L2VPN Pseudowire Switching

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This feature module explains how to configure L2VPN Pseudowire Switching, which extends layer 2 virtual private network (L2VPN) pseudowires across an interautonomous system (inter-AS) boundary or across two separate multiprotocol label switching (MPLS) networks.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the Feature Information Table at the end of this document.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Restrictions for L2VPN Pseudowire Switching

- In Cisco IOS XE Release 2.4, Pseudowire Switching is supported on Ethernet over MPLS attachment circuits.
- L2VPN Pseudowire Switching is supported with AToM.
- Only static, on-box provisioning is supported.
- Sequencing numbers in AToM packets are not processed by L2VPN Pseudowire Switching. The feature blindly passes the sequencing data through the xconnect packet paths, a process that is called transparent sequencing. The endpoint PE-CE connections enforce the sequencing.

- You can ping the adjacent next-hop PE router. End-to-end LSP pings are not supported.
- Do not configure IP or Ethernet interworking on a router where L2VPN Pseudowire Switching is enabled. Instead, configure interworking on the routers at the edge PEs of the network.
- The control word negotiation results must match. If either segment does not negotiate the control word, the control word is disabled for both segments.
- AToM Graceful Restart is negotiated independently on each pseudowire segment. If there is a transient loss of the LDP session between two AToM PE routers, packets continue to flow.
- Per-pseudowire quality of service (QoS) is not supported. Traffic Engineering (TE) tunnel selection is supported.
- Attachment circuit interworking is not supported.

Information About L2VPN Pseudowire Switching

How L2VPN Pseudowire Switching Works

L2VPN Pseudowire Switching allows the user to extend L2VPN pseudowires across an inter-AS boundary or across two separate MPLS networks, as shown in the figures below. L2VPN Pseudowire Switching connects two or more contiguous pseudowire segments to form an end-to-end multihop pseudowire. This end-to-end pseudowire functions as a single point-to-point pseudowire.

As shown in the second figure below, L2VPN Pseudowire Switching enables you to keep the IP addresses of the edge PE routers private across inter-AS boundaries. You can use the IP address of the autonomous system boundary routers (ASBRs) and treat them as pseudowire aggregation (PE-agg) routers. The ASBRs join the pseudowires of the two domains.

L2VPN Pseudowire Switching also enables you to keep different administrative or provisioning domains to manage the end-to-end service. At the boundaries of these networks, PE-agg routers delineate the management responsibilities.

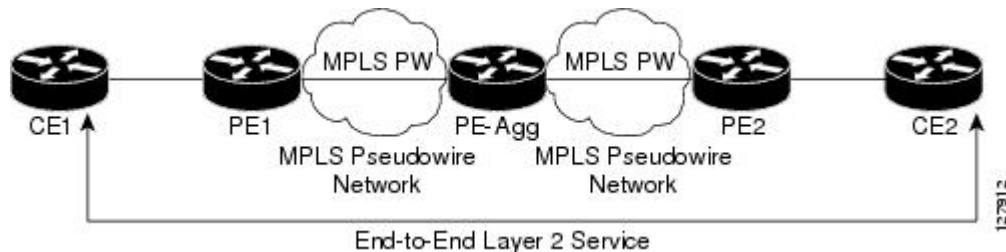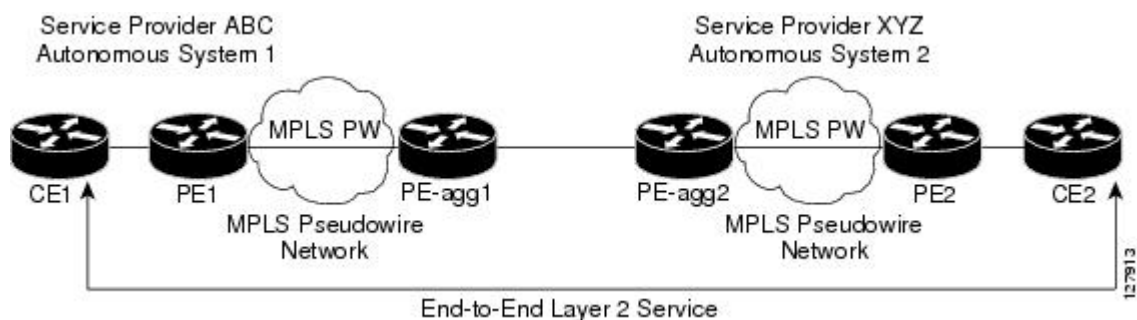**Figure 1**   *L2VPN Pseudowire Switching in an Intra-AS Topology*

Figure 2   *L2VPN Pseudowire Switching in an Inter-AS Topology*

How Packets Are Manipulated at the Aggregation Point

Switching AToM packets between two AToM pseudowires is the same as switching any MPLS packet. The MPLS switching data path switches AToM packets between two AToM pseudowires. The following list explains exceptions:

- The outgoing virtual circuit (VC) label replaces the incoming VC label in the packet. New Internal Gateway Protocol (IGP) labels and Layer 2 encapsulation are added.
- The incoming VC label time-to-live (TTL) field is decremented by one and copied to the outgoing VC label TTL field.
- The incoming VC label EXP value is copied to the outgoing VC label EXP field.
- The outgoing VC label 'Bottom of Stack' S bit in the outgoing VC label is set to1.
- AToM control word processing is not performed at the L2VPN Pseudowire Switching aggregation point. Sequence numbers are not validated. Use the Router Alert label for LSP Ping; do not require control word inspection to determine an LSP Ping packet.

How to Configure L2VPN Pseudowire Switching

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Configuring

Use the following procedure to configure L2VPN Pseudowire Switching on each of the PE-agg routers.

- This procedure assumes that you have configured basic AToM L2VPNs. This procedure does not explain how to configure basic AToM L2VPNs that transport Layer 2 packets over an MPLS backbone. For information on the basic configuration, see Any Transport over MPLS.
- For inter-Autonomous configurations, ASBRs require a labeled interface.

Note   In this configuration, you are limited to two **neighbor**commands after entering the **l2 vfi**command.

>

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **l2 vfi** *name* **point-to-point**
4. **neighbor** *ip-address vcid* **encapsulation mpls** | **pw-class** *pw-class-name*
5. **exit**
6. **exit**
7. **show mpls l2transport vc** [**vcid** [*vc-id* | [*vc-id-min vc-id-max*]] [**interface** *name*[*local-circuit-id*]] [**destination** *ip-address* | *name*] [**detail**]
8. **show vfi** [*vfi-name*]
9. **ping** [*protocol*] [**tag**] {*host-name*| *system-address*}

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** Router> enable	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** Router# configure terminal	Enters global configuration mode.
Step 3	**l2 vfi** *name* **point-to-point** **Example:** Router(config)# l2 vfi atomtunnel point-to-point	Creates a point-to-point Layer 2 virtual forwarding interface (VFI) and enters VFI configuration mode.
Step 4	**neighbor** *ip-address vcid* **encapsulation mpls** | **pw-class** *pw-class-name* **Example:** Router(config-vfi)# neighbor 10.0.0.1 100 pw-class mpls	Sets up an emulated VC. Specify the IP address and the VC ID of the remote router. Also specify the pseudowire class to use for the emulated VC. **Note** Only two **neighbor** commands are allowed for each **l2 vfi point-to-point** command.
Step 5	**exit** **Example:** Router(config-vfi)# exit	Exits VFI configuration mode.
Step 6	**exit** **Example:** Router(config)# exit	Exits global configuration mode.

	Command or Action	Purpose
Step 7	**show mpls l2transport vc** [**vcid** [*vc-id*	[*vc-id-min vc-id-max*]] [**interface** *name*[*local-circuit-id*]] [**destination** *ip-address*	*name*] [**detail**] **Example:** `Router# show mpls l2transport vc`	Verifies that the L2VPN Pseudowire Switching session has been established.
Step 8	**show vfi** [*vfi-name*] **Example:** `Router#` **show vfi atomtunnel**	Verifies that a point-to-point VFI has been established.
Step 9	**ping** [*protocol*] [**tag**] {*host-name*| *system-address*} **Example:** `Router# ping 10.1.1.1`	When issued from the CE routers, this command verifies end-to-end connectivity.

Examples

The following example displays the output of the **show mpls l2transport vc** command:

```
Router# show mpls l2transport vc
Local intf     Local circuit             Dest address     VC ID Status
-------------  ------------------------- ---------------- ----- ----
MPLS PW        10.0.1.1:100              10.0.1.1         100   UP
MPLS PW        10.0.1.1:100              10.0.1.1         100   UP
```

The following example displays the output of the **show vfi** command:

```
Router# show vfi
VFI name: test, type: point-to-point
 Neighbors connected via pseudowires:
   Router ID       Pseudowire ID
   10.0.1.1        100
   10.0.1.1        100
```

Configuration Examples for L2VPN Pseudowire Switching

L2VPN Pseudowire Switching in an Inter-AS Configuration Example

Two separate autonomous systems are able to pass L2VPN packets, because the two PE-agg routers have been configured with L2VPN Pseudowire Switching. This example configuration is shown in the figure below.

Figure 3   *L2VPN Pseudowire Switching in an InterAutonomous System*
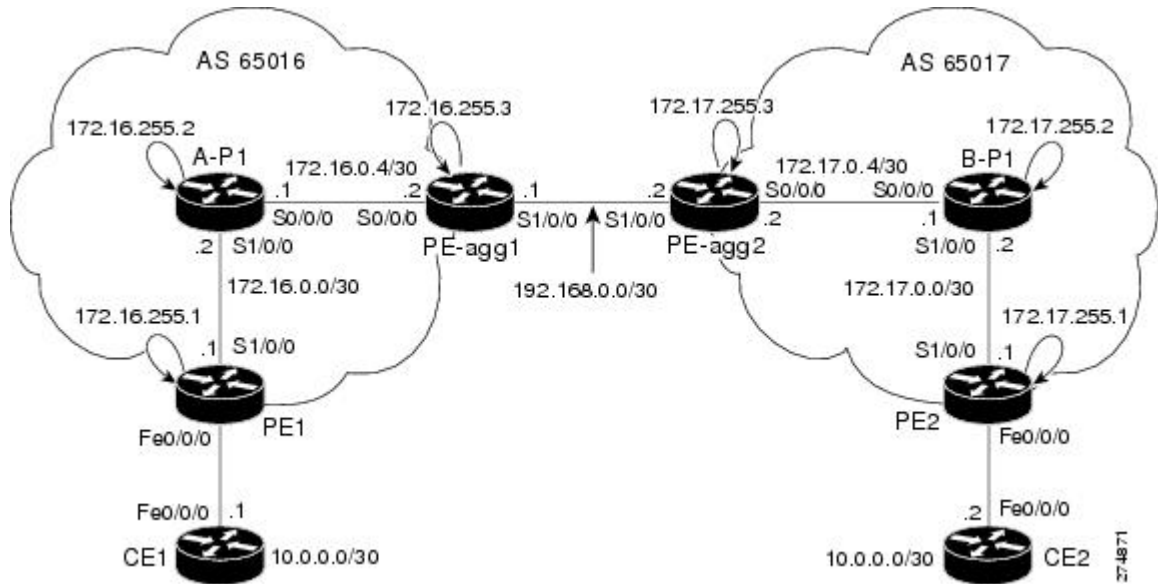
CE1	CE2
version 12.0	version 12.0
service timestamps debug uptime	service timestamps debug uptime
service timestamps log uptime	service timestamps log uptime
service password-encryption	service password-encryption
!	!
hostname [ce1]	hostname [ce2]
!	!
boot-start-marker	boot-start-marker
boot-end-marker	boot-end-marker
!	!
enable secret 5 1o9N6$LSrxHufTn0vjCY0nW8hQX.	enable secret 5 1YHo6$LQ4z5PdrF5B9dnL75Xvvm1
!	!
ip subnet-zero	ip subnet-zero
ip cef	ip cef
no ip domain-lookup	no ip domain-lookup
!	!
interface FastEthernet0/0/0	interface FastEthernet0/0/0
ip address 10.0.0.1 255.255.255.252	ip address 10.0.0.2 255.255.255.252
no ip directed-broadcast	no ip directed-broadcast
!	!
ip classless	ip classless
!	!
control-plane	control-plane
!	!
line con 0	line con 0
exec-timeout 0 0	exec-timeout 0 0
line aux 0	line aux 0
line vty 0 4	line vty 0 4
login	login
!	!
no cns aaa enable	no cns aaa enable

Additional References

The following sections provide references related to L2VPN Pseudowire Switching.

Related Documents

Related Topic	Document Title
Description of commands associated with MPLS and MPLS applications	*Cisco IOS Multiprotocol Label Switching Command Reference*
Any Transport over MPLS	Any Transport over MPLS
Pseudowire redundancy	L2VPN Pseudowire Redundancy
High availability for AToM	AToM Graceful Restart
L2VPN interworking	L2VPN Interworking
Layer 2 local switching	*Layer 2 Local Switching*
PWE3 MIB	Pseudowire Emulation Edge-to-Edge MIBs for Ethernet and Frame Relay Services
Packet sequencing	*Any Transport over MPLS (AToM) Sequencing Support*

Standards

Standard	Title
draft-ietf-pwe3-control-protocol-14.txt	*Pseudowire Setup and Maintenance using LDP*
draft-martini-pwe3-pw-switching-01.txt	*Pseudo Wire Switching*

MIBs

MIB	MIBs Link
• CISCO-IETF-PW-MIB • CISCO-IETF-PW-MPLS-MIB • CISCO-IETF-PW-ENET-MIB • CISCO-IETF-PW-FR-MIB	To locate and download MIBs for selected platforms, Cisco IOS XE software releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFCs	Title
No new or modified RFCs are supported by this feature, and support for existing RFCs has not been modified by this feature.	--

Technical Assistance

Description	Link
The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies.	http://www.cisco.com/techsupport
To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds.	
Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.	

Feature Information for L2VPN Pseudowire Switching

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 1 *Feature Information for L2VPN Pseudowire Switching*

Feature Name	Releases	Feature Information
L2VPN Pseudowire Switching	Cisco IOS XE Release 2.4	The L2VPN Pseudowire Switching feature extends layer 2 virtual private network (L2VPN) pseudowires across an interautonomous system (inter-AS) boundary or across two separate multiprotocol label switching (MPLS) networks. In Cisco IOS XE Release 2.4, The L2VPN Pseudowire Switching feature is supported with Ethernet over MPLS. The following commands were introduced or modified: **l2 vfi point-to-point**, **neighbor**(L2VPN Pseudowire Switching), **show vfi**.