.mm*, where *nnn.mm* is a decimal representing the frequency in terahertz (THz).

For unidirectional CTP, the naming convention is to add "/direction=src or sink" in front of the name. Because the CTPs in WDM SNC are all unidirectional, the name is "/direction=src or sink/frequency=*nnn.mm*" for WDM SNC CTPs.

Because the CTM client uses wavelengths to represent an optical channel, enter the corresponding wavelength value in the nativeEMSName field for the CTP.

The formula for converting wavelength to frequency is:

frequency (THz) = 299792458 / wavelength (nm) / 1000

The formula for converting frequency back to wavelength is:

wavelength (nm) = 299792458 / frequency (THz) / 1000

The possible values of the frequency *nnn.mm* (in THz) in the CTP and the corresponding wavelength values are:

For OCHNC:

- C-band

195.90(1530.33), 195.80(1531.12), 195.70(1531.90), 195.60(1532.68), 195.40(1534.25), 195.30(1535.04), 195.20(1535.82), 195.10(1536.61), 194.90(1538.19), 194.80(1538.98), 194.70(1539.77), 194.60(1540.56), 194.40(1542.14), 194.30(1542.94), 194.20(1543.73), 194.10(1544.53), 193.90(1546.12), 193.80(1546.92), 193.70(1547.72), 193.60(1548.51), 193.40(1550.12), 193.30(1550.92), 193.20(1551.72), 193.10(1552.52), 192.90(1554.13), 192.80(1554.94), 192.70(1555.75), 192.60(1556.55), 192.40(1558.17), 192.30(1558.98), 192.20(1559.79), 192.10(1560.61).

- L-band

1577.86, 1578.69, 1579.52, 1580.35, 1581.18, 1582.02, 1582.85, 1583.69, 1584.53, 1585.36, 1586.20, 1587.04, 1587.88, 1588.73, 1589.57, 1590.41, 1591.26, 1592.10, 1592.95, 1593.79, 1594.64, 1595.49, 1596.34, 1597.19, 1598.04, 1598.89, 1599.75, 1600.60, 1601.46, 1602.31, 1603.17, 1604.03.

For OCHCC:

- C-band (odd)

1529.55 nm, 1530.33 nm, 1531.12 nm, 1531.90 nm, 1532.68 nm, 1533.47 nm, 1534.25 nm, 1535.04 nm, 1535.82 nm, 1536.61 nm, 1537.40 nm, 1538.19 nm, 1538.98 nm, 1539.77 nm, 1540.56 nm, 1541.35 nm, 1542.14 nm, 1542.94 nm, 1543.73 nm, 1544.53 nm, 1545.32 nm, 1546.12 nm, 1546.92 nm, 1547.72 nm,

1548.51 nm, 1549.32 nm, 1550.12 nm, 1550.92 nm, 1551.72 nm, 1552.52 nm, 1553.33 nm, 1554.13 nm, 1554.94 nm, 1555.75 nm, 1556.55 nm, 1557.36 nm, 1558.17 nm, 1558.98 nm, 1559.79 nm, 1560.61 nm, 1561.42 nm.

- C-band (even)

1529.94 nm, 1530.73 nm, 1531.51 nm, 1532.29 nm, 1533.07 nm, 1533.86 nm, 1534.64 nm, 1535.43 nm, 1536.22 nm, 1537.00 nm, 1537.79 nm, 1538.58 nm, 1539.37 nm, 1540.16 nm, 1540.95 nm, 1541.75 nm, 1542.54 nm, 1543.33 nm, 1544.13 nm, 1544.92 nm, 1545.72 nm, 1546.52 nm, 1547.32 nm, 1548.12 nm, 1548.92 nm, 1549.71 nm, 1550.52 nm, 1551.32 nm, 1552.12 nm, 1552.93 nm, 1553.73 nm, 1554.54 nm, 1555.34 nm, 1556.15 nm, 1556.96 nm, 1557.77 nm, 1558.58 nm, 1559.39 nm, 1560.20 nm, 1561.01 nm, 1561.83 nm.

- L-band (odd)

1570.83 nm, 1571.65 nm, 1572.48 nm, 1573.30 nm, 1574.13 nm, 1574.95 nm, 1575.78 nm, 1576.61 nm, 1577.44 nm, 1578.27 nm, 1579.10 nm, 1579.93 nm, 1580.77 nm, 1581.60 nm, 1582.44 nm, 1583.27 nm, 1584.11 nm, 1584.95 nm, 1585.78 nm, 1586.62 nm, 1587.46 nm, 1588.30 nm, 1589.15 nm, 1589.99 nm, 1590.83 nm, 1591.68 nm, 1592.52 nm, 1593.37 nm, 1594.22 nm, 1595.06 nm, 1595.91 nm, 1596.76 nm, 1597.62 nm, 1598.47 nm, 1599.32 nm, 1600.17 nm, 1601.03 nm, 1601.88 nm, 1602.74 nm, 1603.60 nm.

- L-band (even)

1571.24 nm, 1572.06 nm, 1572.89 nm, 1573.71 nm, 1574.54 nm, 1575.37 nm, 1576.20 nm, 1577.03 nm, 1577.86 nm, 1578.69 nm, 1579.52 nm, 1580.35 nm, 1581.18 nm, 1582.02 nm, 1582.85 nm, 1583.69 nm, 1584.53 nm, 1585.36 nm, 1586.20 nm, 1587.04 nm, 1587.88 nm, 1588.73 nm, 1589.57 nm, 1590.41 nm, 1591.26 nm, 1592.10 nm, 1592.95 nm, 1593.79 nm, 1594.64 nm, 1595.49 nm, 1596.34 nm, 1597.19 nm, 1598.04 nm, 1598.89 nm, 1599.75 nm, 1600.60 nm, 1601.46 nm, 1602.31 nm, 1603.17 nm, 1604.03 nm.

2.2.5.5 Floating Termination Point

The FTP naming contains three tuples. The first tuple is the EMS name, the second tuple is the ME name, and the third tuple is the FTP name. The value of the name field in the third tuple is "FTP." The native FTP name is a free-format string. However, CTM GateWay/CORBA follows the convention for PTP and CTP, if applicable.

All Ethernet TPs for circuit provisioning on E-series, G-series, ML-series, CE-100T-8, and FCMR cards are modeled as FTPs. The convention for the FTP values for Ethernet TPs is as follows:

- For FTPs used in single-card EtherSwitch, CTM uses /rack=1/shelf=1/slot=*n*/EtherSwitchGroup.
- For FTPs used in multicard EtherSwitch, CTM uses /MulticardEtherSwitchGroup.
- For FTPs used in linear-card EtherSwitch or G-series cards, CTM uses /rack=1/shelf=1/slot=*n*/port=*m*.
- For FTPs used in ML-series cards, CTM uses /rack=1/shelf=1/slot=*n*/port=*m*, where *m* = 0,1.
- For TunnelCircuitTP used to create/report VTTunnel, CTM uses /VTTunnel.
- For TunnelCircuitTP used to create/report VCTunnel, CTM uses /VCTunnel.
- For TunnelCircuitTP used to create VCTunnel for VC3 port grouping and SNCs, CTM uses /rack=1/shelf=1/slot=*n*/vc4=*m*, where *n* is 1–17 and *m* is 1–4.
- For VT aggregation point circuits used to create or report VAP circuits, CTM uses /VAPTP for SONET NEs.
- For low-order aggregation point circuits, CTM uses /LAPTP for SDH NEs.

2.2.5.6 Equipment

For a list of equipment that CTM GateWay/CORBA reports for each NE type, see Appendix D, "Equipment List for NEs."

2.2.5.7 Equipment Holder

The TMF defines the EquipmentHolder naming convention. Numbering is done from left to right and from top to bottom. For example, slot 15 is named /rack=1/shelf=1/slot=15.

For ONS 15xxx NEs, the numbering for EquipmentHolders starts from 0 in the NE. The TMF convention is to start numbering from 1 for EquipmentHolders. CTM does translation when reporting EquipmentHolder names.

For example, subslot 1 in slot 0 in the NE is named /rack=1/shelf=1/slot=1/sub_slot=2.

For the ONS 15454 MSTP NEs, shelves are numbered using their unique shelf ID, and not their physical location attributes, such as rack number and shelf position.

For example, slot 1 on an MSTP shelf with an ID of 7 that is physically located in rack 1, shelf 2 is named /rack=1/shelf=7/slot=1.

For the ONS 155xx family, there is a new equipment holder called a port_holder. Because the TMF determines whether or not a piece of equipment has to be in an EquipmentHolder, the port_holder is created to hold the transceiver modules that contain the PTPs. A port_holder that is present in subslot 1, slot 0 in an NE is named /rack=1/shelf=1/slot=1/sub_slot=2/port_holder=1.

A port holder present in slot 1 in an NE is named /rack=1/shelf=1/slot=2/port_holder=1.

For the ONS 15600 NE and ASAP cards, a PIM present in slot 3 is named /rack=1/shelf=1/slot=3/sub_slot=1. A PPM present in PIM 3 in slot 2 is named /rack=1/shelf=1/slot=2/sub_slot-3/ppm_holder=1.

For AdditionalHolder, the naming convention is defined as /additionalHolder=1; there is no subholder for AdditionalHolder. AdditionalHolders apply only to ONS 15454 SONET and SDH NEs when AIE or AEP cards are installed.

For CRS-1 and XR 12000 slots that contain more than one card, each card is modeled under a subslot. For example, if a PLIM is present under slot 1, the hierarchy is:

```
/rack=1/shelf=1/slot=1/sub_slot=1/card=1
```

When a CRS-1 or XR 12000 contains an SPA line card under an SPA jacket card in slot 1, the hierarchy is:

```
/rack=1/shelf=1/slot=1/sub_slot=1/spa_holder=1/card=1
```

For the MGX 8880/8850/8830, there is a new equipment holder called peripheral_holder. Because the TMF determines whether or not a piece of equipment has to be in an EquipmentHolder, the peripheral_holder is created to hold the peripherals.

A peripheral_holder present on a shelf is named rack=1/shelf=1/ /peripheral_holder=17236110, where the number 17236110 is the unique peripheral ID.

A peripheral_holder in slot 1 is named /rack=1/shelf=1/slot=1/peripheral_holder=17236111, where the number 17236111 is the unique peripheral ID.

2.2.5.8 Topological Link

CTM discovers topological links and assigns a name with the following default format:

```
<MEName A:slot number/port number-ME Name B: slot number/port number>
```

Integer values are used for slot and port number. You can use the CTM client to change the link name.

For the ONS 15501, ONS 15530 and ONS 15540, the topological link name has the following format:

```
<ME NameA:InterfaceType/slot number/subslot number [/port number]-ME
NameB:InterfaceType/slot number/subslot number[/port number ]>
```

The port number is optional.

For example:

```
NE540A:Wdm0/0--NE540B:Wdm1/0
NE540A:Wavepatch10/1/0--NE540A:Filter0/3/1
```

CTM reports two topological links for a Y-cable link. Both topological links have the same nativeEMSName, but different values in the second tuple of the topological link name. The names "<nativeEMSName>:::1" and "<nativeEMSName>:::2" identify the two legs of the Y-cable link.

2.2.5.9 Protection Group

The protection group name reported by the NE is used as the PGP native name for 1_FOR_1, 1_FOR_N, and 1_PLUS_1 protection groups. The ring ID is used as the PGP native name for 2_FIBER_BLSR and 4_FIBER_BLSR protection groups. "<Ring Id>-EAST" and "<Ring Id>-WEST" are used as the native names for the two component groups of 4_FIBER_BLSR PGP.

2.2.5.10 L2 Topology

L2 topology represents a point-to-point, hub-and-spoke, or Resilient Packet Ring (RPR) Layer 2 network topology. These topologies exist over the underlying Layer 1 topology, which is formed by physical topological links. Each L2 topology name is identified in the context of an EMS and has two tuples. The first tuple represents the EMS name, and the second tuple represents the nativeEMSName of the L2 topology. The L2 topology name is unique within an EMS. Each L2 topology can be associated with multiple ML VLANs.

2.2.5.11 ML VLAN

Each ML VLAN is associated with an L2 topology and is unique for a given L2 topology. The fully qualified ML VLAN name is identified by three tuples. The first tuple represents the EMS name, the second tuple represents the L2 topology name, and the last tuple represents the nativeEMSName of the ML VLAN (which is the VLAN ID). A maximum of 255 ML VLANs can be created per L2 topology, ranging from 1 to 4095.

2.2.5.12 QoS Template

The QoS template is defined in the scope of an EMS domain. The fully qualified QoS template name is identified by two tuples. The first tuple represents the EMS name and the second tuple represents the QoS template name.

2.2.5.13 VCAT

The fully qualified VCAT name is identified by two tuples. The first tuple represents the EMS name and the second tuple represents the VCAT name, which is the same as the nativeEMSName of the VCAT.

2.2.6 Programming Details

2.2.6.1 Boolean Mapping

The following boolean parameters apply:

- On = True
- Off = False

2.2.6.2 Resource Cleanup

Many TMF interfaces that CTM implements return iterator objects for large volumes of data. These iterators are allocated CTM resources. CTM supports a maximum of 128 iterators. If the iterator limit is reached, the NMS receives an EXCPT_TOO_MANY_OPEN_ITERATORS exception.

CTM, by default, cleans up all the iterator objects if they are not accessed in a time interval of six hours.

2.2.6.3 Development Environment

CTM GateWay/CORBA has been developed with Java Development Kit (JDK) 1.5 and jacORB 2.1.3.5 on Sun Solaris 2.10 and is compliant with the CORBA 2.3 specification. The OSS can use Java or the C++ IDL compiler to compile IDL files.

Note If you use Java and jacORB, the CTM server installation provides JAR files for notification IDLs and TMF IDLs.

2.2.6.4 Exception Handling

All interfaces implemented by CTM GateWay/CORBA raise the exception globaldefs::ProcessingFailureException. The following sections discuss each exception type in detail.

2.2.6.4.1 EXCPT_NOT_IMPLEMENTED

This exception indicates whether some IDL operations are optional or are not implemented in this release. If the operation itself is not supported, the errorReason is an empty string.

2.2.6.4.2 EXCPT_INTERNAL_ERROR

This exception indicates an internal EMS error and applies to all methods.

2.2.6.4.3 EXCPT_INVALID_INPUT

This exception indicates an incorrect parameter format, such as a three-level namingAttribute termination point (TP) name that is passed as a single-level name. If a parameter is out of range, this exception is also used. The reason field contains the incorrect parameter.

2.2.6.4.4 EXCPT_ENTITY_NOT_FOUND

This exception indicates that the NMS supplied an object name as a parameter and the EMS cannot find an object with that name. The reason field contains the name that was passed as a parameter.

2.2.6.4.5 EXCPT_UNABLE_TO_COMPLY

This exception is used as a generic value when the server cannot respond to the request.

2.2.6.4.6 EXCPT_NE_COMM_LOSS

This exception is used as a generic value when the server cannot communicate with the NE, preventing the successful completion of the operation. All operations that involve communication with the NE might return this exception type.

2.2.6.4.7 EXCPT_ACCESS_DENIED

This exception indicates that an operation has resulted in a security violation. Verify that you have the required access to invoke the operation.

2.2.6.4.8 EXCPT_TOO_MANY_OPEN_ITERATORS

This exception indicates that the EMS has exceeded the number of iterators it can support. CTM supports 128 iterators. If you receive this exception, it is possible that other sessions are retrieving data in large volume. Wait several minutes; then, retry. Alternately, close other sessions. To avoid this exception, the NMS must invoke the destroy method on iterators.

2.2.6.4.9 EXCPT_USERLABEL_IN_USE

This exception indicates that the userLabel uniqueness constraint cannot be met.

2.2.6.4.10 EXCPT_STRICT_MERGE_FAILED

This exception is raised when an OSS issues an upgrade request to merge circuits with a STRICT MERGE operation type. The OSS can use this exception to issue the upgrade request with a LOOSE MERGE operation type.

2.2.7 Provisioning Subnetwork Connections

SNC provisioning must be within a MultiLayerSubnetwork scope, which means the aEnd and the zEnd of an SNC must be in the same MultiLayerSubnetwork.

CTM defines the method multiLayerSubnetwork::MultiLayerSubnetworkMgr_I::createAndActivateSNCFromUserLabel for SNC provisioning.

2.2.7.1 SNC Provisioning on OC-n or Electrical Equipment

CTM supports SNC provisioning on OC-n or electrical cards for ONS 15310, ONS 15327, ONS 15454 SONET, ONS 15454 SDH, and ONS 15600 SONET NEs.

CTPs are used as the end points to create the SNC.

2.2.7.2 SNC Provisioning on Ethernet Equipment

ONS 15310, ONS 15327, ONS 15454 SONET, and ONS 15454 SDH managed elements support Ethernet equipment. SNC can be created on this equipment to carry Ethernet traffic. The TMF standard supports only SONET, SDH, DWDM, and ATM; it does not support Ethernet at this time.

Provisioning SNC on E-series, G-series, and ML-series equipment supported by the ONS 15310, ONS 15327, ONS 15454 SONET, and ONS 15454 SDH is different from provisioning SNC on SONET or PDH equipment. For SNCs on Ethernet equipment, CTM uses FTP to model the end point. See 2.2.5.5 Floating Termination Point, page 2-46 for naming conventions.

The three modes supported for SNC provisioning on Ethernet equipment are:

- Single-card mode—E-series cards; VLANs can be associated during creation.
- Multicard mode—E-series cards; VLANs can be associated during creation.
- Linear-card mode—E-series, G-series, and ML-series cards.

To obtain available source and destination FTPs for SNC provisioning, use the following methods:

- managedElementManager::ManagedElementManager_I::getAllSrcFTPsForSNCProvisioning
- managedElementManager::ManagedElementManager_I::getAllDestFTPsForSNCProvisioning

2.2.7.2.1 Single-Card Mode and Multicard Mode

By default, all E-series cards are in the multicard mode EtherSwitch group. Each node has only one multicard mode EtherSwitch group; the group exists even if the node has no Ethernet cards. A single-card EtherSwitch group can exist only if a node has at least one Ethernet card.

- To create SNC in multicard mode, both aEnd and zEnd must be in the multicard EtherSwitch group.
- To create SNC in single-card mode, one end can be OCn CTP. You must create bidirectional SNC.

The following table shows the maximum bandwidth allowed for single- and multicard EtherSwitches.

Table 2-29 Single-Card and Multicard Mode

ONS 15327 Single Card	ONS 15454 SONET/SDH Single Card	ONS 15327 Multicard	ONS 15454 SONET/SDH Multicard
Six STS1s	Six STS1s and two STS3c (SONET only)	Three STS1s	Six STS1s (SONET only)
Two STS3c	Four STS3c (VC4)	One STS3c	Two STS3c (VC4)
One STS6c	One STS6c (VC4_2c) and six STS1s (SONET only)	—	One STS6c (VC4_2c)
One STS12c	One STS6c (VC4_2c) and two STS3c (VC4)	—	—
—	Two STS6c (VC4_2c)	—	—
—	One STS12c (VC4_4c)	—	—

2.2.7.2.2 Linear-Card Mode

You can apply linear-card mode SNC provisioning to all types of Ethernet cards. One end of the SNC must be an FTP; the other end can be a CTP on any OC-n port, or an FTP. The FTPs must use linear-mode naming conventions.

Only single source and single destination are supported for the SNC creation, and the SNC must be bidirectional.

For E-series and G-series cards, the port number in the FTP name is the number of the front Ethernet port. For ML-series cards, the port number is the number of the virtual back-end port.

2.2.7.2.3 Layer Rates

CTM supports the following layer rates for E-series cards:

- LR_STS1_and_AU3_High_Order_VC3
- LR_STS3c_and_AU4_VC4
- LR_STS6c_and_VC4_2c
- LR_STS12c_and_VC4_4c

CTM supports the following layer rates for G-series cards:

- LR_STS1_and_AU3_High_Order_VC3
- LR_STS3c_and_AU4_VC4
- LR_STS6c_and_VC4_2c
- LR_STS9c_and_VC4_3c
- LR_STS12c_and_VC4_4c
- LR_STS24c_and_VC4_8c
- LR_STS48c_and_VC4_16c

CTM supports the following layer rates for ML-series cards:

- LR_STS1_and_AU3_High_Order_VC3
- LR_STS3c_and_AU4_VC4
- LR_STS6c_and_VC4_2c
- LR_STS9c_and_VC4_3c
- LR_STS12c_and_VC4_4c
- LR_STS24c_and_VC4_8c

CTM supports the following layer rates for FCMR cards:

- LR_STS1_and_AU3_High_Order_VC3
- LR_STS3c_and_AU4_VC4

CTM supports the following layer rate for CE-100T-8 and ML-100T-8 cards:

- LR_STS1_and_AU3_High_Order_VC3

2.2.7.3 Tunnel SNC Provisioning

CTM supports tunnel SNC provisioning on ONS 15310, ONS 15327, ONS 15454 SONET, and ONS 15454 SDH NEs. The tunnel SNC must be bidirectional.

The tunnel SNC for the ONS 15310, ONS 15327, and ONS 15454 SONET is called VT tunnel, and the layer rate must be 14 (LR_STS1_and_AU3_High_Order_VC3). The tunnel SNC for the ONS 15454 SDH is called VC tunnel, and the layer rate must be 15 (LR_STS3c_and_AU4_VC4). See 2.2.5 Naming Conventions, page 2-40 for naming conventions.

Only one aEnd and zEnd are specified for the VT/VC tunnel SNC provisioning.

CTM only supports fully automatically routed VT/VC tunnel SNCs. CTM does not support manually routed and constraint-based automatically routed VT/VC tunnel SNCs.

CTM supports VC tunnel for VC3 port grouping and SNC provisioning on ONS 15454 SDH. For VC tunnel for VC3 port grouping and SNC provisioning, if the source or destination end is an STM-*n* card, it is modeled as CTP; if the source or destination end is on an E3, DS3I, or DS3IN card, it is modeled as FTP.

The following table shows the combinations of cards that can be selected for creating the VC4 tunnel for VC3 port grouping circuits.

Table 2-30 Tunnel SNC Provisioning

A-End	Z-End
DS3I or DS3IN	DS3I, DS3IN, or STM-*n*
E3	E3 or STM-*n*
STM-*n*	DS3I, DS3IN, or E3

When VC tunnel for VC3 port grouping and SNC provisioning is complete:

- One VC4 tunnel SNC is created with the SNC name <*name*>:PGT1
- Three VC3 SNCs are created with the SNC names <*name*>:PGC1, <*name*>:PGC2, and <*name*>:PGC3

Deleting one PGC SNC results in the deletion of all four SNCs. You cannot delete a PGT SNC if any PGC SNCs exist. See 2.2.5 Naming Conventions, page 2-40 for the naming conventions.

2.2.7.4 SNC Provisioning on WDM Equipment

2.2.7.4.1 OCHCC Circuit Provisioning

CTM supports OCHCC circuit provisioning on transponders, muxponders, and International Telecommunication Union (ITU-T) line cards for ONS 15454 SONET and ONS 15454 SDH NEs.

The OCHCC SNC is created between client ports on transponders, muxponders cards, or trunk ports on ITU-T line cards.

OCHCC is an extension of the OCHNC. OCHCC is a part of the OCHCC SNC. OCHCC can have only one source and one destination.

CTP naming is identical to OCHNC SNCs: CTM GateWay/CORBA determines whether to create an OCHNC or OCHCC, depending on the layer. See 2.2.5.4 Connection Termination Point, page 2-42 for the CTP details.

OCHCC must be bidirectional.

CTM supports different sizes corresponding to possible payload types of transponder and muxponder client ports. A specific layer must be defined for each payload type.

OCHCC is either *unprotected* or *protected*. Protected is only created on protected transponders or muxponders cards where there is a protected trunk port.

Note To create OCHCC, you must create manual links at an optical channel layer between the transponders, muxponders, or ITU-T line cards and DWDM ports.

OSPF-detected links between GCC termination on transponder or muxponder cards are indicated at the Optical_Transport_OTUk layer.

When an OCHCC circuit is created, unless transponder cards are directly connected by a topological link, an additional OCH trail tunnel circuit is created automatically.

The following method is defined for protected OCHCC circuits when it is necessary to specify constraints for both working and protected routes: multiLayerSubnetwork::MultiLayerSubnetworkMgr_I::createAndActivateProtectedOchccFromUserLabel

2.2.7.4.2 OCHNC Circuit Provisioning

CTM supports OCHNC circuit provisioning on the following WDM cards for ONS 15454 SONET and ONS 15454 SDH NEs:

- AD_1B_CARD_EQPT
- AD_1C_CARD_EQPT
- AD_2C_CARD_EQPT
- AD_4B_CARD_EQPT
- AD_4C_CARD_EQPT
- AMP_PORT_EQPT
- DMX32_L_CARD_EQPT
- DMX32_O_CARD_EQPT
- DMX32_R_CARD_EQPT
- DMX40_LINE_CARD_EQPT
- MMU_CARD_EQPT
- MUX_DMX_PORT_EQPT
- MUX_DMX4_CARD_EQPT
- MUX32_O_CARD_EQPT
- MUX40_LINE_CARD_EQPT
- OADM_PORT_EQPT
- OPT_AMP_17_C_LINE_CARD_EQPT
- OPT_AMP_L_EQPT
- OPT_BST_E_EQPT
- OPT_BST_EQPT
- OPT_BST_L_EQPT
- OPT_PRE_EQPT
- OSC_CSM_CARD_EQPT
- OSCM_CARD_EQPT

- OSCM_PORT_EQPT
- WSS_32_CARD_EQPT
- WSS32_L_CARD_EQPT
- WSS40_LINE_CARD_EQPT
- WXC40_LINE_CARD_EQPT

This type of circuit is referred to as WDM SNC. The WDM SNC is created on a particular wavelength channel with a direction of either east-to-west or west-to-east. WDM SNCs are unidirectional or bidirectional. CTM GateWay/CORBA supports the creation of bidirectional OCHNC circuits on R5.0 and later NEs. You can also create two unidirectional OCHNC circuits on the same frequency, in opposite directions.

The CTPs used in WDM SNCs are different from the CTPs used in SONET/SDH SNCs in terms of naming and nature. See 2.2.5.4 Connection Termination Point, page 2-42 for the CTP naming conventions. The layer rate for the CTPs and WDM SNC must be LR_Optical_Channel.

The OCHNC size is “Equipped not specific.” You can specify four possible directions:

- East-to-west unidirectional
- East-to-west bidirectional
- West-to-east unidirectional
- West-to-east bidirectional

The preceding values are added to the globaldefs::ConnectionDirection_T structure.

For OCHNC on ONS 15454 SONET and ONS 15454 SDH R7.0 and later, you do not have to specify the east-to-west or west-to-east direction; instead, UniDir and BiDir must be used. For R8.0 NEs you can specify route constraints (NE include/exclude constraints) in the SNCCreateData_T parameter.

When creating OCHNC bidirectional circuits on R5.x or R6.x NEs, you must specify all four circuit endpoints: source, destination, secondary source (the source in the opposite direction), and secondary destination (the destination in the opposite direction). For R7.x or R8.x NEs you must specify only the source and destination in one direction, because the endpoints for the opposite direction are calculated automatically.

CTM GateWay/CORBA distinguishes the mode to be used by the NE version.

2.2.7.5 Specifying Route Constraints for OCH*xx* Circuit Provisioning

For OCHCC, OCHNC, and OCH trail tunnel circuits, you can specify route constraints (NE include/exclude constraints) in the SNCCreateData_T parameter.

For protected OCHCC circuits, constraints for the working path are specified in the SNCCreateData_T parameter; constraints for the protected path are specified in a separate parameter. See details in the createAndActivateProtectedOchccFromUserLabel API description.

2.2.7.6 Low-Order Circuit Provisioning Using VAP/LAP

CTM supports low-order circuit provisioning using VT aggregation point (VAP) circuits on ONS 15310, ONS 15327, and ONS 15454 SONET NEs, and low-order aggregation point (LAP) circuits on ONS 15454 SDH NEs. The VAP/LAP circuits must be bidirectional.

When provisioning VAP/LAP circuits, the source is treated as the STS grooming end; the destination is treated as the VT grooming end and is used later to connect VT circuits.

The source is a CTP and the destination is an FTP. See 2.2.5 Naming Conventions, page 2-40 for naming conventions.