Any Transport over MPLS: Tunnel Selection

First Published: April 14, 2003
Last Updated: February 19, 2007

The Any Transport over MPLS: Tunnel Selection feature allows you to specify the path that Any Transport over MPLS (AToM) traffic uses. You can specify either a Multiprotocol Label Switching (MPLS) traffic engineering tunnel or a destination IP address and Domain Name System (DNS) name. If the specified path is unreachable, you can specify that the virtual circuits (VCs) should use the default path, which is the path that MPLS Label Distribution Protocol (LDP) uses for signaling. The option of having a backup LDP path is enabled by default; you must explicitly disable it.

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 Any Transport over MPLS: Tunnel Selection" section on page 13.

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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Prerequisites for Any Transport over MPLS: Tunnel Selection

For the Cisco 7600 series router, see the following documents for prerequisites:

- *Configuring PFC3BXL and PFC3B Mode Multiprotocol Label Switching*
- *Configuring Multiprotocol Label Switching on the Optical Services Modules*

Restrictions for Any Transport over MPLS: Tunnel Selection

This feature is supported only on the Cisco 7600 series router in Cisco IOS Release 12.2(33)SRA and later releases.. For the Cisco 7600 series router, see the following documents for restrictions:

- *Configuring PFC3BXL and PFC3B Mode Multiprotocol Label Switching*
- *Configuring Multiprotocol Label Switching on the Optical Services Modules*

Information About Any Transport over MPLS: Tunnel Selection

This feature allows you to specify the path that Any Transport over MPLS (AToM) traffic uses. You can specify either a Multiprotocol Label Switching (MPLS) Traffic Engineering tunnel or a destination IP address and Domain Name System (DNS) name. If the specified path is unreachable, you can specify that the virtual circuits (VCs) should use the default path, which is the path that MPLS Label Distribution Protocol (LDP) used for signaling. This option is enabled by default; you must explicitly disable it.

How to Configure Any Transport over MPLS: Tunnel Selection

Configuring Any Transport over MPLS: Tunnel Selection

You configure tunnel selection when you set up a pseudowire class. You enable tunnel selection with the **preferred-path** command. Then you apply the pseudowire class to an interface that has been configured to transport AToM packets.

The following guidelines provide more information about configuring tunnel selection:

- The **preferred-path** command is available only if the pseudowire encapsulation type is MPLS.
- This feature is enabled when you exit from pseudowire submode.
- The selected path should be a label switched path (LSP) destined to the peer PE router.
- The selected tunnel must be an MPLS TE tunnel.
- If you select a tunnel, the tunnel tailend must be on the remote provider edge (PE) router.

- If you specify an IP address, that address must be the IP address of the loopback interface on the remote PE router. The address must have a /32 mask. There must be an LSP destined to that selected address. The LSP need not be a TE tunnel.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **pseudowire-class** *name*
4. **encapsulation mpls**
5. **preferred-path** {**interface tunnel** *tunnel-number* | **peer** {*ip-address* | *host-name*}} [**disable-fallback**]
6. **exit**
7. **interface** *slot/port*
8. **encapsulation** *encapsulation-type*
9. **xconnect** *peer-router-id vcid* **pw-class** *name*

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 ts1`	Establishes a pseudowire class with a name that you specify and enters pseudowire configuration mode.
Step 4	**encapsulation mpls** **Example:** `Router(config-pw)# encapsulation mpls`	Specifies the tunneling encapsulation. For AToM, the encapsulation type is **mpls**.
Step 5	**preferred-path** {**interface tunnel** *tunnel-number* | **peer** {*ip-address* | *host-name*}} [**disable-fallback**] **Example:** `Router(config-pw)# preferred path peer 10.18.18.18`	Specifies the MPLS traffic engineering tunnel or IP address or host name to be used as the preferred path.

	Command or Action	Purpose
Step 6	**exit** **Example:** `Router(config-pw)# exit`	Exits pseudowire configuration mode.
Step 7	**interface** *slot/port* **Example:** `Router(config)# interface atm1/1`	Specifies an interface and enters interface configuration mode.
Step 8	**encapsulation** *encapsulation-type* **Example:** `Router(config-if)# encapsulation aal5`	Specifies the encapsulation for the interface.
Step 9	**xconnect** *peer-router-id vcid* **pw-class** *name* **Example:** `Router(config-if)# xconnect 10.0.0.1 123 pw-class ts1`	Binds the attachment circuit to a pseudowire VC.

Configuration Examples for Any Transport over MPLS: Tunnel Selection

This section contains the following configuration example:

Configuring Tunnel Selection: Example

The following example sets up two preferred paths for PE1. One preferred path specifies an MPLS traffic engineering tunnel. The other preferred path specifies an IP address of a loopback address on PE2. There is a static route configured on PE1 that uses a TE tunnel to reach the IP address on PE2.

Router PE1

```
mpls label protocol ldp
mpls traffic-eng tunnels
tag-switching tdp router-id Loopback0
pseudowire-class pw1
 encapsulation mpls
 preferred-path interface Tunnel1 disable-fallback
!
pseudowire-class pw2
 encapsulation mpls
 preferred-path peer 10.18.18.18
!
interface Loopback0
```

```
 ip address 10.2.2.2 255.255.255.255
 no ip directed-broadcast
 no ip mroute-cache
!
interface Tunnel1
 ip unnumbered Loopback0
 no ip directed-broadcast
 tunnel destination 10.16.16.16
 tunnel mode mpls traffic-eng
 tunnel mpls traffic-eng priority 7 7
 tunnel mpls traffic-eng bandwidth 1500
 tunnel mpls traffic-eng path-option 1 explicit name path-tu1
!
interface Tunnel2
 ip unnumbered Loopback0
 no ip directed-broadcast
 tunnel destination 10.16.16.16
 tunnel mode mpls traffic-eng
 tunnel mpls traffic-eng priority 7 7
 tunnel mpls traffic-eng bandwidth 1500
 tunnel mpls traffic-eng path-option 1 dynamic
!
interface gigabitethernet0/0/0
 no ip address
 no ip directed-broadcast
 no negotiation auto
!
interface gigabitethernet0/0/0.1
 encapsulation dot1Q 222
 no ip directed-broadcast
 xconnect 10.16.16.16 101 pw-class pw1
!
interface ATM1/0/0
 no ip address
 no ip directed-broadcast
 no atm enable-ilmi-trap
 no atm ilmi-keepalive
 pvc 0/50 l2transport
  encapsulation aal5
  xconnect 10.16.16.16 150 pw-class pw2
!
interface gigabitEthernet2/0/1
 ip address 10.0.0.1 255.255.255.0
 no ip directed-broadcast
 tag-switching ip
 mpls traffic-eng tunnels
 ip rsvp bandwidth 15000 15000
!
router ospf 1
 log-adjacency-changes
 network 10.0.0.0 0.0.0.255 area 0
 network 10.2.2.2 0.0.0.0 area 0
 mpls traffic-eng router-id Loopback0
 mpls traffic-eng area 0
!
ip route 10.18.18.18 255.255.255.255 Tunnel2
!
ip explicit-path name path-tu1 enable
 next-address 10.0.0.1
 index 3 next-address 10.0.0.1
```

PE2

```
mpls label protocol ldp
```

```
mpls traffic-eng tunnels
mpls ldp router-id Loopback0
interface Loopback0
 ip address 10.16.16.16 255.255.255.255
 no ip directed-broadcast
 no ip mroute-cache
!
interface Loopback2
 ip address 10.18.18.18 255.255.255.255
 no ip directed-broadcast
!
interface gigabitEthernet3/1
 ip address 10.0.0.2 255.255.255.0
 no ip directed-broadcast
 mpls traffic-eng tunnels
 mpls ip
 no cdp enable
 ip rsvp bandwidth 15000 15000
!
interface gigabitEthernet3/3
 no ip address
 no ip directed-broadcast
 no cdp enable
!
interface gigabitEthernet3/3.1
 encapsulation dot1Q 222
 no ip directed-broadcast
 no cdp enable
 mpls l2transport route 10.2.2.2 101
!
interface ATM5/0
 no ip address
 no ip directed-broadcast
 no atm enable-ilmi-trap
 no atm ilmi-keepalive
 pvc 0/50 l2transport
  encapsulation aal5
  xconnect 10.2.2.2 150 encapsulation mpls
!
router ospf 1
 log-adjacency-changes
 network 10.0.0.0 0.0.0.255 area 0
 network 10.16.16.16 0.0.0.0 area 0
 mpls traffic-eng router-id Loopback0
 mpls traffic-eng area 0
```

Verifying the Configuration: Example

In the following example, the **show mpls l2transport vc** command shows the following information (in bold) about the VCs:

- VC 101 has been assigned a preferred path called Tunnel1. The default path is disabled because the preferred path specified that the default path should not be used if the preferred path fails.
- VC 150 has been assigned an IP address of a loopback address on PE2. The default path can be used if the preferred path fails.

```
Router# show mpls l2transport vc detail

Local interface: Gi0/0/0.1 up, line protocol up, Eth VLAN 222 up
  Destination address: 10.16.16.16, VC ID: 101, VC status: up
    Preferred path: Tunnel1,  active
```

```
    Default path: disabled
    Tunnel label: 3, next hop point2point
    Output interface: Tu1, imposed label stack {17 16}
  Create time: 00:27:31, last status change time: 00:27:31
  Signaling protocol: LDP, peer 10.16.16.16:0 up
    MPLS VC labels: local 25, remote 16
    Group ID: local 0, remote 6
    MTU: local 1500, remote 1500
    Remote interface description:
  Sequencing: receive disabled, send disabled
  VC statistics:
    packet totals: receive 10, send 10
    byte totals:   receive 1260, send 1300
    packet drops:  receive 0, send 0

Local interface: AT1/0/0 up, line protocol up, ATM AAL5 0/50 up
  Destination address: 10.16.16.16, VC ID: 150, VC status: up
    Preferred path: 10.18.18.18, active
    Default path: ready
    Tunnel label: 3, next hop point2point
    Output interface: Tu2, imposed label stack {18 24}
  Create time: 00:15:08, last status change time: 00:07:37
  Signaling protocol: LDP, peer 10.16.16.16:0 up
    MPLS VC labels: local 26, remote 24
    Group ID: local 2, remote 0
    MTU: local 4470, remote 4470
    Remote interface description:
  Sequencing: receive disabled, send disabled
  VC statistics:
    packet totals: receive 0, send 0
    byte totals:   receive 0, send 0
    packet drops:  receive 0, send 0
```

Troubleshooting Tunnel Selection: Example

You can use the **debug mpls l2transport vc event** command to troubleshoot tunnel selection. For example, if the tunnel interface that is used for the preferred path is shut down, the default path is enabled. The **debug mpls l2transport vc event** command provides the following output:

```
AToM SMGR [10.2.2.2, 101]: Processing imposition update, vc_handle 62091860, update_action
3, remote_vc_label 16
AToM SMGR [10.2.2.2, 101]: selected route no parent rewrite: tunnel not up
AToM SMGR [10.2.2.2, 101]: Imposition Programmed, Output Interface: Et3/2
```

Additional References

The following sections provide references related to the Any Transport over MPLS: Tunnel Selection feature.

Related Documents

Related Topic	Document Title
Any Transport over MPLS for the Cisco 7600 series routers	*Cisco 7600 Series Cisco IOS Software Configuration Guide*, Release 12.2SX

Standards

Standard	Title
None	—

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
None	—

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 modified commands only.

- **debug mpls l2transport vc**
- **preferred-path**

debug mpls l2transport vc

To display information about the status of the Any Transport over MPLS (AToM) virtual circuits (VCs), use the **debug mpls l2transport vc** command in privileged EXEC mode. To disable debugging output, use the **no** form of this command.

debug mpls l2transport vc {**event** | **fsm**}

no debug mpls l2transport vc {**event** | **fsm**}

Syntax Description

event	Displays AToM event messages about the VCs.
fsm	Displays the finite state machine.

Command Modes

Privileged EXEC

Command History

Release	Modification
12.0(23)S	This command was introduced.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(15)T	This command was integrated into Cisco IOS Release 12.2(15)T.
12.0(25)S	This command was integrated into Cisco IOS Release 12.0(25).
12.2(25)S	This command was integrated into Cisco IOS Release 12.2(25)S.
12.2(28)SB	This command was integrated into Cisco IOS Release 12.2(28)SB.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.

Usage Guidelines

You can issue this command from the line card or the route processor.

Examples

The following is sample output from the **debug mpls l2transport vc** commands:

```
Router# debug mpls l2transport vc event

AToM vc event debugging is on

Router# debug mpls l2transport vc fsm

AToM vc fsm debugging is on

Router# show debugging

AToM:
  AToM vc event debugging is on
  AToM vc fsm debugging is on

*Mar 24 23:17:24.371: AToM MGR [10.9.9.9, 50]: Event provision, state changed from idle to
provisioned
*Mar 24 23:17:24.371: AToM MGR [10.9.9.9, 50]: Provision vc
*Mar 24 23:17:24.371: AToM SMGR [10.9.9.9, 50]: Requesting VC create, vc_handle 61A09930
```

```
*Mar 24 23:17:24.371: AToM MGR [10.9.9.9, 50]: Event local up, state changed from
provisioned to local standby
*Mar 24 23:17:24.371: AToM MGR [10.9.9.9, 50]: Update local vc label binding
*Mar 24 23:17:24.371: AToM SMGR [10.9.9.9, 50]: sucessfully processed create request
*Mar 24 23:17:24.875: %SYS-5-CONFIG_I: Configured from console by console
*Mar 24 23:17:25.131: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial3/0, changed
state to up

*Mar 24 23:17:28.567: AToM MGR [10.9.9.9, 50]: Event ldp up, state changed from local
standby to local ready
*Mar 24 23:17:28.567: AToM MGR [10.9.9.9, 50]: Advertise local vc label binding
*Mar 24 23:17:28.567: AToM MGR [10.9.9.9, 50]: Event remote up, state changed from local
ready to establishing
*Mar 24 23:17:28.567: AToM MGR [10.9.9.9, 50]: Remote end up
*Mar 24 23:17:28.567: AToM MGR [10.9.9.9, 50]: Event remote validated, state changed from
establishing to established
*Mar 24 23:17:28.567: AToM MGR [10.9.9.9, 50]: Validate vc, activating data plane
*Mar 24 23:17:28.567: AToM SMGR [10.9.9.9, 50]: Processing imposition update, vc_handle
61A09930, update_action 3, remote_vc_label 21
*Mar 24 23:17:28.567: AToM SMGR [10.9.9.9, 50]: Imposition Programmed, Output Interface:
PO5/0
*Mar 24 23:17:28.567: AToM SMGR [10.9.9.9, 50]: Processing disposition update, vc_handle
61A09930, update_action 3, local_vc_label 22
*Mar 24 23:17:28.571: AToM SMGR: Processing TFIB event for 9.9.9.9
*Mar 24 23:17:28.571: AToM SMGR [10.9.9.9, 50]: Imposition Programmed, Output Interface:
PO5/0
```

preferred-path

To specify the path that traffic uses (a Multiprotocol Label Switching (MPLS) Traffic engineering (TE) tunnel or destination IP address and Domain Name Server (DNS) name), use the **preferred-path** command in pseudowire configuration mode. To disable tunnel selection, use the **no** form of this command.

preferred-path {**interface tunnel** *tunnel-number* | **peer** {*ip-address* | *host-name*}} [**disable-fallback**]

no preferred-path {**interface tunnel** *tunnel-number* | **peer** {*ip-address* | *host-name*}} [**disable-fallback**]

Syntax Description

interface tunnel *tunnel-number*	Specifies an MPLS TE tunnel interface that is the core-facing output interface.
peer *ip-address* | *host-name*	Specifies an IP address or DNS name configured on the peer provider edge (PE) router, which is reachable through a label switched path (LSP).
disable-fallback	(Optional) Disables the router from using the default path when the preferred path is unreachable.

Defaults

Tunnel selection is not enabled.

Command Modes

Pseudowire configuration

Command History

Release	Modification
12.0(25)S	This command was introduced.
12.2(25)S	This command was integrated into Cisco IOS Release 12.2(25)S.
12.2(28)SB	This command was integrated into Cisco IOS Release 12.2(28)SB.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.

Usage Guidelines

The following guidelines provide more information about using this command:

- The destination IP address can be different from the peer router ID used in MPLS Label Distribution Protocol (LDP). For example, a peer PE router can have multiple loopback IP addresses, which can be reached by different paths, such as a TE tunnel, static IP route, or Interior Gateway Protocol (IGP) route.
- This command is available only if the pseudowire encapsulation type is MPLS.
- Tunnel selection is enabled when you exit from pseudowire configuration mode.
- The selected path should be an LSP destined to the peer PE router.
- The selected tunnel must be an MPLS traffic engineering tunnel.

- If you select a tunnel, the tunnel tailend must be on the remote PE router.
- If you specify an IP address, that address must be the IP address of the loopback interface on the remote PE. The address must have a /32 mask.

Examples

The following example creates a pseudowire class and specifies tunnel 1 as the preferred path:

```
Router(config)# pseudowire-class pw1
Router(config-pw)# encapsulation mpls
Router(config-pw)# preferred-path interface tunnel 1 disable-fallback
```

Related Commands

Command	Description
show mpls l2transport vc	Displays information about AToM VCs that have been enabled to route Layer 2 packets on a router.

Feature Information for Any Transport over MPLS: Tunnel Selection

Table 1 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 1 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 1 Feature Information for Any Transport over MPLS: Tunnel Selection

Feature Name	Releases	Feature Information
Any Transport over MPLS: Tunnel Selection	12.0(25)S, 12.2(25)S, 12.0(30)S, 12.2(33)SRA	Any Transport over MPLS: Tunnel Selection allows you to specify the path that Any Transport over MPLS (AToM) traffic uses. You can specify either a Multiprotocol Label Switching (MPLS) traffic engineering tunnel or a destination IP address and Domain Name System (DNS) name. In Cisco IOS Release 12.0(25)S, this feature was introduced on the Cisco 7200 and 7500 platforms. In Cisco IOS Release 12.2(25)S, this feature was integrated. In Cisco IOS Release 12.0(30)S, support was added for the the Cisco 12000 series routers and the Cisco 10720 routers. In Cisco IOS Release 12.2(33)SRA, support was added for the Cisco 7600 series router.