Layer 2 Local Switching

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The Layer 2 Local Switching feature allows you to switch Layer 2 data in two ways:

- Between two interfaces on the same router
- Between two circuits on the same interface port, which is called same-port switching

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 Multilink Frame Relay in Cisco IOS Release 12.0(28)S and later)
- High-Level Data Link Control (HDLC)

The following same-port switching features are supported:

- ATM Permanent Virtual Circuit (PVC) and Permanent Virtual Path (PVP)
- Ethernet VLAN
- Frame Relay

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. To find information

about the features documented in this module, and to see a list of the releases in which each feature is supported, see the Feature Information Table at the end of this document.

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

Prerequisites for Layer 2 Local Switching

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

Restrictions for Layer 2 Local Switching

Cisco 7200 and 7500 Series Router Restrictions

- 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.
- NSF/SSO: Layer 2 local switching is supported on Cisco 7500 series routers.

Layer 2 local switching is supported on the following interface processors in the 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

Layer 2 local switching is supported on the following interface processors in the Cisco 7500 series routers:

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

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 Fast Ethernet (FE) adapter) [Cisco 7200 only]
- PA-GE (Gigabit Ethernet port adapter) [Cisco 7200 only]
- PA-H (single-port High-Speed Serial Interface (HSSI) adapter)
- PA-2H (dual-port HSSI adapter)
- PA-MC-8E1 (8-port multichannel E1 G.703/G.704 120-ohm interfaces)
- PA-MC-2EI (2-port multichannel E1 G.703/G.704 120-ohm interfaces)
- PA-MC-8T1 (8-port multichannel T1 with integrated data service units (DSUs) and channel service units CSUs))
- 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 STM-1 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-OC-3SML (single-port Packet over SONET (POS), single-mode, long reach)
- PA-POS-OC-3SMI (single-port PoS, single-mode, intermediate reach)
- PA-POS-OC-3MM (single-port PoS, multimode)
- PA-A3-OC-3 (1-port ATM OC-3/STM1 port adapter, enhanced)
- PA-A3-OC-12 (1-port ATM OC-12/STM-4 port adapter, enhanced) [Cisco 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)
- PA-A6 (Cisco ATM Port Adapter)

Cisco 7600 and 6500 Series Router Restrictions

- Layer 2 local switching supports the following port adapters and interface processors on the Cisco 7600-SUP720/MSFC3 router:
  - All port adapters on the Enhanced FlexWAN module
  - All shared prot adaptors (SPAs) on the SIP-200 line cards
- On the Cisco 6500 series and 7600 series routers, only *like-to-like* local switching is supported (ATM to ATM and Frame Relay to Frame Relay).
- Same-port switching is not supported on the Cisco 6500 series and 7600 series routers.

Cisco 10000 Series Router Restrictions

For information about Layer 2 local switching on the Cisco 10000 series routers, see Configuring Layer 2 Local Switching .

Gigabit Switch Router Restrictions

- VPI/VCI rewrite is supported.
- All GSR line cards support Frame Relay-to-Frame Relay local switching.
- 8-port OC-3 ATM Engine 2 line cards support only like-to-like Layer 2 local switching.
- IP Service Engine (ISE) (Engine 3) line cards support like-to-like and any-to-any local switching. Non-ISE line cards support only like-to-like local switching.

Starting in Cisco IOS Release 12.0(31)S2, ISE customer edge-facing interfaces support the following types of like-to-like and any-to-any local switching:

- ◦ ATM to ATM
  - ◦ ATM to Ethernet
  - ◦ ATM to Frame Relay
  - ◦ Ethernet to Ethernet VLAN
  - ◦ Frame Relay to Frame Relay (including Multilink Frame Relay)
  - ◦ Same-port switching for ATM (PVC and PVP)
  - ◦ Same-port switching for Ethernet VLAN
  - ◦ Same-port switching for Frame Relay

Note Native Layer 2 Tunnel Protocol Version 3 (L2TPv3) tunnel sessions on customer edge-facing line cards can coexist with tunnel sessions that use a tunnel-server card.

- Starting in Cisco IOS Release 12.0(32)SY, customer edge-facing interfaces on Engine 5 SPAs and SPA Interface Processors (SIPs) support the following types of like-to-like local switching:

  - ◦ Ethernet to Ethernet VLAN
  - ◦ Frame Relay to Frame Relay (including Multilink Frame Relay)
  - ◦ Same-port switching for Ethernet VLAN
  - ◦ Same-port switching for Frame Relay
- 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 GSR
  - ◦ ATM single cell relay VC and VP modes on ISE line cards on the GSR
- Starting with Cisco IOS Release 12.0(30)S, you can use local switching and cell packing with ATM VP or VC mode on the GSR on IP Services Engine (ISE/Engine 3) line cards. For information about how to configure cell packing, refer to Any Transport over MPLS.

Unsupported Hardware

The following hardware is not supported:

- Cisco 7200--non-VXR chassis
- Cisco 7500--Route Switch Processor (RSP)1 and 2
- Cisco 7500--Versatile Interface Processor (VIP) 2-40 and below
- GSR--4-port OC-3 ATM Engine-0 line card
- GSR--4-port OC-12 ATM Engine-2 line card
- GSR--1-port OC-12 ATM Engine-0 line card
- GSR--Ethernet Engine-1, Engine-2, and Engine-4 line cards

Information About Layer 2 Local Switching

Layer 2 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 (RPs) and checkpointing of data to ensure minimal packet loss when the primary RP goes down. NSF/SSO support is available for the following locally switched attachment circuits:

- Ethernet to Ethernet VLAN
- Frame Relay to Frame Relay

Layer 2 Local Switching Applications

Incumbent local exchange carriers (ILECs) who use an interexchange carrier (IXC) to carry traffic between two local exchange carriers can use the Layer 2 Local Switching feature. 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.

The figure below shows a network that uses local switching for both Frame Relay to Frame Relay and ATM to Frame Relay local switching.

Figure 1   *Local Switching Example*
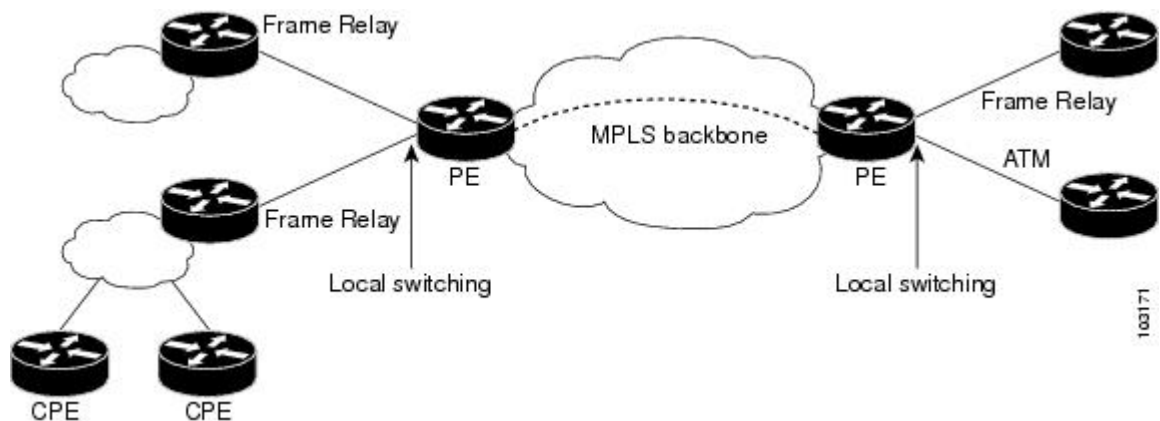
Access Circuit Redundancy Local Switching

The Automatic Protection Switching (APS) mechanism provides a switchover time of less than 50 milliseconds. However, the switchover time is longer in a pseudowire configuration due to the time the pseudowire takes to enter the UP state on switchover. The switchover time of the pseudowire can be eliminated if there is a single pseudowire on the working and protect interfaces instead of separate pseudowire configurations. A single pseudowire also eliminates the need to have Label Distribution Protocols (LDP) negotiations on a switchover. The virtual interface or controller model provides a method to configure a single pseudowire between the provider edge (PE) routers.

Access Circuit Redundancy (ACR) ensures low data traffic downtime by reducing the switchover time. ACR works on the APS 1+1, nonrevertive model where each redundant line pair consists of a working line and a protect line. If a signal fail condition or a signal degrade condition is detected, the hardware switches from the working line to the protect line.

The working and protect interfaces can be on the following:

- Same SPA
- Different SPA but on the same line card
- SPAs on different line cards

When the working or protection interface is configured with ACR, a virtual interface is created and a connection is established between the virtual interfaces to facilitate the switching of data between the interfaces.

ACR for ATM-to-ATM Local Switching

ACR for ATM-to-ATM local switching supports the ATM AAL5 and ATM AAL0 encapsulation types and switches Layer 2 data between L2 transport virtual circuits (VCs).
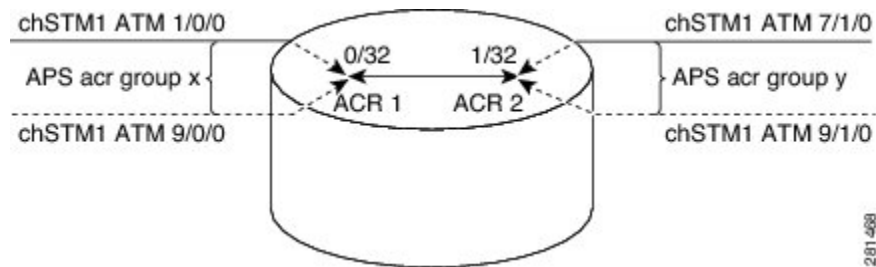
Note The L2 transport VCs must be configured with the same encapsulation type.

The figure below shows the ACR for ATM-to-ATM local switching model.

Figure 2   ***ATM-to-ATM ACR Local Switching Model***

In the figure:

- ATM 1/0/0 and ATM 9/0/0 are configured as working and protection interfaces of ACR 1 group.
- ATM 7/1/0 and ATM 9/1/0 are configured as working and protection interfaces of ACR 2 group.
- A connection is established between the ACRs.
- The Add/Drop Multiplexer (ADM) sends data to both the interfaces, which are part of the ACR group ACR 1.
- The cells or packets received on the APS active interface VC (0/32) of ACR group 1 are switched to the ACR 2 interface VC (1/32) and the cells or packets from the APS inactive interface are dropped.
- The packets received on the ACR 2 VC (1/32) interface are replicated on both the physical interfaces, which are part of the ACR group ACR 2.

ACR for CEM-to-CEM Local Switching

Circuit Emulation (CEM) transports Time Division Multiplexing (TDM) data over TDM pseudowires, allowing mobile operators to carry TDM traffic over an IP or Multiprotocol Label Switching (MPLS) network. ACR for CEM-to-CEM involves creating a virtual controller and associating the virtual controller with the physical controllers. The virtual controller is created when APS and ACR are configured on the physical controller. All commands executed on the virtual controller apply to the working and protect controller. The virtual controller simplifies the single point of configuration and provides the flexibility of not running a backup pseudowire for the protect controller in the event of a failure. This way there is no switchover between the pseudowires, which in turn reduces the recovery time when the physical link fails.

When the CEM group is configured on the virtual controller, a virtual CEM-ACR interface is created and associated with the CEM circuit. ACR creates CEM interfaces and CEM circuits on the physical interfaces that correspond to the physical controllers belonging to the same ACR group.

The figure below shows the ACR for CEM-to-CEM local switching model:

Figure 3 *CEM-to-CEM ACR Local Switching Model*
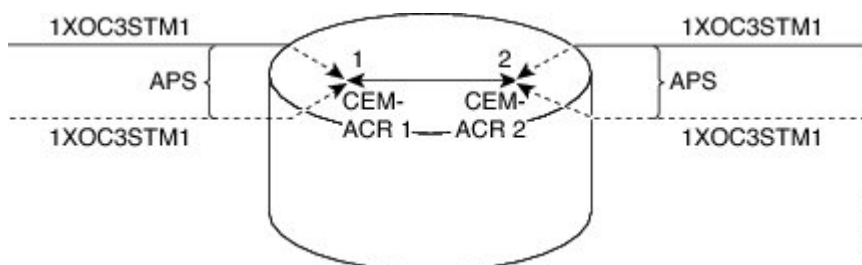
In the figure:

- Packets are received from the ADM. The packets from the APS inactive interface are dropped and the packets received on the APS active interface are switched.
- The packets received on the CEM circuit ID 1 of the APS active interface, which is part of ACR group 1, are switched to the CEM circuit ID 2 of the APS active interface, which is part of ACR group 2.
- The packets are duplicated and sent on both the APS active and inactive physical CEM interfaces that are part of ACR group 2.

How to Configure Layer 2 Local Switching

For information about Layer 2 local switching on the Cisco 10000 series routers, see Configuring Layer 2 Local Switching .

Configuring ATM-to-ATM PVC Local Switching and Same-Port Switching

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.

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Note   Starting with Cisco IOS Release 12.0(30)S, you can configure same-port switching following the steps in this section.

Perform this task to configure ATM-to-ATM PVC local switching and same-port switching.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface atm** *slot* / *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	**enable** **Example:** Router> enable	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** Router# configure terminal	Enters global configuration mode.
Step 3	**interface atm** *slot* / *port* **Example:** Router(config)# interface atm1/0	Specifies an ATM line card, subslot (if available), and port, and enters interface configuration mode.
Step 4	**pvc** *vpi* / *vci* **l2transport** **Example:** Router(config-if)# pvc 1/200 l2transport	Assigns a VPI and VCI and enters ATM PVC l2transport configuration mode. • The **l2transport**keyword indicates that the PVC is a switched PVC instead of a terminated PVC.

	Command or Action	Purpose
Step 5	**encapsulation** *layer-type* **Example:** `Router(cfg-if-atm-l2trans-pvc)# encapsulation aal5`	Specifies the encapsulation type for the ATM PVC. Both AAL0 and AAL5 are supported. • Repeat Steps 3 through 5 for another ATM PVC on the same router.
Step 6	**exit** **Example:** `Router(cfg-if-atm-l2trans-pvc)# exit`	Exits PVC l2transport configuration mode and returns to interface configuration mode.
Step 7	**exit** **Example:** `Router(config-if)# exit`	Exits interface configuration mode and returns to global configuration mode.
Step 8	**connect** *connection-name interface pvc interface pvc* **Example:** `Router(config)# connect atm-con atm1/0/0 0/100 atm2/0/0 0/100`	Creates a local connection between the two specified permanent virtual circuits.

Configuring ATM-to-ATM PVP Local Switching

Perform this task to configure ATM-to-ATM PVP local switching.

Starting with Cisco IOS Release 12.0(30)S, you can configure same-port switching, as detailed in the Configuring ATM PVP Same-Port Switching, page 12.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface atm** *slot* / *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	**enable** **Example:** Router> enable	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** Router# configure terminal	Enters global configuration mode.
Step 3	**interface atm** *slot* / *port* **Example:** Router(config)# interface atm1/0	Specifies an ATM line card, subslot (if available), and port, and enters interface configuration mode.
Step 4	**atm pvp** *vpi* **l2transport** **Example:** Router(config-if)# atm pvp 100 l2transport	Identifies the virtual path and enters PVP l2transport configuration mode. The **l2transport**keyword indicates that the PVP is a switched PVP instead of a terminated PVP. • Repeat Steps 3 and 4 for another ATM permanent virtual path on the same router.
Step 5	**exit** **Example:** Router(config-if-atm-l2trans-pvp)# exit	Exits PVP l2transport configuration mode and returns to interface configuration mode.
Step 6	**exit** **Example:** Router(config-if)# exit	Exits interface configuration mode and returns to global configuration mode.

	Command or Action	Purpose
Step 7	**connect** *connection-name interface pvp interface pvp*	In global configuration mode, creates a local connection between the two specified permanent virtual paths.
	Example:	
	Router(config)# connect atm-con	
	Example:	
	atm1/0 100 atm2/0 200	

Configuring ATM PVP Same-Port Switching

Perform this task to configure ATM PVP switching on an ATM interface.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface atm** *slot* / *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	**enable**	Enables privileged EXEC mode.
		• Enter your password if prompted.
	Example:	
	Router> enable	
Step 2	**configure terminal**	Enters global configuration mode.
	Example:	
	Router# configure terminal	

	Command or Action	Purpose
Step 3	**interface atm** *slot* / *subslot* / *port* **Example:** `Router(config)# interface atm1/0/0`	Specifies an ATM line card, subslot (if available), and port, and enters interface configuration mode.
Step 4	**atm pvp** *vpi* **l2transport** **Example:** `Router(config-if)# atm pvp 100 l2transport`	Specifies one VPI and enters PVP l2transport configuration mode. Repeat this step for the other ATM permanent virtual path on this same port. • The **l2transport**keyword indicates that the indicated PVP is a switched PVP instead of a terminated PVP.
Step 5	**exit** **Example:** `Router(config-if-atm-l2trans-pvp)# exit`	Exits PVP l2transport configuration mode and returns to interface configuration mode.
Step 6	**exit** **Example:** `Router(config-if)# exit`	Exits interface configuration mode and returns to global configuration mode.
Step 7	**connect** *connection-name interface pvp interface pvp* **Example:** `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

For ATM to Ethernet port mode local switching, 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. When the Ethernet interworking type is used, the interworking device (router) expects a bridged packet. Therefore, configure the ATM CPE for either IRB or RBE.

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Note   Enabling ICMP Router Discovery Protocol on the Ethernet side is recommended.

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

Perform this task to configure local switching between ATM and Ethernet port mode.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface atm** *slot* / *port*
4. **pvc** *vpi* / *vci* **l2transport**
5. **encapsulation** *layer-type*
6. **exit**
7. **exit**
8. **interface fastethernet** *slot* / *subslot* / *port*
9. **exit**
10. **connect** *connection-name interface pvc interface* [**interworking ip** | **ethernet**]

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** Router> enable	Enables privileged EXEC mode. - Enter your password if prompted.
Step 2	**configure terminal** **Example:** Router# configure terminal	Enters global configuration mode.
Step 3	**interface atm** *slot* / *port* **Example:** Router(config)# interface atm1/0	Specifies an ATM line card, subslot (if available), and port, and enters interface configuration mode.
Step 4	**pvc** *vpi* / *vci* **l2transport** **Example:** Router(config-if)# pvc 1/200 l2transport	Assigns a VPI and VCI and enters PVC l2transport configuration mode. - The **l2transport**keyword indicates that the PVC is a switched PVC instead of a terminated PVC.

	Command or Action	Purpose
Step 5	**encapsulation** *layer-type* **Example:** `Router(cfg-if-atm-l2trans-pvc)# encapsulation aal5snap`	Specifies the encapsulation type for the PVC.
Step 6	**exit** **Example:** `Router(config-if-atm-l2trans-pvc)# exit`	Exits PVC l2transport configuration mode and returns to interface configuration mode.
Step 7	**exit** **Example:** `Router(config-if)# exit`	Exits interface configuration mode and returns to global configuration mode.
Step 8	**interface fastethernet** *slot* / *subslot* / *port* **Example:** `Router(config)# interface fastethernet6/0/0`	Specifies a Fast Ethernet line card, subslot (if available), and port, and enters interface configuration mode.
Step 9	**exit** **Example:** `Router(config-if)# exit`	Exits interface configuration mode and returns to global configuration mode.
Step 10	**connect** *connection-name interface pvc interface* [**interworking ip** | **ethernet**] **Example:** `Router(config)# connect atm-eth-con atm1/0 0/100 fastethernet6/0/0 interworking ethernet`	In global configuration mode, creates a local connection between the two interfaces and specifies the interworking type. • Both the IP and Ethernet interworking types are supported.

Configuring ATM-to-Ethernet VLAN Mode Local Switching

For ATM-to-Ethernet VLAN mode local switching, 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. When the Ethernet interworking type is used, the interworking device (router) expects a bridged packet. Therefore, configure the ATM CPE for either IRB or RBE.

Note Enabling ICMP Router Discovery Protocol on the Ethernet side is recommended.

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.

Perform this task to configure local switching for ATM to Ethernet in VLAN mode.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface atm** *slot* / *subslot* / *port*
4. **pvc** *vpi* / *vci* **l2transport**
5. **encapsulation** *layer-type*
6. **exit**
7. **interface fastethernet** *slot* / *port* / *subinterface-number*
8. **encapsulation dot1q** *vlan-id*
9. **exit**
10. **connect** *connection-name interface pvc interface* [**interworking ip** | **ethernet**]

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	**interface atm** *slot* / *subslot* / *port* **Example:** Router(config)# interface atm1/0/0	Specifies an ATM line card, subslot (if available), and port, and enters interface configuration mode.
Step 4	**pvc** *vpi* / *vci* **l2transport** **Example:** Router(config-if)# pvc 1/200 l2transport	Assigns a VPI and VCI and enters PVC l2transport configuration mode. • The **l2transport**keyword indicates that the PVC is a switched PVC instead of a terminated PVC.
Step 5	**encapsulation** *layer-type* **Example:** Router(cfg-if-atm-l2trans-pvc)# encapsulation aal5snap	Specifies the encapsulation type for the PVC.
Step 6	**exit** **Example:** Router(cfg-if-atm-l2trans-pvc)# exit	Exits PVC l2transport configuration mode and returns to interface configuration mode.
Step 7	**interface fastethernet** *slot* / *port* / *subinterface-number* **Example:** Router(config-if)# interface fastethernet6/0/0.1	Specifies a Fast Ethernet line card, subslot (if available), port, and subinterface, and enters subinterface configuration mode.
Step 8	**encapsulation dot1q** *vlan-id* **Example:** Router(config-subif)# encapsulation dot1q 100	Enables the interface to accept 802.1Q VLAN packets.
Step 9	**exit** **Example:** Router(config-subif)# exit	Exits subinterface configuration mode and returns to global configuration mode.

Command or Action	Purpose

Step 10 **connect** *connection-name interface pvc interface* [**interworking ip** | **ethernet**]
 	
Example:
 	
`Router(config)# connect atm-eth-vlan-con`
`atm1/0/0 0/100 fastethernet6/0/0.1`
`interworking ethernet`
	In global configuration mode, creates a local connection between the two interfaces and specifies the interworking type.
	
	• Both the IP and Ethernet interworking types are supported.

Configuring Ethernet VLAN Same-Port Switching

Perform this task to configure Ethernet VLAN same-port switching.

SUMMARY STEPS

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

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	**interface fastethernet** *slot* / *port.subinterface-number* **Example:** Router(config)# interface fastethernet6/0.1	Specifies the first Fast Ethernet line card, subslot (if available), port, and subinterface, and enters subinterface configuration mode.
Step 4	**encapsulation dot1q** *vlan-id* **Example:** Router(config-subif)# encapsulation dot1q 10	Enables that subinterface to accept 802.1Q VLAN packets and specifies the first VLAN.
Step 5	**exit** **Example:** Router(config-subif)# exit	Exits subinterface configuration mode and returns to global configuration mode.
Step 6	**interface fastethernet** *slot* / *port.subinterface-number* **Example:** Router(config)# interface fastethernet6/0.2	In global configuration mode, specifies the second Fast Ethernet line card, subslot (if available), port, and subinterface, and enters subinterface configuration mode.
Step 7	**encapsulation dot1q** *vlan-id* **Example:** Router(config-subif)# encapsulation dot1q 20	Enables this subinterface to accept 802.1Q VLAN packets and specifies the second VLAN.
Step 8	**exit** **Example:** Router(config-subif)# exit	Exits subinterface configuration mode and returns to global configuration mode.
Step 9	**connect** *connection-name interface interface* **Example:** Router(config)# connect conn fastethernet6/0.1 fastethernet6/0.2	In global configuration mode, creates a local connection between the two subinterfaces (and hence their previously specified VLANs) on the same Fast Ethernet port.

Configuring Ethernet Port Mode to Ethernet VLAN Local Switching

Perform this task to configure local switching for Ethernet (port mode) to Ethernet VLAN.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface fastethernet** *slot* / *subslot* / *port*
4. **interface fastethernet** *slot* / *port* / *subinterface-number*
5. **encapsulation dot1q** *vlan-id*
6. **exit**
7. **connect** *connection-name interface interface* [**interworking ip** | **ethernet**]

DETAILED STEPS

Command or Action	Purpose
Step 1 **enable** **Example:** Router> enable	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2 **configure terminal** **Example:** Router# configure terminal	Enters global configuration mode.
Step 3 **interface fastethernet** *slot* / *subslot* / *port* **Example:** Router(config)# interface fastethernet3/0/0	Specifies a Fast Ethernet line card, subslot (if available), and port, and enters interface configuration mode. This is the interface on one side of the PE router that passes Ethernet packets to and from the customer edge (CE) router.
Step 4 **interface fastethernet** *slot* / *port* / *subinterface-number* **Example:** Router(config)# interface fastethernet6/0/0.1	Specifies a Fast Ethernet line card, subslot (if available), port, and subinterface, and enters subinterface configuration mode. This is the interface on the other side of the PE router than passes Ethernet VLAN packets to and from the CE router.
Step 5 **encapsulation dot1q** *vlan-id* **Example:** Router(config-subif)# encapsulation dot1q 100	Enables the interface to accept 802.1Q VLAN packets.

	Command or Action	Purpose
Step 6	**exit** **Example:** `Router(config-subif)# exit`	Exits subinterface configuration mode and returns to global configuration mode.
Step 7	**connect** *connection-name interface interface* [**interworking ip** | **ethernet**] **Example:** `Router(config)# connect eth-ethvlan-con fastethernet3/0/0 fastethernet6/0/0.1 interworking ethernet`	Creates a local connection between the two interfaces and specifies the interworking type. • Both the IP and Ethernet interworking types are supported.

Configuring ATM-to-Frame Relay Local Switching

You use the **interworking ip** keywords 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.

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 (GSR 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* / *subslot* / *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 ip** \| **ethernet**]

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable**	Enables privileged EXEC mode.
		• Enter your password if prompted.
	Example:	
	Router> enable	
Step 2	**configure terminal**	Enters global configuration mode.
	Example:	
	Router# configure terminal	
Step 3	**interface atm** *slot* / *port*	Specifies an ATM line card, subslot (if available), and port, and enters interface configuration mode.
	Example:	
	Router(config)# interface atm1/0	
Step 4	**pvc** *vpi* / *vci* **l2transport**	Assigns a VPI and VCI and enters PVC l2transport configuration mode.
		• The **l2transport**keyword indicates that the PVC is a switched PVC instead of a terminated PVC.
	Example:	
	Router(config-if)# pvc 1/200 l2transport	
Step 5	**encapsulation** *layer-type*	Specifies the encapsulation type for the PVC.
	Example:	
	Router(cfg-if-atm-l2trans-pvc)# encapsulation aal5snap	
Step 6	**exit**	Exits PVC l2transport configuration mode and returns to interface configuration mode.
	Example:	
	Router(cfg-if-atm-l2trans-pvc)# exit	
Step 7	**interface serial** *slot* / *subslot* / *port*	Specifies a channelized line card, subslot (if available), and serial port.
	Example:	
	Router(config-if)# interface serial6/0/0	

	Command or Action	Purpose
Step 8	**encapsulation frame-relay** [**cisco** | **ietf**] **Example:** `Router(config-if)# encapsulation frame-relay ietf`	Specifies Frame Relay encapsulation for the interface. • The encapsulation type does not matter for local switching. It has relevance only for terminated circuits.
Step 9	**frame-relay interface-dlci** *dlci* **switched** **Example:** `Router(config-if)# frame-relay interface-dlci 100 switched`	(Optional) Configures a switched Frame Relay DLCI. • If you do not create a Frame Relay PVC in this step, one is automatically created by the **connect** command.
Step 10	**exit** **Example:** `Router(config-if)# exit`	Exits interface configuration mode and returns to global configuration mode.

Step 11	**connect** *connection-name interface pvc interface dlci* [**interworking ip** | **ethernet**]
	
	Example:
	
	`Router(config)# connect atm-fr-con`
	
	Example:
	
	`atm1/0 0/100 serial6/0/0 100 interworking ip`
		Creates a local connection between the two interfaces.

Configuring Frame Relay-to-Frame Relay Local Switching

For information on Frame Relay-to-Frame Relay Local Switching, see the Distributed Frame Relay Switching feature module.

With Cisco IOS 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, page 25.

SUMMARY STEPS

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

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	**ip cef distribute d** **Example:** Router(config)# ip cef	Enables Cisco Express Forwarding operation. • For the Cisco 7500 series router, use the **ip cef distributed** command. (On the GSR, this command is already enabled by default). • For the Cisco 7200 series router, use the **ip cef** command.
Step 4	**frame-relay switching** **Example:** Router(config)# frame-relay switching	Enables PVC switching on a Frame Relay DCE device or a Network-to-Network Interface (NNI).
Step 5	**interface** *type number* **Example:** Router(config)# interface serial 0	Specifies a Frame Relay interface and enters interface configuration mode.

	Command or Action	Purpose
Step 6	**encapsulation frame-relay** [**cisco**	**ietf**] **Example:** `Router(config-if)# encapsulation frame-relay`	Enables Frame Relay encapsulation. • The default is **cisco** encapsulation. • You do not need to specify an encapsulation type.
Step 7	**frame-relay interface-dlci** *dlci* **switched** **Example:** `Router(config-if)# frame-relay interface-dlci 100 switched`	(Optional) Creates a switched PVC and enters Frame Relay DLCI configuration mode. • Repeat Steps 5 through 7 for each switched PVC. • If you do not create a Frame Relay PVC in this step, it will automatically be created by the **connect**command.
Step 8	**exit** **Example:** `Router(config-fr-dlci)# exit`	Exits Frame Relay DLCI configuration mode and returns to interface configuration mode.
Step 9	**exit** **Example:** `Router(config-if)# exit`	Exits interface configuration mode and returns to global configuration mode.
Step 10	**connect** *connection-name interface dlci interface dlci* **Example:** `Router(config)# connect connection1 serial0 100 serial1 101`	Defines a connection between Frame Relay PVCs.

Configuring Frame Relay Same-Port Switching

Perform this task to configure Frame Relay switching on the same 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** [**dce**| **dte**| **nni**]
8. **frame-relay interface-dlci** *dlci* **switched**
9. **exit**
10. **exit**
11. **connect** *connection-name interface dlci interface dlci*

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	**ip cef** [**distributed**] **Example:** Router(config)# ip cef	Enables Cisco Express Forwarding operation. • For the Cisco 7500 series router, use the **ip cef distributed** command. (On the GSR, this command is already enabled by default). • For the Cisco 7200 series router, use the **ip cef** command.
Step 4	**frame-relay switching** **Example:** Router(config)# frame-relay switching	Enables PVC switching on a Frame Relay DCE device or a NNI.

Command or Action	Purpose
Step 5 **interface** *type number* **Example:** Router(config)# interface serial 0	Specifies a Frame Relay interface and enters interface configuration mode.
Step 6 **encapsulation frame-relay** [**cisco** | **ietf**] **Example:** Router(config-if)# encapsulation frame-relay	Enables Frame Relay encapsulation. • The default is **cisco** encapsulation. • You do not need to specify an encapsulation type.
Step 7 **frame-relay intf-type** [**dce**| **dte**| **nni**] **Example:** Router(config-if)# frame-relay intf-type nni	(Optional) Enables support for a particular type of connection: • DCE • DTE (default) • NNI
Step 8 **frame-relay interface-dlci** *dlci* **switched** **Example:** Router(config-if)# frame-relay interface-dlci 100 switched	(Optional) Creates a switched PVC and enters Frame Relay DLCI configuration mode. • If you do not create a Frame Relay PVC in this step, it will automatically be created by the **connect**command.
Step 9 **exit** **Example:** Router(config-fr-dlci)# exit	Exits Frame Relay DLCI configuration mode and returns to interface configuration mode.
Step 10 **exit** **Example:** Router(config-if)# exit	Exits interface configuration mode and returns to global configuration mode.
Step 11 **connect** *connection-name interface dlci interface dlci* **Example:** Router(config)# connect connection1 serial1/0 100 serial1/0 200	Defines a connection between the two data links.

Configuring HDLC Local Switching

Perform this task to configure local switching for HDLC. The PE routers are configured with HDLC encapsulation. The CE routers are configured with any HDLC-based encapsulation, including HDLC, PPP, and Frame Relay.

- Ensure that the interfaces you configure for HDLC encapsulation can handle ping packets that are smaller, the same size as, or larger than the CE interface MTU.
- Enable Cisco Express Forwarding.

Note

- Do not configure other settings on the interfaces configured for HDLC encapsulation. If you assign an IP address on the interface, the **connect** command is rejected and the following error message displays:

```
Incompatible with IP address command on interface - command rejected.
```

If you configure other settings on the interface that is enabled for HDLC encapsulation, the local switching feature may not work.

- Interworking is not supported.
- Same-port local switching for HDLC is not supported.
- Dialer and ISDN interfaces are not supported. Only serial, HSSI, and POS interfaces can be configured for HDLC local switching.

>

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip cef**
4. **interface** *type number*
5. **exit**
6. **connect** *connection-name interface interface*

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable**	Enables privileged EXEC mode.
		- Enter your password if prompted.
	Example:	
	`Router> enable`	

	Command or Action	Purpose
Step 2	**configure terminal**	Enters global configuration mode.
	Example:	
	Router# configure terminal	
Step 3	**ip cef**	Enables Cisco Express Forwarding operation.
	Example:	
	Router(config)# ip cef	
Step 4	**interface** *type number*	Specifies an interface and enters interface configuration mode.
	Example:	
	Router(config)# interface serial 2/0	
Step 5	**exit**	Exits interface configuration mode and returns to global configuration mode.
	Example:	
	Router(config-if)# exit	
Step 6	**connect** *connection-name interface interface*	Defines a connection between the two interfaces.
	Example:	
	Router(config)# connect connection1 serial1/0 serial1/0	

Configuring ACR for ATM-to-ATM Local Switching

Note The **connect** command provides an infrastructure to create the required L2 transport VCs with the default AAl0 encapsulation type and does not require that the VCs must exist.

Perform this task to configure ACR for ATM-to-ATM local switching.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface atm** *slot/subslot/port*
4. **aps group** [**acr**] *group-number*
5. **aps working** *circuit-number*
6. **aps protect** *circuit-number ip-address*
7. **exit**
8. **interface acr** *acr-group-number*
9. **pvc** [*name*] *vpi/vci* **l2transport**
10. **exit**
11. **exit**
12. **connect** *connection-name type number pvc type number pvc*
13. **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.
Step 3	**interface atm** *slot/subslot/port* **Example:** `Router(config)# interface atm8/0/0`	Specifies an ATM line card, a subslot (if available), and a port, and enters interface configuration mode.
Step 4	**aps group** [**acr**] *group-number* **Example:** `Router(config-if)# aps group acr 1`	Configures an ACR working and protect interface. • *group-number* --Number of the group.

	Command or Action	Purpose
Step 5	**aps working** *circuit-number* **Example:** `Router(config-if)# aps working 1`	Enables an ATM OC-3 interface as the working interface. • *circuit-number* --Number of the circuit that will be enabled as the working interface. Repeat Steps 3 to 5 for the protect interface.
Step 6	**aps protect** *circuit-number ip-address* **Example:** `Router(config-if)# aps protect 1 10.0.0.1`	Enables an ATM OC-3 interface as the protect interface. • *circuit-number* --Number of the circuit that will be enabled as the protect interface. • *ip-address* --IP address of the router that has the working ATM OC-3 interface.
Step 7	**exit** **Example:** `Router(config-if)# exit`	Exits interface configuration mode and returns to global configuration mode.
Step 8	**interface acr** *acr-group-number* **Example:** `Router(config)# interface acr 1`	Specifies an ACR interface and enters interface configuration mode. • *acr-group-number* --The group number assigned to the working and protect interface.
Step 9	**pvc** [*name*] *vpi/vci* **l2transport** **Example:** `Router(config-if)# pvc 0/32 l2transport`	Creates an ATM PVC and enters ATM virtual circuit configuration mode.
Step 10	**exit** **Example:** `Router(config-if-atm-vc)# exit`	Exits ATM virtual circuit configuration mode and returns to interface configuration mode. Repeat Steps 8 and 9 for the other ACR group.
Step 11	**exit** **Example:** `Router(config-if)# exit`	Exits interface configuration mode and returns to global configuration mode.

Command or Action	Purpose
Step 12 **connect** *connection-name type number pvc type number pvc* **Example:** `Router(config)# connect connection1 acr 1 0/32 acr 2 1/32`	Defines the connection between the ATM-ACR interfaces. • *connection-name* --Local switching connection name. • *type* --Interface or circuit type used to create a local switching connection. • *number* --Integer that identifies the number of the interface or circuit.
Step 13 **exit** **Example:** `Router(config)# exit`	Exits global configuration and returns to privileged EXEC mode.

Configuring CEM-to-CEM ACR Local Switching

Perform this task to configure ACR for CEM-to-CEM local switching.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **controller sonet** *slot* / *subslot* / *port*
4. **aps group** [**acr**] *group-number*
5. **aps working** *circuit-number*
6. **aps protect** *circuit-number ip-address*
7. **exit**
8. **controller sonet-acr** *acr-group-number*
9. **framing sonet**
10. **sts-1** *number*
11. **mode** *vt-15*
12. **vtg** *number* **t1** *number* **cem-group** *number* **timeslots** *number*
13. **exit**
14. **exit**
15. **interface cem-acr** *acr-group-number*
16. **exit**
17. **cem** *slot* / *port* / *channel*
18. **xconnect** *virtual-connect-id*
19. **exit**
20. **exit**
21. **connect** *connection-name type number circuit-id type number circuit-id*
22. **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.
Step 3	**controller sonet** *slot* / *subslot* / *port* **Example:** Router(config)# controller sonet 8/0/0	Specifies a virtual controller and enters SONET controller configuration mode.
Step 4	**aps group** [**acr**] *group-number* **Example:** Router(config-controller)# aps group acr 1	Configures an ACR working and protect interface. • *group-number* --Number of the group.
Step 5	**aps working** *circuit-number* **Example:** Router(config-controller)# aps working 1	Enables a SONET interface as the working interface. • *circuit-number* --Number of the circuit that will be enabled as the working interface. Repeat steps 3 to 5 for the protect interface.
Step 6	**aps protect** *circuit-number ip-address* **Example:** Router(config-controller)# aps protect 1 10.0.0.1	Enables a SONET interface as the protect interface. • *circuit-number* --Number of the circuit that will be enabled as the protect interface. • *ip-address* --IP address of the router that has the working SONET interface.
Step 7	**exit** **Example:** Router(config-controller)# exit	Exits SONET controller configuration mode and returns to global configuration mode.

	Command or Action	Purpose
Step 8	**controller sonet-acr** *acr-group-number* **Example:** Router(config)# controller SONET-acr 1	Specifies the SONET ACR controller and enters SONET controller configuration mode. • *acr-group-number* --The group number assigned to the working and protect interface.
Step 9	**framing sonet** **Example:** Router(config-controller)# framing sonet	Configures the controller framing for SONET framing.
Step 10	**sts-1** *number* **Example:** Router(config-controller)# sts-1 2	Specifies the STS identifier and enters STS configuration mode.
Step 11	**mode** *vt-15* **Example:** Router(config-ctrlr-sts1)# mode vt-15	Specifies VT-15 as the STS-1 mode of operation.
Step 12	**vtg** *number* **t1** *number* **cem-group** *number* **timeslots** *number* **Example:** Router(config-ctrlr-sts1)# vtg 2 t1 4 cem-group 2 timeslots 1-5,14	Creates a virtual tributary group carrying a single T1 Circuit Emulation Service over Packet Switched Networks (CESoPSN) group.
Step 13	**exit** **Example:** Router(config-ctrlr-sts1)# exit	Exits STS configuration mode and returns to SONET controller configuration mode.
Step 14	**exit** **Example:** Router(config-controller)# exit	Exits SONET controller configuration mode and returns to global configuration mode.

Command or Action	Purpose
Step 15 **interface cem-acr** *acr-group-number* **Example:** Router(config)# interface cem-acr 1	Specifies the CEM-ACR interface and enters interface configuration mode.
Step 16 **exit** **Example:** Router(config-if)# exit	Exits interface configuration mode and returns to global configuration mode.
Step 17 **cem** *slot* / *port* / *channel* **Example:** Router(config)# cem 1/2/0	Configures CEM and enters circuit emulation (CEM) configuration mode.
Step 18 **xconnect** *virtual-connect-id* **Example:** Router(config-cem)# xconnect 0	Builds the CEM connection and enters CEM xconnect configuration mode. • *virtual-connect-id* --Virtual connect ID (VCID).
Step 19 **exit** **Example:** Router(config-cem-xconnect)# exit	Exits CEM xconnect configuration mode and returns to CEM configuration mode.
Step 20 **exit** **Example:** Router(config-cem)# exit	Exits CEM configuration mode and returns to global configuration mode. Repeat Steps 15 to 19 for the other CEM group.
Step 21 **connect** *connection-name type number circuit-id type number circuit-id* **Example:** Router(config)# connect connect1 cem-acr 1 2 cem-acr 2 3	Defines a connection between the two CEM-ACR circuits. • *connection-name* --Local switching connection name. • *type* --Interface or circuit type used to create a local switching connection. • *number* --Integer that identifies the number of the interface or circuit. • *circuit-id* --CEM group ID.

	Command or Action	Purpose
Step 22	**exit** **Example:** `Router(config)# exit`	Exits global configuration and returns to privileged EXEC mode.

Verifying Layer 2 Local Switching

Verifying Layer 2 Local Switching Configuration

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** [**all** | *element* | **id** *id* | **name** *name* | **port** *port*]
2. **show atm pvc**
3. **show frame-relay pvc** [*pvc*]

DETAILED STEPS

Step 1   **show connection** [**all** | *element* | **id** *id* | **name** *name* | **port** *port*]

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

Example:

```
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:

Example:

```
Router# show connection name atm-fr-con
ID  Name             Segment 1               Segment 2         State
=================================================================
1   atm-fr-con       ATM0/0/0 AAL5 0/100     Serial1/0/0  16    UP
```

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

Example:

```
Router# show connection name same-port
ID  Name            Segment 1            Segment 2          State
================================================================
1   same-port       Serial1/1/1  101     Serial1/1/1  102   UP
```

Step 2   **show atm pvc**

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

Example:

```
Router# show atm pvc
            VCD/                              Peak   Avg/Min  Burst
Interface   Name   VPI  VCI  Type  Encaps   SC Kbps  Kbps     Cells    Sts
3/0         10     1    32   PVC   FRATMSRV  UBR 155000                 UP
```

Step 3   **show frame-relay pvc** [*pvc*]

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

Example:

```
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
```

Verifying the NSF SSO Local Switching Configuration

Layer 2 local switching provides NSF/SSO 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 NSF/SSO on the RPs, see the Stateful Switchover feature module. To verify that the NSF/SSO: Layer 2 Local Switching is working correctly, follow the steps in this section.

SUMMARY STEPS

1. Issue the **ping** command or initiate traffic between the two CE routers.
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.
3. Issue the **show connect all** command to ensure that the Layer 2 local switching connection on the dual RP is operating.
4. Issue the **ping** command from the CE router to verify that the contiguous packet outage was minimal during the switchover.

DETAILED STEPS

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.

Example:

```
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   Issue the **ping** command from the CE router to verify that the contiguous packet outage was minimal during the switchover.

Troubleshooting Tips

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

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

Configuration Examples for Layer 2 Local Switching

Example ATM-to-ATM Local Switching

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

```
interface atm1/0/0
 pvc 0/100 l2transport
 encapsulation aal5
interface atm2/0/0
 pvc 0/100 l2transport
 encapsulation aal5
connect aal5-conn atm1/0/0 0/100 atm2/0/0 0/100
```

Example ATM PVC Same-Port Switching

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

```
interface atm1/0/0
 pvc 0/100 l2transport
 encapsulation aal5
 pvc 0/200 l2transport
 encapsulation aal5
connect conn atm1/0/0 0/100 atm1/0/0 0/200
```

Example ATM PVP Same-Port Switching

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

```
interface atm1/0/0
 atm pvp 100 l2transport
 atm pvp 200 l2transport
connect conn atm1/0/0 100 atm1/0/0 200
```

Example ATM-to-Ethernet Local Switching

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.

- Example ATM to Ethernet VLAN, page 39
- Example ATM to Ethernet Port Mode, page 40

Example ATM to Ethernet VLAN

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 atm2/0/0
 pvc 0/400 l2transport
 encapsulation aal5
connect atm-ethvlan-con atm2/0/0 0/400 fastethernet6/0/0.1 interworking ethernet
```

Example ATM to Ethernet Port Mode

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
```

Example Ethernet VLAN Same-Port Switching

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
```

Example ATM-to-Frame Relay Local Switching

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
```

Example Frame Relay-to-Frame Relay Local Switching

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 serial3/1/0 200
```

Example Frame Relay DLCI Same-Port Switching

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 serial1/0 100 serial1/0 200
```

Example HDLC Local Switching

The following example shows local switching of two serial interfaces for HDLC:
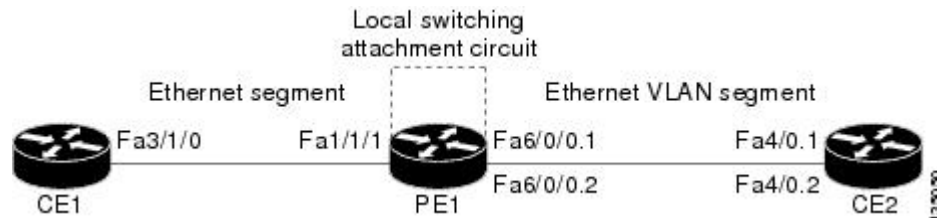
```
interface serial1/0
 no ip address
interface serial2/0
 no ip address
connect conn1 serial1/0 serial1/0
```

Example NSF SSO Ethernet Port Mode to Ethernet VLAN Local Switching

The following configuration uses the network topology shown in the figure below.

Figure 4 *NSF/SSO: Layer 2 Local Switching: Ethernet to Ethernet VLAN*

The following example shows the configuration of the CE interfaces to connect to the PE1 router:

CE1	CE2
ip routing	ip routing
!	!
interface fa3/1/0	interface fa4/0
description: connection to PE fa1/1/1	no shutdown
no shutdown	!
ip address 10.1.1.1 255.255.255.0	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 172.16.1.2 255.255.255.0

The following example shows the configuration of the PE1 router with NSF/SSO and the 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
```

The following example shows the configuration of ICMP Router Discovery Protocol (IRDP) on the CE router for Interworking IP for ARP mediation:

CE1	CE2
interface FastEthernet3/1/0	interface FastEthernet4/0.1
ip irdp	ip irdp
ip irdp maxadvertinterval 0	ip irdp maxadvertinterval 0

The following example shows the configuration of OSPF on the CE routers:

CE1	CE2
interface loopback 1	interface loopback 1
ip address 10.11.11.11 255.255.255.255	ip address 12.12.12.12 255.255.255.255
!	!
router ospf 10	router ospf 10
network 10.11.11.11 0.0.0.0 area 0	network 10.12.12.12 0.0.0.0 area 0
network 192.168.1.1 0.0.0.0 area 0	network 192.168.1.2 0.0.0.0 area 0

The following example shows the configuration of local switching on the PE1 router 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
```

The following example shows the configuration of local switching on the PE1 router 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

Related Documents

Related Topic	Document Title
MPLS	MPLS Product Literature
Layer 2 local switching configuration tasks	Configuring Layer 2 Local Switching

Related Topic	Document Title
Frame Relay-ATM interworking configuration tasks	Configuring Frame Relay-ATM Interworking
Frame Relay-to-Frame Relay local switching configuration tasks	Distributed Frame Relay Switching
CEoP and Channelized ATM SPAs on 7600 series router configuration tasks	Configuring the CEoP and Channelized ATM SPAs

Standards

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

MIBs

MIB	MIBs Link
None	To locate and download MIBs for selected platforms, Cisco software 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 and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

Feature Information for Layer 2 Local Switching

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

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

Table 1   *Feature Information for Layer 2 Local Switching*

Feature Name	Releases	Feature Information
Layer 2 Local Switching	12.0(27)S 12.2(25)S 12.0(30)S 12.0(31)S2 12.0(32)SY 12.2(28)SB 12.4(11)T 12.2(33)SRB 12.2(33)SXH 12.2(33)SB 15.0(1)S	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 feature was introduced in Cisco IOS Release 12.0(27)S on the Cisco 7200 and 7500 series routers. The feature was integrated into Cisco IOS Release 12.2(25)S for the Cisco 7500 series router. In Cisco IOS Release 12.0(30)S, support for same-port switching was added. Support for Layer 2 interface-to-interface local switching was added on the GSR. In Cisco IOS Release 12.0(31)S2, support was added for customer edge-facing IP Service Engine (ISE) interfaces on the GSR. In Cisco IOS Release 12.0(32)SY, support was added for customer edge-facing interfaces on Engine 5 shared port adapters (SPAs) and SPA Interface Processors (SIPs) on the GSR. In Cisco IOS Release 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 on nonstop forwarding/stateful switchover (NSF/SSO): • NSF/SSO--Ethernet-to-Ethernet VLAN local switching support • NSF/SSO--Frame Relay-to-Frame Relay local switching support In Cisco IOS Release 12.4(11)T, support was added for the

Feature Name	Releases	Feature Information
		following local switching types for the Cisco 7200 series router: • Ethernet to Ethernet VLAN • Same-port switching for Ethernet VLAN • Frame Relay to Frame Relay • Same-port switching for Frame Relay In Cisco IOS Release 12.2(28)SB, supported was added for Local Switching on the Cisco 10000 series router. In Cisco IOS Release 12.2(33)SXH, support was added for like-to-like Local Switching (ATM to ATM, and FR to FR only) on Cisco 6500 series switches and Cisco 7600 series routers. Same-port switching is not supported on those routers. In Cisco IOS Release 12.2(33)SB, support was added for HDLC Local Switching on the Cisco 7200 series router and the Cisco 10000 series router. The following commands were introduced or modified: **connect** (L2VPN local switching), **encapsulation** (Layer 2 local switching), **show connection**.

Feature Name	Releases	Feature Information
Access Circuit Redundancy for ATM Local Switching	15.1(1)S	Access Circuit Redundancy (ACR) ensures low data traffic downtime by reducing the switchover time. ACR works on the APS 1+1, nonrevertive model where each redundant line pair consists of a working line and a protect line. If a signal fail condition or a signal degrade condition is detected, the hardware switches from the working line to the protect line. In Cisco IOS Release 15.1(1)S, this feature was introduced. The following commands were introduced or modified: **aps group**, **connect** (L2VPN local switching).
ACR support for CEM	15.1(1)S	This feature provides Access Circuit Redundancy (ACR) support for CEM. In Cisco IOS Release 15.1(1)S, this feature was introduced. The following commands were introduced or modified: **aps group**, **connect** (L2VPN local switching).