



Mapping Service Flows to MPLS-VPN on the Cisco uBR7100 Series and Cisco uBR7200 Series Routers

Feature History

Release	Modification
12.2(11)BC2	This feature was supported on the Cisco uBR7100 series and Cisco uBR7200 series universal broadband routers.

This document describes the Mapping Service Flows to MPLS-VPN feature, which enhances the existing multiprotocol label switching (MPLS) virtual private networks (VPNs) support to provide more flexible Managed Access for multiple Internet Service Provider (ISP) support over a hybrid fiber-coaxial (HFC) cable network.

This document contains the following major sections:

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Feature Overview

Starting with Cisco IOS 12.1(2)T and Cisco IOS 12.1(2)EC, the Cisco uBR7100 series and Cisco uBR7200 series routers have provided Managed Access using MPLS-VPNs configured over cable subinterfaces, with each subinterface configured for a specific ISP. This use of MPLS-VPNs gives service providers a manageable way to offer users access to multiple ISPs over the same physical HFC cable network.

This system works very well when all CPE devices behind a cable modem are using the same ISP. However, users are increasingly requesting more complex networks that would allow multiple CPE devices to access different ISPs through the same cable modem.

For example, different users in one household might want to use different PCs to access different ISPs. Another increasingly common situation is that one user requires a secure VPN connection for telecommuting through one ISP, while other users in the household use other computers to access the public Internet through a separate ISP.

The Mapping Service Flows to MPLS-VPN feature solves this problem by using DOCSIS 1.1 upstream packet classifiers and service flow IDs (SFIDs) to map individual CPE devices to separate MPLS-VPN interfaces. The SFID to MPLS-VPN mapping occurs as follows:

1. The service provider creates a DOCSIS configuration file for each cable modem that contains the following information:
 - Multiple secondary upstream service flows that specify a QoS profiles for each CPE device that uses this particular cable modem.
 - Each upstream service flow must contain a Vendor Specific QoS Parameter (TLV type 43, subtype 04) that identifies the MPLS-VPN route to be used for packets using this particular service flow.
 - Multiple secondary upstream packet classifiers that the Cisco uBR7100 series and Cisco uBR7200 series routers will use to match packets to the proper service flows. To accomplish this, each classifier must contain the MAC address for one or more CPE devices as the Source MAC Address parameter (TLV type 10, subtype 2).



Note The DOCSIS configuration file also must create a primary downstream and a primary upstream service flow and packet classifier, as well as other required parameters, but these are not used for the SFID to MPLS-VPN mapping.

2. The cable modem downloads the DOCSIS configuration file during its registration process and configures itself for the proper service flows and packet classifiers.
3. The cable modem then comes online, at which point it begins receiving packets from its CPE devices. The cable modem uses the packet's source MAC address to match the packet to the proper packet classifier, which then identifies the correct SFID to use. The cable modem then transmits the packet to the Cisco uBR7100 series and Cisco uBR7200 series routers using this upstream SFID.
4. The Cisco uBR7100 series and Cisco uBR7200 series routers examines the packet to determine its SFID, and then uses the Vendor-Specific QoS Parameter associated with that service flow to route the packet to the appropriate MPLS-VPN interface.

If the DOCSIS configuration file for the cable modem does not contain an MPLS-VPN route, the packets from that cable modem are routed according to the routing tables on the Cisco uBR7100 series and Cisco uBR7200 series routers.

Benefits

The Mapping Service Flows to MPLS-VPN feature provides the following benefits to cable service providers and their partners and customers:

- Allows the service provider to maintain full control over the cable modems and other devices that are directly connected to the cable plant.
- Provides a highly flexible, scalable, and easy to manage system.
- Supports overlapping IP address ranges.
- Provides secure support for multiple intranets and extranets.

- Supports multiple IP Quality of Service (QoS) classes.

Restrictions

The Mapping Service Flows to MPLS-VPN feature has the following restrictions and limitations:

- Each cable modem using this feature should be using its own unique DOCSIS configuration file that creates an upstream packet classifier and service flow for each CPE device that is behind the cable modem.
- The DOCSIS configuration file for a cable modem must be updated whenever a CPE device is added or removed, or whenever the MAC address for a CPE device changes.
- Whenever a user adds, removes, or changes a CPE device, the cable modem must be reset so that it will load the updated DOCSIS configuration file.
- This mapping occurs only with classifiers and service flows that are created statically in the DOCSIS configuration file. It does not occur with dynamically-created service flows.

Related Features and Technologies

The following documents describe features and technologies that are related to the Mapping Service Flows to MPLS-VPN feature:

- MPLS Protocol, which is at the following URL:

http://www.cisco.com/en/US/tech/tk436/tk428/tsd_technology_support_protocol_home.html

- Cisco VPN Solution Center Software VPN Solutions Center: MPLS Solution Provisioning and Operations Guide, 1.2, which is at the following URL:

http://www.cisco.com/en/US/products/sw/netmgmtsw/ps2327/products_technical_reference_book09186a0080087ca3.html

Related Documents

The following documents provide additional supporting information about the Mapping Service Flows to MPLS-VPN feature:

- Cisco Cable-Ready High Speed Data (HSD) Managed Access Solution for Service Providers, which is at the following URL:

http://www.cisco.com/en/US/docs/cable/cmts/feature/guide/ufg_serv.html

- Cisco uBR7200 Series MPLS VPN Cable Enhancements, which is at the following URL:

http://www.cisco.com/en/US/docs/ios/12_1t/12_1t2/feature/guide/dtvpn.html

Supported Platforms

The Mapping Service Flows to MPLS-VPN feature is supported on the following platforms:

- Cisco uBR7100 series universal broadband router
- Cisco uBR7200 series universal broadband router

Determining Platform Support Through Cisco Feature Navigator

Cisco IOS software is packaged in feature sets that are supported on specific platforms. To get updated information regarding platform support for this feature, access Cisco Feature Navigator. Cisco Feature Navigator dynamically updates the list of supported platforms as new platform support is added for the feature.

Cisco Feature Navigator is a web-based tool that enables you to determine which Cisco IOS software images support a specific set of features and which features are supported in a specific Cisco IOS image. You can search by feature or release. Under the release section, you can compare releases side by side to display both the features unique to each software release and the features in common.

To access Cisco Feature Navigator, you must have an account on Cisco.com. If you have forgotten or lost your account information, send a blank e-mail to cco-locksmith@cisco.com. An automatic check will verify that your e-mail address is registered with Cisco.com. If the check is successful, account details with a new random password will be e-mailed to you. Qualified users can establish an account on Cisco.com by following the directions found at this URL:

<https://tools.cisco.com/RPF/register/register.do>

Cisco Feature Navigator is updated regularly when major Cisco IOS software releases and technology releases occur. For the most current information, go to the Cisco Feature Navigator home page at the following URL:

<http://www.cisco.com/go/fn>

Availability of Cisco IOS Software Images

Platform support for particular Cisco IOS software releases is dependent on the availability of the software images for those platforms. Software images for some platforms may be deferred, delayed, or changed without prior notice. For updated information about platform support and availability of software images for each Cisco IOS software release, refer to the online release notes or, if supported, Cisco Feature Navigator.

Supported Standards, MIBs, and RFCs

The Mapping Service Flows to MPLS-VPN feature is based on the following standards, MIBs, and RFCs:

Standards

- Data-Over-Cable Service Interface Specifications Radio Frequency Interface Specification (SP-RFIV1.1-I08-020301)

MIBs

No new or modified MIB objects are supported by the Mapping Service Flows to MPLS-VPN feature.

To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL:

<http://tools.cisco.com/ITDIT/MIBS/servlet/index>

If Cisco MIB Locator does not support the MIB information that you need, you can also obtain a list of supported MIBs and download MIBs from the Cisco MIBs page at the following URL:

<http://www.cisco.com/public/sw-center/netmgmt/cmtk/mibs.shtml>

To access Cisco MIB Locator, you must have an account on Cisco.com. If you have forgotten or lost your account information, send a blank e-mail to cco-locksmith@cisco.com. An automatic check will verify that your e-mail address is registered with Cisco.com. If the check is successful, account details with a new random password will be e-mailed to you. Qualified users can establish an account on Cisco.com by following the directions found at this URL:

<https://tools.cisco.com/RPF/register/register.do>

RFCs

- RFC 1163, A Border Gateway Protocol
- RFC 1164, Application of the Border Gateway Protocol in the Internet
- RFC 2233, DOCSIS OSSI Objects Support
- RFC 2283, Multiprotocol Extensions for BGP-4
- RFC 2547, BGP/MPLS VPNs
- RFC 2665, DOCSIS Ethernet MIB Objects Support
- RFC 2669, Cable Device MIB

Prerequisites

- The Cisco uBR7100 series and Cisco uBR7200 series routers must be running Cisco IOS Release 12.2(11)BC2 or later Cisco IOS Release 12.2 BC release.
- The Cisco uBR7100 series and Cisco uBR7200 series routers must be configured for the proper VPN routing/forwarding (VRF) interfaces, as specified by the documentation in the “[Related Documents](#)” section on page 3.
- Your DOCSIS configuration file editor must support the inclusion of Vendor Specific Options (TLV subtype 43) in the Upstream Service Flow Encodings parameter set (TLV type 24). The new option to be added is called the VPN Route Distinguisher parameter (TLV subtype 4) and must be preceded by the Cisco Vendor ID (00000C).

For example, using the Cisco DOCSIS Configurator tool, you would specify the following fields in the ASCII configuration file:

```
S43 (Vendor Specific Options)
    T08 (Vendor ID)                = 00 00 0c
    T04 (VPN Route Distinguisher) = xx xx xx xx xx xx xx xx
```

where the VPN Route Distinguisher contains eight hexadecimal bytes. The first two hexadecimal bytes specify the format of the remaining six bytes:

- If bytes 1 and 2 are 00 00, bytes 3 and 4 specify the 16-bit autonomous system (AS) number, and bytes 5 to 8 specify a unique 32-bit identifier.
- If bytes 1 and 2 are 00 01, bytes 3 to 6 specify the 32-bit IP address, and bytes 7 and 8 specify a unique 16-bit identifier.

Configure the VPN Route Distinguisher parameter to the same *route-distinguisher* ID that you have specified on the Cisco uBR7100 series and Cisco uBR7200 series routers using the **rd** command in VRF configuration submode.

Configuration Tasks

See the following section for the configuration tasks to configure the Mapping Service Flows to MPLS-VPN feature. Each task in the list is identified as either required or optional.

- [Creating a DOCSIS Configuration File \(required\)](#), page 6



Note

This section describes only the configuration tasks needed to enable the Mapping Service Flows to MPLS-VPN feature. It does not describe the basic MPLS-VPN configuration tasks. For information on configuring MPLS-VPN routes, see the documentation listed in the [“Related Documents” section on page 3](#).

Creating a DOCSIS Configuration File (required)

The Cisco uBR7100 series and Cisco uBR7200 series routers automatically maps service flows to MPLS-VPN interfaces when an upstream service flow includes the VPN Route Distinguisher parameter as a vendor-specific TLV. The VPN Route Distinguisher parameter points to the *route-distinguisher* ID that has been specified using the **rd** command in VRF configuration submode.

You must also create a corresponding upstream packet classifier that identifies the source MAC address that will use this SFID-to-MPLS VPN mapping. To create a DOCSIS configuration file that contains both of these parameters, use the following procedure.



Note

This procedure uses the Cisco DOCSIS Configurator tool to create the DOCSIS configuration file. However, you can use any tool that creates DOCSIS-compatible configuration files.

- Step 1** Obtain the MAC addresses for the CPE devices that will use this particular cable modem.
- Step 2** Create an upstream packet classifier for each CPE device, specifying the corresponding SFID and Source MAC Address, along with the other appropriate parameters. For example, the following configuration for classifier 14 specifies that service flow 7 should be used for the MAC address at 00 00 0C A1 B2 C3:

```
22 (Upstream Packet Classification Encoding Block)
S01 (Classifier Reference)           = 14
S03 (Service Flow Reference)        = 7
S10 (Ethernet LLC Packet Classification Encodings)
T02 (Source MAC Address)           = 00 00 0C A1 B2 C3
```

- Step 3** Create a matching upstream service flow for this CPE device. This service flow must include all necessary parameters, as well as a vendor-specific VPN Route Distinguisher parameter (TLV subtype 4) that identifies the route-designator ID for the VRF route that has been created for this user.

The route-designator ID consists of two integers that can be in the following two forms:

- Type 0—Contains a 16-bit autonomous system (AS) number and a unique 32-bit identifier
- Type 1—Contains a 32-bit IP address and a unique 16-bit identifier

Configure the VPN Route Distinguisher parameter to the same *route-distinguisher* ID that you have specified on the Cisco uBR7100 series and Cisco uBR7200 series routers using the **rd** command in VRF configuration submode. For example, if you configured a type 0 route using the following CLI commands:

```
ip vrf isp1
rd 64000:1
```

Configure the matching upstream service flow with the following parameters:

```
24 (Upstream Service Flow Encodings)
S43 (Vendor Specific Options) = 8.3.0.0.12.4.8.0.0.250.0.0.0.0.1
```

The Vendor Specific Options field translates into two TLVs. The first TLV is of type 8 (Vendor ID), length 3, and value of 00.00.0C hexadecimal to identify Cisco Systems. The second TLV is of type 4 (VPN Route Distinguisher), length 8, and value of 00.00.FA.0.0.0.0.1 (hexadecimal).



Tip If you are using the graphical interface in the Cisco DOCSIS Configurator tool to create the DOCSIS configuration file, enter the entire dotted decimal string into the “Vendor Specific QoS” field in the Upstream and Downstream Service Flow screens. Using the above example, you would enter “8.3.0.0.12.4.8.0.0.250.0.0.0.1” into this field.

Similarly, if you configured a type 1 route using the following CLI commands:

```
ip vrf isp2
rd 10.10.10.15:1
```

Configure the matching upstream service flow with the following parameters:

```
24 (Upstream Service Flow Encodings)
S43 (Vendor Specific Options) = 8.3.0.0.12.4.8.0.1.10.10.10.15.0.1
```

Similarly, the Vendor Specific Options field translates into two TLVs. The first TLV is of type 8 (Vendor ID), length 3, and value of 00.00.0C hexadecimal to identify Cisco Systems. The second TLV is of type 4 (VPN Route Distinguisher), length 8, and value of 00.01.0A.0A.0A.0F.00.01 (hexadecimal).

Repeat this procedure for each upstream packet classifier and service flow that is to be mapped to an MPLS-VPN interface.

Monitoring and Maintaining the Mapping Service Flows to MPLS-VPN Feature

This section provides examples of the CLI commands that show the configuration and current status of the CMs that are using the Mapping Service Flows to MPLS-VPN feature. These examples display a number of CMs that are online, and the last CM (with the primary SID of 6) has three CPE devices connected to separate ISPs.

Displaying CMs and CPE devices

To display the number of CMs that are currently registered and online, use the **show cable modem** command:

```
Router# show cable modem
```

MAC Address	IP Address	I/F	MAC State	Prim Sid	RxPwr (db)	Timing Offset	Num CPE	BPI Enb
0030.8047.b41f	5.108.1.21	C3/0/U2	online(pt)	1	0.75	2821	0	Y
0007.0e03.1349	5.109.1.9	C3/0/U0	online	2	*0.00	2816	0	N
0007.0e03.12bd	5.108.1.18	C3/0/U0	online(pt)	3	-0.25	2812	0	Y
0030.80bc.22d5	5.108.1.20	C3/0/U0	online(pt)	4	0.25	2819	0	Y
0007.0e03.1331	5.111.1.6	C3/0/U0	online	5	-0.25	2816	0	N
00a0.73b0.4cc1	5.110.1.6	C3/0/U0	online(pt)	6	-0.25	2990	3	Y

```
Router#
```

To display the CPE devices that are associated with each CM, use the **show interface cable modem** command:

```
Router# show interface cable 3/0 modem 0
```

SID	Priv bits	Type	State	IP address	method	MAC address
1	11	modem	up	5.108.1.21	dhcp	0030.8047.b41f
2	00	modem	up	5.109.1.9	dhcp	0007.0e03.1349
3	11	modem	up	5.108.1.18	dhcp	0007.0e03.12bd
4	11	modem	up	5.108.1.20	dhcp	0030.80bc.22d5
5	00	modem	up	5.111.1.6	dhcp	0007.0e03.1331
6	11	modem	up	5.110.1.6	dhcp	00a0.73b0.4cc1
6	11	host	unknown	131.1.2.30	dhcp	0002.e323.ac08
6	11	host	unknown	129.1.2.18	dhcp	0050.046b.8b97
6	11	host	unknown	130.1.2.24	dhcp	0050.da80.c13e

```
Router#
```

Displaying SID and MPLS Mappings

To display the mapping of currently-used SIDs to SFIDs and their current state, use the **show interface cable sid verbose** command:

```
Router# show interface cable 3/0 sid verbose
```

Sid	Prim	MAC Address	IP Address	Type	Age	Admin State	Sched Type	Sfid
1		0030.8047.b41f	5.108.1.21	stat	3h43m	enable	RSVD	3
2		0007.0e03.1349	5.109.1.9	stat	3h43m	enable	RSVD	5
3		0007.0e03.12bd	5.108.1.18	stat	3h43m	enable	BE	7
4		0030.80bc.22d5	5.108.1.20	stat	3h43m	enable	BE	9
5		0007.0e03.1331	5.111.1.6	stat	3h42m	enable	BE	11
6		00a0.73b0.4cc1	5.110.1.6	stat	08:19	enable	BE	13
7	6	00a0.73b0.4cc1	5.110.1.6	stat	08:19	enable	BE	15
8	6	00a0.73b0.4cc1	5.110.1.6	stat	08:19	enable	BE	16
9	6	00a0.73b0.4cc1	5.110.1.6	stat	08:19	enable	BE	17

```
Router#
```

To display the mappings between service flow IDs and MPLS-VPN subinterface, use the **show interface cable sid association** command:

```
Router# show interface cable 3/0 sid association
```

Sid	Prim	Online	IP Address	MAC Address	Interface	VRF Name
1		online(pt)	5.108.1.21	0030.8047.b41f	Ca3/0.2	isp1
2		online	5.109.1.9	0007.0e03.1349	Ca3/0.3	isp2
3		online(pt)	5.108.1.18	0007.0e03.12bd	Ca3/0.2	isp1
4		online(pt)	5.108.1.20	0030.80bc.22d5	Ca3/0.2	isp1
5		online	5.111.1.6	0007.0e03.1331	Ca3/0.5	isp4
6		online(pt)	5.110.1.6	00a0.73b0.4cc1	Ca3/0.4	isp3
7	6				Ca3/0.2	isp1
8	6				Ca3/0.3	isp2
9	6				Ca3/0.4	isp3

Router#

Displaying Service Flow Configurations

To display the basic mapping of service flows and packet classifiers, use the **show interface cable service-flow** command. To display complete service flow configuration information, add the **verbose** keyword (**show interface cable service-flow verbose** command).

The following example displays the service flow information for the CM that is using the primary SID of 6 and the SFID of 13:

Router# **show interface cable 3/0 service-flow 13**

Sfid	Sid	Mac Address	QoS	Param	Index	Type	Dir	Curr	Active
			Prov	Adm	Act			State	Time
13	6	00a0.73b0.4cc1	7	7	7	prim	US	act	12:59

Router# **show interface cable 3/0 13 verbose**

```

Sfid                               : 13
Mac Address                         : 00a0.73b0.4cc1
Type                                : Primary
Direction                          : Upstream
Current State                       : Active
Current QoS Indexes [Prov, Adm, Act] : [7, 7, 7]
Active Time                         : 13:02
Sid                                 : 6
Traffic Priority                    : 0
Maximum Sustained rate              : 0 bits/sec
Maximum Burst                       : 3044 bytes
Minimum Reserved Rate               : 0 bits/sec
Admitted QoS Timeout                : 200 seconds
Active QoS Timeout                  : 0 seconds
Packets                             : 13
Bytes                               : 1833
Rate Limit Delayed Grants           : 8
Rate Limit Dropped Grants           : 0
Current Throughput                  : 0 bits/sec, 0 packets/sec
Classifiers: NONE

```

Router#

The following example displays the service flow information for the first CPE device that is using the CM that is using the primary SID of 6. This CPE device is using a secondary SID of 7 and the SFID of 15, and is using the VRF configuration named **isp1**.

Router# **show interface cable 3/0 15**

Sfid	Sid	Mac Address	QoS	Param	Index	Type	Dir	Curr	Active
			Prov	Adm	Act			State	Time
15	7	00a0.73b0.4cc1	8	8	8	sec(S)	US	act	13:33

```

Router# show interface cable 3/0 15 verbose

Sfid                               : 15
Mac Address                         : 00a0.73b0.4cc1
Type                                : Secondary(Static)
Direction                           : Upstream
Current State                       : Active
Current QoS Indexes [Prov, Adm, Act] : [8, 8, 8]
Active Time                          : 13:36
Sid                                  : 7
Traffic Priority                     : 0
Maximum Sustained rate              : 1000000 bits/sec
Maximum Burst                       : 65224 bytes
Minimum Reserved Rate               : 0 bits/sec
Admitted QoS Timeout                : 0 seconds
Active QoS Timeout                  : 0 seconds
Packets                             : 56
Bytes                               : 8608
Rate Limit Delayed Grants           : 0
Rate Limit Dropped Grants           : 0
Current Throughput                   : 0 bits/sec, 0 packets/sec
Classifiers:

Classifier Id                       : 1
Service Flow Id                     : 15
CM Mac Address                      : 00a0.73b0.4cc1
Direction                           : upstream
Activation State                    : active
Classifier Matching Priority         : 0
PHSI                                : 0
Number of matches                   : -
Ethernet/LLC Classifier Parameters:
    Source MAC                      : 0000.0CA1.B2C3
Router#

```

The following example displays the service flow information for the second CPE device that is using the CM that is using the primary SID of 6. This CPE device is using a secondary SID of 8 and the SFID of 16, and is using the VRF configuration named **isp2**.

```

Router# show interface cable 3/0 service-flow 16
Sfid Sid  Mac Address      QoS Param Index  Type  Dir  Curr  Active
                               Prov Adm Act                               State Time
16   8    00a0.73b0.4cc1    8    8    8    sec(S) US  act  14:04

```

```
Router#
```

```

Router# show interface cable 3/0 service-flow 16 verbose

Sfid                               : 16
Mac Address                         : 00a0.73b0.4cc1
Type                                : Secondary(Static)
Direction                           : Upstream
Current State                       : Active
Current QoS Indexes [Prov, Adm, Act] : [8, 8, 8]
Active Time                          : 14:08
Sid                                  : 8
Traffic Priority                     : 0
Maximum Sustained rate              : 1000000 bits/sec
Maximum Burst                       : 65224 bytes
Minimum Reserved Rate               : 0 bits/sec
Admitted QoS Timeout                : 0 seconds
Active QoS Timeout                  : 0 seconds
Packets                             : 155
Bytes                               : 20418

```

```

Rate Limit Delayed Grants           : 0
Rate Limit Dropped Grants          : 0
Current Throughput                  : 0 bits/sec, 0 packets/sec
Classifiers:

Classifier Id                       : 2
Service Flow Id                    : 16
CM Mac Address                      : 00a0.73b0.4cc1
Direction                          : upstream
Activation State                    : active
Classifier Matching Priority         : 0
PHSI                                : 0
Number of matches                   : -
Ethernet/LLC Classifier Parameters:
    Source MAC                      : 0000.0CA1.B2D4
Router#

```

The following example displays the service flow information for the third CPE device that is using the CM that is using the primary SID of 6. This CPE device is using a secondary SID of 9 and the SFID of 17, and is using the VRF configuration named **isp3**.

```

Router# show interface cable 3/0 service-flow 17
Sfid Sid  Mac Address      QoS Param Index  Type  Dir  Curr  Active
      Sid  Address           Prov  Adm  Act   sec(S) US  State Time
17   9   00a0.73b0.4cc1    8    8    8    sec(S) US  act  14:33

```

```

Router# show interface cable 3/0 service-flow 17 verbose

```

```

Sfid                               : 17
Mac Address                         : 00a0.73b0.4cc1
Type                                : Secondary(Static)
Direction                          : Upstream
Current State                       : Active
Current QoS Indexes [Prov, Adm, Act] : [8, 8, 8]
Active Time                         : 14:36
Sid                                  : 9
Traffic Priority                    : 0
Maximum Sustained rate              : 1000000 bits/sec
Maximum Burst                       : 65224 bytes
Minimum Reserved Rate               : 0 bits/sec
Admitted QoS Timeout                : 0 seconds
Active QoS Timeout                  : 0 seconds
Packets                             : 141
Bytes                               : 16152
Rate Limit Delayed Grants           : 0
Rate Limit Dropped Grants          : 0
Current Throughput                  : 33 bits/sec, 0 packets/sec
Classifiers:

Classifier Id                       : 3
Service Flow Id                    : 17
CM Mac Address                      : 00a0.73b0.4cc1
Direction                          : upstream
Activation State                    : active
Classifier Matching Priority         : 0
PHSI                                : 0
Number of matches                   : -
Ethernet/LLC Classifier Parameters:
    Source MAC                      : 0000.0CA1.B2E5
Router#

```

Configuration Examples

This section provides the following configuration examples:

- [DOCSIS Configuration File, page 12](#)—Shows a cable modem being configured to support three MPLS-VPN routes. This includes three upstream packet classifiers and three upstream service flow parameter sets.
- [MPLS-VPN Interface Configuration, page 13](#)—Shows the corresponding VRF configurations with the three VRF route-designators that match the MPLS-VPN configuration that is used on the cable modem.

DOCSIS Configuration File

```

CM-CONFIG
=====
03 (Net Access Control)           = 1
18 (Maximum Number of CPE)       = 100
28 (Max Number of Classifiers)   = 4
29 (Privacy Enable)              = 1

22 (Upstream Packet Classification Encoding Block)
S01 (Classifier Reference)        = 10
S03 (Service Flow Reference)     = 3
S10 (Ethernet LLC Packet Classification Encodings)
T02 (Source MAC Address)         = 00 00 0C A1 B2 C3

22 (Upstream Packet Classification Encoding Block)
S01 (Classifier Reference)        = 12
S03 (Service Flow Reference)     = 5
S10 (Ethernet LLC Packet Classification Encodings)
T02 (Source MAC Address)         = 00 00 0C A1 B2 D4

22 (Upstream Packet Classification Encoding Block)
S01 (Classifier Reference)        = 14
S03 (Service Flow Reference)     = 7
S10 (Ethernet LLC Packet Classification Encodings)
T02 (Source MAC Address)         = 00 00 0C A1 B2 E5

24 (Upstream Service Flow Encodings)
S01 (Service Flow Reference)     = 1
S06 (QoS Parameter Set Type)    = 7

25 (Downstream Service Flow Encodings)
S01 (Service Flow Reference)     = 2
S06 (QoS Parameter Set Type)    = 7

24 (Upstream Service Flow Encodings)
S01 (Service Flow Reference)     = 3
S06 (QoS Parameter Set Type)    = 7
S08 (Max Sustained Traffic Rate) = 1000000
S09 (Maximum Traffic Burst)     = 65224
S12 (Timeout Active QoS Parms)  = 0
S13 (Timeout Admitted QoS Parms) = 0
S15 (Service Flow Sched Type)   = 2
S43 (Vendor Specific Options)   = 8.3.0.0.12.4.8.0.0.250.0.0.0.1

24 (Upstream Service Flow Encodings)
S01 (Service Flow Reference)     = 5
S06 (QoS Parameter Set Type)    = 7

```

```
S08 (Max Sustained Traffic Rate)      = 1000000
S09 (Maximum Traffic Burst)           = 65224
S12 (Timeout Active QoS Params)      = 0
S13 (Timeout Admitted QoS Params)    = 0
S15 (Service Flow Sched Type)        = 2
S43 (Vendor Specific Options) = 8.3.0.0.12.4.8.0.0.246.24.0.0.0.1

24 (Upstream Service Flow Encodings)
S01 (Service Flow Reference)          = 7
S06 (QoS Parameter Set Type)         = 7
S08 (Max Sustained Traffic Rate)      = 1000000
S09 (Maximum Traffic Burst)           = 65224
S12 (Timeout Active QoS Params)      = 0
S13 (Timeout Admitted QoS Params)    = 0
S15 (Service Flow Sched Type)        = 2
S43 (Vendor Specific Options) = 8.3.0.0.12.4.8.0.0.253.232.0.0.0.1

#<EOF>
```

MPLS-VPN Interface Configuration

```
ip vrf isp1
 rd 64000:1
  route-target export 64000:1
  route-target import 64000:1
  route-target import 62000:1
!
ip vrf isp2
 rd 63000:1
  route-target export 63000:1
  route-target import 63000:1
  route-target import 62000:1
!
ip vrf isp3
 rd 65000:1
  route-target export 65000:1
  route-target import 65000:1
  route-target import 62000:1
!
```

