



AToM Static Pseudowire Provisioning

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The AToM Static Pseudowire Provisioning feature allows provisioning an Any Transport over Multiprotocol (AToM) label switching static pseudowire without the use of a directed control connection. In environments that do not or cannot use directed control protocols, this feature provides a means for provisioning the pseudowire parameters statically at the Cisco IOS command-line interface (CLI).

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 AToM Static Pseudowire Provisioning](#)” section on page 25.

Finding Support Information for Platforms and Cisco IOS and Catalyst OS Software Images

Use Cisco Feature Navigator to find information about platform support and Cisco IOS and Catalyst OS software image support. To access Cisco Feature Navigator, go to <http://www.cisco.com/go/cfn>. An account on Cisco.com is not required.

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Restrictions for AToM Static Pseudowire Provisioning

The following parameters are exchanged using directed control protocol messages on pseudowires, but cannot be changed using the AToM Static Pseudowire feature introduced in Cisco IOS software Release 12.33(SRB). Instead, the software has preconfigured defaults.

- The maximum number of concatenated ATM cells is set to 1, which means no cell packing is available.
- The Virtual Circuit Connectivity Verification (VCCV) options used for fault detection, isolation, and verification at both ends of the connection are set as follows:
 - Control channel type 1 sets the control word.
 - Control channel type 2 sets the Multiprotocol Label Switching (MPLS) router alert label.
 - Connectivity verification type 2 sets the label switched path (LSP) **ping** command.

Auto-sensing of the virtual circuit type for Ethernet over MPLS is not supported.

Additionally, the following functionality is not supported for static pseudowires:

- Sequence number resynchronization—configured by the sequencing function in the Cisco IOS **pseudowire-class** command—is not supported because the sequence number resynchronization is done when the LDP software sends an LDP Label Release or Withdraw message followed by a Label Request or Mapping message, and static pseudowires do not use LDP.
- Tunnel stitching, because it requires an extension of the Cisco IOS **neighbor** command to start the mode that allows configuring static pseudowire parameters such as remote and local labels, which is not supported in Cisco IOS software Release 12.33(SRB). Note that a tunnel switch point can be configured using a different static label command. The tunnel switch point will not process control words, but label swapping will occur.
- Pseudowire redundancy, because it requires using a directed control protocol between the peer provider edge routers.

Information About AToM Static Pseudowire Provisioning

To provision an AToM static pseudowire, you should understand the following concepts:

- [Pseudowire Provisioning, page 2](#)
- [Benefits of Statically Provisioned Pseudowires, page 3](#)

Pseudowire Provisioning

In software prior to Cisco IOS software Release 12.33(SRB), pseudowires were dynamically provisioned using Label Distribution Protocol (LDP), or another directed control protocol such as Resource Reservation Protocol over traffic-engineered tunnels (RSVP-TE), to exchange the various parameters required for these connections. In environments that do not or cannot use directed control protocols, a means for provisioning the pseudowire parameters statically at the Cisco IOS CLI is provided by the AToM Static Pseudowire feature.

The AToM Static Pseudowire feature is platform-independent, but has been tested on only the Cisco 7600 series routers for Cisco IOS software Release 12.33(SRB).

Benefits of Statically Provisioned Pseudowires

Cisco IOS software release 12.33(SRB) allows provisioning an AToM label switching static pseudowire without the use of a directed control connection. This feature also includes static provisioning of the tunnel label and the pseudowire label.

How to Provision an AToM Static Pseudowire

This section contains the following procedures:

- [Provisioning an AToM Static Pseudowire, page 3](#)
- [Verifying the AToM Static Pseudowire Configuration, page 4](#)

Provisioning an AToM Static Pseudowire

In this configuration task, you use options in the **xconnect** Ethernet interface configuration command to specify a static connection, and **mpls** commands in xconnect mode to statically set the following pseudowire parameters:

- Set the local and remote pseudowire labels
- Enable or disable sending the MPLS control word

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *Ethernet-type interface-number*
4. **xconnect** *peer-ip-address vcid encapsulation mpls manual pw-class class-name*
5. **mpls label** *local-pseudowire-label remote-pseudowire-label*
6. **[no] mpls control-word**
7. **exit**

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.

	Command or Action	Purpose
Step 3	<code>interface Ethernet-type interface-number</code> Example: Router(config)# interface Ethernet 1/0	Enters configuration mode for the specified interface.
Step 4	<code>xconnect peer-ip-address vcid encapsulation mpls manual pw-class class-name</code> Example: Router(config-if)# xconnect 10.131.191.252 100 encapsulation mpls manual pw-class mpls	Configures a static AToM pseudowire and enters xconnect configuration mode where the local and remote pseudowire labels are set.
Step 5	<code>mpls label local-pseudowire-label remote-pseudowire-label</code> Example: Router(config-if-xconn)# mpls label 100 150	Sets the local and remote pseudowire labels . <ul style="list-style-type: none"> The label must be an unused static label within the static label range configured using the mpls label range command. The mpls label command checks the validity of the label entered and displays an error message if it is not valid. The label supplied for the <i>remote-pseudowire-label</i> argument must be the value of the peer PE's local pseudowire label.
Step 6	<code>[no] mpls control-word</code> Example: Router(config-if-xconn)# no mpls control-word	Sets whether or not the MPLS control word is sent. <ul style="list-style-type: none"> This command must be set for Frame Relay data-link connection identifier (DLCI) and ATM adaptation layer 5 (AAL5) attachment circuits. For other attachment circuits, the control word is included by default. If you enable inclusion of the control word, it must be enabled on both ends of the connection for the circuit to work properly. Inclusion of the control word can be explicitly disabled using the no mpls control-word command.
Step 7	<code>exit</code> Example: Router(config-if-xconn)# exit	Exits the configuration mode. Continue entering the exit command at the router prompt until you reach the desired configuration mode.

Verifying the AToM Static Pseudowire Configuration

To verify the AToM static pseudowire configuration, use the **show running-config EXEC** command. To verify that the AToM static pseudowire was provisioned correctly, use the **show mpls l2transport vc detail** and **ping mpls pseudowire EXEC** commands as described in the following steps.

SUMMARY STEPS

1. **show mpls l2transport vc detail**
2. **ping mpls pseudowire ipv4-address vc-id vc-id**

DETAILED STEPS

Step 1 **show mpls l2transport vc detail**

For nonstatic pseudowire configurations, this command lists the type of protocol used to send the MPLS labels (such as LDP). For static pseudowire configuration, the value of the signaling protocol field should be Manual. Following is sample output:

```
Router# show mpls l2transport vc detail

Local interface: Et1/0 up, line protocol up, Ethernet up
  Destination address: 10.0.1.1, VC ID: 200, VC status: up
    Output interface: Et3/0, imposed label stack {17}
    Preferred path: not configured
    Default path:
    Next hop: 10.0.0.2
  Create time: 00:27:27, last status change time: 00:27:24
  Signaling protocol: Manual
    MPLS VC labels: local 17, remote 17
    Group ID: local 0, remote 0
    MTU: local 1500, remote 1500
  Sequencing: receive disabled, send disabled
  VC statistics:
    packet totals: receive 193, send 193
    byte totals:   receive 19728, send 23554
    packet drops:  receive 0, send 0
```

Step 2 **ping mpls pseudowire ipv4-address vc-id vc-id**

Because there is no directed control protocol exchange of parameters on a static pseudowire, both ends of the connection must be correctly configured. One way to detect mismatch of labels or control word options is to send an MPLS pseudowire LSP **ping** command as part of configuration task, and then reconfigure the connection if problems are detected. An exclamation point (!) is displayed when the **ping** command is successfully sent to its destination. An example of command use and output follows:

```
Router# ping mpls pseudowire 10.7.1.2 vc-id 1001

Sending 5, 100-byte MPLS Echos to 10.7.1.2,
  timeout is 2 seconds, send interval is 0 msec:

Codes: '!' - success, 'Q' - request not sent, '.' - timeout,
       'L' - labeled output interface, 'B' - unlabeled output interface,
       'D' - DS Map mismatch, 'F' - no FEC mapping, 'f' - FEC mismatch,
       'M' - malformed request, 'm' - unsupported tlvs, 'N' - no label entry,
       'P' - no rx intf label prot, 'p' - premature termination of LSP,
       'R' - transit router, 'I' - unknown upstream index,
       'X' - unknown return code, 'x' - return code 0

Type escape sequence to abort.
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/2/4 ms
```

Configuration Examples for AToM Static Pseudowire Provisioning

This section contains the following example:

- [Provisioning an AToM Pseudowire: Example, page 6](#)

Provisioning an AToM Pseudowire: Example

The following examples show the configuration commands for an AToM static pseudowire connection between two PEs, PE1 and PE2.

The **mpls label range static** command must be used to configure the static label range prior to provisioning the AToM static pseudowire.

```
Router# configure terminal
Router(config)# mpls label range 200 16000 static 16 199
% Label range changes will take effect at the next reload.
Router(config)#
```

The **mpls ip** command must also be configured on the core-facing interface of both PE1 and PE2 (which is also done for directed control protocol signaled pseudowires). Following is a configuration example:

```
Router(config)# interface Ethernet 0/0
Router(config-if)# description Backbone interface
Router(config-if)# ip address 10.0.0.1 255.255.255.0
Router(config-if)# mpls ip
Router(config-if)# end
```

Following is an example AToM static pseudowire configuration for PE 1:

```
Router(config)# interface Ethernet 1/0
Router(config-if)# no ip address
Router(config-if)# xconnect 10.131.191.251 100 encapsulation mpls manual pw-class mpls
Router(config-if-xconn)# mpls label 100 150
Router(config-if-xconn)# end
```

Following is an example AToM static pseudowire configuration for PE 2:

```
Router(config)# interface Ethernet 1/0
Router(config-if)# no ip address
Router(config-if)# xconnect 10.132.192.252 100 encapsulation mpls manual pw-class mpls
Router(config-if-xconn)# mpls label 150 100
Router(config-if-xconn)# end
```

This feature also allows tunnel labels to be statically configured using the **mpls static binding ipv4 vrf** command. This means that there is no need to use a directed control protocol to provision tunnels and pseudowires. Refer to the [MPLS Static Labels](#) feature module and the *Cisco IOS Multiprotocol Label Switching Command Reference* for information about static labels and the **mpls static binding ipv4 vrf** command.

Additional References

The following sections provide references related to the AToM Static Pseudowire Provisioning feature.

Related Documents

Related Topic	Document Title
Configuring the pseudowire class	Any Transport over MPLS module
MPLS and xconnect commands	Cisco IOS Multiprotocol Label Switching Command Reference , Release 12.2SB

Standards

Standard	Title
IETF draft-ietf-pwe3-vccv-12.txt	<i>Pseudo Wire Virtual Circuit Connectivity Verification (VCCV)</i>

MIBs

MIB	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

RFC	Title
RFC 3036	<i>LDP Specification</i>

Technical Assistance

Description	Link
The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password. If you have a valid service contract but do not have a user ID or password, you can register on Cisco.com.	http://www.cisco.com/techsupport

Command Reference

This section documents only the following new or modified commands.

- [mpls control-word](#)
- [mpls label](#)
- [show mpls l2transport vc](#)
- [xconnect](#)

mpls control-word

To enable the Multiprotocol Label Switching (MPLS) control word in an Any Transport over MPLS (AToM) static pseudowire connection, use the **mpls control-word** command in xconnect configuration mode. To disable the control word, use the **no** form of this command.

mpls control-word

no mpls control-word

Syntax Description This command has no arguments or keywords.

Command Default The control word is included in connections.

Command Modes Xconnect configuration

Command History	Release	Modification
	12.2(33)SRB	This command was introduced.

Usage Guidelines This command is used when configuring AToM static pseudowires, and is mandatory when configuring Frame Relay data-link connection identifier (DLCI) and ATM adaptation layer 5 (AAL5) attachment circuits.

Because the control word is included by default, it may be necessary to explicitly disable this command in AToM static pseudowire configurations.

When the **mpls control-word** command is used in static pseudowire configurations, the command must be configured the same way on both ends of the connection to work correctly, or else the provider edge routers will not be able to exchange control messages to negotiate inclusion or exclusion of the control word.

Examples The following example shows the configuration for both sides of an AToM static pseudowire connection:

```
Router# configure terminal
Router(config)# interface Ethernet 1/0
Router(config-if)# xconnect 10.131.191.251 100 encapsulation mpls manual pw-class mpls
Router(config-if-xconn)# mpls label 100 150
Router(config-if-xconn)# no mpls control-word
Router(config-if-xconn)# exit
Router(config-if)# exit
```

```
Router# configure terminal
Router(config)# interface Ethernet 1/0
Router(config-if)# xconnect 10.132.192.252 100 encapsulation mpls manual pw-class mpls
Router(config-if-xconn)# mpls label 150 100
```

mpls control-word

```
Router(config-if-xconn)# no mpls control-word
Router(config-if-xconn)# exit
Router(config-if)# exit
```

Related Commands	Command	Description
	mpls label	Configures an AToM static pseudowire connection by defining local and remote pseudowire labels.
	mpls label range	Configures the range of local labels available for use on packet interfaces.
	show mpls l2transport vc	Displays information about AToM VCs and AToM static pseudowires that have been enabled to route Layer 2 packets on a router.
	xconnect	Binds an attachment circuit to a pseudowire, and configures an AToM static pseudowire.

mpls label

To configure an Any Transport over MPLS (AToM) static pseudowire connection by defining local and remote circuit labels, use the **mpls label** command in xconnect configuration mode. To remove the local and remote pseudowire labels, use the **no** form of this command.

mpls label *local-pseudowire-label remote-pseudowire-label*

no mpls label

Syntax Description	<i>local-pseudowire-label</i>	An unused static label that is within the range defined by the mpls label range command.
	<i>remote-pseudowire-label</i>	The value of the peer provider edge router's local pseudowire label.

Command Default No default labels.

Command Modes Xconnect configuration

Command History	Release	Modification
	12.2(33)SRB	This command was introduced.

Usage Guidelines This command is mandatory when configuring AToM static pseudowires, and must be configured at both ends of the connection.

The **mpls label** command checks the validity of the local pseudowire label and will generate an error message if the label is invalid.

Examples The following example shows configurations for both ends of an AToM static pseudowire connection:

```
Router# configure terminal
Router(config)# interface Ethernet 1/0
Router(config-if)# no ip address
Router(config-if)# xconnect 10.131.191.251 100 encapsulation mpls manual pw-class mpls
Router(config-if-xconn)# mpls label 100 150
Router(config-if-xconn)# exit
Router(config-if)# exit
```

```
Router# configure terminal
Router(config)# interface Ethernet 1/0
Router(config-if)# no ip address
Router(config-if)# xconnect 10.132.192.252 100 encapsulation mpls manual pw-class mpls
Router(config-if-xconn)# mpls label 150 100
Router(config-if-xconn)# exit
Router(config-if)# exit
```

Related Commands	Command	Description
	mpls control-word	Enables sending the MPLS control word in an AToM static pseudowire connection.
	mpls label range	Configures the range of local labels available for use on packet interfaces.
	show mpls l2transport vc	Displays information about AToM VCs and AToM static pseudowires that have been enabled to route Layer 2 packets on a router.
	xconnect	Binds an attachment circuit to a pseudowire, and configures an AToM static pseudowire.

show mpls l2transport vc

To display information about Any Transport over MPLS (AToM) virtual circuits (VCs) and static pseudowires that have been enabled to route Layer 2 packets on a router, use the **show mpls l2transport vc** command in privileged EXEC mode.

```
show mpls l2transport vc [vcid vc-id | vcid vc-id-min vc-id-max] [interface name
[local-circuit-id]] [destination ip-address | name] [detail]
```

Syntax Description	
vcid	(Optional) A specific VC ID to display.
<i>vc-id</i>	(Optional) The VC ID number.
<i>vc-id-min</i> <i>vc-id-max</i>	(Optional) A range of VCs to display. The range is from 1 to 4294967295.
interface	(Optional) The interface or subinterface of the router that has been enabled to transport Layer 2 packets. Use this keyword to display information about the VCs that have been assigned VC IDs on that interface or subinterface.
<i>name</i>	(Optional) The name of the interface or subinterface.
<i>local-circuit-id</i>	(Optional) The number assigned to the local circuit. This argument value is supported only with the following transport types: <ul style="list-style-type: none"> • For Frame Relay, enter the data-link connection identifier (DLCI) of the permanent virtual circuit (PVC). • For ATM adaptation layer 5 (AAL5) and cell relay, enter the virtual path identifier (VPI) or virtual channel identifier (VCI) of the PVC. • For Ethernet VLANs, enter the VLAN number.
destination	(Optional) The remote router.
<i>ip-address</i>	(Optional) The IP address of the remote router.
<i>name</i>	(Optional) The name assigned to the remote router.
detail	(Optional) The detailed information about the VCs.

Command Modes	Privileged EXEC
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Command History	Release	Modification
	12.1(8a)E	This command was introduced.
	12.0(21)ST	This command was integrated into Cisco IOS Release 12.0(21)ST.
	12.0(22)S	This command was implemented on the Cisco 10720 router.
	12.0(23)S	The interface and destination keywords were added.
	12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
	12.2(14)SX	This command was implemented on the Supervisor Engine 720.
	12.2(14)SZ	This command was integrated into Cisco IOS Release 12.2(14)SZ.
	12.2(15)T	This command was integrated into Cisco IOS Release 12.2(15)T.
	12.2(18)S	This command was implemented on Cisco 7304 routers.

12.0(25)S	This command was updated with new output and fields to display information about tunnel selection and ATM cell relay port mode.
12.2(17d)SXB	Support for this command on the Supervisor Engine 2 was extended to Release 12.2(17d)SXB.
12.2(25)S	This command was updated with new output and fields for nonstop forwarding (NSF), stateful switchover (SSO), and graceful restart (GR) abilities.
12.2(28)SB	This command was implemented on the Cisco 10000 series routers. Example output was changed for the Cisco 10000 series router, and two fields (SSO Descriptor and SSM segment/switch IDs) were removed from the output, because they are not supported.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2(33)SRB	This command was updated to include forwarding equivalence class (FEC) 129 signaling information for pseudowires that are configured through VPLS Autodiscovery, and to support provisioning AToM static pseudowires.

Usage Guidelines

If you do not specify any keywords or arguments, the command displays a summary of all the VCs.

Examples

The output of the commands varies, depending on the type of Layer 2 packets being transported over the AToM VCs.

The following sample output shows information about the interfaces and VCs that have been configured to transport various Layer 2 packets on the router:

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

Local intf	Local circuit	Dest address	VC ID	Status
Se5/0	FR DLCI 55	10.0.0.1	55	UP
AT4/0	ATM AAL5 0/100	10.0.0.1	100	UP
AT4/0	ATM AAL5 0/200	10.0.0.1	200	UP
AT4/0.300	ATM AAL5 0/300	10.0.0.1	300	UP

[Table 1](#) describes the fields shown in the display.

Table 1 *show mpls l2transport vc Field Descriptions*

Field	Description
Local intf	The interface on the local router that has been enabled to transport Layer 2 packets.
Local circuit	The type and number (if applicable) of the local circuit. The output shown in this column varies, depending on the transport type: <ul style="list-style-type: none"> • For Frame Relay, the output shows the DLCI of the PVC. • For ATM cell relay and AAL5, the output shows the VPI/VCI of the PVC. • For Ethernet VLANs, the output shows the VLAN number. • For PPP and High-Level Data Link Control (HDLC), the output shows the interface number.
Dest address	The IP address of the remote router’s interface that is the other end of the VC.
VC ID	The virtual circuit identifier assigned to one of the interfaces on the router.
Status	The status of the VC. The status can be one of the following: <ul style="list-style-type: none"> • ADMIN DOWN—The VC has been disabled by a user. • DOWN—The VC is not ready to carry traffic between the two VC endpoints. Use the detail keyword to determine the reason that the VC is down. • RECOVERING—The VC is recovering from a stateful switchover. • UP—The VC is in a state where it can carry traffic between the two VC endpoints. A VC is up when both imposition and disposition interfaces are programmed. <ul style="list-style-type: none"> – The disposition interface is programmed if the VC has been configured and the client interface is up. – The imposition interface is programmed if the disposition interface is programmed and you have a remote VC label and an Interior Gateway Protocol (IGP) label. The IGP label can be implicit null in a back-to-back configuration. An IGP label means there is a label switched path (LSP) to the peer.

The following example shows information about the NSF/SSO and graceful restart capability. The SSO portion indicates when checkpointing data has either been sent (on active) or received (on standby). When SSO data has not been successfully sent or has been released, the SSO information is not shown.

```
Router# show mpls l2transport vc detail

Local interface: Fa5/1/1.2 down, line protocol down, Eth VLAN 2 up
Destination address: 10.55.55.2, VC ID: 1002, VC status: down
Output interface: Se4/0/3, imposed label stack {16}
Preferred path: not configured
Default path: active
Tunnel label: imp-null, next hop point2point
Create time: 02:03:29, last status change time: 02:03:26
Signaling protocol: LDP, peer 10.55.55.2:0 down
MPLS VC labels: local 16, remote unassigned
```

show mpls l2transport vc

```

Group ID: local 0, remote unknown
MTU: local 1500, remote unknown
Remote interface description:
Sequencing: receive disabled, send disabled
SSO Descriptor: 10.55.55.2/1002, local label: 16
SSM segment/switch IDs: 12290/8193, PWID: 8193
VC statistics:
packet totals: receive 0, send 0
byte totals:   receive 0, send 0
packet drops:  receive 0, send 0

```

The following example shows information provided when an AToM static pseudowire has been provisioned and the **show mpls l2transport vc detail** command is used to check the configuration. The Signaling protocol field specifies Manual, because a directed control protocol such as Label Distribution Protocol (LDP) cannot be used to exchange parameters on static pseudowires. The remote interface description field seen for nonstatic pseudowire configurations is not displayed, because remote information is exchanged using signaling between the PEs and this is not done on static pseudowires.

```

Router# show mpls l2transport vc detail

Local interface: Et1/0 up, line protocol up, Ethernet up
  Destination address: 10.1.1.2, VC ID: 100, VC status: up
  Output interface: Et2/0, imposed label stack {10003 150}
  Preferred path: not configured
  Default path: active
  Next hop: 10.0.0.2
  Create time: 00:18:57, last status change time: 00:16:10
  Signaling protocol: Manual
  MPLS VC labels: local 100, remote 150
  Group ID: local 0, remote 0
  MTU: local 1500, remote 1500
  Remote interface description:
  Sequencing: receive disabled, send disabled
  VC statistics:
  packet totals: receive 219, send 220
  byte totals:   receive 20896, send 26694
  packet drops:  receive 0, send 0

```

Table 2 describes the significant fields shown in the displays.

Table 2 *show mpls l2transport vc detail Field Descriptions*

Field	Description
Local interface	Interface on the local router that has been enabled to send and receive Layer 2 packets. The interface varies, depending on the transport type. The output also shows the status of the interface.
line protocol	Status of the line protocol on the edge-facing interface.
Destination address	IP address of the remote router specified for this VC. You specify the destination IP address as part of the mpls l2transport route command.
VC ID	Virtual circuit identifier assigned to the interface on the router.

Table 2 *show mpls l2transport vc detail Field Descriptions (continued)*

Field	Description
VC status	<p>Status of the VC, which is one of the following:</p> <ul style="list-style-type: none"> • Admin down—The VC has been disabled by a user. • Down—The VC is not ready to carry traffic between the two VC endpoints. • Up—The VC is in a state where it can carry traffic between the two VC endpoints. A VC is up when both imposition and disposition interfaces are programmed. <ul style="list-style-type: none"> – The disposition interface is programmed if the VC has been configured and the client interface is up. – The imposition interface is programmed if the disposition interface is programmed and a remote VC label and an IGP label exist. The IGP label can be an implicit null in a back-to-back configuration. (An IGP label means there is an LSP to the peer.)
Output interface	Interface on the remote router that has been enabled to transmit and receive Layer 2 packets.
imposed label stack	Summary of the MPLS label stack used to direct the VC to the PE router.
Preferred path	Path that was assigned to the VC and the status of that path. The path can be a Multiprotocol Label Switching (MPLS) traffic engineering tunnel or an IP address or hostname of a peer provider edge (PE) router.
Default path	<p>Status of the default path, which can be disabled or active.</p> <p>By default, if the preferred path fails, the router uses the default path. However, you can disable the router from using the default path when the preferred path fails by specifying the disable-fallback keyword with the preferred-path command.</p>

Table 2 *show mpls l2transport vc detail Field Descriptions (continued)*

Field	Description
Tunnel label	<p>An IGP label used to route the packet over the MPLS backbone to the destination router with the egress interface. The first part of the output displays the type of label. The second part of the output displays the route information.</p> <p>The tunnel label information can display any of the following states:</p> <ul style="list-style-type: none"> • imp-null: Implicit null means that the provider (P) router is absent and the tunnel label will not be used. Alternatively, imp-null can signify traffic engineering tunnels between the PE routers. • unassigned: The label has not been assigned. • no route: The label is not in the routing table. • no adjacency: The adjacency for the next hop is missing. • not ready, no route: An IP route for the peer does not exist in the routing table. • not ready, not a host table: The route in the routing table for the remote peer router is not a host route. • not ready, Cisco Express Forwarding disabled: Cisco Express Forwarding is disabled. • not ready, LFIB disabled: The MPLS switching subsystem is disabled. • not ready, Label Forwarding Information Base (LFIB) entry present: The tunnel label exists in the LFIB, but the VC is down.
Create time	The time (in hours, minutes, and seconds) when the VC was provisioned.
last status change time	Last time (in hours, minutes, and seconds) the VC state changed.
Signaling protocol	Type of protocol used to send the MPLS labels on dynamically configured connections. The output also shows the status of the peer router. For AToM statically configured pseudowires, the field indicates Manual, because there is no exchange of labels using a directed control protocol such as LDP.
MPLS VC labels	Local VC label is a disposition label, which determines the egress interface of an arriving packet from the MPLS backbone. The remote VC label is a disposition VC label of the remote peer router.
Group ID	Local group ID is used to group VCs locally. The remote group ID is used by the peer to group several VCs.
MTU	Maximum transmission unit specified for the local and remote interfaces.
Remote interface description	Interface on the remote router that has been enabled to transmit and receive Layer 2 packets.
Sequencing	Indicates whether sequencing of out-of-order packets is enabled or disabled.
SSO Descriptor	Identifies the VC for which the information was checkpointed.
local label	The value of the local label that was checkpointed (that is, sent on the active Route Processor [RP], and received on the standby RP).

Table 2 *show mpls l2transport vc detail Field Descriptions (continued)*

Field	Description
SSM segment/switch IDs	The IDs used to refer to the control plane and data plane for this VC. This data is not for customer use but for Cisco personnel for troubleshooting purposes. When the Source Specific Multicast (SSM) IDs are followed by the word “used,” the checkpointed data has been successfully sent and not released.
PWID	The pseudowire ID used in the data plane to correlate the switching context for the segment mentioned with the MPLS switching context. This data is not for customer use but for Cisco personnel for troubleshooting purposes.
packet totals	Number of packets sent and received. Received packets are those AToM packets received from the MPLS core. Sent packets are those AToM packets sent to the MPLS core. This does not include dropped packets.
byte totals	Number of bytes sent and received from the core-facing interface, including the payload, control word if present, and AToM VC label.
packet drops	Number of dropped packets.

The following example shows the command output of the **show mpls l2transport vc detail** command with when VPLS Autodiscovery has configured the VPLS pseudowires. The output that is specific to VPLS Autodiscovery is show in bold.

```
Router# show mpls l2transport vc detail

Local interface: VFI my_test VFI up
MPLS VC type is VFI, interworking type is Ethernet
Destination address: 10.3.3.1, VC ID: 123456, VC status: up
Next hop PE address: 10.55.55.2
Output interface: Et3/0, imposed label stack {17 19}
Preferred path: not configured
Default path:
Next hop: 10.1.0.2
Create time: 2d05h, last status change time: 2d05h

Signaling protocol: LDP, peer 10.55.55.2:0 up
MPLS VC labels: local 21, remote 19
AGI: type 1, len 8, 0000 3333 4F4E 44C4
Local AII: type 1, len 4, 0909 0909 (10.9.9.9)
Remote AII: type 1, len 4, 0303 0301 (10.3.3.3)
Group ID: local 0, remote 0
MTU: local 1500, remote 1500
Remote interface description:
Sequencing: receive disabled, send disabled
VC statistics:
packet totals: receive 22611, send 22611
byte totals: receive 2346570, send 2853581
packet drops: receive 0, send 0
```

Table 3 describes the fields shown in the display.

Table 3 *show mpls l2transport vc detail Field Descriptions for VPLS Autodiscovery*

Field	Description
Next hop PE address	The IP address of the next-hop router.
AGI	The attachment group identifier (AGI).
Local AII	The attachment individual identifier (AII). The local IP address used for signaling.
Remote AII	The remote IP address used for signaling. This address is the provisioned IP address, which might not be the same as the LDP peer IP address.

Related Commands

Command	Description
show mpls l2transport summary	Displays summary information about VCs that have been enabled to route AToM Layer 2 packets on a router.
show xconnect	Displays information about xconnect attachment circuits and pseudowires

xconnect

To bind an attachment circuit to a pseudowire, and to configure an Any Transport over MPLS (AToM) static pseudowire, use the **xconnect** command in one of the supported configuration modes. To restore the default values, use the **no** form of this command.

```
xconnect peer-ip-address vc-id encapsulation {l2tpv3 [manual] | mpls [manual] } [pw-class
pw-class-name] [sequencing {transmit | receive | both}]
```

```
no xconnect
```

Syntax Description	
<i>peer-ip-address</i>	IP address of the remote provider edge (PE) peer. The remote router ID can be any IP address, as long as it is reachable.
<i>vc-id</i>	The 32-bit identifier of the virtual circuit (VC) between the PE routers.
encapsulation { l2tpv3 [manual] mpls [manual] }	Specifies the tunneling method to encapsulate the data in the pseudowire: <ul style="list-style-type: none"> l2tpv3—Specifies Layer 2 Tunneling Protocol, version 3 (L2TPv3) as the tunneling method. mpls—Specifies Multiprotocol Label Switching (MPLS) as the tunneling method. manual—Specifies that no signaling is to be used in the attachment circuit. This keyword places the router in xconnect configuration mode for manual configuration of the attachment circuit. Use this keyword to manually configure an AToM or L2TPv3 static pseudowire.
pw-class <i>pw-class-name</i>	(Optional) Specifies the pseudowire class for advanced configuration.
sequencing	(Optional) Sets the sequencing method to be used for packets received or sent. This keyword is not supported with the AToM Static Pseudowire Provisioning feature.
transmit	Sequences data packets received from the attachment circuit.
receive	Sequences data packets sent into the attachment circuit.
both	Sequences data packets that are both sent and received from the attachment circuit.

Command Default The attachment circuit is not bound to the pseudowire.

Command Modes Connect configuration
Interface configuration
l2transport configuration (for ATM)

Command History

Release	Modification
12.0(23)S	This command was introduced.
12.0(28)S	Support was added for Multilink Frame Relay connections.
12.3(2)T	This command was integrated into Cisco IOS Release 12.3(2)T.
12.2(25)S	This command was integrated into Cisco IOS Release 12.2(25)S.
12.2(27)SBC	This command was integrated into Cisco IOS Release 12.2(27)SBC.
12.4(11)T	This command was integrated into Cisco IOS Release 12.4(11)T.
12.2(33)SRB	This command was updated to add support for AToM static pseudowires, and so that the remote router ID need not be the label distribution protocol (LDP) router ID of the peer.

Usage Guidelines

The combination of the *peer-ip-address* and *vcid* arguments must be unique on the router. Each xconnect configuration must have a unique combination of *peer-ip-address* and *vcid* configuration.

**Note**

If the remote router is a Cisco 12000 series Internet router, the *peer-ip-address* argument must specify a loopback address on that router.

The same *vcid* value that identifies the attachment circuit must be configured using the **xconnect** command on the local and remote PE router. The VC ID creates the binding between a pseudowire and an attachment circuit.

With the introduction of VPLS Autodiscovery in Cisco IOS Release 12.2(33)SRB, the remote router ID need not be the LDP router ID. The address you specify can be any IP address on the peer, as long as it is reachable. When VPLS Autodiscovery discovers peer routers for the VPLS, the peer router addresses might be any routable address.

**Note**

The VPLS Autodiscovery feature is not supported with L2TPv3.

For L2TPv3, to manually configure the settings used in the attachment circuit, use the **manual** keyword in the **xconnect** command. This configuration is called a static session. The router is placed in xconnect configuration mode, and you can then configure the following options:

- Local and remote session identifiers (using the **l2tp id** command) for local and remote PE routers at each end of the session.
- Size of the cookie field used in the L2TPv3 headers of incoming (sent) packets from the remote PE peer router (using the **l2tp cookie local** command).
- Size of the cookie field used in the L2TPv3 headers of outgoing (received) L2TP data packets (using the **l2tp cookie remote** command).
- Interval used between sending hello keepalive messages (using the **l2tp hello** command).

For L2TPv3, if you do not enter the **encapsulation l2tpv3 manual** keywords in the **xconnect** command, the data encapsulation type for the L2TPv3 session is taken from the encapsulation type configured for the pseudowire class specified with the **pseudowire-class pw-class-name** command.

The **pw-class** keyword with the *pw-class-name* value binds the xconnect configuration of an attachment circuit to a specific pseudowire class. In this way, the pseudowire class configuration serves as a template that contains settings used by all attachment circuits bound to it with the **xconnect** command.

Software prior to Cisco IOS software release 12.33(SRB) configured pseudowires dynamically using Label Distribution Protocol (LDP) or another directed control protocol to exchange the various parameters required for these connections. In environments that do not or cannot use directed control protocols, the **xconnect** command allows provisioning an AToM static pseudowire. Use the **manual** keyword in the **xconnect** command to place the router in xconnect configuration mode. MPLS pseudowire labels are configured using the **mpls label** and (optionally) **mpls control-word** commands in xconnect configuration mode.

Examples

The following example configures xconnect service for an Ethernet interface by binding the Ethernet circuit to the pseudowire named 123 with a remote peer 10.0.3.201. The configuration settings in the pseudowire class named vlan-xconnect are used.

```
Router(config)# interface Ethernet0/0.1
Router(config-if)# xconnect 10.0.3.201 123 pw-class vlan-xconnect
```

The following example enters xconnect configuration mode and manually configures L2TPv3 parameters for the attachment circuit:

```
Router(config)# interface Ethernet 0/0
Router(config-if)# xconnect 10.0.3.201 123 encapsulation l2tpv3 manual pw-class ether-pw
Router(config-if-xconn) l2tp id 222 111
Router(config-if-xconn) l2tp cookie local 4 54321
Router(config-if-xconn) l2tp cookie remote 4 12345
Router(config-if-xconn) l2tp hello l2tp-defaults
```

The following example enters xconnect configuration mode and manually configures an AToM static pseudowire. The example shows the configuration for only one side of the connection; the configurations on each side of the connection must be symmetrical.

```
Router# configure terminal
Router(config)# interface Ethernet 1/0
Router(config-if)# no ip address
Router(config-if)# xconnect 10.131.191.251 100 encapsulation mpls manual pw-class mpls
Router(config-if-xconn)# mpls label 100 150
Router(config-if-xconn)# exit
Router(config-if)# exit
```

Related Commands

Command	Description
l2tp cookie local	Configures the size of the cookie field used in the L2TPv3 headers of incoming packets received from the remote PE peer router.
l2tp cookie remote	Configures the size of the cookie field used in the L2TPv3 headers of outgoing packets sent from the local PE peer router.
l2tp hello	Specifies the use of a hello keepalive setting contained in a specified L2TP class configuration for a static L2TPv3 session.
l2tp id	Configures the identifiers used by the local and remote provider edge routers at each end of an L2TPv3 session.
l2tp-class	Configures a template of L2TP control plane configuration settings that can be inherited by different pseudowire classes.
mpls control-word	Enables the MPLS control word in an AToM static pseudowire connection.
mpls label	Configures an AToM static pseudowire connection by defining local and remote pseudowire labels.
mpls label range	Configures the range of local labels available for use on packet interfaces.

Command	Description
pseudowire-class	Configures a template of pseudowire configuration settings used by the attachment circuits transported over a pseudowire.
show xconnect	Displays information about xconnect attachment circuits and pseudowires.

Feature Information for AToM Static Pseudowire Provisioning

Table 4 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.

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Note

Table 4 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 4 Feature Information for AToM Static Pseudowire Provisioning

Feature Name	Releases	Feature Information
AToM Static Pseudowire Provisioning	12.2(33)SRB	<p>This feature allows provisioning an AToM static pseudowire without the use of a directed control protocol connection.</p> <p>The AToM Static Pseudowire feature is platform-independent, but has been tested on only the Cisco 7500 series routers for Cisco IOS software Release 12.33(SRB).</p> <p>The following commands were introduced or modified by this feature: mpls control-word, mpls label, show mpls l2transport vc, xconnect.</p>

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