7

ADSL WAN Connections

Contents

ADSL Overview

Digital Subscriber Line (DSL) technologies provide high-speed wide area network (WAN) connections—typically for a lower cost than older WAN technologies such as E1- or T1-carrier lines. A variety of DSL technologies have been developed, and these technologies are sometimes collectively referred to as x-type DSL, or xDSL. The "x" is replaced with one to three letters that represent a particular type of DSL, such as:

- ADSL, or asymmetric DSL
- HDSL, or high bit-rate DSL
- SHDSL, or single wire HDSL
- READSL, or reach extended ADSL
- VDSL, or very high bit-rate DSL

The various types of xDSL operate at different speeds. They also differ in how much bandwidth is dedicated to upstream and downstream transmissions. *Downstream* refers to the traffic being sent from the public carrier's central office (CO) to the customer's premises, as shown in Figure 7-1. *Upstream* refers to the traffic being sent from the customer's premises to the public carrier's CO.
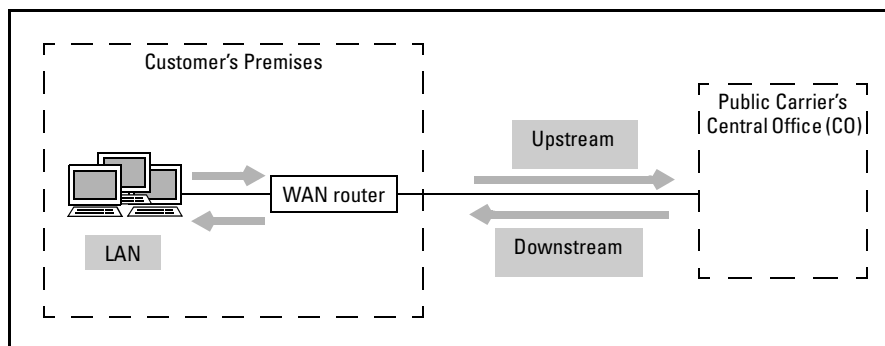

Figure 7-1. Upstream and Downstream Transmissions

If a DSL technology transmits data at the same speed both upstream and downstream, it is symmetric. If a DSL technology provides different transmission speeds for upstream and downstream, it is asymmetric.

With asymmetric DSL technologies, the transmission speed for downstream is higher than the transmission speed for upstream. This makes asymmetric DSL technologies ideal for Internet use because users typically download more data from the Internet than they upload. Asymmetric DSL technologies are also well-suited for video-on-demand or high-definition television (HDTV).

ADSL Technologies

Asymmetric DSL (ADSL) has emerged as one of the most widely used DSL technologies. ADSL provides an end-to-end digital connection between the source device and the destination device. Like an E1- or T1-carrier line, ADSL is a leased private line and is always available.

ADSL service is usually provided through a partnership between an Internet service provider (ISP) and a public carrier. (The public carrier is frequently called the ADSL service provider.) The ISP provides the connection to the Internet, and the public carrier provides the ADSL connection to the customer.

ADSL2 and ADSL2+: Enhancing Transmission Speeds

Originally providing transmission speeds of up to 8 Mbps downstream and 1.544 Mbps upstream, ADSL has been enhanced twice:

- ADSL2 offers up to 12 Mbps downstream and 1.544 Mbps upstream.
- ADSL2+ provides up to 25 Mbps downstream and 1.544 Mbps upstream.

The maximum available bandwidth for either downstream or upstream depends on factors such as:

- Distance between the customer's premises and the public carrier's CO— The greater the distance, the slower the transmission rate.
- Line quality—The more noise on the line, the slower the transmission rate.

As Table 7-1 shows, to qualify for ADSL or ADSL2, customers can be a maximum of 5.49 to 5.67 km from the public carrier's CO. For ADSL2+, customers can be only 1.52 km away from the CO. If a company or home is too far away from the public carrier's CO, ADSL is not even an option.

Table 7-1.   Distance Supported by ADSL, ADSL2, and ADSL2+

Type of ADSL	Distance from CO
ADSL	3.66 km to 5.49 km (12,000 to 18,000 feet)
ADSL2	3.84 to 5.67 km (12,600 to 18,600 feet)
ADSL2+	1.52 km (5,000 feet)

READSL: Supporting Greater Distances

To make ADSL available to more customers, reach extended ADSL2 (READSL) was developed to support greater distances between a customer's premises and the public carrier's CO. (READSL is an ADSL2 or ADSL2+ technology, which is sometimes called READSL and sometimes called READSL2.) According to *CommsDesign.com*, READSL extends the reach of ADSL "up to 2500 ft., allowing ADSL systems to reach as far as 20,000 ft." (Marcus Tzannes, "RE-ADSL2: Helping Extend ADSL's Reach," May 13, 2003.)

Currently, READSL2+ is designed to share the local loop with POTS traffic, just as ADSL Annex A does.

Elements of an ADSL Connection

All WAN connections, including ADSL connections, consist of three basic elements:

■ the physical transmission media, such as the cabling, switches, routers, and other infrastructure required to create and maintain the connection

■ electrical signaling specifications for generating, transmitting, and receiving signals through the various transmission media

■ Data Link Layer protocols, which provide logical flow control for moving data between WAN peers (the devices at either end of a WAN connection)

Physical transmission media and electrical specifications are part of the Physical Layer (or Layer 1) of the Open Systems Interconnection (OSI) model, and Data Link Layer protocols are part of the Data Link Layer (or Layer 2). (See Figure 7-2.)

7	Application Layer	
6	Presentation Layer	
5	Session Layer	
4	Transport Layer	
3	Network Layer	
2	Data link Layer	ATM
1	Physical Layer	ADSL
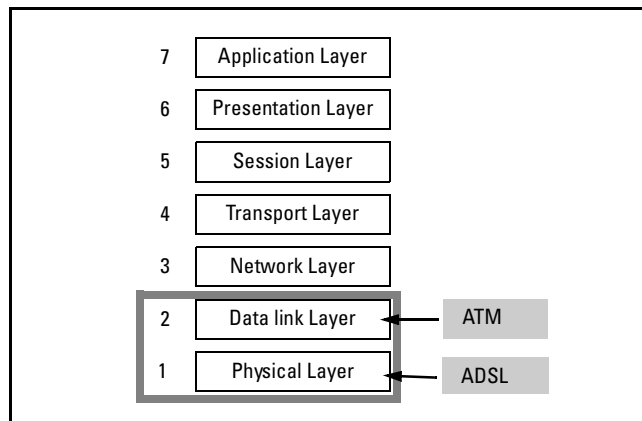
Figure 7-2.   Physical and Data Link Layers of the OSI Model

When you configure an ADSL connection, you must configure both the Physical Layer and the Data Link Layer (which is also called the Logical Layer). The Physical Layer is, of course, ADSL. The Data Link Layer protocol is Asynchronous Transfer Mode (ATM).

ADSL Infrastructure

When you purchase an ADSL connection, your company's premises must be connected to the public carrier's nearest CO. All of the telecommunications infrastructure that is used to connect your company's premises to the CO is collectively called the *local loop*.

ADSL uses modulation to increase the speed at which data can be transmitted over the plain copper wire that is used for most local loops. Once the ADSL traffic reaches the public carrier's CO, it is sent to a DSL Access Multiplexer (DSLAM) and then routed over the regional broadband, or packet, network. (See Figure 7-3.) Traffic transmitted over E1- and T1-carrier lines, on the other hand, is sent to a voice switch before being transmitted through the public carrier network.
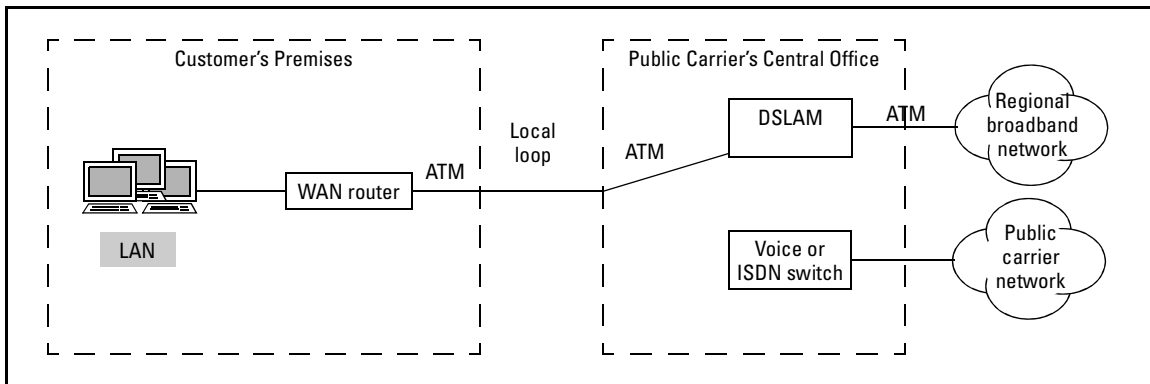
Figure 7-3.   The ADSL Network

The regional broadband network is connected to the Internet. (See Figure 7-4.)
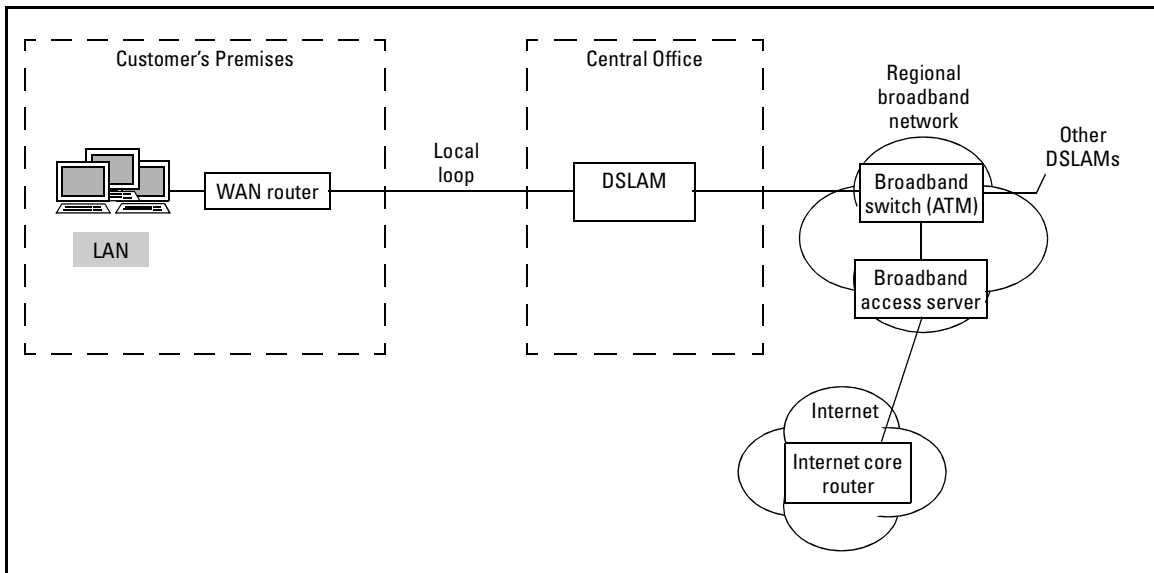
Figure 7-4.   ADSL Connection to the Internet

Moving high-speed WAN connections onto a separate network infrastructure alleviates a serious problem for most public carriers: congestion in the traditional public carrier network. With the increasing popularity of the Internet, more and more businesses and residential users are connecting to the Internet through the public carrier network, which is not built to handle the high-volume caused by many Internet connections.

ADSL Annex A and Annex B: Sharing the Line with Analog or ISDN Voice Traffic

ADSL is designed to share the local loop with analog voice or Integrated Services Digital Network (ISDN) traffic used for either voice or fax transmissions. (ADSL cannot share the local loop with an ISDN *WAN* connection, which is used to transmit data.) To share the local loop, ADSL devices reserve the bottom frequencies for analog voice and ISDN traffic. (See Figure 7-5.)

In the ADSL standards, support for analog voice is called ADSL over Plain Old Telephone Service (POTS), or ADSL Annex A. The customer's existing telephone equipment can continue to send voice traffic over the same pair of wires that carry ADSL traffic.

Customers who have ISDN equipment such as telephones and fax machines can continue using this equipment while moving their Internet or WAN connection to ADSL. Support for ISDN is called ADSL over ISDN, or ADSL Annex B, and is common in countries such as Germany where ISDN is popular.
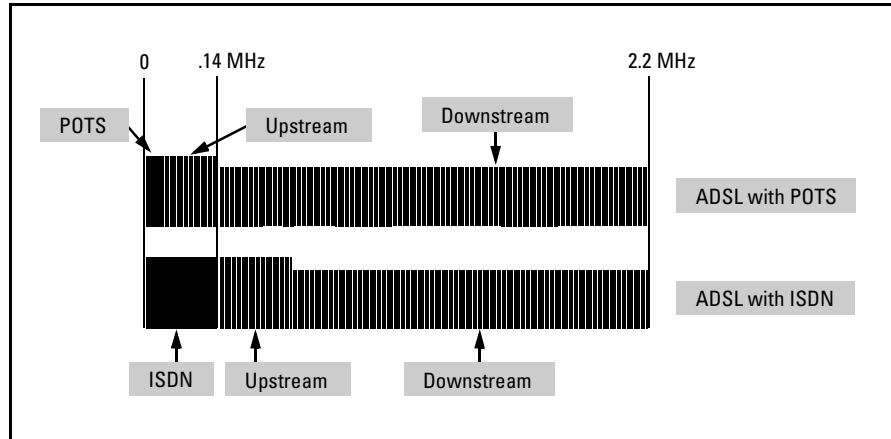
Figure 7-5.   ADSL with POTS or ADSL with ISDN

ADSL Splitters

Because ADSL supports analog voice or ISDN traffic, the local loop is a shared medium. In an ADSL Annex A environment, telephones send analog voice over the local loop, and the WAN router sends digital data. At the CO, the analog voice must be transmitted to the voice switch and then routed over the public carrier network. The digital data, on the other hand, must be transmitted to the DSLAM and then routed over the regional broadband network. At the customer's premises, the analog voice must be sent to the telephones, and the digital data must be sent to the WAN router.

To separate the analog voice from the ADSL data, a POTS splitter is installed at both the customer's premises and the public carrier's CO. The POTS splitter filters the traffic at both ends of the local loop and ensures that the analog voice and the ADSL traffic are sent to the appropriate device at each location.

In an ADSL Annex B environment, ISDN equipment and the WAN router transmit data over the local loop. At the CO, the ISDN traffic must be transmitted to the ISDN switch and then routed over the public carrier network. The ADSL data must be transmitted to the DSLAM and then routed over the regional broadband network. At the customer's premises, the ISDN data must be sent to the ISDN equipment, and the ADSL data must be sent to the WAN router.

To separate the ISDN data from the ADSL data, an ISDN splitter is installed at both the customer's premises and the CO. This splitter ensures that each type of traffic is transmitted to the appropriate device at each location. (See Figure 7-6.)
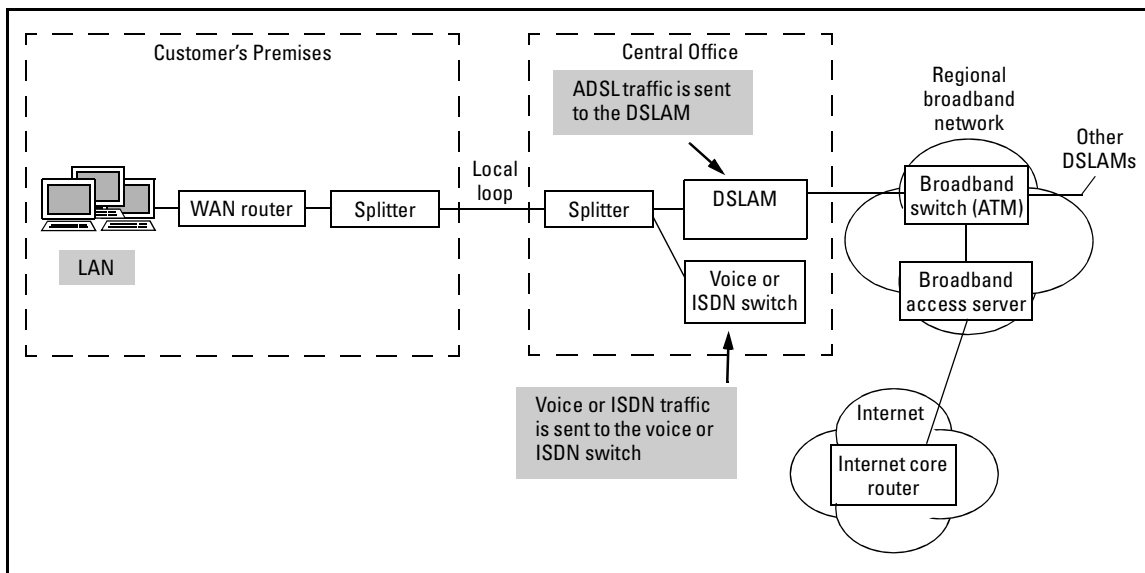
Figure 7-6.   ADSL Network

ADSL Without Splitters

ADSL Lite, or G.lite, was developed to provide a low-cost, no-hassle WAN connection. Instead of the up to 8 Mbps downstream transmission rate of ADSL, ADSL Lite provides just 1 Mbps downstream. The upstream rate is only 512 Kbps, rather than the 1.544 Mbps offered by ADSL.

In addition to the low cost, subscribers receive the following advantages:

- No splitter—No splitter is required at the customer's premises. Instead, ADSL Lite uses a microfilter, which is easy to install. Typically, the microfilter is a small device that is attached on the wire that connects the DSL modem to the wall jack at the customer's premises.

- Easy installation—With ADSL Lite, no modifications need to be made to the local loop, so the customer does not have to wait for a service call from the local carrier. After the DSL modem and the microfilter are plugged in, the installation is complete.

ADSL Modules for the ProCurve Secure Router

ProCurve Networking offers two ADSL modules:

- ADSL2+ Annex A module for ADSL over POTS
- ADSL2+ Annex B module for ADSL over ISDN

ADSL2+ Annex A modules are used primarily in the United States and Canada. ADSL2+ Annex B modules are used in Europe, South America, Asia (except Japan), and Australia.

N o t e   Japan uses ADSL Annex C. Currently, the ProCurve Secure Router does not support ADSL Annex C.

The ProCurve ADSL2+ Annex A and Annex B modules support standards for ADSL, ATM, Point-to-Point Protocol over Ethernet (PPPoE), and PPP over ATM (PPPoA). (See Table 7-2.)

Table 7-2.   Standards Supported by the ADSL Modules

ADSL Module	ADSL Standards	ATM Standards	PPPoA and PPPoE
ADSL2+ Annex A (ADSL over POTS)	• International Telecommunications Union (ITU) G.992.1 Annex A (G.dmt) • ITU G.992.2 Annex A (G.lite) • ITU G.992.3 Annex A ADSL2 (G.dmt.bis) • ITU G.992.3 Annex L READSL2 • ITU G.992.5 Annex A ADSL2+ • ANSI T1.413 Issue 2	• Multiple Protocol over AAL5 (Request for Comments [RFC] 2684) • ATM Forum UNI 3.1/4.0 PVC • ATM Class of Service (UBR) • ATM F5 OAM	• PPP over ATM AAL5 (RFC 2364) • PPP over Ethernet (RFC 2516)
ADSL2+ Annex B (ADSL over ISDN)	• ITU G.992.1 Annex B (G.dmt) • ITU G.992.3 Annex B ADSL2 (G.dmt.bis) • ITU G.992.5 Annex B ADSL2+	• Multiple Protocol over AAL5 (RFC 2684) • ATM Forum UNI 3.1/4.0 PVC • ATM Class of Service (UBR) • ATM F5 OAM	• PPP over ATM AAL5 (RFC 2364) • PPP over Ethernet (RFC 2516)

Configuring the ADSL Interface: the Physical Layer

To connect the ADSL interface on the front panel of the ProCurve Secure Router to the wall jack provided by your service provider, you use unshielded twisted pair (UTP) ribbon cable with RJ-11 connectors.

N o t e   In some countries, the ADSL service provider supplies the customer premises equipment (CPE), which requires an RJ-45 connector.

You must then configure the physical interface for the ADSL connection.

Accessing the ADSL Interface Configuration Mode Context

To begin configuring the ADSL module that will provide the WAN connection, you must access the appropriate configuration mode context. Move to the global configuration mode context and enter:

Syntax: interface *<interface> <slot>/<port>*

When you are configuring an ADSL interface, you replace ***<interface>*** with **adsl**.

On the ProCurve Secure Router, each physical interface is identified by its slot number and port number.

The possible slot numbers for ADSL modules are:

■   1 = dl option module slot 1
■   2 = dl option module slot 2

For ADSL modules, the port number is always one. For example, if the ADSL module is located in slot one, enter.

ProCurve(config)# interface adsl 1/1

The router prompt indicates that you have entered the proper interface configuration mode context:

ProCurve(config-adsl 1/1)#

From the configuration mode context, you can enter the **?** help command to display the commands available from this configuration mode context.

ProCurve(config-adsl 1/1)# ?

The settings that you must configure in order to establish an ADSL WAN connection are explained in the following sections.

Activating the ADSL Interface

By default, all interfaces on the ProCurve Secure Router are shutdown. You must activate the ADSL interface. From the ADSL interface configuration mode context, enter:

ProCurve(config-adsl 1/1)# no shutdown

A message is displayed at the CLI, indicating that the interface is now administratively up. Messages such as this are displayed by default. To disable these messages, enter the following command from the enable mode context:

ProCurve# no events

To enable these messages again, enter:

ProCurve# events

Defining the Training Mode

Like other ADSL routers and modems, the ProCurve Secure Router must go through a training phase. During the training phase, the ADSL interface and the DSLAM evaluate the quality of the line and identify the best way to use the available bandwidth to achieve the highest transmission rate possible.

After the training phase, the ProCurve Secure Router and the DSLAM establish an ADSL connection and exchange Physical Layer signaling. This phase of the connection is called *showtime.* Although the two devices have established a physical connection, they have not yet begun to exchange ATM cells or to communicate at the Data Link Layer.

You must select the standard that the ADSL interface uses during the training mode. Table 7-3 lists the training mode options, the standards on which each one is based, and a brief description.

Table 7-3.   Training Modes Supported by the ProCurve Secure Router

Command Option	Standard	Description
training-mode ADSL2	ITU G.922.3 ADSL2 (G.dmt.bis)	Trains the interface for the ADSL2 transmission rate. This mode requires a splitter at both the user's and the public carrier's premises to divide traffic between voice and data lines.
training-mode ADSL2+	ITU G.922.5 ADSL2+	Trains the interface for the ADSL2+ transmission rate. This mode requires a splitter at both the user's and the public carrier's premises to divide traffic between voice and data lines.
training-mode G.DMT	ITU G.992.1 (G.dmt)	Trains the interface in the full-rate ANSI standard. This mode requires a splitter at both the user's and the public carrier's premises to divide traffic between voice and data lines.
training-mode G.LITE	ITU G.922.2 (G.lite)	Supports the splitterless ANSI standard with a smaller bandwidth than the full-rate ANSI standard.
training-mode Multi-Mode		Automatically detects the appropriate configuration and conforms to the standard used by the DSLAM. This is the default setting.
training-mode READSL2	ITU G.992.3 Annex L READSL2	Trains the interface to use READSL2.
training-mode T1.413	ANSI T1.413 Issue 2	Supports lower-speed connections than the full-rate ANSI standard.

Table 7-4 shows which options are supported by the ADSL2+ Annex A module and which options are supported by the Annex B module. As you can see, the ADSL2+ Annex A module supports all the options listed. The ADSL2+ Annex B module, on the other hand, supports ADSL2, ADSL2+, and G.DMT. The ADSL2+ Annex B module also supports the **Multi-Mode** option, but when this option is used with this module, only three training modes are possible: ADSL2, ADSL2+, and G.DMT. (In future versions of the Secure Router OS, additional training modes will be supported by the ADSL2+ Annex B module.)

Table 7-4.   Training Modes Supported by the ProCurve Secure Router

Command Option	ADSL2+ Annex A	ADSL2+ Annex B
training-mode ADSL2	Yes	Yes
training-mode ADSL2+	Yes	Yes
training-mode G.DMT	Yes	Yes
training-mode G.LITE	Yes	No
training-mode Multi-Mode	Yes	Yes
training-mode READSL2	Yes	No
training-mode T1.413	Yes	No

To define the training mode, enter the following command from the ADSL interface configuration mode context.

Syntax: training-mode [ADSL2 | ADSL2+ | G.DMT | G.LITE | Multi-Mode | READSL2 | T1.413]

For example, to set the training mode for ADSL2, enter:

ProCurve(config-adsl 2/1)# training-mode ADSL2

The default setting for both the ADSL2+ Annex A module and the ADSL2+ Annex B module is **Multi-Mode**.

Setting the SNR-Margin

Because ADSL connections are affected by line interference, you must specify the level at which the quality of the signal on the ADSL line is acceptable. This quality of the signal is determined by the signal-to-noise ratio (SNR) margin.

The SNR margin is calculated logarithmically. An SNR margin of 15 means the signal is approximately 5.6 times stronger than background noise, while a signal with an SNR margin of 1 is only marginally stronger than the background noise.

Because transmission speeds on ADSL lines are affected by line interference, you want to maximize the signal and minimize the background noise. When you narrow the signaling band to maximize the signal, however, you also decrease the transmission rate.

Determining the minimum SNR margin is a compromise: the higher the SNR margin, the slower the transmission rate. However, if you set the SNR margin too low, the line may go down, or your data may be garbled.

To set the SNR margin, enter the following command from the ADSL configuration mode context:

Syntax: snr-margin <*margin*>

Replace **<*margin*>** with a number between 1 and 15 decibels (db).

For example, if you want to set the SNR margin to 4, enter:

ProCurve(config-adsl 2/1)# snr-margin 4

Monitoring the SNR-Margin

You can enable monitors to ensure that the minimum SNR is maintained on the line during both the ADSL training and the ADSL showtime phases. These monitors periodically check the line to ensure that the SNR margin does not fall below your setting.

To enable the monitors, enter the following command from the ADSL configuration mode context:

Syntax: snr-margin [showtime-monitor | training-monitor]

For example, to enable the showtime monitor, enter:

ProCurve(config-adsl 2/1)# snr-margin showtime-monitor

Manually Forcing Retraining

After you configure the ADSL interface options, you can force the ADSL interface to retrain itself. From the ADSL interface configuration mode context, enter:

ProCurve(config-adsl 2/1)# retrain

When the line reaches an acceptable SNR margin, its status will change to up.

Configuring the Data Link Layer for the ADSL Connection

You can configure the ADSL line with ATM as the Data Link Layer, or you can configure ADSL with either PPPoE or PPPoA. No matter which option you use, however, your configuration will include ATM, and you will need to configure both an ATM interface and an ATM subinterface.

Creating the ATM Interface

To begin configuring ATM for an ADSL connection, you must create a logical interface. From the global configuration mode context, enter:

Syntax: interface *<interface> <number>*

Replace *<interface>* with **atm** and replace *<number>* with any number between 1 and 1024. Each ATM interface you configure on the router must have a unique number.

For example, if you are configuring the first ATM interface on the router, you might enter:

ProCurve(config)# interface atm 1

The router prompt indicates that you have entered the appropriate interface configuration mode context:

ProCurve(config-atm 1)#

You can then enter the **?** help command to display the commands available from this configuration mode context.

ProCurve(config-atm 1)# ?

Activating the ATM Interface

By default, all logical interfaces on the ProCurve Secure Router are shutdown, so you must activate the ATM interface. From the ATM interface configuration mode context, enter:

ProCurve(config-atm 1)# no shutdown

Configuring a Subinterface for each PVC

You must configure an ATM subinterface to define the endpoint of the ADSL connection. By default, each ATM interface supports up to 16 permanent virtual circuits (PVCs), so you can create a maximum of 16 subinterfaces on each ATM interface.

Configuring a subinterface involves the following basic steps:

1. Create the ATM subinterface.

2. Activate the ATM subinterface.

3. Assign the subinterface a virtual path identifier (VPI) and virtual channel identifier (VCI).

4. Set the encapsulation type.

5. Assign an IP address to the ATM subinterface.

If you are configuring PPPoE or PPPoA for the ADSL connection, you will need to complete some additional steps. You will also need to assign the IP address to the PPP interface, rather than to the ATM subinterface.

These are the basic steps for configuring the ATM subinterface, but you can configure other settings (such as quality of service, access controls, and backup settings) for the subinterface as well.

Creating the Subinterface

From the global configuration mode context or the ATM interface configuration mode context, enter:

Syntax: interface *<interface> <number.subinterface number>*

Replace *<interface>* with **atm**, and replace *<number>* with the number of the ATM interface you created previously. Then replace *<subinterface>* with a number between 1 and 65535.

For example, if you want to configure the ATM 1.1 subinterface, enter:

ProCurve(config-atm 1)# interface atm 1.1

Activating the ATM Subinterface

By default, all subinterfaces on the ProCurve Secure Router are shut down.
You must activate the ATM subinterface. From the ATM interface configura-
tion mode context, enter:

ProCurve(config-atm 1.1)# no shutdown

Configuring the VPI/VCI

ATM networks are fundamentally connection-oriented, which means that a
logical connection must be set up across the ATM network before any data
can be transmitted. After this connection is set up, there is only one possible
path for cells to take, so they cannot be received in the wrong order.

ATM setup standards define two types of ATM connections. (See Figure 7-7.)

■ Virtual path (VP)—Identified by a virtual path identifier (VPI)
■ Virtual channel (VC)—Identified by the VPI and a virtual channel
   identifier (VCI)

VPIs and VCIs are established during the ATM connection setup phase. These
values are carried in the headers of ATM cells to facilitate ATM cell switching.
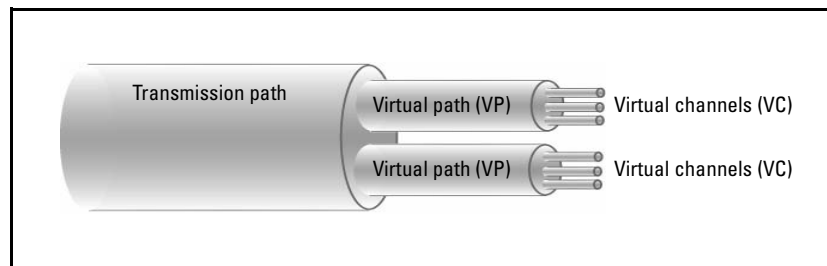
Figure 7-7. The VPI/VCI

Your public carrier will provide the VPI and VCI values for your ADSL
connection. From the ATM subinterface configuration mode context, set the
VPI/VCI by entering:

Syntax: pvc *<vpi>/<vci>*

Replace *<vpi>* with the number that your ADSL service provider gave you for
the VPI. The VPI can be a number between 0 and 255. Replace *<vci>* with the
unique number that your service provider has assigned to this connection. If
you establish more than one subinterface on an ATM interface, each subinter-
face will have a unique VCI. The VCI can be a number between 32 and 65535.

For example, to assign the ATM subinterface a VPI/VCI of 0/33, enter:

ProCurve(config-atm 1.1)# pvc 0/33

Defining the ATM Encapsulation

The ATM Data Link Layer for the ADSL connection includes these sublayers:

- the ATM adaptation layer (AAL), which is called Layer 2-1
- the point-to-point layer, which is referred to as Layer 2-2

You must configure the adaptation layer by specifying an encapsulation type. Enter one of the following commands to enable the encapsulation type specified by your service provider:

Syntax: encapsulation aal5snap

or

Syntax: encapsulation aal5mux [ip | ppp]

The default setting is **aal5snap**, which establishes an encapsulation type that supports the Link Layer Control/Sub-Network Access Protocol (LLC/SNAP). AAL5 LLC/SNAP encapsulation works with any type of protocol for the ADSL connection: bridging, PPPoA, PPPoE, and IP with and without bridging.

Use the **aal5mux** encapsulation setting for multiplexed virtual circuits. You must then specify a protocol for each subinterface to use: IP or PPP.

If your service provider is using PPPoE, you must set the encapsulation to **aal5snap** or **aal5mux ppp**, as shown below:

ProCurve(config-atm 1.1)# encapsulation aal5snap

or

ProCurve(config-atm 1.1)# encapsulation aal5mux ppp

Assigning the ATM Subinterface an IP Address

If you are configuring just ATM as the Data Link Layer protocol, you assign the IP address to the ATM subinterface. If you are configuring PPPoE or PPPoA, you assign the IP address to the PPP interface.

If you are configuring the IP address on the ATM subinterface, you can configure:

- a static IP address
- the ATM subinterface as a DHCP client
- the ATM subinterface as an unnumbered interface

Configuring a Static Address. To assign the ATM subinterface a static IP address, use the following command syntax:

Syntax: ip address <*A.B.C.D*> <*subnet mask | /prefix length*>

For example, you might enter:

ProCurve(config-atm 1.1)# ip address 10.1.1.1 255.255.255.0

Because the ProCurve Secure Router supports Classless Inter-Domain Routing (CIDR) notations, you could also enter:

ProCurve(config-atm 1.1)# ip address 10.1.1.1 /24

N o t e

You must include a space between the IP address and the **/** symbol in front of the prefix length.

Configuring the ATM Subinterface as a DHCP Client. Your service provider may want you to configure the ATM subinterface as a DHCP client. To enable the DHCP client for the ATM subinterface, use one of the following commands:

Syntax: ip address dhcp {client-id [ethernet 0/<*port*> | HH:HH:HH:HH:HH:HH:HH] | hostname <*word*>} [track <*name*>] [<*administrative distance*>]

Syntax: ip address dhcp [hostname <*word*> | no-default-route | no-domain-name | no-nameservers] [track <*name*>] [<*administrative distance*>]

In addition to enabling the DHCP client, these commands allow you to configure the settings shown in Table 7-5.

Table 7-5.   Default Settings for the DHCP Client

Option	Meaning	Default Setting
client-id	configures the client identifier displayed for this interface in the DHCP server's table	media type and interface's MAC address
hostname	configures the hostname displayed for this interface in the DHCP server's table	router hostname
no-default-route	specifies that the DHCP client should not accept the default route obtained through DHCP	accept the default route from the DHCP server
no-domain-name	specifies that the DHCP client should not accept the domain name included with the other lease settings sent by the DHCP server	accept the domain name setting from the DHCP server
no-nameservers	specifies that the DHCP client should not accept the Domain Name System (DNS) setting included with the other lease settings sent by the DHCP server	accept DNS settings from the DHCP server
track	attaches a network monitoring track to the DHCP client	(none)
<administrative distance>	specifies the administrative distance to use when adding the DHCP gateway into the route table	1

Before you enable the DHCP client, you must decide whether or not you want to configure the settings listed in Table 7-5, and you must then include the settings in the same command you enter to enable the DHCP client. After you enable the DHCP client, it immediately begins to search for a DHCP server and negotiate a lease. You cannot impose settings on that lease after it is established.

Accepting the Default Settings. If you want to use all of the default DHCP settings for ATM subinterface, you can simply enter:

ProCurve(config-atm 1.1)# ip address dhcp

The DHCP client on the ATM subinterface will immediately begin to send DHCP discovery messages to find a DHCP server. When a DHCP server responds, the client will negotiate an IP address.

The DHCP client will send DHCP discovery messages whether or not the ATM subinterface is activated or a valid connection has been established. It will continue to send DHCP discovery messages until a DHCP server responds.

You should ensure that the DHCP client receives an IP address so that these requests do not consume router resources or bandwidth on your ADSL link. To determine if the ATM subinterface has been assigned an IP address, enter:

ProCurve(config-atm 1.1)# do show int atm 1.1

The **do** command allows you to enter enable mode commands from any context (except the basic mode context).

Configuring a Client Identifier. By default, the Secure Router OS populates the client identifier with the media type and the interface's media access control (MAC) address. You can specify that the DHCP client uses the MAC address of an Ethernet port, or you can configure a customized client identifier.

To configure a client identifier when you enable the DHCP client, enter:

Syntax: ip address dhcp client-id [ethernet 0/<*port*> | HH:HH:HH:HH:HH:HH:HH]

In the same command in which you configure the client identifier, you can also configure a hostname, as explained in the next section.

Configuring a Hostname. The Secure Router OS uses the router's hostname as the ATM subinterface's default DHCP client hostname. If you want to override this name when you enable the DHCP client, enter the following command:

Syntax: ip address dhcp hostname <*word*>

For example, you might want to specify that the hostname is *RouterB*. In this case, you would enter:

ProCurve(config-atm 1.1)# ip address dhcp hostname RouterB

You can also configure a client identifier at the same time as the hostname, as shown below.

ProCurve(config-atm 1.1)# ip address dhcp client-id ethernet 0/1 hostname RouterB

If you enter this command, the DHCP client will use the MAC address of the Ethernet 0/1 interface as its client identifier. The DHCP client will also use the hostname RouterB.

Alternatively, you can specify the hostname and configure the client to ignore the settings received from the DHCP server. These commands are described in the following sections.

Overriding Settings Received from the DHCP Server. If the DHCP server is configured to provide a default route, a domain name, or the IP address of a domain name system (DNS) server, the DHCP client for the ATM subinterface will accept and use these settings. If you do not want to use one or more of these settings, enter the appropriate options when you enable the DHCP client:

Syntax: ip address dhcp [hostname <*word*> | no-default-route | no-domain-name | no-nameservers]

For example, if you do not want the DHCP client to use the default gateway and DNS name server addresses that it receives from the DHCP server, enter:

ProCurve(config-atm 1.1)# ip address dhcp no-default-route no-nameservers

Attaching a Network Monitoring Track to the DHCP Interface. As a part of the network monitoring feature, you can attach a network monitoring track to the DHCP client, in order to monitor the default route received from a DHCP server. A track uses probes to test routes and servers, with the goal of either removing failed routes or logging poor performance.

You can use the **track** option with the **ip address dhcp** command to configure the ProCurve Secure Router to add the default route as a monitored route. You can combine the **track** option with any of the other options for the **ip address dhcp** command (except **no-default-route**—the router cannot monitor a route that the interface does not accept).

For example, to attach the track named DHCPDefault, enter:

ProCurve(config-atm 1.1)# ip address dhcp track DHCPDefault

Before entering the command, you should create the track named DHCPDefault. Also, you should create a probe to test the route. For example, the probe could test connectivity to the default gateway listed in the DHCP default route. If the probe fails to reach the gateway, the track determines that the default route has failed and removes it.

For more information about network monitoring and configuring tracks and probes, see the *Advanced Management and Configuration Guide, Chapter 9: Network Monitoring*.

Setting the Administrative Distance. You can specify the administrative distance to use when adding the DHCP gateway into the route table. The router uses the administrative distance to determine the best route when multiple routes to the same destination exist. The router assumes that the smaller the administrative distance, the more reliable the route is.

For example, to set an administrative distance of 5, enter:

ProCurve(config-atm 1.1)# ip address dhcp 5

Changing a Setting for the DHCP Client. If you want to change a setting for the DHCP client, you must first disable the client. Then you can enter the command to enable the client with the setting that you want to change.

Before you disable the client, you should release the IP address obtained through DHCP. This will prevent the DHCP server from holding the IP address and allow it to assign the IP address to another client.

Releasing or Renewing an IP Address. If you want to manually force the ATM subinterface to release or renew an IP address, enter these commands from the ATM subinterface configuration mode context:

ProCurve(config-atm 1.1)# ip dhcp release
ProCurve(config-atm 1.1)# ip dhcp renew

Removing the DHCP Client Setting. If you decide that you no longer want the ATM subinterface to be a DHCP client, enter:

ProCurve(config-atm 1.1)# no ip address dhcp

Configuring the ATM Subinterface as an Unnumbered Interface. To conserve IP addresses on your network, you may want to create the ATM subinterface as an unnumbered interface. When you assign the ATM subinterface an IP address, that IP address cannot overlap with the IP addresses assigned to other interfaces on your network. As a result, each interface that has an IP address represents an entire subnet. Depending on the subnetting scheme you use, this could use more IP addresses than you can spare.

You can configure the ATM subinterface as an unnumbered interface. The ATM subinterface will then use the IP address of the interface you specify. The Secure Router OS uses the IP address of the specified interface when sending routing updates over the unnumbered interface.

Before configuring the ATM subinterface as an unnumbered interface, you should be aware of a potential disadvantage: if the interface to which the IP address is actually assigned goes down, the ATM subinterface will be unavailable. For example, suppose you configure the ATM 1.1 subinterface as an unnumbered interface that takes its IP address from an Ethernet interface. If the Ethernet interface goes down, the ATM 1.1 subinterface will be unavailable as well.

To minimize the chances of the ATM subinterface becoming unavailable, you can assign the IP address to a loopback interface, which typically does not go down.

To configure the ATM subinterface as an unnumbered interface, enter the following command from the ATM subinterface configuration mode context:

Syntax: ip unnumbered <*interface*>

Valid interfaces from which the ATM subinterface can takes its address include:

- other ATM subinterfaces
- demand interfaces
- Ethernet interfaces or subinterfaces
- Frame Relay subinterfaces
- HDLC interfaces
- loopback interfaces
- PPP interfaces

If you configure an Ethernet interface to support virtual LANs (VLANs), you can specify an Ethernet subinterface.

For example, you would enter the following commands to configure a loopback interface and then to configure the ATM 1.1 subinterface to use the IP address assigned to that loopback interface:

```
ProCurve(config)# interface loopback 1
ProCurve(config-loop 1)# ip address 10.1.1.1 /24
ProCurve(config-loop 1)# interface atm 1.1
ProCurve(config-atm 1.1)# ip unnumbered loopback 1
ProCurve(config-atm 1.1)# no shut
```

N o t e   You do not have to enter **no shutdown** to activate a loopback interface. The status of a loopback interface automatically changes to up after you enter the **interface loopback <*number*>** command.

OAM Settings

By default, an activated ATM interface sends F5 Operation, Administration, and Maintenance (OAM) cells over a reserved VCI to monitor the ATM link and ensure that is open from end-to-end. The **oam retry** command enables you to configure the OAM settings that the ProCurve Secure Router OS uses to determine if a PVC is up or down.

Syntax: oam retry *<up-count>* *<down-count>* *<retry-frequency>*

The *<up-count>* option determines the number of consecutive, end-to-end F5 OAM loopback cell responses that the ADSL interface must receive before the Secure Router OS changes a PVC connection state to up.

Replace *<up-count>* with a number between 1 and 255. The default setting is 3.

The *<down-count>* option determines the number of consecutive, end-to-end F5 OAM loopback cell responses that the ATM subinterface must miss before the Secure Router OS changes the PVC state to down.

Replace *<down-count>* with a number between 1 and 255. The default setting is 5.

The *<retry-frequency>* option determines the frequency (in seconds) at which the ADSL interface transmits F5 OAM loopback cells when verifying a PVC state change. Replace *<retry-frequency>* with a number of seconds between 1 and 600. The default setting is 1 second.

The value you specify for the *<retry-frequency>* option is used only when the Secure Router OS is verifying a change in the state of a PVC. To configure the time delay between OAM loopback cells for all other circumstances, you enter this command from the ATM subinterface configuration mode context:

Syntax: oam-pvc managed *<frequency>*

This command determines the number of seconds the Secure Router OS waits between transmitting OAM loopback cells. The range is 0 to 600 seconds, and the default setting is 1 second.

For example, to configure the Secure Router OS to wait 4 seconds between transmitting OAM loopback cells, enter:

ProCurve(config-atm 1.1)# oam-pvc managed 4

Bind the ADSL Interface to the ATM Interface

When you configure WAN connections on the ProCurve Secure Router, you must bind the physical interface to the logical interface. For ADSL WAN connections, you must bind the ADSL interface to the ATM interface. Enter the following command from the global configuration mode context:

Syntax: bind *<number> <physical interface> <slot number>/<port number> <logical interface> <logical interface number>*

You can also enter this command from the ATM interface configuration mode context.

For example, if you want to bind the ADSL 1/1 interface to the ATM 1 interface, enter:

ProCurve(config)# bind 1 adsl 1/1 atm 1

The ATM interface may take a few minutes to establish a connection. To view the status of the ATM interface and subinterface, enter:

ProCurve(config)# do show interface atm 1
ProCurve(config)# do show interface atm 1.1

N o t e
The **do** command allows you to enter enable mode commands (such as **show** commands) from any context (except the basic mode context).

If you need to configure PPPoE for your ADSL connection, see "PPPoE Overview" on page 7-29. If you need to configure PPPoA for your ADSL connection, see "PPPoA Overview" on page 7-36.

Additional Settings

In addition to configuring the settings to enable and establish the ADSL connection, you can configure settings such as access controls on the ATM subinterfaces. Table 7-6 lists additional configurations that you can enter from the ATM interface and subinterface and the page number where you can find information about those configurations.

Table 7-6.   Additional Configurations for the ATM Interface or Subinterface

Settings	Apply to ATM Interface or Subinterface	Configuration Guide	Page
access controls to filter incoming and outgoing traffic	ATM subinterface	Advanced	5-19, 5-38
bridging	ATM subinterface	Basic	10-6
VPNs	ATM subinterface	Advanced	10-46
routing commands for OSPF, RIP, or BGP	ATM subinterface	Advanced	15-1
quality of service settings	ATM interface	Advanced	8-28

PPPoE Overview

Your service provider may use PPPoE for several reasons:

■   Each host can use its own protocol stack, enabling each user to continue using a familiar interface.

■   The service provider can control access, track usage, provide services, and bill for usage on a per-user basis, rather than on a per-site basis.

■   The service provider can use PPP authentication to ensure that the hosts requesting access to network services are authorized to use those services.

If an individual user is using ADSL with PPPoE to connect from his or her home to the service provider, that user must load a PPPoE client on his workstation. For a company environment, the PPPoE client is frequently configured on the router establishing the ADSL connection. In this case, the users on the company's LAN do not have to run a PPPoE client on their workstation.

To implement PPPoE, the service provider must set up an access concentrator, or access server. This access concentrator negotiates the PPPoE session with the client—which is, in this case, the ProCurve Secure Router. (See Figure 7-8.)
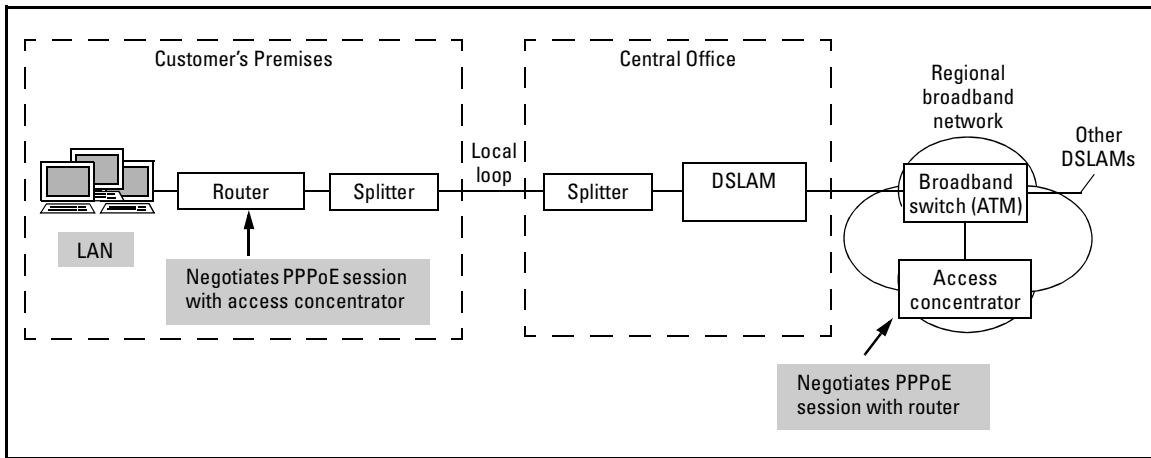
Figure 7-8.   Access Concentrator for PPPoE Access

Two Phases for Establishing a PPPoE Session

To establish a PPPoE session, the client and the access concentrator must successfully complete two phases:

■   discovery phase

■   PPP session

Discovery Phase

During the discovery phase, the PPPoE client must find an access concentrator, obtain the access concentrator's Ethernet MAC address, and learn the session ID that the access concentrator assigns this PPPoE session. If the PPPoE client fails to obtain any of this information, the discovery phase fails, and the PPPoE session is not established.

The PPPoE discovery phase includes four steps, as shown in Figure 7-9.

Discovery Stage

Goal: Learn session ID and peer's Ethernet MAC address

1. PPPoE client broadcasts a PADI (initiation) frame

2. Access concentrator sends a PADO (offer) frame

3. PPPoE client sends a PADR (request) frame

4. Access concentrator sends a PADS (confirmation) frame

If negotiation is successful, PPP session begins

Router

Access concentrator
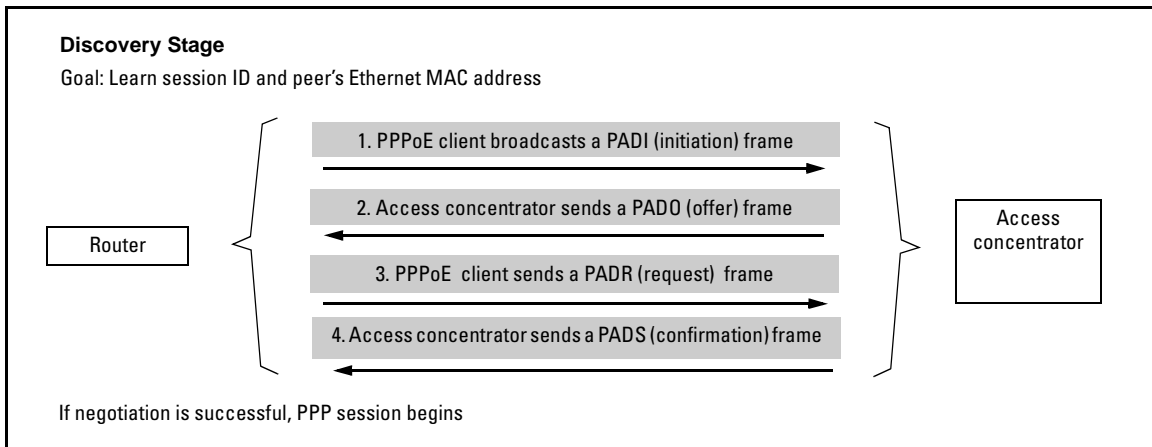
Figure 7-9. Discovery Stage for Negotiating a PPPoE Session

Step 1. The PPPoE client broadcasts a PPPoE Active Discovery Initiation (PADI) frame to locate the available access concentrators. This frame contains at least one service name tag, which specifies the service that the PPPoE client is requesting. As outlined in RFC 2516, the PADI frame (including the PPPoE header) cannot be larger than 1484 bytes.

Step 2. The available access concentrators that can provide the service (or services) specified in the PADI frame send a PPPoE Active Discovery Offer (PADO) frame to the Ethernet MAC address of the PPPoE client. This frame contains the name of the access concentrator and the service name tag that was included in the PADI frame from the PPPoE client. In addition, the PADO frame may include information about other services available from the access concentrator.

Step 3. If the PPPoE client receives a PADO frame from more than one access concentrator, it reviews the offers and selects one, based on either name or services offered. For example, the PPPoE client may be configured to accept the offer from a particular access concentrator. In this case, the client makes the selection based on access concentrator name. Alternatively, the PPPoE client may be configured to accept the offer based on the services offered.

After making the selection, the PPPoE client sends a unicast frame called a PPPoE Active Discovery Request (PADR) to the MAC address of the access concentrator it selected. This frame contains the service name tag of the service the PPPoE client is requesting.

Step 4. When the access concentrator receives the PADR frame, it checks the service name tag. If it accepts the service name tag, the access concentrator generates a unique session ID. It includes this ID and the service name tag in a PPPoE Active Discovery Session-confirmation (PADS) frame and sends this frame to the PPPoE client.

If the access concentrator rejects the service name tag included in the PADR, it sends a PADS frame that includes a service-name error tag and a session ID of 0x0000. This signals to the PPPoE client that the access concentrator cannot provide that service.

PPP Session

After the PPPoE client receives the PADS frame, the PPP session begins, and the two devices begin exchanging frames in the customary sequence for PPP. The devices exchange the PPP frames in the order shown in Figure 7-10.
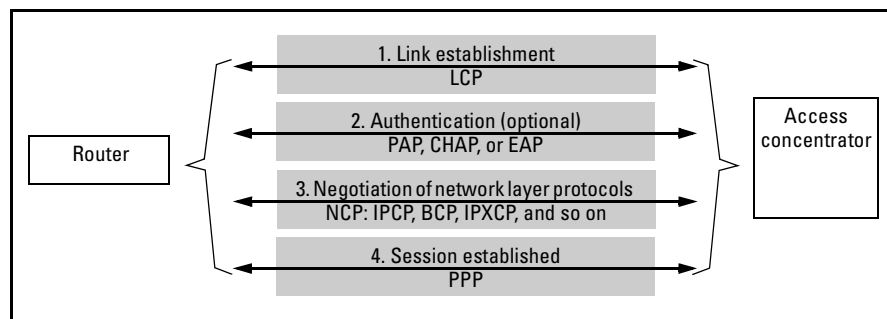
Figure 7-10. Establishing a PPP Session

Step 1. The devices exchange link control protocol (LCP) frames to establish, configure, and control the link.

Step 2. If the devices are configured for authentication, they use one of the following protocols to verify that they are establishing a session with the correct PPP peer: Password Authentication Protocol (PAP), Challenge Handshake Authentication Protocol (CHAP), or Extensible Authentication Protocol (EAP). Exchanging authentication frames is optional.

The ProCurve Secure Router supports PAP and CHAP. For more information about configuring PPP authentication on the ProCurve Secure Router, see "PPP Authentication" on page 6-72 in *Chapter 6: Configuring the Data Link Layer Protocol for E1, T1, and Serial Interfaces*.

Step 3. The devices use network control protocol (NCP) frames to enable the exchange of Network Layer protocols, such as IP, across the link.

Step 4. The devices use PPP frames to transmit the actual data.

(For more information about establishing a PPP session, see *Chapter 6: Configuring the Data Link Layer Protocol for E1, T1, and Serial Interfaces*.)

During the process of establishing a PPP session, the devices will also negotiate the maximum receive unit (MRU) size. For PPPoE, the negotiated MRU cannot be larger than 1492 bytes because Ethernet has a maximum *payload* size of 1500 bytes. The PPPoE header is 6 bytes, and the PPP protocol ID is 2 bytes. With this overhead of 8 bytes, the PPP MTU cannot be larger than 1492 bytes.

Creating the PPP Interface

To configure PPPoE, you first configure the ADSL interface, the ATM interface, and the ATM subinterface. (These instructions begin with "Configuring the ADSL Interface: the Physical Layer" on page 7-12.) When configuring the ATM subinterface, you must set the encapsulation to **aal5snap** or **aal5mux ppp**, as shown below:

Syntax: encapsulation aal5snap

or

Syntax: encapsulation aal5mux [ip | ppp]

Your service provider should tell you which encapsulation to use.

Setting the encapsulation type configures the ATM adaptation layer (which is called Layer 2-1). When you use PPPoE, you must also configure the ATM point-to-point layer (which is called Layer 2-2). To configure this layer, you create a PPP interface and then bind this interface to the ATM subinterface.

To create a PPP interface, move to the global configuration mode context and enter:

Syntax: interface <*interface*> <*number*>

Replace **<*interface*>** with **ppp** and replace **<*number*>** with a number to distinguish this PPP interface from other PPP interfaces created on the router.

Assigning an IP Address

Because you are configuring a PPP interface on top of the ATM subinterface, the PPP interface handles the IP address. Rather than configuring an IP address on the ATM subinterface, you configure the IP address on the PPP interface.

You can configure a static IP address, or you can configure the PPP interface to negotiate an IP address from the service provider's access concentrator. To assign the PPP interface a static IP address, enter the following command from the PPP interface configuration mode context:

Syntax: ip address *<A.B.C.D> <subnet mask | /prefix length>*

Replace **<A.B.C.D>** with the IP address. To specify a subnet mask, replace **<subnet mask>** with the subnet mask or replace **</prefix length>** with the CIDR notation.

To configure the PPP interface to negotiate an IP address, enter:

Syntax: ip address negotiated

If you need to configure authentication protocols for the connection, see "PPP Authentication" on page 6-72 of *Chapter 6: Configuring the Data Link Layer Protocol for E1, T1, and Serial Interfaces.*

Binding the ATM Subinterface to the PPP Interface

To finish defining the point-to-point layer for the ADSL connection, you must bind the ATM subinterface to the PPP interface. Enter the following command from either the global configuration mode context or the PPP interface configuration mode context:

Syntax: bind *<bind number>* atm *<interface number.subinterface number>* ppp *<interface number>* pppoe-client

Replace **<bind number>** with a bind number that you have not yet used on the ProCurve Secure Router. Enter the interface numbers for the ATM subinterface and PPP interface that you want to bind together. Include the **pppoe-client** option to enable the PPPoE client to establish a PPPoE session with the service provider's access concentrator.

You can enter the **show running-config** command from the enable mode context to ensure that you have entered the two **bind** commands that are required for an ADSL connection that uses PPPoE. Figure 7-11 shows a sample running-config for an ADSL interface, ATM interface, ATM subinterface, and PPP interface.

```
interface adsl 2/1
  snr-margin 6
  no shutdown
!
interface atm 1 point-to-point
  no shutdown
  bind 3 adsl 2/1 atm 1        ◄──── Bind the ADSL interface to the ATM interface
!
interface atm 1.1 point-to-point
  no shutdown
  pvc 0/35
!
interface ppp 3
  ip address  10.1.1.1  255.255.255.252
  no shutdown                            Bind the ATM subinterface to
  bind 4 atm 1.1 ppp 3 pppoe-client  ◄──── the PPP interface
```

Figure 7-11. Using the show running-config Command to Check the Two bind Commands Required for PPPoE

Identifying the Access Concentrator

You can configure the name of the access concentrator with which the Secure Router OS should establish a PPPoE session. Your service provider may ask you to configure this setting if there are multiple access concentrators and the service provider wants you to establish a connection with a particular one. You may also want to configure this option to ensure that the ProCurve Secure Router establishes a PPPoE session only with your service provider's access concentrator.

From the PPP interface configuration mode context, enter:

Syntax: pppoe ac-name <*name*>

Replace **<*name*>** with a text string of up to 255 characters that corresponds to the AC-Name Tag as defined in RFC 2516. The AC value may be a combination of trademark, model, and serial ID information (or simply the MAC address of the access concentrator).

If you do not include this field, any access concentrator is acceptable. By default, no access concentrator is specified.

Identifying PPPoE Services

You can also control which PPPoE session offer the Secure Router OS accepts by specifying the PPPoE services that are required. From the PPP interface configuration mode context, enter:

Syntax: pppoe service-name *<name>*

Replace ***<name>*** with a text string of up to 255 characters that identifies the service-name tags outlined in RFC 2516. If you need to configure the Secure Router OS to select an access concentrator by service name, your service provider will give you the service name to enter.

By default, no service names are specified.

PPPoA Overview

Like PPPoE, PPPoA provides several advantages to service providers, including the following:

■   Service providers can control access, track usage, provide services, and bill for usage on a per-user basis, rather than on a per-site basis.

■   Service providers can use PPP authentication to ensure that the hosts requesting access to network services are authorized to use those services.

■   Service providers can build a scalable infrastructure because they can terminate a large number of PPP sessions through one access concentrator.

After the ADSL physical connection is established, the router will try to establish a PPP connection with an access concentrator on the other side of the DSLAM. The two devices will begin exchanging frames in the customary sequence for PPP.

PPP peers exchange PPP frames in the order shown in Figure 7-12.

```
                1. Link establishment
                        LCP

                2. Authentication (optional)
  Router          PAP, CHAP, or EAP            Access
                                               concentrator
                3. Negotiation of network layer protocols
                NCP: IPCP, BCP, IPXCP, and so on

                4. Session established
                        PPP
```
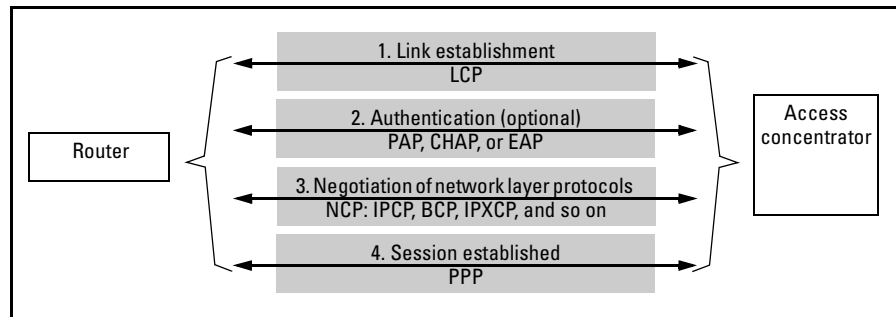
Figure 7-12. Establishing a PPP Session

Step One. The devices exchange link control protocol (LCP) frames to establish, configure, and control the link.

Step Two. If the devices are configured for authentication, they use one of the following protocols to verify that they establish the PPP session with the correct peer: Password Authentication Protocol (PAP), Challenge Handshake Authentication Protocol (CHAP), or Extensible Authentication Protocol (EAP). Exchanging authentication frames is optional.

The ProCurve Secure Router supports PAP and CHAP. For more information about configuring PPP authentication on the ProCurve Secure Router, see "PPP Authentication" on page 6-72 in *Chapter 6: Configuring the Data Link Layer Protocol for E1, T1, and Serial Interfaces*.

Step Three. The devices use network control protocol (NCP) frames to enable the exchange of Network Layer protocols, such as IP, across the link.

Step Four. The devices use PPP frames to transmit the actual data.

(For more information about establishing a PPP session, see *Chapter 6: Configuring the Data Link Layer Protocol for E1, T1, and Serial Interfaces*.)

Creating the PPP Interface

To configure PPPoA, you configure the ADSL interface, the ATM interface, and the ATM subinterface. (These instructions begin with "Configuring the ADSL Interface: the Physical Layer" on page 7-12.) When configuring the ATM subinterface, you must set the encapsulation to **aal5snap** or **aal5mux ppp**, as shown below:

Syntax: encapsulation aal5snap

or

Syntax: encapsulation aal5mux [ip | ppp]

Your service provider should tell you which encapsulation to use.

The encapsulation setting configures the ATM adaptation layer (which is called Layer 2-1). When you use PPPoA, you must also configure the ATM point-to-point layer (which is called Layer 2-2). To configure this layer, you create a PPP interface and then bind this interface to the ATM subinterface.

To create a PPP interface, move to the global configuration mode context and enter:

Syntax: interface *<interface>* *<number>*

Replace ***<interface>*** with **ppp** and replace ***<number>*** with a number to distinguish this PPP interface from other PPP interfaces on the router.

Assigning an IP Address

Because you are configuring a PPP interface on top of the ATM subinterface, the PPP interface handles the IP address. Rather than configuring an IP address on the ATM subinterface, you configure the IP address on the PPP interface.

You can configure a static IP address, or you can configure the PPP interface to negotiate an IP address from the service provider's access concentrator.

To assign the PPP interface a static IP address, enter the following command from the PPP interface configuration mode context:

Syntax: ip address *<A.B.C.D>* *<subnet mask | /prefix length>*

To configure the PPP interface to negotiate an IP address, enter:

Syntax: ip address negotiated

If you need to configure authentication protocols for the connection, see "PPP Authentication" on page 6-72 in *Chapter 6: Configuring the Data Link Layer Protocol for E1, T1, and Serial Interfaces*.

Binding the ATM Subinterface to the PPP Interface

To finish defining the point-to-point layer for the ADSL connection, you must bind the ATM subinterface to the PPP interface. Enter the following command from either the global configuration mode context or the PPP interface configuration mode context:

Syntax: bind <*bind number*> atm <*number.subinterface number*> ppp <*number*>

Replace ***<bind number>*** with a bind number that you have not yet used on the ProCurve Secure Router. Enter the interface numbers for the ATM sub-interface and PPP interface that you want to bind together.

You can enter the **show running-config** command from the enable mode context to ensure that you have entered the two **bind** commands that are required for an ADSL connection that uses PPPoA. Figure 7-13 shows a section of the running-config relating to an ADSL interface, ATM interface, ATM subinterface, and PPP interface.

```
interface adsl 2/1
  snr-margin 5
  no shutdown
!
interface atm 1 point-to-point
  no shutdown
  bind 1 adsl 2/1 atm 1        ◄──── Bind the ADSL interface to the ATM interface
!
interface atm 1.1 point-to-point
  no shutdown
  pvc 0/33
!
interface ppp 1
  ip address  10.1.1.1  255.255.255.252
  no shutdown
  bind 2 atm 1.1 ppp 1        ◄──── Bind the ATM subinterface to
                                     the PPP interface
```

Figure 7-13. Using the show running-config Command to Check the Two bind Commands Required for PPPoA

Routed Bridged Encapsulation

Some DSLAMs use routed bridged encapsulation (RBE) to route IP over bridged Ethernet traffic. RBE is sometimes referred to as "half bridging," because it provides some of the advantages of bridging combined with some of the advantages of routing.

With RBE, the ADSL service provider uses an aggregation device to establish a bridge with the customer's ADSL modem—in this case, the ProCurve Secure Router. (See Figure 7-14.) With RBE, however, the router forwards packets based on the Layer 3, or IP, header. In a pure bridging environment, the router would use the Layer 2 header to forward packets.

When a device sends a packet that must be transmitted on the ATM subinterface, the router disregards the Layer 2 header and uses the Layer 3 header to forward the packet. Likewise, when packets are received on the ATM subinterface, the ProCurve Secure Router examines the IP header. It then consults its internal tables and identifies the MAC address associated with that IP address and places that MAC address in the Layer 2 frame. If the ProCurve Secure Router does not know the MAC address, it sends an Address Resolution Protocol (ARP) frame to request that information.

ADSL service providers use RBE because it minimizes the configuration required at the customer's premises. It also provides better security than pure bridging environments because each customer's ADSL device establishes a point-to-point connection with the service provider's aggregation device. This point-to-point connection also eliminates broadcast storms that are typical in pure bridging environments.
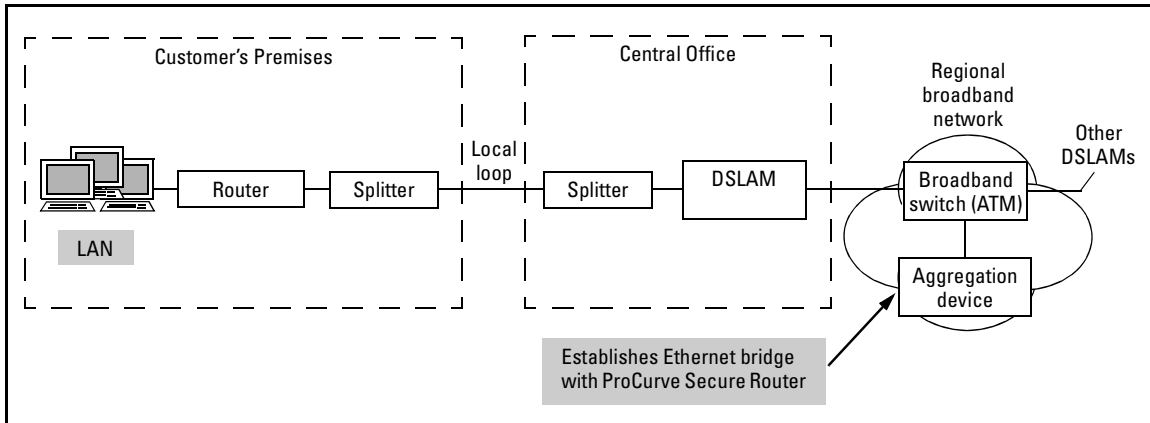
Figure 7-14. RBE Environment

To configure RBE, complete the steps for configuring the ADSL interfaces as explained in "Configuring the ADSL Interface: the Physical Layer" on page 7-12. Then configure the ATM interface as explained in "Configuring the Data Link Layer for the ADSL Connection" on page 7-17 and configure the ATM subinterface as described in "Configuring a Subinterface for each PVC" on page 7-18.

When you configure the ATM subinterface, you must enter an additional command. From the ATM subinterface configuration mode context, enter:

ProCurve(config-atm 1.1)# atm routed-bridged ip

Figure 7-15 shows the running-config for an ADSL connection that is using RBE.

```
interface adsl 2/1
  snr-margin 6
  training-mode G.DMT
  no shutdown

interface atm 1 point-to-point
  no shutdown
  bind 2 adsl 2/1 atm 1

interface atm 1.1 point-to-point
  no shutdown
  pvc 0/33
  encapsulation aal5snap          RBE is configured on the
  atm routed-bridged ip  ◄─────   ATM subinterface.
  ip address  10.1.1.1  255.255.255.252
  bandwidth 896
```

Figure 7-15. Running-config for an ADSL Connection That Is Using RBE

Viewing the Status and Configuration of Interfaces

You can view information about all of the interfaces that are used to create the ADSL connection.

Viewing the Status of the ADSL Interface

To view the status of the ADSL interface, enter:

Syntax: show interfaces adsl *<slot>/<port>*

Replace ***<slot>*** with the slot where the ADSL interface is installed, and replace ***<port>*** with **1**.

Figure 7-16 shows the output from this command for a sample network if the ADSL connection is up. The first line of the display reports the status of the ADSL interface and the line protocol—the logical interface to which you have bound the ADSL interface.

```
!adsl 2/1 is UP, line protocol is UP          ◄──   Status of physical and logical
  Link Status                   Up G.DMT             interface
  Line Type                     Fast
  Line Length                   933 ft         ◄──   Training mode used

                   Actual downstream    Downstream          Upstream
  Line Rate        and upstream rates ──► 8128 kbps      ──► 896 kbps
  Current margin                      10.0 dB            8.0 dB
  Attenuation                          1.0 dB            0.0 dB
  Power                    One indicator of   0 dBm          12 dBm
  Prev Rate                line condition     0 kbps          0 kbps
  Actual Delay                         0 msecs           0 msecs
  Loss of Framing Seconds              0                 0
  Loss of Signal Seconds               0     Watch       0
  Loss of Power Seconds                0     for         0
  Errored Seconds                      0     steadily    0
  Line Inits                           1     incre-      N/A
  Rx Blocks                         7443     menting    7443
  Tx Blocks                         7443     losses or  7443
  Corrected Blocks                     0     errors      0
  UncorrectedBlocks                    0                 0
  Last Failure               NONE
  Last Failure Time          N/A

  DMT Bits Per Bin
  000: 0 0 0 0 0 0 0 A B B C C B B B B
  010: A A A B B B B B A A A 9 9 8 7 0
  020: 0 2 4 5 7 7 8 9 9 A A A B B B B
  030: C B C C C C C C C C C C C B B B
  040: 0 B B B B B B B B B B B B B B B
  050: B B B B B B B B B B B B B B B B
  060: B B B B B B B B B A A A A A A A
  070: A A A A A A A A A A A A A A A A
  080: A A A A A A A A A A A A A A A A
  090: A A A A A 9 9 9 9 9 9 9 9 9 9 9
  0A0: 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9
  0B0: 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9
  0C0: 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9
  0D0: 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9
  0E0: 9 9 8 9 9 8 9 9 9 9 9 9 9 9 9 9
  0F0: 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9
```

Figure 7-16. show interfaces adsl Command

The "Link Status" indicates the training mode standard. If the ADSL interface has established the Physical Layer, the "Line Type" and "Line Length" fields will be populated with information about that particular ADSL connection. In Figure 7-16, for example, the "Line Type" is Fast, and the "Line Length" is 933 feet.

Next, the output from the **show interfaces adsl** command displays the downstream and upstream transmission rates for the connection. This section of the output also reports the attenuation on the line and any framing, signaling, and power losses, as well as error seconds.

To view the commands that have been entered to configure the ADSL interface, use the following enable mode command:

Syntax: show running-config interface adsl *<slot>*/*<port>*

For example, if the ADSL interface is in slot two, port one, enter:

ProCurve# show running-config interface adsl 2/1

This command displays the running-config for just the ADSL 2/1 interface. In the configuration shown in Figure 7-17, only two commands were entered: the **snr-margin** and the **no shutdown** commands. For this network, the default setting for **training-mode** was used.

```
interface adsl 2/1
  snr-margin 5           Displays the commands
  no shutdown            entered for this interface
```

Figure 7-17. show running-config interface adsl Command

The output from the **show running-config interface adsl** command will not include default settings that were not entered manually from the CLI or configured through the Web browser interface. To view all the settings for an ADSL interface—those entered manually and the default settings—include the **verbose** option, as shown below:

Syntax: show running-config interface adsl *<slot>*/*<port>* verbose

For example, to view all the settings for the ADSL 2/1 interface, enter:

ProCurve# show running-config interface adsl 2/1 verbose

Figure 7-18 shows the verbose output for the same interface shown in Figure 7-17.

```
interface adsl 2/1
 description ""                    Displays all the settings for the
  alias ""                        interface, including defaults
  snr-margin 5
  training-mode Multi-Mode
  no shutdown
```

Figure 7-18. show running-config interface adsl verbose Command

Viewing the Status of the ATM Interface and Subinterface

To view the status of the ATM interface, enter the following command from the enable mode context:

Syntax: show interfaces atm *<number>*

Replace **<number>** with the unique number that you assigned the ATM interface. For the ATM 1 interface, enter:

ProCurve# show interfaces atm 1

Figure 7-19 shows the output from this command for a sample network. As you can see, this command displays the status of the interface and the number of virtual circuits active on the interface.

```
atm 1 is UP, line protocol is UP        ◄——  Interface is up
  BW 896 Kbit/s
  16 maximum active VCCs, 16 VCCs per VP, 1 current VCCs
Queueing strategy: Per VC Queueing
  5 minute input rate 58120 bits/sec, 0 packets/sec        Number
  5 minute output rate 58200 bits/sec, 0 packets/sec       of virtual
    10007 packets input, 2520900 bytes                     circuits
    0 pkts discarded, 0 error pkts, 0 unknown protocol pkts
    60024 cells received, 0 OAM cells received
    10062 packets output, 2524900 bytes
    0 tx pkts discarded, 0 tx error pkts
    60123 cells sent, 0 OAM cells sent
```

Figure 7-19. show interfaces atm Command

To view the status of the ATM subinterface, enter the following command from the enable mode context:

Syntax: show interfaces atm *<number.subinterface number>*

Replace ***<number.subinterface number>*** with the unique number and
subinterface number that you assigned the ATM interface. For the ATM 1.1
subinterface, enter:

ProCurve# show interfaces atm 1.1

Figure 7-20 shows the output from this command for a sample network. As
you can see, this command displays the status of the interface and settings
such as the ATM encapsulation, the IP address, and the MTU size. The interface
shown in Figure 7-20 is configured to use RBE.

```
atm 1.1 is Active                                          Interface is up
  ATM Routed Bridge Encapsulation: IP
  Ip address is 192.168.1.20, mask is 255.255.255.0        Interface is
  MTU is 1500 bytes                                        configured
  Encapsulation is AAL5                                    for RBE
  Encapsulation method is SNAP           ATM encapsulation
  VC tx ring limit: 2
  Output Queue: 0/1/200/0 (size/highest/max total/drops)
  10007 packets input, 2881152 bytes
  10066 packets output, 2886240 bytes
  60024 cells input, 60130 cells output
  0 OAM cells input, 0 OAM cells output
  AAL5 CRC errors : 0
  AAL5 SAR Timeouts : 0
  AAL5 Oversized SDUs : 0
  AAL5 length violations : 0
```

Figure 7-20. show interface atm Command for the Subinterface

To view the configuration settings entered for the ATM interface or subinter-
face, enter the appropriate command from the enable mode context:

Syntax: show running-config interface atm *<number>* [verbose]

or

Syntax: show running-config interface atm *<number.subinterface number>* [verbose]

To view all of the configuration settings for the ATM interface or subinterface,
include the **verbose** option at the end of these commands.

Troubleshooting the ADSL Connection

When troubleshooting WAN connections, you should try to isolate the problem and determine if the problem is occurring on the physical interface or the logical interface. With an ADSL WAN connection, you should begin troubleshooting the ADSL interface.

Troubleshooting the ADSL Interface

Your first tool in troubleshooting is always the **show** command. To troubleshoot the ADSL interface, enter the following command from the enable mode context:

Syntax: show interfaces adsl <*slot*>/<*port*>

Replace **<*slot*>** with the slot where the ADSL interface is installed, and replace **<*port*>** with **1**.

If the status of the physical interface is administratively down, you should activate it by entering **no shutdown** from the ADSL interface configuration mode context. If the physical interface is down, you must fix a problem on the Physical Layer level.

Identifying the Problem

You should first check the ADSL configurations. The interface readout indicates the training-mode standard next to "Link Status." Verify that this standard matches that used by your service provider. If you have configured the interface to use a different training mode than that used by the service provider, the physical connection cannot be established.

In Figure 7-21, for example, the **show interfaces adsl** command shows that the Physical Layer and the Data Link Layer are down. In this case, the training mode set on the router did not match the training mode set on the DSLAM. The "Training" setting was reported as unknown.

```
adsl 2/1 is DOWN, line protocol is DOWN
  Link Status                  Training UNKNOWN
  Line Type
  Line Length                  0 ft

                              Downstream        Upstream
  Line Rate                    0 kbps           0 kbps
  Current margin               0.0 dB           0.0 dB
  Attenuation                  0.0 dB           0.0 dB
  Power                        0.0 dB           0.0 dB
  Prev Rate                    0 kbps           0 kbps
  Actual Delay                 0 msecs          0 msecs
  Loss of Framing Seconds      0                0
  Loss of Signal Seconds       0                0
  Loss of Power Seconds        0                0
  Errored Seconds              0                0
  Line Inits                   0                N/A
  Rx Blocks                    0                0
  Tx Blocks                    0                0
  Corrected Blocks             0                0
  UncorrectedBlocks            0                0
  Last Failure         NONE
  Last Failure Time    N/A

  DMT Bits Per Bin
  000:
```

The training mode does not match the training mode used by the DSLAM

Figure 7-21. show interfaces adsl Command

If the signal attenuation is high, you may want to adjust the SNR margin setting. The interface may have shut itself down because the line could not support the SNR margin at the limit you set. You may want to increase the SNR margin and see if the ADSL interface can establish and maintain the connection over time.

If the ADSL configuration settings appear to be correct, you should check the physical links for disconnected or bad cables. If you have another UTP ribbon cable, try using it to connect the ADSL interface to the wall jack.

debug interface adsl events Command

In addition to viewing information about the ADSL interface, you can view events related to the ADSL connection in real time. From the enable mode context, enter:

Syntax: debug interface adsl events

Figure 7-22 shows the **debug** commands for a connection that was established successfully.

```
2005.08.09 19:02:40 ADSL.EVENTS Current DSL state:  ATU_RIDLE
2005.08.09 19:02:40 INTERFACE_STATUS.adsl 2/1 changed state to down
2005.08.09 19:02:54 ADSL.EVENTS Current DSL state:  GDMT_NEGO       Negotiating to use the
2005.08.09 19:02:54 ADSL.EVENTS Current DSL state:  GDMT_ACKX       G.DMT training mode
2005.08.09 19:02:55 ADSL.EVENTS Current DSL state:  ATU_RECT
2005.08.09 19:02:57 ADSL.EVENTS Current DSL state:  ATU_RSEGUE1
2005.08.09 19:03:01 ADSL.EVENTS Current DSL state:  ATU_RMSGS1
2005.08.09 19:03:01 ADSL.EVENTS Current DSL state:  ATU_RRATES2
2005.08.09 19:03:01 ADSL.EVENTS Current DSL state:  ATU_RREVERB5    Connection is
2005.08.09 19:03:02 ADSL.EVENTS Current DSL state:  ATU_RSHOWTIME   established
2005.08.09 19:03:02 INTERFACE_STATUS.adsl 2/1 changed state to up
```

Figure 7-22. Debug Output When a Connection Was Established Successfully

You can use the debug information to pinpoint when and why the line goes down.

N o t e   **Debug** commands are bandwidth intensive.

To turn off debugging, enter:

Syntax: no debug interface adsl events

Troubleshooting the ATM Interface

If the physical interface is up but the line protocol is down, you will need to troubleshoot the logical interface. Use the **show interfaces atm** command to examine the status and configuration of the ATM interface. From the enable mode context, enter:

Syntax: show interfaces atm *<number>*

The output from this command shows the status of the logical interface as well as the information shown in Table 7-7.

Table 7-7.   Information Displayed by the show interfaces atm Command

Information	Meaning
<number> maximum active VCC	displays the maximum number of virtual channels, or connection paths, this interface can carry over the bandwidth allocated to it
<number> VCC per VP	reports how many of these channels can be linked through a single virtual path
<number> current VCCs	reports how many virtual circuits are currently established on this interface

The readout also displays the number of frames received and discarded, and it lists errors. Check the number of OAM cells sent to look for problems in the end-to-end ATM connection.

Troubleshooting the ATM Subinterface

From the enable mode context, enter the appropriate **show interfaces** command to troubleshoot specific ATM sublinks:

Syntax: show interfaces atm <*number.subinterface number*>

Examine the subinterface for problems across a particular connection. For example, a subinterface can be Active or Inactive, depending on whether this virtual end-to-end link is currently active. An inactive ATM connection can be caused by a failed ADSL line (in which case, you would need to resolve Physical Layer problems), by a misconfigured VPI/VCI, or by a problem at the remote endpoint.

You can view information such as the encapsulation method (MUX for multi-plexed circuits or SNAP for circuits that use LLC/SNAP protocol). You can also view output queues and bytes in and out. Check OAM cells to diagnose problems with the end-to-end connection.

debug atm oam Command

You can use the **debug atm oam** command to display OAM frames for a PVC, identified by an ATM virtual circuit descriptor (VCD).

Syntax: debug atm oam <*interface number.subinterface number*> [loopback {end-to-end | segment} {<*LLID*>}]

Replace **<*interface number.subinterface number*>** with the subinterface ID for the PVC. This command displays the OAM frames for a specific PVC.

Include the **loopback** option to configure an OAM loopback. You have two choices when configuring a loopback: **end-to-end** or **segment**.

You can optionally replace **<*LLID*>** with a 16-byte hexidecimal OAM loopback location ID (LLID).

To disable the display of OAM frames, use the **no** form of the command you entered.

Troubleshooting PPPoE

If the PPPoE negotiation fails and a PPPoE session is not established, you must first verify that the ADSL interface, the ATM interface, and ATM subinterface are up. You should check the status of each interface, and if any one of the interfaces is down, follow the steps for troubleshooting that particular interface.

Troubleshooting the PPPoE Discovery Process

After you ensure that the ADSL interface, the ATM interface, and the ATM subinterface are up, you should check the status of the PPP interface that is bound to the ATM subinterface. From the enable mode context, enter:

Syntax: show interfaces ppp <*interface number*>

If the other interfaces are up and the PPP interface is down, either the PPPoE discovery process failed, or the PPP link establishment process failed. You should begin to focus on the PPPoE negotiation process and determine where the failure is occurring. To begin troubleshooting the process, move to the enable mode context and enter:

Syntax: debug pppoe client

If you included the **pppoe-client** option when you entered the command to bind the ATM subinterface to the PPP interface, the PPPoE client will continually try to establish a PPPoE session, and debug messages will be displayed at the CLI. You can compare these messages to the PPPoE discovery process to identify the cause of the problem.

For example, if the PPPoE client keeps sending PADI frames but does not receive any PADO frames, you know that for some reason the access concentrator is not responding. If the ADSL interface, the ATM interface, and the ATM subinterface are up, you should call your service provider and report the problem. The service provider will need to ensure that the access concentrator is up and the configuration is correct.

Figure 7-23 shows other possible debug messages that may occur. In this example, the PPPoE client on the ProCurve Secure Router went through the entire negotiation process but could not "open PPPoE session." The cause of this problem was a configuration problem on the access concentrator.

```
2005.07.20 17:05:10 PPPOE.CLIENT Sending PADR: Xid = 0xe34b0254
2005.07.20 17:05:10 PPPOE.CLIENT Processing PADS Message
2005.07.20 17:05:10 PPPOE.CLIENT PADS: Session Id Rcvd = 0
2005.07.20 17:05:10 PPPOE.CLIENT PADS: Access Concentrator Error: AC:
Cannot open PPPoE session.
                                    Negotiation failed at final step
```
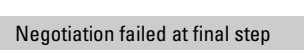
Figure 7-23. Debug Messages for the PPPoE Client

N o t e   **Debug** commands are processor intensive.

Stopping the Debug Messages. Enter one of the following commands from the enable mode context to end the debug messages:

Syntax: no debug pppoe client

or

Syntax: undebug all

After successfully negotiating a PPPoE session, the ProCurve Secure Router begins the process of establishing a PPP session. For information about troubleshooting this process, see "Troubleshooting the PPP Link Establishment Process" on page 7-53.

show pppoe Command

To view all of the PPPoE settings, enter the following command from the enable mode context:

Syntax: show pppoe

Figure 7-24 shows the output from this command.

```
ppp 1
Outgoing Interface: eth 0/1
Outgoing Interface MAC Address: 00:A0:C8:00:85:20
Access-Concentrator Name Requested: FIRST VALID
Access-Concentrator Name Received: 13021109813703-LRVLGSROS20W_IFITL
Access-Concentrator MAC Address: 00:10:67:00:1D:B8
Session Id: 64508
Service Name Requested: ANY
Service Name Available:
PPPoE Client State: Bound (3)
Redial retries: unlimited
Redial delay: 10 seconds
```

Figure 7-24. Viewing PPPoE Settings

Clear a PPPoE Connection

If you are having problems with a PPPoE connection or if you need to change some configurations for the connection, you can clear the connection. From the enable mode context, enter:

Syntax: clear pppoe *<interface id>*

Replace **<interface id>** with the number of the PPP interface that you bound to the ATM subinterface. For example, if you bound the PPP 3 interface to the ATM subinterface, enter:

ProCurve# clear pppoe 3

debug pppoe client Command

You can display all events related to the PPPoE client in real-time. From the enable mode context, enter:

Syntax: debug pppoe client

Troubleshooting the PPP Link Establishment Process

If you are using PPPoE or PPPoA, you must ensure that the PPP session is established. From the enable mode context, enter:

Syntax: show interfaces ppp *<interface number>*

When you view the status of the PPP interface, you must ensure that both the interface and the Network Layer protocol are up. For example, Figure 7-25 shows a PPP interface that is up. However, the user cannot send traffic over the link. If you look more closely at Figure 7-25, you can see the reason: the Network Layer protocol—IP—is down.

```
ppp 1 is UP          ◄────   First, make sure the interface is up
  Configuration:
    Keep-alive is set (10 sec.)
    No multilink
      MTU = 1492
    No authentication
    IP is configured
      192.168.1.20  255.255.255.0
  Link thru atm 1.1 is UP; LCP state is OPENED, negotiated MTU is 1492
    Receive: bytes=3596, pkts=442, errors=0
    Transmit: bytes=3508, pkts=292, errors=0
    5 minute input rate 624 bits/sec, 1 packets/sec
    5 minute output rate 496 bits/sec, 1 packets/sec
  Bundle information
    Queueing method: fifo
    HDLC tx ring limit: 0
    Output queue: 0/1/200/0 (size/highest/max total/drops)
    IP is DOWN, IPCP state is REQSENT   ◄────   Next, ensure that IP is up
    LLDPCP State is REQ SENT
```

Figure 7-25. The PPP interface is up, but IP is down.

To determine why IP is down, use the **debug ppp** commands. Table 7-8 lists the **debug** commands you can use to monitor PPP interfaces.

Table 7-8.   debug ppp Commands

Command	Explanation
debug ppp verbose	displays detailed information about all PPP frames as they arrive on the PPP interface
debug ppp errors	displays error messages relating to PPP
debug ppp negotiations	displays events relating to link negotiation; shows if links protocols are able to open; and reveals when negotiations between two PPP peers fail
debug ppp authentication	displays real-time messages relating to PAP and CHAP
undebug all	turns off debug messages

Quick Start

This section provides the commands you will need to quickly configure an Asymmetric Digital Subscriber Line (ADSL) WAN connection on the ProCurve Secure Router. Only a minimal explanation is provided.

If you need additional information about any of these options, see "Contents" on page 7-1 to locate the section and page number that contains the explanation you need.

Configure the Physical Layer: the ADSL Interface

Before you begin to configure the ADSL interface, you should know the settings that you must enter for the following:

- signal-to-noise ratio (SNR) margin
- training mode

Your service provider should tell you the settings you need to enter.

To configure the ADSL interface, complete these steps:

1. Use ribbon cabling with RJ-11 connectors to connect the ADSL port on the ProCurve Secure Router to the wall jack provided by your service provider.

2. Establish a terminal console session or Telnet session with the ProCurve Secure Router.

   ProCurve>

3. Move to the enable mode context. If you have configured a password for the enable mode context, enter that password when you are prompted to do so.

   ProCurve> enable
   Password:

4. Move to the global configuration mode context.

   ProCurve# configure terminal

5. Access the ADSL interface configuration mode context.

    Syntax: interface adsl <*slot*>/1

    For example, if the ADSL module is in slot two, enter:

    ProCurve(config)# interface adsl 2/1

6. Activate the interface.

    ProCurve(config-adsl 2/1)# no shutdown

7. Set the SNR margin.

    Syntax: snr-margin <*margin*>

    Replace **<*margin*>** with 1-15, which refers to decibels. For example, your service provider may tell you to set the SNR margin to 6.

    ProCurve(config-adsl 1)# snr-margin 6

8. Define the training mode. The default setting is **Multi-Mode**. For a list of settings supported by the ADSL2+ Annex A module and the ADSL2+ Annex B module, see Table 7-9 on page 7-57.

    Syntax: training-mode [ADSL2 | ADSL2+ | G.DMT | G.LITE | Multi-Mode | READSL2 | T1.413]

    ProCurve(config-adsl 2/1)# training-mode multi-mode

N o t e   If you want to use a default setting, it is not necessary to enter the command.

9. Manually retrain the interface

    ProCurve(config-adsl 2/1)# retrain

    Retraining may take a minute. The ADSL interface will go down and then back up.

10. View the status of the ADSL interface.

    ProCurve(config-adsl 2/1)# do show interface adsl 2/1

N o t e   The **do** command enables you to enter enable mode commands (such as **show** commands) from any context (except the basic mode context).

Table 7-9.   Training Modes Supported by the ProCurve Secure Router

Command Option	ADSL2+ Annex A	ADSL2+ Annex B
training-mode ADSL2	Yes	Yes
training-mode ADSL2+	Yes	Yes
training-mode G.DMT	Yes	Yes
training-mode G.LITE	Yes	No
training-mode Multi-Mode	Yes	Yes
training-mode READSL2	Yes	No
training-mode T1.413	Yes	No

Configure the Data Link Layer: the ATM Interface and Subinterface

Before you configure the Data Link Layer for the ADSL connection, you must know the settings that you should enter for the following:

- Data Link Layer protocol
  - Asynchronous Transfer Mode (ATM) only
  - point-to-point protocol (PPP) over Ethernet (PPPoE)
  - PPP over ATM (PPPoA)
  - routed bridged encapsulation (RBE)
- virtual path identifier/virtual channel identifier (VPI/VCI)
- ATM encapsulation
- IP address
  - static IP address
  - unnumbered interface
  - IP address negotiated with the service provider's router

Your service provider should tell you which settings to enter.

Configure ATM Only

1. From the global configuration mode context, create the ATM interface.

   Syntax: interface *<interface>* *<number>*

Replace *<interface>* with **atm**, and replace *<number>* with a unique number for this ADSL connection. For example, to create ATM 1 interface, enter:

ProCurve(config)# interface atm 1

2. Activate the interface.

   ProCurve(config-atm 1)# no shutdown

3. Create a subinterface for each permanent virtual circuit (PVC). ATM interfaces on the ProCurve Secure Router can support up to 16 PVCs.

   Syntax: interface atm *<number.sublink number>*

   ProCurve(config-atm 1)# interface atm 1.1

4. Configure a VPI/VCI for the subinterface.

   Syntax: pvc *<vpi>/<vci>*

   For example, if your service provider assigns you a VPI/VCI of 0/33, enter:

   ProCurve(config-atm 1.1)# pvc 0/33

5. Define the ATM encapsulation. The default setting is **aal5snap**.

   Syntax: encapsulation aalsnap

   or

   Syntax: encapsulation aal5mux [ip | ppp]

   For example, to set the encapsulation to multiplexed AAL5 that encapsulates the packet at the IP header, enter:

   ProCurve(config-atm 1.1)# encapsulation aal5mux ip

6. Configure an IP address.

   Syntax: ip address *<A.B.C.D> <subnet mask | /prefix length>*

   For example, to set the IP address to 10.1.1.1 /24, enter:

   ProCurve(config-atm 1.1)# ip address 10.1.1.1 /24

7. Bind the physical interface—the ADSL interface—to the logical interface.

   Syntax: bind *<number> <physical interface> <slot>/<port> <logical interface> <logical interface number>*

   ProCurve(config-atm 1)# bind 1 adsl 2/1 atm 1

8. View the status of the ATM interface and subinterface.

   ProCurve(config-atm 1)# do show interface atm 1

   ProCurve(config-atm 1)# do show interface atm 1.1

N o t e   The **do** command allows you to enter enable mode commands (such as **show**
commands) from any context (except the basic mode context).

Configure RBE

Your ADSL service provider may ask you to configure the ATM subinterface
to use routed RBE, which routes IP over bridged Ethernet traffic. RBE is
sometimes referred to as "half bridging," because it provides some of the
advantages of bridging and some of the advantages of routing.

To use RBE, complete the steps for configuring ATM as outlined in "Configure
ATM Only" on page 7-57. When you configure the ATM subinterface, you need
to enter one additional command:

ProCurve(config-atm 1.1)# atm routed-bridged ip

When you view the running-config, this command should be listed under the
ATM subinterface, as shown in Figure 7-26.

```
interface adsl 2/1
  snr-margin 6
  training-mode G.DMT
  no shutdown

interface atm 1 point-to-point
  no shutdown
  bind 2 adsl 2/1 atm 1

interface atm 1.1 point-to-point
  no shutdown
  pvc 0/33
  encapsulation aal5snap              RBE is configured on the
  atm routed-bridged ip     ←         ATM subinterface.
  ip address  10.1.1.1  255.255.255.252
  bandwidth 896
```

Figure 7-26. Viewing the Running-config for an ADSL Connection Using RBE

Configure PPPoE

If your service provider wants you to configure PPPoE for your ADSL connection, complete these steps:

1. Create the ATM interface.

   Syntax: interface atm <*number*>

   ProCurve(config)# interface atm 1

2. Activate the interface.

   ProCurve(config-atm 1)# no shutdown

3. Create a subinterface for each PVC. ATM interfaces on the ProCurve Secure Router can support up to 16 PVCs.

   Syntax: interface atm <*number.sublink number*>

   ProCurve(config-atm 1)# interface atm 1.1

4. Configure a VPI/VCI for the subinterface. For example, if your service provider assigns you a VPI/VCI of 0/33, you would enter:

   Syntax: pvc <*vpi*>/<*vci*>

   ProCurve(config-atm 1.1)# pvc 0/33

5. Define the ATM encapsulation. For PPPoE, you must set the encapsulation at **aal5snap** or **aal5mux ppp**. The default setting is **aal5snap**.

   ProCurve(config-atm 1.1)# encapsulation aal5snap

   Syntax: encapsulation aal5snap

   or

   Syntax: encapsulation aal5mux [ip | ppp]

6. Bind the physical interface—the ADSL interface—to the logical interface.

   Syntax: bind <*number*> <*physical interface*> <*slot*>/<*port*> <*logical interface*> <*logical interface number*>

   ProCurve(config-atm 1)# bind 1 adsl 2/1 atm 1

7. View the status of the ATM interface and subinterface.

   ProCurve(config-atm 1)# do show interface atm 1

   ProCurve(config-atm 1)# do show interface atm 1.1

N o t e   The **do** command allows you to enter enable mode commands (such as **show** commands) from any context (except the basic mode context).

8. Create the PPP interface.

    Syntax: interface ppp <*number*>

    ProCurve(config)# interface ppp 1

9. Configure a static IP address or configure the interface to negotiate the IP address with the service provider's router.

    Syntax: ip address <*A.B.C.D*> <*subnet mask | /prefix length*>

    or

    Syntax: ip address negotiated

    For example, to assign the PPP interface a static IP address of 10.1.1.1 / 24, enter:

    ProCurve(config-ppp 1)# ip address 10.1.1.1 /24

10. Bind the PPP interface to the ATM subinterface.

    Syntax: bind <*bind number*> atm <*number.subinterface number*> ppp <*number*> pppoe-client

    ProCurve(config-ppp 1)# bind 2 atm 1.1 ppp 1 pppoe-client

11. View the status of the PPP interface.

    ProCurve(config-ppp 1)# do show interface ppp 1

12. View the running-config to ensure that you have entered two **bind** commands: one to bind the ADSL interface to the ATM interface and one to bind the ATM subinterface to the PPP interface. (See Figure 7-27.) Enter:

    ProCurve(config-ppp 1)# do show running-config

```
interface adsl 2/1
  snr-margin 6
  no shutdown
!
interface atm 1 point-to-point
  no shutdown
  bind 3 adsl 2/1 atm 1          ◀——    Bind the ADSL interface to the ATM interface
!
interface atm 1.1 point-to-point
  no shutdown
  pvc 0/35
!
interface ppp 3
  ip address  10.1.1.1  255.255.255.252
  no shutdown
  bind 4 atm 1.1 ppp 3 pppoe-client  ◀——   Bind the ATM subinterface to
                                            the PPP interface
```
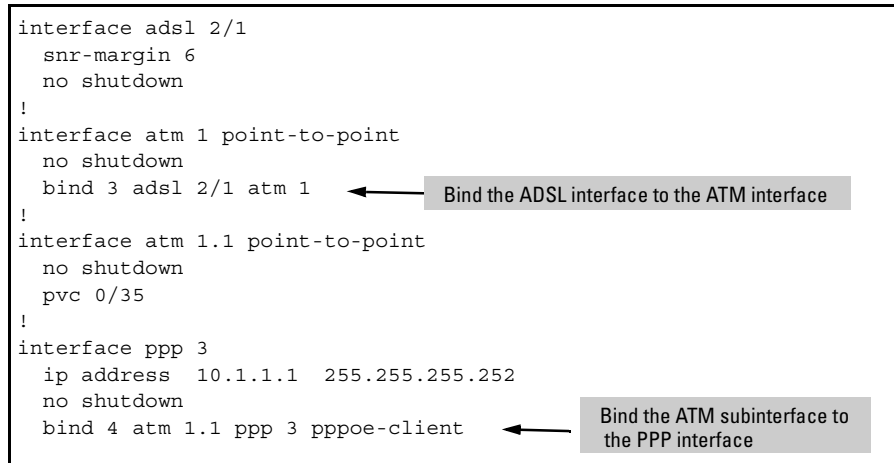
Figure 7-27. Using the show running-config Command to Check the Two bind Commands Required for PPPoE

Configure PPPoA

If your service provider wants you to configure PPPoA for your ADSL connection, complete these steps:

1. Create the ATM interface.

   Syntax: interface atm <*number*>

   ProCurve(config)# interface atm 1

2. Activate the interface.

   ProCurve(config-atm 1)# no shutdown

3. Create a subinterface for each PVC. ATM interfaces on the ProCurve Secure Router can support up to 16 PVCs.

   Syntax: interface atm <*number.sublink number*>

   ProCurve(config-atm 1)# interface atm 1.1

4. Configure a VPI/VCI for the subinterface. For example, if your service provider assigns you a VPI/VCI of 0/33, you would enter:

   Syntax: pvc <*vpi*>/<*vci*>

   ProCurve(config-atm 1.1)# pvc 0/33

5. Define the ATM encapsulation. For PPPoA, you must set the encapsulation at **aal5snap** or **aal5mux ppp**. The default setting is **aal5snap**.

   Syntax: encapsulation aal5snap

   or

   Syntax: encapsulation aal5mux [ip | ppp]

   For example, to use **aal5snap**, enter:

   ProCurve(config-atm 1.1)# encapsulation aal5snap

6. Bind the physical interface—the ADSL interface—to the logical interface.

   Syntax: bind <*number*> <*physical interface*> <*slot*>/<*port*> <*logical interface*> <*logical interface number*>

   ProCurve(config-atm 1)# bind 1 adsl 2/1 atm 1

7. View the status of the ATM interface and subinterface.

   ProCurve(config-atm 1)# do show interface atm 1

   ProCurve(config-atm 1)# do show interface atm 1.1

N o t e   The **do** command allows you to enter enable mode commands (such as **show** commands) from any context (except the basic mode context).

8. Create the PPP interface.

   Syntax: interface ppp <*number*>

   ProCurve(config)# interface ppp 1

9. Configure an IP address or configure the interface to negotiate the IP address with the service provider's router.

   Syntax: ip address <*A.B.C.D*> <*subnet mask | /prefix length*>

   or

   Syntax: ip address negotiated

   ProCurve(config-ppp 1)# ip address 10.1.1.1 /24

10. Bind the PPP interface to the ATM subinterface.

    Syntax: bind <*bind number*> atm <*number.subinterface number*> ppp <*number*>

    ProCurve(config-ppp 1)# bind 2 atm 1.1 ppp 1

11. View the status of the PPP interface.

    ProCurve(config-ppp 1)# do show interface ppp 1

View the running-config to ensure that you have entered two **bind** com-
mands: one to bind the ADSL interface to the ATM interface and one to
bind the ATM subinterface to the PPP interface. (See Figure 7-28.) Enter:

ProCurve(config-ppp 1)# do show running-config

```
interface adsl 2/1
  snr-margin 5
  no shutdown
!
interface atm 1 point-to-point
  no shutdown
  bind 1 adsl 2/1 atm 1        ◄────  Bind the ADSL interface to the ATM interface
!
interface atm 1.1 point-to-point
  no shutdown
  pvc 0/33
!
interface ppp 1
  ip address  10.1.1.1  255.255.255.252
  no shutdown
  bind 2 atm 1.1 ppp 1        ◄────  Bind the ATM subinterface to
                                      the PPP interface
```
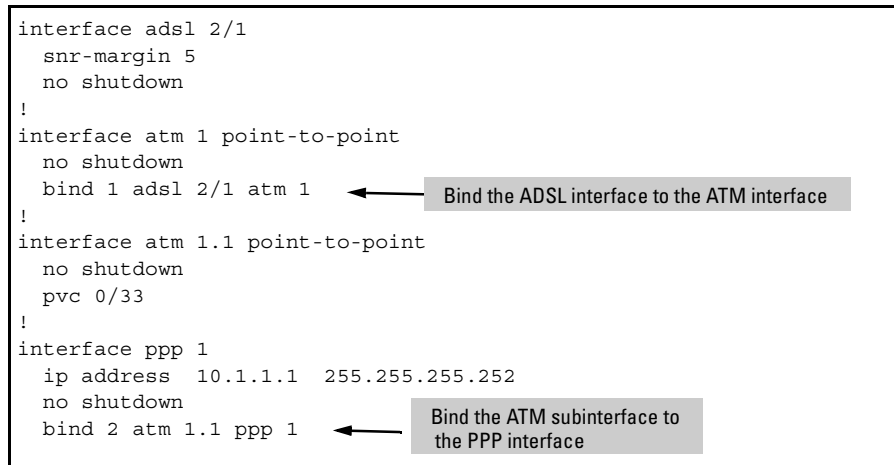
**Figure 7-28. Using the show running-config Command to Check the Two bind
Commands Required for PPPoA**