



Configuring LAN Emulation

This chapter describes LAN emulation (LANE) and how to configure it on the 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 an overview of LANE architecture and operation, refer to the *Guide to ATM Technology*. For complete descriptions of the commands mentioned in this chapter, refer to the *ATM Switch Router Command Reference* publication. For a detailed description of LANE and its components, refer to *Cisco IOS Switching Services Configuration Guide: Virtual LANs*.

This chapter contains the following sections:

- LANE Functionality and Requirements on page 13-1
- LANE Configuration Tasks on page 13-2
- LANE Configuration Examples on page 13-17

LANE Functionality and Requirements

LANE uses ATM as a backbone to interconnect existing legacy LANs. In doing so, LANE allows legacy LAN users to take advantage of ATM's benefits without requiring modifications to end station hardware or software.

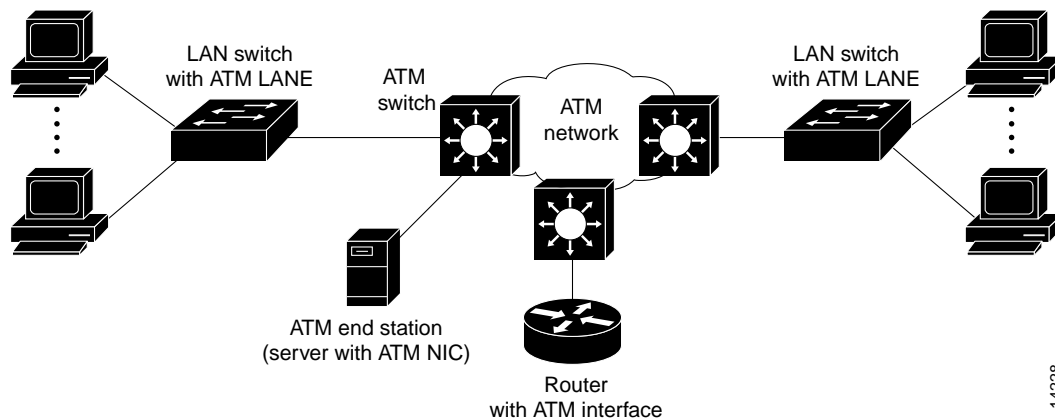
Multiple emulated LANs (ELANs), which are logically separated, can share the same physical ATM network and the same physical ATM interface. LANE makes an ATM interface look like one or more separate Ethernet or Token Ring interfaces.

LANE services provide connectivity between ATM-attached devices and LAN-attached devices. Two primary applications for the LANE protocol are as follows:

- Connectivity between LAN-attached stations across an ATM network, effectively extending LANs over 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 System (DNS), to traditional LAN-attached devices.

Figure 13-1 illustrates the various connections LANE provides.

Figure 13-1 LANE Concept



Refer to the *Guide to ATM Technology* for the following background topics on LANE:

- How LANE works—the operation of LANE and the function of ATM network devices in LANE
- LANE components—the function of the server and client components that are required for LANE
- LANE virtual circuit connection (VCC) types—the role of each VCC type in establishing, maintaining, and tearing down LANE connections
- Addressing—the scheme used in automatically assigning ATM addresses to LANE components
- LANE examples—step-by-step process of joining an emulated LAN and building a LANE connection from a PC

LANE Router and Switch Router Requirements

You must manually configure Q.2931 over Signaling ATM Adaptation Layer (QSAAL) and ILMI signaling PVCs on routers and edge LAN switch routers to run LANE. However, these signaling permanent virtual channels (PVCs) are automatically configured on the ATM switch router.



Note

The Catalyst 8510 MSR and LightStream 1010 processor and port adapters can be installed in slots 9 through 13 of the Catalyst 5500 switch. In this case, no physical connection is required between the ATM port adapter and the LANE card if the ATM Fabric Integration Module is used.

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

LANE Configuration Tasks

Before you begin to configure LANE, you must decide whether you want to set up one or multiple emulated LANs. If you set up multiple emulated LANs, you must also decide where the servers and clients will be located, and whether to restrict the clients that can belong to each emulated LAN. The procedure for configuring bridged emulated LANs is the same as for any other LAN.

To configure LANE, complete the tasks in the following sections:

- Creating a LANE Plan and Worksheet on page 13-3
- Displaying LANE Default Addresses on page 13-6
- Entering the ATM Address of the Configuration Server on page 13-7
- Setting Up the Configuration Server Database on page 13-7

**Note**

For fault tolerance, multiple LANE services and servers can be assigned to the emulated LAN. This requires the use of our ATM switch routers and our ATM edge devices end-to-end.

- Enabling the Configuration Server on page 13-11
An ATM cloud can contain multiple configuration servers.
- Setting Up LESs and Clients on page 13-11
Every ELAN must have at least a LAN emulation server/broadcast-and-unknown server (LES/BUS) pair, the maximum is 10. Every LANE cloud (one or multiple ELANs) must have at least one LAN emulation configuration server (LECS).

You can configure some emulated LANs with unrestricted membership and some emulated LANs with restricted membership. You can also configure a default emulated LAN, which must have unrestricted membership.

After LANE is configured, you can monitor and maintain the components, as described in the “Monitoring and Maintaining the LANE Components” section on page 13-16.

Creating a LANE Plan and Worksheet

Draw up a plan and a worksheet for your LANE scenario, containing the following information and leaving spaces for the ATM address of each LANE component on each subinterface of each participating router or switch router:

- The component and interface where the LECS will be located.
- The component, interface, and subinterface where the LES and BUS for each emulated LAN will be located. Each emulated LAN has multiple servers for fault-tolerant operation.
- The component, interfaces, and subinterfaces where the clients for each emulated LAN will be located.
- The component and database name of the default database.
- The name of the default emulated LAN (optional).
- The names of the emulated LANs that have unrestricted membership.
- The names of the emulated LANs that have restricted membership.

The last three items in this list are very important; they determine how you set up each emulated LAN in the configuration server database.

Automatic ATM Addressing and Address Templates for LANE Components

The ATM switch router automatically assigns ATM addresses to LANE components using the scheme described in the *Guide to ATM Technology*. You can also override the automatic address assignments using an ATM address template.

You can use ATM address templates in many LANE commands that assign ATM addresses to LANE components or that link client ATM addresses to emulated LANs. Using templates can greatly simplify the use of these commands.



Note

E.164-format ATM addresses do not support the use of LANE ATM address templates.

LANE ATM address templates can use two types of wildcards: an asterisk (*) to match any single character, and an ellipsis (...) to match any number of leading or trailing characters.

In LANE, a *prefix template* explicitly matches the prefix but uses wildcards for the end station interface (ESI) and selector fields. An *ESI template* explicitly matches the ESI field but uses wildcards for the prefix and selector fields. Table 13-1 shows how the values of unspecified digits are determined when an ATM address template is used.

Table 13-1 Values of Unspecified Digits in ATM Address Templates

Unspecified Digits In	Value Is
Prefix (first 13 bytes)	Obtained from ATM switch router via Integrated Local Management Interface (ILMI)
ESI (next 6 bytes)	Filled with the slot MAC address ¹ plus <ul style="list-style-type: none"> • 0—LANE Client (LEC) • 1—LANE Server (LES) • 2—LANE broadcast-and-unknown server (BUS) • 3—LANE Configuration Server (LECS)
Selector field (last 1 byte)	Subinterface number, in the range 0 through 255

1. The lowest MAC addresses in the pool addresses assigned to the ATM interface plus a value that indicates the LANE component.

Rules for 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 interface.

The assignment of any other component to the major interface is identical to assigning that component to the 0 subinterface.
- The server and the client of the *same* emulated LAN can be configured on the same subinterface.
- Clients of two *different* emulated LANs cannot be configured on the same subinterface.
- Servers of two *different* emulated LANs cannot be configured on the same subinterface.

**Note**

On the ATM switch router, LANE components can be configured only on the multiservice route processor interface or on one of its subinterfaces.

Example LANE Plan and Worksheet

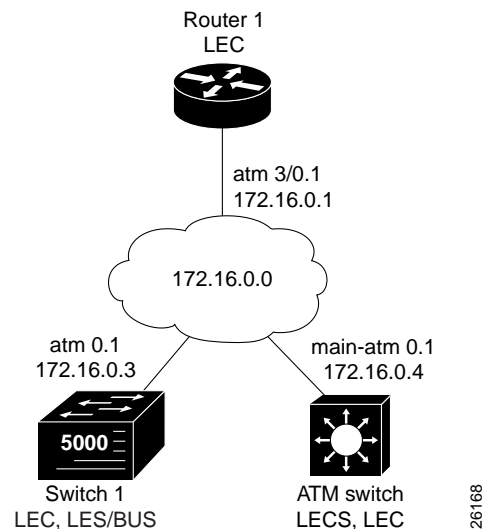
This section is an example of the LANE plan and worksheet that would be created for the example network configuration described in the “Default Configuration for a Single Emulated LAN” section on page 13-17.

**Note**

This example configures LANE on the route processor interface (ATM 0), rather than an ATM router module interface. For LANE client configuration examples on ATM router module interfaces, refer to “Configuring LECs on ATM Router Module Interfaces (Catalyst 8540 MSR)” section on page 21-7.

Figure 13-2 shows the single emulated LAN example network.

Figure 13-2 LANE Plan Example Network



The following information describes the LANE plan in Figure 13-2:

- LECS:
 - Location: ATM_Switch
 - Interface: atm 0
 - ATM address: 47.00918100000000E04FACB401.00E04FACB405.00
- LES:
 - Location: Switch_1
 - Interface/Subinterface: atm 0.1
 - Type: Ethernet
 - ATM address: 47.00918100000000E04FACB401.00E04FACB403.01

- BUS:
 - Location: Switch_1
 - Interface/Subinterface: atm 0.1
 - Type: Ethernet
 - ATM address: “use default”
- Database:
 - Location: ATM_Switch
 - Name: eng_dbase
 - ELAN name: eng_elan
 - Default ELAN name: eng_elan
 - ATM address: 47.00918100000000E04FACB401.00E04FACB403.01
- LANE Client:
 - Location: ATM_Switch
 - Interface/Subinterface: atm 0.1
 - Server/BUS name: eng_elan
 - IP Address/Subnet mask: 172.16.0.4 255.255.0.0
 - Type: Ethernet
- LANE Client:
 - Location: Switch_1
 - Interface/Subinterface: atm 0.1
 - Server/BUS name: eng_elan
 - Type: Ethernet
- LANE Client:
 - Location: Router_1
 - Interface/Subinterface: atm 3/0.1
 - Server/BUS name: eng_elan
 - IP Address/Subnet mask: 172.16.0.1 255.255.0.0
 - Type: Ethernet

**Note**

Virtual LANs (VLANs) need to be configured on the LAN edge switches. These VLANs must be mapped to the appropriate ELANs.

Continue with the following sections to start configuring LANE on your ATM network.

Displaying LANE Default Addresses

To make configuration easier, you should display the LANE default addresses for each router or switch router that is running any of the LESs or services and write down the displayed addresses on your worksheet.

To display the default LANE addresses, use the following EXEC command:

Command	Purpose
show lane default-atm-addresses	Displays the LANE default addresses for all ATM interfaces present on the router or switch router.

Example

The following example displays the default LANE addresses:

```
Switch# show lane default-atm-addresses
interface ATM13/0/0:
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
```

Entering the ATM Address of the Configuration Server

You must enter the configuration server ATM address into the ATM switch routers and save it permanently, so that the value is not lost when the device is reset or powered off. The configuration server address can be specified for all of the ATM switch routers, or per port.

To enter the configuration server addresses for all of the ATM switch routers, perform the following steps in global configuration mode:

	Command	Purpose
Step 1	Switch(config)# atm lecs-address-default <i>lecsaddress</i>	Specifies the LECS ATM address for all of the ATM switch routers.
Step 2	Switch(config)# end Switch#	Exits configuration mode.
Step 3	Switch# copy system:running-config nvram:startup-config	Saves the configuration.

For examples of these commands, see the “LANE Configuration Examples” section on page 13-17.

Setting Up the Configuration Server Database

After you have determined all LESs, BUSs, and LECS on all ATM subinterfaces on all routers and switch routers that will participate in LANE, and have displayed their ATM addresses, you can use the information to populate the configuration server’s database.

You can set up a default emulated LAN, whether or not you set up any other emulated LANs. You can also set up some emulated LANs with restricted membership and others with unrestricted membership.

To set up the LANE database, complete the tasks in the following subsections as appropriate for your emulated LAN plan and scenario. To set up fault-tolerant operation, see the “Configuring Fault-Tolerant Operation” section on page 13-15.

Setting Up the Database for the Default Emulated LAN Only

When you configure a router as the LECS for one default emulated LAN, you provide the following information:

- A name for the database
- The ATM address of the server for the emulated LAN
- The ring number of the emulated LAN for Token Ring (Catalyst 8510 MSR and LightStream 1010)
- A default name for the emulated LAN

When you set up a database of only a default unrestricted emulated LAN, you do not have to specify where the LANE *clients* are located. That is, when you set up the configuration servers database for a single default emulated LAN, you do not have to provide any database entries that link the ATM addresses of any clients with the emulated LAN name.

To set up the LECS for the default emulated LAN, perform the following steps, beginning in global configuration mode:

	Command	Purpose
Step 1	Switch(config)# lane database <i>database-name</i> Switch(lane-config-database)#	Creates a named database for the LECS.
Step 2	Switch(lane-config-database)# name <i>elan-name</i> server-atm-address <i>atm-address</i> [index <i>n</i>]	In the configuration database, binds the name of the emulated LAN to the ATM address of the LES.
Step 3	Switch(lane-config-database)# name <i>elan-name</i> local-seg-id <i>seg-num</i>	(Token Ring only.) In the configuration database, specifies the ring number for the emulated LAN. (Catalyst 8510 MSR and LightStream 1010)
Step 4	Switch(lane-config-database)# default-name <i>elan-name</i>	In the configuration database, assigns an emulated LAN to the LECS trying to join without specifying an ELAN name.

In Step 2, enter the ATM address of the server for the specified emulated LAN, as noted in your worksheet and obtained in the “Displaying LANE Default Addresses” section on page 13-6. You can have any number of servers per emulated LAN for fault tolerance. Entry order determines priority: the first entry has the highest priority unless you override it with the index option.

If you are setting up only a default emulated LAN, the *elan-name* value in Step 2 is the same as the default emulated LAN name you provide in Step 4.

To set up fault-tolerant operation, see the “Configuring Fault-Tolerant Operation” section on page 13-15.

For examples of these commands, see the “LANE Configuration Examples” section on page 13-17.

Setting Up the Database for Unrestricted-Membership Emulated LANs

When you set up a database for unrestricted emulated LANs, you create database entries that link the name of each emulated LAN to the ATM address of its *server*.

However, you can choose *not* to specify the locations of the LANE clients. That is, when you set up the configuration server database, you do not have to provide any database entries that link the ATM addresses or media access control (MAC) addresses of any *clients* with the emulated LAN name.

To configure a router or switch router as the LECS for multiple emulated LANs with unrestricted membership, perform the following steps, beginning in global configuration mode:

	Command	Purpose
Step 1	Switch(config)# lane database <i>database-name</i> Switch(lane-config-database)#	Creates a named database for the LECS.
Step 2	Switch(lane-config-database)# name <i>elan-name1</i> server-atm-address <i>atm-address</i> [index <i>n</i>]	In the configuration database, binds the name of the first emulated LAN to the ATM address of the LES for that emulated LAN.
Step 3	Switch(lane-config-database)# name <i>elan-name1</i> local-seg-id <i>seg-num</i>	(Token Ring only.) In the configuration database, specifies the ring number for the first emulated LAN. (Catalyst 8510 MSR and LightStream 1010)
Step 4	Switch(lane-config-database)# name <i>elan-name2</i> server-atm-address <i>atm-address</i> [index <i>n</i>]	In the configuration database, binds the name of the second emulated LAN to the ATM address of the LES. Repeat this step, providing a different emulated LAN name and an ATM address, for each additional emulated LAN in this switch cloud.
Step 5	Switch(lane-config-database)# name <i>elan-name2</i> local-seg-id <i>seg-num</i>	(Token Ring only) In the configuration database, specifies the ring number for the second emulated LAN. (Catalyst 8510 MSR and LightStream 1010) Repeat this step for each additional Token Ring emulated LAN.
Step 6	Switch(lane-config-database)# default name <i>elan-name1</i>	Specifies a default emulated LAN for LANE clients not explicitly bound to an emulated LAN. (Optional)

In Steps 2 and 4, enter the ATM address of the server for the specified emulated LAN, as noted in your worksheet and obtained in the “Displaying LANE Default Addresses” section on page 13-6.

To set up fault-tolerant operation, see the “Configuring Fault-Tolerant Operation” section on page 13-15.

For examples of these commands, see the “LANE Configuration Examples” section on page 13-17.

Setting Up the Database for Restricted-Membership Emulated LANs

When you set up the database for restricted-membership emulated LANs, you create database entries that link the name of each emulated LAN to the ATM address of its *server*. However, you also must specify where the LANE clients are located. That is, for each restricted-membership emulated LAN, you provide a database entry that explicitly links the ATM address or MAC address of each *client* of that emulated LAN with the name of that emulated LAN.

When clients for the same restricted-membership emulated LAN are located in multiple routers, each client's ATM address or MAC address must be linked explicitly with the name of the emulated LAN. As a result, you must configure as many client entries (See Step 7 in the following procedure) as you have clients for emulated LANs in all the routers. Each client will have a different ATM address in the database entries.

To set up the configuration server for emulated LANs with restricted membership, perform the following steps, beginning in global configuration mode:

	Command	Purpose
Step 1	Switch(config)# lane database <i>database-name</i> Switch(lane-config-database)#	Creates a named database for the LECS.
Step 2	Switch(lane-config-database)# name <i>elan-name1</i> server-atm-address <i>atm-address</i> [index <i>n</i>]	In the configuration database, binds the name of the first emulated LAN to the ATM address of the LES for that emulated LAN.
Step 3	Switch(lane-config-database)# name <i>elan-name1</i> local-seg-id <i>seg-num</i>	(Token Ring only) In the configuration database, specifies the ring number for the first emulated LAN. (Catalyst 8510 MSR and LightStream 1010)
Step 4	Switch(lane-config-database)# name <i>elan-name2</i> server-atm-address <i>atm-address</i> [index <i>n</i>]	In the configuration database, binds the name of the second emulated LAN to the ATM address of the LES. Repeat this step, providing a different name and a different ATM address for each additional emulated LAN.
Step 5	Switch(lane-config-database)# name <i>elan-name2</i> local-seg-id <i>seg-num</i>	(Token Ring only.) In the configuration database, specifies the ring number for the second emulated LAN. (Catalyst 8510 MSR and LightStream 1010) Repeat this step for each additional Token Ring emulated LAN.
Step 6	Switch(lane-config-database)# default-name <i>elan-name1</i>	(Optional.) Specifies a default emulated LAN for LANE clients not explicitly bound to an emulated LAN.
Step 7	Switch(lane-config-database)# client-atm-address <i>atm-address-template</i> name <i>elan-name</i>	Adds a database entry associating a specific client's ATM address with a specific restricted-membership emulated LAN. Repeat this step for each client of each restricted-membership emulated LANs on this switch cloud, in each case specifying that client's ATM address and the name of the emulated LAN with which it is linked.

To set up fault-tolerant operation, see the "Configuring Fault-Tolerant Operation" section on page 13-15.

Enabling the Configuration Server

After you create the database entries appropriate to the type and to the membership conditions of the emulated LANs, you enable the configuration server on the selected ATM interface, router, or switch router, and specify that the configuration server's ATM address is to be computed automatically.

To enable the configuration server, perform the following steps, beginning in global configuration mode:

	Command	Purpose
Step 1	Switch(config)# interface atm 0 [.subinterface#] Switch(config-if)#	If you are not currently configuring the interface, specifies the major ATM interface where the configuration server is located.
Step 2	Switch(config-if)# lane config database <i>database-name</i>	Links the configuration server's database name to the specified major interface, and enables the configuration server.
Step 3	Switch(config-if)# lane config auto-config-atm-address	Specifies that the configuration server's ATM address will be computed by our automatic method.

For examples of these commands, see the "LANE Configuration Examples" section on page 13-17.



Note

Since the 12.0(1a)W5(5b) release of the system software, addressing the interface on the Catalyst 8510 MSR and LightStream 1010 processor card has changed. The ATM interface is now called atm0, and the Ethernet interface is now called ethernet0. The old formats (atm 2/0/0 and ethernet 2/0/0) are still supported.

Setting Up LESs and Clients

For each device that participates in LANE, set up the necessary servers and clients for each emulated LAN; then display and record the server and client ATM addresses. Be sure to keep track of the router or switch router interface where the LECS will be located.

For one default emulated LAN, you must set up one set of servers: one as a primary server and the rest as backup servers for the same emulated LAN. For multiple emulated LANs, you can set up servers for another emulated LAN on a different subinterface or on the same interface of this router or switch router, or you can place the servers on a different router.

When you set up a server and BUS on a router, you can combine them with a client on the same subinterface, a client on a different subinterface, or no client at all on the router.

Where you put the clients is important, because any router with clients for multiple emulated LANs can route frames between those emulated LANs.



Note

For Token Ring LANE environments that source-route bridge IP traffic to the ATM switch routers, multiring must be configured to enable Routing Information Field (RIF) packets. For an example, see the "Default Configuration for a Token Ring ELAN with IP Source Routing (Catalyst 8510 MSR and LightStream 1010)" section on page 13-31.

Setting Up the Server, BUS, and a Client on a Subinterface

To set up the server, BUS, and (optionally) clients for an emulated LAN, perform the following steps, beginning in global configuration mode:

	Command	Purpose
Step 1	Switch(config)# interface atm 0.subinterface# Switch(config-subif)#	Specifies the subinterface for the first emulated LAN on this router.
Step 2	Switch(config-subif)# lane server-bus {ethernet tokenring} elan-name1	Enables a LES and a LANE BUS for the first emulated LAN. (The tokenring option is not supported on the Catalyst 8540 MSR.)
Step 3	Switch(config-subif)# lane client {ethernet tokenring} [elan-name1]	(Optional.) Enables a LANE client for the first emulated LAN. (The tokenring option is not supported on the Catalyst 8540 MSR.)
Step 4	Switch(config-subif)# ip address ip-address mask	Provides a protocol address for the client.

If the emulated LAN in Step 2 will have *restricted membership*, consider carefully whether you want to specify its name here. You will specify the name in the LECS's database when it is set up. However, if you link the client to an emulated LAN, and by some mistake it does not match the database entry linking the client to an emulated LAN, this client will not be allowed to join this or any other emulated LAN.

If you do decide to include the name of the emulated LAN linked to the client in Step 3 and later want to associate that client with a different emulated LAN, make the change in the configuration server's database before you make the change for the client on this subinterface.

Each emulated LAN is a separate subnetwork. In Step 4, make sure that the clients of the same emulated LAN are assigned protocol addresses on the same subnetwork, and that clients of different emulated LANs are assigned protocol addresses on different subnetworks.

For examples of these commands, see the "LANE Configuration Examples" section on page 13-17.

Setting Up a Client on a Subinterface

On any given router or switch router, you can set up one client for one emulated LAN or multiple clients for multiple emulated LANs without a server and BUS. You can set up a client for a given emulated LAN on any routers you select to participate in that emulated LAN. Any router with clients for multiple emulated LANs can route packets among those emulated LANs.

To set up a client for an emulated LAN, perform the following steps, beginning in global configuration mode:

	Command	Purpose
Step 1	Switch(config)# interface atm 0.subinterface# Switch(config-subif)# or Switch(config)# interface atm card/subcard/port.subinterface# Switch(config-subif)#	Specifies the route processor subinterface number for an emulated LAN on this router. If you are using the optional ATM router module, specifies the ATM subinterface number. (Catalyst 8540 MSR)
Step 2	Switch(config-subif)# ip address ip-address	Provides a protocol address for the client on this subinterface.
Step 3	Switch(config-subif)# lane client {ethernet tokenring} elan-name1	Enables a LANE client for the first emulated LAN. (The tokenring option is not supported on the Catalyst 8540 MSR.)

**Note**

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

Each emulated LAN is a separate subnetwork. In Step 2, make sure that the clients of the same emulated LAN are assigned protocol addresses on the same subnetwork, and that clients of different emulated LANs are assigned protocol addresses on different subnetworks.

**Note**

For Token Ring LANE environments that source-route bridge IP traffic to the ATM switch routers, multiring must be configured to enable Routing Information Field (RIF) packets. For an example, see the “Default Configuration for a Token Ring ELAN with IP Source Routing (Catalyst 8510 MSR and LightStream 1010)” section on page 13-31.

Example (Catalyst 8540 MSR)

The following example shows how to configure a client for emulated LAN on an ATM router module subinterface:

```
Switch(config)# interface atm 10/0/1.1
Switch(config-if)# ip address 172.16.4.0 255.255.0.0
Switch(config-if)# lane client ethernet elan_1205
```

For additional examples of these commands, see the “LANE Configuration Examples” section on page 13-17.

Configuring a LAN Emulation Client on the ATM Switch Router

This section explains how to configure a LANE client connection from the ATM switch router in the headquarters building to the route processor interface (or optional ATM router module interface on the Catalyst 8540 MSR) of the ATM switch router.

**Note**

This connection can be used for switch router management only.

A route processor (or optional ATM router module interface) configured as a LANE client allows you to configure the ATM switch router from a remote host.

Configuring an Ethernet LANE Client

To configure the route processor interface (or optional ATM router module interface on the Catalyst 8540 MSR) as an Ethernet LANE client on the ATM switch router, perform the following steps, beginning in global configuration mode:

	Command	Purpose
Step 1	Switch(config)# atm lecs-address <i>lecsaddress</i>	Specifies the address to the LECS.
Step 2	Switch(config)# interface atm 0 [.subinterface#] Switch(config-if)# or Switch(config)# interface atm <i>card/subcard/port</i> [.subinterface#] Switch(config-if)#	Specifies the route processor interface. If you are using the optional ATM router module, specifies the ATM interface number. (Catalyst 8540 MSR)
Step 3	Switch(config-if)# lane client-atm-address <i>atm-address-template</i>	Specifies an ATM address, and overrides the automatic ATM address assignment for the LANE client.
Step 4	Switch(config-if)# lane client ethernet <i>[elan-name]</i>	Configures a LANE client on the specified subinterface.

**Note**

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

Example

The following example shows how to specify the LANE configuration server (LECS) address and configure a LANE client on the route processor interface to emulate an Ethernet connection using the automatic ATM address assignment:

```
Switch(config)# atm lecs-address 47.0091.0000.0000.0000.0000.0000.00
Switch(config)# interface atm 0
Switch(config-if)# lane client ethernet eng_elan
```

For additional examples of these commands, see the “LANE Configuration Examples” section on page 13-17. For LANE client configuration examples on ATM router module interfaces, refer to “Configuring LECs on ATM Router Module Interfaces (Catalyst 8540 MSR)” section on page 21-7.

Configuring Fault-Tolerant Operation

The LANE simple server redundancy feature creates fault tolerance using standard LANE protocols and mechanisms. If a failure occurs on the LECS or on the LES/BUS, the emulated LAN can continue to operate using the services of a backup LES. This protocol is called the Simple Server Redundancy Protocol (SSRP).

For a detailed description of SSRP for LANE, refer to the *Guide to ATM Technology*.

Enabling Redundant LECSs and LES/BUSs

To enable fault tolerance, you enable multiple, redundant, and standby LECSs and multiple, redundant, and standby LES/BUSs. This allows the connected LANE components to obtain the global list of LECS addresses. Our LANE continues to operate seamlessly with other vendors' LANE components, but fault tolerance is not effective when other vendors' LANE components are present.

To configure multiple LES/BUSs for emulated LANs on the routers or switch routers, perform the following steps, beginning in global configuration mode:

	Command	Purpose
Step 1	Switch(config)# lane database <i>database-name</i> Switch(lane-config-database)#	Creates a named database for the LECS.
Step 2	Switch(lane-config-database)# name <i>elan-name</i> server-atm-address <i>address</i> index <i>n</i>	Specifies redundant LES/BUSs, or simple server replication. Enter the command for each LES address for the same emulated LAN. The index determines the priority. The 0 is the highest priority.
Step 3	Switch(lane-config-database)# lane client { ethernet tokenring } <i>elan-name</i>	Enables a LANE client for the first emulated LAN. (The tokenring option is not supported on the Catalyst 8540 MSR.)

Server redundancy guards against the failure of the hardware on which LES components are running. This includes all the ATM interface cards in our routers and Catalyst switches. Fault tolerance is not effective for ATM network or switch router failures.



Caution

For server redundancy to work correctly, all ATM switch routers must have identical lists of the global LECS addresses, in the identical priority order. The operating LECSs must use exactly the same configuration database.

Load the configuration table data using the **configure network** command. This method minimizes errors and enables the database to be maintained centrally in one place.

For examples of these commands, see the "LANE Configuration Examples" section on page 13-17.

Implementation Considerations

For important considerations when implementing SSRP, refer to the LANE discussion in the *Guide to ATM Technology*.

**Caution**

You can override the LECS address on any subinterface by using the **lane auto-config-atm-address**, **lane fixed-config-atm-address**, and **lane config-atm-address** commands. When you perform an override using one of these commands, however, fault-tolerant operation cannot be guaranteed. To avoid affecting the fault-tolerant operation, do not override any LECS, LES, or BUS addresses.

Monitoring and Maintaining the LANE Components

After configuring LANE components on an interface or any of its subinterfaces, on a specified subinterface, or on an emulated LAN, you can display their status. To show LANE information, use the following EXEC commands:

Command	Purpose
show lane [interface atm <i>card/subcard/port[.subinterface#]</i> name <i>elan-name</i>] [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 bus [interface atm <i>card/subcard/port[.subinterface#]</i> name <i>elan-name</i>] [brief]	Displays the global and per-VCC LANE information for the BUS configured on any subinterface or emulated LAN.
show lane client [interface atm <i>card/subcard/port[.subinterface#]</i> name <i>elan-name</i>] [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 <i>card/subcard/port[.subinterface#]</i>]	Displays the global and per-VCC LANE information for the configuration server configured on any interface.
show lane database [<i>name</i>]	Displays the LECS's database.
show lane le-arp [interface atm <i>card/subcard/port[.subinterface#]</i> name <i>elan-name</i>]	Displays the LANE ARP table of the LANE client configured on the specified subinterface or emulated LAN.
show lane server [interface atm <i>card/subcard/port[.subinterface#]</i> name <i>elan-name</i>] [brief]	Displays the global and per-VCC LANE information for the LES configured on a specified subinterface or emulated LAN.

LANE Configuration Examples

The examples in the following sections illustrate how to configure LANE for the following cases:

- Default configuration for a single emulated LAN with a LANE client on the ATM switch router
- Default configuration for a single emulated LAN with a backup LECS and LES on the ATM switch router
- Default configuration for a single emulated Token Ring LAN using IP source routing across a source-route bridged network with a LANE client on the ATM switch router

All examples use the automatic ATM address assignment method described in the “Automatic ATM Addressing and Address Templates for LANE Components” section on page 13-3.

These examples show the LANE configurations, not the process of determining the ATM addresses and entering them.



Note

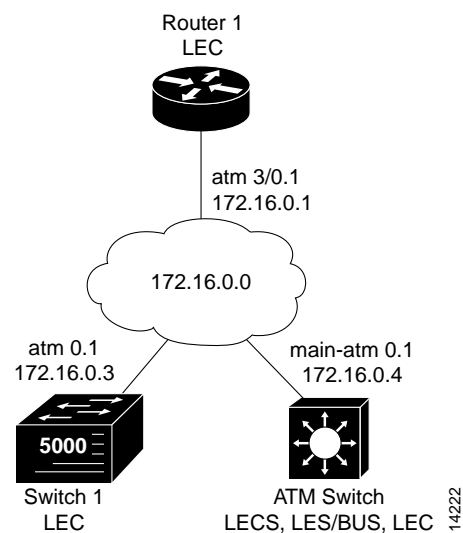
For LANE client configuration examples on ATM router module interfaces, refer to “Configuring LECs on ATM Router Module Interfaces (Catalyst 8540 MSR)” section on page 21-7.

Default Configuration for a Single Emulated LAN

The following examples show how to configure one Cisco 7505 router, one ATM switch, and one Catalyst 5500 switch for a single emulated LAN. Configurations for both Ethernet and Token Ring emulated LANs are shown.

The ATM switch contains the LECS, LES, BUS, and an LEC. The router and Catalyst 5500 switch each contain an LEC for the emulated LAN. This example uses all LANE default settings. For example, it does not explicitly set ATM addresses for the different LANE components that are colocated on the ATM switch. Membership in this emulated LAN is not restricted (see Figure 13-3).

Figure 13-3 Single Emulated LAN Example Network



Ethernet Example

ATM Switch

```

ATM_Switch# show lane default-atm-addresses
interface ATM13/0/0:
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 ATM13/0/0 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 <----- me
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 ATM13/0/0 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 <----- me
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 ATM13/0/0.1 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 ATM13/0/0.1 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 ATM13/0/0.1 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#

```

**Note**

The ELAN ID shown in the above **show lane client** command display is relevant only for LANE version 2-capable clients. The ELAN ID is configured with either the **name elan-name** command in database configuration mode, or the **lane server-bus** command in subinterface configuration mode.

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 11.1

<Information deleted>

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

<information deleted>

!
end

router1# show interfaces atm 3/0.1
ATM3/0.1 is up, line protocol is up
  Hardware is Caxias 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#

```

Confirming Connectivity between the ATM Switch and Other LANE Members

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

ATM Switch

```

Switch# show lane
LE Config Server ATM13/0/0 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 ATM13/0/0.1 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 0 88    2 00e0.4fac.b402 47.00918100000000E04FACB401.00E04FACB402.01
    2 0 96    2 0080.1c93.8060 47.00918100000000E04FACB401.00801C938060.01

LE BUS ATM13/0/0.1 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 ATM13/0/0.1 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

```

Token Ring Example (Catalyst 8510 MSR and LightStream 1010)

In this Token Ring example, the Cisco 7505 router contains the LECS, LES, BUS, and an LEC. The ATM switch router and Catalyst 5500 Fast Ethernet switch each contain an LEC for the emulated LAN. This example uses all LANE default settings. For example, it does not explicitly set ATM addresses for the different LANE components that are co-located on the router. Membership in this emulated LAN is not restricted.

Router 1

```
router1# show lane default-atm-addresses
interface ATM3/0:
LANE Client:      47.00918100000000603E7B2001.00000C407572.**
LANE Server:     47.00918100000000603E7B2001.00000C407573.**
LANE Bus:        47.00918100000000603E7B2001.00000C407574.**
LANE Config Server: 47.00918100000000603E7B2001.00000C407575.00
note: ** is the subinterface number byte in hex
```

ATM Switch

```
Switch# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)# atm lecs-address-default 47.00918100000000603E7B2001.00000C407575.00
Switch(config)# end
Switch#
```

Router 1

```
router1# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
router1(config)# lane database eng_dbase
router1(lane-config-database)# name eng_elan server-atm-address
47.00918100000000603E7B2001.00000C407573.01
router1(lane-config-database)# name eng_elan local-seg-id 2048
router1(lane-config-database)# default-name eng_elan
router1(lane-config-database)# exit
router1(config)# interface atm0
router1(config-if)# atm pvc 1 0 5 qsaal
router1(config-if)# atm pvc 2 0 16 ilmi
router1(config-if)# lane config auto-config-atm-address
router1(config-if)# lane config database eng_dbase
router1(config-if)#
%LANE-5-UPDOWN: ATM0 database example1: LE Config Server (LECS) changed state to up
router1(config-if)# interface atm3/0.1
router1(config-subif)# ip address 172.16.0.1 255.255.0.0
router1(config-subif)# lane server-bus tokenring eng_elan
router1(config-subif)# lane client tokenring eng_elan
router1(config-subif)#
%LANE-5-UPDOWN: ATM0.1 elan eng: LE Client changed state to up
router1(config-subif)# end
router1#
```

Catalyst 5000 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 tokenring 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 tokenring 1 eng_elan
ATM(config-subif)# end
ATM#
```

ATM Switch

```
Switch# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)# interface atm 0.1
Switch(config-subif)# ip address 172.16.0.4 255.255.0.0
Switch(config-subif)# lane client tokenring eng_elan
Switch(config-subif)#
%LANE-5-UPDOWN: ATM13/0/0.1 elan : LE Client changed state to up
Switch(config-subif)# end
Switch#
```

Confirming Connectivity between the ATM switch and the Routers

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

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

```
ATM_Switch# show lane client
LE Client ATM13/0/0.1 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
```

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

```
ATM_Switch# show lane client
LE Client ATM13/0/0.1 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: token ring Max Frame Size: 4544
ATM Address: 47.00918100000000603E7B2001.00603E7B2002.01

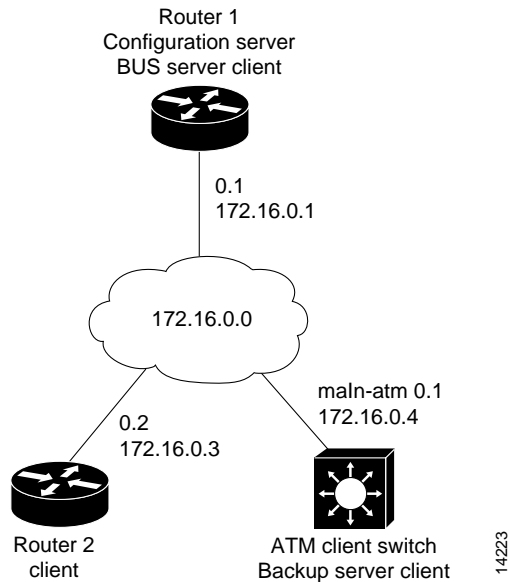
VCD  rxFrames  txFrames  Type      ATM Address
  0         0         0  configure 47.00918100000000603E7B2001.00000C407575.00
 52         1         4  direct   47.00918100000000603E7B2001.00000C407573.01
 53         9         0  distribute 47.00918100000000603E7B2001.00000C407573.01
 54         0        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
```

Default Configuration for a Single Emulated LAN with Backup LECS and LES on the ATM Switch Router

The following examples show how to configure two Cisco 4500 routers and one ATM switch router for one emulated LAN with fault tolerance. Configurations for both Ethernet and Token Ring emulated LANs are shown.

Router 1 contains the LECS, LES, BUS, and an LEC. Router 2 contains only an LEC. The ATM switch router contains the backup LECS and the backup LES for this emulated LAN, along with another LEC (see Figure 13-4).

Figure 13-4 Single Emulated LAN with Backup LANE Example Network



This example shows how to accept all default settings provided. For example, it does not explicitly set ATM addresses for the different LANE components that are also on the router. Membership in this emulated LAN is not restricted.

Ethernet Example

Router 1

```
router1# show lane default-atm-addresses
interface ATM0:
LANE Client:          47.00918100000000603E7B2001.00000C407572.**
LANE Server:          47.00918100000000603E7B2001.00000C407573.**
LANE Bus:             47.00918100000000603E7B2001.00000C407574.**
LANE Config Server:  47.00918100000000603E7B2001.00000C407575.00
note: ** is the subinterface number byte in hex
```

ATM Switch Router

```
Switch# show lane default-atm-address
interface ATM2/0/0:
LANE Client:          47.00918100000000603E7B2001.00603E7B2002.**
LANE Server:          47.00918100000000603E7B2001.00603E7B2003.**
LANE Bus:             47.00918100000000603E7B2001.00603E7B2004.**
LANE Config Server:  47.00918100000000603E7B2001.00603E7B2005.00
note: ** is the subinterface number byte in hex
```

```
Switch# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)# atm lecs-address-default 47.00918100000000603E7B2001.00000C407575.00
Switch(config)# atm lecs-address-default 47.00918100000000603E7B2001.00603E7B2005.00
Switch(config)# end
Switch#
```

Router 1

```

router1# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
router1(config)# lane database example1
router1(lane-config-database)# name eng server-atm-address
47.00918100000000603E7B2001.00000C407573.01
router1(lane-config-database)# name eng server-atm-address
47.00918100000000603E7B2001.00603E7B2003.01
router1(lane-config-database)# default-name eng
router1(lane-config-database)# exit
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)# lane config auto-config-atm-address
router1(config-if)# lane config database example1
router1(config-if)#
%LANE-5-UPDOWN: ATM0 database example1: LE Config Server (LECS) changed state to up
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 server-bus ethernet eng
router1(config-subif)# lane client ethernet eng
router1(config-subif)#
%LANE-5-UPDOWN: ATM0.1 elan eng: LE Client changed state to up
router1(config-subif)# end
router1#

```

ATM Switch Router

```

Switch# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)# lane database example1_backup
Switch(lane-config-database)# name eng server-atm-address
47.00918100000000603E7B2001.00000C407573.01
Switch(lane-config-database)# name eng server-atm-address
47.00918100000000603E7B2001.00603E7B2003.01
Switch(lane-config-database)# default-name eng
Switch(lane-config-database)# exit
Switch(config)# interface atm 0
Switch(config-if)# lane config auto-config-atm-address
Switch(config-if)# lane config database example1_backup
Switch(config-if)#
%LANE-5-UPDOWN: ATM2/0/0 database example1_backup: LE Config Server (LECS) changed state
to up
%LANE-6-LECS_INFO: ATM2/0/0: started listening on the well known LECS address
%LANE-6-LECS_INFO: LECS on interface ATM2/0/0 became a BACKUP
%LANE-6-LECS_INFO: ATM2/0/0: stopped listening on the well known LECS address
Switch(config-if)# interface atm 0.1
Switch(config-subif)# ip address 172.16.0.4 255.255.0.0
Switch(config-subif)# lane server-bus ethernet eng
Switch(config-subif)#
%LANE-5-UPDOWN: ATM2/0/0.1 elan eng: LE Server/BUS changed state to up
Switch(config-subif)# lane client ethernet eng
Switch(config-subif)#
%LANE-5-UPDOWN: ATM2/0/0.1 elan eng: LE Client changed state to up
Switch(config-subif)# end
Switch#

```

Router 2

```

router2# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
router2(config)# interface atm 3/0
router2(config-if)# atm pvc 1 0 5 qsaal
router2(config-if)# atm pvc 2 0 16 ilmi
router2(config-if)# interface atm 3/0.2
router2(config-subif)# ip address 172.16.0.3 255.255.0.0
router2(config-subif)# lane client ethernet eng
router2(config-subif)#
%LANE-5-UPDOWN: ATM0.2 elan : LE Client changed state to up
router2(config-subif)# end
router2#

```

Token Ring Example (Catalyst 8510 MSR and LightStream 1010)

Router 1

```

router1# show lane default-atm-addresses
interface ATM3/0:
LANE Client:          47.00918100000000603E7B2001.00000C407572.**
LANE Server:         47.00918100000000603E7B2001.00000C407573.**
LANE Bus:            47.00918100000000603E7B2001.00000C407574.**
LANE Config Server: 47.00918100000000603E7B2001.00000C407575.00
note: ** is the subinterface number byte in hex

```

ATM Switch

```

Switch# show lane default-atm-address
interface ATM2/0/0:
LANE Client:          47.00918100000000603E7B2001.00603E7B2002.**
LANE Server:         47.00918100000000603E7B2001.00603E7B2003.**
LANE Bus:            47.00918100000000603E7B2001.00603E7B2004.**
LANE Config Server: 47.00918100000000603E7B2001.00603E7B2005.00
note: ** is the subinterface number byte in hex

```

```

Switch# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)# atm lecs-address-default 47.00918100000000603E7B2001.00000C407575.00
Switch(config)# atm lecs-address-default 47.00918100000000603E7B2001.00603E7B2005.00
Switch(config)# end
Switch#

```

Router 1

```

router1# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
router1(config)# lane database example1
router1(lane-config-database)# name eng server-atm-address
47.00918100000000603E7B2001.00000C407573.01
router1(lane-config-database)# name eng server-atm-address
47.00918100000000603E7B2001.00603E7B2003.01
router1(lane-config-database)# name eng local-seg-id 2048
router1(lane-config-database)# default-name eng
router1(lane-config-database)# exit
router1(config)# interface atm 3/0
router1(config-if)# atm pvc 1 0 5 qsaa1
router1(config-if)# atm pvc 2 0 16 ilmi
router1(config-if)# lane config auto-config-atm-address
router1(config-if)# lane config database example1
router1(config-if)#
%LANE-5-UPDOWN: ATM0 database example1: LE Config Server (LECS) changed state to up
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 server-bus tokenring eng
router1(config-subif)# lane client tokenring eng
router1(config-subif)#
%LANE-5-UPDOWN: ATM0.1 elan eng: LE Client changed state to up
router1(config-subif)# end
router1#

```

ATM Switch

```

Switch# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)# lane database example1_backup
Switch(lane-config-database)# name eng server-atm-address
47.00918100000000603E7B2001.00000C407573.01
Switch(lane-config-database)# name eng server-atm-address
47.00918100000000603E7B2001.00603E7B2003.01
Switch(lane-config-database)# name eng local-seg-id 2048
Switch(lane-config-database)# default-name eng
Switch(lane-config-database)# exit
Switch(config)# interface atm 0
Switch(config-if)# lane config auto-config-atm-address
Switch(config-if)# lane config database example1_backup
Switch(config-if)#
%LANE-5-UPDOWN: ATM2/0/0 database example1_backup: LE Config Server (LECS) changed state
to up
%LANE-6-LECS_INFO: ATM2/0/0: started listening on the well known LECS address
%LANE-6-LECS_INFO: LECS on interface ATM2/0/0 became a BACKUP
%LANE-6-LECS_INFO: ATM2/0/0: stopped listening on the well known LECS address
Switch(config-if)# interface atm 0.1
Switch(config-subif)# ip address 172.16.0.4 255.255.0.0
Switch(config-subif)# lane server-bus tokenring eng
Switch(config-subif)#
%LANE-5-UPDOWN: ATM2/0/0.1 elan eng: LE Server/BUS changed state to up
Switch(config-subif)# lane client tokenring eng
Switch(config-subif)#
%LANE-5-UPDOWN: ATM2/0/0.1 elan eng: LE Client changed state to up
Switch(config-subif)# end
Switch#

```

Router 2

```

router2# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
router2(config)# interface atm 3/0
router2(config-if)# atm pvc 1 0 5 qsaal
router2(config-if)# atm pvc 2 0 16 ilmi
router2(config-if)# interface atm 3/0.2
router2(config-subif)# ip address 172.16.0.3 255.255.0.0
router2(config-subif)# lane client tokenring eng
router2(config-subif)#
%LANE-5-UPDOWN: ATM0.2 elan : LE Client changed state to up
router2(config-subif)# end
router2#

```

Displaying the LECS Configuration on the ATM Switch Router

The following example shows the **show lane config** command display for the LECS (Ethernet and Token Ring):

```

Switch# show lane config
LE Config Server ATM2/0/0 config table: example1_backup
Admin: up State: operational
LECS Mastership State: backup
list of global LECS addresses (45 seconds to update):
47.00918100000000603E7B2001.00000C407575.00 incoming call (vcd 88)
47.00918100000000603E7B2001.00603E7B2005.00 <----- me
ATM Address of this LECS: 47.00918100000000603E7B2001.00603E7B2005.00 (auto)
  vcd rxCnt txCnt callingParty
   88    0    0 47.00918100000000603E7B2001.00000C407575.00 LECS
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

```

Displaying the LES Configuration on the ATM Switch Router

The following example shows the **show lane server** command display for the Ethernet LES:

```

Switch# show lane server
LE Server ATM2/0/0.1 ELAN name: eng Admin: up State: operational
type: ethernet Max Frame Size: 1516
ATM address: 47.00918100000000603E7B2001.00603E7B2003.01
LECS used: 47.00918100000000603E7B2001.00000C407575.00 connected, vcd 95

```

The following example shows the **show lane server** command display for the Token Ring LANE server:

```

Switch# show lane server
LE Server ATM2/0/0.1 ELAN name: eng Admin: up State: operational
type: token ring Max Frame Size: 4544 Segment ID: 2048
ATM address: 47.00918100000000603E7B2001.00603E7B2003.01
LECS used: 47.00918100000000603E7B2001.00000C407575.00 connected, vcd 95

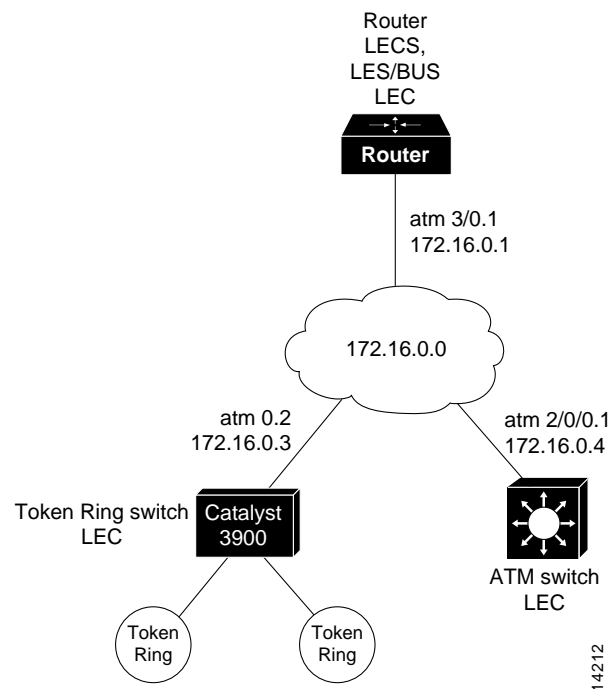
```

Default Configuration for a Token Ring ELAN with IP Source Routing (Catalyst 8510 MSR and LightStream 1010)

The following example shows how to configure a single emulated Token Ring LAN using a Cisco 4500 router and an ATM switch with IP source routing across a source-route bridged network. In this example, the emulated Token Ring LAN is source-route bridged to two physical Token Rings.

The router contains the LECS, LES, BUS, and an LEC. Both the ATM switch and Token Ring switch contain an LEC for the emulated LAN. 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 router. Membership in this emulated LAN is not restricted (see Figure 13-5).

Figure 13-5 Single Emulated Token Ring LAN with Token Ring Switch



Router

```
router# show lane default-atm-addresses
interface ATM0:
LANE Client:      47.00918100000000603E7B2001.00000C407572.**
LANE Server:     47.00918100000000603E7B2001.00000C407573.**
LANE Bus:        47.00918100000000603E7B2001.00000C407574.**
LANE Config Server: 47.00918100000000603E7B2001.00000C407575.00
note: ** is the subinterface number byte in hex
```

ATM Switch

```
Switch# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)# atm lecs-address-default 47.00918100000000603E7B2001.00000C407575.00
Switch(config)# end
Switch#
```

Router

```
router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
router(config)# lane database example1
router(lane-config-database)# name eng server-atm-address
47.00918100000000603E7B2001.00000C407573.01
router(lane-config-database)# name eng local-seg-id 2048
router(lane-config-database)# default-name eng
router(lane-config-database)# exit
router(config)# interface atm 3/0
router(config-if)# atm pvc 1 0 5 qsaal
router(config-if)# atm pvc 2 0 16 ilmi
router(config-if)# lane config auto-config-atm-address
router(config-if)# lane config database example1
router(config-if)#
%LANE-5-UPDOWN: ATM0 database example1: LE Config Server (LECS) changed state to up
router(config-if)# interface atm 3/0.1
router(config-subif)# ip address 172.16.0.1 255.255.0.0
router(config-subif)# lane server-bus tokenring eng
router(config-subif)# lane client tokenring eng
router(config-subif)#
%LANE-5-UPDOWN: ATM0.1 elan eng: LE Client changed state to up
router(config-subif)# end
router#
```

ATM Switch

```
Switch# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)# interface atm 0.1
Switch(config-subif)# ip address 172.16.0.4 255.255.0.0
Switch(config-subif)# lane client tokenring eng
Switch(config-subif)# multiring ip
Switch(config-subif)#
%LANE-5-UPDOWN: ATM2/0/0.1 elan : LE Client changed state to up
Switch(config-subif)# end
Switch#
```