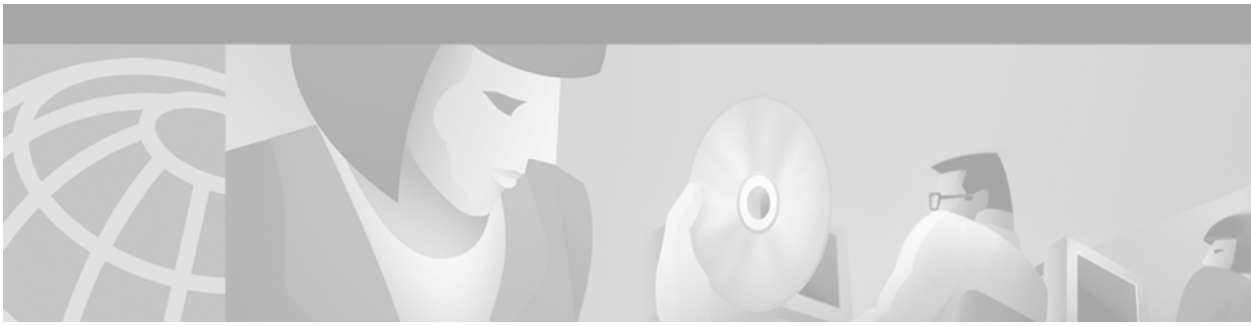


MPLS AToM—Ethernet over MPLS for the Cisco 7304 Router

Feature History

Release	Modification
12.1(8a)E	This feature was introduced on the Cisco 7600 Series Internet routers. See the Ethernet over MPLS for the Cisco 7600 Internet Router feature module.
12.0(21)ST	This feature was modified to support the Cisco 12000 Series routers.
12.0(22)S	This feature was modified to support the Cisco 10720 Internet router.
12.2(14)SZ	This feature was modified to support the Cisco 7304 router.
12.2(18)S	This feature was introduced on Cisco 7304 routers running Cisco IOS Release 12.2 S.

This feature module describes the Ethernet over Multiprotocol Label Switching (MPLS) feature, which transports Layer 2 VLAN packets across an MPLS backbone. This feature module is part of the Any Transport over MPLS (AToM) product set. This feature module describes the benefits of Ethernet over MPLS (EoMPLS) and lists supported platforms. It also provides configuration tasks, examples and related commands.

This document includes the following sections:

Feature Overview

This feature allows you to connect two VLAN networks that are in different locations, without using expensive bridges, routers, or switches at the VLAN locations. You can enable the MPLS backbone network to accept Layer 2 VLAN traffic by configuring the label edge routers (LERs) at both ends of the MPLS backbone.

Adding a point-to-point virtual circuit (VC) requires you to configure the two VC endpoints at the two PE routers. Only the two PE routers at the ingress/egress points of the MPLS backbone know about the VCs dedicated to transporting Layer 2 VLAN traffic. All other routers do not have table entries for those VCs.

Label Stacking

PE routers connected to the MPLS backbone perform label imposition and disposition. The imposition PE router encapsulates the Layer 2 VLAN packet into an MPLS PDU to transport it across the backbone to the disposition PE router. The disposition PE router takes the MPLS PDU, de-encapsulates the MPLS PDU, and delivers the Layer 2 VLAN packet to the correct interface.

When the imposition PE router encapsulates a Layer 2 VLAN packet to route it across the MPLS backbone, it includes a label stack with two levels of labels:

- An Interior Gateway Protocol (IGP) stack, also known as a tunnel label
- A VC-based label

The MPLS backbone uses the IGP labels to transport the VLAN packet between the PE routers. The disposition PE router uses the VC-based label to select the outgoing interface for the VLAN packet.

Benefits

The following list explains some of the benefits of enabling the transport of Layer 2 packets over the MPLS network:

- The Any Transport over MPLS product set accommodates many types of Layer 2 packets, including Ethernet and AAL5, across multiple Cisco router platforms. This enables the service provider to transport all types of traffic over the backbone and accommodate all types of customers.
- AToM adheres to the standards developed for transporting Layer 2 packets over MPLS. (See "Standards and Drafts Upon Which AToM Is Based" for the specific standards that AToM follows.) This benefits the service provider who wants to incorporate industry-standard methodologies in the network.
- Upgrading to AToM is transparent to the customer. Because the service provider network is separate from the customer network, the service provider can upgrade to AToM without disruption of service to the customer. The customers assume that they are using a traditional Layer 2 backbone.

Restrictions

The following restrictions apply to the Cisco 7304 router:

- **Modular QoS**: The **match input interface** command cannot be used to match based on subinterfaces when using Ethernet over MPLS. The **match qos-group** command is not supported in Ethernet over MPLS.

- **Multipoint Virtual Circuits**: Multipoint Virtual Circuits are not supported in Ethernet over MPLS on the Cisco 7304 router.
- **NSE-100 Restrictions**: On Cisco 7304 routers using an NSE-100 and running Ethernet over MPLS, the PE interface facing the MPLS core must use one of the following encapsulations:
  - HDLC, Frame Relay, or PPP encapsulation if the T3 or POS interface is the PE interface facing the MPLS core.
  - AAL5 SNAP if the ATM interface is the PE interface facing the MPLS core.
  - ARPA or 802.1q if a GigabitEthernet or FastEthernet interface is the PE interface facing the MPLS core. SNAP is not supported on the interface facing the MPLS core for GigabitEthernet and FastEthernet interfaces.

Related Documents

Refer to the following documents for more information:

- *Multiprotocol Label Switching on Cisco Routers*
- *MPLS Label Distribution Protocol*

Supported Platforms

Ethernet over MPLS is supported on the the following platforms:

- Cisco 12000 Series router. For information on which engines and line cards are supported, see the *Release Notes for Cisco IOS Release 12.0 ST*.
- Cisco 10720 Internet Router, which provides two line card slots.
  - The top slot can contain either of the following uplink cards:

    DPT uplink card equipped with two physical OC-48c/STM-16c ports with an aggregate bandwidth of 5 Gbps.

    Console/Auxiliary card when using the Cisco 10720 Internet Router as an Ethernet-only router.
  - The bottom slot can contain one of the following access cards:

    24-port FX Fast Ethernet access card, available in TX, FX multimode, and FX single-mode

    4-port Gigabit Ethernet 8-Port 10/100 Ethernet TX access card
- Cisco 7304
  - A Cisco 7304 using an NSE-100, EoMPLS can be run on the built-in Gigabit Ethernet port or on the PA-2FE port adapter.
  - For the Cisco 7304 router using an NPE-G100, Ethernet over MPLS is only supported on the built-in GigabitEthernet port on the NPE-G100, a PA-GE, or on a PA-2FE-FX 2-Port Port Adapter (which require a Cisco 7304 PCI Port Adapter Carrier Card for installation in a Cisco 7304 router).

Determining Platform Support Through Cisco Feature Navigator

Cisco IOS software is packaged in feature sets that support 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 quickly 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 at http://www.cisco.com/register.

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 homepage 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

Standards

This feature supports the following IETF draft documents:

- *Transport of Layer 2 Frames Over MPLS*
- *Encapsulation Methods for Transport of Layer 2 Frames Over MPLS*

MIBs

None.

RFCs

- *RFC 3032: MPLS Label Stack Encoding*
- *RFC 3036: LDP Specification*

Configuration Tasks

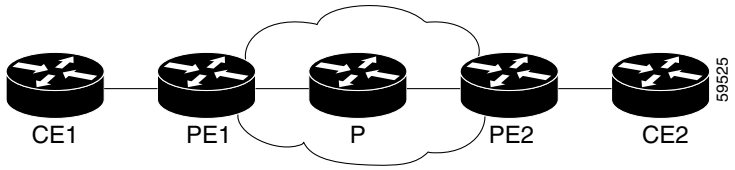
Perform the following configuration tasks to enable Ethernet over MPLS:

- Enabling Ethernet Over MPLS on the PE Routers (required)
- Configuring the Customer CE Routers (required)
- Enabling Quality of Service (optional)
- Verifying the Configuration (optional)

Enabling Ethernet Over MPLS on the PE Routers

Figure 1 is a sample topology used in this section.

Figure 1 Sample Topology



Configuration Notes

- You must enable dynamic MPLS labeling (through the command **mpls ip**) on all paths between the imposition and disposition PE routers.
- All loopback addresses on PE routers must be configured with 32-bit masks to ensure proper operation of MPLS forwarding between PE routers.
- You may assign an LDP router ID to each PE router. The **mpls ldp router-id** command allows you to specify which interface's IP address to use as the router ID. The **force** keyword guarantees that the PE routers are correctly targeting the appropriate router ID. If you do not use the **force** keyword, the router might assign a different router ID, which can prevent the establishment of VCs between PE routers.
- Both PE routers require a loopback address that you can use to create a VC between the routers.
- The subinterfaces between the CE and PE routers that are running Ethernet over MPLS must have the same VLAN identifier. This requirement does not apply to all other subinterfaces and backbone routers.

To configure MPLS to transport Layer 2 VLAN packets between two PE routers, perform the following steps on the PE routers:

	Command	Purpose
Step 1	`Router(config)# mpls label protocol ldp`	(Optional) Specifies LDP as the label distribution protocol. If you do not specify LDP, TDP is used instead.
Step 2	`Router(config)# interface loopback0`	Enters interface configuration mode.
Step 3	`Router(config-if)# ip address` *x.x.x.x y.y.y.y*	Assigns an IP address to the loopback interface. An IP address with a 32-bit subnet mask is necessary for a loopback interface on the PE routers that will transport VLAN packets.
Step 4	`Router(config)# mpls ldp router-id loopback0 force`	Forces the IP address of loopback 0 to be used as the router ID.
Step 5	`Router(config)# interface GigabitEthernet`*x/x.x*	Specifies the Gigabit Ethernet subinterface for the imposition interface. Make sure the subinterface on the adjoining CE router is on the same VLAN as this PE router.

	Command	Purpose
Step 6	`Router(config-if)# encapsulation dot1Q vlan-id`	Enables the subinterface to accept 802.1q VLAN packets. Make sure the VLAN ID is the same as the VLAN ID on the adjoining CE router.
Step 7	`Router(config-if)# mpls l2transport route destination vc-id`	Specifies the VC to use to transport the VLAN packets. The argument *destination* specifies the loopback address of the remote PE router at the other end of the VC. The argument *vc-id* is a value you supply. It must be unique for each VC. The VC ID is used to connect the endpoints of the VC. Specify the same VC ID on both ends of the VC.

Configuring the Customer CE Routers

The CE routers act as adjacent routers when the PE routers are configured to transport VLAN packets.

Note Make sure the subinterfaces on the CE routers connected to the PE routers have the same VLAN ID.

If the customer CE routers are configured to accept Layer 2 VLAN packets, these steps are not necessary. Otherwise, use the following procedure to transport Layer 2 VLAN packets between the PE router and the CE router:

	Command	Purpose
Step 1	`Router(config)# interface GigabitEthernet x/x.x`	Specifies a Gigabit Ethernet subinterface. Make sure the subinterface on the adjoining PE router shares the same VLAN ID as this router. **Note** You must define a subinterface.
Step 2	`Router(config-if)# encapsulation dot1Q vlan-id`	Enables the subinterface to accept 802.1q VLAN packets. Make sure the VLAN ID is the same as the VLAN ID on the adjoining PE router.
Step 3	`Router(config-if)# ip address x.x.x.x`	Assigns an IP address to the subinterface.

Enabling Quality of Service

The following sections detail the Modular QoS CLI commands for enabling QoS on the PE router.

For more information on the commands used to enable Quality of Service, see the following documents:

- *Modular Quality of Service Command-Line Interface*
- *Cisco IOS Quality of Service Solutions Command Reference, Release 12.2*

Note Quality of Service for Ethernet over MPLS is supported only on the Cisco 10720 Internet Router for Cisco IOS Release 12.0(22)S.

Note All of the Quality of Service features available for the Cisco 7304 on MPLS should also be available in Ethernet over MPLS. Please see other Cisco documentation for information on support for these features.

Setting the Priority of Packets with the Experimental Bits

Ethernet over MPLS provides Quality of Service (QoS) using the three experimental bits in a label to determine the priority of packets. To support QoS between LERs, set the experimental bits in both the VC and tunnel labels.

Perform the following steps to set the experimental bits:

	Command	Purpose
Step 1	`Router(config)# class-map` *class-name*	Specifies the user-defined name of the traffic class.
Step 2	`Router(config-cmap)# match any`	Specifies that all packets will be matched.
Step 3	`Router(config-cmap)# policy-map` *policy-name*	Specifies the name of the traffic policy to configure.
Step 4	`Router(config-pmap)# class` *class-name*	Specifies the name of a predefined traffic class, which was configured with the class-map command, used to classify traffic to the traffic policy.
Step 5	`Router (config-pmap-c)# set mpls experimental` *value*	Designates the value to which the MPLS bits are set if the packets match the specified policy map.
Step 6	`Router(config)# interface FastEthernet`*x/x.x*	Enters the subinterface.
Step 7	`Router(config-if)# service-policy input` *policy-name*	Attaches a traffic policy to an interface.

Enabling Traffic Policing

Traffic policing allows you to control the maximum rate of traffic sent or received on an interface. Traffic policing is often configured on interfaces at the edge of a network to limit traffic in or out of the network. Traffic that falls within the rate parameters is sent, whereas traffic that exceeds the parameters is dropped or sent with a different priority. To add traffic policing, issue the following commands:

	Command	Purpose
Step 1	`Router(config)# class-map` *class-name*	Specifies the user-defined name of the traffic class.
Step 2	`Router(config-cmap)# match any`	Specifies that any packets be matched.
Step 3	`Router(config-cmap)# policy-map` *policy-name*	Specifies the name of the traffic policy to configure.

	Command	Purpose
Step 4	`Router(config-pmap)# class` *class-name*	Specifies the name of a predefined traffic class, which was configured with the class-map command, used to classify traffic to the traffic policy.
Step 5	`Router (config-pmap-c)#` **police** *bit-rate*	Polices traffic according to the bit rate you specify.
Step 6	`Router(config)# interface FastEthernet`*x/x.x*	Enters the subinterface.
Step 7	`Router(config-if)#` **service-policy input** *policy-name*	Assigns a traffic policy to an interface.

Displaying the Traffic Policy Assigned to an Interface

To display the traffic policy attached to an interface, issue the following command:

```
Router# show policy-map interface FastEthernet 2/2.1

FastEthernet2/2.1
Service-policy output: pol (1060)

    Class-map: class-default (match-any) (1061/0)
      7351298 packets, 646914312 bytes
      30 second offered rate 85362000 bps, drop rate 69066000 bps
      Match: any  (1063)
        7351298 packets, 646914312 bytes
        30 second rate 85362000 bps
      police:
        20000000 bps, 10000 limit, 10000 extended limit
        conformed 1403523 packets, 123510024 bytes; action: transmit
        exceeded 5947776 packets, 523404288 bytes; action: drop
```

Verifying the Configuration

The following steps help to verify the configuration of Layer 2 VLAN transport over MPLS tunnels. Some of the steps help you determine that a targeted LDP session has been initiated between the PE routers and that an LDP session exists between the PE and P routers.

CE Routers

Issue the following command on CE1 and CE2 to ensure that the VC is active:

Use the **show ip interface brief** command on CE1 and CE2 to make sure the router interfaces are operating.

```
CE1# show ip interface brief

Interface                  IP-Address      OK? Method Status                Protocol
FastEthernet2/1.1          11.11.11.11     YES unset  up                    up
FastEthernet2/1.2           2.12.12.12     YES unset  up                    up
FastEthernet1/1.2          10.10.10.10     YES unset  up                    up
```

PE Routers

Issue the following commands on each PE router to ensure that the PE routers are working properly.

Step 1 To make sure the PE router endpoints have discovered each other, issue the **show mpls ldp discovery** command. The command output shows that PE1 established a targeted LDP session with PE2.

```
PE1# show mpls ldp discovery

Local LDP Identifier:
    11.11.11.11:0
Discovery Sources:
    Interfaces:
        SRP1/1 (ldp): xmit/recv
            LDP Id: 15.15.15.15:0
    Targeted Hellos:
        11.11.11.11 -> 12.12.12.12 (ldp): active, xmit/recv
            LDP Id: 12.12.12.12:0
```

Step 2 Issue the **show mpls l2transport vc** command to check the a VC has been established between the PE routers and that the VC is operational.

```
PE1#show mpls l2transport vc

VC ID     Client          VC       Local       Remote      Tunnel
          Intf           State   VC Label      VC Label    Label
1         Fa2/2.1         UP       18             20         26
```

Step 3 To make sure the label distribution session has been established, issue the **show mpls ldp neighbors** command. The output shows that:

- PE1 and PE2 have established a targeted LDP session.
- The LDP session is operational.
- Messages are being sent and received.

```
PE1#show mpls ldp neighbor

Peer LDP Ident: 15.15.15.15:0; Local LDP Ident 11.11.11.11:0
        TCP connection: 15.15.15.15.11072 - 11.11.11.11.646
        State: Oper; Msgs sent/rcvd: 65/73; Downstream
        Up time: 00:43:02
        LDP discovery sources:
          SRP1/1, Src IP addr: 30.5.0.2
        Addresses bound to peer LDP Ident:
          8.0.5.4         180.3.0.3       15.15.15.15     30.5.0.2
          30.5.0.3
Peer LDP Ident: 12.12.12.12:0; Local LDP Ident 11.11.11.11:0
        TCP connection: 12.12.12.12.11000 - 11.11.11.11.646
        State: Oper; Msgs sent/rcvd: 26/25; Downstream
        Up time: 00:10:35
        LDP discovery sources:
          Targeted Hello 11.11.11.11 -> 12.12.12.12, active
        Addresses bound to peer LDP Ident:
          8.0.6.3         12.12.12.12     30.5.0.4
```

P Router

Issue the following commands to ensure that the P router is correctly configured.

Step 1 Issue the **show mpls ldp discovery** command ensure that an LDP session exists. The command output shows that the P router has regular LDP sessions with the PE routers, not targeted LDP sessions.

```
P# show mpls ldp discovery
```

```
Local LDP Identifier:
    15.15.15.15:0
    Discovery Sources:
    Interfaces:
        POS3/0 (ldp): xmit/recv
            LDP Id: 11.11.11.11:0
        POS6/0 (ldp): xmit/recv
            LDP Id: 12.12.12.12:0
    Targeted Hellos:
        15.15.15.15 -> 11.11.11.11 (ldp): active, xmit
```

Step 2 To make sure the label distribution session has been established, issue the **show mpls ldp neighbors** command. The output shows that:

- The P routers has LDP sessions with PE1 and PE2.
- The LDP session is operational.
- Messages are being sent and received.

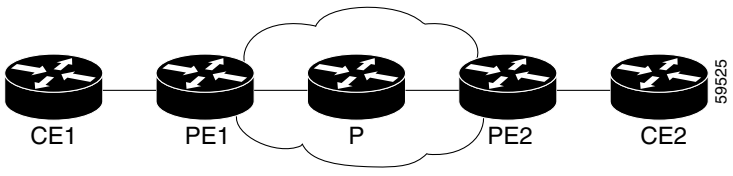
```
P# show mpls ldp neighbor

Peer LDP Ident: 11.11.11.11:0; Local LDP Ident 15.15.15.15:0
        TCP connection: 11.11.11.11.646 - 15.15.15.15.11072
        State: Oper; Msgs sent/rcvd: 80/71; Downstream
        Up time: 00:48:50
        LDP discovery sources:
          POS3/0, Src IP addr: 30.5.0.1
        Addresses bound to peer LDP Ident:
          8.0.5.20        11.11.11.11     180.3.0.2       20.20.20.3
          200.200.200.5   30.5.0.1
    Peer LDP Ident: 12.12.12.12:0; Local LDP Ident 15.15.15.15:0
        TCP connection: 12.12.12.12.646 - 15.15.15.15.11169
        State: Oper; Msgs sent/rcvd: 29/27; Downstream
        Up time: 00:16:28
        LDP discovery sources:
          POS6/0, Src IP addr: 30.5.0.4
        Addresses bound to peer LDP Ident:
          8.0.6.3         12.12.12.12     30.5.0.4
```

Configuration Examples

The following configuration example lists the commands for enabling MPLS to transport Layer 2 VLAN packets between two endpoints. Figure 2 illustrates the network configuration that the configuration commands reference.

Figure 2 Configuring Ethernet Over MPLS



Notes:

- Dynamic MPLS switching is enabled between the PE routers. Dynamic MPLS switching should be enabled throughout the MPLS core.
- The sample configurations assume OSPF is used within the MPLS core to ensure that the PE routers have routes to the endpoints.

CE1 Configuration

The subinterface GigabitEthernet2/1.2 is connected to the subinterface on PE1 (GigabitEthernet2/1.2), which was configured to transport VLAN packets. Corresponding subinterfaces on both CE1 and CE2 are in the same VLAN and subnet. In this example configuration, the VLAN ID is 200 and the subnet is 10.1.2.0.

```
!
interface GigabitEthernet2/1
no ip address
 no ip redirects
 no ip directed-broadcast
 no ip proxy-arp
 no ip mroute-cache
 no keepalive
 no negotiation auto
 no cdp enable
!
interface GigabitEthernet2/1.2
 encapsulation dot1Q 200
 ip address 10.1.2.1 255.255.255.0
 no ip directed-broadcast
 no cdp enable
```

PE1 Configuration

In this example configuration, note the following:

- PE1 requires a loopback address so that it can create a tunnel to PE2. The **mpls l2transport route** command requires the address of the remote PE router.
- The subinterface GigabitEthernet2/1.2 is configured to transport VLAN packets over the MPLS backbone. The VC ID (123) in the **mpls l2transport route** command is the same VC ID as specified in PE2.
- The interface GigabitEthernet2/4 connects to the MPLS backbone through the **mpls ip** command. This is the disposition interface.
- The last section of the configuration example advertises the loopback address and the addresses of the interfaces connecting to the PE routers. These commands help establish LDP and the LSP tunnels.

```
interface Loopback0
 ip address 2.2.2.2 255.255.255.255
 no ip directed-broadcast
!
interface GigabitEthernet2/1
 description "connected to gsr1 2/1"
 no ip address
 no ip redirects
 no shut
 no ip directed-broadcast
 no ip mroute-cache
 no keepalive
 no negotiation auto
 no cdp enable
```

```
mpls ip
!
interface GigabitEthernet2/1.2
 encapsulation dot1Q 200
 no shut
no ip directed-broadcast
 mpls l2transport route 4.4.4.4 123
no cdp enable
!
interface GigabitEthernet2/4
 ip address 11.1.1.2 255.255.255.0
 no ip directed-broadcast
 no negotiation auto
 mpls ip
 no cdp enable
!
router ospf 100
 log-adjacency-changes
 network 2.2.2.2 0.0.0.0 area 0
 network 11.1.1.0 0.0.0.255 area 0
```

P Configuration

In this configuration example, note the following:

- Interface GigabitEthernet2/1 is connected to PE2. The **mpls ip** command enables MPLS on this interface.
- Interface GigabitEthernet2/4 is connected to PE1. The **mpls ip** command enables MPLS on this interface.
- The last section of the configuration example advertises the loopback address and the addresses of the interfaces connecting to the PE routers. These commands help establish LDP and the LSP tunnels.

```
interface Loopback0
 ip address 3.3.3.3 255.255.255.255
 no ip directed-broadcast
!
interface GigabitEthernet2/1
 ip address 12.1.1.3 255.255.255.0
 no ip directed-broadcast
 no keepalive
 no negotiation auto
 mpls ip
 no cdp enable
!
interface GigabitEthernet2/4
 ip address 11.1.1.3 255.255.255.0
 no ip directed-broadcast
 no negotiation auto
 mpls ip
 no cdp enable
!
router ospf 100
 log-adjacency-changes
 network 3.3.3.3 0.0.0.0 area 0
 network 11.1.1.0 0.0.0.255 area 0
 network 12.1.1.0 0.0.0.255 area 0
```

PE2 Configuration

In this configuration example, note the following:

- PE2 requires a loopback address so that it can create a tunnel to PE1. The **mpls l2transport route** command requires the address of the remote PE router.
- The interface SRP1/1 connects to the MPLS backbone through the **mpls ip** command. This is the disposition interface.
- The subinterface GigabitEthernet2/1.2 is configured to transport VLAN packets over the MPLS backbone.
- The VC ID (123) in the **mpls l2transport route** command is the same VC ID as specified in PE1.
- The last section of the configuration example advertises the loopback address and the address of the interface connecting to the MPLS backbone. These commands help establish LDP and the LSP tunnel.

```
interface Loopback0
 ip address 4.4.4.4 255.255.255.255
 no ip directed-broadcast
!
interface SRP1/1
 ip address 12.1.1.2 255.255.255.0
 mpls ip
!
interface GigabitEthernet2/1
no ip directed-broadcast
 no keepalive
 no negotiation auto
 mpls ip
 no cdp enable
!
interface GigabitEthernet2/1.2
 encapsulation dot1Q 200
 no ip directed-broadcast
 mpls l2transport route 2.2.2.2 123
 no cdp enable
!
router ospf 100
 log-adjacency-changes
 network 4.4.4.4 0.0.0.0 area 0
 network 12.1.1.0 0.0.0.255 area 0
```

CE2 Configuration

The subinterface GigabitEthernet2/1.2 is connected to the subinterface on PE2 (GigabitEthernet2/1.2), which was configured to transport VLAN packets. Corresponding subinterfaces on both CE1 and CE2 are in the same VLAN and subnet. In this example configuration, the VLAN ID is 200 and the subnet is 10.1.2.0.

```
interface GigabitEthernet2/1
 no ip address
 no shut
 no ip redirects
 no ip directed-broadcast
 no ip proxy-arp
 no ip mroute-cache
 no keepalive
 no negotiation auto
 no cdp enable
!
interface GigabitEthernet2/1.2
 encapsulation dot1Q 200
 ip address 10.1.2.5 255.255.255.0
 no ip directed-broadcast
 no cdp enable
```

Command Reference

This section describes the following commands:

- **show mpls l2transport vc**

show mpls l2transport vc

To display the state of VCs on a router, use the **show mpls l2transport vc** command in EXEC mode.

show mpls l2transport vc [**summary**] | [*vc-id*] | [*vc-id-min vc-id-max*] [**detail**]

Syntax Description

summary	(Optional) Displays a summary of the active VCs on a PE router's MPLS interfaces.
vc-id	(Optional) Displays information about the VC specified.
vc-id-min and *vc-id-max*	(Optional) Displays information about a range of VC IDs that you specify. The range is from 0 to 429,467,295.
detail	(Optional) Displays detailed information about the VCs on a PE router.

Defaults

No default behavior or values.

Command Modes

EXEC

Command History

Release	Modification
12.1(8a)E	This command was introduced for the Cisco 7600 router.
12.0(21)ST	This command was integrated into Cisco IOS Release 12.0(21)ST for the Cisco 12000 series routers.
12.0(22)S	This command was integrated into Cisco IOS Release 12.0(22)S for the Cisco 10720 router.
12.2(14)SZ	This command was integrated into Cisco IOS Release 12.2(14)SZ.
12.2(18)S	This command was introduced on Cisco 7304 routers running Cisco IOS Release 12.2 S.

Examples

The following example shows the status of the VCs on the router.

```
Router# show mpls l2transport vc

Transport Client     VC       Local       Remote      Tunnel
VC ID     Intf       State    VC Label    VC Label    Label
4         Fa2/1.1     UP       23          21          77
101       Fa2/1.2     UP       24          22          77
```

Table 1 describes the significant fields displayed in the output.

Table 1 show mpls l2transport vc Field Descriptions

Field	Description
Transport VC ID	The virtual circuit identifier assigned to one of the interfaces on the router.
Client Intf	The ingress or egress interface through which the Layer 2 VLAN packet travels.
VC State	The status of the VC. The status can be one of the following: UP—VC is in a state where it can carry traffic between the two VC end points. A VC is up when both imposition and disposition interfaces are programmed. • The disposition interfaces are programmed if the VC has been configured and the client interface is up. • The imposition interface is programmed if the disposition interface is programmed and we have a remote VC label and an IGP label. The IGP label can be implicit null in a back-to-back configuration. (An IGP label means there is a LSP to the peer.) DOWN—The VC is not ready to carry traffic between the two VC end points.
Local VC Label	The VC label that a router signals to its peer router, which is used by the peer router during imposition. The local VC label is a disposition label. The local VC label determines the egress interface of an arriving packet from the MPLS backbone.
Remote VC Label	The disposition VC label of the remote peer router.
Tunnel Label	An IGP label used to route the packet over the MPLS backbone to the destination router with the egress interface.

The following example shows the output of the **summary** keyword. The first part of the example shows VC information for the interfaces on the PE router. The second part of the example shows how many VCs have been configured for destination 13.0.0.1.

```
Router# show mpls l2transport vc summary
MPLS interface VC summary:
  interface: Gi2/1, programmed imposition vcs: 1
  interface: Gi2/3, programmed imposition vcs: 1

VC summary (active/non-active) by destination:
  destination: 13.0.0.1, Number of locally configured vc(s): 2
```

The following example shows detailed information about currently routed VCs on the router interfaces:

```
Router# show mpls l2transport vc detail
VC ID: 111, Local Group ID: 5, Remote Group ID: 2 (VC is up)
Client Intf: Gi2/1.1 is up, Destination: 2.2.2.2, Peer LDP Ident: 2.2.2.2:0
Local VC Label: 17, Remote VC Label: 17, Tunnel Label: 16
Outgoing Interface: SRP1/1, Next Hop: 12.1.1.3
Local MTU: 1500, Remote MTU: 1500
Remote interface description: GigabitEthernet2/1.1
Imposition: LC Programmed
Current Imposition/Last Disposition Slot: 1/255
Packet Totals(in/out): 0/0
Byte totals(in/out): 0/0

VC ID: 123, Local Group ID: 6, Remote Group ID: 3 (VC is up)
Client Intf: Gi2/1.2 is up, Destination: 2.2.2.2, Peer LDP Ident: 2.2.2.2:0
```

```
Local VC Label: 18, Remote VC Label: 19, Tunnel Label: 16
Outgoing Interface: SRP1/1, Next Hop: 12.1.1.3
Local MTU: 1500, Remote MTU: 1500
Remote interface description: GigabitEthernet2/1.2
Imposition:
Current Imposition/Last Disposition Slot:
Packet Totals(in/out): 0/0
Byte totals(in/out): 0/0
```

The following example shows the detailed VC information for a specified VC:

```
Router# show mpls l2transport vc 111 detail
VC ID: 111, Local Group ID: 5, Remote Group ID: 2 (VC is up)
Client Intf: Gi2/1.2 is up, Destination: 2.2.2.2, Peer LDP Ident: 2.2.2.2:0
Local VC Label: 17, Remote VC Label: 17, Tunnel Label: 16
Outgoing Interface: SRP1/1, Next Hop: 12.1.1.3
Local MTU: 1500, Remote MTU: 1500
Remote interface description: GigabitEthernet2/1.1
Imposition:
Current Imposition/Last Disposition Slot:
Packet Totals(in/out): 0/0
Byte totals(in/out): 0/0
```

Table 2 describes the significant fields displayed in the output.

Table 2 show mpls l2transport vc detail Field Descriptions

Field	Description
VC ID	The virtual circuit identifier assigned to one of the interfaces on the router.
Local Group ID	The ID used to group VCs locally. Ethernet over MPLS groups VCs by the hardware port, which is unique for each port on a router.
Remote Group ID	The ID used by the peer to group several VCs.
VC is up or VC is down	The status of the VC. The status can be one of the following: UP—VC is in a state where it can carry traffic between the two VC end points. A VC is up when both imposition and disposition interfaces are programmed. • The disposition interfaces is programmed if the VC has been configured and the client interface is up. • The imposition interface is programmed if the disposition interface is programmed and we have a remote VC label and an IGP label. The IGP label can be implicit null in a back-to-back configuration. (An IGP label means there is a LSP to the peer.) DOWN—The VC is not ready to carry traffic between the two VC end points.
Client	The ingress or egress interface through which the Layer 2 VLAN packet travels.
Destination	The destination specified for this VC. You specify the destination ip address as part of the **mpls l2transport route** command.
Peer LDP ID	The targeted peer's LDP IP address.
Local VC Label	The VC label that a router signals to its peer router, which is used by the peer router during imposition. The local VC label is a disposition label. The local VC label determines the egress interface of an arriving packet from the MPLS backbone.

Field	Description
Remote VC Label	The disposition VC label of the remote peer router.
Tunnel Label	An IGP label used to route the packet over the MPLS backbone to the destination router with the egress interface.
Outgoing Interface	The egress interface of the VC.
Next Hop	The IP address of the next hop.
Local MTU	The maximum transmission unit specified for the client interface.
Remote MTU	The maximum transmission unit specified for the remote router's client interface.
Imposition	The status of the line card: • LC programmed • LC not programmed **Note** This field does not display pertinent output for the Cisco 10720 router.
Current Imposition/Last Disposition Slot	The current imposition is the outgoing interface used for imposition. The last disposition slot is the interface where packets for this VC arrive. **Note** This field does not display pertinent output for the Cisco 10720 router.
Packet Totals (in/out)	The total number of packets forwarded in each direction.
Byte Totals (in/out)	The total number of bytes forwarded in each direction