

L2VPN Pseudowire Preferential Forwarding

The L2VPN: Pseudowire Preferential Forwarding feature allows you to configure the pseudowires so that you can use **ping** and **show** commands to find status information for the pseudowires before, during, and after a switchover.

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Prerequisites for L2VPN—Pseudowire Preferential Forwarding

- Before configuring the L2VPN: Pseudowire Preferential Forwarding feature, you should understand the concepts in the following documents:
  - Preferential Forwarding Status Bit Definition (draft-ietf-pwe3-redundancy-bit-xx.txt)
  - *MPLS Pseudowire Status Signaling*
  - *L2VPN Pseudowire Redundancy*
  - *NSF/SSO--Any Transport over MPLS and AToM Graceful Restart*
  - *MPLS LSP Ping/Traceroute for LDP/TE, and LSP Ping for VCCV*
- The PE routers must be configured with the following features:
  - *L2VPN Pseudowire Redundancy*
  - *NSF/SSO--Any Transport over MPLS and AToM Graceful Restart*
- The L2VPN: Pseudowire Preferential Forwarding feature requires that the following mechanisms be in place to enable you to detect a failure in the network:
  - *Label switched paths (LSPs) Ping/Traceroute and Any Transport over MPLS Virtual Circuit Connection Verification (AToM VCCV)*
  - *Local Management Interface (LMI)*
  - *Operation, Administration, and Maintenance (OAM)*

Guidelines and Limitations for L2VPN--Pseudowire Preferential Forwarding

- Only ATM attachment circuits are supported.
- The following features are not supported:
  - Port mode cell relay
  - Any Transport over MPLS: AAL5 over MPLS
  - VC cell packing
  - OAM emulation
  - ILMI/PVC-D
  - Permanent virtual circuit (PVC) Range
  - L2TPv3 Pseudowire Redundancy
  - Local switching
  - Multiple backup pseudowires
  - Static pseudowires

Information About L2VPN--Pseudowire Preferential Forwarding

Overview of L2VPN--Pseudowire Preferential Forwarding

The L2VPN: Pseudowire Preferential Forwarding feature allows you to configure pseudowires so that you can use **ping** , **traceroute** , and **show** commands to find status information before, during, and after a switchover. The implementation of this feature is based on *Preferential Forwarding Status Bit Definition* (draft-ietf-pwe3-redundancy-bit-xx.txt). The L2VPN: Pseudowire Preferential Forwarding feature provides the following enhancements for displaying information about the pseudowires:

- You can issue **ping mpls** commands on the backup pseudowires.
- You can display status of the pseudowires before, during, and after a switchover using the **show xconnect** and **show mpls l2transport vc** commands.



Note In a single-segment pseudowire, the PE routers at each end of the pseudowire serve as the termination points. In multisegment pseudowires, the terminating PE routers serve as the termination points.

Overview of L2VPN—Pseudowire Preferential Forwarding using the commands associated with the L2VPN Protocol-Based CLIs feature

The L2VPN: Pseudowire Preferential Forwarding feature allows you to configure pseudowires so that you can use **ping**, **traceroute**, and **show** commands to find status information before, during, and after a switchover. The implementation of this feature is based on *Preferential Forwarding Status Bit Definition*

(draft-ietf-pwe3-redundancy-bit-xx.txt). The L2VPN: Pseudowire Preferential Forwarding feature provides the following enhancements for displaying information about the pseudowires:

- You can issue **ping mpls** commands on the backup pseudowires.
- You can display status of the pseudowires before, during, and after a switchover using the **show l2vpn service** and **show l2vpn atom vc** commands.

Note In a single-segment pseudowire, the PE routers at each end of the pseudowire serve as the termination points. In multisegment pseudowires, the terminating PE routers serve as the termination points.

How to Configure L2VPN--Pseudowire Preferential Forwarding

Configuring the Pseudowire Connection Between PE Routers

You set up a connection called a pseudowire between the routers to transmit Layer 2 frames between PE routers.

As part of the pseudowire configuration, issue the **status redundancy master** command to make it the master. This enables the L2VPN: Pseudowire Preferential Forwarding feature to display the status of the active and backup pseudowires. By default, the PE router is in slave mode.

Note One pseudowire must be the master, and the other must be the slave. You cannot configure both pseudowires as master or slave.

Note You must specify the **encapsulation mpls** command as part of the pseudowire class in order for the AToM VCs to work properly. If you omit the **encapsulation mpls** command, you receive the following error: % Incomplete command.

Before you begin

The PE routers must be configured for the L2VPN Pseudowire Redundancy and NSF/SSO--Any Transport over MPLS and AToM Graceful Restart features. See the following documents for configuration instructions.

- *L2VPN Pseudowire Redundancy*
- *NSF/SSO--Any Transport over MPLS and AToM Graceful Restart*

SUMMARY STEPS

1. **configure terminal**
2. **pseudowire-class name**
3. **encapsulation mpls**

4. **status redundancy** {**master**| **slave**}
5. **interworking** {**ethernet** | **ip**}

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `switch# configure terminal`	Enters global configuration mode.
Step 2	**pseudowire-class name** **Example:** `switch(config)# pseudowire-class atom`	Establishes a pseudowire class with a name that you specify, and enters pseudowire class configuration mode.
Step 3	**encapsulation mpls** **Example:** `switch(config-pw)# encapsulation mpls`	Specifies the tunneling encapsulation. • For AToM, the encapsulation type is mpls.
Step 4	**status redundancy** {**master**| **slave**} **Example:** `switch(config-pw)# status redundancy master`	Configures the pseudowire as the master or slave. This enables the L2VPN: Pseudowire Preferential Forwarding feature to display the status of the active and backup pseudowires. • By default, the PE router is in slave mode. **Note** One pseudowire must be the master, and the other must be the slave. You cannot configure both pseudowires as master or slave.
Step 5	**interworking** {**ethernet**	**ip**} **Example:** `switch(config-pw)# interworking ip`	(Optional) Enables the translation between the different Layer 2 encapsulations.

Configuring the Pseudowire Connection Between PE Routers

You set up a connection called a pseudowire between the routers to transmit Layer 2 frames between PE routers.

As part of the pseudowire configuration, issue the **status redundancy master** command to make it the master. This enables the L2VPN: Pseudowire Preferential Forwarding feature to display the status of the active and backup pseudowires. By default, the PE router is in slave mode.

Note One pseudowire must be the master, and the other must be the slave. You cannot configure both pseudowires as master or slave.

Note You must specify the **encapsulation mpls** command as part of the pseudowire class in order for the AToM VCs to work properly. If you omit the **encapsulation mpls** command, you receive the following error: % Incomplete command.

Before you begin

The PE routers must be configured for the L2VPN Pseudowire Redundancy and NSF/SSO--Any Transport over MPLS and AToM Graceful Restart features. See the following documents for configuration instructions.

- *L2VPN Pseudowire Redundancy*
- *NSF/SSO--Any Transport over MPLS and AToM Graceful Restart*

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface pseudowire** *number*
4. **encapsulation mpls**
5. **neighbor** *peer-address vcid-value*
6. **status redundancy** {**master**| **slave**}
7. **interworking** {**ethernet** | **ip**}

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**interface pseudowire** *number* **Example:**	Establishes an interface pseudowire with a value that you specify, and enters pseudowire class configuration mode.

	Command or Action	Purpose
	`Device(config)# interface pseudowire 1`	
Step 4	**encapsulation mpls** **Example:** `Device(config-pw)# encapsulation mpls`	Specifies the tunneling encapsulation. • For AToM, the encapsulation type is mpls.
Step 5	**neighbor** *peer-address vcid-value* **Example:** `Router(config-pw)#  neighbor 10.0.0.1 123`	Specifies the peer IP address and virtual circuit (VC) ID value of a Layer 2 VPN (L2VPN) pseudowire.
Step 6	**status redundancy** {**master**| **slave**} **Example:** `Device(config-pw)# status redundancy master`	Configures the pseudowire as the master or slave. This enables the L2VPN: Pseudowire Preferential Forwarding feature to display the status of the active and backup pseudowires. • By default, the PE router is in slave mode. **Note** One pseudowire must be the master, and the other must be the slave. You cannot configure both pseudowires as master or slave.
Step 7	**interworking** {**ethernet** | **ip**} **Example:** `Device(config-pw)# interworking ip`	(Optional) Enables the translation between the different Layer 2 encapsulations.

Configuration Examples for L2VPN--Pseudowire Preferential Forwarding

Example: L2VPN--Pseudowire Preferential Forwarding Configuration

The following commands configure a PE router with the L2VPN: Pseudowire Preferential Forwarding feature:

```
mpls ldp graceful-restart
mpls ip
mpls label protocol ldp
mpls ldp router-id Loopback0 force
mpls ldp advertise-labels
!
pseudowire-class mpls
 encapsulation mpls
 status redundancy master
interface ATM0/2/0.1 multipoint
```

```
 logging event subif-link-status
 atm pvp 50 l2transport
  xconnect 10.1.1.2 100 pw-class mpls
   backup peer 10.1.1.3 100 encap mpls
end
```

Example: L2VPN--Pseudowire Preferential Forwarding Configuration using the commands associated with the L2VPN Protocol-Based CLIs feature

The following commands configure a PE router with the L2VPN: Pseudowire Preferential Forwarding feature:

```
mpls ldp graceful-restart
mpls ip
mpls label protocol ldp
mpls ldp router-id Loopback0 force
mpls ldp advertise-labels
!
interface pseudowire1
 encapsulation mpls
 status redundancy master
 neighbor 10.0.0.1 123
interface ATM0/2/0.1 multipoint
 logging event subif-link-status
 atm pvp 50 l2transport
  interface pseudowire 100
  encapsulation mpls
  neighbor 10.1.1.2 100
!
l2vpn xconnect context A
 member pseudowire 100
 member atm 100
end
```

Example: Displaying the Status of the Pseudowires

The following examples show the status of the active and backup pseudowires before, during, and after a switchover.

The **show mpls l2transport vc** command on the active PE router displays the status of the pseudowires:

```
Router# show mpls l2transport vc

Local intf     Local circuit              Dest address    VC ID      Status
-------------  -------------------------- --------------- ---------- ----------
AT0/2/0/0.1    ATM VPC CELL 50            10.1.1.2         100        UP
AT0/2/0/0.1    ATM VPC CELL 50            10.1.1.3         100        STANDBY
```

The **show mpls l2transport vc** command on the backup PE router displays the status of the pseudowires. The active pseudowire on the backup PE router has the HOTSTANDBY status.

```
Router1-standby# show mpls l2transport vc

Local intf     Local circuit              Dest address    VC ID      Status
-------------  -------------------------- --------------- ---------- ----------
AT0/2/0/0.1    ATM VPC CELL 50            10.1.1.2         100        HOTSTANDBY
AT0/2/0/0.1    ATM VPC CELL 50            10.1.1.3         100        DOWN
```

During a switchover, the status of the active and backup pseudowires changes:

```
Router# show mpls l2transport vc

Local intf     Local circuit              Dest address    VC ID      Status
-------------  -------------------------- --------------- ---------- ----------
AT0/2/0/0.1    ATM VPC CELL 50            10.1.1.2         100        RECOVERING
AT0/2/0/0.1    ATM VPC CELL 50            10.1.1.3         100        DOWN
```

After the switchover is complete, the recovering pseudowire shows a status of UP:

```
Router# show mpls l2transport vc

Local intf     Local circuit              Dest address    VC ID      Status
-------------  -------------------------- --------------- ---------- ----------
AT0/2/0/0.1    ATM VPC CELL 50            10.1.1.2         100        UP
AT0/2/0/0.1    ATM VPC CELL 50            10.1.1.3         100        STANDBY
```

The **show xconnect** command displays the standby (SB) state for the backup pseudowire, which is independent of the stateful switchover mode of the router:

```
Router# show xconnect all

Legend:    XC ST=Xconnect State  S1=Segment1 State  S2=Segment2 State
  UP=Up       DN=Down            AD=Admin Down      IA=Inactive
  SB=Standby  HS=Hot Standby     RV=Recovering      NH=No Hardware
XC ST        Segment 1                                  S1 Segment 2
            S2
------+---------------------------------+--+---------------------------------+---------
UP pri ac   AT1/1/0/0.1/1/1:220/220(ATM V  UP mpls 10.193.193.3:330            UP
IA sec ac   AT1/1/0/0.1/1/1:220/220(ATM V  UP mpls 10.193.193.3:331            SB
```

The **ping mpls** and **traceroute mpls** commands show that the dataplane is active on the backup pseudowire:

```
Router# ping mpls pseudowire 10.193.193.22 331

%Total number of MS-PW segments is less than segment number; Adjusting the segment number
to 1
Sending 5, 100-byte MPLS Echos to 10.193.193.22,
     timeout is 2 seconds, send interval is 0 msec:
Codes: '!' - success, 'Q' - request not sent, '.' - timeout,
  'L' - labeled output interface, 'B' - unlabeled output interface,
  'D' - DS Map mismatch, 'F' - no FEC mapping, 'f' - FEC mismatch,
  'M' - malformed request, 'm' - unsupported tlvs, 'N' - no label entry,
  'P' - no rx intf label prot, 'p' - premature termination of LSP,
  'R' - transit router, 'I' - unknown upstream index,
  'X' - unknown return code, 'x' - return code 0
Type escape sequence to abort.
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/4 ms

Router# traceroute mpls pseudowire 10.193.193.22 331 segment 1

Tracing MS-PW segments within range [1-1] peer address 10.193.193.22 and timeout 2 seconds
Codes: '!' - success, 'Q' - request not sent, '.' - timeout,
  'L' - labeled output interface, 'B' - unlabeled output interface,
  'D' - DS Map mismatch, 'F' - no FEC mapping, 'f' - FEC mismatch,
  'M' - malformed request, 'm' - unsupported tlvs, 'N' - no label entry,
  'P' - no rx intf label prot, 'p' - premature termination of LSP,
  'R' - transit router, 'I' - unknown upstream index,
  'X' - unknown return code, 'x' - return code 0
Type escape sequence to abort.
```

```
! 1 10.193.33.22 4 ms [Labels: 23 Exp: 0]
    local 10.193.193.3 remote 10.193.193.22 vc id 331
```

Additional References

Related Documents

Related Topic	Document Title
Description of commands associated with MPLS and MPLS applications	*Cisco IOS Multiprotocol Label Switching Command Reference*
L2VPN Pseudowires	• *L2VPN Pseudowire Redundancy* • *MPLS Pseudowire Status Signaling*
NSF/SSO for L2VPNs	*NSF/SSO--Any Transport over MPLS and AToM Graceful Restart*
Ping and Traceroute for L2VPNs	*MPLS LSP Ping/Traceroute for LDP/TE, and LSP Ping for VCCV*

Standards

Standard	Title
draft-ietf-pwe3-redundancy-bit-xx.txt	Preferential Forwarding Status Bit Definition

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. 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.	http://www.cisco.com/techsupport

Feature Information for L2VPN--Pseudowire Preferential Forwarding

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 Preferential Forwarding

Feature Name	Releases	Feature Information
L2VPN: Pseudowire Preferential Forwarding	Cisco IOS XE Release 2.3	This feature allows you to configure the pseudowires so that you can use **ping** and **show** commands to find status information of the pseudowires before, during, and after a switchover. The following commands were introduced or modified: **show mpls l2transport vc**, **show xconnect**, **status redundancy**.