



# Configuring the Remote Cable MSO Links Solution

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## Introduction

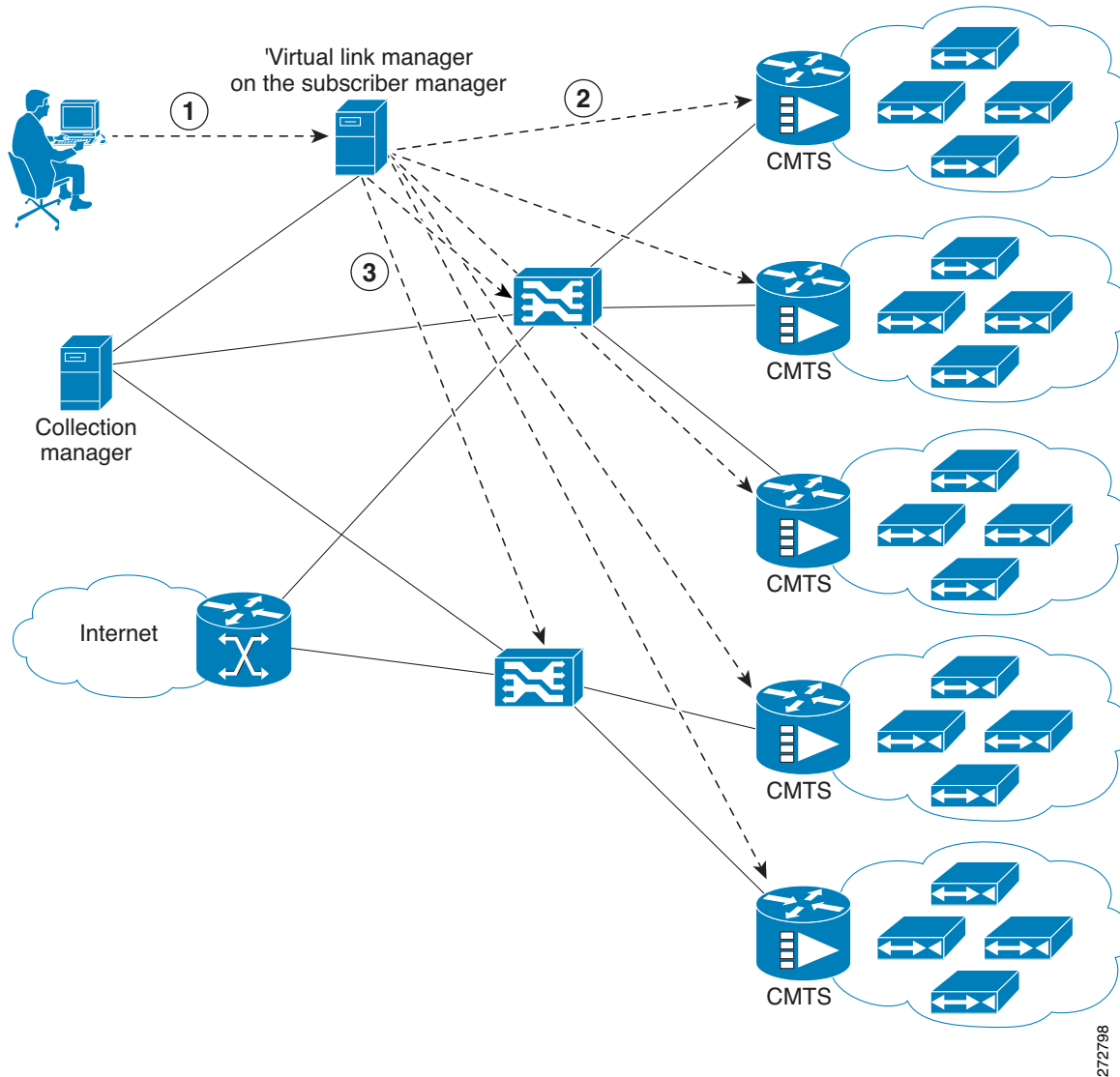
This chapter describes:

- Basic topology for managing remote cable MSO links and the high-level steps to configure the solution—[“Solution Topology” section on page 4-2](#)
- Prerequisites for configuring a solution that uses traffic optimization on remote links with the VLM—[“Prerequisites” section on page 4-3](#)
- Configuring the VLM by using the configuration files contained in the Subscriber Manager installation—[“Configuring the Solution” section on 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 is optional and is not required for the solution to work. To work with the Collection Manager, you must associate the Cisco Service Control Collection Manager with the Cisco 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.

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

## CMTS Device Compatibility

This traffic optimization on remote links solution supports these devices at present:

- Cisco CMTS Universal Broadband Router (uBR)
  - uBR10K
  - uBR7246
- Non-Cisco CMTS
  - Arris CMTS

To use other CMTS devices, you must ensure that these 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 Cisco SCE.
- To use Cisco CMTS and non-Cisco CMTS devices for IPDR, you must ensure that these conditions are also met:
  - The Upstream IDs are retrieved or identified by using `CmtsIpv4Addr`, `CmtsMdIfIndex` and `CmtsTcsId` fields, which is a part of CM registration IPDR messages.
  - The Downstream IDs are retrieved or identified by using `CmtsIpv4Addr`, `CmtsMdIfIndex` and `CmtsRcsId` fields, which is a part of CM registration IPDR messages.
  - The Cable Modem MAC address, which is used as Subscriber-ID, is retrieved or identified by `CMmacAddress` field that is a part of the Cable Modem Registration IPDR messages.

Traffic optimization on the remote links solution uses DOCSIS MIBs and standard MIBs.

## Prerequisites

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

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

# Configuring the Solution

This section describes how to configure the solution.

## Configuring Virtual Link Global Controllers

- Step 1** Start the Cisco SCA BB console by choosing **Start > All Programs > Cisco SCA > SCA BB Console 5.1.x > SCA BB Console 5.1.x**.

The Cisco 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.

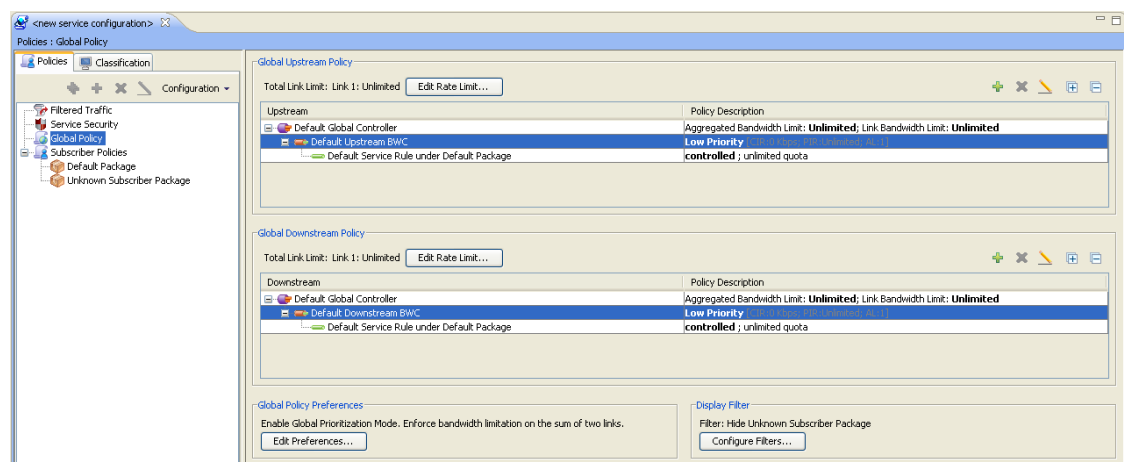
- Step 3** From the Console main menu, choose **Tools > Service Configuration Editor**.

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

- To create a new service configuration, click **Yes**. A New Service Configuration Settings dialog box appears.
- Select an operational mode for the service configuration.
- Click **OK**.

The new service configuration is added to the Console window (Figure 4-2) that becomes the active service configuration.

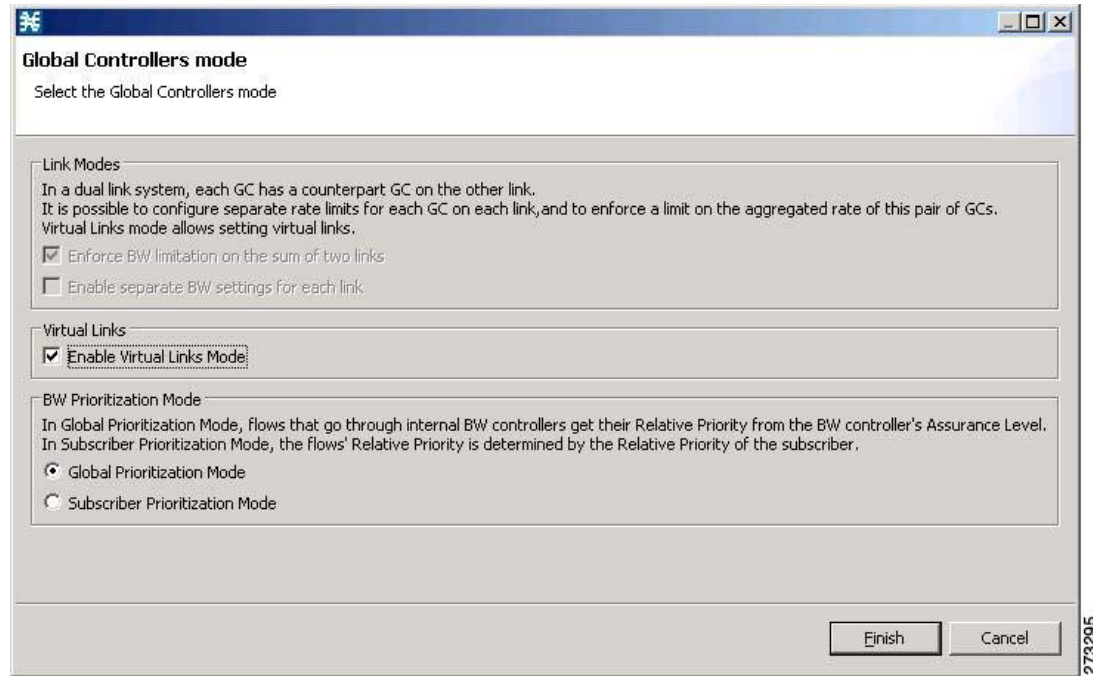
**Figure 4-2** Console Window



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- Step 4** In the Global Policy Preferences area, click **Edit Preferences**.  
The Global Controllers mode dialog box appears (Figure 4-3).

**Figure 4-3 Global Controllers Mode Dialog Box**



**Note**

The Virtual Link Mode works only in Subscriber Prioritization Mode by default.

- Step 5** Check the **Enable Virtual Links Mode** check box.  
The Apply Template rate limits to all Virtual Links? dialog box appears (Figure 4-4).

**Figure 4-4 Virtual Links? Dialog Box**



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

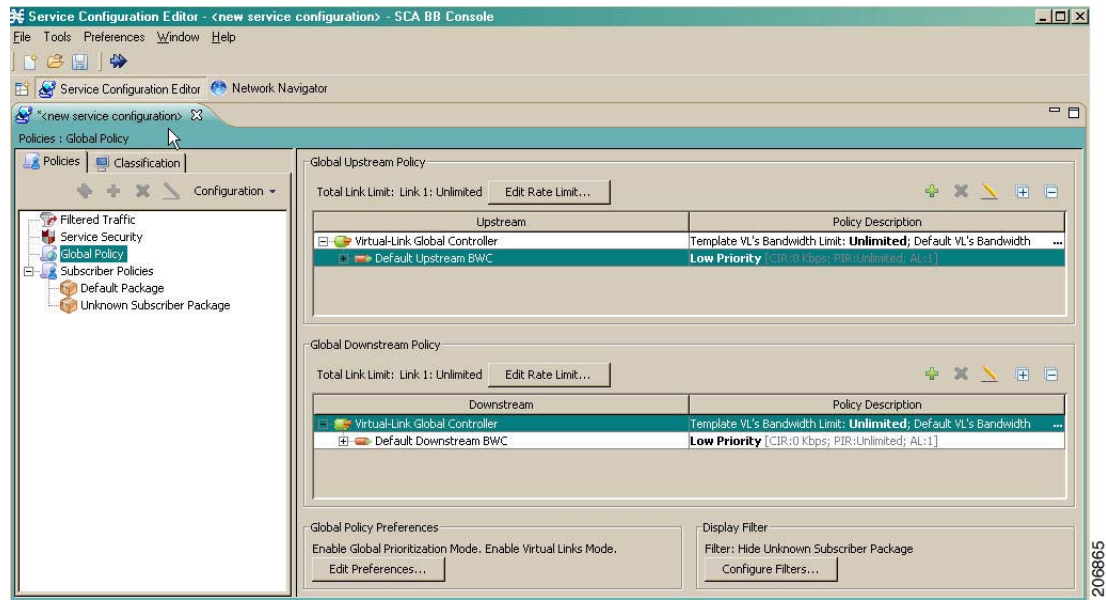
If you are applying the template for the first time, always select Rest all Virtual Links. Whenever the template is getting changed with respect to the AGC and the BWC, then use **Reset all Virtual Links to Template rate limits**. Otherwise, to retain the modified template, use the **Keep Virtual Link rate limits unchanged**.

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 (Figure 4-5).

**Figure 4-5** New Service Configuration Window



For more information on the Service Configuration Editor, see the *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 these sections:

- [How to Add Global Controllers, page 4-7](#)
- [How to Add Global Controllers Inside Virtual Link, page 4-9](#)
- [How to Edit Package Subscriber BWCs, page 4-10](#)


## How to Add Global Controllers


**Note**

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

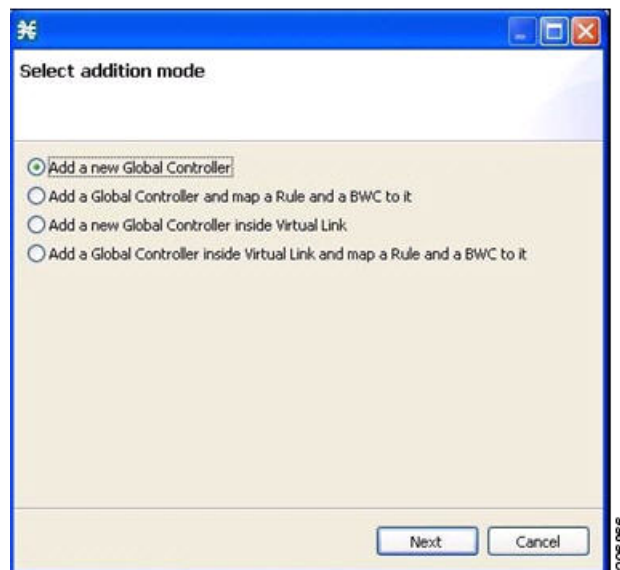
**Step 1** In the Policies tab, click **Global Policy**.

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 the **Add**  icon.

The Select Addition mode dialog box appears ([Figure 4-6](#)).

**Figure 4-6** **Select Addition Mode**



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

**Step 4** Click **Next**.

The Global Controller Settings dialog box appears. See [Figure 4-7](#).


**Note**

The display in [Figure 4-7](#) depends on the global controller mode setting.

Figure 4-7 Upstream Global Controller Settings

**Global Controller Settings**

Global Controller must have a gcNameText

Name:

The global controller enforces a L1 rate limit on traffic that is mapped to it. The global controller can enforce an aggregate rate limit across all SCE links, as well as a separate rate limit per SCE link.

**Aggregate Global Controller**

The global controller can enforce a different rate limit per time frame.

The same rate limit for all time frames

A different rate limit per time frame

Single Rate Limit (Kbps)

Global Controller	Rate Limit
Aggregate	Unlimited

**Per Link Global Controller**

The global controller can enforce a different rate limit per time frame.

The same rate limit for all time frames

A different rate limit per time frame

Single Rate Limit (Kbps)

Global Controller	Rate Limit
For all Links	Unlimited

OK Cancel

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- Step 5** In the **Name** field, enter a meaningful name.
- Step 6** Edit the maximum bandwidth of the aggregate and per link global controller rate limits.
- 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.

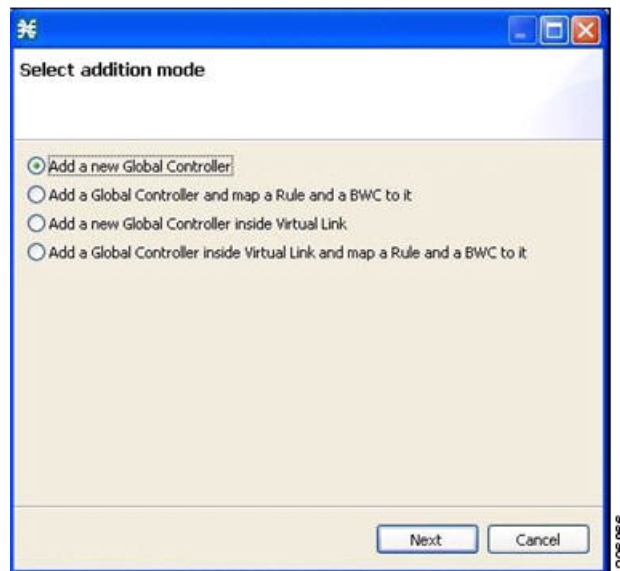
**Step 1** In the Policies tab, click **Global Policy**.

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 the **Add**  icon.

The Select addition mode dialog box appears ([Figure 4-8](#)).

**Figure 4-8** *Select Addition Mode*



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

**Step 4** Click **Next**.

The Global Controller Settings dialog box appears. See [Figure 4-9](#).



### Note

The display in [Figure 4-9](#) depends on the global controller mode setting.

Figure 4-9 Upstream Global Controller Settings

**Global Controller Settings**

Configure the rate limit that this global controller should enforce.

Name:

The global controller enforces a L1 rate limit on traffic that is mapped to it. The global controller enforces an aggregate rate limit across all SCE links belonging to the same virtual link.

In virtual links mode, rate limits for each virtual link are provisioned dynamically to the SCE, yet 'Template' and 'Default' values allow static provisioning:  
 'Template' rate limits apply to newly-created virtual links.  
 'Default' rate limits apply to the default virtual link (virtual link 0).

**Template Virtual Link**

The global controller can enforce a different rate limit per time frame.

The same rate limit for all time frames  
 A different rate limit per time frame

**Single Rate Limit (Kbps)**

Virtual Link	Rate Limit
Template	Unlimited

**Default Virtual Link**

The global controller can enforce a different rate limit per time frame.

The same rate limit for all time frames  
 A different rate limit per time frame

**Single Rate Limit (Kbps)**


Virtual Link	Rate Limit
Default	Unlimited

OK Cancel

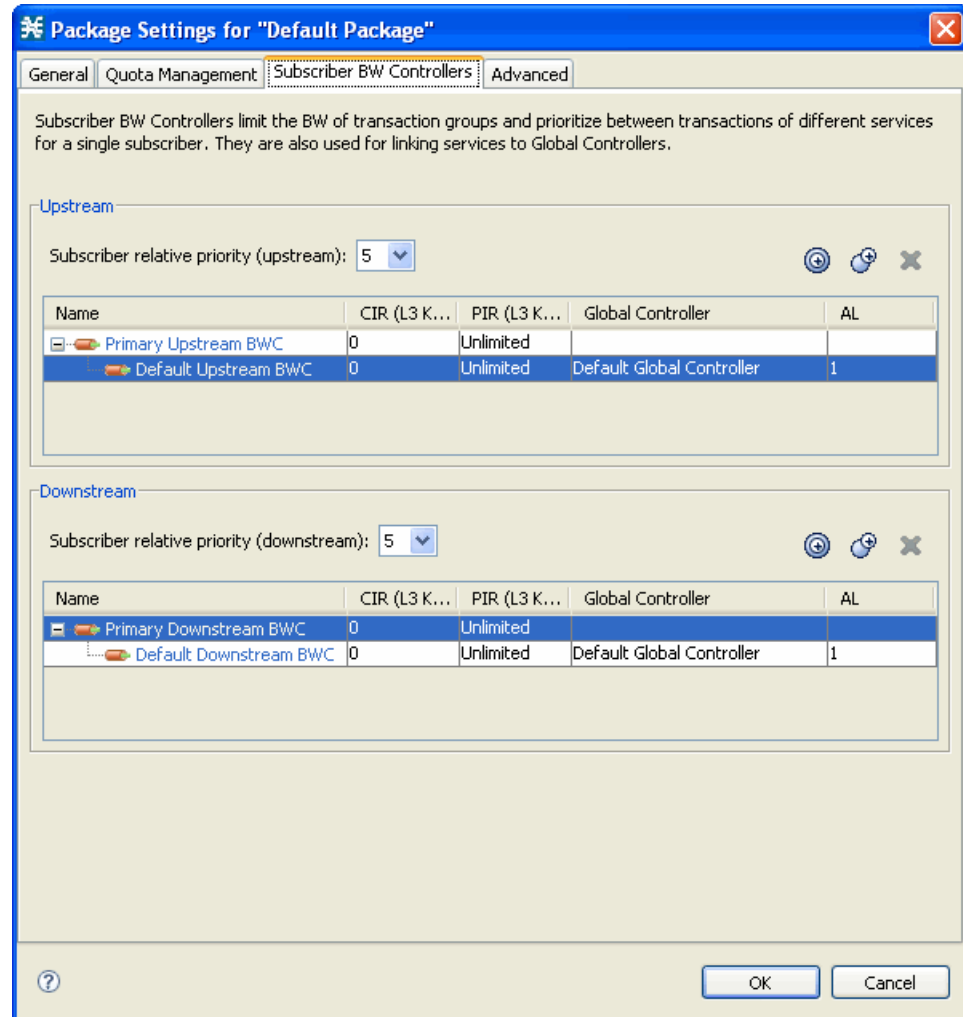
- Step 5** In the **Name** field enter a meaningful name.
- Step 6** Edit the maximum bandwidth of the template and the default values rate limit
- Step 7** Click **OK**.
- Your changes are saved.
- The Global Controller Settings dialog box closes.



## How to Edit Package Subscriber BWCs

- Step 1** In the Policies tab, click **Global Policy**.
- The Global Bandwidth Settings dialog box is displayed in the right (Rule) pane.

- Step 2** In the right (Rule) pane, select a BWC and click the **Edit**  icon. 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. See [Figure 4-10](#).

**Figure 4-10** Subscriber BW Controllers Tab

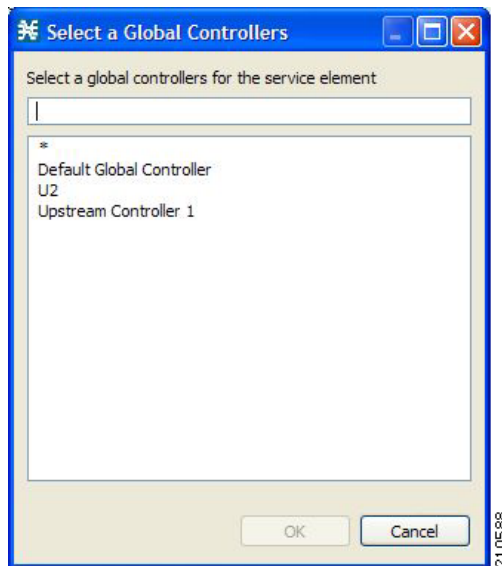


- Step 4** Set your requirements for upstream bandwidth control in the Upstream area of the dialog box.
- Select a value from the Subscriber relative priority drop-down list.
  - Set the parameters for the Primary Upstream BWC.
    - In the CIR field, enter the BWC CIR in Kbps.
    - In the PIR field, select **Unlimited** from the drop-down list, or enter the BWC PIR in Kbps.
  - To add BWCs to the package, click the **Add a sub BW Controller**  icon once for each additional BWC.
  - To add Extra BWCs to the package, click the **Add an extra BW Controller**  icon 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. See [Figure 4-11](#).

**Figure 4-11** Select a Global Controller Dialog Box



- 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 Cisco SCE Platforms

**Step 1** Using the Network Navigator tool, in the Site Manager tree, right-click an Cisco 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**.

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 Cisco SCE progress bar appears. The service configuration is applied to the selected Cisco 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 Cisco SCE devices and define the IP address and optionally the port values of the Cisco SCE devices. This example shows the Cisco SCE sections created for two Cisco 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 Cisco SCE devices. Defining the Collection Manager port value is optional; if a value is not defined, the default value of 14375 is used.

The following example shows the Collection Manager section created that receives the RDRs for two Cisco 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.

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

[Step 3](#) to [Step 6](#) are applicable only to DHCP Sniffer LEG configuration. If you are using IPDR LEG, proceed to [Step 7](#). [Step 7](#) and [Step 8](#) are applicable only to IPDR LEG.

**Step 3** (Only for DHCP Sniffer LEG) 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 Service Control Subscriber Manager LEGs User Guide*.

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

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

All the other values can be left at the 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:

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

All the other values can be left at the default values.

**Step 4** (Only for DHCP Sniffer LEG) Save and close the dhcpsnif.cfg configuration file.

**Step 5** (Only for DHCP Sniffer LEG) 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 Service Control Subscriber Manager 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. Set the rules to define DHCP data coming from the DOCSIS 3.0 cable modem interface

- To identify if DOCSIS 3.0 is the cable modem type, use this parameter:

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

This parameter has two attributes—option and option\_type.

The format of the parameter is the option number itself. But for DHCP options with 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, 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** (Only for DHCP Sniffer LEG) 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** (Only for IPDR LEG) Configure the file <pcube>/sm/server/root/config/ipdr.cfg.

CM Mac Address will be the default Subscriber ID. The CMTS Name should be mapped to the CMTS Name configured in vlink.cfg.

IPDR LEG supports both static and dynamic mappings. If there are any conflicts, dynamic mappings learnt from the CMTS will be considered for subscriber association. The start parameter in the IPDR LEG configuration section defines whether the VLM is enabled or disabled. The default value is “no”. If you enable VLM, the VLM starts learning the device topology defined in the configuration file and starts the dynamic VLINK assignments on the relevant Cisco SCEs. You must manually create the VLINKs and AGCs in the Cisco SCE, for the static mappings you configure in the ipdr.cfg.

Each customer has a Cable Modem with embedded Gateways (GWs). The gateway provides the following three distinct IP addresses:

- IP address for the eMTA - The voice client is filtered at Cisco SCE due to a very low traffic, so that there is no control or visibility of the voice client.
- IP address for the home network GW - A public IP address is provided to a subscriber to browse the internet. This IP address is associated with the subscriber ID and is used by Cisco SCE.
- IP address for the public Wifi GW - Another public IP address is associated with all the roaming subscribers and its traffic is not related with a specific subscriber ID. This IP traffic is controlled separately from the traffic of the home network GW.

The specified IP traffic crosses the same Cable Modem that maps to the Upstream and Downstream VLINKs with the CMTS solution. The VLINK usage is managed and its congestion levels are controlled effectively. The Wifi subscribers can be identified by the IP address range. The Cisco Service Control Subscriber Manager decides if the CPE is Wifi or home network based on the IP address/range of Wifi CPE.

The Cable Modem MAC address is used as the subscriber ID in the SCE solution. When a Wifi CPE is identified, a new subscriber is created with the subscriber ID in the format <CMMAC>@zone name (@wifi) to differentiate between the Wifi and home network subscribers. The new subscriber is associated with Wifi IP address and different package ID specific to Wifi CPE. The VLINK (upVlinkId and downVlinkId) association is common to both the subscribers. Whenever there is a change in the VLINK ID, it will be updated to all the subscribers with CMMAC address in the subscriber ID.

The Wifi IP address/range is provided in a new CSV configuration file (zoneip.csv) which is located in the Cisco Service Control Subscriber Manager and is used when subscribers login through IPDR.

The configuration file is formatted as *iprange=name* of the zone, to map subscriber from different zone to different name. Whenever a login comes through IPDR leg for a CPE, the IP address of the CPE is checked. If the IP address matches with the configured IP address or within the configured IP address range, the subscriber is considered as Wifi CPE and subscriber ID is appended with corresponding name (for example, @wifi4) mapped in the configuration file to create a new subscriber. The VLINK ID is assigned or updated with the same value as the normal subscriber with <CMMAC> id.

The following example provides a section of the **ipdr.cfg** config file:

```
# Enable subscriber zone feature to handle wifi CPE separately in cable environment.
# The default value is false.
# enable_subscriber_zone=<true/false>
[IPDR.Field.SubsId]
ipdr_key=SubsId
ipdr_key_type=string
[IPDR.Policy.packageId]
fields=subsId
policy_property_name=packageId
policy_property_type=integer
mapping_table.*@wifi1=10
mapping_table.*@wifi2=20
```



The following example provides a section of the `zoneip.csv` file:

```
10.7.2.3/16=@wifi1
10.8.2.3/16=@wifi2
10.9.9.0/16=@wifi3
10.1.2.3/16=@wifi4
```


**Note**

The limited number of zones can be configured.

This is an example of the configuration:

```
[IPDR LEG]
start=yes
log_failures=yes
log_all=no
# Enable the below option to log the receiving IPDR messages
# (Default value: false)
# log_subs_details=false

# Enable the below option to log the mapping table information
# (Default value: false)
# log_mapping_table=false

# Enable the below option to log the subscribers who are partially logging in
# (Default value: false)
# log_login_partial_subs=false

cm_mode=no

#CM Mac Address will be the default Subscriber ID
[IPDR.Subscriber ID]
fields=CmmacAddress

[IPDR.Field.CmmacAddress]
ipdr_key=CmMacAddr
ipdr_key_type=string

#Configure IPDR Exporter
# [IPDR.Exporter.<CMTS NAME>]
# The CMTS Name should mapped to the CMTS Name configured in vlink.cfg

[IPDR.Exporter.CMTS1]
start_exporter=yes
exporter_connection_type=active
connection_time_out=100
keep_alive=15
port=4737
# Configure the sesion ids specified in the exporter.
#session_id=<session_id>,<session_id>
session_id=2,3,4
```

**Step 8** (Only for IPDR LEG) If the host entry is not added in the Subscriber Manager, then add the IPDR Collector IP address to the `ipdr.cfg`.

Example:

```
CMTS(config)# ipdr collector dt-sm-linux 10.78.242.22
```

**Step 9** 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 these parameters:

- start—Setting the start parameter to yes instructs the Subscriber Manager to start the VLM when the Subscriber Manager starts. Possible values for this parameter are yes and no.




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

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- 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.
- ignore\_duplicate\_ip—Ignores the duplicate IP in the ipAddrTable of the configured CMTS. The default value is false. Possible values are true and false.
- upstream\_vlink\_factor—Determines the percentage of the interface bandwidth that Cisco SCE allows to be sent from the CMTS device to the Internet. The default value is 95.
- downstream\_vlink\_factor—Determines the percentage of the interface bandwidth that the Cisco 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 very low value causes wastage of bandwidth capacity. Setting a very high value causes data loss because of dropped packets.

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**Note** Whenever you change the default values of upstream\_vlink\_factor and downstream\_vlink\_factor, you must manually resync the vlink information by using the **p3vlink --resync-all** command to reflect the changes on all Cisco SCEs.

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- 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 Link Global Controllers” section on page 4-4.](#)




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

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- 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_giaddr_learning`—(Optional) Avoids learning new giaddr during log in. If this value is set to false, if the Cisco Subscriber Manager identifies during the login that the relay agent does not belong to a known CMTS, the Cisco Subscriber Manager ignores the query and continues with the login. This functionality is applicable only for static device configuration. The default value is true.
- `general_default_cli_integrated`— Defines a default integrated CLI that is executed in the device. The default value is `show controllers Integrated-Cable card ? association`.
- `general_default_cli_modular`— Defines a default modular CLI that is executed in the device. The default value is `show hw-module bay ? config wideband-channel`.
- `general_default_cli_3g_60`—Defines a default 3G60 CLI that is executed in the device. The default value is `show controllers Modular-Cable card ? association`.
- `encrypt_cmts_credentials`— Defines whether the CMTS credentials are encrypted or plaintext. The default value is true.
- `num_of_retry_attempts_for_device_login`— Defines the maximum number of times the VLM must try to connect to the device. The default value is 3.
- `wait_for_device_uptime`—Defines the minimum period to wait after the device is restarted, in minutes. Virtual Link Manager checks the `sysUpTime` of the Device before starting the query, If it is less than the configured value, then the query to that device is ignored. Valid range is from 0 to 60. The default value is 0.
- `access_timeout_for_device_login`— Defines the number access timeout in milliseconds. The default value is 10000 milliseconds. If the maximum number of retry attempts is five, and the interval between retrying connections is three minutes or less, the VLM server tries to connect to the device five times with an interval of three minutes between each attempt. The VLM server does not try to connect after 15 minutes.
- `import_subs_into_db_on_device_add`—Defines whether to import all cable modem MAC addresses and the associated CMTS IP addresses to the database when the VLM detects that a new CMTS is added to the topology. Possible values are true and false. The default value is false.
- `time_interval_for_periodic_snmp_bg_query`—Defines the interval, in minutes, at which the corresponding LEG should initiate a bulk query for all subscribers at various VLink modes (`partialvlinkmappings`, `fullvlinkmappings`, `all`). The default value is 0 minutes. The minimum possible value is 2 minutes. By default, this parameter is disabled.
- `vlink_mode_for_periodic_snmp_bg_query`—Defines whether to query for subscribers with partial VLink mappings, full VLink mappings, and all. Possible values are `none`, `partialvlinkmappings`, `fullvlinkmappings`, `all`. The default value is `none`.
- `subscriber_mode_for_periodic_snmp_bg_query`—Defines whether to query all subscribers or subscribers based on the DOCSIS version. Possible values are `DOCSIS2.0`, `DOCSIS3.0`, `all`. The default value is `all`.




---

**Note** Setting log\_all to true can cause performance degradation.

---

- subscribers\_for\_snmp\_bg—Defines whether to query all the subscribers in Cisco Service Control Subscriber Manager or only the subscribers introduced to Cisco SCE. Possible values are all and introduced. The value introduced is used only in pull mode. If you use introduced, the Cisco Service Control Subscriber Manager queries only the subscribers introduced to the Cisco SCE. The default value is all.

This 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_giaddr_learning=true
encrypt_cmts_credentials=true
num_of_retry_attempts_for_device_login=3
access_timeout_for_device_login=10000
```

- Modify the Cisco SCE container such that it loads all Cisco SCE IP addresses specified in vlink.cfg as sceIPs in cache. This confirms that VLM integration is done for the DHCP packets only if the packets comes from those Cisco SCEs that are part of the VLM configuration (vlink.cfg).
- For each CMTS device, configure a [Device.<device name>] section with these parameters:




---

**Note** <device name> of the section is used as part of the virtual link name for all virtual links associated with this CMTS device.

---

- device\_type—Specifies whether CMTS device is a Cisco CMTS or a non-Cisco CMTS. Possible values are, cisco and arris. The default value is cisco.
- ip—Specifies the IP address of the CMTS device.
- sce\_name—Specifies the name of the Cisco SCE to which the CMTS device is connected. This must match an Cisco SCE section defined in the p3sm.cfg configuration file.
- ignore\_upvlink\_ids—Specifies the configured UpVlink IDs to be ignored by the Cisco Subscriber Manager while removing the IDs from Cisco SCE. Users should ensure that the configured IDs are not assigned to any of the channels or virtual links by the Subscriber Manager and not provisioned to Cisco SCE. The VLink ID value must be an integer. The values can be separated by a comma (,) or can be a range of values separated by an en dash (-) can be mentioned, as shown in the following example:

```
ignore_upvlink_ids= 11,12,15-20
```

- ignore\_downvlink\_ids—Specifies the configured DownVlink IDs to be ignored by the Subscriber Manager while removing the IDs from Cisco SCE. Users should ensure that the configured ID's are not assigned to any of the channels or virtual links by the Subscriber Manager and not provisioned to Cisco SCE. The VLink ID value must be an integer. The values can be separated by a comma (.). Alternatively, a range of values can be separated by an en dash (-) as shown in the following example:

```
ignore_downvlink_ids= 5-15
```

- `upstream_vlink_factor`—(Optional) Determines the percentage of the interface bandwidth that the Cisco 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 Cisco 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 the 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 the 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.
- `snmp_port`—Specifies the SNMP port on which the VLM communicates to the CMTS device. The default value is 161.
- `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 the VLM created after querying the CMTS device. Use a comma “,” delimiter between IP addresses. The default value for this parameter is empty.

- `giaddr_replace`—Specifies whether the VLM uses the IP addresses defined in the `giaddr_external` parameter as the only `giaddr` list of the CMTS device. When this parameter is set to `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`—Removes a list of IPs from the mapping table that the VLM created after querying the CMTS device. 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 a comma “,” delimiter between the IP addresses.
- `cli_integrated`—Defines an optional value the VLM uses to communicate with the device. This attribute loads the `general_default_cli_integrated` property in general section. The default value is `show controllers Integrated-Cable card ? association`.

For parsing the CLI, the output of wideband to bonding group mapping is expected to be in a specific format. The line with wideband to bonding group information must start with “Wideband-Cable”. After the wideband cable, the `ifDescription` and the bonding group ID separated by a space. For example, `Wideband-Cable1/1/0:0 33, Wideband-Cable7/1/0:0 1057`.

- `cli_modular`—Defines an optional value the VLM uses to communicate with the device. This attribute loads the `general_default_cli_modular` property in general section. The default value is `show hw-module bay ? config wideband-channel`.
- `cli_3g60`—This attribute overloads the `general_default_cli_3g_60` property in general section. The default value is `show controllers Modular-Cable card ? association`.
- `integrated_interface_name`—Defines the interface name format of the integrated cable that appears in the `ifDescr`. By default the interface name supported is `Integrated-Cable7/1/0:0` (`Integrated-Cable<slot/subslot/port>:<channelNo>`). If the interface name is `Integrated-Cable7/1/0-downstream0`, configure the “`integrated_interface_name`” parameter as `Integrated-Cable<slot/subslot/port>-downstream<channelNo>`. You can also configure two or more formats by entering the values separated by a comma.
- `modular_interface_name`—Defines the interface name format of the modular cable that appears in the `ifDescr`. By default the interface name supported is `Modular-Cable1/0/0:0` (`Modular-Cable<slot/subslot/port>:<channelNo>`). If the interface name is `Modular-Cable1/0/0-downstream0`, configure the “`modular_interface_name`” parameter as `Modular-Cable<slot/subslot/port>-downstream<channelNo>`. You can also configure two or more formats by entering the values separated by a comma.




---

**Note** In a multiple format configuration, the Cisco Service Control Subscriber Manager supports only one format at a time for a given channel. It is expected that an integrated or modular cable channel has any one of the formats configured with the `integrated_interface_name` and `modular_interface_name` parameters. The Cisco Service Control Subscriber Manager does not support a channel name with more than one format.

---

- `ignore_periodic_device_query`—Defines whether to enable the VLM periodic SNMP query for topology learning for a specific CMTS. The default value is `false`.
- `vlink_mode_for_periodic_snmp_bg_query`—Defines whether to query for subscribers with partial VLink mappings, full VLink mappings, and all. Configuring this parameter overrides the global configuration for the device. Possible values are `none`, `partialvlinkmappings`, `fullvlinkmappings`, `all`. The default value is `none`.

- `enable_dynamic_bg`—(Applicable only for Arris CMTS) Defines whether to learn dynamically created bonding group. Possible values are true and false. The default value is false.



**Note** Because the channels in a MAC domain may be shared with more than one dynamic bonding group, we recommend that you check the vlink reports at the MAC domain level. We also recommend that you set the number of bonding groups or channels within the Cisco SCE limit.

- `show_vlink_with_macdomain_name`—Defines whether to show the name of the MAC domain or the index of the MAC domain in vlink names and channel names. Possible values are true or false.

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

```
[Device.CMTS1]
ip=192.0.2.10
sce_name=SCE1
ignore_upvlink_ids=11,12,15-20
ignore_downvlink_ids=5-15
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
```

This example shows the option for disabling periodic topology learning of VLM:

```
[Device.CMTS1]
ip=<192.0.2.10>
sce_name=<SCE1>
log_all=true
port=161
snmp_community=public
ignore_periodic_device_query=true
```

- d. To support DOCSIS 3.0 channel in Cisco devices, VLM queries the devices for bonding group association by using Telnet or SSH. To query the devices, VLM requires the device credentials. To provide the VLM with device credentials, complete the next two steps:
  - Create an input CSV file, (for example, import.csv), with values in the format `CMTS_IP,username,password,enable_password,protocol,port` with separate line for each device.
  - Import the credentials to VLM by using the `p3vlink --import-cmts-details` CLU.

If the credentials are wrong, or if the device is not reachable on the configured port using the configured protocol, then the VLINK for DOCSIS 3.0 interfaces is not created and the CMTS supports only DOCSIS 2.0.

This example shows a sample input CSV file with 2 devices configured.

```
#cmtsip,username,loginpass,enablpass,protocol,port
10.52.26.22,cisco,cisco,cisco,telnet,23
10.52.26.21,cisco,cisco,cisco,telnet,23
```

If there is no enable password, the `enable_password` field can be “0”.

- e. Configure a device template that enables the users to define the dynamic device behavior. For more information on creating dynamic device, see the [“Dynamic GIADDR Learning” section on page 3-3](#).

The required parameters are:

- start—Setting the start parameter to yes instructs the VLM to create a dynamic device template. Possible values for this parameter are yes and no.  
If start is set to false, the VLM does not create a dynamic device. Changing 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 scc\_name are not defined; they are retrieved from the DHCP data during login operations. IPDR LEG does not support this feature.

---

**Step 10** Save and close the vlink.cfg configuration file.

**Step 11** Load the configuration to the Cisco Subscriber Manager by running the `>p3sm --load-config` command as the user pcube on the Cisco Subscriber Manager machine from the bin directory.




---

**Note** Remove Cisco SCE from the VLM solution using the `p3sm --load-config` command after changing the configuration file while the Subscriber Manager is running; otherwise, the Subscriber Manager might not delete Cisco SCE and the corresponding Vlinks from the database.

---

To load the configuration changes, after updating the configuration in the vlink.cfg file, it is necessary to run the `p3sm --load-config` command before restarting the Cisco Service Control Subscriber Manager. The configuration changes may have to be performed for any of the following tasks:

- Add a new CMTS.
- Remove a CMTS.
- Move CMTS across Cisco SCEs.
- Change the Cisco Service Control Collection Manager associated to Cisco SCE