C H A P T E R 4

Configuring PPP over ATM with NAT

The Cisco 857, Cisco 876, Cisco 877, and Cisco 878 access routers support Point-to-Point Protocol over Asynchronous Transfer Mode (PPPoA) clients and network address translation (NAT).

Multiple PCs can be connected to the LAN behind the router. Before traffic from the PCs is sent to the PPPoA session, it can be encrypted, filtered, and so forth. PPP over ATM provides a network solution with simplified address handling and straight user verification like a dial network. Figure 4-1 shows a typical deployment scenario with a PPPoA client and NAT configured on the Cisco router. This scenario uses a single static IP address for the ATM connection.

Figure 4-1   PPP over ATM with NAT
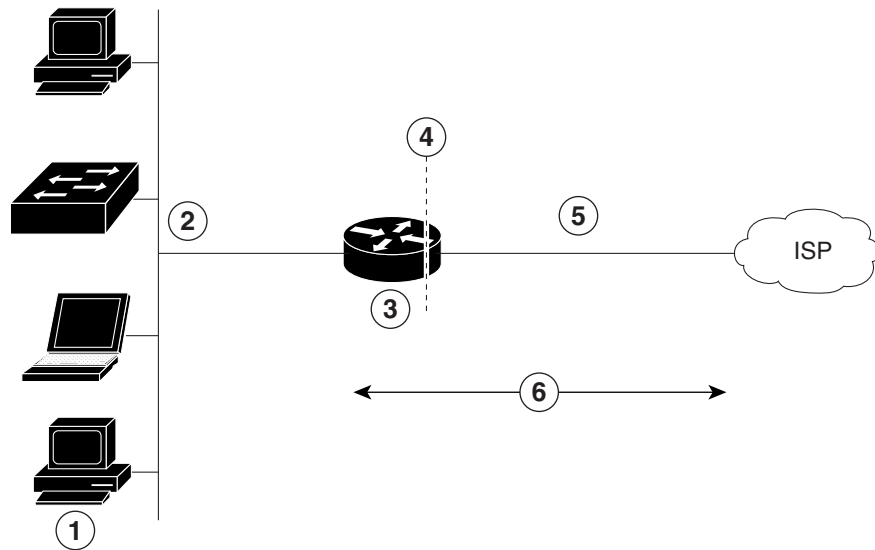
1	Small business with multiple networked devices—desktops, laptop PCs, switches
2	Fast Ethernet LAN interface (inside interface for NAT, 192.168.1.1/24)
3	PPPoA Client—Cisco 857, Cisco 876, Cisco 877, or Cisco 878 router
4	Point at which NAT occurs
5	ATM WAN interface (outside interface for NAT)
6	PPPoA session between the client and a PPPoA server at the ISP

In this scenario, the small business or remote user on the Fast Ethernet LAN can connect to an Internet service provider (ISP) using the following protocols on the WAN connection:

- Asymmetric digital subscriber line (ADSL) over plain old telephone service (POTS) using the Cisco 857 or Cisco 877 router

- ADSL over integrated services digital network (ISDN) using the Cisco 876 router

- Single-pair high-speed digital subscriber line (G.SHDSL) using the Cisco 878 router

The Fast Ethernet interface carries the data packet through the LAN and off-loads it to the PPP connection on the ATM interface. The ATM traffic is encapsulated and sent over the ADSL, ISDN, or G.SHDSL lines. The dialer interface is used to connect to the ISP.

PPPoA

The PPPoA Client feature on the router provides PPPoA client support on ATM interfaces. A dialer interface must be used for cloning virtual access. Multiple PPPoA client sessions can be configured on an ATM interface, but each session must use a separate dialer interface and a separate dialer pool.

A PPPoA session is initiated on the client side by the Cisco 850 or Cisco 870 series router.

NAT

NAT (represented as the dashed line at the edge of the Cisco router) signifies two addressing domains and the inside source address. The source list defines how the packet travels through the network.

Configuration Tasks

Perform the following tasks to configure this network scenario:

- Configure the Dialer Interface
- Configure the ATM WAN Interface
- Configure DSL Signaling Protocol
- Configure Network Address Translation

An example showing the results of these configuration tasks is shown in the "Configuration Example" section on page 4-11.

Configure the Dialer Interface

The dialer interface indicates how to handle traffic from the clients, including, for example, default routing information, the encapsulation protocol, and the dialer pool to use. It is also used for cloning virtual access. Multiple PPPoA client sessions can be configured on an ATM interface, but each session must use a separate dialer interface and a separate dialer pool.

Perform these steps to configure a dialer interface for the ATM interface on the router, starting in global configuration mode.

	Command	Purpose

Step 1	**interface dialer** *dialer-rotary-group-number*
	
	Example:
	`Router(config)# interface dialer 0`
	`Router(config-if)#`
		Creates a dialer interface (numbered 0–255), and enters into interface configuration mode.

Step 2	**ip address negotiated**
	
	Example:
	`Router(config-if)# ip address negotiated`
	`Router(config-if)#`
		Specifies that the IP address for the dialer interface is obtained through PPP/IPCP (IP Control Protocol) address negotiation.

Step 3	**ip mtu** *bytes*
	
	Example:
	`Router(config-if)# ip mtu 4470`
	`Router(config-if)#`
		Sets the size of the IP maximum transmission unit (MTU). The default minimum is 128 bytes. The maximum for ATM is 4470 bytes.

Step 4	**encapsulation** *encapsulation-type*
	
	Example:
	`Router(config-if)# encapsulation ppp`
	`Router(config-if)#`
		Sets the encapsulation type to PPP for the data packets being transmitted and received.

Step 5	**ppp authentication** {*protocol1* [*protocol2...*]}
	
	Example:
	`Router(config-if)# ppp authentication chap`
	`Router(config-if)#`
		Sets the PPP authentication method.
		
		The example applies the Challenge Handshake Authentication Protocol (CHAP).
		
		For details about this command and additional parameters that can be set, see the *Cisco IOS Security Command Reference*.

Step 6	**dialer pool** *number*
	
	Example:
	`Router(config-if)# dialer pool 1`
	`Router(config-if)#`
		Specifies the dialer pool to use to connect to a specific destination subnetwork.

	Command	Purpose

Step 7	**dialer-group** *group-number*
	
	Example:
	`Router(config-if)# dialer-group 1`
	`Router(config-if)#`
		Assigns the dialer interface to a dialer group (1–10).
		
		Tip Using a dialer group controls access to your router.

Step 8	**exit**
	
	Example:
	`Router(config-if)# exit`
	`Router(config)#`
		Exits the dialer 0 interface configuration.

Step 9	**dialer-list** *dialer-group* **protocol** *protocol-name* {**permit** | **deny** | **list** *access-list-number* | **access-group**}
	
	Example:
	`Router(config)# dialer-list 1 protocol ip permit`
	`Router(config)#`
		Creates a dialer list and associates a dial group with it. Packets are then forwarded through the specified interface dialer group.
		
		For details about this command and additional parameters that can be set, see the *Cisco IOS Dial Technologies Command Reference*.

Step 10	**ip route** *prefix mask* {*interface-type interface-number*}
	
	Example:
	`Router(config)# ip route 10.10.25.2 0.255.255.255 dialer 0`
	`Router(config)#`
		Sets the IP route for the default gateway for the dialer 0 interface.
		
		For details about this command and additional parameters that can be set, see the *Cisco IOS IP Command Reference, Volume 1 of 4: Routing Protocols*.

Repeat these steps for any additional dialer interfaces or dialer pools needed.

Configure the ATM WAN Interface

Perform these steps to configure the ATM interface, beginning in global configuration mode.

	Command	Purpose

Step 1	**interface** *type number*
	
	Example:
	`Router(config)# interface atm 0`
	`Router(config-if)#`
		Enters interface configuration mode for the ATM interface (labeled ADSLoPOTS or G.SHDSL on the back of your router).
		
		Note This interface was initially configured during basic router configuration. See the "Configure WAN Interfaces" section on page 1-6.

Step 2	**pvc** *vpi*/*vci*
	
	Example:
	`Router(config-if)# pvc 8/35`
	`Router(config-if-atm-vc)#`
		Creates an ATM PVC for each end node (up to ten) with which the router communicates. Enters ATM virtual circuit configuration mode.
		
		When a PVC is defined, AAL5SNAP encapsulation is defined by default. Use the **encapsulation** command to change this, as shown in Step 3. The VPI and VCI arguments cannot be simultaneously specified as zero; if one is 0, the other cannot be 0.
		
		For details about this command and additional parameters that can be set, see the *Cisco IOS Wide-Area Networking Command Reference*.

Step 3	**encapsulation** {**aal5auto** | **aal5autoppp virtual-template** *number* [**group** *group-name*] | **aal5ciscoppp virtual-template** *number* | **aal5mux** *protocol* | **aal5nlpid** | **aal5snap**}
	
	Example:
	`Router(config-if-atm-vc)# encapsulation aal5mux ppp dialer`
	`Router(config-if-atm-vc)#`
		Specifies the encapsulation type for the PVC and points back to the dialer interface.
		
		For details about this command and additional parameters that can be set, see the *Cisco IOS Wide-Area Networking Command Reference*.

Step 4	**dialer pool-member** *number*
	
	Example:
	`Router(config-if-atm-vc)# dialer pool-member 1`
	`Router(config-if-atm-vc)#`
		Specifies the ATM interface as a member of a dialer profile dialing pool. The pool number must be in the range of 1–255.

	Command	Purpose

Step 5	**no shutdown**
	
	Example:
	`Router(config-if-atm-vc)# no shutdown`
	`Router(config-if)#`
		Enables interface and configuration changes just made to the ATM interface.

Step 6	**exit**
	
	Example:
	`Router(config-if)# exit`
	`Router(config)#`
		Exits configuration mode for the ATM interface.

Configure DSL Signaling Protocol

DSL signaling must be configured on the ATM interface for connection to your ISP. The Cisco 857 and Cisco 877 routers support ADSL signaling over POTS, the Cisco 876 supports ADSL signaling over ISDN, and the Cisco 878 supports SHDSL signaling. Based on the router you are configuring, see one of the following sections to configure the appropriate DSL signaling protocol.

- Configuring ADSL
- Configuring SHDSL

Configuring ADSL

The default configuration for ADSL signaling is shown in Table 4-1.

Table 4-1   Default ADSL Configuration

Attribute	Description	Default Value
Operating mode	Specifies the operating mode of the digital subscriber line (DSL) for an ATM interface. - ADSL over POTS—ANSI or ITU full rate, or automatic selection. - ADSL over ISDN—ITU full rate, ETSI, or automatic selection.	Auto
Loss of margin	Specifies the number of times a loss of margin may occur.	—
Training log	Toggles between enabling the training log and disabling the training log.	Disabled

If you wish to change any of these settings, use one of the following commands in global configuration mode.

- **dsl operating-mode** (from the ATM interface configuration mode)
- **dsl lom** *integer*
- **dsl enable-training-log**

See the *Cisco IOS Wide-Area Networking Command Reference* for details of these commands.

Verify the Configuration

You can verify that the configuration is set the way you want by using the **show dsl interface atm** command from privileged EXEC mode.

Configuring SHDSL

Complete the following steps to configure the DSL controller in your router to use SHDSL signaling, beginning in global configuration mode.

	Command	Purpose

Step 1	**controller dsl** *port*
	
	Example:
	`Router(config)# controller dsl 0`
	`Router(config-controller)#`
		Enters the configuration mode for the DSL controller.

Step 2	**line-term** {**co** | **cpe**}
	
	Example:
	`Router(config-controller)# line-term co`
	`Router(config-controller)#`
		Specifies if the DSL line is terminated at a central office (CO) or at customer premises equipment (CPE).

Step 3	**mode** *protocol*
	
	Example:
	`Router(config-controller)# mode atm`
	`Router(config-controller)#`
		Specifies the mode of the DSL controller.

Step 4	**line-mode** {**4-wire** | **2-wire**}
	
	Example:
	`Router(config-controller)# line-mode 4-wire`
	`Router(config-controller)#`
		Specifies whether this DSL connection is operating in 2-wire or 4-wire mode.

	Command	Purpose
Step 5	**ignore-error-duration** *number* **Example:** ``` Router(config-controller)# ignore-error-duration 15 Router(config-controller)# ```	Specifies how long, 15 to 30 seconds, to ignore errors.
Step 6	**exit** **Example:** ``` Router(config-controller)# exit Router(config)# ```	Exits controller configuration mode, returning to global configuration mode.

✎

Note   If you are integrating your Cisco router into a European network, use the **dsl dsl-mode shdsl symmetric annex** {**A** | **B**} command to choose annex B. The router uses annex A by default (United States).

Verify the Configuration

You can verify that the configuration is set the way you want by using the **show controllers dsl** command from the privileged EXEC mode.

```
Router# show controllers dsl 0
DSL 0 controller UP
SLOT 0: Globespan xDSL controller chipset
DSL mode: SHDSL Annex A
Frame mode: Utopia
Configured Line rate: Auto
Line Re-activated 6 times after system bootup
LOSW Defect alarm: ACTIVE
CRC per second alarm: ACTIVE
Line termination: CPE

    Current 15 min CRC: 0
    Current 15 min LOSW Defect: 0
    Current 15 min ES Defect: 0
    Current 15 min SES Defect: 0
    Current 15 min UAS Defect: 33287

    Previous 15 min CRC Defect: 0
    Previous 15 min LOSW Defect: 0
    Previous 15 min ES Defect: 0
    Previous 15 min SES Defect: 0
    Previous 15 min UAS Defect: 0

Line-0 status
Chipset Version: 0
Firmware Version: A388
Modem Status: Data, Status 1
Last Fail Mode: No Failure status:0x0
Line rate: 2312 Kbps
Framer Sync Status: In Sync
Rcv Clock Status: In the Range
Loop Attenuation: 341.1450 dB
Transmit Power: 7.5 dB
```

```
Receiver Gain: 22.5420 dB
SNR Sampling: 36.8590 dB
Dying Gasp: Present
```

Configure Network Address Translation

Network Address Translation (NAT) translates packets from addresses that match a standard access list, using global addresses allocated by the dialer interface. Packets that enter the router through the inside interface, packets sourced from the router, or both are checked against the access list for possible address translation. You can configure NAT for either static or dynamic address translations.

Perform these steps to configure the outside ATM WAN interface with dynamic NAT, beginning in global configuration mode:

	Command	Purpose

Step 1	**ip nat pool** *name start-ip end-ip* {**netmask** *netmask* | **prefix-length** *prefix-length*}
	
	Example:
	`Router(config)# `**`ip nat pool`**` pool1 192.168.1.0 192.168.2.0 `**`netmask`**` 255.255.255.0`
	`Router(config)#`
		Creates pool of global IP addresses for NAT.

Step 2	**ip nat inside source** {**list** *access-list-number*} {**interface** *type number* | **pool** *name*} [**overload**] **Example 1:** `Router(config)# `**`ip nat inside source list`**` 1 `**`interface dialer 0 overload`** or **Example 2:** `Router(config)# `**`ip nat inside source list acl1 pool`**` pool1`	Enables dynamic translation of addresses on the inside interface. The first example shows the addresses permitted by the access list *1* to be translated to one of the addresses specified in the dialer interface *0*. The second example shows the addresses permitted by access list *acl1* to be translated to one of the addresses specified in the NAT pool *pool1*. For details about this command and additional parameters that can be set, as well as information about enabling static translation, see the *Cisco IOS IP Command Reference, Volume 1 of 4: Addressing and Services*.

Step 3	**interface** *type number*
	
	Example:
	`Router(config)# `**`interface`**` vlan 1`
	`Router(config-if)#`
		Enters configuration mode for the VLAN (on which the Fast Ethernet LAN interfaces [FE0–FE3] reside) to be the inside interface for NAT.

	Command	Purpose

Step 4	**ip nat** {**inside** | **outside**}
	
	Example:
	`Router(config-if)# ip nat inside`
	`Router(config-if)#`
		Applies NAT to the Fast Ethernet LAN interface as the inside interface.
		
		For details about this command and additional parameters that can be set, as well as information about enabling static translation, see the *Cisco IOS IP Command Reference, Volume 1 of 4: Addressing and Services*.

Step 5	**no shutdown**
	
	Example:
	`Router(config-if)# no shutdown`
	`Router(config-if)#`
		Enables the configuration changes just made to the Ethernet interface.

Step 6	**exit**
	
	Example:
	`Router(config-if)# exit`
	`Router(config)#`
		Exits configuration mode for the Fast Ethernet interface.

Step 7	**interface** *type number*
	
	Example:
	`Router(config)# interface atm 0`
	`Router(config-if)#`
		Enters configuration mode for the ATM WAN interface (ATM0) to be the outside interface for NAT.

Step 8	**ip nat** {**inside** | **outside**}
	
	Example:
	`Router(config-if)# ip nat outside`
	`Router(config-if)#`
		Identifies the specified WAN interface as the NAT outside interface.
		
		For details about this command and additional parameters that can be set, as well as enabling static translation, see the *Cisco IOS IP Command Reference, Volume 1 of 4: Addressing and Services*.

Step 9	**no shutdown**
	
	Example:
	`Router(config-if)# no shutdown`
	`Router(config-if)#`
		Enables the configuration changes just made to the Ethernet interface.

	Command	Purpose

Step 10	**exit**
	
	Example:
	`Router(config-if)# exit`
	`Router(config)#`
		Exits configuration mode for the ATM interface.

Step 11	**access-list** *access-list-number* {**deny** | **permit**} *source* [*source-wildcard*]
	
	Example:
	`Router(config)# access-list 1 permit`
	`192.168.1.0 255.255.255.0`
		Defines a standard access list permitting addresses that need translation.
		
		Note All other addresses are implicitly denied.

> **Note**   If you want to use NAT with a virtual-template interface, you must configure a loopback interface. See Chapter 1, "Basic Router Configuration," for information on configuring the loopback interface.

For complete information on NAT commands, see the Cisco IOS Release 12.3 documentation set. For more general information on NAT concepts, see Appendix B, "Concepts."

Configuration Example

The following configuration example shows a portion of the configuration file for a client in the PPPoA scenario described in this chapter.

The VLAN interface has an IP address of 192.168.1.1 with a subnet mask of 255.255.255.0. NAT is configured for inside and outside.

> **Note**   Commands marked by "(**default**)" are generated automatically when you run the **show running-config** command.

```
!
interface Vlan1
 ip address 192.168.1.1 255.255.255.0
 ip nat inside
 ip virtual-reassembly (default)
!
interface ATM0
 no ip address
 ip nat outside
 ip virtual-reassembly
 no atm ilmi-keepalive
 pvc 8/35
  encapsulation aal5mux ppp dialer
  dialer pool-member 1
 !
 dsl operating-mode auto
!
```

```
interface Dialer0
 ip address negotiated
 ip mtu 1492
 encapsulation ppp
 dialer pool 1
 dialer-group 1
 ppp authentication chap
!
ip classless (default)
!
ip nat pool pool1 192.168.1.0 192.168.2.0 netmask 0.0.0.255
ip nat inside source list 1 interface Dialer0 overload
!
access-list 1 permit 192.168.1.0 0.0.0.255
dialer-list 1 protocol ip permit

ip route 10.10.25.2 0.255.255.255 dialer 0
!
```

Verifying Your Configuration

Use the **show ip nat statistics** command in privileged EXEC mode to verify the PPPoA client with NAT configuration. You should see verification output similar to the following example:

```
Router# show ip nat statistics
Total active translations: 0 (0 static, 0 dynamic; 0 extended)
Outside interfaces:
  ATM0
Inside interfaces:
  Vlan1
Hits: 0  Misses: 0
CEF Translated packets: 0, CEF Punted packets: 0
Expired translations: 0
Dynamic mappings:
-- Inside Source
[Id: 1] access-list 1 interface Dialer0 refcount 0
Queued Packets: 0
```