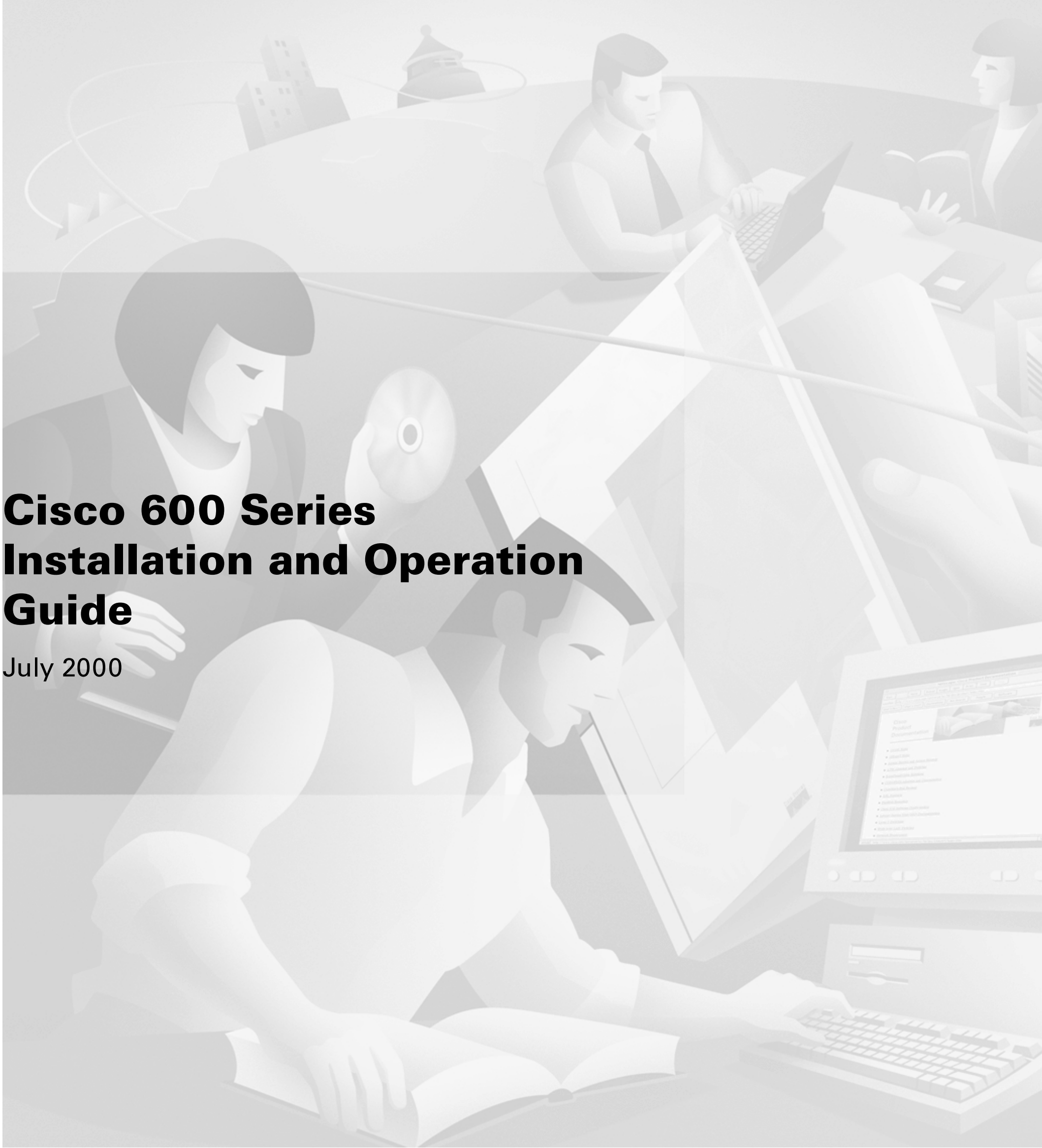

Cisco 600 Series Installation and Operation Guide

July 2000

Corporate Headquarters
Cisco Systems, Inc.
170 West Tasman Drive
San Jose, CA 95134-1706
USA
http://www.cisco.com
Tel: 408 526-4000
800 553-NETS (6387)
Fax: 408 526-4100

Customer Order Number: DOC-7811190=
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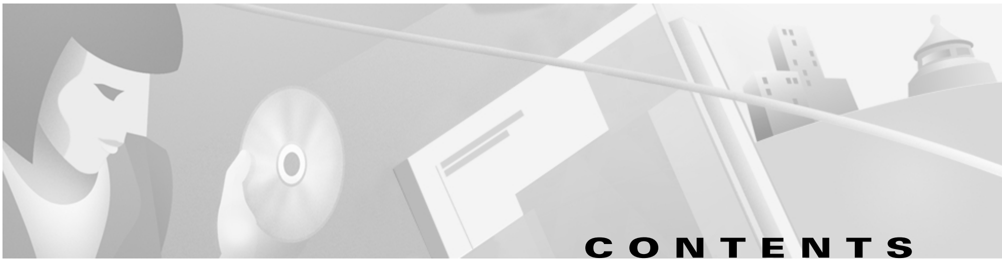

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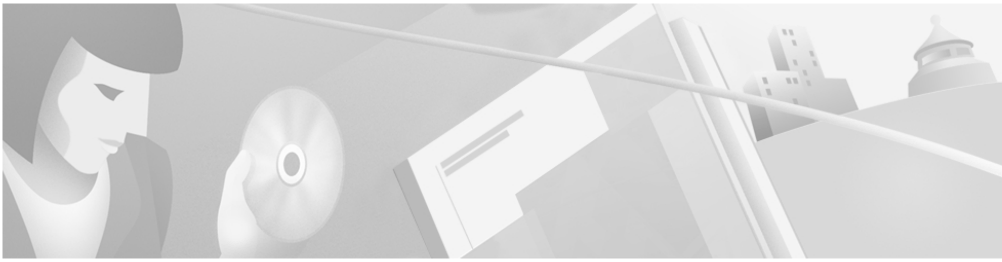

About This Manual

This manual, developed for system managers and network managers, contains information about installing, configuring, and operating the Cisco 600 series customer premises equipment (CPE) devices.

Document Objectives

The objectives of this manual are to describe all initial hardware installation and basic configuration procedures for the Cisco 600 series CPE devices.

Document Organization

This guide is organized into the following chapters and appendixes:

Chapter/ Appendix	Title	Topics Covered
Chapter 1	Overview of the Cisco 600 Series	Provides information on functions and features of the Cisco 600 series CPEs.
Chapter 2	Installation Procedures	Describes the installation procedures for the Cisco 600 series CPEs.

Chapter/ Appendix	Title	Topics Covered
Chapter 3	Configuration Procedures for the Cisco 627	Describes the steps for configuring the Cisco 627 for operation. This chapter also describes in detail how Cisco has implemented the Telnet, and Trivial File Transfer Protocol (TFTP) general applications for the Cisco 627.
Chapter 4	Configuration Procedures for the Cisco 633	Describes the steps for configuring the Cisco 633 for operation. This chapter also describes in detail how Cisco has implemented the Telnet, Syslog, and TFTP general applications for the Cisco 633.
Chapter 5	Configuration Procedures for the Cisco 67x CPE Devices	Describes the steps for configuring the Cisco 67x routers for operation. This chapter also describes in detail how Cisco has implemented the Telnet, Syslog, Remote Authentication Dial-In User Service (RADIUS), and TFTP general applications for these CPEs. This applies to the Cisco 673, Cisco 675, Cisco 675e, Cisco 676, Cisco 677, and Cisco 678.
Chapter 6	Troubleshooting	Contains information about known issues and how to resolve them.
Appendix A	Connectors	Provides details on the cables and connectors.
Appendix B	Specifications	Contains a list of physical, interface and operating specifications.
Appendix C	EZ-DSL Microfilter Specifications	Provides details on the EZ-DSL microfilter. This applies to the Cisco 627, Cisco 675, Cisco 675e, Cisco 676, Cisco 677, and Cisco 678 only.
	Glossary	Provides ADSL technology definitions.

Document Conventions

This publication uses the document conventions listed in Table 1, Table 2, and Table 3.

Table 1 Font Conventions

Convention	Definition	Sample
Times bold	Text body font used for arguments, commands, keywords, and punctuation that is part of a command that the user enters in text and command environments.	This is similar to the UNIX **route** command.
Times italic	Text body font used for publication names and for emphasis.	Refer to the *Cisco Broadband Operating System UserGuide* for further details.
`courier`	Example font used for screen displays, prompts, and scripts.	`Are you ready to continue?  [Y]`
`courier bold`	Example font used to indicate what the user enters in examples of command environments.	Login: **`root`**

Table 2 Command Syntax Conventions

Convention	Definition	Sample
vertical bars (|)	Separate alternative, mutually exclusive elements	**offset-list** {**in** | **out**} *offset*
square brackets ([ ])	Indicate optional elements	[**no**] **offset-list** {**in** | **out**} *offset*
braces ({ })	Indicate a required choice	**offset-list** {**in** | **out**} *offset*
braces within square brackets ([{ }])	Indicate a required choice within an optional element	[{*letter/number*}**Enter**]
boldface	Indicates commands and keywords that are entered literally as shown	[**no**] **offset-list** {**in** | **out**} *offset*
italics	Indicate arguments for which you supply values **Note** In contexts that do not allow italics, arguments are enclosed in angle brackets (< >).	**offset-list** {**in** | **out**} *offset*

Table 3 Note, Timesaver, Tip, Caution, and Warning Conventions

Convention	Description
Note ✎	Means *reader take note*. Notes contain helpful suggestions or references to material not covered in the manual.
Timesaver ⏱	Means *the described action saves time*. You can save time by performing the action described in the paragraph.
Caution ⚠	Means *reader be careful*. In this situation, you might do something that could result in equipment damage or loss of data.
Warning ⚠	Means *danger*. You are in a situation that could cause bodily injury. Before you work on any equipment, you must be aware of the hazards involved with electrical circuitry and familiar with standard practices for preventing accidents. To see translated versions of warnings, refer to the *Regulatory Compliance and Safety Information* document that accompanied the device.

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CHAPTER 1

Overview of the Cisco 600 Series

Purpose

This chapter provides an overview of the Cisco 600 series customer premises equipment (CPE) devices including the following CPE models:

- Cisco 627
- Cisco 633
- Cisco 673
- Cisco 675
- Cisco 675e
- Cisco 676
- Cisco 677
- Cisco 678

This chapter also describes the general applications available with the Cisco 600 series CPEs.

Note This chapter documents general product features available in the Cisco 600 series CPEs. Please refer to the *Release Notes for the Cisco Broadband Operating System* available on CCO for a current list of upgraded software features.

Product Description

The Cisco 600 series CPEs provide home connectivity to a digital subscriber line (DSL) service provider network over a DSL/ATM physical layer. Table 1-1 shows the maximum receive and transmit rates for the Cisco 600 series CPEs:

Table 1-1 Maximum Receive and Transmit Rates (kbps)

CPE Model/Encoding	Receive (Downstream)	Transmit (Upstream)
Cisco 627		
DMT[1]	8032	864
G.Lite	1536	512
G.DMT	8032	864
Cisco 633	1168	1168
Cisco 673	1168	1168
Cisco 675	7168	1088
Cisco 675e	7168	1088
Cisco 676	9200	832
Cisco 677		
DMT	8032	864
G.Lite	1536	512
G.DMT	8032	864
Cisco 678		
DMT	8032	864
CAP[2]	7168	1088
G.Lite	1536	512

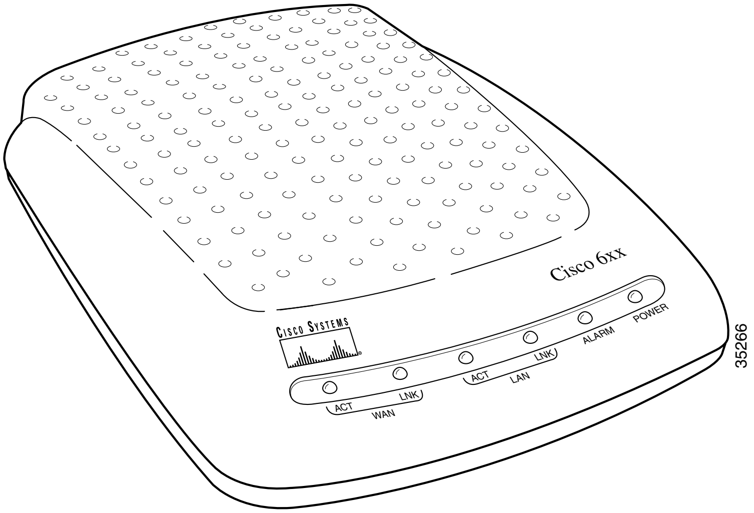
[1] Discrete Multi-Tone

[2] Carrierless Amplitude and Phase modulation

Note Despite the maximum transmission rates listed above, the actual maximum operative rate is determined by the service provider's central office (CO) equipment. Line length and line conditions can also have a great effect on transmission rate.

Figure 1-1 shows a front view of the generic Cisco 600 series CPEs.

Figure 1-1 Cisco 600 series CPEs



System Features

Hardware Features

Table 1-2 summarizes the hardware features of the Cisco 600 series CPEs.

Table 1-2 Cisco 600 Series CPE Hardware Features

Feature	627	633	673	675	675e	676	677	678
DMT Issue 1[1]-based ADSL physical layer						✓		
DMT Issue 2[2] (T1.413), G.Lite (G.992.2)-based ADSL physical layer	✓						✓	✓
SDSL[3] interface with 2B1Q line code		✓	✓					
CAP ADSL[4] interface				✓	✓			✓
G.DMT-based ADSL physical layer	✓						✓	
Serial interface with Frame Relay encapsulation		✓						
ATM25 interface	✓							
ATM cell delineation adherent to ITU-T I.432	✓	✓	✓	✓	✓	✓	✓	✓
Supports ATM Forum-compliant PVCs)	✓	✓	✓	✓	✓	✓	✓	✓
Autonegotiating 10BaseT or 100BaseTX Ethernet interface, compliant with IEEE 802.3 and 802.3u Fast Ethernet			✓	✓	✓	✓	✓	✓
Status LEDs indicating ATM25/Ethernet/Serial and ADSL/SDSL activity	✓	✓	✓	✓	✓	✓	✓	✓

[1] Discrete Multi-Tone Issue 1

[2] Discrete Multi-Tone Issue 2

[3] Symmetrical digital subscriber line

[4] Asymmetric digital subscriber line

Software Features

Table 1-3 summarizes the software standards supported by the Cisco 600 series CPEs.

Standards Compliance

Table 1-3 Standards Compliance

Standard	627	633	673	675	675e	676	677	678
DMT (ANSI T1.413) Issue 1						✓		
DMT (ANSI T1.413) Issue 2	✓						✓	✓
Point-to-Point Protocol (PPP) (RFC 1661)			✓	✓	✓	✓	✓	✓
*Multiprotocol Encapsulation over ATM Adaptation Layer 5 (*RFC 1483)	✓	✓	✓	✓	✓	✓	✓	✓
ATM Forum UNI Version 3.1 PVC	✓	✓	✓	✓	✓	✓	✓	✓
IEEE 802.3 and 802.3u 10BaseT and 100BaseTX Physical Layer Specification			✓	✓	✓	✓	✓	✓
IEEE 802.1d Transparent Learning Bridging		✓	✓	✓	✓	✓	✓	✓
PPP Bridging Control Protocol (BCP) (RFC 1638)			✓	✓	✓	✓	✓	✓
Splitterless ADSL Transceivers G.992.2	✓						✓	✓

[1] American National Standards Institute

Routing Support (Cisco 67x)

- *Internet Protocol* (RFC 791)
  - *User Datagram Protocol* (RFC 768)

  - *Internet Control Message Protocol* (RFC 792)
  - *Ethernet Address Resolution Protocol* (RFC 826)
  - RIP version 1 updating of routing tables
- Static routing
- *Remote Authentication Dial-In User Service (RADIUS) Security and Accounting* (RFC 2058, RFC 2059)
- Dynamic Host Configuration Protocol (DHCP) client and server
- Network Address Translation (NAT)

Bridging Support

- Transparent learning bridge:
  - *Multiprotocol Encapsulation over ATM Adaptation Layer 5 (*RFC 1483)
  - *PPP (Bridging Control Protocol)* (RFC 1638)
- Management channel support for remote configuration/management

Management

Table 1-4 summarizes the management methods supported by the Cisco 600 series CPEs.

Table 1-4 Management Methods

Management method	627	633	673	675	675e	676	677	678
HTML browser interface		✓	✓	✓	✓	✓	✓	✓
Command-line interface	✓	✓	✓	✓	✓	✓	✓	✓
Telnet support	✓	✓	✓	✓	✓	✓	✓	✓
TFTP[1]	✓	✓	✓	✓	✓	✓	✓	✓
SNMP[2] MIB[3] support				✓	✓	✓	✓	✓
Multilevel password protection	✓	✓	✓	✓	✓	✓	✓	✓
Enables different logins through serial management port	✓							

[1] Trivial File Transfer Protocol

[2] Simple Network Management Protocol

[3] Management Information Base

System Memory

The Cisco 600 series CPEs are equipped with 4 MB of DRAM.

Environmental Constraints

The Cisco 600 series CPEs operate in an ambient temperature environment of 32° to 104°F (0° to 40°C) and may be stored in an ambient temperature environment of –40°to 185°F (–40°to 85°C).

Note Electrical equipment generates heat. Ambient air temperature might not be adequate to cool equipment to acceptable operating temperatures without adequate circulation. Ensure that the room in which you operate the CPE has adequate air circulation.

Be careful not to block the air vents on the CPE.

Network Management and Security Applications

The Cisco 627 and Cisco 633 support the following network system management applications:

- Telnet server described in "Using Telnet" section on page 3-6.
- TFTP server described in "Using a Trivial File Transfer Protocol Server" section on page 3-10.

The general applications supported by the Cisco 673, Cisco 675, Cisco 675e, Cisco 676, Cisco 677, and Cisco 678 are:

- DHCP client and server
- NAT

- Ping
- RADIUS
- RIP
- SNMP
- SYSLOG client
- Telnet server
- TFTP server and client
- Traceroute
- Web server (HTTP server)

For more information on each of these applications, see the "Configure Applications" section on page 5-18.

CHAPTER 2

Installation Procedures

This chapter provides information about installing the Cisco 600 series CPE devices.

Installation Checklist

Table 2-1 lists the tasks to be completed when installing the Cisco 600 series CPE.

Table 2-1 Installation Checklist

Installation Procedures	Page Number
Unpack the Shipping Carton	2-2
Set Up the Hardware Environment:	
• Connect the Management Port to the PC's COM Port	2-4
• Configure the PC's COM Port	2-5
• Possible Configurations	2-5
• Connect Cables to the CPE	2-13
• Power On the CPE	2-18

Unpack the Shipping Carton

Check the shipping carton carefully to ensure that the contents include the items you ordered. You can identify the Cisco 600 series CPE by the product name on the top of the unit at the end with the LEDs.

The contents of your carton might vary depending on your service provider. Tables 2-2 and 2-3 show a list of the standard contents of a Cisco 600 series CPE shipment.

Table 2-2 Standard Shipment Contents

Contents	Description
Cisco 600 series CPE	Cisco DSL CPE for home/office use.
Quick Start for the Cisco 6xx	Quick start information for the specific Cisco 600 series CPE model.

Table 2-3 Standard Cables Shipped

Cable	627	633	673	675	675e	676	677	678
Power supply—Worldwide AC power adapter	✓	✓	✓	✓	✓	✓	✓	✓
ADSL/SDSL cable—RJ-11 telephone cable (14 ft)	✓	✓	✓	✓	✓	✓	✓	✓
ATM25 cable—Category 5 cable (6 ft)	✓							
Ethernet cable—Yellow Ethernet category 5 “no-hub” twisted pair crossover cable (6 ft)			✓	✓	✓	✓	✓	✓
SERIAL cable (Blue)—12-in-1 Smart Serial connector		✓						

If any items you ordered were not delivered, contact Cisco.

Hardware Requirements

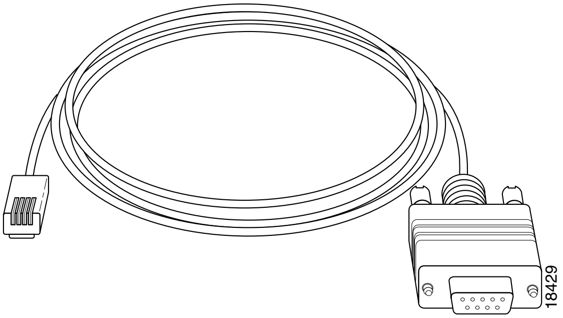
The following hardware is necessary to configure the Cisco 600 series CPE:

- PC with a standard terminal emulation program or a dumb terminal, with a DB-9 COM port.

Note If only a DB-25 serial port is available on the computer, a DB-9-male-to-DB-25-female adapter is also needed to connect the management cable to the computer.

- Management cable (RJ-45-to-DB-9) like the one in Figure 2-1 to connect the CPE to the PC or dumb terminal you will use to configure it. You can order one from Cisco or provide your own. See Appendix A, “Connectors” for information on connector pin assignments.

Figure 2-1 Management Cable



Set Up the Hardware Environment

This section describes how to connect the Cisco 600 series CPE.

Note Electrical equipment generates heat. Ambient air temperature might not be adequate to cool equipment to acceptable operating temperatures without adequate circulation. Ensure that the room in which you operate the CPE has adequate air circulation.

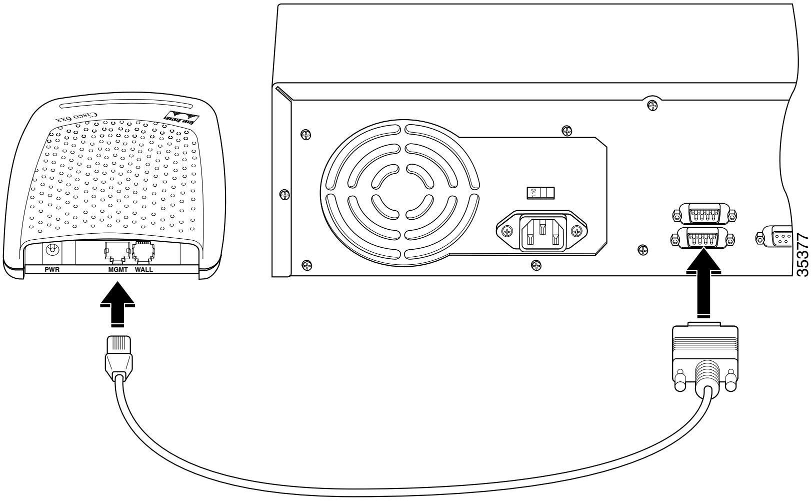
Be careful not to block the air vents on the CPE.

Connect the Management Port to the PC's COM Port

Step 1 Connect the RJ-45 connector on the management cable to the MGMT port on the CPE.

Step 2 Connect the other end of the management cable to the computer's COM port. If your computer is equipped only with a DB-25 serial port, you need a DB-9-male-to-DB-25-female adapter.

Figure 2-2 Cisco 600 series CPE Management Port Cabling



Configure the PC's COM Port

For the best access to the CBOS, use your terminal emulation program (such as HyperTerminal in Windows) to set your COM protocol to the following settings:

- Baud rate: 38400 bps recommended (standard 9600 bps possible)
- Data bits: 8
- Parity: None
- Stop bits: 1
- Flow control: None

Possible Configurations

This section shows you different ways of connecting your Cisco 600 series CPE to your telephone and computer equipment, depending on whether or not your telephone equipment is connected to a POTS splitter.

Table 2-4 shows the configurations that will work with each Cisco 600 series CPE model.

Table 2-4 Network Configurations

Configuration	627	633	673	675	675e	676	677	678
POTS Splitter	✓	✓	✓	✓	✓	✓	✓	✓
EZ-DSL (Splitterless)	✓			✓	✓	✓	✓	✓
Back-to-back (bridging mode only)		✓	✓					

Back-to-Back Cabling (Cisco 633 and Cisco 673 only)

You can connect two Cisco 633s or Cisco 673s in a “back-to-back” configuration. This allows one CPE to terminate the traffic of a second CPE without central office (CO) equipment. This configuration can be used as a low-cost solution for communicating between two locations at a distance greater than Ethernet’s

100-meter range. The two locations must be directly connected, for example, through some internally owned telephone system wiring in a campus-type environment.

Step 1 At the first location, connect one end of the SDSL cable into the WALL port on one of the Cisco 633 or Cisco 673 units. Connect the other end of the SDSL cable into the wall jack.

Step 2 At the second location, connect one end of the second SDSL cable into the WALL port of the second Cisco 633 or Cisco 673 unit. Connect the other end of the second SDSL cable into the wall jack.

Step 3 Configure the CPE that you want to terminate traffic to operate in CO mode and the other to operate in CPE mode. See the "Attention Back-to-Back Connection Users" section on page 4-5 for more information.

Note Back-to-back configuration works in bridging mode only.

POTS Splitter Configuration (Required for the Cisco 627)

A POTS splitter separates data signals from voice signals on your telephone line. The POTS splitter works by running a separate data line from the voice line, so that the CPE has a dedicated cable for data transmission. Figure 2-3, Figure 2-4, and Figure 2-5 show telephone equipment connected to a POTS splitter.

Figure 2-3 Cisco 627 Connected through an Internal POTS Splitter

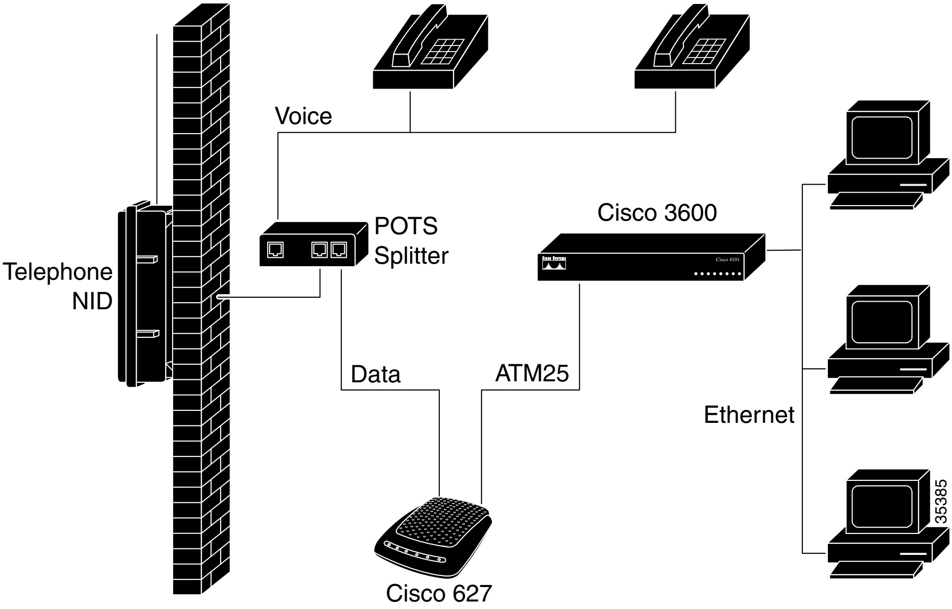


Figure 2-4 Cisco 633 Connected through an Internal POTS Splitter

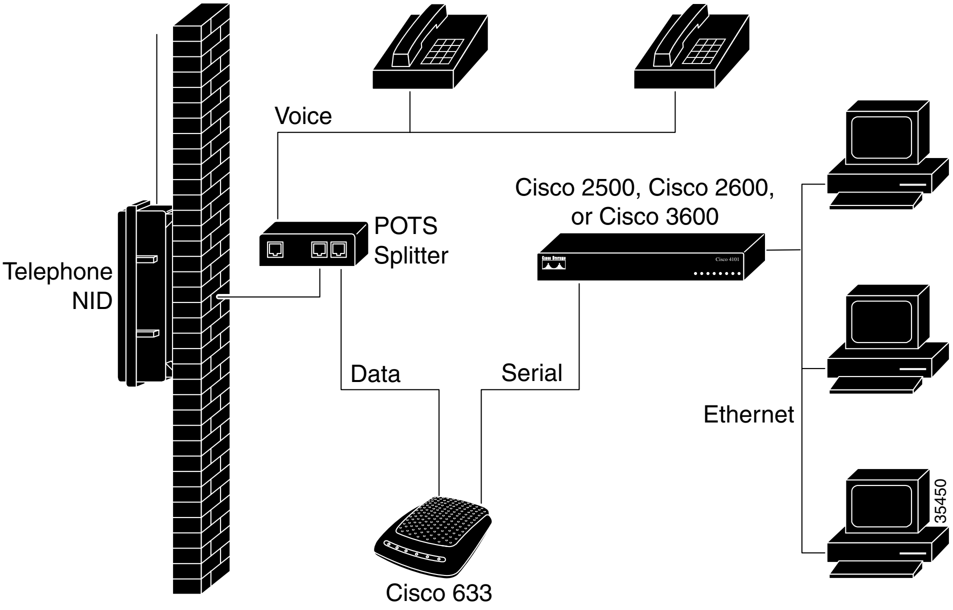
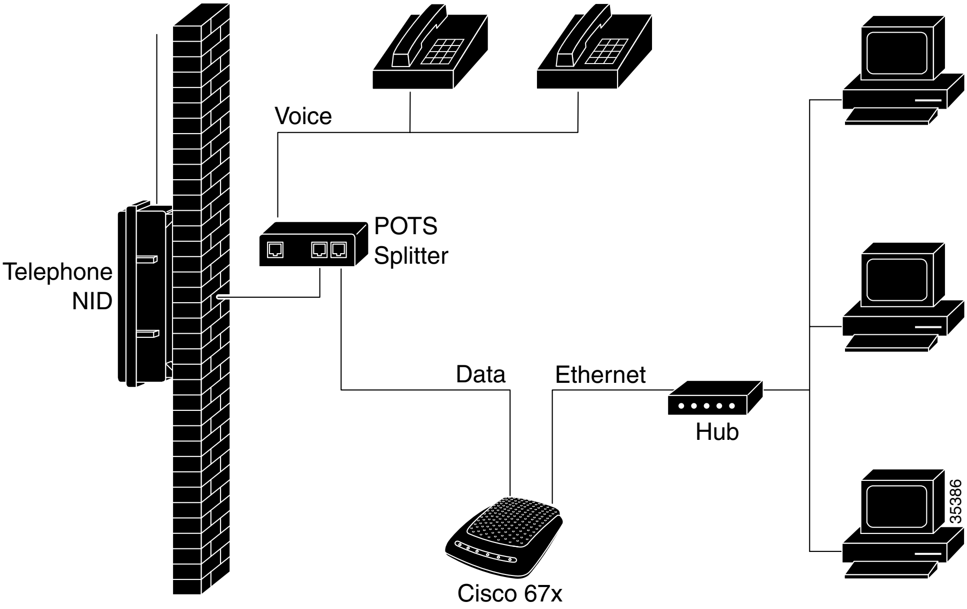


Figure 2-5 Cisco 67x Connected through an Internal POTS Splitter



Note The POTS splitter can also be installed adjacent to the telephone network interface device (NID) on the outside of the house.

EZ-DSL™ (Splitterless) Configuration

Note This configuration applies to the Cisco 627, Cisco 675, Cisco 675e, Cisco 676, Cisco 677, and Cisco 678 only.

In the EZ-DSL configuration, your telephone equipment is not connected to a POTS splitter. Without a POTS splitter and under certain circumstances, transient noise from a telephone can interfere with the router's operation, and the router can cause noise on the telephone line. To prevent this from happening, small microfilters must be connected to the telephone lines. If you implement an EZ-DSL configuration, your installation landscape should look similar to Figure 2-6, Figure 2-7, Figure 2-8, or Figure 2-9.

Figure 2-6 Cisco 627 Splitterless Configuration

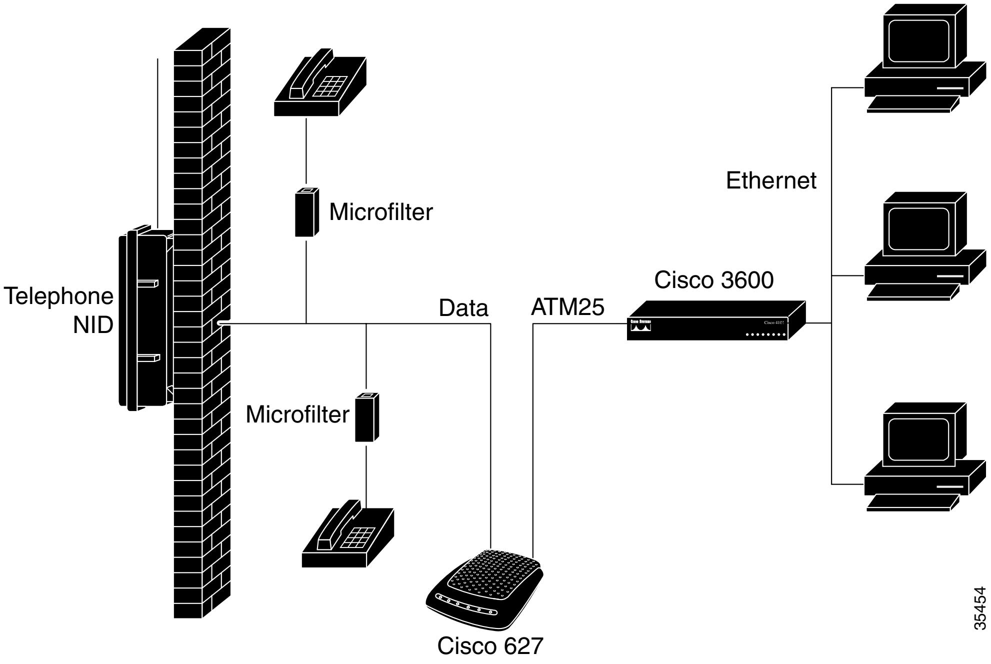


Figure 2-7 Cisco 675 Splitterless Configuration

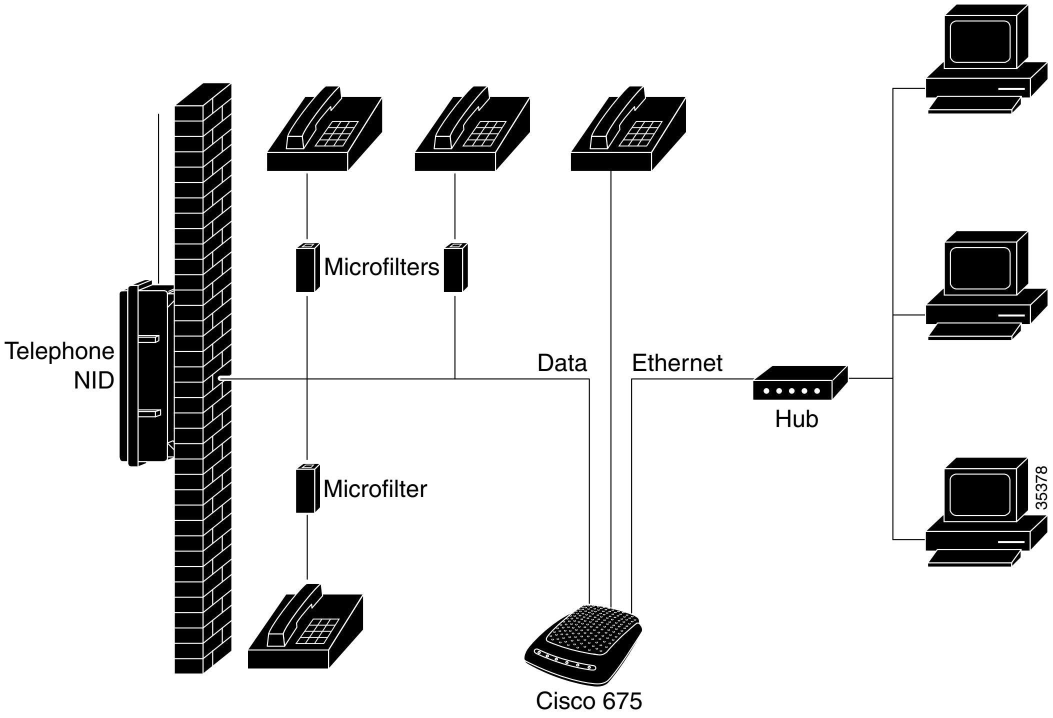


Figure 2-8 Cisco 675e, Cisco 676, Cisco 677 Splitterless Configuration

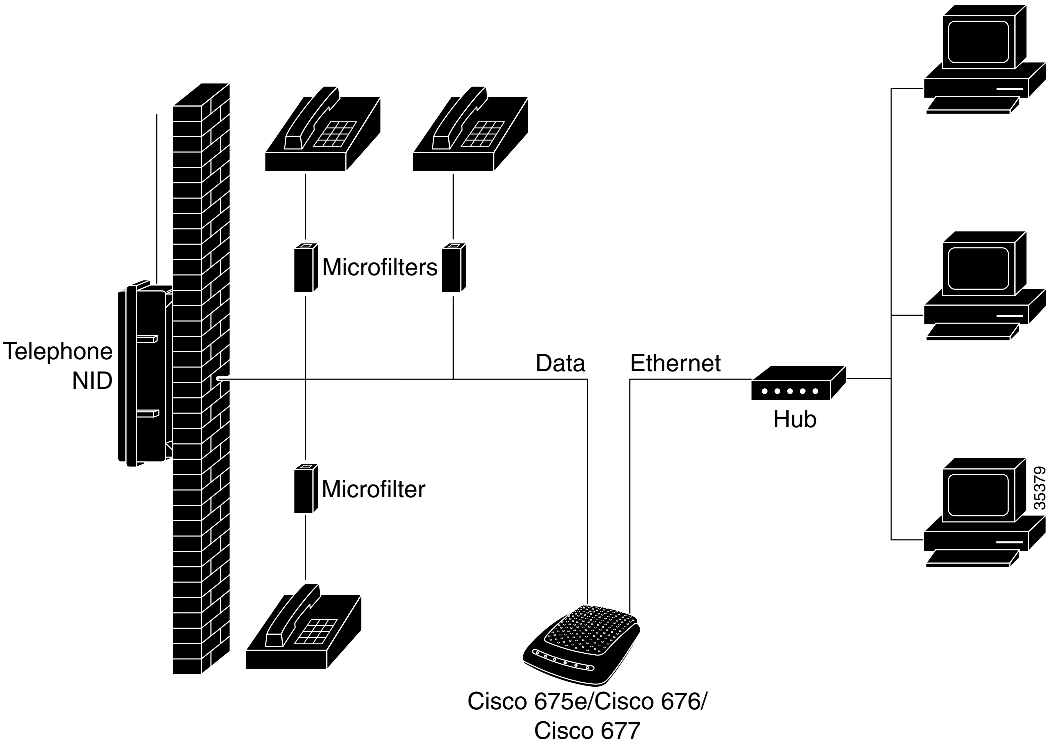
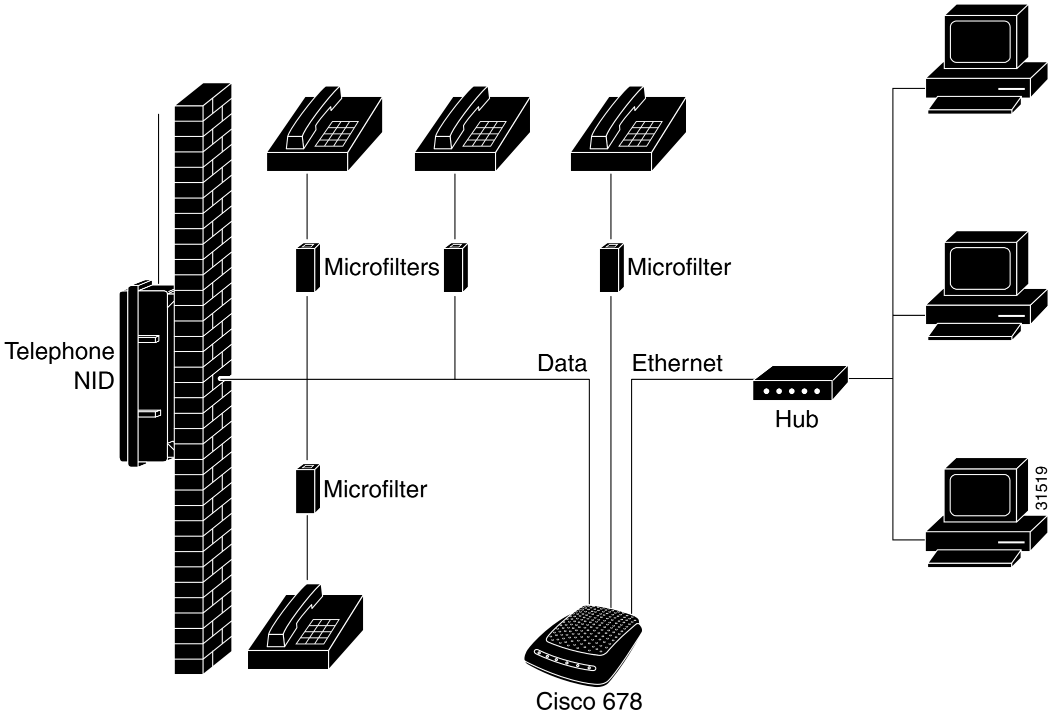


Figure 2-9 Cisco 678 Splitterless Configuration



Note The microfilters do not work if connected improperly. For connection instructions, see Appendix C, "EZ-DSL Microfilter Specifications."

Connect Cables to the CPE

This section describes how to connect cables to the CPE and to your telephone and computer systems.

Cabling Diagrams

Figures 2-10 through 2-13 show how to connect cables to the rear panels of Cisco 600 series CPEs.

Figure 2-10 Rear Panel Cabling for the Cisco 633

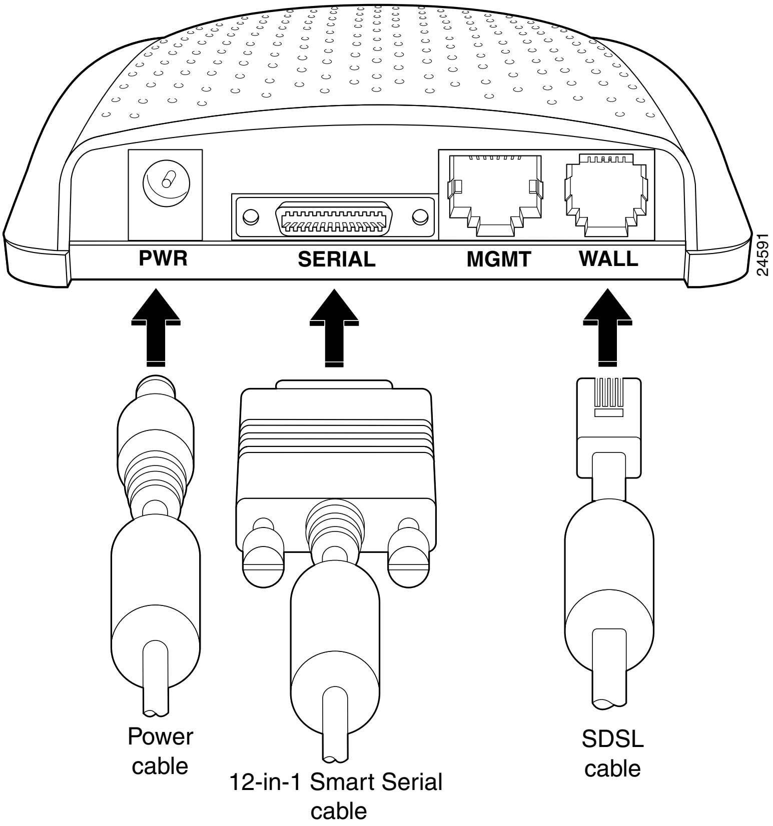


Figure 2-11 Rear Panel Cabling for the Cisco 627

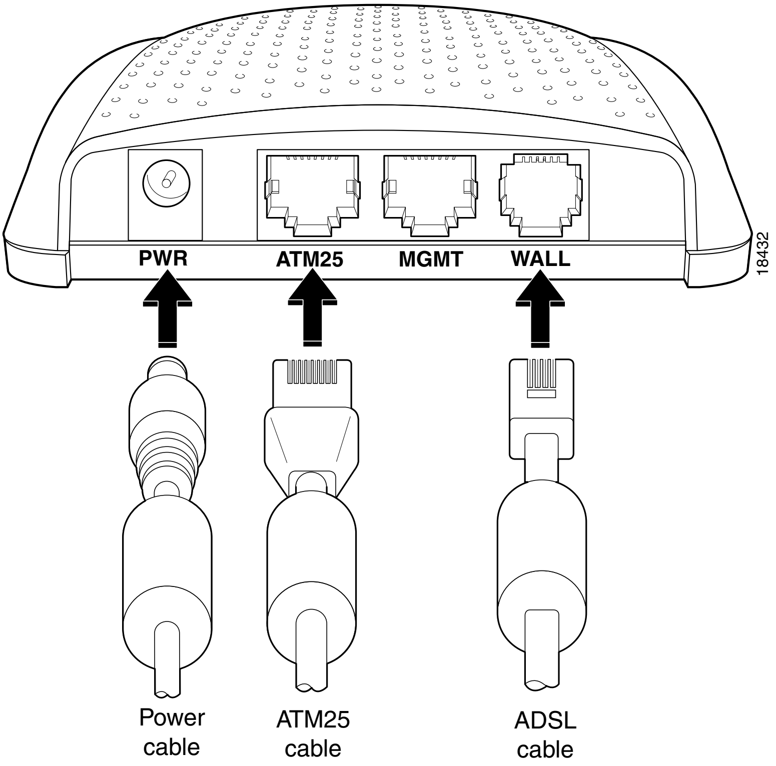


Figure 2-12 Rear Panel Cabling for the Cisco 673, Cisco 675e, Cisco 676, and Cisco 677

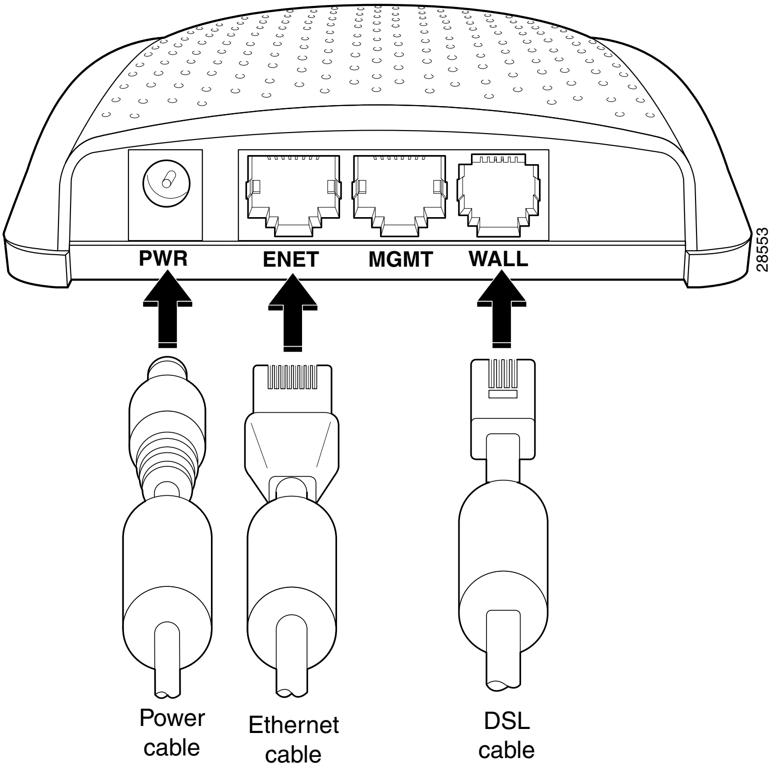
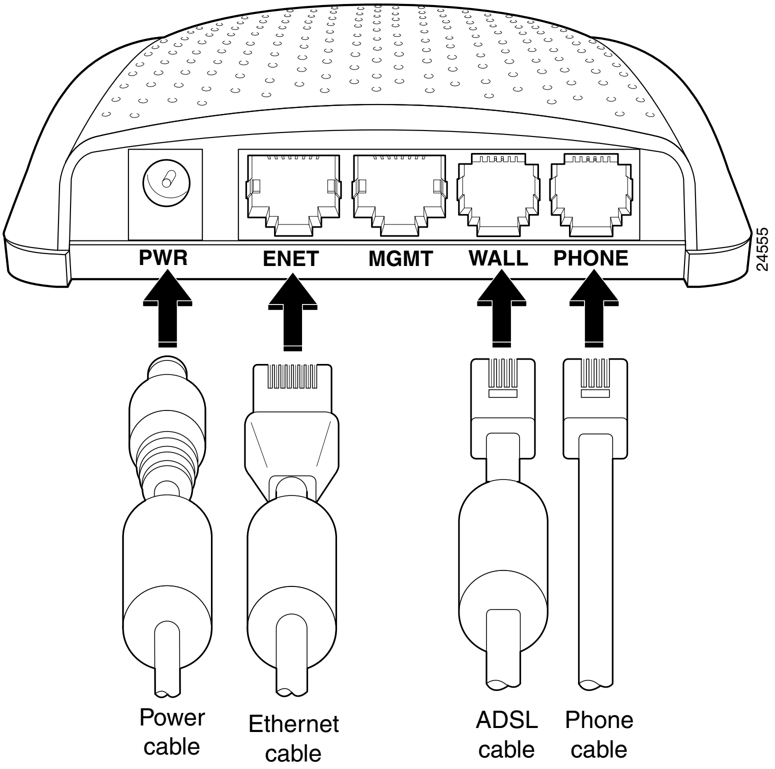


Figure 2-13 Rear Panel Cabling for the Cisco 675 and Cisco 678



Cabling Instructions

To connect the cables to the Cisco 600 series CPE:

Step 1 Plug the power cable into the back of the unit.

Step 2 Plug the network cable into the ATM25 port of the Cisco 627, or the ENET port of the Cisco 67x.

For the Cisco 633, connect one end of the serial cable to the SERIAL port. Connect the other end to your router.

For the Cisco 627, connect the other end of the network cable to your premises router, for example, a Cisco 3600 series router.

For the Cisco 67x, if the customer premises has only a single Ethernet-equipped computer, attach the Cisco 600 series CPE to the computer's Ethernet adapter with the crossover cable provided. Otherwise, connect the Cisco 600 series CPE Ethernet port to an Ethernet hub via a straight-through cable (not provided).

Step 3 Connect the telephone cable to the WALL port. Connect the other end of the telephone cable in the appropriate configuration as discussed in the "Possible Configurations" section on page 2-5.

Step 4 (Optional step for the Cisco 678) Plug the microfilter into the PHONE port. Then plug the telephone into the microfilter.

Note Never connect a telephone directly to the PHONE port of the Cisco 678; this affects the CPE's performance.

Step 5 (Optional step for the Cisco 675) Plug the telephone into the PHONE port. The telephone can be connected directly to the PHONE port of the Cisco 675 because it uses a built-in microfilter.

Power On the CPE

Step 1 Connect power to the Cisco 600 series CPE by plugging the power supply into an appropriate electrical outlet.

Note Use only the Cisco-approved power supply that shipped with the CPE as your power supply.

Note Cisco recommends that you unplug your CPE when you are not using it.

Step 2 When you have powered up the Cisco 600 series CPE, check that the Power LED is ON.

Step 3 If the Power LED is not lit, immediately remove the barrel power connector from the Cisco 600 series CPE. Refer to Chapter 6, "Troubleshooting," for information.

Note To power down the Cisco 600 series CPE, unplug the power supply cable from the Cisco 600 series CPE rear panel PWR connector.

Next Step

Now that you have installed and powered on your Cisco 600 series CPE, you must configure it.

To configure the Cisco 627, see Chapter 3, "Configuration Procedures for the Cisco 627."

To configure the Cisco 633, see Chapter 4, "Configuration Procedures for the Cisco 633."

To configure the Cisco 673, Cisco 675, Cisco 67e, Cisco 676, Cisco 677 or Cisco 678, see Chapter 5, "Configuration Procedures for the Cisco 67x CPE Devices."

Warnings and Cautions

Warning **To prevent dangerous overloading of the power circuit, read the label on the bottom of the Cisco 600 series CPE that indicates maximum power load ratings. Failure to follow these rating guidelines could result in a dangerous situation.**

Warning **Do not use this product near water; for example, near a bath tub, wash bowl, kitchen sink or laundry tub, in a wet basement, or near a swimming pool.**

Warning **Never install telephone wiring during an electrical storm.**

Warning **Never install telephone jacks in wet locations unless the jack is specifically designed for wet locations.**

Warning **Never touch uninsulated telephone wires or terminals unless the telephone line has been disconnected at the network interface.**

Caution Use caution when installing or modifying telephone lines.

Warning **Avoid using a telephone (other than a cordless type) during an electrical storm. There may be a remote risk of electric shock from lightning.**

Warning **Do not use a telephone to report a gas leak in the vicinity of the leak.**

Configuration Procedures for the Cisco 627

Introduction

This chapter provides information about configuring your Cisco 627. Your unit is preconfigured for full operation. However, you might need to configure the Cisco 627 for management virtual connections (VCs).

Configuration Checklist

Table 3-1 identifies the configuration procedures you might need.

Table 3-1 Checklist for Configuration

Configuration Procedures	Page Number
Log On to the Cisco Broadband Operating System	3-2
Configure Management Virtual Connections	3-3
Update the CBOS Prompt	3-18
Set Passwords	3-19
Save Configuration Changes	3-19
Evaluate System Activity and Performance	3-20
Retrieve Statistics	3-20

Log On to the Cisco Broadband Operating System

After connecting all cables to the Cisco 627 and powering it on, start the terminal emulation program and press the **Enter** key until the Cisco Broadband Operating System (CBOS) welcome screen appears. When you see the welcome screen, you can log on to CBOS.

```
Hello!
Expanding CBOS image...
CBOS v2.3.5.012 - Release Software

Password:
```

Determine the CBOS Version

After you log on to CBOS, you can use the **show version** command to determine the CBOS version of the Cisco 627:

```
cbos# show version
```

Operation Modes

CBOS also has two modes of operation: **exec** and **enable**. The CBOS defaults to **exec** mode when you log on. The **exec** mode grants read-only (command execution) privileges to a user.

To write changes to NVRAM, you must work in **enable** mode. To invoke **enable** mode:

Step 1 At the command line, enter:

```
cbos> enable
```

Step 2 Enter the enable password when CBOS prompts you:

```
Password:
```

Note If you have not set any passwords, press the **Enter** key when the system prompts you for a password.

Configure Management Virtual Connections

Your system comes preconfigured for full and immediate network operation. However, you might need to manage your Cisco 627 directly over the network. To do this, you must establish and set management virtual connections (VCs).

Note You must be in the **enable** mode to perform these procedures.

Each interface is expressed as atm*x*, where *x* is either 0 or 1. The atm0 interface is reserved for ATM25. The atm1 interface is used for the ADSL remote interface.

The valid range for VPI is 0 to 255. 0 to 65535 is the valid range for VCI addresses.

Note The Cisco 627 is configured with atm0 using VPI/VCI 0/34 by default. The atm0 interface is used for management. Cisco recommends that you do not change VPI/VCI values for atm0.

Changing VPI Settings

Step 1 To set the VPI number to 2, enter:

```
cbos# set interface atm1 vpi 2
```

Step 2 To begin using this connection with the new settings, enter:

```
cbos# set interface atm1 enable
```

Step 3 To verify your setting:

```
cbos# show interface atm1
```

A display similar to the following will appear on your screen:

```
atm1  RFC1483 Ethernet HWaddr 00:E0:D0:01:19:7F
      IP address 10.0.1.1 Mask 255.255.255.0
      MTU 1500 Metric 0
      RX packets 0 errors 0
      TX packets 0 errors 0
      Port is currently enabled with link status
      VCI 34          VPI 2
      Severely Errored Frame Count:0
       Data rate     6944 Kbps down;    480 Kbps up
       Line capacity 7456 Kbps down;    480 Kbps up
       SNR Margin       8 dB; previous    8 dB
       Attenuation   13.0 dB; previous 13.0 dB
Status:
   Last Self-Test Result:Not Available
   Modem Microcode:      0x1119be0d
Configured:
   Trellis Coding:          Enabled
   Echo Cancellation:      Disabled
   FDQ Adaptation:          Enabled
   Rate Adaptation:          Normal
   Overhead Framing:         Mode-3
   Bit-Swapping:           Disabled
   ATM Payload Scrambling: Disabled
   PGA-Cutback:                0 dB
Actual:
   FEC Redundancy Bytes:
      Interl. Path:   downstream:   16, upstream     0
         Fast Path:   downstream:    0, upstream     0
   Interleaver Depth: downstream:    0, upstream     0
   Trellis Coding:         Not-Used
   Echo Cancellation:      Not-Used
   FDQ Adaptation:           In-Use
   Overhead Framing:         Mode-0 (910 compatible)
   Bit-Swapping:           Not-Used
Last Line Fault:  NONE
ATM Statistics:
   Interleaved-Path Counters:
      HEC errors:                 0
      LOCD events:                0
   Fast-Path Counters:
      HEC errors:                 0
      LOCD events:                0
DSL Statistics:
   Superframes:                 956
   Corrected Superframes:         0  (+INF)
   Uncorrected Superframes:       0
   LOCD Retrains                  0
```

```
LOS Retrains:                  0
LOF/RFI Retrains:              0
ES Events:                     0
Time Trained (h:m:s)      0:00:16
   Trained...
```

Step 4 To save the new WAN port configuration, enter:

```
cbos# write
```

Step 5 To exit CBOS, enter:

```
cbos# quit
```

Note To close an ATM management connection, enter: **set interface atm***x* **disable**. To set the ATM25 management VPI, repeat the previous steps substituting **atm0** for **atm1**.

Changing VCI Settings

Step 1 To set the VCI number to 32, enter:

```
cbos# set interface atm0 vci 32
```

To verify your setting:

```
cbos# show interface atm0
```

A display similar to the following will appear on your screen:

```
atm0 RFC1483 Ethernet Hwaddr 00:E0:D0:01:19:7F
IP address 192.168.1.100 Mask 255.255.255.0
MTU 1500 Metric 0
RX packets 0 errors 0
TX packets 0 errors 0
Port is currently disabled with no link status
VCI 32          VPI 0
```

Step 2 To begin using this connection with the new settings, enter:

```
cbos# set interface atm0 enable
```

Step 3 To save the new WAN port configuration, enter:

```
cbos# write
```

Step 4 To exit CBOS, enter:

```
cbos# quit
```

Note To close an ATM management connection, enter: **set interface atm***x* **disable**. To set the ADSL ATM VCI, repeat the previous steps substituting **atm1** for **atm0**.

Using Telnet

Telnet provides a command-line interface for remote login connections between machines on many networks, including the Internet. To establish a Telnet connection to the CPE, Telnet must be enabled in CBOS.

Caution Before closing a Telnet connection, always enter **exit** or **quit** at the `cbos#` prompt.

Connecting from a Windows NT or Windows 95 Machine

Step 1 Click the **Start** button.

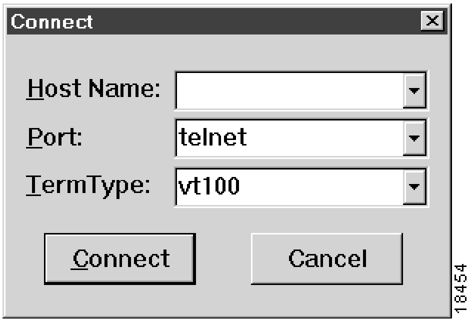
Step 2 Select the **Run...** option.

Step 3 When the Run box appears, enter **`telnet`** in the space provided.

Step 4 Click the **OK** button. The Connect menu appears.

Step 5 Select the **Remote System...** option from the Connect menu. The Remote System List Box appears. (See Figure 3-1.)

Figure 3-1 Remote System List Box



Step 6 Enter the atm0 IP address of your modem in the **Host Name** box and click **Connect**. The system then initiates a connection session. When connection is initiated, information similar to the following displays:

```
User Access Verification
Password:
```

Note Press the **Enter** key several times to establish a connection.

Step 7 Provide the logon and password information. After the system authenticates your password, you have access to the CBOS.

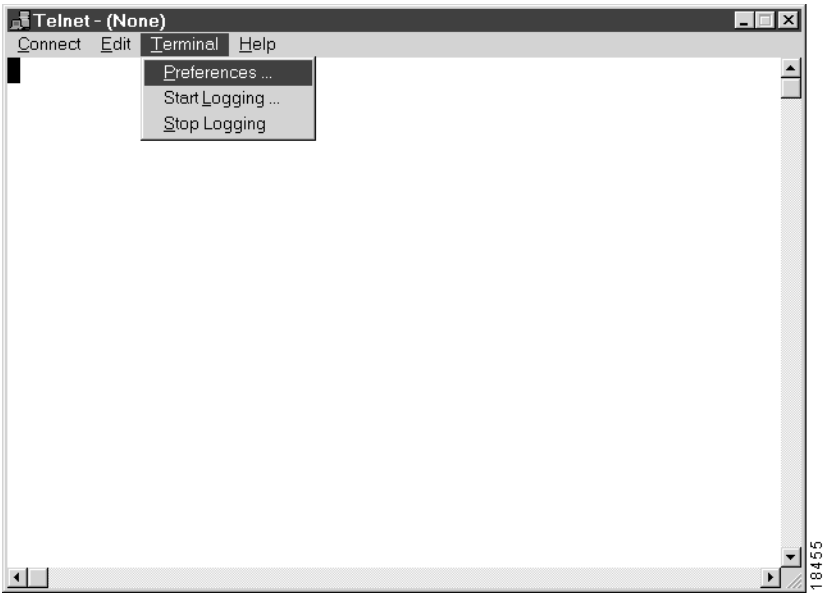
Note You can log on to the CPE using no password by pressing the **Enter** key at the password prompt. Refer to the "Set Passwords" section on page 3-19 for more information about how to set and change passwords.

Notice to Windows Users

Windows' Telnet client does not support NVT (Network Virtual Terminal) or any extra form of option negotiation. However, if you are going to use the Windows Telnet client, complete the following steps to set your terminal settings.

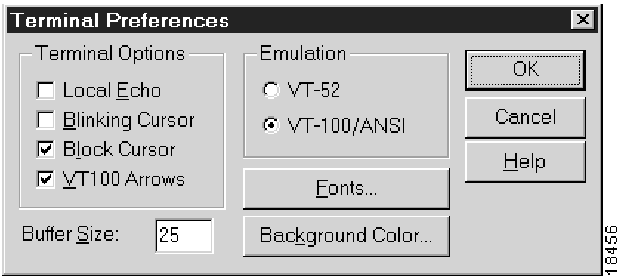
Step 1 When the Telnet window appears, go to the **Terminal** drop-down menu, and click **Preferences**. (See Figure 3-2.)

Figure 3-2 Telnet Preferences



Step 2 Set the terminal settings on the Terminal Preferences menu to the values shown in Figure 3-3.

Figure 3-3 Terminal Preferences


Terminal Preferences

Terminal Options
- □ Local Echo
- □ Blinking Cursor
- ☑ Block Cursor
- ☑ VT100 Arrows

Emulation
- ○ VT-52
- ● VT-100/ANSI

Buffer Size: 25

Notice to Linux Users

When you run Linux without installing the Term/Termcap database, the message **BAD ADDRESS** displays during a connection attempt. Use the original Linux installation disks to install the Term/Termcap database.

Connecting from a UNIX Machine

The following procedure describes how to log on to your modem from a UNIX system:

Step 1 Enter the following at your prompt:

```
telnet IP address of atm0
```

After you have connected, information similar to the following appears on your display:

```
Cisco Broadband Operating System
CBOS (tm) 2.3.5.012 - Release Software
Copyright (c) 1986-1999 by cisco Systems, Inc.
cbos>
```

Step 2 Provide the login and password information. After the system authenticates your password, you have access to CBOS.

How to Keep Telnet from Timing Out During Your Session

Telnet sessions time out after a period of inactivity. Enter the following commands to keep the Telnet client from timing out.

```
cbos# set telnet timeout off
cbos# write
```

The **set telnet timeout off** setting is not saved in NVRAM after a reboot. You must explicitly set it for every session.

Using a Trivial File Transfer Protocol Server

The Trivial File Transfer Protocol (TFTP) enables you to transfer files to and from your modem. Your system runs a **tftp** daemon that enables remote users who have TFTP client software, to transfer files to and from the system. The TFTP client is enabled and disabled from the CBOS or the Web Management Interface.

Caution For security reasons, Cisco recommends that you disable the TFTP application, except when uploading or downloading a file.

Software Updates

Use the TFTP utility to transfer a new software image from Cisco to your system, where the filename equals nsrouter.c627.*x*.ima, where *x* is the release number.

Versions of CBOS 2.3 or higher use the filename format c627.*x*.bin, where *x* is the release number.

Archives

Use the TFTP utility to back up a copy of your configuration file before changing it,

so you can easily recover the old file if necessary. The naming conventions for the configuration file are:

- When using the **put** option of the **tftp** command, you must name the file nscfg.cfg.
- When using the **get** option of the **tftp** command, name the file any name that a standard text editor can view and edit.

Using TFTP from a UNIX Machine

For information on the UNIX TFTP client, access the online manual on your UNIX system. At the command-line prompt, enter:

```
man tftp
```

The manual page for TFTP appears. The TFTP UNIX man page contains all the information you need to establish and invoke a remote TFTP session.

Using TFTP from a Windows NT Machine

Before attempting to use TFTP, make sure of the following:

- On the Cisco 627, TFTP is enabled and the IP address of the ATM*x* port is the same IP address used in Step 2 of the following procedure.
- The ATM*x* port is enabled, and the VCI/VPI is set correctly on it.
- The remote host computer must be configured for RFC 1483 Logical Link Control (LLC)/Subnetwork Access Protocol (SNAP) encapsulation if the PC is directly connected to the CPE through the atm0 interface, or verify the IP connectivity between the PC and the CPE.

To use TFTP:

Step 1 Start a DOS session and verify connectivity from the PC to the CPE. Enter:

```
C:>ping IP address
```

Step 2 Enter one of the following commands:

```
C:>tftp -i IP address put nsrouter software image filename
C:>tftp -i IP address put system configuration config filename
C:>tftp -i IP address put DSP firmware file name
```

where *IP address* is the IP address of the ATM*x* port.

Where necessary, implement the following options:

-i - Sets the transfer mode to binary mode.

put - Uploads a file to that IP address.

Note The CPE might take up to 2 minutes to upgrade the firmware. Wait until the management console reappears before rebooting the CPE.

Step 3 Be sure that you reboot the device to activate the new image. When you log back on to your system after the reboot, use the following command to verify the version of the firmware that is active:

```
cbos# show version
```

Notice to Windows 95 Users

Windows 95 does not have a TFTP client. If you want to utilize TFTP on a Windows 95 system, you must install a TFTP client from a third-party vendor on your system. One way to locate a TFTP client is to use an Internet search engine to locate a vendor who sells a TFTP client. Some TFTP clients are provided as share or freeware on the Internet. By request, Cisco will provide a TFTP client.

Upgrade Software through Serial Download

You can upgrade software on your CPE using the serial interface:

Step 1 Enter the following settings through a serial console connected to your system:
38.4 Kbaud
No parity
8 data bits
1 stop bit
No flow control

Step 2 To turn debug monitor on, enter:

```
debug monitor on
```

Step 3 To save your changes, enter:

```
write
```

Step 4 To reboot the device, enter:

```
reboot
```

After the modem reboots, press **Enter** twice. The prompt should change to =>.

Step 5 To erase sector 0, enter:

```
es 0
```

Repeat this step for sectors 1 through 5.

Step 6 To start serial download, enter:

```
df 10008000
```

Step 7 Use a terminal emulation application, such as Hyperterminal, to start an Xmodem download of a new Cisco 67x image.

Step 8 When the download is complete, the following message appears:

```
Transferred xxxxxxxx bytes
```

Record the number of bytes transferred.

Step 9 To program the area of memory to Flash, enter:

```
pb 10008000 fef00000 xxxxxxxx
```

where *xxxxxxxx* is the value recorded in Step 6.

Step 10 To turn debug monitor off, enter:

```
m0
```

Step 11 To reboot, enter:

```
rb
```

Configure Line Coding

The Cisco 627 allows you to choose transmission protocols to match your network configuration by changing the CPE's configuration file and operating system. You will use the TFTP to transfer files to and from the CPE. This section describes procedures to configure the Cisco 627 for G.Lite and G.DMT protocols.

Note Changes to your CPE must be coordinated with the central office equipment.

Configure for DMT2

Step 1 Verify the connection from the router to the location where the correct software image is stored. This location is provided by your service provider. Typically, you use the **ping** command for this step.

Step 2 Enable TFTP by entering:

```
cbos#set tftp enabled
TFTP is enabled
```

Step 3 Set the remote address for the TFTP host computer by entering:

```
cbos # tftp remote ip address
```

This command tells the CPE to accept TFTP transfers from a specific IP address. An example remote IP address would be *192.168.35.4*. This address is an example only; do not use it to configure the router.

Note If you do not have the CPE address, consult your network administrator.

For more information about TFTP, see "Using a Trivial File Transfer Protocol Server" section on page 3-10.

Step 4 To start the file transfer from a PC, start a DOS session and enter the following command:

```
C:>tftp -i CPE IP address put image_filename
```

To start the file transfer from a UNIX machine, enter the following commands:

```
root@staten-</6xx>tftp
tftp> mode binary
tftp> put CPE IP address:image_filename
Sent 922294 bytes in 54.9 seconds
```

Where necessary, implement the following values:

-i Sets the transfer mode to binary mode

get Downloads a file to a specified IP address

put Uploads a file onto that IP address

Substitute the filename for the software image update. See the latest *Release Notes for the Cisco Broadband Operating System* available on CCO for the appropriate filenames to use.

Caution Do not turn off the power to the router until after the file transfer is completed.

Step 5 Be sure to reboot the CPE to activate the new image. When you log back in to the CPE after the reboot, use the **show version** command to verify the version of the firmware that is active. Note the DMT firmware version.

Sample Output of Configuration Session for DMT2

```
cbos#set tftp enabled
TFTP is enabled

cbos#tftp image TFTP_server_IP_address image_filename
Starting download...
        Downloading in progress...... done.
        Saving image..........done.
        Please reboot the CPE for the new downl
cbos#reboot
Hello!
C6xx self-update code: Release 2.3.5.012
NOTE: Do not power off router until update is finished!

Decompressing router...
Erasing FLASH......
Programming...
Decompressing monitor...
Erasing FLASH.........
Programming...
```

```
Finished.  Rebooting...
Hello!
Expanding CBOS image...
CBOS v2.3.5.012 - Release Software

User Access Verification
Password:

cbos>enable
Password:

cbos#show version

Cisco Broadband Operating System
CBOS (tm) 627 Software (C627-I-M), Version v2.3.0.053, RELEASE
SOFTWARE
Copyright (c) 1986-1999 by cisco Systems, Inc.
Compiled Feb 13 2000 17:36:16
Monitor build  111 (Feb 13 2000 17:37:07)
```

Configure for G.DMT

Before the CPE can be configured for G.DMT, the **.full** image must be loaded. See the latest *Release Notes for the Cisco Broadband Operating Sytsem* for the appropriate filenames to use. The central office hardware must be correctly configured to accept a G.DMT service user.

Step 1 Enter the following command:

```
cbos# set interface atm1 standard g.992.1
```

Step 2 Be sure to retrain the CPE to activate the new line code. When the CPE is retrained, use the **show interface atm1** command to verify the G.DMT standard is active. Note that the standard configuration for the **.full** image is DMT2.

Note Changes made to the running configuration must be written to NVRAM for changes to be seen on reboot.

Sample Output of Configuration Session for G.DMT

```
cbos#set interface atm1 standard
SET INTERFACE WANx STANDARD requires one of the following arguments
T1.413
G.dmt (G992.1)

cbos#set interface atm1 standard g.992.1
Note:  Change will take effect on next retrain.

cbos#show interface atm1
atm1 ADSL Physical Port
       Line Trained
Actual Configuration:
  Overhead Framing:          3
  Trellis Coding:            Disabled
  Standard Compliance:       g.992.1
  Downstream Data Rate:      8032 Kbps
  Upstream Data Rate:        864 Kbps
  Interleave S Downstream:   1
  Interleave D Downstream:   64
  Interleave R Downstream:   2
  Interleave S Upstream:     4
  Interleave D Upstream:     8
  Interleave R Upstream:     16
  Modem Microcode:           G96
  DSP version:               0
  Operating State:           Showtime/Data Mode
Configured:
  Echo Cancellation:         Disabled
  Overhead Framing:          3
  Coding Gain:               Auto
  TX Power Attenuation:      0dB
  Trellis Coding:            Enabled
  Bit Swapping:              Disabled
  Standard Compliance:       Multimode
  Remote Standard Compliance:g.992.1
  Tx Start Bin:              0x6
  Tx End Bin:                0x1f
  Data Interface:            Utopia L1
Status:
  Local SNR Margin:          3.5dB
  Local Coding Gain:         0.0dB
  Local Transmit Power:      12.5dB
  Local Attenuation:         28.5dB
  Remote Attenuation:        18.5dB
Local Counters:
  Interleaved RS Corrected Bytes:        0
  Interleaved Symbols with CRC Errors:   2
  No Cell Delineation Interleaved:       0
  Out of Cell Delineation Interleaved:   0
  Header Error Check Counter Interleaved:0
  Count of Severely Errored Frames:      0
  Count of Loss of Signal Frames:        0
Remote Counters:
  Interleaved RS Corrected Bytes:        0
  Interleaved Symbols with CRC Errors:   0
  No Cell Delineation Interleaved:       0
  Header Error Check Counter Interleaved:0
  Count of Severely Errored Frames:      0
  Count of Loss of Signal Frames:        0
```

Update the CBOS Prompt

The default Cisco 627 system prompt is `cbos#`. The command prompt is limited to 8 characters. You can change this prompt to a unique subscriber identifier as shown in the following example.

Step 1 Log on to the CBOS using either the serial or Telnet interfaces. Refer to the "Using Telnet" section on page 3-6 for more information on how to use Telnet to log on to the CBOS.

Step 2 To change the default prompt to 4412883 as the subscriber identifier, enter:

```
cbos# set prompt 4412883
4412883#
```

Step 3 To save your changes, enter:

```
4412883# write
```

Step 4 To exit the CBOS, enter:

```
4412883# quit
```

Set Passwords

After you have configured your system, you should pick new passwords for both the **enable** and **exec modes**. Keep in mind that the **enable** mode provides all the functionality of a system administrator for the CPE. Examples of good and bad passwords are:

- Good Password—77ta99y (Do not use the sample password.)
- Bad Passwords—Passwords such as your name; or your street address, or home telephone number are too predictable.

Use the **set password** command to change both the enable and exec passwords as in the following:

Step 1 To change the password enter:

```
cbos# set password mode new password
```

Example:

```
    set password enable 33Low44PassMe
    set password exec 44High55Pass
```

Step 2 To save your changes, enter:

```
cbos# write
```

Step 3 To exit CBOS, enter:

```
cbos# quit
```

Save Configuration Changes

Use the **write** command to save any changes you have made during provisioning to the NVRAM configuration file:

```
cpe627# write
```

⚠ **Caution** If you do not use the **write** command after changes, all the changes you made during your current session will be lost when you reboot the Cisco 627.

Evaluate System Activity and Performance

Table 3-2 describes the LEDs and their status.

Table 3-2 Status LEDs

LED Label	Full Name	Description
WAN-LNK	WAN Link	When this light is ON, it indicates that a link has been established on the WAN port. The WAN-LNK light blinks steadily during ADSL line training activities. When the light is solid, the system is connected and trained.
WAN-ACT	WAN Activity	When this light blinks, it indicates that the WAN port is transmitting or receiving data.
LAN-LNK	ATM25 LAN Link	When this light is ON, it indicates that a link has been established on the ATM-25 port. **Note** For some ATM-25 routers or NICs, this light may not be on till data is sent to the modem.
LAN-ACT	ATM25 LAN Activity	When this light blinks, it indicates activity on the ATM-25 port.
PWR	Power Light	When this light is Green, the system is ON and working correctly.
ALARM	Alarm Light	When the light is Red, the system is ON but indicates a problem that needs to be resolved.

Retrieve Statistics

The **stats** command shows information about the number of packets transmitted and received and activity information about general applications.

To retrieve statistics:

Step 1 To see a list of variables, enter:

```
cbos# stats
```

Step 2 To display specific statistics, enter:

```
cbos# stats variable from list
```

Step 3 To exit the CBOS, enter:

```
cbos# quit
```

Interpret Statistics

Use the **stats atm0** and **show interface atm1** commands to retrieve key statistics regarding ADSL performance. These statistics are:

- CRC Errors—Number of CRC errors. CRC errors might occur when the ATM traffic rate is faster than the ADSL rate, causing ATM cells to be dropped. This corrupts the AAL5 logical packets. CRC errors might also be an indication of excessive noise on the DSL line.
- Errored Seconds—Number of Superframe CRC errors. If this field is incremented, the user data path is encountering uncorrected errors.
- Rx'ed Blocks—Number of blocks received by the unit. A block is 250 milliseconds. This statistic is reset whenever the modem trains.
- Tx'ed Blocks—Number of blocks transmitted by the unit. A block is 250 milliseconds. This statistic is reset whenever the modem trains.
- Corrected/Uncorrected Blocks—The modem can correct a block containing errors. If the block correction fails, the block is counted as an uncorrected block and discarded.
- Attenuation—Difference in decibels (dB) between the power level received at the near end versus the power level transmitted from the far end. The attenuation range is 0 to 63 dB in 1 db increments. Attenuation is calculated every 10 seconds.

- Signal-to-Noise (SNR) Margin—Amount of increased received signal noise (in decibels) relative to the signal noise power level the unit is designed to tolerate without disconnecting from the network. The SNR Margin range is -64.0 to +63 dB in 1 dB increments. SNR Margin is calculated every 10 seconds. The previous value is moved to the Previous SNR Margin field.
- Previous SNR Margin—Last SNR Margin measurement, which occurs approximately every 10 seconds.
- Operation, Administration, Maintenance (OAM) Loopback Cells—The Cisco 627 supports the Operation, Administration, and Maintenance (OAM) F5 loopback cell to verify end-to-end ATM network connectivity. The OAM-F5 loopback cell is generated by a network-side system. The cell is injected into a specific virtual circuit along with the normal user traffic flow. The cell is carried unmodified by each intermediate ATM switching node until it arrives at the circuit's other endpoint such as the Cisco 627. The receiving endpoint modifies the cell payload to indicate that the cell has been looped back and transmits this new cell back into the ATM circuit. It is relayed by each intermediate node until it arrives at the original transmitting endpoint. The receipt of this cell indicates a valid end-to-end connection between the two endpoints over the intervening ATM network.

CHAPTER 4

Configuration Procedures for the Cisco 633

Introduction

This chapter provides instructions for configuring the Cisco 633 SDSL modem. Configuration procedures vary depending on how your Cisco 633 is configured when shipped. You must be in **enable** mode to perform these configuration procedures.

Note Cisco recommends that only one command-line application at a time be used to configure the Cisco 633. For example, Telnet and the serial management interface should not be used simultaneously.

Checklist

Table 4-1 Checklist for Configuration

Configuration Procedures	Page Number
Log on to Cisco Broadband Operating System	4-2
Configure Interworking	4-3
Configure the Cisco 633 for Remote Management	4-4

Table 4-1 Checklist for Configuration (continued)

Configuration Procedures	Page Number
Configuring External Routers	4-6
Upgrade Software through Serial Download	4-6
Update the CBOS Prompt	4-8
Set Passwords	4-8
Save Configuration Changes	4-9

Log on to Cisco Broadband Operating System

After connecting all the cables to the Cisco 633 and powering it on, start the terminal emulation program and press the **Enter** key until the CBOS login screen appears. When you see the welcome screen, you can log on to CBOS.

```
Hello!
Expanding CBOS image...
CBOS v2.3.5.012

User Access Verification
Password:
```

Note If you have not set any passwords for the Cisco 633, press the **Enter** key when the system prompts you for a password to enter CBOS.

Determine the CBOS Version

After you log on to CBOS and before proceeding any further with your configuration process, check the version of CBOS to verify that the version number and date reflect the most recent firmware update:

```
cbos> show version
```

If the CBOS version is earlier than 2.2.0, get the latest version from Cisco. See the Trivial File Transfer Protocol (**tftp**) command in the *Cisco Broadband Operating System User Guide* for more information on how to update the Cisco 633 firmware. You can also update the CBOS version through the management port also.

Operation Modes

CBOS implements two operational modes: **exec** and **enable**. CBOS defaults to **exec** mode when you log in. The **exec** mode grants program execution (read-only) privileges to a user. To read or write changes to nonvolatile random-access memory (NVRAM), you must work in **enable** mode. To invoke the **enable** mode:

Step 1 At the **exec** mode command-line prompt, enter:

```
cbos> enable
```

Step 2 Enter a password when CBOS prompts you:

```
cbos> enable
Password:
```

Note If you have not set any passwords for the Cisco 633, press the **Enter** key when the system prompts you for a password to enter CBOS. If you have not preset a password, you can still log on to CBOS.

You are now in **enable** mode. The system prompt appears:

```
cbos#
```

Configure Interworking

To translate from Frame Relay (FR) to ATM, you must first configure an IWF data path.

Step 1 Close the virtual WAN port for which you are creating an IWF:

```
set int wan0-1 close
```

Step 2 Configure a Data Link Connection ID (DLCI) on the FR (serial) network:

```
set int serial0-1 dlci 17
```

Note Enter a DLCI range between 16 and 1007.

Step 3 Repeat steps 1 and 2 to create multiple IWF data paths.

Step 4 Write the changes to Non-Volatile Read Only Memory (NVRAM):

```
write
```

Step 5 Reboot the Cisco 633:

```
reboot
```

Configure the Cisco 633 for Remote Management

Remote management allows you to configure the Cisco 633.

Note The WAN0-0 and SER0-0 interfaces are reserved for remote management.

Step 1 Close the WAN0-0 port:

```
set int wan0-0 close
```

Step 2 Decide which side of the network you are on, either the FR network (SER0-0) or the ATM (WAN0-0) network. The following steps show configuration for the ATM network.

Step 3 Configure an IP address for the WAN0-0 interface:

```
set int wan0-0 ip 10.0.1.0
```

Step 4 Configure a netmask address for the WAN0-0 interface:

```
set int wan0-0 mask 255.255.255.0
```

Step 5 Add a static IP route to and from the remote network. This allows data to pass between your Cisco 633 and the remote network.

```
set route add ip x.x.x.x gw wan0-0
```

where *x.x.x.x* is the static IP route to and from the remote network.

Note You must add a static route or you will not be able to pass data.

Step 6 To Telnet to the Cisco 633, enable the Telnet application:

```
set telnet enabled
```

Step 7 To use the Trivial File Transfer Protocol (TFTP) to transfer files to and from the Cisco 633, enable the TFTP application:

```
set tftp enabled
```

Step 8 To save your changes, enter:

```
write
```

Step 9 To reboot the CPE, enter:

```
reboot
```

The Cisco 633 is now configured for remote management. Now the FR router (for example, a Cisco 1600) needs to be configured to pass management data. See the following section for more information.

Attention Back-to-Back Connection Users

The back-to-back configuration between two Cisco 633 units allows one Cisco 633 to act as CO equipment and terminate traffic initiated by another Cisco 633.

Step 1 Cable the two Cisco 633s. See the "Back-to-Back Cabling (Cisco 633 and Cisco 673 only)" section on page 2-5 for cabling information.

Step 2 Set one Cisco 633 to central office (CO) mode, so that it terminates the traffic that the Cisco 633 in customer premises equipment (CPE) mode initiates.

Note The Cisco 633 ships with a default setting of CPE mode.

To set the Cisco 633 to CO mode:

```
set int wan0 mode co
```

Step 3 Set up an IWF data path between the Cisco 633s. See the "Configure Interworking" section on page 4-3 for more information.

Step 4 Verify that both Cisco 633s are in either RFC 1483 bridging or RFC 1483 routing mode only, not PPP (Point-to-Point Protocol) routing or bridging mode. See the sections below for either bridging or routing procedures.

Configuring External Routers

Please consult the user documentation for your router to connect the Cisco 633 to routers on the FR and ATM networks. The Cisco 633 can pass traffic that uses the following protocols:

- RFC 1483 bridging
- PPP bridging

Upgrade Software through Serial Download

You can upgrade software on your CPE using the serial interface:

Note Changes to your CPE must be coordinated with the central office equipment.

Step 1 Enter the following settings through a serial console connected to your system:
38.4 Kbaud
No parity
8 data bits
1 stop bit
No flow control

Step 2 To turn debug monitor on, enter:

```
debug monitor on
```

Step 3 To save your changes, enter:

```
write
```

Step 4 To reboot the device, enter:

```
reboot
```

After the modem reboots, press Enter twice. The prompt should change to =>.

Step 5 To erase sector 0, enter:

```
es 0
```

Repeat this step for sectors 1 through 5.

Step 6 To start serial download, enter:

```
df 10008000
```

Step 7 Use a terminal emulation application, such as Hyperterminal, to start an Xmodem download of a new Cisco 67x image.

Step 8 When the download is complete, the following message appears:

```
Transferred xxxxxxxx bytes
```

Record the number of bytes transferred.

Step 9 To program the area of memory to Flash, enter:

```
pb 10008000 fef00000 xxxxxxxx
```

where *xxxxxxxx* is the value recorded in Step 6.

Step 10 To turn debug monitor off, enter:

```
m0
```

Step 11 To reboot, enter:

```
rb
```

Update the CBOS Prompt

The default Cisco 633 system prompt is `cbos>`. The command prompt is limited to 8 characters. You can change this prompt to a unique subscriber identifier as shown in the following example.

Step 1 Log on to CBOS using either the serial or Telnet interfaces.

Step 2 To change the default prompt to 4412883 as the subscriber identifier, enter:

```
cbos# set prompt 4412883
4412883#
```

Step 3 To save your changes, enter:

```
4412883# write
```

Step 4 To exit CBOS, enter:

```
4412883# quit
```

Set Passwords

After you have configured your system, you should pick new passwords for both the **enable** and **exec modes**. Keep in mind that the **enable** mode provides all the functionality of a system administrator for the CPE. Examples of good and bad passwords are:

- Good Password—77ta99y (Do not use the sample password.)
- Bad Passwords—Passwords such as your name; or your street address, or home telephone number are too predictable.

Use the **set password** command to change both the enable and exec passwords as in the following:

Step 1 To change the password enter:

```
cbos# set password mode new password
```

Example: **`set password enable 33Low44PassMe`**

Step 2 To save your changes, enter:

```
cbos# write
```

Step 3 To exit the CBOS, enter:

```
cbos# quit
```

Save Configuration Changes

Use the **write** command to save any changes you have made during provisioning to the NVRAM configuration file:

```
cpe627# write
```

Caution If you do not use the **write** command after changes, all the changes you made during your current session will be lost when you reboot the Cisco 633.

CHAPTER 5

Configuration Procedures for the Cisco 67x CPE Devices

Introduction

This chapter provides information about configuring the Cisco 67x CPE devices. This information applies to the Cisco 673, Cisco 675, Cisco 675e, Cisco 676, Cisco 677, and Cisco 678.

Note Cisco recommends that only one command-line application at a time be used to configure the Cisco 67x. For example, Telnet and the serial management interface should not be used simultaneously. Also, please note that all configuration procedures are performed in the **enable** mode.

Configuration Checklist

Table 5-1 Checklist for Router Configuration

Configuration Procedures	Page Number
Log On to the Cisco Broadband Operating System	5-3
Determine the CBOS Version	5-3
Select a Connection Mode	5-5

Table 5-1 Checklist for Router Configuration (continued)

Configuration Procedures	Page Number
Bridging Mode Procedures or Routing Mode Procedures	5-5 or 5-8
Configure the Ethernet Port (eth0)	5-11
Configure the WAN Ports and ATM Virtual Connections	5-12
Create Routing Tables	5-16
Enable IP Filtering	5-17
Configure Applications:	5-18
• DHCP Client	5-18
• DHCP Server	5-19
• NAT	5-20
• RADIUS Client	5-20
• SNMP	5-22
• SYSLOG Client	5-23
• Telnet	5-24
• TFTP Server	5-27
• Web Server	5-30
Configure Timeout Values (Cisco 675, Cisco 678 in CAP mode only)	5-30
Configure Line Coding (Cisco 677 and Cisco 678 only)	5-31
Upgrade Software through Serial Download	5-42
Configure Static NAT	5-43
Configure Multiple PCs Connected to the CPE	5-44
Update the CBOS Prompt	5-46
Set Passwords	5-47
Save Configuration Changes	5-48
Evaluate System Activity and Performance	5-48
Retrieve Statistics	5-49

Log On to the Cisco Broadband Operating System

After connecting all the cables to the Cisco 67x and powering it on, start the terminal emulation program and press the **Enter** key until the CBOS login screen appears. When you see the welcome screen, you can log on to CBOS.

```
Hello!
Expanding CBOS image...
CBOS v2.3.5.012 - Release Software

Password:
```

Note If you have not set any passwords for the Cisco 67x, press the **Enter** key when the system prompts you for a password to enter CBOS.

Determine the CBOS Version

After you log on to CBOS, you can use the **show version** command to determine the CBOS version of the Cisco 67x:

```
cbos# show version
```

The output for Cisco 67x configured for CAP line coding is similar to the following:

```
Cisco Broadband Operating System
CBOS (tm) 678 Software (C678-I-M), Version v2.3.5.012 - Release
Software
Copyright (c) 1986-1999 by cisco Systems, Inc.
Compiled Jan 10 2000 03:54:07
CAP firmware version C.19
NVRAM image at 0x10357fe0
```

The output for Cisco 678 configured for DMT Issue 2, G.Lite line coding is similar to the following:

```
Cisco Broadband Operating System
CBOS (tm) 678 Software (C678-I-M), Version v2.3.5.012 - Release
Software
Copyright (c) 1986-1999 by cisco Systems, Inc.
Compiled Jan  5 2000 00:07:36
DMT firmware version 210
NVRAM image at 0x1034d930

*** RFC1483 Bridging Mode Enabled ***
```

Note The **show version** command above displays the line coding method, either CAP or DMT, for which the Cisco 67x is configured. If you have a Cisco 677 or Cisco 678 and need to upgrade to a different line coding method, follow the procedure in the "Configure Line Coding (Cisco 677 and Cisco 678 only)" section on page 5-31 before proceeding with configuration.

Operation Modes

The CBOS implements two operational modes: **exec** and **enable**. CBOS defaults to **exec** mode when you log in. The **exec** mode grants program execution (read-only) privileges to a user. To read or write changes to nonvolatile random-access memory (NVRAM), you must work in **enable** mode. To invoke **enable** mode:

Step 1 Type enable at the exec mode command line:

```
cbos> enable
```

Step 2 Enter a password when CBOS prompts you:

```
cbos> enable
Password:password
```

Note If you have not set any passwords for the Cisco 67x, press the **Enter** key when the system prompts you for a password to enter CBOS. If you have not preset a password, you can still log on to the CBOS. You must have an **exec** password set in order to Telnet into the Cisco 67x.

You are now in **enable** mode. The system prompt appears:

```
cbos#
```

Select a Connection Mode

The CBOS supports two kinds of connection modes: bridging and routing. Routing mode has two options: PPP routing (default) and RFC 1483 routing.

Note Routing and bridging cannot be used simultaneously.

Bridging Mode Procedures

When the Cisco 67x operates in bridge mode, it behaves like a wire connecting a local PC directly to a service provider's network. Bridge data is encapsulated using the RFC 1483 or PPP (BCP) protocol to enable data transport. Because bridges operate at the Media Access Control (MAC) layer only, applications requiring IP communication, such as Telnet, TFTP, RADIUS, Syslog, Ping, and the web interface, are not available unless a management VC is configured.

Cisco currently supports a learning bridge mode. The virtual path identifier/virtual channel identifier (VPI/VCI) configuration of the Cisco 67x is unaffected by the operational mode (bridging versus routing) of the device.

Cisco also provides two methods of configuring and managing the bridged Cisco 67x, through in-band bridging management or through a separate management VC. The two methods cannot be used simultaneously. If a separate management VC is used, the Cisco 67x can only be managed remotely through wan0-1 and not from the local network.

With RFC 1483 management enabled, you can manage the router using Telnet. The following commands are accessible through the managed bridge:

- **ping**
- **telnet**
- **tftp**

The following procedure shows how to set up the Cisco 67x for in-band bridging management.

Note You must be in **enable** mode and perform the procedure in the sequence shown.

Step 1 To enable RFC 1483 bridging, enter:

```
set bridging rfc1483 enabled
```

Step 2 To save your changes, enter:

```
write
```

Step 3 To reboot the device, enter:

```
reboot
```

Step 4 To enable in-band management of the bridge, enter:

```
set bridging management enabled
set int eth0 address ip address
```

The IP address of the Ethernet port should be an IP address on the same network as that of the “far-end” station.

Step 5 To save your changes, enter:

```
write
```

Step 6 To enable your changes, reboot the router:

```
reboot
```

To manage the bridged Cisco 67x using a separate management VC:

Step 1 To disable in-band bridging management, enter:

```
set bridging management disabled
```

Step 2 To enable bridging PVC, enter:

```
set bridging PVC enabled
```

Step 3 To save your changes, enter:

```
write
```

Step 4 To reboot the device, enter:

```
reboot
```

After rebooting, the Cisco 67x will have two PVCs enabled. Wan0-0 is used strictly for bridged traffic, while wan0-1 is used strictly for management traffic. Wan0-1 will be using RFC 1483 routing.

Step 5 Set an IP address on the Ethernet port that is on the same network as the far-end station out the wan0-1 interface:

```
set int eth0 address ip address
```

For more information on using the **set bridging** command, see the *Cisco Broadband Operating System User Guide*.

The rules that govern the **bridge** command are:

- Bridging and routing do not operate simultaneously on the Cisco 67x ADSL router.
- Only one bridging mode is allowed at any one time (that is, RFC 1483 or PPP/BCP, not both).
- The following commands do not work while in bridge mode:
  - **set route** (and setting static routes)
  - RIP-related commands (**set** and **show**)
  - Filter-related commands (**set** and **show**)
  - Web interface (only allowed if management is enabled)

- RADIUS
- Syslog
- NAT

If you choose bridging as your connection mode, see also the following sections:

- "Configure the WAN Ports and ATM Virtual Connections" section on page 5-12
- "Configure Applications" section on page 5-18 through "Evaluate System Activity and Performance" section on page 5-48

Routing Mode Procedures

The Cisco 67x CPEs support two types of routing: PPP routing and RFC 1483 routing.

PPP Routing

Three Cisco 67x applications compose the PPP routing feature: DHCP server, and Network Address Translation (NAT). With these applications enabled, you can use the Cisco 67x without following the procedures described in this chapter such as the "Bridging Mode Procedures" section on page 5-5 or the "Configure the WAN Ports and ATM Virtual Connections" section on page 5-12. See the following section to enable PPP routing.

Enabling PPP Routing

For each of the applications, the **show** *application* command reports if the feature is enabled. Complete the following steps to enable the PPP routing feature for the Cisco 67x. You must be in the **enable** mode to do this procedure.

Step 1 Enable the DHCP server:

```
set dhcp server enabled
```

Step 2 To check whether this feature is enabled, enter:

```
show dhcp server pool 0
```

Step 3 Enable NAT:

```
set nat enabled
```

Step 4 Reboot the Cisco 67x:

```
reboot
```

Step 5 To check whether NAT is enabled, enter:

```
show nat
```

Step 6 Write the changes to NVRAM:

```
write
```

Step 7 Reboot the Cisco 67x:

```
reboot
```

When the Cisco 67x reboots, PPP routing is enabled.

Disabling PPP Routing

Complete the following steps to disable the PPP routing feature for the Cisco 67x. You must be in the **enable** mode.

Step 1 Disable the DHCP server:

```
set dhcp server disabled
```

Step 2 Disable NAT:

```
set nat disabled
```

Step 3 Write the changes to NVRAM:

```
write
```

Step 4 Reboot the Cisco 67x:

```
reboot
```

Note After you disable the PPP routing feature, you must manually configure the Cisco 67x.

Changing PPP Routing

These commands change the components of PPP routing:

- **set dhcp server pool**
- **set dhcp client -interface**
- **set nat entry add**
- **set nat entry delete**
- **set nat timeout**
- **set nat outside -ip**

For a complete description of each of these commands, see the *Cisco Broadband Operating System User Guide*.

RFC 1483 Routing

If you disable PPP routing, see the following steps for RFC 1483 routing: from the "Configure the Ethernet Port (eth0)" section on page 5-11 through the "Evaluate System Activity and Performance" section on page 5-48.

Configure the Ethernet Port (eth0)

To configure the Ethernet port, you must assign an IP address and netmask to the port. Complete the following steps to configure your IP address and your netmask. When setting the IP address of a particular interface, the netmask is set automatically unless it is explicitly specified. Substitute your own IP addresses for the ones shown in steps 2 through 4.

You must be in the **enabled** mode to do this procedure:

Step 1 Log on to the CBOS (`cbos#`) using the serial connection.

> **Note** When changing the Cisco 67x IP configuration, use the serial management connection to ensure you maintain your session connection to CBOS.

Step 2 To set the IP address (and your netmask), follow this example of a sample command:

```
set interface eth0 address 192.168.34.9
```

The IP address becomes 192.168.34.9 and the netmask becomes 255.255.255.0 by default. If you wish to explicitly set the netmask, enter:

```
set interface eth0 mask 255.255.255.248
```

Step 3 To set the destination IP address for the WAN port, enter:

```
set interface wan0-0 dest 192.168.34.10
```

Step 4 To save your changes, enter:

```
write
```

Step 5 To allow the system to come up with these new settings, reboot the Cisco 67x:

```
reboot
```

Step 6 Log back on to the CBOS to continue.

For more detailed information on the **set interface** command, see the *Cisco Broadband Operating System User Guide*.

Configure the WAN Ports and ATM Virtual Connections

The Cisco 67x has two types of WAN ports: physical (wan0) and logical (wan0-x). The physical WAN port connects the Cisco 67x to the wide area network. The logical WAN port or ports allow you to create virtual WAN connections for plural destinations. To configure logical WAN ports, you must provision ATM virtual connections. The instructions for each are provided in this section.

The Cisco 67x automatically trains up to the ideal line speed. By default, the Cisco 67x is provisioned with the following rates:

Encoding	Downstream/Upstream Rate (Mbps)
DMT	8.032/.864
CAP	7.168/1.088
G.Lite	1.536/.512

The maximum operative rate is determined by the central office ADSL equipment, line length and line conditions.

On the Cisco 67x, the WAN0 port is always ready to send and receive network traffic.You need to define an ATM virtual connection (VC), which might differ from the default, when communicating across an ATM network. There are two types of ATM connections:

- Virtual paths, identified by virtual path identifiers (VPI)
- Virtual circuit, identified by the combination of a VPI and a virtual circuit identifier (VCI).

Because the Cisco 67x connects to the Cisco 6xxx series, the subscriber side VPI/VCI settings are not seen by the ATM network. All subscriber side VCs use VPI 1 and VCI 1 by default.

Cisco 67x comes preconfigured with one VC already established. Each VC is expressed as WAN0-*x*, where *x* is a number between 0 and 3.

To set the maximum number of VCs, enter:

```
cbos# set interface wan0 maxvcs n
```

where *n* is between 1 and 8.

Table 5-2 shows the valid ranges for the VPI and VCI addresses.

Table 5-2 VPI/VCI Address Ranges

Maximum VCs	VPI Range	VCI Range
1	0-3	0-63
2	0-3	0-63
4	0-3	0-63
8	0-3	0-63

Note In CBOS version 2.3 or earlier, the VPI count is 1 to 4. In later versions, the VPI count is 1 to 8.

Changing VPI Settings

Step 1 To make sure the wan0-0 connection remains closed during configuration, enter:

```
set interface wan0-0 disable
```

Step 2 To set the VPI number to 2, enter:

```
set interface wan0-0 vpi 2
```

Note If you try to enter the command **set interface wan0-1** on a connection that is already open, the system prompts you to close that connection before you change the VPI setting. Close the connection by entering **set interface wan0-1 close**.

Step 3 To enable the wan0-0 connection, enter:

```
set interface wan0-0 enable
```

Step 4 To begin using this connection with the new settings, enter:

```
set interface wan0-0 open
```

Step 5 Repeat steps 2 through 4 for every VPI assignment you want to make.

Step 6 To save the new WAN port configuration, enter:

```
write
```

Step 7 To exit CBOS, enter:

```
quit
```

Changing VCI Settings

Step 1 To make sure the wan0-0 connection remains closed during configuration, enter:

```
set interface wan0-0 disable
```

Step 2 To set the VCI number to 4, enter:

```
set interface wan0-0 vci 4
```

Note If you try to enter the command **set interface wan0-0** on a connection that is already open, the system prompts you to close that connection before you change the VCI setting. To do this, enter the command **set interface wan0-0 close.**

Step 3 To enable the wan0-0 connection, enter:

```
set interface wan0-0 enable
```

Step 4 To begin using this connection with the new settings, enter:

```
set interface wan0-0 open
```

Step 5 Repeat steps 2 through 4 for every VCI assignment you want to make.

Step 6 To save the new WAN port configuration, enter:

```
write
```

Step 7 To exit CBOS, enter:

```
quit
```

For more information on configuring VPI/VCI address mapping, see the *Cisco Broadband Operating System User Guide*.

Set ScalaRate for wan0-x

ScalaRate is a technology developed by Cisco that allows dynamic allocation of bandwidth within an ATM-based ADSL connection. This bandwidth allocation is specified and controlled by the end-point devices without affecting the provisioning or status of the underlying ATM transport VC. Bandwidth within the ADSL connection is allocated on a VC basis and provides flexibility in rate structures and deployment models for service providers and network administrators.

The key features of ScalaRate are:

- Applicable to individual logical WAN ports (wan0-x).
- Sets maximum upstream rate per VC in the CPE, and maximum downstream rate per subscriber in the central office equipment.
- Can be set in increments of 64 Kbps.
- Rounds down to the nearest 64 Kbps increment. For example, if you set the rate to 68 Kbps, the setting will be rounded down to 64 Kbps.
- Can be set for less than or equal to the maximum ADSL trained rate.

To set the wan0-x to ScalaRate:

Step 1 To close the wan0-*x* port, enter:

```
set interface wan0-x close
```

where *x* is the port you want to close.

Step 2 To set an upstream ScalaRate for a particular VC, enter:

```
cbos# set interface wan0-0 rate 512
```

Step 3 To set an upstream ScalaRate to the maximum allowable rate, enter:

```
cbos# set interface wan0-0 rate auto
```

Step 4 To save your changes, enter:

```
cbos# write
```

Step 5 To exit the CBOS, enter:

```
cbos# quit
```

Create Routing Tables

In order to pass data through a network and onto the Internet or wide area network, you might need to add the IP address(es) of gateway(s) to the routing table. Follow the instructions below to build a routing table manually by adding or deleting entries in the table.

Note If your Cisco 67x was provisioned to run in bridging or PPP routing mode, you must disable both before attempting to establish routing.

Step 1 To add a route and gateway to IP address 192.168.9.1, without specifying a specific mask or metric, enter:

```
set route add ip 192.168.9.1 gw 192.168.10.250
```

Step 2 To add a route and specify a netmask, gateway, or metric, enter:

```
set route add ip 192.168.10.0 mask 255.255.255.0
gw 192.168.245.228 metric 1
```

Step 3 To set a default route, enter:

```
set route default 192.168.245.228
```

Step 4 To set a destination address for each VC, enter:

```
set interface wan0-0 dest 192.168.245.228
mask 255.255.255.0
```

Step 5 To save your changes, enter:

```
write
```

Step 6 To exit the CBOS, enter:

```
quit
```

For more information on using the **set route** command, see the *Cisco Broadband Operating System User Guide*.

Enable Routing Information Protocol (RIP)

To enable RIP and RIP2 in CBOS, enter:

```
set rip enabled
```

To disable RIP, enter:

```
set rip disabled
```

For more information on using the **set rip** commands, see the *Cisco Broadband Operating System User Guide*.

Enable IP Filtering

The Cisco 67x supports up to 20 filters for TCP and UDP packets passing through the Cisco 67x's interfaces. Enabled filters are applied to packets in sequential order according to filter number.

To use filtering to block all packets going through the Ethernet interface, enter:

```
set filter 0 on deny eth0 0.0.0.0 0.0.0.0 0.0.0.0 0.0.0.0
```

For more information on using the **set filter** command, see the *Cisco Broadband Operating System User Guide*.

Configure Applications

The Cisco 67x supports these applications for system management and control:

- DHCP client
- DHCP server
- NAT
- RADIUS client
- SNMP
- SYSLOG client
- Telnet server
- TFTP server
- Web server (HTTP server)

DHCP Client

The DHCP client requests an IP address from a DHCP server. To enable the DHCP client:

Note Enabling the DHCP client automatically disables the DHCP server on the CPE.

Step 1 Enable the DHCP client:

```
set dhcp client enabled
```

Step 2 To change the DHCP client interface, enter:

```
set dhcp client interface eth0
```

Step 3 To check whether this feature is enabled, enter:

```
show dhcp client
```

Step 4 Write the changes to NVRAM:

```
write
```

Step 5 Reboot the Cisco 67x:

```
reboot
```

For more information on using DHCP clients, see the **set dhcp client** commands in the *Cisco Broadband Operating System User Guide*.

DHCP Server

The DHCP server application automatically assigns IP addresses to DHCP clients. To enable the DHCP server feature for the Cisco 67x.

Note Enabling the DHCP server automatically disables the DHCP client on the CPE.

Step 1 Enable the DHCP server:

```
set dhcp server enabled
```

Step 2 To check whether this feature is enabled, enter:

```
show dhcp server
```

Step 3 Write the changes to NVRAM:

```
write
```

Step 4 Reboot the Cisco 67x:

```
reboot
```

Note The DHCP server defaults with one IP address poolcconfigured.

For more information on using DHCP servers, see the **set dhcp server** series of commands in *Cisco Broadband Operating System User Guide*.

NAT

The NAT application converts IP addresses on a private network (designated as "inside" or "LAN") to global IP addresses that can forward packets to another registered network (designated as "outside" or "WAN"). To enable NAT:

Step 1 Enable NAT:

```
set nat enabled
```

Step 2 To check whether this feature is enabled, enter:

```
show nat
```

Step 3 Write the changes to NVRAM:

```
write
```

Step 4 Reboot the Cisco 67x:

```
reboot
```

For more information on using NAT, see the **set nat** series of commands in *Cisco Broadband Operating System User Guide*.

RADIUS Client

RADIUS authenticates users for access to a network. The RADIUS server uses an authentication scheme, such as PAP, to authenticate incoming messages from RADIUS clients. When a password is present, it is hidden using a method based on the RSA Message Digest Algorithm MD5 [1].

The Cisco 67x has been successfully tested for compatibility with the following RADIUS server providers:

- Livingston Enterprises RADIUS 2.01
- Merit RADIUS (Sun binary)
- RADIUS NT (Microsoft)

- CiscoSecure for UNIX
- CiscoSecure for Windows NT

Cisco 67x Implementation

The Cisco 67x supports a RADIUS client. However, for most environments, the Cisco 67x RADIUS client is not used. The RADIUS profile exists on the service provider's remote access server.

Configuring RADIUS on the Cisco 67x

The following examples assume that the Cisco 67x is connected to a network equipped with a RADIUS server:

Note If you enable RADIUS on the CPE, you have to disable authentication on the service provider's remote access server.

Step 1 Enable the Cisco 67x RADIUS application:

```
set radius enabled
RADIUS is enabled
```

Step 2 Point the CPE to the remote RADIUS server:

```
set radius remote x.x.x.x
RADIUS will now send messages to x.x.x.x
```

where *x.x.x.x* is the address of the remote RADIUS server.

Step 3 Set the RADIUS secret password:

```
set radius secret mysecret
RADIUS Secret now set - All secrets are in lowercase
```

where *mysecret* is the RADIUS secret password.

Step 4 Enable RADIUS authentication and set the PPP login and password for the WAN0-0 port:

```
set ppp wan0-0 radius enabled
set ppp wan0-0 login cisco
set ppp wan0-0 password is_great
```

where *cisco* is the PPP login and *is_great* is the password.

Step 5 Use the **show radius** command to display the Cisco 67x default configuration for RADIUS.

Note The RADIUS test command **set radius test** activates the RADIUS debug option. This allows you to test that RADIUS works with current client settings by sending a test message to the RADIUS server.

For more information on RADIUS commands, see the *Cisco Broadband Operating System User Guide*.

SNMP

To configure SNMP settings, enter the following command from **enable** mode:

`set snmp enabled` | **`disabled`** | **`remote`** *remote-address* | **`traps`** *host-address*

where

disabled	Disables SNMP settings
enabled	Enables SNMP settings
remote *remote-address*	Specifies the IP address for the remote location running SNMP
traps *host-address*	Sets the IP address of the host on which to trap SNMP messages

The following example command uses hypothetical IP addresses to demonstrate the use of the **set snmp** command:

```
set snmp remote 198.162.2.57
set snmp traps 198.162.2.50
```

SYSLOG Client

SYSLOG logs significant system information to a remote SYSLOG server for processing without requiring large amounts of local storage or local processing.

Implementing SYSLOG

Using the CBOS, the Cisco 67x allows you to specify a remote server for logging system messages. Cisco supports the following levels of severity:

- Debug
- Info
- Warning
- Alarm
- Critical
- Crash

The messages are similar to the standard Berkley Software Distribution (BSD)-style severity levels for SYSLOG; however, they do not include None and Mark. To configure your SYSLOG daemon to receive Cisco SYSLOG messages, modify the `/etc/syslog.conf` configuration file (remember to use tabs, not spaces). Many systems, such as Linux and FreeBSD, have SYSLOG set up by default.

Note The command **set syslog test** activates the SYSLOG debug option. This will verify that SYSLOG works with current client settings by sending a test message to the SYSLOG server.

The following /etc/syslog.conf configuration file entry enables all messages for Info severity levels and above:

```
*.info/var/log/messages
```

To enable only alarm messages and above, enter the following in /etc/syslog.conf:

```
*.alarm/var/log/messages
```

Be sure your UNIX **syslogd** daemon accepts remote reception (network messages). Some processes might need to be killed and restarted with a **-r** option. Using the **man syslog** command to view the online UNIX manuals for information about the SYSLOG daemon.

Using SYSLOG from a UNIX Machine

To use SYSLOG, simply enter the following at your CBOS prompt:

```
set syslog remote ip address of remote server
```

Attention Windows NT and Windows 95/98 Users

Windows does not have a SYSLOG server. If you want to utilize SYSLOG on a Windows 95, Windows 98, or Windows NT system, you must install a SYSLOG server from a third-party vendor onto your system. One way to locate a SYSLOG server is to use an Internet search engine to locate a vendor who sells a SYSLOG server. Some SYSLOG servers are provided as share or freeware on the Internet.

Cisco has proven compatibility with the following third-party products:

- Sun Solaris 2.5
- Linux 2.0.27
- NTSyslog (shareware program)

For more information on SYSLOG commands, see the *Cisco Broadband Operating System User Guide*.

Telnet

Telnet provides a command-line interface and is used as a means of providing remote login connections between machines on many networks, including the Internet.

⚠ **Caution** Before closing a Telnet connection, always enter **exit** or **quit** at the `cbos#` prompt.

Using Telnet to Connect to the Cisco 67x

Use the **telnet** daemon to connect to CBOS and configure and operate the Cisco 67x.

Note You must have an **exec** password set to make a Telnet connection to the Cisco 67x.

Connecting from a Windows NT 4.0 or Windows 95/98 Machine

Step 1 Click **Start**.

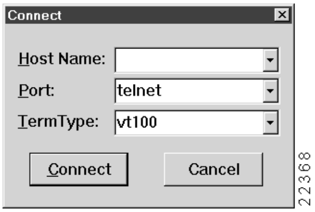
Step 2 Select the **Run...** option.

Step 3 When the Run box appears, enter **telnet** in the space provided.

Step 4 Click **OK**. The Connect menu appears.

Step 5 Select the **Remote System...** option from the Connect menu. The screen shown in Figure 5-1 appears.

Figure 5-1 Remote System List Box



Host Name:
Port: telnet
TermType: vt100

Step 6 Enter the IP address of the Cisco 67x in the **Host Name** box and click **Connect**. The system then initiates a session with the Cisco 67x. Press the **Enter** key three or four times to establish a connection.

Step 7 Provide the **exec** user password information. After the system authenticates your password, you have access to CBOS.

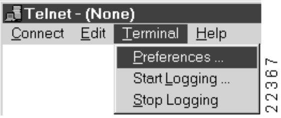
Note See the *Cisco Broadband Operating System User Guide* for more information about how to set and change passwords.

Notice to Windows Users

The Windows Telnet client does not support NVT (Network Virtual Terminal) or any extra form of option negotiation. However, if you are going to use the Windows Telnet client, follow these steps to set your terminal settings.

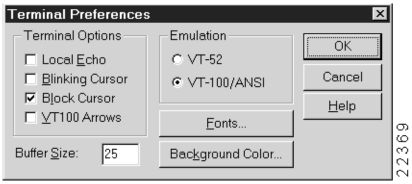
Step 1 When the Telnet window appears, access the *Preferences* menu in Telnet by selecting **Preferences** from the **Terminal** drop-down menu. (See Figure 5-2.)

Figure 5-2 Telnet Preferences



Step 2 Set the terminal settings on the Terminal Preferences menu to the values shown in Figure 5-3, then click `OK`.

Figure 5-3 Telnet Preferences


Terminal Preferences

Terminal Options

- □ Local Echo
- □ Blinking Cursor
- ☑ Block Cursor
- □ VT100 Arrows

Buffer Size: 25

Emulation

- ○ VT-52
- ● VT-100/ANSI

Notice to Linux Users

If you try to run Linux without installing the Term/Termcap database, the message BAD ADDRESS displays during a connection attempt. To install the Term/Termcap database, check the original Linux installation disks.

Connecting from a UNIX Machine

Step 1 Enter the following at your prompt:

```
telnet ip address of Cisco 67x
```

After you have connected to the Cisco 67x, the following information appears on your terminal:

```
Password: password
```

Step 2 Provide the **exec** user password. After the system authenticates the password, you have access to the CBOS.

How to Keep Telnet from Timing Out During Your Session

Telnet sessions time out after a period of inactivity. Enter the following commands to keep the Telnet client from timing out.

```
set telnet timeout off
write
```

For more information on Telnet commands, see the *Cisco Broadband Operating System User Guide*.

TFTP Server

TFTP allows you to transfer files to and from a Cisco 67x. The Cisco 67x runs a **tftp** daemon, which allows users from remote machines who have TFTP client software to remotely transfer files to and from the Cisco 67x. The TFTP client can be enabled and disabled from the CBOS or the Web Management Interface.

Caution For security reasons, Cisco recommends that you disable the TFTP application, except when uploading or downloading a file.

Software Updates

Use TFTP to transfer a new software image from Cisco to your Cisco 67x, where the file name format is: nsrouter.c67*y*dmt.*x.x.x.x*.bin or c67*y*dmt.*x.x.x.x*.bin. The *x.x.x* represents the image version number, and 67*y* is your CPE model number, for example, 677.

Note If you are upgrading from CBOS 2.2, you must use the nsrouter.c67*y*dmt.*x.x.x.x*.bin filename format. If you are upgrading from CBOS 2.3, you can use either format.

Archives

Use TFTP to back up a copy of your configuration file before changing it, so you can easily recover the old file when necessary. The naming conventions for the configuration file are:

- When using the **put** option of the **tftp** command, you must name the file nscfg.cfg.
- When using the **get** option of the **tftp** command, name the file any name that a standard text editor can view and edit.

Using TFTP from a UNIX Machine

For information on the UNIX TFTP client, access the online manual by entering:

```
man tftp
```

The manual page for TFTP appears.

To upgrade the Cisco 67x image:

```
root@staten-</67x>tftp
tftp> mode binary
tftp> put 12.0.8.5:nsrouter.c67xdmt.2.3.5.012.bin
Sent 923574 bytes in 60.8 seconds
```

The CPE displays the following when the image is being upgraded:

```
cbos>
        Downloading legacy image..... done.

        Saving image................ done.

        Please reboot the CPE for the new download to take effect
```

The released images come in two file formats:

```
-rw-r--r--   1 root     other     924976 Jan 31 09:04 c678cap.2.3.5.012.bin
-rw-r--r--   1 root     other     922336 Jan 31 09:04 c678dmt.2.3.5.012.bin
-rw-r--r--   1 root     other     924870 Jan 31 09:04 nsrouter.c678cap.2.3.5.012.bin
-rw-r--r--   1 root     other     922230 Jan 31 09:04 nsrouter.c678dmt.2.3.5.012.bin
```

Using TFTP from a Windows NT Machine

Step 1 Enable the tftp server on the Cisco 67x. As an enabled user, enter:

```
set tftp enabled
```

Step 2 Start a DOS session and enter:

```
C:>tftp -i ip address of Cisco 67x put image_filename
```

Where necessary, implement the following options:

-i—Sets the transfer mode to binary mode (all router images)

put—Uploads a file to a specified IP address

Use the **show errors** command to verify that TFTP is working.

Step 3 Be sure that you reboot the device to activate the new image.

Step 4 When you log back in to the Cisco 67x after the reboot, use the following command to verify the version of the firmware that is active:

```
show version
```

Attention Windows 95/98 Users

Windows 95/98 does not have a TFTP client. If you want to utilize TFTP on a Windows 95/98 system, you must install a TFTP client from a third-party vendor on your system. One way to locate a TFTP client is to use an Internet search engine to locate a vendor who sells a TFTP client. Some TFTP clients are provided as shareware or freeware on the Internet. Cisco will provide a TFTP client upon request. TFTP client requests should be directed to the Technical Assistance Center.

For more information on TFTP commands, see the *Cisco Broadband Operating System User Guide*.

Web Server

The Cisco 67x supports a web server, which allows you to perform tasks such as configuring interfaces, displaying statistics, and much more. For a complete description of the web interface, see the *Cisco Broadband Operating System User Guide*.

Configure Timeout Values (Cisco 675, Cisco 678 in CAP mode only)

The Cisco 67x supports two timeout values: *session* and *idle*. The *session* timeout is based on the total uptime of the session. The setting of the *idle* timeout facilitates the release of the ADSL physical layer so that the central office resource can be released, based on inactivity. The expiration of either timeout will end the ADSL session. However, because authentication is invisible, only the training delay is perceived by the user (7 to 46 seconds) when the connection is reestablished.

Use the **set timeout** command in a DOH environment to configure the idle or session timeout values in seconds.

Step 1 To set the session timeout rate to 300 seconds, enter:

```
set timeout session 300
```

Step 2 To set the idle timeout rate to 300 seconds, enter:

```
set timeout idle 300
```

Step 3 To verify these values, enter:

```
show timeout
```

Step 4 To save your changes, enter:

```
write
```

Step 5 To exit CBOS, enter:

```
quit
```

Configure Line Coding (Cisco 677 and Cisco 678 only)

The Cisco 677 and Cisco 678 allow you to choose transmission protocols to match your network configuration by changing the router's configuration file. Use TFTP to transfer files to and from a CPE. This section describes procedures to configure the CPE for Discrete Multi-Tone (DMT), Carrierless Amplitude and Phase Modulation (CAP), G.Lite, or G.DMT protocols.

Note Changes to your CPE must be coordinated with the central office equipment. Not all protocols described here are available on all CPE models.

Configure for CAP

Step 1 Verify the connection from the router to the location where the correct software image is stored. This location is provided by your network administrator. Typically, you use the **ping** command for this step.

Step 2 Enable TFTP:

```
cbos#set tftp enabled
TFTP is enabled
```

Step 3 Set the remote address for the TFTP host computer:

```
cbos # set tftp remote ip address
```

This command tells the CPE to accept TFTP transfers from a specific IP address. An example remote IP address would be *192.168.35.4*. This address is an example only; do not use it to configure the router.

Note If you do not have the CPE address, consult your network administrator.

For more information about TFTP, see the "TFTP Server" section on page 5-27.

Step 4 To start the file transfer from a PC, start a DOS session and enter the following command:

```
C:>tftp -i CPE IP address put image_filename
```

Where necessary, implement the following values:

-i	Sets the transfer mode to binary mode
put	Uploads a file onto that IP address

To start the file transfer from a UNIX machine, enter:

```
root@staten-</678>tftp
tftp> mode binary
tftp> put CPE IP address:image_filename
Sent 922294 bytes in 54.9 seconds
```

Substitute the file name for the software image update. Files use the naming format c67*y*cap.*x.x.x.x*.bin, where 67*y* is the CPE model number, and *x.x.x.x* is the image version number.

Caution Do not turn off the power to the router until after the file transfer is completed.

Step 5 Be sure to reboot the CPE to activate the new image. When you log back in to the CPE after the reboot, use the **show version** command to verify the version of the firmware that is active. Note the CAP firmware version.

Sample Output of Configuration Session for CAP

```
cbos#set tftp enabled
TFTP is enabled

cbos#tftp image 10.9.1.20 c678cap.2.3.5.012.bin
Starting download...
        Downloading in progress...... done.
        Saving image...........done.
        Please reboot the CPE for the new downl
cbos#reboot
Hello!
C67x self-update code: Release 2.3
NOTE: Do not power off router until update is finished!

Decompressing router...
Erasing FLASH......
Programming...
Decompressing monitor...
Erasing FLASH.........
Programming...
Finished.  Rebooting...
Hello!
Expanding CBOS image...
CBOS v2.3.5.012 - Release Software

User Access Verification
Password:

cbos>enable
Password:
cbos#show version
Cisco Broadband Operating System
CBOS (tm) 025 - Release Software
Copyright (c) 1986-1999 by cisco Systems, Inc.
Compiled Dec 21 1999 20:37:27
CAP firmware version C.19
NVRAM image at 0x10356930
```

Configure for DMT

Step 1 Verify the connection from the router to the location where the correct software image is stored. This location is provided by your network administrator. Typically, you use the **ping** command for this step.

Step 2 Enable TFTP:

```
cbos#set tftp enabled
TFTP is enabled
```

Step 3 Set the remote address for the TFTP host computer:

```
cbos # tftp remote ip address
```

This command tells the CPE to accept TFTP transfers from a specific IP address. An example remote IP address would be *192.168.35.4*. This address is an example only; do not use it to configure the router.

Note If you do not have the CPE address, consult your network administrator.

For more information about TFTP, see "TFTP Server" section on page 5-27.

Step 4 To start the file transfer from a PC, start a DOS session and enter:

```
C:>tftp -i CPE IP address put image_filename
```

Where necessary, implement the following values:

-i Sets the transfer mode to binary mode

put Uploads a file onto that IP address

To start the file transfer from a UNIX machine, enter:

```
root@staten-</678>tftp
tftp> mode binary
tftp> put CPE IP address:image_filename
Sent 922294 bytes in 54.9 seconds
```

Substitute the filename for the software image update. Files use the naming format c67*y*dmt.*x.x.x.x*.bin where 67*y* is the CPE model number, and *x.x.x.x* is the image version number.

Caution Do not turn off the power to the router until after the file transfer is completed.

Step 5 Be sure to reboot the CPE to activate the new image. When you log back in to the CPE after the reboot, use the **show version** command to verify the version of the firmware that is active. Note the DMT firmware version.

Sample Output of Configuration Session for DMT

```
cbos#set tftp enabled
TFTP is enabled

cbos#tftp -i 10.9.1.20 get c678dmt.2.3.5.012.bin
Starting download...
        Downloading in progress...... done.
        Saving image..........done.
        Please reboot the CPE for the new downl
cbos#reboot
Hello!
C67x self-update code: Release 2.3.5.012
NOTE: Do not power off router until update is finished!

Decompressing router...
Erasing FLASH......
Programming...
Decompressing monitor...
Erasing FLASH.........
Programming...
Finished.  Rebooting...
Hello!
Expanding CBOS image...
CBOS v2.3.5.012 - Release Software

User Access Verification
Password:

cbos>enable
Password:
```

```
cbos#show version

Cisco Broadband Operating System
CBOS (tm) 025 - Release Software
Copyright (c) 1986-1999 by cisco Systems, Inc.
Compiled Dec 21 1999 20:37:27
DMT firmware version 210
NVRAM image at 0x10356930
```

Configure for G.Lite

Before the CPE can be configured for G.Lite, it must first be configured for DMT. In addition, the central office hardware must be correctly configured to accept a G.Lite service user.

Step 1 Configure the CPE for DMT. See the “Configure for DMT” section on page 5-34.

Step 2 Enter:

```
cbos# set interface wan0 standard g.lite
```

Step 3 Be sure to retrain the CPE to activate the new line code. When the CPE is retrained, use the **show interface wan0** command to verify the G.Lite standard is active.

Note Changes made to the running configuration must be written to NVRAM for changes to be seen on reboot.

Sample Output of Configuration Session for G.Lite

```
cbos#set interface wan0 standard
SET INTERFACE WANx STANDARD requires one of the following arguments
T1.413
G.lite (G992.2)

cbos#set interface wan0 standard g.lite
Note:  Change will take effect on next retrain.
```

```
cbos#set interface wan0 retrain

cbos#show interface wan0
wan0   ADSL Physical Port
       Line Trained
Actual Configuration:
  Overhead Framing:          3
  Trellis Coding:            Disabled
  Standard Compliance:       G.lite
  Downstream Data Rate:      1536 Kbps
  Upstream Data Rate:        512 Kbps
  Interleave S Downstream:   4
  Interleave D Downstream:   16
  Interleave R Downstream:   4
  Interleave S Upstream:     8
  Interleave D Upstream:     8
  Interleave R Upstream:     8
  Modem Microcode:           G96
  DSP version:               0
  Operating State:           Showtime/Data Mode
Configured:
  Echo Cancellation:         Disabled
  Overhead Framing:          3
  Coding Gain:               Auto
  TX Power Attenuation:      0dB
  Trellis Coding:            Enabled
  Bit Swapping:              Disabled
  Standard Compliance:       G.lite
  Remote Standard Compliance:T1.413
  Tx Start Bin:              0x6
  Tx End Bin:                0x1f
  Data Interface:            Utopia L1
Status:
  Local SNR Margin:          28.0dB
  Local Coding Gain:         1.5dB
  Local Transmit Power:      12.3dB
  Local Attenuation:         22.5dB
  Remote Attenuation:        21.5dB
Local Counters:
  Interleaved RS Corrected Bytes:        0
  Interleaved Symbols with CRC Errors:   0
  No Cell Delineation Interleaved:       0
  Out of Cell Delineation Interleaved:   0
  Header Error Check Counter Interleaved:0
  Count of Severely Errored Frames:      0
  Count of Loss of Signal Frames:        0
Remote Counters:
  Interleaved RS Corrected Bytes:        0
  Interleaved Symbols with CRC Errors:   0
  No Cell Delineation Interleaved:       0
  Header Error Check Counter Interleaved:0
  Count of Severely Errored Frames:      0
  Count of Loss of Signal Frames:        0
```

Configure for DMT2

The default line coding mode for the Cisco 677 and Cisco 678 is DMT2. The central office hardware must be correctly configured to accept a DMT2 service user.

Step 1 Configure the CPE for DMT. See the "Configure for DMT" section on page 5-34.

Step 2 Enter:

```
cbos# set interface wan0 standard t1.413
```

Step 3 Be sure to retrain the CPE to activate the new line code. When the CPE is retrained, use the **show interface wan0** command to verify the DMT2 standard is active.

Note Changes made to the running configuration must be written NVRAM for changes to be seen on reboot.

Sample Output of Configuration Session for DMT2

```
cbos#set interface wan0 standard
SET INTERFACE WANx STANDARD requires one of the following arguments
T1.413
G.lite (G992.2)

cbos#set interface wan0 standard t1.413
Note:  Change will take effect on next retrain.

cbos#set interface wan0 retrain

cbos#show interface wan0
wan0   ADSL Physical Port
```

```
       Line Trained
Actual Configuration:
  Overhead Framing:          3
  Trellis Coding:            Disabled
  Standard Compliance:       T1.413
  Downstream Data Rate:      8032 Kbps
  Upstream Data Rate:        864 Kbps
  Interleave S Downstream:   1
  Interleave D Downstream:   64
  Interleave R Downstream:   2
  Interleave S Upstream:     4
  Interleave D Upstream:     8
  Interleave R Upstream:     16
  Modem Microcode:           G96
  DSP version:               0
  Operating State:           Showtime/Data Mode
Configured:
  Echo Cancellation:         Disabled
  Overhead Framing:          3
  Coding Gain:               Auto
  TX Power Attenuation:      0dB
  Trellis Coding:            Enabled
  Bit Swapping:              Disabled
  Standard Compliance:       Multimode
  Remote Standard Compliance:T1.413
  Tx Start Bin:              0x6
  Tx End Bin:                0x1f
  Data Interface:            Utopia L1
Status:
  Local SNR Margin:          3.5dB
  Local Coding Gain:         0.0dB
  Local Transmit Power:      12.5dB
  Local Attenuation:         28.5dB
  Remote Attenuation:        18.5dB
Local Counters:
  Interleaved RS Corrected Bytes:        0
  Interleaved Symbols with CRC Errors:   2
  No Cell Delineation Interleaved:       0
  Out of Cell Delineation Interleaved:   0
  Header Error Check Counter Interleaved:0
  Count of Severely Errored Frames:      0
  Count of Loss of Signal Frames:        0
Remote Counters:
  Interleaved RS Corrected Bytes:        0
  Interleaved Symbols with CRC Errors:   0
  No Cell Delineation Interleaved:       0
  Header Error Check Counter Interleaved:0
  Count of Severely Errored Frames:      0
  Count of Loss of Signal Frames:        0
```

Configure for G.DMT

Before the CPE can be configured for G.DMT, the **.full** image must be loaded. See the latest *Release Notes for the Cisco Broadband Operating Sytsem* for the appropriate filenames to use. The central office hardware must be correctly configured to accept a G.DMT service user.

Step 1 Enter the following command:

```
cbos# set interface wan0 standard g.992.1
```

Step 2 Be sure to retrain the CPE to activate the new line code. When the CPE is retrained, use the **show interface wan0** command to verify the G.DMT standard is active. Note that the standard configuration for the **.full** image is DMT2.

Note Changes made to the running configuration must be written to NVRAM for changes to be seen on reboot.

Sample Output of Configuration Session for G.DMT

```
cbos#set interface wan0 standard
SET INTERFACE WANx STANDARD requires one of the following arguments
T1.413
G.dmt (G992.1)

cbos#set interface wan0 standard g.992.1
Note:  Change will take effect on next retrain.

cbos#show interface wan0
wan0 ADSL Physical Port
       Line Trained
Actual Configuration:
  Overhead Framing:          3
  Trellis Coding:            Disabled
  Standard Compliance:       g.992.1
  Downstream Data Rate:      8032 Kbps
  Upstream Data Rate:        864 Kbps
  Interleave S Downstream:   1
  Interleave D Downstream:   64
  Interleave R Downstream:   2
  Interleave S Upstream:     4
  Interleave D Upstream:     8
  Interleave R Upstream:     16
  Modem Microcode:           G96
  DSP version:               0
  Operating State:           Showtime/Data Mode
Configured:
  Echo Cancellation:         Disabled
  Overhead Framing:          3
  Coding Gain:               Auto
  TX Power Attenuation:      0dB
  Trellis Coding:            Enabled
  Bit Swapping:              Disabled
  Standard Compliance:       Multimode
  Remote Standard Compliance:g.992.1
  Tx Start Bin:              0x6
  Tx End Bin:                0x1f
  Data Interface:            Utopia L1
Status:
  Local SNR Margin:          3.5dB
  Local Coding Gain:         0.0dB
  Local Transmit Power:      12.5dB
  Local Attenuation:         28.5dB
  Remote Attenuation:        18.5dB
Local Counters:
  Interleaved RS Corrected Bytes:        0
  Interleaved Symbols with CRC Errors:   2
  No Cell Delineation Interleaved:       0
  Out of Cell Delineation Interleaved:   0
  Header Error Check Counter Interleaved:0
  Count of Severely Errored Frames:      0
  Count of Loss of Signal Frames:        0
Remote Counters:
  Interleaved RS Corrected Bytes:        0
  Interleaved Symbols with CRC Errors:   0
  No Cell Delineation Interleaved:       0
  Header Error Check Counter Interleaved:0
  Count of Severely Errored Frames:      0
  Count of Loss of Signal Frames:        0
```

Upgrade Software through Serial Download

You can upgrade software on your CPE using the serial interface:

Note Changes to your CPE must be coordinated with the central office equipment.

Step 1 Enter the following settings through a serial console connected to your system:
38.4 Kbaud
No parity
8 data bits
1 stop bit
No flow control

Step 2 To turn debug monitor on, enter:

```
debug monitor on
```

Step 3 To save your changes, enter:

```
write
```

Step 4 To reboot the device, enter:

```
reboot
```

After the CPE reboots, press **Enter** twice. The prompt should change to =>.

Step 5 To erase sector 0, enter:

```
es 0
```

Repeat this step for sectors 1 through 5.

Step 6 To start serial download, enter:

```
df 10008000
```

Step 7 Use a terminal emulation application, such as HyperTerminal, to start an Xmodem download of a new Cisco 67x image.

Step 8 When the download is complete, the following message appears:

```
Transferred xxxxxxxx bytes
```

Record the number of bytes transferred.

Step 9 To program the area of memory to Flash, enter:

```
pb 10008000 fef00000 xxxxxxxx
```

where *xxxxxxxx* is the value recorded in Step 6.

Step 10 To turn debug monitor off, enter:

```
m0
```

Step 11 To reboot, enter:

```
rb
```

Configure Static NAT

Prior to following these steps, contact your application vendor to find out which ports they use.

Step 1 At the command prompt of the CPE, enter:

```
cbos#enable
```

Step 2 Enter:

```
set nat entry add inside-ip-addr inside-port outside-ip-addr
    outside-port protocol
```

where *protocol* is UDP, TCP or ICMP. The default local CPE services ports are:

Service	Protocol	Port
Telnet	TCP	23
TFTP	UDP	69
SNMP	UDP	161
Web Server	TCP	80

For example, if the private address of your server is 10.0.0.2 and the public/routed address assigned to your CPE is 216.160.92.4 and you are running a web server, enter:

```
set nat entry add 10.0.0.2 80 216.160.92.4 80 tcp
```

If you are running an FTP server, enter one of the following:

```
set nat entry add 10.0.0.2 20 216.160.92.4 20 tcp
```

or

```
set nat entry add 10.0.0.2 21 216.160.92.4 21 tcp
```

Configure Multiple PCs Connected to the CPE

After you have connected two or more PCs to the CPE (see "Connect Cables to the CPE" section on page 2-13), you need to obtain an IP address for each PC to start network connectivity. You can either obtain IP addresses from the CPE or from your network administrator.

To obtain IP addresses from the CPE:

Step 1 Enable DHCP (see "DHCP Client" and "DHCP Server").

Step 2 Select the Obtain an IP address automatically option on the TCP/IP properties on your PC.

Step 3 Restart the PC.

To obtain IP addresses from your network administrator:

Step 1 Obtain the following information from the network administrator:

IP address
subnet mask
gateway
DNS server address

Step 2 Manually enter this information in the TCP/IP properties on the PC, then click **OK** to save the TCP/IP configuration.

Step 3 Restart the PC.

Step 4 After the PC has restarted, try to ping the Ethernet address of the CPE. If the ping fails, check the hardware connections and the configuration on both the PC and the CPE.

Note If the CPE is configured for NAT, the default LAN IP network is 10.0.0.0, and the default subnet mask is 255.255.255.0. You can assign an IP address to your PC starting at 10.0.0.2 with a subnet mask of 255.255.255.0. The default gateway, which is the IP address of the Ethernet on the CPE, is 10.0.0.1.

Configure PPP over ATM with NAT

To configure the CPE for PPP over ATM with NAT enabled, log in to the management port of the CPE in privileged mode.

Step 1 Erase any saved configuration. Enter:

```
set nvram erase
```

Step 2 Enter:

```
write
```

Step 3 Enter:

```
set ppp wan0-0 login login
```

where *login* is the username provided by your network administrator.

Step 4 Enter:

```
set ppp wan0-0 password password
```

where *password* is the password provided by your network administrator.

Step 5 Enter:

```
set ppp wan0-0 ipcp 0.0.0.0
```

Step 6 Enter:

```
set ppp wan0-0 dns 0.0.0.0
```

Step 7 To enable NAT, enter:

```
set nat enable
```

Step 8 To enable the DHCP server, enter:

```
set dhcp server enable
```

Step 9 To save your changes, enter:

```
write
```

Step 10 To reboot the CPE, enter:

```
reboot
```

Update the CBOS Prompt

The default CBOS prompt is `cbos#`. You can change this prompt to a unique subscriber identifier, as shown in the following example.

Step 1 Log on to CBOS using either the serial or Telnet interface. See the "Telnet" section on page 5-24 for information on how to use Telnet to log on to the CBOS.

Step 2 To change the default prompt to c678, enter:

```
set prompt c678
```

Note The prompt is limited to seven characters.

Step 3 The following prompt now appears:

```
c678#
```

Step 4 To save your changes, enter:

```
write
```

Step 5 To exit the CBOS, enter:

```
quit
```

Set Passwords

After you have configured your Cisco 67x, select and configure new passwords for both the **enable** and **exec** modes. Examples of good and bad passwords are:

- Good Password: 77ta99y (Do not use the sample password.)
- Bad Passwords: Names, personal identification numbers, birthdates, addresses, home telephone numbers.

Use the **set password** command to change both the enable and exec user passwords:

Step 1 To change the **enable** user password, enter:

```
set password enable new password
```

Step 2 To change the **exec** user password, enter:

```
set password exec new password
```

Step 3 To save your changes, enter:

```
write
```

Step 4 To exit the CBOS, enter:

```
quit
```

Save Configuration Changes

Use the **write** command to save any changes you have made during provisioning to the NVRAM configuration file. Enter:

```
write
```

⚠

Caution If you do not use the **write** command after changes, all the changes you made during your current session will be lost when you reboot the Cisco 67x.

Evaluate System Activity and Performance

Table 5-3 describes the Cisco 67x LEDs and their status. The LEDs are located on the front of the unit.

Table 5-3 Status LEDs

LED Label	Full Name	Description
WAN-LNK	WAN Link	When this light is ON, a link has been established on the WAN port. When the light is solid, the Cisco 67x is connected and trained. The WAN-LNK light blinks steadily during ADSL line training activities.
WAN-ACT	WAN Activity	When this light blinks ON, the WAN port is transmitting or receiving data.
LAN-LNK	(Ethernet) LAN Link	When this light is ON, a link has been established on the Ethernet port.
LAN-ACT	(Ethernet) LAN Activity	When this light blinks ON, it indicates activity on the Ethernet port.
ALARM	Alarm Light	When the light is Red, this indicates a problem or alarm that needs to be resolved. A brief Red light during power up is a normal behavior of the power-on self-test.
POWER	Power Light	When this light is ON, the Cisco 67x is ON and the unit is receiving power.

Retrieve Statistics

Use the **stats** command to display statistics on Cisco 67x activities. The statistics provided by the **stats** command varies on the application or interface selected. To retrieve Cisco 67x statistics:

Step 1 To see a list of applications and interfaces that provide status, enter:

```
stats ?
```

Step 2 To display specific statistics, for example, for the wan0 interface, enter:

```
stats wan0
```

Step 3 To exit CBOS, enter:

```
quit
```

Interpret Statistics

Use the **stats wan0** command to retrieve certain key statistics regarding ADSL performance of your Cisco 67x. A sample output appears below:

```
cbos#stats wan0
Physical WAN Port 0 Statistics
# of dropped cells:0                # of invalid cells:0
# of CRC errors:0
# of processed OAM loopback cells
     segment:0       end-to-end:0
```

The statistics displayed by the **stats wan0** command are:

- CRC Errors—Number of CRC errors. CRC errors might occur when the ATM traffic rate is faster than the ADSL rate, causing ATM cells to be dropped. This corrupts the AAL5 logical packets. CRC errors might also be an indication of excessive noise on the DSL line.
- Operation, Administration, Maintenance (OAM) Loopback Cells—The Cisco 67x supports the OAM-F5 loopback cell to verify end-to-end ATM network connectivity. The OAM-F5 loopback cell is generated by a network-side system, such as a Cisco 7200 series router, a Cisco 6400

universal access concentrator, or a Cisco 678. The cell is injected into a specific virtual circuit along with the normal user traffic flow. The cell is carried unmodified by each intermediate ATM switching node until it arrives at the circuit's other endpoint, such as the Cisco 67x. The receiving endpoint modifies the cell payload to indicate that the cell has been looped-back and transmits this new cell back into the ATM circuit. It is relayed by each intermediate node until it arrives at the original transmitting endpoint. The receipt of this cell indicates a valid end-to-end connection between the two endpoints over the intervening ATM network.

- Invalid Cell counter (ICC)—Number of received ATM cells with non-zero General Flow Control (GFC) fields.

The **stats wan0-0** command displays more information:

```
cbos#stats wan0-0
WAN0-0 Statistics
# of packets   Rx:49          Tx:0
# of packets Rx errors:0
# of wrong byte counts Rx:0
# of out of Rx buffers:3
# of out of Rx descriptors:0
# of too large packets Rx:0
# of bytes Rx:2170        Tx:70
# of queued Tx commands:0
# of Tx underruns:0
# of packets to Tx:1
# of rejected Tx packets:0
total # of Tx errors:0
# of processed OAM loopback cells
     segment:0       end-to-end:0
```

CHAPTER 6

Troubleshooting

This chapter provides information about product issues in the Cisco 600 series CPE.

WAN Link and Power-Up Issues

When you power up the CPE, this is the normal sequence of events:

- The ALARM light comes on within 5 seconds, flashes for half a second, then goes off.
- Between 1 and 10 seconds after the ALARM light goes off, the WAN-LNK light starts blinking, indicating that the CPE is attempting to establish communication with the central office equipment. After communication is established, the WAN-LNK becomes solid.

So under normal conditions, the ALARM light should be off within six seconds of powering up the CPE, and within one minute the WAN-LNK light should become solid.

If the CPE cannot establish communication with the service provider equipment, the WAN-LNK light will go off and the CPE will wait 10 seconds. The WAN-LNK light will start blinking when the CPE tries again to establish communication.

If, after repeated attempts to establish communication, the WAN-LNK light continues blinking, turn the power off and then on. If the WAN-LNK light still does not become solid within one minute, call your service representative.

If the ALARM light flashes RED or lights RED and stays on, call your service representative.

Note With the POWER light ON, the WAN-LNK light may appear OFF under certain circumstances, even though the CPE is operating correctly. This condition can occur, for instance, if there is no data traffic across the WAN-LNK for two minutes or more. In this case, the PPP session will time out and the WAN-LNK light will go off. During subsequent requests for data across the link, the WAN-LNK light should start to blink, indicating that the ADSL or SDSL connection sequence has started.

Web Interface Password Lengths

Web interface passwords can be from 1 to 7 characters in length.

Web Browser Compatibility

Netscape 3.01 or higher or Internet Explorer 3.01 or higher is recommended for use as a browser for the Cisco Web Management Interface.

Serial Buffer Overflow

When using the serial port as your terminal connection, large amounts of serial data might overflow the serial buffer. This results in ASCII garbage appearing on the screen, but does not affect performance or operation in any way. To avoid this issue, use Telnet to manage the CPE.

RADIUS Password and Username Lengths

The Cisco 600 series CPE supports RADIUS passwords with more than 16 characters, however, RADIUS servers only support 16 characters or less. RADIUS usernames can be up to 255 characters. Refer to the "RADIUS Client" section on page 5-20.

Computers Running Linux Without term/termcap

Computers running Linux without the term/termcap database installed will have trouble connecting to Cisco equipment. The message "BAD ADDRESS" is sometimes displayed as an error message. The term/termcap database can be installed from the Linux install disks or CD-ROM.

Clearing PC Cache with ARP

If you update IP addresses on many Cisco 600 series CPEs in rapid succession using a Windows PC, the ARP cache on the PC might not clear right away. This causes communications problems with the subsequent CPEs in the line. Use the **arp -a** command to obtain the current ARP list, then update the entries. For example, to clear the PC cache, use the following command at the MS-DOS prompt on your PC:

```
c:\> arp -d 192.168.0.100
```

This deletes the MAC address and causes IP to send an ARP request (or packet) to the IP address 192.168.0.100. The ARP utility comes with Windows 95, Windows 98, and Windows NT, so if you don't have it in your current installation, you can install it from your original Windows install media.

RIP and Idle Timeouts

On a busy network with many RIP broadcasts and requests, RIP traffic alone can cause the Cisco 600 series CPE to remain sufficiently active to not trigger the idle timeout. Cisco recommends that RIP be disabled if Cisco 600 series CPE idle timeouts are used.

ADSL Parameters for the set interface command

The **set interface wan0** command supports these parameters:

baud []	Allows the ADSL line rate to train at the highest rate possible.
looptimeout[]	Enter a time for the length of time in seconds required for a faulty line to cause a retrain event.
overhead-framing mode-*number*	Configures the requested ATM framing structure. The Cisco 600 series CPE supports ATM overhead framing mode 3. A retrain is required to negotiate the new overhead framing mode with the central office equipment. This parameter only applies to DMT Issue 2 encoding. This command can be saved in NVRAM.
stay	Sets stay-trained mode. ADSL line will not retrain.
trellis-coding {enabled | disabled}	Configures the device to request trellis coding on the wan0 interface. Trellis coding can be enabled or disabled. A retrain is required to negotiate trellis coding with central office equipment. Trellis coding must also be enabled on the DSLAM for it to be enabled. This parameter only applies to DMT Issue 2 encoding. This command can be saved in NVRAM. **Note** Do not enable trellis coding on the Cisco 677.

Frequently Asked Questions about the WAN LNK LED

The WAN LNK LED blink patterns indicate the connection state of the CPE.

Table 6-1 WAN Link LED Blink Patterns

Blink Pattern/Rate	Description
Steady ON	A link is established to the WAN port. All parameters for physical and logical connections are correctly set. The CPE successfully transmits and receives data.
Continuous rapid blinking, about 3 blinks per second	The CPE is trying to establish a connection. The pattern continues until a connection is established.
Intermittent blinking. For the Cisco 675: 6 rapid blinks followed by a 2-second pause before repeating. For the Cisco 676 or 677: 5 rapid blinks followed by a 2-second pause before repeating.	The CPE is trying to establish a physical connection. At this time, the training session is not yet completed; there are no logical connections and negotiated line conditions with other equipment (such as DSLAMs) are not yet established.
OFF	Check all connections. Ensure the WAN0 interface is not disabled.

This list describes all known conditions indicated by the WAN LNK LED:

- If the WAN LNK LED blinks continuously and never stays solid on, the Cisco 600 series CPE never trains to a system such as the Cisco 6xxx series:
  - ADSL/SDSL line is not connected to the Cisco 600 series CPE.
  - Subscriber is locked on the Cisco 6xxx series.
  - Subscriber's LIM port is locked on the Cisco 6xxx series
  - Subscriber's LIM port is not associated to an ATU-C pool
  - ADSL/SDSL circuit is physically too long.
  - There is excessive noise on the ADSL/SDSL circuit.
- If the CPE trains up and the WAN LNK LED turns off after approximately 105 seconds when the CPE is in routing mode, this means that the CPE PPP requests are not getting answered by the equipment on the service provider's network, such as a Cisco 7200 series or Cisco 6400. It takes 105 seconds for

three PPP requests to be sent from the CPE, and if they are not answered by the service provider's equipment, the CPE stops sending them and the WAN LNK LED turns off.

There are a number of possibilities why this would happen:

  - VPI/VCI provisioning is not correct in the ATM cloud. This could signify that the service provider's equipment or the ATM switch along the path does not have the correct provisioning.
  - VPI/VCI mapping in the service provider's equipment or the CPE is not configured properly.
  - ATM Cell scrambling is enabled on one end of the link but not the other. The **show running** command will display an entry with "*ATM WAN Cell Scrambling = disabled*" if cell scrambling is disabled. No entry implies the default behavior of ATM cell scrambling is enabled.
  - Service provider's equipment is powered off.
  - CPE is configured for routing mode, but the equipment at the service provider's network that is terminating CPE traffic is configured for bridging.

Use the **show errors** command to check the contents of the error log.

- If the CPE trains up and the WAN LNK LED turns off, this is a sign of no ATM cell delineation.Verify that you have the ATM link terminated at the central office end. Without ATM cell delineation, the router will attempt to retrain the line in 1 to 10 seconds.
- If the CPE trains up and then immediately drops the connection, the near-end DMT firmware might not be compatible with the far-end DMT firmware. For example, an ITU G.Lite router might not train to an ANSI Issue 1 Central Office. To see the DMT firmware version installed on your router, use the **show version** command.

- If the WAN LNK LED turns off after the CPE has successfully been transferring data end-to-end for some time, this means that the CPE or the service provider's equipment might have a timeout set. Use the **show errors** command to see if the error log shows that timeouts caused the drop. There are two timeouts that could affect the WAN LNK LED:
  - IDLE timeout—This timeout can be set on the CPE or the service provider's equipment. If the IDLE timeout is set to some value, then the CPE WAN LNK LED will turn off if the CPE becomes idle for that specified period of time. The `show timeout` command will display the current timeout status and settings.
  - SESSION timeout—This timeout can be set on the CPE or the service provider's equipment. If the SESSION timeout is set to some value, then the CPE WAN LNK LED will turn off after that certain period of set time whether it is idle or not. The **show timeout** command will display the current timeout status and settings.
- If the WAN LNK LED goes solid for approximately four seconds and then turns off, this primarily points to a RADIUS problem. After the CPE trains and the service provider's equipment that is being used to authenticate its PPP session is using RADIUS, then this could point to a failed RADIUS authentication. Possible reasons for a failed RADIUS authentication include:
  - Service provider's equipment has the wrong IP address for the RADIUS server.
  - Username and password on the CPE do not match the username and password running on the RADIUS server's user list.
  - RADIUS server is not running.

  Disabling RADIUS on the service provider's equipment would be a simple test to see if it is a RADIUS problem.

The **show interface wan0** command provides feedback on the wan0 configuration as well as the actual configuration negotiated with the central office equipment as shown here:

```
cbos#show interface wan0
wan0   ADSL Physical Port
       Line Trained
Actual Configuration:
  Overhead Framing:          3
  Trellis Coding:            Disabled
  Standard Compliance:       T1.413
  Downstream Data Rate:      8032 Kbps
  Upstream Data Rate:        864 Kbps
  Interleave S Downstream:   1
  Interleave D Downstream:   64
  Interleave R Downstream:   2
  Interleave S Upstream:     4
  Interleave D Upstream:     8
  Interleave R Upstream:     16
  Modem Microcode:           G96
  DSP version:               0
  Operating State:           Showtime/Data Mode
Configured:
  Echo Cancellation:         Disabled
  Overhead Framing:          3
  Coding Gain:               Auto
  TX Power Attenuation:      0dB
  Trellis Coding:            Enabled
  Bit Swapping:              Disabled
  Standard Compliance:       Multimode
  Remote Standard Compliance:T1.413
  Tx Start Bin:              0x6
  Tx End Bin:                0x1f
  Data Interface:            Utopia L1
Status:
  Local SNR Margin:          3.5dB
  Local Coding Gain:         0.0dB
  Local Transmit Power:      12.5dB
  Local Attenuation:         28.5dB
  Remote Attenuation:        18.5dB
Local Counters:
  Interleaved RS Corrected Bytes:         0
  Interleaved Symbols with CRC Errors:    2
  No Cell Delineation Interleaved:        0
  Out of Cell Delineation Interleaved:    0
  Header Error Check Counter Interleaved:0
  Count of Severely Errored Frames:       0
  Count of Loss of Signal Frames:         0
Remote Counters:
  Interleaved RS Corrected Bytes:         0
  Interleaved Symbols with CRC Errors:    0
  No Cell Delineation Interleaved:        0
  Header Error Check Counter Interleaved:0
  Count of Severely Errored Frames:       0
  Count of Loss of Signal Frames:         0
```

You can also use the **show interface wan0-0** command to display the status of the virtual circuit:

```
cbos#show int wan0-0
WAN0-0  ATM Logical Port
        PVC (VPI 1, VCI 1) is open.
        ScalaRate set to Auto
        AAL 5         UBR Traffic
        PPP LCP State: Starting
        PPP NCP State (IP Routing): Starting
        PPP MRU: 2048    HDLC Framing: enabled    MPOA Mode: VC Mux
        PPP Login: ppp1
        Authentication Type: Autodetecting/PAP
        RADIUS: disabled
        PPP Tx: 0                Rx: 60742
        Dest IP: 205.142.210.1
        Dest Mask: 255.255.255.255
        IP Port Enabled
```

For PPP problems, use the **show ppp** command to display a summary of each virtual circuit for PPP mode. Check that the state of each virtual circuit is opened.

```
cbos#show ppp
VC       VPI/VCI  STATE       MRU    USERNAME  RADIUS   TX       RX
wan0-0   01/01   Starting     2048   ppp1      disabled 0        60742
wan0-1   01/02   Starting     2048   ppp2      disabled 0        59950
wan0-2   01/03   Starting     2048   ppp3      disabled 1476     738
wan0-3   01/00   Starting     2048   ppp4      disabled 0        59822
```

BERT Testing (Cisco 675, Cisco 675e and Cisco 676 only)

This section describes BERT tests using a Cisco 6100 DSLAM, Cisco 675, Cisco 675e, or Cisco 676, and an optional HP Broadband test set.

HP Test Set Configuration

All tests are based on the single cell version of S-PRBS9. This is the only PRBS pattern that is supported by the HP for generating multiple channels of cell load. All cells will have the same data, therefore it is necessary to have a cell sequence number to verify cell loss. This is done using AAL1.

Cells are generated by the HP and terminated by the Cisco 675s in the downstream direction, and vice versa for the upstream direction. The HP can only check BERT data on one channel at a time. It is therefore necessary to manually walk through every channel to verify data integrity. The BERT test can be performed without the HP test set if the Cisco 6100 NIU is physically looped back at the OC3 port.

Transmitting BERT Data

The following are the procedures for transmitting BERT data. Note that all pertinent tests will be initiated from the Optical Line Interface Card, and not a Cell Processor.

Step 1 Configure the load generator (truck icon) to send S-PRBS9 data to each CPE on VPI X / VCI X. Starting with channel 2 on the load generator, set up a connection using VPI 1 / VCI 32. Continue with channel 3 as VPI 1 / VCI 33 and so on until the number of channels that need to be tested are accounted for.

Step 2 Set the contents of each cell to S-PRBS9 with AAL1 enabled. All channels can be done at once by highlighting all of the channels and then setting the contents. AAL1 provides sequence numbers to determine if cells are being dropped.

Step 3 Set the bandwidth to the desired downstream rate. Again, all channels can be highlighted and changed simultaneously. This rate should be slightly lower than the trained rate (for example, 1.4M).

Step 4 Configure the Cisco 6100 or Cisco 6260 to set up connections from the NIs OC3 to the CPEs. Use the same connection parameters (VPI/VCI) that were used to configure the load generator.

Step 5 Verify that no other cell generation sources are active on the HP and that the laser is turned on.

Step 6 Compile the load generator and data will start flowing to the NI, through the Cisco 6100 or Cisco 6260 and out to the CPEs. Every time a parameter is changed in the load generator, it is necessary to compile for the change to take effect.

Step 7 The CPE should now be receiving BERT data.

Receiving BERT Data

After the CPEs have been BERT enabled, they will send S-PRBS9 BERT data toward the Cisco 6100 or Cisco 6260. The HP can verify the BERT data one channel at a time. Follow this procedure to receive BERT data:

Step 1 Select the receive filter from the Optical Line Interface Card and not the Cell Processor Card. This is the net/strainer icon.

Step 2 Specify the VPI and VCI that needs to be checked. The receive filter mode should be Virtual Channel.

Step 3 Select S-PRBS9 and AAL1. Now, only the specified cells will make it to the statistics counters.

Step 4 Select the statistics icon (ones and zeros). Select **View** and **ATM Statistics**.

Step 5 Select **Selected Cell Count**, **Bandwidth**, **Cell Loss**, etc.

Step 6 Apply.

Step 7 Select measurements and start the counters.

This will give you the statistics for the cell currently selected in the receive filter. Repeat the above procedure to check other channels. The Cell Protocol Processors can be used to view incoming cells if desired.

Cisco 600 Series CPE Configuration

Configure the CPE to perform BERT testing:

Step 1 Log in to the CPE via Ethernet or serial port.

Step 2 Give access to the BERT commands:

```
cbos> enable debug commands
```

Step 3 Keep the CPEs from trying to retrain even though they do not see the CO equipment on the far end:

```
cbos#  ifconfig wan0 stay
```

Step 4 Initiate the BERT test:

```
cbos#  debug bert on
```

Step 5 Set the header bits of the outgoing cells and qualify the incoming cells.

Step 6 Enter:

```
cbos#  debug bert header 00100010
```

Note Note that these are the four bytes of header not including the calculated HEC byte. Table 6-2 provides descriptions of the bit fields.

Example: VPI=1, VCI=1 (GFC=0, PTI=0, CLP=0) across the ADSL loop (see command line above).

Table 6-2 BERT Header Bit Map

7	6	5	4	3	2	1	0
		GFC				VPI	
		VPI				VCI	
		VCI				VCI	
		VCI			PTI		CLP

Step 7 Display a count of the BERT errors and cell loss since the previous query:

```
cbos#  debug bert count
```

Step 8 Note that the two LEDs on the left of the CPE take on a new meaning during the BERT tests.

- BERT SYNC LED—This is the LED at the left (WAN-ACT) and is illuminated once the PE detects a valid BERT pattern.
- BERT ERROR LED—This is the second LED from the left (WAN-LNK) and is toggled whenever the CPE detects a BERT error.

During a successful BERT test, the LED at the left will be illuminated, and the second LED from the left will be solid (either off or on, but not blinking).

APPENDIX A

Connectors

Rear Panel Connectors

Figure A-2 through Figure A-4 show the connectors located on the rear panels of the Cisco 600 series CPEs.

Figure A-1 Rear View of the Cisco 633

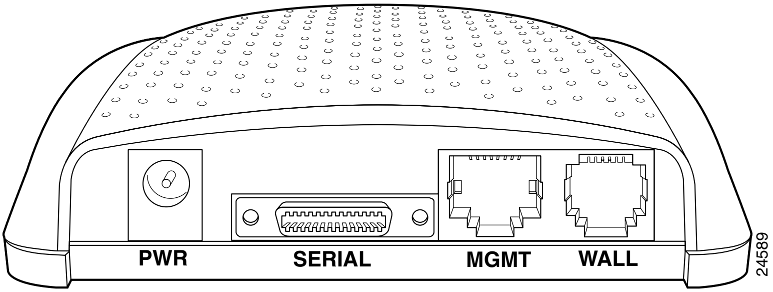


Figure A-2 Rear View of the Cisco 627

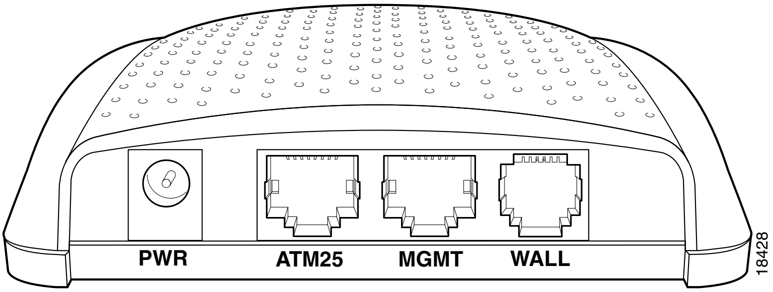


Figure A-3 Rear View of the Cisco 673, Cisco 675e, Cisco 676 and Cisco 677

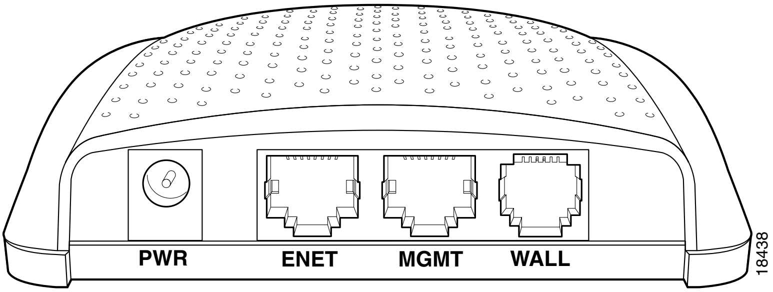
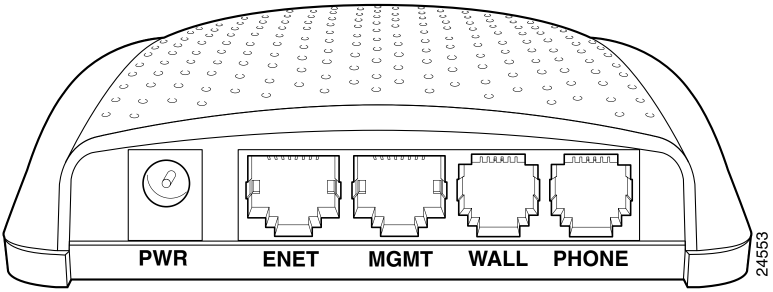


Figure A-4 Rear View of the Cisco 675 and Cisco 678



The following ports are located on the backside of the Cisco 600 series CPEs.

Table A-1 Rear Panel Connector

Interface	626	627	633	673	675	675e	676	677	678
Serial (Blue) - Serial Interface			✓						
ATM25—LAN Interface	✓	✓							
ENET (yellow) - LAN Interface				✓	✓	✓	✓	✓	✓
MGMT (light blue) - Management Interface	✓	✓	✓	✓	✓	✓	✓	✓	✓
WALL (lavender) - ADSL/SDSL Port Interface	✓	✓	✓	✓	✓	✓	✓	✓	✓
PHONE (gray) - Phone interface (must use microfilter between PHONE port and telephone)									✓
PHONE (gray) - No microfilter needed					✓				

These interfaces are described in the following sections.

Serial Interface (Cisco 633)

The serial interface uses 12-in-1 V.35 Data Terminal Equipment (DTE) serial connector. This interfface connects to a 5-in-1 V.35 Data Communications Equipment (DCE) serial port on a Cisco router.

12-in-1 Connector to 5-in-1 Connector Pinouts

Table A-2 12-in-1 to 5-in-1 Connector Pinouts

FROM	SB	SIGNAL	NOTE	SIGNAL	SB	TO
J1-21	X	MODE_2	LOCAL CONNECTIONS	MODE_2 GND GND MODE_DCE	X X X X	J2-47 J2-48 J2-51 J2-52
			SHIELD	SHIELD GND		J2-46
J1-5 J1-18		I_RXD/TXD+ I_RXD/TXD-	TWISTED PAIR # 5	O_TXD/RXD+ O_TXD/RXD-		J2-11 J2-12
J1-11 J1-10		I_CTS/RTS+ I_CTS/RTS-	TWISTED PAIR # 3	O_RTS/CTS+ O_RTS/CTS-		J2-9 J2-10
J1-1 J1-14		O_TXD/RXD+ O_TXD/RXD-	TWISTED PAIR # 8	I_RXD/TXD+ I_RXD/TXD-		J2-28 J2-27
J1-8 J1-9		O_RTS/CTS+ O_RTS/CTS-	TWISTED PAIR # 2	I_CTS/RTS+ I_CTS/RTS-		J2-1 J2-2
J1-2 J1-15		O_TXCE/RXC+ O_TXCE/RXC-	TWISTED PAIR # 7	I_RXC/TXCE+ I_RXC/TXCE-		J2-26 J2-25
J1-26	X	GND NOT USED	TWISTED PAIR # 1	GND NOT USED		J2-15
		NOT USED NOT USED	TWISTED PAIR # 4	NOT USED NOT USED		

J1 is 12-in-1 plug and J2 is 5-in-1 plug. J1 is DCE and J2 is DTE

SB = Shorting Block

X = Connection to Shorting Block

Note: Shorting Block on J2 should be grouped as shown

Table A-2 12-in-1 to 5-in-1 Connector Pinouts (continued)

		NOT USED NOT USED	TWISTED PAIR # 6	NOT USED NOT USED		
		NOT USED NOT USED	TWISTED PAIR # 9	NOT USED NOT USED		

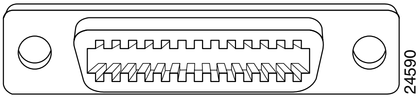
J1 is 12-in-1 plug and J2 is 5-in-1 plug. J1 is DCE and J2 is DTE

SB = Shorting Block

X = Connection to Shorting Block

Note: Shorting Block on J2 should be grouped as shown

Figure A-5 Front View of Serial Connector



LAN Interface

Ethernet Connector (Cisco 673, Cisco 678)

The LAN interface uses an Ethernet port that conforms to the IEEE 802.3 and 802.3u protocols and supports 10 or 100 Mbps half-duplex or full-duplex data rates on Category 3 (10 Mbps) or Category 5 (10/100 Mbps) twisted-pair wire up to 100 meters. The Ethernet connector is an RJ-45. Table A-3 shows the connector pinouts.

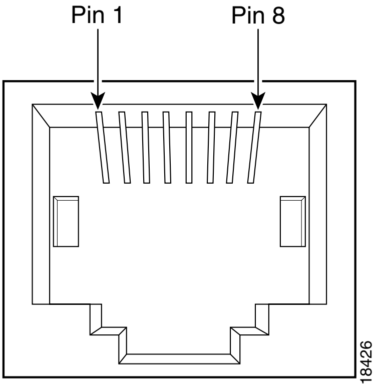
Table A-3 Ethernet Connector Pinouts

Pin	Signal
1	TXD+
2	TXD-

Table A-3 Ethernet Connector Pinouts

Pin	Signal
3	RXD+
6	RXD-

Figure A-6 Front View of Ethernet Connector



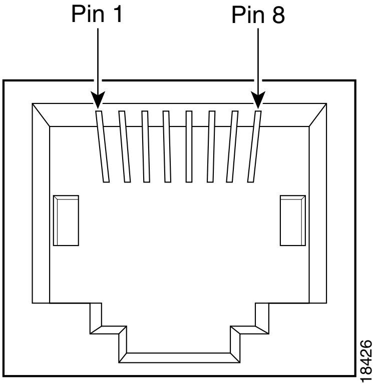
ATM25 Connector (Cisco 627)

The LAN interface uses an RJ-45 connector that conforms to the ATM Forum Specification for ATM 25.6 Mbits over a category 5 twisted-pair wire up to 100 meters. Table A-4 shows the connector pinouts.

Table A-4 ATM25 Connector Pinouts

Pin	Signal
7	TXD+
8	TXD-
1	RXD+
2	RXD-

Figure A-7 Front View of ATM25 Connector



Management Interface

The management port uses an RJ-45 connector.

If you are not using a management cable ordered from Cisco, use the pinouts in Table A-5 for the DB-9 end of the serial cable used to connect the management port to the serial port of the PC.

Management Port Pinouts

Table A-5 shows the connector pinouts for the management port and the DB-9 end of the serial cable.

Table A-5 Management Connector Pinouts

Signal	Management Port (RJ-45 Pin)	RJ-45-to-DB-9 Serial Cable (DB-9 Pin)	Signal
Do not connect	1	1	Do not connect
Do not connect	2	4	Do not connect
Do not connect	3	6	Do not connect
Ground	4	5	Ground

Table A-5 Management Connector Pinouts

Signal	Management Port (RJ-45 Pin)	RJ-45-to-DB-9 Serial Cable (DB-9 Pin)	Signal
RX (input to the Cisco 600 series CPEs product)	5	3	RX (output from the PC/terminal)
TX (output from the Cisco 600 series CPEs product)	6	2	TX (input to the PC/terminal)
Do not connect	7	7	Do not connect
Do not connect	8	8	Do not connect
		9	Do not connect

Caution Do not connect pins 1, 2, 3, 7, and 8 of the RJ-45 end of the serial cable or pins 1, 4, 6, 7, 8, and 9 of the DB-9 end of the serial cable. Connecting these pins might damage the CPE.

Figure A-8 Front View of RJ-45 End of the Serial Cable

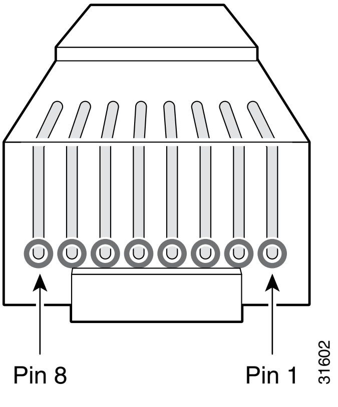
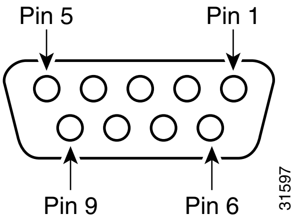


Figure A-9 Front View of DB-9 End of the Serial Cable



ADSL/SDSL Port Interface

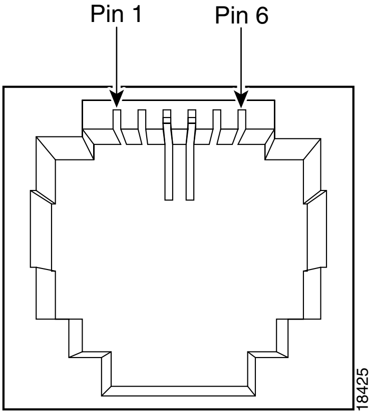
The ADSL/SDSL port uses an RJ-11 connector. Table A-6 shows the connector pinouts for the ADSL/SDSL connector.

ADSL/SDSL Connector Pinouts

Table A-6 ADSL/SDSL Connector Pinouts

Pin	Signal
3	Ring
4	Tip

Figure A-10 Front View of ADSL/SDSL Connector



Phone Port Interface

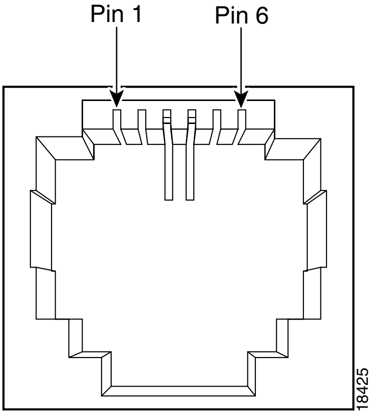
The Phone port uses an RJ-11 connector. Table A-7 shows the connector pinouts for the Phone connector.

Phone Connector Pinouts

Table A-7 Phone Connector Pinouts

Pin	Signal
3	Ring
4	Tip

Figure A-11 Front View of Phone Connector



APPENDIX B

Specifications

Physical Specifications

Dimensions

- 5.0 x 6.2 x 1.75 in (12.7 x 15.7 x 4.5 cm)

Weight

- 8 to 10 oz, depending on CPE model

Interface Specifications

Serial Interface (Cisco 633)

The 12-in-1 V.35 Data Terminal Equipment (DTE) serial connector connects to a 5-in-1 V.35 Data Communications Equipment (DCE) serial port on a Cisco router.

LAN Interface

LAN Interface	626	627	633	673	675	675e	676	677	678
RJ-45 connector, ATM-25	✓	✓							
RJ-45 connector, 10Base-T/100Base-TX Ethernet, half-duplex, compliant with IEEE 802.3 and 802.3u				✓	✓	✓	✓	✓	
RJ-45 connector, 10Base-T/100Base-TX Ethernet, half-duplex/full-duplex, compliant with IEEE 802.3 and 802.3u									✓

Management Interface

- RJ-45 connector
- Baud rate: 9600 to 38400 Kbps
- Data bits: 8
- Parity: none
- Stop bits: 1
- Flow control: none

ADSL/SDSL Interface

RJ-11 Connector/Encoding	626	627	633	673	675	675e	676	677	678
DMT Issue 1 encoding	✓						✓		
DMT Issue 2 encoding		✓						✓	✓
SDSL, 2B1Q encoding			✓	✓					
CAP encoding					✓	✓			✓
G.Lite encoding		✓						✓	✓

Phone/Microfilter Interface (Cisco 675 and Cisco 678)

- RJ-11 connector with built-in EZ-DSL microfilter (North American version only) (Cisco 675)
- RJ-11 connector (Cisco 678)

Software Upgrade

- Built-in Flash ROM

Power and Operating Requirements

Power Requirements

- 5 VDC @ 1.5 Amp

Operating Requirements

- Temperature: 32° to 104° F (0° to 40°C)
- Humidity: 5 to 90% (non-condensing)

SDSL 2B1Q Transmission Specifications (Cisco 633 and Cisco 673)

Table B-1 shows the SDSL 2B1Q transmission specifications for the Cisco 633 and Cisco 673.

Table B-1 SDSL 2B1Q Transmission Specifications

Specification	Downstream	Upstream
Maximum Transmit Power	13.5 dBm	13.5 dBm
Maximum Rate	1168 kbps	1168 kbps
Spectrum	DC-2.92 MHz	DC-2.92 MHz
Bandwidth	2.92 MHz	2.92 MHz

CAP RADSL Transmission Specifications (Cisco 675, Cisco 675e and Cisco 678)

Table B-2 shows the CAP RADSL transmission specification.

Table B-2 CAP RADSL Transmission Specifications

Specification	Downstream	Upstream
Maximum Transmit Power	22.7 dBm	13.3 dBm
Maximum Rate	7168 kbps	1088 kbps
Spectrum	240 – 1335KHz	35 – 191.4KHz
Bandwidth	1.095MHz	156KHz

DMT Issue 1 Transmission Specifications (Cisco 676)

Table B-3 shows the DMT Issue 1 RADSL transmission specification.

Table B-3 **DMT Issue 1 Transmission Specifications**

Specification	Downstream	Upstream
Maximum Transmit Power	20.4 dBm	12.5 dBm
Maximum Rate	9200 kbps	832 kbps
Spectrum	138-1104 KHz	26-138 KHz
Bandwidth	966 KHz	112 KHz

DMT Issue 2 Transmission Specifications (Cisco 627, Cisco 677 and Cisco 678)

Table B-4 shows the DMT Issue 2 Rate Adaptive DSL transmission specification.

Table B-4 ***DMT Issue 2 Transmission Specifications***

Specification	Downstream	Upstream
Maximum Transmit Power	20.4 dBm/Hz	12.5 dBm/Hz
Maximum Rate	8032 kbps	864 kbps
Spectrum	138-1104 KHz	26-138 KHz
Bandwidth	966 KHz	112 KHz

APPENDIX C

EZ-DSL Microfilter Specifications

Introduction

> **Note** This appendix details the mechanical characteristics of the EZ-DSL microfilter, which is used only with the Cisco 627, Cisco 675, Cisco 675e, Cisco 676, Cisco 677 and Cisco 678 CPEs.

The EZ-DSL microfilters are used to connect telephones at the customer premises to the premises telephone wiring. The microfilters are designed to prevent interference between the router and the telephone set, and to reduce the effect of POTS-generated noise on the ADSL transceiver.

> **Note** Use EZ-DSL Microfilters only at premises that do not have an ADSL POTS splitter installed.

Specifications

The EZ-DSL microfilters exist in two forms: an in-line version and a wall-mount version. This section list the specifications for both.

In-Line Microfilter

The in-line microfilters contain a plastic enclosure that houses a PCB assembly and RJ-11 female connector at either end. The top-level assembly includes a 3-inch RJ-11-to-RJ-11 pigtail for connection to the wall outlet. (See Figure C-1.)

Dimensions

- 2.50 x 1.00 x 1.03 inches
- 6.35 x 2.54 . x 2.6 cm

Figure C-1 In-Line Microfilter and Cable

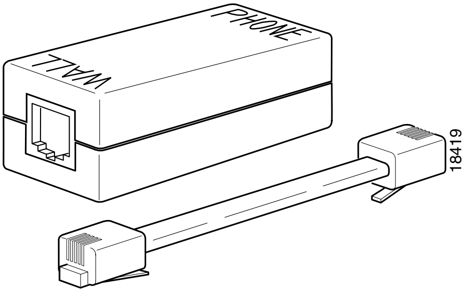


Table C-1 In-Line Microfilter Pinouts

Pin	Signal
3	Ring
4	Tip

Note The in-line microfilters do not work if connected improperly. To ensure that the microfilters work, connect the wall side of the microfilter to the wall jack and the phone side of the microfilter to the telephone.

Caution The in-line microfilters do not provide protection against transient noise for multi-line telephones, nor do they provide protection against power surges.

Installation Instructions

Step 1 Identify all home telephones plugged in and in service. An EZ-DSL microfilter should be installed at each home telephone.

Step 2 Unplug the telephone from the wall. Plug the telephone cord into the end of the EZ-DSL microfilter marked PHONE.

Step 3 Using the 3-inch telephone cord provided, plug one end of the cord into the microfilter marked WALL. Plug the other end of the cord into the telephone wall receptacle.

Step 4 After you have finished installation, verify that your telephone service works. If your telephone service does not work, disconnect the EZ-DSL Microfilter and contact your local telephone company or Cisco Systems.

Safety Precautions

Warning **Take the telephone handset off the hook while wiring.**

Warning **Persons with pacemakers should never work with telephone wiring.**

Wall-Mount Microfilter

The wall-mount version is a plastic plate used in conjunction with wall-mount telephones. The wall-mount microfilter installs in the place of normal telephone jack outlets where the wall-mount telephones are used.

Dimensions

- 4.50 x 2.75 inches
- 11.4 x 6.98 cm

Figure C-2 Wall Mount Microfilter

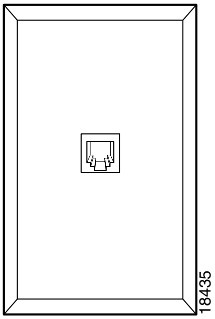


Table C-2 Wall Mount Microfilter Pinouts

Pin	Signal
3	Ring
4	Tip

Installation Instructions

Step 1 Remove any existing wall mounts.

Step 2 Remove 3 inches from the outer jacket of telephone wire in the outlet box. Strip .75 inch from each individual conductor.

Step 3 Loosen screws on all jack terminals. Each terminal is color coded. Connect four wires to corresponding terminal screws. Check wiring.

Wire Code Installation Guide

Table C-3 Jack Labeling and Wire Color Codes

Jack Labeling	Wire Color Code 1	Wire Color Code 2
Red	Red	White with blue stripes
Green	Green	Blue with white stripes
Yellow	Yellow	White with orange stripes
Black	Black	Orange with white stripes

Step 1 Remove front panel from supplied wall jack and attach jack to the outlet box with the screws provided. The word "Top" faces upward.

Step 2 To connect the telephone, align the plug on the telephone to the newly-installed wall jack. The rivet holes on the jack should line up with the rivet holes on the back of the telephone. Move the telephone downward to lock into place.

Step 3 Place the telephone handset back on the telephone.

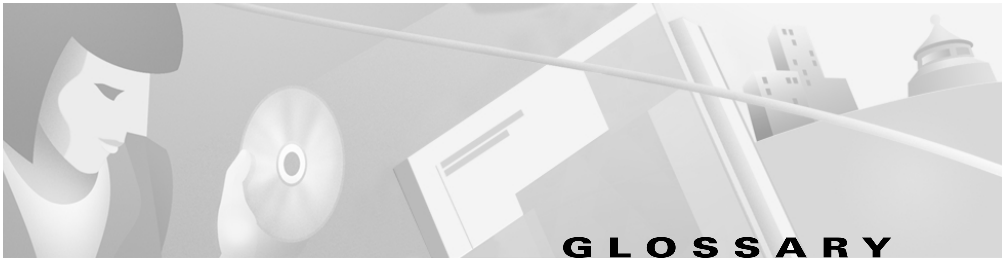
Safety Precautions

Warning **Take the telephone handset off the hook while wiring.**

Warning **Persons with pacemakers should never work with telephone wiring.**

Regulatory Approvals

- UL 1950, Third Edition
- FCC Part 68 (in-line microfilters only)



GLOSSARY

Numerics

2B1Q line encoding The 2B1Q (two binary, one quaternary) line encoding was intended for use by the ISDN DSL and SDSL. 2B1Q is a four-level line code that represents two binary bits (2B) as one quaternary symbol (1Q). ("Quaternary" means consisting of four, in this case, a four-level line code.) The 2B1Q line coding was seen as a major enhancement over the original T1 line coding, because 2B1Q encoded two bits instead of just one with every signaling state (baud).

A

address mask A bit mask used to select bits from an Internet address for subnet addressing. The mask is 32 bits long and selects the network portion of the Internet address and one or more bits of the local portion. Sometimes called subnet mask.

AAL5 ATM Adaptation Layer. This layer maps higher layer user data into ATM cells, making the data suitable for transport through the ATM network.

ADSL Asymmetric digital subscriber line. A digital subscriber line (DSL) technology in which the transmission of data from server to client is much faster than the transmission from the client to the server.

ATM Asynchronous Transfer Mode. A cell-based data transfer technique in which channel demand determines packet allocation. ATM offers fast packet technology, real time, demand led switching for efficient use of network resources.

authentication A security feature that allows access to information to be granted on an individual basis.

A

auto-negotiation Procedure for adjusting line speeds and other communication parameters automatically between two computers during data transfer.

AWG American Wire Gauge. The measurement of thickness of a wire.

B

bandwidth The range of frequencies a transmission line or channel can carry: the greater the bandwidth, the greater the information-carrying capacity of a channel. For a digital channel this is defined in bits. For an analog channel it is dependent on the type and method of modulation used to encode the data.

bandwidth-on-demand The ability of a user to dynamically set upstream and downstream line speeds to a particular speed.

bps Bits per second. A standard measurement of digital transmission speeds.

bridge A device that connects two or more physical networks and forwards packets between them. Bridges can usually be made to filter packets, that is, to forward only certain traffic. Related devices are: repeaters which simply forward electrical signals from one cable to the other, and full-fledged routers which make routing decisions based on several criteria. See repeater and router.

broadband Characteristic of any network that multiplexes independent network carriers onto a single cable. This is usually done using frequency division multiplexing (FDM). Broadband technology allows several networks to coexist on one single cable; traffic from one network does not interfere with traffic from another because the “conversations” happen on different frequencies in the “ether” rather like the commercial radio system.

Broadband Remote Access Server Device that terminates remote users at the corporate network or Internet users at the Internet service provider (ISP) network, that provides firewall, authentication, and routing services for remote users.

broadcast A packet delivery system where a copy of a given packet is given to all hosts attached to the network. Example: Ethernet.

C

CAP encoding Carrierless Amplitude Phase signal modulation.

CO Central office. Refers to equipment located at a Telco or service provider’s office.

CPE Customer premises equipment. Refers to equipment located in a user's premises.

D

DMT Discrete Multi-Tone frequency signal modulation.

downstream rate The line rate for return messages or data transfers from the network machine to the user’s customer premises machine.

DRAM Dynamic Random Access Memory. A type of semiconductor memory in which the information is stored in capacitors on a metal oxide semiconductor integrated circuit.

DSLAM Digital Subscriber Line Access Multiplexer. Concentrates and multiplexes signals at the telephone service provider location to the broader wide area network.

E

encapsulation The technique used by layered protocols in which a layer adds header information to the protocol data unit (PDU) from the layer above. As an example, in Internet terminology, a packet would contain a header from the physical layer, followed by a header from the network layer (IP), followed by a header from the transport layer (TCP), followed by the application protocol data.

Ethernet One of the most common local area network (LAN) wiring schemes, Ethernet has a transmission rate of 10, 100, or 1000 Mbps.

F

FCC Federal Communications Commission. A U.S. government agency that regulates interstate and foreign communications. The FCC sets rates for communication services,

FTP File Transfer Protocol. The Internet protocol (and program) used to transfer files between hosts.

H

hop count A measure of distance between two points on the Internet. It is equivalent to the number of gateways that separate the source and destination.

HTML Hypertext Markup Language. The page-coding language for the World Wide Web.

HTML browser A browser used to traverse the Internet, such as Netscape or Microsoft Internet Explorer.

http Hypertext Transfer Protocol. The protocol used to carry world-wide web (www) traffic between a www browser computer and the www server being accessed.

I

ICMP Internet Control Message Protocol. The protocol used to handle errors and control messages at the IP layer. ICMP is actually part of the IP protocol.

Internet address An IP address assigned in blocks of numbers to user organizations accessing the Internet. These addresses are established by the United States Department of Defense's Network Information Center. Duplicate addresses can cause major problems on the network, but the NIC trusts organizations to use individual addresses responsibly. Each address is a 32-bit address in the form of x.x.x.x where *x* is an eight- bit number from 0 to 255. There are three classes: A, B and C, depending on how many computers on the site are likely to be connected.

I

Internet A collection of networks interconnected by a set of routers which allow them to function as a single, large virtual network. When written in upper case, Internet refers specifically to the DARPA (Defense Advanced Research Projects Agency) Internet and the TCP/IP protocols it uses.

Internet Protocol (IP) The network layer protocol for the Internet protocol suite.

IP See Internet Protocol.

IP address The 32-bit address assigned to hosts that want to participate in a TCP/IP Internet.

IP datagram The fundamental unit of information passed across the Internet. It contains source and destination addresses along with data and a number of fields that define such things as the length of the datagram, the header checksum, and flags to say whether the datagram can be or has been fragmented.

ISO International Standards Organization. A voluntary, non-treaty organization founded in 1946, responsible for creating international standards in many areas, including computers and communications.

ISP Internet service provider. A company that allows home and corporate users to connect to the Internet.

ITU-T International Telecommunications Union, Standardization Sector. ITU-T is the telecommunication standardization sector of ITU and is responsible for making technical recommendations about telephone and data (including fax) communications systems for service providers and suppliers.

L

LAN Local area network. A limited distance (typically under a few kilometers or a couple of miles) high-speed network (typically 4 to 100 Mbps) that supports many computers.

LED Light emitting diode. The lights indicating status or activity on electronic equipment.

L

line rate The speed by which data is transferred over a particular line type, expressed in bits per second (bps).

logical port A logical entry to a server machine. These ports are mostly invisible to the user, though you might occasionally see a URL with a port number included in it. These ports do not refer to physical locations; they are set up by server administrators for network trafficking.

loopback A diagnostic test that returns the transmitted signal back to the sending device after it has passed through a network or across a particular link. The returned signal can then be compared to the transmitted one. The discrepancy between the two helps to trace the fault. When trying to locate a faulty piece of equipment, loopbacks will be repeated, eliminating satisfactory machines until the problem is found.

M

MAC Media Access Control Layer. A sublayer of the Data Link Layer (Layer 2) of the ISO OSI Model responsible for media control.

MIB Management Information Base. A collection of objects that can be accessed via a network management protocol, such as SNMP and CMIP (Common Management Information Protocol).

modem pooling The ability of a service provider to dynamically switch users' messages between modems, rather than requiring a modem to be dedicated to a particular user on a network.

multiplexer A device that can send several signals over a single line. The signals are then separated by a similar device at the other end of the link. This can be done in a variety of ways: time division multiplexing, frequency division multiplexing, and statistical multiplexing. Multiplexers are also becoming increasingly efficient in terms of data compression, error correction, transmission speed, and multi-drop capabilities.

N

NAT Network Address Translation.

network layer The OSI layer that is responsible for routing, switching, and subnetwork access across the entire OSI environment.

node A general term used to refer to a computer or related device; often used to refer to a networked computer or device.

NVT Network Virtual Terminal.

NVRAM Non-Volatile Random Access Memory. The router uses this memory to store configuration information. The contents of this memory are not lost after a reboot or power cycle of the unit.

O

octet A networking term that identifies 8 bits. In TCP/IP, it is used instead of *byte,* because some systems have bytes that are not 8 bits.

OSI Open Systems Interconnection. An international standardization program to facilitate communications among computers from different manufacturers. See ISO.

P

packet The unit of data sent across a packet switching network.

PAP Password Authentication Protocol.

PCI Peripheral Component Interconnect. An industry local bus standard. Supports up to 16 physical slots but is electrically limited to typically three or four plug-in PCI cards in a PC. Has a typical sustained burst transfer rate of 80 Mbps, which is enough to handle 24-bit color at 30 frames per second (full-color, full-motion video).

P

Permanent Virtual Connection (PVC) A fixed virtual circuit between two users: the public data network equivalent of a leased line. No call setup or clearing procedures are needed.

physical layer Handles transmission of raw bits over a communication channel. The physical layer deals with mechanical, electrical, and procedural interfaces.

physical port A physical connection to a computer through which data flows. An "Ethernet port," for example, is where Ethernet network cabling plugs in to a computer.

port The abstraction used by Internet transport protocols to distinguish among multiple simultaneous connections to a single destination host. See selector.

POTS Plain Old Telephone Service. This is the term used to describe basic telephone service.

PPP Point-to-Point-Protocol. The successor to SLIP, PPP provides router-to-router and host-to-network connections over both synchronous and asynchronous circuits. See SLIP.

protocol A formal description of messages to be exchanged and rules to be followed for two or more systems to exchange information.

PVC See Permanent Virtual Connection.

R

RADIUS Remote Authentication Dial-In User Service (RADIUS). A client/server security protocol created by Livingston Enterprises. Security information is stored in a central location, known as the RADIUS server.

RADIUS Accounting Client Permits system administrators to track dial-in use.

RADIUS Security Client Controls access to specific services on the network.

R

RADSL Rate Adaptive Digital Subscriber Line (RADSL). A technique for keeping the quality of transmissions within specified parameters.

remote address The IP address of a remote server.

remote server A network computer that allows a user to log on to the network from a distant location.

RFC Request for Comments. The document series, begun in 1969, which describes the Internet suite of protocols and related experiments. Not all RFCs describe Internet standards, but all Internet standards are written up as RFCs.

route The path that network traffic takes from its source to its destination. The route a datagram follows can include many gateways and many physical networks. In the Internet, each datagram is routed separately.

router A system responsible for making decisions about which of several paths network (or Internet) traffic will follow. To do this, it uses a routing protocol to gain information about the network and algorithms to choose the best route based on several criteria known as “routing metrics.” See bridge and repeater.

routing table Information stored within a router that contains network path and status information. It is used to select the most appropriate route to forward information along.

RS-232 An EIA standard that is the most common way of linking data devices together.

S

SDSL Symmetrical digital subscriber line. A digital subscriber line (DSL) technology in which the transmission of data from server to client is the same speed as the transmission from the client to the server.

secret Encryption key used by RADIUS to send authentication information over a network.

S

serial line A serial line is used to refer to data transmission over a telephone line via a modem or when data goes from a computer to a printer or other device.

shared secret RADIUS uses the shared secret to encrypt the passwords in the authentication packets, so outside parties do not have access to the passwords on your network.

SNMP Simple Network Management Protocol. The network management protocol of choice for TCP/IP-based internets.

socket (1) The Berkeley UNIX mechanism for creating a virtual connection between processes. (2) IBM term for software interfaces that allow two UNIX application programs to talk via TCP/IP protocols.

Spanning-Tree Bridge Protocol (STP) Spanning-Tree Bridge Protocol (STP). Part of an IEEE standard. A mechanism for detecting and preventing loops from occurring in a multi-bridged environment. When three or more LAN segments are connected by bridges, a loop can occur. Because a bridge forwards all packets which are not recognized as being local, some packets can circulate for long periods of time, eventually degrading system performance. This algorithm ensures only one path connects any pair of stations, selecting one bridge as the 'root' bridge, with the highest priority one as identifier, from which all paths should radiate.

spoofing A method of fooling network end stations into believing that keepalive signals have come from and returned to the host. Polls are received and returned locally at either end of the network and are transmitted only over the open network if there is a condition change.

STP See Spanning-Tree Bridge Protocol.

subnet For routing purposes, IP networks can be divided into logical subnets by using a subnet mask. Values below those of the mask are valid addresses on the subnet.

subnet mask See address mask.

synchronous connection During synchronous communications, data is not sent in individual bytes, but as frames of large data blocks.

SYSLOG SYSLOG allows you to log significant system information to a remote server.

T

TCP Transmission Control Protocol. The major transport protocol in the Internet suite of protocols providing reliable, connection-oriented full-duplex streams.

TFTP Trivial File Transfer Protocol. A simple file transfer protocol (a simplified version of FTP) that is often used to boot diskless workstations and other network devices such as routers over a network (typically a LAN). Has no password security.

Telnet The virtual terminal protocol in the Internet suite of protocols. Allows users of one host to log into a remote host and act as normal terminal users of that host.

training mode Characteristic of a router that allows it to use RADSL technology to adjust its line speed according to noise conditions on the transmission line.

transparent bridging So named because the intelligence necessary to make relaying decisions exists in the bridge itself and is thus transparent to the communicating workstations. It involves frame forwarding, learning workstation addresses and ensuring no topology loops exist (in conjunction with the Spanning-Tree algorithm).

Trivial File Transfer Protocol See TFTP.

twisted pair Two insulated copper wires twisted together with the twists or lays varied in length to reduce potential signal interference between the pairs.

U

UDP User Datagram Protocol. A connectionless transport protocol that runs on top of TCP/IP's IP. UDP, like TCP, uses IP for delivery; however, unlike TCP, UDP provides for exchange of datagrams without acknowledgments or guaranteed delivery. Best suited for small, independent requests, such as requesting a MIB value from an SNMP agent, in which first setting up a connection would take more time than sending the data.

UL Underwriters Laboratories. A private organization that tests and certifies electrical components and devices against rigorous safety standards. A UL Listing Mark on a product means that representative samples of the product have been tested and evaluated to nationally recognized safety standards with regard to fire, electric shock, and other related safety hazards.

UNI signaling User Network Interface signaling for ATM communications.

upstream rate The line rate for message or data transfer from the source machine to a destination machine on the network. Also see downstream rate.

V

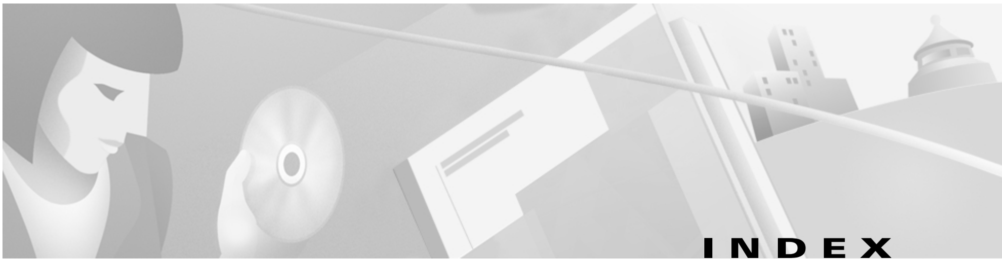
VC See Virtual Connection.

Virtual Connection (VC) A link that seems and behaves like a dedicated point-to-point line or a system that delivers packets in sequence, as happens on an actual point-to-point network. In reality, the data is delivered across a network via the most appropriate route. The sending and receiving devices do not have to be aware of the options and the route is chosen only when a message is sent. There is no pre-arrangement, so each virtual connection exists only for the duration of that one transmission.

VIP Virtual Ethernet Interface.

W

WAN Wide area network. A data communications network that spans any distance and is usually provided by a public carrier (such as a telephone company or service provider).



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