



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. The feature supports ATM and time-division multiplexing (TDM) attachment circuits (ACs) and Ethernet ACs.

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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.

Prerequisites for L2VPN Pseudowire Switching

For the Cisco 12000 series routers, the L2VPN Pseudowire Switching feature for Any Transport over MPLS (AToM) is supported on the following engines:

- E2
- E3
- E4+



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- E5
- E6

For engines that do not support this feature, the packets are sent to the software and forwarded through the slow path.



Note

Engines E1 and E4 do not support L2VPN Pseudowire Switching, even in the slow path.

Restrictions for L2VPN Pseudowire Switching

- 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 provider-edge (PE) to customer-edge (CE) connections enforce the sequencing.
- You can ping the adjacent next-hop PE router. End-to-end label switched path (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 label distribution protocol (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, page 2](#)
- [How Packets Are Manipulated at the L2VPN Pseudowire Switching Aggregation Point, page 3](#)

How L2VPN Pseudowire Switching Works

L2VPN Pseudowire Switching allows the user to extend L2VPN pseudowires across two separate MPLS networks or across an inter-AS boundary, as shown in the two 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-aggr) 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*

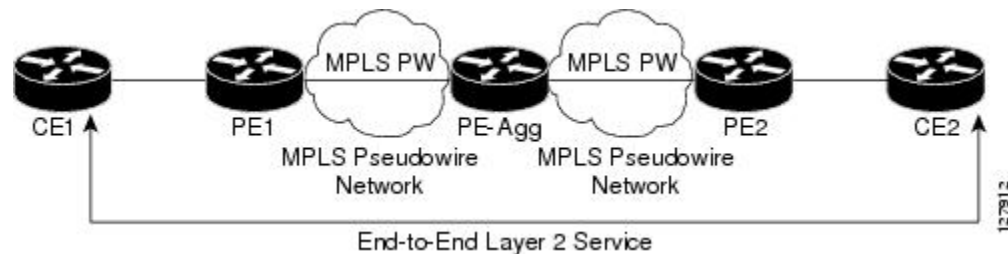
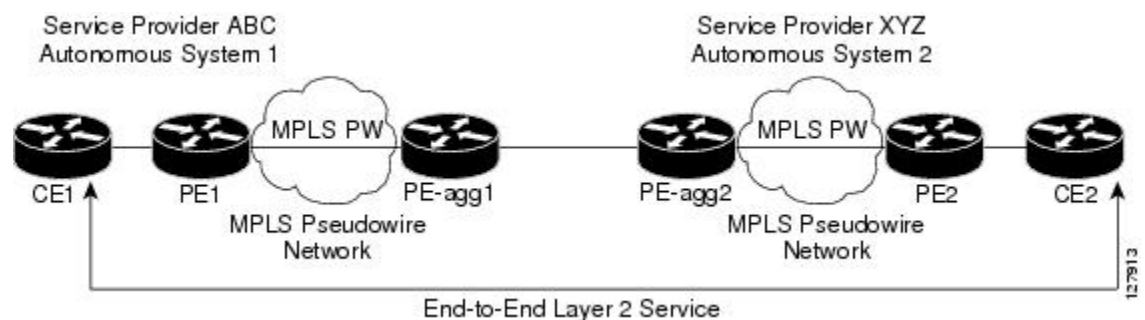


Figure 2 *L2VPN Pseudowire Switching in an Inter-AS Topology*



How Packets Are Manipulated at the L2VPN Pseudowire Switching 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 to 1.
- 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

Use the following procedure to configure L2VPN Pseudowire Switching on each of the PE-agg routers. In this configuration, you are limited to two **neighbor** commands after entering the **l2 vfi** command.

- 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 interautonomous configurations, ASBRs require a labeled interface.

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	Configures 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.

	Command or Action	Purpose
Step 5	exit Example: Router(config-vfi)# exit	Exits VFI configuration mode.
Step 6	exit Example: Router(config)# exit	Exits global configuration mode.
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, verifies end-to-end connectivity.

- [Examples, page 5](#)

Examples

The following example displays output from 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 output from 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

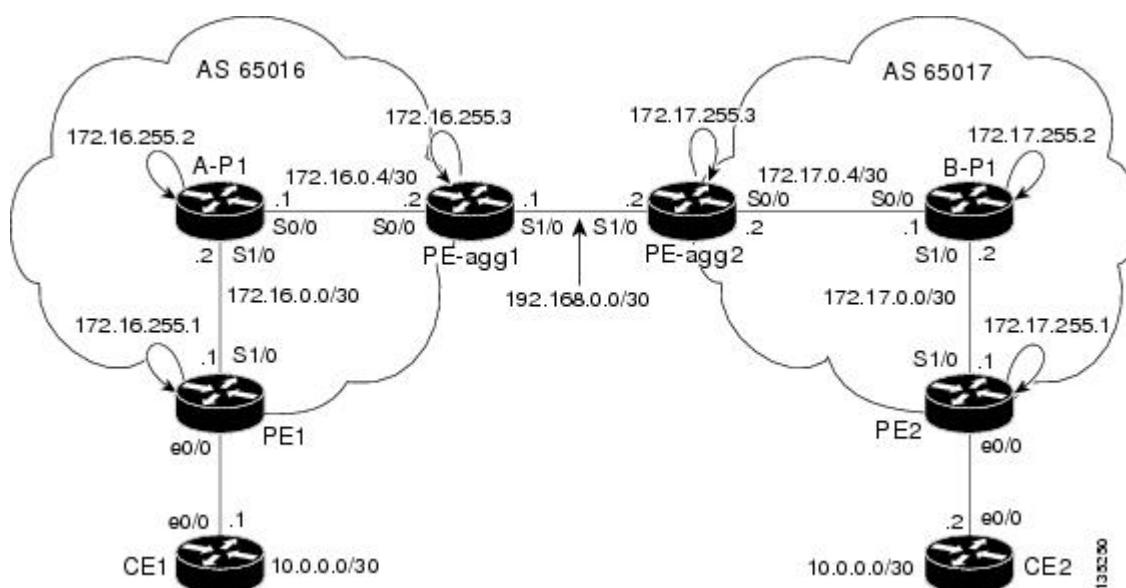
Configuration Examples for L2VPN Pseudowire Switching

- [L2VPN Pseudowire Switching in an Inter-AS Configuration Example, page 6](#)

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



PE-agg-1	PE-agg-2
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 [pe-agg1]	hostname [pe-agg2]
!	!
boot-start-marker	boot-start-marker
boot-end-marker	boot-end-marker
!	!
enable secret 5 \$1\$Q0Bb \$32sIU82pHRgyddWaeB4zs/	enable secret 5 \$1\$32jd \$zQRfxXzjstr4llV9DcWf7/
!	!
ip subnet-zero	ip subnet-zero
ip cef	ip cef
no ip domain-lookup	no ip domain-lookup
mpls label protocol ldp	mpls label protocol ldp
pseudowire-class SW-PW	pseudowire-class SW-PW
encapsulation mpls	encapsulation mpls
!	!
l2 vfi PW-SWITCH-1 point-to-point	l2 vfi PW-SWITCH-1 point-to-point
neighbor 172.17.255.3 100 pw-class SW-PW	neighbor 172.16.255.3 100 pw-class SW-PW
neighbor 172.16.255.1 16 pw-class SW-PW	neighbor 172.17.255.1 17 pw-class SW-PW
!	!
interface Loopback0	interface Loopback0
ip address 172.16.255.3 255.255.255.255	ip address 172.17.255.3 255.255.255.255
no ip directed-broadcast	no ip directed-broadcast
!	!
interface Serial0/0	interface Serial0/0
ip address 172.16.0.6 255.255.255.252	ip address 172.17.0.6 255.255.255.252
no ip directed-broadcast	no ip directed-broadcast
mpls ip	mpls ip

A-P1	B-P1
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 [a-p1]	hostname [b-p1]
!	!
boot-start-marker	boot-start-marker
boot-end-marker	boot-end-marker
!	!
enable secret 5 \$1\$eiUn \$rTMnZiYnJxtMTp00NKpQQ/	enable secret 5 \$1\$svU/\$2JmJZ/ 5gx1w4nVXVniIJe1
!	!
ip subnet-zero	ip subnet-zero
ip cef	ip cef
no ip domain-lookup	no ip domain-lookup
mpls label protocol ldp	mpls label protocol ldp
!	!
interface Loopback0	interface Loopback0
ip address 172.16.255.2 255.255.255.255	ip address 172.17.255.2 255.255.255.255
no ip directed-broadcast	no ip directed-broadcast
!	!
interface Serial0/0	interface Serial0/0
ip address 172.16.0.5 255.255.255.252	ip address 172.17.0.5 255.255.255.252
no ip directed-broadcast	no ip directed-broadcast
mpls ip	mpls ip
!	!
interface Serial1/0	interface Serial1/0
ip address 172.16.0.2 255.255.255.252	ip address 172.17.0.2 255.255.255.252
no ip directed-broadcast	no ip directed-broadcast
mpls ip	mpls ip
!	!

PE1	PE2
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 [pe1]	hostname [pe2]
!	!
boot-start-marker	boot-start-marker
boot-end-marker	boot-end-marker
!	!
enable secret 5 \$1\$9z8F\$2A1/ YLc6NB6d.WLQXF0Bz1	enable secret 5 \$1\$rT.V\$8Z6Dy/r8/ eaRdx2TR/05r/
!	!
ip subnet-zero	ip subnet-zero
ip cef	ip cef
no ip domain-lookup	no ip domain-lookup
mpls label protocol ldp	mpls label protocol ldp
pseudowire-class ETH-PW	pseudowire-class ETH-PW
encapsulation mpls	encapsulation mpls
!	!
interface Loopback0	interface Loopback0
ip address 172.16.255.1 255.255.255.255	ip address 172.17.255.1 255.255.255.255
no ip directed-broadcast	no ip directed-broadcast
!	!
interface Ethernet0/0	interface Ethernet0/0
no ip address	no ip address
no ip directed-broadcast	no ip directed-broadcast
no cdp enable	no cdp enable
xconnect 172.16.255.3 16 pw-class ETH-PW	xconnect 172.17.255.3 17 pw-class ETH-PW
!	!
interface Serial1/0	interface Serial1/0
ip address 172.16.0.1 255.255.255.252	ip address 172.17.0.1 255.255.255.252

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 \$1\$o9N6\$LSrxHufTn0vjCY0nw8hQX.	enable secret 5 \$1\$YHo6\$LQ4z5PdrF5B9dnL75Xvvm1
!	!
ip subnet-zero	ip subnet-zero
ip cef	ip cef
no ip domain-lookup	no ip domain-lookup
!	!
interface Ethernet0/0	interface Ethernet0/0
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

Related Documents

Related Topic	Document Title
Any Transport over MPLS	Any Transport over MPLS
Pseudowire redundancy	http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120limit/120s/120s31/fsstitch.htm <i>L2VPN Pseudowire Redundancy</i>
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	<i>Pseudowire Setup and Maintenance using LDP</i>
draft-martini-pwe3-pw-switching-01.txt	<i>Pseudo Wire Switching</i>

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 releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFCs	Title
None	—

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/cisco/web/support/index.html
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	12.0(31)S, 12.2(28)SB, 12.2(33)SRB, 12.2(33)SRD2, 12.2(33)SRE	This feature configures L2VPN Pseudowire Switching, which extends L2VPN pseudowires across an interautonomous system (inter-AS) boundary or across two separate MPLS networks. In Cisco IOS Release 12.2(28)SB, support was added for the Cisco 7200 and 7301 series routers. In 12.2(33)SRD2, support was added for ATM and TDM ACs. The following commands were introduced or modified: l2 vfi point-to-point, neighbor(L2VPN Pseudowire Switching), show vfi.

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