



## Layer 2 Local Switching

---

The Layer 2 Local Switching feature allows you to switch Layer 2 data between two interfaces on the same router, and in some cases to switch Layer 2 data between two circuits on the same interface port. The interface-to-interface switching combinations supported by this feature are:

- ATM to ATM
- ATM to Ethernet
- ATM to Frame-Relay
- Ethernet to Ethernet VLAN
- Frame Relay to Frame Relay (and since 12.0(28)S, also to Multilink Frame Relay)

The same-port switching feature introduced with Release 12.0(30)S supports the following:

- Same-Port Switching for ATM (PVC and PVP)
- Same-Port Switching for Ethernet VLAN
- Same-Port Switching for Frame Relay

Beginning with Cisco IOS Release 12.0(30)S, cell packing is available during ATM VP or VC local switching—on the Cisco Series 12000 router Engine 3 linecards. For information about how to configure cell-packing, see [Any Transport over MPLS](#).

### Feature History of Layer 2 Local Switching

| Release    | Modification   |
|------------|--|
| 12.0(27)S  | The feature was introduced on the Cisco 7200 and 7500 series routers.  |
| 12.2(25)S  | The feature was integrated into Cisco IOS Release 12.2(25)S.   |
| 12.0(30)S  | Same-port switching was added. Support for that and for local switching between interfaces was also added for Cisco 12000 series routers.  |
| 12.2(28)SB | This feature was updated to include NSF/SSO support on the Cisco 7500 series routers for the following local switching types: <ul style="list-style-type: none"><li>• NSF/SSO—Ethernet to Ethernet VLAN Local Switching Support</li><li>• NSF/SSO—Frame Relay to Frame Relay Local Switching Support</li></ul> |



### 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.

## Contents

- [Information About Layer 2 Local Switching, page 2](#)
- [Prerequisites for Layer 2 Local Switching, page 3](#)
- [Restrictions for Layer 2 Local Switching, page 3](#)
- [How to Configure Layer 2 Local Switching, page 7](#)
- [Configuration Examples for Layer 2 Local Switching, page 31](#)
- [Additional References, page 36](#)
- [Command Reference, page 38](#)

## Information About Layer 2 Local Switching

The following sections provide an introduction to the Layer 2 Local Switching feature:

- [Local Switching Overview, page 2](#)
- [NSF/SSO—Local Switching Overview, page 2](#)
- [When to Use Local Switching, page 3](#)

## Local Switching Overview

Local switching allows you to switch Layer 2 data between two interfaces of the same type (for example, ATM to ATM, or Frame Relay to Frame Relay) or between interfaces of different types (for example, Frame Relay to ATM) on the same router. The interfaces can be on the same line card or on two different cards. During these kinds of switching, the Layer 2 address is used, not any Layer 3 address.

Additionally, same-port local switching allows you to switch Layer 2 data between two circuits on the same interface.

## NSF/SSO—Local Switching Overview

Nonstop Forwarding (NSF) and Stateful Switchover (SSO) improve the availability of the network by providing redundant route processors and checkpointing of data to ensure minimal packet loss when the primary route processor goes down. NSF/SSO support is available for the following locally switched attachment circuits:

- Ethernet to Ethernet VLAN
- Frame Relay to Frame Relay

## When to Use Local Switching

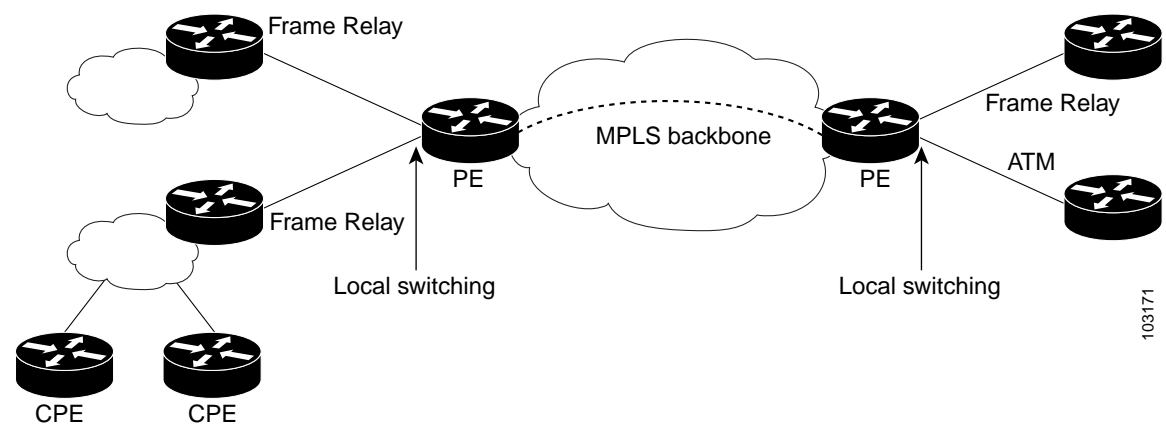
Incumbent local exchange carriers (ILECs) who use an interexchange carrier (IXC) to carry traffic between two local exchange carriers can use Local Switching. Telecom regulations require the ILECs to pay the IXCs to carry that traffic. At times, the ILECs cannot terminate customer connections that are in different local access and transport areas (LATAs). In other cases, customer connections terminate in the same LATA, which may also be on the same router.

For example, company A has more than 50 LATAs across the country and uses three routers for each LATA. Company A uses companies B and C to carry traffic between local exchange carriers. Local switching of Layer 2 frames on the same router might be required.

Similarly, if a router is using, for example, a channelized interface, it might need to switch incoming and outgoing traffic across two logical interfaces that reside on a single physical port. The same-port local switching feature addresses that implementation.

Figure 1 shows a network that using local switching for both Frame Relay to Frame Relay and ATM to Frame Relay local switching.

Figure 1 Local Switching Example



## Prerequisites for Layer 2 Local Switching

- You must enable Cisco Express Forwarding (CEF) for the Cisco 7200 series router. You must use CEF or Distributed CEF for the Cisco 7500 series router. (Distributed CEF is enabled already by default on the Cisco 12000 series routers).
- For Frame Relay local switching, you must globally issue the **frame-relay switching** command.

## Restrictions for Layer 2 Local Switching

The following sections list the restrictions for the Layer 2 Local Switching feature:

- [General Restrictions, page 4](#)
- [Supported Port Adapters on Cisco 7200 and 7500 Series Routers, page 4](#)
- [Supported Interface Processors on Cisco 7200 Series Routers, page 5](#)

- [Supported Interface Processors on Cisco 7500 Series Routers, page 5](#)
- [Supported Interface Processors on Cisco 12000 Series Routers, page 5](#)
- [Unsupported Hardware, page 6](#)

## General Restrictions

- For ATM-to-ATM local switching, the following ATM types are supported for the Layer 2 Local Switching feature:
  - ATM adaptation layer 5 (AAL5)
  - ATM Single Cell Relay adaptation layer 0 (AAL0), VC mode
  - ATM Single Cell Relay VP mode on the Cisco 12000 series routers
  - ATM Packed Cell Relay VC and VP modes on the ISE linecard of Cisco 12000 series routers
- In ATM Single Cell Relay AAL0, the ATM virtual path identifier/virtual channel identifier (VPI/VCI) values must match between the ingress and egress ATM interfaces on the Cisco 7200 series and 7500 series routers. If Layer 2 local switching is desired between two ATM VPIs and VCIs whose values do not match and are on two different interfaces, choose ATM AAL5. However, if the ATM AAL5 is using Operation, Administration, and Maintenance (OAM) transparent mode, the VPI and VCI values must match.
- On the Cisco 12000 series routers, VPI/VCI rewrite is supported.
- NSF/SSO for Layer 2 Local Switching is supported on the Cisco 7500 series routers.

## Supported Port Adapters on Cisco 7200 and 7500 Series Routers

Layer 2 local switching is supported on the following port adapters in the Cisco 7200 and 7500 series routers:

- PA-FE-TX (single-port Fast Ethernet 100BASE-TX)
- PA-FE-FX (single-port Fast Ethernet 100BASE-FX)
- PA-2FE-TX (dual-port Fast Ethernet 100BASE-TX)
- PA-2FE-FX (dual-port Fast Ethernet 100BASE-FX)
- PA-4E (4-port Ethernet adapter)
- PA-8E (8-port Ethernet adapter)
- PA-4T (4-port synchronous serial port adapter)
- PA-4T+ (enhanced 4-port synchronous serial port adapter)
- PA-8T (8-port synchronous serial port adapter)
- PA-12E/2FE (12-port Ethernet/2-port FE adapter) [Cisco 7200 only]
- PA-GE (Gigabit Ethernet port adapter) [Cisco 7200 only]
- PA-H (single-port HSSI adapter)
- PA-2H (dual-port HSSI adapter)
- PA-MC-8E1 (8-port multichannel E1 G.703/G.704 120-ohm interfaces)
- PA-MC-2E1 (2-port multichannel E1 G.703/G.704 120-ohm interfaces)

- PA-MC-8T1 (8-port multichannel T1 with integrated CSUs and DSUs)
- PA-MC-4T1 (4-port multichannel T1 with integrated CSUs and DSUs)
- PA-MC-2T1 (2-port multichannel T1 with integrated CSUs and DSUs)
- PA-MC-8TE1+ (8-port multichannel T1/E1)
- PA-MC-T3 (1-port multichannel T3 interface)
- PA-MC-E3 (1-port multichannel E3 interface)
- PA-MC-2T3+ (2-port enhanced multichannel T3 port adapter)
- PA-MC-STM1 (1-port multichannel STM1 port adapter) [Cisco 7500 only]
- PA-T3 (single-port T3 port adapter)
- PA-E3 (single-port E3 port adapter)
- PA-2E3 (2-port E3 port adapter)
- PA-2T3 (2-port T3 port adapter)
- PA-POS-OC3SML (single-port POS, single-mode, long reach)
- PA-POS-OC3SMI (single-port POS, single-mode, intermediate reach)
- PA-POS-OC3MM (single-port POS, multimode)
- PA-A3-OC3 (1-port ATM OC3/STM1 port adapter, enhanced)
- PA-A3-OC12 (1-port ATM OC12/STM4 port adapter, enhanced) [7500 only]
- PA-A3-T3 (DS3 high-speed interface)
- PA-A3-E3 (E3 medium-speed interface)
- PA-A3-8T1IMA (ATM inverse multiplexer over ATM port adapter with 8 T1 ports)
- PA-A3-8E1IMA (ATM inverse multiplexer over ATM port adapter with 8 E1 ports)

## Supported Interface Processors on Cisco 7200 Series Routers

- C7200-I/O-2FE
- C7200-I/O-GE+E (Only the Gigabit Ethernet port of this port adapter is supported.)
- C7200-I/O-FE

## Supported Interface Processors on Cisco 7500 Series Routers

- GEIP (Gigabit Ethernet interface processor)
- GEIP+ (Enhanced Gigabit Ethernet interface processor)

## Supported Interface Processors on Cisco 12000 Series Routers

- Engine-3 linecards support like-to-like and any-to-any local switching
- 8-port OC3 ATM Engine-2 linecards support only like-to-like local switching
- All linecards support FR-to-FR local switching

## Unsupported Hardware

The following hardware is not supported:

- Cisco 7200—non-VXR chassis
- Cisco 7500—RSP1 and RSP2
- Cisco 7500—VIP 2-40 and below
- Cisco 12000 series—4-port OC3 ATM Engine-0 linecard
- Cisco 12000 series—4-port OC12 ATM Engine-2 linecard
- Cisco 12000 series—1-port OC12 ATM Engine-0 linecard
- Cisco 12000 series—Ethernet Engine-1, Engine-2, and Engine-4 linecards

# How to Configure Layer 2 Local Switching

The following sections explain the tasks you can perform to set up Layer 2 Local Switching:

- [Configuring ATM-to-ATM PVC Local Switching, page 8](#) (required)
- [Configuring ATM PVC Same-Port Switching, page 10](#) (required)
- [Configuring ATM-to-ATM PVP Local Switching, page 12](#) (required)
- [Configuring ATM PVP Same-Port Switching, page 14](#) (required)
- [Configuring ATM-to-Ethernet \(Port Mode\) Local Switching, page 16](#) (required)
- [Configuring ATM-to-Ethernet \(VLAN Mode\) Local Switching, page 18](#) (required)
- [Configuring Ethernet VLAN Same-Port Switching, page 20](#) (required)
- [Configuring Ethernet \(Port Mode\) to Ethernet VLAN Local Switching, page 21](#) (required)
- [Configuring ATM-to-Frame-Relay Local Switching, page 23](#) (required)
- [Configuring Frame-Relay-to-Frame-Relay Local Switching, page 25](#) (required)
- [Configuring Frame Relay Same-Port Switching, page 27](#) (required)
- [Verifying Layer 2 Local Switching, page 29](#) (optional)
- [Configuring NSF/SSO—Local Switching Support, page 30](#) (optional)
- [Verifying the SSO/NSF Configuration, page 31](#) (optional)

## Configuring ATM-to-ATM PVC Local Switching

Important points:

- You can configure local switching for both ATM AAL5 and ATM AAL0 encapsulation types.
- Creating the ATM PVC is not required. If you do not create a PVC, one is created for you. For ATM-to-ATM local switching, the autoprovisioned PVC is given the default encapsulation type AAL0 cell relay.
- Starting with Release 12.0(30)S, you can configure same-port switching, as detailed in the section [“Configuring ATM PVC Same-Port Switching”](#) section on page 10.

Use the following steps to configure ATM-to-ATM local switching.

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *atmslot/port*
4. **pvc** *vpi/vci l2transport*
5. **encapsulation** *layer-type*
6. **exit**
7. **exit**
8. **connect** *connection-name interface pvc interface pvc*

### DETAILED STEPS

|        | Command or Action  | Purpose   |
|--------|--|---|
| Step 1 | <b>enable</b><br><br><b>Example:</b><br>Router> enable   | Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul>  |
| Step 2 | <b>configure terminal</b><br><br><b>Example:</b><br>Router# configure terminal                           | Enters global configuration mode.   |
| Step 3 | <b>interface</b> <i>atmslot/port</i><br><br><b>Example:</b><br>Router(config)# interface atm1/0          | Specifies an ATM interface and enters interface configuration mode.   |
| Step 4 | <b>pvc</b> <i>vpi/vci l2transport</i><br><br><b>Example:</b><br>Router(config-if)# pvc 1/200 l2transport | Assigns a virtual path identifier (VPI) and virtual channel identifier (VCI). The <b>l2transport</b> keyword indicates that the PVC is a switched PVC instead of a terminated PVC. Enters PVC l2transport configuration mode. |



|        | Command or Action  | Purpose   |
|--------|--|---|
| Step 5 | <p><b>encapsulation</b> <i>layer-type</i></p> <p><b>Example:</b><br/> Router(cfg-if-atm-l2trans-pvc)# encapsulation<br/> aal5</p>  | <p>Specifies the encapsulation type for the PVC. Both AAL0 and AAL5 are supported.</p> <ul style="list-style-type: none"> <li>Repeat Steps 3 through 5 for another ATM PVC on the same router.</li> </ul> |
| Step 6 | <p><b>exit</b></p> <p><b>Example:</b><br/> Router(cfg-if-atm-l2trans-pvc)# exit</p>  | <p>Exits PVC l2transport configuration mode and returns to interface configuration mode.</p>  |
| Step 7 | <p><b>exit</b></p> <p><b>Example:</b><br/> Router(config-if)# exit</p>   | <p>Exits interface configuration mode and returns to global configuration mode.</p>   |
| Step 8 | <p><b>connect</b> <i>connection-name interface pvc interface pvc</i></p> <p><b>Example:</b><br/> Router(config)# connect atm-con<br/> atm1/0/0 0/100 atm 2/0/0 0/100</p> | <p>Creates a local connection between the two specified permanent virtual circuits.</p>   |

## Configuring ATM PVC Same-Port Switching

Use the following steps to configure local PVC switching on a single ATM interface.

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *atmslot/subslot/port*
4. **pvc** *vpi/vci* **l2transport**
5. **encapsulation** *layer-type*
6. **exit**
7. **exit**
8. **connect** *connection-name interface pvc interface pvc*

### DETAILED STEPS

|        | Command or Action   | Purpose  |
|--------|---|--|
| Step 1 | <b>enable</b><br><br><b>Example:</b><br>Router> enable  | Enables privileged EXEC mode.<br><ul style="list-style-type: none"><li>• Enter your password if prompted.</li></ul>  |
| Step 2 | <b>configure terminal</b><br><br><b>Example:</b><br>Router# configure terminal                                      | Enters global configuration mode.  |
| Step 3 | <b>interface</b> <i>atmslot/subslot/port</i><br><br><b>Example:</b><br>Router(config)# interface atm1/0/0           | Specifies an ATM slot, subslot (if available), and port, and enters interface configuration mode.  |
| Step 4 | <b>pvc</b> <i>vpi/vci</i> <b>l2transport</b><br><br><b>Example:</b><br>Router(config-if)# pvc 0/100 l2transport     | Specifies the PVC according to its virtual path identifier (VPI) and virtual channel identifier (VCI) and enters PVC l2transport configuration mode.<br><ul style="list-style-type: none"><li>• The <b>l2transport</b> keyword indicates that the PVC is a switched PVC instead of a terminated PVC.</li></ul> |
| Step 5 | <b>encapsulation</b> <i>layer-type</i><br><br><b>Example:</b><br>Router(cfg-if-atm-l2trans-pvc)# encapsulation aal5 | Indicates the encapsulation type of the PVC. Both AAL0 and AAL5 are supported.<br><ul style="list-style-type: none"><li>• Repeat Steps 4 and 5 for the other ATM permanent virtual circuit on this port.</li></ul>   |
| Step 6 | <b>exit</b><br><br><b>Example:</b><br>Router(cfg-if-atm-l2trans-pvc)# exit  | Exits PVC l2transport configuration mode and returns to interface configuration mode.  |

|        | Command or Action   | Purpose  |
|--------|---|--|
| Step 7 | <code>exit</code><br><br><b>Example:</b><br><code>Router(config-if)# exit</code>  | Exits interface configuration mode and returns to global configuration mode.                                   |
| Step 8 | <code>connect connection-name interface pvc interface pvc</code><br><br><b>Example:</b><br><code>Router(config)# connect atm-con<br/>atm1/0/0 0/100 atm1/0/0 0/200</code> | In global configuration mode, creates a local connection between the two specified permanent virtual circuits. |

## Configuring ATM-to-ATM PVP Local Switching

Use the following steps to configure ATM-to-ATM PVP local switching.

(Starting with Release 12.0(30)S, you can configure same-port switching, as detailed in the [“Configuring ATM PVP Same-Port Switching”](#) section on page 14.)

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface atmslot/port**
4. **atm pvp vpi l2transport**
5. **exit**
6. **exit**
7. **connect connection-name interface pvp interface pvp**

### DETAILED STEPS

|        | Command or Action   | Purpose  |
|--------|---|--|
| Step 1 | <b>enable</b><br><br><b>Example:</b><br>Router> enable  | Enables privileged EXEC mode.<br><ul style="list-style-type: none"><li>• Enter your password if prompted.</li></ul>  |
| Step 2 | <b>configure terminal</b><br><br><b>Example:</b><br>Router# configure terminal                      | Enters global configuration mode.  |
| Step 3 | <b>interface atmslot/port</b><br><br><b>Example:</b><br>Router(config)# interface atm1/0            | Specifies an ATM interface and enters interface configuration mode.  |
| Step 4 | <b>atm pvp vpi l2transport</b><br><br><b>Example:</b><br>Router(config-if)# atm pvp 100 l2transport | Identifies the virtual path and enters PVP l2transport configuration mode. The <b>l2transport</b> keyword indicates that the PVP is a switched PVP instead of a terminated PVP.<br><ul style="list-style-type: none"><li>• Repeat Steps 3 and 4 for another ATM permanent virtual path on the same router.</li></ul> |
| Step 5 | <b>exit</b><br><br><b>Example:</b><br>Router(config-if-atm-l2trans-pvp)# exit                       | Exits PVP l2transport configuration mode and returns to interface configuration mode.  |

|        | Command or Action   | Purpose   |
|--------|---|---|
| Step 6 | <code>exit</code><br><br><b>Example:</b><br>Router(config-if)# <code>exit</code>  | Exits interface configuration mode and returns to global configuration mode.                                |
| Step 7 | <code>connect connection-name interface pvp interface pvp</code><br><br><b>Example:</b><br>Router(config)# <code>connect atm-con atm1/0 100 atm2/0 200</code> | In global configuration mode, creates a local connection between the two specified permanent virtual paths. |

## Configuring ATM PVP Same-Port Switching

Use the following steps to configure local PVP switching on a single ATM interface.

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface atmslot/subslot/port**
4. **atm pvp vpi l2transport**
5. **exit**
6. **exit**
7. **connect connection-name interface pvp interface pvp**

### DETAILED STEPS

|        | Command or Action   | Purpose  |
|--------|---|--|
| Step 1 | <b>enable</b><br><br><b>Example:</b><br>Router> enable  | Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul>   |
| Step 2 | <b>configure terminal</b><br><br><b>Example:</b><br>Router# configure terminal                      | Enters global configuration mode.  |
| Step 3 | <b>interface atmslot/subslot/port</b><br><br><b>Example:</b><br>Router(config)# interface atm1/0/0  | Specifies an ATM interface, subslot (if available), and port.  |
| Step 4 | <b>atm pvp vpi l2transport</b><br><br><b>Example:</b><br>Router(config-if)# atm pvp 100 l2transport | Specifies one virtual path identifier (VPI) and enters PVP l2transport configuration mode. Repeat this step for the other ATM permanent virtual path on this same port. <ul style="list-style-type: none"> <li>• The <b>l2transport</b> keyword indicates that the indicated PVP is a switched PVP instead of a terminated PVP.</li> </ul> |
| Step 5 | <b>exit</b><br><br><b>Example:</b><br>Router(config-if-atm-l2trans-pvp)# exit                       | Exits PVP l2transport configuration mode and returns to interface configuration mode.  |

|        | Command or Action  | Purpose   |
|--------|--|---|
| Step 6 | <code>exit</code><br><br><b>Example:</b><br>Router(config-if)# exit  | Exits interface configuration mode and returns to global configuration mode.                                  |
| Step 7 | <code>connect connection-name interface pvp interface pvp</code><br><br><b>Example:</b><br>Router(config)# connect atm-con atm1/0/0 100 atm1/0/0 200 | In global configuration mode, creates the local connection between the two specified permanent virtual paths. |

## Configuring ATM-to-Ethernet (Port Mode) Local Switching

Important points:

- Creating the ATM PVC is not required. If you do not create a PVC, one is created for you. For ATM-to-Ethernet local switching, the autoprovisioned PVC is given the default encapsulation type AAL5SNAP.
- ATM-to-Ethernet local switching supports both the IP and Ethernet interworking types.
- ATM-to-Ethernet local switching supports the following encapsulation types:
  - ATM-to-Ethernet with IP interworking: AAL5SNAP, AAL5MUX
  - ATM-to-Ethernet with Ethernet interworking: AAL5SNAP

Use the following steps to configure local switching between ATM and Ethernet port mode.

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *atmslot/port*
4. **pvc** *vpi/vci* **l2transport**
5. **encapsulation** *layer-type*
6. **exit**
7. **exit**
8. **interface** *fastethernetslot/port*
9. **exit**
10. **connect** *connection-name interface pvc interface* **interworking** *interworking-type*

### DETAILED STEPS

|        | Command or Action   | Purpose   |
|--------|---|---|
| Step 1 | <b>enable</b><br><br><b>Example:</b><br>Router> enable  | Enables privileged EXEC mode.<br><br>• Enter your password if prompted. |
| Step 2 | <b>configure terminal</b><br><br><b>Example:</b><br>Router# configure terminal                  | Enters global configuration mode.                                       |
| Step 3 | <b>interface</b> <i>atmslot/port</i><br><br><b>Example:</b><br>Router(config)# interface atm1/0 | Specifies an ATM interface and enters interface configuration mode.     |



|         | Command or Action  | Purpose  |
|---------|--|--|
| Step 4  | <p><code>pvc vpi/vci l2transport</code></p> <p><b>Example:</b><br/>Router(config-if)# pvc 1/200 l2transport</p>  | <p>Assigns a virtual path identifier (VPI) and virtual channel identifier (VCI), and enters PVC l2transport configuration mode.</p> <ul style="list-style-type: none"> <li>The <b>l2transport</b> keyword indicates that the PVC is a switched PVC instead of a terminated PVC.</li> </ul> |
| Step 5  | <p><code>encapsulation layer-type</code></p> <p><b>Example:</b><br/>Router(cfg-if-atm-l2trans-pvc)# encapsulation aal5snap</p>   | <p>Specifies the encapsulation type for the PVC.</p>   |
| Step 6  | <p><code>exit</code></p> <p><b>Example:</b><br/>Router(config-if-atm-l2trans-pvp)# exit</p>  | <p>Exits PVC l2transport configuration mode and returns to interface configuration mode.</p>   |
| Step 7  | <p><code>exit</code></p> <p><b>Example:</b><br/>Router(config-if)# exit</p>  | <p>Exits interface configuration mode and returns to global configuration mode.</p>  |
| Step 8  | <p><code>interface fastethernet slot/port</code></p> <p><b>Example:</b><br/>Router(config)# interface fastethernet6/0/0</p>  | <p>Specifies a FastEthernet interface.</p>   |
| Step 9  | <p><code>exit</code></p> <p><b>Example:</b><br/>Router(config-if)# exit</p>  | <p>Exits interface configuration mode and returns to global configuration mode.</p>  |
| Step 10 | <p><code>connect connection-name interface pvc interface interworking interworking-type</code></p> <p><b>Example:</b><br/>Router(config)# connect atm-eth-con atm1/0 0/100 fastethernet6/0/0 interworking ethernet</p> | <p>In global configuration mode, creates a local connection between the two interfaces and specifies the interworking type.</p> <ul style="list-style-type: none"> <li>Both the IP and Ethernet interworking types are supported.</li> </ul>   |

## Configuring ATM-to-Ethernet (VLAN Mode) Local Switching

Important points:

- Creating the ATM PVC is not required. If you do not create a PVC, one is created for you. For ATM-to-Ethernet Local Switching, the autoprovisioned PVC is given the default encapsulation type AAL5SNAP.
- ATM-to-Ethernet Local Switching supports both the IP and Ethernet interworking types.
- ATM-to-Ethernet Local Switching supports the following encapsulation types:
  - ATM-to-Ethernet with IP interworking: AAL5SNAP, AAL5MUX
  - ATM-to-Ethernet with Ethernet interworking: AAL5SNAP
- The VLAN header is removed from frames that are received on an Ethernet subinterface.

Use the following steps to configure local switching for ATM to Ethernet in VLAN mode.

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *atmslot/port*
4. **pvc** *vpi/vci l2transport*
5. **encapsulation** *layer-type*
6. **exit**
7. **interface** *fastethernetslot/port/subint*
8. **encapsulation dot1q** *vlan-id*
9. **exit**
10. **connect** *connection-name interface pvc interface interworking interworking-type*

### DETAILED STEPS

|        | Command or Action   | Purpose  |
|--------|---|--|
| Step 1 | <b>enable</b><br><br><b>Example:</b><br>Router> enable  | Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul> |
| Step 2 | <b>configure terminal</b><br><br><b>Example:</b><br>Router# configure terminal                            | Enters global configuration mode.  |
| Step 3 | <b>interface</b> <i>atmslot/subslot/port</i><br><br><b>Example:</b><br>Router(config)# interface atm1/0/0 | Specifies an ATM interface and enters interface configuration mode.  |

|         | Command or Action  | Purpose  |
|---------|--|--|
| Step 4  | <p><code>pvc vpi/vci l2transport</code></p> <p><b>Example:</b><br/> Router(config-if)# pvc 1/200 l2transport</p>   | <p>Assigns a virtual path identifier (VPI) and virtual circuit identifier (VCI), and enters PVC l2transport configuration mode.</p> <ul style="list-style-type: none"> <li>The <b>l2transport</b> keyword indicates that the PVC is a switched PVC instead of a terminated PVC.</li> </ul> |
| Step 5  | <p><code>encapsulation layer-type</code></p> <p><b>Example:</b><br/> Router(cfg-if-atm-l2trans-pvc)# encapsulation aal5snap</p>  | <p>Specifies the encapsulation type for the PVC.</p>   |
| Step 6  | <p><code>exit</code></p> <p><b>Example:</b><br/> Router(cfg-if-atm-l2trans-pvc)# exit</p>  | <p>Exits PVC l2transport configuration mode and returns to interface configuration mode.</p>   |
| Step 7  | <p><code>interface fastethernet slot/port/subint</code></p> <p><b>Example:</b><br/> Router(config-if)# interface fastethernet6/0/0.1</p>   | <p>Specifies a FastEthernet interface and enters subinterface configuration mode.</p>  |
| Step 8  | <p><code>encapsulation dot1q vlan-id</code></p> <p><b>Example:</b><br/> Router(config-subif)# encapsulation dot1q 100</p>  | <p>Enables the interface to accept 802.1Q virtual LAN (VLAN) packets.</p>  |
| Step 9  | <p><code>exit</code></p> <p><b>Example:</b><br/> Router(config-subif)# exit</p>  | <p>Exits subinterface configuration mode and returns to global configuration mode.</p>   |
| Step 10 | <p><code>connect connection-name interface pvc interface interworking interworking-type</code></p> <p><b>Example:</b><br/> Router(config)# connect atm-eth-vlan-con atm1/0/0 0/100 fastethernet6/0/0.1 interworking ethernet</p> | <p>In global configuration mode, creates a local connection between the two interfaces and specifies the interworking type.</p> <ul style="list-style-type: none"> <li>Both the IP and Ethernet interworking types are supported.</li> </ul>   |

## Configuring Ethernet VLAN Same-Port Switching

Use the following steps to configure switching from one VLAN to another VLAN on the same Ethernet or FastEthernet port.

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface fastethernetslot/port.subinterface-number**
4. **encapsulation dot1q vlan-id**
5. **exit**
6. **interface fastethernetslot/port.subinterface-number**
7. **encapsulation dot1q vlan-id**
8. **exit**
9. **connect connection-name interface interface**

### DETAILED STEPS

|        | Command or Action  | Purpose   |
|--------|--|---|
| Step 1 | <b>enable</b><br><br><b>Example:</b><br>Router> enable   | Enables privileged EXEC mode.<br><ul style="list-style-type: none"><li>• Enter your password if prompted.</li></ul> |
| Step 2 | <b>configure terminal</b><br><br><b>Example:</b><br>Router# configure terminal   | Enters global configuration mode.   |
| Step 3 | <b>interface fastethernetslot/port.subinterface-number</b><br><br><b>Example:</b><br>Router(config)# interface fastethernet6/0.1 | Specifies the first FastEthernet subinterface, and opens subinterface configuration mode.                           |
| Step 4 | <b>encapsulation dot1q vlan-id</b><br><br><b>Example:</b><br>Router(config-subif)# encapsulation dot1q 10                        | Enables that subinterface to accept 802.1Q VLAN packets and specifies the first VLAN.                               |
| Step 5 | <b>exit</b><br><br><b>Example:</b><br>Router(config-subif)# exit   | Exits subinterface configuration mode and returns to global configuration mode.                                     |

|        | Command or Action   | Purpose  |
|--------|---|--|
| Step 6 | <pre>interface fastethernet&lt;slot/port&gt;.subinterface-number</pre> <p><b>Example:</b><br/>Router(config)# interface fastethernet6/0.2</p>     | In global configuration mode, specifies the other FastEthernet subinterface and opens subinterface configuration mode.   |
| Step 7 | <pre>encapsulation dot1q vlan-id</pre> <p><b>Example:</b><br/>Router(config-subif)# encapsulation dot1q 20</p>                                    | Enables this subinterface to accept 802.1Q VLAN packets and specifies the second VLAN.   |
| Step 8 | <pre>exit</pre> <p><b>Example:</b><br/>Router(config-subif)# exit</p>   | Exits subinterface configuration mode and returns to global configuration mode.  |
| Step 9 | <pre>connect connection-name interface interface</pre> <p><b>Example:</b><br/>Router(config)# connect fastethernet6/0.1<br/>fastethernet6/0.2</p> | In global configuration mode, creates a local connection between the two subinterfaces (and hence their previously specified VLANs) on the same FastEthernet port. |

## Configuring Ethernet (Port Mode) to Ethernet VLAN Local Switching

This section explains how to configure local switching for Ethernet (port mode) to Ethernet VLAN.

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface fastethernet<slot/port>**
4. **interface fastethernet<slot/port>.subint**
5. **encapsulation dot1q <vlan-id>**
6. **exit**
7. **connect <connection-name> fastethernetinterface\_1 fastethernetinterface\_2 interworking <interworking-type>**

## DETAILED STEPS

|        | Command or Action   | Purpose  |
|--------|---|--|
| Step 1 | <code>enable</code><br><br><b>Example:</b><br>Router> enable  | Enables privileged EXEC mode.<br><ul style="list-style-type: none"><li>Enter your password if prompted.</li></ul>  |
| Step 2 | <code>configure terminal</code><br><br><b>Example:</b><br>Router# configure terminal  | Enters global configuration mode.  |
| Step 3 | <code>interface fastethernet slot/port</code><br><br><b>Example:</b><br>Router(config)# interface fastethernet3/0/0   | Specifies a FastEthernet interface. This is the interface on one side of the PE router that passes Ethernet packets to and from CE1.   |
| Step 4 | <code>interface fastethernet slot/port/subint</code><br><br><b>Example:</b><br>Router(config)# interface fastethernet6/0/0.1  | Specifies a FastEthernet interface. This is the interface on the other side of the PE router than passes Ethernet VLAN packets to and from CE2.  |
| Step 5 | <code>encapsulation dot1q vlan-id</code><br><br><b>Example:</b><br>Router(config-subif)# encapsulation dot1q 100  | Enables the interface to accept 802.1Q virtual LAN (VLAN) packets.   |
| Step 6 | <code>exit</code><br><br><b>Example:</b><br>Router(config-subif)# exit  | Exits subinterface configuration mode and returns to global configuration mode.  |
| Step 7 | <code>connect connection-name fastethernetinterface_1<br/>fastethernetinterface_2 interworking<br/>interworking-type</code><br><br><b>Example:</b><br>Router(config)# connect eth-ethvlan-con<br>fastethernet3/0/0 fastethernet6/0/0.1<br>interworking ethernet | In global configuration mode, creates a local connection between the two interfaces and specifies the interworking type.<br><ul style="list-style-type: none"><li>Both the IP and Ethernet interworking types are supported.</li></ul> |

## Configuring ATM-to-Frame-Relay Local Switching

ATM-to-Frame-Relay local switching was introduced in an earlier release of Cisco IOS software. Now you use the **interworking ip** keyword for configuring ATM-to-Frame-Relay local switching.

FRF.8 Frame-Relay-to-ATM service interworking functionality is not supported. Frame Relay discard-eligible (DE) bits do not get mapped to ATM cell loss priority (CLP) bits, and forward explicit congestion notification (FECN) bits do not get mapped to ATM explicit forward congestion indication (EFCI) bits.

For additional information about ATM-to-Frame-Relay Local Switching, see the “[Configuring Frame Relay-ATM Interworking](#)” section of the *Cisco IOS Wide Area Networking Configuration Guide*.

Creating the PVC is not required. If you do not create a PVC, one is created for you. For ATM-to-Ethernet local switching, the automatically provisioned PVC is given the default encapsulation type AAL5SNAP.

ATM-to-Frame-Relay Local Switching supports the following encapsulation types:

- AAL5SNAP
- AAL5NLPID (Cisco 12000 series uses AAL5MUX instead, for IP interworking)

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface atm***slot/port*
4. **pvc** *vpi/vci* **l2transport**
5. **encapsulation** *layer-type*
6. **exit**
7. **interface serial***slot/port*
8. **encapsulation frame-relay** [**cisco** | **ietf**]
9. **frame-relay interface-dlci** *dlci* **switched**
10. **exit**
11. **connect** *connection-name interface pvc interface dlci* **interworking** *interworking-type*

### DETAILED STEPS

|        | Command or Action  | Purpose   |
|--------|--|---|
| Step 1 | <b>enable</b><br><br><b>Example:</b><br>Router> enable                         | Enables privileged EXEC mode.<br><br>• Enter your password if prompted. |
| Step 2 | <b>configure terminal</b><br><br><b>Example:</b><br>Router# configure terminal | Enters global configuration mode.                                       |

|         | Command or Action   | Purpose   |
|---------|---|---|
| Step 3  | <code>interface atmslot/port</code><br><br><b>Example:</b><br>Router(config)# interface atm1/0  | Specifies an ATM interface, and opens interface configuration mode.   |
| Step 4  | <code>pvc vpi/vci l2transport</code><br><br><b>Example:</b><br>Router(config-if)# pvc 1/200 l2transport   | Assigns a virtual path identifier (VPI) and virtual circuit identifier (VCI), and enters PVC l2transport configuration mode. <ul style="list-style-type: none"> <li>The <b>l2transport</b> keyword indicates that the PVC is a switched PVC instead of a terminated PVC.</li> </ul> |
| Step 5  | <code>encapsulation layer-type</code><br><br><b>Example:</b><br>Router(cfg-if-atm-l2trans-pvc)# encapsulation aal5snap  | Specifies the encapsulation type for the PVC.   |
| Step 6  | <code>exit</code><br><br><b>Example:</b><br>Router(cfg-if-atm-l2trans-pvc)# exit  | Exits PVC l2transport configuration mode and returns to interface configuration mode.   |
| Step 7  | <code>interface serialslot/port</code><br><br><b>Example:</b><br>Router(config-if)# interface serial6/0/0   | Specifies a serial interface.   |
| Step 8  | <code>encapsulation frame-relay [cisco   ietf]</code><br><br><b>Example:</b><br>Router(config-if)# encapsulation frame-relay ietf   | Specifies Frame Relay encapsulation for the interface. <ul style="list-style-type: none"> <li>The encapsulation type does not matter for local switching. It has relevance only for terminated circuits.</li> </ul>   |
| Step 9  | <code>frame-relay interface-dlci dlci switched</code><br><br><b>Example:</b><br>Router(config-if)# frame-relay interface-dlci 100 switched  | (Optional) Configures a switched Frame Relay DLCI. <ul style="list-style-type: none"> <li>If you do not create a Frame Relay PVC in this step, one is automatically created by the <b>connect</b> command in the next step.</li> </ul>  |
| Step 10 | <code>exit</code><br><br><b>Example:</b><br>Router(config-if)# exit   | Exits interface configuration mode and returns to global configuration mode.  |
| Step 11 | <code>connect connection-name interface pvc interface dlci interworking interworking-type</code><br><br><b>Example:</b><br>Router(config)# connect atm-fr-con atm 1/0 0/100 serial6/0/0 100 interworking ip | In global configuration mode, creates a local connection between the two interfaces.  |



## Configuring Frame-Relay-to-Frame-Relay Local Switching

For background information about Frame-Relay-to-Frame-Relay Local Switching, see the [Distributed Frame Relay Switching](#) feature module.

With Release 12.0(30)S, you can switch between virtual circuits on the same port, as detailed in the “[Configuring Frame Relay Same-Port Switching](#)” section on page 27.

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip cef [distributed]**
4. **frame-relay switching**
5. **interface** *type number*
6. **encapsulation frame-relay [cisco | ietf]**
7. **frame-relay interface-dlci** *dlci switched*
8. **exit**
9. **connect** *connection-name interface dlci interface dlci*

### DETAILED STEPS

|        | Command or Action  | Purpose   |
|--------|--|---|
| Step 1 | <b>enable</b><br><br><b>Example:</b><br>Router> enable                                       | Enables privileged EXEC mode.<br><ul style="list-style-type: none"><li>• Enter your password if prompted.</li></ul>   |
| Step 2 | <b>configure terminal</b><br><br><b>Example:</b><br>Router# configure terminal               | Enters global configuration mode.   |
| Step 3 | <b>ip cef [distributed]</b><br><br><b>Example:</b><br>Router(config)# ip cef                 | Enables CEF operation.<br><ul style="list-style-type: none"><li>• For the Cisco 7500 series router, use the <b>ip cef distributed</b> command. (On the Cisco 12000 series router, this command is already enabled by default).</li><li>• For the Cisco 7200 series router, use the <b>ip cef</b> command.</li></ul> <p>This command is not required by the FR-FR local switching feature.</p> |
| Step 4 | <b>frame-relay switching</b><br><br><b>Example:</b><br>Router(config)# frame-relay switching | Enables PVC switching on a Frame Relay data communications equipment (DCE) device or a Network-to-Network Interface (NNI).  |

|        | Command or Action  | Purpose  |
|--------|--|--|
| Step 5 | <code>interface type number</code><br><br><b>Example:</b><br>Router(config)# interface serial 0  | Specifies an interface and enters interface configuration mode.  |
| Step 6 | <code>encapsulation frame-relay [cisco   ietf]</code><br><br><b>Example:</b><br>Router(config-if)# encapsulation frame-relay                             | Enables Frame Relay encapsulation. <ul style="list-style-type: none"> <li>The default is <b>cisco</b> encapsulation.</li> <li>You do not need to specify an encapsulation type.</li> </ul>   |
| Step 7 | <code>frame-relay interface-dlci dlci switched</code><br><br><b>Example:</b><br>Router(config-if)# frame-relay interface-dlci 100 switched               | (Optional) Creates a switched PVC and enters Frame Relay DLCI configuration mode. <ul style="list-style-type: none"> <li>Repeat steps 5 through 7 for each switched PVC.</li> <li>If you do not create a Frame Relay PVC in this step, it will automatically be created in the next step by the <b>connect</b> command.</li> </ul> |
| Step 8 | <code>exit</code><br><br><b>Example:</b><br>Router(config-if)# exit  | Exits interface configuration mode and returns to global configuration mode.   |
| Step 9 | <code>connect connection-name interface dlci interface dlci</code><br><br><b>Example:</b><br>Router(config)# connect connection1 serial0 100 serial1 101 | In global configuration mode, defines a connection between Frame Relay PVCs.   |

## Configuring Frame Relay Same-Port Switching

Use the following steps to configure local Frame Relay switching on a single interface.

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip cef [distributed]**
4. **frame-relay switching**
5. **interface** *type number*
6. **encapsulation frame-relay [cisco | ietf]**
7. **frame-relay intf-type [dte | dce | nni]**
8. **frame-relay interface-dlci** *dlci switched*
9. **exit**
10. **connect** *connection-name interface dlci interface dlci*

### DETAILED STEPS

|        | Command or Action  | Purpose   |
|--------|--|---|
| Step 1 | <b>enable</b><br><br><b>Example:</b><br>Router> enable                                       | Enables privileged EXEC mode.<br><ul style="list-style-type: none"><li>• Enter your password if prompted.</li></ul>   |
| Step 2 | <b>configure terminal</b><br><br><b>Example:</b><br>Router# configure terminal               | Enters global configuration mode.   |
| Step 3 | <b>ip cef [distributed]</b><br><br><b>Example:</b><br>Router# ip cef                         | Enables CEF operation.<br><ul style="list-style-type: none"><li>• For the Cisco 7500 series router, use the <b>ip cef distributed</b> command. (On the Cisco 12000 series router, this command is already enabled by default).</li><li>• For the Cisco 7200 series router, use the <b>ip cef</b> command.</li></ul> <p>This command is not required by the FR-FR local switching feature.</p> |
| Step 4 | <b>frame-relay switching</b><br><br><b>Example:</b><br>Router(config)# frame-relay switching | Enables PVC switching on a Frame Relay data communications equipment (DCE) device or a Network-to-Network Interface (NNI).  |

|         | Command or Action  | Purpose   |
|---------|--|---|
| Step 5  | <code>interface type number</code><br><br><b>Example:</b><br>Router(config)# interface serial 0  | Specifies the interface and enters interface configuration mode.  |
| Step 6  | <code>encapsulation frame-relay [cisco   ietf]</code><br><br><b>Example:</b><br>Router(config-if)# encapsulation frame-relay                                 | Enables Frame Relay encapsulation. <ul style="list-style-type: none"> <li>The default is <b>cisco</b> encapsulation.</li> <li>You do not need to specify an encapsulation type.</li> </ul>  |
| Step 7  | <code>frame-relay intf-type {dce   dte   nni}</code><br><br><b>Example:</b><br>Router(config-if)# frame-relay intf-type nni                                  | (Optional) Enables support for a particular type of connection: <ul style="list-style-type: none"> <li>Data Communications Equipment (DCE)</li> <li>Data Terminal Equipment (DTE)</li> <li>Network-to-Network Interface (NNI)</li> </ul>                                  |
| Step 8  | <code>frame-relay interface-dlci dlci switched</code><br><br><b>Example:</b><br>Router(config-if)# frame-relay interface-dlci 100 switched                   | (Optional) Creates a switched PVC and enters Frame Relay DLCI configuration mode. <ul style="list-style-type: none"> <li>If you do not create a Frame Relay PVC in this step, it will automatically be created in the next step by the <b>connect</b> command.</li> </ul> |
| Step 9  | <code>exit</code><br><br><b>Example:</b><br>Router(config-fr-dlci)# exit   | Exits Frame Relay DLCI configuration mode and returns to interface configuration mode.  |
| Step 10 | <code>exit</code><br><br><b>Example:</b><br>Router(config-if)# exit  | Exits interface configuration mode and returns to global configuration mode.  |
| Step 11 | <code>connect connection-name interface dlci interface dlci</code><br><br><b>Example:</b><br>Router(config)# connect connection1 serial1/0 100 serial1/0 200 | In global configuration mode, defines a connection between the two data links.  |

## Verifying Layer 2 Local Switching

To verify configuration of the Layer 2 Local Switching feature, use the following commands on the provider edge (PE) router.

### SUMMARY STEPS

1. **show connection**
2. **show atm pvc**
3. **show frame-relay pvc**

#### Step 1 **show connection**

The **show connection** command displays the local connection between an ATM interface and a Fast Ethernet interface.

```
Router# show connection name atm-eth-con
```

| ID | Name        | Segment 1           | Segment 2         | State |
|----|-------------|---------------------|-------------------|-------|
| 1  | atm-eth-con | ATM0/0/0 AAL5 0/100 | FastEthernet6/0/0 | UP    |

This example displays the local connection between an ATM interface and a serial interface.

```
Router# show connection name atm-fr-con
```

| ID | Name       | Segment 1           | Segment 2       | State |
|----|------------|---------------------|-----------------|-------|
| 1  | atm-fr-con | ATM0/0/0 AAL5 0/100 | Serial11/0/0 16 | UP    |

This example displays a same-port connection on a serial interface.

```
Router# show connection name same-port
```

| ID | Name      | Segment 1        | Segment 2        | State |
|----|-----------|------------------|------------------|-------|
| 1  | same-port | Serial11/1/1 101 | Serial11/1/1 102 | UP    |

#### Step 2 **show atm pvc**

The **show atm pvc** command shows that interface ATM3/0 is UP.

```
Router# show atm pvc
```

| Interface | Name | VCD/<br>VPI | VCI | Type | Encaps   | Peak<br>SC Kbps | Avg/Min<br>Kbps | Burst<br>Cells | Sts |
|-----------|------|-------------|-----|------|----------|-----------------|-----------------|----------------|-----|
| 3/0       | 10   | 1           | 32  | PVC  | FRATMSRV | UBR 155000      |                 |                | UP  |

#### Step 3 **show frame-relay pvc**

The **show frame-relay pvc** command shows a switched Frame Relay PVC:

```
Router # show frame-relay pvc 16
```

```
PVC Statistics for interface POS5/0 (Frame Relay NNI)
DLCI = 16, DLCI USAGE = SWITCHED, PVC STATUS = UP, INTERFACE = POS5/0
LOCAL PVC STATUS = UP, NNI PVC STATUS = ACTIVE
input pkts 0 output pkts 0 in bytes 0
out bytes 0 dropped pkts 100 in FECN pkts 0
in BECN pkts 0 out FECN pkts 0 out BECN pkts 0
in DE pkts 0 out DE pkts 0
out bcast pkts 0 out bcast bytes 0
```

```
switched pkts 0
Detailed packet drop counters:
no out intf 0 out intf down 100 no out PVC 0
in PVC down 0 out PVC down 0 pkt too big 0
pvc create time 00:25:32, last time pvc status changed 00:06:31
```

---

## Troubleshooting Tips

You can troubleshoot Layer 2 local switching using the following commands on the PE router:

- **show connection**
- **show atm pvc**
- **show frame-relay pvc**
- **debug conn**
- **debug atm l2transport**
- **debug frame-relay pseudowire**

## Configuring NSF/SSO—Local Switching Support

This feature provides SSO/NSF support for Local Switching of the following attachment circuits on the same router:

- Ethernet (port mode) to Ethernet VLAN
- Frame Relay to Frame Relay

For information about configuring SSO/NSF on the route processors, see the [Stateful Switchover](#) feature module.

## Verifying the SSO/NSF Configuration

To verify that the NSF/SSO—Layer 2 Local Switching Support is working correctly, use the following procedure:

- 
- Step 1** Issue the **ping** command or initiate traffic between the two CE routers.
- Step 2** Force the switchover from the active RP to the standby RP by using the **redundancy force-switchover** command. This manual procedure allows for a “graceful” or controlled shutdown of the active RP and switchover to the standby RP. This graceful shutdown allows critical cleanup to occur.
- Step 3** Issue the **show connect all** command to ensure that the Layer 2 Local Switching connection on the dual RP is operating.

```
Router # show connect all
```

| ID | Name      | Segment 1 | Segment 2   | State |
|----|-----------|-----------|-------------|-------|
| 2  | Eth-Vlan1 | Fa1/1/1   | Fa6/0/0/0.1 | UP    |

- Step 4** Check the ping buffer from the CE router to verify that the contiguous packet outage was minimal during the switchover.
- 

## Configuration Examples for Layer 2 Local Switching

This section provides the following configuration examples:

- [ATM-to-ATM Local Switching: Example, page 31](#)
- [ATM PVC Same-Port Switching: Example, page 32](#)
- [ATM PVP Same-Port Switching: Example, page 32](#)
- [ATM-to-Ethernet Local Switching: Examples, page 32](#)
- [Ethernet VLAN Same-Port Switching: Example, page 33](#)
- [ATM-to-Frame-Relay Local Switching: Example, page 33](#)
- [Frame-Relay-to-Frame-Relay Local Switching: Example, page 33](#)
- [Frame Relay DLCI Same-Port Switching: Example, page 33](#)
- [NSF/SSO—Ethernet \(Port Mode\) to Ethernet VLAN Local Switching: Example, page 34](#)

### ATM-to-ATM Local Switching: Example

The following example shows local switching on ATM interfaces configured for AAL5:

```
interface atm 1/0/0
 pvc 0/100 l2transport
 encapsulation aal5

interface atm 2/0/0
 pvc 0/100 l2transport
 encapsulation aal5

connect aal5_conn atm 1/0/0 0/100 atm 2/0/0 0/100
```

## ATM PVC Same-Port Switching: Example

The following example shows same-port switching between two PVCs on one ATM interface:

```
interface atm 1/0/0
  pvc 0/100 l2transport
    encapsulation aal5
  pvc 0/200 l2transport
    encapsulation aal5

connect conn atm 1/0/0 0/100 atm 1/0/0 0/200
```

## ATM PVP Same-Port Switching: Example

The following example shows same-port switching between two PVPs on one ATM interface:

```
interface atm 1/0/0
  atm pvp 100 l2transport
  atm pvp 200 l2transport

connect conn atm 1/0/0 100 atm 1/0/0 200
```

## ATM-to-Ethernet Local Switching: Examples

ATM-to-Ethernet local switching terminates an ATM frame to an Ethernet/VLAN frame over the same PE router. Two interworking models are used: Ethernet mode and IP mode.

### ATM to Ethernet VLAN: Example

The following example shows an Ethernet interface configured for Ethernet VLAN, and an ATM PVC interface configured for AAL5 encapsulation. The **connect** command allows local switching between these two interfaces and specifies the interworking type as Ethernet mode.

```
interface fastethernet6/0/0.1
  encapsulation dot1q 10

interface atm 2/0/0
  pvc 0/400 l2transport
    encapsulation aal5

connect atm_ethvlan_con atm 2/0/0 0/400 fastethernet6/0/0.1 interworking ethernet
```

### ATM to Ethernet (Port Mode): Example

The following example shows an Ethernet interface configured for Ethernet and an ATM interface configured for AAL5SNAP encapsulation. The **connect** command allows local switching between these two interfaces and specifies the interworking type as IP mode.

```
interface atm0/0/0
  pvc 0/100 l2transport
    encapsulation aal5snap

interface fastethernet6/0/0

connect atm_eth_con atm0/0/0 0/100 fastethernet6/0/0 interworking ip
```



## Ethernet VLAN Same-Port Switching: Example

The following example shows same-port switching between two VLANs on one Ethernet interface:

```
interface fastethernet0/0.1
  encapsulation dot1q 1
interface fastethernet0/0.2
  encapsulation dot1q 2

connect conn FastEthernet0/0.1 FastEthernet0/0.2
```

## ATM-to-Frame-Relay Local Switching: Example

The following example shows a serial interface configured for Frame Relay and an ATM interface configured for AAL5SNAP encapsulation. The **connect** command allows local switching between these two interfaces.

```
interface serial1/0
  encapsulation frame-relay

interface atm1/0
  pvc 7/100 l2transport
  encapsulation aal5snap

connect atm_fr_conn atm1/0 7/100 serial1/0 100 interworking ip
```

## Frame-Relay-to-Frame-Relay Local Switching: Example

The following example shows serial interfaces configured for Frame Relay. The **connect** command allows local switching between these two interfaces.

```
frame-relay switching
ip cef distributed

interface serial3/0/0
  encapsulation frame-relay
  frame-relay interface-dlci 100 switched
  frame-relay intf-type dce

interface serial3/1/0
  encapsulation frame-relay ietf
  frame-relay interface-dlci 200 switched
  frame-relay intf-type dce

connect fr_con serial3/0/0 100 serial 3/1/0 200
```

## Frame Relay DLCI Same-Port Switching: Example

The following example shows same-port switching between two data links on one Frame Relay interface:

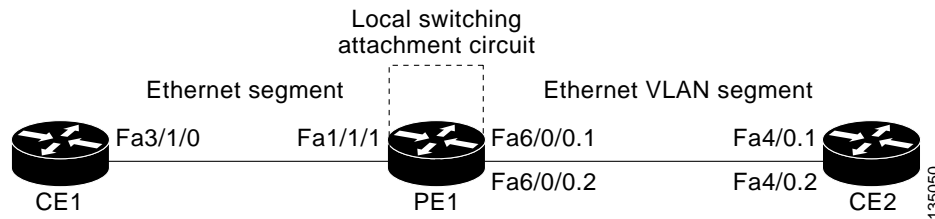
```
interface serial1/0
  encapsulation frame-relay
  frame-relay int-type nni

connect conn serial/0 100 serial1/0 200
```

## NSF/SSO—Ethernet (Port Mode) to Ethernet VLAN Local Switching: Example

The following configuration uses the network topology shown in [Figure 2](#).

**Figure 2** NSF/SSO—Layer 2 Local Switching Support : Ethernet to Ethernet VLAN



### Configuring the CE Interfaces to Connect to the PE1 Router: Example

| CE1   | CE2  |
|---|--|
| <pre>ip routing ! interface fa3/1/0 description: connection to PE fa1/1/1 no shutdown ip address 10.1.1.1 255.255.255.0</pre> | <pre>ip routing ! interface fa4/0 no shutdown ! interface fa4/0.1 description: connection to PE1 fa6/0/0.1 encapsulation dot1Q 10 ip address 10.1.1.2 255.255.255.0 ! interface fa4/0.2 description - connection to PE1 fa6/0/0.2 encapsulation dot1Q 20 ip address 10.1.1.2 255.255.255.0</pre> |

### Configuring the PE1 Router with NSF/SSO and PE Interfaces to the CE Routers

---

#### PE1

---

```

redundancy
  no keepalive-enable
  mode sso
!
hw-module slot 2 image disk0:rsp-pv-mz.shaft.111004
hw-module slot 3 image disk0:rsp-pv-mz.shaft.111004
!
ip routing
ip cef distributed
!
interface fa1/1/1
  description - connection to CE1 fa3/1/0
  no shutdown
  no ip address
!
interface fa4/0/0
  description - connection to CE3 fa6/0
  no shutdown
  no ip address
!
interface fa6/0/0
  no shutdown
  no ip address
!
interface fa6/0/0.1
  description - connection to CE2 fa4/0.1
  encapsulation dot1Q 10
  no ip address
!
interface fa6/0/0.2
  description - connection to CE2 fa4/0.2
  encapsulation dot1Q 20
  no ip address

```

---

#### Configuring ICMP Router Discovery Protocol on the CE Routers: Example

This example configures ICMP router discovery protocol (IRDP) on the CE router for Interworking IP for ARP mediation.

| CE1  | CE2  |
|--|--|
| <pre> interface FastEthernet3/1/0   ip irdp   ip irdp maxadvertinterval 0 </pre> | <pre> interface FastEthernet4/0.1   ip irdp   ip irdp maxadvertinterval 0 </pre> |

### Configuring OSPF on the CE Routers

| CE1   | CE2   |
|---|---|
| <pre>interface loopback 1  ip address 10.11.11.11 255.255.255.255 ! router ospf 10  network 10.11.11.11 0.0.0.0 area 0  network 10.1.1.1 0.0.0.0 area 0</pre> | <pre>interface loopback 1  ip address 10.12.12.12 255.255.255.255 ! router ospf 10  network 10.12.12.12 0.0.0.0 area 0  network 10.1.1.2 0.0.0.0 area 0</pre> |

### Configuring Local Switching on the PE1 Router

#### PE1

For interworking Ethernet:

```
connect eth-vlan1 fa1/1/1 fa6/0/0.1 interworking ethernet
connect eth-vlan2 fa4/0/0 fa6/0/0.2 interworking ethernet
```

For interworking IP:

```
connect eth-vlan1 fa1/1/1 fa6/0/0.1 interworking ip
connect eth-vlan2 fa4/0/0 fa6/0/0.2 interworking ip
```

## Additional References

The following sections provide references related to the Layer 2 Local Switching feature.

## Related Documents

| Related Topic                                 | Document Title  |
|---|---|
| Stateful Switchover                           | <a href="#">Stateful Switchover</a>                                       |
| Nonstop Forwarding                            | <a href="#">Cisco Nonstop Forwarding</a>                                  |
| High Availability for Any Transport over MPLS | <a href="#">NSF/SSO-Any Transport over MPLS and AToM Graceful Restart</a> |
| Layer 2 Local Switching                       | <a href="#">Layer 2 Local Switching</a>                                   |
| L2VPN Interworking                            | <a href="#">L2VPN Interworking</a>  |
| Frame-Relay-to-ATM Interworking               | <a href="#">Configuring Frame Relay-ATM Interworking</a>                  |
| Frame-Relay-to-Frame-Relay local switching    | <a href="#">Distributed Frame Relay Switching</a>                         |
| Layer 2 Tunnel Protocol Version 3             | <a href="#">Layer 2 Tunnel Protocol Version 3</a>                         |
| Any Transport over MPLS                       | <a href="#">Any Transport over MPLS</a>                                   |

## Standards

| Standard                                  | Title  |
|---|--|
| draft-ietf-l2tpext-l2tp-base-03.txt       | <i>Layer Two Tunneling Protocol (Version 3) 'L2TPv3'</i>                               |
| draft-martini-l2circuit-trans-mpls-09.txt | <i>Transport of Layer 2 Frames Over MPLS</i>   |
| draft-martini-l2circuit-encap-mpls-04.txt | <i>Encapsulation Methods for Transport of Layer 2 Frames Over IP and MPLS Networks</i> |
| draft-ietf-ppvpn-l2vpn-00.txt             | <i>An Architecture for L2VPNs</i>  |

## MIBs

| MIB  | MIBs Link   |
|--|---|
| <ul style="list-style-type: none"> <li>• CISCO-IETF-PW-MIB (PW-MIB)</li> <li>• CISCO-IETF-PW-MPLS-MIB (PW-MPLS-MIB)</li> <li>• CISCO-IETF-PW-ENET-MIB (PW-ENET-MIB)</li> <li>• CISCO-IETF-PW-FR-MIB (PW-FR-MIB)</li> </ul> | <p>To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL:</p> <p><a href="http://www.cisco.com/go/mibs">http://www.cisco.com/go/mibs</a></p> |

## RFCs

| RFC  | Title |
|------|-------|
| None | —     |

## Technical Assistance

| Description   | Link  |
|---|---|
| The Cisco Technical Support 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. | <a href="http://www.cisco.com/techsupport">http://www.cisco.com/techsupport</a> |

# Command Reference

This section documents new and modified commands only.

- **connect (L2VPN local switching)**
- **encapsulation (Layer 2 Local Switching)**
- **show connection**

## connect (L2VPN local switching)

To create Layer 2 data connections between two ports on the same router, use the **connect** command in global configuration mode. To remove such connections, use the **no** form of this command.

**connect** *connection-name* interface [*dldci* / *pvc* / *pvp*] interface [*dldci* / *pvc* / *pvp*] [**interworking** *interworking-type*]

**no connect** *connection-name* interface [*dldci* / *pvc* / *pvp*] interface [*dldci* / *pvc* / *pvp*] [**interworking** *interworking-type*]

| Syntax Description       |  |  |
|--------------------------|--|--|
| <i>connection-name</i>   |  | A name for this local switching connection.  |
| <i>interface</i>         |  | The interface type and number used to create a local switching connection; for example serial1/0 or atm1/0/1.  |
| <i>dldci</i>             |  | (Optional) The data-link connection identifier (DLCI) assigned to the interface.   |
| <i>pvc</i>               |  | (Optional) The permanent virtual circuit (PVC) assigned to the interface, expressed by its vpi/vci (Virtual Path and Virtual Channel identifiers).   |
| <i>pvp</i>               |  | (Optional) The permanent virtual path (PVP) assigned to the interface.   |
| <b>interworking</b>      |  | (Optional) Specifies that this local connection enables different transport types to be switched locally. This keyword is not necessary for configurations that locally switch the same transport type, such as ATM to ATM, or FR to FR.   |
| <i>interworking-type</i> |  | (Optional) Specifies one of the following types of L2VPN Interworking to use to transport the data: <ul style="list-style-type: none"> <li><b>ip</b>—Causes IP packets to be extracted from the attachment circuit and sent over the pseudowire. Attachment circuit frames that do not contain IPv4 packets are dropped.</li> <li><b>ethernet</b>—Causes Ethernet frames to be extracted from the attachment circuit and sent over the pseudowire. Ethernet end-to-end transmission is assumed. Attachment circuit frames that do not contain Ethernet frames are dropped. In the case of VLAN, the VLAN tag is removed, leaving a pure Ethernet frame.</li> </ul> |

**Defaults** No default behavior or values

**Command Modes** Global configuration

| Command History | Release    | Modification   |
|-----------------|------------|--|
|                 | 12.0(27)S  | This command was introduced for local switching.               |
|                 | 12.2(25)S  | This command was integrated into Cisco IOS Release 12.2(25)S.  |
|                 | 12.0(30)S  | This command was integrated into Cisco IOS Release 12.0(30)S.  |
|                 | 12.2(28)SB | This command was integrated into Cisco IOS Release 12.2(28)SB. |

**Examples**

The following example shows an Ethernet interface configured for Ethernet, plus an ATM interface configured for AAL5SNAP encapsulation. The **connect** command allows local switching between these two interfaces and specifies the interworking type as IP mode.

```
Router(config)# interface atm0/0/0
Router(config-if)# pvc 0/100 l2transport
Router(cfg-if-atm-l2trans-pvc)# encapsulation aal5snap

Router(config)# interface fastethernet6/0/0.1
Router(config-subif)# encapsulation dot1q 100

Router(config)# connect atm_eth_con atm0/0/0 0/100 fastethernet6/0/0.1 interworking ip
```

**Related Commands**

| Command                      | Description  |
|------------------------------|--|
| <b>frame-relay switching</b> | Enables PVC switching on a Frame Relay DCE or NNI. |



## encapsulation (Layer 2 Local Switching)

To configure the ATM adaptation layer (AAL) for a Layer 2 local switching ATM permanent virtual circuit (PVC), use the **encapsulation** command in ATM PVC L2transport configuration mode. To remove an encapsulation from a PVC, use the **no** form of this command.

**encapsulation** *layer-type*

**no encapsulation** *layer-type*

### Syntax Description

|                   |   |
|-------------------|---|
| <i>layer-type</i> | Adaptation layer type. Possible values are: |
|                   | aal5  |
|                   | aal0  |
|                   | aal5snap                                    |
|                   | aal5mux                                     |
|                   | aal5nlpid (not on Cisco 12000 series)       |

### Defaults

If you do not create a PVC, one is created for you. The default encapsulation types for autoprovisioned PVCs are as follows:

- For ATM-to-ATM local switching, the default encapsulation type for the PVC is AAL0.
- For ATM-to-Ethernet or ATM-to-Frame-Relay, the default encapsulation type for the PVC is AAL5SNAP.

### Command Modes

ATM PVC L2transport configuration

### Command History

| Release     | Modification   |
|-------------|--|
| 12.0(27)S   | This command was introduced for Layer 2 local switching.       |
| 12.2(25)S   | This command was integrated into Cisco IOS Release 12.2(25)S.  |
| 12.0(30)S   | This command was integrated into Cisco IOS Release 12.0(30)S.  |
| 12.2(28)SBC | This command was integrated into Cisco IOS Release 12.2(28)SB. |

### Usage Guidelines

The **pvc** command and the **encapsulation** command work together. The use of these commands with Layer 2 local switching is slightly different from the use of these commands with other applications. The following list highlights the differences:

- For Layer 2 local switching, you must add the **l2transport** keyword to the **pvc** command. The **l2transport** keyword enables the PVC to transport Layer 2 packets.
- The Layer 2 local switching **encapsulation** command works only with the **pvc** command. You cannot create switched virtual circuits or VC bundles to transport Layer 2 packets. You can only use PVCs to transport Layer 2 packets.

The following table shows the encapsulation types supported for each transport type:

| Interworking Type                          | Encapsulation Type  |
|--|---------------------|
| ATM to ATM                                 | AAL0, AAL5          |
| ATM to Ethernet with IP interworking       | AAL5SNAP, AAL5MUX   |
| ATM to Ethernet with Ethernet interworking | AAL5SNAP            |
| ATM to Frame-Relay                         | AAL5SNAP, AAL5NLPID |

### Examples

The following example shows how to configure a PVC to transport AAL0 packets for Layer 2 local switching:

```
pvc 1/100 l2transport
 encapsulation aal0
```

### Related Commands

| Command    | Description                              |
|------------|--|
| <b>pvc</b> | Creates or assigns a name to an ATM PVC. |

# show connection

To display the status of interworking connections, use the **show connection** command in EXEC mode.

**show connection** [*all* | *element* | **id** *ID* | **name** *name* | **port** *port*]

| Syntax Description      |   |
|-------------------------|---|
| <b>all</b>              | (Optional) Displays information about all interworking connections.   |
| <i>element</i>          | (Optional) Displays information about the specified connection element.   |
| <b>id</b> <i>ID</i>     | (Optional) Displays information about the specified connection identifier.  |
| <b>name</b> <i>name</i> | (Optional) Displays information about the specified connection name.  |
| <b>port</b> <i>port</i> | (Optional) Displays information about all connections on an interface. (In the 12.0S train, only ATM, Serial, and Fast Ethernet are shown.) |

**Command Modes** EXEC

| Command History | Release    | Modification  |
|-----------------|------------|---|
|                 | 12.1(2)T   | This command was introduced as <b>show connect</b> (FR-ATM).  |
|                 | 12.0(27)S  | This command was integrated into Cisco IOS Release 12.0(27)S and updated to show all ATM, Serial, and Fast Ethernet interworking connections. |
|                 | 12.2(25)S  | This command was integrated into Cisco IOS Release 12.2(25)S.   |
|                 | 12.4(2)T   | Segment state and channel ID added output of Segment 1 and Segment 2 fields.  |
|                 | 12.0(30)S  | This command was integrated into Cisco IOS Release 12.0(30)S.   |
|                 | 12.2(28)SB | This command was integrated into Cisco IOS Release 12.2(28)SB.  |

## Examples

The following example shows the local interworking connections on a router:

```
Router# show connection
```

```

ID   Name           Segment 1           Segment 2           State
-----
1   conn1          ATM 1/0/0 AAL5 0/100  ATM 2/0/0 AAL5 0/100  UP
2   conn2          ATM 2/0/0 AAL5 0/300  Serial0/1 16          UP
3   conn3          ATM 2/0/0 AAL5 0/400  FA 0/0.1 10          UP
4   conn4          ATM 1/0/0 CELL 0/500  ATM 2/0/0 CELL 0/500  UP
5   conn5          ATM 1/0/0 CELL 100    ATM 2/0/0 CELL 100    UP

```

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

**Table 1** *show connection* Field Descriptions

| Display | Description   |
|---------|---|
| ID      | Arbitrary connection identifier assigned by the operating system. |
| Name    | Name of the connection.   |

**Table 1** *show connection Field Descriptions (continued)*

| Display                | Description  |
|------------------------|--|
| Segment 1<br>Segment 2 | Information about the interworking segments, including: <ul style="list-style-type: none"> <li>• Interface name and number.</li> <li>• Segment state, interface name and number, and channel ID. Segment state will display nothing if the segment state is UP, “-” if the segment state is DOWN, and “***Card Removed***” if the segment state is DETACHED.</li> <li>• Type of encapsulation (if any) assigned to the interface.</li> <li>• PVC assigned to the ATM interface, DLCI assigned to the serial interface, or VLAN ID assigned to the Ethernet interface.</li> </ul> |
| State or Status        | Status of the connection, including the following states: INVALID, UP, ADMIN UP, ADMIN DOWN, OPER DOWN, COMING UP, NOT VERIFIED, ERR.  |

**Related Commands**

| Command                                | Description  |
|--|--|
| <b>connect (L2VPN local switching)</b> | Connects two different or like interfaces on a router. |
| <b>show atm pvc</b>                    | Displays the status of ATM PVCs and SVCs.              |
| <b>show frame-relay pvc</b>            | Displays the status of Frame Relay interfaces.         |

---

CCSP, CCVP, the Cisco Square Bridge logo, Follow Me Browsing, and StackWise are trademarks of Cisco Systems, Inc.; Changing the Way We Work, Live, Play, and Learn, and iQuick Study are service marks of Cisco Systems, Inc.; and Access Registrar, Aironet, ASIST, BPX, Catalyst, CCDA, CCDP, CCIE, CCIP, CCNA, CCNP, Cisco, the Cisco Certified Internetwork Expert logo, Cisco IOS, Cisco Press, Cisco Systems, Cisco Systems Capital, the Cisco Systems logo, Cisco Unity, Empowering the Internet Generation, Enterprise/Solver, EtherChannel, EtherFast, EtherSwitch, Fast Step, FormShare, GigaDrive, GigaStack, HomeLink, Internet Quotient, IOS, IP/TV, iQ Expertise, the iQ logo, iQ Net Readiness Scorecard, LightStream, Linksys, MeetingPlace, MGX, the Networkers logo, Networking Academy, Network Registrar, *Packet*, PIX, Post-Routing, Pre-Routing, ProConnect, RateMUX, ScriptShare, SlideCast, SMARTnet, StrataView Plus, TeleRouter, The Fastest Way to Increase Your Internet Quotient, and TransPath are registered trademarks of Cisco Systems, Inc. and/or its affiliates in the United States and certain other countries.

All other trademarks mentioned in this document or Website are the property of their respective owners. The use of the word partner does not imply a partnership relationship between Cisco and any other company. (0502R)

---

Any Internet Protocol (IP) addresses used in this document are not intended to be actual addresses. Any examples, command display output, and figures included in the document are shown for illustrative purposes only. Any use of actual IP addresses in illustrative content is unintentional and coincidental.

Copyright © 2006 Cisco Systems, Inc. All rights reserved.

■ show connection