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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Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see Bug Search Tool and 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.

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 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.
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

X1 = End-to-end routing failure
X2 = PE hardware or software failure
X3 = Attachment circuit failure from a line break
X4 = CE hardware or software failure

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
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**

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td>Example:</td>
<td>• Enter your password if prompted.</td>
</tr>
<tr>
<td>Router&gt; enable</td>
<td></td>
</tr>
<tr>
<td><strong>Step 2</strong> configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Router# configure terminal</td>
<td></td>
</tr>
<tr>
<td><strong>Step 3</strong> pseudowire-class name</td>
<td>Establishes a pseudowire class with a name that you specify.</td>
</tr>
<tr>
<td>Example:</td>
<td>Enters pseudowire class configuration mode.</td>
</tr>
<tr>
<td>Router(config)# pseudowire-class atom</td>
<td></td>
</tr>
<tr>
<td><strong>Step 4</strong> encapsulation mpls</td>
<td>Specifies the tunneling encapsulation. For AToM, the encapsulation type is mpls.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Router(config-pw-class)# encapsulation mpls</td>
<td></td>
</tr>
<tr>
<td><strong>Step 5</strong> interworking {ethernet</td>
<td>ip}</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Router(config-pw-class)# interworking ip</td>
<td></td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th>Command or Action</th>
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<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td></td>
</tr>
<tr>
<td>enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td>Example:</td>
<td>• Enter your password if prompted.</td>
</tr>
<tr>
<td>Router&gt; enable</td>
<td></td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td></td>
</tr>
<tr>
<td>configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Router# configure terminal</td>
<td></td>
</tr>
</tbody>
</table>
### Purpose

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 3</strong></td>
<td>Establishes an interface pseudowire with a value that you specify. Enters pseudowire configuration mode.</td>
</tr>
<tr>
<td><code>interface pseudowire number</code></td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>Router(config)# interface pseudowire 1</td>
</tr>
<tr>
<td><strong>Step 4</strong></td>
<td>Specifies the tunneling encapsulation. For AToM, the encapsulation type is <code>mpls</code>.</td>
</tr>
<tr>
<td><code>encapsulation mpls</code></td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>Router(config-pw)# encapsulation mpls</td>
</tr>
<tr>
<td><strong>Step 5</strong></td>
<td>Specifies the peer IP address and virtual circuit (VC) ID value of a Layer 2 VPN (L2VPN) pseudowire.</td>
</tr>
<tr>
<td><code>neighbor peer-address vcid-value</code></td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>Router(config-pw)# neighbor 10.0.0.1 123</td>
</tr>
<tr>
<td><strong>Step 6</strong></td>
<td>(Optional) Enables the translation between the different Layer 2 encapsulations.</td>
</tr>
<tr>
<td>`interworking {ethernet</td>
<td>ip}`</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>Router(config-pw)# interworking ip</td>
</tr>
</tbody>
</table>

### 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

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td><strong>enable</strong></td>
</tr>
<tr>
<td><strong>Purpose</strong></td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>Router&gt; enable</td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td><strong>configure terminal</strong></td>
</tr>
<tr>
<td><strong>Purpose</strong></td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>Router# configure terminal</td>
</tr>
<tr>
<td><strong>Step 3</strong></td>
<td><strong>interface gigabitethernet slot / subslot / interface . subinterface</strong></td>
</tr>
<tr>
<td><strong>Purpose</strong></td>
<td>Specifies the Gigabit Ethernet subinterface and enters subinterface configuration mode.</td>
</tr>
<tr>
<td><strong>Note</strong></td>
<td>Make sure that the subinterface on the adjoining CE router is on the same VLAN as this PE router.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>Router(config)# interface gigabitethernet0/0/0.1</td>
</tr>
<tr>
<td><strong>Step 4</strong></td>
<td><strong>encapsulation dot1q vlan-id</strong></td>
</tr>
<tr>
<td><strong>Purpose</strong></td>
<td>Enables the subinterface to accept 802.1Q VLAN packets.</td>
</tr>
<tr>
<td><strong>Note</strong></td>
<td>The subinterfaces between the CE and PE routers that are running Ethernet over MPLS must be in the same subnet.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>Router(config-subif)# encapsulation dot1q 100</td>
</tr>
<tr>
<td><strong>Step 5</strong></td>
<td>**xconnect peer-router-id vcid [encapsulation mpls</td>
</tr>
<tr>
<td><strong>Purpose</strong></td>
<td>Binds the attachment circuit to a pseudowire VC and enters xconnect configuration mode.</td>
</tr>
<tr>
<td><strong>Note</strong></td>
<td>The syntax for this command is the same as for all other Layer 2 transports.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>Router(config-subif)# xconnect 10.0.0.1 123 pw-class atom</td>
</tr>
<tr>
<td><strong>Step 6</strong></td>
<td><strong>backup peer peer-router-ip-addr vcid [pw-class pw-class-name]</strong></td>
</tr>
<tr>
<td><strong>Purpose</strong></td>
<td>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.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>Router(config-if-xconn)# backup peer 10.0.0.3 125 pw-class atom</td>
</tr>
<tr>
<td><strong>Step 7</strong></td>
<td>**backup delay e nable-delay {disable-delay</td>
</tr>
<tr>
<td><strong>Purpose</strong></td>
<td>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.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>Router(config-if-xconn)# backup delay 5 never</td>
</tr>
</tbody>
</table>
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**

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td></td>
</tr>
<tr>
<td><code>enable</code></td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td>Example:</td>
<td>• Enter your password if prompted.</td>
</tr>
<tr>
<td><code>Device&gt; enable</code></td>
<td></td>
</tr>
</tbody>
</table>
### Command or Action

<table>
<thead>
<tr>
<th>Step 2</th>
<th>configure terminal</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Device# configure terminal</td>
<td>Enters global configuration mode.</td>
<td></td>
</tr>
</tbody>
</table>

| Step 3 | interface gigabitethernet slot / subslot / interface . subinterface | 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. |
| Example: |
| Device(config)# interface gigabitethernet0/0/0.1 |

| Step 4 | encapsulation dot1q vlan-id | 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. |
| Example: |
| Device(config-subif)# encapsulation dot1q 100 |

| Step 5 | end | Exits to privileged EXEC mode. |
| Example: |
| Router(config-subif)# end |

| Step 6 | interface pseudowire number | Specifies the pseudowire interface and enters interface configuration mode. |
| Example: |
| Router(config)# interface pseudowire 100 |

| Step 7 | source template type pseudowire template-name | Configures the source template of type pseudowire named atom |
| Example: |
| Router(config-if)# source template type pseudowire atom |

| Step 8 | neighbor peer-address vcid-value | Specifies the peer IP address and virtual circuit (VC) ID value of a Layer 2 VPN (L2VPN) pseudowire. |
| Example: |
| Router(config-if)# neighbor 10.0.0.1 123 |

| Step 9 | exit | Exits to privileged EXEC mode. |
| Example: |
| Router(config-if)# exit |
### Purpose

**Command or Action** | **Purpose**
--- | ---
**Step 10** l2vpn xconnect context *context-name* | Creates a Layer 2 VPN (L2VPN) cross connect context and enters xconnect configuration mode.

**Example:**

```
Router(config)# l2vpn xconnect context con1
```

**Step 11** member pseudowire *interface-number* | Specifies a member pseudowire to form a Layer 2 VPN (L2VPN) cross connect.

**Example:**

```
Device(config-xconnect)# member pseudowire 100 group GR_1 priority 2
```

**Step 12** member pseudowire *interface-number* | Specifies a second member pseudowire for redundancy.

**Example:**

```
Device(config-xconnect)# member pseudowire 1001 group GR_1 priority 2
```

**Step 13** member gigabitethernet *interface-number* | Specifies the location of the Gigabit Ethernet member interface.

**Example:**

```
Device(config-xconnect)# member GigabitEthernet0/0/0.1 service instance 1
```

**Step 14** redundancy delay *enable-delay* | 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.

**Example:**

```
Device(config-xconnect)# redundancy delay 0
```

Forced 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

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1 enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td>Example:</td>
<td>• Enter your password if prompted.</td>
</tr>
<tr>
<td>Router&gt; enable</td>
<td></td>
</tr>
<tr>
<td>Step 2 xconnect backup force-switchover { interface interface-info</td>
<td>peer ip-address vcid}</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Router# xconnect backup force-switchover peer 10.10.10.1 123</td>
<td></td>
</tr>
</tbody>
</table>

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

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
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:**

```plaintext
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:**

```plaintext
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:**

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

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

Activating the primary member:

**Example:**

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

Activating the backup member:

**Example:**

```plaintext
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**

**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  RS=Hot Standby  RV=Recovering  NH=No Hardware
m=manually selected

Interface Group Encapsulation Prio St XC St
--------- ----- ----------------------- ---- -- ----
VPWS name: foo, State: UP
```

MPLS Layer 2 VPNs Configuration Guide
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 12transport
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 GigabitEthernet0/0/0.774

! 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:

```plaintext
define interface Serial4/0
define 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:

```plaintext
connect fr-fr-pw Serial6/0 225 l2transport
define 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:

```plaintext
define interface Ethernet0/0
define 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
```

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

```plaintext
define interface Ethernet1/0.1
encapsulation dot1Q 200
no ip directed-broadcast
define 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
```
The following example shows a Frame Relay attachment circuit xconnect with L2VPN IP interworking and a backup pseudowire:

```conf
connect fr-ppp-pw Serial6/0 250 l2transport
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
```

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

```conf
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:

```conf
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:

```conf
interface GigabitEthernet0/0/2
interface pseudowire 100
    source template type pseudowire ether-pw
```
neighbor 10.22.70.83 50
!
12vpn 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
!
12vpn 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
!
12vpn 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
!
12vpn 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
!
12vpn xconnect context con1
12vpn 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

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### Additional References

#### Related Documents

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<tr>
<th>Related Topic</th>
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<tr>
<td>Cisco IOS commands</td>
<td>Cisco IOS Master Commands List, All Releases</td>
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<tr>
<td>Wide-area networking commands</td>
<td>Cisco IOS Wide-Area Networking Command Reference</td>
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<tr>
<td>Cisco IOS XE Multiprotocol Label Switching configuration tasks</td>
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#### Standards

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#### MIBs

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<tr>
<th>MIBs</th>
<th>MIBs Link</th>
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<tr>
<td>No new or modified MIBs are supported by this feature, and support for existing MIBs has not been modified by this feature.</td>
<td>To locate and download MIBs for selected platforms, Cisco software releases, and feature sets, use Cisco MIB Locator found at the following URL: <a href="http://www.cisco.com/go/mibs">http://www.cisco.com/go/mibs</a></td>
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#### RFCs

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</table>
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

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
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<tr>
<td>L2VPN Pseudowire Redundancy</td>
<td>XE 2.3 XE 3.3S</td>
<td>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.</td>
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