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FiberstoreOS
MPLS Configuration Guide

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1 Configuring LDP

1.1 Overview

This chapter describes how to configure LDP.

A fundamental concept in MPLS is that two Label Switching Routers (LSRs) must agree on the meaning of the labels used to forward traffic between and through them. This common understanding is achieved by using a set of procedures, called label distribution protocol -LDP. The OS software supports these features:

- Downstream unsolicited label distribution with liberal retention mode.
- Supports control-mode modification.
- Supports lsr-id and transport-address modification.
- Supports target peer setting.
- Supports outbound label filtering.
- Supports explicit null label.

This configuration guide will describe the basic configuration of LDP in our system and give some examples for it.

More information about LDP, please see RFC3031 and FRC3036.

1.2 Topology

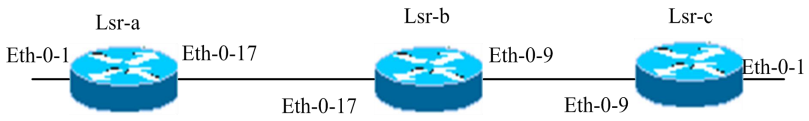

Figure 1-1 LSP map

1.3 Configuring up LDP connection

The following example will describe how to use LDP to set up a label switching path (LSP) from lsr-a to lsr-c.

1.3.1 Configuration

Configure lsr-a

Beginning in privileged EXEC mode, follow these steps to configure the LDP.

Switch1# configure terminal	Enter the Configure mode
Switch1(config)# interface eth-0-17	Enter the Interface mode
Switch1(config-if)# no shutdown	Turn up the interface
Switch1(config-if)# no switchport	Configure the port as route port.
Switch1(config-if)# ip address 11.11.17.1/24	Create IP address on the port
Switch1(config-if)# enable-ldp	Configuring Interface for LDP
Switch1(config-if)# label-switching	Enable label-switching on interface
Switch1(config-if)# exit	Exit the Interface mode and enter the Configure mode
Switch1(config)# router ldp	Enter the router-ldp mode
Switch1(config-router)# exit	Exit the router-ldp mode
Switch1(config)# router rip	Enter the router-rip mode
Switch1(config-router)# network 11.11.1.1/16	Associate networks with the RIP process

Configure lsr-b

Beginning in privileged EXEC mode, follow these steps to configure the LDP.

Switch2# configure terminal	Enter the Configure mode
Switch2(config)# interface eth-0-17	Enter the Interface mode •eth-0-17—Specify the interface
Switch2(config-if)# no shutdown	Turn up the interface
Switch2(config-if)# no switchport	Configure the port as route port.
Switch2(config-if)# ip address 11.11.17.2/24	Create IP address on the port
Switch2(config-if)# enable-ldp	Configuring Interface for LDP
Switch2(config-if)# label-switching	Enable label-switching on interface
Switch2(config-if)# exit	Exit the Interface mode and enter the Configure mode
Switch2(config)# router ldp	Enter the router-ldp mode
Switch2(config-router)# exit	Exit the router-ldp mode
Switch2(config)# router rip	Enter the router-rip mode

Switch2(config-router)# network 11.11.1.1/16	Associate networks with the RIP process
Switch2(config-router)# exit	Exit the router-rip mode
Switch2(config)# interface eth-0-9	Enter the Interface mode • eth-0-9—Specify the interface
Switch2(config-if)# no shutdown	Turn up the interface
Switch2(config-if)# no switchport	Configure the port as route port
Switch2(config-if)# ip address 11.11.9.1/24	Create IP address on the port
Switch2(config-if)# enable-ldp	Configuring Interface for LDP
Switch2(config-if)# label-switching	Enable label-switching on interface

Configure lsr-c

Beginning in privileged EXEC mode, follow these steps to configure the LDP.

Switch3#configure terminal	Enter the Configure mode.
Switch3(config)# interface eth-0-9	Enter the Interface mode. • eth-0-9—Specify the interface
Switch3(config-if)# no shutdown	Turn up the interface
Switch3(config-if)# no switchport	Configure the port as route port.
Switch3(config-if)# ip address 11.11.9.2/24	Create IP address on the port
Switch3(config-if)# enable-ldp	Configuring Interface for LDP
Switch3(config-if)# label-switching	Enable label-switching on interface
Switch3(config-if)# exit	Exit the Interface mode and enter the Configure mode
Switch3(config)# router ldp	Enter the router-ldp mode
Switch3(config-router)# exit	Exit the router-ldp mode
Switch3(config)# router rip	Enter the router-rip mode
Switch3(config-router)# network 11.11.1.1/16	Associate networks with the RIP process

1.3.2 Validation

To display the LDP configuration, use the show ldp session privileged EXEC command.

Show status lsr-a

Switch1# show ldp session

```
Peer IP Address     IF Name     My Role    State          KeepAlive
11.11.17.2          eth-0-17    Passive    OPERATIONAL    30
```

Show status lsr-b

Switch2# show ldp session

```
Peer IP Address     IF Name     My Role    State          KeepAlive
11.11.9.2           eth-0-9     Active     OPERATIONAL    30
11.11.17.1          eth-0-17    Active     OPERATIONAL    30
```

Show status lsr-c

Switch3# show ldp session

```
Peer IP Address     IF Name     My Role    State          KeepAlive
11.11.17.2          eth-0-9     Passive    OPERATIONAL    30
```

1.4 Configure FEC

1.4.1 Configuration

Configure lsr-c

Switch3#configure terminal	Enter the Configure mode
Switch3(config)# router rip	Enter the router-rip mode
Switch3(config-router)# redistribute static	Redistribute static routes to RIP with default metri
Switch3(config-router)# exit	Exit the router-rip mode
Switch3(config)# ip route 5.5.5.0/24 11.11.10.1	Configuring a static ip route entry
Switch1(config)# interface eth-0-10	Enter the Interface mode. • eth-0-10—Specify the interface
Switch3(config-if)# no shutdown	Turn up the interface
Switch3(config-if)# no switchport	Configure the port as route port.
Switch3(config-if)# ip address 11.11.10.2/24	Create IP address on the port

1.4.2 Validation

To display the LDP configuration, use the show mpls forwarding-table privileged EXEC command.

Show result on lsr-a

Switch1# show mpls ftn-forwarding

```
FEC                 Out-Label    Nexthop          Out-Intf
```

5.5.5.0/24	1024	11.11.17.2	eth-0-17
11.11.9.0/24	3	11.11.17.2	eth-0-17
11.11.10.0/24	1027	11.11.17.2	eth-0-17

Show result on lsr-b

Switch2# show mpls ilm-forwarding

FEC	I/O Label	Nexthop	Out-Intf
5.5.5.0/24	1024/1024	11.11.9.2	eth-0-9
11.11.10.0/24	1027/3	11.11.9.2	eth-0-9

2 Configuring MPLS

2.1 Overview

MPLS stands for "Multiprotocol Label Switching", multiprotocol, because its techniques are applicable to ANY network layer protocol. In this document, however, we focus on the use of IP as the network layer protocol.

Packet headers contain considerably more information than is needed simply to choose the next hop. Choosing the next hop can therefore be thought of as the composition of two functions. The first function partitions the entire set of possible packets into a set of "Forwarding Equivalence Classes (FECs)". Secondly maps each FEC to a next hop. So far as the forwarding decision is concerned, different packets which get mapped into the same FEC are indistinguishable. All packets which belong to a particular FEC and which travel from a particular node will follow the same path (or if certain kinds of multi-path routing are in use, they will all follow one of a set of paths associated with the FEC). In conventional IP forwarding, a particular router will typically consider two packets to be in the same FEC if there is some address prefix X in that router's routing tables such that X is the "longest match" for each packet's destination address. As the packet traverses the network, each hop in turn reexamines the packet and assigns it to a FEC.

In MPLS, the assignment of a particular packet to a particular FEC is done just once, as the packet enters the network. The FEC to which the packet is assigned is encoded as a short fixed length value known as a "label". When a packet is forwarded to its next hop, the label is sent along with it; that is, the packets are "labeled" before they are forwarded. At subsequent hops, there is no further analysis of the packet's network layer header. Rather, the label is used as an index into a table which specifies the next hop, and a new label. The old label is replaced with the new label, and the packet is forwarded to its next hop.

In the MPLS forwarding paradigm, once a packet is assigned to a FEC, no further header analysis is done by subsequent routers; all forwarding is driven by the labels.

2.2 Topology

This chapter will descript how to set up a LSP and carry the traffic on the LSP. The example is based on the model of Figure 2-1 below.

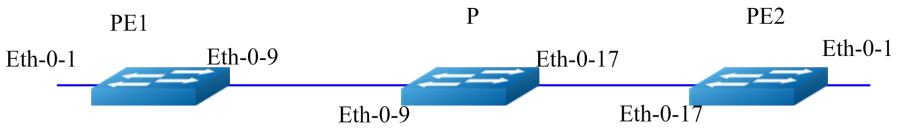

Figure 2-1 MPLS LSP model

2.3 Configure MPLS LSP

Configure PE1

Beginning in privileged EXEC mode, follow these steps to configure the MPLS.

PE1# configure terminal	Enter the Configure mode
PE1(config)# interface eth-0-9	Enter the Interface mode
PE1(config-if)# no switchport	Configure the port as route port
PE1(config-if)# no shutdown	Configure the port up
PE1(config-if)# ip address 11.11.9.1/24	Create IP address on the port
PE1(config-if)# label-switching	Enable label-switching on interface
PE1(config-if)# exit	Exit the Configure mode
PE1(config)# interface eth-0-1	Enter the Interface mode
PE1(config-if)# no switchport	Configure the port as route port.
PE1(config-if)# no shutdown	Configure the port up
PE1(config-if)# ip address 10.10.10.1/24	Create IP address on the port
PE1(config-if)# label-switching	Enable label-switching on interface
PE1(config-if)# exit	Exit the Configure mode
PE1(config)# mpls ftn-entry 172.22.4.1/24 100 11.11.9.2	Configure ftn entry to carry FEC 172.22.4.1/24 to label 100

Configure P

Beginning in privileged EXEC mode, follow these steps to configure the MPLS.

P# configure terminal	Enter the Configure mode
P(config)# interface eth-0-9	Enter the Interface mode
P(config-if)# no switchport	Configure the port as route port

P(config-if)# no shutdown	Configure the port up
P(config-if)# ip address 11.11.9.2/24	Create IP address on the port
P(config-if)# label-switching	Enable label-switching on interface
P(config-if)# exit	Exit the Configure mode
P(config)# interface eth-0-17	Enter the Interface mode
P(config-if)# no switchport	Configure the port as route port
P(config-if)# no shutdown	Configure the port up
P(config-if)# ip address 11.11.17.2/24	Create IP address on the port
P(config-if)# label-switching	Enable label-switching on interface
P(config-if)# exit	Exit the Configure mode
P(config)# mpls ilm-entry swap 100 11.11.17.3 200	Configure ilm entry to swap label 100 to 200

Configure PE2

Beginning in privileged EXEC mode, follow these steps to configure the MPLS.

PE2# configure terminal	Enter the Configure mode
PE2(config)# interface eth-0-17	Enter the Interface mode
PE2(config-if)# no switchport	Configure the port as route port
PE2(config-if)# no shutdown	Configure the port up
PE2(config-if)# ip address 11.11.17.3/24	Create IP address on the port
PE2(config-if)# label-switching	Enable label-switching on interface
PE2(config-if)# exit	Exit the Configure mode
PE2(config)# interface eth-0-1	Enter the Interface mode
PE2(config-if)# no switchport	Configure the port as route port
PE2(config-if)# no shutdown	Configure the port up
PE2(config-if)# ip address 20.20.20.1/24	Create IP address on the port
PE2(config-if)# label-switching	Enable label-switching on interface
PE2(config-if)# exit	Exit the Configure mode
PE2(config)# mpls ilm-entry php 200 20.20.20.2	Configure ilm entry to php label 200 to nexthop 20.20.20.2

2.4 Validate

Validate on PE1

PE1# show mpls ftn-database

```
Codes: > - selected FTN, p - stale FTN, B - BGP FTN, K - CLI FTN,
       L - LDP FTN, R - RSVP-TE FTN, S - SNMP FTN, I - IGP-Shortcut,
       U - unknown FTN

Code     FEC                 Out-Label     Nexthop          Out-Intf
K>       172.22.4.0/24       100           11.11.9.2        eth-0-9
```

Validate on P

P# show mpls ilm-database

```
Codes: > - selected ILM, p - stale ILM, B - BGP ILM, K - CLI ILM,
       L - LDP ILM, R - RSVP-TE ILM, S - SNMP ILM, I - IGP-Shortcut,
       U - unknown ILM

Code      FEC                 I/O Label           Nexthop          Out-Intf
K>        0.0.0.0/0           100/200             11.11.17.3       eth-0-17
```

Validate on PE2

PE2# show mpls ilm-database

```
Codes: > - selected ILM, p - stale ILM, B - BGP ILM, K - CLI ILM,
       L - LDP ILM, R - RSVP-TE ILM, S - SNMP ILM, I - IGP-Shortcut,
       U - unknown ILM

Code      FEC                 I/O Label           Nexthop          Out-Intf
K>        0.0.0.0/0           200/3               20.20.20.2       eth-0-1
```

3 Configuring VPLS

3.1 Overview

This chapter describes how to configure VPLS. Virtual Private LAN Service (VPLS) provides a way to enable transparent Layer-2 Ethernet LAN services to geographically dispersed customer sites connected by a Wide Area Network (WAN) by providing support for traditional Layer-2 broadcast and multicast services.

3.2 Topology

The following configuration is based on Figure 3-1.

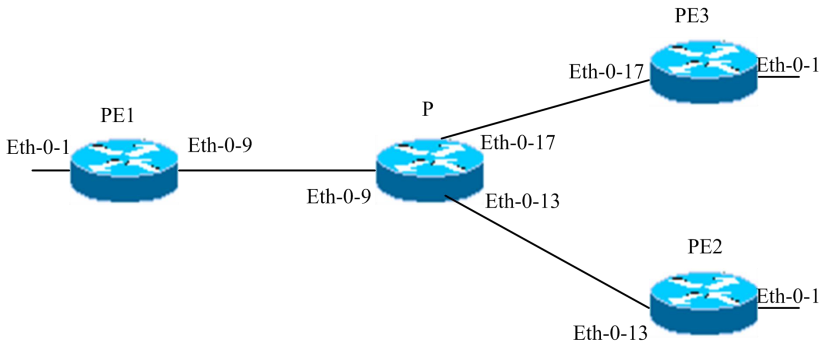

Figure 3-1 VPLS model

3.3 Configuring VPLS using LDP

VPLS uses a set of Martini circuits grouped by a common VPLS identifier to achieve this service objective. LDP is used to signal the constituent VCs and the service provider may use either LDP to set up LSP tunnels to transport data through virtual circuits. This chapter includes a step-by-step configuration of Virtual Private LAN Service (VPLS).

3.3.1 Configuring the VPLS on PE1

PE1# configure terminal	Enter the Configure mode

PE1(config)# interface eth-0-9	Enter the Interface mode • eth-0-9—Specify the interface
PE1(config-if)# no shutdown	Make interface UP
PE1(config-if)# no switchport	Configure the port to layer 3 port.
PE1(config-if)# ip address 11.11.9.1/24	Create IP address on the port
PE1(config-if)# enable-ldp	Configure Interface for LDP
PE1(config-if)# label-switching	Enable label-switching on interface
PE1(config-if)# exit	Exit the Interface mode
PE1(config)# interface loopback 0	Enter the Interface mode • loopback0—Specify the loopback interface name
PE1(config-if)# ip address 11.11.1.1/32	Create loopback addresses on both PE routers. Use a /32 host route for the loopback address
PE1(config)# exit	Exit the Interface mode
PE1(config)# router ldp	Enter the router-ldp mode
PE1(config-router)# router-id 11.11.1.1	Configure Router Identity
PE1(config-router)# targeted-peer 11.11.3.3	Configure Targeted Peer
PE1(config-router)# targeted-peer 11.11.4.4	Configure Targeted Peer
PE1(config-router)# transport-address 11.11.1.1	Configure the transport address for a label space
PE1(config-router)# exit	Exit the router-ldp mode
PE1(config)# router rip	Enter the router-rip mode
PE1(config-router)# network 11.11.1.1/16	Associate networks with the RIP process
PE1(config-router)# exit	Exit the router-rip mode
PE1(config)# mpls vpls v1 100	Create a VPLS instance and come into the VPLS instance mode
PE1(config-vpls)# vpls-peer 11.11.3.3 raw	Add a PE for VPLS instance
PE1(config-vpls)# vpls-peer 11.11.4.4 raw	Add a PE for VPLS instance
PE1(config-vpls)# exit	Exit VPLS instance mode
PE1(config)# interface eth-0-1	Enter the Interface mode • eth-0-1—Specify the interface
PE1(config-if)# no shutdown	Make interface UP
PE1(config-if)# mpls-vpls v1	Bind an interface to a VPLS instance
PE1(config-if)# exit	Exit the Interface mode

PE1(config)# interface eth-0-2	Enter the Interface mode • eth-0-2—Specify the interface
PE1(config-if)# no shutdown	Make interface UP
PE1(config-if)# mpls-vpls v1	Bind an interface to a VPLS instance
PE1(config-if)# exit	Exit the Interface mode

3.3.2 Configuring the VPLS on PE2

PE2# configure terminal	Enter the Configure mode
PE2(config)# interface eth-0-13	Enter the Interface mode • eth-0-13—Specify the interface
PE2(config-if)# no shutdown	Make interface UP
PE2(config)# no switchport	Configure the port to layer 3 port
PE2(config-if)# ip add 11.11.13.4/24	Create IP address on the port
PE2(config-if)# enable-ldp	Configure Interface for LDP
PE2(config-if)# label-switching	Enable label-switching on interface
PE2(config-if)# exit	Exit the Interface mode
PE2(config)# interface loopback 0	Enter the Interface mode • loopback0—Specify the loopback interface name
PE2(config-if)# ip address 11.11.4.4/32	Create loopback addresses on both PE routers. Use a /32 host route for the loopback address
PE2(config)# exit	Exit the Interface mode
PE2(config)# router ldp	Enter the router-ldp mode
PE2(config-router)# router-id 11.11.4.4	Configure Router Identity
PE2(config-router)# transport-address 11.11.4.4	Configure the transport address for a label space
PE2(config-router)# targeted-peer 11.11.1.1	Configure Targeted Peer
PE2(config-router)# targeted-peer 11.11.3.3	Configure Targeted Peer
PE2(config)# exit	Exit the router-ldp mode
PE2(config)# router rip	Enter the router-rip mode
PE2(config-router)# network 11.11.1.1/16	Associate networks with the RIP process
PE2(config-router)# exit	Exit the router-rip mode
PE2(config)# mpls vpls v4 100	Create a VPLS instance and come into the VPLS instance mode

PE2(config-vpls)# vpls-peer 11.11.1.1 raw	Add a PE for VPLS instance
PE2(config-vpls)# vpls-peer 11.11.3.3 raw	Add a PE for VPLS instance
PE2(config-vpls)# exit	Exit VPLS instance mode
PE2(config)# interface eth-0-1	Enter the Interface mode • eth-0-1—Specify the interface
PE2(config-if)# no shutdown	Make interface UP
PE2(config-if)# mpls-vpls v4	Bind an interface to a VPLS instance
PE2(config-if)# exit	Exit the Interface mode
PE2(config)# interface eth-0-2	Enter the Interface mode • eth-0-1—Specify the interface
PE2(config-if)# no shutdown	Make interface UP
PE2(config-if)# switchport mode trunk	Configure trunk mode on the port
PE2(config-if)# mpls-vpls v4 vlan 2	Bind an interface to a VPLS instance
PE2(config-if)# exit	Exit the Interface mode

3.3.3 Configuring the VPLS on PE3

PE3# configure terminal	Enter the Configure mode
PE3(config)# interface eth-0-17	Enter the Interface mode • eth-0-17—Specify the interface
PE3(config-if)# no shutdown	Make interface UP
PE3(config)# no switchport	Configure the port to layer 3 port
PE3(config-if)# ip address 11.11.17.3/24	Create IP address on the port
PE3(config-if)# enable-ldp	Configure Interface for LDP
PE3(config-if)# label-switching	Enable label-switching on interface
PE3(config-if)# exit	Exit the Interface mode
PE3(config)# interface loopback 0	Enter the Interface mode • loopback0—Specify the loopback interface name
PE3(config-if)# ip address 11.11.3.3/32	Create loopback addresses on both PE routers. Use a /32 host route for the loopback address
PE3(config-if)# exit	Exit the Interface mode
PE3(config)# router ldp	Enter the router-ldp mode
PE3(config-router)# router-id 11.11.3.3	Configure Router Identity

PE3(config-router)# transport-address 11.11.3.3	Configure the transport address for a label space
PE3(config-router)# targeted-peer 11.11.1.1	Configure Targeted Peer
PE3(config-router)# targeted-peer 11.11.4.4	Configure Targeted Peer
PE3(config)# exit	Exit the router-ldp mode
PE3(config)# router rip	Enter the router-rip mode
PE3(config-router)# network 11.11.1.1/16	Associate networks with the RIP process
PE3(config-router)# exit	Exit the router-rip mode
PE3(config)# mpls vpls v3 100	Create a VPLS instance and come into the VPLS instance mode
PE3(config-vpls)# vpls-peer 11.11.1.1 raw	Add a PE for VPLS instance
PE3(config-vpls)# vpls-peer 11.11.4.4 raw	Add a PE for VPLS instance
PE3(config-vpls)# exit	Exit VPLS instance mode
PE3(config)# interface eth-0-1	Enter the Interface mode • eth-0-1—Specify the interface
PE3(config-if)# no shutdown	Make interface UP
PE3(config-if)# mpls-vpls v3	Bind an interface to a VPLS instance
PE3(config-if)# exit	Exit the Interface mode
PE3(config)# interface eth-0-2	Enter the Interface mode • eth-0-2—Specify the interface
PE3(config-if)# no shutdown	Make interface UP
PE3(config-if)# mpls-vpls v3	Bind an interface to a VPLS instance
PE3(config-if)# exit	Exit the Interface mode

3.3.4 Configuring the VPLS on P

P# configure terminal	Enter the Configure mode
P(config)# interface eth-0-9	Enter the Interface mode • eth-0-9—Specify the interface
P(config-if)# no shutdown	Make interface UP
P(config)# no switchport	Configure the port to layer 3 port
P(config-if)# ip address 11.11.9.2/24	Create IP address on the port
P(config-if)# enable-ldp	Configure Interface for LDP
P(config-if)# label-switching	Enable label-switching on interface

P(config-if)# exit	Exit the Interface mode
P(config)# interface eth-0-13	Enter the Interface mode • eth-0-13—Specify the interface
P(config-if)# no shutdown	Make interface UP
P(config-if)# no switchport	Configure the port to layer 3 port
P(config-if)# ip address 11.11.13.2/24	Create IP address on the port
P(config-if)# enable-ldp	Configure Interface for LDP
P(config-if)# label-switching	Enable label-switching on interface
P(config-if)# exit	Exit the Interface mode
P(config)# interface eth-0-17	Enter the Interface mode • eth-0-17—Specify the interface
P(config-if)# no shutdown	Make interface UP
P(config-if)# no switchport	Configure the port to layer 3 port
P(config-if)# ip address 11.11.17.2/24	Create IP address on the port
P(config-if)# enable-ldp	Configure Interface for LDP
P(config-if)# label-switching	Enable label-switching on interface
P(config-if)# exit	Exit the Interface mode
P(config)# router ldp	Enter the router-ldp mode
P(config-router)# exit	Exit the router-ldp mode
P(config)# router rip	Enter the router-rip mode
P(config-router)# network 11.11.1.1/16	Associate networks with the RIP process
P(config-router)# exit	Exit the router-rip mode

3.3.5 Validation

Use the show ldp session and the show mpls vpls mesh commands respectively to display complete information about theVPLS. The following are the sample outputs for the show commands displaying VPLS.

PE1

PE1# show ldp session

```
Peer IP Address     IF Name     My Role    State          KeepAlive
11.11.3.3           eth-0-9     Passive    OPERATIONAL    30
11.11.4.4           eth-0-9     Passive    OPERATIONAL    30
11.11.17.2          eth-0-9     Passive    OPERATIONAL    30
```

PE1# show mpls vpls mesh

```
VPLS-ID     Peer Addr          In-Label    Out-Intf    Out-Label   Type        Lkps/St
100         11.11.3.3          257         eth-0-9     261         RAW         2/Up
100         11.11.4.4          256         eth-0-9     256         RAW         2/Up
```

PE2

PE2# show ldp session

```
Peer IP Address     IF Name     My Role    State          KeepAlive
11.11.1.1           eth-0-13    Active     OPERATIONAL    30
11.11.3.3           eth-0-13    Active     OPERATIONAL    30
11.11.17.2          eth-0-13    Passive    OPERATIONAL    30
```

Switch# show mpls vpls mesh

```
VPLS-ID     Peer Addr          In-Label    Out-Intf    Out-Label   Type        Lkps/St
100         11.11.1.1          256         eth-0-13    256         RAW         2/Up
100         11.11.3.3          257         eth-0-13    256         RAW         2/Up
```

PE3

PE3# show ldp session

```
Peer IP Address     IF Name     My Role    State          KeepAlive
11.11.1.1           eth-0-17    Active     OPERATIONAL    30
11.11.17.2          eth-0-17    Passive    OPERATIONAL    30
```

PE3# show mpls vpls mesh

```
VPLS-ID     Peer Addr          In-Label    Out-Intf    Out-Label   Type        Lkps/St
100         11.11.1.1          261         eth-0-17    257         RAW         2/Up
100         11.11.4.4          256         eth-0-17    257         RAW         2/Up
```

P

P# show ldp session

```
Peer IP Address     IF Name     My Role    State          KeepAlive
11.11.1.1           eth-0-9     Active     OPERATIONAL    30
11.11.3.3           eth-0-17    Active     OPERATIONAL    30
11.11.4.4           eth-0-13    Active     OPERATIONAL    30
```

3.4 Configuring VPLS using static conmmand

3.4.1 Configuring the VPLS on PE1

PE1# configure terminal	Enter the Configure mode
PE1(config)# interface eth-0-9	Enter the Interface mode • eth-0-9—Specify the interface
PE1(config-if)# no shutdown	Make interface UP

PE1(config-if)# no switchport	Configure the port to layer 3 port.
PE1(config-if)# ip address 11.11.9.1/24	Create IP address on the port
PE1(config-if)# label-switching	Enable label-switching on interface
PE1(config-if)# exit	Exit the Interface mode
PE1(config)# mpls ftn-entry 11.11.17.1/24 97 11.11.9.2	Configure one static FTN entry
PE1(config)# mpls ftn-entry 11.11.13.1/24 93 11.11.9.2	Configure one static FTN entry
PE1(config)# mpls vpls vpls1 1	Create a VPLS instance and come into the VPLS instance mode
PE1(config-vpls)# vpls-peer 11.11.17.1 raw manual	Add a PE for VPLS instance
PE1(config-vpls)# vpls-peer 11.11.13.1 raw manual	Add a PE for VPLS instance
PE1(config)# interface eth-0-1	Enter the Interface mode • eth-0-1—Specify the interface
PE1(config-if)# no shutdown	Make interface UP
PE1(config-if)# mpls-vpls vpls1	Bind an interface to a VPLS instance
PE1(config-if)# exit	Exit the Interface mode
PE1(config)# interface eth-0-2	Enter the Interface mode • eth-0-2—Specify the interface
PE1(config-if)# no shutdown	Make interface UP
PE1(config-if)# switchport mode trunk	Enter trunk mode
PE1(config-if)# mpls-vpls vpls1 vlan 100	Bind an interface to a VPLS instance
PE1(config)# vpls-fib-add vpls1 peer 11.11.17.1 102 201	Bind an interface to a VPLS instance
PE1(config)# vpls-fib-add vpls1 peer 11.11.13.1 103 31	Bind an interface to a VPLS instance

3.4.2 Configuring the VPLS on PE2

PE2# configure terminal	Enter the Configure mode
PE2(config)# interface eth-0-17	Enter the Interface mode • eth-0-17—Specify the interface
PE2(config-if)# no shutdown	Make interface UP
PE2(config-if)# no switchport	Configure the port to layer 3 port.

PE2(config-if)# ip address 11.11.13.1/24	Create IP address on the port
PE2(config-if)# label-switching	Enable label-switching on interface
PE2(config-if)# exit	Exit the Interface mode
PE2(config)# mpls ftn-entry 11.11.9.1/32 44 11.11.13.2	Configure one static FTN entry
PE2(config)# mpls vpls vpls1 1	Create a VPLS instance and come into the VPLS instance mode
PE2(config-vpls)# vpls-peer 11.11.9.1 raw manual	Add a PE for VPLS instance
PE2(config)# interface eth-0-1	Enter the Interface mode • eth-0-1—Specify the interface
PE2(config-if)# no shutdown	Make interface UP
PE2(config-if)# switchport mode trunk	Enter trunk mode
PE2(config-if)# mpls-vpls vpls1 vlan 200	Bind an interface to a VPLS instance
PE2(config-if)# exit	Exit the Interface mode
PE2(config)# vpls-fib-add vpls1 peer 11.11.9.1 31 103	Add a static PW for a PE in a VPLS instance

3.4.3 Configuring the VPLS on PE3

PE3# configure terminal	Enter the Configure mode
PE3(config)# interface eth-0-17	Enter the Interface mode • eth-0-17—Specify the interface
PE3(config-if)# no shutdown	Make interface UP
PE3(config-if)# no switchport	Configure the port to layer 3 port
PE3(config-if)# ip address 11.11.17.1/24	Create IP address on the port
PE3(config-if)# label-switching	Enable label-switching on interface
PE3(config-if)# exit	Exit the Interface mode
PE3(config)# mpls ftn-entry 11.11.9.1/32 33 11.11.17.2	Configure one static FTN entry
PE3(config)# mpls vpls vpls1 1	Create a VPLS instance and come into the VPLS instance mode
PE3(config-vpls)# vpls-peer 11.11.9.1 raw manual	Add a PE for VPLS instance
PE3(config)# interface eth-0-1	Enter the Interface mode • eth-0-1—Specify the interface
PE3 (config-if)# no shutdown	Make interface UP

PE3(config-if)# mpls-vpls vpls1	Bind an interface to a VPLS instance
PE3(config-if)# exit	Exit the Interface mode
PE3(config)# vpls-fib-add vpls1 peer 11.11.9.1 201 102	Add a static PW for a PE in a VPLS instance

3.4.4 Configuring the VPLS on P

P# configure terminal	Enter the Configure mode
P(config)# interface eth-0-9	Enter the Interface mode • eth-0-9—Specify the interface
P(config-if)# no shutdown	Make interface UP
P(config)# no switchport	Configure the port to layer 3 port
P(config-if)# ip address 11.11.9.2/24	Create IP address on the port
P(config-if)# label-switching	Enable label-switching on interface
P(config-if)# exit	Exit the Interface mode
P(config)# interface eth-0-17	Enter the Interface mode • eth-0-17—Specify the interface
P(config-if)# no shutdown	Make interface UP
P(config)# no switchport	Configure the port to layer 3 port.
P(config-if)# ip address 11.11.17.2/24	Create IP address on the port
P(config-if)# label-switching	Enable label-switching on interface
P(config-if)# exit	Exit the Interface mode
P(config)# interface eth-0-13	Enter the Interface mode • eth-0-13—Specify the interface
P(config-if)# no shutdown	Make interface UP
P(config)# no switchport	Configure the port to layer 3 port
P(config-if)# ip address 11.11.13.2/24	Create IP address on the port
P(config-if)# label-switching	Enable label-switching on interface
P(config-if)# exit	Exit the Interface mode
P(config)# mpls ilm-entry php 97 11.11.17.1	Configure one static ILM entry
P(config)# mpls ilm-entry php 93 11.11.13.1	Configure one static ILM entry
P(config)# mpls ilm-entry php 33 11.11.9.1	Configure one static ILM entry
P(config)# mpls ilm-entry php 44 11.11.9.1	Configure one static ILM entry

3.4.5 Validation

Use the show mpls vpls and the show mpls vpls mesh commands respectively to display complete information about the VPLS. The following are the sample outputs for the show commands displaying VPLS.

PE1

PE1# show mpls vpls mesh

VPLS-ID	Peer Addr	In-Label	Out-Intf	Out-Label	Type
1	11.11.13.1	103	eth-0-9	31	RAW
1	11.11.17.1	102	eth-0-9	201	RAW

PE2

PE2# show mpls vpls mesh

VPLS-ID	Peer Addr	In-Label	Out-Intf	Out-Label	Type
1	11.11.9.1	201	eth-0-17	102	RAW

```
PE2#
```

PE3

PE3# show mpls vpls mesh

VPLS-ID	Peer Addr	In-Label	Out-Intf	Out-Label	Type
1	11.11.9.1	31	eth-0-17	103	RAW

P

P# show mpls ilm-database

```
Codes: > - selected ILM, p - stale ILM, B - BGP ILM, K - CLI ILM,
       L - LDP ILM, R - RSVP-TE ILM, S - SNMP ILM, I - IGP-Shortcut,
       U - unknown ILM
```

Code	FEC	I/O Label	Nexthop	Out-Intf
K>	0.0.0.0/0	33/3	11.11.9.1	eth-0-9
K>	0.0.0.0/0	44/3	11.11.9.1	eth-0-9
K>	0.0.0.0/0	93/3	11.11.13.1	eth-0-13
K>	0.0.0.0/0	97/3	11.11.17.1	eth-0-17

3.5 Configuring Tunnel L2 protocol packets by VPLS

Customers at different sites connected across a service-provider network need to run various Layer 2 protocols to scale their topology to include all remote sites, as well as the local sites. STP must run properly, and build a proper spanning tree that includes the local site and all remote sites across the service-provider infrastructure.

The following example will display how to tunnel STP protocol packets by vpls. Users can configure other L2 protocol packets like that. The following configuration is also based on Figure 3-1.

3.5.1 Configuring VPLS on PE1

PE1# configure terminal	Enter the Configure mode
PE1(config)# l2protocol enable	Enable l2protocol globally
PE1(config)# interface eth-0-9	Enter the Interface mode • eth-0-9—Specify the interface
PE1(config-if)# no shutdown	Make interface UP
PE1(config-if)# no switchport	Configure the port to layer 3 port.
PE1(config-if)# ip address 11.11.9.1/24	Create IP address on the port
PE1(config-if)# enable-ldp	Configure Interface for LDP
PE1(config-if)# label-switching	Enable label-switching on interface
PE1(config-if)# exit	Exit the Interface mode
PE1(config)# interface loopback 0	Enter the Interface mode • loopback0—Specify the loopback interface name
PE1(config-if)# ip address 11.11.1.1/32	Create loopback addresses on both PE routers. Use a /32 host route for the loopback address
PE1(config)# exit	Exit the Interface mode
PE1(config)# router ldp	Enter the router-ldp mode
PE1(config-router)# router-id 11.11.1.1	Configure Router Identity
PE1(config-router)# targeted-peer 11.11.3.3	Configure Targeted Peer
PE1(config-router)# targeted-peer 11.11.4.4	Configure Targeted Peer
PE1(config-router)# transport-address 11.11.1.1	Configure the transport address for a label space
PE1(config-router)# exit	Exit the router-ldp mode
PE1(config)# router rip	Enter the router-rip mode
PE1(config-router)# network 11.11.1.1/16	Associate networks with the RIP process
PE1(config-router)# exit	Exit the router-rip mode
PE1(config)# mpls vpls v1 100	Create a VPLS instance and come into the VPLS instance mode
PE1(config-vpls)# vpls-peer 11.11.3.3 raw	Add a PE for VPLS instance
PE1(config-vpls)# vpls-peer 11.11.4.4 raw	Add a PE for VPLS instance
PE1(config-vpls)# exit	Exit VPLS instance mode

PE1(config)# interface eth-0-1	Enter the Interface mode • eth-0-1—Specify the interface
PE1(config-if)# no shutdown	Make interface UP
PE1(config-if)# mpls-vpls v1	Bind an interface to a VPLS instance
PE1(config-if)# l2protocol stp tunnel	Tunnel the stp bpdu packets into the VPLS instance
PE1(config-if)# end	Exit the Interface mode

3.5.2 Configuring VPLS on PE2

PE2# configure terminal	Enter the Configure mode
PE2(config)# l2protocol enable	Enable l2protocol globally
PE2(config)# interface eth-0-13	Enter the Interface mode • eth-0-13—Specify the interface
PE2(config-if)# no shutdown	Make interface UP
PE2(config)# no switchport	Configure the port to layer 3 port
PE2(config-if)# ip add 11.11.13.4/24	Create IP address on the port
PE2(config-if)# enable-ldp	Configure Interface for LDP
PE2(config-if)# label-switching	Enable label-switching on interface
PE2(config-if)# exit	Exit the Interface mode
PE2(config)# interface loopback 0	Enter the Interface mode • loopback0—Specify the loopback interface name
PE2(config-if)# ip address 11.11.4.4/32	Create loopback addresses on both PE routers. Use a /32 host route for the loopback address
PE2(config)# exit	Exit the Interface mode
PE2(config)# router ldp	Enter the router-ldp mode
PE2(config-router)# router-id 11.11.4.4	Configure Router Identity
PE2(config-router)# transport-address 11.11.4.4	Configure the transport address for a label space
PE2(config-router)# targeted-peer 11.11.1.1	Configure Targeted Peer
PE2(config-router)# targeted-peer 11.11.3.3	Configure Targeted Peer
PE2(config)# exit	Exit the router-ldp mode
PE2(config)# router rip	Enter the router-rip mode
PE2(config-router)# network 11.11.1.1/16	Associate networks with the RIP process
PE2(config-router)# exit	Exit the router-rip mode

PE2(config)# mpls vpls v4 100	Create a VPLS instance and come into the VPLS instance mode
PE2(config-vpls)# vpls-peer 11.11.1.1 raw	Add a PE for VPLS instance
PE2(config-vpls)# vpls-peer 11.11.3.3 raw	Add a PE for VPLS instance
PE2(config-vpls)# exit	Exit VPLS instance mode
PE2(config)# interface eth-0-1	Enter the Interface mode • eth-0-1—Specify the interface
PE2(config-if)# no shutdown	Make interface UP
PE2(config-if)# mpls-vpls v4	Bind an interface to a VPLS instance
PE2(config-if)# l2protocol stp tunnel	Tunnel the stp bpdu packets into the VPLS instance
PE2(config-if)# end	Exit the Interface mode

3.5.3 Configuring VPLS on PE3

PE3# configure terminal	Enter the Configure mode
PE3(config)# l2protocol enable	Enable l2protocol globally
PE3(config)# interface eth-0-17	Enter the Interface mode • eth-0-17—Specify the interface
PE3(config-if)# no shutdown	Make interface UP
PE3(config)# no switchport	Configure the port to layer 3 port.
PE3(config-if)# ip address 11.11.17.3/24	Create IP address on the port
PE3(config-if)# enable-ldp	Configure Interface for LDP
PE3(config-if)# label-switching	Enable label-switching on interface
PE3(config-if)# exit	Exit the Interface mode
PE3(config)# interface loopback 0	Enter the Interface mode • loopback0—Specify the loopback interface name
PE3(config-if)# ip address 11.11.3.3/32	Create loopback addresses on both PE routers. Use a /32 host route for the loopback address
PE3(config-if)# exit	Exit the Interface mode
PE3(config)# router ldp	Enter the router-ldp mode
PE3(config-router)# router-id 11.11.3.3	Configure Router Identity
PE3(config-router)# transport-address 11.11.3.3	Configure the transport address for a label space
PE3(config-router)# targeted-peer 11.11.1.1	Configure Targeted Peer

PE3(config-router)# targeted-peer 11.11.4.4	Configure Targeted Peer
PE3(config)# exit	Exit the router-ldp mode
PE3(config)# router rip	Enter the router-rip mode
PE3(config-router)# network 11.11.1.1/16	Associate networks with the RIP process
PE3(config-router)# exit	Exit the router-rip mode
PE3(config)# mpls vpls v3 100	Create a VPLS instance and come into the VPLS instance mode
PE3(config-vpls)# vpls-peer 11.11.1.1 raw	Add a PE for VPLS instance
PE3(config-vpls)# vpls-peer 11.11.4.4 raw	Add a PE for VPLS instance
PE3(config-vpls)# exit	Exit VPLS instance mode
PE3(config)# interface eth-0-1	Enter the Interface mode • eth-0-1—Specify the interface
PE3(config-if)# no shutdown	Make interface UP
PE3(config-if)# mpls-vpls v3	Bind an interface to a VPLS instance
PE3(config-if)# l2protocol stp tunnel	Tunnel the stp bpdu packets into the VPLS instance
PE3(config-if)# end	Exit the Interface mode

3.6 Configuring static MAC entries for VPLS

In a Virtual Switch Instance (VSI), if a PE receives a packet with an unknown destination MAC address, the PE will flood the packet. User can configure static MAC entries to specify the interface or peer node to which the received packets to be forwarded.

The following example shows how to configure static MAC entries for a VSI. The following configuration is based on Figure 3-1.

3.6.1 Configuring VPLS on PE1

PE1#configure terminal	Enter the Configure mode
PE1(config)# interface eth-0-9	Enter the Interface mode • eth-0-9—Specify the interface
PE1(config-if)# no shutdown	Make interface UP
PE1(config-if)# no switchport	Configure the port to layer 3 port
PE1(config-if)# ip address 11.11.9.1/24	Create IP address on the port
PE1(config-if)# enable-ldp	Configure Interface for LDP
PE1(config-if)# label-switching	Enable label-switching on interface

PE1(config-if)# exit	Exit the Interface mode
PE1(config)# interface loopback 0	Enter the Interface mode • loopback0—Specify the loopback interface name
PE1(config-if)# ip address 11.11.1.1/32	Create loopback addresses on both PE routers. Use a /32 host route for the loopback address
PE1(config)# exit	Exit the Interface mode
PE1(config)# router ldp	Enter the router-ldp mode
PE1(config-router)# router-id 11.11.1.1	Configure Router Identity
PE1(config-router)# targeted-peer 11.11.3.3	Configure Targeted Peer
PE1(config-router)# targeted-peer 11.11.4.4	Configure Targeted Peer
PE1(config-router)# transport-address 11.11.1.1	Configure the transport address for a label space
PE1(config-router)# exit	Exit the router-ldp mode
PE1(config)# router rip	Enter the router-rip mode
PE1(config-router)# network 11.11.1.1/16	Associate networks with the RIP process
PE1(config-router)# exit	Exit the router-rip mode
PE1(config)# interface eth-0-1	Enter the Interface mode • eth-0-1—Specify the interface
PE1(config-if)# no shutdown	Make interface UP
PE1(config-if)# mpls-vpls v1	Bind an interface to a VPLS instance
PE1(config-if)# end	Exit the Interface mode
PE1(config)# mpls vpls v1 100	Create a VPLS instance and come into the VPLS instance mode
PE1(config-vpls)# vpls-peer 11.11.3.3 raw	Add a PE for VPLS instance
PE1(config-vpls)# vpls-peer 11.11.4.4 raw	Add a PE for VPLS instance
PE1(config-vpls)# mac-address-table 0000.0000.0001 forward eth-0-1	Add a static MAC entry for VPLS instance
PE1(config-vpls)# mac-address-table 0000.0000.0003 forward peer 11.11.3.3	Add a static MAC entry for VPLS instance
PE1(config-vpls)# mac-address-table 0000.0000.0004 forward peer 11.11.4.4	Add a static MAC entry for VPLS instance
PE1(config-vpls)# exit	Exit VPLS instance mode

3.6.2 Configuring VPLS on PE2

PE2# configure terminal	Enter the Configure mode
PE2(config)# interface eth-0-13	Enter the Interface mode • eth-0-13—Specify the interface
PE2(config-if)# no shutdown	Make interface UP
PE2(config)# no switchport	Configure the port to layer 3 port
PE2(config-if)# ip add 11.11.13.4/24	Create IP address on the port
PE2(config-if)# enable-ldp	Configure Interface for LDP
PE2(config-if)# label-switching	Enable label-switching on interface
PE2(config-if)# exit	Exit the Interface mode
PE2(config)# interface loopback 0	Enter the Interface mode • loopback0—Specify the loopback interface name
PE2(config-if)# ip address 11.11.4.4/32	Create loopback addresses on both PE routers. Use a /32 host route for the loopback address
PE2(config)# exit	Exit the Interface mode
PE2(config)# router ldp	Enter the router-ldp mode
PE2(config-router)# router-id 11.11.4.4	Configure Router Identity
PE2(config-router)# transport-address 11.11.4.4	Configure the transport address for a label space
PE2(config-router)# targeted-peer 11.11.1.1	Configure Targeted Peer
PE2(config-router)# targeted-peer 11.11.3.3	Configure Targeted Peer
PE2(config)# exit	Exit the router-ldp mode
PE2(config)# router rip	Enter the router-rip mode
PE2(config-router)# network 11.11.1.1/16	Associate networks with the RIP process
PE2(config-router)# exit	Exit the router-rip mode
PE2(config)# interface eth-0-1	Enter the Interface mode • eth-0-1—Specify the interface
PE2(config-if)# no shutdown	Make interface UP
PE2(config-if)# mpls-vpls v4	Bind an interface to a VPLS instance
PE2(config-if)# end	Exit the Interface mode.
PE2(config)# mpls vpls v4 100	Create a VPLS instance and come into the VPLS instance mode
PE2(config-vpls)# vpls-peer 11.11.1.1 raw	Add a PE for VPLS instance
PE2(config-vpls)# vpls-peer 11.11.3.3 raw	Add a PE for VPLS instance

PE2(config-vpls)# mac-address-table 0000.0000.0004 forward eth-0-1	Add a static MAC entry for VPLS instance
PE2(config-vpls)# mac-address-table 0000.0000.0001 forward peer 11.11.1.1	Add a static MAC entry for VPLS instance
PE2(config-vpls)# mac-address-table 0000.0000.0003 forward peer 11.11.3.3	Add a static MAC entry for VPLS instance
PE2(config-vpls)# exit	Exit VPLS instance mode

3.6.3 Configuring VPLS on PE3

PE3# configure terminal	Enter the Configure mode
PE3(config)# interface eth-0-17	Enter the Interface mode • eth-0-17—Specify the interface
PE3(config-if)# no shutdown	Make interface UP
PE3(config)# no switchport	Configure the port to layer 3 port.
PE3(config-if)# ip address 11.11.17.3/24	Create IP address on the port
PE3(config-if)# enable-ldp	Configure Interface for LDP
PE3(config-if)# label-switching	Enable label-switching on interface
PE3(config-if)# exit	Exit the Interface mode
PE3(config)# interface loopback 0	Enter the Interface mode • loopback0—Specify the loopback interface name
PE3(config-if)# ip address 11.11.3.3/32	Create loopback addresses on both PE routers. Use a /32 host route for the loopback address
PE3(config-if)# exit	Exit the Interface mode
PE3(config)# router ldp	Enter the router-ldp mode
PE3(config-router)# router-id 11.11.3.3	Configure Router Identity
PE3(config-router)# transport-address 11.11.3.3	Configure the transport address for a label space
PE3(config-router)# targeted-peer 11.11.1.1	Configure Targeted Peer
PE3(config-router)# targeted-peer 11.11.4.4	Configure Targeted Peer
PE3(config)# exit	Exit the router-ldp mode
PE3(config)# router rip	Enter the router-rip mode
PE3(config-router)# network 11.11.1.1/16	Associate networks with the RIP process
PE3(config-router)# exit	Exit the router-rip mode

PE3(config)# interface eth-0-1	Enter the Interface mode • eth-0-1—Specify the interface
PE3(config-if)# no shutdown	Make interface UP
PE3(config-if)# mpls-vpls v3	Bind an interface to a VPLS instance
PE3(config-if)# end	Exit the Interface mode
PE3(config)# mpls vpls v3 100	Create a VPLS instance and come into the VPLS instance mode
PE3(config-vpls)# vpls-peer 11.11.1.1 raw	Add a PE for VPLS instance
PE3(config-vpls)# vpls-peer 11.11.4.4 raw	Add a PE for VPLS instance
PE3(config-vpls)# mac-address-table 0000.0000.0003 forward eth-0-1	Add a static MAC entry for VPLS instance
PE3(config-vpls)# mac-address-table 0000.0000.0001 forward peer 11.11.1.1	Add a static MAC entry for VPLS instance
PE3(config-vpls)# mac-address-table 0000.0000.0004 forward peer 11.11.4.4	Add a static MAC entry for VPLS instance
PE3(config-vpls)# exit	Exit VPLS instance mode

3.6.4 Configuring VPLS on P

P#configure terminal	Enter the Configure mode.
P(config)# interface eth-0-9	Enter the Interface mode • eth-0-9—Specify the interface
P(config-if)# no shutdown	Make interface UP
P(config)# no switchport	Configure the port to layer 3 port.
P(config-if)# ip address 11.11.9.2/24	Create IP address on the port
P(config-if)# enable-ldp	Configure Interface for LDP
P(config-if)# label-switching	Enable label-switching on interface
P(config-if)# exit	Exit the Interface mode
P(config)# interface eth-0-13	Enter the Interface mode • eth-0-13—Specify the interface
P(config-if)# no shutdown	Make interface UP
P(config-if)# no switchport	Configure the port to layer 3 port.
P(config-if)# ip address 11.11.13.2/24	Create IP address on the port
P(config-if)# enable-ldp	Configure Interface for LDP

P(config-if)# label-switching	Enable label-switching on interface
P(config-if)# exit	Exit the Interface mode
P(config)# interface eth-0-17	Enter the Interface mode • eth-0-17—Specify the interface
P(config-if)# no shutdown	Make interface UP
P(config-if)# no switchport	Configure the port to layer 3 port.
P(config-if)# ip address 11.11.17.2/24	Create IP address on the port
P(config-if)# enable-ldp	Configure Interface for LDP
P(config-if)# label-switching	Enable label-switching on interface
P(config-if)# exit	Exit the Interface mode
P(config)# router ldp	Enter the router-ldp mode
P(config-router)# exit	Exit the router-ldp mode
P(config)# router rip	Enter the router-rip mode
P(config-router)# network 11.11.1.1/16	Associate networks with the RIP process
P(config-router)# exit	Exit the router-rip mode

3.6.5 Validation

Use the show mac address-table vpls to display complete information about the VPLS MAC entries. The following are the sample outputs for the show command.

PE1

PE1# show mac address-table vpls

```
vpls            peer                mac                 static
v1              eth-0-1             0000.0000.0001 1
v1              11.11.3.3           0000.0000.0003 1
v1              11.11.4.4           0000.0000.0004 1
```

PE2

PE2# show mac address-table vpls

```
vpls            peer                mac                 static
v1              eth-0-1             0000.0000.0004 1
v1              11.11.1.1           0000.0000.0001 1
v1              11.11.3.3           0000.0000.0003 1
```

PE3

PE3# show mac address-table vpls

```
vpls            peer                mac                 static
v1              eth-0-1             0000.0000.0003 1
v1              11.11.1.1           0000.0000.0001 1
v1              11.11.4.4           0000.0000.0004 1
```

3.7 Set mpls l2vpn default-vlan on AC port

Use mpls l2vpn default-vlan to specify the default vlan for VPLS AC port. For example, for BPDU transmission, the device will discard untag BPDU packets if no "mpls l2vpn default-vlan" on the tagged AC port.

3.7.1 Configuring VPLS on PE1

PE1# configure terminal	Enter the Configure mode
PE1(config)# interface eth-0-9	Enter the Interface mode •eth-0-9—Specify the interface
PE1(config-if)# no shutdown	Make interface UP
PE1(config-if)# no switchport	Configure the port to layer 3 port
PE1(config-if)# ip address 11.11.9.1/24	Create IP address on the port
PE1(config-if)# enable-ldp	Configure Interface for LDP
PE1(config-if)# label-switching	Enable label-switching on interface
PE1(config-if)# exit	Exit the Interface mode
PE1(config)# interface loopback 0	Enter the Interface mode • loopback0—Specify the loopback interface name
PE1(config-if)# ip address 11.11.1.1/32	Create loopback addresses on both PE routers. Use a /32 host route for the loopback address
PE1(config)# exit	Exit the Interface mode
PE1(config)# router ldp	Enter the router-ldp mode
PE1(config-router)# router-id 11.11.1.1	Configure Router Identity
PE1(config-router)# targeted-peer 11.11.3.3	Configure Targeted Peer
PE1(config-router)# targeted-peer 11.11.4.4	Configure Targeted Peer
PE1(config-router)# transport-address 11.11.1.1	Configure the transport address for a label space
PE1(config-router)# exit	Exit the router-ldp mode
PE1(config)# router rip	Enter the router-rip mode
PE1(config-router)# network 11.11.1.1/16	Associate networks with the RIP process
PE1(config-router)# exit	Exit the router-rip mode

PE1(config)# mpls vpls v1 100	Create a VPLS instance and come into the VPLS instance mode
PE1(config-vpls)# vpls-peer 11.11.3.3 raw	Add a PE for VPLS instance
PE1(config-vpls)# vpls-peer 11.11.4.4 raw	Add a PE for VPLS instance
PE1(config-vpls)# exit	Exit VPLS instance mode
PE1(config)# interface eth-0-1	Enter the Interface mode • eth-0-1—Specify the interface
PE1(config-if)# no shutdown	Make interface UP
PE1(config-if)# switchport mode trunk	Configure trunk mode on the port
PE1(config-if)# switchport trunk native vlan 20	Config mpls VPLS default vlan for AC port
PE1(config-if)# mpls-vpls v1 vlan 20	Bind an interface to a VPLS instance
PE1(config-if)# end	Exit the Interface mode

3.7.2 Configuring VPLS on PE2

PE2# configure terminal	Enter the Configure mode
PE2(config)# l2protocol enable	Enable l2protocol globally
PE2(config)# interface eth-0-13	Enter the Interface mode • eth-0-13—Specify the interface
PE2(config-if)# no shutdown	Make interface UP
PE2(config)# no switchport	Configure the port to layer 3 port.
PE2(config-if)# ip add 11.11.13.4/24	Create IP address on the port
PE2(config-if)# enable-ldp	Configure Interface for LDP
PE2(config-if)# label-switching	Enable label-switching on interface
PE2(config-if)# exit	Exit the Interface mode
PE2(config)# interface loopback 0	Enter the Interface mode • loopback0—Specify the loopback interface name
PE2(config-if)# ip address 11.11.4.4/32	Create loopback addresses on both PE routers. Use a /32 host route for the loopback address
PE2(config)# exit	Exit the Interface mode
PE2(config)# router ldp	Enter the router-ldp mode
PE2(config-router)# router-id 11.11.4.4	Configure Router Identity
PE2(config-router)# transport-address 11.11.4.4	Configure the transport address for a label space

PE2(config-router)# targeted-peer 11.11.1.1	Configure Targeted Peer
PE2(config-router)# targeted-peer 11.11.3.3	Configure Targeted Peer
PE2(config)# exit	Exit the router-ldp mode
PE2(config)# router rip	Enter the router-rip mode
PE2(config-router)# network 11.11.1.1/16	Associate networks with the RIP process
PE2(config-router)# exit	Exit the router-rip mode
PE2(config)# mpls vpls v4 100	Create a VPLS instance and come into the VPLS instance mode
PE2(config-vpls)# vpls-peer 11.11.1.1 raw	Add a PE for VPLS instance
PE2(config-vpls)# vpls-peer 11.11.3.3 raw	Add a PE for VPLS instance
PE2(config-vpls)# exit	Exit VPLS instance mode
PE2(config)# interface eth-0-1	Enter the Interface mode • eth-0-1—Specify the interface
PE2(config-if)# no shutdown	Make interface UP
PE2(config-if)# switchport mode trunk	Configure trunk mode on the port
PE2(config-if)# switchport trunk native vlan 20	Config mpls VPLS default vlan for AC port
PE2(config-if)# mpls-vpls v4 vlan 20	Bind an interface to a VPLS instance
PE2(config-if)# end	Exit the Interface mode

3.7.3 Configuring VPLS on PE3

PE3# configure terminal	Enter the Configure mode
PE3(config)# l2protocol enable	Enable l2protocol globally
PE3(config)# interface eth-0-17	Enter the Interface mode • eth-0-17—Specify the interface
PE3(config-if)# no shutdown	Make interface UP
PE3(config)# no switchport	Configure the port to layer 3 port
PE3(config-if)# ip address 11.11.17.3/24	Create IP address on the port
PE3(config-if)# enable-ldp	Configure Interface for LDP
PE3(config-if)# label-switching	Enable label-switching on interface
PE3(config-if)# exit	Exit the Interface mode
PE3(config)# interface loopback 0	Enter the Interface mode • loopback0—Specify the loopback interface name

PE3(config-if)# ip address 11.11.3.3/32	Create loopback addresses on both PE routers. Use a /32 host route for the loopback address
PE3(config-if)# exit	Exit the Interface mode
PE3(config)# router ldp	Enter the router-ldp mode
PE3(config-router)# router-id 11.11.3.3	Configure Router Identity
PE3(config-router)# transport-address 11.11.3.3	Configure the transport address for a label space
PE3(config-router)# targeted-peer 11.11.1.1	Configure Targeted Peer
PE3(config-router)# targeted-peer 11.11.4.4	Configure Targeted Peer
PE3(config)# exit	Exit the router-ldp mode
PE3(config)# router rip	Enter the router-rip mode
PE3(config-router)# network 11.11.1.1/16	Associate networks with the RIP process
PE3(config-router)# exit	Exit the router-rip mode
PE3(config)# mpls vpls v3 100	Create a VPLS instance and come into the VPLS instance mode
PE3(config-vpls)# vpls-peer 11.11.1.1 raw	Add a PE for VPLS instance
PE3(config-vpls)# vpls-peer 11.11.4.4 raw	Add a PE for VPLS instance
PE3(config-vpls)# exit	Exit VPLS instance mode
PE3(config)# interface eth-0-1	Enter the Interface mode • eth-0-1—Specify the interface
PE3(config-if)# no shutdown	Make interface UP
PE3(config-if)# switchport mode trunk	Configure trunk mode on the port
PE3(config-if)# mpls-vpls v3 vlan 20	Bind an interface to a VPLS instance
PE3(config-if)# mpls l2vpn default-vlan 20	Config mpls VPLS default vlan for AC port
PE3(config-if)# end	Exit the Interface mode

3.7.4 Validation

Use the show run interface to display complete information about mpls l2vpn default vlan. The following are the sample outputs for the show command.

PE1

PE1# sh run interface eth-0-1

```
Building configuration...
!
interface eth-0-1
 switchport mode trunk
```

```
 mpls-vpls v1 vlan 20
 mpls l2vpn default-vlan 20
```

PE2

PE1# sh run interface eth-0-1

```
Building configuration...
!
interface eth-0-1
 switchport mode trunk
 mpls-vpls v4 vlan 20
 mpls l2vpn default-vlan 20
```

PE3

PE1# sh run interface eth-0-1

```
Building configuration...
!
interface eth-0-1
 switchport mode trunk
 mpls-vpls v3 vlan 20
 mpls l2vpn default-vlan 20
```

4 Configuring VPWS

4.1 Overview

This chapter describes how to configure VPWS.

The MPLS L2CIRCUIT is a point-to-point Layer 2 connection transported by means of Multiprotocol Label Switching (MPLS) on the service provider's network. The Layer 2 circuit is transported over a single Label Switched Path (LSP) tunnel between two Provider Edge (PE) routers.

4.2 Topology

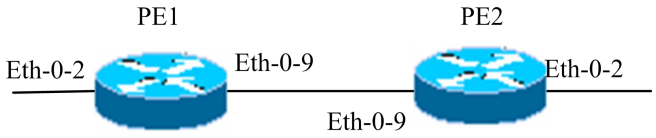

Figure 4-1 Topology of vpws configuration

4.3 Configuring VPWS using LDP

The Virtual Circuit module is a part of the LDP module. It is based on the IETF drafts proposed by Martini, et al [L2TRANS]. The Virtual Circuits module sets up virtual circuits for transporting Layer 2 protocols across an MPLS network. This chapter includes a step-by-step configuration of VPWS.

4.3.1 Configuring the VPWS on PE1

PE1#configure terminal	Enter the Configure mode
PE1(config)# interface eth-0-2	Enter the Interface mode eth-0-2—Specify the interface
PE1(config-if)# no shutdown	Make interface UP
PE1(config-if)# mpls-l2-circuit t1 ethernet	Bind an interface to the VPWS

PE1(config-if)# exit	Exit the Interface mode
PE1(config)# interface loopback 0	Enter the Interface mode loopback0—Specify the loopback interface name.
PE1(config-if)# ip address 192.168.10.10/32	Create loopback addresses on both PE routers. Use a /32 host route for the loopback address
PE1(config)# exit	Exit the Interface mode.
PE1(config)# router ldp	Enter the router-ldp mode
PE1(config-router)# router-id 192.168.10.10	Configure Router Identity
PE1(config-router)# targeted-peer 192.168.11.10	Configure Targeted Peer in LDP
PE1(config-router)# exit	Exit the router-ldp mode
PE1(config)# mpls l2-circuit t1 200 192.168.11.10	Create a VPWS. Both PE routers must be configured with the same VC-ID (200)
PE1(config)# interface eth-0-9	Enter the Interface mode eth-0-9—Specify the interface
PE1(config-if)# no shutdown	Make interface UP
PE1(config-if)# no switchport	Configure the port to layer 3 port
PE1(config-if)# ip address 8.8.8.1/24	Create IP address on the port
PE1(config-if)# enable-ldp	Configure Interface for LDP
PE1(config-if)# label-switching	Enable label-switching on interface
PE1(config-if)# exit	Exit the Interface mode.
PE1(config)# router rip	Enter the router-rip mode
PE1(config-router)# network 0.0.0.0/0	Associate networks with the RIP process

4.3.2 Configuring the VPWS on PE2

PE2#configure terminal	Enter the Configure mode
PE2(config)# interface eth-0-2	Enter the Interface mode. • eth-0-2—Specify the interface
PE2(config-if)# no shutdown	Make interface UP
PE2(config-if)# mpls-l2-circuit t1 ethernet	Bind an interface to the VPWS
PE2(config-if)# exit	Exit the Interface mode
PE2(config)# interface loopback 0	Enter the Interface mode • loopback0—Specify the loopback interface name.
PE2(config-if)# ip address 192.168.11.10/32	Create loopback addresses on both PE routers. Use a /32 host route for the loopback address

PE2(config)# exit	Exit the Configure mode
PE2(config)# router ldp	Enter the router-ldp mode
PE2(config-router)# router-id 192.168.11.10	Configure Router Identity
PE2(config-router)# targeted-peer 192.168.10.10	Configure Targeted Peer in LDP
PE2(config-router)# exit	Exit the router-ldp mode
PE2(config)# mpls l2-circuit t1 200 192.168.10.10	Create a VPWS. Both PE routers must be configured with the same VC-ID (200)
PE2(config)# interface eth-0-9	Enter the Interface mode. • eth-0-9—Specify the interface
PE2(config-if)# no shutdown	Make interface UP
PE2(config-if)# no switchport	Configure the port to layer 3 port
PE2(config-if)# ip address 8.8.8.2/24	Create IP address on the port
PE2(config-if)# enable-ldp	Configure Interface for LDP
PE2(config-if)# label-switching	Enable label-switching on interface
PE2(config-if)# exit	Exit the Interface mode
PE2(config)# router rip	Enter the router-rip mode
PE2(config-router)# network 0.0.0.0/0	Associate networks with the RIP process

4.3.3 Validation

Use the show mpls l2circuitand the show mpls vc-table commands respectively to display complete information about the Layer-2 Virtual Circuit. The following are the sample outputs for the show commands displaying Layer-2 virtual circuit information.

On PE1

PE1#show mpls vc-table

```
VC-ID    In Intf    Out Intf   In Label   Out Label   EndPoint         Status    Manual
200      eth-0-2    eth-0-1    3328         3328        192.168.11.10  Active    No
```

On PE2

PE2#show mpls vc-table

```
VC-ID    In Intf   Out Intf   In Label   Out Label   EndPoint         Status   Manual
200      eth-0-2   eth-0-1    3328         3328        192.168.10.10  Active    No
```

4.4 VC configuration using static command

4.4.1 Configuring the VPWS on PE1

PE1#configure terminal	Enter the Configure mode
PE1(config)# interface eth-0-2	Enter the Interface mode • eth-0-2—Specify the interface
PE1(config-if)# no shutdown	Make interface UP
PE1(config-if)# mpls-l2-circuit t2 ethernet	Bind an interface to the VPWS.
PE1(config-if)# exit	Exit the Interface mode.
PE1(config)# interface loopback 0	Enter the Interface mode. • loopback0—Specify the loopback interface name.
PE1(config-if)# ip address 192.168.10.10/32	Create loopback addresses on both PE routers. Use a /32 host route for the loopback address
PE1(config-if)# exit	Exit the Interface mode.
PE1(config)# mpls ftn-entry 192.168.11.1/24 111 8.8.8.2	Configure FTN entry for tunnel
PE1(config)# mpls ilm-entry pop 212	Configure ILM entry for tunnel
PE1(config)# mpls l2-circuit t2 201 192.168.11.10 manual	Create a Virtual Circuit
PE1(config)# interface eth-0-9	Enter the Interface mode • eth-0-9—Specify the interface
PE1(config-if)# no shutdown	Make interface UP
PE1(config-if)# no switchport	Configure the port to layer 3 port
PE1(config-if)# ip address 8.8.8.1/24	Create IP address on the port
PE1(config-if)# label-switching	Enable label-switching on interface
PE1(config-if)# exit	Exit the Interface mode
PE1(config)# mpls l2-circuit-fib-entry t2 44 33	Configure VC label for the VC

4.4.2 Configuring the VPWS on PE2

PE2#configure terminal	Enter the Configure mode
PE2(config)# interface eth-0-2	Enter the Interface mode • eth-0-2—Specify the interface
PE2(config-if)# no shutdown	Make interface UP

PE2(config-if)# mpls-l2circuit t2 ethernet	Bind an interface to the VPWS
PE2(config-if)# exit	Exit the Interface mode
PE2(config)# interface loopback 0	Enter the Interface mode • loopback0—Specify the loopback interface name.
PE2(config-if)# ip address 192.168.11.10/32	Create loopback addresses on both PE routers. Use a /32 host route for the loopback address
PE2(config-if)# exit	Exit the Interface mode
PE2(config)# mpls ftn-entry 192.168.10.1/24 222 8.8.8.1	Configure FTN entry for tunnel
PE2(config)# mpls ilm-entry pop 111	Configure ILM entry for tunnel
PE2(config)# mpls l2-circuit t2 201 192.168.10.10 manual	Create a VPWS
PE2(config)# interface eth-0-9	Enter the Interface mode • eth-0-9—Specify the interface
PE2(config-if)# no shutdown	Make interface UP
PE2(config-if)# no switchport	Configure the port to layer 3 port
PE2(config-if)# ip address 8.8.8.2/24	Create IP address on the port
PE2(config-if)# label-switching	Enable label-switching on interface
PE2(config-if)# exit	Exit the Interface mode
PE2(config)# mpls l2-circuit-fib-entry t2 33 44	Configure VC label for the VC

4.4.3 Validation

Use the show mpls l2circuitand the show mpls vc-table commands respectively to display complete information about the Layer-2 Virtual Circuit. The following are the sample outputs for the show commands displaying Layer-2 virtual circuit information.

On PE1

PE1# show mpls vc-table

```
VC-ID        PW Intf    AC Intf    L/R Label        EndPoint          Status    Manual
201          eth-0-9    eth-0-2    44/33            192.168.11.10     Active    Yes
```

On PE2

PE2# show mpls vc-table

```
VC-ID        PW Intf    AC Intf    L/R Label        EndPoint          Status    Manual
201          eth-0-9    eth-0-2    33/44            192.168.10.10     Active    Yes
```

4.5 Set mpls l2vpn default-vlan on AC port

Use switchport trunk native vlan to specify the default vlan for L2VPN AC. For example, for BPDU transmission, the device will discard untag BPDU packets if no "mpls l2vpn default-vlan" on the tagged AC.

4.5.1 Configuring the VPWS on PE1

PE1#configure terminal	Enter the Configure mode
PE1(config)# interface eth-0-2	Enter the Interface mode • eth-0-2—Specify the interface
PE1(config-if)# no shutdown	Make interface UP
PE1(config-if)# switchport mode trunk	Configure trunk mode on the port
PE1(config-if)# mpls-l2-circuit t2 vlan 20	Bind an interface to the VPWS
PE1 (config-if)# mpls l2vpn default-vlan 20	Config mpls l2circuitdefault vlan for AC port
PE1(config-if)# exit	Exit the Interface mode
PE1(config)# interface loopback 0	Enter the Interface mode • loopback0—Specify the loopback interface name.
PE1(config-if)# ip address 192.168.10.10/32	Create loopback addresses on both PE routers. Use a /32 host route for the loopback address
PE1(config-if)# exit	Exit the Interface mode
PE1(config)# mpls ftn-entry 192.168.11.1/24 111 8.8.8.2	Configure FTN entry for tunnel
PE1(config)# mpls ilm-entry pop 212	Configure ILM entry for tunnel
PE1(config)# mpls l2-circuit t2 201 192.168.11.10 manual	Create a Virtual Circuit
PE1(config)# interface eth-0-9	Enter the Interface mode • eth-0-9—Specify the interface
PE1(config-if)# no shutdown	Make interface UP
PE1(config-if)# no switchport	Configure the port to layer 3 port
PE1(config-if)# ip address 8.8.8.1/24	Create IP address on the port
PE1(config-if)# label-switching	Enable label-switching on interface
PE1(config-if)# exit	Exit the Interface mode
PE1(config)# mpls l2-circuit-fib-entry t2 44 33	Configure VC label for the VC

4.5.2 Configuring the VPWS on PE2

PE2# configure terminal	Enter the Configure mode
PE2(config)# interface eth-0-2	Enter the Interface mode • eth-0-2—Specify the interface
PE2(config-if)# no shutdown	Make interface UP
PE2(config-if)# switchport mode trunk	Configure trunk mode on the port
PE2 (config-if)# switchport trunk native vlan 20	Bind an interface to the VPWS
PE2(config-if)# mpls-l2-circuit t2 vlan 20	Config mpls l2circuitdefault vlan for AC port
PE2(config-if)# exit	Exit the Interface mode
PE2(config)# interface loopback 0	Enter the Interface mode • loopback0—Specify the loopback interface name.
PE2(config-if)# ip address 192.168.11.10/32	Create loopback addresses on both PE routers. Use a /32 host route for the loopback address
PE2(config-if)# exit	Exit the Interface mode
PE2(config)# mpls ftn-entry 192.168.10.1/24 222 8.8.8.1	Configure FTN entry for tunnel
PE2(config)# mpls ilm-entry pop 111	Configure ILM entry for tunnel
PE2(config)# mpls l2-circuit t2 201 192.168.10.10 manual	Create a Virtual Circuit
PE2(config)# interface eth-0-9	Enter the Interface mode • eth-0-9—Specify the interface
PE2(config-if)# no shutdown	Make interface UP
PE2(config-if)# no switchport	Configure the port to layer 3 port
PE2(config-if)# ip address 8.8.8.2/24	Create IP address on the port
PE2(config-if)# label-switching	Enable label-switching on interface
PE2(config-if)# exit	Exit the Interface mode
PE2(config)# mpls l2-circuit-fib-entry t2 33 44	Configure VC label for the VC

4.5.3 Validation

Use the show run interface to display complete information about mpls l2vpn default vlan. The following are the sample outputs for the show command.

PE1

PE1# sh run interface eth-0-2

```
Building configuration...
!
interface eth-0-2
 mpls-l2circuit t2 ethernet
 mpls l2vpn default-vlan 20
!
```

PE2

PE2# sh run interface eth-0-2

```
Building configuration...
!
interface eth-0-2
 swithport trunk native vlan 20
 mpls-l2-circuit t2 ethernet
```

4.6 Configuring Tunnel L2 protocol packets by VPWS

Customers at different sites connected across a service-provider network need to run various Layer 2 protocols to scale their topology to include all remote sites, as well as the local sites. STP must run properly, and build a proper spanning tree that includes the local site and all remote sites across the service-provider infrastructure.

The following example will display how to tunnel STP protocol packets by vpws. Users can configure other L2 protocol packets like that. The following configuration is also based on chart 1.

4.6.1 Configuring the VPWS on PE1

PE1#configure terminal	Enter the Configure mode
PE1(config)# l2protocol enable	Enable l2protocol globally
PE1(config)# interface eth-0-2	Enter the Interface mode • eth-0-2—Specify the interface
PE1(config-if)# no shutdown	Make interface UP
PE1(config-if)# mpls-l2-circuit t1 ethernet	Bind an interface to the VPWS
PE1(config-if)# l2protocol stp tunnel	Tunnel the stp bpdu packets into the Virtual Circuit
PE1(config-if)# exit	Exit the Interface mode
PE1(config)# interface loopback 0	Enter the Interface mode • loopback0—Specify the loopback interface name.
PE1(config-if)# ip address 192.168.10.10/32	Create loopback addresses on both PE routers. Use a /32 host route for the loopback address.
PE1(config)# exit	Exit the Interface mode
PE1(config)# router ldp	Enter the router-ldp mode

PE1(config-router)# router-id 192.168.10.10	Configure Router Identity
PE1(config-router)# targeted-peer 192.168.11.10	Configure Targeted Peer in LDP
PE1(config-router)# exit	Exit the router-ldp mode
PE1(config)# mpls l2-circuit t1 200 192.168.11.10	Create a VPWS. Both PE routers must be configured with the same VC-ID (200)
PE1(config)# interface eth-0-9	Enter the Interface mode • eth-0-9—Specify the interface
PE1(config-if)# no shutdown	Make interface UP
PE1(config-if)# no switchport	Configure the port to layer 3 port
PE1(config-if)# ip address 8.8.8.1/24	Create IP address on the port
PE1(config-if)# enable-ldp	Configure Interface for LDP
PE1(config-if)# label-switching	Enable label-switching on interface
PE1(config-if)# exit	Exit the Interface mode
PE1(config)# router rip	Enter the router-rip mode
PE1(config-router)# network 0.0.0.0/0	Associate networks with the RIP process

4.6.2 Configuring the VPWS on PE2

PE2#configure terminal	Enter the Configure mode
PE2(config)# l2protocol enable	Enable l2protocol globally
PE2(config)# interface eth-0-2	Enter the Interface mode • eth-0-2—Specify the interface
PE2(config-if)# no shutdown	Make interface UP
PE2(config-if)# mpls-l2-circuit t1 ethernet	Bind an interface to the VPWS
PE2(config-if)# l2protocol stp tunnel	Tunnel the stp BPDU packets into the Virtual Circuit
PE2(config-if)# exit	Exit the Interface mode
PE2(config)# interface loopback 0	Enter the Interface mode • loopback0—Specify the loopback interface name.
PE2(config-if)# ip address 192.168.11.10/32	Create loopback addresses on both PE routers. Use a /32 host route for the loopback address.
PE2(config)# exit	Exit the Configure mode
PE2(config)# router ldp	Enter the router-ldp mode
PE2(config-router)# router-id 192.168.11.10	Configure Router Identity

PE2(config-router)# targeted-peer 192.168.10.10	Configure Targeted Peer in LDP
PE2(config-router)# exit	Exit the router-ldp mode
PE2(config)# mpls l2-circuit t1 200 192.168.10.10	Create a Virtual Circuit. Both PE routers must be configured with the same VC-ID (200)
PE2(config)# interface eth-0-9	Enter the Interface mode • eth-0-9—Specify the interface
PE2(config-if)# no shutdown	Make interface UP
PE2(config-if)# no switchport	Configure the port to layer 3 port
PE2(config-if)# ip address 8.8.8.2/24	Create IP address on the port
PE2(config-if)# enable-ldp	Configure Interface for LDP
PE2(config-if)# label-switching	Enable label-switching on interface
PE2(config-if)# exit	Exit the Interface mode
PE2(config)# router rip	Enter the router-rip mode
PE2(config-router)# network 0.0.0.0/0	Associate networks with the RIP process