CHAPTER 24

Configuring ATM Router Module Interfaces

This chapter describes steps required to configure the ATM router module on the Catalyst 8540 MSR, Catalyst 8510 MSR, and LightStream 1010 ATM switch routers, and the enhanced ATM router module for the Catalyst 8540 MSR. The ATM router module allows you to integrate Layer 3 switching with ATM switching on the same ATM switch router.

Note This chapter provides advanced configuration instructions for the Catalyst 8540 MSR, Catalyst 8510 MSR, and LightStream 1010 ATM switch routers. For complete descriptions of the commands mentioned in this chapter, refer to the *ATM Switch Router Command Reference* publication. For hardware installation and cabling instructions, refer to the *ATM and Layer 3 Module Installation Guide*.

Note The LightStream 1010 system software image does not include support for the ATM router module or Layer 3 features. You can download the Catalyst 8510 MSR image to a LightStream 1010 ATM switch router with a multiservice ATM switch processor installed.

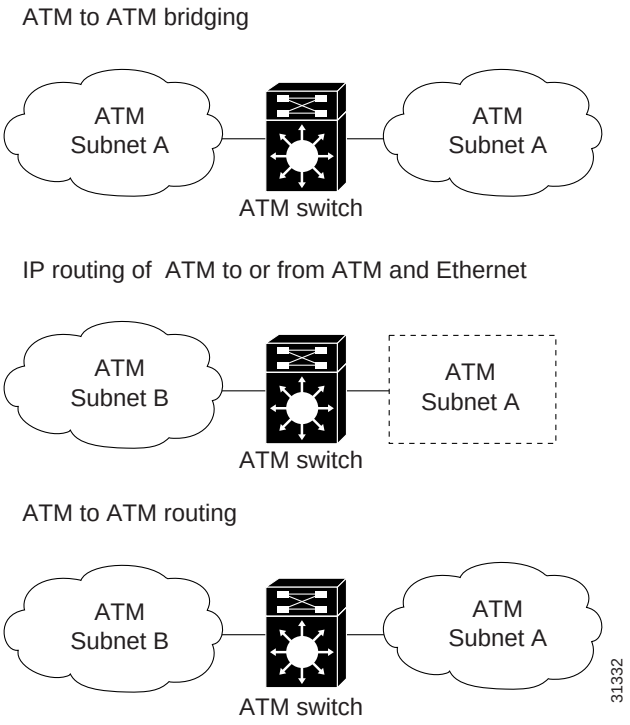
This chapter includes the following sections:

Overview of the ATM Router Module

The ATM router module allows you to integrate Layer 3 routing and ATM switching within a single chassis. When you install the ATM router module, you no longer need to choose either Layer 3 or ATM technology, as is frequently the case with enterprise, campus, and MAN applications.

The ATM router module can perform one or more of the functions described in Figure 24-1.

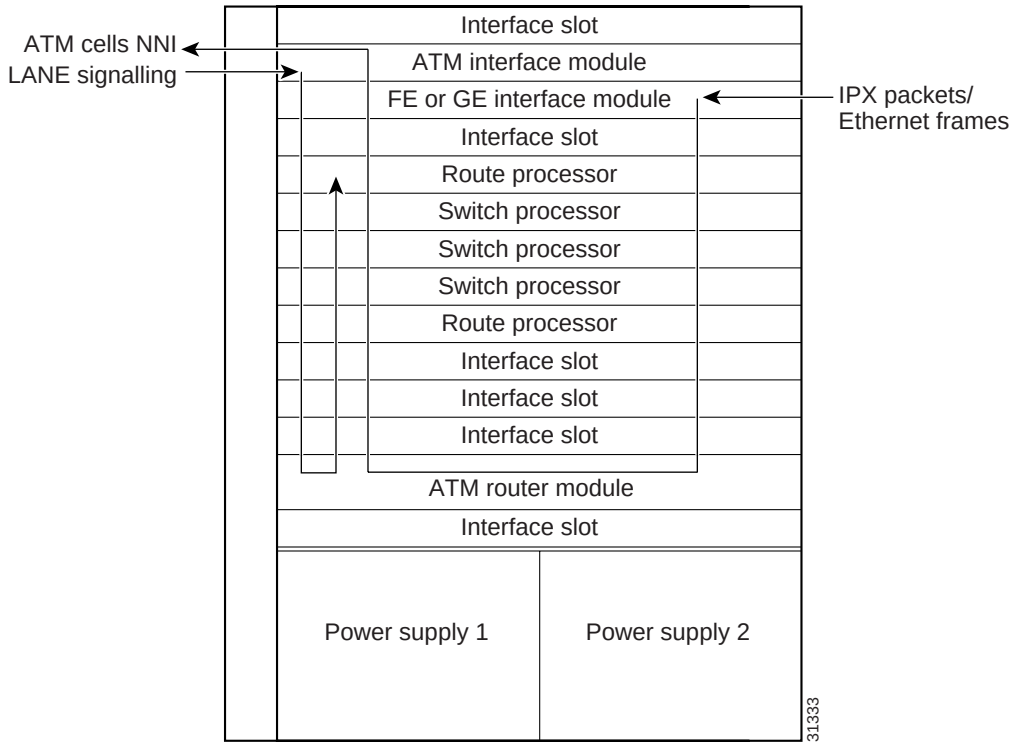
Figure 24-1 ATM Router Module Routing and Bridging Functions



The ATM router module receives Address Resolution Protocol (ARP) messages and route broadcasts from connected ATM peers and sends the appropriate control information to the route processor. On the ATM side, the ATM router module connects to the switching fabric as would any other interface module.

On the Catalyst 8540 MSR, the ATM router module supports LANE clients (LECs), but not LANE servers (LES, LECS, and BUS). It separates the control and data path so that all LANE control messages are handled by the route processor, and data messages are switched on the ATM router module port, as shown in Figure 24-2. The LEC is configured on the ATM router module interface, but control message traffic is sent to the route processor by the ATM router module. The ATM router module sends all ATM data traffic to the appropriate VCs.

Figure 24-2 ATM Router Module Traffic Flow (Catalyst 8540 MSR)



Catalyst 8540 MSR Enhanced ATM Router Module Features

The Catalyst 8540 MSR enhanced ATM router module offers the following benefits:

- Interoperates with all of the Layer 3 switching interface modules available for the Catalyst 8540 CSR chassis. For more information on the Catalyst 8540 CSR Layer 3 interface modules, refer to the *ATM and Layer 3 Module Installation Guide*.
- Provides an integrated high performance link between ATM and Layer 3 cards. The ATM router module provides an aggregate switching capacity of 2 Gbps between ATM and Layer 3 ports (2 x 1-Gbps interfaces per module). Data transfers to the switch core at the rate of 1 Gbps.
- Simplifies management.
- Hot-swappable.
- Occupies only one slot in the chassis.
- Supports multiprotocol encapsulation over ATM (RFC 1483) switched virtual connections (SVCs), soft permanent virtual circuits (PVCs) and permanent PVCs with either ATM adaptation layer 5 (AAL5) Subnetwork Access Protocol (SNAP) or AAL5 MUX encapsulation.
- Supports classical ATM over IP (RFC 1577) SVCs and PVCs.
- Standard and extended access control list (ACL) support for IP, and standard ACL support for IPX.

  For information configuring on IP ACLs, see Chapter 11, "Using Access Control," and refer to the "Configuring IP Services" chapter in the *Cisco IOS IP and IP Routing Configuration Guide.* For information configuring on IPX ACLs, refer to the "Configuring Novell IPX" chapter in the *Cisco IOS AppleTalk and Novell IPX Configuration Guide*.

- IP fragmentation support.
- IP 6-path load balancing support.
- Supports OAM-based PVC management.
- Supports Bridge Group Virtual Interface (BVI).
- Supports integrated routing and bridging (IRB).

Note The Catalyst 8540 MSR enhanced ATM router module does not support LANE clients.

The ATM router module has no external interfaces. All traffic is sent and received through internal interfaces to the switching fabric. The Catalyst 8540 MSR enhanced ATM router module has two internal ports.

Catalyst 8540 MSR ATM Router Module Features

The Catalyst 8540 MSR ATM router module offers the following benefits:

- Interoperates with all of the Layer 3 switching interface modules available for the Catalyst 8540 CSR chassis. For more information on the Catalyst 8540 CSR Layer 3 interface modules, refer to the *ATM and Layer 3 Module Installation Guide*.
- Provides an integrated high performance link between ATM and Layer 3 cards. The ATM router module provides an aggregate switching capacity of 2 Gbps between ATM and Layer 3 ports (2 x 1-Gbps interfaces per module). Data transfers to the switch core at the rate of 1 Gbps.
- Simplifies management.
- Hot-swappable.
- Occupies only one slot in the chassis.
- Supports LANE clients (LECs).
- Supports RFC 1483 SVCs and PVCs with AAL5 SNAP encapsulation.
- Supports RFC 1577 SVCs and PVCs.
- Supports Soft PVCs
- Supports VBR
- Supports Shaped Tunnels
- Supports OAM-based PVC management.
- Supports BVI.
- Supports IRB.

The ATM router module has no external interfaces. All traffic is sent and received through internal interfaces to the switching fabric. The Catalyst 8540 MSR enhanced ATM router module has two internal ports.

Catalyst 8510 MSR and LightStream 1010 ATM Router Module Features

The Catalyst 8510 MSR and LightStream 1010 ATM router module offers the following benefits:

- Interoperates with all of the Layer 3 switching interface modules available for the Catalyst 8510 CSR chassis. For more information on the Catalyst 8510 CSR Layer 3 interface modules, refer to the *ATM and Layer 3 Module Installation Guide*.
- Provides an integrated high performance link between ATM and Layer 3 cards. The ATM router module provides a switching capacity of 1 Gbps between ATM and Layer 3 ports. Data transfers to the switch core at the rate of 1 Gbps.
- Simplifies management.
- Hot-swappable.
- Occupies only one slot in the chassis.
- Supports RFC 1483 SVCs and PVCs with AAL5 SNAP encapsulation.
- Supports RFC 1577 SVCs and PVCs.
- Supports OAM-based PVC management.
- Supports BVI.
- Supports IRB.
- Supports VBR.

The ATM router module has no external interfaces. All traffic is sent and received through internal interfaces to the switching fabric. The Catalyst 8510 MSR and LightStream 1010 ATM router module has one internal port.

Hardware and Software Restrictions of the ATM Router Module

Hardware Restrictions

The following hardware restrictions apply to the Catalyst 8540 MSR, Catalyst 8510 MSR, and LightStream 1010 ATM router modules, and the Catalyst 8540 MSR enhanced ATM router modules:

- You can install the ATM router module in any slot except a route processor slot, and, in the case of the Catalyst 8540 MSR, a switch processor slot.
- The ATM router module is only supported on LightStream 1010 ATM switches with multiservice ATM switch route processor with FC-PFQ and the Catalyst 8510 MSR system software image.
- You can install up to two ATM router modules per chassis.
- When you hot swap an ATM router module, wait one minute after removing the module before inserting a new module.

Note The ATM router module is only supported on ATM switches which have multiservice ATM switch processor installed.

Catalyst 8540 MSR Enhanced ATM Router Module Software Restrictions

The following software restrictions apply to the Catalyst 8540 MSR enhanced ATM router module:

- LANE is not supported.
- LANE Clients are not supported.
- Use tag switching functionality with caution. Do not distribute routes learned through tag switching to Fast Ethernet (FE) or Gigabit Ethernet (GE), or vice versa. Otherwise, you might have unreachable route destinations.
- The ATM router module does not initialize if it replaces an ATM port adapter or interface module when hierarchical VP tunnels are globally enabled. Reboot the switch to initialize the ATM router module.
- IP multicast is only supported over 1483 LLC/SNAP encapsulated PVCs.
- ATM Director does not support any PVC commands.
- Even though each ATM router module interface supports a maximum of 2048 VCs, only 1400 to 1500 external VCs can be configured. Internal VCs use up the rest.
- Do not install an ATM router module in a slot pair where hierarchical VP tunnels are configured. Slot pairs 0 and 1, 2 and 3, 9 and 10, and 11 and 12 use the same switching modules for scheduling. For example, do not install an ATM router module in slot 10 when hierarchical VP tunnels are configured on slot 9. For more information on hierarchical VP tunneling restrictions, see Chapter 6, “Configuring Virtual Connections.”

The Catalyst 8540 MSR enhanced ATM router modules do not support the following features:

- Tag-edged router functionality
- Fast Simple Server Redundancy Protocol (FSSRP)
- Bridging for multiplexing device encapsulation
- Protocol Independent Multicast (PIM) IP multipoint signalling
- PIM nonbroadcast multiaccess (NBMA)
- PIM over ATM multipoint signalling
- Translation from IP quality of service (QoS) to ATM QoS
- Resource Reservation Protocol (RSVP) to ATM SVC
- PVC management using ILMI
- IP multicast over RFC 1483 SVCs
- Access lists for ATM to ATM routing
- Half-bridge devices
- Layer 2 ACLs

Catalyst 8540 MSR ATM Router Module Software Restrictions

The following software restrictions apply to the Catalyst 8540 MSR ATM router module:

- Use tag switching functionality with caution. Do not distribute routes learned through tag switching to FE or GE, or vice versa. Otherwise, you might have unreachable route destinations.
- The ATM router module does not initialize if it replaces an ATM port adapter or interface module when hierarchical VP tunnels are globally enabled. Reboot the switch to initialize the ATM router module.
- ATM Director does not support any PVC commands.
- Only LANE clients or RFC 1483, not both, can be configured on an ATM router module interface.
- RFC 1483 on the ATM router module supports only AAL5 SNAP encapsulation.
- Even though each ATM router module interface supports a maximum of 2048 VCs, only 1400 to 1500 external VCs can be configured. Internal VCs use up the rest.
- IP multicast is only supported over 1483 LLC/SNAP encapsulated PVCs.
- You can have a maximum of 64 LECs per chassis.
- Do not install an ATM router module in a slot pair where hierarchical VP tunnels are configured. Slot pairs 0 and 1, 2 and 3, 9 and 10, and 11 and 12 use the same switching modules for scheduling. For example, do not install an ATM router module in slot 10 when hierarchical VP tunnels are configured on slot 9. For more information on hierarchical VP tunneling restrictions, see Chapter 6, “Configuring Virtual Connections.”
- Token Ring LANE is not supported.

The Catalyst 8540 MSR ATM router modules do not support the following features:

- Tag-edged router functionality
- Fast Simple Server Redundancy Protocol (SSRP)
- Bridging for multiplexing device encapsulation
- PIM IP multipoint signalling
- PIM NBMA
- PIM over ATM multipoint signalling
- Translation from IP QoS to ATM QoS
- RSVP to ATM SVC
- PVC management using ILMI
- Access lists for ATM to ATM routing
- Half-bridge devices
- RFC 1483 MUX encapsulation
- IP multicast over RFC 1483 SVCs
- ACLs for IP, and standard ACLs for IPX
- IP fragmentation.
- IP 6-path load balancing.

Catalyst 8540 MSR and LightStream 1010 ATM Router Module Software Restrictions

The following software restrictions apply to the Catalyst 8540 MSR enhanced ATM router module:

- Use tag switching functionality with caution. Do not distribute routes learned through tag switching to FE or GE, or vice versa. Otherwise, you might have unreachable route destinations.
- The ATM router module does not initialize if it replaces an ATM port adapter or interface module when hierarchical VP tunnels are globally enabled. Reboot the switch to initialize the ATM router module.
- ATM Director does not support any PVC commands.
- RFC 1483 on the ATM router module supports only AAL5 SNAP encapsulation.
- Even though each ATM router module interface supports a maximum of 2048 VCs, only 1400 to 1500 external VCs can be configured. Internal VCs use up the rest.
- Do not install an ATM router module in a slot pair where hierarchical VP tunnels are configured. Slot pair 0 and 1 and slot pair 3 and 4 use the same switching modules for scheduling. For example, do not install an ATM router module in slot 1 when hierarchical VP tunnels are configured on slot 0. For more information on hierarchical VP tunneling restrictions, see Chapter 6, “Configuring Virtual Connections.”
- RFC 1577 SVCs
- LANE clients are not supported.
- Only UBR PVCs are supported.
- IP multicast is only supported over 1483 LLC/SNAP encapsulated PVCs.

The Catalyst 8510 MSR and LightStream 1010 ATM router modules do not support the following features:

- Point-to-point subinterfaces. Only point-to-multipoint subinterfaces are supported.
- Tag-edged router functionality
- SSRP
- Bridging for multiplexing device encapsulation
- Protocol Independent Multicast (PIM) IP multipoint signalling
- PIM nonbroadcast multiaccess (NBMA)
- PIM over ATM multipoint signalling
- Translation from IP quality of service (QoS) to ATM QoS
- Resource Reservation Protocol (RSVP) to ATM SVC
- PVC management using ILMI
- Access lists for ATM to ATM routing
- Half-bridge devices
- RFC 1483 MUX encapsulation
- IP multicast over RFC 1483 SVCs
- ACLs for IP, and standard ACLs for IPX

- IP fragmentation.
- IP 6-path load balancing.

Note The ATM router module is only supported on ATM switches which have a multiservice ATM switch processor installed.

Note The LightStream 1010 system software image does not include support for the ATM router module or Layer 3 features. You can download this image to a LightStream 1010 ATM switch router with a multiservice ATM switch processor installed.

Configuring ATM Router Module Interfaces

The you can configure the following features directly on the ATM router module interfaces:

- Maximum virtual channel identifier (VCI) bits
- Maximum Transmission Units (MTUs) (enhanced Catalyst 8540 MSR)
- LANE clients (Catalyst 8540 MSR)
- RFC 1483
- Classical IP over ATM (RFC 1577)
- Bridging
- IP multicast

Note This document describes how to configure ATM software features combined with Layer 3 features only. For more detailed information on how to configure the Layer 3 modules that interoperate with the ATM router module in the Catalyst 8540 MSR chassis, refer to the *Layer 3 Switching Software Feature and Configuration Guide*, which is available on the Documentation CD-ROM that came with your ATM switch router, online at Cisco.com, or when ordered separately as a hard copy document.

Note ATM router modules have internal interfaces, but no external ports. Use the **interface atm** *card*/*subcard*/*port* command to specify these interfaces.

Note Virtual path identifier (VPI) 2 is reserved for ATM router module interfaces, which allows up to 2048 external VCs on each ATM router module interface. Using VPI 0 would have allowed less than 1024 external VCs on an ATM router module interface because the ATM router module external VCs would have been forced to share the VC space within VPI 0 with the internal PVCs.

Even though each ATM router module interface supports a maximum of 2048 VCs, only 1400 to 1500 external VCs can be configured. Internal VCs use up the rest.

Default ATM Router Module Interface Configuration Without Autoconfiguration

If ILMI is disabled or if the connecting end node does not support ILMI, the following defaults are assigned to all ATM router module interfaces:

- ATM interface type = UNI
- UNI version = 3.0
- Maximum VCI bits = 11
- MTU size = 1500 bytes
- ATM interface side = network
- ATM UNI type = private

Note Only Catalyst 8540 MSR enhanced ATM router module interfaces support IP unicast and IP multicast fragmentation. For IP unicast fragmentation, the packet must ingress on an enhanced ATM router module interface and egress on any interface. For IP multicast fragmentation, IP multicast data packets greater than 1500 bytes are fragmented to 1500 bytes on the ingress enhanced ATM router module interface before being switched to other members in the multicast group. All the members in the multicast group must have an MTU equal to or greater than 1500 bytes.

Manual ATM Router Module Interface Configuration

To manually change the default configuration values, perform the following steps, beginning in global configuration mode:

	Command	Purpose
Step 1	Switch(config)# **interface atm** *card/subcard/port* Switch(config-if)#	Specifies an ATM interface and enters interface configuration mode.
Step 2	Switch(config-if)# **atm maxvci-bits** *max-vci-bits*	Modifies the maximum number of active VCI bits.
Step 3	Switch(config-if)# **mtu** *bytes*	Modifies the MTU size. The default MTU size is 1500 bytes. **Note** Only Catalyst 8540 MSR enhanced ATM router modules support variable MTU sizes.

Example

The following example shows how to change the default number of active VCI bits:

```
Switch(config)# interface atm 0/0/0
Switch(config-if)# atm maxvci-bits 10
```

Configuring LECs on ATM Router Module Interfaces (Catalyst 8540 MSR)

The procedures for configuring LANE clients (LECs) on the ATM router module are the same as for the configuration of LECs on the route processor, with one exception: To specify an ATM router module interface, rather than the route processor interface, use the **interface atm** *card*/*subcard*/*port* command. On the route processor, you would use the **interface atm 0** command.

Note To route traffic between an emulated LAN and a Fast Ethernet (FE) or Gigabit Ethernet (GE) interface, you must configure the LEC on an ATM router module interface rather than a route processor interface.

Note An ATM router module interface can be configured for either LECs or RFC 1483 PVCs, not both. For both features to operate on the same ATM router module, configure LECs on one interface and RFC 1483 PVCs on the other.

Note LANE clients are not supported on the Catalyst 8540 MSR enhanced ATM router module.

To configure a LEC on an ATM router module interface, use the following commands, beginning in global configuration mode:

	Command	Purpose
Step 1	Switch(config)# **interface atm** *card*/*subcard*/*port*.*subinterface#* **multipoint** Switch(config-subif)#	Creates the ATM router module point-to-multipoint subinterface and enters subinterface mode. **Note** The ATM router module only supports point-to-multipoint subinterfaces.
Step 2	Switch(config-subif)# **ip address** *ip-address mask*	Provides a protocol address and subnet mask for the client on this subinterface.
Step 3	Switch(config-subif)# **lane client ethernet** *elan-name*	Enables a LANE client for an emulated LAN.

Example

The following example shows how to configure two LECs on an ATM router module interface:

```
Switch# configure terminal
Switch(config)# interface atm 1/0/0.4 multipoint
Switch(config-subif)# ip address 40.0.0.1 255.0.0.0
Switch(config-subif)# lane client ethernet VLAN4
Switch(config-subif)# exit
Switch(config)# interface atm 1/0/0.5 multipoint
Switch(config-subif)# ip address 50.0.0.1 255.0.0.0
Switch(config-subif)# lane client ethernet VLAN5
Switch(config-subif)# exit
Switch(config)# router ospf 1
Switch(config-router)# network 40.0.0.0 0.255.255.255 area 0
Switch(config-router)# network 50.0.0.0 0.255.255.255 area 0
```

For more information on configuring LECs on ATM router module interfaces, see Chapter 13, "Configuring LAN Emulation." For a detailed description of LANE and its components, refer to *Cisco IOS Switching Services Configuration Guide: Virtual LANs*.

LEC Configuration Examples

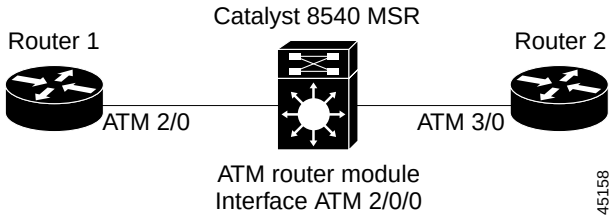
The examples in this section show how to configure LANE clients (LECs) on networks with two routers and one Catalyst 8540 MSR. For detailed information on configuring the LANE server (LES), LANE configuration server (LECS), and broadcast-and-unknown server (BUS), see Chapter 13, "Configuring LAN Emulation."

Caution For performance reasons, avoid configuring the LANE server components on ATM switch routers. Instead, configure the LANE server components on a router such as a Cisco 7500 series router or a Catalyst 5500 router with a LANE module installed.

LANE Routing Over ATM

The following example shows how to configure LANE routing over ATM using the ATM router module. Figure 24-3 shows an example of a network for LANE routing over ATM.

Figure 24-3 Example Network for LANE Routing over ATM



Router 1 ATM Interface

```
Router1# configure terminal
Router1(config)# interface atm 2/0
Router1(config-if)# ip address 1.0.0.1 255.0.0.0
Router1(config-if)# atm pvc 1 0 5 qsaal
Router1(config-if)# atm pvc 2 0 16 ilmi
Router1(config-if)# lane client ethernet happy
Router1(config-if)# end
Router1#
```

ATM Switch Router ATM Router Module Interface

```
Switch# configure terminal
Switch(config)# interface atm 2/0/0
Switch(config-if)# ip address 1.0.0.2 255.0.0.0
Switch(config-if)# lane client ethernet BACKBONE
Switch(config-if)# end
Switch#
```

Router 2 ATM Interface

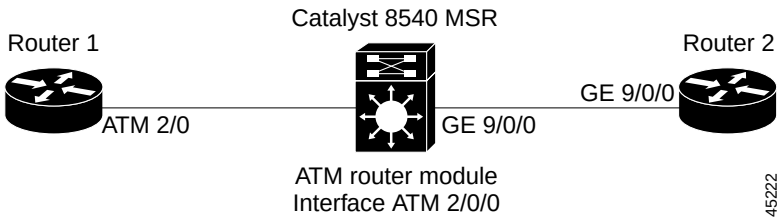
```
Router2# configure terminal
Router2(config)# interface atm 3/0
Router2(config-if)# ip address 1.0.0.3 255.0.0.0
Router2(config-if)# no ip mroute-cache
Router2(config-if)# atm pvc 1 0 5 qsaal
Router2(config-if)# atm pvc 2 0 16 ilmi
Router2(config-if)# no atm ilmi-keepalive
Router2(config-if)# lane client ethernet BACKBONE
Router2(config-if)# end
Router2#
```

For detailed information on configuring LANE clients (LECs), see Chapter 13, “Configuring LAN Emulation.”

LANE Routing from ATM to Ethernet

The following example shows how to configure LANE routing from ATM to Ethernet using the ATM router module. Figure 24-4 shows an example of a LANE network for LANE routing from ATM to Ethernet.

Figure 24-4 Example Network for LANE Routing from ATM to Ethernet



Router 1 ATM Interface

```
Router1# configure terminal
Router1(config)# interface atm 2/0
Router1(config-if)# ip address 1.0.0.1 255.0.0.0
Router1(config-if)# atm pvc 1 0 5 qsaal
Router1(config-if)# atm pvc 2 0 16 ilmi
Router1(config-if)# lane client ethernet happy
Router1(config-if)# end
Router1#
```

ATM Switch Router ATM Router Module Interface

```
Switch# configure terminal
Switch(config)# interface atm 2/0/0
Switch(config-if)# ip address 1.0.0.2 255.0.0.0
Switch(config-if)# lane client ethernet BACKBONE
Switch(config-if)# end
Switch#
```

ATM Switch Router Ethernet Interface

```
Switch# configure terminal
Switch(config)# interface gigabitethernet 9/0/0
Switch(config-if)# ip address 129.1.0.1 255.255.255.0
Switch(config-if)# no ip directed-broadcast
Switch(config-if)# end
Switch#
```

Router 2 Ethernet Interface

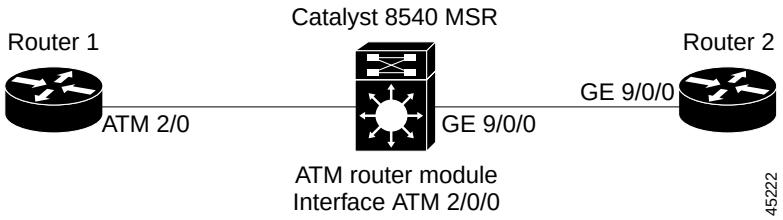
```
Router2# configure terminal
Router2(config)# interface gigabitethernet 9/0/0
Router2(config-if)# ip address 129.1.0.2 255.255.255.0
Router2(config-if)# no ip directed-broadcast
Router2(config-if)# end
Router2#
```

Configure the desired network routing protocol, such as RIP, OSPF, or EIGRP, on Ethernet interfaces. For more information on configuring networking protocols and routing, refer to the *Layer 3 Software Configuration Guide*.

LANE Bridging Between ATM and Ethernet

The following example show how to configure LANE bridging between ATM and Ethernet using the ATM router module. Figure 24-5 shows an example of a network for LANE bridging between ATM and Ethernet.

Figure 24-5 Example Network for LANE Bridging Between ATM and Ethernet



Router 1 ATM Interface

```
Router1# configure terminal
Router1(config)# interface atm 2/0
Router1(config-if)# atm pvc 1 0 5 qsaal
Router1(config-if)# atm pvc 2 0 16 ilmi
Router1(config-if)# lane client ethernet happy
Router1(config-if)# bridge-group 1
Router1(config-if)# end
Router1#
```

Router 1 Bridge Interface

```
Router1# configure terminal
Router1(config)# interface BVI1
Router1(config-if)# ip address 130.2.3.1 255.255.255.0
Router1(config-if)# exit
Router1(config)# bridge 1 protocol ieee
Router1(config)# bridge 1 route ip
Router1(config)# bridge irb
Router1(config)# end
Router1#
```

ATM Switch Router ATM Router Module Interface

```
Switch# configure terminal
Switch(config)# interface atm 2/0/0
Switch(config-if)# lane client ethernet BACKBONE
Switch(config-if)# bridge-group 1
Switch(config-if)# exit
Switch(config)# bridge 1 protocol ieee
Switch(config)# end
Switch#
```

ATM Switch Router Ethernet Interface

```
Switch# configure terminal
Switch(config)# interface gigabitethernet9/0/0
Switch(config-if)# bridge-group 1
Switch(config-if)# end
Switch#
```

Router 2 Ethernet Interface

```
Router2# configure terminal
Router2(config)# interface ethernet 9/0/0
Router2(config-if)# bridge-group 1
Router2(config-if)# end
Router2#
```

Router 2 Bridge Interface

```
Router2# configure terminal
Router2(config)# interface BVI1
Router2(config-if)# ip address 130.2.3.4 255.255.255.0
Router2(config-if)# exit
Router2(config)# bridge 1 protocol ieee
Router2(config)# bridge 1 route ip
Router2(config)# bridge irb
Router2(config)# end
Router2#
```

For more information on configuring bridging, refer to the *Layer 3 Software Configuration Guide*.

Confirming the LEC Configuration

To confirm the LEC configuration on the ATM switch router, use the following EXEC commands:

Command	Purpose
show lane [**interface atm** *card/subcard/port*[**.***subinterface#*] | **name** *elan-name*] [**brief**]	Displays the global and per-virtual channel connection LANE information for all the LANE components and emulated LANs configured on an interface or any of its subinterfaces.
show lane client [**interface atm** *card/subcard/port*[**.***subinterface#*] | **name** *elan-name*] [**brief**]	Displays the global and per-VCC LANE information for all LANE clients configured on any subinterface or emulated LAN.
show lane config [**interface atm** *card/subcard/port*[**.***subinterface#*]]	Displays the global and per-VCC LANE information for the configuration server configured on any interface.

Configuring Multiprotocol Encapsulation over ATM

This section describes how to configure multiprotocol encapsulation over ATM, as defined in RFC 1483, on the ATM router module.

The primary use of multiprotocol encapsulation over ATM, also know as RFC 1483, is carrying multiple Layer 3 and bridged frames over ATM. RFC 1483 traffic is routed through an ATM router module interface using static map lists. Static map lists provide an alternative to using the ATM Address Resolution Protocol (ARP) and ATM Inverse ARP (InARP) mechanisms. For more information on static map lists, see Chapter 12, “Configuring IP over ATM.”

For a detailed description of multiprotocol encapsulation over ATM, refer to the *Guide to ATM Technology*.

Note Traffic shaping and policing are not supported on the ATM router module interfaces; for traffic shaping and policing on ATM connections, use VP tunnels. For more information on VP tunnels, see Chapter 6, "Configuring Virtual Connections."

To configure multiprotocol encapsulation over ATM on the ATM router module interface, use the following commands, beginning in global configuration mode:

	Command	Purpose
Step 1	Switch(config)# **interface atm** *card/subcard/port.subinterface#* **multipoint** Switch(config-subif)#	Creates the ATM router module point-to-multipoint subinterface and enters subinterface mode. **Note** The ATM router module only supports point-to-multipoint subinterfaces.
Step 2	Switch(config-subif)# **ip address** *ip-address mask*	Enters the IP address and subnet mask associated with this interface.
Step 3	Switch(config-subif)# **map-group** *name*	Enters the map group name associated with this PVC.
Step 4	Switch(config-subif)# **atm pvc 2** *vci-a* [**upc** *upc*] [**pd** *pd*] [**rx-cttr** *index*] [**tx-cttr** *index*] **interface atm** *card/subcard/port*[**.***vpt#*] *vpi-b vci-b* [**upc** *upc*] **encap** {**aal5mux**[1] | **aal5snap**}	Configures the PVC. **Note** The VPI number on the ATM router module interface must be 2.
Step 5	Switch(config-subif)# **exit** Switch(config)#	Returns to global configuration mode.
Step 6	Switch(config)# **map-list** *name* Switch(config-map-list)#	Creates a map list by naming it, and enters map-list configuration mode.
Step 7	Switch(config-map-list)# **ip** *ip-address* {**atm-nsap** *address* | **atm-vc** *vci*} [**broadcast**]	Associates a protocol and address with a specific virtual circuit.

1. Only the Catalyst 8540 MSR enhanced ATM router module supports AAL5 MUX encapsulation.

Example

The following example shows how to configure RFC 1483 on an ATM router module interface, beginning in global configuration mode:

```
Switch(config)# interface atm 1/0/0.1011 multipoint
Switch(config-subif)# ip address 10.1.1.1 255.255.255.0
Switch(config-subif)# map-group net1011
Switch(config-subif)# atm pvc 2 1011 interface atm 3/0/0 0 1011 encap aal5snap
Switch(config-subif)# exit
Switch(config)# map-list net1011
Switch(config-map-list)# ip 10.1.1.2 atm-vc 1011
Switch(config-map-list)# end
Switch#
```

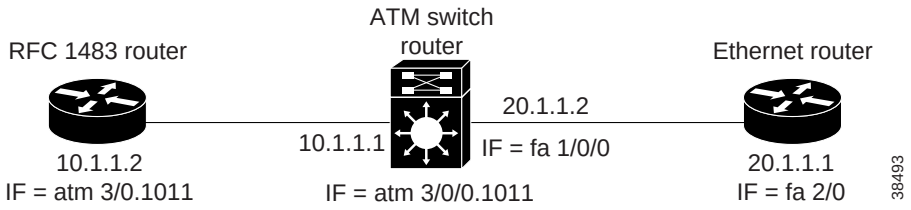
Multiprotocol Encapsulation over ATM Configuration Example

The following example shows how to configure for multiprotocol encapsulation over ATM with two routers and a ATM switch router.

The ATM switch router has an ATM router module in slot 0, a Fast Ethernet interface module in slot 1, and an ATM interface module in slot 3. One router has an ATM interface processor in slot 3. The other router has a Fast Ethernet interface module in slot 2.

Figure 24-6 shows an example of an RFC 1483 network.

Figure 24-6 Example Network for RFC 1483



Router with ATM Interface

```
RouterA# configure terminal
RouterA(config)# interface atm 3/0.1011 multipoint
RouterA(config-subif)# ip address 10.1.1.2 255.255.255.0
RouterA(config-subif)# atm pvc 1011 0 1011 aal5snap
RouterA(config-subif)# map group net1011
RouterA(config-subif)# ipx network 1011
RouterA(config-subif)# exit
RouterA(config)# map-list net1011
RouterA(config-map-list)# ip 10.1.1.1 atm-vc 1011
RouterA(config-map-list)# ipx 1011.1111.1111.1111 atm-vc 1011
RouterA(config-map-list)# exit
RouterA(config)#
```

ATM Switch Router

```
Switch# configure terminal
Switch(config)# interface atm 0/0/0.1011 multipoint
Switch(config-subif)# ip address 10.1.1.1 255.255.255.0
Switch(config-subif)# ipx network 1011
Switch(config-subif)# map-group net1011
Switch(config-subif)# atm pvc 2 1011 interface atm 3/0/0 0 1011
Switch(config-subif)# map-list net1011
Switch(config-map-list)# ip 10.1.1.2 atm-vc 1011
Switch(config-map-list)# ipx 1011.2222.2222.2222 atm-vc 1011
Switch(config-map-list)# exit
Switch(config)# interface fastethernet 1/0/0
Switch(config-if)# ip address 20.1.1.2 255.255.255.0
Switch(config-if)# ipx network 2011
Switch(config-if)# end
Switch#
```

Note The VCI in the **atm pvc** command must match the **atm-vc** VCI in the map list.

Ethernet Router

```
RouterB# configure terminal
RouterB(config)# ipx routing
RouterB(config)# interface fastethernet 2/0
RouterB(config-if)# ip address 20.1.1.1 255.255.255.0
RouterB(config-if)# ipx network 2011
RouterB(config-if)# end
RouterB#
```

Configuring Classical IP over ATM in a PVC Environment

This section describes how to configure classical IP over ATM, as described in RFC 1577, in a PVC environment on the ATM router module. The ATM Inverse ARP (InARP) mechanism is applicable to networks that use permanent virtual connections (PVCs), where connections are established but the network addresses of the remote ends are not known. For more information on configuring ATM ARP and ATM InARP, see Chapter 12, "Configuring IP over ATM,"

For a description of classical IP over ATM and RFC 1577, refer to the *Guide to ATM Technology*.

In a PVC environment, configure the ATM InARP mechanism on the ATM router module by performing the following steps, beginning in global configuration mode:

	Command	Purpose
Step 1	Switch(config)# **interface atm** *card/subcard/port* Switch(config-if)#	Specifies the ATM router module interface to configure.
Step 2	Switch(config-if)# **ip address** *ip-address mask*	Specifies the IP address of the interface.
Step 3	Switch(config-if)# **atm pvc 2** *vci* **interface atm** *card/subcard/port vpi vci* **encap** {**aal5mux**[1] | **aal5snap**} [**inarp** *minutes*]	Creates a PVC and enables ATM InARP. **Note** The VPI number on the ATM router module interface must be 2.

1. Only the Catalyst 8540 MSR enhanced ATM router module supports AAL5 MUX encapsulation.

Repeat these tasks for each PVC you want to create.

The **inarp** *minutes* interval specifies how often inverse ARP datagrams are sent on this virtual circuit. The default value is 15 minutes.

Example

The following example shows how to configure an IP-over-ATM interface on interface ATM 3/0/0, using a PVC with AAL5SNAP encapsulation, InARP set to ten minutes, VPI = 2, and VCI = 100:

```
Switch(config)# interface atm 3/0/0
Switch(config-if)# ip address 11.11.11.11 255.255.255.0
Switch(config-if)# atm pvc 2 100 interface atm 0/0/0 50 100 encap aal5snap inarp 10
```

Configuring Classical IP over ATM in an SVC Environment

This section describes how to configure classical IP over ATM in an SVC environment on your ATM router module. It requires configuring only the device's own ATM address and that of a single ATM Address Resolution Protocol (ARP) server into each client device.

For a detailed description of the role and operation of the ATM ARP server, refer to the *Guide to ATM Technology*.

The ATM switch router can be configured as an ATM ARP client, thereby being able to work with any ATM ARP server conforming to RFC 1577. Alternatively, one of the ATM switch routers in a logical IP subnet (LIS) can be configured to act as the ATM ARP server itself. In that case, it automatically acts as a client as well. The following sections describe configuring the ATM switch router in an SVC environment as either an ATM ARP client or an ATM ARP server.

Configuring as an ATM ARP Client

In an SVC environment, configure the ATM ARP mechanism on the interface by performing the following steps, beginning in global configuration mode:

	Command	Purpose
Step 1	Switch(config)# **interface atm** *card/subcard/port* Switch(config-if)#	Selects the ATM router module interface.
Step 2	Switch(config-if)# **atm nsap-address** *nsap-address* or Switch(config-if)# **atm esi-address** *esi.selector*	Specifies the network service access point (NSAP) ATM address of the interface. or Specifies the end-system-identifier (ESI) address of the interface.
Step 3	Switch(config-if)# **ip address** *ip-address mask*	Specifies the IP address of the interface.
Step 4	Switch(config-if)# **atm arp-server nsap** *nsap-address*	Specifies the ATM address of the ATM ARP server.
Step 5	Switch(config-if)# **exit** Switch(config)#	Exits interface configuration mode.
Step 6	Switch(config)# **atm route** *addr-prefix*[1] **atm** *card/subcard/port* **internal**	Configures a static route through the ATM router module interface. See the note that follows this table.

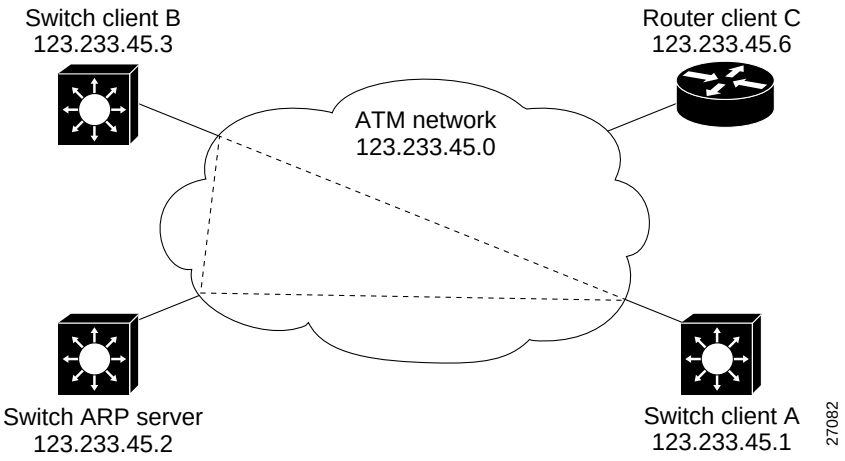
1. The address prefix is the first 19 bytes of the NSAP address.

Note The end system identifier (ESI) address form is preferred, in that it automatically handles the advertising of the address. Use the network service access point (NSAP) form of the command when you need to define a full 20-byte unique address with a prefix unrelated to the network prefix on that interface. You only need to specify a static route when configuring an ARP client using an NSAP address.

NSAP Address Example

Figure 24-7 shows three ATM switch routers and a router connected using classical IP over ATM.

Figure 24-7 Classical IP over ATM Connection Setup



The following example shows how to configure the ATM router module interface ATM 1/0/0 of Client A in Figure 24-7, using the NSAP address:

```
Client A(config)# interface atm 1/0/0
Client A(config-if)# atm nsap-address 47.0091.8100.0000.1111.1111.1111.1111.1111.1111.00
Client A(config-if)# ip address 123.233.45.1 255.255.255.0
Client A(config-if)# atm arp-server nsap 47.0091.8100.0000.1111.1111.1111.2222.2222.2222.00
Client A(config-if)# exit
Client A(config)# atm route 47.0091.8100.0000.1111.1111.1111.1111.1111.1111 atm 1/0/0 internal
```

ESI Example

The following example shows how to configure the ATM router module interface ATM 1/0/0 of Client A in Figure 24-7, using the ESI:

```
Client A(config)# interface atm 1/0/0
Client A(config-if)# atm esi-address 0041.0b0a.1081.40
Client A(config-if)# ip address 123.233.45.1 255.255.255.0
Client A(config-if)# atm arp-server nsap 47.0091.8100.0000.1111.1111.1111.2222.2222.2222.00
Client A(config-if)# exit
```

Configuring as an ATM ARP Server

Cisco's implementation of the ATM ARP server supports a single, nonredundant server per LIS, and one ATM ARP server per subinterface. Thus, a single ATM switch router can support multiple ARP servers by using multiple interfaces.

To configure the ATM ARP server, perform the following steps, beginning in global configuration mode:

	Command	Purpose
Step 1	Switch(config)# **interface atm** *card/subcard/port*[**.***subinterface#*] Switch(config-if)#	Selects the Catalyst 8540 MSR enhanced ATM router module interface.
Step 2	Switch(config-if)# **atm nsap-address** *nsap-address* or Switch(config-if)# **atm esi-address** *esi***.***selector*	Specifies the NSAP ATM address of the interface. or Specifies the end-system-identifier address of the interface.
Step 3	Switch(config-if)# **ip address** *ip-address mask*	Specifies the IP address of the interface.
Step 4	Switch(config-if)# **atm arp-server time-out** *minutes*[1]	Configures the ATM ARP server optional idle timer.
Step 5	Switch(config-if)# **atm route** *addr-prefix*[2] **atm** *card/subcard/port* **internal**	Configures a static route through the optional ATM router module interface.

1. This form of the **atm arp-server** command indicates that this interface performs the ATM ARP server functions. When you configure the ATM ARP client (described earlier), the **atm arp-server** command is used—with a different keyword and argument—to identify a different ATM ARP server to the client.
2. Address prefix is the first 19 bytes of the NSAP address.

Note The ESI address form is preferred in that it automatically handles the advertising of the address. Use the NSAP form of the command when you need to define a full 20-byte unique address with a prefix unrelated to the network prefix on that interface. You only need to specify a static route when configuring an ARP server using an NSAP address.

The idle timer interval is the number of minutes a destination entry listed in the ATM ARP server's ARP table can be idle before the server takes any action to timeout the entry.

Example

The following example configures the route processor interface ATM 0 as an ARP server (shown in Figure 24-7):

```
ARP_Server(config)# interface atm 1/0/0
ARP_Server(config-if)# atm esi-address 0041.0b0a.1081.00
ARP_Server(config-if)# atm arp-server self
ARP_Server(config-if)# ip address 123.233.45.2 255.255.255.0
```

Displaying the IP-over-ATM Interface Configuration

To show the IP-over-ATM interface configuration, use the following EXEC commands:

Command	Purpose
show atm arp-server	Shows the ATM interface ARP configuration.
show atm map	Shows the ATM map list configuration.

Examples

In the following example, the **show atm arp-server** command displays the configuration of the interface ATM 1/0/0:

```
Switch# show atm arp-server

Note that a '*' next to an IP address indicates an active call

      IP Address        TTL     ATM Address
ATM1/0/0:
    * 10.0.0.5          19:21   47009181005670000000000112200410b0a108140
```

The following example displays the map-list configuration of the static map and IP-over-ATM interfaces:

```
Switch# show atm map
Map list ATM1/0/0_ATM_ARP : DYNAMIC
arp maps to NSAP 36.0091810000000003D5607900.0003D5607900.00
        , connection up, VPI=0 VCI=73, ATM2/0/0
ip 5.1.1.98 maps to s 36.0091810000000003D5607900.0003D5607900.00
        , broadcast, connection up, VPI=0 VCI=77, ATM2/0/0

Map list ip : PERMANENT
ip 5.1.1.99 maps to VPI=0 VCI=200
```

Configuring Bridging

All PVCs configured on ATM router module interfaces are used for bridging.

To configure bridging on an ATM router module interface, use the following commands, beginning in global configuration mode:

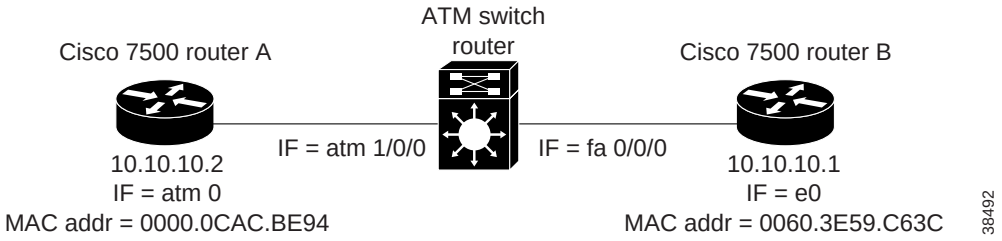
	Command	Purpose
Step 1	Switch(config)# **interface atm** *card/subcard/port* Switch(config-if)#	Specifies the interface on the ATM router module to configure.
Step 2	Switch(config-if)# **atm pvc 2** *vci* **interface atm** *card/subcard/port vpi*	Configures a PVC. **Note** The VPI number on the ATM router module interface must be 2.
Step 3	Switch(config-if)# **bridge-group** *number*	Assigns the interface to a bridge group.
Step 4	Switch(config-if)# **end** Switch(config)#	Returns to global configuration mode.
Step 5	Switch(config)# **interface fastethernet** *card/subcard/port* Switch(config-if)#	Specifies the Fast Ethernet interface to configure.
Step 6	Switch(config-if)# **no cdp enable**	Disables Cisco Discovery Protocol on the interface.
Step 7	Switch(config-if)# **bridge-group** *number*	Assigns the interface to a bridge group.
Step 8	Switch(config-if)# **end** Switch(config)#	Returns to global configuration mode.
Step 9	Switch(config)# **bridge** *number* **protocol ieee**	Specifies the IEEE 802.1D Spanning-Tree Protocol for the bridge group.

Example

The following example shows how to configure bridging on a Catalyst 8540 MSR with a Fast Ethernet interface module in slot 0, an ATM interface module in slot 1, and an ATM router module in slot 3.

Figure 24-8 shows an example bridging network.

Figure 24-8 Example Network for Bridging



```
Switch(config)# interface atm 3/0/0
Switch(config-if)# atm pvc 2 200 interface atm 1/0/0 0 200
Switch(config-if)# bridge-group 5
Switch(config-if)# end
Switch(config)# interface fastethernet 0/0/0
Switch(config-if)# no cdp enable
Switch(config-if)# bridge-group 5
Switch(config-if)# end
Switch(config)# bridge 5 protocol ieee
```

Configuring Packet Flooding on a PVC

Typically, a specific static map list configuration is not required for bridging to occur. In case of packet flooding, the bridging mechanism individually sends the packet to be flooded on all PVCs configured on the interface. To restrict the broadcast of the packets to only a subset of the configured PVCs you must define a separate static map list. Use the **broadcast** keyword in the **static-map** command to restrict packet broadcasting.

	Command	Purpose
Step 1	Switch(config)# **interface atm** *card/subcard/port* Switch(config-if)#	Specifies the interface to configure on the ATM router module.
Step 2	Switch(config-if)# **no ip address**	Disables IP processing.
Step 3	Switch(config-if)# **no ip directed-broadcast**	Disables the translation of directed broadcasts to physical broadcasts.
Step 4	Switch(config-if)# **map-group** *number*	Enters the map group name associated with this PVC.
Step 5	Switch(config-if)# **atm pvc 2** *vci-A* **interface atm** *card/subcard/port vpi-B*	Configures a PVC. **Note** The VPI number on the ATM router module interface must be 2.
Step 6	Switch(config-if)# **bridge-group** *number*	Assigns the interface to a bridge group.
Step 7	Switch(config-if)# **end** Switch(config)#	Returns to global configuration mode.
Step 8	Switch(config)# **map-list** *name* Switch(config-map-list)#	Creates a map list by naming it, and enters map-list configuration mode.
Step 9	Switch(config-map-list)# **bridge atm-vc** *number* **broadcast**	Enables packet flooding on a PVC.

Example

In the following example only PVC 2, 200 is used for packet flooding:

```
Switch(config)# interface atm 3/0/0
Switch(config-if)# no ip address
Switch(config-if)# no ip directed-broadcast
Switch(config-if)# map-group bg_1
Switch(config-if)# atm pvc 2 200 interface atm 1/0/1 0 200
Switch(config-if)# atm pvc 2 201 interface atm 1/0/1 0 300
Switch(config-if)# bridge-group 5
Switch(config-if)# end
Switch(config)# map-list bg_1
Switch(config-map-list)# bridge atm-vc 200 broadcast
```

Note For more information about bridging, refer to the *Layer 3 Software Configuration Guide*.

Displaying the Bridging Configuration

To display the bridging configuration on the ATM router module interface, use the following privileged EXEC command:

Command	Purpose
show bridge verbose	Displays the entries in the bridge forwarding database.

Example

```
Switch# show bridge verbose

Total of 300 station blocks, 297 free
Codes: P - permanent, S - self
BG Hash      Address      Action  Interface         VC    Age   RX count   TX count
 5 28/0   0000.0ce4.341c forward  Fa0/0/0             -
 5 2A/0   0000.0cac.be94 forward  ATM3/0/0          200
 5 FA/0   0060.3e59.c63c forward  Fa0/0/0             -
```

Configuring IP Multicast

To configure IP multicast over an RFC 1483 permanent virtual connection (PVC) on an ATM router module, use the following commands, beginning in global configuration mode:

	Command	Purpose
Step 1	Switch(config)# **ip multicast-routing**	Enables IP multicast routing.
Step 2	Switch(config)# **interface atm** *card*/*subcard*/*port*.*subinterface#* **multipoint** Switch(config-subif)#	Creates the ATM router module point-to-multipoint subinterface, and enters subinterface mode. **Note** The ATM router module only supports point-to-multipoint subinterfaces.
Step 3	Switch(config-subif)# **map-group** *name*	Enters the map group name associated with this PVC.
Step 4	Switch(config-subif)# **atm pvc 2** *vci-a* [**upc** *upc*] [**pd** *pd*] **interface atm** *card*/*subcard*/*port*[.*vpt#*] *vpi-b vci-b* [**upc** *upc*] **encap aal5snap**	Configures the PVC. **Note** The VPI number on the ATM router module interface must be 2.
Step 5	Switch(config-subif)# **ip pim dense-mode**	Enables Protocol Independent Multicast dense mode on the subinterface.
Step 6	Switch(config-subif)# **exit** Switch(config)#	Returns to global configuration mode.
Step 7	Switch(config)# **map-list** *name* Switch(config-map-list)#	Creates a map list by naming it, and enters map-list configuration mode.
Step 8	Switch(config-map-list)# **ip** *ip-address* {**atm-nsap** *address* | **atm-vc** *vci*} **broadcast**	Associates a protocol and address with a specific virtual circuit.
Step 9	Switch(config-map-list)# **end** Switch#	Returns to privileged EXEC mode.

Example

```
Switch(config)# ip multicast-routing
Switch(config)# interface atm 1/0/0.1011 multipoint
Switch(config-subif)# ip address 10.1.1.1 255.255.255.0
Switch(config-subif)# map-group net1011
Switch(config-subif)# atm pvc 2 1011 interface atm 3/0/0 0 1011 encap aal5snap
Switch(config-subif)# ip pim dense-mode
Switch(config-subif)# exit
Switch(config)# map-list net1011
Switch(config-map-list)# ip 10.1.1.2 atm-vc 1011 broadcast
```

Note For more information on IP multicast, refer to the *Layer 3 Software Configuration Guide*.

About Rate Limiting

Rate limiting is available on the Catalyst 8540 MSR, Catalyst 8510 MSR, Catalyst 8540 CSR, and Catalyst 8510 CSR. This feature is similar to the IOS committed access rate (CAR) feature. You can deploy rate limiting on your switch router to ensure that a packet, or data source, adheres to a stipulated contract, and to determine the QoS for a packet.

Rate limiting can be applied to individual interfaces. When an interface is configured with this feature, the traffic rate will be monitored by the Ethernet processor interface microcode to verify conformity. Non-conforming traffic is dropped, conforming traffic passes through without any changes.

Features Supported

The following features are supported for rate limiting on the Catalyst 8500 switch router:

- This feature is supported on the following interface modules:
  - Eight-Port 10/100BASE-T Fast Ethernet Interface Modules
  - 16-Port 10/100BASE-T Fast Ethernet Interface Modules
  - Eight-Port 100BASE-FX Fast Ethernet Interface Modules
  - 16-port 100BASE-FX Fast Ethernet Interface Modules
- This feature can be applied on a per-physical-port basis.
- This feature is available for input traffic and output traffic.

Restrictions

Restrictions for rate limiting on the Catalyst 8500 switch router include the following:

- This feature is not supported on the LightStream 1010.
- IPX and rate limiting cannot be configured at the same time. If rate limiting is configured on an interface, IPX will be automatically disabled on that interface. In addition, IPX will be automatically disabled on any of the three other interfaces which are controlled by the same hardware micro-controller as the configured interface. For example, if rate limiting is configured on Fast Ethernet slot 0, IPX will not work on slots 0, 1, 2, and 3.
- The QoS mapping ratio might be disrupted by the rate limiting configuration.
- Due to additional processing, when rate limiting is enabled, switching might not be at wire speed.

Note Broadcast packets, dropped ACL packets, packets dropped due to expiration of the designed Time To Live, and bad CRC packets are included in the rate limit calculation. This might cause a problem if the policed port is not part of a point-to-point connection and is connected via a hub rather than a layer 2 switch.

Configuring Rate Limiting

Enter the following command in interface configuration mode to configure rate limiting on your switch router:

Command	Purpose
rate-limit {**input** | **output**} *rate burst*	Configures rate limiting on an interface.

For more detailed configuration information, refer to the “Policing and Shaping Overview” section of the *Cisco IOS Quality of Service Solutions Configuration Guide*.

Example

The following is an example of how to configure rate limiting on your switch router:

```
Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z
Router(config)# interface f0/0/0
Router(config-if)# rate-limit input 1000000 20000
Router(config-if)# rate-limit output 100000 30000
Router(config-if)# exit
```