



CHAPTER 4

Managing MPLS/VPN Support

This module explains how to manage MPLS/VPN support.

- [How to Manage MPLS/VPN Support via SNMP, page 4-1](#)
- [How to Monitor MPLS/VPN Support via SCE Platform CLI, page 4-2](#)
- [How to Manage MPLS/VPN Support via SM CLU, page 4-8](#)

How to Manage MPLS/VPN Support via SNMP

SNMP support for MPLS/VPN auto-learn is provided in two ways:

- MIB variables
- SNMP traps

MPLS/VPN MIB Objects

The *mplsVpnAutoLearnGrp* MIB object group (pcubeSEObjs 17) contains information regarding MPLS/VPN auto-learning.

The objects in the *mplsVpnAutoLearnGrp* provide the following information:

- maximum number of mappings
- allowed current number of mappings

For more information, see the "Proprietary MIB Reference" in the *Cisco Service Control Engine Software Configuration Guide*.

MPLS/VPN Traps

There is one MPLS/VPN-related trap:

- *mplsVpnTotalHWMappingsThresholdExceeded* (pcubeSeEvents 45)

To provide online notification of a resource deficiency, when the system reaches a level of 80% utilization of the hardware MPLS/VPN mappings, a warning message appears in the user log, and this SNMP trap is sent.

Both the warning and the trap are sent for each 100 mappings that are added after the threshold has been exceeded.

How to Monitor MPLS/VPN Support via SCE Platform CLI

The SCE platform CLI allows you to do the following:

- Display VPN-related mappings
- Monitor subscriber counters
- Monitor PE routers
- Monitor bypassed VPNs

How to Display VPN-related Mappings

Use the following Viewer commands to display subscriber mappings. These commands display the following information:

- All the mappings for a specified VPN
- A listing of all currently logged-in VPNs
- A listing of all subscribers mapped to an IP range on a specified VPN
- The number of subscribers mapped to an IP range on a specified VPN
- The subscriber to whom a specified downstream mapping (PE loopback IP address & BGP label) is mapped. (This option is provided for backwards compatibility and has certain restrictions. See below [How to Display the Name of the Subscriber Mapped to a Specified VPN, page 4-4.](#))

How to Display Mappings for a Specified VPN

- [Options, page 4-2](#)
- [Displaying Mappings for a Specified VPN: Examples, page 4-2](#)

Options

The following option is available:

- **vpn-name** — The name of the VPN for which to display mappings.

Step 1 From the SCE> prompt, type `show interface linecard 0 VPN name vpn-name` and press **Enter**.

Displaying Mappings for a Specified VPN: Examples

The following example illustrates the output of this command for an MPLS-based VPN.

```
SCE# show interface linecard 0 VPN name vpn1
VPN name: Vpn1
Downstream MPLS Mappings:
PE-ID = 1.0.0.1 Mpls Label = 20
PE-ID = 1.0.0.1 Mpls Label = 30
=====>Total Downstream Mappings: 2
Upstream MPLS Mappings:
=====>Total Upstream Mappings: 0
Number of subscriber mappings: 0
Explicitly introduced VPN
```

The following example illustrates the output of this command for a VLAN-based VPN.

```
SCE> show interface linecard 0 VPN name Vpn3
VPN name: Vpn3
VLAN: 2
Number of subscriber mappings: 0
Explicitly introduced VPN
```

The following example illustrates the output of this command for an automatically created VLAN.

```
SCE> show interface linecard 0 VPN name 2
VPN name: 2
VLAN: 2
Number of subscriber mappings: 1
Automatically created VPN
```

How to Display a Listing of all VPNs

Use this command to display a listing of all currently logged-in VPNs

Step 1 From the SCE> prompt, type `show interface linecard 0 VPN all-names` and press **Enter**.

Displaying a Listing of All VPNs: Example

```
SCE# show interface linecard 0 VPN all-names
```

How to Display Subscriber Mappings for an IP range on a Specified VPN

- [Options, page 4-3](#)
- [Displaying Subscribers Mapped to a IP range on a Specified VPN: Example, page 4-3](#)

Options

The following options are available:

- **ip-range** — The IP range for which to display mapped subscribers
- **vpn-name** — The name of the VPN for which to display mappings.

Step 1 From the SCE> prompt, type `show interface linecard 0 subscriber mapping included-in IP ip-range VPN vpn-name` and press **Enter**.

The VPN option allows you to search for subscribers with a private IP mapping

Displaying Subscribers Mapped to a IP range on a Specified VPN: Example

```
SCE# show interface linecard 0 subscriber mapping included-in IP 10.0.0.0/0 VPN vpn1
Subscribers with IP mappings included in IP range '10.0.0.0/0@vpn1':
Subscriber 'Sub10', mapping '10.1.4.150/32@vpn1'.
Subscriber 'Sub10', mapping '10.1.4.149/32@vpn1'.
Subscriber 'Sub10', mapping '10.1.4.145/32@vpn1'.
Subscriber 'Sub11', mapping '10.1.4.146/32@vpn1'.
Total 2 subscribers found, with 4 matching mappings
```

How to Display the Number of Subscribers Mapped to an IP range on a Specified VPN

- [Options, page 4-4](#)
- [Displaying the Number of Subscribers Mapped to range on a Specified VPN: Example, page 4-4](#)

Options

The following options are available:

- **ip-range** — The IP range for which to display mapped subscribers
- **vpn-name** — The name of the VPN for which to display mappings.

Use the ‘ **amount** ’ keyword to display the number of subscribers rather than a listing of subscriber names.

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- Step 1** From the SCE> prompt, type `show interface linecard 0 subscriber amount mapping included-in IP ip-range VPN vpn-name` and press **Enter**.
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Displaying the Number of Subscribers Mapped to range on a Specified VPN: Example

```
SCE# show interface linecard 0 subscriber amount mapping included-in IP 0.0.0.0/0 VPN vpn1
There are 2 subscribers with 4 IP mappings included in IP range '0.0.0.0/0'.
```

How to Display the Name of the Subscriber Mapped to a Specified VPN

If the MPLS/VPN is configured as a single subscriber mapped to 0.0.0.0/0 on the VPN that is mapped to the specified MPLS, this option displays that subscriber



Note

This command provides backward compatibility for MPLS/VPN subscriber configuration in SCOS versions previous to 3.1.5.

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- Step 1** From the SCE# prompt, type `show interface linecard 0 subscriber mapping MPLS-VPN PE-ID pe-id BGP-label label` and press **Enter**.
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- [Displaying the Subscriber Mapped to a Specified VPN: Example 1, page 4-4](#)
- [Displaying the Subscriber Mapped to a Specified VPN: Example 2, page 4-4](#)

Displaying the Subscriber Mapped to a Specified VPN: Example 1

```
SCE#>show interface lineCard 0 subscriber mapping MPLS-VPN PE-ID 1.0.0.1 BGP-label 30
BGP MPLS label 30 on PE 1.0.0.1 is mapped to VPN named 'Vpn1'
The VPN is NOT mapped to a single subscriber (0.0.0.0/0@Vpn1)
```

Displaying the Subscriber Mapped to a Specified VPN: Example 2

```
SCE#>show interface lineCard 0 subscriber mapping MPLS-VPN PE-ID 1.0.0.1 BGP-label 30
BGP MPLS label 30 on PE 1.0.0.1 is mapped to VPN named 'Vpn1'
Subscriber 'Sub10' is mapped to 0.0.0.0/0@Vpn1
```

How to Display the Mappings of Upstream Labels that Belong to Non-VPN Flows

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- Step 1** From the SCE# prompt, type `show interface linecard 0 MPLS-VPN non-VPN-mappings` and press **Enter**.
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How to Clear Upstream VPN Mappings

Use this command to remove all learned upstream labels of a specified VPN.

Options

The following option is available:

- **vpn-name** — The name of the VPN for which to display mappings.

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- Step 1** From the SCE# prompt, type `clear interface linecard 0 VPN name vpn-name upstream mpls all` and press **Enter**.

This command, in effect, causes early label aging. Clearing the mappings allows relearning; labels will probably be quickly relearned after they have been cleared. Therefore, this command is useful when you want to update the VPN mappings without waiting for the standard aging period.

How to Monitor Subscriber Counters

Use the following Viewer command to display subscriber counters, including those related to MPLS/VPN mappings.

- [About Subscriber Counters, page 4-5](#)
- [Monitoring Subscriber Counters: Example, page 4-6](#)

About Subscriber Counters

When MPLS/VPN-based subscribers are enabled, the following related counters appear in addition to the basic subscriber counters:

- MPLS/VPN-based subscribers:
 - Current number of MPLS/-based subscribers that have VPN mappings.
 - Maximum number of MPLS/VPN-based subscribers
- MPLS/VPN-based subscribers are also counted in the general subscribers counters, but the general subscribers maximum number does not apply to MPLS/VPN-based subscribers, which have a smaller maximum number.
- MPLS/VPN mappings:
 - Current number of used MPLS/VPN mappings
 - Maximum number of MPLS/VPN mappings

- Note that these values reflect the total number of mappings, not just the mappings used by MPLS/VPN-based subscribers. Bypassed VPNs also consume MPLS/VPN mappings.

Step 1 From the SCE# prompt, type `show interface linecard 0 subscriber db counters` and press **Enter**.

Monitoring Subscriber Counters: Example

```
SCE#show interface linecard 0 subscriber db counters
Current values:
=====
Subscribers: 2 used out of 99999 max.
Introduced subscribers: 2.
Anonymous subscribers: 0.
Subscribers with mappings: 2 used out of 99999 max.
SINGLE non-VPN IP mappings: 1.
non-VPN IP Range mappings: 1.
IP Range over VPN mappings: 1.
Single IP over VPN mappings: 3.
MPLS-based subscribers are enabled.
MPLS/VPN mappings: 2 used out of 57344 max.
MPLS based VPNs with subscriber mappings: 2 used out of 2015 max.
Subscribers with open sessions: 0.
Subscribers with TIR mappings: 0.
Sessions mapped to the default subscriber: 0.
Peak values:
=====
Peak number of subscribers with mappings: 2
Peak number occurred at: 14:56:55 ISR MON June 9 2007
Peak number cleared at: 15:29:39 ISR MON June 9 2007
Event counters:
=====
Subscriber introduced: 2.
Subscriber pulled: 0.
Subscriber aged: 0.
Pull-request notifications sent: 0.
State notifications sent: 0.
Logout notifications sent: 0.
Subscriber mapping TIR contradictions: 0
```

How to Monitor MPLS/VPN Counters

Use the following Viewer command to display MPLS/VPN information.

Step 1 From the SCE# prompt, type `show interface linecard 0 mpls vpn` and press **Enter**.

Monitoring MPLS/VPN Counters: Example

```
SCE#show interface linecard 0 mpls vpn
MPLS/VPN auto-learn mode is enabled.
MPLS based VPNs with subscriber mappings: 0 used out of 2015 max
Total HW MPLS/VPN mappings utilization: 0 used out of 57344 max
MPLS/VPN mappings are divided as follows:
```

```
downstream VPN subscriber mappings: 0
upstream VPN subscriber mappings: 0
non-vpn upstream mappings: 0
downstream bypassed VPN mappings: 0
upstream bypassed VPN mappings: 0
```

How to Monitor the PE Routers

Use the following Viewer commands to monitor PE routers. These commands provide the following information:

- Configuration of all currently defined PE routers.
- Configuration of a specified PE router.

How to Display the Configuration of all Currently Defined PE Routers

Step 1 From the SCE# prompt, type `show interface linecard 0 MPLS VPN PE-Database` and press **Enter**.

How to Display the Configuration of a Specified PE Router

Step 1 From the SCE# prompt, type `show interface linecard 0 MPLS VPN PE-Database PE-ID pe-id` and press **Enter**.

How to Monitor Bypassed VPNs

- [How to Display the Currently Bypassed VPNs, page 4-7](#)
- [How to Remove all Learned Bypassed VPNs, page 4-7](#)

How to Display the Currently Bypassed VPNs

Step 1 From the SCE# prompt, type `show interface linecard 0 MPLS VPN Bypassed-VPNs` and press **Enter**.

How to Remove all Learned Bypassed VPNs

Step 1 From the SCE# prompt, type `clear interface linecard 0 MPLS VPN Bypassed-VPNs` and press **Enter**.

How to Monitor Non-VPN Mappings

- [How to Display Non-VPN Mappings, page 4-8](#)
- [How to Remove all Learned non-VPN Mappings, page 4-8](#)

How to Display Non-VPN Mappings

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- Step 1** From the SCE# prompt, type `show interface linecard 0 MPLS VPN non-VPN-mappings` and press **Enter**.
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How to Remove all Learned non-VPN Mappings

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- Step 1** From the SCE# prompt, type `clear interface linecard 0 MPLS VPN non-VPN-mappings` and press **Enter**.
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How to Manage MPLS/VPN Support via SM CLU

The SM CLU allows you to do the following:

- Add and remove VPNs
- Display VPN information
- Clear MPLS/VPN mappings

For more information, see the *Cisco Service Control Management Suite Subscriber Manager User Guide*.

Managing VPNs

Use the `p3vpn` utility to manage VPNs.

- [Options, page 4-8](#)
- [How to Add a New MPLS-based VPN, page 4-9](#)
- [How to Remove a VPN, page 4-9](#)
- [How to Display VPN Information, page 4-9](#)
- [How to Manage VPN Mappings, page 4-10](#)

Options

The following options are available:

- **VPN-Name** — The name assigned to the VPN when it was added, or, if adding a VPN, the name to be assigned to it..

- **RT@PE-IP** — The mapping assigned to the VPN. Multiple mappings can be specified using a comma.
 - **RT** = the route target of the VPN, specified using the ASN:n notation or the IP:n notation
 Note that the Route Distinguisher may be specified rather than the route target
 - **PE-IP** = the loopback IP of the PE router connected to that VPN

How to Add a New MPLS-based VPN

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- Step 1** From the shell prompt, type the following command: `p3vpn --add --vpn=VPN-Name --mpls-vpn=RT@PE, (RT@PE2, RT@PE3, ...)` .
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How to Remove a VPN

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- Step 1** From the shell prompt, type the following command: `p3vpn --remove --vpn=VPN-Name`
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How to Display VPN Information

- [To List All Existing VPNs, page 4-9](#)
- [To List All Subscribers for a Specified VPN, page 4-9](#)
- [To Display the Mappings for a Specified VPN, page 4-9](#)

To List All Existing VPNs

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- Step 1** From the shell prompt, type the following command: `p3vpn --show-all`
-

To List All Subscribers for a Specified VPN

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- Step 1** From the shell prompt, type the following command: `p3vpn --show-sub --vpn=VPN-Name`
-

Listing All Subscribers for a Specified VPN: Example

```
p3vpn -show-sub --vpn=vpn1
sub1: 10.1.1.0/24@vpn1
sub2: 20.1.1.0/24@vpn1
Command terminated successfully
```

To Display the Mappings for a Specified VPN

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- Step 1** From the shell prompt, type the following command: `p3vpn --show --vpn=VPN-Name`
-

Listing All Subscribers for a Specified VPN: Example

```
p3vpn --show --vpn=vpn1
Name:          vpn1
Domain:        subscribers
Mappings:
MPLS/VPN: 1:1000@10.0.0.1      (no BGP information)
MPLS/VPN: 1:1000@10.0.0.2      label: 10 IP range: 1.1.1.1/32
Command terminated successfully
```

How to Manage VPN Mappings

- [To Remove All Existing Mappings from a Specified VPN, page 4-10](#)
- [To Remove a Specified Mapping from a Specified VPN, page 4-10](#)

To Remove All Existing Mappings from a Specified VPN

Step 1 From the shell prompt, type the following command: `p3vpn --remove-all-mappings --vpn=VPN-Name`

To Remove a Specified Mapping from a Specified VPN

Step 1 From the shell prompt, type the following command: `p3vpn --remove-mappings --vpn=VPN-Name --mpls-vpn=RT@PE, (RT@PE2, RT@PE3, ...)`

How to Add Mappings to VPN-based Subscribers

There are three types of mappings that can be added to an existing VPN-based subscriber:

- A set of IP addresses defined as IP@VPN
- A complete VPN (this is actually a special case of IP@VPN mappings, in which the mapping is defined as 0.0.0.0/0@VPN)
- All the IP addresses of a CE router, defined by a AS:value@VPN-NAME (BGP community)

How to Add IP Address Mappings**Options**

The following options are available

- **SUB-NAME** — The name of the subscriber to be associated with the specified community attribute
- **IP1[/RANGE][,...]@VPN-NAME** — IP address or addresses to assign to the VPN
 - **IP** = the IP address. This may be any of the following
 - a single IP address (x.x.x.x)
 - a single range of IP addresses (x.x.x.x/y)
 - a list of IP addresses separated by commas (x.x.x.x, y.y.y.y, z.z.z.z)
 - a list of IP address ranges (x.x.x.x/a, y.y.y.y/b, z.z.z.z/c)

- **VPN-NAME** = name of the VPN to which the community attribute will be assigned
- **--additive-mappings** — Use this option to add the new mapping(s) to any existing ones. (Without this option, any existing mappings are overwritten.)

Step 1 From the shell prompt, type the following command: `p3subs -add --subscriber=SUB-NAME --ip=IP1 [/RANGE] [, ...]@VPN-NAME [--additive-mappings]`

How to Add VPN-based Mappings

This option is supported to provide backwards compatibility with MPLS/VPN-based subscribers in releases before 3.1.5.

Options

The following options are available

- **SUB-NAME** — The name of the subscriber to be associated with the specified community attribute
- **VPN-NAME** — The name of the VPN to which the subscriber will be mapped. (This option is equivalent to defining the mapping as `0.0.0.0/0@VPN`)
- **--additive-mappings** — Use this option to add the new mapping(s) to any existing ones. (Without this option, any existing mappings are overwritten.)

Step 1 From the shell prompt, type the following command: `p3subs -add --subscriber=SUB-NAME --vpn=VPN-NAME [--additive-mappings]`

How to Configure the Community Parameter

An optional parameter may be set defining a community attribute. The community attribute provides a mechanism for defining the BGP community as one subscriber, using the `community@VPN` specification.

The community attribute in the BGP protocol is used to dynamically map IP ranges to subscribers. The community attribute can be configured in the Provider Edge (PE) router or in the Customer Edge (CE) router.

The `community@VPN` specification is replaced by an `IP@VPN` specification by the BGP LEG.

Use the **p3subs** utility to configure the community parameter.

Options

The following options are available:

- **SUB-NAME** — The name of the subscriber to be associated with the specified community attribute
- **AS:value@VPN-NAME** — The community attribute to assign to the VPN
 - **AS** = autonomous system. Integer in the range 0-65535 assigned by the network administrator
 - **value** = the community attribute. Integer in the range 0-65535 assigned by the network administrator
 - **VPN-NAME** = name of the VPN to which the community attribute will be assigned

Step 1 From the shell prompt, type the following command: `p3subs -add --subscriber=SUB-NAME
--community=AS:value@VPN-NAME`

How to Remove VPN Mappings from Subscribers

- [To Remove All Existing Mappings from a Specified Subscriber, page 4-12](#)
- [To Remove a Specified IP Mapping from a Specified Subscriber, page 4-12](#)
- [To Remove a Specified VPN Mapping from a Specified Subscriber, page 4-12](#)
- [To Remove a Specified Community-based Mapping from a Specified Subscriber, page 4-12](#)

To Remove All Existing Mappings from a Specified Subscriber

Step 1 From the shell prompt, type the following command: `p3subs --remove-all-mappings
--subscriber=SUB-NAME`

To Remove a Specified IP Mapping from a Specified Subscriber

Step 1 From the shell prompt, type the following command: `p3psubs --remove-mappings
--subscriber=SUB-NAME --ip=IP1[/RANGE][, ...]@VPN-NAME`

To Remove a Specified VPN Mapping from a Specified Subscriber

Step 1 From the shell prompt, type the following command: `p3psubs --remove-mappings
--subscriber=SUB-NAME --vpn=VPN-NAME`

To Remove a Specified Community-based Mapping from a Specified Subscriber

Step 1 From the shell prompt, type the following command: `p3psubs --remove-mappings
--subscriber=SUB-NAME --community=AS:value@VPN-NAME`

How to Monitor Subscriber MPLS/VPN Mappings

Use the `p3subs` utility to manage VPNs.

Step 1 From the shell prompt, type the following command: `p3subs --show-all-mappings`
`--subscriber=SUB-NAME`
