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ATM Switch Router Quick Software Configuration Guide

For the Catalyst 8540 MSR, Catalyst 8510 MSR, and LightStream 1010

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CONTENTS

About This Guide

This preface describes the purpose, audience, organization, and conventions of this *ATM Switch Router Quick Software Configuration Guide,* and provides information on how to obtain related documentation.

Purpose

This guide is intended as a starting place for configuring the ATM switch router. Only a small subset of features are described in this guide. For complete configuration information, refer to the *ATMSwitch Router Software Configuration Guide*.

Audience

This guide provides quick configuration instructions for experienced network administrators or engineers who are responsible for the initial configuration of the ATM switch router.

Organization

This guide is organized as follows:

Chapter	Title	Description
Chapter 1	Using the Command-Line Interface	Describes what you need to know about the Cisco IOS software before you begin to configure the ATM switch router
Chapter 2	Getting Started	Describes how to name the ATM switch router, assign a password, and set up remote administrative access
Chapter 3	Configuring SVCs, PVCs, SoftPVCs, PVPs, and VPTunnels	Describes how to configure the following virtual connections: SVCs[1], PVCs[2], soft PVCs, PVPs, and VP tunnels
Chapter 4	Configuring LANE	Describes how to configure LANE[3]
Chapter 5	Configuring Tag Switching	Describes how to configure tag switching

1 SVCs = switched virtual circuits.
2 PVCs = permanent virtual circuits.
3 LANE = LAN Emulation.

Related Documentation

This guide is part of the ATM switch router software documentation set, which includes:

- *Guide to ATM Technology*
- *ATM Switch Router Software Configuration Guide*
- *ATM Switch Router Command Reference*

Conventions

This document uses the following conventions:

Convention	Description
boldface font	Commands and keywords are in **boldface**.
italic font	Arguments for which you supply values are in *italics*.
[ ]	Elements in square brackets are optional.
{ x | y | z }	Alternative keywords are grouped in braces and separated by vertical bars.
[x | y | z]	Optional alternative keywords are grouped in brackets and separated by vertical bars.
string	A nonquoted set of characters. Do not use quotation marks around the string or the string will include the quotation marks.
`screen` font	Terminal sessions and information the system displays are in `screen` font.
`boldface screen` font	Information you must enter is in **`boldface screen`** font.
`italic screen` font	Arguments for which you supply values are in *`italic screen`* font.
	`This pointer highlights an important line of text in an example.`
^	The symbol ^ represents the key labeled Control—for example, the key combination ^D in a screen display means hold down the Control key while you press the D key.
< >	Nonprinting characters, such as passwords are in angle brackets.

Notes use the following conventions:

Note Means *reader take note*. Notes contain helpful suggestions or references to material not covered in the publication.

Timesavers use the following conventions:

Timesaver Means *the described action saves time* . You can save time by performing the action described in the paragraph.

Tips use the following conventions:

Tips

Means *the following are useful tips.*

Cautions use the following conventions:

Caution Means *reader be careful*. In this situation, you might do something that could result in equipment damage or loss of data.

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CHAPTER 1

Using the Command-Line Interface

This chapter describes what you need to know about the Cisco IOS software (the software that runs the ATM switch router) before you begin to configure it, and includes the following sections:

- Getting Help
- Understanding Command Modes
- Understanding Interface Numbering
- Undoing a Command or Feature
- Displaying the Configuration
- Saving Configuration Changes

Understanding these concepts will save you time later on. If you have never used the Cisco IOS software or need a refresher, take a few minutes to read this chapter before you proceed to the next chapter.

If you are already familiar with the CiscoIOS software, skip this chapter and proceed to the next chapter, "Getting Started."

Note This document assumes you have already connected all necessary external devices to the ATM switch router and configured your PC terminal emulation program for 9600baud, 8 data bits, no parity, and 2 stop bits.

Getting Help

You can use the question mark (?) and arrow keys to help you enter commands.

For a list of available commands, type the question mark:

```
Switch> ?
```

To complete a command, type a few known characters followed by the question mark (with no space):

```
Switch> s?
```

For a list of command variables, type the command followed by a space and a question mark:

```
Switch> show ?
```

To redisplay a command you previously entered, press the up arrow key. Continue to press the up arrow key for more commands.

Understanding Command Modes

You use many different command modes when you configure the ATM switch router. Each command mode restricts you to a subset of commands.

In the following example, notice how the prompt changes after each command to indicate a new command mode:

```
Switch> enable
Switch# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)# line vty 1 4
Switch(config-line)# atm router pnni
Switch(config-atm-router)# exit
Switch(config)# end
Switch#
```

Tips

If you are having difficulty entering a command, check the prompt and then enter the question mark (?) for a list of available commands. You might be in the wrong command mode or using the wrong syntax.

Understanding Interface Numbering

Before you can configure a software interface, you need to know how the physical location of the port adapter or interface module in the chassis corresponds to how it is addressed (referred to) in the software. In interface configuration mode, you must enter the *card/subcard/port* number to configure an interface:

- *card*—Card number
- *subcard*—Subcard number
- *port*—Port number

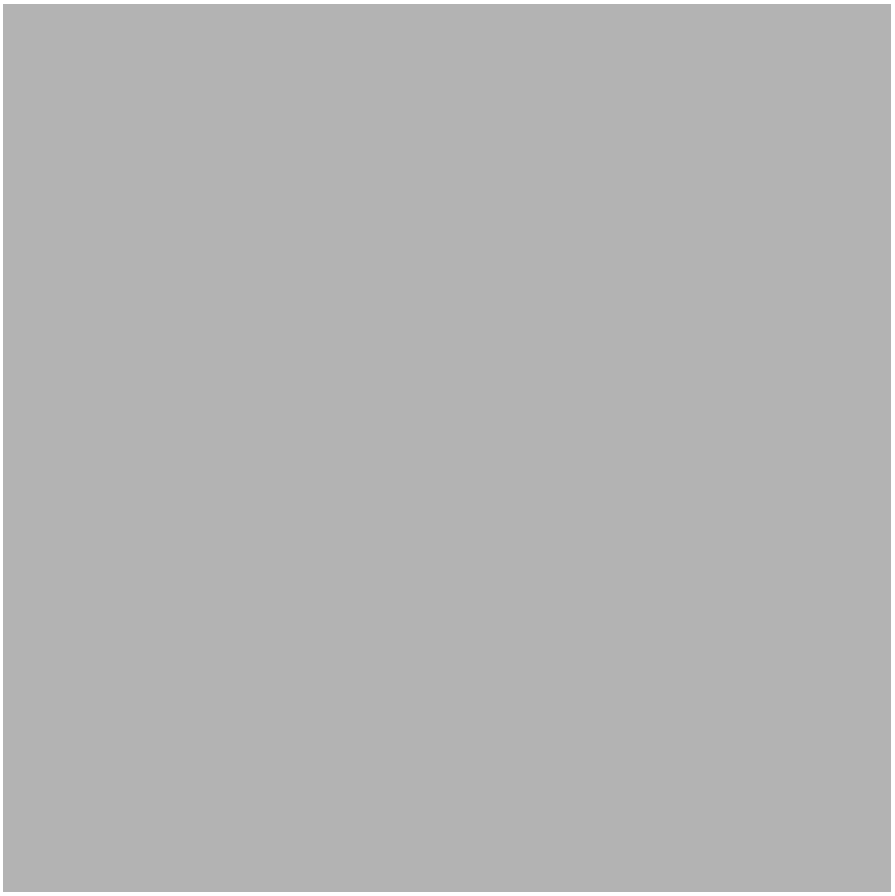
Card, subcard, and port numbering all start at 0 and increment by 1, from top to bottom, and from left to right.

Note In the subsections that follow, the Catalyst8540MSR chassis is shown because it is the most robust system. The Catalyst8540MSR chassis has 13 slots and supports redundant route processors and switch cards. The Catalyst8510MSR and LightStream1010 chassis have only 5 slots and do not support redundant route processors or switch cards. But the numbering scheme concept is the same, regardless of which chassis you have.

Card Numbering

Card numbering starts at 0 and increments by 1 from top to bottom, as shown in Figure1-1. The card number slots are silkscreened on the left side of each slot.

Figure1-1 Card Numbering (Catalyst8540MSR Shown)



Subcard Numbering

Subcards are numbered from 0 to 1, left to right. Subcards include half-width port adapters and full-width interface modules (such as an OC-12 interface module).

Two half-width port adapters can occupy one chassis slot. Figure1-2 shows that the two half-width port adapters in slot 0 are numbered subcards 0 and 1, from left to right. The port adapter in the left slot is numbered subcard 0, and the port adapter in the right slot is numbered subcard 1.

When you apply this numbering scheme to full-width interface modules, the subcard number is 0, because only one full-width interface module fits in a card slot. See Figure 1-2.

So, the *subcard* portion of the *card/subcard/port* CLI variable is either 0 or 1 for half-width port adapters, and 0 only for full-width interface modules. For example, in 0/0/1 the second 0 represents subcard 0.

Figure1-2 Subcard Numbering

Processor Card Numbering

The CPU interface on the processor card is addressed as either **ethernet 0** or **atm 0**, depending on the type of configuration. The other interfaces on the processor card start with 0 and increment by 1. See Figure 1-3.

Figure1-3 Processor Card Numbering (Catalyst8540MSR Route Processor Shown)

Port Numbering

Port numbering for each subcard starts with 0 and increments by 1, from left to right, as shown in Figure 1-4.

Figure1-4 Port Numbering

Example of Interface Numbering

Figure1-5 shows a Catalyst8540MSR chassis populated with several half-width port adapters and full-width interface modules. In this example, 12/0/3 is called out in the last interface module installed in the chassis. The 12/0/3 interface number is derived by:

- Card (12)—The interface module is in the thirteenth slot of the chassis; therefore, the card number is 12. (Card numbering starts at 0 and increments by 1 from top to bottom.)
- Subcard (0)—The full-width interface module is the only subcard within the twelfth slot; therefore, the subcard number is 0.
- Port (3)—The callout points to the fourth port on the interface module; therefore, the port number is 3. (Port numbering starts at 0 and increments by 1 from left to right.)

Figure1-5 Interface Numbering Example (Catalyst8540MSR Shown)

Undoing a Command or Feature

If you want to undo a command you entered or disable a feature, you can enter the keyword **no** before most commands; for example, **no atm router pnni**.

Displaying the Configuration

You can display various aspects of the ATM switch router configuration by entering **more** commands. You can only use **more** commands in user EXEC and privileged EXEC modes.

To display the current running (unsaved) configuration, enter the **more system:running-config** command:

```
Switch# more system:running-config
Building configuration...

Current configuration:
!
version XX.X
<<Information omitted>>
!
line con 0
line vty 0 4
no login
!
end
```

To display the saved configuration (stored in nonvolatile random-access memory [NVRAM]), enter the **more nvram:startup-config** command.

To see a complete list of available **more** commands, enter the **more ?** command:

```
Switch# more ?
  access-lists    List access lists
  accounting      Accounting data for active sessions
  aliases         Display alias commands
  arp             ARP table
  async           Information on terminal lines used as router
interfaces
  atm             ATM information
  boot            Boot and related environment variable
  buffers         Buffer pool statistics
  calendar        Display the hardware calendar
  cdp             CDP information
  <<Information omitted.>>
```

Saving Configuration Changes

Enter the **copy system:running-config nvram:startup-config** command to save your configuration changes to NVRAM so that they will not be lost if there is a system reload or power outage:

```
Switch# copy system:running-config nvram:startup-config
Building configuration...
```

Depending on the size and complexity of the configuration file, it might take a minute or two to save the configuration to NVRAM. After the configuration has been saved, the following displays:

```
[OK]
Switch#
```

The ATM switch router contains two types of configuration files: the running configuration and the startup configuration. The running configuration is the current (unsaved) configuration that reflects the most recent configuration changes. The startup configuration is the saved configuration in NVRAM and is used when the system initializes. The two configuration files provide a safeguard against configuration mistakes. If you make a mistake while configuring the ATM switch router, you can revert back to the saved startup configuration by entering the **copy nvram:startup-config system:running-config** command. Or you can reboot the ATM switch router (without saving the configuration changes) to use the startup configuration in NVRAM.

Where to Go Next

Now that you have learned some CiscoIOS software basics, you can begin to configure the ATM switch router.

Remember that:

- You can use the question mark (?) and arrow keys to help you enter commands.
- Each command mode restricts you to a set of commands. If you have difficulty entering a command, check the prompt and then enter the question mark (?) for a list of available commands. You might be in the wrong command mode or using the wrong syntax.
- If you want to disable a feature, enter the keyword **no** before the command; for example, **no atm router pnni**.
- You need to save your configuration changes to NVRAM so that they will not be lost if a system reload or power outage occurs.

Proceed to the next chapter, “Getting Started,” to begin configuring the ATM switch router.

CHAPTER 2

Getting Started

This chapter describes basic software configuration of the ATM switch router, and includes the following sections:

- Naming the ATM Switch Router
- Assigning a Password
- Setting Up Remote Administrative Access

Note For more software configuration information, refer to the *ATM Switch Router Software Configuration Guide*. Refer to the *ATM Switch Router Command Reference* publication for command syntax.

Naming the ATM Switch Router

You can name the ATM switch router to distinguish it from other Cisco devices in your network. This feature is especially useful when you have multiple console windows open and you need to distinguish one Cisco device from another. Naming the switch changes the default prompt (Switch>) to a prompt name of your choice; for example, Nevada_Switch>.

Take these steps:

Step	Command	Purpose
1	`Switch> enable`	Enter privileged EXEC mode.
2	`Switch# configure terminal` `Switch(config)#`	Enter global configuration mode.
3	`Switch(config)# hostname name` `Name(config)#`	Enter the host name for the switch. Note that the prompt changes to match the host name. **Note** The pound sign (#) that follows the host name indicates the current mode of operation and is added automatically.
4	`Name(config)# end` `Name#`	Return to privileged EXEC mode.

Example

```
Switch> enable
Switch# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)# hostname Nevada_Switch
Nevada_Switch(config)#
```

Verify

```
Switch# more system:running-config
!
version xx.x
no service pad
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
!
hostname Nevada_Switch
!
<<Information omitted.>>
```

Assigning a Password

Configure an administrative password on the ATM switch router to prevent unauthorized configuration changes.

Take these steps:

Step	Command	Purpose
1	`Switch> enable`	Enter privileged EXEC mode.
2	`Switch# configure terminal` `Switch(config)#`	Enter global configuration mode.
3	`Switch(config)# enable password password`	Enter the enable password.
4	`Switch(config)# exit` `Switch#`	Return to privileged EXEC mode.

Example

```
Switch> enable
Switch# configure terminal
Switch(config)# enable password guessme
Switch(config)# exit
Switch#
```

Verify

```
Switch# exit
Switch con0 is now available
Press RETURN to get started.
Switch> enable
Password: guessme
Switch#
```

Setting Up Remote Administrative Access

You can configure the Ethernet interface on the processor card (CPU card) so that you can Telnet to the ATM switch router and configure it remotely. This section describes how to configure the Ethernet port for remote administrative access.

Note For local administrative access, connect a PC or workstation to the console port on the processor card. This requires *physical* access to the ATM switch router.

Take these steps:

Step	Command	Purpose
1	`Switch> enable`	Enter privileged EXEC mode.
2	`Switch# configure terminal` `Switch(config)#`	Enter global configuration mode.
3	`Switch(config)# ip route` *prefix mask* `ethernet 0`[`.`*subinterface*]	Configure a static route on the Ethernet interface. If your management station or TFTP[1] server is on a different subnet than the switch, you must configure a static IP route.[2]
4	`Switch(config)# interface ethernet 0` `Switch(config-if)#`	Enter interface configuration mode on the Ethernet interface.
5	`Switch(config-if)# ip address` *address*	Configure an IP address on the Ethernet interface.
6	`Switch(config)# end` `Switch#`	Return to privileged EXEC mode.

1 TFTP = Trivial File Transfer Protocol.

2 If you fail to configure a static IP route before installing a new image, you might lose remote administrative access to the switch. If this happens, you can regain access from a direct console connection, although this requires physical access to the console port on the processor card.

Example

```
Switch> enable
Switch# configure terminal
Switch(config)# ip route 172.20.52.0 255.255.255.0 ethernet 0
Switch(config)# interface ethernet 0
Switch(config-if)# ip address 172.20.52.20
Switch(config-if)# end
Switch#
```

Verify

```
Switch# show interface ethernet 0
Ethernet0 is up, line protocol is up
  Hardware is SonicT, address is 00e0.4fac.b400 (bia 00e0.4fac.b400)
  Internet address is 172.20.52.20/26
  MTU 1500 bytes, BW 10000 Kbit, DLY 1000 usec, rely 255/255, load 1/255
  Encapsulation ARPA, loopback not set, keepalive set (10 sec)
  ARP type: ARPA, ARP Timeout 04:00:00
  Last input 00:00:00, output 00:00:00, output hang never
  Last clearing of "show interface" counters never
  Queueing strategy: fifo
  Output queue 0/40, 0 drops; input queue 0/75, 0 drops
  5 minute input rate 1000 bits/sec, 2 packets/sec
  5 minute output rate 0 bits/sec, 1 packets/sec
     897 packets input, 55088 bytes, 0 no buffer
     Received 337 broadcasts, 0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     0 input packets with dribble condition detected
     20731 packets output, 2024862 bytes, 0 underruns
     0 output errors, 0 collisions, 1 interface resets
     0 babbles, 0 late collision, 0 deferred
     0 lost carrier, 0 no carrier
     0 output buffer failures, 0 output buffers swapped out
Switch#
```

CHAPTER 3

Configuring SVCs, PVCs, Soft PVCs, PVPs, and VP Tunnels

This chapter describes how to configure switched virtual circuits (SVCs), permanent virtual circuits (PVCs), soft PVCs, permanent virtual paths (PVPs), and VP tunnels, and includes the following sections:

- Configuring SVCs
- Configuring PVCs
- Configuring Soft PVCs
- Configuring PVPs
- Configuring VP Tunnels

Note For more software configuration information, refer to the *ATM Switch Router Software Configuration Guide*. Refer to the *ATM Switch Router Command Reference* publication for command syntax.

Configuring SVCs

An SVC is a logical connection established using signaling messages, which reduces the amount of manual configuration required. SVCs are established on demand and torn down when a release message is generated either by signaling messages or by the application.

On the ATM switch router, no configuration is necessary to set up a transit SVC (an SVC that does not terminate on the ATM switch router). The signaling channels are set up by default and do not require manual configuration.

If the SVC terminates on a router, however, configuration *is* required on the router where the SVC terminates. For your convenience, the router configuration is described in this section.

Figure3-1 shows an example network that illustrates how to set up SVCs. This example network is used throughout this section.

Figure3-1 Example Network for Configuring SVCs

Configuring the Router

Perform the following tasks on both routers that terminate the SVC:

- Configure PVCs for QSAAL and ILMI signaling
- Configure IP and ESI addresses and subnet masks
- Determine the NSAP address
- Configure a map group and map list

The following subsections describe these procedures in detail.

Tips Open two Telnet windows for both the source and destination routers.

Configuring Signaling on the Routers

Configure PVCs for QSAAL and ILMI signaling on the main ATM interfaces of both the source and destination routers that terminate the SVC.

Note On the ATM switch router, the signaling and ILMI channels are set up by default and do not require manual configuration.

Take these steps:

Step	Command	Purpose
1	`Router> enable` `Router#`	Enter privileged EXEC mode.
2	`Router# configure terminal` `Router(config)#`	Enter global configuration mode.
3	`Router(config)# interface atm` *port*`[/`*slot*`]` `Router(config-if)#`	Enter interface configuration mode on the ATM interface.
4	`Router(config-if)# atm pvc` *number* `0 5 qsaal`	Configure a PVC for QSAAL[1] signaling.
5	`Router(config-if)# atm pvc` *number* `0 16 ilmi`	Configure a PVC for ILMI signaling.
6	`Router(config-if)# end` `Router#`	Return to privileged EXEC mode.
7	`(No command.)`	Repeat this procedure on the other router.

1 QSAAL = Q.2931 protocol over signaling ATM adaptation layer

Example

```
Router> enable
Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)# interface atm 0
Router(config-if)# atm pvc 1 0 5 qsaal
Router(config-if)# atm pvc 2 0 16 ilmi
Router(config-if)# end
Router#
```

Verify

```
Switch# show atm vc interface atm 0
             VCD /                                      Peak Avg/Min Burst
Interface    Name          VPI   VCI  Type   Encaps     Kbps   Kbps  Cells Sts
0            1               0     5   PVC    SAAL     155000 155000         UP
0            2               0    16   PVC    ILMI     155000 155000         UP
Switch#
```

Configuring the IP Address and ESI Address

On an ATM subinterface, configure the IP address and an ESI address.

Take these steps:

Step	Command	Purpose
1	`Router> enable` `Router#`	Enter privileged EXEC mode.
2	`Router# configure terminal` `Router(config)#`	Enter global configuration mode.
3	`Router(config-if)# interface atm` *port*[/*slot*][.*subinterface*] `multipoint`	Configure an ATM subinterface.
4	`Router(config-subif)# ip address` *address mask*	Configure an IP address on the subinterface.

Step	Command	Purpose
5	`Router(config-subif)# atm esi-address address`	Configure a 14-digit ESI address on the subinterface (for example, 111111222222.00). After ILMI address registration is complete, an NSAP address is automatically created based on the ESI address you entered.
6	`Router(config-subif)# end` `Router#`	Return to privileged EXEC mode.
7	`(No command.)`	Repeat this procedure on the other router.

Example

```
Router> enable
Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)# interface atm 0.1 multipoint
Router(config-subif)# ip address 193.153.185.33 255.255.255.224
Router(config-subif)# atm esi-address 999999888888.00
Router(config-subif)# end
Router#
```

Verify

```
Switch# show interface atm 0.1
ATM0.1 is up, line protocol is up
  Hardware is ATMizer BX-50
  Internet address is 193.153.185.33/27
  MTU 4470 bytes, BW 155520 Kbit, DLY 100 usec, rely 255/255, load 1/255
  NSAP address: 47.0091810000000061E5BC01.999999888888.00
  Encapsulation ATM
Switch#
```

Determining the NSAP Address

Determine the ATM network service access point (NSAP) address for both the source and destination routers. The NSAP addresses is required to complete the SVC.

Step	Command	Purpose
1	`Router# show interface atm port[/slot][.subinterface]`	Display the 20-byte NSAP address of the router port on which the SVC terminates. Enter the address in Table3-1. The NSAP address does not display in certain modes. In this case, you must enter an NSAP address that meets the following criteria: • It must be unique in the network. • It must *not* be a broadcast or multicast MAC address.
2	`(No command.)`	Repeat this procedure to display the NSAP address of the other router.

Enter the 20-byte NSAP address of each router in the space provided below in Table3-1.

Table3-1 NSAP Addresses

Router	NSAP Address
Source router[1]	
Destination router[2]	

1 In Figure3-1, the source router is router A.
2 In Figure3-1, the destination router is router D.

Example

```
Switch# show interface atm 0.1
ATM0.1 is up, line protocol is up
  Hardware is ATMizer BX-50
  Internet address is 192.153.185.65/27
  MTU 4470 bytes, BW 155520 Kbit, DLY 100 usec, rely 255/255, load 1/255
  NSAP address: 47.0091810000000061E5B5C01.555555555555.00
  Encapsulation ATM
Switch#
```

Verify

Not applicable.

Configure a Map Group and Map List

On an ATM subinterface, configure the map group and a map list.

Take these steps:

Step	Command	Purpose
1	`Router> enable` `Router#`	Enter privileged EXEC mode.
2	`Router# configure terminal` `Router(config)#`	Enter global configuration mode.
3	`Router(config-if)# interface atm` *port*[/*slot*][.*subinterface*] `multipoint`	Configure an ATM subinterface.
4	`Router(config-subif)# map-group` *name*	Enter the map group name on the ATM subinterface. The map group name is used to associate a map list to the subinterface.
5	`Router(config-subif)# no shutdown`	Enable the interface. Enter this command even if the interface is already up. This command enables the SAR [1] process to use the newly configured parameters.
6	`Router(config-subif)# exit` `Router(config)#`	Return to global configuration mode.

Step	Command	Purpose
7	`Router(config)# map-list name`	Create a map list to define an ATM map statement for the SVC. The name you enter here must match the map group name you specified in Step 4.
8	`Router(config-map-list)# ip dest-ipaddress atm-nsap dest-nsapaddrss`	Add the destination router IP address and ATM NSAP address to the map list. Enter the addresses you noted in Table3-1 in the section "Determining the NSAP Address."
9	`Router(config-map-list)# end` `Router#`	Return to privileged EXEC mode.
10	`(No command.)`	Repeat this procedure on the other router.

1 SAR = Segmentation and Reassembly.

Example

```
Router> enable
Router# configure terminal
Router(config)# interface atm 0.1 multipoint
Router(config-subif)# map-group hawaii
Router(config-subif)# no shutdown
Router(config-subif)# exit
Router(config)# map-list hawaii
Router(config-map-list)# ip 192.153.185.65 atm-nsap
47.0091810000000061E5B5C01.555555555555.00
Router(config-map-list)# end
Router#
```

Verify

```
Router# ping 192.153.185.65
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echoes to 192.153.185.65, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/2/4 ms
```

Configuring PVCs

A PVC is a permanent logical connection that you must configure manually, from source to destination, through the ATM network. Once configured, the ATM network maintains the connection at all times, regardless of traffic flow. That is, the connection is always up whether there is traffic to send or not.

Figure3-2 shows an example PVC between ATM-capable router A and router D. This example network is used throughout this section to describe how to set up PVCs.

Figure3-2 Example Network for Configuring PVCs

When configuring a PVC, the virtual path identifiers/virtual channel identifiers (VPIs/VCIs) must match between devices, as shown in Figure3-2 between:

- Source router A and ATM switch router B, which both use VPI=0, VCI=50
- ATM switch routers B and C, which both use VPI=2, VCI=100
- ATM switch router C and destination router D, which both use VPI=50, VCI=255

The VPI/VCIs that create an internal crossconnect within a switch can differ, as shown in:

- ATM switch router B between interfaces 3/0/1 (VPI=0, VCI=50) and 3/0/2 (VPI=2, VCI=100)
- ATM switch router C between interfaces 0/1/1 (VPI=2, VCI=100) and 0/0/1 (VPI=50, VCI=255)

Table3-2 describes the in and out interfaces and associated VPIs/VCIs for the PVC shown in Figure 3-2.

Table3-2 VPI/VCIs for the Example PVC

	Router A	Switch B	Switch B	Switch C	Switch C	Router D
	Out	In	Out	In	Out	In
Interface	0.10	3/0/1	3/0/2	0/1/1	0/0/1	0.12
VPI/VCI	0/50	0/50	2/100	2/100	50/255	50/255

Configuring the ATM Switch Router

Take these steps:

Step	Command	Purpose
1	`Switch> enable` `Switch#`	Enter privileged EXEC mode.
2	`Switch# configure terminal` `Switch(config)#`	Enter global configuration mode.
3	`Switch(config)# interface atm` *`card/subcard/port`*`[.`*`subinterface`*`]` `Switch(config-if)#`	Select the interface to configure.
4	`Switch(config-if)# atm pvc` *`vpi vci`* `interface atm` *`card/subcard/port`*`[.`*`vpt#`*`]` *`vpi vci`*	Configure the PVC. When configuring PVCs, configure the lowest available VPI and VCI numbers first. **Note** VCIs 0 to 31 on all VPIs are reserved.
5	`Switch(config-if)# end` `Switch#`	Return to privileged EXEC mode.

Note If the PVC terminates on an ATM switch router, you must terminate the connection on the route processor interface ATM 0. The **atm pvc 0 any-vci** command allocates the next available VCI value on the route processor interface ATM 0, although you can specify the VCI value if you choose. An example follows:

```
Switch(config-if)# atm pvc 2 100 interface atm 0 0 any-vci
```

Example

The following example shows how to configure the internal cross connect (within the switch) PVC on ATM switch router B between interface 3/0/1, VPI = 0, VCI = 50, and interface 3/0/2, VPI = 2, VCI = 100 (see Figure 3-2):

```
Switch> enable
Switch# configure terminal
Switch(config)# interface atm 3/0/1
Switch(config-if)# atm pvc 0 50 interface atm 3/0/2 2 100
Switch(config-if)# end
Switch#
```

Verify

```
Switch# show atm vc interface atm 3/0/1
Interface     VPI   VCI   Type    X-Interface  X-VPI X-VCI Encap Status
ATM3/0/1      0     5      PVC    ATM0         0     55    QSAAL  UP
ATM3/0/1      0     16     PVC    ATM0         0     39    ILMI   UP
ATM3/0/1      0     18     PVC    ATM0         0     74    PNNI   UP
ATM3/0/1      0     50     PVC    ATM3/0/2     2     100         UP
Switch#
```

Configuring the Router

If the PVC terminates on a router, you must configure a PVC from the router to the ATM switch router.

Take these steps:

Step	Command	Purpose
1	`Router> enable` `Router#`	Enter privileged EXEC mode.
2	`Router# configure terminal` `Router(config)#`	Enter global configuration mode.
3	`Router(config)# interface atm` *`port`*`[/`*`slot`*`][.`*`subinterface`*`]` `Router(config-subif)#`	Enter subinterface configuration mode on the main ATM interface.
4	`Router(config-subif)# ip address` *`address mask`*	Configure an IP address and subnet mask on the subinterface.
5	`Router(config-subif)# atm pvc` *`vcd vpi vci aal-encap`*	Create the PVC. **Note** VCIs 0 to 31 on all VPIs are reserved.
6	`Router(config-subif)# map-group` *`name`*	Assign a map group to this interface. This command references a map list that you create in the next step.
7	`Router(config-subif)# exit` `Router(config)#`	Return to global configuration mode.
8	`Router(config)# map-list` *`name`*	Create a map list. Match the name you enter here to the name in Step 6.
9	`Router(config-map-list)# ip` *`dest-address`* `atm-vc` *`vcd`* `broadcast`	Add the destination router IP address. The VCD[1] number must match the VCD number you assigned in Step 5. This configuration allows the VC to receive routing updates.

Step	Command	Purpose
10	`Router(config-map-list)# end` `Router#`	Return to privileged EXEC mode.
11	`(No command.)`	Repeat this procedure on the other router.

1 VCD = virtual circuit descriptor.

Example

```
Router> enable
Router# configure terminal
Router(config)# interface atm 0.10 multipoint
Router(config-subif)# ip address 192.153.185.33 255.255.255.224 (source router)
Router(config-subif)# atm pvc 2 0 50 aal5snap
Router(config-subif)# map-group cal
Router(config-subif)# exit
Router(config)# map-list cal
Router(config-map-list)# ip 192.153.185.65 atm-vc 2 broadcast (destination router)
Router(config-map-list)# end
Router#
```

Verify

```
Router# ping 192.153.185.65
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echoes to 192.153.185.65, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms
```

Configuring Soft PVCs

Soft PVCs are a combination of SVCs and PVCs. SVCs are set up on the inside of the path among ATM switch routers, and PVCs are set up between an edge ATM switch router and the terminating device (such as a router).

Soft PVCs require less manual configuration than PVCs. With soft PVCs, you need to configure only the destination ATM switch router in the path and PVCs on the devices that terminate the softPVC (such as a router).

Figure3-3 illustrates how to set up soft PVCs. This example network is used throughout this section.

Figure3-3 Example Network for Configuring Soft PVCs

Configuring the ATM Switch Router

Perform the following tasks on the ATM switch router to set up a soft PVC:

- Determine the destination ATM switch router NSAP address
- Configure the source ATM switch router

The subsections that follow describe these procedures in detail.

Determining the Destination ATM Switch Router NSAP Address

Determine the destination ATM switch router NSAP address for the interface. See the ATM switch router C in Figure3-3.

Take these steps:

Step	Command	Purpose
1	`Switch# show atm addresses`	On the *destination* ATM switch router, display the destination ATM address. You need this address to complete the soft PVC. Write the address in the space provided below (or copy it to memory):
2	`(No command.)`	Proceed to the next section, "Configuring the Source ATM Switch Router" to complete the soft PVC.

Example

```
Switch# show atm address

Switch Address(es):
  47.00918100000000E04FACB401.00E04FACB401.00 active

Soft VC Address(es):
  47.0091.8100.0000.00e0.4fac.b401.4000.0c84.9030.00 ATM-P9/1/3
  47.0091.8100.0000.0061.E5B5.C011.1111.1122.2222.00 ATM0/0/1
  47.0091.8100.0000.00e0.4fac.b401.4000.0c85.0020.00 ATM0/1/0
  47.0091.8100.0000.00e0.4fac.b401.4000.0c85.0030.00 ATM0/1/1

ILMI Switch Prefix(es):
  47.0091.8100.0000.00e0.4fac.b401

ILMI Configured Interface Prefix(es):

LECS Address(es):
  47.0091.8100.0000.00e0.4fac.b401.00e0.4fac.b405.00
Switch#
```

Verify

Not applicable.

Configuring the Source ATM Switch Router

Most of the configuration for the soft PVC occurs on the source switch. See the ATM switch router B in Figure3-3.

Take these steps:

Step	Command	Purpose
1	`Switch# configure terminal` `Switch(config)#`	Enter global configuration mode.
2	`Switch(config)# interface atm card/subcard/port` `Switch(config-if)#`	Enter interface configuration mode on the interface from which you want the soft PVC to originate (that is, the starting point).
3	`Switch(config-if)# atm soft-vc src-vpi src-vci dest-address dest_address dest-vpi dest-vci`	Enter the soft PVC VPI/VCIs for the interface on the source switch and the destination ATM address and destination VPI/VCIs.
4	`Switch(config-if)# end` `Switch#`	Return to privileged EXEC mode.
5	`(No command.)`	Proceed to the section "*Configuring the Router*" to complete the soft PVC.

Example

```
Switch# configure terminal
Switch(config)# interface atm 3/0/1
Switch(config-if)# atm soft-vc 0 50 dest-address
47.0091.8100.0000.0061.E5BC.0000.1111.11122.2222.00 1 60
Switch(config-if)# end
Switch#
```

Verify

The following example displays the soft VC configuration of switch B, on interface 3/0/1 out to the ATM network:

```
Switch# show atm vc interface atm 0/0/0
Interface    VPI   VCI   Type    X-Interface  X-VPI X-VCI  Encap Status
ATM0/0/0     0     5      PVC     ATM0         0     52    QSAAL  DOWN
ATM0/0/0     0     16     PVC     ATM0         0     32    ILMI   DOWN
ATM3/0/1     0     50     SoftVC  ATM0/0/1     1     60          UP
Switch#
```

Configuring the Router

If the soft PVC terminates on a router, you must configure a PVC from the router to the ATM switch router.

Take these steps:

Step	Command	Purpose
1	`Router> enable` `Router#`	Enter privileged EXEC mode.
2	`Router# configure terminal` `Router(config)#`	Enter global configuration mode.
3	`Router(config)# interface atm` *port*[/*slot*][.*subinterface*] `Router(config-subif)#`	Enter subinterface configuration mode on the ATM interface.
4	`Router(config-subif)# ip address` *address mask*	Configure an IP address and subnet mask on the subinterface.
5	`Router(config-subif)# atm pvc` *vcd vpi vci aal-enacap*	Create the PVC. **Note** VCIs 0 to 31 on all VPIs are reserved.
6	`Router(config-subif)# map-group` *name*	Assign a map group to this interface. This command references a map list that you create in the next step.
7	`Router(config-subif)# exit` `Router(config)#`	Return to global configuration mode.

Step	Command	Purpose
8	`Router(config-subif)# map-list` *name*	Create a map list. The name you enter here should match the name you specified in Step 6.
9	`Router(config-map-list)# ip` *dest-address* `atm-vc` *vcd* `broadcast`	Add the destination router IP address. The VCD number must match the VCD number you assigned in Step 5.
10	`Router(config-map-list)# end` `Router#`	Return to privileged EXEC mode.
11	`(No command.)`	Repeat this procedure on the other router.

Example

```
Router> enable
Router# configure terminal
Router(config)# interface atm 0.10
Router(config-subif)# ip address 192.153.185.33 255.255.255.224 (source router)
Router(config-subif)# atm pvc 2 0 50 aal5snap
Router(config-subif)# map-group cal
Router(config-subif)# exit
Router(config)# map-list cal
Router(config-map-list)# ip 192.153.185.65 atm-vc 2 broadcast (destination router)
Router(config-map-list)# end
Router#
```

Verify

```
Router# ping 192.153.185.65
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echoes to 192.153.185.65, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms
```

Configuring PVPs

A VP connection is like a bundle of VCs, transporting all cells with a common VPI, rather than a specific VPI and VCI. A PVP is a provisioned VP (like a PVC).

Figure3-4 illustrates how to set up PVPs. This example network is used throughout this section.

Figure3-4 Example Network for Configuring PVPs

Table3-3 describes the in and out interfaces and associated VPIs for the PVP shown in Figure3-4. Between ATM switch routers, the VPIs for the out port and the in port must match. For example, in Figure3-4, the VPIs match between ATM switch routers A and B (VPI=3).

Note The VPIs for the internal crossconnects do not have to match. For example, in Figure3-4, the VPIs do not match in ATM switch router A for the internal crossconnect between ports 3/0/1 (VPI=2) and 3/0/2 (VPI=3).

Table3-3 VPIs for the Example PVP

	Switch A	Switch B	Switch B	Switch C	Switch C	Switch D
	Out	In	Out	In	Out	In
Interface	3/0/2	0/0/0	1/1/1	3/1/1	1/0/0	0/1/1
VPI	3	3	5	5	8	8

Take these steps:

Step	Command	Purpose
1	`Switch> enable` `Switch#`	Enter privileged EXEC mode.
2	`Switch# configure terminal` `Switch(config)#`	Enter global configuration mode.
3	`Switch(config)# interface atm` *`card/subcard/port`* `Router(config-if)#`	Enter interface configuration mode on the ATM interface.
4	`Switch(config-subif)# atm pvp` *`vpi-A`* `interface` *`card/subcard/port vpi-B`*	Configure the PVP. **Note** When configuring PVP connections, use the lowest available VPI numbers first.
5	`Switch(config-subif)# end` `Switch#`	Return to privileged EXEC mode.

Example

The following example shows how to configure the internal cross connect (within the switch) PVP on ATM switch router B between interface 3/0/1, VPI = 2 and interface 3/0/2, VPI = 3:

```
Switch# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)# interface atm 3/0/1
Switch(config-if)# atm pvp 2 interface atm 3/0/2 3
Switch(config-if)# end
Switch#
```

Verify

```
Switch# show atm vp
Interface    VPI    Type  X-Interface     X-VPI     Status
ATM3/0/1     2      PVP   ATM3/0/2        3         UP
ATM3/0/2     3      PVP   ATM3/0/1        2         UP
Switch#
```

Configuring VP Tunnels

A VP tunnel is a method of linking two private ATM networks across a public network that does not support SVCs. The VP tunnel provides a permanent path through the public network. The public network transparently trunks the entire collection of virtual channels in the virtual path between the two private networks. Signaling traffic is mapped into the PVP and the switches allocate a virtual channel connection (VCC) on that VP, instead of the default VP 0. This mapping allows the signaling traffic to pass transparently through the public network.

Figure3-5 illustrates how to set up VP tunnels. This example network is used throughout this section.

Figure3-5 Example Network for Configuring VP Tunnels

Table3-4 describes the interfaces and associated VPIs and VPTs for the VP tunnel shown in Figure3-5. Between the source and destination ATM switch routers, the VPIs and VPTs must match. For example, in Figure 3-5, the VPIs and VPTs (99) match between ATM switch routers A and B.

Table3-4 VPIs and VPTs for the Example VP Tunnel

	Switch A	Switch B
Interface	3/0/2.99	0/0/0.99
VPI	99	99
VPT	99	99

Take these steps:

Step	Command	Purpose
1	`Switch> enable` `Switch#`	Enter privileged EXEC mode.
2	`Switch# configure terminal` `Switch(config)#`	Enter global configuration mode.
3	`Switch(config)# interface atm` *`card/subcard/port`* `Switch(config-if)#`	Enter interface configuration mode on the ATM interface.
4	`Switch(config-if)# atm pvp` *`vpi`*	Configure a PVP leg.
5	`Switch(config-if)# interface` *`card/subcard/port.vpt#`* `Switch(config-subif)#`	Create a VP tunnel using a VPT number that matches the PVP leg VPI you configured in Step 4.
6	`Switch(config-subif)# end` `Switch#`	Return to privileged EXEC mode.
7	`(No command.)`	Repeat this procedure on the other ATM switch router.

Example

The following example shows how to configure the VP tunnel on VPI=99.

```
Switch# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)# interface atm 3/0/2
Switch(config-if)# atm pvp 99
Switch(config-if)# interface atm 3/0/2.99
Switch(config-subif)# end
Switch#
```

Verify

When the VP tunnel is configured on both ends and the connection is up, the AutoCfgState displays “completed.”

```
Switch# show atm interface atm 3/0/2.99

Interface:      ATM3/0/2.99     Port-type:      vp tunnel
IF Status:      UP              Admin Status:   up
Auto-config:    enabled         AutoCfgState:   completed
IF-Side:        Network         IF-type:        NNI
Uni-type:       not applicable  Uni-version:    not applicable
<Information omitted.>
Switch#

Switch# show atm vp
Interface         VPI  Type  X-Interface         X-VPI     Status
ATM3/0/2          99   PVP    TUNNEL
Switch#
```

CHAPTER 4

Configuring LANE

This chapter describes how to configure LAN Emulation (LANE) on the ATM switch router, and includes the following sections:

- Understanding LANE on ATM
- Understanding LANE Components
- Implementing LANE
- Configuring a LEC
- Configuring the LECS
- Configuring the LES/BUS
- LANE Configuration Examples

Note For more software configuration information about LANE, refer to the *ATMSwitch Router Software Configuration Guide*. Refer to the *ATMSwitch Router Command Reference* publication for command syntax.

Understanding LANE on ATM

LANE is a protocol that allows devices attached to traditional LANs (such as Ethernet and Token Ring) to connect to ATM networks. That is, LANE allows legacy LAN users to take advantage of the benefits of ATM without modifying end station hardware or software.

LANE services provide connectivity between ATM-attached devices and LAN-attached devices. Two primary applications of LANE follow:

- Connectivity between LAN-attached stations across a high-speed ATM transport backbone.
- Connectivity between ATM-attached hosts and LAN-attached hosts. Centralized hosts with high-speed ATM port adapters provide services (such as Domain Name Service [DNS]) to traditional LAN-attached devices.

Understanding LANE Components

A single emulated LAN (ELAN) includes the following components:

- LANE client (LEC)—A software client that resides in an end station (such as a workstation, LAN switch, or router). The LEC performs data forwarding and receiving, address resolution, and other control functions for a single endpoint in a single ELAN. A router or switch can have multiple LANE clients, each connecting with different ELANs. The LANE client registers its MAC and ATM address with the LES.
- LANE configuration server (LECS)—A server that assigns individual LECs to particular ELANs by providing to the LECs the ATM address of the LES. The LECS maintains a database of ELAN names and the corresponding addresses of the LESs. A LECS can serve multiple ELANs. One LECS must be configured for each LANE cloud.

Note The LECS is also used for security by restricting ELAN membership to certain LECs, based on their MAC addresses.

- LANE server (LES)—A server that registers LECs to join the ELAN. In LANE 1.0, without Simple Server Redundancy Protocol (SSRP), each ELAN has only one Cisco LES, which handles LAN Emulation Address Resolution Protocol (LE_ARP) requests.
- Broadcast-and-unknown server (BUS)—A server that floods unknown destination addresses and forwards multicast and broadcast traffic to clients within an ELAN. In LANE 1.0 without SSRP, one Cisco BUS exists per ELAN.

Implementing LANE

The following sections describe specific information and considerations you might need to consider prior to LANE implementation:

- Supporting LAN Protocols
- Addressing
- Assigning Components to Interfaces and Subinterfaces

Supporting LAN Protocols

The ATM switch router supports both Ethernet and Token Ring LANE. This chapter describes only Ethernet configuration information. For Token Ring configuration information, refer to the *ATMSwitch Router Software Configuration Guide*.

Addressing

On a LAN, packets are addressed by the MAC-layer address of the destination and source stations. To provide similar functionality for LANE, every LANE client must have a MAC address. In addition, every LANE component (LES, LEC, BUS, and LECS) must have a unique ATM address.

All LANE clients on the same interface have the same automatically assigned MAC address, which is also used as the end-system identifier (ESI) part of the ATM address. Although client MAC addresses are not unique, all ATM addresses are unique.

Assigning Components to Interfaces and Subinterfaces

The following rules apply to assigning LANE components to the major ATM interface and its subinterfaces:

- The LECS always runs on the major ATM interface.

  If you assign any other component to the major interface, it is identical to assigning that component to the 0 subinterface.

- Configure the LES/BUS and the LEC of the *same* ELAN on the same subinterface.
  - — You cannot configure LECs of two *different* ELANs on the same subinterface.
  - — You cannot configure LESs/BUSs of two *different* ELANs on the same subinterface.

Note On the ATM switch router, you can configure LAN components only on the processor card (CPU) interface or on one of its subinterfaces.

Configuring LANE Router and LAN Switch Requirements

You must manually configure QSAAL and ILMI signaling PVCs on routers and edge LAN switches to run LANE.

Note These PVCs are configured automatically on the ATM switch router.

At least one ATM switch router is required to run LANE. For example, you cannot run LANE on routers connected back-to-back.

Configuring a LEC

This section describes how to configure a LANE client connection from a remote ATM switch router to the processor card (CPU) of a local switch. This connection allows you to configure the ATM switch router remotely.

Note This connection is for switch management only.

Take these steps:

Step	Command	Purpose
1	`Switch> enable` `Switch#`	Enter privileged EXEC mode.
2	`Switch# configure terminal` `Switch(config)#`	Enter global configuration mode.
3	`Switch(config)# interface atm 0[.subinterface]` `Switch(config-if)#`	Select the processor card (CPU) subinterface. **Note** We recommend that you configure LECs on subinterfaces (atm 0.1), not main interfaces (atm 0).
4	`Switch(config-if)# lane client-atm-address atm-address-template`	Specify an ATM address (and override the automatic ATM address assigned to the LANE client).
5	`Switch(config-if)# lane client ethernet elan-name`	Configure a LANE client on the specified subinterface.
6	`Switch(config-if)# end` `Switch#`	Return to privileged EXEC mode.

For examples of these commands, see the section “LANE Configuration Examples” at the end of this chapter.

Configuring the LECS

This section describes how to configure the LECS, and includes the following procedures:

- Configuring the ATM Address of the LECS
- Configuring the LECS Database

You must configure the ATM address of the LECS on the ATM switch router.

Configuring the ATM Address of the LECS

The ATM switch router comes with a default unique prefix. To see the default prefix, enter the **show lane default atm address** command. You can use the default prefix or assign a new one. If you want to use the default prefix, skip this section and proceed to the next section.

This section describes how to change the default prefix and configure a new one. All attached LANE entities use the prefix to create their own ATM network service access point (NSAP) addresses.

Take these steps:

Step	Command	Purpose
1	`Switch> enable` `Switch#`	Enter privileged EXEC mode.
2	`Switch# configure terminal` `Switch(config)#`	Enter global configuration mode.
3	`Switch(config)# interface atm 0`	Select the ATM interface on the processor card (CPU).
4	`Switch(config)# atm lecs-address` *lecsaddress*	Configure the LECS address on the ATM switch router.
5	`Switch(config)# atm lecs-address-default` *address* [*sequence#*]	Configure a redundant LECS address and sequence number for the entire switch. The sequence number specifies the order of the address in the LECS address table. If you do not specify a sequence number, the addresses are used in the order entered.

Step	Command	Purpose
6	`Switch(config)# atm address address`	Configure a new ATM address.
7	`Switch(config)# no atm address address`	Disable the old default ATM address. **Note** Enter the **show atm addresses** command to display the default ATM addresses.

For examples of these commands, see the section "LANE Configuration Examples" at the end of this chapter.

Configuring the LECS Database

Take these steps:

Step	Command	Purpose
1	`Switch> enable` `Switch#`	Enter privileged EXEC mode.
2	`Switch# configure terminal` `Switch(config)#`	Enter global configuration mode.
3	`Switch(config)# lane database database-name`	Create a named database for the LECS.
4	`Switch(lane-config-database)# name elan-name server-atm-address atm-address`	In the configuration database, bind the name of the ELAN to the ATM address of the LES. **Note** Enter the **show lane default-atm-address** for the ATM address of the server for the ELAN.
5	`Switch(config)# name elan-name server-atm-address address index n`	Specify redundant LES/BUSs, or simple server replication. Enter the command for each LES address for the same ELAN. The index determines the priority. Zero (0) is the highest priority.

Step	Command	Purpose
6	`Switch(lane-config-database)#` **`default-name`** *`elan-name`*	In the configuration database, assign an ELAN to the LECs to join without specifying an ELAN name.
7	`Switch(lane-config-database)#` **`end`** `Switch#`	Return to privileged EXEC mode.

For examples of these commands, see the section “LANE Configuration Examples” at the end of this chapter.

Configuring the LES/BUS

In Cisco’s implementation of LANE, the LES and BUS are treated as one LANE component. You configure the LES and BUS together as one component (the LES/BUS), instead of two separate LANE components.

Take these steps:

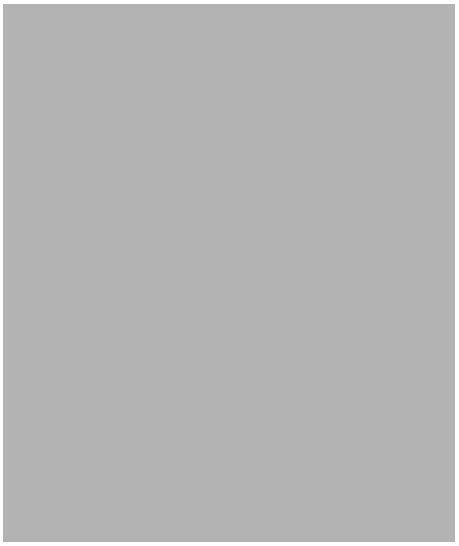
Step	Command	Purpose
1	`Switch>` **`enable`** `Switch#`	Enter privileged EXEC mode.
2	`Switch#` **`configure terminal`** `Switch(config)#`	Enter global configuration mode.
3	`Switch(config)#` **`interface ethernet 0`**[*`.subinterface`*] `Switch(config-if)#`	Specify the subinterface for the first ELAN.
4	`Switch(config-if)#` **`lane server-bus ethernet`** *`elan-name1`*	Enable a LES/BUS for the first ELAN.
5	`Switch(config-if)#` **`ip address`** *`address mask`*	Assign an IP address to the subinterface.
6	`Switch(config-if)#` **`end`** `Switch#`	Return to privileged EXEC mode.

LANE Configuration Examples

The following examples show how to configure one Cisco 7505 router, one ATM switch router, and one Catalyst 5500 switch for a single ELAN.

The ATM switch router contains the LECS, LES, BUS, and a LEC. The remaining router and Catalyst5500 switch each contain an LEC for the ELAN. This example uses all LANE default settings. For example, it does not explicitly set ATM addresses for the different LANE components that are collocated on the ATM switch router. Membership in this LAN is not restricted (see Figure4-1).

Figure4-1 Single ELAN Example Network



ATM Switch Router

```
ATM_Switch# show lane default-atm-addresses
interface ATM0:
LANE Client:        47.00918100000000E04FACB401.00E04FACB402.**
LANE Server:        47.00918100000000E04FACB401.00E04FACB403.**
LANE Bus:           47.00918100000000E04FACB401.00E04FACB404.**
LANE Config Server: 47.00918100000000E04FACB401.00E04FACB405.00
note: ** is the subinterface number byte in hex

ATM_Switch# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
ATM_Switch(config)# atm lecs-address-default
47.00918100000000E04FACB401.00E04FACB405.00
ATM_Switch(config)# end
ATM_Switch#
ATM_Switch# copy system:running-config nvram:startup-config
Building configuration...
[OK]
ATM_Switch# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
ATM_Switch(config)# lane database eng_dbase
ATM_Switch(lane-config-database)# name eng_elan server-atm-address
47.00918100000000E04FACB401.00E04FACB403.01
ATM_Switch(lane-config-database)# default-name eng_elan
ATM_Switch(lane-config-database)# end
ATM_Switch# show lane database

LANE Config Server database table 'eng_dbase'
default elan: eng_elan
elan 'eng_elan': un-restricted
  server 47.00918100000000E04FACB401.00E04FACB403.01 (prio 0)

ATM_Switch# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
ATM_Switch(config)# interface atm 0
ATM_Switch(config-if)# lane config database eng_dbase
ATM_Switch(config-if)# lane config auto-config-atm-address
ATM_Switch(config-if)# exit
ATM_Switch(config)# end
```

```
ATM_Switch# show lane config
LE Config Server ATM0 config table: eng_dbase
Admin: up  State: operational
LECS Mastership State: active master
list of global LECS addresses (42 seconds to update):
47.00918100000000E04FACB401.00E04FACB405.00
ATM Address of this LECS: 47.00918100000000E04FACB401.00E04FACB405.00
(auto)
cumulative total number of unrecognized packets received so far: 0
cumulative total number of config requests received so far: 0
cumulative total number of config failures so far: 0

ATM_Switch# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
ATM_Switch(config)# interface atm 0.1
ATM_Switch(config-subif)# lane server-bus ethernet eng_elan
ATM_Switch(config-subif)# ip address 172.16.0.4 255.255.0.0
ATM_Switch(config-subif)# end
ATM_Switch# show lane
LE Config Server ATM0 config table: eng_dbase
Admin: up  State: operational
LECS Mastership State: active master
list of global LECS addresses (46 seconds to update):
47.00918100000000E04FACB401.00E04FACB405.00
ATM Address of this LECS: 47.00918100000000E04FACB401.00E04FACB405.00
(auto)
 vcd  rxCnt  txCnt  callingParty
  82      0      0  47.00918100000000E04FACB401.00E04FACB403.01 LES
eng_elan 0 active
cumulative total number of unrecognized packets received so far: 0
cumulative total number of config requests received so far: 0
cumulative total number of config failures so far: 0

LE Server ATM0.1  ELAN name: eng_elan  Admin: up  State: operational
type: ethernet         Max Frame Size: 1516
ATM address: 47.00918100000000E04FACB401.00E04FACB403.01
LECS used: 47.00918100000000E04FACB401.00E04FACB405.00 connected, vcd 81

LE BUS ATM0.1  ELAN name: eng_elan  Admin: up  State: operational
type: ethernet         Max Frame Size: 1516
ATM address: 47.00918100000000E04FACB401.00E04FACB404.01
```

```
ATM_Switch# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
ATM_Switch(config)# interface atm 0.1
ATM_Switch(config-subif)# lane client ethernet eng_elan
ATM_Switch(config-subif)# end
ATM_Switch# show lane client
LE Client ATM0.1  ELAN name: eng_elan  Admin: up  State: operational
Client ID: 1                LEC up for 30 seconds
ELAN ID: 0
Join Attempt: 1
HW Address: 00e0.4fac.b402   Type: ethernetMax Frame Size: 1516
ATM Address: 47.00918100000000E04FACB401.00E04FACB402.01

 VCD  rxFrames  txFrames  Type       ATM Address
   0         0         0  configure
47.00918100000000E04FACB401.00E04FACB405.00
  87         1         2  direct
47.00918100000000E04FACB401.00E04FACB403.01
  90         1         0  distribute
47.00918100000000E04FACB401.00E04FACB403.01
  91         0         1  send
47.00918100000000E04FACB401.00E04FACB404.01
  94         0         0  forward
47.00918100000000E04FACB401.00E04FACB404.01

ATM_Switch# copy system:running-config nvram:startup-config
Building configuration...
[OK]
ATM_Switch#
```

Router 1

```
router1# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
router1(config)# interface atm 3/0
router1(config-if)# atm pvc 1 0 5 qsaal
router1(config-if)# atm pvc 2 0 16 ilmi
router1(config-if)# interface atm 3/0.1
router1(config-subif)# ip address 172.16.0.1 255.255.0.0
router1(config-subif)# lane client ethernet eng_elan
router1(config-subif)# end
router1# more system:running-config
Building configuration...
```

```
Current configuration:
!
version 12.0

<Information deleted>

!
interface ATM3/0
 no ip address
 atm pvc 1 0 5 qsaal
 atm pvc 2 0 16 ilmi
!
interface ATM3/0.1 multipoint
 lane client ethernet eng_elan
!

<Information deleted>

!
end

router1# show inter atm 3/0.1
ATM3/0.1 is up, line protocol is up
  Hardware is cxBus ATM
  MTU 1500 bytes, BW 156250 Kbit, DLY 80 usec, rely 255/255, load 1/255
  Encapsulation ATM-LANE
  ARP type: ARPA, ARP Timeout 04:00:00
router1#
```

Catalyst 5500 Switch 1

```
Switch1> session 4
Trying ATM-4...
Connected to ATM-4.
Escape character is '^]'.
ATM> enable
ATM# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
ATM(config)# interface atm 0
ATM(config-if)# lane server-bus ethernet eng_elan
ATM(config-if)# end
ATM# copy system:running-config nvram:startup-config
Building configuration...
[OK]
```

```
ATM# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
ATM(config)# interface atm 0
ATM(config-if)# atm pvc 1 0 5 qsaal
ATM(config-if)# atm pvc 2 0 16 ilmi
ATM(config-if)# end
ATM#
ATM# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
ATM(config)# interface atm 0.1
ATM(config-subif)# lane client ethernet 1 eng_elan
ATM(config-subif)# end
ATM# show lane client
LE Client ATM0.1  ELAN name: eng_elan  Admin: up  State: operational
Client ID: 3                 LEC up for 24 seconds
Join Attempt: 11
HW Address: 00e0.4fac.b030   Type: ethernetMax Frame Size: 1516
VLANID: 1
ATM Address: 47.00918100000000E04FACB401.00E04FACB030.01

 VCD  rxFrames  txFrames  Type       ATM Address
   0         0         0  configure
47.00918100000000E04FACB401.00E04FACB405.00
  27         1        14  direct
47.00918100000000E04FACB401.00E04FACB403.01
  29        13         0  distribute
47.00918100000000E04FACB401.00E04FACB403.01
  30         0        15  send
47.00918100000000E04FACB401.00E04FACB404.01
  31         0         0  forward
47.00918100000000E04FACB401.00E04FACB404.01

ATM# copy system:running-config nvram:startup-config
Building configuration...
[OK]
ATM#
```

Verifying Connectivity

The following example shows how to use the **show lane** and **ping** commands to confirm the connection between the ATM switch router, routers, and LAN switches:

ATM Switch Router

```
Switch# show lane
LE Config Server ATM0 config table: eng_dbase
Admin: up  State: operational
LECS Mastership State: active master
list of global LECS addresses (31 seconds to update):
47.00918100000000E04FACB401.00E04FACB405.00  <-------- me
ATM Address of this LECS: 47.00918100000000E04FACB401.00E04FACB405.00
(auto)
 vcd  rxCnt  txCnt  callingParty
  82      2      2  47.00918100000000E04FACB401.00E04FACB403.01 LES
eng_elan 0 active
cumulative total number of unrecognized packets received so far: 0
cumulative total number of config requests received so far: 4
cumulative total number of config failures so far: 0

LE Server ATM0.1  ELAN name: eng_elan  Admin: up  State: operational
type: ethernet         Max Frame Size: 1516
ATM address: 47.00918100000000E04FACB401.00E04FACB403.01
LECS used: 47.00918100000000E04FACB401.00E04FACB405.00 connected, vcd 81
control distribute: vcd 89, 2 members, 2 packets

proxy/ (ST: Init, Conn, Waiting, Adding, Joined, Operational, Reject,
Term)
lecid ST vcd    pkts Hardware Addr  ATM Address
   1  O   88       2 00e0.4fac.b402
47.00918100000000E04FACB401.00E04FACB402.01
   2  O   96       2 0080.1c93.8060
47.00918100000000E04FACB401.00801C938060.01

LE BUS ATM0.1  ELAN name: eng_elan  Admin: up  State: operational
type: ethernet         Max Frame Size: 1516
ATM address: 47.00918100000000E04FACB401.00E04FACB404.01
data forward: vcd 93, 2 members, 95 packets, 0 unicasts

lecid  vcd     pkts   ATM Address
    1   92       95 47.00918100000000E04FACB401.00E04FACB402.01
    2   97       42 47.00918100000000E04FACB401.00801C938060.01
```

```
LE Client ATM0.1  ELAN name: eng_elan  Admin: up  State: operational
Client ID: 1                 LEC up for 1 hour 34 minutes 46 seconds
ELAN ID: 0
Join Attempt: 1
HW Address: 00e0.4fac.b402   Type: ethernetMax Frame Size: 1516
ATM Address: 47.00918100000000E04FACB401.00E04FACB402.01

 VCD  rxFrames  txFrames  Type       ATM Address
   0         0         0  configure
47.00918100000000E04FACB401.00E04FACB405.00
  87         1         2  direct
47.00918100000000E04FACB401.00E04FACB403.01
  90         2         0  distribute
47.00918100000000E04FACB401.00E04FACB403.01
  91         0        95  send
47.00918100000000E04FACB401.00E04FACB404.01
  94        42         0  forward
47.00918100000000E04FACB401.00E04FACB404.01

ATM_Switch# ping 172.16.0.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.16.0.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/202/1000
ms
ATM_Switch# ping 172.16.0.3
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.16.0.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/202/1000
ms
ATM_Switch#
```

Confirming Connectivity between the ATM Switch Router and the Routers

The following example shows how to use the **ping** command to confirm the connection between the ATM switch router and routers:

```
ATM_Switch# ping 172.16.0.1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.16.0.1, timeout is 2 seconds:
!!!!!
```

```
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/202/1000
ms
ATM_Switch# ping 172.16.0.3

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.16.0.3, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/202/1000
ms
```

Displaying the LANE Client Configuration on the ATM Switch Router

The following example shows the **show lane client** command display for the Ethernet LANE client in the ATM switch router:

```
ATM_Switch# show lane client
LE Client ATM0.1  ELAN name: eng  Admin: up  State: operational
Client ID: 3                 LEC up for 4 minutes 58 seconds
Join Attempt: 1
HW Address: 0060.3e7b.2002   Type: ethernet             Max Frame Size:
1516
ATM Address: 47.00918100000000603E7B2001.00603E7B2002.01

 VCD  rxFrames  txFrames  Type       ATM Address
   0         0         0  configure
47.00918100000000603E7B2001.00000C407575.00
  52         1         4  direct
47.00918100000000603E7B2001.00000C407573.01
  53         9         0  distribute
47.00918100000000603E7B2001.00000C407573.01
  54         0        13  send
47.00918100000000603E7B2001.00000C407574.01
  55        19         0  forward
47.00918100000000603E7B2001.00000C407574.01
  56        11        10  data
47.00918100000000603E7B2001.00000C407572.01
  57         6         5  data
47.00918100000000603E7B2001.00000C407C02.02

Switch#
```

CHAPTER 5

Configuring Tag Switching

This chapter describes how to configure tag switching, and includes the following sections:

- Software Restrictions
- Configuring Tag Switching on an ATM Switch Router
- Configuring Tag Switching on a Router
- Tag Switching Configuration Example

Note For more software configuration information about tag switching, refer to the *ATM Switch Router Software Configuration Guide* . Refer to the *ATMSwitch Router Command Reference* publication for command syntax.

Software Restrictions

The software restrictions for tag switching follow:

- Open Shortest Path First (OSPF) is the only routing protocol currently supported.
- IP is the only network layer protocol currently supported.

Configuring Tag Switching on an ATM Switch Router

This section describes how to configure tag switching on an ATM switch router, and includes the following procedures:

- Enabling Tag Switching on the ATM Interface
- Configuring the Routing Protocol

Enabling Tag Switching on the ATM Interface

Note Configure all parallel interfaces between switches for either IP unnumbered or with a specific IP address. Unnumbering some parallel interfaces and assigning specific IP addresses to others might cause Tag Distribution Protocol (TDP) sessions to restart on some parallel interfaces when another parallel interface is shut down. Therefore, we highly recommend that you unnumber all parallel interfaces to loopback.

Take these steps:

Step	Command	Purpose
1	`Switch(config)# interface atm` *`card/subcard/port`* `Switch(config-if)#`	Enter interface configuration mode on the specified ATM interface.
2	`Switch(config-if)# ip unnumbered` *`type number`*	Enable IP unnumbered on the ATM interface and assign the unnumbered interface to an interface that has an IP address. We recommend enabling IP unnumbered because it allows you to conserve IP addresses and reduces the number of TVCs[1] terminating on the switch.
	or	or
	`Switch(config-if)# ip address` *`ip-address mask`*	Assign an IP address and subnet mask to the ATM interface.

Step	Command	Purpose
3	`Switch(config-if)# tag-switching ip`	Enable tag switching of IP packets on the interface.
4	`Switch(config-if)# exit` `Switch(config)#`	Return to global configuration mode.

1 TVCs = tag virtual channels.

Examples

```
Switch(config-if)# interface atm 1/0/1
Switch(config-if)# ip unnumbered loopback 0
Switch(config-if)# tag-switching ip
Switch(config-if)# exit
Switch(config)#

Switch(config)# interface atm 0/0/3
Switch(config-if)# ip address 1.3.11.3 255.255.0.0
Switch(config-if)# tag-switching ip
Switch(config-if)# exit
Switch(config)#
```

Verify

```
Switch# show tag-switching interfaces
Interface              IP    Tunnel   Operational
ATM0/0/3               Yes   No       No          (ATM tagging)
ATM1/0/1               Yes   No       No          (ATM tagging)
Switch#
```

Configuring the Routing Protocol

Enable the routing protocol (OSPF) on the ATM switch router so that it can create routing tables, which identify routes through the network. Then add the addresses and associated routing areas to the routing process so that it can propagate the addresses to other ATM switches and routers.

Take these steps:

Step	Command	Purpose
1	`Switch(config)# router ospf process_number`	Enable the routing protocol and assign it a process number. The process number is any positive integer.
2	`Switch(config-router)# network address wildcard-mask area area-id`	Define the network prefix, a wildcard subnet mask, and the associated area number on which to run the routing protocol. An area number is an identification number for an address range. Repeat this command for each additional area you want to add to the routing process. **Caution** Ethernet interface 0 on the processor card (CPU card) is used for system management only (for example, downloading system images or configuration files from a TFTP[1] server). Do not add this interface to the routing process.
3	`Switch(config-router)# exit` `Switch(config)#`	Return to global configuration mode.

1 TFTP = Trivial File Transfer Protocol

Example

Note An IP address of 1.1.1.1 with a subnet mask of 255.255.255.0 is entered as an IP network prefix of 1.1.1.0 with a subnet mask of 0.0.0.255. Likewise, an IP address of 1.2.1.1 with a subnet mask of 255.255.255.0 is entered as an IP network prefix of 1.2.1.0 with a subnet mask of 0.0.0.255.

```
Switch(config)# router ospf 10000
Switch(config-router)# network 1.1.1.0 0.0.0.255 area 0
Switch(config-router)# network 1.2.1.0 0.0.0.255 area 0
Switch(config-router)# network 1.3.0.0 0.0.255.255 area 0
Switch(config-router)# network 200.2.2.0 0.0.0.255 area 0
Switch(config-router)# network 1.0.1.0 0.0.0.255 area 0
Switch(config-router)# network 1.18.0.0 0.0.255.255 area 0
Switch(config-router)# exit
Switch(config)#
```

Verify

```
Switch# show ip ospf
 Routing Process "ospf 10000" with ID 1.0.1.11
 Supports only single TOS(TOS0) routes
 SPF schedule delay 5 secs, Hold time between two SPFs 10 secs
 Number of DCbitless external LSA 0
 Number of DoNotAge external LSA 0
 Number of areas in this router is 1. 1 normal 0 stub 0 nssa
    Area BACKBONE(0) (Inactive)
         Number of interfaces in this area is 4
         Area has no authentication
         SPF algorithm executed 2 times
         Area ranges are
         Link State Update Interval is 00:30:00 and due in 00:14:42
         Link State Age Interval is 00:20:00 and due in 00:14:10
         Number of DCbitless LSA 0
         Number of indication LSA 0
         Number of DoNotAge LSA 0

Switch#
```

Configuring Tag Switching on a Router

This section describes how to configure tag switching between a router and an ATM switch router.

Take these steps:

Step	Command	Purpose
1	`Router# configure terminal` `Router(config)#`	Enter global configuration mode.
2	`Router(config)# interface` *type port*`[`*/slot*`][`*.subinterface*`]` `Router(config-subif)#`	Select the subinterface to configure.
3	`Router(config-subif)# ip address` *address subnet*	Enter the IP address and subnet mask for the interface.
4	`Router(config-subif)# tag-switching ip`	Enable tag switching of IP packets on an interface.
5	`Router(config-subif)# no shutdown`	Enable the interface.
6	`Router(config-subif)# exit` `Router(config)#`	Return to global configuration mode.
7	`Router(config)# interface type` *port*`[`*/slot*`]` `Router(config-if)#`	Enter interface configuration on the main interface you selected in Step 2.
8	`Router(config-if)# no shutdown`	Enable the interface.

Example

```
Router# configure terminal
Router(config)# interface atm 2/0.1
Router(config-subif)# ip address 189.26.11.15 255.255.0.0
Router(config-subif)# tag-switching ip
Router(config-subif)# no shutdown
Router(config-subif)# exit
Router(config)# interface atm 2.0
Router(config-if)# no shutdown
```

Verify

```
Router# show tag-switching interface
Interface              IP    Tunnel   Operational
ATM2/0.1               Yes   No       Yes          (ATM tagging)
```

Tag Switching Configuration Example

Figure5-1 shows an example tag switching network.

Figure5-1 Example Network for Tag Switching

Router 5-1 Configuration

The configuration of router R5-1, interface e0/1, follows:

```
router_R5-1# configure terminal
router_R5-2(config)# ip cef switch
router_R5-1(config)# tag-switching advertise-tags
router_R5-1(config)# interface e0/1
router_R5-1(config-if)# tag-switching ip
router_R5-1(config-if)# exit
router_R5-1#(config)#
```

Router 5-2 Configuration

The configuration between router R5-1, interface e0/1, and R5-2, interface e0/1, follows:

```
router_R5-2# configure terminal
router_R5-2(config)# ip cef switch
router_R5-2(config)# tag-switching advertise-tags
router_R5-2(config)# interface e0/1
router_R5-2(config-if)# tag-switching ip
router_R5-2(config-if)# exit
router_R5-2#(config)#
```

The configuration between router R5-2, interface e0/2, and R5-3, interface e0/2, follows:

```
route_R5-2(config)# interface e0/2
route_R5-2(config-if)# tag-switching ip
route_R5-2(config-if)# exit
```

The configuration of router R5-2, interface a2/0.1, follows:

```
router_R5-2(config-if)# interface a2/0.1
router_R5-2(config-subif)# ip address 189.26.11.15 255.255.0.0
router_R5-2(config-subif)# tag-switching ip
router_R5-2(config-subif)# no shutdown
router_R5-2(config-subif)# exit
router_R5-2(config)# interface a2/0
router_R5-2(config)# no shutdown
```

Router 5-3 Configuration

The configuration of router R5-3, interface e0/2, follows:

```
router_R5-3# configure terminal
router_R5-3(config)# ip cef switch
router_R5-3(config)# tag-switching advertise-tags
router_R5-3(config)# interface e0/2
router_R5-3(config-if)# tag-switching ip
router_R5-3(config-if)# exit
```

The configuration of router R5-3, interface e0/5 follows:

```
router_R5-3(config)# interface e0/5
router_R5-3(config-if)# tag-switching ip
router_R5-3(config-if)# exit
```

The configuration of router R5-3, interface a2/0.1, follows:

```
router_R5-3# configure terminal
router_R5-3(config)# interface a2/0.1
router_R5-3(config-if)# ip address 189.25.12.13 255.255.0.0
router_R5-3(config-if)# tag-switching ip
router_R5-3(config-if)# no shutdown
router_R5-3(config-if)# exit
router_R5-3(config-if)# interface a2/0
router_R5-3(config)# no shutdown
```

ATM Switch Router A5-4 Configuration

The configuration of ATM switch router A5-4, interfaces a0/1/1 and 0/0/3, follows:

```
atm_A5-4# configure terminal
atm_A5-4(config)# interface a0/1/1
atm_A5-4(config-if)# no shutdown
atm_A5-4(config-if)# ip address 189.24.15.12 255.255.0.0
atm_A5-4(config-if)# tag-switching ip
atm_A5-4(config-if)# exit
atm_A5-4(config)# tag-switching ip
atm_A5-4(config)# interface a0/0/3
atm_A5-4(config-if)# no shutdown
atm_A5-4(config-if)# ip address 189.25.15.11 255.255.0.0
atm_A5-4(config-if)# tag-switching ip
atm_A5-4(config-if)# exit
atm_A5-4(config)# tag-switching ip
```

Router 5-5 Configuration

The configuration of router R5-5, interface e0/2, follows:

```
router_R5-5# configure terminal
router_R5-5(config)# ip cef switch
router_R5-5(config)# tag-switching advertise-tags
router_R5-5(config)# interface e0/2
router_R5-5(config-if)# tag-switching ip
router_R5-5(config-if)# exit
```

ATM Switch Router A6-4 Configuration

The configuration of ATM switch router A6-4, interface a0/1/1, follows:

```
atm_A6-4# configure terminal
atm_A6-4(config)# interface a0/1/1
atm_A6-4(config-if)# no shutdown
atm_A6-4(config-if)# ip address 189.24.14.12 255.255.0.0
atm_A6-4(config-if)# tag-switching ip
atm_A6-4(config-if)# exit
```

The configuration of ATM switch router A6-4, interface a0/0/3, follows:

```
atm_A6-4# configure terminal
atm_A6-4(config)# interface a0/0/3
atm_A6-4(config-if)# no shutdown
atm_A6-4(config-if)# ip address 189.26.14.11 255.255.0.0
atm_A6-4(config-if)# tag-switching ip
atm_A6-4(config-if)# exit
```

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