CAYMAN

Cayman 3220-H

User's Guide

Release 5.6.2
November 2000

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Contents

Preface

About This Manual

This manual describes how to connect your Cayman 3220-H to your local area network (LAN) and wide area network (WAN) and how to configure it to function as an Ethernet hub/router. You should read this manual completely before you connect your Cayman 3220-H to your Ethernet networks.

Who Should Read This Manual

This manual is intended for network or system administrators responsible for setting up and maintaining the hardware and software to connect Ethernet networks.

What This Manual Covers

Here's what you will find in this manual:

- **Chapter 1, "About Your Cayman 3220-H,"** presents an overview of the features, ports, and LEDs on your Cayman 3220-H.
- **Chapter 2, "Setting Up Your Cayman 3220-H,"** describes how to unpack your Cayman 3220-H and how to connect and disconnect it from your Ethernet networks.
- **Chapter 3, "Configuring Your Cayman 3220-H,"** describes how to use the web-based configuration interface to enter operating settings for your Cayman 3220-H.

- **Chapter 4, "Using the Command Line Interface,"** describes how to use the text-based command line interface to enter operating settings for your Cayman 3220-H.
- **Chapter 5, "Monitoring Your Cayman 3220-H,"** describes how to monitor the performance of your Cayman 3220-H.
- **Chapter 6, "Updating Your System Software,"** describes how to install a new version of the Cayman 3220-H operating software in your router.
- **Appendix A, "Technical Specifications,"** details hardware specifications and certifications for the Cayman 3220-H.
- **Appendix B, "Diagnostic Console,"** describes how to connect a terminal to the Cayman 3220-H maintenance console port and how to use the Cayman 3220-H diagnostic console to display and modify the device's boot settings.
- **Appendix C, "How Your Cayman 3220-H Works,"** presents background information on how the Cayman 3220-H supports address mapping, bridging, and the Dynamic Host Control Protocol (DHCP).

Documentation Conventions

This manual uses the following conventions to present information:

- Menu commands and button names appear in ***bold italic sans serif*** type face.
- Computer display text appears in `terminal type face`.
- User-entered text appears in **`bold terminal type face`**.

Syntax conventions for the Cayman 3220-H command line interface are as follows:

- Optional command arguments are presented in straight ([ ]) brackets.

- Alternative values for an argument are presented in curly ({ }) brackets, with values separated with vertical bars (|).
- Variables for which you must supply your own values are presented in *italic terminal type face*.

1 About Your Cayman 3220-H

The Cayman 3220-H combines a four-port Ethernet hub with an Asymmetric Digital Subscriber Line (ADSL) router. The Cayman 3220-H connects the personal computers, printers, and other network devices in a workgroup to a remote network or the Internet.

What's New in Release 5.6.2

- Support for RIP version 2 with MD5 authentication provides a secure method of exchanging routing information with other trusted routers while detecting and ignoring forged routing messages sent from
- Support for Alcatel multimode Asymmetric Digital Subscriber Line (ADSL) , which allows your Cayman 3220-H to detect and establish a connection over all industry-standard forms of asynchronous DSL (ANSI T1.413 Issue2, G.dmt, and G.lite) automatically.

Cayman 3220-H Features

- ADSL technology supports throughput of up to eight megabits per second.
- Asynchronous Transfer Mode (ATM) supports up to eight simultaneous virtual circuits (VCs) for reliable high-speed data transmission.

- Integrated 10BaseT Ethernet hub on the Cayman 3220-H front panel lets you add or move workgroup network connections quickly and easily.
- SWIFT-IP™ means that installing the Cayman 3220-H consists of connecting the device to your networks and entering a few basic settings.You can install and configure the Cayman 3220-H in less than 10 minutes.
- Web-based browser configuration makes configuration and management easy from anywhere on your network. Command-line configuration lets you monitor the 3220-H through a Telnet or VT100 connection.
- Full-featured wide-area network bridge supports non-TCP/IP protocols.
- Network Address Translation (NAT) lets your workgroup network share one IP address when communicating with other hosts on your corporate network or the Internet.
- Dynamic Host Configuration Protocol (DHCP) client functionality lets your Internet Service Provider (ISP) or a host on your Wide Area Network configure the IP address and other network settings for the WAN interface on your Cayman 3220-H automatically.
- DHCP server functionality lets the Cayman 3220-H automatically configure the IP address and other network settings for computers on your Local Area Network.
- DHCP relay agent functionality lets devices on the Local Area Network obtain network address information from a DHCP server on the WAN without any user setup at the workstation.
- IP pinholes let you provide web services from your Local Area Network without sacrificing network security.
- Bandwidth shaping lets carriers and service providers regulate the amount of WAN traffic.
- Alcatel access concentrator interoperability.

- Support for Point-to-Point Protocol over Ethernet (PPPoE) lets you connect to an Internet Service Provider using well-defined protocols.
- Diagnose utility simplifies identification and resolution of network problems.
- Cayman 3220-H configuration pages automatically warn you if an administrator password has not been set.
- Security features include restrictions on access to the Cayman 3220-H through its WAN port, limitations on packets addressed to an interface's broadcast address, and enhanced handling of "spoofed" IP addresses.
- Ability to install new software images from the Cayman 3220-H Home page.
- Support for Checkpoint and Nortel Contivity virtual private networks.
- Support for negotiation of IPCP subnet allocation from a Remote Access Server.
- Enhanced security, diagnostics, and error reporting for PPP and PPPoE connections.
- Support for a NAT default server lets your Cayman 3220-H direct NAT traffic to a specified host on your network.

Cayman 3220-H Front Panel

The front panel of your Cayman 3220-H (Figure 1-1) includes the following LEDs and ports.

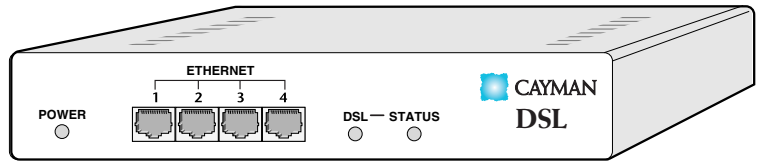


Figure 1-1 Cayman 3220-H Front Panel

- The **power LED** remains steadily on when you connect your Cayman 3220-H to a power supply.
- **Four 10BaseT Ethernet hub ports** lets you connect network devices within a workgroup. Each hub port has an integrated LED that remains on when the Cayman 3220-H is connected to the device and that flashes when a packet is sent or received over the associated hub port.
- The **DSL LED** flashes when a packet is sent or received over the DSL port.
- The **Status LED** remains on steadily when the DSL link is functioning.

Cayman 3220-H Back Panel

The back panel of your Cayman 3220-H (Figure 1-2) includes three ports.

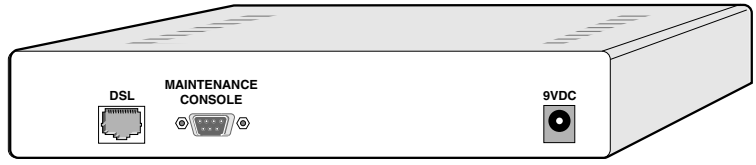


Figure 1-2 Cayman 3220-H Back Panel

- The **DSL port** lets you connect your Cayman 3220-H to one or more remote networks over a DSL connection.
- The **maintenance console port** lets you connect the Cayman 3220-H to a terminal or personal computer running a terminal emulation application to configure its operating settings with the command line interface (described in Chapter 4.)
- The **power port** lets you connect the Cayman 3220-H to an electrical power supply.Transformers for standard U.S. and international power sources are available from your router vendor.

Using a transformer that has not been approved by Cayman Systems will void your warranty. While non-approved power supplies may appear compatible with the Cayman 3220-H power jack, they may result in damage to your Cayman 3220-H.

2 Setting Up Your Cayman 3220-H

Unpacking Your Cayman 3220-H

The first thing you should do when you receive the Cayman 3220-H package is confirm that you have everything you should. Remove all the materials from the shipping carton and verify that you have the following:

- The Cayman 3220-H server in a protective bag
- Power transformer (U.S. or international)
- *Cayman 3220-H QuickStart* and other documentation
- Cayman 3220-H installation CD-ROM
- Blue and green DSL data cables

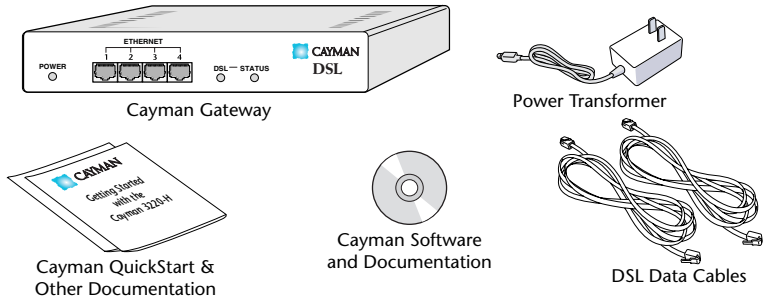


Figure 2-1 Cayman 3220-H Package Components

Your Cayman 3220-H shipping carton may also include release notes and other materials. If your shipping carton does not contain everything on this list, contact Cayman Technical Support.

Keep the shipping carton and all the packing materials used to ship your Cayman 3220-H. Repack your Cayman 3220-H in its original carton if you have to move it over long distances or if you need to ship it to another location.

Connecting Your Cayman 3220-H

The 10Base-T Ethernet ports on the front panel of the Cayman 3220-H let you connect the personal computers, printers, and other network devices in your workgroup. The DSL port on the rear panel of the Cayman 3220-H is used to connect the device to a DSL jack.

Step 1: Position the Cayman 3220-H

Position the Cayman 3220-H in a location where air can circulate freely around it. The Cayman 3220-H case has vents on its top and bottom. Leave at least two (2) inches of clearance between the vents on the top of the Cayman 3220-H and any object that might restrict air flow. Never operate the Cayman 3220-H when its vents are covered or obstructed.

Step 2: Connect Your Local Devices

Insert one end of a twisted-pair cable in one of the ports labeled LAN 10BT on the Cayman 3220-H front panel until you feel it lock (Figure 2-1). Connect the other end of the cable to the Ethernet port on a personal computer or other networked device. You can connect your network devices to any of the Cayman 3220-H Ethernet hub ports.

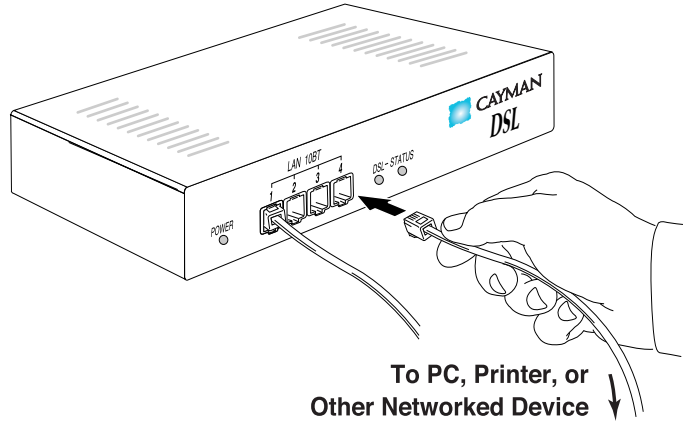


Figure 2-1 Connecting the Cayman 3220-H to Your LAN

If you require more than four Ethernet hub ports, you can connect your Cayman 3220-H to another Ethernet hub. To do so, use a standard twisted-pair Ethernet cross-over cable to connect any LAN port on the Cayman 3220-H to any Ethernet port on the other hub.

Step 3: Connect Your Wide Area Network

Insert one end of the green DSL data cable in the port labeled DSL on the Cayman 3220-H back panel until you feel it lock (Figure 2-2). Connect the other end of the cable to your DSL wall jack. If the DSL status LED does not come on after you power your Cayman 3220-H, replace the green DSL data cable with the blue one.

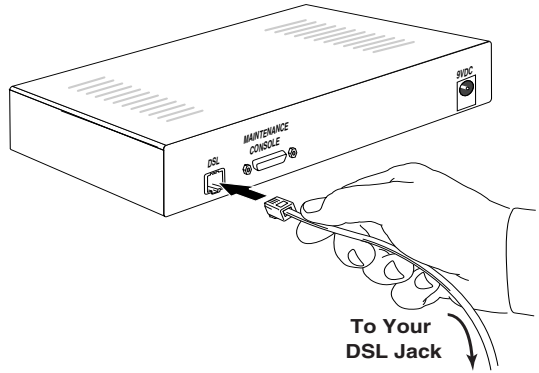


Figure 2-2 Connecting Your Cayman 3220-H to Your WAN

Step 4: Power On the Cayman 3220-H

Plug the round end of the transformer cord into the power jack on the back panel of the Cayman 3220-H (Figure 2-3).

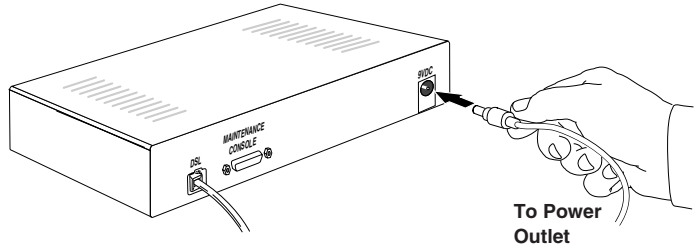


Figure 2-3 Connecting Your Cayman 3220-H to a Power Supply

After you have connected the transformer to the Cayman 3220-H, plug the pronged end of the transformer cord into a 110-120 volt AC outlet (or the electrical power outlet appropriate to your location).

Users outside the United States may need a transformer compatible with local electrical power specifications. Contact your authorized router vendor for information on appropriate transformers.

Disconnecting Your Cayman 3220-H

Complete the following steps to disconnect your Cayman 3220-H from your Ethernet networks. Return the Cayman 3220-H to its original carton if you are moving it to a different location.

1. **Warn and disconnect network users.**

   Before you disconnect the Cayman 3220-H, let your network users know that remote access services will be interrupted temporarily.

2. **Unplug the Cayman 3220-H power supply.**

   Unplug the Cayman 3220-H transformer from the wall outlet. After you have unplugged the transformer from its wall outlet, disconnect the transformer from the Cayman 3220-H.

3. **Disconnect the Cayman 3220-H from your local Ethernet devices.**

   Disconnect the Ethernet cables from the LAN ports on the Cayman 3220-H front panel.

4. **Disconnect the cable from the Cayman 3220-H DSL port.**

   Disconnect the cable from the DSL port on the Cayman 3220-H back panel.

3 Configuring Your Cayman 3220-H

- Gathering Configuration Information
- Configuring Your Computer
- Opening a Web Connection
- Entering Basic Settings
- Entering Ethernet (LAN) Settings
- Entering ATM Settings
- Configuring Password Settings
- Configuring Pinhole Settings
- Configuring Bridge Settings
- Configuring SNMP Settings

Gathering Configuration Information

Before you configure your Cayman 3220-H, you need to gather information about your networks. Most users will only need to complete the QuickStart section.

For many users, the default configuration of the product will provide all the necessary services. Some DSL service providers may require settings that vary from the default configuration. In such cases, you should contact the service provider or network administrator and have them complete the Quickstart form below.

QuickStart Information

You can print the following table and use it to enter information in the Cayman 3220-H QuickStart window.

Field Name	Description	Your Information
System Name	The name used to identify your Cayman 3220-H on your network. Default is ***Cayman-DSL<serialnumber>***	
IP Address	The IP address your Cayman 3220-H uses on virtual circuit 1 (VCC1). Default is ***0.0.0.0.***	
Net Mask	Subnet mask in use for the network connected to VCC1. Default is typically ***255.255.255.0***.	
Default Gateway	IP address of the host to which the Cayman 3220-H should send network traffic when it can't find the destination host. Blank by default.	
Domain Name	The name of the DNS domain you access most frequently. Blank by default.	

Field Name	Description	Your Information
Primary Nameserver Address	The IP address of the primary DNS name server for your network. Default is ***0.0.0.0***.	
Secondary Nameserver Address	The IP address of the backup DNS name server for your network. Default is ***0.0.0.0***.	

Ethernet (LAN) Port Information (Optional)

If you want to customize the settings for the Ethernet interface on your Cayman 3220-H, print the following table and use it to enter information in the Cayman 3220-H Ethernet window.

Some fields listed in the table only appear after you click the ***Expert Mode*** button on the Cayman 3220-H Home window.

Field Name	Description	Your Information
Local Address	The IP address of the Cayman 3220-H on the network connected to its LAN interface. Default is ***192.168.1.254***.	
Net Mask	Subnet mask in use for the network connected to the Ethernet port. Default is typically ***255.255.255.0***.	
DHCP Mode (expert mode)	***Off*** – Disable DHCP server. ***Server*** – Your Cayman 3220-H uses DHCP to provide network configuration information to hosts on the Local Area Network. ***Server*** is the default setting. ***Relay-agent*** – Your Cayman 3220-H forwards DHCP requests and responses to a remote DHCP server.	

Field Name	Description	Your Information
Start Address (expert mode)	The first IP address the Cayman 3220-H should assign for Dynamic Host Control Protocol clients. Applicable when DHCP Mode is set to ***Server***. Default is ***192.168.1.1***.	
End Address (expert mode)	The last IP address the Cayman 3220-H should assign for Dynamic Host Control Protocol clients. Applicable when DHCP Mode is set to ***Server***. Default is ***192.168.1.254***.	
Lease Time (expert mode)	The time period, in DD:HH:MM:SS format, for which a configuration issued by the Cayman 3220-H DHCP server is valid. Applicable when DHCP Mode is set to ***Server***. Default is ***00:01:00:00*** (one hour).	
Server Address (expert mode)	The IP address the remote DHCP server to which your Cayman 3220-H will relay Dynamic Host Control Protocol address requests. Applicable when DHCP Mode is set to ***Relay-agent***.	

ATM Port Information (Optional)

If you want to customize the settings for the ATM port on your Cayman 3220-H, print a copy of the following table for each virtual circuit you want to set up and use it to enter information in the Cayman 3220-H ATM Configuration window.

Field Name	Description	Your Information

Encapsulation	The manner in which data transported through the ATM connection is encapsulated. You can select different encapsulation methods for different virtual circuit connections.	Choose one:
		`None`
		`ether-llc`
		`ether-vcmux`
		`ip-llc`
		`ip-vcmux`
		`ppp-llc`
		`ppp-vcmux`
		`pppoe-llc`
		`pppoe-vcmux`

You will need the following information if you choose `ether-llc`, `ether-vcmux`, `ip-llc`, or `ip-vcmux` for a virtual circuit.

Field Name	Description	Your Information
VPI	Virtual path identifier. Enter a number in the range 0-255. Default is 0.	
VCI	Virtual circuit identifier. Enter a number in the range 0-65535. Default is 35.	
Local Address	The IP address of the Cayman 3220-H on the virtual circuit.	
Net Mask	Subnet mask in use for the network connected to the virtual circuit. Default is typically ***255.255.255.0***.	

Field Name	Description	Your Information

RIP-Send Version	Specifies how your Cayman 3220-H distributes information about its routes to other routers.	Choose one:
		`V1`
		`V2`
		`V1-compatible`

RIP-Receive Version	Specifies how your Cayman 3220-H learns about the routes maintained by other routers accessible through the virtual circuit.	Choose one:
		`V1`
		`V2`
		`V1-compatible`

You will need the following information if you choose `ppp-llc`, `ppp-vcmux`, `pppoe-llc`, or `pppoe-vcmux` for a virtual circuit.

Field Name	Description	Your Information
VPI	Virtual path identifier. Enter a number in the range 0-255. Default is 0.	
VCI	Virtual circuit identifier. Enter a number in the range 0-65535. Default is 35.	
Local Address	The IP address of the Cayman 3220-H on the virtual circuit. Enter 0.0.0.0 if you want the Cayman 3220-H to negotiate its IP address.	
Peer Address	The IP address of the PPP peer on the virtual circuit. Enter 0.0.0.0 if you want the Cayman 3220-H to negotiate the remote peer's IP address.	

RIP-Send Version	Specifies how your Cayman 3220-H distributes information about its routes to other routers.	Choose one:
		`V1`
		`V2`
		`V1-compatible`

Field Name	Description	Your Information

RIP-Receive Version	Specifies how your Cayman 3220-H learns about the routes maintained by other routers accessible through the virtual circuit.	Choose one:
		`V1`
		`V2`
		`V1-compatible`

PAP Username	Specifies the PAP username used to authenticate the connection on VCC1.	
PAP Password	Specifies the PAP password used to authenticate the connection on VCC1.	
CHAP Username	Specifies the CHAP username used to authenticate the connection on VCC1.	
CHAP Secret	Specifies the CHAP secret used to authenticate the connection on VCC1.	

Configuring Your Computer

The following instructions assume that you want all devices on your workgroup Ethernet network to use IP addresses on the 192.168.1.0 local area network. If your workgroup network must use another network number, refer to *Entering Ethernet (LAN) Settings* on page 3-15 for information on how to change the IP address of the LAN interface for the Cayman 3220-H.

1. **Configure your computer to use an IP address on the same TCP/IP network as the Cayman 3220-H.**

   ▷ If you are using Windows 95/Windows 98/Windows NT:

   a. Open the Network Control Panel and select the TCP/IP service for the Ethernet card in your computer (for example, ***TCP/IP ->3Com EtherLink III***).

   b. Open the Properties window.

c. Click the ***Gateways*** tab, and remove any installed gateways.

d. Click the ***DNS Configuration*** tab, and disable DNS.

e. Click the ***IP Address*** tab, and click the ***Obtain an IP Address Automatically*** option button.

f. Click ***OK*** to save the modified TCP/IP settings.

▷ If you are using a Macintosh running Open Transport:

a. Open the TCP/IP Control Panel.

b. Choose ***Connect via Ethernet***.

c. Choose ***Configure Using DHCP Server*** and enter the IP address of the Cayman 3220-H (192.168.1.254) in the ***Name Server Address*** text box.

d. Click ***OK***.

▷ If you are using a Macintosh running MacTCP:

a. Open the MacTCP Control Panel and select the ***Ethernet*** interface icon.

b. Enter 192.168.1.x (where x is any number in the range 1-253) in the ***IP Address*** text field.

c. Click the ***More*** button.

d. Click the ***Obtain Address Manually*** radio button.

e. Enter 192.168.1.254 in the ***Gateway Address*** text field.

f. Pull down the ***Class*** dropdown list and choose C, which sets your subnet mask to 255.255.255.0.

g. In the ***Domain Name Server Information*** fields, enter your Internet Service Provider's domain name in the Domain text field and enter 192.168.1.254 in the IP ***Address*** text field.

2. Restart your computer.

3. **Configure each computer that will use the Cayman 3220-H's address sharing feature to use DHCP, as described in Step 1, above.**

   Configure devices that will not use DHCP with static IP addresses on the same network as the Cayman 3220-H. Restart each device after you have updated its TCP/IP configuration.

Opening a Web Connection

You use a Web browser, such as Netscape Navigator or Microsoft Internet Explorer, to open a connection to your Cayman 3220-H.

To open a connection to your Cayman 3220-H:

1. **Run your Web browser.**

2. **Enter the name or IP address of your Cayman 3220-H in the browser's *Open Location* window and press Enter.**

   For example, you would enter `http://192.168.1.254/` if your Cayman 3220-H is using its default IP address. You can enter `http://cayman-dsl./` (including the final period and slash) if your computer has been configured to obtain its network configuration from a DHCP server.

3. **If an administrator or user password has been assigned to the Cayman 3220-H, enter your name and the appropriate password and click *OK*.**

   The Cayman 3220-H Home window (Figure 3-1) opens. By default, you are in Novice Mode, which is appropriate for most users.

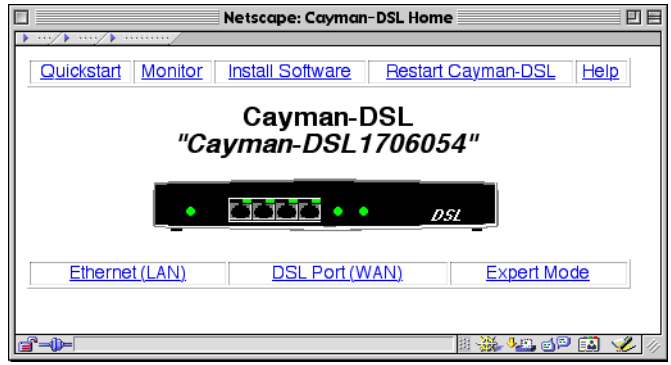


Figure 3-1 Cayman 3220-H Home Window (Novice Mode)

4. **Use the buttons on the Cayman 3220-H Home Page to issue a command or open a window.**

   - The ***Quickstart*** button opens the QuickStart window, which lets you enter basic settings for your Cayman 3220-H.
   - The ***Monitor*** button opens the Monitor window, which lets you display operating statistics for your Cayman 3220-H.
   - The ***Install Software*** button opens the Install New Cayman Software window, which lets you install new operating system software in your Cayman 3220-H.
   - The ***Restart Cayman-DSL*** button restarts your Cayman 3220-H, causing it to load any updated configuration information.
   - The ***Help*** button opens a window explaining how to access the Cayman 3220-H online help system.
   - The ***Ethernet A (LAN)*** button opens the Ethernet window, which lets you configure TCP/IP address settings for the Ethernet hub ports on the Cayman 3220-H.
   - The ***DSL Port*** button opens the DSL window, which lets you configure TCP/IP address settings for the DSL port on the Cayman 3220-H.
   - The ***Expert Mode*** button adds four additional buttons (***Passwords***, ***Pinhole***, ***Bridge***, and ***SNMP***) to the Cayman 3220-H Home page (Figure 3-2). Under normal circumstances, you do not need to modify these settings.

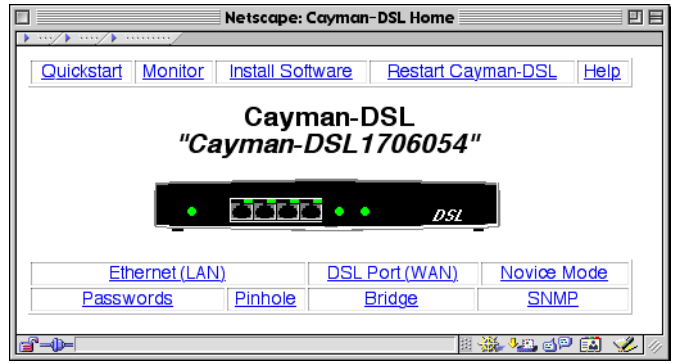


Figure 3-2 Cayman 3220-H Home Window (expert mode)

Entering Basic Settings

The Cayman 3220-H QuickStart window lets you enter basic configuration information for your Cayman 3220-H. If you use the default settings for IP address information for the device's WAN (DSL) port, the Cayman 3220-H QuickStart window asks you only for the name you want to assign your Cayman 3220-H. If you have overridden the default settings for IP address information for VCC1 on the WAN (DSL) port and entered IP address information manually, you can use the Cayman 3220-H QuickStart window to display and modify those settings.

Default QuickStart Window

To display the QuickStart window, click the ***QuickStart*** button on the Cayman 3220-H Home Page. If you are using the default settings (PPPoE) for your WAN (DSL) port, the default Cayman-DSL PPP Quickstart window (Figure 3-3) opens.

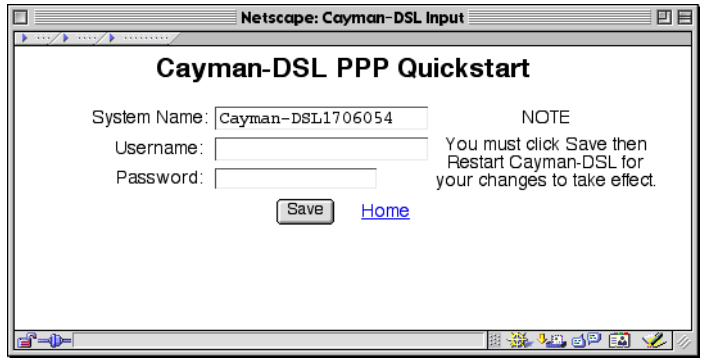


Figure 3-3 QuickStart Window

To configure the QuickStart window:

1. **Enter the name of your Cayman 3220-H in the *System Name* field.**

   Each Cayman 3220-H is assigned a name as part of its factory initialization.The default name for a Cayman 3220-H consists of the word "Cayman-DSL" and the serial number of the device. A device name can be 1-32 characters long and cannot include spaces or special characters.

2. **Enter the identifier you want your Cayman 3220-H to send when the PPP link is being established in the *Username* field.**

   This is the username the Cayman 3220-H sends in a PAP or CHAP response packet.The information you enter must match the CHAP username configured in the remote PPP peer's authentication database.

3. **Enter the password you want your Cayman 3220-H to send when the PPP link is being established in the *Password* field.**

   This is the PAP password or CHAP secret the Cayman 3220-H sends.The information you enter must match the PAP password/CHAP secret configured in the remote PPP peer's authentication database.

4. **Click the *Save* button to store your modified configuration in the Cayman 3220-H memory.**

5. **Click the *Restart Cayman-DSL* button to restart your Cayman 3220-H with its new configuration.**

RFC-1483 QuickStart Window

If you have configured your WAN port to use IP or Ethernet framing, a window similar to the one in Figure 3-4 opens when you click the ***QuickStart*** button.

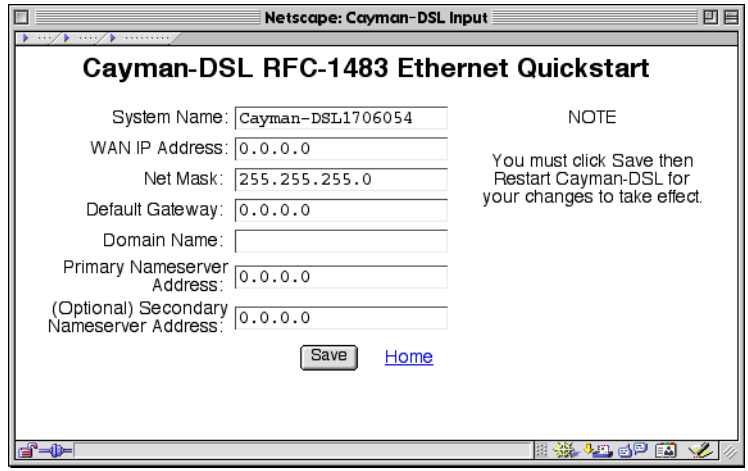


Figure 3-4 RFC-1483 QuickStart Window

To configure the Manual QuickStart window:

1. **Enter the name of your Cayman 3220-H in the *System Name* field.**

   Each Cayman 3220-H is assigned a name as part of its factory initialization. The default name for a Cayman 3220-H consists of the word "Cayman-DSL" and the serial number of the device. A device name can be 1-32 characters long and cannot include spaces or special characters.

2. **Enter the IP address for virtual circuit 1 (VCC1) on the DSL port in the *WAN IP Address* field.**

   The IP address you assign to VCC1 must not be used by another device on your wide area network.

3. **Enter the subnet mask for virtual circuit 1 (VCC1) in the *Net Mask* field.**

   The subnet mask specifies which bits of the 32-bit binary IP address represent network information. Most sites should use `255.255.255.0` for their subnet mask.

4. **Enter the IP address of the default gateway for your network in the *Default Gateway* field.**

   The default gateway is the host to which the Cayman 3220-H will send packets if it does not know how to reach a destination host.

5. **Enter your domain name in the *Domain Name* field.**

   Domain names identify organizations on the Internet. Enter the domain name you use most frequently in the ***Domain Name*** field.

6. **Enter the IP address of your primary domain name server in the *Primary Nameserver Address* field.**

   A domain name server is a network computer responsible for matching host names to numeric IP addresses so that network traffic can be routed correctly. Your Internet Service Provider can provide the IP address of their domain nameserver.

7. **Enter the IP address of your backup domain name server in the *Secondary Nameserver Address* field.**

   The secondary nameserver is consulted when the primary nameserver cannot be reached.

8. **Click the *Save* button to store your modified configuration in the Cayman 3220-H memory.**

   The Cayman 3220-H Home Page opens.

9. **Click the *Restart Cayman-DSL* button on the Cayman 3220-H Home Page to restart your Cayman 3220-H with its new configuration.**

Entering Ethernet (LAN) Settings

The Ethernet Port Configuration window lets you enter TCP/IP configuration information for the LAN (Ethernet A) interface on your Cayman 3220-H. The Cayman 3220-H provides default settings that are appropriate for networks that do not already have TCP/IP addresses. If your network falls into this category, do not change the LAN Ethernet settings.

To display the Ethernet Port (LAN) Configuration window (Figure 3-5), click the ***Ethernet*** button on the Cayman 3220-H Home Page.

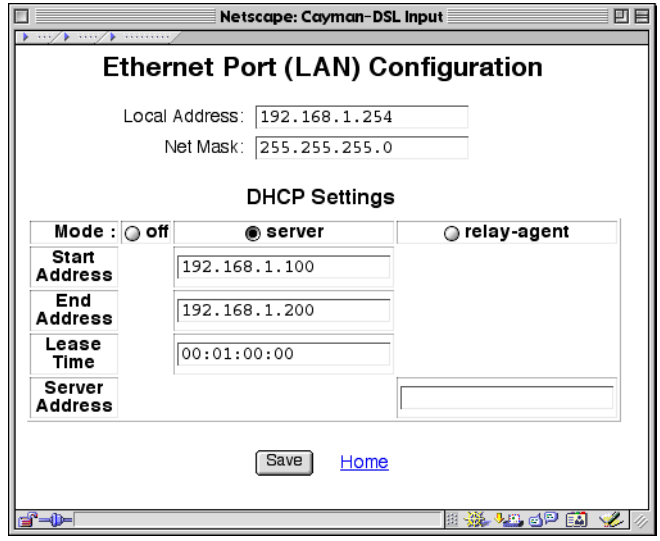


Figure 3-5 Ethernet Port (LAN) Configuration Window (expert mode)

To configure your Ethernet settings:

1. **Enter the IP address of the Cayman 3220-H's LAN Ethernet interface in the *Local Address* field.**

   The IP address you assign to your Cayman 3220-H'S LAN interface must not be used by another device on your LAN network.The IP address you assign the Cayman 3220-H LAN interface does not correspond to the IP address associated with any of the device's hub ports.

2. **Enter the subnet mask for the network connected to the LAN Ethernet interface in the *Net Mask* field.**

   The subnet mask specifies which bits of the 32-bit binary IP address represent network information. Most sites should use `255.255.255.0` for their subnet mask.

If you have turned on Expert Mode on the Cayman 3220-H Home window, you will see a set of DHCP fields on the Ethernet Port Configuration (LAN) window. If you did not turn on Expert Mode, you can skip to Step 8, below.

If you use the Cayman 3220-H as a DHCP server, you should assign IP addresses outside the DHCP address range to devices requiring static IP addresses. Before the Cayman 3220-H assigns an IP address to a DHCP client, it verifies that no other device is using that address. However, network conflicts can result when the Cayman 3220-H assigns an address in its DHCP range to one device and then another device configured to use that address is turned on.

3. **Use the *DHCP Mode* buttons to specify whether you want your Cayman 3220-H to act as a DHCP server or DHCP relay agent for other devices on your local area network.**

   Options are:

   - ***Off*** – Disable DHCP server functions in the Cayman 3220-H.
   - ***Server*** – Cayman 3220-H uses DHCP to provide network configuration information to hosts on the Local Area Network. ***Server*** is the default setting.

- ***Relay-agent*** – Cayman 3220-H forwards DHCP requests and responses to a remote DHCP server.

4. **If you chose *Server* in Step 3, enter the first IP address the Cayman 3220-H should assign for Dynamic Host Control Protocol clients in the *Start Address* field.**

   The default starting IP address is 192.168.1.1.

5. **If you chose *Server* in Step 3, enter the last IP address the Cayman 3220-H should assign for Dynamic Host Control Protocol clients in the *End Address* field.**

   The default ending IP address is 192.168.1.254.

6. **If you chose *Server* in Step 3, specify the default duration for DHCP leases in the *Lease Time* field.**

   Enter the lease duration in day:hour:minute:second (DD:HH:MM:SS) format.The default duration for DHCP leases is one hour (`00:01:00:00`).

7. **If you chose *Relay-agent* in Step 3, specify the IP address the remote DHCP server to which your Cayman 3220-H will relay Dynamic Host Control Protocol address requests in the *Server Address* field.**

8. **Click the *Save* button to store your modified configuration in the Cayman 3220-H memory.**

9. **Click the *Restart Cayman-DSL* button on the Cayman 3220-H Home Page to restart your Cayman 3220-H with its new configuration.**

Entering ATM Settings

The ATM Configuration window lets you configure as many as eight virtual circuits on the Cayman 3220-H ATM connection.

To display the ATM Configuration window (Figure 3-6), click the ***DSL Port (WAN)*** button on the Cayman 3220-H Home Page.

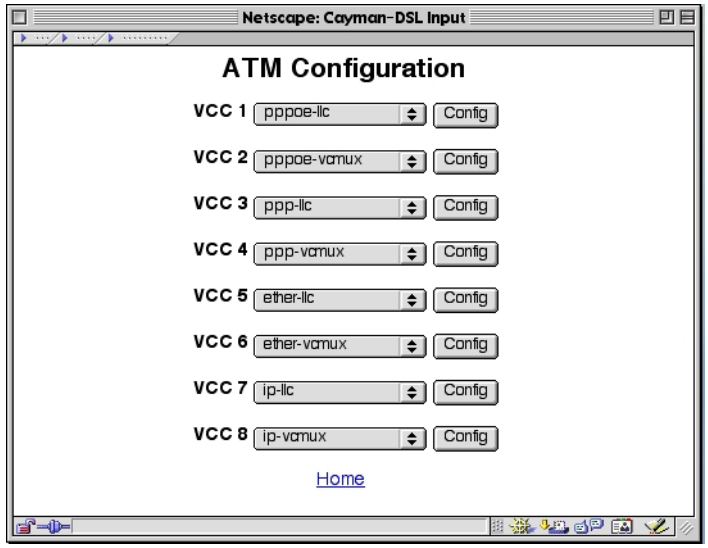


Figure 3-6 ATM Configuration Window

To configure ATM settings for each virtual circuit:

1. **Use the *VCC* dropdown list to select the encapsulation setting you want for the applicable virtual circuit.**

   You can choose one of the following options for each virtual circuit you want the Cayman 3220-H to maintain. The selection made for one virtual circuit does not affect other virtual circuits.

   - ***pppoe-llc*** – (default) PPP over Ethernet (LLC/SNAP encapsulation)
   - ***pppoe-vcmux*** – PPP over Ethernet (VC-muxed)
   - ***ether-llc*** – Ethernet over RFC 1483 (LLC/SNAP encapsulation)
   - ***ether-vcmux*** – Ethernet over RFC 1483 (VC-Muxed)
   - ***ppp-llc*** – PPP over ATM (LLC/SNAP encapsulation)
   - ***ppp-vcmux*** – PPP over ATM (VC-muxed)
   - ***ip-llc*** – IP over RFC1483 (LLC/SNAP encapsulation)
   - ***ip-vcmux*** – IP over RFC1483 (VC-muxed)
   - ***Off*** – Do not use this virtual circuit

2. **Click the *Config* button to enter the settings for the virtual circuit.**

   The screen that appears depends on the type of encapsulation you selected in Step 1.The following sections describe the settings applicable for each type of encapsulation.

3. **Click the *Restart Cayman-DSL* button on the Cayman 3220-H Home Page to restart your Cayman 3220-H with its new configuration.**

PPP over Ethernet (LLC-SNAP Encapsulation)

If you choose ***pppoe-llc*** on the ATM Configuration window (Figure 3-6 on page 3-18) for a virtual circuit and click the ***Configure*** button, the PPP over Ethernet (LLC-SNAP Encapsulation) window (Figure 3-7) lets you configure how the virtual circuit uses PPP framing and LLC-SNAP encapsulation.

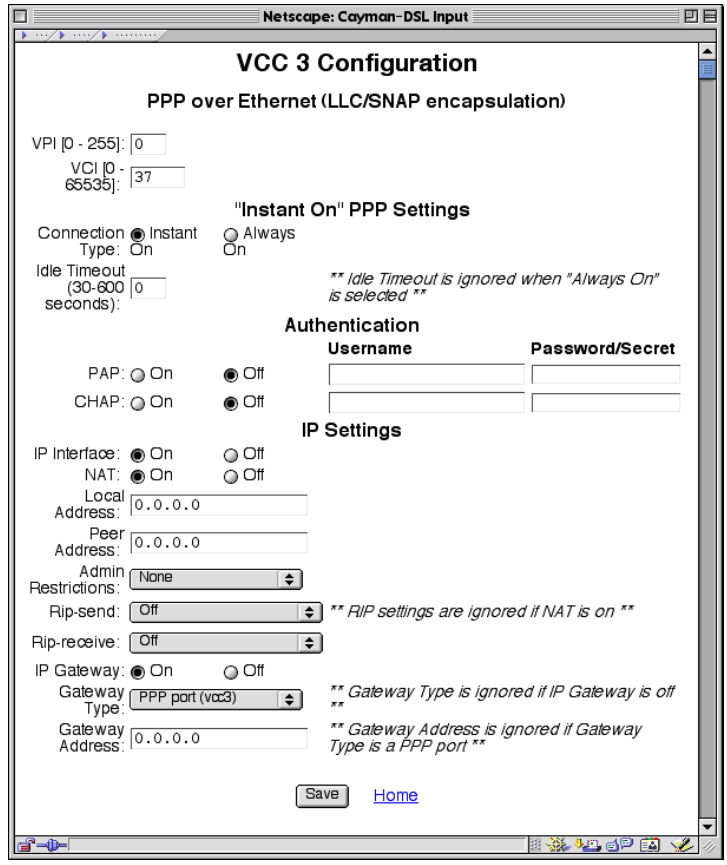


Figure 3-7 PPP over Ethernet (LLC-SNAP Encapsulation) Window

1. **Enter the number of the virtual path identifier in the *VPI* field.**

   The VPI is a number in the range 0-255. Consult your ATM transport administrator for what number you should enter in this field.

2. **Enter the number of the virtual circuit identifier in the *VCI* field.**

   The VCI is a number in the range 0-65535. Consult your ATM transport administrator for what number you should enter in this field.

3. **Specify whether you want the connection to be maintained constantly or only when it is needed.**

   If you choose a connection type of ***Instant On***, the Cayman 3220-H shuts down the PPP link if it is not being used for the number of seconds specified in the ***Idle Timeout*** field. If you choose a connection type of ***Always On***, the Cayman 3220-H never shuts down the PPP link.

4. **If you specified a connection type of Instant On, specify the number of seconds, in the range 30-600, you want the Cayman 3220-H to wait before shutting down the PPP link.**

   The default is 300 seconds.

5. **If you use the Password Authentication Protocol (PAP) to authenticate connections over the virtual circuit, click the *On* radio button, enter your user name in the *Username* field, and enter your access password in the *Password/Secret* field.**

6. **If you use the Challenge Handshake Authentication Protocol (CHAP) to authenticate connections over the virtual circuit, click the *On* radio button, enter your user name in the *Username* field, and enter your access secret in the *Password/Secret* field.**

7. **Use the *IP Interface* radio buttons to enable or disable IP traffic over this virtual circuit.**

8. **Use the *NAT* radio buttons to enable or disable network address translation for this virtual circuit.**

9. **Enter the IP address the Cayman 3220-H will use on this virtual circuit in the *Local Address* field.**

   The IP address you enter must not be in use by other devices on this virtual circuit. Enter `0.0.0.0` if you want the Cayman 3220-H to negotiate its IP address with the remote peer.

10. **Enter the IP address for the remote peer in the *Peer Address* field.**

    Enter `0.0.0.0` if you want the Cayman 3220-H to negotiate the IP address for the remote peer.

11. **Use the *Admin Restrictions* list to specify whether the Cayman 3220-H accepts administrative commands received over this virtual circuit.**

    Options are:

    - ***None*** – All traffic is accepted over this port.
    - ***Admin-Disabled*** – Router traffic is accepted over this port but administration commands are ignored.
    - ***Admin-Only*** – Administration commands are accepted over this port but router traffic is ignored.

12. **Use the *RIP-Send* list to specify whether you want the Cayman 3220-H to send Routing Information Protocol (RIP) messages to other routers.**

    RIP lets your Cayman 3220-H inform other routers of routes available through its interfaces. Options are:

    - ***Off*** – Do not send RIP messages to other routers.
    - ***RIP-1*** – Broadcast routing information in RIP version 1 format.
    - ***RIP-2***– Multicast routing information in RIP version 2 format.
    - ***RIP-1 Compatibility*** – Broadcast routing information in RIP version 2 format.

    You cannot use RIP when network address translation is turned on.

13. **Use the *RIP-Receive* list to specify whether you want the Cayman 3220-H to accept Routing Information Protocol (RIP) messages from other routers.**

    RIP lets your Cayman 3220-H learn about routes available through other routers. Options are:

- ***Off*** – Do not accept RIP messages from other routers.
- ***RIP-1*** – Accept routing information in RIP version 1 format from other routers.
- ***RIP-2***– Accept multicast routing information in RIP version 2 format multicast by other routers.
- ***RIP-1 Compatibility*** – Accept routing information in RIP version 2 format broadcast by other routers.

You cannot use RIP when network address translation is turned on.

14. **Use the *IP Gateway* radio buttons to specify whether you want this virtual circuit to use a gateway.**

15. **If you selected *On* in Step 14, use the *Gateway Type* list to specify the type of gateway.**

    Options are:

    - ***Fixed IP Address*** – The IP gateway for this virtual circuit has a fixed IP address.
    - ***PPP Port (VCC #)*** – The IP gateway for this virtual circuit is accessible over the specified point-to-point link.

16. **If you selected *Fixed IP Address* in Step 15, use the *Gateway Address* field to specify the IP address of the default IP gateway.**

17. **Click the *Save* button to store your modified configuration in the Cayman 3220-H memory.**

18. **Click the *Restart Cayman-DSL* button on the Cayman 3220-H Home Page to restart your Cayman 3220-H with the new configuration.**

PPP over Ethernet (VC-Muxed)

If you choose ***pppoe-vcmux*** on the ATM Configuration window (Figure 3-6 on page 3-18) for a virtual circuit and click the ***Configure*** button, the PPP over Ethernet (VC-Muxed) window (Figure 3-8) lets you configure how the virtual circuit uses PPP framing and VC-based multiplexing.

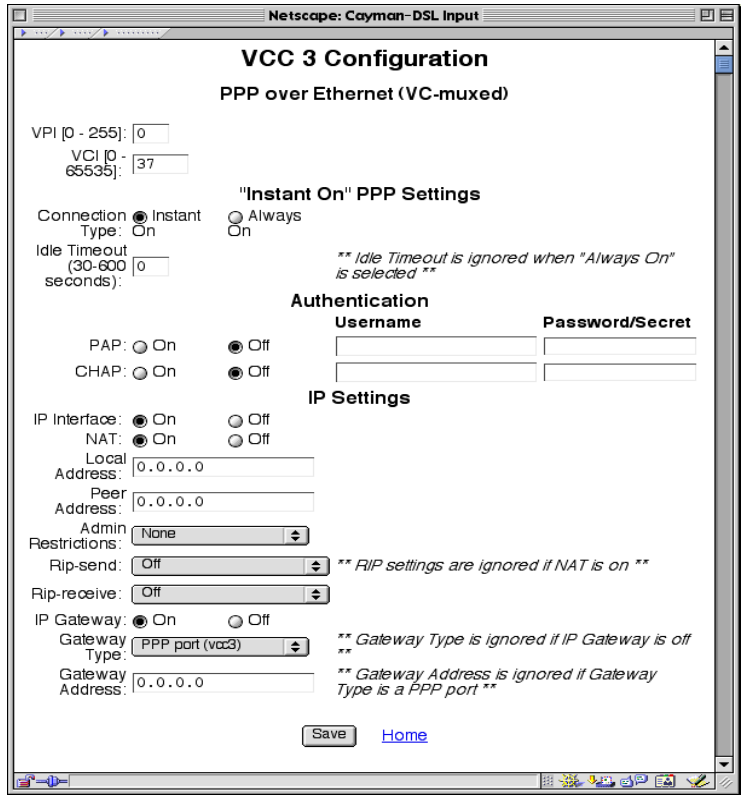


Figure 3-8 PPP over Ethernet (VC-Muxed) Window

1. **Enter the number of the virtual path identifier in the *VPI* field.**

   The VPI is a number in the range 0-255. Consult your ATM transport administrator for what number you should enter in this field.

2. **Enter the number of the virtual circuit identifier in the *VCI* field.**

   The VCI is a number in the range 0-65535. Consult your ATM transport administrator for what number you should enter in this field.

3. **Specify whether you want the connection to be maintained constantly or only when it is needed.**

   If you choose a connection type of ***Instant On***, the Cayman 3220-H shuts down the PPP link if it is not being used for the number of seconds specified in the ***Idle Timeout*** field. If you choose a connection type of ***Always On***, the Cayman 3220-H never shuts down the PPP link.

4. **If you specified a connection type of Instant On, specify the number of seconds, in the range 30-600, you want the Cayman 3220-H to wait before shutting down the PPP link.**

   The default is 300 seconds.

5. **If you use the Password Authentication Protocol (PAP) to authenticate connections over the virtual circuit, click the *PAP On* radio button, enter your user name in the *Username* field, and enter your access password in the *Password/Secret* field.**

6. **If you use the Challenge Handshake Authentication Protocol (CHAP) to authenticate connections over the virtual circuit, click the *CHAP On* radio button, enter your user name in the *Username* field, and enter your access secret in the *Password/Secret* field.**

7. **Use the *IP Interface* radio buttons to enable or disable IP traffic over this virtual circuit.**

8. **Use the *NAT* radio buttons to enable or disable or disable network address translation for this virtual circuit.**

9. **Enter the IP address the Cayman 3220-H will use on this virtual circuit in the *Local Address* field.**

   The IP address you enter must not be in use by other devices on this virtual circuit. Enter `0.0.0.0` if you want the Cayman 3220-H to negotiate its IP address with the remote peer.

10. **Enter the IP address for the remote peer in the *Peer Address* field.**

    Enter `0.0.0.0` if you want the Cayman 3220-H to negotiate the IP address for the remote peer.

11. **Use the *Admin Restrictions* list to specify whether the Cayman 3220-H accepts administrative commands received over this virtual circuit.**

    Options are:

    - ***None*** – All traffic is accepted over this port.
    - ***Admin-Disabled*** – Router traffic is accepted over this port but administration commands are ignored.
    - ***Admin-Only*** – Administration commands are accepted over this port but router traffic is ignored.

12. **Use the *RIP-Send* list to specify whether you want the Cayman 3220-H to send Routing Information Protocol (RIP) messages to other routers.**

    RIP lets your Cayman 3220-H inform other routers of routes available through its interfaces. Options are:

    - ***Off*** – Do not send RIP messages to other routers.
    - ***RIP-1*** – Broadcast routing information in RIP version 1 format.
    - ***RIP-2***– Multicast routing information in RIP version 2 format.
    - ***RIP-1 Compatibility*** – Broadcast routing information in RIP version 2 format.

    You cannot use RIP when network address translation is turned on.

13. **Use the *RIP-Receive* list to specify whether you want the Cayman 3220-H to accept Routing Information Protocol (RIP) messages from other routers.**

    RIP lets your Cayman 3220-H learn about routes available through other routers. Options are:

- ***Off*** – Do not accept RIP messages from other routers.
- ***RIP-1*** – Accept routing information in RIP version 1 format from other routers.
- ***RIP-2***– Accept multicast routing information in RIP version 2 format multicast by other routers.
- ***RIP-1 Compatibility*** – Accept routing information in RIP version 2 format broadcast by other routers.

You cannot use RIP when network address translation is turned on.

14. **Use the *IP Gateway* radio buttons to specify whether you want this virtual circuit to use a gateway.**

15. **If you selected *On* in Step 10, use the *Gateway Type* list to specify the type of gateway.**

    Options are:

    - ***Fixed IP Address*** – The IP gateway for this virtual circuit has a fixed IP address.
    - ***PPP Port (VCC #)*** – The IP gateway for this virtual circuit is accessible over the specified point-to-point link.

16. **If you selected *Fixed IP Address* in Step 11, use the *Gateway Address* field to specify the IP address of the default IP gateway.**

17. **Click the *Save* button to store your modified configuration in the Cayman 3220-H memory.**

18. **Click the *Restart Cayman-DSL* button on the Cayman 3220-H Home Page to restart your Cayman 3220-H with the new configuration.**

Ethernet over RFC 1483 (LLC-SNAP Encapsulation)

If you choose ***ether-llc*** on the ATM Configuration window (Figure 3-6 on page 3-18) for a virtual circuit and click the ***Configure*** button, the Ethernet over RFC1483 (LLC-SNAP Encapsulation) window (Figure 3-9) lets you configure how the virtual circuit uses Ethernet framing and LLC-SNAP encapsulation.

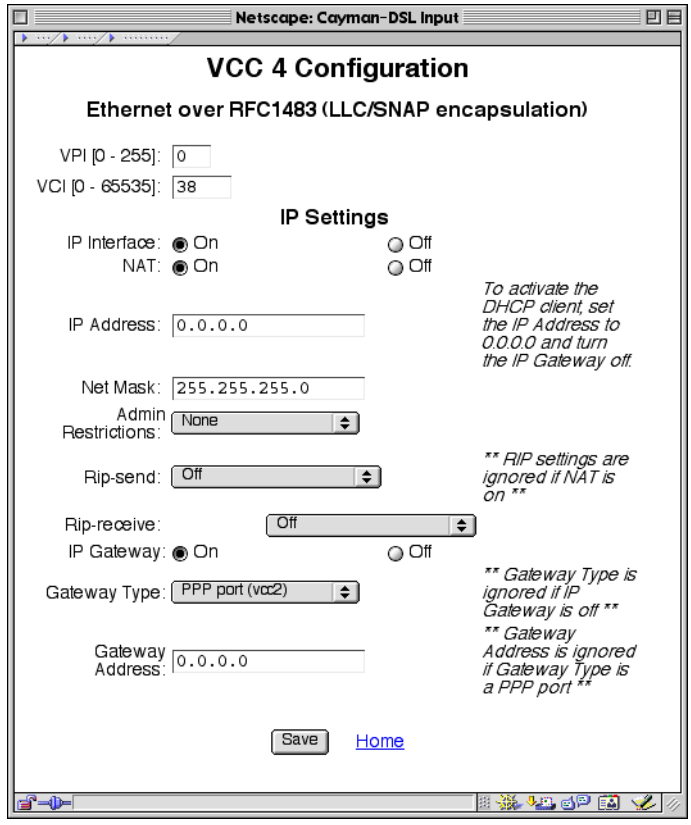


Figure 3-9 Ethernet over RFC1483 (VC-Muxed) Window

1. **Enter the number of the virtual path identifier in the *VPI* field.**

   The VPI is a number in the range 0-255. Consult your ATM transport administrator for what number you should enter in this field.

2. **Enter the number of the virtual circuit identifier in the *VCI* field.**

   The VCI is a number in the range 0-65535. Consult your ATM transport administrator for what number you should enter in this field.

3. **Use the *IP Interface* radio buttons to enable or disable IP traffic over this virtual circuit.**

4. **Use the *NAT* radio buttons to enable or disable network address translation for this virtual circuit.**

5. **Enter the IP address the Cayman 3220-H will use on this virtual circuit in the *IP Address* field.**

   The IP address you enter must not be in use by other devices on this virtual circuit. Enter `0.0.0.0` if you want the Cayman 3220-H to receive the IP address information for this interface from a DHCP server on the other end of the ATM connection.

6. **Enter the subnet mask for the network connected to this virtual circuit in the *Net Mask* field.**

   The subnet mask specifies which bits of the 32-bit binary IP address represent network information. Most sites should use 255.255.255.0 for their subnet mask.

7. **Use the *Admin Restrictions* list to specify whether the Cayman 3220-H accepts administrative commands received over this virtual circuit.**

   Options are:

   - ***None*** – All traffic is accepted over this port.
   - ***Admin-Disabled*** – Router traffic is accepted over this port but administration commands are ignored.
   - ***Admin-Only*** – Administration commands are accepted over this port but router traffic is ignored.

8. **Use the *RIP-Send* list to specify whether you want the Cayman 3220-H to send Routing Information Protocol (RIP) messages to other routers.**

   RIP lets your Cayman 3220-H inform other routers of routes available through its interfaces. Options are:

   - ***Off*** – Do not send RIP messages to other routers.
   - ***RIP-1*** – Broadcast routing information in RIP version 1 format.

- ***RIP-2***– Multicast routing information in RIP version 2 format.
- ***RIP-1 Compatibility*** – Broadcast routing information in RIP version 2 format.

You cannot use RIP when network address translation is turned on.

9. **Use the *RIP-Receive* list to specify whether you want the Cayman 3220-H to accept Routing Information Protocol (RIP) messages from other routers.**

   RIP lets your Cayman 3220-H learn about routes available through other routers. Options are:

   - ***Off*** – Do not accept RIP messages from other routers.
   - ***RIP-1*** – Accept routing information in RIP version 1 format from other routers.
   - ***RIP-2***– Accept multicast routing information in RIP version 2 format multicast by other routers.
   - ***RIP-1 Compatibility*** – Accept routing information in RIP version 2 format broadcast by other routers.

   You cannot use RIP when network address translation is turned on.

10. **Use the *IP Gateway* radio buttons to specify whether you want this virtual circuit to use a gateway.**

11. **If you selected *On* in Step 10, use the *Gateway Type* list to specify the type of gateway.**

    Options are:

    - ***Fixed IP Address*** – The IP gateway for this virtual circuit has a fixed IP address.
    - ***PPP Port (VCC #)*** – The IP gateway for this virtual circuit is accessible over the specified point-to-point link.

12. **If you selected *Fixed IP Address* in Step 11, use the *Gateway Address* field to specify the IP address of the default IP gateway.**

13. **Click the *Save* button to store your modified configuration in the Cayman 3220-H memory.**

14. **Click the *Restart Cayman-DSL* button on the Cayman 3220-H Home Page to restart your Cayman 3220-H with the new configuration.**

Ethernet over RFC 1483 (VC-Muxed)

If you choose ***ether-vcmux*** on the ATM Configuration window (Figure 3-6 on page 3-18) for a virtual circuit and click the ***Configure*** button, the Ethernet over RFC1483 (VC-Muxed) window (Figure 3-10) lets you configure how the virtual circuit uses Ethernet framing and VC-based multiplexing.

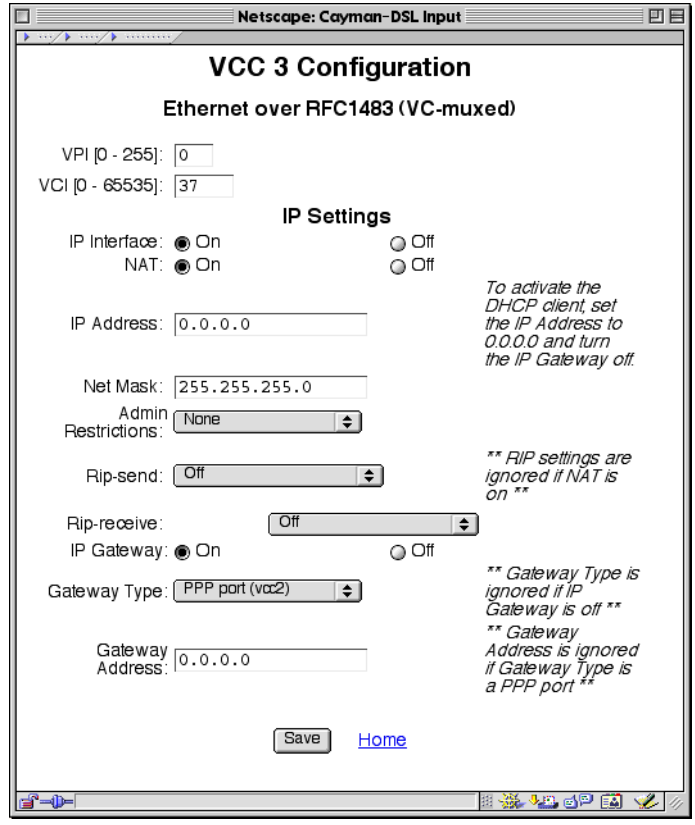


Figure 3-10 Ethernet over RFC1483 (VC-Muxed) Window

1. **Enter the number of the virtual path identifier in the *VPI* field.**

   The VPI is a number in the range 0-255. Consult your ATM transport administrator for what number you should enter in this field.

2. **Enter the number of the virtual circuit identifier in the *VCI* field.**

   The VCI is a number in the range 0-65535. Consult your ATM transport administrator for what number you should enter in this field.

3. **Use the *IP Interface* radio buttons to enable or disable IP traffic over this virtual circuit.**

4. **Use the *NAT* radio buttons to enable or disable network address translation for this virtual circuit.**

5. **Enter the IP address the Cayman 3220-H will use on this virtual circuit in the *IP Address* field.**

   The IP address you enter must not be in use by other devices on this virtual circuit. Enter `0.0.0.0` if you want the Cayman 3220-H to receive the IP address information for this interface from a DHCP server on the other end of the ATM connection.

6. **Enter the subnet mask for the network connected to this virtual circuit in the *Net Mask* field.**

   The subnet mask specifies which bits of the 32-bit binary IP address represent network information. Most sites should use 255.255.255.0 for their subnet mask.

7. **Use the *Admin Restrictions* list to specify whether the Cayman 3220-H accepts administrative commands received over this virtual circuit.**

   Options are:

   - ***None*** – All traffic is accepted over this port.

- ***Admin-Disabled*** – Router traffic is accepted over this port but administration commands are ignored.
- ***Admin-Only*** – Administration commands are accepted over this port but router traffic is ignored.

8. **Use the *RIP-Send* list to specify whether you want the Cayman 3220-H to send Routing Information Protocol (RIP) messages to other routers.**

   RIP lets your Cayman 3220-H inform other routers of routes available through its interfaces. Options are:

   - ***Off*** – Do not send RIP messages to other routers.
   - ***RIP-1*** – Broadcast routing information in RIP version 1 format.
   - ***RIP-2***– Multicast routing information in RIP version 2 format.
   - ***RIP-1 Compatibility*** – Broadcast routing information in RIP version 2 format.

   You cannot use RIP when network address translation is turned on.

9. **Use the *RIP-Receive* list to specify whether you want the Cayman 3220-H to accept Routing Information Protocol (RIP) messages from other routers.**

   RIP lets your Cayman 3220-H learn about routes available through other routers. Options are:

   - ***Off*** – Do not accept RIP messages from other routers.
   - ***RIP-1*** – Accept routing information in RIP version 1 format from other routers.
   - ***RIP-2***– Accept multicast routing information in RIP version 2 format multicast by other routers.
   - ***RIP-1 Compatibility*** – Accept routing information in RIP version 2 format broadcast by other routers.

   You cannot use RIP when network address translation is turned on.

10. **Use the *IP Gateway* radio buttons to specify whether you want this virtual circuit to use a gateway.**

11. **If you selected *On* in Step 10, use the *Gateway Type* list to specify the type of gateway.**

    Options are:

    - ***Fixed IP Address*** – The IP gateway for this virtual circuit has a fixed IP address.
    - ***PPP Port (VCC #)*** – The IP gateway for this virtual circuit is accessible over the specified point-to-point link.

12. **If you selected *Fixed IP Address* in Step 11, use the *Gateway Address* field to specify the IP address of the default IP gateway.**

13. **Click the *Save* button to store your modified configuration in the Cayman 3220-H memory.**

14. **Click the *Restart Cayman-DSL* button on the Cayman 3220-H Home Page to restart your Cayman 3220-H with the new configuration.**

PPP over ATM (LLC-SNAP Encapsulation)

If you choose ***ppp-llc*** on the ATM Configuration window (Figure 3-6 on page 3-18) for a virtual circuit and click the ***Configure*** button, the PPP over ATM (LLC-SNAP Encapsulation) window (Figure 3-11) lets you configure how the virtual circuit uses PPP framing and LLC-SNAP encapsulation.

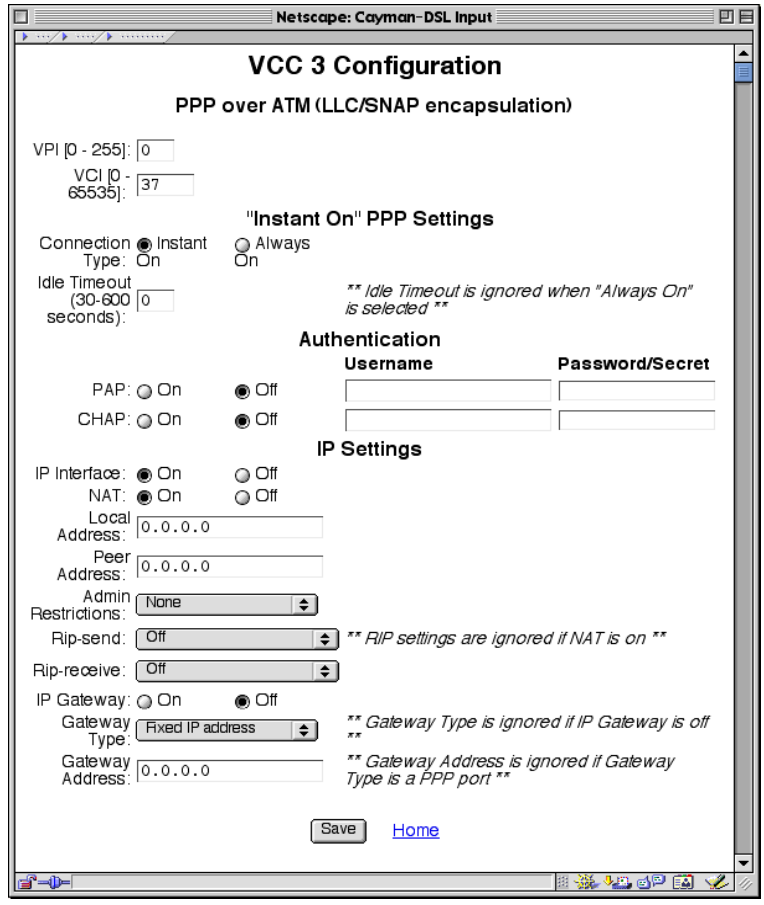


Figure 3-11 PPP over ATM (LLC-SNAP Encapsulation) Window

1. **Enter the number of the virtual path identifier in the *VPI* field.**

   The VPI is a number in the range 0-255. Consult your ATM transport administrator for what number you should enter in this field.

2. **Enter the number of the virtual circuit identifier in the *VCI* field.**

   The VCI is a number in the range 0-65535. Consult your ATM transport administrator for what number you should enter in this field.

3. **Specify whether you want the connection to be maintained constantly or only when it is needed.**

   If you choose a connection type of ***Instant On***, the Cayman 3220-H shuts down the PPP link if it is not being used for the number of seconds specified in the ***Idle Timeout*** field. If you choose a connection type of ***Always On***, the Cayman 3220-H never shuts down the PPP link.

4. **If you specified a connection type of Instant On, specify the number of seconds, in the range 30-600, you want the Cayman 3220-H to wait before shutting down the PPP link.**

   The default is 300 seconds.

5. **If you use the Password Authentication Protocol (PAP) to authenticate connections over the virtual circuit, click the *On* radio button, enter your user name in the *Username* field, and enter your access password in the *Password/Secret* field.**

6. **If you use the Challenge Handshake Authentication Protocol (CHAP) to authenticate connections over the virtual circuit, click the *On* radio button, enter your user name in the *Username* field, and enter your access secret in the *Password/Secret* field.**

7. **Use the *IP Interface* radio buttons to enable or disable IP traffic over this virtual circuit.**

8. **Use the *NAT* radio buttons to enable or disable network address translation for this virtual circuit.**

9. **Enter the IP address the Cayman 3220-H will use on this virtual circuit in the *Local Address* field.**

   The IP address you enter must not be in use by other devices on this virtual circuit. Enter `0.0.0.0` if you want the Cayman 3220-H to negotiate its IP address with the remote peer.

10. **Enter the IP address for the remote peer in the *Peer Address* field.**

    Enter `0.0.0.0` if you want the Cayman 3220-H to negotiate the IP address for the remote peer.

11. **Use the *Admin Restrictions* list to specify whether the Cayman 3220-H accepts administrative commands received over this virtual circuit.**

    Options are:

    - ***None*** – All traffic is accepted over this port.
    - ***Admin-Disabled*** – Router traffic is accepted over this port but administration commands are ignored.
    - ***Admin-Only*** – Administration commands are accepted over this port but router traffic is ignored.

12. **Use the *RIP-Send* list to specify whether you want the Cayman 3220-H to send Routing Information Protocol (RIP) messages to other routers.**

    RIP lets your Cayman 3220-H inform other routers of routes available through its interfaces. Options are:

    - ***Off*** – Do not send RIP messages to other routers.
    - ***RIP-1*** – Broadcast routing information in RIP version 1 format.
    - ***RIP-2***– Multicast routing information in RIP version 2 format.
    - ***RIP-1 Compatibility*** – Broadcast routing information in RIP version 2 format.

    You cannot use RIP when network address translation is turned on.

13. **Use the *RIP-Receive* list to specify whether you want the Cayman 3220-H to accept Routing Information Protocol (RIP) messages from other routers.**

    RIP lets your Cayman 3220-H learn about routes available through other routers. Options are:

    - ***Off*** – Do not accept RIP messages from other routers.
    - ***RIP-1*** – Accept routing information in RIP version 1 format from other routers.
    - ***RIP-2***– Accept multicast routing information in RIP version 2 format multicast by other routers.
    - ***RIP-1 Compatibility*** – Accept routing information in RIP version 2 format broadcast by other routers.

    You cannot use RIP when network address translation is turned on.

14. **Use the *IP Gateway* radio buttons to specify whether you want this virtual circuit to use a gateway.**

15. **If you selected *On* in Step 10, use the *Gateway Type* list to specify the type of gateway.**

    Options are:

    - ***Fixed IP Address*** – The IP gateway for this virtual circuit has a fixed IP address.
    - ***PPP Port (VCC #)*** – The IP gateway for this virtual circuit is accessible over the specified point-to-point link.

16. **If you selected *Fixed IP Address* in Step 11, use the *Gateway Address* field to specify the IP address of the default IP gateway.**

17. **Click the *Save* button to store your modified configuration in the Cayman 3220-H memory.**

18. **Click the *Restart Cayman-DSL* button on the Cayman 3220-H Home Page to restart your Cayman 3220-H with the new configuration.**

PPP over ATM (VC-Muxed)

If you choose ***ppp-vcmux*** on the ATM Configuration window (Figure 3-6 on page 3-18) for a virtual circuit and click the ***Configure*** button, the PPP over ATM (VC-Muxed) window (Figure 3-12) lets you configure how the virtual circuit uses PPP framing and VC-based multiplexing.

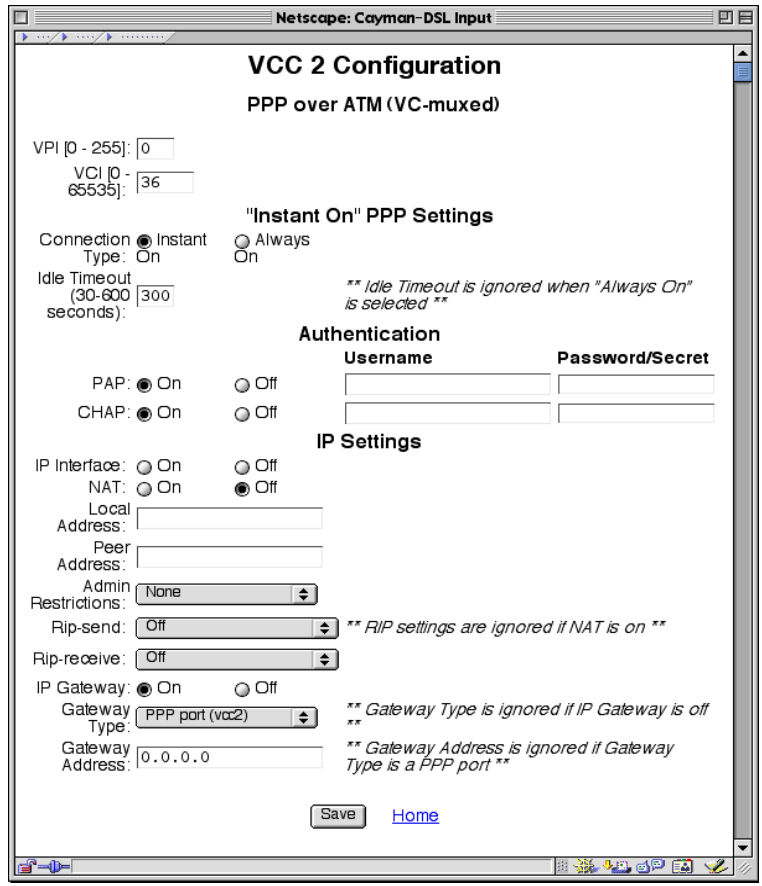


Figure 3-12 PPP over ATM (VC-Muxed) Window

1. **Enter the number of the virtual path identifier in the *VPI* field.**

   The VPI is a number in the range 0-255. Consult your ATM transport administrator for what number you should enter in this field.

2. **Enter the number of the virtual circuit identifier in the *VCI* field.**

   The VCI is a number in the range 0-65535. Consult your ATM transport administrator for what number you should enter in this field.

3. **Specify whether you want the connection to be maintained constantly or only when it is needed.**

   If you choose a connection type of ***Instant On***, the Cayman 3220-H shuts down the PPP link if it is not being used for the number of seconds specified in the ***Idle Timeout*** field. If you choose a connection type of ***Always On***, the Cayman 3220-H never shuts down the PPP link.

4. **If you specified a connection type of Instant On, specify the number of seconds, in the range 30-600, you want the Cayman 3220-H to wait before shutting down the PPP link.**

   The default is 300 seconds.

5. **Enter the number of the virtual circuit identifier in the *VCI* field.**

   The VCI is a number in the range 0-65535. Consult your ATM transport administrator for what number you should enter in this field.

6. **If you use the Password Authentication Protocol (PAP) to authenticate connections over the virtual circuit, click the *PAP On* radio button, enter your user name in the *Username* field, and enter your access password in the *Password/Secret* field.**

7. **If you use the Challenge Handshake Authentication Protocol (CHAP) to authenticate connections over the virtual circuit, click the *CHAP On* radio button, enter your user name in the *Username* field, and enter your access secret in the *Password/Secret* field.**

8. **Use the *IP Interface* radio buttons to enable or disable IP traffic over this virtual circuit.**

9. **Use the *NAT* radio buttons to enable or disable network address translation for this virtual circuit.**

10. **Enter the IP address the Cayman 3220-H will use on this virtual circuit in the *Local Address* field.**

    The IP address you enter must not be in use by other devices on this virtual circuit. Enter `0.0.0.0` if you want the Cayman 3220-H to negotiate its IP address with the remote peer.

11. **Enter the IP address for the remote peer in the *Peer Address* field.**

    Enter `0.0.0.0` if you want the Cayman 3220-H to negotiate the IP address for the remote peer.

12. **Use the *Admin Restrictions* list to specify whether the Cayman 3220-H accepts administrative commands received over this virtual circuit.**

    Options are:

    - ***None*** – All traffic is accepted over this port.
    - ***Admin-Disabled*** – Router traffic is accepted over this port but administration commands are ignored.
    - ***Admin-Only*** – Administration commands are accepted over this port but router traffic is ignored.

13. **Use the *RIP-Send* list to specify whether you want the Cayman 3220-H to send Routing Information Protocol (RIP) messages to other routers.**

    RIP lets your Cayman 3220-H inform other routers of routes available through its interfaces. Options are:

    - ***Off*** – Do not send RIP messages to other routers.
    - ***RIP-1*** – Broadcast routing information in RIP version 1 format.

- ***RIP-2***– Multicast routing information in RIP version 2 format.
- ***RIP-1 Compatibility*** – Broadcast routing information in RIP version 2 format.

You cannot use RIP when network address translation is turned on.

14. **Use the *RIP-Receive* list to specify whether you want the Cayman 3220-H to accept Routing Information Protocol (RIP) messages from other routers.**

    RIP lets your Cayman 3220-H learn about routes available through other routers. Options are:

    - ***Off*** – Do not accept RIP messages from other routers.
    - ***RIP-1*** – Accept routing information in RIP version 1 format from other routers.
    - ***RIP-2***– Accept multicast routing information in RIP version 2 format multicast by other routers.
    - ***RIP-1 Compatibility*** – Accept routing information in RIP version 2 format broadcast by other routers.

    You cannot use RIP when network address translation is turned on.

15. **Use the *IP Gateway* radio buttons to specify whether you want this virtual circuit to use a gateway.**

16. **If you selected *On* in Step 10, use the *Gateway Type* list to specify the type of gateway.**

    Options are:

    - ***Fixed IP Address*** – The IP gateway for this virtual circuit has a fixed IP address.
    - ***PPP Port (VCC #)*** – The IP gateway for this virtual circuit is accessible over the specified point-to-point link.

17. **If you selected *Fixed IP Address* in Step 11, use the *Gateway Address* field to specify the IP address of the default IP gateway.**

18. **Click the *Save* button to store your modified configuration in the Cayman 3220-H memory.**

19. **Click the *Restart Cayman-DSL* button on the Cayman 3220-H Home Page to restart your Cayman 3220-H with the new configuration.**

IP over RFC 1483 (LLC-SNAP Encapsulation)

If you choose ***ip-llc*** on the ATM Configuration window (Figure 3-6 on page 3-18) for a virtual circuit and click the ***Configure*** button, the IP over RFC1483 (LLC-SNAP Encapsulation) window (Figure 3-9) lets you configure how the virtual circuit uses IP framing and LLC-SNAP encapsulation.

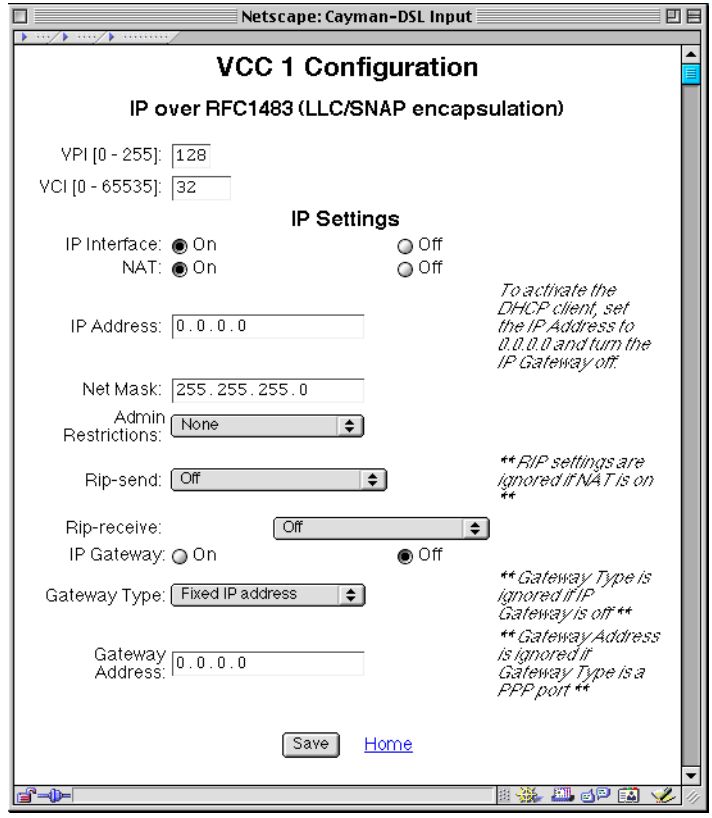


Figure 3-13 IP over RFC1483 (LLC-SNAP Encapsulation) Window

1. **Enter the number of the virtual path identifier in the *VPI* field.**

   The VPI is a number in the range 0-255. Consult your ATM transport administrator for what number you should enter in this field.

2. **Enter the number of the virtual circuit identifier in the *VCI* field.**

   The VCI is a number in the range 0-65535. Consult your ATM transport administrator for what number you should enter in this field.

3. **Use the *IP Interface* radio buttons to enable or disable IP traffic over this virtual circuit.**

4. **Use the *NAT* radio buttons to enable or disable network address translation for this virtual circuit.**

5. **Enter the IP address the Cayman 3220-H will use on this virtual circuit in the *IP Address* field.**

   The IP address you enter must not be in use by other devices on this virtual circuit. Enter `0.0.0.0` if you want the Cayman 3220-H to receive the IP address information for this interface from a DHCP server on the other end of the ATM connection.

6. **Enter the subnet mask for the network connected to this virtual circuit in the *Net Mask* field.**

   The subnet mask specifies which bits of the 32-bit binary IP address represent network information. Most sites should use 255.255.255.0 for their subnet mask.

7. **Use the *Admin Restrictions* list to specify whether the Cayman 3220-H accepts administrative commands received over this virtual circuit.**

   Options are:

   - ***None*** – All traffic is accepted over this port.

- ***Admin-Disabled*** – Router traffic is accepted over this port but administration commands are ignored.
- ***Admin-Only*** – Administration commands are accepted over this port but router traffic is ignored.

8. **Use the *RIP-Send* list to specify whether you want the Cayman 3220-H to send Routing Information Protocol (RIP) messages to other routers.**

   RIP lets your Cayman 3220-H inform other routers of routes available through its interfaces. Options are:

   - ***Off*** – Do not send RIP messages to other routers.
   - ***RIP-1*** – Broadcast routing information in RIP version 1 format.
   - ***RIP-2***– Multicast routing information in RIP version 2 format.
   - ***RIP-1 Compatibility*** – Broadcast routing information in RIP version 2 format.

   You cannot use RIP when network address translation is turned on.

9. **Use the *RIP-Receive* list to specify whether you want the Cayman 3220-H to accept Routing Information Protocol (RIP) messages from other routers.**

   RIP lets your Cayman 3220-H learn about routes available through other routers. Options are:

   - ***Off*** – Do not accept RIP messages from other routers.
   - ***RIP-1*** – Accept routing information in RIP version 1 format from other routers.
   - ***RIP-2***– Accept multicast routing information in RIP version 2 format multicast by other routers.
   - ***RIP-1 Compatibility*** – Accept routing information in RIP version 2 format broadcast by other routers.

   You cannot use RIP when network address translation is turned on.

10. **Use the *IP Gateway* radio buttons to specify whether you want this virtual circuit to use a gateway.**

11. **If you selected *On* in Step 10, use the *Gateway Type* list to specify the type of gateway.**

    Options are:

    - ***Fixed IP Address*** – The IP gateway for this virtual circuit has a fixed IP address.
    - ***PPP Port (VCC #)*** – The IP gateway for this virtual circuit is accessible over the specified point-to-point link.

12. **If you selected *Fixed IP Address* in Step 11, use the *Gateway Address* field to specify the IP address of the default IP gateway.**

13. **Click the *Save* button to store your modified configuration in the Cayman 3220-H memory.**

14. **Click the *Restart Cayman-DSL* button on the Cayman 3220-H Home Page to restart your Cayman 3220-H with the new configuration.**

IP over RFC 1483 (VC-Muxed)

If you choose ***ip-vcmux*** on the ATM Configuration window (Figure 3-6 on page 3-18) for a virtual circuit and click the ***Configure*** button, the IP over RFC1483 (VC-Muxed) window (Figure 3-14) lets you configure how the virtual circuit uses IP framing and VC-based multiplexing.

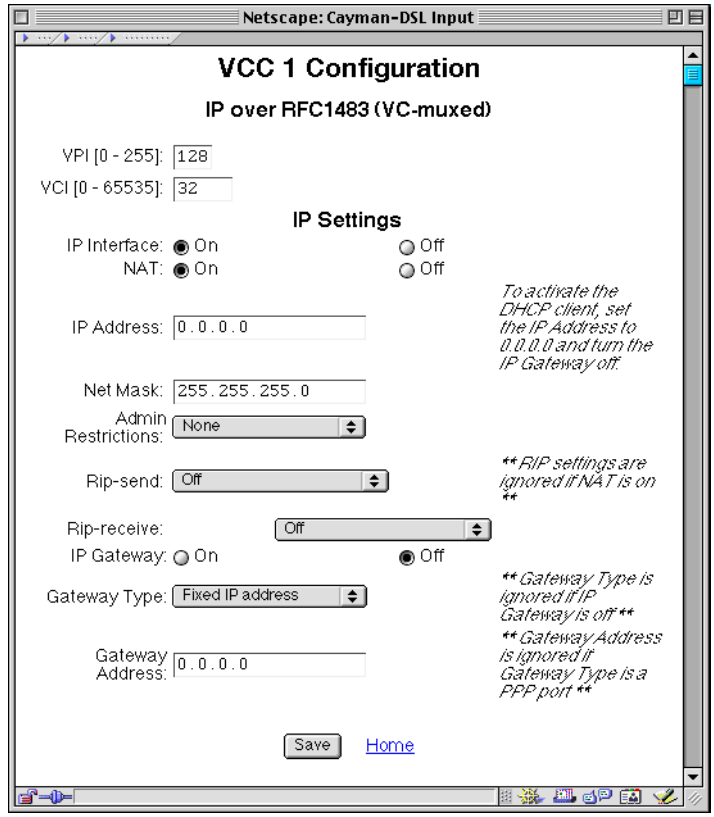


Figure 3-14 IP over RFC1483 (VC-Muxed) Window

1. **Enter the number of the virtual path identifier in the *VPI* field.**

   The VPI is a number in the range 0-255. Consult your ATM transport administrator for what number you should enter in this field.

2. **Enter the number of the virtual circuit identifier in the *VCI* field.**

   The VCI is a number in the range 0-65535. Consult your ATM transport administrator for what number you should enter in this field.

3. **Use the *IP Interface* radio buttons to enable or disable IP traffic over this virtual circuit.**

4. **Use the *NAT* radio buttons to enable or disable network address translation for this virtual circuit.**

5. **Enter the IP address the Cayman 3220-H will use on this virtual circuit in the *IP Address* field.**

   The IP address you enter must not be in use by other devices on this virtual circuit. Enter `0.0.0.0` if you want the Cayman 3220-H to receive the IP address information for this interface from a DHCP server on the other end of the ATM connection.

6. **Enter the subnet mask for the network connected to this virtual circuit in the *Net Mask* field.**

   The subnet mask specifies which bits of the 32-bit binary IP address represent network information. Most sites should use 255.255.255.0 for their subnet mask.

7. **Use the *Admin Restrictions* list to specify whether the Cayman 3220-H accepts administrative commands received over this virtual circuit.**

   Options are:

   - ***None*** – All traffic is accepted over this port.
   - ***Admin-Disabled*** – Router traffic is accepted over this port but administration commands are ignored.
   - ***Admin-Only*** – Administration commands are accepted over this port but router traffic is ignored.

8. **Use the *RIP-Send* list to specify whether you want the Cayman 3220-H to send Routing Information Protocol (RIP) messages to other routers.**

   RIP lets your Cayman 3220-H inform other routers of routes available through its interfaces. Options are:

   - ***Off*** – Do not send RIP messages to other routers.
   - ***RIP-1*** – Broadcast routing information in RIP version 1 format.

- ***RIP-2***– Multicast routing information in RIP version 2 format.
- ***RIP-1 Compatibility*** – Broadcast routing information in RIP version 2 format.

You cannot use RIP when network address translation is turned on.

9. **Use the *RIP-Receive* list to specify whether you want the Cayman 3220-H to accept Routing Information Protocol (RIP) messages from other routers.**

   RIP lets your Cayman 3220-H learn about routes available through other routers. Options are:

   - ***Off*** – Do not accept RIP messages from other routers.
   - ***RIP-1*** – Accept routing information in RIP version 1 format from other routers.
   - ***RIP-2***– Accept multicast routing information in RIP version 2 format multicast by other routers.
   - ***RIP-1 Compatibility*** – Accept routing information in RIP version 2 format broadcast by other routers.

   You cannot use RIP when network address translation is turned on.

10. **Use the *IP Gateway* radio buttons to specify whether you want this virtual circuit to use a gateway.**

11. **If you selected *On* in Step 10, use the *Gateway Type* list to specify the type of gateway.**

    Options are:

    - ***Fixed IP Address*** – The IP gateway for this virtual circuit has a fixed IP address.
    - ***PPP Port (VCC #)*** – The IP gateway for this virtual circuit is accessible over the specified point-to-point link.

12. **If you selected *Fixed IP Address* in Step 11, use the *Gateway Address* field to specify the IP address of the default IP gateway.**

13. **Click the *Save* button to store your modified configuration in the Cayman 3220-H memory.**

14. **Click the *Restart Cayman-DSL* button on the Cayman 3220-H Home Page to restart your Cayman 3220-H with the new configuration.**

Configuring Password Settings

You can establish different levels of access security to protect your Cayman 3220-H settings from unauthorized display or modification.

- **Admin level access** lets you display and modify all settings in the Cayman 3220-H.
- **User level access** lets you display (but not change) settings in the Cayman 3220-H. You must assign the Cayman 3220-H an Admin password before you can assign it a User password.

You will see a warning on the Cayman 3220-H configuration screens until you set an administrative password.

To prevent anyone from observing the password you enter, characters in the old and new passwords are not displayed as you type them.

Passwords go into effect immediately. You do not have to restart the Cayman 3220-H for the password to take effect. Assigning a password to a Cayman 3220-H does not affect ongoing communications through the device.

To display the Password Configuration window (Figure 3-15), click the ***Passwords*** button on the Cayman 3220-H Home Page. You must be in Expert Mode to open the Password Configuration window.

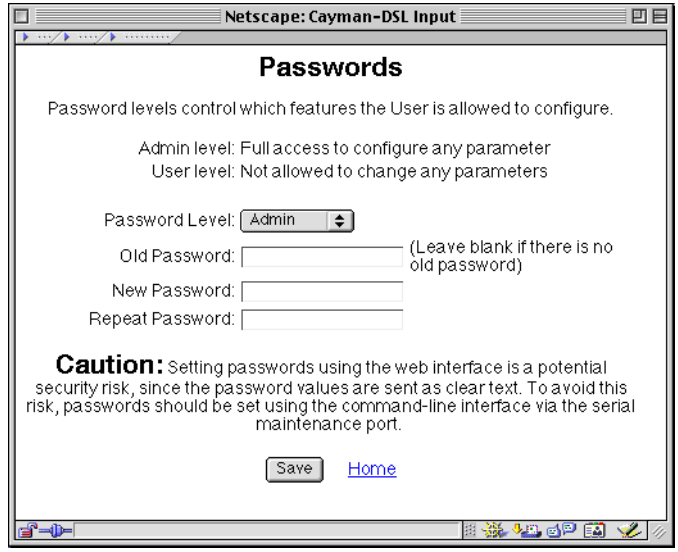


Figure 3-15 Password Configuration Window

To configure passwords for your Cayman 3220-H:

1. **Use the *Password Level* list to select the type of password you want to enter.**

   You can choose ***Admin*** or ***User***. You must assign the Cayman 3220-H an Admin (administrator) password before you can assign it a User password.

2. **If you assigned a password to the Cayman 3220-H previously, enter your current password in the *Old Password* field.**

3. **Enter your new password in the *New Password* field.**

   A password can be as many as eight alphanumeric characters. Passwords are case-sensitive and cannot include special characters or leading, trailing, or embedded spaces. For example, if you assign a password of `GatoR`, you could not enter `GATOR`, `gator`, or `Gator` as an acceptable password.

4. **Enter your new password again in the *Repeat Password* field.**

   You repeat the new password to verify that you entered it correctly the first time.

5. **When you are finished, click the *Save* button to store your modified configuration in the Cayman 3220-H memory.**

Configuring Pinhole Settings

Network Address Translation (NAT) pinholes let you pass specific types of network traffic through the router's NAT interfaces. NAT pinholes allow you to route selected types of network traffic, such as FTP requests or HTTP (Web) connections, to a specific host on the Cayman 3220-H's LAN network transparently.

To set up NAT pinholes, you identify the type(s) of traffic you want to redirect by port number, and you specify the internal host to which each specified type of traffic should be directed.

The following list identifies protocol type and port number for common TCP/IP protocols:

- FTP (TCP 21)
- Telnet (TCP 23)
- SMTP (TCP 25),
- TFTP (UDP 69)
- SNMP (TCP 161, UDP 161)

Establishing pinholes to allow access through the router to internal hosts can create potential security risks. You should implement internal network security measures to prevent unauthorized access by outside users.

To display the Pinhole Configuration window (Figure 3-16), click the ***Pinhole*** button on the Cayman 3220-H Home Page. You must be in Expert Mode to open the Pinhole Configuration window.

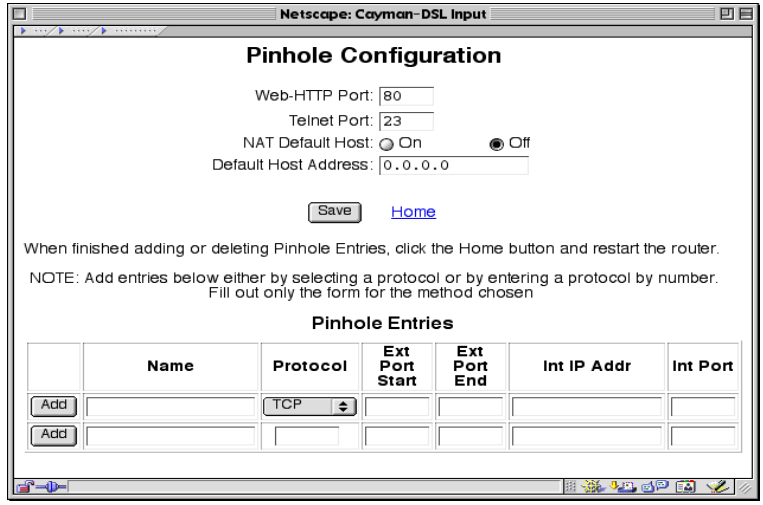


Figure 3-16 Pinhole Configuration Window

To configure pinhole settings:

1. **Enter the number identifying the port used by the Cayman 3220-H to listen for Web-based configuration connection requests in the *Web-HTTP Port* field.**

   If you set up a NAT pinhole for HTTP traffic (port 80), enter a number other than 80 in this field.

After you have made this change, you will need to use this port number to open a Web connection to the Cayman 3220-H. For example, if you change the Web-HTTP port to 1080 on a Cayman 3220-H using its default IP address (`192.168.1.254`), you would open a web connection to the device by entering the URL `http://192.168.1.254:1080`.

2. **Enter the number identifying the port used by the router to listen for Telnet-based configuration connection requests in the *Telnet Port* field.**

   If you set up a NAT pinhole for Telnet traffic (port 23), enter a number other than 23 in this field.

After you have made this change, you will need to include this port number when you open a Telnet connection to the Cayman 3220-H. For example, if you change the Telnet port to 1023 on a Cayman 3220-H using its default IP address (`192.168.1.254`*), you would open a Telnet connection to the device by entering* `telnet 192.168.1.254 1023` *in a DOS window or command line.*

3. **Use the *NAT Default Host* radio buttons to specify whether you want your Cayman 3220-H to send NAT traffic it would otherwise drop to a host on your network.**

   The NAT default host function is useful in situations where you cannot create a specific NAT pinhole for a traffic stream because you cannot anticipate what port number an application might use. For example, some network games select arbitrary port numbers when a connection is being opened. By identifying your computer (or another host on your network) as a NAT default server, you can specify that NAT traffic that would otherwise be discarded by the Cayman 3220-H should be directed to a specific hosts.

4. **Use the *Default Host Address* field to specify the IP address of the internal host to which NAT traffic should be directed.**

5. **If you are finished, click the *Save* button to store your modified configuration in the Cayman 3220-H memory.**

6. **Enter an identifier for the pinhole table entry in the *Name* field.**

   You can identify table entries by protocol name (`ftp`, `Telnet`, `http`), sequentially (`1`, `2`, `3`), by port number (`21`, `80`, `23`), or by some other naming scheme.

7. **Use the *Protocol* dropdown menu to select the type of protocol (TCP, UDP, ICMP, or PPTP) you want to redirect.**

   If you want to redirect a protocol type other than TCP, UDP, ICMP, or PPTP, use the second line of the table to enter the protocol type name.

8. **Enter the starting number of the external port range over which incoming traffic will be received in the *Ext Port Start* field.**

   For example, you would enter `21` to indicate you want FTP traffic forwarded to another host.

9. **Enter the ending number of the external port range over which incoming traffic will be received in the *Ext Port End* field.**

   For example, you would enter `23` to indicate you want Telnet traffic forwarded to another host.

10. **Enter the IP address of the internal host to which traffic of the specified type(s) should be transferred in the *Int IP Addr* field.**

11. **Enter the port number your router should use when forwarding traffic of the specified type(s) in the *Int Port* field.**

    Under most circumstances, you would use the same number for the external and internal ports.

12. **Click the *Add* button in the left column of the pinhole table.**

    The configuration page adds a new row to the Pinhole Entries table.

13. **When you are finished adding pinhole table entries, click the *Home* button.**

    Your router saves the new pinhole information and return you to the Cayman 3220-H home page.

14. **Click the *Restart Cayman-DSL* button on the Cayman 3220-H Home Page to restart your Cayman 3220-H with its new configuration.**

Configuring Bridge Settings

The Bridge Configuration window lets you use the Cayman 3220-H to connect two or more local area networks, so that devices on one can easily access resources on a bridged network. Bridges let you extend your logical network, while segmenting traffic between networks.

To display the Bridge Configuration window (Figure 3-17), click the ***Bridge*** button on the Cayman 3220-H Home Page. You must be in Expert Mode to open the Bridge Configuration window.

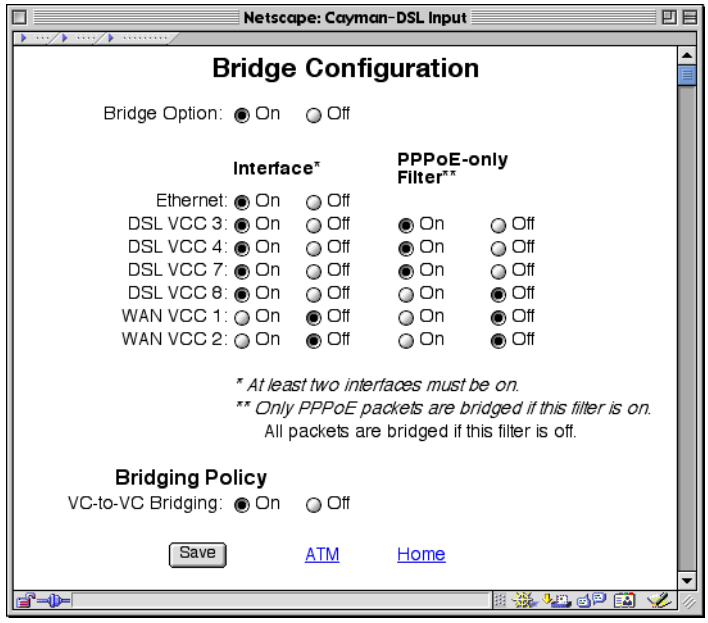


Figure 3-17 Bridge Configuration Window

The Bridge Configuration window displays controls for each active network interface on the Cayman 3220-H. The window you see may not match the one shown above.

To configure bridging:

1. **Click the *Bridge Option On* button.**

   You must enable bridging to enter other bridge settings.

2. **Click the *On* for each network interface you want to include in the bridged network.**

   The list of interfaces on which you can enable bridging is created dynamically, based on which network interfaces and virtual circuit connections you have set up in the Cayman 3220-H. You must enable at least two interfaces when you use bridging.

3. **If you want to restrict bridged traffic over an interface to PPP over Ethernet packets, click the *PPPoE-Only Filter On* button for the appropriate network interface.**

   If bridging over an interface is enabled but the filter setting for an interface is off, all packets are passed across the interface.

4. **If you want to bridge traffic between virtual circuit connections, click the *VC-to-VC Bridging On* button.**

   For example, if you want to set up a bridged network to connect several locations, you would enable bridging for each virtual circuit connecting your location to the other locations.

5. **Click the *Save* button to store your modified configuration in the Cayman 3220-H memory.**

6. **Click the *Restart Cayman-DSL* button on the Cayman 3220-H Home Page to restart your Cayman 3220-H with its new configuration.**

Configuring SNMP Settings

The Simple Network Management Protocol (SNMP) lets a network administrator monitor problems on a network by retrieving settings on remote network devices. The network administrator typically runs an SNMP management station program on a local host to obtain

information from an SNMP agent such as the Cayman 3220-H.The SNMP Setup window lets you enter SNMP configuration information for your Cayman 3220-H.

To display the SNMP Setup window (Figure 3-18), click the ***SNMP*** button on the Cayman 3220-H Home Page.You must be in Expert Mode to open the SNMP Setup window.

Figure 3-18 SNMP Setup Window

To configure the SNMP settings for your Cayman 3220-H:

1. **Enter information about the system contact in the *System Contact* field.**

   For example, you might enter the name, phone number, beeper number, or email address of the person responsible for the Cayman 3220-H.

2. **Enter information about the system location in the *System Location* field.**

   For example, you might enter the building, floor, or room number where the Cayman 3220-H is located.

3. **If you want the Cayman 3220-H to use authentication traps, click the *Authentication Traps On* radio button.**

   If SNMP trapping is enabled, your Cayman 3220-H sends authentication traps to all SNMP trap destinations. You must enable trap authentication before you set up your trap destinations.

4. **Identify the SNMP communities to which the Cayman 3220-H belongs by entering a community name in the *Communities* field and clicking the *Add* button.**

   By default, the Cayman 3220-H is associated with the public community. You can associate as many as 16 communities with the Cayman 3220-H.

5. **If your Cayman 3220-H is using authentication traps, identify the destinations to which the Cayman 3220-H should send SNMP trap messages.**

   Enter the IP address of a host acting as an SNMP console in the *IP Address* field.

6. **Optionally, enter the name of the community for which the trap destination is responsible in the *Community* field.**

   The optional community name identifies the name of the Cayman 3220-H community, which is included in the trap message the device sends to the management console. This name, which is not used for authentication, does not have to match a predefined community name.

7. **Click the *Add* button.**

8. **Click the *Save* button to store your modified configuration in the Cayman 3220-H memory.**

9. **Click the *Restart Cayman-DSL* button on the Cayman 3220-H Home Page to restart your Cayman 3220-H with its new configuration.**

4 Using the Command Line Interface

Overview

The Cayman 3220-H operating software includes a command line interface (CLI) that lets you monitor and configure your Cayman 3220-H over a Telnet or console connection. You can use the command line interface to enter and update a Cayman 3220-H's configuration settings, monitor its performance, and restart it.

Starting and Ending a CLI Session

You can open a command line interface session by opening a Telnet connection from a workstation on your network or by connecting a terminal to the console port on the Cayman 3220-H.

Connecting from Telnet

You initiate a Telnet connection by issuing the following command from an IP host that supports Telnet (or a personal computer running a Telnet application such as NCSA Telnet).

```
telnet ip_address
```

You must know the IP address of the Cayman 3220-H before you can make a Telnet connection to it. By default, your Cayman 3220-H uses 192.168.1.254 as the IP address for its LAN interface. You can use a Web browser or the maintenance console to configure the Cayman 3220-H IP address.

Connecting from the Maintenance Console Port

You can connect a terminal or terminal emulator to the maintenance console port on the Cayman 3220-H to configure, administer, and monitor your Cayman 3220-H.

To use the Cayman 3220-H console, you need a serial cable and either a terminal or terminal emulator (such as a personal computer with a terminal emulation application that supports 9600-baud communication).

To connect your Cayman 3220-H to a terminal or terminal emulator:

1. **Plug the DB-9 end of a serial cable into the maintenance console port on the Cayman 3220-H back panel.**

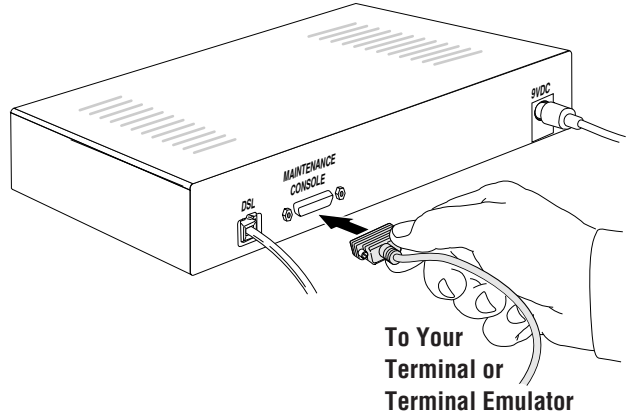


Figure 4-1. Connecting Your Cayman 3220-H to a Terminal

2. **Connect the other end of the serial cable to the serial port on your terminal (or terminal emulator) or the modem port of your computer.**

3. **Turn on the terminal or run the terminal emulator program on your computer.**

   Use the following settings to configure your terminal emulation session:

Setting	Set To
Speed	9600 bps
Parity	None
Databits	8
Stopbits	1
Duplex	Full
Flow Control	None

The console interface uses the same command line interface as the Telnet interface.

Logging In

The command line interface log-in process emulates the log-in process for a UNIX host. If your Cayman 3220-H has been assigned an administrator password or user password, you must enter a username (up to 32 characters) and your password.

- Entering your username lets the Cayman 3220-H record your access; your username is not used to validate your authorization.
- Entering the administrator password lets you display and update all Cayman 3220-H settings.
- Entering a user password lets you display (but not update) Cayman 3220-H settings.

When you have logged in successfully, the command line interface lists the username and the security level associated with the password you entered in the diagnostic log.

Ending a CLI Session

You end a command line interface session by typing `quit` from the ROOT node of the command line interface hierarchy.

Using the CLI Help Facility

The help command lets you display on-line help for ROOT and CONFIG commands. To display a list of the commands available to you from your current location in the command line interface hierarchy, enter `help`.

To obtain help for a specific CLI command, type `help command`. You can truncate the `help` command to `h` or a question mark when you request help for a CLI command.

Saving Settings

The `save` command saves the working copy of the settings to restart values. You can save the changes you have entered for a specific function or for all functions in the Cayman 3220-H. The Cayman 3220-H automatically validates its settings when you save and displays a warning message if the configuration is not correct.

About Root Commands

You begin in ROOT mode when you start a CLI session. ROOT mode lets you monitor the performance of your Cayman 3220-H, display and reset Cayman 3220-H statistics, and issue administrative commands to restart Cayman 3220-H functions.

ROOT Prompt

When you are in ROOT mode, the CLI prompt is the name of the Cayman 3220-H followed by a right angle bracket (>). For example, if you open a CLI connection to the Cayman 3220-H named "Dogzilla," you would see `Dogzilla>` as your CLI prompt.

ROOT Command Shortcuts

You can truncate most commands in the CLI to their shortest unique string. For example, you can use the truncated command `q` in place of the full `quit` command to exit the CLI. However, you would need to enter `rese` for the `reset` command, since the first characters of `reset` are common to the `restart` command.

The only command you cannot truncate is `restart`. To prevent accidental interruption of communications, you must enter the `restart` command in its entirety.

You can use the Up and Down arrow keys to scroll backward and forward through recent commands you have entered. Alternatively, you can use the `!!` command to repeat the last command you entered.

ROOT Commands

`arp` *`nnn.nnn.nnn.nnn`*

Sends an Address Resolution Protocol (ARP) request to match the *`nnn.nnn.nnn.nnn`* IP address to an Ethernet hardware address.

`atmping` *`vpi vci`* `[ segment | end-to-end ]`

Lets you check ATM connection reachability and network connectivity. The `atmping` command sends five OAM (operation, administration, and maintenance) loopback cells to the specified VPI/VCI destination.

Use the `segment` argument to ping a neighbor switch. Use the `end-to-end` argument to ping a remote end node.

`clear [yes]`

Clears the configuration settings in a Cayman 3220-H. If you do not use the optional `yes` qualifier, you are prompted to confirm the `clear` command.

`configure`

Puts the command line interface into Configure mode, which lets you configure your Cayman 3220-H with Config commands. Config commands are described starting on page 4-15.

`diagnose`

Runs a diagnostic utility to conduct a series of internal checks and loopback tests to verify network connectivity over each interface on your Cayman 3220-H. The console displays the results of each test as the diagnostic utility runs. If one test is dependent on another, the diagnostic utility indents its entry in the console window. For example, the diagnostic utility indents the Check IP connect to Ethernet (LAN) entry, since that test will not run if the Check Ethernet LAN Connect test fails.

Each test generates one of the following result codes:

PASS	The test was successful.
FAIL	The test was unsuccessful.
SKIPPED	The test was skipped because a test on which it depended failed.
PENDING	The test timed out without producing a result. Try running the test again.

`download [`*`server_address`*`] [`*`filename`*`] [confirm]`

Copies the current configuration settings of the Cayman 3220-H from a TFTP (Trivial File Transfer Protocol) server. The TFTP server must be accessible on your Ethernet network.

You can include one or more of the following arguments with the download command. If you omit arguments, the console prompts you for this information.

- The *server_address* argument identifies the IP address of the TFTP server from which you want to copy the Cayman 3220-H configuration file.

- The *filename* argument identifies the path and name of the configuration file on the TFTP server.
- If you include the optional confirm keyword, the download begins as soon as all information is entered.

`install [server_address] [filename] [confirm]`

Downloads a new version of the Cayman 3220-H operating software from a TFTP (Trivial File Transfer Protocol) server, validates the software image, and programs the image into the Cayman 3220-H memory. After you install new operating software, you must restart the Cayman 3220-H.

The TFTP server must be accessible on your Ethernet network. The *server_address* argument identifies the IP address of the TFTP server on which your Cayman 3220-H operating software is stored. The *filename* argument identifies the path and name of the operating software file on the TFTP server.

If you include the optional confirm keyword, you will not be prompted to identify a TFTP server or file name. Your Cayman 3220-H begins the software installation using its default boot settings.

`log message_string`

Adds the message in the *message_string* argument to the Cayman 3220-H diagnostic log.

`loglevel [level]`

Displays or modifies the types of log messages you want the Cayman 3220-H to record. If you enter the loglevel command without the optional *level* argument, the command line interface displays the current log level setting.

You can enter the loglevel command with the *level* argument to specify the types of diagnostic messages you want to record. All messages with a level number equal to or greater than the level you specify are recorded. For example, if you specify loglevel 3, the

diagnostic log will retain high-level informational messages (level 3), warnings (level 4), and failure messages (level 5).

Use the following values for the *level* argument:

- 1 or low – Low-level informational messages or greater; includes trivial status messages.
- 2 or medium – Medium-level informational messages or greater; includes status messages that can help monitor network traffic.
- 3 or high – High-level informational messages or greater; includes status messages that may be significant but do not constitute errors.
- 4 or warning – Warnings or greater; includes recoverable error conditions and useful operator information.
- 5 or failure – Failures; includes messages describing error conditions that may not be recoverable.

`netstat -i`

Displays the IP interfaces for your Cayman 3220-H.

`netstat -r`

Displays the IP routes stored in your Cayman 3220-H.

`nslookup { hostname | ip_address }`

Performs a domain name system lookup for a specified host.

- The *hostname* argument is the name of the host for which you want DNS information; for example, `nslookup klaatu`.
- The *ip_address* argument is the IP address, in dotted decimal notation, of the device for which you want DNS information.

`ping [-s size] [-c count]{ hostname | ip_address }`

Causes the Cayman 3220-H to issue a series of ICMP Echo requests for the device with the specified name or IP address.

- The *hostname* argument is the name of the device you want to ping; for example, `ping ftp.cayman.com`.
- The *ip_address* argument is the IP address, in dotted decimal notation, of the device you want to locate. If a host using the specified name or IP address is active, it returns one or more ICMP Echo replies, confirming that it is accessible from your network.
- The `-s` *size* argument lets you specify the size of the ICMP packet.
- The `-c` *count* argument lets you specify the number of ICMP packets generated for the ping request.

You can use the `ping` command to determine whether a hostname or IP address is already in use on your network. You cannot use the `ping` command to ping the Cayman 3220-H's own IP address.

`quit`

Exits the Cayman 3220-H command line interface.

`reset arp`

Clears the Address Resolution Protocol (ARP) cache on your Cayman 3220-H.

`reset atm`

Resets ATM statistics to zero.

`reset crash`

Clears crash-dump information, which identifies the contents of the c registers at the point of system malfunction.

`reset dhcp client release [` *vcc-id* `]`

Releases the DHCP lease the Cayman 3220-H is currently using to acquire the IP settings for the specified DSL port. The *vcc-id* identifier is a letter in the range B–I. Enter the `reset dhcp client`

`release` without the variable to see the letter assigned to each virtual circuit.

`reset dhcp client renew [ vcc-id ]`

Renews the DHCP lease the Cayman 3220-H is currently using to acquire the IP settings of the specified DSL port. The *vcc-id* identifier is a letter in the range B–I. Enter the `reset dhcp client renew` without the variable to see the letter assigned to each virtual circuit.

`reset dhcp server`

Clears the DHCP lease table in the Cayman 3220-H.

`reset dsl`

Resets any open DSL connection.

`reset dsl counters`

Resets DSL statistics to zero.

`reset enet`

Resets Ethernet statistics to zero.

`reset ipmap`

Clears the IP mapping table.

`reset log`

Rewinds the diagnostic log display to the top of the existing Cayman 3220-H diagnostic log. The `reset log` command does not clear the diagnostic log. The next `show log` command will display information from the beginning of the log file.

`reset ppp vcc`*n*

Resets the point-to-point connection over the specified virtual circuit. The command only applies to virtual circuits that use PPP framing.

`restart [`*seconds*`]`

Restarts your Cayman 3220-H. If you include the optional *seconds* argument, your Cayman 3220-H will restart when the specified number of seconds have elapsed. You must enter the complete `restart` command to initiate a restart.

`show atm [all]`

Displays ATM statistics for your Cayman 3220-H. If you include the optional `all` argument, your Cayman 3220-H will display a more detailed set of ATM statistics.

`show bridge interfaces`

Displays bridge interfaces maintained by the Cayman 3220-H.

`show bridge table`

Displays the bridging table maintained by the Cayman 3220-H.

`show crash`

Displays the most recent crash information, if any, for your Cayman 3220-H.

`show dhcp agent`

Displays the DHCP relay-agent leases being administered by your Cayman 3220-H.

`show dhcp client`

Displays the DHCP address information being used by your Cayman 3220-H for each WAN interface.

`show dhcp server leases [ used | free ]`

Displays the DHCP leases stored in RAM by your Cayman 3220-H. You can include the `used` argument to see the list of DHCP leases that are in use or that have been used since your Cayman 3220-H was restarted. You can include the `free` argument to see the list of DHCP leases that are available for use.

`show dhcp server store`

Displays the DHCP leases stored in NVRAM by your Cayman 3220-H.

`show dsl`

Displays DSL port statistics, such as upstream and downstream connection rates and noise levels.

`show enet`

Displays the Ethernet statistics for your Cayman 3220-H.

`show ip arp`

Displays the Ethernet address resolution table stored in your Cayman 3220-H.

`show ip igmp`

Displays the contents of the IGMP Group Address table and the IGMP Report table maintained by your Cayman 3220-H.

`show ip interfaces`

Displays the IP interfaces for your Cayman 3220-H.

`show ip routes`

Displays the IP routes stored in your Cayman 3220-H.

`show log`

Displays blocks of information from the Cayman 3220-H diagnostic log. To see the entire log, you can repeat the `show log` command or you can enter `show log all` and scroll through the complete log.

`show memory [all]`

Displays memory usage information for your Cayman 3220-H. If you include the optional `all` argument, your Cayman 3220-H will display a more detailed set of memory statistics.

`show ppp [{ stats | lcp | ipcp | lastconnect }] [ vcc`*n* `]`

Displays information about open PPP links. You can display a subset of the PPP statistics by including an optional `stats`, `lcp`, `ipcp`, or `lastconnect` argument for the `show ppp` command. The optional vcc*n* argument lets you specify the virtual circuit for which you want statistics.

`show pppoe`

Displays status information for each PPP socket, such as the socket state, service names, and host ID values.

`show status`

Displays the current status of a Cayman 3220-H, the device's hardware and software revision levels, a summary of errors encountered, and the length of time the Cayman 3220-H has been running since it was last restarted. Identical to the `status` command.

`start ppp vcc`*n*

Opens a PPP link on the specified virtual circuit.

`status`

Displays the current status of a Cayman 3220-H, the device's hardware and software revision levels, a summary of errors encountered, and the length of time the Cayman 3220-H has been running since it was last restarted. Identical to the `show status` command.

`telnet { `*hostname* `|` *ip_address* `} [`*port*`]`

Lets you open a Telnet connection to the specified host through your Cayman 3220-H.

- The *hostname* argument is the name of the device to which you want to connect; for example, `telnet ftp.cayman.com`.
- The *ip_address* argument is the IP address, in dotted decimal notation, of the device to which you want to connect.
- The *port* argument is the number of t he port over which you want to open a Telnet session.

`traceroute { hostname | ip_address }`

Lets you trace the route between the Cayman 3220-H and the specified host.

- The *hostname* argument is the name of the device you want to trace; for example, `traceroute ftp.cayman.com`.
- The *ip_address* argument is the IP address, in dotted decimal notation, of the device you want to trace.

```
Dogzilla> traceroute 192.168.1.10
Traceroute to 192.168.1.10 from local address
192.168.1.254 (timer gran. 100 ms)
...
traceroute to 192.168.1.10, 30 hops max, 56 byte packets
 1 192.168.1.10 0 ms! 0 ms! 0 ms!
```

`upload [server_address] [filename] [confirm]`

Copies the current configuration settings of the Cayman 3220-H to a TFTP (Trivial File Transfer Protocol) server. The TFTP server must be accessible on your Ethernet network. The *server_address* argument identifies the IP address of the TFTP server on which you want to store the Cayman 3220-H settings. The *filename* argument identifies the path and name of the configuration file on the TFTP server. If you include the optional `confirm` keyword, you will not be prompted to identify a TFTP server or file name.

`who`

Displays the names of the current shell users.

About CONFIG Commands

You reach the configuration mode of the command line interface by typing `configure` (or any truncation of `configure`, such as `c` or `config`) at the CLI ROOT prompt.

CONFIG Mode Prompt

When you are in CONFIG mode, the CLI prompt consists of the name of the Cayman 3220-H followed by your current node in the hierarchy and two right angle brackets (>>). For example, when you enter CONFIG mode (by typing `config` at the ROOT prompt), the `Dogzilla (top)>>` prompt reminds you that you are at the top of the CONFIG hierarchy. If you move to the `ip` node in the CONFIG hierarchy (by typing `ip` at the CONFIG prompt), the prompt changes to `Dogzilla (ip)>>` to identify your current location.

Some CLI commands are not available until certain conditions are met. For example, you must enable IP for an interface before you can enter IP settings for that interface.

Navigating the CONFIG Hierarchy

- **Moving from CONFIG to ROOT** — You can navigate from anywhere in the CONFIG hierarchy back to the ROOT level by entering `quit` at the CONFIG prompt and pressing RETURN.

  ```
  Dogzilla (top)>> quit
  Dogzilla >
  ```

- **Moving from `top` to a subnode** — You can navigate from the top node to a subnode by entering the node name (or the significant letters of the node name) at the CONFIG prompt and pressing RETURN. For example, you move to the IP subnode by entering `ip` and pressing RETURN.

  ```
  Dogzilla (top)>> ip
  Dogzilla (ip)>>
  ```

  As a shortcut, you can enter the significant letters of the node name in place of the full node name at the CONFIG prompt. The significant characters of a node name are the letters that uniquely identify the node. For example, since no other

CONFIG node starts with I, you could enter one letter ("i") to move to the IP node.

```
Dogzilla (top)>> i
Dogzilla (ip)>>
```

- **Jumping down several nodes at once** — You can jump down several levels in the CONFIG hierarchy by entering the complete path to a node.

```
Dogzilla (top)>> ip static-routes
Dogzilla (ip static-routes)>>
```

- **Moving up one node** — You can move up through the CONFIG hierarchy one node at a time by entering the `up` command.

```
Dogzilla (ip static-routes)>> up
Dogzilla (ip>>
```

- **Jumping to the top node** — You can jump to the top level from anywhere in the CONFIG hierarchy by entering the `top` command.

```
Dogzilla (ip static-routes)>> top
Dogzilla (top)>>
```

- **Moving from one subnode to another** — You can move from one subnode to another by entering a partial path that identifies how far back to climb.

```
Dogzilla (ip)>> bridge
Dogzilla (bridge)>>
```

- **Moving from any subnode to any other subnode** — You can move from any subnode to any other subnode by entering a partial path that starts with a top-level CONFIG command.

```
Dogzilla (ip ethernet)>> ip gateway
Dogzilla (ip gateway)>>
```

- **Scrolling backward and forward through recent commands —** You can use the Up and Down arrow keys to scroll backward and forward through recent commands you have entered. When the command you want appears, press Enter to execute it.

Entering Commands in CONFIG Mode

CONFIG commands consist of *keywords* and *arguments*. Keywords in a CONFIG command specify the action you want to take or the entity on which you want to act. Arguments in a CONFIG command specify the values appropriate to your site. For example, the CONFIG command

```
set ip ethernet address ip_address
```

consists of three keywords (`ip`, `ethernet`, and `address`) and one argument (*`ip_address`*). When you use the command to configure your router, you would replace the argument with a value appropriate to your site.

```
set ip ethernet address 192.31.222.57
```

The following table provides guidelines for entering and formatting CONFIG commands.

Command component	Rules for entering CONFIG commands
Command verbs	CONFIG commands must start with a command verb (set, view, delete). You can truncate CONFIG verbs to three characters (set, vie, del). CONFIG verbs are case-insensitive. You can enter "SET," "Set," or "set."
Keywords	Keywords are case-insensitive. You can enter "Ethernet," "ETHERNET," or "ethernet" as a keyword without changing its meaning. Keywords can be abbreviated to the length that they are differentiated from other keywords.
Argument Text	Text strings can be as many as 32 characters long, unless otherwise specified. Special characters are represented using backslash notation. Text strings may be enclosed in double (") or single (') quote marks. If the text string includes an embedded space, it must be enclosed in quotes. Special characters are represented using backslash notation.

Command component	Rules for entering CONFIG commands
Numbers	Enter numbers as integers.
IP addresses	Enter IP addresses in dotted decimal notation (0 to 255).

If a command is ambiguous or miskeyed, the CLI prompts you to enter additional information. For example, you must specify which virtual circuit you are configuring when you are setting up a Cayman 3220-H.

```
Dogzilla (ip)>> ip-ppp
  ip-ppp (?) [vcc1 | vcc2 | vcc7 | vcc8]: vcc1
Dogzilla (ip ip-ppp [vcc1])>>
```

Displaying Current Router Settings

You can use the `view` command to display the current CONFIG settings for your Cayman 3220-H. If you enter the `view` command at the top level of the CONFIG hierarchy, the CLI displays the settings for all enabled functions. If you enter the `view` command at an intermediate node, you see settings for that node and its subnodes.

Stepping Through Cayman 3220-H Configuration

The Cayman 3220-H command line interface includes a step mode to automate the process of entering configuration settings. When you use the CONFIG step mode, the command line interface prompts you for all required and optional information. You can then enter the configuration values appropriate for your site without having to enter complete CLI commands.

When you are in step mode, the command line interface prompts you to enter required and optional settings. If a setting has a default value or a current setting, the command line interface displays the default value for the command in parentheses. If a command has a limited number of acceptable values, those values are presented in brackets, with each value separated by a vertical line. For example, the following CLI step command indicates that the default value is `off` and that valid entries are limited to `on` and `off`.

```
option (off) [on | off]: on
```

You can accept the default value for a field by pressing the Return key. To use a different value, enter it and press Return.

You can enter the CONFIG step mode by entering `set` from the top node of the CONFIG hierarchy. You can enter step mode for a particular service by entering `set` *service_name*. For example:

```
Dogzilla (top)>> set system
Stepping set mode (press Control-X <Return/Enter> to
exit)
...
system
   name ("Dogzilla"): Mycroft
   Diagnostic Level (High): medium
Stepping mode ended.
```

Validating Your Configuration

You can use the validate CONFIG command to make sure that your configuration settings have been entered correctly. If you use the `validate` command, the Cayman 3220-H verifies that all required settings for all services are present and that settings are consistent.

```
Dogzilla (top)>> validate
Error: Subnet mask is incorrect
Global Validation did not pass inspection!
```

You can use the `validate` command to verify your configuration settings at any time. Your Cayman 3220-H automatically validates your configuration any time you save a modified configuration.

CONFIG Commands

This section describes the keywords and arguments for the various CONFIG commands.

ATM Settings

You can use the command line interface to set up each ATM virtual circuit.

```
set atm option { on | off }
```

Enables or disables ATM services in the Cayman 3220-H. You must enable ATM services before you can enter other ATM settings for the Cayman 3220-H. If you turn off ATM services and save the new configuration, the Cayman 3220-H clears its ATM settings.

```
set atm vcc n option { on | off }
```

Enables or disables a virtual circuit in the Cayman 3220-H (where n is a number in the range 1-8). You must enable a virtual circuit before you can enter other settings for it.

```
set atm vcc n vpi vpi
```

Specifies the virtual path identifier for the circuit. Enter a number in the range 0-255.

```
set atm vcc n vci vci
```

Specifies the virtual circuit identifier for the circuit. Enter a number in the range 0-65535.

```
set atm vcc n encap { ppp-vcmux | ppp-llc | ether-vcmux |
 ether-llc | ip-vcmux | ip-llc }
```

Specifies the encapsulation method for the circuit. Options are:

- `ppp-vcmux` - PPP over ATM, VC-multiplexed
- `ppp-llc` - PPP over ATM, LLC-SNAP
- `ether-vcmux` - RFC 1483 bridged Ethernet, VC-multiplexed

- `ether-llc` - RFC 1483 bridged Ethernet, LLC-SNAP
- `ip-vcmux` - RFC 1483 routed IP, VC-multiplexed
- `ip-llc` - RFC 1483 routed IP, LLC-SNAP
- `pppoe-vcmux` - PPP over Ethernet, VC-multiplexed
- `pppoe-llc` - PPP over Ethernet, LLC-SNAP

`set atm vcc` *n* `tx-priority { low | high }`

Determines the routing priority among virtual circuits. The Cayman 3220-H transmits traffic for high-priority virtual circuits before it transmits traffic for low-priority virtual circuits. If two virtual circuits have the same priority (high or low), the Cayman 3220-H splits the available bandwidth between them.

`set atm vcc` *n* `tx-max-kbps { 0 | 1-1000 }`

Specifies the maximum upstream (transmission) rate of the virtual circuit (measured in kilobytes per second). If you enter 0, the Cayman 3220-H does not restrict the transmission rate of the virtual circuit. If you enter a number in the range 1-1000, the Cayman 3220-H restricts transmission through the virtual circuit to the specified rate.

BNCP Settings

`set bncp option {on | off }`

Enables or disables bridging over a PPP link. Typically used when the PPP peer doesn't support IPCP encapsulation.

Bridging Settings

Bridging lets the Cayman 3220-H use MAC (Ethernet hardware) addresses to forward non-TCP/IP traffic from one network to another. When bridging is enabled, the Cayman 3220-H maintains a table of up to 255 MAC addresses. Entries that are not used within 10 minutes are dropped. If the bridging table fills up, the oldest table entries are dropped to make room for new entries.

You cannot bridge virtual circuits that use IP framing.

`set bridge option {on | off }`

Enables or disables bridging services in the Cayman 3220-H. You must enable bridging services within the Cayman 3220-H before you can enable bridging for a specific interface.

`set bridge ethernet option { on | off }`

Enables or disables bridging services for the Ethernet interface.

`set bridge dsl vcc`*n* `option { on | off }`

Enables or disables bridging services for the specified virtual circuit. using Ethernet framing.

`set bridge wan vcc`*n* `option { on | off }`

Enables or disables bridging services for the specified virtual circuit using PPP framing.

`set bridge interwan-bridging { on | off }`

Enables or disables bridging between virtual circuit connections.

DHCP Settings

As a Dynamic Host Control Protocol (DHCP) server, your Cayman 3220-H can assign IP addresses and provide configuration information to other devices on your network dynamically. A device that acquires its IP address and other TCP/IP configuration settings from the Cayman 3220-H can use the information for a fixed period of time (called the DHCP lease).

`set dhcp option { off | server | relay-agent }`

Enables or disables DHCP services in the Cayman 3220-H. You must enable DHCP services before you can enter other DHCP settings for the Cayman 3220-H.

If you turn off DHCP services and save the new configuration, the Cayman 3220-H clears its DHCP settings.

`set dhcp start-address` *ip_address*

If you selected `server`, specifies the first address in the DHCP address range. The Cayman 3220-H can reserve a sequence of up to 253 IP addresses within a subnet, beginning with the specified address for dynamic assignment.

`set dhcp end-address` *ip_address*

If you selected `server`, specifies the last address in the DHCP address range.

`set dhcp lease-time` *lease-time*

If you selected `server`, specifies the default length for DHCP leases issued by the Cayman 3220-H. Enter lease time in `dd:hh:mm:ss` (day/hour/minute/second) format.

`set dhcp relay-agent` *ip_address*

If you selected `relay-agent`, specifies the IP address in the remote DHCP server to which your Cayman 3220-H relays DHCP requests.

Domain Name System Settings

Domain Name System (DNS) is an information service for TCP/IP networks that uses a hierarchical naming system to identify network domains and the hosts associated with them. You can identify a primary DNS server and one secondary server.

`set dns domain-name` *domain-name*

Specifies the default domain name for your network. When an application needs to resolve a host name, it appends the default domain name to the host name and asks the DNS server if it has an address for the "fully qualified host name."

`set dns primary-address` *ip_address*

Specifies the IP address of the primary DNS name server.

`set dns secondary-address ip_address`

Specifies the IP address of the secondary DNS name server. Enter `0.0.0.0` if your network does not have a secondary DNS name server.

IP Settings

You can use the command line interface to specify whether TCP/IP is enabled, identify a default gateway, and to enter TCP/IP settings for the Cayman 3220-H LAN and WAN ports.

Basic Settings

`set ip option { on | off }`

Enables or disables TCP/IP services in the Cayman 3220-H. You must enable TCP/IP services before you can enter other TCP/IP settings for the Cayman 3220-H. If you turn off TCP/IP services and save the new configuration, the Cayman 3220-H clears its TCP/IP settings.

DSL Settings

Use the following commands to configure settings for routing IP over a virtual circuit using Ethernet framing.

`set ip dsl vcc`*`n`* `option { on | off }`

Specifies whether virtual circuit n on Cayman 3220-H is active (where *n* is a number in the range 1-8). You must enable a virtual circuit before you can enter other settings for it.

`set ip dsl vcc`*`n`* `address ip_address`

Assigns an IP address to the virtual circuit. Enter `0.0.0.0` if you want the virtual circuit to obtain its IP address from a remote DHCP server.

`set ip dsl vcc`*`n`* `broadcast broadcast_address`

Specifies the broadcast address for the TCP/IP network connected to the virtual circuit. IP hosts use the broadcast address to send messages to every host on your network simultaneously.

The broadcast address for most networks is the network number followed by 255. For example, the broadcast address for the 192.168.1.0 network is 192.168.1.255.

`set ip dsl vcc`*n* `netmask` *netmask*

Specifies the subnet mask for the TCP/IP network connected to the virtual circuit. The subnet mask specifies which bits of the 32-bit binary IP address represent network information. The default subnet mask for most networks is 255.255.255.0 (Class C subnet mask).

```
set ip dsl vccn restriction
{ admin-disabled | admin-only | none }
```

Specifies restrictions on the types of traffic the Cayman 3220-H accepts over the DSL virtual circuit. For security reasons, the `admin-disabled` argument is the default; it means that router traffic is accepted but that administrative commands are ignored. The `admin-only` argument means that router traffic is ignored but that administrative commands are accepted. The `none` argument means that all traffic is accepted.

`set ip dsl vcc`*n* `addr-mapping { on | off }`

Specifies whether you want the Cayman 3220-H to use network address translation (NAT) when communicating with remote routers. Address mapping lets you conceal details of your network from remote routers. By default, address mapping is turned on.

For more information on network address translation, see "About Network Address Translation" on page C-2..

`set ip dsl vcc`*n* `proxy-arp { on | off }`

Specifies whether you want the Cayman 3220-H to respond when it receives an address resolution protocol for devices behind it. By default, proxy ARP is turned off.

`set ip dsl vcc`*n* `rip-send { off | v1 | v2 | v1-compat | v2-MD5 }`

Specifies whether the Cayman 3220-H should use Routing Information Protocol (RIP) broadcasts to advertise its routing tables to other routers on your wide area network (WAN). RIP Version 2 (RIP-2) is an extension of the original Routing Information Protocol (RIP-1) that expands the amount of useful information in the RIP packets. While RIP-1 and RIP-2 share the same basic algorithms, RIP-2 supports several new features, including inclusion of subnet masks in RIP packets and implementation of multicasting instead of broadcasting (which reduces the load on hosts which do not support routing protocols). RIP-2 with MD5 authentication is an extension of RIP-2 that increases security by requiring an authentication key when routes are advertised.

Depending on your network needs, you can configure your Cayman 3220-H to support RIP-1, RIP-2, or both.

`set ip dsl vcc`*n* `rip-receive { off | v1 | v2 | v1-compat | v2-MD5 }`

Specifies whether the Cayman 3220-H should use Routing Information Protocol (RIP) broadcasts to update its routing tables with information received from other routers on your wide area network.

`set ip dsl vcc`*n* `rip-send-keyid` *keyid*

Specifies the authentication key that will be included with all outgoing RIP packets if `v2-MD5` is selected for `rip-send`. This authentication key must match the key the remote router is expecting, or the RIP update will be ignored. RIP authentication keys can be 1-16 characters long, and can include spaces and special characters. You must enclose the authentication key string in double quotes (“”).

`set ip dsl vcc`*n* `rip-receive-keyid` *keyid*

Specifies the key that will be used to authenticate all incoming RIP packets if `v2-MD5` is selected for `rip-send`. When your Cayman

3220-H receives a RIP packet, it uses the expected key to create an MD-5 digest of the RIP message. It then compares this calculated digest to the MD-5 digest sent with the RIP packet. If the calculated digest does not match the received digest, the RIP message is discarded. If the two digests match, the packet is processed as a normal RIP-2 packet.

IP authentication keys can be 1-16 characters long, and can include spaces and special characters. You must enclose the authentication key string in double quotes ("").

Ethernet Settings

`set ip ethernet option { on | off }`

Enables or disables communications on the local area network for the Cayman 3220-H. You must enable TCP/IP functions for the local Ethernet interface before you can configure its network settings.

`set ip ethernet address` *`ip_address`*

Assigns an IP address to the Cayman 3220-H on the local area network. The IP address you assign to the local Ethernet interface must be unique on your network. By default, the Cayman 3220-H uses 192.168.1.254 as its LAN IP address.

`set ip ethernet broadcast` *`broadcast_address`*

Specifies the broadcast address for the local Ethernet interface. IP hosts use the broadcast address to send messages to every host on your network simultaneously.

The broadcast address for most networks is the network number followed by 255. For example, the broadcast address for the 192.168.1.0 network would be 192.168.1.255.

`set ip ethernet netmask` *`netmask`*

Specifies the subnet mask for the local Ethernet interface. The subnet mask specifies which bits of the 32-bit binary IP address represent

network information. The default subnet mask for most networks is 255.255.255.0 (Class C subnet mask).

```
set ip ethernet restrictions { none | admin-disabled }
```

Specifies whether an administrator can open a Telnet connection to the Cayman 3220-H over the Ethernet interface to monitor and configure the Cayman 3220-H.

```
set ip ethernet proxy-arp { on | off }
```

Specifies whether you want the Cayman 3220-H to respond when it receives an address resolution protocol for devices behind it. By default, proxy ARP is turned off.

```
set ip ethernet rip-send { off | v1 | v2 | v1-compat |
v2-MD5 }
```

Specifies whether the Cayman 3220-H should use Routing Information Protocol (RIP) broadcasts to advertise its routing tables to other routers on your network. RIP Version 2 (RIP-2) is an extension of the original Routing Information Protocol (RIP-1) that expands the amount of useful information in the RIP packets. While RIP-1 and RIP-2 share the same basic algorithms, RIP-2 supports several new features, including inclusion of subnet masks in RIP packets and implementation of multicasting instead of broadcasting (which reduces the load on hosts which do not support routing protocols. RIP-2 with MD5 authentication is an extension of RIP-2 that increases security by requiring an authentication key when routes are advertised.

Depending on your network needs, you can configure your Cayman 3220-H to support RIP-1, RIP-2, or both.

```
set ip ethernet rip-receive { off | v1 | v2 | v1-compat |
v2-MD5 }
```

Specifies whether the Cayman 3220-H should use Routing Information Protocol (RIP) broadcasts to update its routing tables with information received from other routers on your network.

`set ip ethernet rip-send-keyid` *keyid*

Specifies the authentication key that will be included with all outgoing RIP packets if `v2-MD5` is selected for `rip-send`. This authentication key must match the key the remote router is expecting, or the RIP update will be ignored. RIP authentication keys can be 1-16 characters long, and can include spaces and special characters. You must enclose the authentication key string in double quotes (“”).

`set ip ethernet rip-receive-keyid` *keyid*

Specifies the key that will be used to authenticate all incoming RIP packets if `v2-MD5` is selected for `rip-send`. When your Cayman 3220-H receives a RIP packet, it uses the expected key to create an MD-5 digest of the RIP message. It then compares this calculated digest to the MD-5 digest sent with the RIP packet. If the calculated digest does not match the received digest, the RIP message is discarded. If the two digests match, the packet is processed as a normal RIP-2 packet.

IP authentication keys can be 1-16 characters long, and can include spaces and special characters. You must enclose the authentication key string in double quotes (“”).

Default IP Gateway Settings

`set ip gateway option { on | off }`

Specifies whether the Cayman 3220-H should send packets to a default gateway if it does not know how to reach the destination host.

`set ip gateway interface { ip-address | ppp-vc`*n* `}`

Specifies whether the gateway is reached using a fixed IP address or through a PPP virtual circuit.

```
set ip gateway default ip_address
```

Specifies the IP address of the default IP gateway. Only used if you specify that the gateway can be reached at a fixed IP address and not through a PPP virtual circuit.

WAN-to-WAN Routing Settings

Use the following command to configure settings for routing between WAN connections.

```
set ip interwan-routing { on | off }
```

Enables or disables routing between WAN connections.

IP-over-PPP Settings

Use the following commands to configure settings for routing IP over a virtual PPP interface.

```
set ip ip-ppp vccn option { on | off }
```

Enables or disables IP routing through the virtual PPP interface. By default, IP routing is turned off. You must enable IP routing before you can enter other IP routing settings for the virtual PPP interface. If you turn off IP routing and save the new configuration, the Cayman 3220-H clears IP routing settings.

```
set ip ip-ppp vccn address ip_address
```

Assigns an IP address to the virtual PPP interface. If you specify an IP address other than 0.0.0.0, your Cayman 3220-H will not negotiate its IP address with the remote peer. If the remote peer does not accept the IP address specified in the *ip_address* argument as valid, the link will not come up.

The default value for the *ip_address* argument is 0.0.0.0, which indicates that the virtual PPP interface will use the IP address assigned to it by the remote peer. Note that the remote peer must be configured to supply an IP address to your Cayman 3220-H if you enter 0.0.0.0 for the *ip_address* argument.

`set ip ip-ppp vcc`*n* `peer-address` *`ip_address`*

Specifies the IP address of the peer on the other end of the PPP link. If you specify an IP address other than 0.0.0.0, your Cayman 3220-H will not negotiate the remote peer's IP address. If the remote peer does not accept the address in the *`ip_address`* argument as its IP address (typically because it has been configured with another IP address), the link will not come up.

The default value for the *`ip_address`* argument is 0.0.0.0, which indicates that the virtual PPP interface will accept the IP address returned by the remote peer. If you enter 0.0.0.0, the peer system must be configured to supply this address.

```
set ip ip-ppp vccn restriction
{ admin-disabled | admin-only | none }
```

Specifies restrictions on the types of traffic the Cayman 3220-H accepts over the PPP virtual circuit. For security reasons, the `admin-disabled` argument is the default; it means that router traffic is accepted but that administrative commands are ignored. The `admin-only` argument means that router traffic is ignored but that administrative commands are accepted. The `none` argument means that all traffic is accepted.

```
set ip ip-ppp vccn addr-mapping { on | off }
```

Specifies whether you want the Cayman 3220-H to use network address translation (NAT) when communicating with remote routers. Network address translation lets you conceal details of your network from remote routers. By default, address mapping is turned on.

For more information on network address translation, see "About Network Address Translation" on page C-2.

```
set ip ip-ppp vccn vj-compression { on | off }
```

Specifies whether you want to negotiate Van Jacobson header compression for asynchronous PPP links. By default, TCP/IP header compression is turned on.

When Van Jacobson header compression is turned on, your Cayman 3220-H allocates memory for 16 slots (headers) by default. The number of slots may be reduced during link configuration if the remote peer can only support a lower number.

```
set ip ip-ppp ipcp-subnet { on | off }
```

Specifies whether you want your Cayman 3220-H to negotiate allocation of an IP subnet, rather than a single IP address, from a remote access server. You should only enable this feature if you are told to do so by your Internet Service Provider.

```
sset ip ip-ppp vcc<n> rip-send { off | v1 | v2 | v1-compat }
```

Specifies whether the Cayman 3220-H should use Routing Information Protocol (RIP) broadcasts to advertise its routing tables to routers on the other side of the PPP link. RIP Version 2 (RIP-2) is an extension of the original Routing Information Protocol (RIP-1) that expands the amount of useful information in the RIP packets. While RIP-1 and RIP-2 share the same basic algorithms, RIP-2 supports several new features, including inclusion of subnet masks in RIP packets and implementation of multicasting instead of broadcasting (which reduces the load on hosts which do not support routing protocols).

This command is only available when address mapping for the specified virtual circuit is turned off.

```
set ip ip-ppp vcc<n> rip-receive
{ off | v1 | v2 | v1-compat }
```

Specifies whether the Cayman 3220-H should use Routing Information Protocol (RIP) broadcasts to update its routing tables with information received from other routers on the other side of the PPP link.

This command is only available when address mapping for the specified virtual circuit is turned off.

`set ip ip-ppp vcc`*n* `flush-routes { on | off }`

Specifies whether the Cayman 3220-H should flush (delete) entries from its routing table when the specified virtual circuit is down and those routes are inaccessible. This command is only available when address mapping for the specified virtual circuit is turned off.

Static ARP Settings

Your Cayman 3220-H maintains a dynamic Address Resolution Protocol (ARP) table to map IP addresses to Ethernet (MAC) addresses. Your Cayman 3220-H populates this ARP table dynamically, by retrieving IP address/MAC address pairs only when it needs them. Optionally, you can define static ARP entries to map IP addresses to their corresponding Ethernet MAC addresses. Unlike dynamic ARP table entries, static ARP table entries do not time out.

You can configure as many as 16 static ARP table entries for a Cayman 3220-H. Use the following commands to add static ARP entries to the Cayman 3220-H static ARP table:

`set ip static-arp ip-address` *`ip_address`*

Specifies the IP address for the static ARP entry. Enter an IP address in the *`ip_address`* argument in dotted decimal format. The *`ip_address`* argument cannot be 0.0.0.0.

`set ip static-arp hardware-address` *`MAC_address`*

Specifies the Ethernet hardware address for the static ARP entry. Enter an Ethernet hardware address in the *`MAC_address`* argument in `nn.nn.nn.nn.nn.nn` (hexadecimal) format.

Static Route Settings

A static route identifies a manually configured pathway to a remote network. Unlike dynamic routes, which are acquired and confirmed periodically from other routers, static routes do not time out. Consequently, static routes are useful when working with PPP, since an intermittent PPP link may make maintenance of dynamic routes problematic.

You can configure as many as 16 static IP routes for a Cayman 3220-H. Use the following commands to maintain static routes to the Cayman 3220-H routing table:

`set ip static-routes destination-network` *net_address*

Specifies the network address for the static route. Enter a network address in the *net_address* argument in dotted decimal format. The *net_address* argument cannot be 0.0.0.0.

`set ip static-routes destination-network` *net_address* `netmask` *netmask*

Specifies the subnet mask for the IP network at the other end of the static route. Enter the *netmask* argument in dotted decimal format. The subnet mask associated with the destination network must represent the same network class (A, B, or C) or a lower class (such as a class C subnet mask for class B network number) to be valid.

`set ip static-routes destination-network` *net_address* `interface { ip-address | ppp-vc`*n*` }`

Specifies the interface through which the static route is accessible.

`set ip static-routes destination-network` *net_address* `gateway-address` *gate_address*

Specifies the IP address of the gateway for the static route. The default gateway must be located on a network connected to the Cayman 3220-H configured interface.

`set ip static-routes destination-network` *net_address* `metric` *integer*

Specifies the metric (hop count) for the static route. The default metric is 1. Enter a number from 1 to 15 for the integer argument to indicate the number of routers (actual or best guess) a packet must traverse to reach the remote network.

You can enter a metric of 1 to indicate either:

- The remote network is one router away and the static route is the best way to reach it;
- The remote network is more than one router away but the static route should not be replaced by a dynamic route, even if the dynamic route is more efficient.

`delete ip static-routes destination-network` *`net_address`*

Deletes a static route. Deleting a static route removes all information associated with that route.

WAN Settings

`set ip wan vcc`*`n`* `option { on | off }`

Enables or disables communications through the specified VCC interface on the Cayman 3220-H. You must enable BNCP functions before you can configure WAN settings.

`set ip wan vcc`*`n`* `address` *`ip_address`*

Assigns an IP address to the Cayman 3220-H on the specified VCC. The IP address you assign must be unique on your network.

`set ip wan vcc`*`n`* `broadcast` *`broadcast_address`*

Specifies the broadcast address for the TCP/IP network connected to the specified VCC. IP hosts use the broadcast address to send messages to every host on your network simultaneously.

The broadcast address for most networks is the network number followed by 255. For example, the broadcast address for the 192.168.1.0 network would be 192.168.1.255.

`set ip wan vcc`*`n`* `netmask` *`netmask`*

Specifies the subnet mask for the TCP/IP network connected to the specified VCC. The subnet mask specifies which bits of the 32-bit

binary IP address represent network information.The default subnet mask for most networks is 255.255.255.0 (Class C subnet mask).

```
set ip wan vccn restrictions
{ admin-disabled | admin-only | none }
```

Specifies whether an administrator can open a Telnet connection to the Cayman 3220-H over the specified VCC interface to monitor and configure the Cayman 3220-H. For security reasons, administrative access is disabled by default, meaning an administrator cannot open a Telnet connection through the WAN port.The `admin-only` argument means that router traffic is ignored but that administrative commands are accepted.The `none` argument means that all traffic is accepted.

If you specify admin-only access for the Cayman 3220-H, you will turn off routing services through that interface. Do not turn on admin-only access without consulting your network administrator.

```
set ip wan vccn addr-mapping { off | on }
```

Specifies whether network address translation (NAT) is enabled for the specified VCC interface on the Cayman 3220-H.

```
set ip wan vccn proxy-arp { on | off }
```

Specifies whether you want the Cayman 3220-H to respond when it receives an address resolution protocol for devices behind it. By default, proxy ARP is turned off.

Network Address Translation (NAT) Default Settings

NAT default settings let you specify whether you want your Cayman 3220-H to forward NAT traffic to a default server when it doesn't know what else to do with it.The NAT default host function is useful in situations where you cannot create a specific NAT pinhole for a traffic stream because you cannot anticipate what port number an application might use. For example, some network games select arbitrary port numbers when a connection is being opened. By identifying your computer (or another host on your network) as a NAT default server, you can specify that NAT traffic that would

otherwise be discarded by the Cayman 3220-H should be directed to a specific hosts.

```
set nat-default option { off | on }
```

Specifies whether you want your Cayman 3220-H to forward NAT traffic to a default server when it doesn't know what else to do with it.

```
set nat-default address ip-address
```

Specifies the IP address of the default NAT server.

Network Address Translation (NAT) Pinhole Settings

NAT pinholes let you pass specific types of network traffic through the NAT interfaces on the Cayman 3220-H. NAT pinholes allow you to route selected types of network traffic, such as FTP requests or HTTP (Web) connections, to a specific host behind the Cayman 3220-H transparently.

To set up NAT pinholes, you identify the type(s) of traffic you want to redirect by port number, and you specify the internal host to which each specified type of traffic should be directed.

The following list identifies protocol type and port number for common TCP/IP protocols:

- FTP (TCP 21)
- Telnet (TCP 23)
- SMTP (TCP 25),
- TFTP (UDP 69)
- SNMP (TCP 161, UDP 161)

```
set pinhole name name
```

Specifies the identifier for the entry in the router's pinhole table.You can name pinhole table entries sequentially (1, 2, 3), by port number (21, 80, 23), by protocol, or by some other naming scheme.

```
set pinhole protocol-select { tcp | udp | icmp | pptp |
other }
```

Specifies the type of protocol being redirected.

```
set pinhole numerical-protocol [ 0 - 65535 ]
```

If you select `other`, specifies the number of the protocol you want to translate.

```
set pinhole external-port-start [ 0 - 65535 ]
```

Specifies the first port number in the range being translated.

```
set pinhole external-port-end [ 0 - 65535 ]
```

Specifies the last port number in the range being translated.

```
set pinhole internal-ip internal-ip
```

Specifies the IP address of the internal host to which traffic of the specified type should be transferred.

```
set pinhole internal-port internal-port
```

Specifies the port number your Cayman 3220-H should use when forwarding traffic of the specified type. Under most circumstances, you would use the same number for the external and internal port.

PPP Settings

You can use the following commands to configure basic settings, port authentication settings, and peer authentication settings for PPP interfaces on your Cayman 3220-H.

Basic PPP Settings

Perform the following steps to configure basic PPP settings for a virtual circuit.

```
set PPP module vccn option { on | off }
```

Enables PPP on a virtual PPP interface. By default, PPP is turned off.

`set PPP module vccn mru integer`

Specifies the Maximum Receive Unit for the virtual PPP interface. The *integer* argument can be any number between 128 and 2048. By default, the MRU value for the virtual PPP interface is 1500.

`set PPP module vccn async-map map`

Specifies the asynchronous control character map for the PPP link. The default value for the *map* argument is `0x00000000`.

`set PPP module vccn magic-number { on | off }`

Enables or disables LCP magic number negotiation. By default, magic number negotiation is turned on.

`set PPP module vccn protocol-compression { on | off }`

Specifies whether you want the Cayman 3220-H to compress the PPP Protocol field when it transmits datagrams over the PPP link. By default, protocol field compression is turned on.

`set PPP module vccn address-compression { on | off }`

Specifies whether you want the Cayman 3220-H to compress the HDLC Address and Control fields when it transmits datagrams over the PPP link. By default, address field compression is turned on.

`set PPP module vccn lcp-echo-requests { on | off }`

Specifies whether you want your Cayman 3220-H to send LCP echo requests. By default, LCP echoing is turned on. You should turn off LCP echoing if you do not want the Cayman 3220-H to drop a PPP link to a nonresponsive peer.

`set PPP module vccn failures-max integer`

Specifies the maximum number of Configure-NAK messages the PPP module can send without having sent a Configure-ACK message. The integer argument can be any number between 1 and 20. The default value for the maximum failure count is 10.

`set PPP module vcc`*n* `configure-max` *integer*

Specifies the maximum number of unacknowledged configuration requests that your Cayman 3220-H will send. The integer argument can be any number between 1 and 10. The default value for the integer argument is 10.

`set PPP module vcc`*n* `terminate-max` *integer*

Specifies the maximum number of unacknowledged termination requests that your Cayman 3220-H will send before terminating the PPP link. The integer argument can be any number between 1 and 10. The default value for the integer argument is 2.

`set PPP module vcc`*n* `restart-timer` *integer*

Specifies the number of seconds the Cayman 3220-H should wait before retransmitting a configuration or termination request. The integer argument can be any number between 1 and 30. The default value for the integer argument is 3 seconds. You can reduce the restart timer value if your link is relatively fast (28,800 bps or greater). Conversely, you should increase the restart timer value for slow links.

`set PPP module vcc`*n* `connection-type`
`{ instant-on | always-on }`

Specifies whether a PPP connection is maintained by the Cayman 3220-H when it is unused for extended periods. If you specify `always-on`, the Cayman 3220-H never shuts down the PPP link. If you specify `instant-on`, the Cayman 3220-H shuts down the PPP link after the number of seconds specified in the `time-out` setting (below) if no traffic is moving over the circuit.

`set PPP module vcc`*n* `time-out` *integer*

If you specified a connection type of `instant-on`, specifies the number of seconds, in the range 30-600, the Cayman 3220-H should wait for communication activity before terminating the PPP link. The default is 300 seconds.

Port Authentication

You can use the following commands to specify how your Cayman 3220-H should respond when it receives an authentication request from a remote peer.

The settings for port authentication on the local Cayman 3220-H must match the authentication that is expected by the remote peer. For example, if the remote peer requires CHAP authentication and has a name and CHAP secret for the Cayman 3220-H, you must enable CHAP and specify the same name and secret on the Cayman 3220-H before the link can be established.

`set PPP module vcc`*`n`* `port-authentication chap-option { on | off }`

Specifies whether CHAP authentication is enabled. By default, CHAP authentication is turned off. CHAP authentication must be enabled before you can enter other CHAP information. If CHAP is turned on, it will be the first authentication method offered to the remote peer during link negotiation.

If you turn port authentication off and peer authentication on, the PPP software still uses the port authentication chap-name and pap-name for authentication. As a result, the port authentication names for PAP and CHAP must be identical to the peer names for your Cayman 3220-H on the remote peer. If you do not configure a chap-name or pap-name, then the authentication packets sent by the local peer will have blank name values. This may cause authentication to fail for some PPP implementations.

`set PPP module vcc`*`n`* `port-authentication chap-name` *`chap_name`*

Specifies the name the Cayman 3220-H sends in a CHAP response packet. The *`chap_name`* argument is 1-32 alphanumeric characters. The information you enter must match the CHAP username configured in the remote PPP peer's authentication database.

`set PPP module vcc`*n* `port-authentication chap-secret` *secret*

Specifies the CHAP secret for CHAP authentication. The secret argument is 1-32 alphanumeric characters. The information you enter must match the CHAP secret used by the PPP peer.

`set PPP module vcc`*n* `port-authentication pap-option { on | off }`

Specifies whether PAP authentication is enabled for a port. By default, PAP authentication is turned off. PAP authentication must be enabled before you can enter other PAP information. If you disable PAP authentication and save the modified configuration, your Cayman 3220-H retains its PAP settings.

`set PPP module vcc`*n* `port-authentication pap-name` *pap_name*

Specifies the name the Cayman 3220-H sends in a PAP response packet. The pap_name argument is 1- 32 alphanumeric characters. The information you enter must match the PAP username configured in the PPP peer's authentication database.

`set PPP module vcc`*n* `port-authentication pap-password` *password*

Specifies the password the Cayman 3220-H sends when a PPP peer sends a PAP authentication request. The password argument is 1-32 alphanumeric characters. The information you enter must match the PAP password used by the PPP peer.

Configuring Peer Authentication

You can specify that your Cayman 3220-H will use PAP, CHAP, or both to authenticate a remote peer as a PPP link is being completed. Perform the following steps to specify how your Cayman 3220-H should authenticate remote peers.

`set PPP module vcc`*`n`* `peer-authentication chap-option { on | off }`

Specifies whether the Cayman 3220-H will use CHAP to authenticate connections to PPP peers. By default, CHAP authentication is turned off.

`set PPP module vcc`*`n`* `peer-authentication pap-option { on | off }`

Specifies whether the Cayman 3220-H will use PAP to authenticate connections to PPP peers. By default, PAP authentication is turned off.

`set PPP peer-database` *`peer-name hostname`*

Specifies the hostname for an authorized PPP peer. The hostname argument is 1-32 alphanumeric characters. The information you enter must match the username that will be returned by the PPP peer when it is being authenticated.

`set PPP peer-database` *`peer-name`* `hostname chap-secret` *`secret`*

Specifies the secret associated with a PPP peer. The secret argument is 1-32 alphanumeric characters. The information you enter must match the secret that will be returned by the PPP peer when it is being authenticated.

`set PPP peer-database peer-name hostname pap-password` *`password`*

Specifies the password associated with a PPP peer. The password argument is 1-32 alphanumeric characters. The password you enter for that peer must match the password that will be returned by the PPP peer when it is being authenticated.

Command Line Interface Preference Settings

You can set command line interface preferences to customize your environment.

```
set preference verbose { on | off }
```

Specifies whether you want command help and prompting information displayed. By default, the command line interface verbose preference is turned off. If you turn it on, the command line interface displays help for a node when you navigate to that node.

```
set preference more lines
```

Specifies how many lines of information you want the command line interface to display at one time. The lines argument specifies the number of lines you want to see at one time. By default, the command line interface shows you 16 lines of text before displaying the prompt More ...[y|n] ?. If you enter 0 for the lines argument, the command line interface displays information as an uninterrupted stream (which is useful for capturing information to a text file).

Port Renumbering Settings

If you use NAT pinholes to forward HTTP or Telnet traffic through your Cayman 3220-H to an internal host, you must change the port numbers the Cayman 3220-H uses for its own configuration traffic. For example, if you set up a NAT pinhole to forward network traffic on Port 80 (HTTP) to another host, you would have to tell the Cayman 3220-H to listen for configuration connection requests on a port number other than 80, such as 6080.

After you have changed the port numbers the Cayman 3220-H uses for its configuration traffic, you must use those port numbers instead of the standard numbers when configuring the Cayman 3220-H. For example, if you move the router's Web service to port 6080 on a box with a DNS name of superbox, you would enter the URL http://superbox:6080 in a Web browser to open the Cayman 3220-H graphical user interface. Similarly, you would have to configure your Telnet application to use the appropriate port when opening a configuration connection to your Cayman 3220-H.

```
set servers web-http [ 0 - 32767 ]
```

Specifies the port number for HTTP (web) communication with the Cayman 3220-H. Because port numbers in the range 0-1024 are used by other protocols, you should use numbers in the range 2000-32767

when assigning new port numbers to the Cayman 3220-H web configuration interface.

```
set servers telnet-tcp [ 0 - 32767 ]
```

Specifies the port number for Telnet (CLI) communication with the Cayman 3220-H. Because port numbers in the range 0-1024 are used by other protocols, you should use numbers in the range 2000-32767 when assigning new port numbers to the Cayman 3220-H Telnet configuration interface.

SNMP Settings

The Simple Network Management Protocol (SNMP) lets a network administrator monitor problems on a network by retrieving settings on remote network devices. The network administrator typically runs an SNMP management station program on a local host to obtain information from an SNMP agent such as the Cayman 3220-H.

```
set snmp community name
```

Adds the specified name to the list of communities associated with the Cayman 3220-H. By default, the Cayman 3220-H is associated with the public community. You can associate as many as 16 communities with the Cayman 3220-H.

```
set snmp traps authentication-traps { on | off }
```

Enables or disables SNMP trapping. If SNMP trapping is enabled, your Cayman 3220-H sends authentication traps to all SNMP trap destinations. You must enable trap authentication before you set up your trap destinations.

```
set snmp traps ip-traps ip-address [ community
community-name ]
```

Identifies the destination for SNMP trap messages. The *ip-address* argument is the IP address of the host acting as an SNMP console. The optional community *community-name* identifies the name of the Cayman 3220-H community, which is included in the trap message the device sends to the management console. This name, which is not used for authentication, does not have to match a predefined community name.

`set snmp sysgroup contact contact_info`

Identifies the system contact, such as the name, phone number, beeper number, or email address of the person responsible for the Cayman 3220-H. You can enter up to 256 characters for the *contact_info* argument. You must put the *contact_info* argument in double-quotes if it contains embedded spaces.

`set snmp sysgroup location location_info`

Identifies the location, such as the building, floor, or room number, of the Cayman 3220-H. You can enter up to 256 characters for the *location_info* argument. You must put the *location_info* argument in double-quotes if it contains embedded spaces.

System Settings

You can configure system settings to assign a name to your Cayman 3220-H and to specify what types of messages you want the diagnostic log to record.

`set system name name`

Specifies the name of your Cayman 3220-H. Each Cayman 3220-H is assigned a name as part of its factory initialization. The default name for a Cayman 3220-H consists of the word "Cayman-DSL" and the serial number of the device; for example, Cayman-DSL810700. A device name can be 1-16 characters long and cannot include spaces or special characters. Once you have assigned a name to your Cayman 3220-H, you can enter that name in the ***Open Location*** text field of your browser to open a connection to your Cayman 3220-H.

`set system diagnostic-level level`

Specifies the types of log messages you want the Cayman 3220-H to record. All messages with a level number equal to or greater than the level you specify are recorded. For example, if you specify set system diagnostic-level 3, the diagnostic log will retain high-level informational messages (level 3), warnings (level 4), and failure messages (level 5).

Use the following values for the *level* argument:

- `1` or `low` - Low-level informational messages or greater; includes trivial status messages.
- `2` or `medium` - Medium-level informational messages or greater; includes status messages that can help monitor network traffic.
- `3` or `high` - High-level informational messages or greater; includes status messages that may be significant but do not constitute errors.
- `4` or `warning` - Warnings or greater; includes recoverable error conditions and useful operator information.
- `5` or `failure` - Failures; includes messages describing error conditions that may not be recoverable.

```
set system password { admin | user }
```

Specifies the administrator or user password for a Cayman 3220-H. When you enter the `set system password` command, you are prompted to enter the old password (if any) and new password. You are prompted to repeat the new password to verify that you entered it correctly the first time. To prevent anyone from observing the password you enter, characters in the old and new passwords are not displayed as you type them.

A password can be as many as eight alphanumeric characters. Passwords are case-sensitive and cannot include special characters or leading, trailing, or embedded spaces. For example, if you assign a password of "GatoR" to a Cayman 3220-H, you could not enter "GATOR", "gator", "Gator", or "GatoR " (with a trailing space) as an acceptable password.

Passwords go into effect immediately. You do not have to restart the Cayman 3220-H for the password to take effect. Assigning an administrator or user password to a Cayman 3220-H does not affect communications through the device.

Traffic Shaping Settings

Traffic shaping lets you control how much traffic can flow through an Ethernet interface by limiting the size of the WAN "pipe." This function is most suitable for Internet Service Providers or multi-interface routers.

When you use the traffic-shaping option to set the maximum speed for a router port, the router will silently discard any packets that exceed the maximum port speed.

```
set trafficshape option { on | off }
```

Enables or disables traffic-shaping in the Cayman 3220-H.

```
set trafficshape ethernet option { on | off }
```

Enables or disables traffic-shaping on the designated Ethernet interface.

```
set trafficshape ethernet rate [ 56000 - 10000000 ]
```

Specifies the maximum number of bits that can be transmitted. Options are 56000, 384000, and 1000000.

5 Monitoring Your Cayman 3220-H

- Displaying the Overview Status
- Displaying Memory Statistics
- Displaying DHCP Client Statistics
- Displaying DHCP Server Statistics
- Displaying DSL Statistics
- Displaying PPP Statistics
- Displaying PPPoE Statistics
- Displaying Ethernet Statistics
- Displaying ATM Statistics
- Displaying the Diagnostic Log
- Displaying IP ARP Statistics
- Displaying IP Interface Statistics
- Displaying IP Routes
- Displaying Bridge Interface Statistics
- Displaying Bridge Table Statistics
- Using the Diagnose Utility

The Monitor window lets you display information about the status of your Cayman 3220-H. To open the Monitor window, click the ***Monitor*** button on the Cayman 3220-H Home Page. When the Monitor window opens, click the button for the type of information you want.

Displaying the Overview Status

The Overview Status window displays the current status of your Cayman 3220-H, the device's hardware and software revision levels, a summary of the errors encountered, and the time elapsed since the Cayman 3220-H was restarted.

To display the Overview Status window, click the ***Overview*** button on the Monitor window.

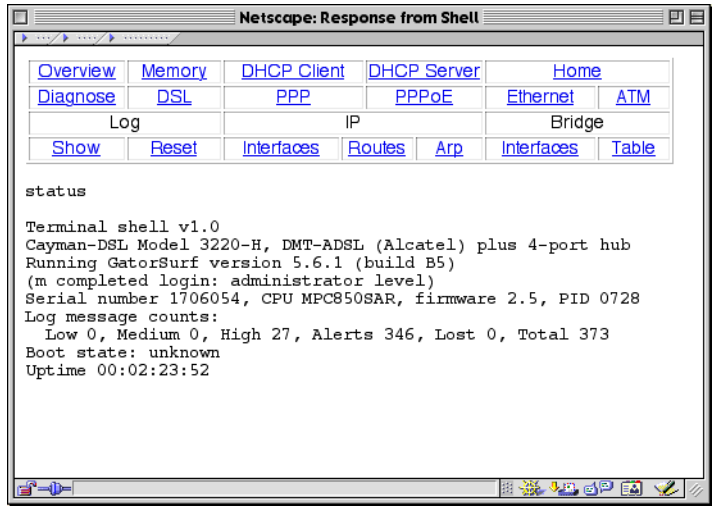


Figure 5-1 Overview Status Window

Displaying Memory Statistics

The Memory monitor window displays information about memory allocation in your Cayman 3220-H.To display the Memory monitor window, click the ***Memory*** button on the Monitor window.

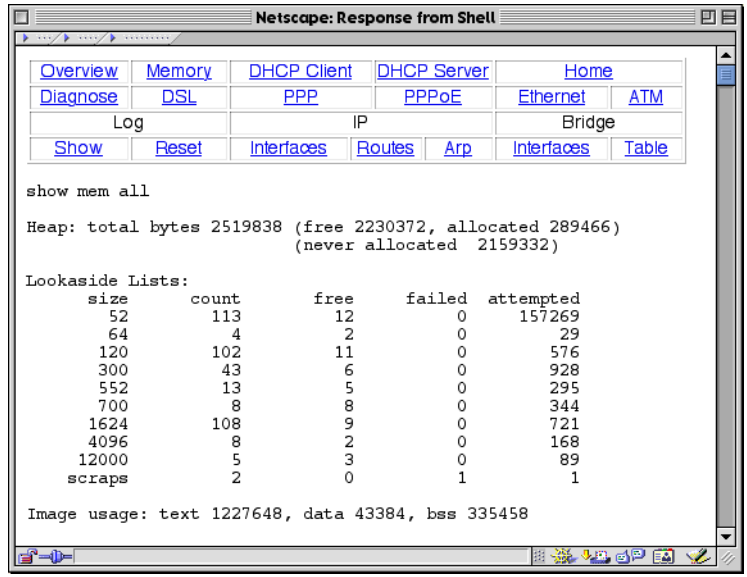


Figure 5-2 Memory Monitor

Displaying DHCP Client Statistics

As a DHCP client, your Cayman 3220-H can accept IP address information from a DHCP server on your network. To display the DHCP Client Statistics window, click the ***DHCP Client*** button on the Monitor window.

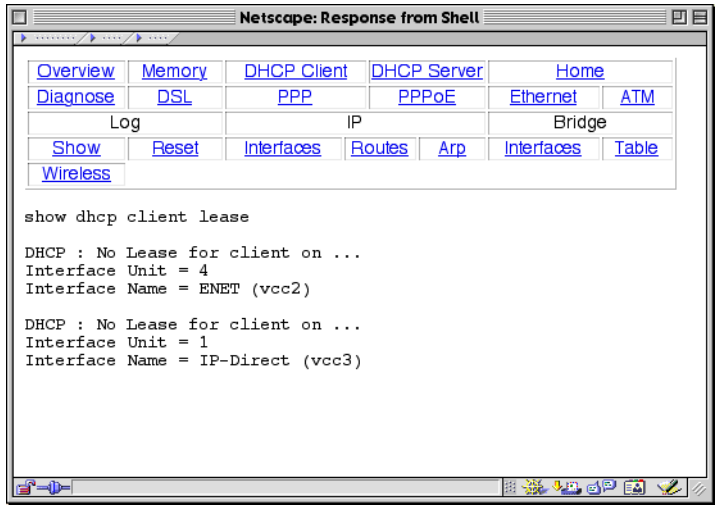


Figure 5-3 DHCP Client Monitor

Displaying DHCP Server Statistics

The Dynamic Host Configuration Protocol (DHCP) lets your Cayman 3220-H assign IP addresses and network configuration information to computers on your network.The DHCP monitor window displays the Ethernet hardware address that corresponds to each IP address your Cayman 3220-H has assigned to a device on your network.

To display the DHCP Server Statistics window, click the ***DHCP Server*** button on the Monitor window.

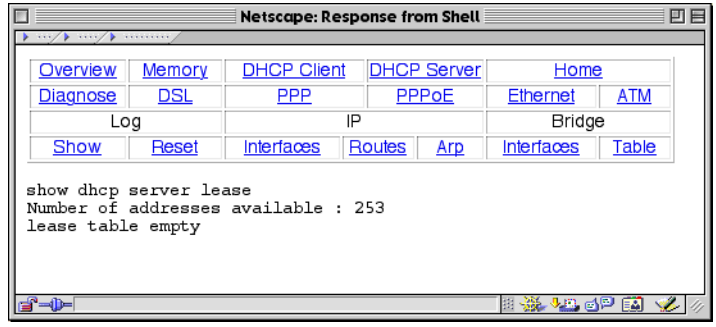


Figure 5-4 DHCP Server Statistics

Displaying DSL Statistics

The DSL Statistics window (Figure 5-5) displays information about the upstream and downstream traffic traveling over the ADSL port.

To display the DSL Statistics window, click the ***DSL*** button on the Monitor window.

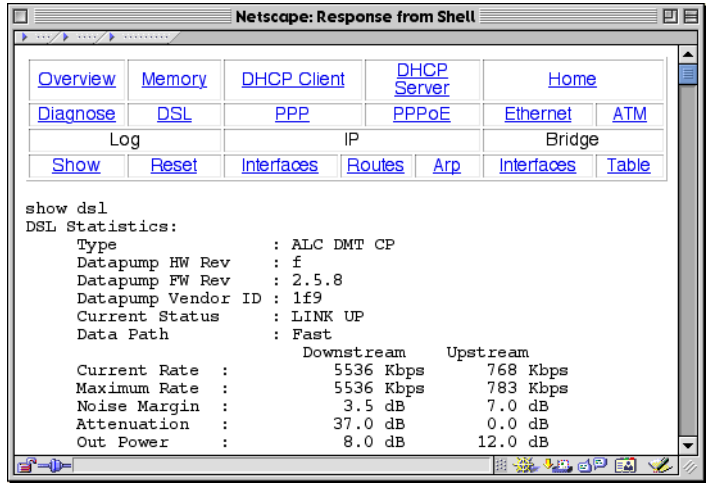


Figure 5-5 DSL Statistics Monitor

Displaying PPP Statistics

The PPP Statistics monitor window (Figure 5-6) displays information about the PPP connection maintained over an ATM link.

To display the PPP Statistics window, click the ***PPP*** button on the Monitor window.

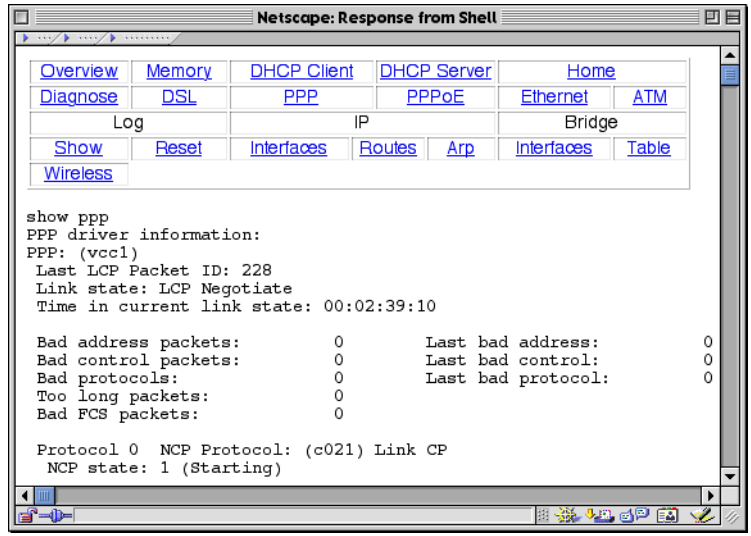


Figure 5-6 PPP Statistics

Displaying PPPoE Statistics

The PPPoE Statistics monitor window (Figure 5-7) displays information about the PPPoE connection maintained over an ATM link.

To display the PPPoE Statistics window, click the ***PPPoE*** button on the Monitor window.

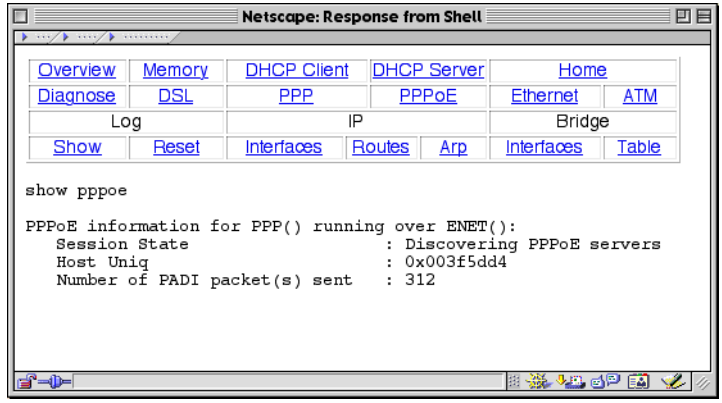


Figure 5-7 PPPoE Statistics

Displaying Ethernet Statistics

The Ethernet Statistics monitor window displays information about each Ethernet interface for your Cayman 3220-H.To display the Ethernet Statistics window, click the ***Ethernet*** button on the Monitor window.

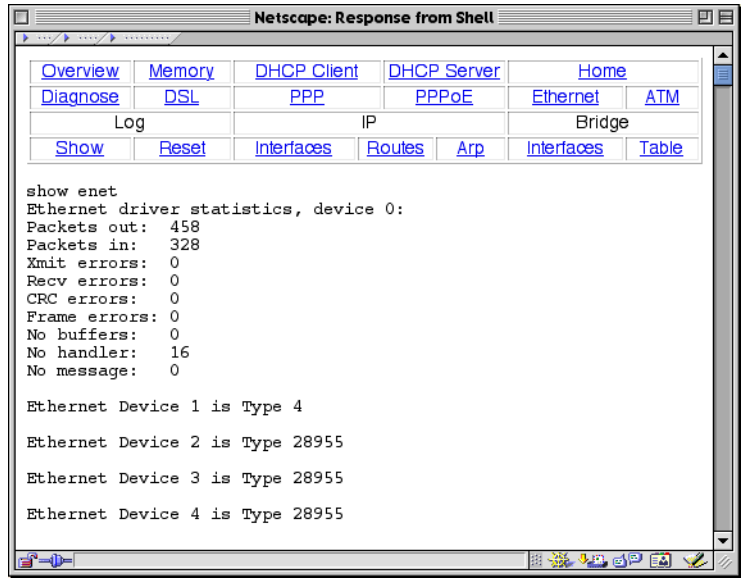


Figure 5-8 Ethernet Statistics

Displaying ATM Statistics

The ATM Statistics monitor window displays information about the ATM traffic traveling over the ADSL port.

To display the ATM Statistics window, click the ***ATM*** button on the Monitor window.

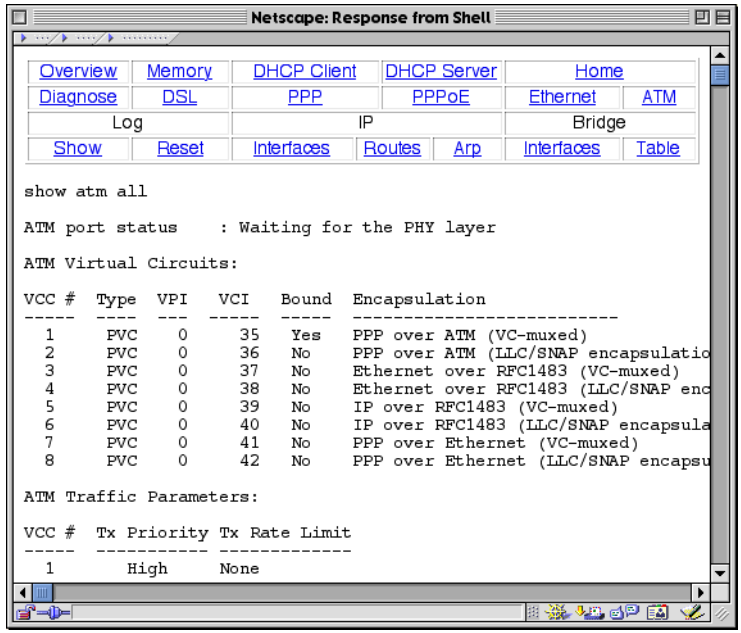


Figure 5-9 ATM Statistics

Displaying the Diagnostic Log

Your Cayman 3220-H maintains a log file consisting of diagnostic and error messages it generates during operation. The Diagnostic Log window (Figure 5-10) displays the contents of the Cayman 3220-H diagnostic log. To display the Diagnostic Log window, click the ***Log: Show*** button on the Monitor window.

The Diagnostic Log window does not update itself automatically. If you want to view messages added after the Diagnostic Log window was opened, click the ***Show*** button again.

If you want to view a complete updated list of diagnostic messages, you must set the log file back to the top. To scroll the Diagnostic Log window back to the first message, click the ***Reset*** button on the Monitor window and then click the ***Show*** button.

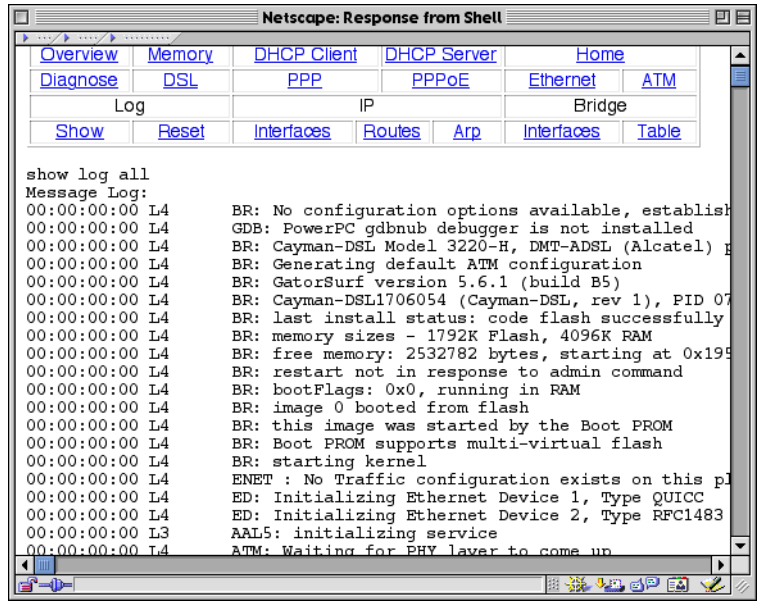


Figure 5-10 Log Monitor

Displaying IP Interface Statistics

The IP Interfaces monitor window displays information about the Ethernet ports on your Cayman 3220-H.To display the IP Interfaces Statistics window, click the ***IP Interfaces*** button on the Monitor window.

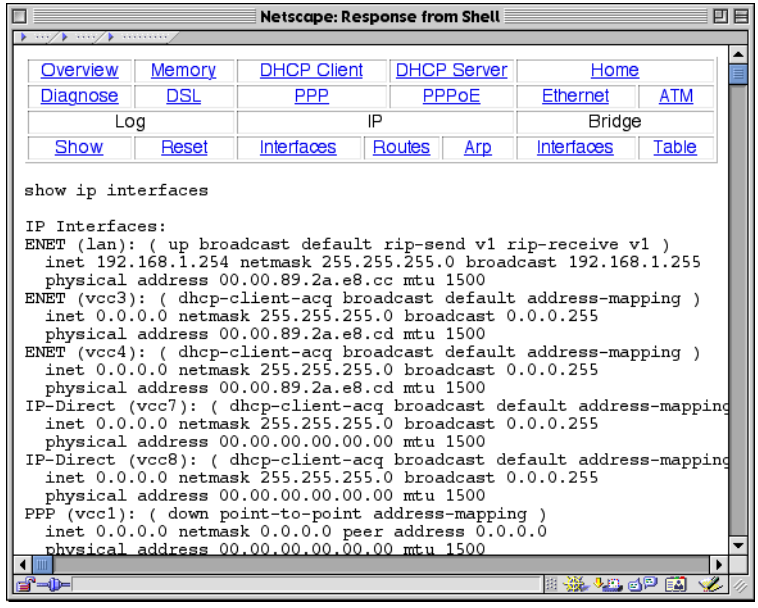


Figure 5-11 IP Interface Monitor

Displaying IP ARP Statistics

The IP ARP table displays the address resolution information maintained by the Cayman 3220-H. To display the IP ARP Statistics window, click the ***IP ARP*** button on the Monitor window.

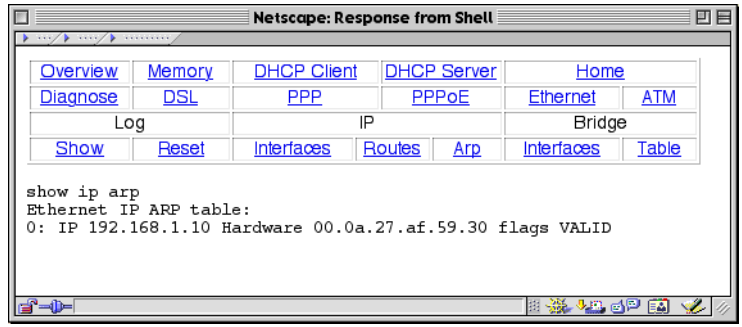


Figure 5-12 IP ARP Monitor

Displaying IP Routes

The IP Routes window displays information about the IP routes stored in your Cayman 3220-H.To display the IP Routes window, click the ***IP Routes*** button on the Monitor window.

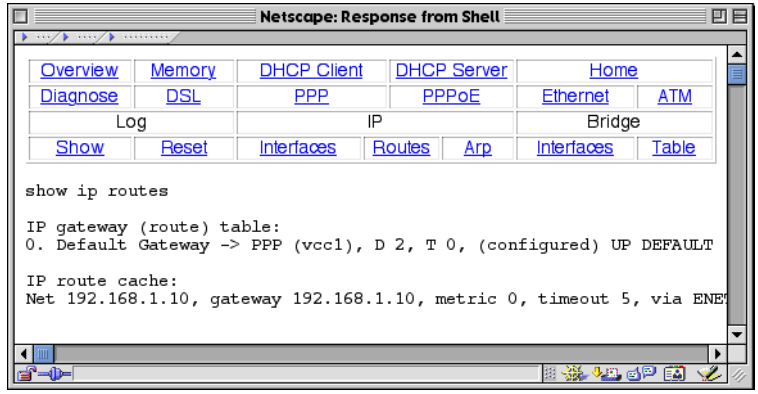


Figure 5-13 IP Routes Monitor

Displaying Bridge Interface Statistics

The Bridge Interface Statistics window displays information about the bridge traffic maintained by your Cayman 3220-H.To display the Bridge Interface Statistics window, click the ***Bridge: Interfaces*** button on the Monitor window.

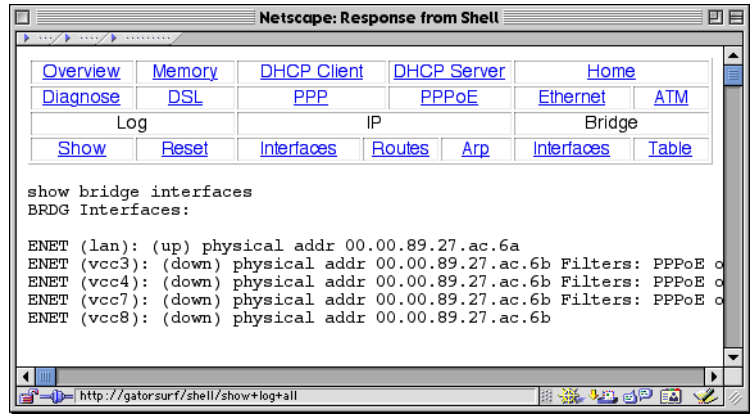


Figure 5-14 Bridge Interface Statistics Monitor

Displaying Bridge Table Statistics

The Bridge Table Statistics window displays information about the bridging table maintained by your Cayman 3220-H. To display the Bridge Table Statistics window, click the ***Bridge: Table*** button on the Monitor window.

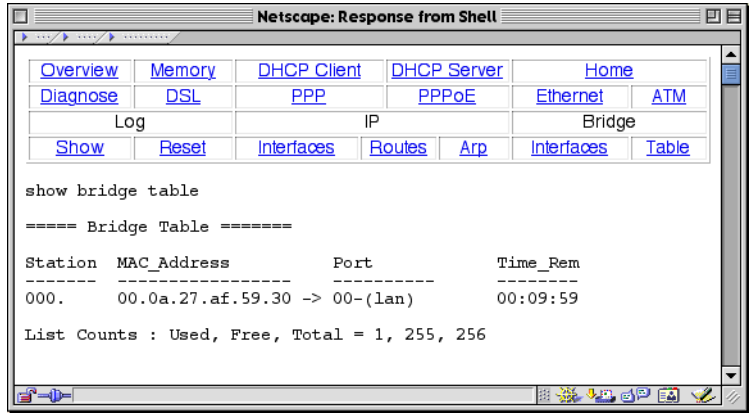


Figure 5-15 Bridge Table Statistics Window

Using the Diagnose Utility

The Diagnose utility runs a series of internal checks and loopback tests to verify network connectivity over each interface on your Cayman 3220-H.To run the Diagnose utility, click the ***Diagnose*** button on the Monitor window.

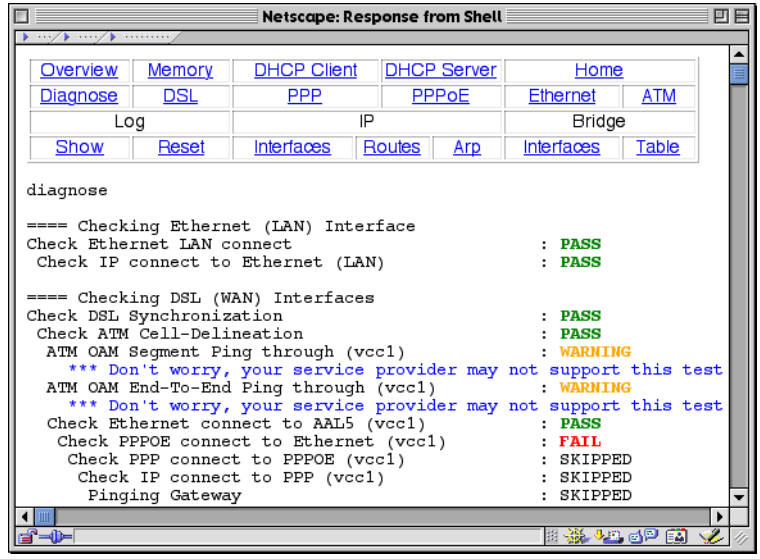


Figure 5-16 Diagnose Utility Window

The Diagnose window displays the results of each test as the utility runs. If one test is dependent on another, the Diagnose utility indents its entry in the Diagnose window. For example, the Diagnose utility indents the Check IP connect to Ethernet (LAN) entry, since that test will not run if the Check Ethernet LAN Connect test fails.

Each test generates one of the following result codes:

PASS	The test was successful.
FAIL	The test was unsuccessful.
SKIPPED	The test was skipped because a test on which it depended failed.
PENDING	The test timed out without producing a result. Try running the test again.

6 Updating Your System Software

Using the Home Page to Install a New Image

You can install a new operating system image in your Cayman 3220-H from the Home Page. To do so, the computer you are using to connect to the Cayman 3220-H must be on the same local area network as the Cayman 3220-H.

To install new operating system software in your Cayman 3220-H from the Home Page:

1. **Download the software image from** `http://www.cayman.com` **and copy it to a computer on your local area network.**

2. **Open a web connection to your Cayman 3220-H from the computer on your LAN.**

3. **If necessary, save the configuration settings on your Cayman 3220-H.**

   If you have not previously saved your configuration (that is, if you are running the factory default configuration your Cayman 3220-H came with), click the *Ethernet* button on the Cayman 3220-H home page. When the Ethernet window appears, click *Save*.

   If you have previously saved your Cayman 3220-H configuration, you can skip this step.

4. **Click the *Install Software* button on the Cayman 3220-H home page.**

   The Install New Cayman Software window (Figure 6-1) opens.

Figure 6-1 Install New Cayman Software Window

5. **Enter the name and path of the software image you want to install in the text field.**

   To locate the file on your computer, click the ***Browse*** button, select the file you want, and click ***Open***.

6. **Click the *Install* button.**

   The Cayman 3220-H copies the image file from your computer and installs it into its memory storage. You will see a series of dots appear on your screen as the image is copied and installed.

7. **When the *Please Click Restart* message appears, click the *Restart* button.**

   Your Cayman 3220-H restarts with its new image.

   Note: When you install a new image file into your Cayman 3220-H, your existing configuration is not modified. If you save a configuration that includes default settings and a subsequent release of the image software uses a different value for that setting, your configuration retains the saved setting and is not updated to use the new default value.

Using the Installer to Install a New Image

You must run the Installer utility from a computer running Windows 95, Windows 98, or Windows NT on the Cayman 3220-H local area network.

To install new operating system software in your Cayman 3220-H from a Windows computer:

1. **Close any open applications running on your computer.**

2. **Insert the Cayman 3220-H installation CD-ROM.**

3. **Run the `setup.exe` program.**

   Double-click the `setup.exe` icon in the Explorer or choose Run from the Start menu and select the `setup.exe` program.

4. **When the Welcome screen appears, click *OK*.**

5. **When the Installation window appears, click the large button with the icon of a computer to install the Cayman 3220-H operating system files.**

   By default, the `setup.exe` program copies the `cayminst.exe` installation program, the Cayman 3220-H operating system file, and the Cayman 3220-H documentation to a directory called `C:\Program Files\Cayman Installer\` on your computer. If you want to put the Cayman 3220-H files in another directory,

click the ***Change Directory*** button, select the directory you want to use, and click ***OK***.

6. **When the `setup.exe` program finishes running, click *OK*.**

7. **Run the `cayminst.exe` program to install the new operating system software in your Cayman 3220-H.**

8. **Double-click the *Installer* icon in the Cayman Installer directory or choose *Cayman* from the Start menu and choose the Installer program.**

9. **When the Installation Target Selection window appears, enter the name or IP address of your Cayman 3220-H in the *IP Address or Name* text field.**

   The default IP address is `192.168.1.254`.

10. **If you set an administrator password, enter it in the *Password* text field. Click *Connect*.**

11. **When the Installer window appears, select the operating system file you want to install in your Cayman 3220-H and click *Install*.**

12. **When a dialog box asks you to confirm the installation, click *Yes*.**

    The Installer program installs the operating system software and restarts your Cayman 3220-H. When the installation is complete, the program closes the Installer window and returns you to the Installation Target Selection window.

13. **Click *Exit*.**

Using TFTP to Install a New Image

You can install new operating system software in a Cayman 3220-H from any computer capable of functioning as a Trivial File Transfer Protocol (TFTP) server. Your TFTP server must be on the same Ethernet network as the LAN interface of your Cayman 3220-H.

To install new operating system software in your Cayman 3220-H from a TFTP server:

1. **Download the software image from** `http://www.cayman.com`**.**

2. **Copy the file to the TFTP server for your location.**

3. **Use the `install` command in the Cayman 3220-H command line interface to install the new software in your Cayman 3220-H.**

   For information on the `install` command, refer to page 4-7.

A Technical Specifications

Technical specifications and certifications subject to change. Changes or modifications not expressly approved by Cayman Systems can void your authority to operate the equipment.

Components

Processor	Motorola MPC 850
Memory	4 MB DRAM 1 MB Flash EPROM

Interfaces

LAN Hub Interface	Four RJ-45 (10Base-T) Ethernet ports
WAN (ADSL) Interface	RJ-11 (ADSL) port
Console Interface	DB-9 (female) port 9600 bps 8-N-1

Power

Power	External AC Adapter Input: 110-120VAC 60 Hz Output: 9VDC

Size

Dimensions	1.75″ (H) x 8.0″ (W) x 9.0″ (D)
Weight	2.10 lbs

Environment

Operating Temperature	32-105° F 0-40° C
Humidity	5%-95% non-condensing

Certifications

ETL to UL 1950
cETL to CSA C22.2 No. 950

CE Markings to:
EN60950/A3:1995
EN55022:1994 Class A
EN50082-1:1992

FCC Part 15, Subpart J Class B
FCC Part 68
CS03, Issue 8

FCC Class B Notice

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning

the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna
- Increase the separation between the equipment and receiver
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected
- Consult the dealer or an experienced radio/TV technician for help

FCC Part 68 Notice

This equipment complies with FCC rules, Part 68. On the RJ11 connection of this equipment is a label that contains, among other information, the FCC Registration Number (6TWUSA-35508-DL-N) and Ringer Equivalence Number (REN: 0) for this equipment. If requested, provide this information to your telephone company.

The REN is useful to determine the quantity of devices you may connect to your telephone line and still have all of those devices ring when your number is called. In most, but not all, areas, the sum of the RENs of all devices should not exceed five (5). To be certain of the number of devices you may connect to you line, as determined by the REN, you should call your local telephone company to determine the maximum REN for your calling area.

If this equipment causes harm to the telephone network, the Telephone Company may discontinue your service temporarily. If possible, they will notify you in advance. But if advance notice isn't practical, you will be notified as soon as possible. You will be advised of your right to file a complaint with the FCC.

Your telephone company may make changes in its facilities, equipment, operations, or procedures that could affect the proper operation of your equipment. If they do, you will be given advance notice so as to give you an opportunity to maintain uninterrupted service.

If you experience trouble with this equipment, please contact the manufacturer for warranty/repair information. The telephone company may ask that you disconnect this equipment from the

network until the problem has been corrected or until you are sure that the equipment is not malfunctioning.

Canadian Interference Notice

This Class B digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la classe B respecte toutes les exigences du Reglement sur le matériel brouilleur du Canada.

Notice

The Industry Canada label identifies certified equipment. This certification means that the equipment meets telecommunications network protective, operation, and safety requirements, as prescribed in the appropriate Terminal Equipment Technical Requirements document(s). The Department does not guarantee the equipment will operate to the user's satisfaction. Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be coordinated by a representative designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment.

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines, and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

***Caution**: Users should not attempt to make such connections themselves, but should contact the appropriate electric inspection authority, or electrician, as appropriate.*

Notice

The Ringer Equivalence Number (REN) assigned to each terminal device provides an indication of the maximum number of terminals allowed to be connected to a telephone interface.The termination on an interface may consist of any combination of devices subject only to the requirement that the sum of the Ringer Equivalence Numbers of all the devices does not exceed five (5).

B Diagnostic Console

About the Diagnostic Console

The Cayman 3220-H diagnostic console lets you configure a Cayman 3220-H to boot and/or download its software from various sources. The diagnostic console also lets you clear or program the Cayman 3220-H flash EPROM, which stores the main system software.

WARNING: Because you can accidentally erase or overwrite the Cayman 3220-H boot settings or flash EPROM when you use the diagnostic console, you should not use the diagnostic console without conferring with Cayman Technical Support.

You communicate with the diagnostic console by connecting a terminal or terminal emulator to the Cayman 3220-H maintenance console port and restarting into diagnostic (EPROM) mode. To use the Cayman 3220-H diagnostic console, you need a serial cable and either a terminal or terminal emulator (such as a personal computer with a terminal emulation application that supports 9600-baud communication).

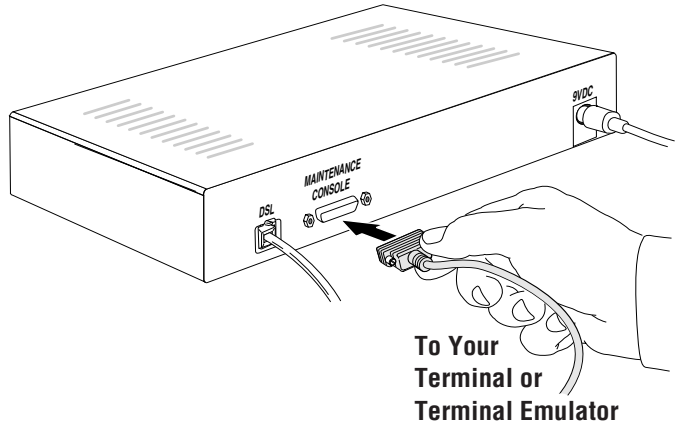
You can save the settings configured via the diagnostic console in non-volatile memory so that they need not be entered at every boot. An `autoboot` option lets you configure the Cayman 3220-H once: after that, it will download or load the specified image every time it is turned on.

Connecting a Terminal to the Console Port

To connect your Cayman 3220-H to a terminal or terminal emulator:

1. **Turn off the Cayman 3220-H.**

2. **Plug one end of the serial cable into the maintenance console port on the Cayman 3220-H back panel.**



3. **Connect the other end of the serial cable to the serial port on your terminal (or terminal emulator) or the modem port of your computer.**

4. **Turn on the terminal or run the terminal emulator program on your computer.**

   You should use the following settings to configure your terminal emulation session:

Setting	Set To
Speed	9600 bps
Parity	None
Databits	8
Stopbits	1
Duplex	Full

5. **Turn on the Cayman 3220-H.**

   The terminal console window will begin displaying startup messages from the Cayman 3220-H.

6. **When the console displays STAY IN EPROM?, type `Y`.**

   The Cayman 3220-H console prompt (`BootPROM>`) appears, indicating that the Cayman 3220-H is now operating in diagnostic (EPROM) mode.

Using the Diagnostic Console

You communicate with the diagnostic console via a simple command-line interface. You must enter commands in their entirety; you cannot truncate commands to the first three characters or to some shorter "first match" string. IP addresses are entered in "dotted decimal" notation. IP addresses, filenames, and server names may all be "de-configured" by specifying them as 0 (zero). You can use the help command to obtain on-line information about the diagnostic console commands.

When you finish using the diagnostic console, turn your Cayman 3220-H off and on to return it to normal operation.

Diagnostic Console Commands

This section presents the commands you will use to enter, modify, or clear settings in the Cayman 3220-H EPROM.

- Optional command arguments are presented in straight brackets [ ].
- Alternative values for an argument are presented in curly brackets { }, with values separated with vertical bars (|).

Variable for which you must supply your own values are presented in *italics*. For example, `ipgateway` *`ip_address`* means that you must supply an *`ip_address`* argument for the `ipgateway` command.

If a text string includes spaces or tabs, you must enclose the string with double quote marks.

Basic Commands

The `defaults` and `help` commands are especially useful for users not familiar with the diagnostic console.

`defaults`

The `defaults` command sets the EPROM settings in the Cayman 3220-H to their factory default values. After you reset the Cayman 3220-H EPROM values to their defaults, you must save them to non-volatile storage with the `save` command.

The default boot settings for the Cayman 3220-H are presented in the following table.

Setting	Explanation
`flash on`	Use the image in flash memory if possible.
`ip 0`	The IP address of the Cayman 3220-H has not been specified. TFTP download will not be attempted.
`bootp on`	The Cayman 3220-H will use BOOTP as part of its autoboot sequence.
`autoboot 10`	Use autoboot on startup and try 10 times before giving up.
`autoprog never`	Do not reprogram the Cayman 3220-H flash memory automatically.

The default settings cause the Cayman 3220-H to boot from flash if possible. If the flash image is corrupt or unusable, the Cayman 3220-H tries the BOOTP protocol 10 times to find IP configuration and a TFTP download server. If the Cayman 3220-H server succeeds in downloading an image from a TFTP server, it copies the downloaded image to flash memory.

help [*command*] or *command* ?

The help command displays a summary of the available commands. The help command displays the syntax and function of the command you specify.

To access an overview of the diagnostic console commands, type help or ? at the console prompt.To access on-line help for a specific command, type help *command* or command ? at the console prompt. For example, the console command file ? returns the following:

```
BootPROM> file ?
usage: file <file-name>
specifies the file to be retrieved from a server.
Filenames containing whitespace may be enclosed in
double quotes (``). Also, whitespace may be quoted with
a ^ character, and special characters may be entered in
hex, following a leading ^x sequence.
```

Administration Commands

The following commands configure the Cayman 3220-H restart settings.

boot [{ flash | tftp | bootp }] [nogo]

If you do not enter an argument, the boot command causes the Cayman 3220-H to behave as if it had been powered up with autoboot enabled.That is, it will try to download its image from flash, TFTP, and BOOTP (if enabled) in that order.

If you enter a flash, tftp, or bootp argument for the boot command, the Cayman 3220-H attempts to download its image from the specified download source.

If you include the optional nogo argument for a boot command, control is not transferred to the image after it is loaded.

clear

The clear command clears the current and non-volatile copies of the Cayman 3220-H EPROM settings. Compare the erase options command, which clears the contents of the parameter flash.

erase [code | options | headers] [yes]

The erase command completely erases the specified flash memory area in the Cayman 3220-H.

- erase code clears the code flash in the Cayman 3220-H.
- erase options clears the parameter flash (not the EPROM settings). Compare to the clear command, which clears the current and non-volatile copies of the Cayman 3220-H EPROM settings.
- erase headers clears the setting headers, which is a quick way of invalidating the code flash and forcing an image download.

The optional yes argument suppresses the "Are you sure?" confirmation message.

install [yes]

The install command tells the Cayman 3220-H to download an image and program the code flash memory with the new image.

The optional yes argument suppresses the "Are you sure?" confirmation message.

program [yes]

The program command tells the Cayman 3220-H to copy a downloaded image to flash memory.

The optional yes argument suppresses the "Are you sure?" confirmation message.

revert

The `revert` command retrieves the saved version of settings from non-volatile storage and overwrites any changes made since the last save.

save

The `save` command saves the EPROM settings you have entered or changed to non-volatile storage in the Cayman 3220-H.

show

The `show` command displays the current EPROM settings for the Cayman 3220-H and a brief explanation of those settings. For example, the show command produces the following:

```
BootPROM> show
flash on          (flash will be tried)
ip 0              (no ip address; tftp will not be tried)
file <unset>      (must be set for tftp download)
bootp on          (will attempt configuration via bootp)
autoboot 10       (will autoboot on powerup, and will try
                  10 times)
autoprog never    (will never program a downloaded
                  image into flash)

Cayman 3220-H serial no. 800700, h/w rev. 1, eprom v1.3
Last install status: code flash successfully programmed
flash image 1: Cayman 3220-H 5.3.0
```

Boot Setting Commands

The following commands specify boot settings for the Cayman 3220-H.

autoboot { *retry_count* | off }

The `autoboot` *`retry_count`* command (where *`retry_count`* is any whole number) sets the number of times the Cayman 3220-H should attempt to start an image and run it when powered up. If you enable autoboot with the `autoboot` *`retry_count`* command, the

autoboot sequence tries to load an image from download sources in the following order:

1. If flash is enabled, start an image from the Cayman 3220-H code flash memory, using the configured image number; else

2. If ip is enabled, load an image via IP TFTP using the configured IP server, IP gateway, netmask and filename; else

3. If bootp is enabled, load an image from a BOOTP server on your IP network.

The Cayman 3220-H alternates steps 2 and 3 at 10-second intervals for the number of attempts specified in the *retry_count* argument, trying each download source that is enabled.

bootp { on | off }

The `bootp` command enables/disables BOOTP downloading. If BOOTP is enabled, the Cayman 3220-H broadcasts a BOOTP request. It will use the response as the source of its IP address, the server and gateway IP addresses, and the name of the file to TFTP-download. The EPROM recognizes the CMU and RFC-1048 "vendor extensions" to the basic BOOTP format, and uses the netmask and gateway address provided by BOOTP if available.

file *file_name*

The `file` command specifies the name of the EPROM software file the Cayman 3220-H should download.

flash { on | off }

The `flash` command enables/disables flash booting. If the specified boot image in flash memory is valid, it will be used as the source of the image to run when the box autoboots or when the command boot flash is given.

- `flash on` enables downloading from flash.

- `flash off` disables downloading from flash (which removes the flash step from the boot and autoboot sequence).

ip *ip_address*

The `ip` *`ip_address`* command enables TFTP downloading and specifies the IP address of the Cayman 3220-H in dotted-decimal notation. Enter ip 0 to disable IP TFTP downloading.

Changing the IP address of a Cayman 3220-H may result in ARP cache inconsistencies on your IP hosts.

ipgateway *ip_address*

The `ipgateway` *`ip_address`* command specifies the IP address of the router (if any) between the Cayman 3220-H and its IP TFTP server in dotted decimal notation. Enter `ipgateway 0` to disable the IP gateway function.

ipnetmask *netmask*

The `ipnetmask` *`netmask`* command specifies the subnet mask for your IP interface in dotted decimal format. If you specify an IP gateway but do not enter a subnet mask, your Cayman 3220-H uses the class A, B, or C netmask appropriate to its own IP address. The IP gateway is only used if, after application of the netmask, the gateway and the Cayman 3220-H appear to be on different networks.

ipserver *tftp_ip_address*

The `ipserver` *`tftp_ip_address`* command specifies the IP address of the TFTP download server in dotted-decimal notation.

C How Your Cayman 3220-H Works

About ATM

Asynchronous Transfer Mode (ATM) is a connection-oriented cell-based transport mechanism that allows very high-speed transfer of data, voice, and video from one point to another. An ATM network consists of a series of switches that connect one end of a virtual circuit to another. These switches use virtual path identifiers and virtual circuit identifiers to direct cells as they travel. Cells are switched onto paths operating at up to gigabit-per-second transmission speeds.

ATM uses fixed-length cells to transport data. When data, such as an Ethernet packet, is passed to ATM, the data is segmented into a series of small (53-byte) cells. Each ATM cell consists of 5 bytes of header information (virtual path identifier, virtual circuit identifier, and CRC checksum) and 48 bytes of data. Information in the header identifies cells belonging to the same virtual channel, which is used to route the cell to its intended destination.

Each end-point on an ATM virtual circuit generates a constant stream of cells to the circuit's other end-point. When there is no data to transport, ATM sends a stream of empty cells from one end of a virtual circuit to the other. When a user at one end-point sends a message or file to a user at the other end, ATM incorporates the data into the stream of cells. If several users want to transfer data simultaneously, ATM uses multiplexing to let each user share the data stream dynamically.

About Network Address Translation

Network address translation (NAT) lets a Cayman 3220-H conceal the topology of an Ethernet network connected to its LAN interface from routers on networks connected to its WAN interface.

When NAT is enabled, the Cayman 3220-H "proxies" for computers on your network by pretending to be the originating host for network communications from non-originating networks. The Cayman 3220-H tracks which local hosts are communicating with which remote hosts, and routes packets received from remote networks to the correct computer on the LAN (Ethernet A) interface. Sites communicating through an Internet service provider typically enable NAT, since they often receive one IP address from the ISP.

When NAT is disabled, the Cayman 3220-H acts as a traditional TCP/IP router. It uses RIP (Routing Information Protocol) to advertise the networks connected to its Ethernet ports to the routers on the other end of the network connection.

About Bridging and Routing

Your Cayman 3220-H device functions as a network router for TCP/IP traffic and as a network bridge for other traffic, such as NetWare, DECnet, or AppleTalk.

TCP/IP Routing

As a TCP/IP router, your Cayman 3220-H keeps track of the networks that are accessible through each network interface. If you have configured your Cayman 3220-H to use the Routing Information Protocol (RIP), the Cayman 3220-H exchanges information with other routers to learn about the best routes to remote networks and to advertise the networks for which the Cayman 3220-H is the appropriate route.

When it receives a TCP/IP packet, the Cayman 3220-H looks up the network portion of the packet's destination IP address in its routing table, and then forwards the packet through the network interface that will let the packet reach its destination most efficiently.

Bridging

Bridges let you join two local area networks, so that they appear to be part of the same physical network. As a bridge for protocols other than TCP/IP, your Cayman 3220-H keeps track of as many as 255 MAC (Ethernet hardware) addresses, each of which uniquely identifies an individual host on a network. Your Cayman 3220-H uses this bridging table to identify which hosts are accessible through which of its network interfaces. The Cayman 3220-H builds its bridging table by storing the MAC address of each packet it sees, along with the interface over which it received the packet. Over time, the Cayman 3220-H learns which hosts are available through its Ethernet A port, which hosts are available through its Ethernet B port, and which hosts are available through its serial port.

When the Cayman 3220-H receives a packet, it looks up the packet's MAC address in its bridging table. If the packet is addressed to a MAC address in its bridging table, the Cayman 3220-H forwards the packet on the appropriate network interface. (If the appropriate interface is the one over which the packet was received, the Cayman 3220-H ignores it, since no action would be required.) If the packet is

addressed to a MAC address that isn't in its bridging table, the Cayman 3220-H relays the packet to all network interfaces other than the one from which it received the packet. If it later receives a reply from the destination host, it adds that host's MAC address and the interface appropriate for reaching that host to its bridging table.

The Cayman 3220-H tracks the age of each entry in its bridging table, and deletes entries that aren't used after 10 minutes. If more than 255 entries are active at the same time, the Cayman 3220-H discards the oldest entries to make room for new ones.

Bridging of non-TCP/IP protocols is disabled by default. You must use the `set bridge` CLI commands if you want your Cayman 3220-H to function as a network bridge.

About DHCP

The Dynamic Host Configuration Protocol (DHCP) allows one host on a TCP/IP network to provide configuration information to other hosts on that network. DHCP is built on a client-server model, where designated DHCP servers allocate network addresses and deliver configuration parameters to dynamically configured hosts. When DHCP is enabled, the DHCP client requests configuration information, such as an IP address and network information, from a DHCP server each time it is restarted. The DHCP server responds to the request by sending the client an IP address and information about a network, such as the network's subnet mask, broadcast address, name service information, authentication information, and routing information.

Cayman 3220-H as DHCP Server

The Cayman 3220-H can provide IP addresses for as many as 253 devices on the subnet connected to its Ethernet hub ports. When the Cayman 3220-H receives a DHCP request from a client computer, it determines what address to assign by checking its DHCP lease table to identify an unused address in its DHCP range. When it finds an address that should be free, the Cayman 3220-H sends a broadcast message on the network to verify that no other host is using the same IP address. If another host indicates that it is using the selected

address, the Cayman 3220-H selects another address and repeats the sequence until it finds an address that is not in use.

Dynamic allocation of IP addresses means that an IP address can be reused when it is not longer needed by the client to which it is assigned. Dynamic IP address allocation is particularly useful in situations where clients connect to a network temporarily or where a site needs to share a limited pool of IP addresses among a group of clients that do not need permanent IP addresses.

Cayman 3220-H as DHCP Client

The Cayman 3220-H is configured at the factory to act as a DHCP client on its WAN port. This means that, if substitute IP address information is not configured for the WAN port, the Cayman 3220-H will send a DHCP broadcast message asking for configuration information from any available DCHP server. If a DHCP server is active on the network connected to the WAN port, the Cayman 3220-H will accept and use the network configuration settings the DCHP server provides to configure the Ethernet settings for the WAN port.

About PPP

The Point-to-Point Protocol (PPP) is a set of network protocols that enables you to connect TCP/IP hosts and networks over serial telephone connections. Extensions to the PPP protocol suite enable a PPP link to support other network protocols, including IPX, AppleTalk, and DECnet.

The nodes at each end of a PPP link are referred to as peers. Unlike client-server networks, where one device is responsible for providing services to another, peer-to-peer networks function as equals, providing services to one another as needed.

How PPP Works

PPP provides a standard method of encapsulating network protocol information over point-to-point links. PPP also defines a Link Control Protocol (LCP), which provides for link configuration, peer authentication, and link quality monitoring. Finally, PPP includes

several Network Control Protocols (NCPs), which establish how datagrams for a specific higher-level protocol using PPP as a data link should be encapsulated. Network control protocols establish and configure different network-layer protocols, such as TCP/IP.

PPP encapsulation provides for transmission of different network-layer protocols simultaneously over the same link. Once a PPP link is established, a PPP peer can negotiate the exchange of TCP/IP, IPX, or AppleTalk packets over standard telephone lines.

Phases of a PPP Link

When one PPP peer opens a link to another peer, the PPP link moves through several phases:

- Link establishment
- Link configuration
- Authentication
- Network configuration
- Link up
- Link termination

Each phase is described separately below.

Link Establishment

The manner in which a PPP link is opened depends on whether the router's serial port is configured as a dial-in, dial-out, or dedicated interface:

- Dial-in – If a port is configured as a dial-in interface, the router sends an initialization string to the modem when it is turned on to prepare it to accept calls. When the local modem receives an incoming call and negotiates the serial connection settings, the serial connection is established and the link peers begin negotiating the link configuration.

- Dial-out – If a port is configured as a dial-out interface, the router opens a PPP link when an internal Network Protocol routes a packet out the PPP interface. If PPP determines that the serial connection is not open, the router passes a telephone number and modem configuration information to the modem, which calls the modem connected to the remote peer. When the two modems establish a connection, the two peers begin negotiating the link configuration.

- Dedicated – If a port is configured as a dedicated interface, the router maintains a PPP link, typically over a leased telephone line, at all times.

Link Configuration

Link Control Protocol (LCP) configuration options allow modification to the standard characteristics of a PPP link to be negotiated. Negotiable options include settings for the maximum receive unit (MRU), asynchronous control character mapping, and link authentication. If a configuration option is not negotiated (that is, if a Configure-Request packet does not include a value for a particular option), the default value for that option is assumed.

Once a serial connection is made, each peer negotiates its side of the link's configuration by sending a Configure-Request message that lists its complete set of proposed configuration settings. When one peer sends a Configure-Request, the other peer responds in one of three ways:

- Configure-Ack – If every configuration option in the Configure-Request packet is both recognizable and acceptable, the second peer returns a Configure-Ack message that lists the complete set of proposed settings and indicates that the peer accepts the settings. All configuration options are acknowledged simultaneously.

- Configure-Nak – If every configuration option in the Configure-Request is recognizable but some values are not acceptable, then the second peer returns a Configure-Nak message that identifies the unacceptable option settings and

proposes new settings acceptable to the second peer. A Configure-Nak message may also include proposed configuration settings for options that the second peer requires but that the first peer did not include in its Configure-Request.

- Configure-Reject – If one or more of the configuration options in a Configure-Request are not recognizable or are not acceptable for negotiation, the second peer returns a Configure-Reject message that identifies the rejected options. The first peer can then send another Configure-Request that does not include any of the options listed in the Configure-Reject.

The negotiation mechanism is conducted independently in each direction: a setting negotiated for one peer does not apply to the other peer until it negotiates that option for itself. For example, if Peer A negotiates that it has a maximum receive unit of 1600 bytes with Peer B but Peer B does not negotiate its own MRU (implying that it uses the default value of 1500), then Peer A can send frames up to 1500 bytes long to Peer B but Peer B can send frames up to 1600 bytes long to Peer A.

Authentication

The PPP protocol suite includes two optional methods (Password Authentication Protocol (PAP) and Challenge Handshake Authentication Protocol (CHAP)) to ensure that unauthorized users do not access network services. By default, authentication is not required as part of the PPP link process. However if a peer requires authentication, it must negotiate the use of an authentication protocol during the link establishment phase.

The manner in which each peer will authenticate the other is negotiated during the link configuration phase, when each peer specifies whether it requires authentication and, if it does, the authentication method it uses. If a link peer requires authentication (if it is an authenticator, in the terminology of RFC 1334), the other peer must submit its name and authentication information before the link can proceed. If the peer fails to send valid authentication information, the authenticator terminates (closes) the PPP link.

The authentication method used by one peer can be different from the authentication method used by the other peer. For example, a peer at one end of a link may require authentication while the other end of the link may not. Similarly, one end of a link may use PAP to authenticate peers while the other end uses CHAP.

A PPP interface can support one or both authentication methods. If you specify that a serial port must use one method but not the other, the remote peer must authenticate itself according to the specified authentication protocol. If you specify that a serial port can use either CHAP or PAP to authenticate a remote peer (that is, both CHAP and PAP are enabled), the router tries to use CHAP to authenticate connection requests. If the remote peer does not support CHAP, the router requires that the remote peer use PAP to authenticate itself.

- Password Authentication Protocol (PAP) – The Password Authentication Protocol (PAP) provides a simple method for a peer to establish its identity. A peer being authenticated with PAP sends Authentication Request messages that contain its name and PAP password until the authenticator acknowledges and accepts the information or until the connection is terminated. Passwords are sent in clear text format, which offers no protection from interception and playback by unauthorized users.

- Challenge Handshake Authentication Protocol (CHAP) – The Challenge Handshake Authentication Protocol (CHAP) is a more secure authentication method than PAP. CHAP authentication involves three entities: a "secret" known to both link peers, a random challenge value, and a sequential challenge identifier. The authenticator sends a numbered message that includes a challenge value to the remote peer. The remote peer uses the secret to encrypt the challenge value and challenge identifier using a one-way hash function, ensuring that the response cannot be intercepted and used by an unauthorized user to obtain a legal password. The challenge identifier ensures that the encrypted authentication information cannot be recorded and played back later to gain access by an unauthorized user.

Network Configuration

After a PPP link has been established and authentication has been satisfied, PPP sends Network Control Protocol (NCP) packets to configure one or more network layer protocols, such as TCP/IP.

Link Up

Once a network-layer protocol is configured, the PPP link is considered up (open), and datagrams for that protocol are exchanged over the link. Either peer can close a network-layer connection without interfering with other network-layer connections or the LCP connection.

A PPP peer discards any packets received when the corresponding NCP is not open.

Link Termination

A link can be terminated during initialization because a configuration or authentication failure occurs. Once a PPP link is established, it remains configured for communication unless explicit LCP or NCP packets close the link or until some external event, such as the expiration of an activity time or intervention by a network administrator, occurs.

When a peer no longer needs a link, it sends a Terminate-Request packet to the remote peer and closes any open NCP sessions. When a peer sending a Terminate-Request receives a Terminate-Ack packet (or after a specified number of unacknowledged Terminate-Request packets are sent), it signals the physical layer to disconnect to enforce the termination of the link.

PPP and Routing Tables

Your 3220-H maintains a routing table for its IP routing service. The routing table identifies the networks a router can reach, the interface and gateway through which the router must forward a packet to reach its destination, and the number of routers (metric or hop count) through which a packet must travel to reach a remote

network. When the router receives a packet, it consults its routing table to decide where to send the packet.

Static and Dynamic Routes

Routes to other networks can be entered and maintained manually (static routes) or acquired from other routers interactively (dynamic routes):

- Static routes identify pathways to destination networks that are stable over time or to networks that must always be available, even if a link is not currently open. These static routes let each router recognize how to reach the other, even if one router hasn't heard from the other recently. Static routes are usually required for a PPP link to be established "on demand," since, without it, the router does not know which interface to route a packet over to reach the remote network.

- Dynamic routes identify pathways to destination networks that may change over time. Dynamic routes are created and configured when routers broadcast RIP (Routing Information Protocol) packets advertising the networks they can reach and the distance (number of routers) to each network.

Selecting the Most Efficient Route

The efficiency of a route is expressed in terms of the route's metric, or hop count, which measures the number of routers a packet must pass through to reach its destination. A route to a network connected directly to the router has a metric of 1, a route to a network reachable through one other gateway has a metric of 2, and so on. Routes with metrics greater than 16 are considered unreachable and are discarded.

The PPP interface tries to use the most efficient path to reach a remote destination network. When only one route (static or dynamic) to a remote network is available, the router uses that route to reach the network. When more than one route to a network is available (for example, when the router has one route to a network but learns of another one from a new router), the router selects the more efficient route (that is, the one with the lower metric, or hop count) and discards the less-efficient one.

If the router has a static route and a dynamic route with the same metric, it uses the static route and discards the dynamic route. If a router has one dynamic route to a remote network but learns of another with the same metric, it retains the existing route and discards the new route.

Under some circumstances, you may want your router to use the same path consistently to reach a remote network, even if another, more efficient route to the remote network exists. To accomplish this, set up a static route for the preferred pathway and assign it a metric of 1 (even if the actual destination to that network is more than 1). This will ensure the route cannot be replaced by a dynamic route.

Dealing with Unavailable Routes

A router acquiring dynamic routes from other gateways needs to be able to identify routes that are no longer available.A router considers a route unavailable when the route times out or a PPP link goes down:

- Timing out – When a router adds a dynamic route to its routing table, it starts a timer for that route.This timer is restarted whenever the router receives another RIP packet advertising the router. If the router does not see the route advertised for three minutes, it considers the route unreachable and deletes it from its routing table.

- Link down – When a PPP link goes down, the router is informed immediately by the network layer.The router does not time out routes accessible over a PPP link when the link goes down. Instead, how a router handles a route available over a PPP interface when the link goes down depends on whether route flushing is turned on:

  - If route flushing is turned on, the router begins advertising the unreachable route as having a metric of 16 (telling other interfaces and routers that those routes are no longer reachable) for two minutes. At the end of two minutes, the unavailable dynamic route is removed from the routing table. If the deleted dynamic route replaced a less-efficient static route, the static route is re-activated.

Route flushing is especially important when a port is configured as a dial-in PPP interface, since the router will not be able to dial out to re-establish a link after it goes down.

- If route flushing is turned off, the router does not change the route's status or metric when the link goes down. Instead, it maintains its routing table entry and freezes the RIP timer for the route. When the link comes back up, the router continues aging the route without restarting its RIP timer.

  Turning route flushing off is most appropriate for dial-out PPP interfaces, since you may want the router to hold onto routes it acquired dynamically over a PPP link and not time them out after the link closes. If the router receives a packet destined for a network on the other side of the down PPP link, it dials out to re-establish the link.

About PPP over Ethernet (PPPoE)

PPP (Point-to-Point Protocol) over Ethernet is an emerging technology that lets a personal computer or network connect with a high-speed data network over a cable or *x*DSL modem.

Advantages of PPPoE

- PPPoE simplifies deployment of high-speed networks. PPPoE provides access to high-speed (*x*DSL or cable modem) networks while preserving familiar dial-up models for Internet access. Consequently, users and ISPs can transition from dial-up network access to PPPoE network access quickly and inexpensively.

- PPPoE integrates easily into dial-up ISP infrastructure. Carriers and ISPs who are moving from a dial-up network base to a broadband network base can continue using their existing authentication, billing, access control, and IP address management models.

- PPPoE requires no additional knowledge on the part of the end user other than that needed for traditional dial-up Internet access. Multiple users can share a broadband connection without additional support or training costs, making it PPPoE ideal for small offices/home offices.

- Cayman's implementation of PPPoE is compatible with networking products from Shasta/Nortel, Redback Networks, and other standard industry servers.

PPP over Ethernet Stages

A PPPoE connection has two stages: a Discovery stage and a PPP Session stage.

Discover Stage

The Discovery stage of a PPPoE session consists of four steps:

1. **Initiation** – When a host wants to open a PPPoE session, it sends out a PPPoE Active Discovery Initiation (PADI) broadcast asking any available Access Concentrators to respond. If a host does not receive a response within the timeout period, it resends its PADI packet and doubles its timeout period.

2. **Offer** – If an Access Concentrator for the network can serve the request, it sends a PPPoE Active Discovery Offer (PADO) packet to the host identifying its name and the services it can offer to the host. If more than one Access Concentrator is available, a host may receive multiple PADO packets.

3. **Request** – The initiating host chooses an Access Concentrator (based on its name or the services it offered in its PADO packet) and sends a PPPoE Active Discovery Request (PADR) message identifying the service it wants.

4. **Confirmation** – After the Access Concentrator receives the PADR message, it generates a unique identifier for the PPPoE session and replies to the host with a PPPoE Active Discovery Session-confirmation (PADS) message. The PADS message identifies the service under which the Access Concentrator has accepted the PPPoE session.

When the host receives the Confirmation packet from the Access Concentrator, negotiations are concluded and they can proceed to the PPP Session stage.

PPP Session Stage

Once the PPPoE session is operative, the host and Access Concentrator exchange PPP packets using the unique session identifier they negotiated during discovery.

An Access Concentrator may periodically send ICMP Echo-Request packets to the host to verify connectivity. This serves to identify situations where a host terminates a session without sending a Terminate-Request packet (described in the next section), since the Access Concentrator might not otherwise be able to determine that the session is no longer functional.

At any time after they have established a PPP session, either the host or the Access Concentrator can terminate the session by sending the other a PPPoE Active Discovery Terminate (PADT) packet. When this occurs, no further PPP traffic, including standard PPP termination traffic, is permitted between the host and the Access Concentrator.

Glossary

10Base2	IEEE 802.3 specification for Ethernet that uses thin coaxial cable to run at 10 Mbps. Limited to 185 meters per segment. 10Base5 IEEE 802.3 baseband physical layer specification for Ethernet that uses thick coaxial cable to run at 10 Mbps. Limited to 500 meters per segment.
10Base-T	IEEE 802.3 specification for Ethernet that uses unshielded twisted pair (UTP) wiring with RJ-45 eight-conductor plugs at each end. Runs at 10 Mbps.
ACK	Acknowledgment. Message sent from one network device to another to indicate that some event has occurred. See NAK.
access rate	Transmission speed, in bits per second, of the circuit between the end user and the network.
adapter	Board installed in a computer system to provide network communication capability to and from that computer system.
address mask	See subnet mask.
ADSL	Asymmetric Digital Subscriber Line. Modems attached to twisted pair copper wiring that transmit 1.5-9 Mbps downstream (to the subscriber) and 16 -640 kbps upstream, depending on line distance.
ANSI	American National Standards Institute.
ASCII	American Standard Code for Information Interchange (pronounced ASK-ee). Code in which numbers from 0 to 255 represent individual characters, such as letters, numbers, and punctuation marks; used in text representation and communication protocols.

asynchronous communication	Network system that allows data to be sent at irregular intervals by preceding each octet with a start bit and following it with a stop bit. Compare synchronous communication.
AUI	Attachment Unit Interface. Connector by which a thick (802.3) Ethernet transceiver cable is attached to a networked device.
backbone	The segment of the network used as the primary path for transporting traffic between network segments.
baud rate	Unit of signaling speed equal to the number of number of times per second a signal in a communications channel varies between states. Baud is synonymous with bits per second (bps) if each signal represents one bit.
binary	Numbering system that uses only zeros and ones.
bps	Bits per second. A measure of data transmission speed.
BRI	Basic Rate Interface. ISDN standard for provision of low-speed ISDN services (two B channels (64 kbps each) and one D channel (16 kbps)) over a single wire pair.
bridge	Device that passes packets between two network segments according to the packets' destination address.
broadcast	Message sent to all nodes on a network.
broadcast address	Special IP address reserved for simultaneous broadcast to all network nodes.
buffer	Storage area used to hold data until it can be forwarded.
carrier	Signal suitable for transmission of information.
CCITT	Comité Consultatif International Télégraphique et Téléphonique or Consultative Committee for International Telegraph and Telephone. An international organization responsible for developing telecommunication standards.
CD	Carrier Detect.

CHAP	Challenge-Handshake Authentication Protocol. Security protocol in PPP that prevents unauthorized access to network services. See RFC 1334 for PAP specifications Compare PAP.
client	Network node that requests services from a server.
CPE	Customer Premises Equipment. Terminating equipment such as terminals, telephones and modems that connects a customer site to the telephone company network.
CO	Central Office. Typically a local telephone company facility responsible for connecting all lines in an area.
compression	Operation performed on a data set that reduces its size to improve storage or transmission rate.
crossover cable	Cable that lets you connect a port on one Ethernet hub to a port on another Ethernet hub. You can order an Ethernet crossover cable from network supply companies such as Black Box.
CSU/DSU	Channel Service Unit/Data Service Unit. Device responsible for connecting a digital circuit, such as a T1 link, with a terminal or data communications device.
CTS	Clear to Send. Circuit activated in hardware flow control when a modem (or other DCE) is ready to accept data from the computer (or other DTE). Compare RTS, xon/xoff.
data bits	Number of bits used to make up a character.
datagram	Logical grouping of information sent as a network-layer unit. Compare frame, packet.
DCE	Digital Communication Equipment. Device that connects the communication circuit to the network end node (DTE). A modem and a CSU/DSU are examples of a DCE.
dedicated line	Communication circuit that is used exclusively to connect two network devices. Compare dial on demand.

DHCP	Dynamic Host Configuration Protocol. A network configuration protocol that lets a router or other device assign IP addresses and supply other network configuration information to computers on your network.
dial in	Port setting that specifies that other routers can initiate a connection to the local router but that the local router cannot initiate a connection to other routers. A port can be set as both dial in and dial out. Compare dial out.
dial on demand	Communication circuit opened over standard telephone lines when a network connection is needed.
dial out	Port setting that specifies that it can initiate a connection to other routers but that other routers cannot initiate a connection to it. A port can be set as both dial in and dial out. Compare dial in.
domain name	Name identifying an organization on the Internet. Domain names consists of sets of characters separated by periods (dots). The last set of characters identifies the type of organization (.GOV, .COM, .EDU) or geographical location (.US, .SE).
domain nameserver	Network computer that matches host names to IP addresses in response to Domain Name System (DNS) requests.
Domain Name System (DNS)	Standard method of identifying computers by name rather than by numeric IP address.
DSL	Digital Subscriber Line. Modems on either end of a single twisted pair wire that delivers ISDN Basic Rate Access.
DTE	Data Terminal Equipment. Network node that passes information to a DCE (modem) for transmission. A computer or router communicating through a modem is an example of a DTE device.
DTR	Data Terminal Ready. Circuit activated to indicate to a modem (or other DCE) that the computer (or other DTE) is ready to send and receive data.
echo interval	Frequency with which the router sends out echo requests.

encapsulation	Technique used to enclose information formatted for one protocol, such as AppleTalk, within a packet formatted for a different protocol, such as TCP/IP.
encryption	The application of a specific algorithm to a data set so that anyone without the encryption key cannot understand the information.
Ethernet crossover cable	See crossover cable.
FCS	Frame Check Sequence. Data included in frames for error control.
flow control	Technique using hardware circuits or control characters to regulate the transmission of data between a computer (or other DTE) and a modem (or other DCE). Typically, the modem has buffers to hold data; if the buffers approach capacity, the modem signals the computer to stop while it catches up on processing the data in the buffer. See CTS, RTS, xon/xoff.
fragmentation	Process of breaking a packet into smaller units so that they can be sent over a network medium that cannot transmit the complete packet as a unit.
frame	Logical grouping of information sent as a link-layer unit. Compare datagram, packet.
FTP	File Transfer Protocol. Application protocol that lets one IP node transfer files to and from another node.
FTP server	Host on network from which clients can transfer files.
hardware handshake	Method of flow control using two control lines, usually Request to Send (RTS) and Clear to Send (CTS).
HDLC	High-level Data Link Control.
HDSL	High-data-rate Digital Subscribe Line. Modems on either end of one or more twisted pair wires that deliver T1 or E1 speeds. T1 requires two lines and E1 requires three. Compare ADSL, SDSL.
header	The portion of a packet, preceding the actual data, containing source and destination addresses and error-checking fields.

hop	A unit for measuring the number of routers a packet has passed through when traveling from one network to another.
hop count	Distance, measured in the number of routers to be traversed, from a local router to a remote network. See metric.
hub	Another name for a repeater.
interface	A connection between two devices or networks.
internet address	IP address. A 32-bit address used to route packets on a TCP/IP network. In dotted decimal notation, each eight bits of the 32-bit number are presented as a decimal number, with the four octets separated by periods.
IPCP	Internet Protocol Control Protocol. A network control protocol in PPP specifying how IP communications will be configured and operated over a PPP link.
ISDN	Integrated Services Digital Network. A digital network with circuit and packet switching for voice and data communications at data rates up to 1.544 or 2.048 Mbps over telephone networks.
LCP	Link Control Protocol. Protocol responsible for negotiating connection configuration parameters, authenticating peers on the link, determining whether a link is functioning properly, and terminating the link. Documented in RFC 1331.
LQM Link Quality Monitoring	Optional facility that lets PPP make policy decisions based on the observed quality of the link between peers. Documented in RFC 1333.
loopback test	Diagnostic procedure in which data is sent from a devices's output channel and directed back to its input channel so that what was sent can be compared to what was received.
magic number	Random number generated by a router and included in packets it sends to other routers. If the router receives a packet with the same magic number it is using, the router sends and receives packets with new random numbers to determine if it is talking to itself.

metric	Distance, measured in the number of routers a packet must traverse, that a packet must travel to go from a router to a remote network. A route with a low metric is considered more efficient, and therefore preferable, to a route with a high metric. See hop count.
modem	Modulator/demodulator. Device used to convert a digital signal to an analog signal for transmission over standard telephone lines. A modem at the other end of the connection converts the analog signal back to a digital signal.
MRU	Maximum Receive Unit. The maximum packet size, in bytes, that a network interface will accept.
MTU	Maximum Transmission Unit. The maximum packet size, in bytes, that can be sent over a network interface.
NAK	Negative acknowledgment. See ACK.
NCP	Network Control Protocol.
null modem	Cable or connection device used to connect two computing devices directly rather than over a network.
packet	Logical grouping of information that includes a header and data. Compare frame, datagram.
PAP	Password Authentication Protocol. Security protocol within the PPP protocol suite that prevents unauthorized access to network services. See RFC 1334 for PAP specifications. Compare CHAP.
parity	Method of checking the integrity of each character received over a communication channel.
PING	Packet INternet Groper. Utility program that uses an ICMP echo message and its reply to verify that one network node can reach another. Often used to verify that two hosts can communicate over a network.

PPP	Point-to-Point Protocol. Provides a method for transmitting datagrams over serial router-to-router or host-to-network connections using synchronous or asynchronous circuits.
protocol	Formal set of rules and conventions that specify how information can be exchanged over a network.
PSTN	Public Switched Telephone Network.
repeater	Device that regenerates and propagates electrical signals between two network segments. Also known as a hub.
RFC	Request for Comment. Set of documents that specify the conventions and standards for TCP/IP networking.
RIP	Routing Information Protocol. Protocol responsible for distributing information about available routes and networks from one router to another.
RJ-45	Eight-pin connector used for 10BaseT (twisted pair Ethernet) networks.
route	Path through a network from one node to another. A large internetwork can have several alternate routes from a source to a destination.
routing table	Table stored in a router or other networking device that records available routes and distances for remote network destinations.
RTS	Request to Send. Circuit activated in hardware flow control when a computer (or other DTE) is ready to transmit data to a modem (or other DCE). See CTS, xon/xoff.
serial communication	Method of data transmission in which data bits are transmitted sequentially over a communication channel.
SLIP	Serial Line Internet Protocol. Predecessor to PPP that allows communication over serial point-to-point connections running TCP/IP. Defined in RFC 1055.
static route	Route entered manually in a routing table.

subnet mask	A 32-bit address mask that identifies which bits of an IP address represent network address information and which bits represent node identifier information.
synchronous communication	Method of data communication requiring the transmission of timing signals to keep PPP peers synchronized in sending and receiving blocks of data.
T1 link	Digital transmission link capable of speeds up to 1544 kilobits per second.
TA	Terminal adaptor. Device that connects a network or terminal to an ISDN network.
Telnet	IP protocol that lets a user on one host establish and use a virtual terminal connection to a remote host.
twisted pair	Cable consisting of two copper strands twisted around each other. The twisting provides protection against electromagnetic interference.
UTP	Unshielded twisted pair cable.
VJ	Van Jacobson. Abbreviation for a compression standard documented in RFC 1144.
WAN	Wide Area Network. Private network facilities, usually offered by public telephone companies but increasingly available from alternative access providers (sometimes called Competitive Access Providers, or CAPs), that link business network nodes.
WWW	World Wide Web.
xon/xoff	Special characters used for software flow control to regulate communication between a device and a modem.

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