Cisco Service Control for Managing Remote Cable MSO Links Solution Guide

Release 3.6.x
November 8, 2010

Americas Headquarters
Cisco Systems, Inc.
170 West Tasman Drive
San Jose, CA 95134-1706
USA
http://www.cisco.com
Tel: 408 526-4000
800 553-NETS (6387)
Fax: 408 527-0883

Text Part Number: OL-21073-02

Cisco Service Control for Managing Remote Cable MSO Links Solution Guide

CONTENTS

CHAPTER 1

Remote Cable MSO Links Solution Overview

Revised: November 8, 2010, OL-21073-02

Introduction

Note This document supports all 3.6.x releases.

This *Cisco Service Control for Managing Remote Cable MSO Links Solution Guide* describes the use of a Cisco Service Control solution in a cable environment to optimize traffic on remote links. It describes the setup of a solution that uses the Virtual Link Manager (VLM) to enable traffic optimization of remote links, and the monitoring of that solution after deployment.

This guide assumes a basic familiarity with the concept of the Cisco Service Control solution, the Service Control Engine (SCE) platforms, and related components.

Overview

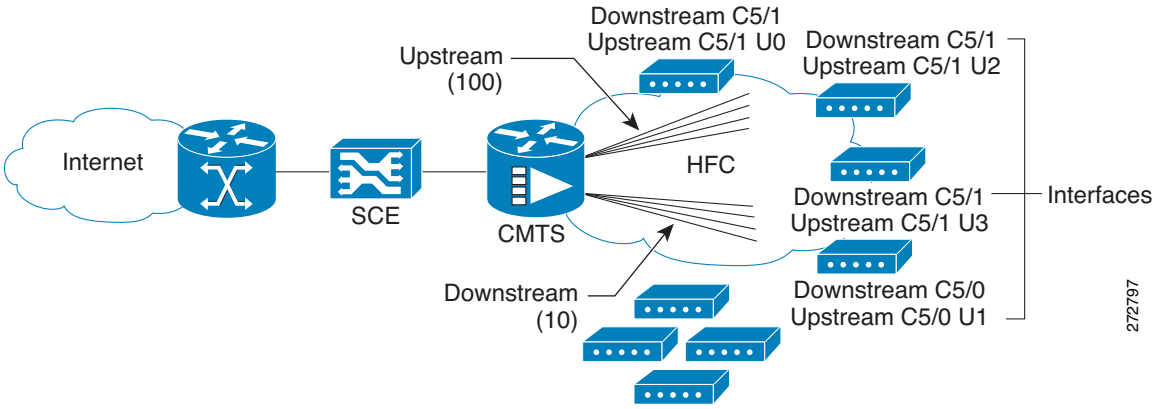
In Cable Multiple Service Operator (MSO) networks, the SCE is inserted in a location upstream of the Cable Modem Termination System (CMTS), which is the first IP hop in the MSO network. In this location, the SCE is often used to implement fair use policies (FUP) and perform congestion mitigation. MSOs work to ensure that the existing network infrastructure is used optimally using the SCE to enforce fairness between the different subscribers when the network is in the state of congestion.

The bandwidth of the radio frequency interfaces of the CMTS ranges from several megabits per second (Mbps) to tens of Mbps. The CMTS aggregates these interfaces into higher bandwidth upstream links, typically 1 gigabit per second (Gbps), where the SCE is connected.

Cable modems which are connected to the hybrid fiber coaxial cable (HFC) downstream connection of the CMTS are associated with CMTS interfaces. The CMTS interfaces can be termed upstream or downstream upon bootup or dynamically (depending on the direction of traffic flow) when you use some load balancing algorithms.

Figure 1-1 shows a typical deployment topology of an SCE in an MSO network.

Figure 1-1 SCE Deployed in MSO Network



Solution Overview

As part of this solution, the Virtual Link Manager (VLM) makes the SCE aware of the interface association of subscribers (cable modems) and accounts for and controls aggregate traffic in the context of a physical interface (CMTS upstream or downstream). This awareness allows the SCE to perform congestion mitigation at the level of the CMTS physical interface.

The solution is required to manage a large number of subscribers, each of which is connected to the CMTS and through it to the SCE. Within the CMTS, subscribers are connected to shared radio frequency interfaces, where they use the Data Over Cable Service Interface Specification (DOCSIS) MAC layer to transport their traffic. The shared radio frequency interfaces are termed *upstream* and *downstream*.

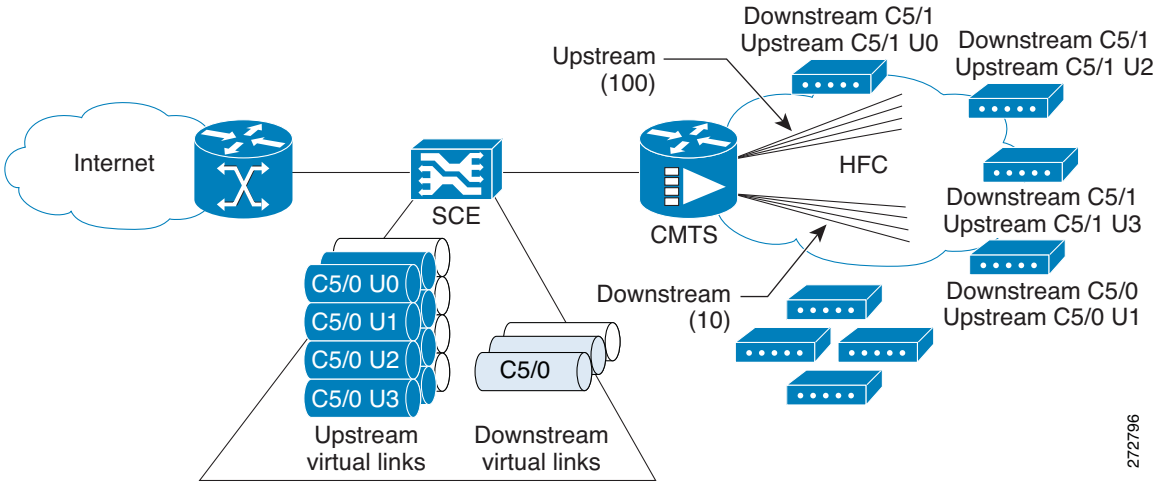
CMTS upstream and downstream interfaces are aggregated through the CMTS interface toward the core of the network, and eventually end in one or several physical interfaces that are connected to the SCE, which monitors and controls traffic.

MSOs use the SCE to prioritize traffic within each of the CMTS radio frequency interfaces when traffic is congested. Cisco Service Control provides a virtual link concept that allows MSOs to monitor and control traffic for each interface.

Although it is possible to prioritize traffic by allocating packages to pairs of interfaces, this is time-consuming. The virtual links approach simplifies the model. Each virtual link is monitored and controlled separately within the service control solution, while virtual link provisioning is performed through the SCE CLI. The policy remains simple, and reflects only per subscriber tiering.

Figure 1-2 shows traffic traveling through the SCE that is mapped into SCE virtual links which reflect the CMTS physical interfaces. Monitoring and control are performed in the context of the virtual links.

Figure 1-2 Traffic Traversing SCE that is Mapped to SCE Virtual Links



The Cisco Service Control solution provides the VLM to automate many of the configuration actions that the network administrator ordinarily performs, including:

- Provisioning virtual-link maps for each SCE based on the interface maps of the CMTSs that provide network access.
- Configuring bandwidth values for the virtual links based on the CMTS interface speed values. These values tend to change regularly as part of cable plant maintenance, or automatically as part of spectrum management. These changes must be traced and acted upon by the network administrator.
- Building the subscriber manager virtual-link mapping configuration.

  The virtual-link mapping configuration defines the mapping between the following:

  – Dynamic Host Control Protocol (DHCP) options that define the subscribers interface associations that are extracted from the DHCP acknowledge message.

  – Corresponding virtual links ID.

CHAPTER 2

DOCSIS 3.0 Support for Remote Cable MSO Links Solution

Last Updated: November 8, 2010, OL-21073-02

Introduction

The *Cisco Service Control for Managing Remote Cable MSO Links Solution* is enhanced with new features that are consistent with DOCSIS 3.0 specifications and includes support for downstream bonding of multiple channels—multiple channels are bonded to a single, virtual interface to provide higher bandwidth to the cable modems.

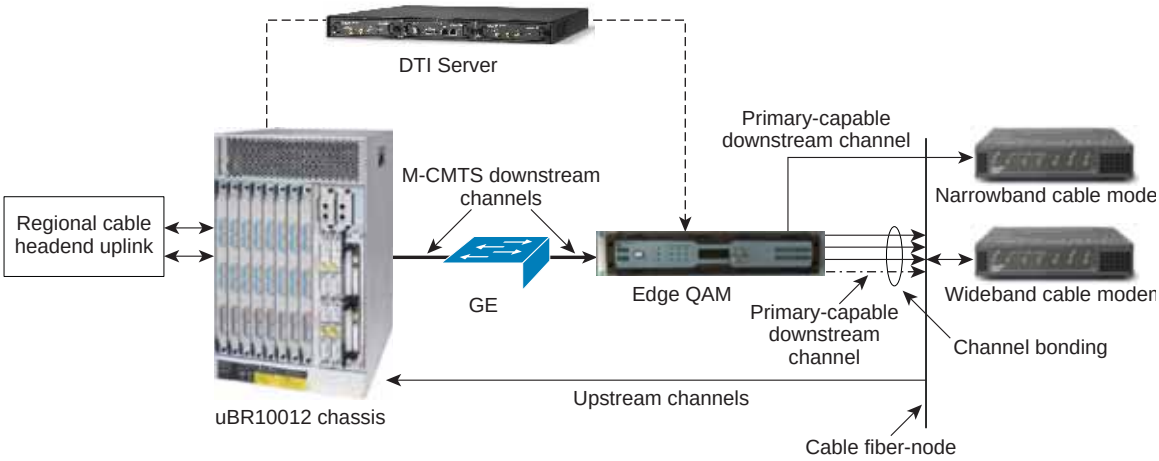
Feature Overview

The DOCSIS 3.0 Downstream bonding enables high-speed broadband access and helps cable operators offer more bandwidth-intensive services by adding one or more additional downstream Quadrature Amplitude Modulation (QAM) channels to the standard broadband DOCSIS system. This new set of downstream (DS) channels is grouped into one larger channel, known as a *bonded channel*.

With wideband data services, multiple DS channels are aggregated into a single logical wideband channel (bonding group) that delivers higher bandwidth to the wideband cable modem when compared to DOCSIS 2.0 technology. This aggregation of the DS channels is referred to as *channel bonding*. Data rates in this virtual channel range from hundreds of megabits to potentially gigabits per second creating more available bandwidth in the network.

Figure 2-1 presents a simplified view of the Cisco DOCSIS 3.0 Downstream Solution.

Figure 2-1 DOCSIS 3.0 Downstream Solution



The DS channels are used either as primary channels (used for both broadband and narrowband channels), or secondary channels (used only for wideband channels), or both. The solution provides narrowband data services to support DOCSIS 1.x or 2.0 modems and wideband data services to support DOCSIS 3.0 modems over existing Hybrid Fiber Coaxial (HFC) networks and allows DOCSIS 1.x or 2.0 and DOCSIS 3.0 modems to share the same DS channel.

The Cisco wideband CMTS uses one or more external edge quadrature amplitude modulation (EQAM) devices. The EQAM device is a network element in a separate chassis from the CMTS. The EQAM device has two or more Gigabit Ethernet input interfaces that connect to a wideband shared port adapters (SPA). For output, the EQAM device has multiple QAM modulators and RF converters that connect to a HFC network. The edge QAM device accepts Moving Pictures Expert Group (MPEG) over IP on its Gigabit Ethernet interfaces and routes the services to its QAM RF outputs.

The enhanced Cisco Service Control solution leverages the SCE bandwidth control and reporting capabilities to monitor and control the CMTS resources at the QAM level. Multiple QAMs are aggregated into a virtual group (bundle group). The bandwidth allocation for different modems are done both on the CMTS and the EQAM. The EQAM minimizes the packets waiting in queue for each channel.

The EQAM manages the queues differently for legacy and 3.0 modems:

- All traffic to the legacy modems are routed through the primary narrowband channel queue.
- Traffic for 3.0 modems are routed through the shortest possible queue.

Bandwidth Control Enhancements

The enhancements to the SCE bandwidth control include:

- Support for wideband channels—a two level virtual link hierarchy is created to support the wideband channels. The wideband channels are associated with the Aggregate Global Control (AGC) that provides a constant output signal despite variations in input signal strength. Wideband channels are associated with three AGCs in a two level hierarchy.The top level AGC is dynamic and the lower level AGCs are equivalent to the existing AGCs. At the lower level, all the 3.0 modems for wideband are aggregated into one AGC. The other AGC contains both legacy and 3.0 modems.

  The Committed Information Rate (CIR) and Peak Information Rate (PIR) parameters are derived from the CMTS and QAM configurations.

  For the example, consider a wideband channel that includes three channels. One of the three channels is a primary channel (narrowband) and contains a mix of legacy and 3.0 cable modems. If 20% bandwidth of the narrowband channel is allocated to 3.0 cable modems then the CIR and PIR values are calculated as:

  Each QAM rate - X = 30 Mb

  Percentage bandwidth allocated for 3.0 cable modems = 20%

  Table 2-1lists the CIR and PIR values of the 3.0 cable modems with 20% bandwidth of narrowband channel allocation.

Table 2-1 CIR and PIR Values

AGC Name	CIR	PIR
Wideband-Cable1/0/0:0 (top level)	0	90 Mb (3X)
Wideband-Cable1/0/0:0_P	24 Mb (0.8X)	30 Mb (X)
Wideband-Cable1/0/0:0 _W	0	90 Mb (3X)

- Subscriber fairness within virtual links—to enforce subscriber fairness within the virtual links, the bandwidth is first allocated between the subscribers based on their RP level followed by the services of each subscriber.
- Application limitation within virtual links—SCE limits specific applications within the virtual link without losing control over the traffic.
- Enabling global control with CMTS-awareness solution.

Mapping of Cable Modems Through DHCP Sniffing

The narrowband channels are updated in the IfIndex in option 82 where the IfIndex is used for both legacy and 3.0 modems. In SCE, wideband channels are associated with three AGCs in a two-level hierarchy and the mapping of the modems to appropriate AGCs depends on the following factors:

- In the VLM mapping table, the modems are mapped from the narrowband IfIndex to the wideband group.
- Modems are linked to the appropriate AGC based on their type.

Detecting 3.0 Modems

The legacy and 3.0 modems are distinguished based on the information in the bootfile. The operators use the bootfile name to identify the modem type and the service package for the subscriber. The service packages are used to map the modems to the right VLM.

The bootfile name is configured using the following options:

- Option 67 in DHCP protocol is called the *Bootfile name*, the information configured in this field is extracted and sent to the DHCP sniffer.
- DHCP header contains a field called *Bootfile name* in the DHCP header.

  DHCP LEG includes regular expression capabilities that are used to configure specific information in the Bootfile name, which is used for mapping.

The VLM extracts the DHCP sniffer query results indicating the modem type (legacy or 3.0). Based on the DHCP sniffer output, VLM maps the modems to either primary or secondary channels.

CHAPTER 3

Learning the Interface Topology and Association

Revised: November 8, 2010, OL-21073-02

Introduction

This chapter describes learning of interface topology and association of the remote cable MSO links solution.

Learning the Interface Topology

To control and report traffic in the context of a remote interface, you must map the topology in terms of the available CMTS interfaces and their associated bandwidth. This map must include keys that are used by the SCE to associate subscriber traffic with specific interfaces.

The SCE learns the interface topology by retrieving the CMTS configuration using the Simple Network Management Protocol (SNMP) and converting the configuration to a virtual links map. Virtual links are provisioned to the relevant SCEs.

VLM queries the CMTS device and learns the upstream and downstream channels, their names, and their rates. VLM supports a single primary channel per wideband group. For primary channels within a wideband group, VLM queries the CMTS for resource allocation that is reserved for legacy modems.

For downstream channels, VLM obtains the mapping information of the channels to wideband groups. For the wideband channels, VLM extracts the:

- Wideband to narrowband mapping to detect a primary channel
- Wideband name from the Interface MIB
- Mapping of channels that belong to the wideband group and their rates to calculate the wideband rate

The parameters for the primary and secondary channels include:

- Peak Information Rate (PIR)
- Committed Information Rate (CIR)

Table 3-1 list the parameters and their values for primary and secondary channels and the dynamic AGCs.

Table 3-1 Parameter Values

Parameters	Values for Primary Channels	Values for Secondary Channels	Values for Dynamic AGC
PIR	The values are extracted from the interface rate of the primary channel of the wideband.	The values are extracted from the total rate of the wideband channel.	The values are extracted from the total rate of the wideband channel.
CIR	The values are calculated from the CMTS configurations.	CIR=0	CIR=0

Learning the Interface Association

Interface association awareness is achieved through DHCP integration. The CMTS IP (specifically, the Relay-Agent IP, or giaddr) is part of the DHCP dialog and upstream and downstream interface IDs are included in the **Relay-Agen**t option (for example, option 82 [encoded in suboption 1, the circuit ID]). This information allows the SCE to uniquely identify upstream and downstream interfaces to which a subscriber is mapped, even in cases in which more than one CMTS is connected to an SCE.

Note If multiple CMTS devices connected to an SCE have the same SNMP SysName, the VLM fails to identify the duplication and results in an unpredictable behavior.

The SCE DHCP sniffer login event generator (LEG) extracts the CMTS IP and reports it to the subscriber manager, which performs the appropriate virtual-link association, allowing the SCE to manage the traffic correctly.

Wideband channels are associated with three AGCs in a two level hierarchy and the cable modems are mapped to their respective AGC. For information on the AGC mapping see Bandwidth Control Enhancements, page 2-3 and Mapping of Cable Modems Through DHCP Sniffing, page 2-4.

Note The VLM device learning does not support interfaces that are directly associated to a Mac domain; it only supports interfaces associated to a bonding group.

Dynamic giaddr Learning

When the VLM queries the CMTS device, it reads all the IP addresses from the CMTS device IP table and creates the mapping table that is used to map IPs to the CMTS device to which they are related. Many of the IP addresses that are read from the CMTS device are not used by subscribers which can cause the mapping table to become too big and unmanageable. To prevent this, the VLM dynamically selects and releases the giaddr values from the IP table.

When a subscriber logs in, the CMTS device appends the giaddr to the DHCP transaction. For giaddr that is new to the DHCP LEG (or an existing giaddr that was not used during previous logins):

- If the login giaddr value is known to the VLM (related to one of the CMTS devices), the VLM updates the DHCP LEG with the policy mapping table related to the login giaddr value.
- If the login giaddr value is unknown to VLM (if the IP is not related to any device in the VLM), the VLM opens the SNMP connection using the login giaddr value as an IP address, and queries the SNMP connection to get the device host name (sysName OID):
  - If a device exists with the same host name, it indicates that a new IP was added to the device therefore the VLM:
    - Queries the device to learn the new updates
    - Updates the policy mappings based on the query output and updates the LEG
    - Login operations continues on the device
  - If the device host name is invalid, it indicates one of the following causes:
    - Device is not configured as expected (sysName MIB value is not set).
    - Device was not intended to be part of the VLM solution.
    - Subscriber is logged in without a vlink policy mapping.
  - If the device host name is valid, name is new to the VLM, and the dynamic device feature is enabled:
    - VLM creates a new device using the device host name.
    - Login operations using the same giaddr value are blocked by the LEG.
    - VLM starts querying the new device and updates its policy mappings accordingly.
    - Login continues on the device.

  From Service Control Application for Broadband Release 3.6.5, for a static device configuration, you can disable learning new giaddr during login. After you disable learning new giaddr, if the SM identifies that the relay agent does not belong to any known CMTS, the SM continues to login instead of doing a query. During periodic queries, the SM continues to learn new giaddrs. To disable learning new giaddr during login, set enable_dynamic_giaddrs_learning to false.
- For giaddr that is known to the DHCP LEG (or an existing giaddr that was in use during the previous logins):
  - If the policy mappings are found, a subscriber is created using the policy mappings.
  - During a login operation if the policy mappings are not found:
    - All login operations related to the device that belongs to the giaddr are put on hold by the DHCP LEG.
    - Based on the giaddr value received from DHCP, the VLM identifies the device associated with the giaddr, and queries the device.
    - After the query is completed, the policy mappings are updated in the LEG.

Note When the VLM queries a device, all login operations of the affected device is stored in a queue. After completing the query operations the login process resumes and there is no loss of login operations. Each subscriber is logged in with their respective mappings.

- VLM defines a lease time for each dynamic giaddr. If no further login operations occur during the lease time period:
  - VLM removes the giaddr from its list of giaddr values.
  - IP value is no longer a giaddr in the CMTS device (when performing **p3vlink --show-device -d** *<device>*, the giaddr attribute does not contain the removed IP).
  - LEG removes the entries from the mapping table that are related to the giaddr.
  - For each subscriber, the VLM checks if the subscriber giaddr custom property is the same as the removed giaddr and if so, changes the property to be the IP address of the CMTS device.

    The following example shows the current details of a subscriber:

```
p3subs --show -s lynn_jones
Name:           lynn_jones
Domain:         subscribers
Mappings:
        IP: 1.1.1.13/32
Properties:
        downVlinkId=7    Name=device1_1_Cmts8/1-downstream1
        upVlinkId=4      Name=device1_1_Cmts8/1-upstream1
Custom Properties:
        giaddr=1.1.1.1
Command terminated successfully

If the IP address 1.1.1.1 is the removed giaddr and 2.2.2.2 is the CMTS device IP
address, the result of the lease time operation is as follows:
p3subs --show -s lynn_jones

Name:           lynn_jones
Domain:         subscribers
Mappings:
        IP: 1.1.1.13/32
Properties:
        downVlinkId=7    Name=device1_1_Cmts8/1-downstream1
        upVlinkId=4      Name=device1_1_Cmts8/1-upstream1
Custom Properties:
        giaddr=2.2.2.2
Command terminated successfully
```

- When a CMTS device reboots, the CMTS allocates new ifIndex values for the interfaces, specifically when the downstream ifIndex values are changed and the VLM mappings are no longer synchronized. The VLM monitors the upstream and downstream parameters of option 82 and compares the values against the mapping tables. If a mismatch is found in the DHCP transaction parameters, VLM initiates a synchronization process with the CMTS device. During this process:
  - DHCP transactions of the affected CMTS device are placed on hold. The VLM buffer is capable of storing 100,000 DHCP events per CMTS.
  - LEG queues up the subscriber login request.
  - On completion of device query operation, the VLM notifies the LEG.
  - LEG removes the stored messages in the queue and restarts the login operation.
  - DHCP transactions of any newly detected CMTS device is stored in the queue until VLM queries the new CMTS information.

Managing Control and Reporting

SCE virtual links emulate the physical interfaces of the CMTSs and the VLM provisions the links with the bandwidth required to control the traffic:

1. For each CMTS physical interface (either upstream or downstream), the VLM creates a virtual link on the SCE.
2. VLM maps traffic that travels from a subscriber that is associated to this interface to the virtual link.
3. To create the proper association of subscribers to virtual links, the VLM creates a mapping between the DHCP information (CMTS-ID, upstream-ID, downstream-ID) and the virtual link IDs.
   - VLM creates a channel and an upstream virtual link for every upstream-ID on a CMTS.
   - VLM creates a legacy channel or wideband and legacy channels for a downstream virtual link for every downstream-ID on a CMTS.

Subscriber management logic is required to associate subscribers with their upstream and downstream virtual links based on the attributes that the DHCP LEG extracts from the DHCP traffic.

For a downstream virtual link, the Subscriber Manager (SM) login determines if the subscriber is associated with legacy or wideband cable modems. Depending on the subscribers modem types they are mapped either to wideband or legacy (primary) channels:

- Subscribers with wideband cable modems are mapped to the wideband channel beneath the VLink.
- Subscribers with legacy modems are mapped to legacy channels beneath the VLink.

In addition to the virtual links association, the subscriber is also assigned a package. In terms of bandwidth management, you can only use schemes that use one virtual-link-controller per direction; therefore, you should design the bandwidth controller architecture (committed information rate, peak information rate, and assurance level) accordingly.

CHAPTER 4

Configuring the Remote Cable MSO Links Solution

Revised: November 8, 2010, OL-21073-02

Introduction

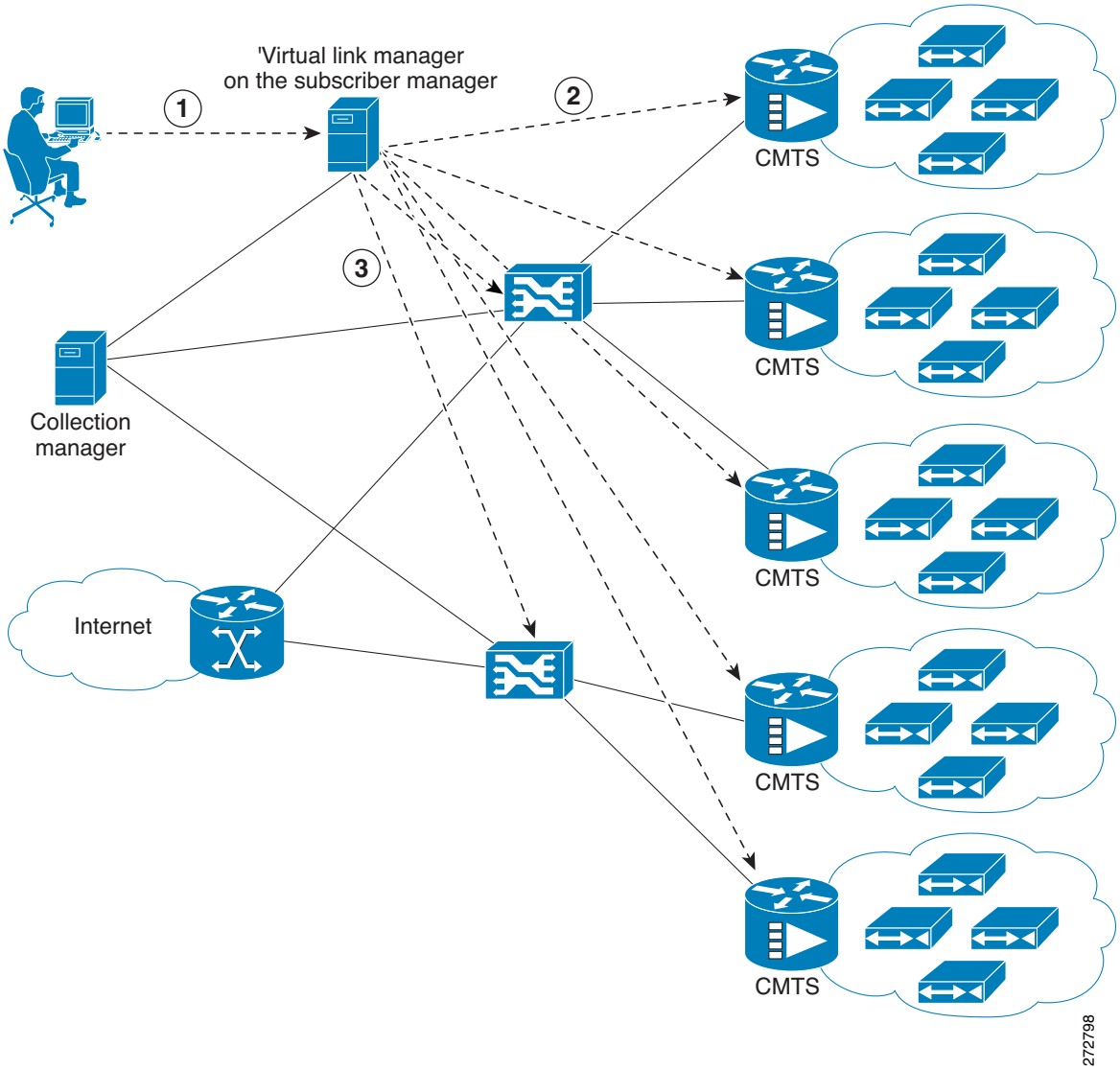
This chapter describes:

- Basic topology for managing remote cable MSO links and the high-level steps to configure the solution—Solution Topology, page 4-2
- Prerequisites for configuring a solution that uses traffic optimization on remote links with the Virtual Links Manager (VLM)—Prerequisites, page 4-3
- Configuring the VLM using the configuration files contained in the subscriber manager installation—Configuring the Solution, page 4-4

Solution Topology

Figure 4-1 shows a system that can be configured for managing remote cable MSO links.

Figure 4-1 Traffic Optimization on Remote Links Topology



Note Using a collection manager (CM) is optional and is not required for the solution to work. However, if you do not use a collection manager, the reports provided by the Service Control Application Reporter (SCA Reporter) can be selected only by the virtual link index and not by the virtual link name.
To work with the collection manager, you must associate the collection manager with the SCE and also with the subscriber manager. However, it is not mandatory to associate the collection manager with the subscriber manager. In this case, the collection manager receives the Raw Data Records (RDRs) but does not automatically receive the index to the vlink name mappings.

The operator configures the IP addresses of the CMTS devices, the SCEs, the CM, and their interrelations on the SM (1). The SM queries each CMTS device through SNMP to determine its sysname, interfaces and their corresponding interface speeds (2). The SM provisions the SCE virtual links (3).

CMTS Device Compatibility

This traffic optimization on remote links solution currently supports the following Cisco CMTS Universal Broadband Router (uBR) devices:

- uBR10K
- uBR7246

To use other CMTS devices, you must ensure the following conditions are met:

- Upstream and downstream interface IDs are encoded as part of option 82, sub option 1 (the circuit ID) and appears in the DHCPACK message.
- CM-MAC, which is used as the Subscriber-ID, is encoded as option 82, suboption 2 (the remote ID) and appears in the DHCPACK message.
- DHCP traffic flows through the SCE.

The traffic optimization on remote links solution uses the following MIBs and RFCs:

- RFC 1213 MIB-2 interface—Following nodes are required: ipAddrTable, ipAddrEntry, ipAdEntAddr, ifTable, ifEntry, ifIndex, ifDescr, ifType, ifSpeed, and ifAdminStatus.
- IANAifType MIB

The DOCSIS 3.0 support for remote links solution uses the following MIBs:

- ccwbWBtoNBMappingTable
- ccwbRFChannelModulation
- ccwbRFChannelWidth

Prerequisites

Before you set up the managing remote cable MSO links solution, you must complete the following:

- Install Release 3.6.5 onto the Subscriber Manager, Collection Manager (optional), and Service Control Engines (SCE).
- Install the Cisco Service Control Application for Broadband (SCA BB) (the Engage pqi file) on the SCEs used in the solution. See the “How to Install PQI Files on SCE Devices” section in “Using the Network Navigator” chapter, of *Cisco Service Control Application for Broadband User Guide*.

Configuring the Solution

The procedures in this section describe how to configure the solution.

Configuring Virtual Links Global Controllers

Step 1 Start the SCA BB console by choosing **Start** > **All Programs** > **Cisco SCA** > **SCA BB Console 3.6.5** > **SCA BB Console 3.6.5**.

The Cisco Service Control SCA BB Console splash screen appears. After the Console loads, the main window of the Console appears. The first time that you launch the Console, the Welcome view is open in the main window.

Step 2 To close the Welcome view, click **Go to the console**. The Welcome view closes. The Network Navigator tool is open in the Console.

Step 3 From the Console main menu, choose **Tools** > **Service Configuration Editor**.

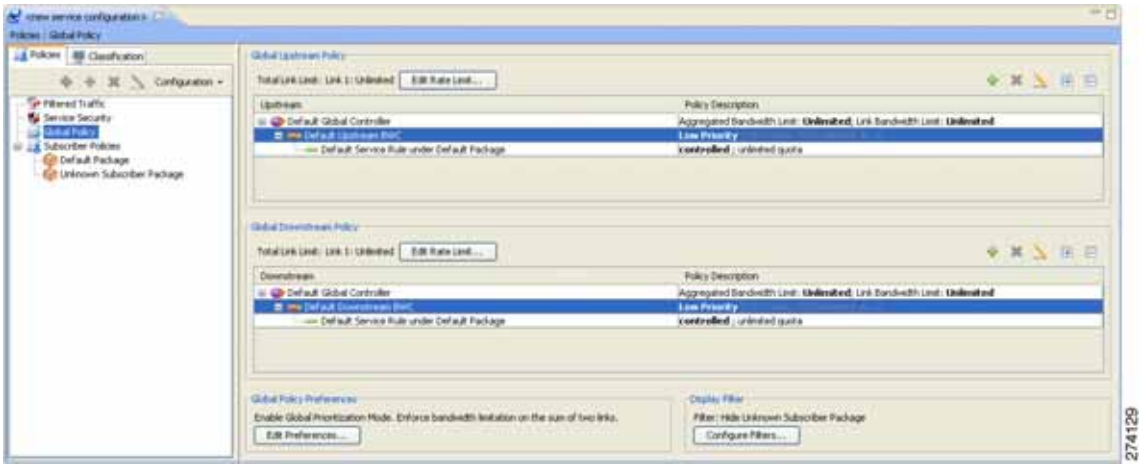
If no service configurations are open when you open the Service Configuration Editor tool, a No Service Configuration Is Open dialog box appears:

a. To create a new service configuration, click **Yes**. A New Service Configuration Settings dialog box appears.

b. Select an operational mode for the service configuration.

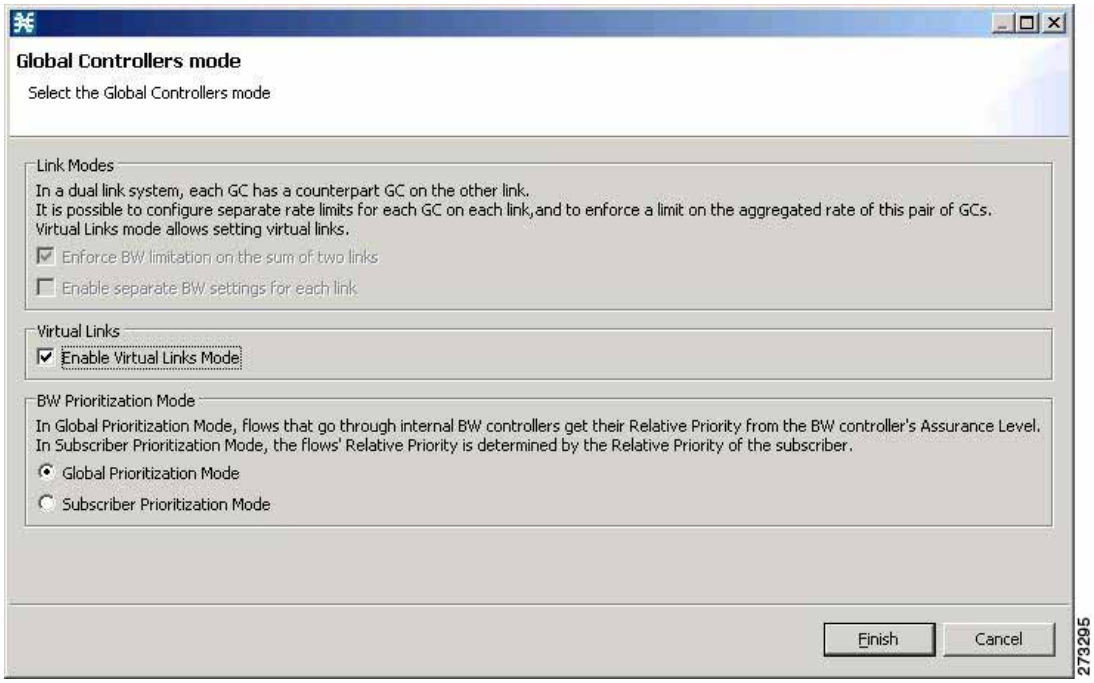
c. Click **OK**.

The new service configuration is added to the Console window that becomes the active service configuration.



Step 4 In the Global Policy Preferences area, click **Edit Preferences**.

The Global Controllers mode dialog box appears.



Step 5 Check the **Enable Virtual Links Mode** check box.

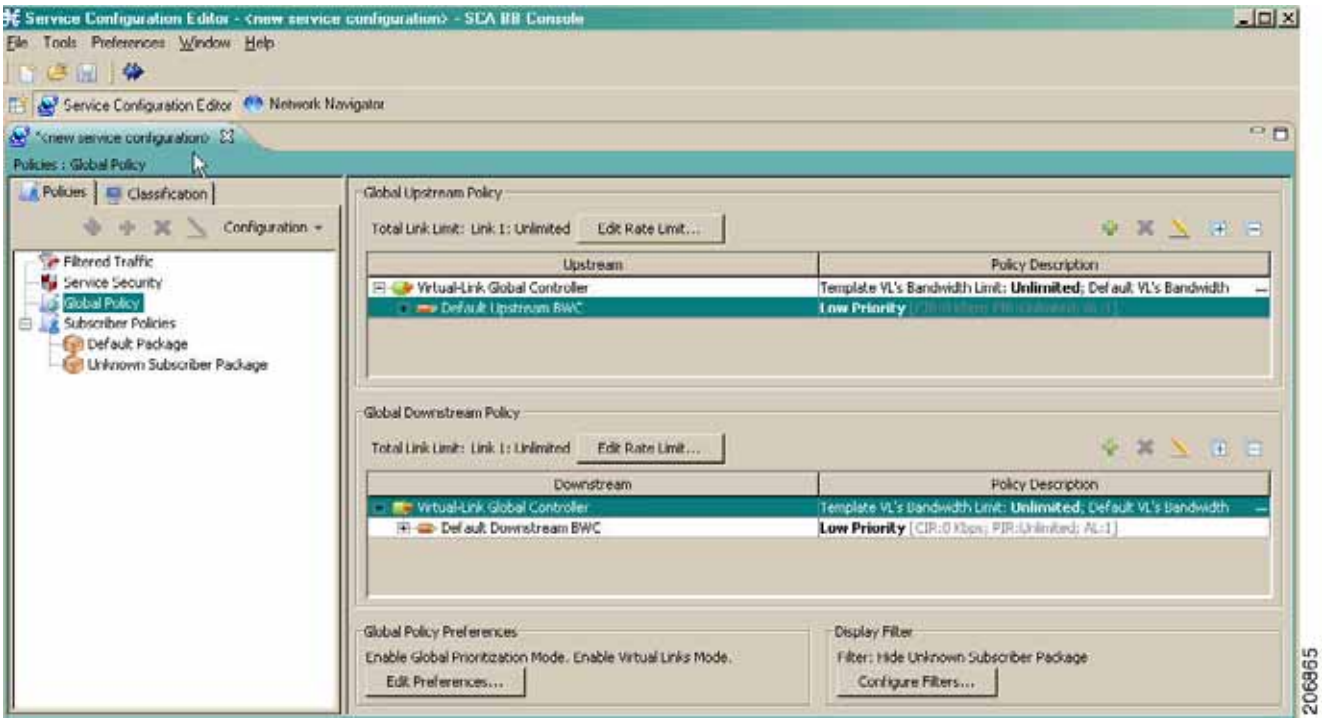
The Apply Template rate limits to all Virtual Links? dialog box appears.

Step 6 Click **Reset all Virtual Links to Template rate limits** when you change the number of Global Controllers.

Click **Keep Virtual Link rate limits unchanged** to retain the current Virtual Links rate limits. Only the defined Virtual link is set to the new template rate limit.

Step 7 Click **Finish**.

The new service configuration window appears.



For more information on the Service Configuration Editor, see *Cisco Service Control Application for Broadband User Guide*.

Virtual link global controllers can be added, edited, and deleted in the same way as regular global controllers. For more information, see the following sections:

- How to Add Global Controllers, page 4-6
- How to Add Global Controllers inside Virtual Link, page 4-8
- How to Edit Package Subscriber BWCs, page 4-11

How to Add Global Controllers

Note You can edit the default global controller settings, however, the default instance of global controller cannot be deleted.

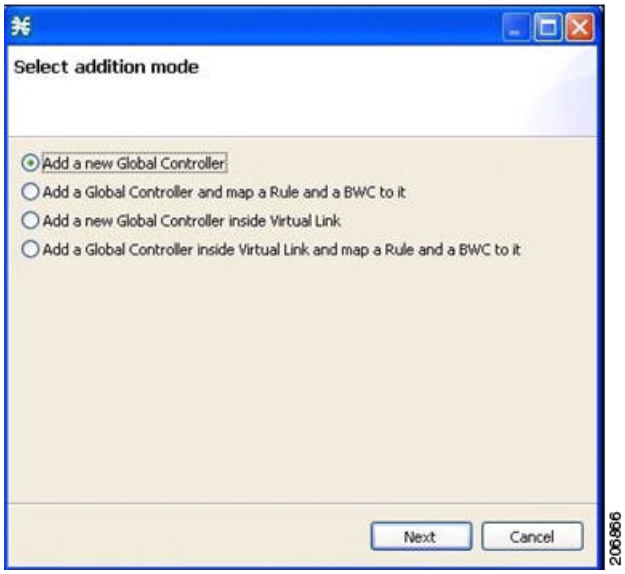
Step 1 In the Policies tab, click **Global Policy**.

The Global Bandwidth Settings dialog box is displayed in the right (Rule) pane.

Step 2 Above the area (Upstream or Downstream) of the desired interface, click (**Add**).

The Select Addition mode dialog box appears (Figure 4-2).

Figure 4-2 Select Addition Mode



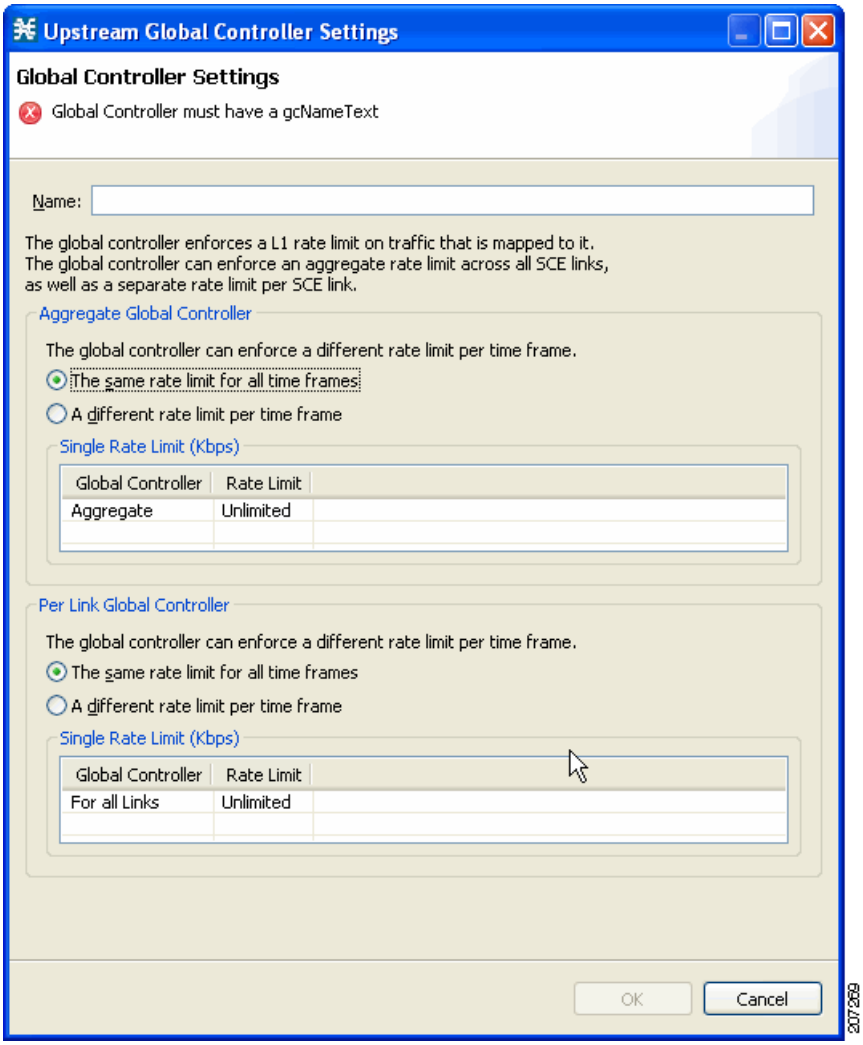
Step 3 To add a new global controller, choose the **Add a new Global Controller** radio button.

Step 4 Click **Next**.

The Global Controller Settings dialog box appears (Figure 4-3).

Note The display of Figure 4-3 depends on the global controller mode setting.

Figure 4-3 Upstream Global Controller Settings



Step 5 In the **Name** field enter a meaningful name.

Step 6 Edit the maximum bandwidth of aggregate and per link global controller rate limit.

Step 7 Click **OK**.

Your changes are saved.

The Global Controller Settings dialog box closes.

How to Add Global Controllers inside Virtual Link

You can create AGCs inside a virtual link global controller.

Note You can edit the default global controller settings, however, the default instance of global controller cannot be deleted.

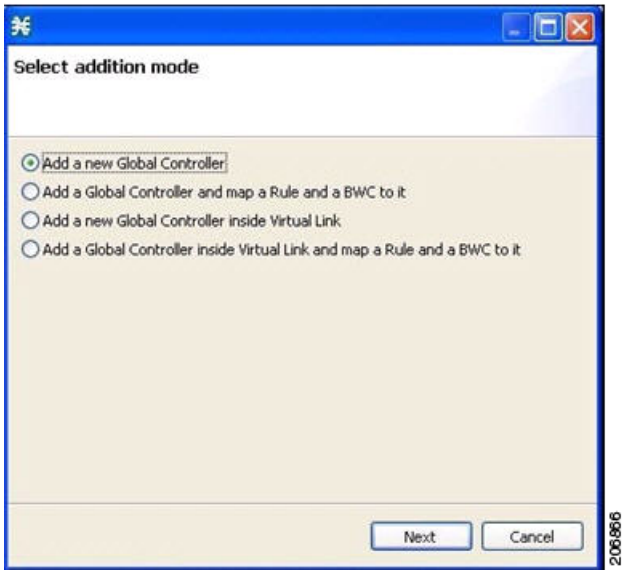
Step 1 In the Policies tab, click **Global Policy**.

The Global Bandwidth Settings dialog box is displayed in the right (Rule) pane.

Step 2 Above the area (Upstream or Downstream) of the desired interface, click (**Add**).

The Select Addition mode dialog box appears (Figure 4-4).

Figure 4-4 Select Addition Mode



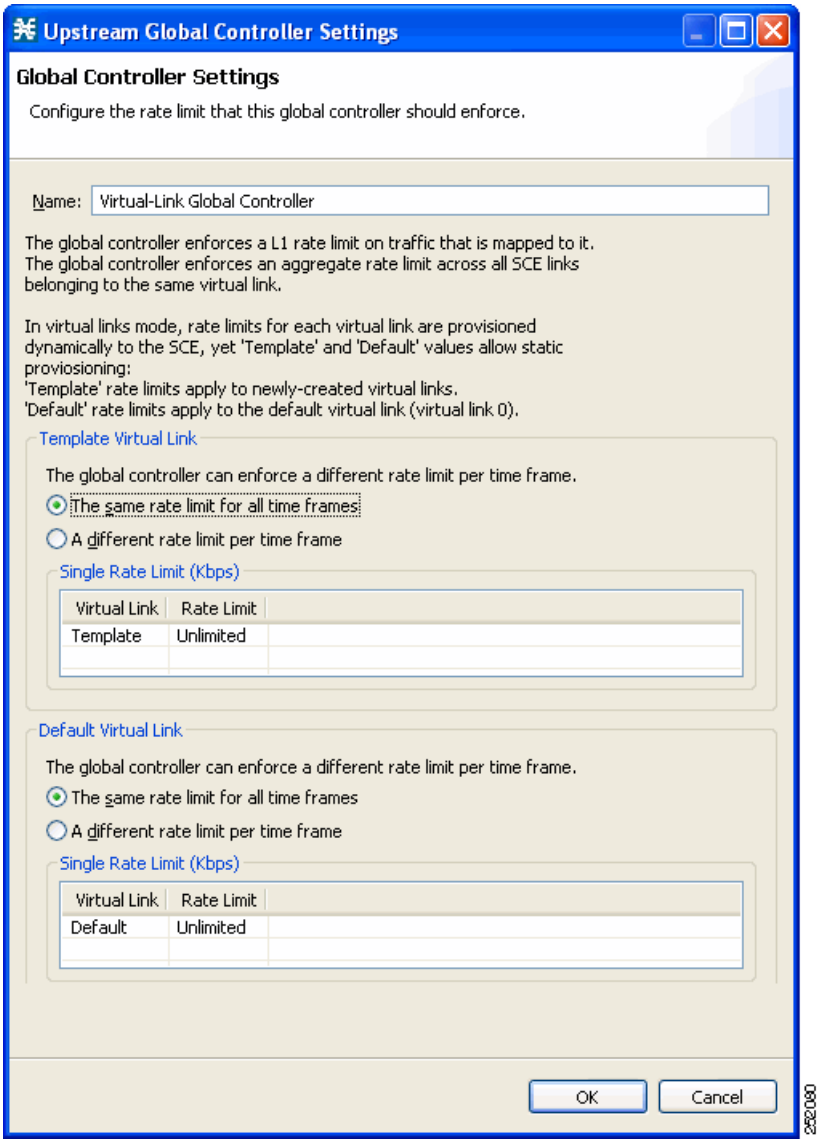
Step 3 To add a new global controller within a virtual link, choose the **Add a new Global Controller inside Virtual Link** radio button.

Step 4 Click **Next**.

The Global Controller Settings dialog box appears (Figure 4-5).

Note The display of Figure 4-5 depends on the global controller mode setting.

Figure 4-5 Upstream Global Controller Settings



Step 5 In the **Name** field enter a meaningful name.

Step 6 Edit the maximum bandwidth of the template and the default values rate limit

Step 7 Click **OK**.

Your changes are saved.

The Global Controller Settings dialog box closes.

How to Edit Package Subscriber BWCs

Step 1 In the Policies tab, click **Global Policy**.

The Global Bandwidth Settings dialog box in the right (Rule) pane.

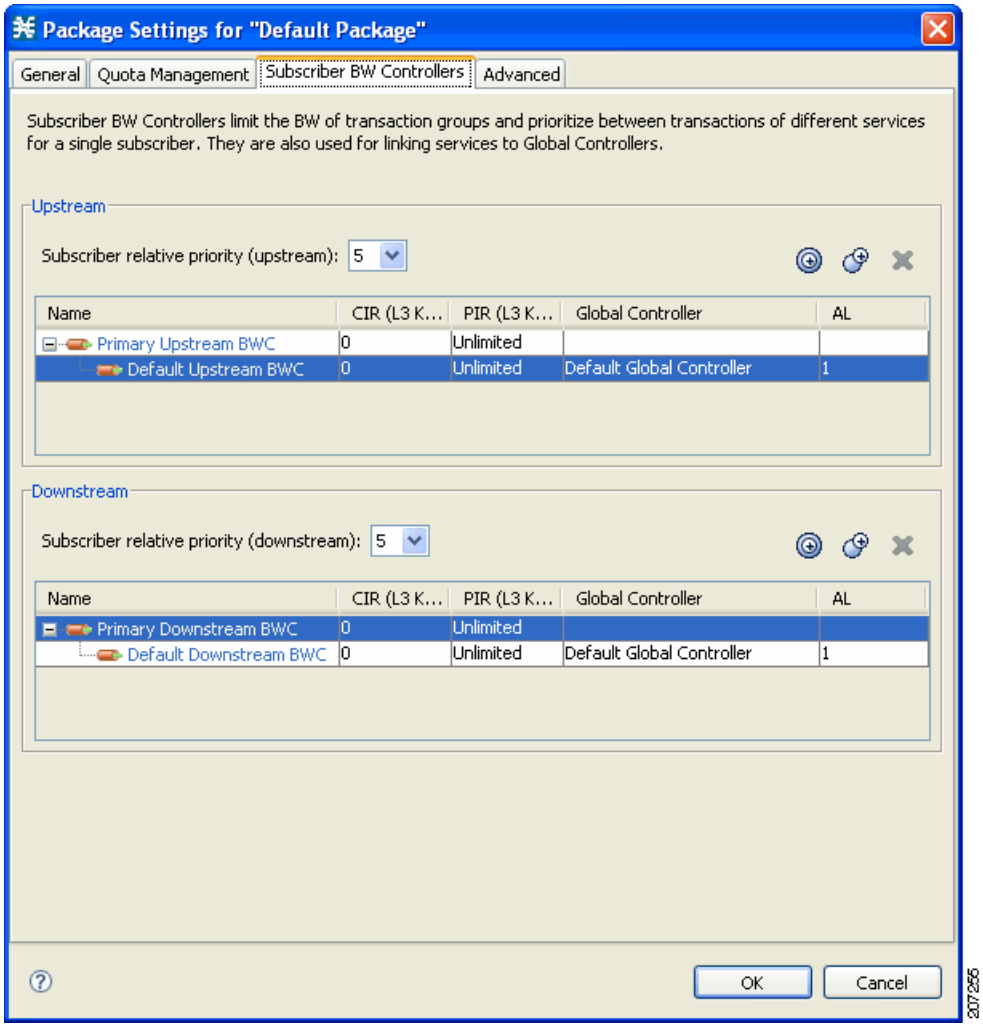
Step 2 In the right (Rule) pane, select a BWC and click (**Edit**).

The Package Settings dialog box appears.

Step 3 In the Package Settings dialog box, click the **Subscriber BW Controllers** tab.

The Subscriber BW Controllers tab opens (Figure 4-6).

Figure 4-6 Subscriber BW Controllers Tab



Step 4 Set your requirements for upstream bandwidth control in the Upstream area of the dialog box.

a. Select a value from the Subscriber relative priority drop-down list.

b. Set the parameters for the Primary Upstream BWC.

– In the CIR field, enter the BWC CIR in Kbps.

– In the PIR field, select **Unlimited** from the drop-down list, or enter the BWC PIR in Kbps.

c. To add BWCs to the package, click (**Add a sub BW Controller)** once for each additional BWC.

d. To add Extra BWCs to the package, click (**Add an extra BW Controller)** once for each additional BWC.

e. Set the parameters for each BWC (including the Primary and Default BWCs).

– (Optional) In the Name field, enter a meaningful name for each BWC. (You cannot rename the Primary or Default BWCs.)

– In the CIR field, enter a value for the BWC CIR in Kbps.

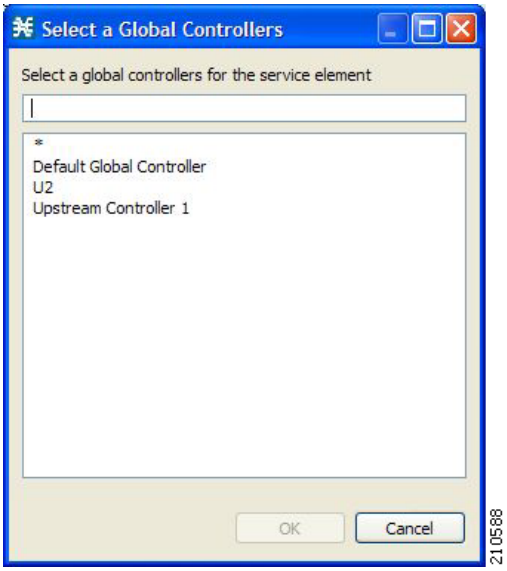
– In the PIR field, select **Unlimited** from the drop-down list, or enter a value for the BWC PIR in Kbps.

– To set the global controller with which this BWC is associated:

Click in the Global Controller cell of the BWC, and then click the **Browse** button that appears.

The Select a Global Controller dialog box appears (Figure 4-7).

Figure 4-7 Select a Global Controller



– Select a global controller and click **OK**.

– Select a value from the AL drop-down list.

Step 5 Repeat Step 3 for downstream bandwidth control in the Downstream area of the dialog box.

Step 6 Click **OK**.

The Package Settings dialog box closes.

All changes to the BWC settings are saved.

Applying Service Configurations to SCE Platforms

Step 1 Using the Network Navigator tool, in the Site Manager tree, right-click an SCE device. A popup menu appears.

Step 2 From the menu, choose **Apply Service Configuration**.

The Choose Policy dialog box appears, listing all service configurations that are open in the Service Configuration Editor.

Note If only one service configuration is open in the Service Configuration Editor, a Password Management dialog box appears. Go to Step 5.

Note If the open policy is a virtual links policy, the Apply Template Virtual Links Values dialog box prompts you to apply the template virtual links value to the existing virtual links. Go to Step 4.

Step 3 Select a service configuration from the list.

Step 4 Click **OK**.

If the policy is a virtual links policy, the Apply Template Virtual Links Values dialog box prompts you to apply the template virtual links value to the existing virtual links.

To apply the template virtual links value to the existing virtual links, click **Yes**.

A Password Management dialog box appears.

Step 5 Enter the appropriate password.

Step 6 Click **Apply**.

The Password Management dialog box closes. An Applying service configuration to SCE progress bar appears. The service configuration is applied to the selected SCE platform.

Configuring the Virtual Links Manager

Step 1 On the subscriber manager machine, open the p3sm.cfg configuration file, which is located in the ~pcube/sm/server/root/config/ directory.

For details about making configuration changes in the p3sm.cfg file, see the “Configuration Files Options” chapter of *Cisco Service Control Management Suite Subscriber Manager User Guide*.

a. Create a section for any SCE devices and define the IP address and optionally the port values of the SCE devices. The following example shows the SCE sections created for two SCE devices named SCE1 and SCE2:

```
[SCE.SCE1]
ip=209.165.201.2
[SCE.SCE2]
ip=209.165.201.3
```

b. (Optional) Create a section for the collection manager and define the IP address and the connected SCE devices. Defining the CM port value is optional; if a value is not defined, the default value of 14375 is used.

The following example shows the CM section created that receives the RDRs for two SCE devices named SCE1 and SCE2:

```
[CM.CM1]
ip=209.165.202.129
port=14375
sce_list=SCE1,SCE2
```

Note Using a collection manager is optional and is not required for the solution to work. However, if you do not use a collection manager, all the virtual link reports can be selected only by the virtual link index and not by the virtual link name.

Step 2 Save and close the p3sm.cfg configuration file.

Step 3 On the subscriber manager machine, open the dhcpsnif.cfg configuration file which is located in the ~pcube/sm/server/root/config/ directory.

For details about making configuration changes in the dhcpsnif.cfg file, see the "SCE-Sniffer DHCP LEG" section in "Configuring the SCE-Sniffer DHCP LEG" chapter of *Cisco SCMS SM LEGs User Guide*.

a. In the [SCE-Sniffer DHCP LEG] section, set the start value to **yes**.

```
[SCE-Sniffer DHCP LEG]
start=yes
```

All other values can be left at default values.

b. In the [Subscriber ID] section, set the dhcp_option to the DHCP option that contains the subscriber ID and set the dhcp_option_type to binary. For example:

```
[Subscirber ID]
dhcp_option=82:2
dhcp_option_type=binary
```

All other values can be left at default values.

Step 4 Save and close the dhcpsnif.cfg configuration file.

Step 5 On the subscriber manager machine, open the dhcp_pkg.cfg configuration file which is located in the ~pcube/sm/server/root/config/ directory.

For details about modifying configuration in the dhcp_pkg.cfg file, see the "SCE-Sniffer DHCP LEG" section, in "Configuring the SCE-Sniffer DHCP LEG" chapter of *Cisco SCMS SM LEGs User Guide*.

a. Define a downstream virtual link policy by setting the parameters:

```
[DHCP.Policy.VirtualLinkDownstream]
policy_property_name=downVlinkId
options_order_for_policy_name=giaddr,82:1
options_type=integer,binary
allow_login_with_no_policy=true
use_default=false
default_policy=0
```

Note Do not define the mapping_table parameter.

b. Define an upstream virtual link policy by setting the parameters:

```
[DHCP.Policy.VirtualLinkUpstream]
policy_property_name=upVlinkId
options_order_for_policy_name=giaddr,82:1
options_type=integer,binary
allow_login_with_no_policy=true
use_default=false
default_policy=0
```

Note Do not define the mapping_table parameter.

c. Detect if the subscriber is related to the DOCSIS 3.0 wideband interface

– The attribute related to [DHCP.Policy.VirtualLinkUpstream] and [DHCP.Policy.VirtualLinkDownstream] parameters is docsis_3_cm_detection. The value of attribute is Modem_Type.DOCSIS3.0.

Note It is mandatory to enter values for the Modem_Type.DOCSIS3.0 field.

```
docsis_3_cm_detection=Modem_Type.DOCSIS3
```

d. Define the rules to define DHCP data coming from the DOCSIS 3.0 cable modem interface

– To identify if the cable modem type is DOCSIS 3.0

```
[Modem_Type.DOCSIS3.0]
```

This parameter has two attributes option and option_type

The format of the parameter is the option number itself

or

For DHCP options which have sub-options the format is the DHCP option and sub-option type separated by a colon.

For example:

```
# 43:123 or 61
(default option 67, "Boot filename")
option=67
```

– The format type of DHCP option is defined by the 'dhcp_option' parameter. Optional values are 'binary' (binary string that is converted to an ASCII hexadecimal string) or 'string' (ASCII string). The default value is string.

```
option_type=string
```

– The parameter to define the search pattern to verify that the cable modem belongs to DOCSIS 3.0 is option_pattern. The value for this parameter is a single regular expression pattern per dhcp_option. If there are more than one dhcp_option, then the values for option_pattern is a list of regular expression patterns (one pattern per option) separated by comma. The default value is 3.0.

```
option_pattern=3.0
```

Step 6 Save and close the dhcp_pkg.cfg configuration file.

Note When the VLM is activated, the DHCP sniffer adds a custom property to each subscriber with the value of the giaddr option, which is one of the CMTS IP addresses.

Step 7 On the subscriber manager machine, open the vlink.cfg configuration file which is located in the ~pcube/sm/server/root/config/ directory.

a. In the [General] section, configure the following parameters:

– start—Setting the start parameter to yes instructs the SM to start the Virtual Link Manager (VLM) when the SM starts. Possible values for this parameter are yes and no.

Note When the start parameter is set to no, the data stored in the database for all CMTS devices is deleted.

– monitoring_period—Determines the interval in minutes at which the VLM queries the CMTS devices for any interface changes. Setting this parameter to 0 stops the VLM querying the CMTS devices, but does not stop the VLM. The default value is 60.

– upstream_vlink_factor—Determines the percentage of the interface bandwidth that the SCE allows to be sent from the CMTS device to the Internet. The default value is 95.

Note downstream_vlink_factor—Determines the percentage of the interface bandwidth that the SCE allows to be sent from the Internet to the CMTS device. The default value is 95.

Note When defining the upstream_vlink_factor and downstream_vlink_factor parameters, take precaution. Setting a value too low causes bandwidth capacity to be wasted. Setting a value too high causes data to be lost because of dropped packets.

– log_all—Setting the log_all parameter to true causes the system to dump log messages to the user log.

– upstream_global_controller_list—Determines the list of non default upstream global controllers, which are defined in the template and managed by VLM.

– downstream_global_controller_list—Determines the list of non default downstream global controllers, which are defined in the template and managed by VLM.

For more information, see the "Configuring Virtual Links Global Controllers" section on page 4-4.

Note Every global controller defined in the configuration file should exist in the policy configuration.

– upstream_global_controller_pir_percentage—(Optional) Determines the percentage of the PIR values of the wideband interfaces. One or more PIR values can be configured, each value corresponds to the global controller that belongs to the global controller list.

Note If the PIR values are not configured, then the default PIR values are used to determine the percentage.

– downstream_global_controller_pir_percentage—(Optional) Determines the percentage of the PIR values of the wideband interfaces. One or more PIR values can be configured, each value corresponds to the global controller that belongs to the global controller list.

– enable_dynamic_giaddrs_learning—(Optional) Avoids learning new giaddrs while login. If this value is set to false, if SM identifies during the login that the relay agent does not belong to a known CMTS , then SM ignores the query and continues with the login. This functionality is applicable only for static device configuration. The default value is true.

Note Setting log_all to true can cause performance degradation.

The following example shows the [General] section of the vlink.cfg configuration file:

```
[General]
start=true
monitoring_period=60
upstream_vlink_factor=95
downstream_vlink_factor=95
log_all=false
upstream_global_controller_list=agc_a, agc_b
downstream_global_controller_list=agc_d, agc_e
upstream_global_controller_pir_percentage=80,90
downstream_global_controller_pir_percentage=85,85
enable_dynamic_giaddrs_learning=true
```

b. Modify the SCE container such that it load all SCE IP addresses specified in vlink.cfg as sceIPs in cache. This confirms that VLM integration is done for the DHCP packets only if it comes from those SCEs that are part of the VLM configuration (vlink.cfg).

c. For each CMTS device, configure a [Device.<device name>] section with the following parameters:

Note The <device name> of the section is used as part of the virtual link name for all virtual links associated with this CMTS device. The name of the CMTS device also appears in the reporter.

– ip—Specifies the IP address of the CMTS device.

– sce_name—Specifies the name of the SCE to which the CMTS device is connected. The sce_name must match an SCE section defined in the p3sm.cfg configuration file.

– upstream_vlink_factor—(Optional) Determines the percentage of the interface bandwidth that the SCE allows to be sent from this CMTS device to the Internet. Setting this parameter overrides the setting in the [General] section. If it is not configured, the value defined in the [General] section is used. The default value is 95.

– downstream_vlink_factor—(Optional) Determines the percentage of the interface bandwidth that the SCE allows to be sent from the Internet to this CMTS device. Setting this parameter overrides the setting in the [General] section. If it is not configured, the value defined in the [General] section is used. The default value is 95.

– log_all—Setting the log_all parameter to true causes the system to dump log messages to the user log for this CMTS device. If the log_all parameter in the [General] section is true, setting this parameter to false has no effect; if the log_all parameter in the [General] section is false, setting this parameter to true enables logging for operations related only to this CMTS device; such as, CMTS device creation and deletion.

– upstream_global_controller_list—(Optional) Determines the list of non default upstream global controllers, which are defined in the template and managed by VLM. If it is not configured, the value defined in the [General] section is used.

– downstream_global_controller_list—(Optional) Determines the list of non default downstream global controllers, which are defined in the template and managed by VLM. If it is not configured, the value defined in the [General] section is used.

Note Every global controller defined in the configuration file should exist in the policy configuration.

– upstream_global_controller_pir_percentage—(Optional) Determines the percentage of the PIR values of the wideband interfaces. One or more PIR values can be configured, each value corresponds to the global controller that belongs to the global controller list. If it is not configured, the value defined in the [General] section is used.

Note If the PIR values are not configured, then the default PIR values are used to determine the percentage.

– downstream_global_controller_pir_percentage—(Optional) Determines the percentage of the PIR values of the wideband interfaces. One or more PIR values can be configured, each value corresponds to the global controller that belongs to the global controller list. If it is not configured, the value defined in the [General] section is used.

– snmp_community—Specifies the SNMP community value for the VLM to communicate with the CMTS device. The default value is public.

– giaddr_external—For each giaddr value, the VLM creates a policy mapping table in the DHCP LEG without waiting for a login from the giaddr values. Use this parameter to insert giaddr values to the mapping table that was created by the VLM after querying the CMTS device. Use a comma ‘,’ delimiter between IP addresses. The default value for this parameter is empty.

– giaddr_replace—Specifies whether or not the VLM uses the IP addresses defined in the giaddr_external parameter as the only giaddr list of the CMTS device. When set giaddr_replace=no, the VLM uses the IP addresses defined in giaddr_external and the giaddr list that is found when querying the CMTS device as the CMTS giaddr list. Possible values for this parameter are yes and no. The default value is no.

– giaddr_remove—For each giaddr value, the VLM creates a policy mapping table in the DHCP LEG without waiting for a login from the giaddr values. Use this parameter to remove a list of IPs from the mapping table that was created by the VLM after querying the CMTS device. Use a comma ‘,’ delimiter between IP addresses.

The following example shows a [Device.<device name>] section of the vlink.cfg configuration file:

```
[Device.CMTS1]
ip=192.0.2.10
sce_name=SCE1
log_all=false
upstream_global_controller_list=agc_a, agc_b
downstream_global_controller_list=agc_d, agc_e
upstream_global_controller_pir_percentage=80,90
downstream_global_controller_pir_percentage=85,85
```

d. Configure a device template that enables the users to define the dynamic device behavior. For more information on creating dynamic device, see "Dynamic giaddr Learning" section on page 3-2.

The required parameters are:

- start—Setting the start parameter to yes instructs the Virtual Link Manager (VLM) to create a dynamic device template. Possible values for this parameter are yes and no. If the start is set to true, the VLM creates the dynamic device.

  If start is set to false, the VLM does not create a dynamic device. Setting the start value from true to false, disables the creation of dynamic device and the VLM deletes all the dynamic devices and their relevant data from the database.
- log_all—Setting the log_all parameter to true causes the system to dump log messages to the user log for this CMTS device. If the log_all parameter in the [General] section is true, setting this parameter to false has no effect; if the log_all parameter in the [General] section is false, setting this parameter to true enables logging for operations related only to this CMTS device; such as, CMTS device creation and deletion.
- snmp_port—(Optional) Specifies the SNMP port value for the VLM to communicate with the CMTS device. The default value is 161.
- snmp_community—(Optional) Specifies the SNMP community value for the VLM to communicate with the CMTS device. The default value is public.

Note The ip and sce_name are not defined instead retrieved from the DHCP data during login operations.

Step 8 Save and close the vlink.cfg configuration file.

Step 9 Load the configuration to the SM by running the following command on the SM machine from the bin directory. (Run the command as user pcube).

```
>p3sm --load-config
```

CHAPTER 5

Managing the Remote Cable MSO Links Solution

Revised: November 8, 2010, OL-21073-02

Introduction

This chapter describes the three monitoring mechanisms that you can use to monitor the traffic optimization on remote links solution:

- p3vlink command line utility (CLU)
- SCE command line interface (CLI)
- Reporter tool virtual links report template group

Virtual Links Names

Each virtual link represents a single interface on the CMTS device and the virtual link name comprises the CMTS device name and the interface name. The virtual links are named according to the following naming convention:

<Device name>_<Interface name>

- <Device name>—This portion of the name is set when configuring the CMTS in the vlink.cfg configuration file.
- <Interface name>—This portion of the name identifies the specific CMTS interface including the direction and the interface index. This information is how the CMTS describes the interface internally and is retrieved from the CMTS device using SNMP.
  - The direction portion of the virtual link name indicates the virtual link direction. This can be *upstream* or *downstream*.
  - The interface index indicates the specific interface on the CMTS of the virtual link.

The following is an example virtual link name for a CMTS device named Device-1:

```
Device-1_CMTS1/0-upstream 1
```

If a downstream virtual link contains two channels, then the virtual link names are displayed as:

<Device name>_<Interface name>-L<index of the primary channel>

or

<Device name>_<Interface name>-W

Monitoring Using the p3vlink Utility

The **p3vlink** utility provides the ability to show virtual link configurations and metrics related to the virtual links. The command format is:

```
p3vlink OPERATION [OPTIONS]
```

Table 5-1 and Table 5-2 lists the **p3vlink** operations and options.

Table 5-1 p3vlink Operations

Operation	Description	Notes
--show	Displays the current general configuration, CMTS device list, and CMTS device information.	—
--show-device	Displays general configuration of the specified CMTS device that is known to the VLM. To specify the CMTS device, use the **-d** option. To show all the links related to the CMTS device, specify the **--detail** option.	—
--resync	This command gets all the SCE virtual link configurations and sends it to the SCE, SCE-Sniffer DHCP LEG, and CM. To specify the SCE, use the option **-n SCE_NAME**. To specify a collection manager, use the option **-n CM_NAME**. In this case, the VLM gets all the SCE virtual links that are related to the specified collection manager and sends the data to the collection manager.	This is a nonblocking command. Query operation and synchronization operation is activated in the background.
--resync-all	For each SCE, this command gets all the SCE virtual link configurations and sends them to the SCE, SCE-Sniffer DHCP LEG, and collection manager.	This is a nonblocking command. Query operation and synchronization operation is activated in the background.
--start-query	Start the on demand query operation (and the CMTS device synchronization operation) for one CMTS device or more separated by “,”. To specify the CMTS device to be queried, use the option **-d <device name>**.	This is a nonblocking command. Query operation and synchronization operation is activated in the background.
--show-vlinks	Shows the virtual links and virtual link indexes related to the specified SCE. Use the option **-n <SCE name>** to specify the SCE. (Optional) To specify the prefix of the virtual links that you want this command to show, use the option **--prefix=<vlink prefix>**.	—
--show-vlink-data	Shows all the data related to the specified link. To specify the vlink, use the one of the following options: **--vlink-name=<name>** or **--vlink-id=<id>**, **--ne-name**, and **--direction**	—

Table 5-1 p3vlink Operations (continued)

Operation	Description	Notes
--show-subs	This command has two uses: Show all subscribers connected to a specific CMTS device. To specify the CMTS device, use the **-d <device name>** option. (Optional) To specify the virtual link ID, use the **--vlink-id=<id>** option. (Optional) To specify the virtual link direction, use the **--direction=<up|down>** option. (Optional) To specify the prefix of the virtual links that you want this command to show, use the option **--prefix=<vlink prefix>**. Show all subscribers connected to a specific CMTS device interface, or related to a specific CMTS device. To show all subscribers related to the vlink, use **--vlink-name=<name>**. Because each vlink represents one CMTS device interface, this command enables you to see all subscribers traveling from a specific CMTS device interface.	This command retrieves subscribers whose giaddr attribute is one of the CMTS devices giaddr attributes. The result can be filtered by using: • Prefix (first use only) • Vlink-id (first use only) • direction
--remove-device	Removes a dynamic device from the VLM. To specify the CMTS device, use the **-d <device name>** option.	Once the device is removed, VLM deletes all virtual links related to the device from the SCE. The subscribers of the affected device are logged in with default vlink mappings.
--enable-logging –d <device name>	Enables login on a specific device. To specify the CMTS device, use the **-d <device name>** option.	This command sets the log_all flag related to the device to true. During load-config and SM restart operations, the value of log_all is reset to the value defined in the configuration file.
--disable-logging –d <device name>	Disables login on a specific device. To specify the CMTS device, use the **-d <device name>** option.	This command sets the log_all flag related to the device to false. During load-config and SM restart operations, the value of log_all is reset to the value defined in the configuration file.

Table 5-2 p3vlink Options

SM Option	Abbreviation	Description
--ne-name=*NAME*	**-n** *NAME*	Specifies the logical name of the SCE platform or CM.
--device=*DEVICE*	**-d** *DEVICE*	Specifies the logical name of the CMTS device.
--direction=*up/down*	—	Specifies the direction of the virtual link.
--prefix=*vlink prefix*	—	Specifies the virtual link prefix.

Table 5-2 p3vlink Options (continued)

SM Option	Abbreviation	Description
--vlink-name=*vlink name*	—	Specifies the virtual link name.
--vlink-id	—	Specifies the index of the virtual link.
--detail	—	(Optional) To display additional information, use this option with the --show-device operation.

p3vlink Utility Examples

To show the CMTS device general configuration, CMTS device list, and CMTS device information:

```
p3vlink --show
General data:
-------------
        Start:                          Yes
        Monitor Every:                  60 minutes
        BW Up Factor                    95
        BW Down Factor                  95
        Next query operation:           Wed Nov 05 08:40:33 IST 2008
        Next ip removal operation:      Wed Nov 12 10:40:11 IST 2008
        Enable Device Learning:         true
        Upstream Global Controllers:    None
        Downstream Global Controllers: None
Device list
-----------
        1) Name: device, Host Name: Paris, Type Static, Query state: Completed, Last
successful query: Wed Nov 05 08:39:35 IST 2008

Command terminated successfully
>
```

To show the general configuration of a specified CMTS device:

```
p3vlink --show-device -d CMTS1 --detail
Name:                           CMTS1
Host Name:                      Paris
IP:                             192.0.2.10
Type:                           Static
SCE Related:                    sce0
Upstream factor:                95
Downstream factor:              95
Last success Query:             Thu Jun 19 17:54:48 IDT 2008
Last Query Attempt:             Thu Jun 19 17:54:48 IDT 2008
Last Query Status:              Completed
Sync state with SCE:            done
Sync state with CM:             done
Giaddr List:                    127.0.0.1
Upstream Global Controllers:    None
Downstream Global Controllers: <GC Name>=<GC Value>,<GC Name>=<GC Value>…
isLogAll:                       true
Num of up interfaces:           6
Num of down interfaces:         2
```

```
VLink Information:
1) Name: CMTS1_Cmts0/0-upstream2, Vlink Id: 1, Direction UP, PIR 5000 kbps.
2) Name: CMTS1_Cmts0/0-downstream1, Vlink Id:1, Direction DOWN, PIR 10000 kbps
       Channel Name: <vlink Name>-W, index <value>, PIR <value> kpbs, CIR <value> kpbs
       Channel Name: <vlink Name>-L<channel index>, index <value>, PIR <value> kpbs, CIR
<value> kpbs
3) Name: CMTS1_Cmts0/0-upstream3, Vlink Id:2, Direction UP, PIR 10000 kbps.
4) Name: CMTS1_Cmts1/0-downstream1, Vlink Id:2, Direction DOWN, PIR 20000 kbps.
5) Name: CMTS1_Cmts0/0-upstream1, Vlink Id:3, Direction UP, PIR 10000 kbps.
6) Name: CMTS1_Cmts1/0-upstream2, Vlink Id:4, Direction UP, PIR 20000 kbps.
7) Name: CMTS1_Cmts1/0-upstream3, Vlink Id:5, Direction UP, PIR 20000 kbps.
8) Name: CMTS1_Cmts1/0-upstream1, Vlink Id:6, Direction UP, PIR 20000 kbps.

Command terminated successfully
>
```

The output of this command includes the following four information elements:

- Num of up interfaces—Summarizes the total number of upstream virtual links related to this CMTS device. *Unknown* indicates that the VLM was not able to communicate with the CMTS device.
- Num of down interfaces—Summarizes the total number of downstream virtual links related to this CMTS device. *Unknown* indicates that the VLM was not able to communicate with the CMTS device.
- Sync state with SCE:
  - Done—The SCE is fully synchronized with CMTS device information. When working in cascade mode, both the active and standby SCEs are synchronized with CMTS device data.
  - Not-done—The SCE (or one of the SCEs in cascade mode) is not synchronized with all CMTS device data. Use the command **p3vlink --resync -n** *<sce which manages the device>* to perform the synchronization operation.
  - Sync-in-process—When VLM detects configuration changes, the change needs to be sent to the SCE. During the update process, the VLM changes the sync to Sync-in-process state.

    For successful updates, the SCE sync state is set to Done else the value is set to Not-Done.
- Sync state with CM:
  - Done—The CM is fully synchronized with CMTS device information.
  - Not-done—The CM is not synchronized with all CMTS device data. Use the command **p3vlink --resync -n** *<sce which manages the device>* to perform the synchronization operation.
  - N/A—The SCE to which the CMTS device belongs, is not connected to any CM.
  - Sync-in-process – When VLM detects configuration changes, the change needs to be sent to the CM. During the update process, the VLM changes the sync to Sync-in-process state.

    For successful updates, SCE sync state is set to Done else the value is set to Not-Done.
- Last Query Status:
  - Not started—Query operation for the device was not started since the last SM boot.
  - Completed—Last query was completed successfully.
  - Failure
  - Waiting for query—Query operation is in queue waiting for resources.
  - In-query—Device is in the process of a query operation.
  - Waiting For Deletion—During the last query, if no giaddr was found, the system queues up the device for deletion. This is applicable to dynamic devices only.

To show all the virtual links for a specific network element (SCE):

```
p3vlink --show-vlinks -n sc0
device0_0_Cmts0/1-downstream1, vlink id=15, direction=DOWN
device0_0_Cmts0/1-upstream1, vlink id=8, direction=UP
device0_0_Cmts0/1-upstream2, vlink id=16, direction=DOWN
device0_1_Cmts1/1-downstream1, vlink id=11, direction=DOWN
device0_1_Cmts1/1-upstream1, vlink id=6, direction=UP
device0_1_Cmts1/1-upstream2, vlink id=12, direction=DOWN
device0_2_Cmts2/1-downstream1, vlink id=25, direction=DOWN
device0_2_Cmts2/1-upstream1, vlink id=13, direction=UP
device0_2_Cmts2/1-upstream2, vlink id=26, direction=DOWN
device0_3_Cmts3/1-downstream1, vlink id=13, direction=DOWN
device0_3_Cmts3/1-upstream1, vlink id=7, direction=UP
device0_3_Cmts3/1-upstream2, vlink id=14, direction=DOWN
device0_4_Cmts4/1-downstream1, vlink id=21, direction=DOWN
device0_4_Cmts4/1-upstream1, vlink id=11, direction=UP
device0_4_Cmts4/1-upstream2, vlink id=22, direction=DOWN
device0_5_Cmts5/1-downstream1, vlink id=1, direction=DOWN
device0_5_Cmts5/1-upstream1, vlink id=1, direction=UP
device0_5_Cmts5/1-upstream2, vlink id=2, direction=DOWN
device0_6_Cmts6/1-downstream1, vlink id=9, direction=DOWN
device0_6_Cmts6/1-upstream1, vlink id=5, direction=UP
device0_6_Cmts6/1-upstream2, vlink id=10, direction=DOWN
device1_0_Cmts7/1-downstream1, vlink id=3, direction=DOWN
device1_0_Cmts7/1-upstream1, vlink id=2, direction=UP
device1_0_Cmts7/1-upstream2, vlink id=4, direction=DOWN
device1_1_Cmts8/1-downstream1, vlink id=7, direction=DOWN
device1_1_Cmts8/1-upstream1, vlink id=4, direction=UP
device1_1_Cmts8/1-upstream2, vlink id=8, direction=DOWN
device1_2_Cmts9/1-downstream1, vlink id=27, direction=DOWN
device1_2_Cmts9/1-upstream1, vlink id=14, direction=UP
device1_2_Cmts9/1-upstream2, vlink id=28, direction=DOWN
device1_3_Cmts10/1-downstream1, vlink id=23, direction=DOWN
device1_3_Cmts10/1-upstream1, vlink id=12, direction=UP
device1_3_Cmts10/1-upstream2, vlink id=24, direction=DOWN
device1_4_Cmts11/1-downstream1, vlink id=19, direction=DOWN
device1_4_Cmts11/1-upstream1, vlink id=10, direction=UP
device1_4_Cmts11/1-upstream2, vlink id=20, direction=DOWN
device1_5_Cmts12/1-downstream1, vlink id=5, direction=DOWN
device1_5_Cmts12/1-upstream1, vlink id=3, direction=UP
device1_5_Cmts12/1-upstream2, vlink id=6, direction=DOWN
device1_6_Cmts13/1-downstream1, vlink id=17, direction=DOWN
device1_6_Cmts13/1-upstream1, vlink id=9, direction=UP
device1_6_Cmts13/1-upstream2, vlink id=18, direction=DOWN
Command terminated successfully
```

To show the vlink data of a specific link:

```
p3vlink --show-vlink-data --vlink-name=device_Cmts0/0-downstream1
VLink Name: device_Cmts0/0-downstream1
VLink Id:    1
Direction:    downstream
SCE Name:     sce0
Device Name:  device
PIR:     200000000


Channels related to VLink
<name>-L, index <index>, PIR <value>, CIR <value>
<name>-W, index <index>, PIR <value>, CIR <value>
```

```
Related upstream virtual links —Lists all upstream interface related to the same MAC layer
as the selected downstream interface.
device_Cmts0/0-upstream0
device_Cmts0/0-upstream1
device_Cmts0/0-upstream2
device_Cmts0/0-upstream3
```

Note If more than one vlink has the same name, this command displays the information for all the vlinks.

To show the subscribers using virtual links:

- Use the **p3subsdb** command to list all the subscribers:

```
p3subsdb --show-all
lynn_jones
Command terminated successfully
>
```

- Use the **p3subs** command to show the virtual links of a particular subscriber:

```
p3subs --show -s lynn_jones
Name:           lynn_jones
Domain:         subscribers
Mappings:
        IP: 1.1.1.13/32
Properties:
        downVlinkId=7    Name=device1_1_Cmts8/1-downstream1
        upVlinkId=4      Name=device1_1_Cmts8/1-upstream1
Custom Properties:
        giaddr=1.1.1.1
Command terminated successfully
>
```

- Use the **p3vlink** command to show the subscribers that are associated with a particular CMTS device:

```
p3vlink --show-subs -d device1_1
Subscribers related to device: device1_1 vlink-id: 4, giaddr: 1.1.1.1, direction UP
lynn_jones
Subscribers related to device: device1_1 vlink-id: 7, giaddr: 1.1.1.1, direction DOWN
lynn_jones
Command terminated successfully
>
```

- Use the **p3vlink** command to show the subscribers that are associated with a particular channel:

```
p3vlink --show-subs -d Test0 --direction=Down --vlink-id=23
Subscribers related to device: Test0 vlink-id: 23, giaddr: 24.191.128.17, direction
DOWN010101010106010101010107
Command terminated successfully

p3vlink --show-subs --vlink-name test1_Cmts0/0-upstream2
Subscribers related to device: test1 vlink-id: 5, giaddr: 10.78.233.149, direction UP
010101010101
1 subscriber was found
Command terminated successfully
>
```

Monitoring Virtual Links Using the SCE CLI

The SCE provides CLI commands to monitor the virtual links in the solution.

Table 5-3 lists the virtual links CLI commands.

Table 5-3 Virtual Links Commands

Commands	Description
Show Commands	
show interface LineCard 0 virtual-links [all | changed | different-from-template]	This command has three uses: • To display all the defined virtual links, use the **all** option. • To display virtual links whose configurations have changed from the template, use the **changed** option. • To display virtual links configurations that differ from the template, use the **different-from-template** option.
show interface LineCard 0 virtual-links [status | mapping]	Displays the status of virtual links and updates the log with virtual links mapping. To display the status of the virtual link, use the **status** option. To update the log with virtual link mapping, use the **mapping** option. This is a debug command.
show interface LineCard 0 virtual-links template [direction [upstream | downstream]]	Displays the virtual link template of both upstream and downstream (Optional) To show only one direction, use the **[direction [upstream | downstream]]** option.
show interface LineCard 0 virtual-links default direction [upstream | downstream] [counter | agc-mapping]	Displays the default virtual link. (Optional) To specify the agc-mapping between virtual link and the actual agc indexes, use the **agc-mapping** option. (Optional) To specify the counter along with agc-mapping, enforce rate and actual rate, use the **counter** option.
show interface LineCard 0 virtual-links [name <name> | index <index>] direction [upstream | downstream] [counter | agc-mapping]	Displays the virtual link by name or index. To display the name or index of the virtual link, use the **[name <name> | index <index>]** option. (Optional) To specify the agc-mapping between virtual link and the actual agc indexes, use the **agc-mapping** option. (Optional) To specify the counter along with agc-mapping, enforce rate and actual rate, use the **counter** option.
Add Commands	
virtual-links index <index> direction [upstream | downstream]	Adds a virtual link index. (Optional) To specify a direction, use the **[direction [upstream | downstream]]** option.

Table 5-3 Virtual Links Commands (continued)

Commands	Description
virtual-links index <index> name <name> direction [upstream | downstream]	Adds a virtual link index and specifies a name To specify a name for the channel, use the **name** option. (Optional) To specify a direction, use the **[direction [upstream | downstream]]** option.
Remove Commands	
no Virtual-links index <index> direction [upstream | downstream]	Removes a virtual link associated with the specified index and direction To specify the index, use the **<index>** option. To specify the direction, use the **direction** option.
no Virtual-links all direction [upstream | downstream]	Removes all the virtual links.
Set Commands	
virtual-links index <index> direction [upstream | downstream] gc <offset> set-PIR value <value>	Sets the virtual link index pir values by gc-offset and direction
Reset Commands	
virtual-links index <index> direction [upstream | downstream] gc <offset> reset-PIR	Resets the virtual link index pir value by gc template offset and direction to template values.

virtual-links Command Examples

The following examples show the output from the CLI virtual links commands.

```
SCE2000#> show interface Linecard 0 virtual-links template
Virtual Link enabled
Global Virtual link Global Controller, upstream:
    name = globalGC - pir: 8000000 - cir: 0 - al: 5
    name = globalGC1 - pir: 8000000 - cir: 0 - al: 5
Virtual link Global Controller, upstream Template hierarchic:
Total bandwidth limit in Virtual-Link:
    name = Virtual-Link Global Controller - pir: 8000000,8000000,8000000,8000000 - cir: 0
    - al: 5
    name = appGC - pir: 8000000,8000000,8000000,8000000 - cir: 0 - al: 5
    Global Virtual link Global Controller, downstream:
    name = globalGC1 - pir: 8000000 - cir: 0 - al: 5
Virtual link Global Controller, downstream Template hierarchic:
Total bandwidth limit in Virtual-Link:
    name = Virtual-Link Global Controller - pir: 8000000,8000000,8000000,8000000 - cir: 0
    - al: 5
    name = appGC - pir: 8000000,8000000,8000000,8000000 - cir: 0 - al: 5
    name = appGC1 - pir: 8000000,8000000,8000000,8000000 - cir: 0 - al: 5
    name = appGC2 - pir: 8000000,8000000,8000000,8000000 - cir: 0 - al: 5

SCE2000#> show interface LineCard 0 virtual-links all
Virtual Link enabled
upstream Virtual-Link:
index=1, name=virtual link 1
index=2, name=virtual link 2
index=3, name=virtual link 3
downstream Virtual-Link:
```

```
index=1, name=virtual link 1
index=2, name=virtual link 2
index=3, name=virtual link 3

SCE2000#> show interface LineCard 0 virtual-links different-from-template
Virtual Link enabled
upstream Virtual-Link:
    virtual index=1, name=virtual link 1
        channel index=1, name=virtual channel 1, pir=99999, cir=99, al=9, agc index=3
        application index=1, name=appGC-1, pir=8000000, cir=0, al=5, agc index=2
    virtual index=2, name=virtual link 2
        channel index=2, name=virtual channel 2, pir=99999, cir=99, al=9, agc index=7
        application index=1, name=appGC-2, pir=8000000, cir=0, al=5, agc index=6
downstream Virtual-Link:
    virtual index=3, name=virtual link 3
        channel index=3, name=virtual channel 3, pir=99999, cir=99, al=9, agc index=15
        application index=1, name=appGC-3, pir=8000000, cir=0, al=5, agc index=12
        application index=2, name=appGC1-3, pir=8000000, cir=0, al=5, agc index=13
        application index=3, name=appGC2-3, pir=8000000, cir=0, al=5, agc index=14

SCE8000#> show interface LineCard 0 virtual-links index 1 direction upstream agc-mapping
Virtual Link enabled
upstream Virtual-Link:
    virtual index=1, name=virtual link 1
        channel index=1, name=virtual channel 1, pir=99999, cir=99, al=9, agc index=3
        application index=1, name=appGC-1, pir=8000000, cir=0, al=5, agc index=2

SCE8000#> show interface LineCard 0 virtual-links index 1 direction upstream counter
Virtual Link enabled
upstream Virtual-Link:
    virtual index=1, name=virtual link 1
        channel index=1, name=virtual channel 1, pir=99999, cir=99, al=9, agc index=3,
        enforce rate=99999, actual rate=0
        application index=1, name=appGC-1, pir=8000000, cir=0, al=5, agc index=2, enforce
        rate=8000000, actual rate=0
```

Monitoring Virtual Links Using the Reporter

The Service Control Application for Broadband (SCA BB) includes a Reporter tool that allows you to produce reports based on the traffic analysis performed by the SCE platform. The information is sent from the SCE platform and is stored in a database. The Reporter can query and retrieve information from the database and present the results in a comprehensive range of reports.

The Reporter includes the Virtual Links Monitoring group of report templates that allow you to view statistics of bandwidth or volume of traffic used by a virtual link. The reports are provided per service usage counter for the total volume used by the virtual link. The volume consumption can be displayed per service for the virtual link. The reports are provided per channel.

Each report can be filtered to focus on a virtual link ID, a virtual link name, a virtual link direction, or a combination of the virtual link identifiers.

The Virtual Links Monitoring group includes the following report templates:

- VLink Bandwidth per Service—Shows the distribution of bandwidth among the different service usage counters defined in the system for all subscribers.
- VLink Aggregated Usage Volume per Service—Shows the total volume of traffic (upstream and downstream) for each service usage counter.

- VLink Bandwidth per Package—Shows the distribution of bandwidth among the different packages defined in the system for selected vlinks.
- VLink Hourly Usage Volume per Service—Shows the distribution of volume among the different service usage counters defined in the system, grouped by hour.
- VLink Daily Usage Volume per Service—Shows the distribution of volume among the different service usage counters defined in the system, grouped by day.
- Daily Peak BW for all VLinks—Shows the daily value of the maximum bandwidth (1-hour or 2-hour average) for all virtual links.
- Total Active Subscribers per VLink—Shows the number of active subscribers for a selected vlink.
- VLink Bandwidth per Channel—Shows the distribution of bandwidth among the different channels for selected vlinks.
- Top Subscribers per VLink—Shows a list of the top subscriber volume consumption in a specific hour or day for a selected Vlink.
- Average Bandwidth per Subscribers per VLink—Shows the average bandwidth for a specific subscriber for a selected vlink.
- Accumulated Bandwidth Distribution per VLink—Shows the accumulated bandwidth distribution for a selected vlink.

Creating a New Report Instance

Step 1 Go to the SCA BB console. From the Tools menu, choose **Reporter**.

The Reporter opens and the Templates tab appears.

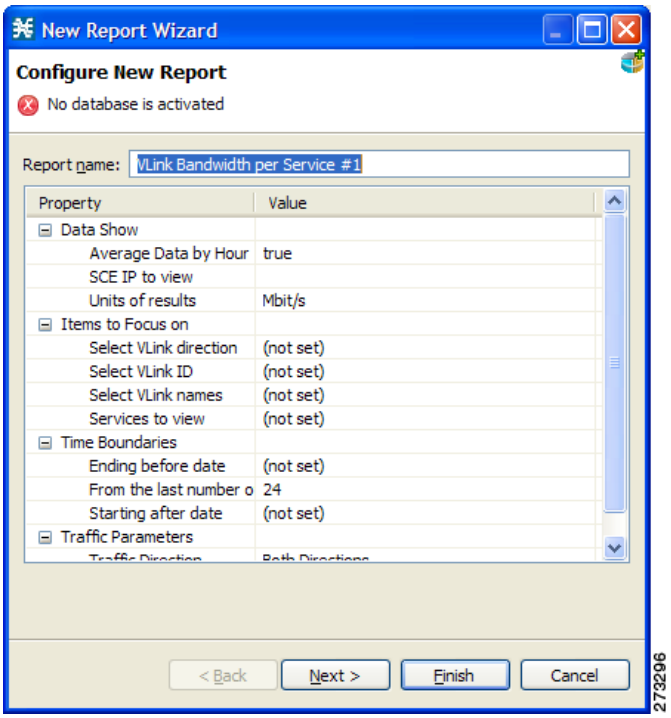
Step 2 In Templates view, expand the Virtual Links Monitoring group.

Step 3 Right-click a report instance (for example, VLink Bandwidth per Service).

A popup menu appears.

Step 4 From the menu, choose **New**.

The New Report Wizard dialog box appears, allowing you to configure the new report.



Step 5 In the Report name field, enter the name of the report instance.

The default report name is **VLink Bandwidth per Service #1**. (If you create another report instance from this report template, it is named **VLink Bandwidth per Service #2**, and so on. You can rename report instances.)

Step 6 To create a report that focuses on a particular CMTS device:

a. In the Select VLink names row, click the right column and click the **Browse** button that appears.

b. Click the **Search** button.

In the search box, enter the name of the CMTS device with a * before and after; for example *CMTS_1*

All the virtual links that contain the string ‘CMTS_1’ appear.

c. Select all the results and click **OK**.

The report is produced that focuses on the specified CMTS device.

CHAPTER 6

TroubleShooting the Remote Cable MSO Links Solution

Revised: November 8, 2010, OL-21073-02

Introduction

This chapter describes several of problem scenarios that you may encounter when using the solution. The problem scenarios and solutions are described under the following sections:

Subscriber Complaints

To troubleshoot the cause of bad service to subscribers, consider the following:

- Congestion in the backbone network may cause congestion in subscriber traffic.
- Problem with the solution, such as assigning the incorrect policy to the subscriber, or an incorrect interface association, may exist.

To make sure the problem is not with the SCE, perform the following procedures:

Verifying the Correct Policy is Enforced on a Specific Subscriber

Step 1 Verify that the subscriber manager-SCE subscriber data is synchronized.

In the SCE, use the **show interface linecard 0 subscriber name** <*sub MAC*> command to verify that the upvlinkId and downVlinkId values are the same as in the **p3subs --show -s** <*sub MAC*> subscriber manager CLU output and that the subscriber package ID is as expected.

The following example shows the output of the SCE CLI:

```
SCE2000#>show interface LineCard 0 subscriber name lynn_jones
Subscriber 'lynn_jones' manager: SM
Subscriber 'lynn_jones' properties:
downVlinkId=10
monitor=0
new_classification_policy=0
packageId=0
QpLimit[0..17]=0*17,8
QpSet[0..17]=0*17,1
upVlinkId=10
.
.
.
```

The following example shows the output of the subscriber manager CLU:

```
>p3subs --show -s lynn_jones
Name:           lynn_jones
Domain:         subscribers
Mappings:
        IP: 5.101.5.129/32
Properties:
        downVlinkId=10   Name=dev0_9_if19-down
        upVlinkId=10     Name=dev0_9_if19-upstream0
Custom Properties:
        giaddr=5.101.254.105
Command terminated successfully
```

Step 2 Verify that the subscriber manager-SCE virtual links data is synchronized.

Compare the output of the SCE **show interface linecard 0 virtual-links different-from-template** command with the subscriber manager CLU **p3vlink --show-vlink-data --vlink-name** *<UpVlinkId/DownVlinkId Name>* to make sure that the PIR configuration is correct.

Note The SCE PIR value is in kilobits. You can calculate the VLM value by performing a multiplication with the relevant CMTS device factor as defined in the vlink.cfg configuration file. The CMTS device factor value appears in the output of the subscriber manager CLU **p3vlink --show-device -d** *<device-name>*.

The following example shows the output of the SCE CLI:

```
SCE2000#> show interface LineCard 0 virtual-links different-from-template
Virtual Link enabled
upstream Virtual-Link:
    virtual index=1, name=virtual link 1
        channel index=1, name=virtual channel 1, pir=99999, cir=99, al=9, agc index=3
        application index=1, name=appGC-1, pir=8000000, cir=0, al=5, agc index=2
    virtual index=2, name=virtual link 2
        channel index=2, name=virtual channel 2, pir=99999, cir=99, al=9, agc index=7
        application index=1, name=appGC-2, pir=8000000, cir=0, al=5, agc index=6
downstream Virtual-Link:
    virtual index=3, name=virtual link 3
        channel index=3, name=virtual channel 3, pir=99999, cir=99, al=9, agc index=15
        application index=1, name=appGC-3, pir=8000000, cir=0, al=5, agc index=12
        application index=2, name=appGC1-3, pir=8000000, cir=0, al=5, agc index=13
        application index=3, name=appGC2-3, pir=8000000, cir=0, al=5, agc index=14
```

The following example shows the output of the **p3vlink --show-vlink-data** subscriber manager CLU:

```
p3vlink --show-vlink-data --vlink-name=device_Cmts0/0-downstream1
VLink Name: device_Cmts0/0-downstream1
VLink Id:    1
Direction:    downstream
SCE Name:     sce0
Device Name:  device
PIR:     200000000


Channels related to VLink
<name>-L, index <index>, PIR <value>, CIR <value>
<name>-W, index <index>, PIR <value>, CIR <value>


Related upstream virtual links —Lists all upstream interface related to the same MAC layer
as the selected downstream interface.
device_Cmts0/0-upstream0
device_Cmts0/0-upstream1
device_Cmts0/0-upstream2
device_Cmts0/0-upstream3

Command terminated successfully
```

The following example shows the output of the **p3vlink --show-device** subscriber manager CLU:

```
p3vlink --show-device -d CMTS1 --detail
Name:                          CMTS1
Host Name:                     Paris
IP:                            192.0.2.10
Type:                          Static
SCE Related:                   sce0
Upstream factor:               95
Downstream factor:             95
Last success Query:            Thu Jun 19 17:54:48 IDT 2008
Last Query Attempt:            Thu Jun 19 17:54:48 IDT 2008
Last Query Status:             Completed
Sync state with SCE:           done
Sync state with CM:            done
Giaddr List:                   127.0.0.1
Upstream Global Controllers:   None
Downstream Global Controllers: <GC Name>=<GC Value>,<GC Name>=<GC Value>…
isLogAll:                      true
Num of up interfaces:          6
Num of down interfaces:        2


VLink Information:
1) Name: CMTS1_Cmts0/0-upstream2, Vlink Id: 1, Direction UP, PIR 5000 kbps.
2) Name: CMTS1_Cmts0/0-downstream1, Vlink Id:1, Direction DOWN, PIR 10000 kbps
        Channel Name: <vlink Name>-W, index <value>, PIR <value> kpbs, CIR <value> kpbs
        Channel Name: <vlink Name>-L<channel index>, index <value>, PIR <value> kpbs, CIR
<value> kpbs
3) Name: CMTS1_Cmts0/0-upstream3, Vlink Id:2, Direction UP, PIR 10000 kbps.
4) Name: CMTS1_Cmts1/0-downstream1, Vlink Id:2, Direction DOWN, PIR 20000 kbps.
5) Name: CMTS1_Cmts0/0-upstream1, Vlink Id:3, Direction UP, PIR 10000 kbps.
6) Name: CMTS1_Cmts1/0-upstream2, Vlink Id:4, Direction UP, PIR 20000 kbps.
7) Name: CMTS1_Cmts1/0-upstream3, Vlink Id:5, Direction UP, PIR 20000 kbps.
8) Name: CMTS1_Cmts1/0-upstream1, Vlink Id:6, Direction UP, PIR 20000 kbps.

Command terminated successfully
>
```

To fix this problem:

a. Monitor all CMTS device interfaces using the subscriber manager CLU **p3vlink --show-device -d** *NAME* [**--detail**].

b. Verify that in the output of the CLU *Sync state with SCE* is done.

   If Sync state with SCE is not done:

   – View the connection state between the subscriber manager and the SCE using the subscriber manager CLU **p3net --show -n** *SCE_NAME*.

   – Synchronize the SCE with the CMTS device configuration using the subscriber manager CLU **p3vlink --resync -n** *SCE_NAME*.

Step 3 Verify that the VLM-CMTS data is synchronized.

Compare the virtual link names from the subscriber manager CLU **p3subs --show -s** <*sub MAC*> output with the CMTS configuration to verify that the subscriber is assigned to the correct CMTS and CMTS interface.

Note The virtual link name structure is <CTMS_NAME>_<INTERFACE_DESCRIPTION> and is obtained from the configuration file and the SNMP ifTable data.

Make sure that the PIR value is the same as the CMTS interface speed (as taken from the SNMP ifTable data) by comparing the virtual link PIR values from the subscriber manager CLU **p3vlink --show-vlink-data --vlink-name** <*UpVlinkId/DownVlinkId Name*> to the CMTS configuration.

To fix this problem:

a. Use **p3vlink --show-device -d** <*DEVICE_NAME*> to verify that:

   – The monitor period is not 0

   – The last query completed successfully. Check the user-log for reasons for failure.

b. Use **p3vlink --start-query -d** <*DEVICE_NAME*> to force a start query on a specific CMTS device.

Verifying that the Distribution of Subscribers to the Virtual Link is Correct

Step 1 Obtain the VLM name for a specific interface using the **p3subs --show -s** <*sub MAC*> command, or build the interface name as <CTMS_NAME>_<INTERFACE_DESCRIPTION>.

Step 2 Retrieve the subscribers list related to a specific interface and compare it to the CMTS data using the **p3vlink --show-subs --vlink-name**= <*UpVlinkId/DownVlinkId Name*> command:

```
>p3vlink --show-subs --vlink-name test1_Cmts0/0-upstream2
Subscribers related to device: test1 vlink-id: 5, giaddr: 10.78.233.149, direction UP
010101010101
1 subscriber was found
Command terminated successfully
>
```

Inaccurate, Unavailable, or Missing Reports Information for a Specific CMTS Interface

The SCA Reporter can generate per interface consumption reports that can be used to monitor the solution. The VLM updates the reporter with the interface ID to name data and the SCE sends the raw data with the interface ID (virtual link).

A problem can stem from the VLM update or from the SCE RDRs.

Two possible solutions include:

- Verify that the SCE sends virtual link update RDRs (VLUR) to the collection manager. For information, see *Cisco SCE8000 10GBE Software Configuration Guide* or *Cisco SCE8000 GBE Software Configuration Guide*.
- Verify that the VLM updates the collection manager.

Verifying that the VLM Updates the Collection Manager

Step 1 Verify the connectivity between the subscriber manager and the collection manager.

View the configured network elements and verify that the collection manager exists using the subscriber manager CLU **p3net --show-all --detail** command.

View the subscriber manager-collection manager connection properties and state using the **p3net --show -n** *CM_NAME* command, and then verify that the SCE list property value contains the SCE to which the CMTS is connected.

To fix this problem:

a. Check that the subscriber manager configuration file contains the relevant collection manager information:

- Check that a CM Section exists and points to the SCE section
- Validate the collection manager IP and port
- Check that the SCE is related to the collection manager.

b. See the “Information About Communication Failures” section in the “Subscriber Manager Overview” chapter of *Cisco Service Control Management Suite Subscriber Manager User Guide*.

Step 2 Verify that the VLM and collection manager data is synchronized.

Verify that the synchronization state with collection manager is set to done using the CLU **p3vlink --show-device -d** <*CMTS_NAME*> command. To view a list of configured virtual links, use the collection manager CLU **update_vlinks.sh --sce**=<*SCE_IP*> **--show** command.

To fix this problem:

a. Force the VLM and the collection manager to synchronize using the **p3vlink --resync -n** <*CM_NAME*> command.

b. For manual configuration, see *Cisco Service Control Management Suite Collection Manager User Guide* to add virtual links using the CLU **update_vlinks.sh --sce**=<*SCE_IP*> **--file=vlinks.csv**.

The following example shows the output of the **p3net --show -n** command:

```
>p3net --show -n cm0
Network Element Information:
============================
Name:                   cm0
Host:                   10.56.197.231
Ip:                     10.56.197.231
Port:                   14375
Status:                 Connection ready
Type:                   Collection Manager
SCE List:               sce0
Synchronization Status: Not-done(100% failures)
Redundancy Status:      Standalone
Quarantine Status:      ok
Command terminated successfully
```

The following example shows the output of the **p3vlink --show-device -d** command:

```
>p3vlink --show-device -d test1
Device Name:                   test1
Host Name:                     singleSimpleDevices
IP:                            10.78.233.149
Type:                          Static
SCE Related:                   sce1
Upstream factor:               95
Downstream factor:             95
Last success Query:            Fri Feb 19 14:29:11 IST 2010
Last Query Attempt:            Fri Feb 19 14:29:11 IST 2010
Last Query Status:             Completed
Sync state with SCE:           Not-done
Sync state with CM:            N/A
Giaddr List:                   10.78.233.149;
Upstream Global Controllers:   None
Downstream Global Controllers: None
isLogAll:                      true
Num of up interfaces:          8
Num of down interfaces:        2

Command terminated successfully
```

The following example shows the output of the update_vlinks.sh script:

```
./update_vlinks.sh --sce=10.56.197.232 --show
.
.
.
TIME_STAMP|             SE_IP|          VLINK_ID|   VLINK_DIRECTION|
VLINK_NAME|
----------+-----------------+-----------------+-----------------+----------------------
--+
.
.
.
2008-12-17|     10.56.197.232|                10|                 0|
dev0_9_if19-upstream0|
2008-12-17|     10.56.197.232|                10|                 1|
dev0_9_if19-down|
.
.
.
```

SCE is Congested, But Connected CMTSs are Not Congested

If the virtual link assignment is incorrect or false subscriber login operations are not handled by the correct virtual link controller, virtual links can become congested. To resolve this issue, you must confirm that there are no subscribers associated with the virtual link and also verify that the distribution of subscribers to the virtual link is as expected.

To verify that the distribution of subscribers to the virtual link is as expected, see the "Verifying that the Distribution of Subscribers to the Virtual Link is Correct" section on page 6-4.

Verifying that No Subscriber Is Associated with the Default Virtual Link

Step 1 Use the SCE CLI **show interface LineCard 0 subscriber property** <*upVlinkId*|*downVlinkId*> **equals 0** to make sure that there are no subscribers associated with the default virtual link.

Subscribers in the SCE can have a virtual link ID set to 0 in several cases:

- If the giaddr list is learned automatically, a few subscribers may have this policy if they performed the first login from this giaddr. In this case, compare the results with the subscriber manager database.
- If a specific interface or CMTS is removed from the VLM, at some point all the subscribers associated with this interface or CMTS are set to use the default virtual link.
- If no match exists in the DHCP Sniffer LEG mapping table and the LEG is configured to log in a subscriber with the default virtual link.

The following example shows the output of the **show interface LineCard 0 subscriber property upVlinkId equals 0** command:

```
SCE2000#>show interface LineCard 0 subscriber property upVlinkId equals 0
N/A
000004650001
000004650002
000004650003
000004650004
000004650005
000004650006
000004650007
000004650008
000004650009
00000465000A
00000465006F
000004650070
000004650071
000004650072
000004650073
000004650074
000004650075
000004650076
000004650077
000004650078
0000046500DD
0000046500DE
0000046500DF
```

The following example shows the output of the **p3dhcpsniff --show-policy --policy=upVlinkId --detail** command:

```
>p3dhcpsniff --show-policy --policy=upVlinkId --detail
Policy Name: upVlinkId
=======================
separator:_
use default: false
default value: 0
allow no package: true
concat option:giaddr,
concat option:82:1,
concat option type: integer,binary
log success: true
log default success: false
Number of mappings: 400

5.101.254.100_00010000=9
5.101.254.100_00010003=10
5.101.254.100_80010000=9
5.101.254.100_80010003=10
5.101.254.101_00010000=9
5.101.254.101_00010003=10
5.101.254.101_80010000=9
5.101.254.101_80010003=10
5.101.254.102_00010000=9
5.101.254.102_00010003=10
5.101.254.102_80010000=9
5.101.254.102_80010003=10
5.101.254.103_00010000=9
5.101.254.103_00010003=10
5.101.254.103_80010000=9
5.101.254.103_80010003=10
5.101.254.104_00010000=9
5.101.254.104_00010003=10
5.101.254.104_80010000=9
5.101.254.104_80010003=10
5.101.254.105_00010000=9
5.101.254.105_00010003=10
5.101.254.105_80010000=9
5.101.254.105_80010003=10
5.101.254.106_00010000=9
5.101.254.106_00010003=10
5.101.254.106_80010000=9
```

Userlog Messages

The messages that are written to the userlog are categorized based on their severity as:

- Userlog Error Messages
- Userlog Warning Messages
- Userlog Information Messages

The preconditions of the messages are described as follows:

- None—Messages are sent irrespective of the value set in the config file.
- General.log_all—Messages are sent only if log_all flag in the general section of the vlink.cfg file is set to true.
- Device.log_all—Messages are sent only if log_all flag in the device section is set to true.

Userlog Error Messages

Table 6-1 lists the error messages that can be written to the userlog.

Table 6-1 Userlog Error Messages

Message	Description	Precondition
Device {0} Error: Speed value {1} cannot be translated to int number.	The SNMP interface provides a non integer value for the if speed.	None
Device {2}: Cannot create query factory class {0} from jar {1}: Error {3}	Cannot instantiate the class related to the device and responsible for the query operation.	None
Failed to send vlink message to SCE {0}	An error occurred when trying to update the SCE with vlinks. The error is specified in the umlog.	None
Failed to update CM {0} with configuration related to SCE {1}	An error occurred when trying to update the collection manager. The error message is specified in the umlog.	None
Clearing {0} vlink information because of the following error:\n System detected reduction in max valid vlink index in SCE <sceName>, valid vlink index was '<maxVlinkIdInDb>' and it was decreased to <maxValidVlinkIndexInSce>	The VLM deleted all vlinks related to a specific SCE because the vlink max valid index was reduced.	None
System detected reduction in max valid vlink index in SCE {0} valid vlink index was '{1} ' and it was decreased to {2}	The VLM detected that the SCE max valid vlink index was reduced.	None
Failed to allocate virtual link index for interface {0} because of lack of vlink {upstream/downstream} resources in SE {name}	SCE free vlink indexes are no longer available; abort the vlink creation.	None
SCE {0}, Failed to set pir {1}, to vlink {2}, with vlink id {3}	The SCE was unable to set the PIR value on the GC. This can occur if the PIR value exceeds the MAX PIR value in the SCE.	None

Table 6-1 Userlog Error Messages (continued)

Message	Description	Precondition
Failed to set Host Name <name> to device <DeviceName_A> since it is already occupied by device < DeviceName_B>.	Host name (MIB .1.3.6.1.2.1.1.5.0) duplication, verify that DeviceName_A has different Host Name, remove DeviceName_A and add it again.	None
SNMP SysName {0} is illegal value for static device {1}, expecting to get {2} value.	Found unexpected sysName for static device query failure IP related to static device can not be moved to other device, IP returns an unexpected sysName value (null/different than current), query operation fails. Work Around: Set the sysName related to the IP to the expected one and start query on the device using **p3vlink –start-query** CLU command. If the device IP changes, update the configuration file, load config and restart the query on the device using **p3vlink –start-query** CLU command.	None
Failed to communicate with device {0}, using its giaddr list {1}, number of retries={2}, timeout between retries={3} ms	Device is not responsive to the VLM using its giaddr list. Check physical connection to the device.	None
Failure in Init process; error in LEG synchronization: {0}	The VLM has a failure in the boot, vlink mapping table is not created properly, and needs to provide a support file.	None
Failure in Init process; failed to synchronize LEG with all mappings on {0} minutes	The VLM has a failure in the boot, vlink mapping table is not created properly, and needs to provide a support file.	None

Userlog Warning Messages

Table 6-3 lists the warning messages that can be written to the userlog.

Table 6-2 Userlog Warning Messages

Message	Description	Precondition
VLM does not have valid RPC connection to SCE {0}, aborting VLink updates in SCE.	This message is sent when the VLM tries to update the SCE with vlink information but the RPC connection is missing.	None
Starting up VLM Solution	—	None
VLM Solution is stopped, going to clear all vlink information.	—	None
System detected change in max valid vlink index in SCE '{0} ', valid vlink index is increased from {1} to {2}	The VLM detected that the SCE max valid vlink index was increased.	None

Table 6-2 Userlog Warning Messages (continued)

Message	Description	Precondition
giaddr value duplication; both devices {0} and {1} are having the same ip definition {2}.	The same IP Address is assigned to two different devices. The VLM assigns the IP to the latest device.	None
PIR size of {0} kbps is more than SCE {1} max bw size, setting vlink {2} with max sce PIR value: {3}	The device interface bandwidth is higher than the maximum bandwidth of the SCE, the VLM sets the MAX SCE bandwidth value instead.	none
SCE {0} does not support vlink functionality, aborting VLink updates in SCE	VLM tries to send message to SCE, RPC connection is available pqi is installed but VLM is disabled. To recover from the failure, download the policy that enables Vlink support and perform VLM synchronization on the SCE.	None
VLM did not find any installed application in SCE {0}	VLM tries to send message to SCE, RPC connection is available but pqi is missing in the SCE or SCEs in cascade. To recover from the failure, install PQI and download the policy that supports Virtual Link. Perform the VLM synchronization using **p3vlink –resynch operation/**.	None
Connection interrupts to SCE {0} while trying to download VLM data.	VLM tries to send message to SCE, RPC connection is not available. Perform SM-SCE disconnection methodology.	None
Failed to set Host Name {0} to device {1} since it is occupied by device {2}	Failed to set host name to non existing device, If the device is static device, send support file to tech support, if the device is dynamic, check if the device was previously deleted by the CLU command or by dynamic giaddr removal procedure.	None
Failed to create CommunityTarget to IP <IP Address>	If VLM is unable to create a SNMP session to the IP address, send the support file to CISCO support.	None
Failed to read sysName related to ip:port {0}, , number of retries={1}, timeout between retries={2} ms	VLM failed to get the sys name MIB value related to IP Address. Validate that sysName value is set.	None
There are no giaddr related to device {0}, VLM is going to remove it from the system	VLM removes the dynamic device that does not have any giaddr related to it.	None
VLM is disabled or not supported in SCE {0}	Ensure relevant pqi is installed in the SCE. Ensure that the policy with vlink enabled is set in the SCE.	None
IP {0} Collision detected between Device {1} to the Device {2}, Deleting device {3} and moving its IP data to {4}.	—	None

Table 6-2 Userlog Warning Messages (continued)

Message	Description	Precondition
Collision detected between Device {0} to the Device {1}, assigning IP {2} to device {3}.	—	None
IP {0} found in device {1} collide with main ip address related to Static Device {2}, operation aborted.	—	None

Userlog Information Messages

Table 6-3 lists the information messages that can be written to the userlog.

Table 6-3 Userlog Information Messages

Message	Description	Precondition
Device {0} was added to VLM	—	None
SCE {0} was added to VLM	—	None
SCE {0} was removed from VLM	—	None
<SCE Name> : Max valid vlink index is set to <value>	Setting the max valid vlink index to … This value is read from the SCE. If the SCE is not available, the system uses the default value (1023).	General.log_all = true or Device.log_all = true
Add device to VLM {name} up factor={1} down factor={2} aliases={3}	A new device was added to the VLM database. The umlog contains the giaddr information.	Device.log_all = true
Create vlink {name} with id {1}, on device {name}	Adding vlink to the VLM. The umlog contains the database internal data.	Device.log_all = true
delete vlink {name} with id {1}, direction-{2}, on device {name}	Removing vlink from the VLM. The umlog contains the database internal data.	Device.log_all = true
Delete device {name}	Deleting device from the repository database.	Device.log_all = true
VLM deviced to remove device {0} since it does not have any giaddr.	The VLM automatically remove the Device {0} since all its giaddr were being removed by the aging mechanism.	None
Virtual Link mappings are missing for subscriber <subscriber_name>, login operation is being delayed, LEG is querying for mappings related to giaddr <ip value>.	While processing DHCP RDR, SCE DHCP SNIFFER detects that Mappings to up/down vlink id are missing. The RDR message is stored in a queue, and the query operation is initiated.	logAll = true Or Print message every 100 occurrences
Virtual Link mappings are missing for subscriber <subscriber_name>, continue login operation with no mappings.	Perform login operation even if mappings are not found. The VLM query on the device is complete before the message is generated.	logAll = true Or Print message every 100 occurrences

Table 6-3 Userlog Information Messages (continued)

Message	Description	Precondition
Blocking operation for mac <mac id> since vlink policy is still not set for giaddr <IP value>	If the LEG detects that policy mappings are not synchronized with the device, the login operation is blocked. After the completion of device query, the login operations continue.	logAll = true Or Print message every 100 occurrences
Device {0} changed its IP to {1}	The dynamic device changes its IP when: • Current IP is not responsive. • **sysName** related to the IP is different from the one defined in the device.	None
Giaddr {0} which was related to device {1} found out to be related to device {2}, VLM starts query on this device	A giaddr which was related to device {1}, is currently related to another device, system tries to query this device.	None
Device {0} was removed	Device was removed from the VLM.	None
VLM detected new dynamic device: Device {0} is related to SCE {1}	Creates a dynamic device.	None
Dynamic Device Creation feature is being enabled	The VLM detects configuration file with Dynamic Device Configuration feature enabled.	None
Dynamic Device Creation feature is being disabled.	The VLM detects configuration file with Dynamic Device Configuration feature disabled.	None
IP Collision between Static Device {0} to the Dynamic Device {1}, The Dynamic device is replaced by the Static device.	—	None