NSF/SSO—L2VPN Pseudowire Redundancy

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The NSF/SSO—L2VPN Pseudowire Redundancy feature enables you to set up your network to detect a failure in the network and reroute the L2 service to another endpoint that can continue to provide service. This feature also functions in an nonstop forwarding (NSF) and stateful switchover (SSO) environment. The active pseudowire does not change after SSO.

Finding Feature Information in This Module

Your Cisco IOS software release may not support all of the features documented in this module. To reach links to specific feature documentation in this module and to see a list of the releases in which each feature is supported, use the "Feature Information for NSF/SSO—L2VPN Pseudowire Redundancy" section on page 27.

Finding Support Information for Platforms and Cisco IOS Software Images

Use Cisco Feature Navigator to find information about platform support and Cisco IOS software image support. Access Cisco Feature Navigator at http://www.cisco.com/go/fn. You must have an account on Cisco.com. If you do not have an account or have forgotten your username or password, click **Cancel** at the login dialog box and follow the instructions that appear.

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Contents

Prerequisites for NSF/SSO—L2VPN Pseudowire Redundancy

- This feature module requires an understanding of how to configure basic L2 VPNs. You can find that information in the following documents:
  - *Any Transport over MPLS*
  - *L2VPN Interworking*
- NSF/SSO—L2VPN Pseudowire Redundancy requires that the following mechanisms be in place to detect a failure in the network:
  - Local Management Interface (LMI)
  - Operation and Maintenance (OAM)
- NSF/SSO—L2VPN Pseudowire Redundancy requires that neighbor networking devices be able to perform AToM Graceful Restart. The Cisco 7500 routers are capable of supporting AToM Graceful Restart and can be used as neighbor networking devices.
- To support seamless failover to the backup Route Processor (RP), configure the RPs for SSO and Graceful Restart. See the *Stateful Switchover* feature module for more information.
- You must enable NSF on the routing protocols running between the provider (P) routers and provider edge (PE) routers. See the *Cisco Nonstop Forwarding* feature module for more information.
- Enable distributed Cisco Express Forwarding on the Cisco 7500 routers.

Restrictions for NSF/SSO—L2VPN Pseudowire Redundancy

- The default Label Distribution Protocol (LDP) session holddown timer will detect failures in about 180 seconds. That time can be configured to detect failures more quickly. See the **mpls ldp holdtime** command for more information.
- Pseudowire redundancy is not supported for Layer 2 Tunnel Protocol Version 3 (L2TPv3) xconnect configurations.
- The primary and backup pseudowires must run the same type of transport service. The primary and backup pseudowires must be configured with AToM.
- Only static, on-box provisioning is supported in this release.
- If you use NSF/SSO—L2VPN Pseudowire Redundancy with L2VPN Interworking, the interworking method must be the same for the primary and backup pseudowires.
- NSF/SSO—L2VPN Pseudowire Redundancy supports setting the experimental (EXP) bit on the Multiprotocol Label Switching (MPLS) pseudowire.
- NSF/SSO—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.
- More than one backup pseudowire is not supported.

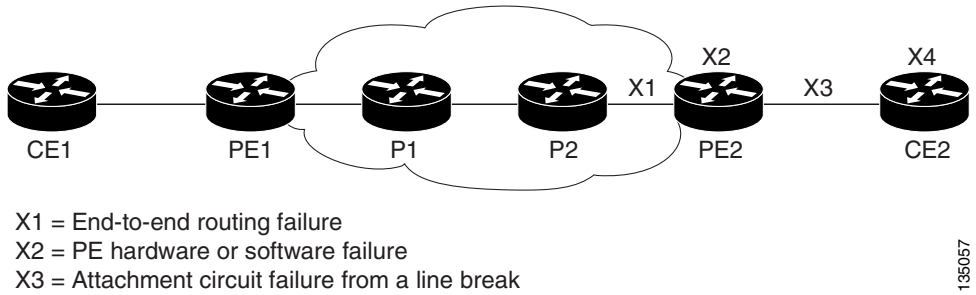
Information About NSF/SSO—L2VPN Pseudowire Redundancy

Before configuring NSF/SSO—L2VPN Pseudowire Redundancy, you should understand the following concept:

Introduction to NSF/SSO—L2VPN Pseudowire Redundancy

Currently, the L2 VPNs provide pseudowire resiliency only 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 interruptions in service. Figure 1 shows those parts of the network that are vulnerable to an interruption in service.

Figure 1 Points of Potential Failure in an L2 VPN Network



NSF/SSO—L2VPN Pseudowire Redundancy provides the ability to ensure that the CE2 router in Figure 1 can always maintain network connectivity, even if one or all the failures in the figure occur. You can configure the network with redundant pseudowires (PWs) and redundant RPs, which are shown in the following figures.

Figure 2 shows a network with redundant pseudowires and redundant attachment circuits.

Figure 2 L2 VPN Network with Redundant PWs and Attachment Circuits

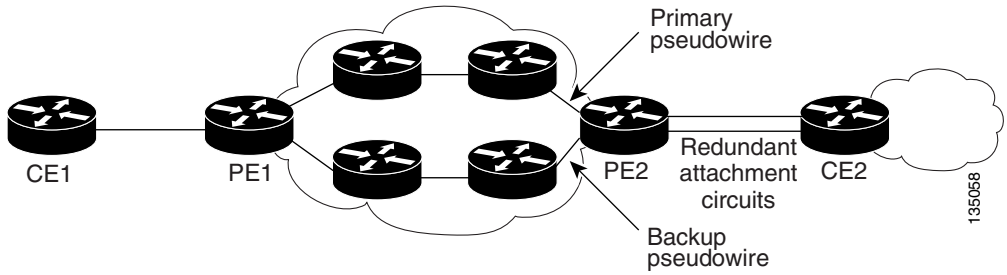


Figure 3 shows a network with redundant pseudowires, attachment circuits, and CE routers.

Figure 3 L2 VPN Network with Redundant PWs, Attachment Circuits, and CE Routers

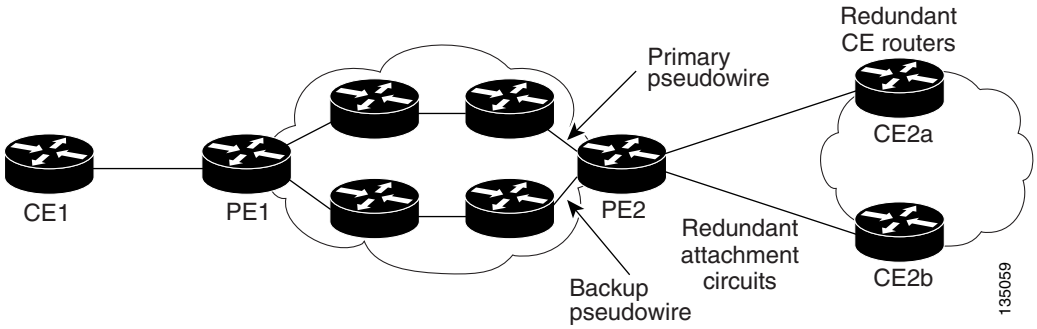
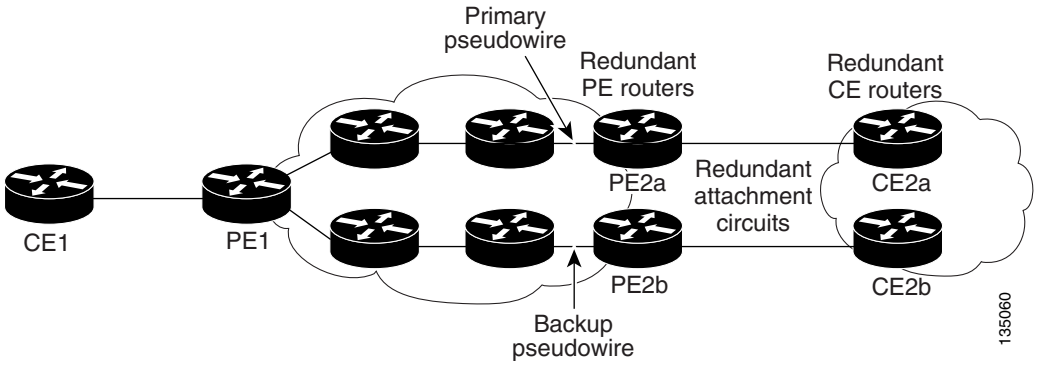


Figure 4 shows a network with redundant pseudowires, attachment circuits, CE routers, and PE routers.

Figure 4 L2 VPN Network with Redundant PWs, Attachment Circuits, CE Routers, and PE Routers



How to Configure NSF/SSO—L2VPN Pseudowire Redundancy

NSF/SSO—L2VPN Pseudowire Redundancy enables you to configure the following:

- 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.
- The ability to provide an SSO/NSF environment. The active pseudowire does not change after SSO.

Note During the switchover from the primary to backup RP, the router may experience packet loss for up to 5 seconds.

The following sections explain how to set up NSF/SSO—L2VPN Pseudowire Redundancy:

- Configuring the Pseudowire Class, page 7 (required)
- Configuring L2VPN Pseudowire Redundancy, page 8 (required)
- Configuring SSO on the Route Processors, page 10 (required)
- Configuring Nonstop Forwarding for the Routing Protocols, page 10 (required)
- Forcing a Manual Switchover to the Backup Pseudowire VC, page 10 (optional)
- Verifying the NSF/SSO—L2VPN Pseudowire Redundancy Configuration, page 11 (optional)

Configuring the Pseudowire Class

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, including:

- Encapsulation type
- Control protocol
- Payload-specific options

You must specify **encapsulation mpls** as part of the pseudowire class for the AToM VCs to work properly. If you omit **encapsulation mpls** 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

	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.

	Command or Action	Purpose
Step 4	**encapsulation mpls** **Example:** `Router(config-pw)# encapsulation mpls`	Specifies the tunneling encapsulation. For AToM, the encapsulation type is **mpls**.
Step 5	**interworking** {**ethernet** | **ip**} **Example:** `Router(config-pw)# interworking ip`	(Optional) Enables the translation between the different Layer 2 encapsulations.

Configuring L2VPN Pseudowire Redundancy

Use the following steps to configure L2VPN Pseudowire Redundancy.

Prerequisites

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** *interface slot /interface.subinterface*
4. **encapsulation dot1q** *vlan-id*
5. **xconnect** *peer-router-ip-addr vcid* **encapsulation mpls | pw-class** *pw-class-name*
6. **backup peer** *peer-router-ip-addr vcid* [**pw-class** *pw-class-name*]
7. **backup delay** *enable-delay* {*disable-delay* | **never**}

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.

Step 3	**interface** *interface slot/interface.subinterface* **Example:** `Router(config)# interface gigabitethernet4/0.1`	Specifies the interface 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:** `Router(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	**xconnect** *peer-router-ip-addr 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 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** *enable-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 the primary pseudowire VC goes down. The range is 0 to 180. Also 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 **never**, the primary pseudowire VC never takes over for the backup. When configuring NSF/SSO—L2VPN Pseudowire Redundancy, use the **never** keyword to prevent the primary RP from taking over as soon as it comes back after a switchover.

Configuring SSO on the Route Processors

To configure the route processors for SSO, see the *Stateful Switchover* feature module.

Configuring Nonstop Forwarding for the Routing Protocols

You must enable Nonstop Forwarding on the routing protocols running between the P routers and PE routers. See the *Cisco Nonstop Forwarding* feature module for more information.

Forcing a Manual Switchover to the Backup Pseudowire VC

To make 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 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 will move to the fully active state when the command is entered.

SUMMARY STEPS

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

DETAILED STEPS

	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 NSF/SSO—L2VPN Pseudowire Redundancy Configuration

Use the following commands to verify that NSF/SSO—L2VPN Pseudowire Redundancy is correctly configured.

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:

```
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
   .
   .
   .
```

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

```
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.

```
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
```

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:

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

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

Activating the primary member:

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

Activating the backup member:

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

Configuration Examples for NSF/SSO—L2VPN Pseudowire Redundancy

The following sections show L2VPN Pseudowire Redundancy examples. These configuration examples show how L2VPN Pseudowire Redundancy can be configured with AToM (like-to-like), L2VPN Interworking, and Layer 2 Local Switching.

- NSF/SSO—L2VPN Pseudowire Redundancy and AToM (Like to Like): Examples, page 12
- NSF/SSO—L2VPN Pseudowire Redundancy and L2VPN Interworking: Examples, page 12
- NSF/SSO—L2VPN Pseudowire Redundancy with Layer 2 Local Switching: Examples, page 13

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
```

NSF/SSO—L2VPN Pseudowire Redundancy and AToM (Like to Like): Examples

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

```
redundancy
 mode sso

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
```

NSF/SSO—L2VPN Pseudowire Redundancy and L2VPN Interworking: Examples

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
```

NSF/SSO—L2VPN Pseudowire Redundancy with Layer 2 Local Switching: Examples

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
```

Additional References

The following sections provide references related to NSF/SSO—L2VPN Pseudowire Redundancy.

Related Documents

Related Topic	Document Title
Any Transport over MPLS	*Any Transport over MPLS*
High Availability for AToM	*NSF/SSO-Any Transport over MPLS and AToM Graceful Restart*
L2VPN Interworking	*L2VPN Interworking*
Layer 2 Local Switching	*Layer 2 Local Switching*

Related Topic	Document Title
PWE3 MIB	*Pseudowire Emulation Edge-to-Edge MIBs for Ethernet and Frame Relay Services*
Packet Sequencing	*Any Transport over MPLS (AToM) Sequencing Support*

Standards

Standards	Title
None	—

MIBs

MIBs	MIBs Link
None	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFCs	Title
None	—

Technical Assistance

Description	Link
The Cisco Technical Support & Documentation website contains thousands of pages of searchable technical content, including links to products, technologies, solutions, technical tips, and tools. Registered Cisco.com users can log in from this page to access even more content.	http://www.cisco.com/techsupport

Command Reference

This section documents modified commands only.

- **backup delay (L2VPN local switching)**
- **backup peer**
- **show xconnect**
- **xconnect backup force-switchover**
- **xconnect logging redundancy**

backup delay (L2VPN local switching)

To specify how long a backup pseudowire virtual circuit (VC) should wait before resuming operation after the primary pseudowire VC goes down, use the **backup delay** command in interface configuration mode or xconnect configuration mode.

backup delay *enable-delay* {*disable-delay* | **never**}

Syntax Description

enable-delay	Number of seconds that elapse after the primary pseudowire VC goes down before the Cisco IOS software activates the secondary pseudowire VC. The range is 0 to 180. The default is 0.
disable-delay	Number of seconds that elapse after the primary pseudowire VC comes up before the Cisco IOS software deactivates the secondary pseudowire VC. The range is 0 to 180. The default is 0.
never	The secondary pseudowire VC will not fall back to the primary pseudowire VC if the primary pseudowire VC becomes available again unless the secondary pseudowire VC fails.

Command Default

If a failover occurs, the xconnect redundancy algorithm will immediately switch over or fall back to the backup or primary member in the redundancy group.

Command Modes

Interface configuration
Xconnect configuration

Command History

Release	Modification
12.0(31)S	This command was introduced.
12.2(28)SB	This command was integrated into Cisco IOS Release 12.2(28)SB.

Examples

The following example shows a Multiprotocol Label Switching (MPLS) xconnect with one redundant peer. Once a switchover to the secondary VC occurs, there will be no fallback to the primary VC unless the secondary VC fails.

```
Router(config)# pseudowire-class mpls
Router(config-pw-class)# encapsulation mpls

Router(config)# connect frpw1 serial0/1 50 l2transport
Router(config-if)# xconnect 10.0.0.1 50 pw-class mpls
Router(config-if-xconn)# backup peer 10.0.0.2 50
Router(config-if-xconn)# backup delay 0 never
```

The following example shows a Multiprotocol Label Switching (MPLS) xconnect with one redundant peer. The switchover will not begin unless the Layer 2 Tunnel Protocol (L2TP) pseudowire has been down for 3 seconds. After a switchover to the secondary VC occurs, there will be no fallback to the primary until the primary VC has been reestablished and is up for 10 seconds.

```
Router(config)# pseudowire-class mpls
Router(config-pw-class)# encapsulation mpls

Router(config)# connect frpw1 serial0/1 50 l2transport
Router(config-if)# xconnect 10.0.0.1 50 pw-class mpls
Router(config-if-xconn)# backup peer 10.0.0.2 50
Router(config-if-xconn)# backup delay 3 10
```

Related Commands

Command	Description
backup peer	Configures a redundant peer for a pseudowire VC.

backup peer

To specify a redundant peer for a pseudowire virtual circuit (VC), use the **backup peer** command in interface configuration mode or xconnect configuration mode. To remove the redundant peer, use the **no** form of this command.

backup peer *peer-router-ip-addr vcid* [**pw-class** *pw-class-name*]

no backup peer *peer-router-ip-addr vcid*

Syntax Description

peer-router-ip-addr	IP address of the remote peer.
vcid	The 32-bit identifier of the virtual circuit between the routers at each end of the layer control channel.
pw-class	(Optional) Pseudowire type. If not specified, then the pseudowire type is inherited from the parent xconnect.
pw-class-name	(Optional) Name of the pseudowire you created when you established the pseudowire class.

Command Default

No redundant peer is established.

Command Modes

Interface configuration
Xconnect configuration

Command History

Release	Modification
12.0(31)S	This command was introduced.
12.2(28)SB	This command was integrated into Cisco IOS Release 12.2(28)SB.

Usage Guidelines

The combination of the *peer-router-ip-addr* and *vcid* arguments must be unique on the router.

Examples

The following example shows a Multiprotocol Label Switching (MPLS) xconnect with one redundant peer:

```
Router(config)# pseudowire-class mpls
Router(config-pw-class)# encapsulation mpls

Router(config)# interface serial0/0
Router(config-if)# xconnect 10.0.0.1 100 pw-class mpls
Router(config-if-xconn)# backup peer 10.0.0.2 200
```

The following example shows a local-switched connection between ATM and Frame Relay (FR) using Ethernet interworking. The Frame Relay circuit is backed up by an MPLS pseudowire.

```
Router(config)# pseudowire-class mpls
Router(config-pw-class)# encapsulation mpls
Router(config-pw-class)# interworking ethernet
```

```
Router(config)# connect atm-fr atm1/0 100/100 s2/0 100 interworking ethernet
Router(config-if)# backup peer 10.0.0.2 100 pw-class mpls
```

Related Commands

Command	Description
backup delay	Specifies how long the backup pseudowire VC should wait before resuming operation after the primary pseudowire VC goes down.

show xconnect

To display information about xconnect attachment circuits and pseudowires, use the **show xconnect** command in privileged EXEC mode.

show xconnect {**all** | **interface** *interface* | **peer** *ip-address* {**all** | **vcid** *vcid*}} [**detail**]

Syntax Description

all	Displays information about all xconnect attachment circuits and pseudowires.
interface *interface*	Displays information about xconnect attachment circuits and pseudowires on the specified interface. Valid values for the *interface* argument are as follows: • **ethernet** *number*—Displays port-mode xconnect information for a specific Ethernet interface or subinterface. • **fastethernet** *number*—Displays port-mode xconnect information for a specific FastEthernet interface or subinterface. • **serial** *number*—Displays xconnect information for a specific serial interface. • **serial** *number dlci-number*—Displays xconnect information for a specific Frame Relay data-link connection identifier (DLCI). • **atm** *number*—Displays xconnect information for a specific ATM interface or subinterface. • **atm** *number* **vp** *vpi-value*—Displays virtual path (VP) xconnect information for a specific ATM virtual path identifier (VPI). This command will not display information about virtual circuit (VC) xconnects using the specified VPI. • **atm** *number* **vp** *vpi-value*/*vci-value*—Displays VC xconnect information for a specific ATM VPI and virtual circuit identifier (VCI) combination.
peer *ip-address* {**all** | **vcid** *vcid*}	Displays information about xconnect attachment circuits and pseudowires associated with the specified peer IP address. • **all**—Displays all xconnect information associated with the specified peer IP address. • **vcid** *vcid*—Displays xconnect information associated with the specified peer IP address and the specified VCID.
detail	(Optional) Displays detailed information about the specified xconnect attachment circuits and pseudowires.

Command Modes

Privileged EXEC

Command History

Release	Modification
12.0(31)S	This command was introduced.
12.2(28)SB	This command was integrated into Cisco IOS Release 12.2(28)SB.

Usage Guidelines

The **show xconnect** command can be used to display, sort, and filter basic information about all xconnect attachment circuits and pseudowires.

You can use the **show xconnect** command output to help determine the appropriate steps to take to troubleshoot an xconnect configuration problem. More specific information about a particular type of xconnect can be displayed using the commands listed in the "Related Commands" table.

Examples

The following example shows **show xconnect all** command output in the brief (default) display format:

```
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     ac   Et0/0(Ethernet)              UP mpls 10.55.55.2:1000              UP
UP     ac   Se7/0(PPP)                   UP mpls 10.55.55.2:2175              UP
UP pri ac   Se6/0:230(FR DLCI)           UP mpls 10.55.55.2:2230              UP
IA sec ac   Se6/0:230(FR DLCI)           UP mpls 10.55.55.3:2231              DN
UP     ac   Se4/0(HDLC)                  UP mpls 10.55.55.2:4000              UP
UP     ac   Se6/0:500(FR DLCI)           UP l2tp 10.55.55.2:5000              UP
UP     ac   Et1/0.1:200(Eth VLAN)        UP mpls 10.55.55.2:5200              UP
UP pri ac   Se6/0:225(FR DLCI)           UP mpls 10.55.55.2:5225              UP
IA sec ac   Se6/0:225(FR DLCI)           UP mpls 10.55.55.3:5226              DN
IA pri ac   Et1/0.2:100(Eth VLAN)        UP ac   Et2/0.2:100(Eth VLAN)        UP
UP sec ac   Et1/0.2:100(Eth VLAN)        UP mpls 10.55.55.3:1101              UP
UP     ac   Se6/0:150(FR DLCI)           UP ac   Se8/0:150(FR DLCI)           UP
```

Table 1 describes the significant fields shown in the display.

Table 1 show xconnect Field Descriptions

Field	Description
XC ST	State of the xconnect attachment circuit or pseudowire. Valid states are: • UP—The xconnect attachment circuit or pseudowire is up. Both segment 1 and segment 2 must be up for the xconnect to be up. • DN—The xconnect attachment circuit or pseudowire is down. Either segment 1, segment 2, or both segments are down. • IA—The xconnect attachment circuit or pseudowire is inactive. This state is valid only when pseudowire redundancy is configured. • NH—One or both segments of this xconnect no longer have the required hardware resources available to the system.

Table 1 show xconnect Field Descriptions (continued)

Field	Description
Segment1 or Segment2	Information about the type of xconnect, the interface type, and the IP address the segment is using. Types of xconnects are as follows: • ac—Attachment circuit. • pri ac—Primary attachment circuit. • sec ac—Secondary attachment circuit. • mpls—Multiprotocol Label Switching. • l2tp—Layer 2 Tunnel Protocol.
S1 or S2	State of the segment. Valid states are: • UP—The segment is up. • DN—The segment is down. • AD—The segment is administratively down.

The following example shows **show xconnect all** command output in the detailed display format:

```
Router# show xconnect all detail

Legend: XC ST=Xconnect State, S1=Segment1 State, S2=Segment2 State
UP=Up, DN=Down, AD=Admin Down, IA=Inactive, NH=No HardwareXC
ST     Segment 1                         S1 Segment 2                          S2
------+---------------------------------+--+---------------------------------+--
UP     ac   Et0/0(Ethernet)              UP mpls 10.55.55.2:1000               UP
            Interworking: ip                    Local VC label 16
                                                Remote VC label 16
                                                pw-class: mpls-ip
UP     ac   Se7/0(PPP)                   UP mpls 10.55.55.2:2175               UP
            Interworking: ip                    Local VC label 22
                                                Remote VC label 17
                                                pw-class: mpls-ip
UP pri ac   Se6/0:230(FR DLCI)           UP mpls 10.55.55.2:2230               UP
            Interworking: ip                    Local VC label 21
                                                Remote VC label 18
                                                pw-class: mpls-ip
IA sec ac   Se6/0:230(FR DLCI)           UP mpls 10.55.55.3:2231               DN
            Interworking: ip                    Local VC label unassigned
                                                Remote VC label 19
                                                pw-class: mpls-ip
UP     ac   Se4/0(HDLC)                  UP mpls 10.55.55.2:4000               UP
            Interworking: none                  Local VC label 18
                                                Remote VC label 19
                                                pw-class: mpls
UP     ac   Se6/0:500(FR DLCI)           UP l2tp 10.55.55.2:5000               UP
            Interworking: none                  Session ID: 34183
                                                Tunnel ID: 62083
                                                Peer name: pe-iou2
                                                Protocol State: UP
                                                Remote Circuit State: UP
                                                pw-class: l2tp
UP     ac   Et1/0.1:200(Eth VLAN)       UP mpls 10.55.55.2:5200               UP
            Interworking: ip                    Local VC label 17
                                                Remote VC label 20
```

```
                                                pw-class: mpls-ip
UP pri ac   Se6/0:225(FR DLCI)          UP mpls 10.55.55.2:5225             UP
            Interworking: none                  Local VC label 19
                                                Remote VC label 21
                                                pw-class: mpls
IA sec ac   Se6/0:225(FR DLCI)          UP mpls 10.55.55.3:5226             DN
            Interworking: none                  Local VC label unassigned
                                                Remote VC label 22
                                                pw-class: mpls
IA pri ac   Et1/0.2:100(Eth VLAN)       UP ac   Et2/0.2:100(Eth VLAN)       UP
            Interworking: none                  Interworking: none
UP sec ac   Et1/0.2:100(Eth VLAN)       UP mpls 10.55.55.3:1101             UP
            Interworking: none                  Local VC label 23
                                                Remote VC label 17
                                                pw-class: mpls
UP     ac   Se6/0:150(FR DLCI)          UP ac   Se8/0:150(FR DLCI)          UP
            Interworking: none                  Interworking: none
```

The additional fields displayed in the detailed output are self-explanatory.

Related Commands

Command	Description
show atm pvc	Displays all ATM PVCs and traffic information.
show atm vc	Displays all ATM PVCs and SVCs and traffic information.
show atm vp	Displays the statistics for all VPs on an interface or for a specific VP.
show connect	Displays configuration information about drop-and-insert connections that have been configured on a router.
show frame-relay pvc	Displays statistics about PVCs for Frame Relay interfaces.
show interfaces	Displays statistics for all interfaces configured on the router or access server.
show l2tun session	Displays the current state of Layer 2 sessions and protocol information about L2TP control channels.
show mpls l2transport binding	Displays VC label binding information.
show mpls l2transport vc	Displays information about AToM VCs that have been enabled to route Layer 2 packets on a router.

xconnect backup force-switchover

To manually force a switchover to an attachment circuit or a pseudowire peer, use the **xconnect backup force-switchover** command in privileged EXEC mode.

xconnect backup force-switchover interface *interface-info* | **peer** *ip-address vcid*

Syntax Description

interface *interface-info*	Interface information of the interface to switch to.
peer *ip-address vcid*	IP address and virtual circuit (VC) ID of the VC to switch to.

Command Default

The pseudowire VC will not be changed.

Command Modes

Privileged EXEC

Command History

Release	Modification
12.0(31)S	This command was introduced.
12.2(28)SB	This command was integrated into Cisco IOS Release 12.2(28)SB.

Usage Guidelines

You can perform a switchover only to an available member in the redundancy group. That is, if the member being specified in the **xconnect backup force-switchover** command is not available, the command will be rejected.

Examples

The following example shows a Multiprotocol Label Switching (MPLS) xconnect with two redundant peers. The primary xconnect is using IP address 10.55.55.1, VCID 500.

```
Router(config)# interface fastethernet1/0
Router(config-if)# xconnect 10.55.55.1 500 encapsulation mpls
Router(config-if-xconn)# backup peer 10.55.55.2 501
!
Router# xconnect backup force-switchover peer 10.55.55.2 501
```

Entering the **xconnect backup force-switchover** command will cause the router to switch to the pseudowire with an IP address of 10.55.55.2, VCID 501.

To switch back to the primary pseudowire, enter the following command:

```
Router# xconnect backup force-switchover peer 10.55.55.1 500
```

If the xconnect cannot be switched over to the redundant pseudowire specified by the user, the standard redundancy algorithm will run and select either the primary or the highest secondary VC, depending on current availability.

The following example shows a local switching connection with two redundant peers. The primary xconnect is VLAN subinterface FastEthernet0/1.1 using dot1q tag 10. The xconnect is currently established with one of the backup peers when the manual switchover is issued to the primary xconnect.

```
Router(config)# interface FastEthernet0/0
!
Router(config)# interface FastEthernet0/1.1
Router(config-if)# encapsulation dot1Q 10
!
Router(config)# connect eth-vln FastEthernet0/0 FastEthernet0/1.1 interworking ethernet
Router(config-if)# backup peer 10.55.55.2 501
!
Router# xconnect backup force-switchover interface FastEthernet0/1.1
```

Entering the **xconnect backup force-switchover** command will cause the router to switch back to the VLAN subinterface FastEthernet0/1.1. If the xconnect cannot be switched over to the primary VLAN subinterface specified by the user, the standard redundancy algorithm will run and select the highest secondary VC, depending on current availability.

Related Commands

Command	Description
backup delay	Specifies how long a backup pseudowire VC should wait before taking over after the primary pseudowire VC goes down.
backup peer	Configures a redundant peer for a pseudowire VC.

xconnect logging redundancy

To enable system message log (syslog) reporting of the status of the xconnect redundancy group, use the **xconnect logging redundancy** command in global configuration mode. To disable syslog reporting of the status of the xconnect redundancy group, use the **no** form of this command.

xconnect logging redundancy

no xconnect logging redundancy

Syntax Description

This command has no keywords or arguments.

Command Default

Syslog reporting of the status of the xconnect redundancy group is off.

Command Modes

Global configuration

Command History

Release	Modification
12.0(31)S	This command was introduced.
12.2(28)SB	This command was integrated into Cisco IOS Release 12.2(28)SB.

Usage Guidelines

Use this command to enable syslog reporting of the status of the xconnect redundancy group.

Examples

The following example enables syslog reporting of the status of the xconnect redundancy group and shows the messages that are generated during switchover events:

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

Activating the primary member:

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

Activating the backup member:

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

Related Commands

Command	Description
xconnect	Binds an Ethernet, 802.1q VLAN, or Frame Relay attachment circuit to an L2TPv3 pseudowire for xconnect service and enters xconnect configuration mode.

Feature Information for NSF/SSO—L2VPN Pseudowire Redundancy

Table 2 lists the release history for this feature.

Not all commands may be available in your Cisco IOS software release. For release information about a specific command, see the command reference documentation.

Cisco IOS software images are specific to a Cisco IOS software release, a feature set, and a platform. Use Cisco Feature Navigator to find information about platform support and Cisco IOS software image support. Access Cisco Feature Navigator at http://www.cisco.com/go/fn. You must have an account on Cisco.com. If you do not have an account or have forgotten your username or password, click **Cancel** at the login dialog box and follow the instructions that appear.

Note Table 2 lists only the Cisco IOS software release that introduced support for a given feature in a given Cisco IOS software release train. Unless noted otherwise, subsequent releases of that Cisco IOS software release train also support that feature.

Table 2 Feature Information for NSF/SSO—L2VPN Pseudowire Redundancy

Feature Name	Releases	Feature Information
NSF/SSO—L2VPN Pseudowire Redundancy	12.2(28)SB	This feature enables you to set up your network to detect a failure in the network and reroute the L2 service to another endpoint that can continue to provide service. This feature provides stateful switchover and nonstop forwarding support. The active pseudowire does not change after SSO. The following sections provide information about this feature: • Information About NSF/SSO—L2VPN Pseudowire Redundancy, page 4 • How to Configure NSF/SSO—L2VPN Pseudowire Redundancy, page 6 • Configuration Examples for NSF/SSO—L2VPN Pseudowire Redundancy, page 12