Cisco Prime Optical 9.3.1 ML Provisioning Methodology

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This document describes the methodology that Cisco Prime Optical 9.3.1 uses to provision ML-series cards.

This document contains the following sections:

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Introduction

Cisco Prime Optical (formerly Cisco Transport Manager) is a carrier-class, multitechnology management system that integrates the end-to-end management of traditional transport networks and new carrier packet transport networks. It can help maintain the integrity of existing services, plus deliver interactive, content-based services and high-bandwidth applications.

Cisco Prime Optical manages the entire Cisco optical portfolio, including:

- Metro core
- Metro dense wavelength-division multiplexing (DWDM)
- Metro edge and access products
- New Carrier Packet Transport (CPT) System products

Prime Optical also serves as a foundation for integration into a larger overall Operations Support System (OSS) environment by providing northbound gateway interfaces to higher-layer management systems.

Prime Optical supports data service provisioning over ML-series cards. Data service provisioning consists of provisioning the Layer 2 topology using optical circuits, and then provisioning the Layer 2 service on top of the Layer 2 topology.

Alarm notification and performance monitoring features on data cards (ML-series cards) are SNMP-based. To allow Prime Optical to support alarm and event notification and performance monitoring on data cards, the SNMP trap forwarding mechanism must be set up on each node of the data card.

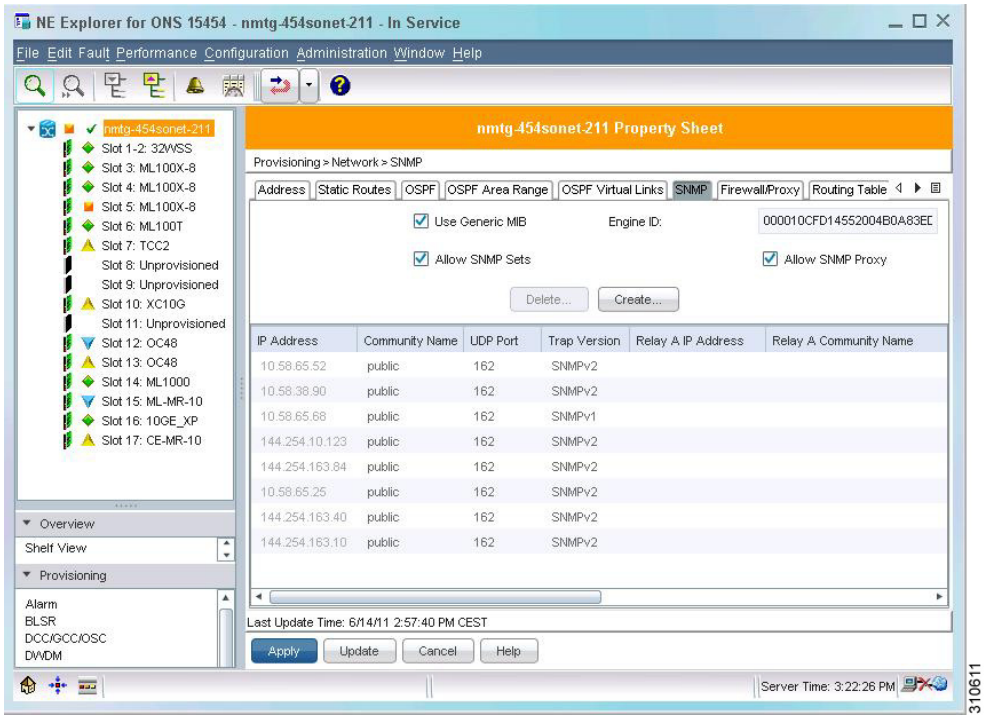
This document provides the set of Cisco IOS commands issued by Prime Optical during Layer 2 topology and Layer 2 service provisioning, including provisioning of interface ports for ML data cards. The syntax used for the commands must be respected for services provisioned directly using Cisco IOS so that Prime Optical recognizes the provisioned services.

SNMPv1 and SNMPv2 Trap Destination Setup

For the cards to have full Prime Optical support, the SNMP trap destination must be set up for each node where there is a data card inserted:

- The NE containing the ML-series card must have a valid SNMP community string. If the SNMP community string is not valid, a resynchronization failure occurs and is logged in the Audit Log.
- The Cisco IOS startup-config file must contain the **snmp-server enable traps** command to receive traps from ML-series cards. See Overview, page 5 for more information.
- You must force resynchronization on the NE by marking it as Out of Service (OOS), and then back In Service (IS) when you change the trap destination in either Cisco Transport Controller (CTC) or Prime Optical. This operation forces the registration of ML-series cards for traps.
- You must set up the trap destination based on the SNMP version (SNMPv1 or SNMPv2) and the gateway NE/end NE (GNE/ENE) configuration of the node. Set the trap destination in the NE Explorer window (see Figure 1).

Figure 1 NE Explorer—SNMPv1 and SNMPv2 Trap Destination Setup



The following table lists the possible SNMP configurations.

Table 1 SNMP Configurations

Node Setup	Allow SNMP Set	Use Generic MIB	Allow SNMP Proxy	IP Address	Community Name	UDP Port	Trap Version	Relay A IP Address
SNMPv1—NE R7.0 and later								
GNE	Enable	Enable	Enable	Prime Optical server IP address	Public	162	SNMPv1	—
ENE (with relay)	Enable	Enable	Enable	Prime Optical IP address	Public	162	SNMPv1	Active GNE's IP address
ENE (without relay)	Enable	Enable	Enable	GNE IP address	Public	391	SNMPv1	—
SNMPv2—NE R7.0 and later								
GNE	Enable	Enable	Enable	Prime Optical server IP address	Public	162	SNMPv2	—
ENE (with relay)	Enable	Enable	Enable	Prime Optical server IP address	Public	162	SNMPv2	Active GNE's IP address

Table 1 SNMP Configurations (continued)

Node Setup	Allow SNMP Set	Use Generic MIB	Allow SNMP Proxy	IP Address	Community Name	UDP Port	Trap Version	Relay A IP Address
ENE (without relay)	Enable	Enable	Enable	GNE IP address	Public	391	SNMPv2	—
SNMPv1—NE releases earlier than R7.0								
GNE	Enable	Enable	Enable	Prime Optical server IP address	Public	162	SNMPv1	—
ENE (with relay)	Enable	Enable	Enable	Prime Optical server IP address	Public	162	SNMPv1	Active GNE's IP address
ENE (without relay)	Enable	Enable	Enable	GNE IP address	Public	391	SNMPv1	—
SNMPv2—NE releases earlier than R7.0								
GNE	Enable	Enable	Enable	Prime Optical server IP address	Public	162	SNMPv2	—
ENE (with relay)	Enable	Enable	Enable	Prime Optical server IP address	Public	162	SNMPv2	Active GNE's IP address
ENE (without relay)	Not supported.							

When setting up an SNMPv1 or SNMPv2 trap destination:

1. Delete the GNE and ENE's SNMP trap destinations before performing GNE-ENE role changes. After a GNE-ENE role switch is complete, add the new SNMP trap destinations according to the new GNE-ENE roles.
2. If the ENE does not contain the GNE's SNMP community string, mark the ENE as Out of Service and then In Service.
3. Do not use an ONS 15600 as the GNE and an ONS 15454 as the ENE.
4. The GNE-ENE SNMP community string must be *Public*.

SNMPv3 Configuration

Prime Optical supports SNMPv3 on CTC-based release 9.3.1 NEs. (SNMPv3 is not supported on ONS 15305, ONS 15305 CTC, or ONS 15327 NEs.)

As is the case for SNMPv1 and SNMPv2, to support SNMPv3, NEs with ML-series cards must have a valid SNMP configuration to guarantee correct initialization and management of Layer 2 parameters. If the SNMP configuration is invalid, the Audit Log records a resynchronization failure.

Configuring SNMPv3 is more complex than configuring SNMPv1 or SNMPv2, because the following tables must be filled in:

- SNMPv3 NE User table—The SNMP users for each NE.
- SNMPv3 User Group table—The grouping of NE SNMP users.
- SNMPv3 Group View table—A view for any SNMPv3 user grouping.
- SNMPv3 NE Trap Destination table—The SNMP trap configuration.
- SNMPv3 NE Notification Filter table—The SNMP trap filtering, if needed.
- SNMPv3 NE Proxy Forwarder table—The GNE/ENE GET/SET forwarding configuration.
- SNMPv3 NE Proxy Trap Forwarder table—The GNE/ENE trap forwarding configuration.

For details about configuring SNMPv3, see the section "Managing SNMPv3—CTC-Based Release 9.3.1 NEs" in Chapter 8, "Managing Security" in the *Cisco Prime Optical 9.3.1 User Guide*.

Overview

A Layer 2 topology can be a point-to-point optical circuit; Resilient Packet Ring (RPR) or an IEEE802.17 RPR consisting of a chain of optical circuits; or hub and spoke, consisting of multiple optical circuits connected in a hub-and-spoke fashion. Hub-and-spoke topologies are supported as multiple point-to-point topologies.

For a point-to-point topology, the following card combinations are supported:

- ML-1000-2/ML-100T-12/ ML-100T-8/ML-100-FX to ML-1000-2/ML-100T-12/ML-100T-8/ML-100-FX card
- ML-1000-2/ML-100T-12/ ML-100T-8/ML-100-FX to CE-100T-8/CE-1000-4/CE-MR-6/CE-MR-10 card
- ML-1000-2/ ML-100T-12/ML-100T-8/ML-100-FX to OC-N/STM-N/MRC/CTX card
- ML-1000-2/ML-100T-12/ML-100T-8/ML-100-FX to G-series card
- ML-1000-2/ML-100T-12/ML-100T-8/ML-100-FX to E-series card with LEX encapsulation (ONS 15327 NEs only)

When deployed as hub and spoke, the ML-series card can be placed at the spoke locations, with the G-series card providing an extension of the traffic to a Cisco 7600, which forms the hub of the architecture. This arrangement provides a cost-effective way to interface to the Cisco 7600. Alternatively, the ML-series card can be deployed at both the hub and the spoke sites.

When deployed as an RPR or DOT17RPR, all sites contain ML-series cards (ML-1000-2, ML-100T-12, or ML-100T-8). A minimum of two ML-series cards is required to configure an RPR.

You use Prime Optical to provision ML-series cards by opening a Telnet session to each card. Before doing this, provision each ML-series card and create a password configuration that allows you to use Prime Optical to log in. For this purpose, a barebone file is provided on the Prime Optical server disk (Disk 1).

A different file is provided for the following cards:

- ONS 15310 ML (*bareboneCLI_Generic.txt*)
- ONS 15454 ML base microcode (*barebone15454CLI_Security.txt*)
- ONS 15454 ML enhanced microcode (*barebone15454CLI_Enhanced_Security.txt*)

Note

- If you want to create a new topology or add a new ML card to an existing RPR topology, you must first download a new barebone file to the ML card, thereby reinitializing the card.
- You can download a barebone file to multiple ML cards. For details, see the section "Initializing ML-Series Cards" in Chapter 7, "Provisioning Services and Connections" in the *Cisco Prime Optical 9.3.1 User Guide*.

Caution Do not remove any of the information from the barebone file provided by Prime Optical. You can customize the username and password, but do not remove them; the username cannot be blank. Do not add the **enable password** *password* command, because Prime Optical cannot interactively enable a password.

Reset the ML-series card after loading the barebone file and wait for 5 minutes before provisioning topologies and services. The login and password are reported in the Control Panel window. You can create other profiles on ML-series cards by using the IOS Users table (available under **Administration > CTC-Based NEs > IOS Users Table**).

After entering command-line interface (CLI) commands through the Telnet session, Prime Optical issues a **write** or **copy run start** command to write the Cisco IOS configuration file to the Timing, Communications and Control (TCC) flash. When the Cisco IOS configuration file is written to the TCC flash (by Prime Optical or by another user), Prime Optical is notified. To verify that Prime Optical has been notified, enter the **write** command after any CLI change.

Prime Optical provides a GUI wizard to facilitate provisioning of L2 topologies and related L1 circuits. See the section "Provisioning Data Services" in Chapter 7, "Provisioning Services and Connections" in the *Cisco Prime Optical 9.3.1 User Guide*. Create an RPR or point-to-point topology involving some of the ML-series cards in the network. Based on the L2 topology circuit type and size that you specify, Prime Optical creates related L1 circuits and installs a base card configuration on each ML-series card in the RPR ring.

The Create Layer 2 Service wizard guides you through the VLAN creation. There is no CLI to create a circuit VLAN. An RPR supports from 1 to 4095 VLANs, and these VLANs are enabled at all times. All that is required is to configure the endpoint to connect a ring VLAN to a port VLAN that is either an Ethernet port or a port channel. Only ML devices are supported on an RPR.

Point-to-point topologies are supported for ML-ML, ML-G1000, ML-OC, and ML-CE cards. Point-to-point topology creation is similar to RPR creation in that based on the L2 topology circuit type and size that you specify, Prime Optical creates related L1 circuits and installs a base card configuration on each ML-series card in the point-to-point topology.

Note To remove NEs from an L2 topology, mark the NEs Out of Service, and wait an appropriate amount of time for the L2 topology and corresponding links to be automatically deleted. Once automatic deletion is confirmed, delete the NEs.

CLI Configuration Details

Note the following CLI conventions:

- Notes are reported within brackets (*[ ]*). For example:

  [notes]

- Optional commands or parameters are reported within brackets ([ ]). For example:

  [match any]

- Configurable parameters are reported within left and right angle brackets (< >). For example:

  parameter

- Multiple parameters or commands are enclosed within braces ({ }) and separated by a vertical bar (|). For example:

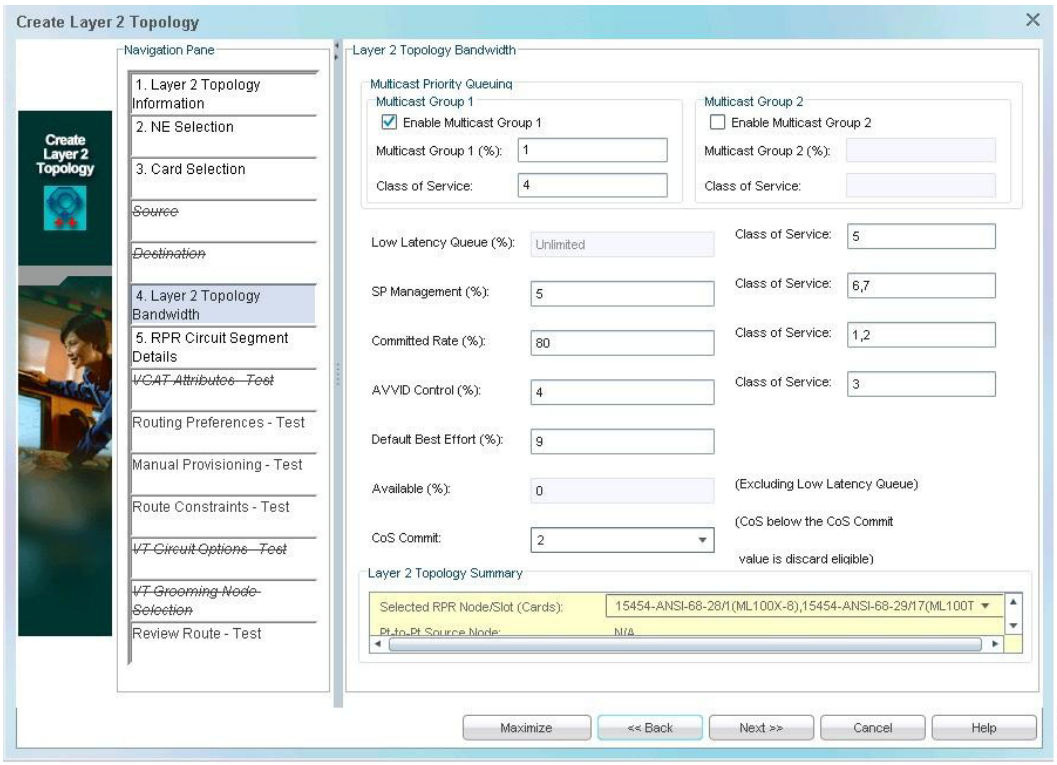
  {parameter_1 | parameter_2 | parameter_3}

Base Card Configuration

The base card configuration is a set of commands entered during the L2 topology creation. The parameters are defined in the Create Layer 2 Topology wizard > Layer 2 Topology Bandwidth pane (see Figure 2).

Note Prime Optical supports the setting of a single **match cos** command for each **class-map** command. If another **match cos** command is present on the card, Prime Optical recognizes this additional **match cos** command incorrectly and displays a null string in the GUI. This additional **match cos** command must be removed during a modify bandwidth operation.

Figure 2 Create Layer 2 Topology Wizard



RPR Base Card Configuration

To create an RPR topology, you must apply the base card configuration to all ML-series cards in the RPR. The ring is not functional and is reported as *L2 Not Ready* until the base card configuration is applied to all cards. You can select an *L2 Not Ready* RPR in the L2 Topology table and enable the L2 service provisioning by choosing **Configuration > Enable L2 Service**.

Caution If the state is reported as *L2 Not Ready*, the base card configuration is missing. Choose **Configuration > Enable L2 Service** to apply the base configuration to the card. This operation affects traffic if the service has already been provisioned on the card.

Prime Optical defines the unique card number within the ring. The actual range is from 1 to 251 in any order. Refer to the NE hardware documentation for the number of ML-series cards allowed per RPR.

```
cos priority-multicast Class of Service percent Multicast Group %1 [If Multicast Group 1
has been enabled]
cos priority-multicast Class of Service percent Multicast Group %2 [If Multicast Group 2
has been enabled]
class-map match-any SP_MANAGEMENT [If SP Management (%) is greater than 0]
    match cos SP Management Class of Service [If SP Management (%) is greater than 0]
class-map match-any AVVID_VOICE_VIDEO
    match cos Low Latency Queue Class of Service
class-map match-any AVVID_CONTROL [If AVVID Control (%) is greater than 0]
    match cos AVVID Control Class of Service [If AVVID Control (%) is greater than 0]
class-map match-any CIR [If Committed Rate (%) is greater than 0]
    match cos Committed Rate Class of Service [If Committed Rate (%) is greater than 0]
```

```
class-map match-all BEST_EFFORT
    match any

Policy-map POLICY_QOS_OUT
    class SP_MANAGEMENT [If SP Management (%) is greater than 0]
        bandwidth percent SP Management (%) [If SP Management (%) is greater than 0]
    class AVVID_VOICE_VIDEO
        Priority 8 [Fixed values are not configurable]
    class AVVID_CONTROL
        bandwidth percent AVVID Control (%) [If AVVID Control (%) is greater than 0]
    class CIR [If Committed Rate (%) is greater than 0]
        bandwidth percent Committed Rate (%) [If Committed Rate (%) is greater than 0]
    class BEST_EFFORT
        Bandwidth percent Default Best Effort (%)

Cos commit CoS Commit

Vlan dot1q tag native

L2protocol-tunnel cos 2 [Fixed value]

interface SPR1
    Spr station-id Card# [The valid range is from 1 to 254; it is not Spr node Card#]
    [The following commands are not issued by Prime Optical; rather, these are default ML
    settings]
    no ip address
    no keep alive
    hold-queue 150 in

Interface {FastEthernetN|GigabitEthernetM} [N=0 to 11 and M=0,1]
    no ip route-cache

interface POS0
    Spr-intf-id 1
    Service-policy output POLICY_QOS_OUT
    [The following commands are not issued by Prime Optical; rather, these are default ML
    settings]
    No ip address
    No ip route-cache
    Crc 32

interface POS1
    Spr-intf-id 1
    Service-policy output POLICY_QOS_OUT
    [The following commands are not issued by Prime Optical; rather, these are default ML
    settings]
    No ip address
    No ip route-cache
    Crc 32
```

Note

- Cisco IOS software supports multiple **match cos** commands for each **class-map** command, but Prime Optical supports only one for each.
- The multicast/broadcast feature applies only to RPR topologies and requires the ONS 15310 R5.0 or ONS 15454 R5.0 or later.

Point-to-Point Base Card Configuration

For a point-to-point topology involved in at least one ML-series card, the other card can be ML, CE, OC, or G1000. The point-to-point base card configuration must be applied only on the ML-series card(s) involved in the topology.

Note

- Prime Optical does not enable spanning tree. Therefore, verify that there are no Layer 2 loops formed by bridged connections outside the ML network. Layer 2 loops in a network without spanning tree enabled might cause network instability.
- If a G1000 card is one endpoint in the point-to-point topology, a Network-to-Network Interface (NNI) connection is assumed. That is, the class of service (CoS) coming into the G1000 is trusted (not overwritten).

```
cos priority-multicast Class of Service percent Multicast Group %1 [If Multicast Group 1
has been enabled]
cos priority-multicast Class of Service percent Multicast Group %2 [If Multicast Group 2
has been enabled]
class-map match-any SP_MANAGEMENT [If SP Management (%) is greater than 0]
    match cos SP Management Class of Service [If SP Management (%) is greater than 0]
class-map match-any AVVID_VOICE_VIDEO
    match cos Low Latency Queue Class of Service
class-map match-any AVVID_CONTROL [If AVVID Control (%) is greater than 0]
    match cos AVVID Control Class of Service [If AVVID Control (%) is greater than 0]
class-map match-any CIR [If Committed Rate (%) is greater than 0]
    match cos Committed Rate Class of Service [If Committed Rate (%) is greater than 0]
class-map match-all BEST_EFFORT
    match any

Policy-map POLICY_QOS_OUT
    class SP_MANAGEMENT [If SP Management (%) is greater than 0]
        bandwidth percent SP Management (%) [If SP Management (%) is greater than 0]
    class AVVID_VOICE_VIDEO
        Priority 8 [Fixed values are not configurable]
    class AVVID_CONTROL
        bandwidth percent AVVID Control (%) [If AVVID Control (%) is greater than 0]
    class CIR [If Committed Rate (%) is greater than 0]
        bandwidth percent Committed Rate (%) [If Committed Rate (%) is greater than 0]
    class BEST_EFFORT
        Bandwidth percent Default Best Effort (%)

Cos commit CoS Commit

Vlan dot1q tag native

l2protocol-tunnel cos 2 [Fixed value]

[The following commands are not issued by Prime Optical; rather, these are default ML
settings]
Interface {FastEthernetN|GigabitEthernetM} [N=0 to 11 and M=0,1]
    no ip route-cache

interface POS0
    service-policy output POLICY_QOS_OUT
    Crc {16|32} [Crc 16 between ML and E-series; otherwise Crc 32]
    [The following commands are not issued by Prime Optical; rather, these are default ML
    settings]
    No ip address
    No ip route-cache
```

```
interface POS1
    service-policy output POLICY_QOS_OUT
    Crc {16|32} [Crc 16 between ML and E-series; otherwise Crc 32]
    [The following commands are not issued by Prime Optical; rather, these are default ML
    settings]
    No ip address
    No ip route-cache
```

Note Cisco IOS software supports multiple **match cos** commands for each **class-map** command, but Prime Optical supports only one for each.

Packet over SONET, Ethernet, and Shared Packet Ring Port Provisioning

You can use the Create Layer 2 Service wizard, Modify Ports dialog box, Modify VLANs dialog box, Add L2 Service Drops wizard, or Modify L2 Drops wizard to provision the parameters described in the following table.

Table 2 Port Provisioning Parameter Support

Card and Port Types		MTU Size	Speed	Duplex	Flow Control (Send)	Flow Control (Receive)	Enable (No Shutdown)/Disable (Shutdown)
ML100T card	Ether	Supported	Supported	Supported	Supported	Not supported	Supported
	PoS[1]	Supported only for PTP	Not supported	Not supported	Not supported	Not supported	Supported
	SPR[2]	Supported only for RPR	Not supported	Not supported	Not supported	Not supported	Not supported
ML1000 (Ether) card	Ether	Supported	Supported only for Auto	Supported only for Auto	Supported	Supported	Supported
	PoS	Supported only for PTP	Not supported	Not supported	Not supported	Not supported	Supported
	SPR	Supported only for RPR	Not supported	Not supported	Not supported	Not supported	Not supported
ML100FX card	Ether	Not supported	Only 100 is supported	Only Full is supported	Supported	Not supported	Supported
	PoS	Supported only for PTP	Not supported	Not supported	Not supported	Not supported	Supported
	SPR	Supported only for RPR	Not supported	Not supported	Not supported	Not supported	Not supported

Table 2 Port Provisioning Parameter Support (continued)

Card and Port Types		MTU Size	Speed	Duplex	Flow Control (Send)	Flow Control (Receive)	Enable (No Shutdown)/Disable (Shutdown)
ML100T-8 card	Ether	Not supported	Supported	Supported	Supported	Not supported	Supported
	PoS	Not supported	Not supported	Not supported	Not supported	Not supported	Supported
	SPR	Only 1500 is supported	Not supported	Not supported	Not supported	Not supported	Not supported

1. PoS = Packet over SONET.
2. SPR = Shared Packet Ring.

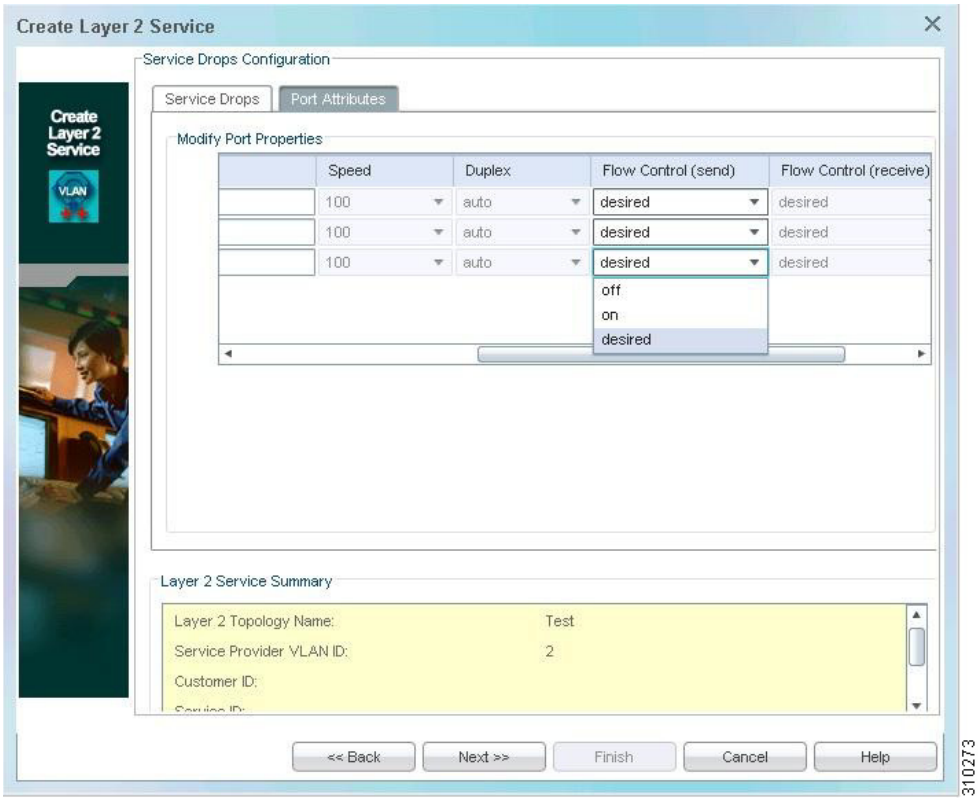
Ethernet port provisioning involves configuring the following parameters (see Figure 3):

- Enable/Disable Ethernet Ports (Administrative State/Link Control)—The ability to enable or disable an Ethernet port at any time is independent of other port provisioning. Prime Optical automatically disables a port when the last connection is removed.
- MTU Size—Maximum transmission unit (MTU) is the maximum packet size, in bytes, that a particular interface can handle.
- Speed—Select the speed from the drop-down list, which displays three values: 10, 100, and Auto. For an ML1000 card, Auto is the only supported option.
- Flow Control (Send)—Select the Flow Control (send) value from the drop-down list, which displays three values: Off, On, and Desired. These values are supported by both Fast Ethernet and Gigabit Ethernet (GE) ports.

PoS port provisioning involves configuring the following parameters (see Figure 3):

- Enable (No Shutdown)/Disable (Shutdown)—The ability to enable or disable a PoS port at any time is independent of other port provisioning. When the PoS port that is shut down is related to the L2 topology, the topology goes into *wrap* state. Prime Optical automatically sends an alarm indicating that the L2 topology has entered wrap state.
- MTU Size—Maximum packet size, in bytes, that a particular interface can handle.

Figure 3 Create Layer 2 Service—Modify Port Properties



Enable

```
Interface {FastEthernetN|GigabitEthernetM} [N = 0 to 11 and M = 0,1]
    No shutdown
```

Disable

```
Interface {FastEthernetN|GigabitEthernetM} [N = 0 to 11 and M = 0,1]
    shutdown
```

MTU Provisioning

```
Interface {FastEthernetN|GigabitEthernetM} [N = 0 to 11 and M = 0,1]
    mtu MTU [MTU = 64 to 9000]
```

Speed Provisioning

```
Interface {FastEthernetN|GigabitEthernetM} [N = 0 to 11 and M = 0,1]
    speed Speed [Speed = 10/100/auto]
```

Duplex Provisioning

```
Interface {FastEthernetN|GigabitEthernetM} [N = 0 to 11 and M = 0,1]
    duplex Duplex [Duplex = half/full/auto]
```

Flow Control (Send) Provisioning

```
Interface {FastEthernetN|GigabitEthernetM} [N = 0 to 11 and M = 0,1]
    flowcontrol send Flow Control(send) [Flow Control = desired/off/on]
```

Enable (No Shut)

```
Interface {POSN} [N = 0 or 1]
    No shutdown
```

Disable (Shutdown)

```
Interface {POSN} [N = 0 or 1]
    shutdown
```

MTU Provisioning

```
Interface {POSN} [N = 0 or 1]
    mtu MTU [MTU = 64 to 9000]
```

Port Channel Provisioning

ML-series cards offer port channel (also known as *link aggregation*) for Gigabit Ethernet and Fast Ethernet ports.

Port channel is a trunking technology that groups together multiple, full-duplex, IEEE 802.3 Gigabit Ethernet/Fast Ethernet interfaces to provide fault-tolerant, high-speed links between switches, routers, and servers.

Creating or Modifying a Port Channel

```
interface port-channel channel-ID
[no] shutdown
mtu MTU-value [The range is from 64 to 9000]
hold-queue HI-queue-value in [The range is from 0 to 4096]
hold-queue HO-queue-value out [The range is from 0 to 4096]
```

Deleting a Port Channel

```
no interface port-channel channel-ID
```

Creating or Modifying a Port Channel Member

```
interface { FastEthernetN | GigabitEthernetM } [N=0 to 11, and M=0,1]
no ip address
no mtu
no shutdown
channel-group channel-ID { mode [active | passive] }
lacp port-priority port-priority [The range is from 1 to 65535]
```

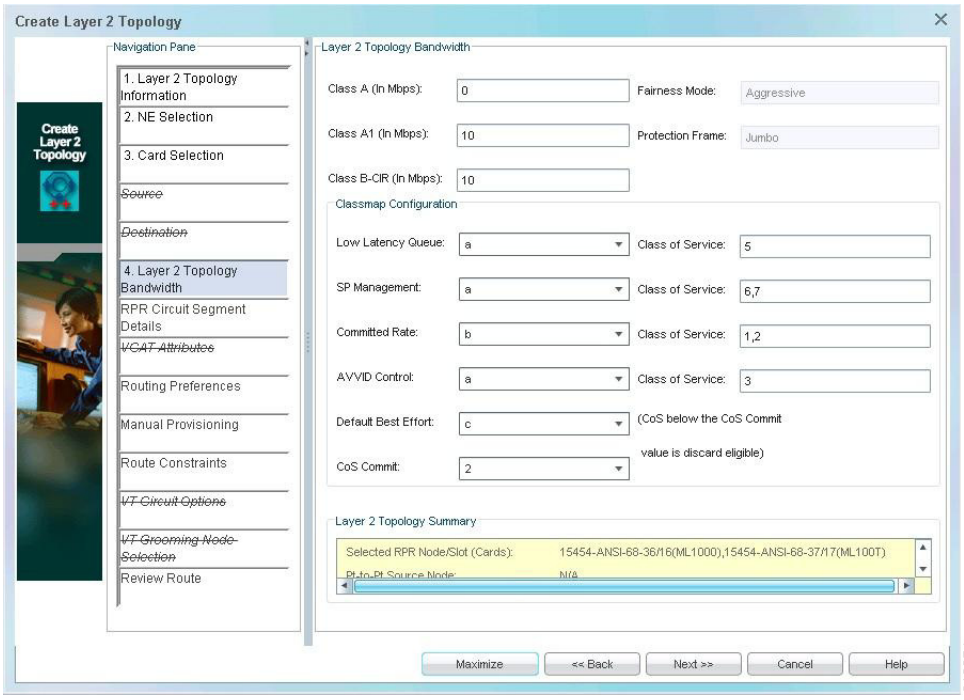
Deleting a Port Channel Member

```
interface { FastEthernetN | GigabitEthernetM } [N=0 to 11, and M=0,1]
no channel-group channel-ID
no lacp port-priority
shutdown
```

IEEE 802.17 RPR Base Card Configuration

The base card configuration is a set of commands you enter when creating the Layer 2 topology. Use the Create Layer 2 Topology wizard > Layer 2 Topology Bandwidth pane (see Figure 4) to define parameters for IEEE 802.17 RPR provisioning.

Figure 4 Create Layer 2 Topology Wizard—IEEE 802.17 RPR Topology Creation



To create an RPR topology, apply the base card configuration to all ML-series cards in the RPR. The topology is reported as *L2 Not Ready* until the base card configuration is applied to all cards. Select an *L2 Not Ready* RPR in the L2 Topology table and choose **Configuration > Enable L2 Service** to enable the L2 service provisioning.

The IEEE 802.17 policy map configuration differs from the policy map configuration in the Cisco RPR. ML-series cards in 802.17 RPR mode support the following traffic classes:

- Class A (A0/A1)
  - Class A0/A1 traffic is guaranteed low-latency traffic.
  - Class A0 conforms to the reserved rate on the ring.
  - Class A1 does not use the reserved bandwidth.
- Class B (B-CIR/B-EIR)
  - Traffic that conforms to the B committed information rate (CIR) is not fairness-eligible.
  - Class B EIR traffic is fairness-eligible; it is distinguished from class C traffic at the add node only.
- Class C traffic is best effort; it is always fairness-eligible.

You can modify the CoS value; the range is from 0 to 7.

Use the following commands to create the IEEE 802.17 RPR:

```
[Class map configuration]
class-map match-any AVVID_VOICE_VIDEO
match cos Low Latency Queue Class of Service

class-map match-any SP_MANAGEMENT
match cos SP Management Class of Service

class-map match-any CIR
match cos Committed Rate Class of Service

class-map match-any AVVID_CONTROL
match cos AVVID Control Class of Service

class-map match-all BEST_EFFORT
match any

[Policy map configuration]
policy-map POLICY_QOS_OUT
class AVVID_VOICE_VIDEO
set rpr-ieee service-class Low Latency Queue [Possible values are a, b, c]
class AVVID_CONTROL
set rpr-ieee service-class AVVID Control [Possible values are a, b, c]
class SP_MANAGEMENT
set rpr-ieee service-class SP Management [Possible values are a, b, c]
class CIR
set rpr-ieee service-class Committed Rate [Possible values are a, b, c]
class BEST_EFFORT
set rpr-ieee service-class Default Best Effort [Possible values are a, b, c]

[Absolute bandwidth configuration]
interface rpr-ieee 0
rpr-ieee protection pref jumbo
rpr-ieee tx-traffic rate-limit reserved Class A east [Class A range is from 0 to 48 Mb/s]
rpr-ieee tx-traffic rate-limit reserved Class A west [Class A range is from 0 to 48 Mb/s]
rpr-ieee tx-traffic rate-limit high Class A1 east [Class A1 range is from 1 to 48 Mb/s]
rpr-ieee tx-traffic rate-limit high Class A1 west [Class A1 range is from 1 to 48 Mb/s]
rpr-ieee tx-traffic rate-limit medium Class B-CIR east [Class B-CIR range is from 1 to
48 Mb/s]
rpr-ieee tx-traffic rate-limit medium Class B-CIR west [Class B-CIR range is from 1 to
48 Mb/s]
service-policy output POLICY_QOS_OUT
```

Note The Protection Frame field is always *Jumbo*; no other configurable options are supported. The Fairness Mode field is always *Aggressive*.

In the commands listed above, the upper limit of the range value depends on the circuit size. For example, if *x* is the maximum range value in megabits per second (Mb/s):

- FOR_STS1 circuit, *x* = 48
- FOR_STS3c_VC4 circuit, *x* = 149
- FOR_STS6c_VC4_2c circuit, *x* = 299
- FOR_STS9c_VC4_3c circuit, *x* = 488
- FOR_STS12c_VC4_4c circuit, *x* = 598
- FOR_STS24c_VC4_8c circuit, *x* = 1196
- FOR_STS9c_VC4_3c circuit, COMMITTED bandwidth, *x* = 499
- FOR_STS12c_VC4_4c circuit, COMMITTED bandwidth, *x*= 599
- BW_FOR_STS24c_VC4_8c circuit, COMMITTED bandwidth, *x* = 1198

Protection Support on ML-Series Cards

You can select IEEE 802.17 RPR ML1000 cards for protection in the Create Layer 2 Topology wizard > Card Selection pane (see Figure 5).

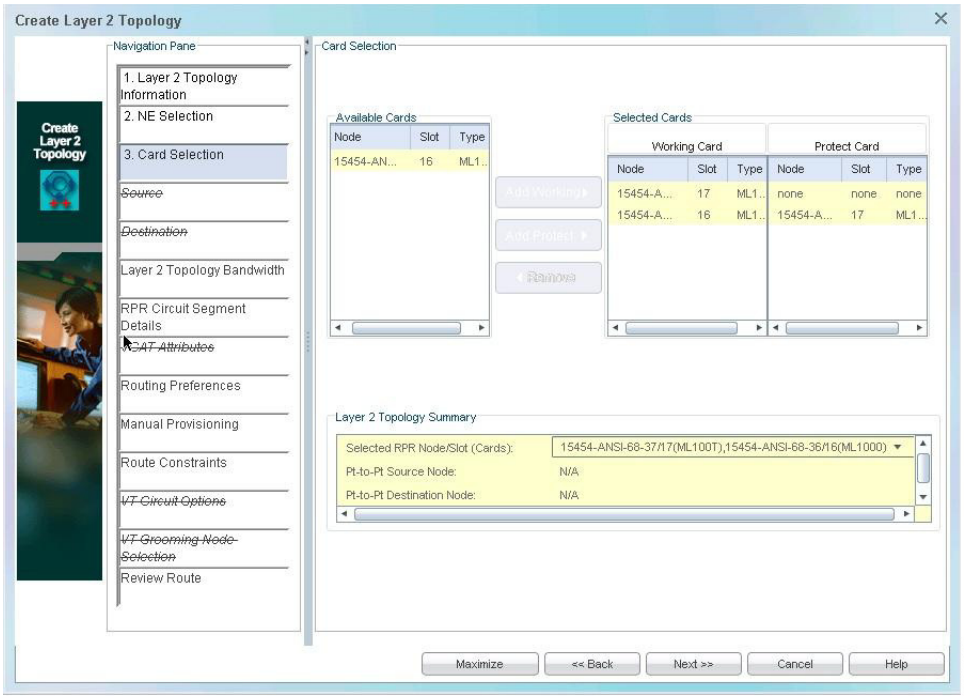
To choose a working card, select any card in the Available Cards list and click **Add Working**.

To choose a protection card for a working card:

1. Select the working card.
2. Select the protection card from the Available Cards list.
3. Click **Add Protect**.

Note Protection is supported only on ML1000 cards; a working ML1000 card can be protected only by another ML1000 card.

Figure 5 Card Selection—Create Layer 2 Topology Wizard (IEEE 802.17 RPR)



After you select the protection, commands are issued on the active and protection ML1000 cards, as follows:

- MAC addresses are configured on both the active and protection cards for the IEEE RPR interface:
  - Active card protection configuration

    ```
    interface RPR-IEEE0
    mac-address MAC address of the interface [MAC address range is from 0000.1111.1111 to 0000.9999.9999]
    ```

  - Protection card protection configuration

    ```
    interface RPR-IEEE0
    mac-address MAC address of the interface [MAC address range is from 0000.1111.1111 to 0000.9999.9999]
    ```

- After the MAC address is configured, the following commands are present on the active and protection cards:
  - Active card protection configuration

    ```
    interface RPR-IEEE0
    rpr-ieee ri mode primary peer MAC address of the active card [MAC address range is from 0000.1111.1111 to 0000.9999.9999]
    ```

  - Protection card protection configuration

    ```
    interface RPR-IEEE0
    rpr-ieee ri mode secondary peer MAC address of the protection card [MAC address range is from 0000.1111.1111 to 0000.9999.9999]
    ```

Note Any MAC address with the first four digits beginning with 11 (11xx.xxxx.xxxx) is a malformed address and is denied; for example, 1100.2222.3333.

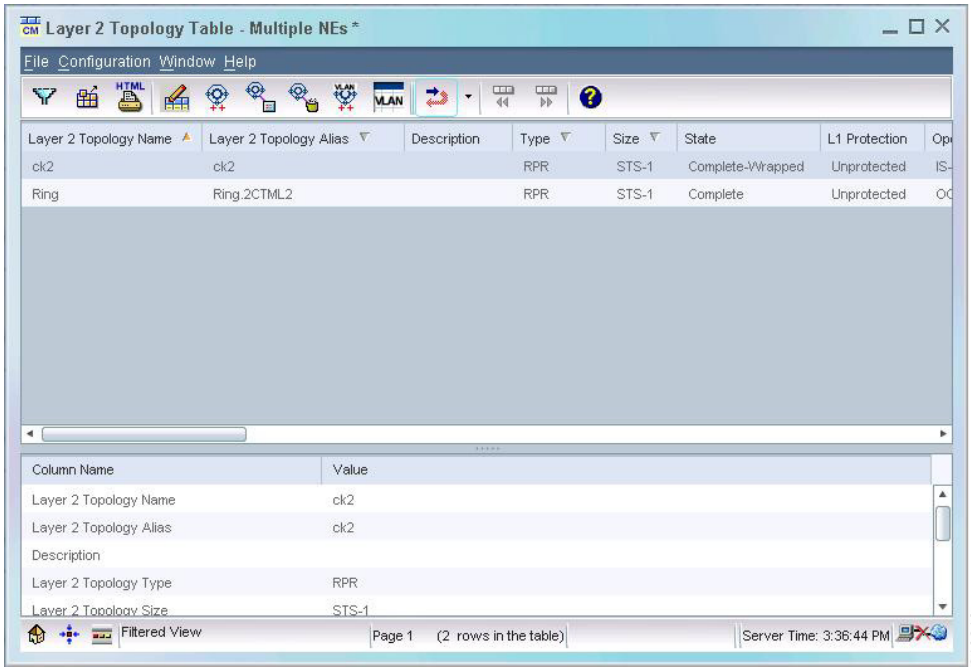
When changing ML1000 GE port states in a scenario with 802.17 RPR redundant interconnect protection configured, the primary ML card remains active if at least one GE port is up.

Conversely, if all GE ports are down, the redundant interconnect protection is triggered and the IEEE 0 interface shuts down on the primary card. When the IEEE 0 interface shuts down, the L2 topology state changes to *Steering*.

Wrap Status

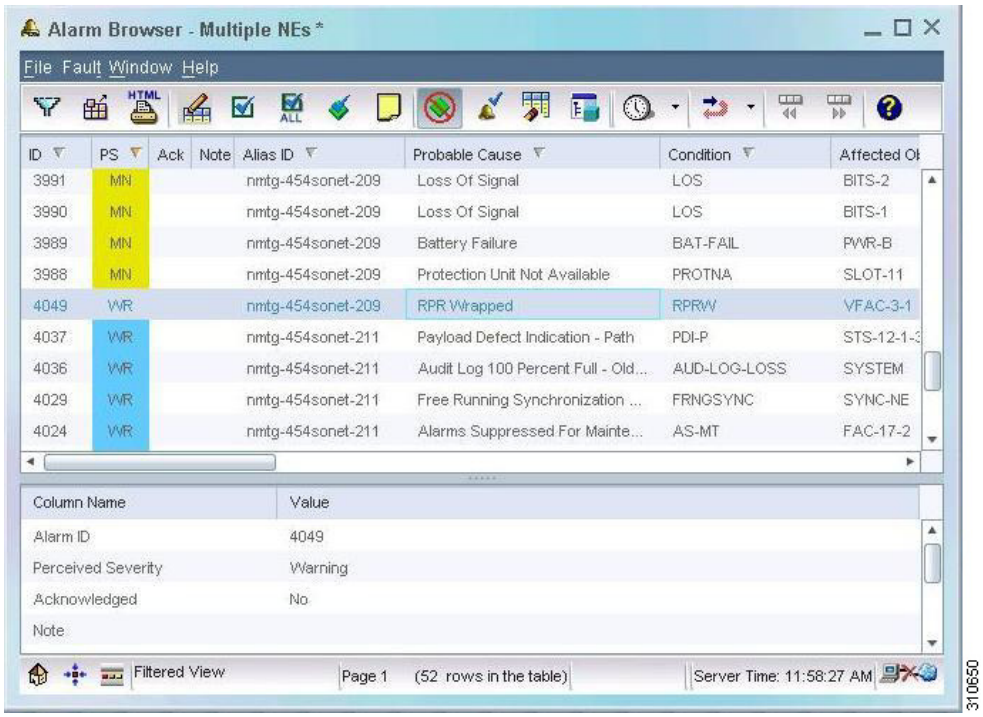
When a PoS port in a Cisco RPR L2 topology shuts down, Prime Optical raises an alarm to indicate that the L2 topology has entered the corresponding protection state, which is referred to as the *wrap* state. The status of the Layer 2 topology changes from the original state (*Complete* or *Incomplete*) to *Complete-Wrapped* or *Incomplete-Wrapped* (see Figure 6).

Figure 6 Layer 2 Topology Table—Complete-Wrapped State



The Alarm Browser (see Figure 7) displays a *wrapped-state* alarm.

Figure 7 Alarm Browser—Complete-Wrapped State



Note For alarms and circuits on ML cards that are configured with card mode 802.17 RPR, the ML card ports are referred to as port 0 for RPR-WEST and port 1 for RPR-EAST. This is also true when Prime Optical communicates through the GateWay/CORBA interface.

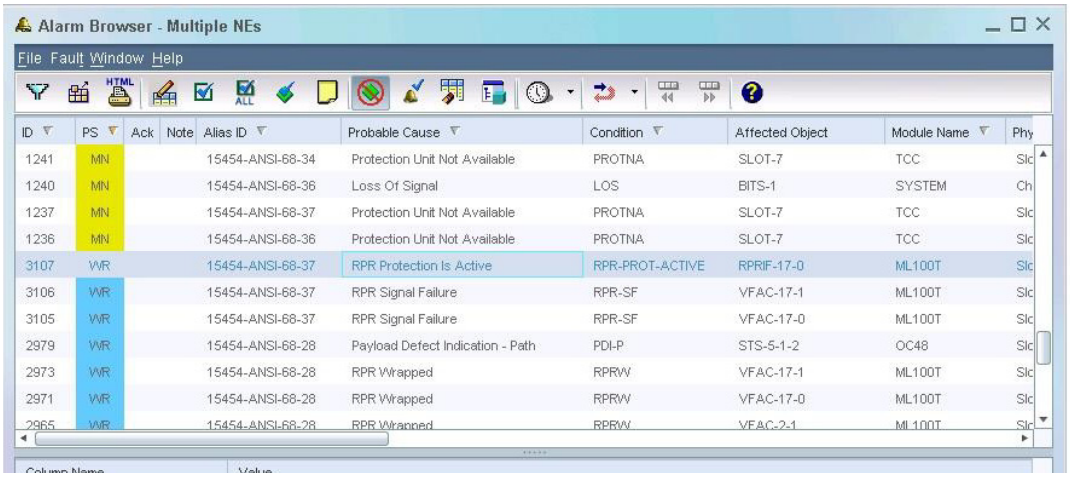
Steering Status

When an RPR-EAST or RPR-WEST port in a standard 802.17 RPR shuts down, Prime Optical raises an alarm to indicate that the L2 topology has entered the corresponding protection state, which is referred to as the *Steering* state. The status of the Layer 2 topology changes from the original state (*Complete* or *Incomplete*) to *Complete-Steering* or *Incomplete-Steering* (see Figure 8).

Figure 8 Layer 2 Topology Table—Complete-Steering State

The Alarm Browser (see Figure 9) displays an *RPR Protection Is Active* alarm.

Figure 9 Alarm Browser—Complete-Steering State



Note For Cisco RPRs, the L2 protection state (*Wrapped* or *Steering*) is not reflected in the L2 topology state through Prime Optical GateWay/CORBA.

Creating Service Connections

Prime Optical contains an L2 service provisioning wizard to facilitate provisioning of VLANs over a defined L2 topology. You can define each Ethernet port as User-Network Interface (UNI) or Network-Network Interface (NNI). VLANs on an Ethernet port are referred to as *port VLANs*. VLANs on PoS and SPR ports (and their connected circuits) are referred to as *service provider VLANs* (or *circuit VLANs*).

You cannot mix NNI and UNI connections on the same port. Prime Optical supports the following types of service configurations:

- UNI QinQ Access (user VLAN and protocol transparency)—Cannot be combined with other connection types on the same port.

- UNI dot1q Access—Select an unused port VLAN from 1 to 4095. It can be combined with untagged connections on the same port. Each port VLAN can be used for only one connection.
- UNI Untagged Access—Configure as Dot1q Access with port VLAN 1.
- NNI dot1q Access—Select an unused port VLAN from 1 to 4095. It can be combined with untagged connections on the same port. Each port VLAN can be used for only one connection.

The circuit VLAN range is from 1 to 4095. On an RPR, all valid circuit VLANs can be used; however, due to limited bridge group resources, each ML-series card can access only 255 circuit VLANs. Due to limited card-level bridge group resources, only 255 circuit VLANs can be used on a point-to-point circuit.

Note VLAN ID 1 is reserved for untagged VLANs.

For VLAN configurations, the port channel interface is treated as a new, single logical interface, even though it consists of multiple interfaces. The following Cisco IOS commands are sent to the ML card to configure the IEEE 802.1Q encapsulation on the port channel interface. (IEEE 802.1Q encapsulation is the only supported encapsulation type in link aggregation.)

```
interface port-channel port-channel-ID.VLAN-number
encapsulation dot1Q VLAN-number
bridge-group bridge-group-number
```

Port channel drops are of NNI type; therefore, no QoS policies are associated to port channel drops, as is true for any other NNI Ethernet drops.

Using the Quality of Service Policy Template

You must configure the following information in the L2 service provisioning and quality of service (QoS) profile wizards:

- Port (FastEthernetM [FEM] or GigabitEthernetN [GIGEN] with M=0 to 11 and N=0,1)
- Service connection type (UNI QinQ, UNI dot1Q, UNI untagged, or NNI dot1Q)
- QoS parameters (selection of the QoS profile name defined in the QoS profile)

Prime Optical assigns an unused bridge group (BG) to the card. The range is from 1 to 255.

The following table lists the configuration information for a best-effort QoS profile. You can select the predefined profile and customize it, or create a new customized profile by using the Advanced option.

Table 3 Configuration Settings for the Best-Effort QoS Profile

QoS Template Name	
Best_Effort	
QoS Template Type	
Best Effort	
QoS Policy	**Setting**
Match Any	True
Match IP	False
IP Precedence Value	N/A

Table 3 Configuration Settings for the Best-Effort QoS Profile (continued)

Match CoS	False
CoS Value	N/A
Match DSCP	False
DSCP Value	N/A
AND	N/A
CIR Type	N/A
Committed Rate	N/A
Committed Burst	N/A
Committed CoS Marking	Mark CoS
Committed CoS Value	0
Excess Traffic	Allow
Peak Rate	N/A
Peak Burst	N/A
Excess CoS Marking/Value	0
Violations	N/A
Violate CoS	N/A
Best Effort Type	Line Rate
Max Rate	96 kb/s
Max Burst	8000 bytes

The following table lists the configuration information for the committed information rate/peak information rate (CIR/PIR) QoS profile. You can select the predefined profile and customize it, or create a new customized profile by using the Advanced option.

Note If you select the CIR/PIR profile and want to modify it, you must configure your own advanced service before you can set the CIR type to Rate_Limited, CIR=PIR, and CIR Burst=PIR Burst.

Table 4 Configuration Settings for the CIR/PIR QoS Profile

QoS Template Name	
CIR_PIR	
QoS Template Type	
Advanced	
QoS Policy	**Setting**
Match Any	True
Match IP	False
IP Precedence Value	N/A
Match CoS	False
CoS Value	N/A

Table 4 Configuration Settings for the CIR/PIR QoS Profile (continued)

Match DSCP	False
DSCP Value	N/A
AND	N/A
CIR Type	Rate_Limited
Committed Rate	96 kb/s
Committed Burst	8000 b/s
Committed CoS Marking	Mark CoS
Committed CoS Value	2
Excess Traffic	Allow
Peak Rate	96 kb/s
Peak Burst	8000 b/s
Excess CoS Marking/Value	2
Violations	Allow
Violate CoS	2
Best Effort Type	N/A
Max Rate	N/A
Max Burst	N/A

Prime Optical allows you to define a QoS policy template, starting with the preceding predefined policies and customizing them within the following predefined ranges:

- CIR_PIR
  - CIR—96,000 to 800,000,000 bits per second (b/s).
  - Max CIR Burst—8000 to 64000 bytes.
  - PIR—96,000 to 800,000,000 b/s. Cannot be less than CIR.
  - Max PIR Burst—8000 to 64000 bytes. Cannot be less than Max CIR Burst.
  - Traffic matching criteria is *match-all*.
  - Only one policy is allowed.
- Best_Effort
  - Line Rate—CIR is 96000 b/s and CIR Burst is 8000 bytes.
  - Rate Limited—You configure the CIR and CIR Burst.
  - Traffic matching criteria is *match-all*.
  - Only one policy is allowed.

You can create your own advanced QoS policy by entering the customized QoS configuration based on the following parameters:

- Traffic matching criteria.
- CoS—The range is from 0 to 7.
- DSCP—The range is from 0 to 63.

- IP Precedence—The range is from 0 to 7.
- CoS transmit values for CIR/PIR.
- Exceed action and violate action and their CoS transmit values.
- Up to eight QoS classes can be configured.

You must configure the following information in the L2 service provisioning and QoS profile wizards:

- Port (FastEthernetM [FEM] or GigabitEthernetN [GIGEN] with M=0 to 11 and N=0,1).
- Service connection type (UNI QinQ, UNI dot1Q, UNI untagged, or NNI dot1Q).
- QoS parameters (selection of the QoS profile name defined in the QoS profile).

Prime Optical assigns an unused bridge group to the card. The range is from 1 to 255.

Note The CLI commands in this section are written for services defined on the RPR topology. For services defined on point-to-point circuits, replace **int spr 1** with **int pos 0** or **int pos 1**, depending on which PoS will carry the service. The **bridge x protocol** command is never issued. Spanning tree is not enabled for RPR or point-to-point circuits. The **L2protocol-tunnel all** command is expanded to three separate lines when saved by the Cisco IOS router.

For any drop-applied QoS profile, Prime Optical checks the available bandwidth and generates an error message if:

- totalBW > GE_TOTBW (GE interfaces GE_TOTBW = 1 Gb/s)
- totalBW > FE_TOTBW (FE interfaces FE_TOTBW = 100 Mb/s)

  where the parameter *totalBW* is calculated as the sum of:

  - New CIR bandwidth reserved for applying the profile
  - CIR bandwidth already reserved on the selected drop by the previously created L2 service
  - Bandwidth reserved for multicast groups during topology creation

For each selected service drop, the configuration is done in three steps:

1. Class map configuration (not required for NNI-configured ports).
2. Policy map configuration (through QoS profiles; not required for NNI-configured ports).
3. Interface configuration (through the Create Layer 2 Service wizard).

The following sections describe the commands for each step.

1. Class Map Configuration

Configuring CIR/PIR Class Map

```
[Class map configuration for CIRPIR]

Class-map match-all CLASS_BG BG_CIRPIR
    match bridge-group BG
```

Configuring Best-Effort Class Map

```
[Class map configuration for BESTEFFORT]

Class-map match-all CLASS_BG BG_BESTEFFORT
    match bridge-group BG
```

Configuring Advanced Class Map

Figure 10 and Figure 11 show how to use the Create QoS Profile wizard to configure an advanced QoS profile.

Figure 10 Create QoS Profile Wizard—Advanced Class Map Configuration (1 of 2)

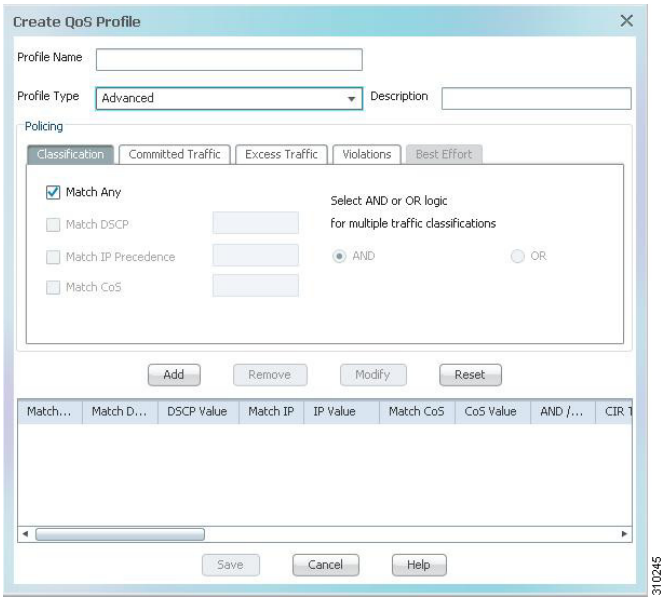
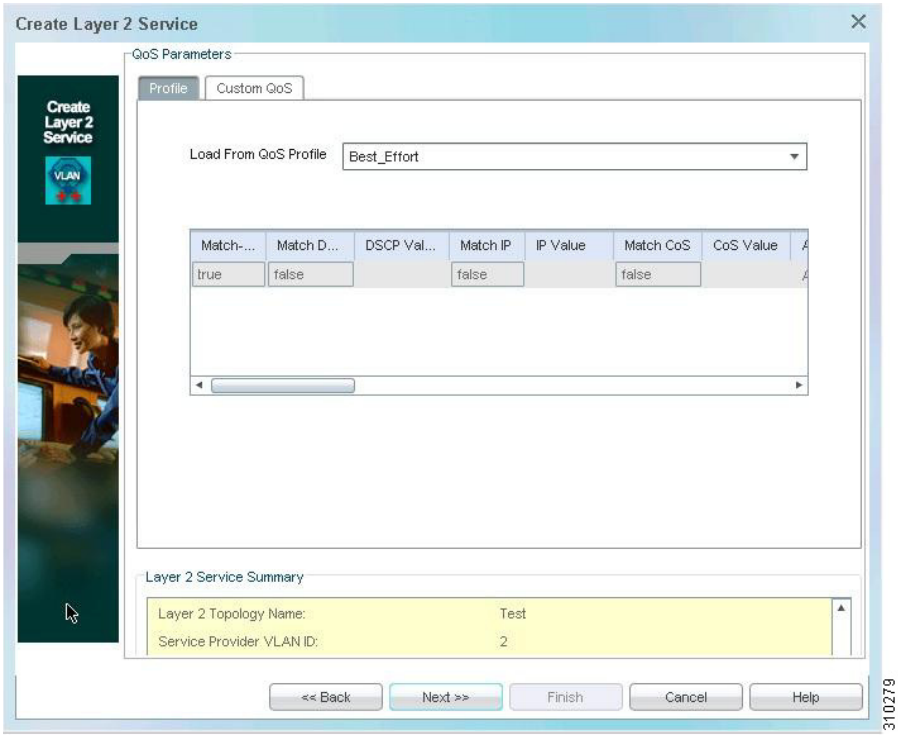


Figure 11 Create QoS Profile Wizard—Advanced Class Map Configuration (2 of 2)



Enter the following commands to create a QoS profile with advanced OR selection:

[Class map configuration for ADVANCED OR selection]

class-map match-any CLASS_BG *BG_ADVANCED_Service Drop Port_N [N number of policies will be configured on the Service Drop Port=0,1 for GigaEthernet and Service Drop Port=0 to 11 for FastEthernet]*
[match ip dscp *Match DSCP*]
[If Match DSCP has been selected, the valid range is from 0 to 63]
[match ip precedence *Match IP Precedence*]
[If Match IP Precedence has been selected, the valid range is from 0 to 7]
[match cos *Match CoS*]
[If Match CoS has been selected, the valid range is from 0 to 7]

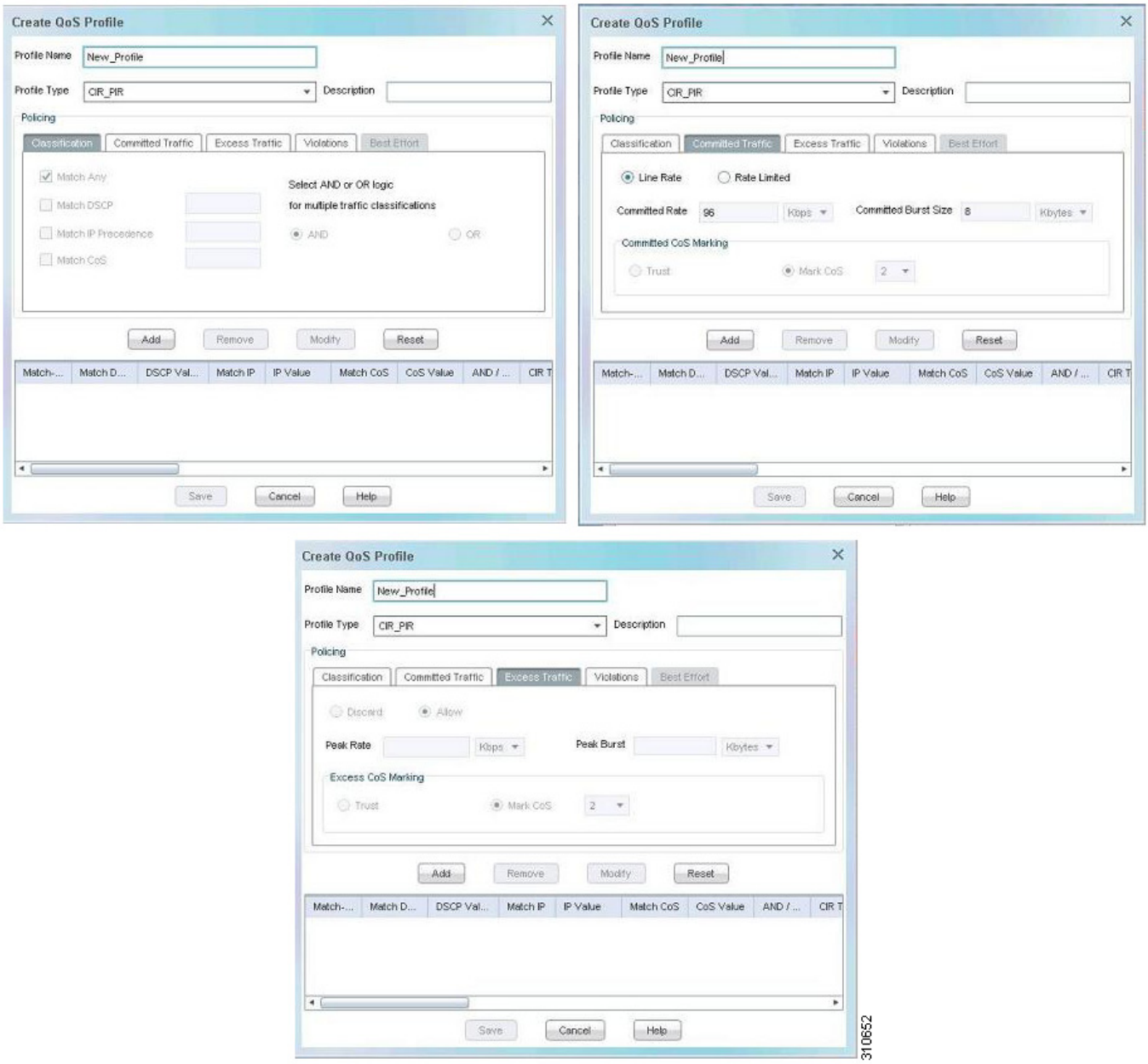
Note A profile with OR conditions can be applied only to a port with a single bridge group configured. Prime Optical excludes the match bridge group statement from the OR class maps and applies class match-any.

2. QoS Profile Configuration

CIR/PIR QoS Profile

Figure 12 is an example of how to create a CIR/PIR QoS profile.

Figure 12 Create QoS Profile Wizard—CIR/PIR



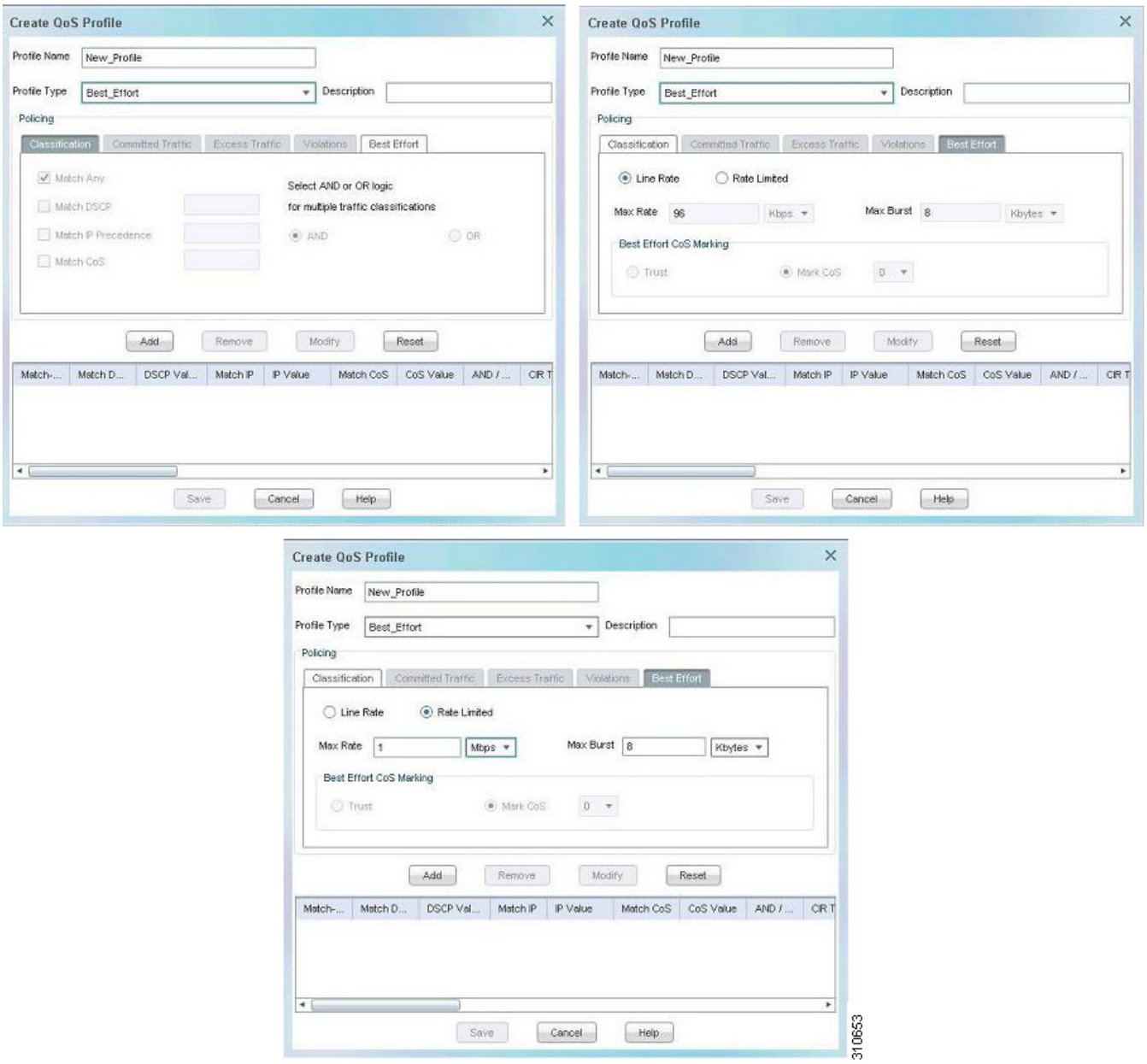
Enter the following commands for policy map configuration of a CIR/PIR QoS profile:

```
[Policy map configuration command for the CIR/PIR QoS profile]

Policy-map POLICY_{GIGE|FE}port_IN
    Class CLASS_BG BG_CIRPIR

    [1. Case Line Rate selection]
    Police 96000 8000 conform-action set-cos-transmit 2 exceed-action set-cos-transmit 2

    [2. Case Rate Limited selection Excess Traffic Discarded]
    Police Committed Rate Committed Burst Size conform-action set-cos-transmit 1
    exceed-action drop

    [3. Case Rate Limited selection Excess Traffic Allowed]
    Police Committed Rate Committed Burst Size Peak Burst pir Peak Rate conform-action
    set-cos-transmit 2 exceed-action set-cos-transmit 1 violate-action drop
```

Best-Effort QoS Profile

Figure 13 is an example of how to create a best-effort QoS profile.

Figure 13 Create QoS Profile Wizard—Best Effort



Enter the following commands to create a best-effort QoS profile:

[Policy map configuration for the BESTEFFORT QoS profile]

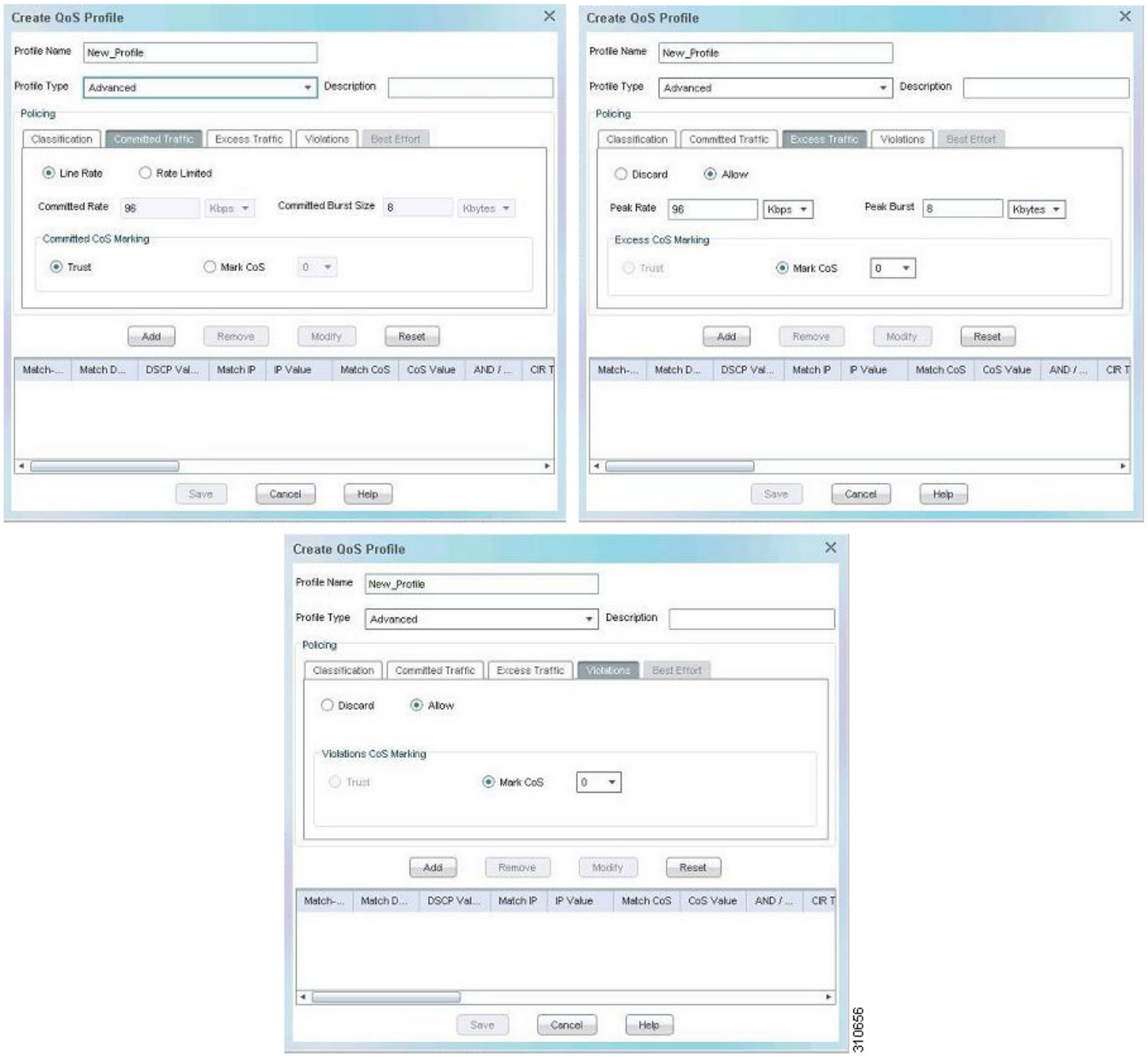
```
Policy-map POLICY_{GIGE|FE}port_IN
```

```
Class CLASS_BG BG_BESTEFFORT

[1. Case Line Rate selection]
Police 96000 8000 conform-action set-cos-transmit 0 exceed-action set-cos-transmit 0

[2. Case Rate Limited selection]
Police Max Rate Max Burst conform-action set-cos-transmit 0 exceed-action drop
```

Advanced QoS Profile

Figure 14 is an example of how to create an advanced QoS profile.

Figure 14 Create QoS Profile Wizard—Advanced



```
[Policy map configuration for the ADVANCED QoS profile]

Policy-map POLICY_{GIGE|FE}port_IN
    Class CLASS_BG BG_ADVANCED_Service Drop Port_N
    [N number of policies will be configured on the Service Drop Port = 0,1 for Gigabit
    Ethernet and Service Drop Port = 0 to 11 for Fast Ethernet.]

    police Committed Rate Committed Burst Size [Peak Rate pir Peak Burst] conform-action
    {transmit|set-cos-transmit Committed CoS Marking Value} [exceed-action
    {drop|set-cos-transmit Excess CoS Marking Value}][violate-action
    {drop|set-cos-transmit Violation CoS Marking Value}]

    [[Peak Rate pir Peak Burst] is applied only if Excess Traffic is Allowed.]
    [exceed-action drop is applied only if Excess Traffic is Discarded.]
    [Trust option is never selectable for Excess Traffic or Violation tab. Mark CoS option
    is always used when the Excess or Violations is Allowed.]
    [violation-action drop is applied only if Excess Traffic is Allowed and Violate
    Traffic is Discarded.]
```

Bandwidth Data Service Provisioning

In the **Control Panel > NE Service > CTC-Based SONET NEs** or **CTC-Based SDH NEs**, select the **Enable Bandwidth DSP** check box to enable the bandwidth data service provisioning check during L2 service provisioning. The bandwidth utilization report shows available and used bandwidth for each L2 topology. Use this report during L2 service provisioning to verify whether the requested CIR is available on the topology. An error is returned if there is not enough bandwidth available for a drop port.

3. Interface Configuration

Adding UNI QinQ Access

Any port with *mode dot1q-tunnel* is a UNI QinQ access connection. Figure 15 and Figure 16 show how to add UNI QinQ access using the Create Layer 2 Service wizard.

Figure 15 Create Layer 2 Service Wizard—Adding UNI QinQ Access

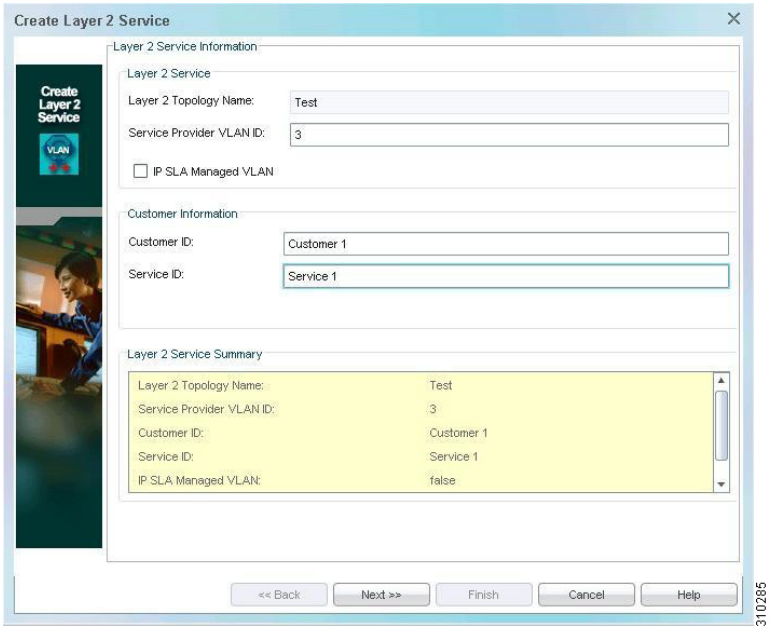
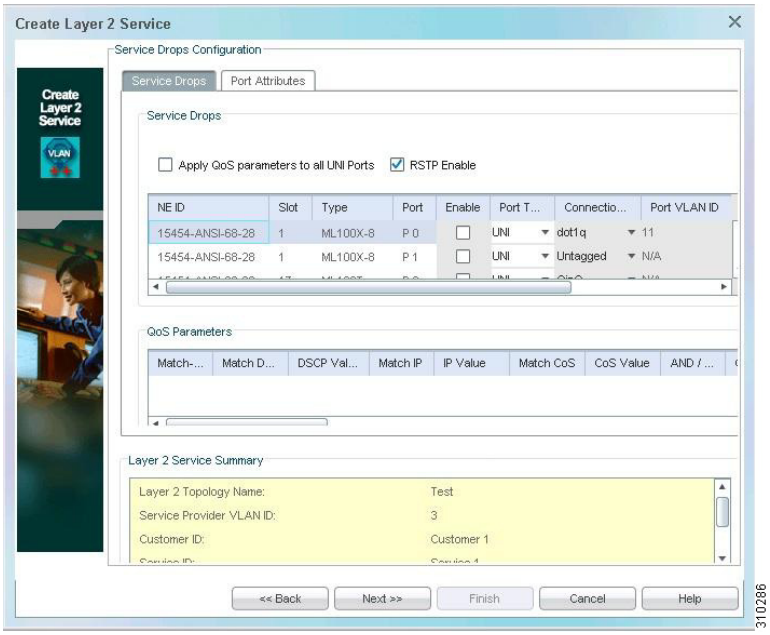


Figure 16 Create Layer 2 Service Wizard—Configuring Service Drops



Enter the following commands to configure an interface:

[Interface configuration]

```
Interface {GigabitEthernetport|FastEthernetport}
    Description QoS profile name
    [Prime Optical issues the L2protocol-tunnel all command and the result is the
    following set of commands]
    l2protocol-tunnel cdp
```

```
    l2protocol-tunnel stp
    l2protocol-tunnel vtp
    no cdp enable

    Mode dot1q-tunnel
    Bridge-group BG
    Service-policy input POLICY_{GIGE|FE}port_IN
    Service-policy output POLICY_QOS_OUT
    [The following commands are not issued by Prime Optical; rather, these are default ML
    settings]
    Bridge-group BG spanning-disable

Interface SPR1.Service Provider VLAN
    Encapsulation dot1q Service Provider VLAN
    Bridge-group BG
    [The following commands are not issued by Prime Optical; rather, these are default ML
    settings]
    Bridge-group BG spanning-disable
```

Removing UNI QinQ Access

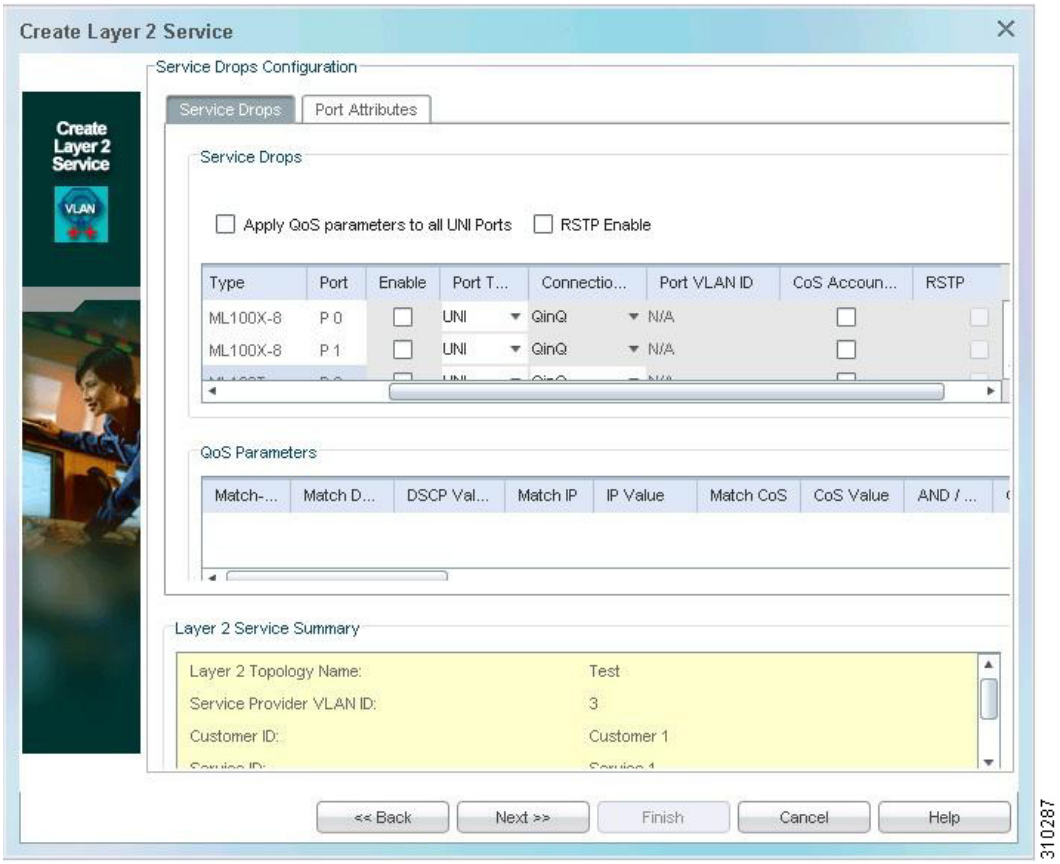
Enter the following commands to delete a UNI QinQ drop:

```
[Note the reverse order of commands]

Interface SPR1.Service Provider VLAN
    No Bridge-group BG
    No Encap dot1q Service Provider VLAN
No Interface SPR1.Service Provider VLAN [Ignore the warning message]
Interface {GigabitEthernetport|FastEthernetport}
    No Bridge-group BG
    No Mode dot1q-tunnel
    No L2protocol-tunnel all
    No description
No class-map CLASS_BG BG_{CIRPIR|BESTEFFORT|ADVANCED_Service Drop Port_N}
[For Advanced QoS, remove all of the N number of class maps]

[When removing the last connection from a port]
No Policy-map POLICY_{GIGE|FE}port_IN
No Service-policy output POLICY_QOS_OUT
```

Adding UNI dot1Q Access

Figure 17 is an example of the Create Layer 2 Service wizard for adding UNI dot1Q access.

Figure 17 Create Layer 2 Service Wizard—Adding UNI dot1Q Access



The port is recognized as UNI if you enter the **service-policy input** command on the port interface; otherwise, the port is recognized as NNI. Every subinterface is a dot1q connection. The classification of UNI versus NNI is based on the port-level parsing. A connection is untagged if you enter the **encap dot1q 1** command. The multiple class map and QoS policy configurations for advanced QoS are similar to the QinQ Access example shown in Figure 17.

Enter the following commands to create a UNI Dot1q:

```
    [Interface configuration]

[First time only; first dot1q on this UNI port]
Interface {GigabitEthernetport|FastEthernetport}
    Service-policy input POLICY_{GIGE|FE}port_IN
    Service-policy output POLICY_QOS_OUT

Interface {FastEthernetport|GigabitEthernetport}.Port VLAN
    Description QoS profile name
    Encapsulation dot1q Port VLAN
    Bridge-group BG
    [In the following command executed by Prime Optical, RSTP is not enabled]
    Bridge-group BG spanning-disable
```

```
Interface SPR1.Service Provider VLAN
    Encapsulation dot1q Service Provider VLAN
    Bridge-group BG
    [In the following command executed by Prime Optical, RSTP is not enabled]
    Bridge-group BG spanning-disable
```

Removing UNI dot1Q Access

Enter the following commands to delete a UNI Dot1q:

```
[Note the reverse order of commands]

Interface SPR1.Service Provider VLAN
    No Bridge-group BG
No Encap dot1q Service Provider VLAN
No Interface SPR1.Service Provider VLAN [Ignore the warning message]
Interface port.Port VLAN
    No Bridge-group BG
    No Encap dot1q Port VLAN
    No description
No Interface port.Port VLAN [Ignore the warning message]
Policy-map POLICY_{GIGE|FE}port_IN
    No Class BG BG_{CIRPIR|BESTEFFORT|ADVANCED_Service Drop Port_N}
    [For Advanced QoS, remove all of the N number of class maps]

No class-map CLASS_BG BG_{CIRPIR|BESTEFFORT|ADVANCED_Service Drop Port_N}
[For Advanced QoS, remove all of the N number of class maps]

[When removing the last connection from a port]
No Policy-map POLICY_{GIGE|FE}port_IN
No Service-policy output POLICY_QOS_OUT
```

Adding UNI Untagged Access

UNI untagged access is similar to UNI dot1Q access with port VLAN ID = 1.

Adding NNI dot1Q Access

Enter the following commands to create an NNI Dot1Q:

```
[Interface configuration]

[First time only; first connection on this port]
Interface {FastEthernetport|GigabitEthernetport}
    Service-policy output POLICY_QOS_OUT

Interface {FastEthernetport|GigabitEthernetport}.Port VLAN
    Encap dot1q Port VLAN

Bridge-group BG
Interface spr 1.Server Provider VLAN
    Encap dot1q Server Provider VLAN
    Bridge-group BG
```

Removing NNI dot1Q Access

Enter the following commands to delete an NNI Dot1Q:

```
[Note the reverse order of commands]
```

```
Interface spr 1.Server Provider VLAN
    No Bridge-group BG
    No Encap dot1q Server Provider VLAN
No Interface spr 1.Circuit VLAN [Ignore the warning message]
Interface port.Port VLAN
    No Bridge-group BG
    No Encap dot1q Port VLAN
No Interface {FastEthernetport|GigabitEthernetport}.Port VLAN [Ignore the warning message]

[When removing the last connection from a port]
No Service-policy output POLICY_QOS_OUT
```

IP Service-Level Agreement on ML-Series Cards

IP SLA is an application embedded in Cisco IOS, which enables you to monitor service-level agreements (SLAs) on IP networks. Service levels are measured by downtime, bandwidth, latency, jitter, packet loss, and so on. Using the IP SLA application, you can verify service guarantees, increase network reliability by validating network performance, proactively identify network issues, and increase return on investment (ROI) by easing the deployment of new IP services.

IP SLA can be configured only on ML-series cards participating in point-to-point and RPR L2 topologies.

Note IP SLA is not supported on 802.17 RPR.

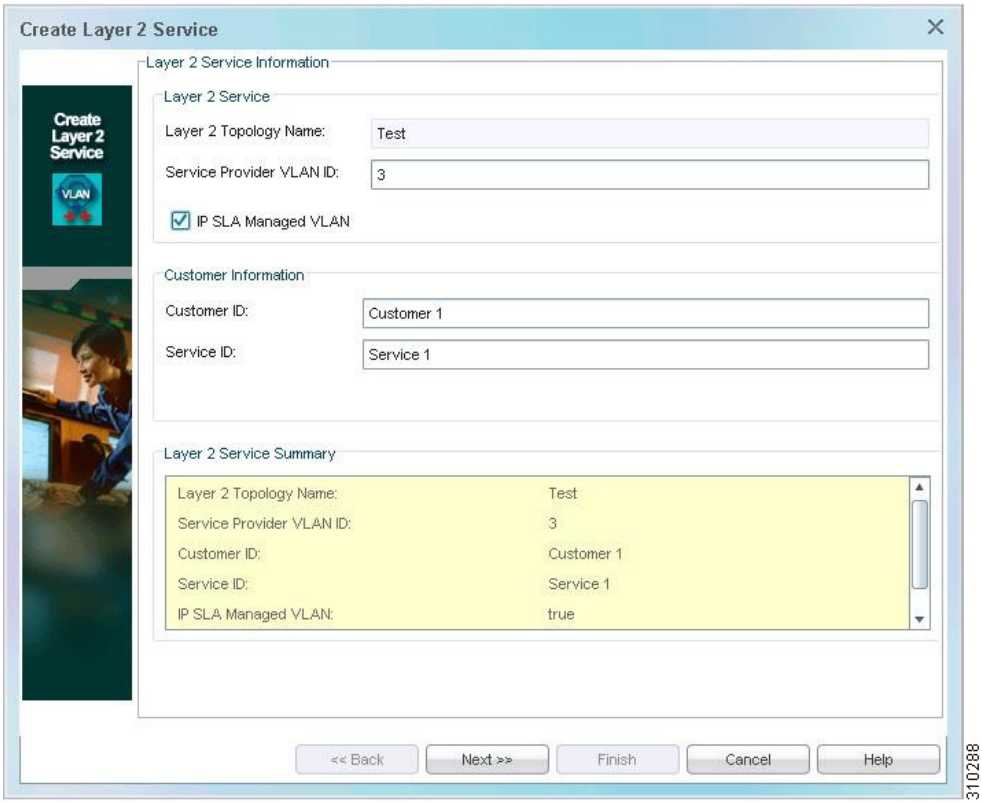
Three steps are required to enable IP SLA features:

1. Create a Managed VLAN, page 37.
2. Create an IP SLA Session, page 39.
3. Manage the IP SLA Session, page 42.

1. Create a Managed VLAN

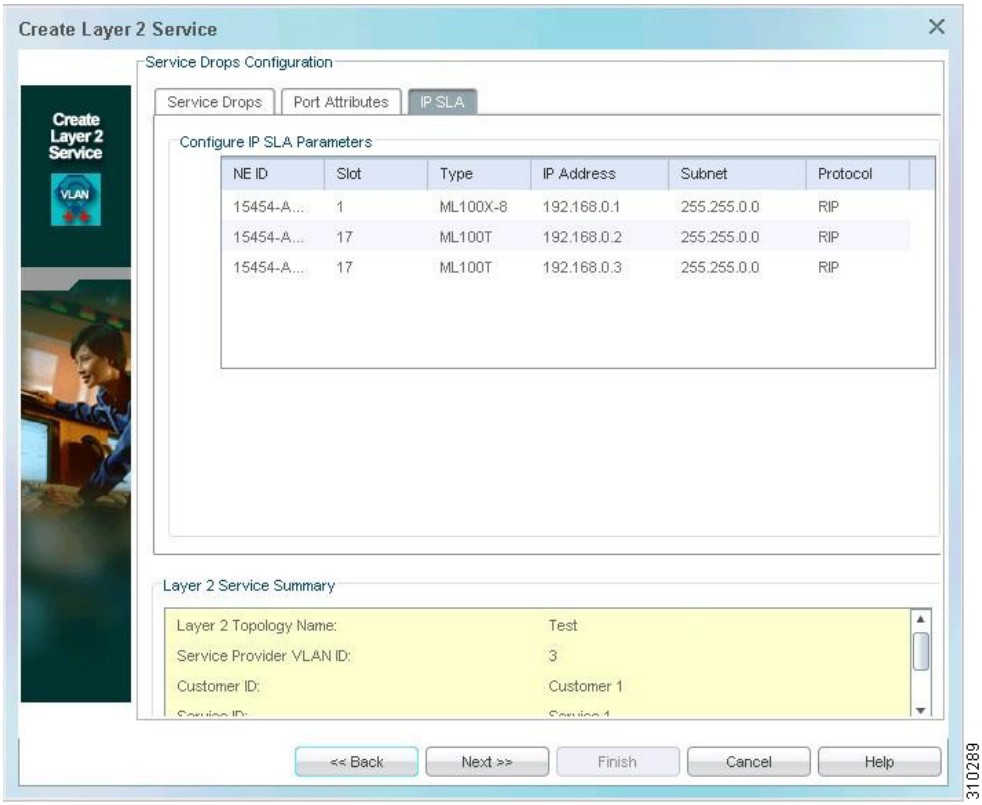
Create a managed VLAN by selecting **IP SLA Managed VLAN** in the Layer 2 Service wizard (see Figure 18) to create a managed VLAN. You can create managed VLANs only on already existing point-to-point and RPR L2 topologies.

Figure 18 Layer 2 Service Wizard—Managed VLAN-Enable



In the Service Drops Configuration pane > IP SLA tab (see Figure 19), IP addresses are automatically generated and assigned to all of the service drop points that Prime Optical manages.

Figure 19 Create Layer 2 Service Wizard—IP SLA



For information about commands that are issued based on the provisioning in the Service Drops and Port Attributes tabs, see Creating Service Connections, page 21.

The following commands are issued when you assign an IP address to the service drop and specify the routing protocol.

IP Address Assignment

```
ip address IP Address Subnet [IP Address range is from 192.168.0.1 to 192.168.255.255. Subnet value is 255.255.0.0.]
```

Routing Protocol Assignment

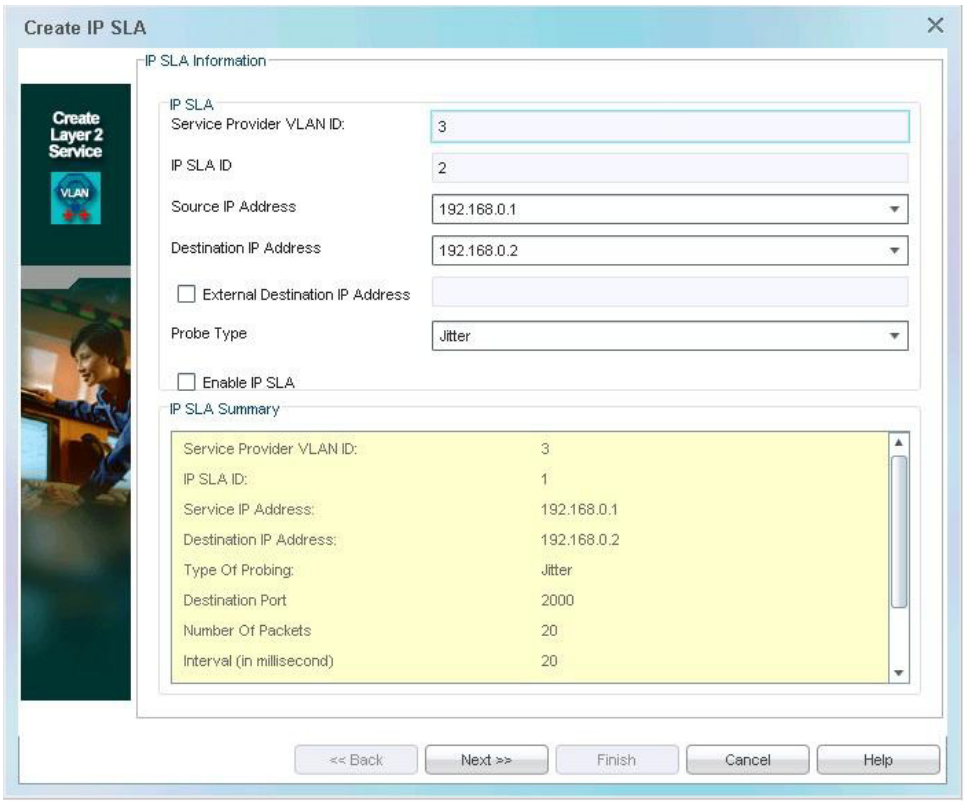
```
bridge bridgegroupno route ip [Unique bridgegroupno is created by Prime Optical. The range is from 1 to 255.]
```

2. Create an IP SLA Session

Create an IP SLA session between a pair of ML-series cards, or between an ML-series card and non-ML IP addresses. Select either Cisco-supported service points or external-destination IP addresses.

You can use the VLAN table (when a managed VLAN is selected) with the Create IP SLA wizard (see Figure 20) to provision the IP SLA session.

Figure 20 Create IP SLA Wizard



Note Prime Optical does not validate nonsupported external destination addresses. Ensure that the external destination is valid and that it responds to a **ping** command.

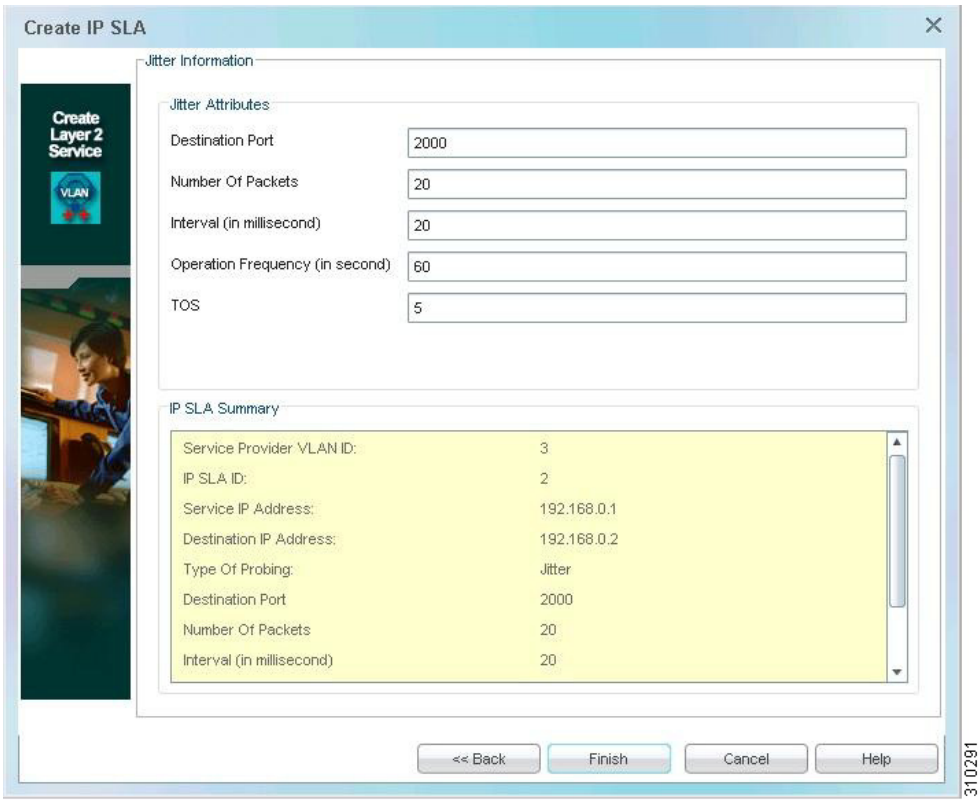
Prime Optical automatically generates the IP SLA ID. The service drop points are displayed in the source and destination points, and you can pick up any drop point. You can specify a non-Prime Optical supported destination. IP SLA can be enabled during or after creation of the IP SLA session.

Note The source and destination port cannot be the same.

Two types of probes are supported: *jitter* and *echo*. Based on the probe type you select in the Create IP SLA wizard, you must enter additional information.

- If you select the jitter probe, enter a value for the following attributes (see Figure 21):
  - Destination Port—1 through 65535
  - NoOfPackets—1 through 60000
  - Interval—1 through 60000 (in milliseconds)
  - TOS (Type of Service)—0 through 255
  - Operation Frequency—1 through 604800 (seconds)

Figure 21 Create IP SLA Wizard—Jitter Probe



Prime Optical issues the following commands on the source:

```
rtr IPSLA ID [IPSLA ID number range is from 1 to 2147483647]
type jitter dest-ipaddr Destination IP Address dest-port Destination Port num-packets
Number of Packets interval Interval
tos TOS frequency Operation Frequency
```

The RTR responder is then configured on the destination for jitter operation. For a Prime Optical-supported destination (any ML-series cards), Prime Optical issues the following command on the destination:

```
rtr (responder)
```

Note For the IP SLA session to work correctly on a destination that Prime Optical does not support, you must enter the **rtr (responder)** command on the destination.

- If you select the echo probe, no additional information is required and Prime Optical issues the following commands on the source:

```
rtr IPSLA ID [IP SLA number range is from 1 to 2147483647]

type echo protocol ipIcmpEcho Destination IP Address source-ipaddr Source IP Address
[Destination IP Address could be a Prime Optical-managed ML card or an external
device. Source IP Address is always a Prime Optical-managed ML card.]
```

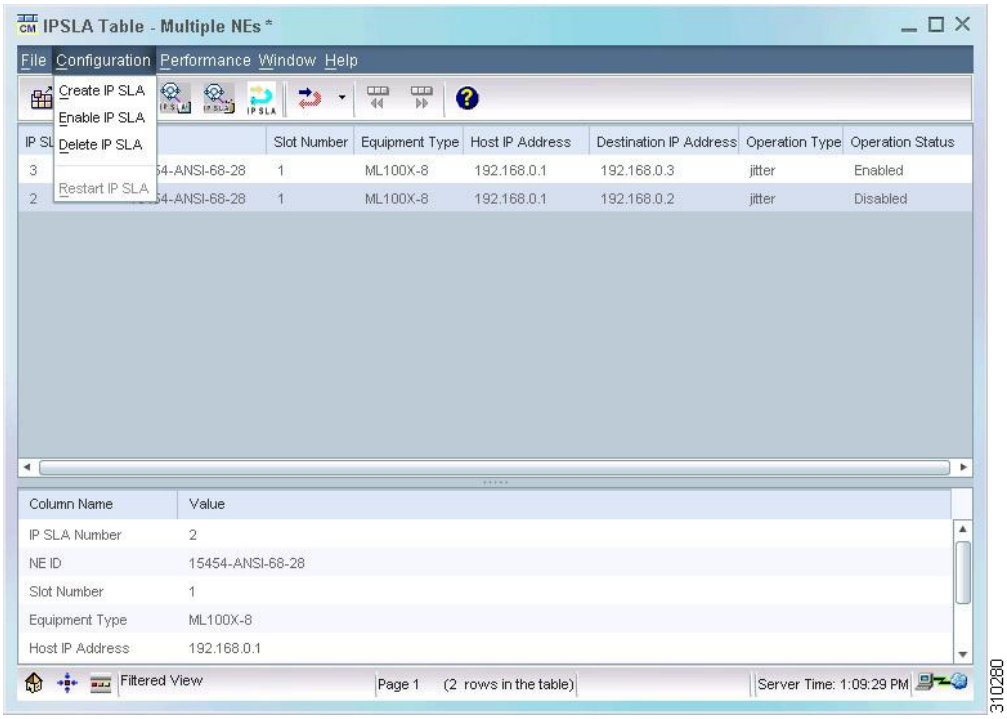
Note Performance monitoring is disabled for the IP SLA echo operation. If you select an echo row in the IP SLA performance monitoring (PM) table, the Performance menu is disabled.

3. Manage the IP SLA Session

To begin collecting, enable the IP SLA session. The operation ends after 3600 seconds, but you can restart it from the Restart IP SLA menu.

Use the IP SLA table (see Figure 22) to enable, restart, and delete IP SLA.

Figure 22 IP SLA Table



Use the following commands to enable, restart, and delete IP SLA:

Enable IP SLA

```
rtr schedule IPSLA ID start-time now [IP SLA Number range is from 1 to 2147483647]
```

Restart IP SLA

```
rtr restart IPSLA ID [IP SLA Number range is from 1 to 2147483647]
```

Delete IP SLA

```
No rtr IPSLA ID [IP SLA Number range is from 1 to 2147483647]
```

Note The MIB uses SNMP to retrieve PM statistics on IP SLA.

The following table lists the PM data retrieved on IP SLA for jitter. To view the statistics, choose **IP SLA Table > Performance** (see Figure 22).

Table 5 PM-Related Data for Jitter

Prime Optical Name	Field Supported
rttMonJitterStatsStartTimeIndex	The time at which the IP SLA was created.
rttMonJitterStatsCompletions	The number of jitter operations that were successful.
rttMonJitterStatsOverThresholds	The number of jitter operations that violate the threshold.
rttMonJitterStatsNumOfRTT	The number of successful round trips.
rttMonJitterStatsRTTSum	The sum of the round-trip values.
rttMonJitterStatsRTTSum2Low	The sum of the squares of the low round-trip values.
rttMonJitterStatsRTTSum2High	The sum of the squares of the high round-trip values.
rttMonJitterStatsRTTMin	The minimum number of round-trip times (RTTs) that were measured successfully.
rttMonJitterStatsRTTMax	The maximum number of RTTs that were measured successfully.
rttMonJitterStatsMinOfPositivesSD	The minimum positive jitter values from the source to the destination. Positive jitter values indicate delays in receiving time from one packet to another.
rttMonJitterStatsMaxOfPositivesSD	The maximum positive jitter values from the source to the destination.
rttMonJitterStatsNumOfPositivesSD	The number of jitter values from the source to the destination that are positive (that is, network latency increases for two consecutive test packets).
rttMonJitterStatsSumOfPositivesSD	The sum of the positive values.
rttMonJitterStatsSum2PositivesSDLow	The sum of the squares of the low positive values.
rttMonJitterStatsSum2PositivesSDHigh	The sum of the squares of the high positive values.
rttMonJitterStatsMinOfNegativesSD	The minimum negative jitter values from the source to the destination. The absolute value is given.
rttMonJitterStatsMaxOfNegativesSD	The maximum negative jitter values from the source to the destination. The absolute value is given.
rttMonJitterStatsNumOfNegativesSD	The number of jitter values from the source to the destination that are negative (that is, network latency decreases for two consecutive test packets).
rttMonJitterStatsSumOfNegativesSD	The sum of the negative values.
rttMonJitterStatsSum2NegativesSDLow	The sum of the squares of the negative low values.
rttMonJitterStatsSum2NegativesSDHigh	The sum of the squares of the negative high values.
rttMonJitterStatsMinOfPositivesDS	The minimum of all positive jitter values from packets sent from the destination to the source.
rttMonJitterStatsMaxOfPositivesDS	The maximum of all positive jitter values from packets sent from the destination to the source.
rttMonJitterStatsNumOfPositivesDS	The sum of numbers of all positive jitter values from packets sent from the destination to the source.
rttMonJitterStatsSumOfPositivesDS	The sum of RTTs of all positive jitter values from packets sent from the destination to the source.
rttMonJitterStatsSum2PositivesDSLow	The sum of squares of RTTs of all positive jitter values from packets sent from the destination to the source (low-order 32 bits).

Table 5 PM-Related Data for Jitter (continued)

Prime Optical Name	Field Supported
rttMonJitterStatsSum2PositivesDSHigh	The sum of the squares of RTTs of all positive jitter values from packets sent from the destination to the source (high-order 32 bits).
rttMonJitterStatsMinOfNegativesDS	The minimum of all negative jitter values from packets sent from the destination to the source.
rttMonJitterStatsMaxOfNegativesDS	The maximum of all negative jitter values from packets sent from the destination to the source.
rttMonJitterStatsNumOfNegativesDS	The sum of numbers of all negative jitter values from packets sent from the destination to the source.
rttMonJitterStatsSumOfNegativesDS	The sum of RTTs of all negative jitter values from packets sent from the destination to the source.
rttMonJitterStatsSum2NegativesDSLow	The sum of the squares of RTTs of all negative jitter values from packets sent from the destination to the source (low-order 32 bits).
rttMonJitterStatsSum2NegativesDSHigh	The sum of the squares of RTTs of all negative jitter values from packets sent from the destination to the source (high-order 32 bits).
rttMonJitterStatsPacketLossSD	The number of packets that were lost from the source to the destination.
rttMonJitterStatsPacketLossDS	The number of packets that were lost from the destination to the source.
rttMonJitterStatsPacketOutOfSequence	The number of packets that were returned out of order.
rttMonJitterStatsPacketMIA	The number of packets that were lost where the direction (source-to-destination or destination-to-source) cannot be determined.
rttMonJitterStatsPacketLateArrival	The number of packets that arrived after the timeout.
rttMonJitterStatsError	The number of times an operation could not be started due to other internal failures.
rttMonJitterStatsBusies	The number of times the operation could not be started because the previously scheduled run was not finished.
rttMonJitterStatsOWSumSD	The sum of one-way times from the source to the destination.
rttMonJitterStatsOWSum2SDLow	The sum of the squares of one-way times from the source to the destination (low-order 32 bits).
rttMonJitterStatsOWSum2SDHigh	The sum of the squares of one-way times from the source to the destination (high-order 32 bits).
rttMonJitterStatsOWMinSD	The minimum of all one-way times from the source to the destination.
rttMonJitterStatsOWMaxSD	The maximum of all one-way times from the source to the destination.
rttMonJitterStatsOWSumDS	The sum of one-way times from the destination to the source.
rttMonJitterStatsOWSum2DSLow	The sum of the squares of one-way times from the destination to the source (low-order 32 bits).
rttMonJitterStatsOWSum2DSHigh	The sum of the squares of one-way times from the destination to the source (high-order 32 bits).
rttMonJitterStatsOWMinDS	The minimum number of all one-way times from the destination to the source.
rttMonJitterStatsOWMaxDS	The maximum number of all one-way times from the destination to the source.

Table 5 PM-Related Data for Jitter (continued)

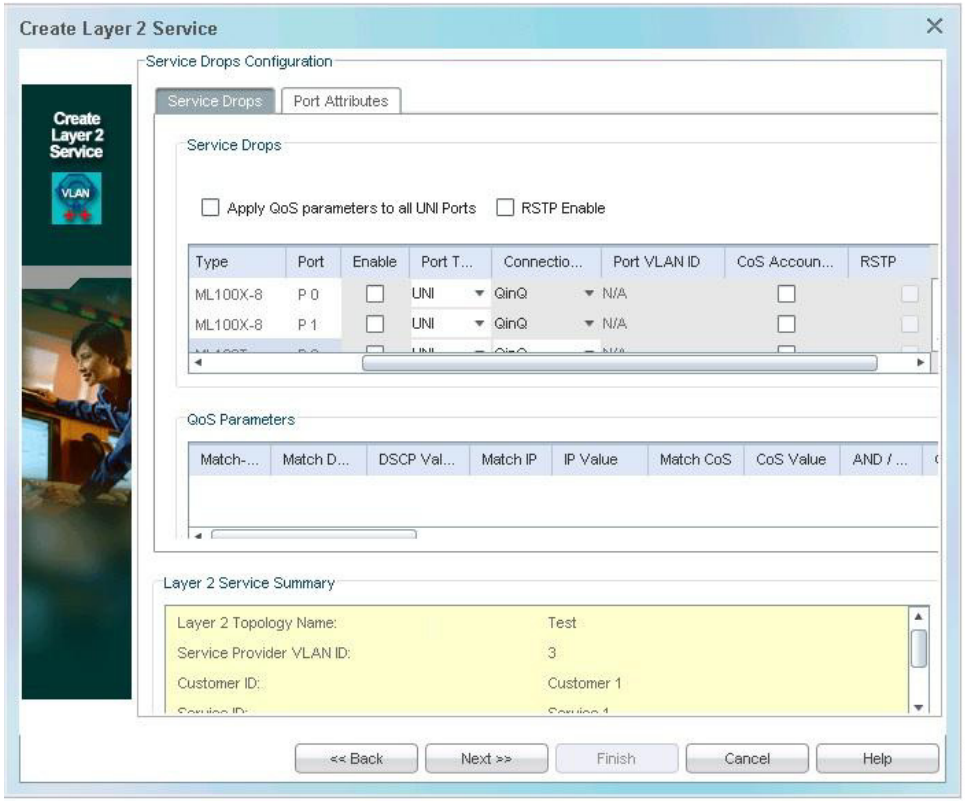
Prime Optical Name	Field Supported
rttMonJitterStatsNumOfOW	The number of one-way times that were measured successfully.
rttMonJitterStatsOWMinSDNew	The minimum number of all one-way times from the source to the destination. Replaces deprecated rttMonJitterStatsOWMinSD.

Enabling or Disabling Rapid Spanning Tree Protocol

You can enable Rapid Spanning Tree Protocol (RSTP) on UNI dot1Q, UNI Untagged, and NNI dot1Q ports by selecting the RSTP for the selected drop port and then checking the RSTP Enable check box (see Figure 23). To disable RSTP, select the RSTP for the selected drop port and uncheck the RSTP Enable check box.

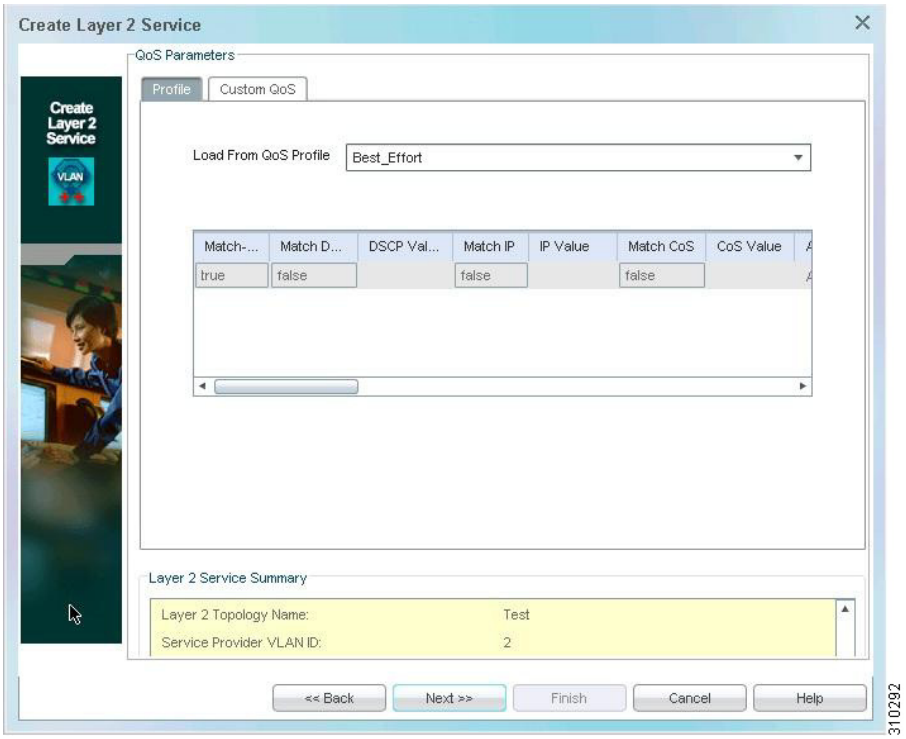
Note RSTP can be enabled only on a drop where UNI/NNI dot1Q is selected and only on a subinterface (that is, UNI dot1Q drop) where no other QinQ drops were created for the same interface.

Figure 23 Create Layer 2 Service Wizard—RSTP Enable



Click **Next** to configure QoS parameters as required (see Figure 24).

Figure 24 Create Layer 2 Service Wizard—QoS Parameters



If the RSTP Enable check box is checked, Prime Optical issues the following command specified for adding a drop:

```
[Configure RSTP; this command is issued once for VLANs]
bridge BG protocol rstp

[Enable RSTP on the selected drop]
Interface {FastEthernetport|GigabitEthernetport}.Port VLAN
Bridge-group BG
```

The following command is issued when you disable RSTP from a drop:

```
[Disable RSTP on the selected drop]
Interface {FastEthernetport|GigabitEthernetport}.Port VLAN
Bridge-group BG
Bridge-group BG spanning-disabled [Disable RSTP on the selected drop]
```

Note

- Enabling or disabling RSTP on a port basis is not valid if you configured a bridge group to the main Ethernet interface. By default, the CLI disables the dot1Q drop in the card.
- If only the RSTP Enable check box is checked, the Spanning Tree Protocol remains disabled on the VLAN service drops.

Enabling or Disabling Cisco Discovery Protocol

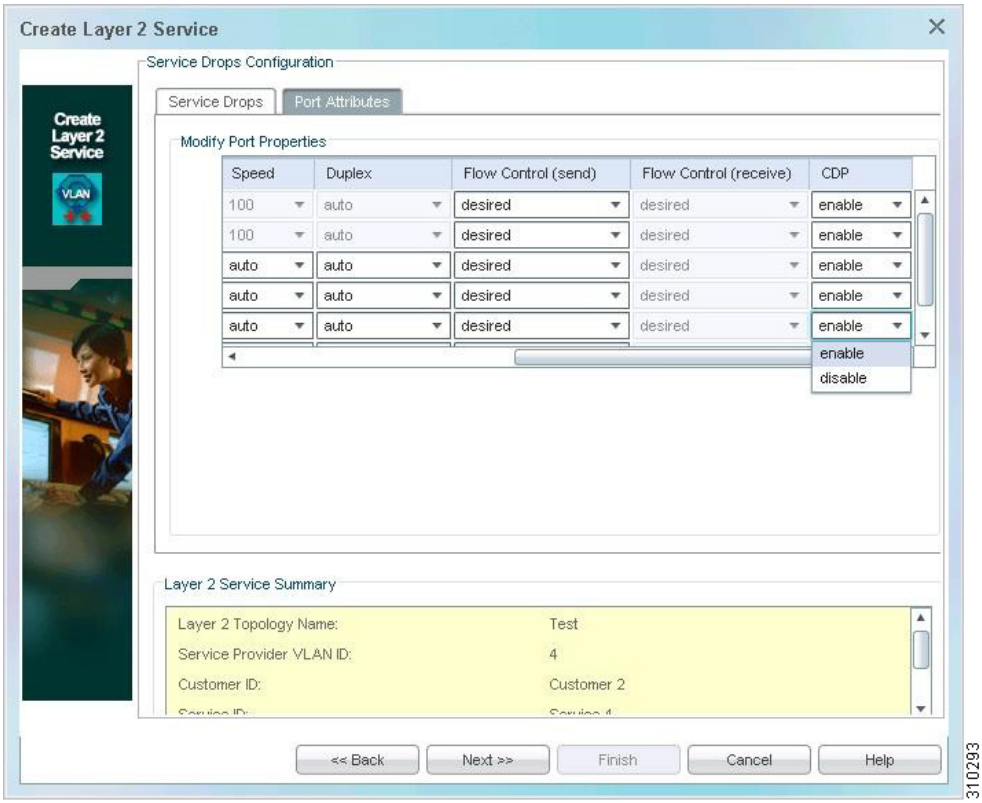
You can enable or disable Cisco Discovery Protocol (CDP) when:

- Creating a Layer 2 Service, page 47
- Modifying Layer 2 Service Drops, page 47
- Modifying Drops, page 48

Creating a Layer 2 Service

In the Create Layer 2 Service wizard > Port Attributes tab > CDP drop-down list (see Figure 25), choose **enable** or **disable** to enable or disable CDP.

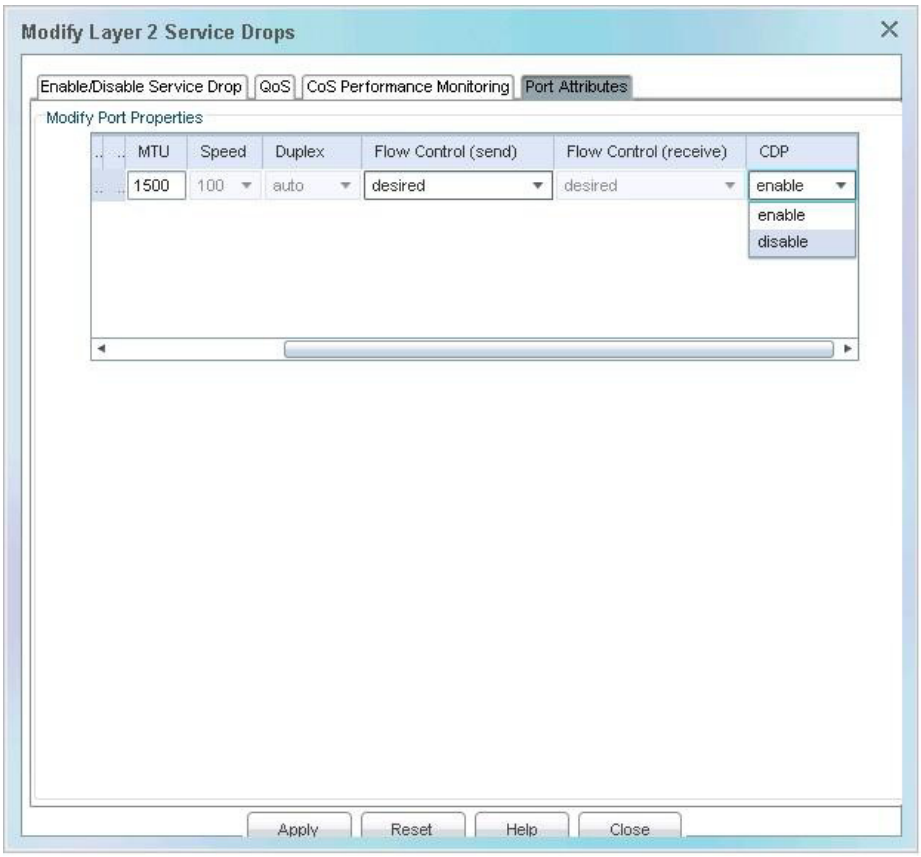
Figure 25 Create Layer 2 Service Wizard—Enable or Disable CDP



Modifying Layer 2 Service Drops

In the Modify Layer 2 Service Drops wizard > Port Attributes tab > CDP drop-down list (see Figure 26), choose **enable** or **disable** to enable or disable CDP. Click **Apply**.

Figure 26 Modify Layer 2 Service Drops Wizard—Enable or Disable CDP



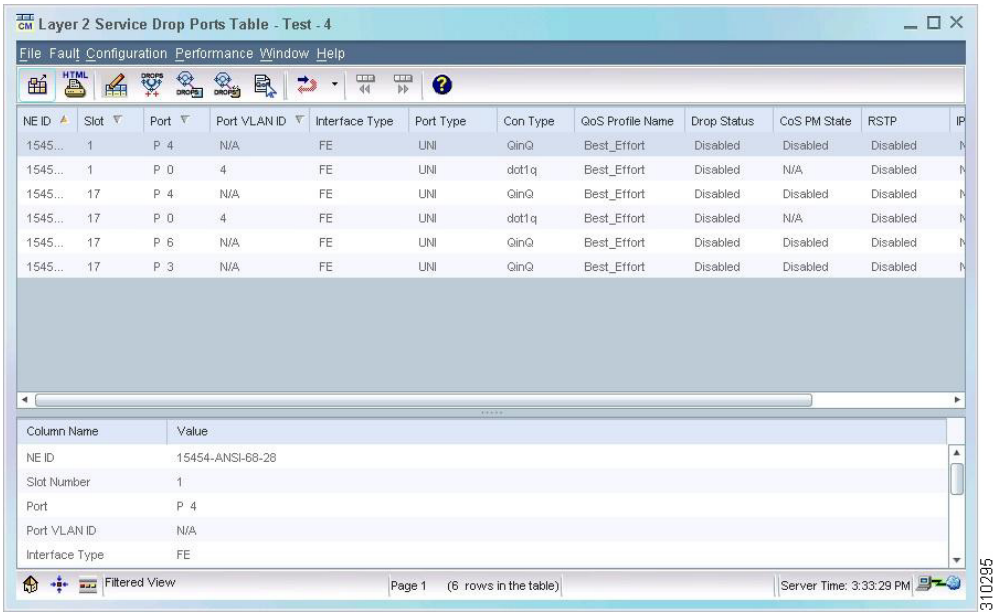
Modifying Drops

Step 1 In the Domain Explorer window, choose **Configuration > CTC-Based SONET NEs** or **CTC-Based SDH NEs > L2 Topology Table**.

Step 2 In the Layer 2 Topology table, choose **Configuration > Show L2 Services**.

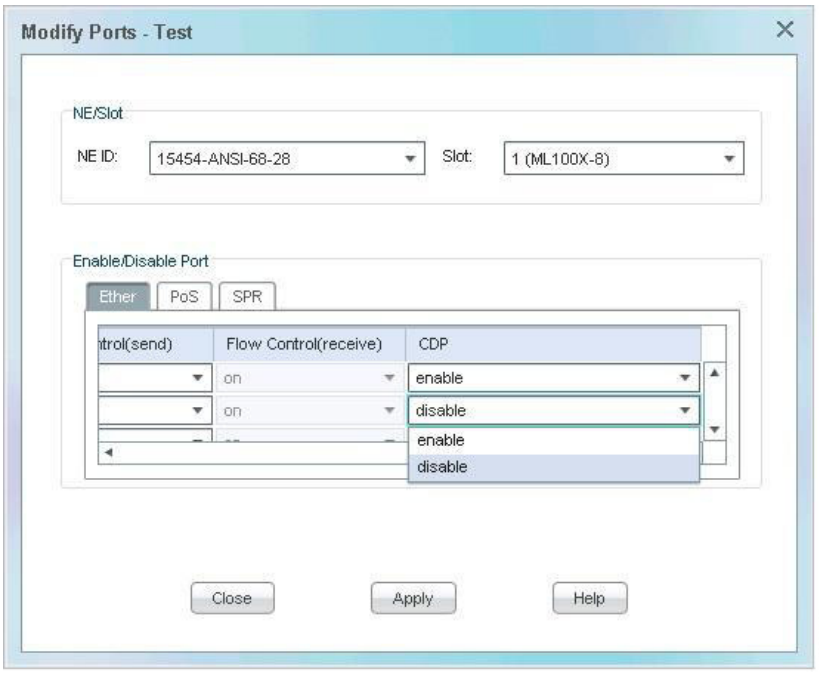
Step 3 In the L2 Services table, select a service; then, choose **Configuration > Show Drops**. The L2 Service Drop Ports table opens, listing all the drops in the selected service.

Figure 27 Layer 2 Service Drop Ports Table



Step 4 Choose **Configuration > Modify Ports**. The Modify Ports dialog box opens (see Figure 28).

Figure 28 Modify Ports



Step 5 In the Enable/Disable Port > CDP drop-down list, choose **enable** or **disable** to enable or disable CDP.

Prime Optical issues the following command when you enable CDP on a selected drop:

`Interface {FastEthernet`*port*`|GigabitEthernet`*port*`}.`*Port-VLAN*

```
cdp enable
```

Prime Optical issues the following command when you disable CDP on a selected drop:

```
Interface {FastEthernetport|GigabitEthernetport}.Port-VLAN
no cdp enable
```

ML Management Troubleshooting

If a problem arises during the initial synchronization, you can resynchronize the Layer 2 topology by choosing **Configuration > Resync L2 Topology** in the Layer 2 Topology table (see Figure 29).

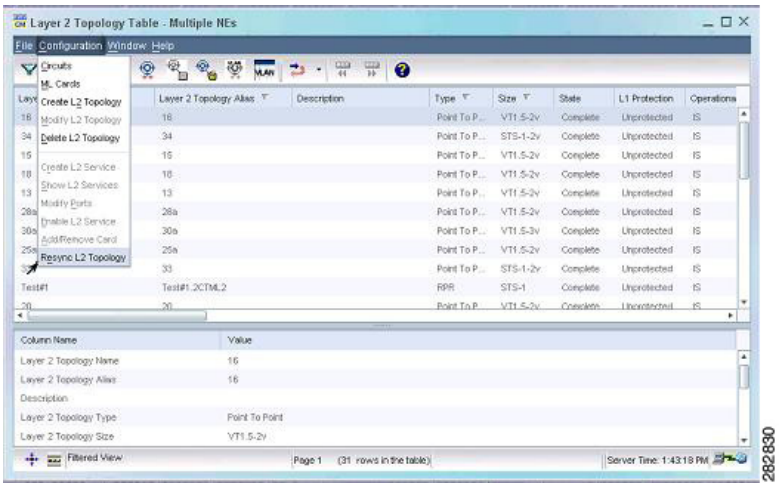
Note This feature only restarts the L2 topology resynchronization state. It does not forcefully apply any configuration on the ML-series card to complete the synchronization of the L2 topology.

Alternative methods of resynchronization are:

- Mark the NEs participating in the L2 topology as Out of Service, and then In Service.
- Restart the NE service.

Although effective, these methods cause a time lag that affects other functions, such as inventory collection and circuit discovery.

Figure 29 Layer 2 Topology Table—Resynchronize L2 Topology



ML Version Up

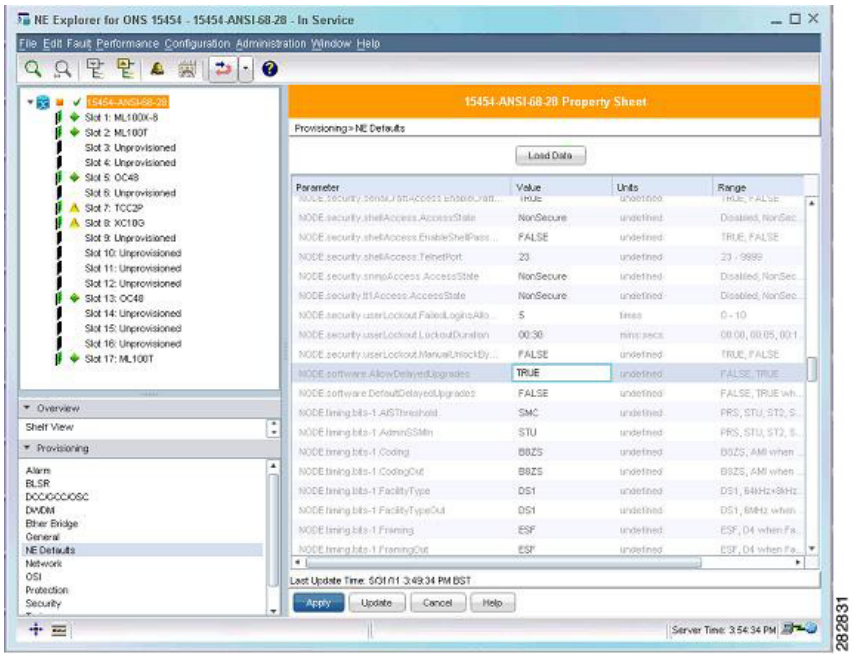
When you upgrade a node, you can choose to upgrade the software running on the ML-series cards at a later time. The Version Up feature allows you to delay upgrading the ML-series card, and to choose which ML-series card to upgrade to the new version. By using this feature, you can also view the state of the node with respect to the upgrade, which can be:

- Complete upgrade—All the non-ML and ML-series cards have been upgraded to the new software release.
- Partial upgrade—The ML-series cards have not all been upgraded to the new software release.

To enable the Version Up feature, complete the following steps:

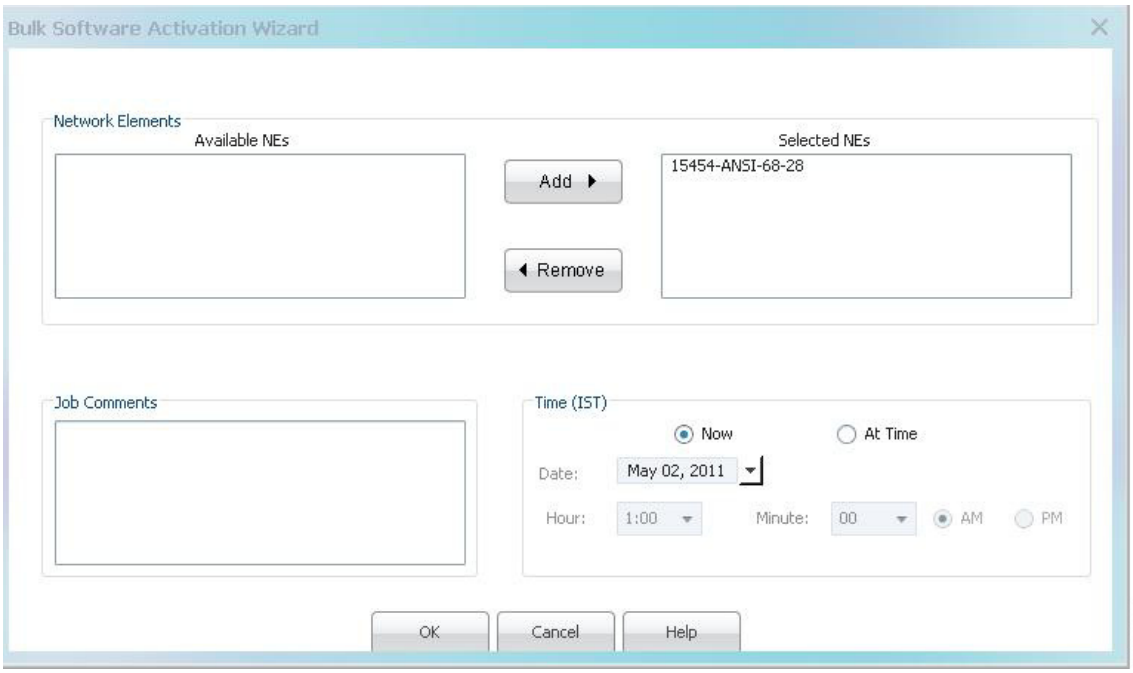
1. Set the value for the parameter NODE.Software.AllowDelayedUpgrade in the Value column under the NE Defaults tab to **TRUE** (see Figure 30).

Figure 30 NE Explorer—NE Defaults Tab



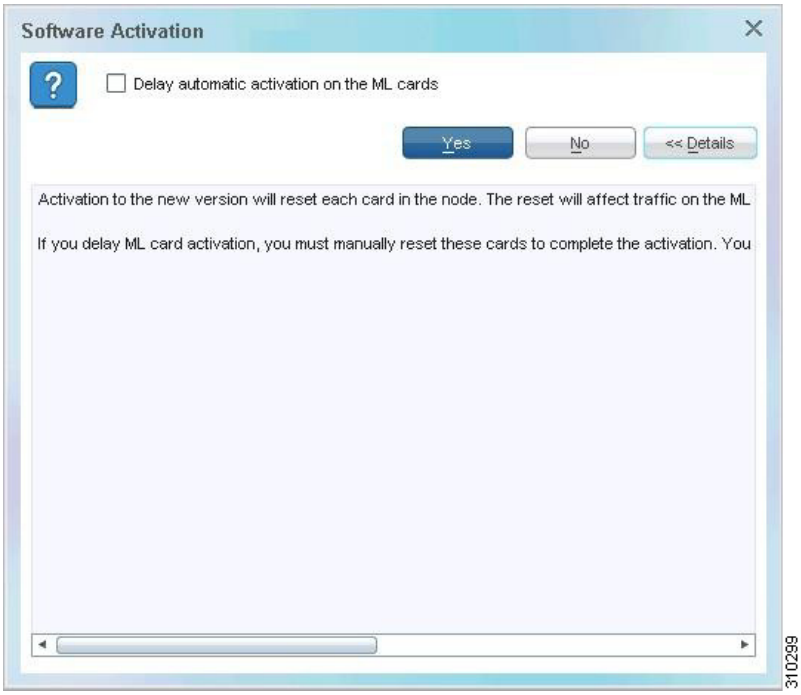
2. Activate the NE software. Use the Bulk Software Activation wizard to activate the NE software (see Figure 31). For specific instructions, see the section “Scheduling Bulk Software Activation” in Chapter 4, “Maintaining an Efficient Network” in the *Cisco Prime Optical 9.3.1 User Guide*.

Figure 31 Bulk Software Activation Wizard



During NE software activation, you are asked if you want to delay the software upgrade on the ML-series cards (see Figure 32). For specific instructions, see the section "Delaying Software Activation on the ML-Series Cards" in Chapter 4, "Maintaining an Efficient Network" in the *Cisco Prime Optical 9.3.1 User Guide*.

Figure 32 Software Activation



Note

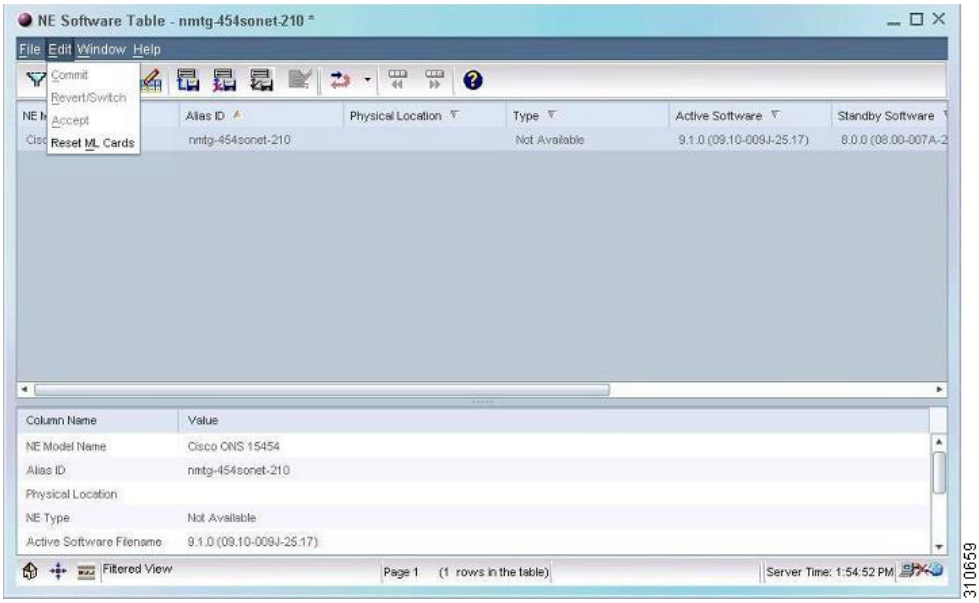
- While ML-series cards on the NE are waiting to be upgraded, all provisioning operations and software downloads on the NE are disallowed.
- You can upgrade the NE fully to the latest version by resetting all the ML-series cards to this version.

After a successful partial software activation on the NE, the NE Software table (see Figure 33) displays *True* in the Partial Upgrade column, which indicates that the activation is pending for ML-series cards.

3. Upgrade the ML-series cards to the current version by resetting them on the NE in either of the following ways:
   - Select multiple ML-series cards and choose **Edit > Reset ML Cards** in the NE Software table. For specific instructions, see the section "Activating a New NE Software Version on One or More ML-Series Card(s)" in Chapter 4, "Maintaining an Efficient Network" in the *Cisco Prime Optical 9.3.1 User Guide*.
   - For individual ML-series cards, use the NE Explorer.

   The Partial Upgrade column in the NE Software table displays *FALSE* when all ML-series cards are upgraded to the current version.

Figure 33 NE Software Table—Reset ML Cards



Enable L2 Service Command Enhancement

The enable L2 service command has been enhanced. (See the section "Enabling Layer 2 Services" in Chapter 7, "Provisioning Services and Connections" in the *Cisco Prime Optical 9.3.1 User Guide*.)

The enable L2 service command is used only when the resynchronization status of the topology is *L2 Service Not Ready*, and its main purpose is to change the Layer 2 topology into a resynchronization status of *Complete* so that a VLAN can be created.

Instead of commanding the default base card configuration on all ML-series cards in the topology to be downloaded, this command downloads a customized base card configuration on only the selected Layer 2 topology ML-series cards that do not have the customized configuration and are in a synchronized configuration state (barebone file downloaded).

This command applies to point-to-point, Cisco RPR, and 802.17 RPR Layer 2 topologies.

Related Documentation

Note You can access the most current Prime Optical documentation online at http://www.cisco.com/en/US/products/ps11670/tsd_products_support_series_home.html.

The Prime Optical documentation set comprises the following guides:

- *Release Notes for Cisco Prime Optical 9.3.1*—Describes the caveats for Prime Optical.
- *Cisco Prime Optical 9.3.1 Installation Guide*—Explains how to install Prime Optical and how to upgrade from previous releases.
- *Cisco Prime Optical 9.3.1 User Guide*—Describes how to use the Prime Optical software, which consists of user applications and tools for network discovery, network configuration, connection management, fault management, system administration, and security management.
- *Cisco Prime Optical 9.3.1 Gateway/CORBA User Guide and Programmer Manual*—Describes the GateWay/CORBA northbound interface product that is available for Prime Optical. This document serves as a reference for developers of OSS applications that work with the GateWay/CORBA interface.
- *Cisco Prime Optical 9.3.1 Database Schema*—Describes the database schema that Prime Optical uses to store information in a Structured Query Language (SQL) database such as the Oracle database. The document is designed for users who need to create their own reports without using Prime Optical.
- *Cisco Prime Optical 9.3.1 High Availability Installation Guide*—Explains how to install Prime Optical in a high availability (HA) environment.

  Note To obtain the *Cisco Prime Optical 9.3.1 High Availability Installation Guide*, contact your Cisco account representative.

- *Cisco Prime Optical 9.3.1 ML Provisioning Methodology*—This document.
- *Cisco Prime Optical 9.3.1 Basic External Authentication*—Describes how Prime Optical supports basic external authentication.
- *Migration Matrix for Service Pack Releases*—Describes the migration matrix for service pack releases.

Obtaining Documentation and Submitting a Service Request

For information on obtaining documentation, submitting a service request, and gathering additional information, see the monthly *What's New in Cisco Product Documentation*, which also lists all new and revised Cisco technical documentation, at:

http://www.cisco.com/en/US/docs/general/whatsnew/whatsnew.html

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Any Internet Protocol (IP) addresses used in this document are not intended to be actual addresses. Any examples, command display output, and figures included in the document are shown for illustrative purposes only. Any use of actual IP addresses in illustrative content is unintentional and coincidental.