

L2VPN Pseudowire Redundancy

The L2VPN Pseudowire Redundancy feature lets you configure your network to detect a failure in the network and reroute the Layer 2 (L2) service to another endpoint that can continue to provide service. This feature provides the ability to recover from a failure either of the remote provider edge (PE) router or of the link between the PE and customer edge (CE) routers.

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Prerequisites for L2VPN Pseudowire Redundancy

- This feature module requires that you understand how to configure basic L2 virtual private networks (VPNs).
  - Any Transport over MPLS
  - L2 VPN Interworking
  - Layer 2 Tunneling Protocol Version 3 (L2TPv3)
- The L2VPN Pseudowire Redundancy feature requires that the following mechanisms be in place to enable you to detect a failure in the network:
  - Label-switched paths (LSP) Ping/Traceroute and Any Transport over MPLS Virtual Circuit Connection Verification (AToM VCCV)
  - Local Management Interface (LMI)
  - Operation, Administration, and Maintenance (OAM)

Restrictions for L2VPN Pseudowire Redundancy

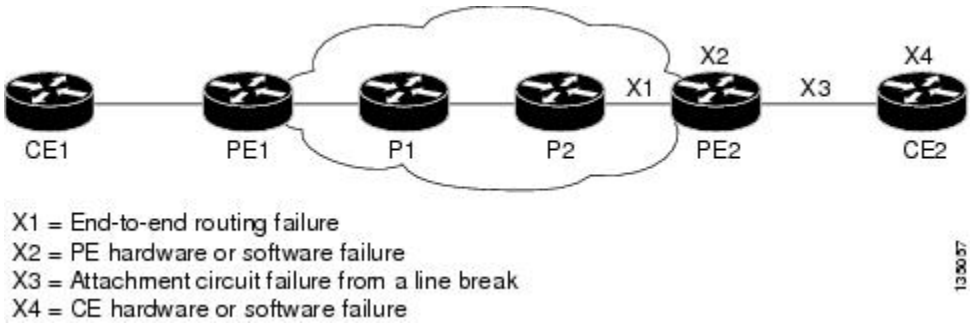
- The default Label Distribution Protocol (LDP) session hold-down timer will enable the software to detect failures in about 180 seconds. That time can be configured so that the software can detect failures more quickly. See the **mpls ldp holdtime** command for more information.
- L2VPN Pseudowire Redundancy does not support pseudowire interworking mode with L2TPv3. The connectivity between CEs may be impacted if you have interworking IP configured in the pseudowire class.
- The primary and backup pseudowires must run the same type of transport service. The primary and backup pseudowires must be configured with AToM or L2TPv3.
- The backup peer can only be configured for nonstatic L2TPv3 sessions. The backup L2TPv3 session cannot be static L2TPv3 session. The encapsulation type of primary and backup pseudowire must be the same.
- If you use L2VPN Pseudowire Redundancy with L2VPN Interworking, the interworking method must be the same for the primary and backup pseudowires.
- L2VPN Pseudowire Redundancy does support setting the experimental (EXP) bit on the Multiprotocol Label Switching (MPLS) pseudowire.
- L2VPN Pseudowire Redundancy does not support different pseudowire encapsulation types on the MPLS pseudowire.
- The **mpls l2transport route** command is not supported. Use the **xconnect** command instead.
- The ability to have the backup pseudowire fully operational at the same time that the primary pseudowire is operational is not supported. The backup pseudowire becomes active only after the primary pseudowire fails.
- The AToM VCCV feature is supported only on the active pseudowire.
- More than one backup pseudowire is not supported.

Information About L2VPN Pseudowire Redundancy

Introduction to L2VPN Pseudowire Redundancy

L2VPNs can provide pseudowire resiliency through their routing protocols. When connectivity between end-to-end PE routers fails, an alternative path to the directed LDP session and the user data can take over. However, there are some parts of the network where this rerouting mechanism does not protect against interruptions in service. The figure below shows those parts of the network that are vulnerable to an interruption in service.

Figure 1: Points of Potential Failure in an L2VPN Network

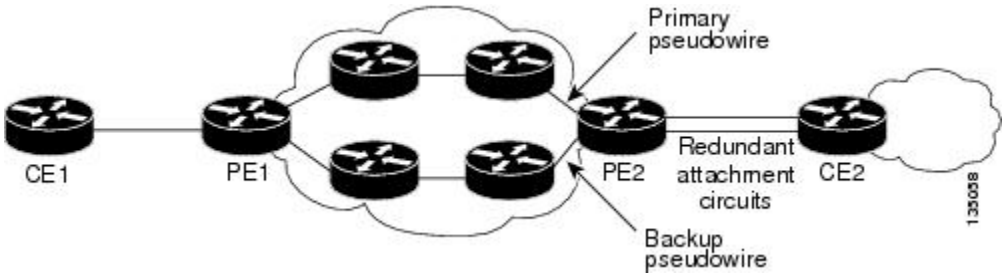


The L2VPN Pseudowire Redundancy feature provides the ability to ensure that the CE2 router in the figure above can always maintain network connectivity, even if one or all the failures in the figure occur.

The L2VPN Pseudowire Redundancy feature enables you to set up backup pseudowires. You can configure the network with redundant pseudowires and redundant network elements, which are shown in the three figures below.

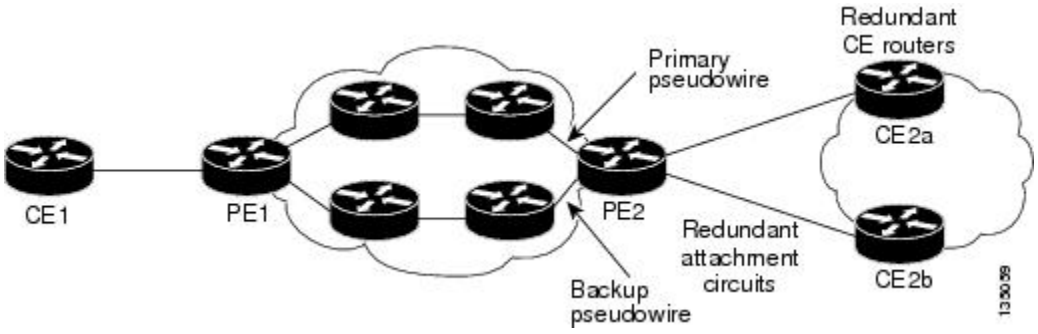
The figure below shows a network with redundant pseudowires and redundant attachment circuits.

Figure 2: L2VPN Network with Redundant PWs and Attachment Circuits



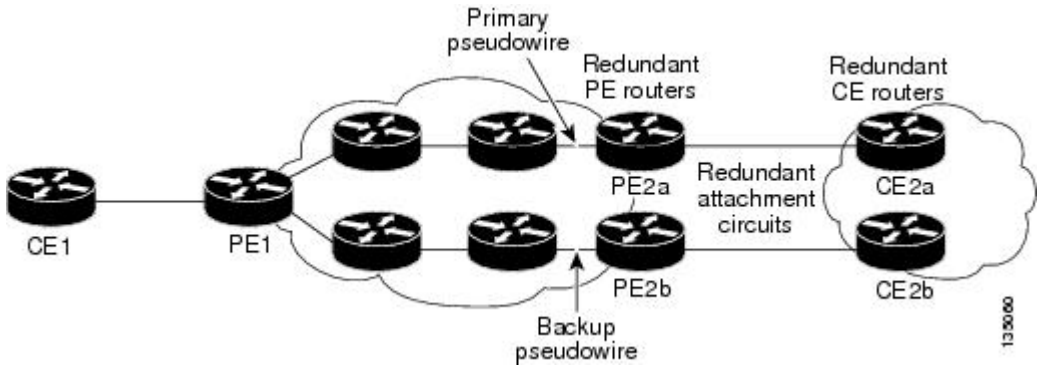
The figure below shows a network with redundant pseudowires, attachment circuits, and CE routers.

Figure 3: L2VPN Network with Redundant PWs, Attachment Circuits, and CE Routers



The figure below shows a network with redundant pseudowires, attachment circuits, CE routers, and PE routers.

Figure 4: L2VPN Network with Redundant PWs, Attachment Circuits, CE Routers, and PE Routers



How to Configure L2VPN Pseudowire Redundancy

The L2VPN Pseudowire Redundancy feature enables you to configure a backup pseudowire in case the primary pseudowire fails. When the primary pseudowire fails, the PE router can switch to the backup pseudowire. You can have the primary pseudowire resume operation after it comes back up.

Configuring the Pseudowire

The successful transmission of the Layer 2 frames between PE routers is due to the configuration of the PE routers. You set up the connection, called a pseudowire, between the routers.

The pseudowire-class configuration group specifies the characteristics of the tunneling mechanism, which are:

- Encapsulation type
- Control protocol
- Payload-specific options

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

```
% Incomplete command.
```

Perform this task to configure a pseudowire class.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **pseudowire-class** name
4. **encapsulation mpls**
5. **interworking** {**ethernet** | **ip**}

DETAILED STEPS

Procedure

	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	**pseudowire-class** name **Example:** `Router(config)# pseudowire-class atom`	Establishes a pseudowire class with a name that you specify. Enters pseudowire class configuration mode.
Step 4	**encapsulation mpls** **Example:** `Router(config-pw-class)# encapsulation mpls`	Specifies the tunneling encapsulation. For AToM, the encapsulation type is **mpls**.
Step 5	**interworking** {**ethernet** | **ip**} **Example:** `Router(config-pw-class)# interworking ip`	(Optional) Enables the translation between the different Layer 2 encapsulations.

Configuring the Pseudowire using the commands associated with the L2VPN Protocol-Based CLIs feature

The successful transmission of the Layer 2 frames between PE routers is due to the configuration of the PE routers. You set up the connection, called a pseudowire, between the routers.

The pseudowire-class configuration group specifies the characteristics of the tunneling mechanism, which are:

- Encapsulation type
- Control protocol
- Payload-specific options

You must specify the **encapsulation mpls**command as part of the pseudowire class for the AToM VCs to work properly. If you omit the **encapsulation mpls**command as part of the **l2vpn xconnectcontext** command, you receive the following error:

```
% Incomplete command.
```

Perform this task to configure a pseudowire class.

SUMMARY STEPS

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

DETAILED STEPS

Procedure

	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	**interface pseudowire** *number* **Example:** `Router(config)# interface pseudowire 1`	Establishes an interface pseudowire with a value that you specify. Enters pseudowire configuration mode.
Step 4	**encapsulation mpls** **Example:** `Router(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	**interworking** {**ethernet**	**ip**} **Example:** `Router(config-pw)# interworking ip`	(Optional) Enables the translation between the different Layer 2 encapsulations.

Configuring L2VPN Pseudowire Redundancy

Perform this task to configure the L2VPN Pseudowire Redundancy feature.

Before you begin

For each transport type, the **xconnect**command is configured slightly differently. The following configuration steps use Ethernet VLAN over MPLS, which is configured in subinterface configuration mode. See *Any Transport over MPLS* to determine how to configure the **xconnect** command for other transport types.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface gigabitethernet** *slot* **/** *subslot* **/** *interface* **.** *subinterface*
4. **encapsulation dot1q** *vlan-id*
5. **xconnect** *peer-router-id vcid* {**encapsulation mpls**| **pw-class** *pw-class-name}*
6. **backup peer** *peer-router-ip-addr vcid* [**pw-class** *pw-class-name*]
7. **backup delay** *e nable-delay* {*disable-delay* | **never**}

DETAILED STEPS

Procedure

	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	**interface gigabitethernet** *slot* **/** *subslot* **/** *interface* **.** *subinterface* **Example:** `Router(config)# interface gigabitethernet0/0/0.1`	Specifies the Gigabit Ethernet subinterface and enters subinterface configuration mode. **Note** Make sure that the subinterface on the adjoining CE router is on the same VLAN as this PE router.
Step 4	**encapsulation dot1q** *vlan-id* **Example:** `Router(config-subif)# encapsulation dot1q 100`	Enables the subinterface to accept 802.1Q VLAN packets. **Note** The subinterfaces between the CE and PE routers that are running Ethernet over MPLS must be in the same subnet.

	Command or Action	Purpose
Step 5	**xconnect** *peer-router-id vcid* {**encapsulation mpls**| **pw-class** *pw-class-name}* **Example:** `Router(config-subif)# xconnect 10.0.0.1 123 pw-class atom`	Binds the attachment circuit to a pseudowire VC and enters xconnect configuration mode. • The syntax for this command is the same as for all other Layer 2 transports.
Step 6	**backup peer** *peer-router-ip-addr vcid* [**pw-class** *pw-class-name*] **Example:** `Router(config-if-xconn)# backup peer 10.0.0.3 125 pw-class atom`	Specifies a redundant peer for the pseudowire VC. The pseudowire class name must match the name that you specified when you created the pseudowire class, but you can use a different pw-class in the **backup peer** command than the name that you used in the primary **xconnect** command.
Step 7	**backup delay** *e nable-delay* {*disable-delay* | **never**} **Example:** `Router(config-if-xconn)# backup delay 5 never`	Specifies how long (in seconds) the backup pseudowire VC should wait to take over after the primary pseudowire VC goes down. The range is from 0 to 180. Specifies how long the primary pseudowire should wait after it becomes active to take over for the backup pseudowire VC. The range is from 0 to 180 seconds. If you specify the **never** keyword, the primary pseudowire VC never takes over for the backup.

Configuring L2VPN Pseudowire Redundancy using the commands associated with the L2VPN Protocol-Based CLIs feature

Perform this task to configure the L2VPN Pseudowire Redundancy feature.

Before you begin

For each transport type, the **l2vpn xconnect context** command is configured slightly differently. The following configuration steps use Ethernet VLAN over MPLS, which is configured in subinterface configuration mode. See *Any Transport over MPLS* to determine how to configure the **l2vpn xconnect context** command for other transport types.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface gigabitethernet** *slot* / *subslot* / *interface* **.** *subinterface*
4. **encapsulation dot1q** *vlan-id*
5. **end**
6. **interface pseudowire** *number*
7. **source template type pseudowire** *template-name*
8. **neighbor** *peer-address vcid-value*
9. **exit**

10. **l2vpn xconnect context** *context-name*
11. **member pseudowire** *interface-number*
12. **member pseudowire** *interface-number*
13. **member gigabitethernet** *interface-number*
14. **redundancy delay** *enable-delay*{*disable-delay* | **never**}

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 gigabitethernet** *slot* / *subslot* / *interface* **.** *subinterface* **Example:** `Device(config)# interface gigabitethernet0/0/0.1`	Specifies the Gigabit Ethernet subinterface and enters subinterface configuration mode. Make sure that the subinterface on the adjoining CE router is on the same VLAN as this PE router.
Step 4	**encapsulation dot1q** *vlan-id* **Example:** `Device(config-subif)# encapsulation dot1q 100`	Enables the subinterface to accept 802.1Q VLAN packets. The subinterfaces between the CE and PE routers that are running Ethernet over MPLS must be in the same subnet. All other subinterfaces and backbone routers do not.
Step 5	**end** **Example:** `Router(config-subif)# end`	Exits to privileged EXEC mode.
Step 6	**interface pseudowire** *number* **Example:** `Router(config)# interface pseudowire 100`	Specifies the pseudowire interface and enters interface configuration mode.
Step 7	**source template type pseudowire** *template-name* **Example:** `Router(config-if)# source template type pseudowire atom`	Configures the source template of type pseudowire named atom

	Command or Action	Purpose
Step 8	**neighbor** *peer-address vcid-value* **Example:** `Router(config-if)# 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 9	**exit** **Example:** `Router(config-if)# exit`	Exits to privileged EXEC mode.
Step 10	**l2vpn xconnect context** *context-name* **Example:** `Router(config)# l2vpn xconnect context con1`	Creates a Layer 2 VPN (L2VPN) cross connect context and enters xconnect configuration mode.
Step 11	**member pseudowire** *interface-number* **Example:** `Device(config-xconnect)# member pseudowire 100 group GR_1 priority 2`	Specifies a member pseudowire to form a Layer 2 VPN (L2VPN) cross connect.
Step 12	**member pseudowire** *interface-number* **Example:** `Device(config-xconnect)# member pseudowire 1001 group GR_1 priority 2`	Specifies a second member pseudowire for redundancy.
Step 13	**member gigabitethernet** *interface-number* **Example:** `Device(config-xconnect)# member GigabitEthernet0/0/0.1 service instance 1`	Specifies the location of the Gigabit Ethernet member interface.
Step 14	**redundancy delay** *enable-delay*{*disable-delay* | **never**} **Example:** `Device(config-xconnect)# redundancy delay 0 0 group GR_1`	Specifies how long (in seconds) the backup pseudowire VC should wait to take over after the primary pseudowire VC goes down. The range is 0 to 180. Specifies how long the primary pseudowire should wait after it becomes active to take over for the backup pseudowire VC. The range is 0 to 180 seconds. If you specify the **never keyword**, the primary pseudowire VC never takes over for the backup.

Forcing a Manual Switchover to the Backup Pseudowire VC

To force the router switch over to the backup or primary pseudowire, you can enter the **xconnect backup force switchover** command in privileged EXEC mode. You can specify either the interface of the primary attachment circuit (AC) to switch to or the IP address and VC ID of the peer router.

A manual switchover can be made only if the interface or peer specified in the command is actually available and the xconnect moves to the fully active state when executing the command.

SUMMARY STEPS

1. **enable**
2. **xconnect backup force-switchover {** **interface** *interface-info* | **peer** *ip-address vcid}*

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**xconnect backup force-switchover {** **interface** *interface-info*	**peer** *ip-address vcid}* **Example:** `Router# xconnect backup force-switchover peer 10.10.10.1 123`	Specifies that the router should switch to the backup or to the primary pseudowire.

Verifying the L2VPN Pseudowire Redundancy Configuration

Perform this task to verify that the L2VPN Pseudowire Redundancy feature is correctly configured.

SUMMARY STEPS

1. **show mpls l2transport vc**
2. **show xconnect all**
3. **xconnect logging redundancy**

DETAILED STEPS

Procedure

Step 1 **show mpls l2transport vc**

The following is sample output from the **show mpls l2transport vc** command. In this example, the primary attachment circuit is up. The backup attachment circuit is available, but not currently selected.

Example:

```
Router# show mpls l2transport vc
```

```
Local intf     Local circuit           Dest address    VC ID      Status
-------------  ----------------------- --------------- ---------- ----------
Et0/0.1        Eth VLAN 101            10.0.0.2        101        UP
Et0/0.1        Eth VLAN 101            10.0.0.3        201        DOWN
Router# show mpls l2transport vc detail
Local interface: Et0/0.1 up, line protocol up, Eth VLAN 101 up
   Destination address 10.0.0.2 VC ID: 101, VC status UP
   .
   .
   .
Local interface: Et0/0.1 down, line protocol down, Eth VLAN 101 down
   Destination address 10.0.0.3 VC ID: 201, VC status down
   .
   .
   .
```

Step 2 **show xconnect all**

In this example, the topology is Attachment Circuit 1 to Pseudowire 1 with a Pseudowire 2 as a backup:

Example:

```
Router# show xconnect all
Legend: XC ST=Xconnect State, S1=Segment1 State, S2=Segment2 State
UP=Up, DN=Down, AD=Admin Down, IA=Inactive, NH=No Hardware
XC ST  Segment 1                         S1 Segment 2                         S2
------+---------------------------------+--+---------------------------------+--
UP pri ac   Et0/0(Ethernet)              UP mpls 10.55.55.2:1000              UP
IA sec ac   Et0/0(Ethernet)              UP mpls 10.55.55.3:1001              DN
```

In this example, the topology is Attachment Circuit 1 to Attachment Circuit 2 with a pseudowire backup for Attachment Circuit 2:

Example:

```
Router# show xconnect all
Legend: XC ST=Xconnect State, S1=Segment1 State, S2=Segment2 State
UP=Up, DN=Down, AD=Admin Down, IA=Inactive, NH=No Hardware
XC ST  Segment 1                         S1 Segment 2                         S2
------+---------------------------------+--+---------------------------------+--
UP pri ac   Se6/0:150(FR DLCI)           UP ac   Se8/0:150(FR DLCI)           UP
IA sec ac   Se6/0:150(FR DLCI)           UP mpls 10.55.55.3:7151              DN
```

Step 3 **xconnect logging redundancy**

In addition to the **show mpls l2transport vc** command and the **show xconnect** command, you can use the **xconnect logging redundancy** command to track the status of the xconnect redundancy group:

Example:

```
Router(config)# xconnect logging redundancy
```

When this command is configured, the following messages are displayed during switchover events:

Activating the primary member:

Example:

```
00:01:07: %XCONNECT-5-REDUNDANCY: Activating primary member 10.55.55.2:1000
```

Activating the backup member:

Example:

```
00:01:05: %XCONNECT-5-REDUNDANCY: Activating secondary member 10.55.55.3:1001
```

Verifying the L2VPN Pseudowire Redundancy Configuration using the commands associated with the L2VPN Protocol-Based CLIs feature

Use the following commands to verify that the L2VPN Pseudowire Redundancy feature is correctly configured.

SUMMARY STEPS

1. **show l2vpn atom vc**
2. **show l2vpn service all**
3. **logging redundancy**
4. **logging pseudowire status**

DETAILED STEPS

Procedure

Step 1 **show l2vpn atom vc**

In this example, the primary attachment circuit is up. The backup attachment circuit is available, but not currently selected. The **show** output displays as follows:

Example:

```
Device# show l2vpn atom vc
Local intf     Local circuit           Dest address    VC ID      Status
-------------  ----------------------- --------------- ---------- ----------
Et0/0.1        Eth VLAN 101            10.0.0.2        101        UP
Et0/0.1        Eth VLAN 101            10.0.0.3        201        DOWN
Router# show l2vpn atom vc detail
Local interface: Et0/0.1 up, line protocol up, Eth VLAN 101 up
   Destination address 10.0.0.2 VC ID: 101, VC status UP
   .
   .
   .
Local interface: Et0/0.1 down, line protocol down, Eth VLAN 101 down
   Destination address 10.0.0.3 VC ID: 201, VC status down
   .
   .
   .
```

Step 2 **show l2vpn service all**

In this example, the topology is attachment circuit 1 to pseudowire 1 with apPseudowire 2 as a backup:

Example:

```
Device# show l2vpn service all
Legend: St=State    XC St=State in the L2VPN Service      Prio=Priority
        UP=Up       DN=Down             AD=Admin Down     IA=Inactive
```

```
        SB=Standby  HS=Hot Standby     RV=Recovering      NH=No Hardware
        m=manually selected

  Interface          Group       Encapsulation                  Prio  St  XC St
  ---------          -----       -------------                  ----  --  -----
VPWS name: foo, State: UP
  Eth1/1.1                       Eth1/1.1:100(Eth VLAN)         0     UP  UP
  pw101              blue        102.1.1.1:100(MPLS)            2     UP  UP
  pw102              blue        103.1.1.1:100(MPLS)            5     SB  IA
  pw103              blue        104.1.1.1:100(MPLS)            8     SB  IA
  pw104              blue        105.1.1.1:100(MPLS)            11    SB  IA
```

In this example, the topology is attachment circuit 1 to attachment circuit 2 with a pseudowire backup for attachment circuit 2:

Example:

```
Device# show l2vpn service all
Legend: XC ST=Xconnect State, S1=Segment1 State, S2=Segment2 State
UP=Up, DN=Down, AD=Admin Down, IA=Inactive, NH=No Hardware
XC ST  Segment 1                       S1 Segment 2                          S2
------+--------------------------------+--+--------------------------------+--
UP pri ac   Se6/0:150(FR DLCI)         UP ac   Se8/0:150(FR DLCI)           UP
IA sec ac   Se6/0:150(FR DLCI)         UP mpls 10.55.55.3:7151              DN
```

Step 3 **logging redundancy**

In addition to the **show l2vpn atom vc** command and the **show l2vpn service** command, you can use the **logging redundancy** command to enable system message log (syslog) reporting of xconnect redundancy status events:

Example:

```
Device(config)# l2vpn
Device(config-l2vpn)# logging redundancy
```

When this command is configured, the messages below will be generated during switchover events:

Activating the primary member:

Example:

```
Device(config)# l2vpn
Device(config-l2vpn)# logging pseudowire status
```

When this command is configured, this is configured the status of the pseudowire can be monitored:

Activating the primary member:

Example:

```
00:01:07: %XCONNECT-5-REDUNDANCY: Activating primary member 10.55.55.2:1000
```

Activating the backup member:

Example:

```
00:01:05: %XCONNECT-5-REDUNDANCY: Activating secondary member 10.55.55.3:1001
```

Step 4 **logging pseudowire status**

you can use the **logging pseudowire status** command to monitor the status of the pseudowire.

Example:

```
Device(config)# l2vpn
Device(config-l2vpn)# logging pseudowire status
```

Configuration Examples for L2VPN Pseudowire Redundancy

Each of the configuration examples refers to one of the following pseudowire classes:

- AToM (like-to-like) pseudowire class:

```
pseudowire-class mpls
 encapsulation mpls
```

- L2VPN IP interworking:

```
pseudowire-class mpls-ip
 encapsulation mpls
 interworking ip
```

Example L2VPN Pseudowire Redundancy and AToM (Like to Like)

The following example shows a High-Level Data Link Control (HDLC) attachment circuit xconnect with a backup pseudowire:

```
interface Serial4/0
 xconnect 10.55.55.2 4000 pw-class mpls
 backup peer 10.55.55.3 4001 pw-class mpls
```

The following example shows a Frame Relay attachment circuit xconnect with a backup pseudowire:

```
connect fr-fr-pw Serial6/0 225 l2transport
 xconnect 10.55.55.2 5225 pw-class mpls
 backup peer 10.55.55.3 5226 pw-class mpls
```

Example L2VPN Pseudowire Redundancy and L2VPN Interworking

The following example shows an Ethernet attachment circuit xconnect with L2VPN IP interworking and a backup pseudowire:

```
interface Ethernet0/0
 xconnect 10.55.55.2 1000 pw-class mpls-ip
 backup peer 10.55.55.3 1001 pw-class mpls-ip
```

The following example shows an Ethernet VLAN attachment circuit xconnect with L2VPN IP interworking and a backup pseudowire:

```
interface Ethernet1/0.1
 encapsulation dot1Q 200
 no ip directed-broadcast
```

```
 xconnect 10.55.55.2 5200 pw-class mpls-ip
 backup peer 10.55.55.3 5201 pw-class mpls-ip
```

The following example shows a Frame Relay attachment circuit xconnect with L2VPN IP interworking and a backup pseudowire:

```
connect fr-ppp-pw Serial6/0 250 l2transport
 xconnect 10.55.55.2 8250 pw-class mpls-ip
 backup peer 10.55.55.3 8251 pw-class mpls-ip
```

The following example shows a PPP attachment circuit xconnect with L2VPN IP interworking and a backup pseudowire:

```
interface Serial7/0
 encapsulation ppp
 xconnect 10.55.55.2 2175 pw-class mpls-ip
 backup peer 10.55.55.3 2176 pw-class mpls-ip
```

Example L2VPN Pseudowire Redundancy with Layer 2 Local Switching

The following example shows an Ethernet VLAN-VLAN local switching xconnect with a pseudowire backup for Ethernet segment E2/0.2. If the subinterface associated with E2/0.2 goes down, the backup pseudowire is activated:

```
connect vlan-vlan Ethernet1/0.2 Ethernet2/0.2
 backup peer 10.55.55.3 1101 pw-class mpls
```

The following example shows a Frame Relay-to-Frame Relay local switching connect with a pseudowire backup for Frame Relay segment S8/0 150. If data-link connection identifier (DLCI) 150 on S8/0 goes down, the backup pseudowire is activated:

```
connect fr-fr-ls Serial6/0 150 Serial8/0 150
 backup peer 10.55.55.3 7151 pw-class mpls
```

Example L2VPN Pseudowire Redundancy and Layer 2 Tunneling Protocol Version 3

The following example shows how to configure a backup peer for an xconnect session:

```
pseudowire-class 773
 encapsulation l2tpv3
 ip local interface GigabitEthernet0/0/0.773
!
pseudowire-class 774
 encapsulation l2tpv3
 ip local interface GigabitEthernet0/0/1.774
!
interface GigabitEthernet0/0/0.780
 encapsulation dot1Q 780
 xconnect 10.22.73.14 100 pw-class 773
  backup peer 10.22.74.14 101 pw-class 774
  backup delay 0 0
```

The following example shows how to configure a Gigabit Ethernet port with L2VPN pseudowire redundancy and L2TPv3:

```
interface GigabitEthernet0/0/2
 xconnect 10.22.70.83 50 pw-class pe1-pw-primary
 backup peer 20.22.70.85 51 pw-class pe1-pw-secondary
```

The following example shows how to configure a Gigabit Ethernet VLAN with L2VPN pseudowire redundancy and L2TPv3:

```
interface GigabitEthernet0/0/0.100
 encapsulation dot1q 100
 xconnect 10.22.70.83 60 pw-class pe1-pw-primary
 backup peer 10.22.70.85 61 pw-class pe1-pw-secondary
```

The following example shows how to configure a Gigabit Ethernet Q-in-Q with L2VPN pseudowire redundancy and L2TPv3:

```
interface GigabitEthernet0/0/0.200
 encapsulation dot1q 200 second-dot1q 400
 xconnect 10.22.70.83 70 pw-class pe1-pw-primary
 backup peer 10.22.70.85 71 pw-class pe1-pw-secondary
```

The following example shows how to configure a Gigabit Ethernet Q-in-any with L2VPN pseudowire redundancy and L2TPv3:

```
interface GigabitEthernet0/0/0.300
 encapsulation dot1q 300 second-dot1q any
 xconnect 10.22.70.83 80 pw-class pe1-pw-primary
 backup peer 10.22.70.85 81 pw-class pe1-pw-secondary
```

The following example shows how to configure an HDLC with L2VPN pseudowire redundancy and L2TPv3

```
interface Serial0/2/0:0
 no ip address
 xconnect 10.22.71.83 40 pw-class pe1-pw-hdlc
 backup peer 10.22.70.85 41 pw-class pe1-pw-hdlc-2
```

Configuration Examples for L2VPN Pseudowire Redundancy using the commands associated with the L2VPN Protocol-Based CLIs feature

Each of the configuration examples refers to one of the following interface pseudowires:

- AToM (like-to-like) interface pseudowire:

```
interface pseudowire 1
 encapsulation mpls
 neighbor 33.33.33.33 1
```

- L2VPN IP interworking:

```
interface pseudowire 1
 encapsulation mpls
```

```
 neighbor 33.33.33.33 1
 interworking ip
```

Example L2VPN Pseudowire Redundancy and AToM (Like to Like) using the commands associated with the L2VPN Protocol-Based CLIs feature

The following example shows a High-Level Data Link Control (HDLC) attachment circuit xconnect with a backup pseudowire:

```
interface Serial4/0
 interface pseudowire 100
 source template type pseudowire ether-pw
 neighbor 10.55.55.3 4001
!
l2vpn xconnect context con1
 member pseudowire 100 group GR_1 priority 1
 member pseudowire 1001 group GR_1 priority 2
 member GigabitEthernet0/0/2 service-instance 1
 redundancy delay 0 0 group GR_1
```

The following example shows a Frame Relay attachment circuit xconnect with a backup pseudowire:

```
connect fr-fr-pw Serial6/0 225 l2transport
interface pseudowire 100
 source template type pseudowire ether-pw
 neighbor 10.55.55.3 5226
!
l2vpn xconnect context con1
 member pseudowire 100 group GR_1 priority 1
 member pseudowire 1001 group GR_1 priority 2
 member GigabitEthernet0/0/2 service-instance 1
 redundancy delay 0 0 group GR_1
```

Example L2VPN Pseudowire Redundancy and L2VPN Interworking using the commands associated with the L2VPN Protocol-Based CLIs feature

The following example shows an Ethernet attachment circuit xconnect with L2VPN IP interworking and a backup pseudowire:

```
interface Ethernet0/0
interface pseudowire 100
 source template type pseudowire ether-pw
!
l2vpn xconnect context con1
 member pseudowrire 100 group GR_1 priority 1
 member pseudowire 1001 group GR_1 priority 2
 member GigabitEthernet0/0/2 service-instance 1
 redundancy delay 0 0 group GR_1
 interworking ip
```

The following example shows an Ethernet VLAN attachment circuit xconnect with L2VPN IP interworking and a backup pseudowire:

```
interface Ethernet1/0.1
```

```
 encapsulation dot1Q 200
 no ip directed-broadcast
 interface pseudowire 100
 source template type pseudowire ether-pw
!
l2vpn xconnect context con1
 member pseudowrire 100 group GR_1 priority 1
 member pseudowire 1001 group GR_1 priority 2
 member GigabitEthernet0/0/2 service-instance 1
 redundancy delay 0 0 group GR_1
 interworking ip
```

The following example shows a Frame Relay attachment circuit xconnect with L2VPN IP interworking and a backup pseudowire:

```
connect fr-ppp-pw Serial6/0 250 l2transport
 interface pseudowire 100
 source template type pseudowire ether-pw
!
l2vpn xconnect context con1
 member pseudowrire 100 group GR_1 priority 1
 member pseudowire 1001 group GR_1 priority 2
 member GigabitEthernet0/0/2 service-instance 1
 redundancy delay 0 0 group GR_1
 interworking ip
```

The following example shows a PPP attachment circuit xconnect with L2VPN IP interworking and a backup pseudowire:

```
interface Serial7/0
 encapsulation ppp
 interface pseudowire 100
 source template type pseudowire ether-pw
!
l2vpn xconnect context con1
 member pseudowire 100 group GR_1 priority 1
 member pseudowire 1001 group GR_1 priority 2
 member GigabitEthernet0/0/2 service-instance 1
 redundancy delay 0 0 group GR_1
 interworking ip
```

Example L2VPN Pseudowire Redundancy and Layer 2 Tunneling Protocol Version 3 using the commands associated with the L2VPN Protocol-Based CLIs feature

The following example shows how to configure a backup peer for an xconnect session:

```
interface pseudowire 773
 encapsulation l2tpv3
 ip local interface GigabitEthernet0/0/0.773
!
interface pseudowire 774
 encapsulation l2tpv3
 ip local interface GigabitEthernet0/0/1.774
!
interface GigabitEthernet0/0/0.780
 encapsulation dot1Q 780
 interface pseudowire 100
```

```
 source template type pseudowire ether-pw
 neighbor 10.22.73.14 100
!
l2vpn xconnect context con1
 member pseudowire 100 group GR_1 priority 1
 member pseudowire 1001 group GR_1 priority 2
 member GigabitEthernet0/0/2 service-instance 1
 redundancy delay 0 0 group GR_1
 interworking ip
```

The following example shows how to configure a Gigabit Ethernet port with L2VPN pseudowire redundancy and L2TPv3:

```
interface GigabitEthernet0/0/2
 interface pseudowire 100
 source template type pseudowire ether-pw
 neighbor 10.22.70.83 50
!
l2vpn xconnect context con1
 member pseudowire 100 group GR_1 priority 1
 member pseudowire 1001 group GR_1 priority 2
 member GigabitEthernet0/0/2 service-instance 1
 redundancy delay 0 0 group GR_1
 interworking ip
```

The following example shows how to configure a Gigabit Ethernet VLAN with L2VPN pseudowire redundancy and L2TPv3:

```
interface GigabitEthernet0/0/0.100
 encapsulation dot1q 100
 interface pseudowire 100
 source template type pseudowire ether-pw
 neighbor 10.22.70.83 60
!
l2vpn xconnect context con1
 member pseudowire 100 group GR_1 priority 1
 member pseudowire 1001 group GR_1 priority 2
 member GigabitEthernet0/0/2 service-instance 1
 redundancy delay 0 0 group GR_1
 interworking ip
```

The following example shows how to configure a Gigabit Ethernet Q-in-Q with L2VPN pseudowire redundancy and L2TPv3:

```
interface GigabitEthernet0/0/0.200
 encapsulation dot1q 200 second-dot1q 400
 interface pseudowire 100
 source template type pseudowire ether-pw
 neighbor 10.22.70.83 70
!
l2vpn xconnect context con1
 member pseudowire 100 group GR_1 priority 1
 member pseudowire 1001 group GR_1 priority 2
 member GigabitEthernet0/0/2 service-instance 1
 redundancy delay 0 0 group GR_1
 interworking ip
```

The following example shows how to configure a Gigabit Ethernet Q-in-any with L2VPN pseudowire redundancy and L2TPv3:

```
interface GigabitEthernet0/0/0.300
```

```
 encapsulation dot1q 300 second-dot1q any
 interface pseudowire 100
 source template type pseudowire ether-pw
 neighbor 10.22.70.83 80
!
l2vpn xconnect context con1
 member pseudowire 100 group GR_1 priority 1
 member pseudowire 1001 group GR_1 priority 2
 member GigabitEthernet0/0/2 service-instance 1
 redundancy delay 0 0 group GR_1
 interworking ip
```

The following example shows how to configure an HDLC with L2VPN pseudowire redundancy and L2TPv3

```
interface Serial0/2/0:0
 no ip address
 interface pseudowire 100
 source template type pseudowire ether-pw
 neighbor 10.22.71.83 40
!
l2vpn xconnect context con1
 l2vpn xconnect context con1
 member pseudowire 100 group GR_1 priority 1
 member pseudowire 1001 group GR_1 priority 2
 member GigabitEthernet0/0/2 service-instance 1
 redundancy delay 0 0 group GR_1
 interworking ip
```

Additional References

Related Documents

Related Topic	Document Title
Cisco IOS commands	Cisco IOS Master Commands List, All Releases
Wide-area networking commands	*Cisco IOS Wide-Area Networking Command Reference*
Cisco IOS XE Multiprotocol Label Switching configuration tasks	*Cisco IOS XE Multiprotocol Label Switching Configuration Guide*
Cisco IOS XE Wide-area networking configuration tasks	*Cisco IOS XE Wide-Area Networking Configuration Guide*

Standards

Standards	Title
None	--

MIBs

MIBs	MIBs Link
No new or modified MIBs are supported by this feature, and support for existing MIBs has not been modified by this feature.	To locate and download MIBs for selected platforms, Cisco software 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 and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

Feature Information for L2VPN Pseudowire Redundancy

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 Redundancy

Feature Name	Releases	Feature Information
L2VPN Pseudowire Redundancy	XE 2.3 XE 3.3S	This feature enables you to set up your network to detect a failure in the network and reroute the Layer 2 service to another endpoint that can continue to provide service. In Cisco IOS XE Release 2.3, this feature was integrated into the Cisco ASR 1000 Series Aggregation Service Routers. In Cisco IOS XE Release 3.3S, this feature supports Layer 2 Tunneling Protocol Version 3 (L2TPv3). The following commands were introduced or modified: **backup delay (L2VPN local switching), backup peer, show xconnect, xconnect backup force-switchover, xconnect logging redundancy.**
L2VPN Pseudowire Redundancies	Cisco IOS XE Fuji 16.9.1	In Cisco IOS XE Fuji 16.9.1, this feature is supported on Cisco 1000 Series ISRs.