Doc. No. 78-3278-01

SA-Comp/1 and SA-Comp/4 Data Compression Service Adapter Installation and Configuration

Product Numbers: SA-Comp/1(=), SA-Comp/4(=)

This configuration note describes the installation and configuration of the data compression service adapters (referred to throughout this publication collectively as *CSA*), which are used in the Cisco 7200 series routers and on the second-generation Versatile Interface Processor (VIP2) in all Cisco 7500 series routers, and in Cisco 7000 series routers using the 7000 Series Route Switch Processor (RSP7000) and 7000 Series Chassis Interface (RSP7000CI). (The specific VIP2 model required by the CSA is VIP2-40.)

Note For VIP2 users, use this configuration note in conjunction with the configuration note *Second-Generation Second-Generation Versatile Interface Processor (VIP2) Installation and Configuration* (Document Number 78-2658-xx), which shipped with your VIP2-40.

For Cisco 7200 users, use this configuration note in conjunction with the *Cisco 72xx Installation and Configuration Guide* that shipped with your Cisco 7200 series router.

For complete descriptions of interface subcommands and the configuration options available for interfaces, and which support CSA functionality, refer to the appropriate Cisco Internetwork Operating System (Cisco IOS) configuration publication listed in the section “If You Need More Information.”

Corporate Headquarters
Cisco Systems, Inc.
170 West Tasman Drive
San Jose, CA 95134-1706
USA

Document Contents

1. The following sections include general information and information about compression adapter installation:
   - If You Need More Information, page 2
   - Data Compression Overview, page 3
   - Compression Service Adapter Installation Prerequisites, page 4
2. The following section includes information specific to the compression service adapter:
   - What Is the Data Compression Service Adapter?, page 6
3. The following sections include information specific to the compression service adapter's use with the VIP2 in Cisco 7000 family routers and in the Cisco 7200 series routers:
   - VIP2 and the Compression Service Adapter, page 9
   - Cisco 7200 Series Routers and the Compression Service Adapter, page 25

The section "Cisco Connection Online," on page 40, includes general reference information.

If You Need More Information

The Cisco Internetwork Operating System (Cisco IOS) software running your router contains extensive features and functionality. The effective use of many of many of these features is easier if you have more information at hand. For additional information on configuring the Cisco 7000 family routers and VIP2, or the Cisco 7200 series, the following documentation resources are available:

- Cisco Connection Documentation, Enterprise Series CD-ROM

  This publication and additional Cisco Systems publications are available on a CD-ROM called Cisco Connection Documentation, Enterprise Series, which is Cisco's online library of product information. The CD-ROM is updated and shipped monthly, so it might be more up to date than printed documentation. To order Cisco Connection Documentation, Enterprise Series CD-ROM, contact a Cisco Sales or Customer Service representative.

- For Cisco 7000 family systems with Cisco IOS Release 11.1(6)CA, a Cisco-approved Release 11.1(6)CA beta software version, or a later Cisco IOS release or, for Cisco 7200 series systems with Cisco IOS Release 11.1(6)CA, a Cisco-approved Release 11.1(6)CA beta software version, or a later Cisco IOS release, refer to the following modular configuration and modular command reference publications as appropriate for your configuration:
  - *Configuration Fundamentals Configuration Guide*
  - *Configuration Fundamentals Command Reference*
  - *Wide-Area Networking Configuration Guide*
  - *Wide-Area Networking Command Reference*
  - *Network Protocols Configuration Guide*
  - *Network Protocols Command Reference*
  - *Bridging and IBM Networking Configuration Guide*
  - *Bridging and IBM Networking Command Reference*
  - *Configuration Builder Getting Started Guide*
  - *Troubleshooting Internetworking Systems*

- For hardware installation and maintenance information on the Cisco 7000 family routers and the VIP2, refer to the following publications:
  - *Cisco 7000 Hardware Installation and Maintenance*
  - *Cisco 7010 Hardware Installation and Maintenance*
  - *Cisco 7505 Hardware Installation and Maintenance*
  - *Cisco 7507 Hardware Installation and Maintenance*
  - *Cisco 7513 Hardware Installation and Maintenance*
  - *Second-Generation Versatile Interface Processor (VIP2) Installation and Configuration*
- For hardware installation and maintenance information on the Cisco 7200 series routers, refer to the *Cisco 72xx Installation and Configuration Guide* that shipped with your Cisco 7200 series router.
- To obtain information about documentation, refer to the Cisco Connection Documentation, Enterprise Series CD-ROM, the section "Cisco Connection Online," on page 40, or call Customer Service at 800 553-6387 or 408 526-7208. Customer Service hours are 5:00 a.m. to 6:00 p.m. Pacific time, Monday through Friday (excluding company holidays). You can also send e-mail to cs-rep@cisco.com. You can also refer to the *Cisco Information Packet* that shipped with your router.

Data Compression Overview

The basic function of data compression is to reduce the size of a data frame to be transmitted over a network link. Reducing the size of the frame reduces the time required to transmit the frame across the network. Data compression works by providing a coding scheme at each end of a transmission link that allows characters to be removed from the frames of data at the sending side of the link and then replaced correctly at the receiving side. Because the condensed frames take up less bandwidth, greater numbers of them can be transmitted per unit of time.

Data compression schemes used in internetworking devices are referred to as lossless compression algorithms. These schemes reproduce the original bit streams exactly, with no degradation or loss, a feature required by routers and other devices to transport data across the network. The two most commonly used compression algorithms on internetworking devices are the Stacker compression and Novell predictor data compression algorithms.

Stacker compression was developed by STAC Electronics and is based on the Lempel-Ziv compression algorithm. The Stacker algorithm uses an encoded dictionary that replaces a continuous stream of characters with codes. The symbols represented by the codes are stored in memory in a dictionary-style list. Because the relationship between a code and the original symbol varies as the data varies, this approach is more responsive to the variations in the data. This flexibility is particularly important for LAN data, because many different applications can be transmitting over the WAN at any one time. In addition, as the data varies, the dictionary changes to accommodate and adapt to the varying needs of the traffic.

The predictor compression algorithm tries to predict the next sequence of characters in a data stream by using an index to look up a sequence in the compression dictionary. It then examines the next sequence in the data stream to see if it matches. If it does, that sequence replaces the looked-up sequence in the dictionary. If there is no match, the algorithm locates the next character sequence in the index and the process begins again. The index updates itself by hashing a few of the most recent character sequences from the input stream.

Cisco internetworking devices use the Stacker and predictor data compression algorithms. The CSA only supports the Stacker algorithm.

Compression Service Adapter Installation Prerequisites

This section provides the software and hardware requirements, a list of parts and tools you will need to perform the installation, and safety and ESD-prevention guidelines to help you avoid injury and damage to the equipment.

Software and Hardware Requirements

Following are specific hardware and software prerequisites to ensure proper operation of the CSA:

- The CSA can be used in the second-generation Versatile Interface Processor (VIP2) in all Cisco 7500 series routers, and in Cisco 7000 series routers using the RSP7000 and RSP7000CI.
- The specific VIP2 model required for the CSA is VIP2-40(=), which has 2 MB of SRAM and 32 MB of DRAM.
- For the initial release of the CSA, only compression and decompression of data passing through serial interfaces on the PA-4T and PA-8T synchronous serial port adapters is supported.

Note The CSA can be installed in either port adapter slot 0 or slot 1 on the VIP2-40 motherboard; however, the CSA will only compress and decompress data passing through interfaces on the PA-4T or PA-8T port adapter in the adjacent VIP2 port adapter slot. The Cisco 7000 series and 7500 series chassis support mutiple CSAs. The CSA can be installed in any available port adapter slot in Cisco 7200 series chassis and will compress and decompress interfaces on PA-4T or PA-8T port adapters installed in any other port adapter slot. The Cisco 7200 series chassis only support one installed CSA.

- The CSA requires that the host router is running Cisco IOS Release 11.1(6)CA, or later.

List of Parts and Tools

You need the following tools and parts to install a compression service adapter. If you need additional equipment, contact a service representative for ordering information.

- SA-Comp/1 or SA-Comp/4 service adapter
- VIP2-40 (for installation in a Cisco 7000 or Cisco 7500 series chassis only)
- PA-4T(=) or PA-8T(=) port adapter in the adjacent port adapter slot on the VIP2-40
- Number 1 Phillips and a 3/16-inch, flat-blade screwdriver (for VIP2 installation only)
- Your own ESD-prevention equipment or the disposable grounding wrist strap included with all upgrade kits, FRUs, and spares

Safety Guidelines

Following are safety guidelines that you should follow when working with any equipment that connects to electrical power or telephone wiring.

Electrical Equipment Guidelines

Follow these basic guidelines when working with any electrical equipment:

- Before beginning any procedures requiring access to the chassis interior, locate the emergency power-off switch for the room in which you are working.
- Disconnect all power and external cables before moving a chassis.
- Do not work alone when potentially hazardous conditions exist.
- Never assume that power has been disconnected from a circuit; always check.
- Do not perform any action that creates a potential hazard to people or makes the equipment unsafe.
- Carefully examine your work area for possible hazards such as moist floors, ungrounded power extension cables, and missing safety grounds.

Telephone Wiring Guidelines

Use the following guidelines when working with any equipment that is connected to telephone wiring or to other network cabling:

- Never install telephone wiring during a lightning storm.
- Never install telephone jacks in wet locations unless the jack is specifically designed for wet locations.
- Never touch uninsulated telephone wires or terminals unless the telephone line has been disconnected at the network interface.
- Use caution when installing or modifying telephone lines.

Preventing Electrostatic Discharge Damage

Electrostatic discharge (ESD) damage, which can occur when electronic cards or components are improperly handled, results in complete or intermittent failures. A processor module comprises a printed circuit board that is fixed in a metal carrier. Electromagnetic interference (EMI) shielding, connectors, and a handle are integral components of the carrier. Although the metal carrier helps to protect the board from ESD, use a preventive antistatic strap whenever handling a processor module.

Following are guidelines for preventing ESD damage:

- Always use an ESD wrist or ankle strap and ensure that it makes good skin contact.
- Connect the equipment end of the strap to a captive installation screw on an installed power supply.
- When installing a processor module, use the ejector levers to properly seat the bus connectors in the backplane, then tighten both captive installation screws. These screws prevent accidental removal, provide proper grounding for the system, and help to ensure that the bus connectors are seated in the backplane.

- When removing a processor module, use the ejector levers to release the bus connectors from the backplane. Use the handle to pull the processor module out slowly while keeping your other hand underneath the carrier to guide it straight out of the slot.
- Handle carriers by the handles and carrier edges only; avoid touching the board or connectors.
- Place a removed processor module board-side-up on an antistatic surface or in a static shielding bag. If you plan to return the component to the factory, immediately place it in a static shielding bag.
- Avoid contact between the processor module and clothing. The wrist strap only protects the board from ESD voltages on the body; ESD voltages on clothing can still cause damage.
- Never attempt to remove the printed circuit board from the metal interface processor carrier.

Caution For safety, periodically check the resistance value of the antistatic strap. The measurement should be between 1 and 10 megohms.

What Is the Data Compression Service Adapter?

The CSA (see Figure 1) provides high performance, hardware-based, data compression capabilities for Cisco 7000 series, Cisco 7500 series, and Cisco 7200 series routers.

Figure 1 SA-Comp Service Adapter, Faceplate View

Following are the two CSA models:

- SA-Comp/1(=)—768-KB memory configuration
- SA-Comp/4(=)—3-MB memory configuration

There are no media interfaces on the CSA faceplate. The CSA off-loads all compression and decompression-related packet handling from host processors by compressing and decompressing packets passing through interfaces on PA-4T and PA-8T port adapters installed in the host chassis.

The CSA supports simultaneous Stacker data compression algorithms, with independent full-duplex compression and decompression capabilities. The CSA supports only Point-to-Point Protocol (PPP) encapsulation.

Note While the VIP2 supports online insertion and removal (OIR), individual port adapters and service adapters do not. To replace a port adapter or service adapter, you must first remove the VIP2 from the chassis, then replace adapters as required.

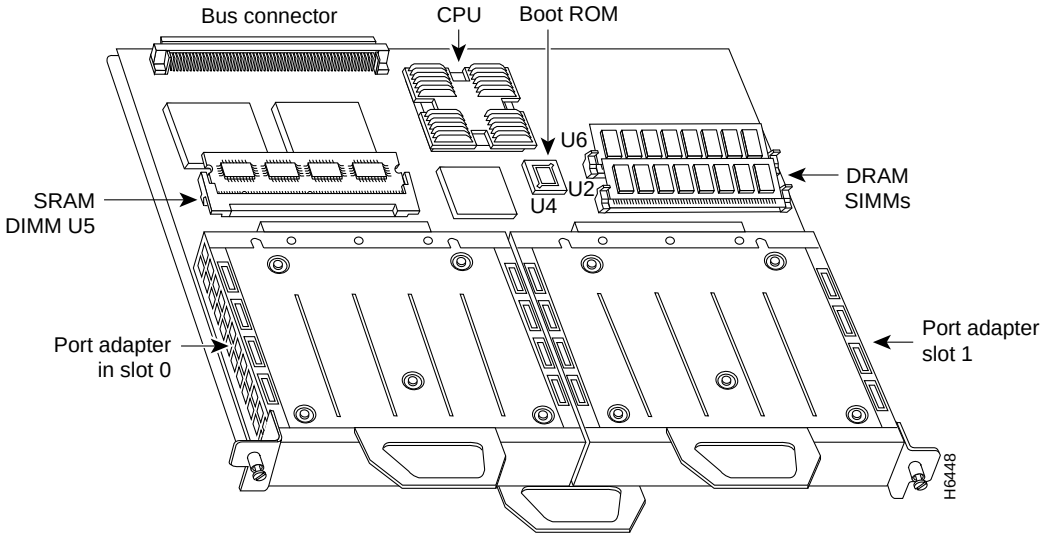
The Cisco 7200 series routers support the OIR of all port adapter and service adapter types.

The following sections discuss information specific to the CSA:

Service Adapter and Port Adapter Locations

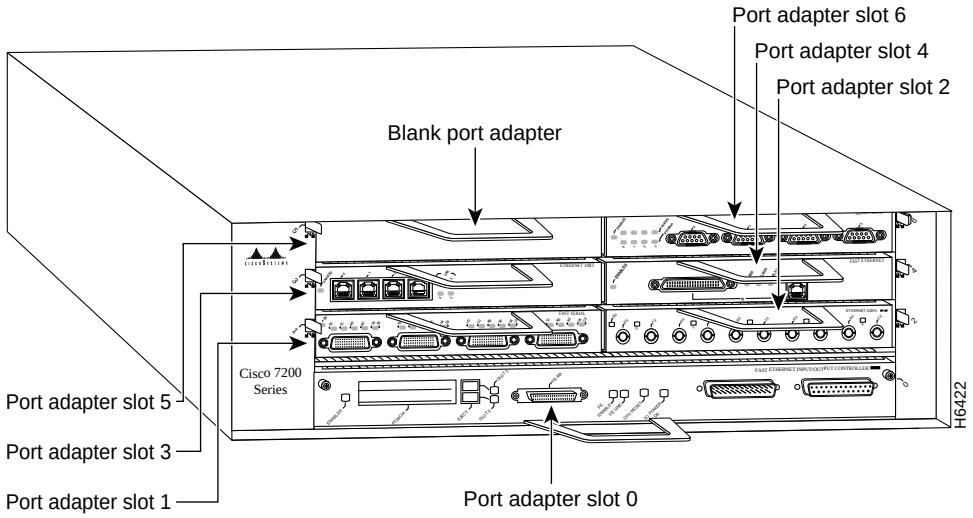
You can install service adapters in VIP2 and Cisco 7200 series port adapter slots. Figure 2 shows a VIP2 with installed port adapters. The VIP2 card, service adapters, and port adapters have handles that allow for easy installation and removal. With the VIP2 oriented as shown in Figure 2, the left slot is port adapter slot 0, and the right slot is port adapter slot 1. In the Cisco 7000, Cisco 7507, and Cisco 7513 chassis, the VIP2 is installed vertically.

Figure 2 VIP2 Port Adapter Slots (Horizontal Orientation Shown)



In the Cisco 7200 series, which consist of the Cisco 7204 and the Cisco 7206, port adapter slots are numbered from left to right, beginning with port adapter slot 1 and continuing through port adapter slot 4 for the Cisco 7204, and slot 6 for the Cisco 7206. Port adapter slot 0 is the optional Fast Ethernet port on the I/O controller. Figure 3 shows a Cisco 7206 with port adapters installed.

Figure 3 Cisco 7200 Series Port Adapter Slots—Cisco 7206 Shown



CSA LEDs

The CSA has an enabled LED, standard on all service adapters, plus the active and error LEDs. After system initialization, the enabled LED goes on to indicate that the CSA has been enabled for operation. (The LEDs are shown in Figure 4.) The following conditions must be met before the enabled LED goes on:

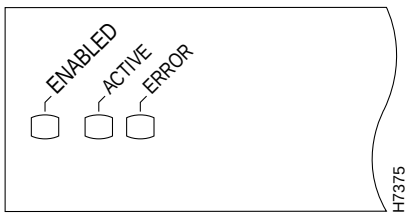
- The data compression interface is correctly connected to the backplane and receiving power.
- The data-compression-equipped VIP2 contains a valid microcode version that has been downloaded successfully and the bus recognizes the data-compression-equipped VIP2.

If either of these conditions is not met, or if the router initialization fails for other reasons, the enabled LED does not go on.

In addition to the enabled LED, the CSA has the following two LEDs and indications:

- ACTIVE—this green LED indicates the CSA is active and ready to process data. This LED goes on when the service adapter's boot process is complete and remains off during normal system operation.
- ERROR—this amber LED indicates an error was found, and if it remains on, it indicates the error might prevent accurate compression. Error codes are generated by software. This LED remains off during normal system operation.

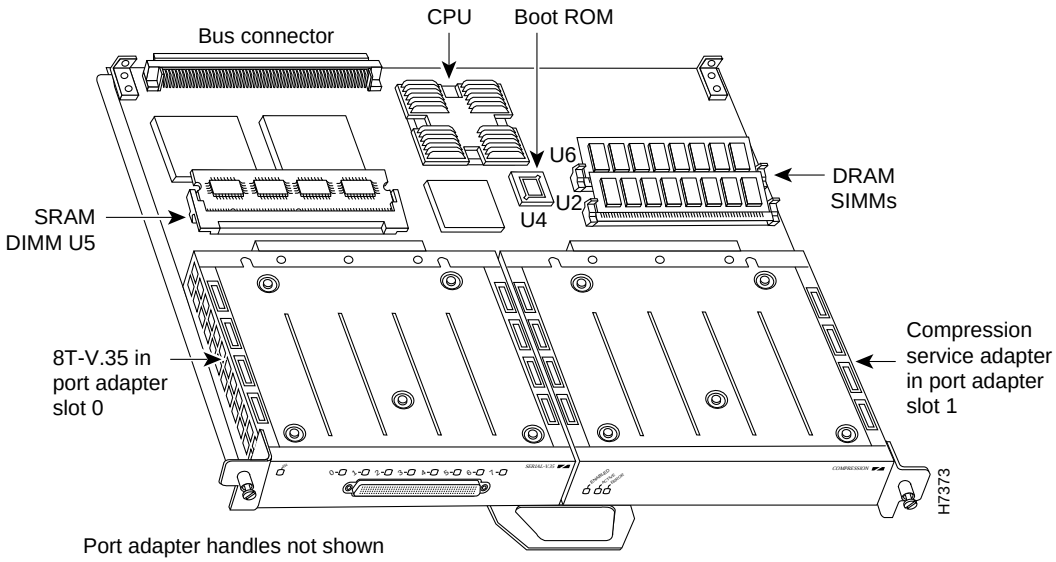
Figure 4 LEDs on the CSA (Partial Faceplate View)



VIP2 and the Compression Service Adapter

The CSA is used on the VIP2, and can be installed in either port adapter slot 0 or port adapter slot 1; however, the CSA will only compress and decompress data passing through interfaces on the PA-4T or the PA-8T port adapter in the adjacent VIP2 port adapter slot. Figure 5 shows the CSA installed on a VIP2 in port adapter slot 1.

Figure 5 VIP2 with a Compression Service Adapter in Port Adapter Slot 1



The following sections discuss information specific to the CSA and its use on the VIP2 in Cisco 7000 series and Cisco 7500 series routers:

- Installing or Replacing a Service Adapter on a VIP2, page 9
- Configuring Compression on VIP2 Interfaces, page 14

Installing or Replacing a Service Adapter on a VIP2

Depending on the circumstances, you might need to install a new service adapter on a VIP2 motherboard or replace a failed service adapter in the field. In either case, you need a number 1 Phillips screwdriver, an antistatic mat onto which you can place the removed interface processor, and an antistatic container into which you can place a failed service adapter for shipment back to the factory.

Caution To prevent system problems, do not remove service adapters from the VIP2 motherboard, or attempt to install other service adapters on the VIP2 motherboard while the system is operating. To install or replace service adapters, first remove the VIP2 from its interface processor slot.

Note Each service adapter circuit board is mounted on a metal carrier and is sensitive to ESD damage. The following procedures should be performed by a Cisco-certified service provider only. While the VIP2 supports online insertion and removal (OIR), individual service adapters do not. To replace service adapters, you must first remove the VIP2 from the chassis, then install or replace service adapters as required. If a blank service adapter is installed on the VIP2 in which you want to install a new service adapter, you must first remove the VIP2 from the chassis, then remove the blank service adapter.

When only one service adapter is installed on a VIP2, a blank service adapter must fill the empty slot to allow the VIP2 and router chassis to conform to electromagnetic interference (EMI) emissions requirements, and so that air flows through the chassis properly. If you plan to install a new service adapter, you must first remove the blank service adapter.

Following is the standard procedure for removing and replacing any type of service adapter on the VIP2:

Step 1 Attach an ESD-preventive wrist strap between you and an unfinished chassis surface.

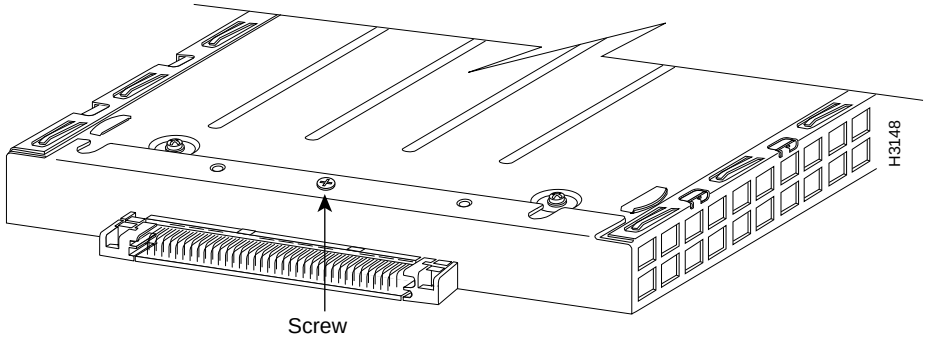
Step 2 For a new service adapter installation or a service adapter replacement, disconnect any interface cables from the ports on the front of the service adapter, although this is not required. You can remove VIP2s with cables attached; however, we do not recommend it.

Step 3 To remove the VIP2 from the chassis, follow the steps in the section "Removing a VIP2" in the configuration note *Second-Generation Second-Generation Versatile Interface Processor (VIP2) Installation and Configuration* (Document Number 78-2658-xx), which shipped with your VIP2.

Step 4 Place the removed VIP2 on an antistatic mat.

Step 5 Locate the screw at the rear of the service adapter (or blank service adapter) to be replaced. (See Figure 6.) This screw secures the service adapter (or blank service adapter) to its slot.

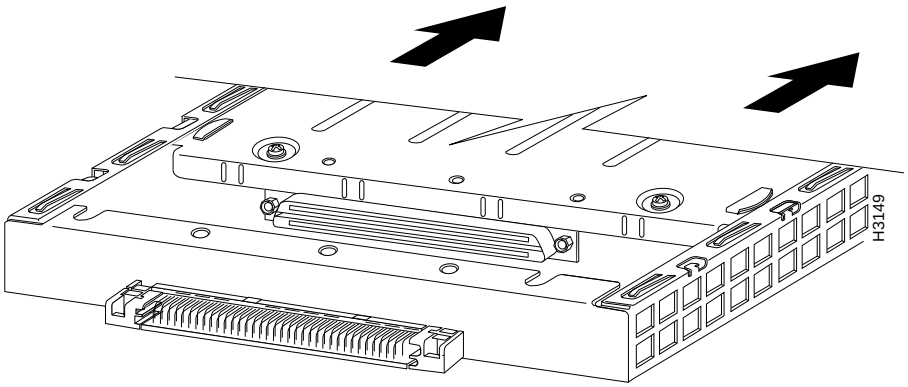
Figure 6 Location of Service Adapter Screw, Partial Service Adapter View



Step 6 Remove the screw that secures the service adapter (or blank service adapter).

Step 7 With the screw removed, grasp the handle on the front of the service adapter (or blank service adapter) and carefully pull it out of its slot, away from the edge connector at the rear of the slot. (See Figure 7.)

Figure 7 Pulling a Service Adapter Out of a Slot, Partial Service Adapter View

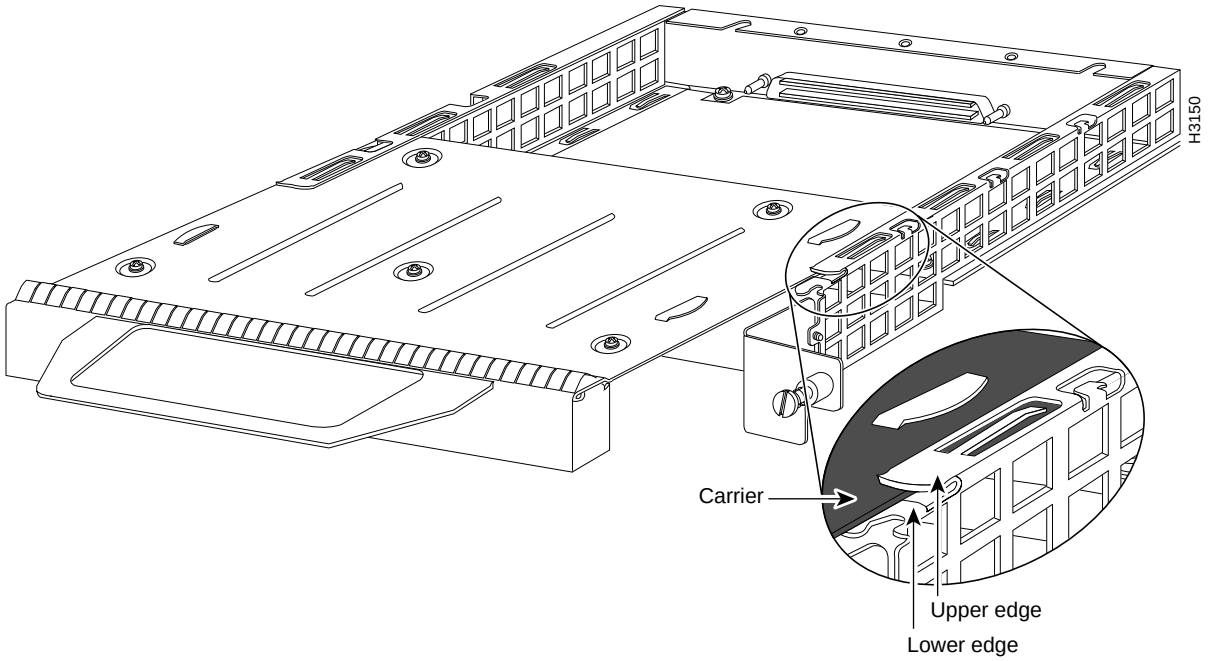


Step 8 If you removed a service adapter, place it in an antistatic container for safe storage or shipment back to the factory. If you removed a blank service adapter, no special handling is required; however, store the blank service adapter for potential future use.

Step 9 Remove the new service adapter from its antistatic container and position it at the opening of the slot. (See Figure 8.)

Caution To prevent jamming the carrier between the upper and lower edges of the service adapter slot, and to assure that the edge connector at the rear of the service adapter mates with the connector at the rear of the service adapter slot, make certain that the leading edges of the carrier are between the upper and lower slot edges, as shown in the cutaway in Figure 8.

Figure 8 Installing a Service Adapter

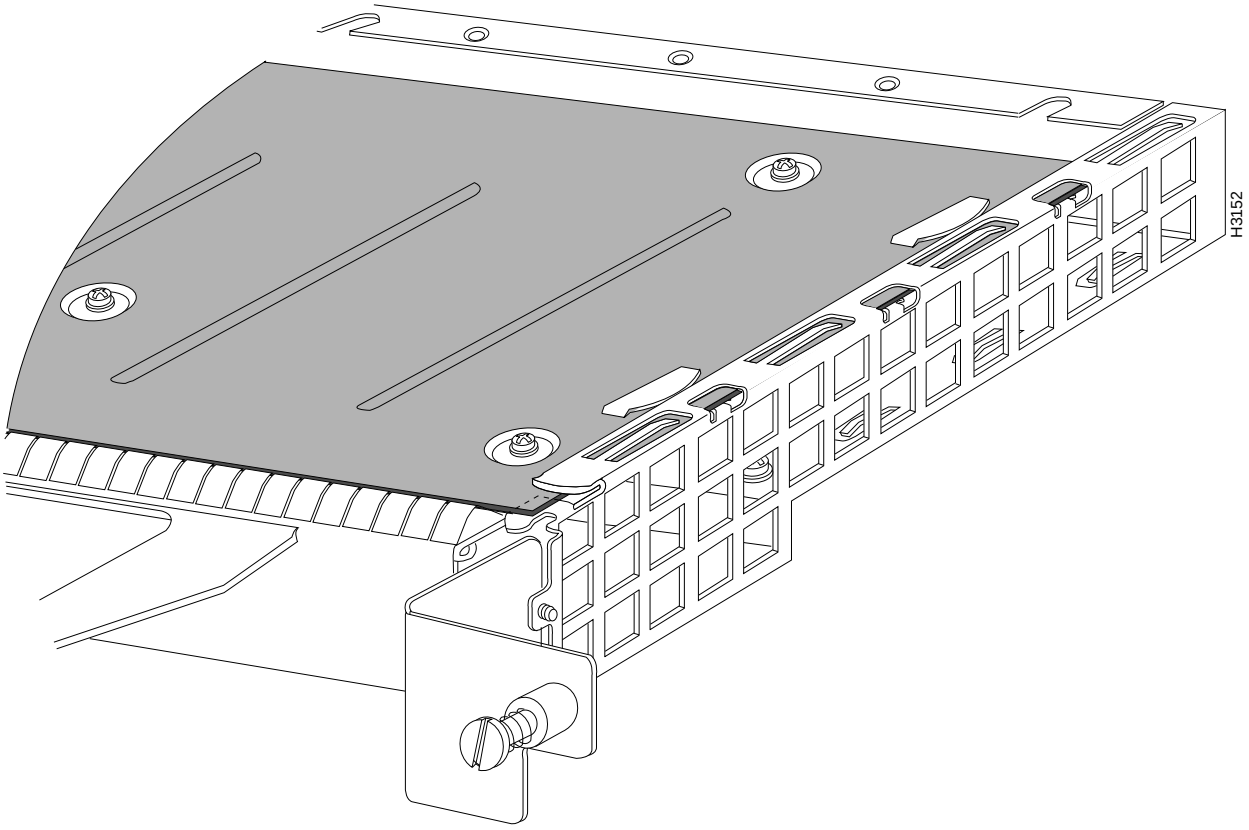


Step 10 Before you begin to insert the new service adapter in its slot, verify that the service adapter carrier is between the upper and lower slot edges, as shown in Figure 9. Do not jam the carrier between the slot edges.

Caution To ensure a positive ground attachment between the service adapter carrier and the VIP2 motherboard and service adapter slot, and to ensure that the connectors at the rear of the service adapter and slot mate properly, the carrier must be between the upper and lower slot edges, as shown in Figure 9.

Step 11 Carefully slide the new service adapter into the service adapter slot until the connector on the service adapter is completely mated with the connector on the motherboard.

Figure 9 Aligning the Carrier Edge with Upper and Lower Slot Edges, Partial View



Step 12 Install the screw in the rear of the service adapter slot. (See Figure 6 for its location.) Do not overtighten this screw.

Step 13 To replace the VIP2 in the chassis, follow the steps in the section "Installing a VIP2," in the configuration note *Second-Generation Second-Generation Versatile Interface Processor (VIP2) Installation and Configuration* (Document Number 78-2658-xx), which shipped with your VIP2.

Step 14 If disconnected, reconnect the interface cables to the interface processor.

This completes the procedure for installing a new service adapter or replacing a service adapter on a VIP2.

Configuring Compression on VIP2 Interfaces

If you installed a new CSA-equipped VIP2 or if you want to change the configuration of an existing interface, you must enter Configuration mode using the **configure** command. If you replaced a CSA that was previously configured, the system will recognize the new CSA and bring up each interface previously configured for compression.

After you verify that the new CSA is installed correctly (the enabled LED goes on), use the privileged-level **configure** command to configure compression on the new interfaces.

The following sections describe the commands for configuring compression on individual interfaces. Configuration commands are executed from the privileged level of the EXEC command interpreter, which usually requires password access. (See the section “Shutting Down an Interface” on page 16.) Refer to the description that follows and contact your system administrator, if necessary, to obtain access.

Selecting Chassis Slot, Port Adapter, and Port Numbers

The following section describes how to identify chassis slot, port adapter, and interface port numbers. You must specify these locations when configuring compression on an interface. A CSA installed in slot 0 or slot 1 of a VIP2 will only compress interfaces on the serial port adapter installed in the adjacent VIP2 slot.

Note Although the processor slots in the seven-slot Cisco 7507 and 13-slot Cisco 7513 are vertically oriented, both models use the same method for slot and port numbering.

In the router, physical port addresses specify the actual physical location of each interface port on the router interface processor end. (See Figure 10.) This address is composed of a three-part number in the format *chassis slot number/port adapter number/interface port number.*

- The first number identifies the chassis slot in which the VIP2 is installed (as shown in the example system in Figure 10).
- The second number identifies the physical port adapter number on the VIP2, and is either 0 or 1.
- The third number identifies the interface ports on each port adapter.

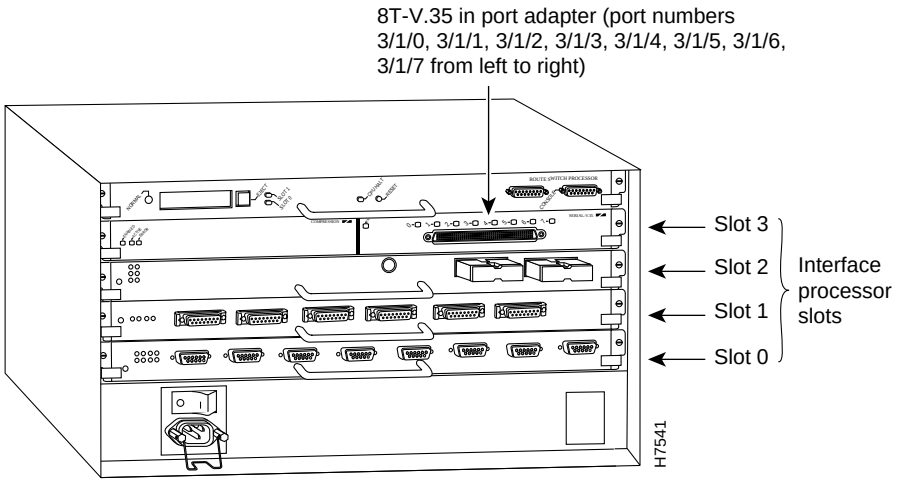
Interface ports on the port adapter maintain the same address regardless of whether other interface processors are installed or removed. However, when you move a VIP2 to a different slot, the first number in the address changes to reflect the new slot number.

Figure 10 shows some of the chassis slot, port adapter, and interface ports of a sample Cisco 7505 system. For example, on the 8T-V.35-equipped VIP2 in chassis slot 3, the addresses for the interface ports are 3/1/0 through 3/1/7 (chassis slot 3, port adapter slot 1, and interface ports 0 through 7). If the 8T-V.35 port adapter was in port adapter slot 2, these same interface ports would be numbered 3/2/0 through 3/2/7.

The first port adapter slot number is always 0; the second port adapter slot number is always 1. The individual interface port numbers always begin with 0. The number of additional ports depends on the number of ports on a port adapter. Port adapters can occupy either port adapter slot. There are no restrictions.

Note If you remove the 8T-V.35-equipped VIP2 (shown in Figure 10) from chassis slot 3 and install it in chassis slot 2, the addresses of those same ports become 2/1/0 through 2/1/7.

Figure 10 Serial Interface Port Number Example (Cisco 7505 Shown)



You can identify interface ports by physically checking the slot/port adapter/interface port location on the back of the router or by using **show** commands to display information about a specific interface or all interfaces in the router.

Using the EXEC Command Interpreter

Before you use the **configure** command to configure interfaces or change an existing configuration, you must enter the privileged level of the EXEC command interpreter with the **enable** command. The system will prompt you for a password if one has been set.

The system prompt for the privileged level ends with a pound sign (#) instead of an angle bracket (>). At the console terminal, enter the privileged level as follows:

Step 1 At the user-level EXEC prompt, enter the **enable** command. The EXEC prompts you for a privileged-level password, as follows:

```
Router> enable

Password:
```

Step 2 Enter the password (the password is case-sensitive). For security purposes, the password is not displayed.

Step 3 When you enter the correct password, the system displays the privileged-mode system prompt (#) as follows:

```
Router#
```

Proceed to the following section “Shutting Down an Interface” for instructions that explain how to shut down an interface.

Shutting Down an Interface

If you plan to remove an interface that you will not replace, or replace port adapters, shut down (disable) the interfaces to prevent anomalies when you reinstall the new or reconfigured interface processor. When you shut down an interface, it is designated *administratively down* in the **show** command displays.

Follow these steps to shut down an interface:

Step 1 Enter the privileged level of the EXEC command interpreter. (Refer to the previous section for instructions.)

Step 2 At the privileged-level prompt, enter Configuration mode and specify that the console terminal will be the source of the configuration subcommands, as follows:

```
Router# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#
```

Step 3 Specify the chassis slot, port adapter, and port of the first interface you want shut down by entering the subcommand **interface**, followed by the *type* (**serial**) and *chassis slot number/port adapter number/interface port number.* The example that follows is for a VIP2 in interface processor slot 3:

```
Router(config)# interface serial 3/1/0
```

Step 4 Enter the **shutdown** command, as follows:

```
Router(config-int)# shutdown
```

Step 5 To shut down additional interfaces, enter the chassis slot, port adapter, and port for each additional interface followed by the **shutdown** command. When you have finished shutting down interfaces, press **Ctrl-Z** (hold down the **Control** key while you press **Z**) to exit Configuration mode and return to the EXEC command interpreter prompt, as follows:

```
Router(config-int)# int serial 3/1/1
Router(config-int)# shutdown
Router(config-int)# int serial 3/1/2
Router(config-int)# shutdown
Ctrl-Z
Router#
```

Step 6 Write the new configuration to memory, as follows:

```
Router# copy running-config startup-config
[OK]
Router#
```

The system displays an OK message when the configuration has been stored.

Step 7 To verify that new interfaces are now in the correct state (shutdown), use the **show interface serial** *chassis slot number/port adapter number/interface port number* command to display the specific interface, or use the **show interfaces** command, without variables, to display the status of all interfaces.

```
Router# show int serial 3/1/0

Serial 3/1/0 is administratively down, line protocol is down
  Hardware is M8T-V.35
  [display text omitted]
```

Step 8 To reenable interfaces, repeat the previous steps, but use the **no shutdown** command in Step 4, then write the new configuration to memory, as follows:

```
Router(config)# int serial 3/1/0
Router(config-int)# no shutdown
Ctrl-Z
Router#

Router# copy running-config startup-config
[OK]
Router# show int serial 3/1/0

Serial 3/1/0 is up, line protocol is up
  Hardware is M8T-V.35
  [display text omitted]
```

For complete descriptions of software configuration commands, refer to the publications listed in the section "If You Need More Information" on page 2.

Configuring Interfaces for Compression

A CSA installed in slot 0 or slot 1 of a VIP2 will only compress interfaces on the serial port adapter installed in the adjacent VIP2 slot. For Cisco 7500 series routers that have an installed VIP2 with a CSA, there are three methods for configuring PPP compression.

- Software compression—Compression is implemented in the Cisco IOS release software installed in the router's main processor.
- Distributed compression—Compression is implemented in software that is installed in a VIP2. Distributed compression removes compression and decompression responsibilities from the router's main processor and is supported only by Cisco 7500 series routers that have an installed VIP2.
- Hardware compression—Compression is implemented in the CSA hardware installed in a VIP2. Hardware compression removes compression and decompression responsibilities from the VIP2 or the main processor installed in your router.

Use the **compress stac** [*software*|*distributed*] command to configure compression on interfaces. The **compress stac** command used without variables enables hardware compression on a specified interface; if a CSA is not installed in the router, distributed compression is enabled on the interface; if a VIP2 is not installed in the router, software compression is enabled on the interface.

If your Cisco 7500 series router has an installed VIP2 with a CSA, you can force distributed compression on an interface using the **compress stac distributed** command. You can also force software compression on an interface using the **compress stac software** command.

Following are instructions for configuring compression on a serial interface. Press the **Return** key after each step unless otherwise noted. At any time you can exit the privileged level and return to the user level by entering **disable** at the prompt as follows:

```
Router# disable

Router>
```

Complete the following steps to configure compression on serial interface using the **compress stac** [*ditributed*|*software*] command:

Step 1 Enter Configuration mode and specify that the console terminal will be the source of the configuration subcommands, as follows:

```
Router# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#
```

Step 2 Specify the chassis slot, port adapter, and port of the first interface you want to configure for compression by entering the subcommand **interface**, followed by the *type* (**serial**) and *chassis slot number/port adapter number/interface port number.* The example that follows is for a VIP2 in interface processor slot 3:

```
Router(config)# interface serial 3/1/0
```

Step 3 Specify PPP encapsulation for the interface as follows:

```
router(config-int)# encapsulattion PPP
```

Note Hardware and distributed compression are only supported on PPP links.

Step 4 Enter the **compress stac** [*ditributed*|*software*] command as follows:

```
router(config-int)# compress stac
```

Step 5 To configure compression on additional interfaces, enter the chassis slot, port adapter, and port of each additional interface followed by the **compress stac** [*ditributed*|*software*] command. When you have finished configuring compression on interfaces, press **Ctrl-Z** (hold down the **Control** key while you press **Z**) to exit Configuration mode and return to the EXEC command interpreter prompt, as follows:

```
Router(config-int)# int serial 3/1/1
Router(config-int)# compress stac
Router(config-int)# int serial 3/1/2
Router(config-int)# compress stac
Ctrl-Z
Router#
```

Step 6 Write the new configuration to memory, as follows:

```
Router# copy running-config startup-config
[OK]
Router#
```

The system displays an OK message when the configuration has been stored.

Step 7 To verify that compression is configured on the interfaces, use the **show compress** command to display the status of all interfaces in the system. Refer to the following section, “Checking the Configuration,” for examples of the **show compress** command.

Step 8 To remove compression from the interfaces, repeat the previous steps, but use the **no compress** command in Step 4; then write the new configuration to memory, as follows:

```
Router(config)# int serial 3/1/0
Router(config-int)# no compress
Ctrl-Z
Router#

Router# copy running-config startup-config
[OK]
```

After removing compression from an interface, the interface will not appear in the output from the **show compress** command. To check the configuration of the interfaces, proceed to the section "Checking the Configuration."

Checking the Configuration

After configuring the interfaces for compression, use the **show** commands to display the status of the interfaces, and use the **ping** and **loopback** commands to check connectivity.

Using show Commands to Verify Compression and System Configuration

The following steps use **show** commands to verify that the interfaces are configured and operating correctly.

Step 1 Display the system hardware configuration with the **show version** command. Ensure that the list includes the CSA.

Step 2 Display all the interfaces configured for compression and the compression type (hardware, distributed, or software) with the **show compress** command. Verify that the compression type is configured on the appropriate interface.

Step 3 Display the type of port adapters is installed on a VIP2 in your system with the **show diag** command.

Step 4 Specify one of the new interfaces with the **show interfaces** *type slot/port adapter/interface* command and verify that the first line of the display specifies the interface with the correct slot number. Also verify that the interface and line protocol are in the correct state: up or down.

Step 5 Display the protocols configured for the entire system and specific interfaces with the **show protocols** command. If necessary, return to Configuration mode to add or remove protocol routing on the system or specific interfaces.

Step 6 Display the running configuration file with the **show running-config** command. Display the configuration stored in NVRAM using the **show startup-config** command. Verify that the configuration is accurate for the system and each interface.

If the displays indicate that the hardware is not functioning properly, ensure that the network interface is properly connected and terminated. If you still have problems, contact a customer service representative for assistance.

The **show version** (or **show hardware**) command displays the configuration of the system hardware (the number of each interface processor type installed), the software version, the names and sources of configuration files, and the boot images. Following is an example of the **show version** command used with a Cisco 7500 series system:

```
Router# show version

Cisco Internetwork Operating System Software
IOS (tm) GS Software (RSP-A), Version 11.1(6) [amcrae 125]
Copyright (c) 1986-1996 by cisco Systems, Inc.
Compiled Sat 10-Aug-96 17:56 by amcrae
Image text-base: 0x600108A0, data-base: 0x60952000

ROM: System Bootstrap, Version 5.3(16645) [szhang 571], INTERIM SOFTWARE
ROM: GS Software (RSP-BOOT-M), Version 11.1(472), RELEASE SOFTWARE (fc1)

gshen_7500 uptime is 5 days, 4 minutes
System restarted by reload
System image file is "rsp-jv-mz", booted via slot0

cisco RSP2 (R4600) processor with 16384K bytes of memory.
R4600 processor, Implementation 33, Revision 2.0
Last reset from power-on
G.703/E1 software, Version 1.0.
SuperLAT software copyright 1990 by Meridian Technology Corp).
Bridging software.
X.25 software, Version 2.0, NET2, BFE and GOSIP compliant.
TN3270 Emulation software (copyright 1994 by TGV Inc).
Chassis Interface.
1 EIP controller (6 Ethernet).
1 VIP2 controller (8 Serial)(1 Compression).
6 Ethernet/IEEE 802.3 interfaces.
1 HSSI network interface.
1 Compression port adapter.
125K bytes of non-volatile configuration memory.

8192K bytes of Flash PCMCIA card at slot 0 (Sector size 128K).
8192K bytes of Flash internal SIMM (Sector size 256K).
Configuration register is 0x0
```

To determine which interfaces in the router are configured for compression, use the **show compress** command. All interfaces configured for compression are displayed, as well as the type of compression configured on each interface, as shown in the following example (the **show compress** command only displays interfaces that are configured for compression):

```
Router# sh compress
Serial3/1/0
     Distributed h/w compression enabled
     Compressed bytes sent:      4932 bytes   0 Kbits/sec  ratio: 10.500
     Compressed bytes recv:      5019 bytes   0 Kbits/sec  ratio: 10.019
     restarts: 10
     last clearing of counters: 165828 seconds

 Serial3/1/1
     Distributed h/w compression enabled
     Compressed bytes sent:      4942 bytes   0 Kbits/sec  ratio: 10.700
     Compressed bytes recv:      5029 bytes   0 Kbits/sec  ratio: 10.009
     restarts: 10
     last clearing of counters: 162528 seconds
```

```
Serial3/1/2
     Distributed h/w compression enabled
     Compressed bytes sent:      4922 bytes   0 Kbits/sec  ratio: 10.720
     Compressed bytes recv:      5019 bytes   0 Kbits/sec  ratio: 10.119
     restarts: 10
     last clearing of counters: 162528 seconds

Serial3/1/3
     Distributed h/w compression enabled
     Compressed bytes sent:      2836 bytes   0 Kbits/sec  ratio: 8.845
     Compressed bytes recv:      3080 bytes   0 Kbits/sec  ratio: 8.034
     restarts: 9
     last clearing of counters: 162528 seconds
Serial3/1/4
     Distributed h/w compression enabled
     Compressed bytes sent:      2736 bytes   0 Kbits/sec  ratio: 8.835
     Compressed bytes recv:      3180 bytes   0 Kbits/sec  ratio: 8.014
     restarts: 9
     last clearing of counters: 162528 seconds

Serial3/1/5
     Distributed h/w compression enabled
     Compressed bytes sent:      2832 bytes   0 Kbits/sec  ratio: 8.622
     Compressed bytes recv:      3088 bytes   0 Kbits/sec  ratio: 8.321
     restarts: 9
     last clearing of counters: 162528 seconds

Serial3/1/6
     Distributed h/w compression enabled
     Compressed bytes sent:      2110 bytes   0 Kbits/sec  ratio: 8.845
     Compressed bytes recv:      3432 bytes   0 Kbits/sec  ratio: 8.734
     restarts: 9
     last clearing of counters: 162528 seconds

Serial3/1/7
     Distributed h/w compression enabled
     Compressed bytes sent:      2829 bytes   0 Kbits/sec  ratio: 8.335
     Compressed bytes recv:      3676 bytes   0 Kbits/sec  ratio: 8.214
     restarts: 9
     last clearing of counters: 162528 seconds
```

To determine the type of port adapters installed on a VIP2 in your system, use the **show diag** *slot* command. Specific port adapter information is displayed, as shown in the following example of a 8T-V.35 port adapter in chassis slot 3:

```
Router# show diag 3
Slot 3:
        Physical slot 3, ~physical slot 0xF, logical slot 0, CBus 0
        Microcode Status 0x4
        Master Enable, LED, WCS Loaded
        Board is analyzed
        Pending I/O Status: None
        EEPROM format version 1
        VIP2 controller, HW rev 2.1, board revision UNKNOWN
        Serial number: 03341394  Part number: 73-1684-02
        Test history: 0x00        RMA number: 00-00-00
        Flags: cisco 7000 board; 7500 compatible

        EEPROM contents (hex):
          0x20: 01 15 02 01 00 32 FC 52 49 06 94 02 00 00 00 00
          0x30: 07 2E 00 2A 1A 00 00 00 00 00 00 00 00 00 00 00

        Slot database information:
        Flags: 0x4      Insertion time: 0x8E11A48 (04:51:14 ago)
```

```
Controller Memory Size: 8 MBytes DRAM, 1024 KBytes SRAM

PA Bay 0 Information:
        Compression PA, 3M SRAM, 0 ports
        EEPROM format version 255
        HW rev FF.FF, Board revision UNKNOWN
        Serial number: 4294967295  Part number: 255-65535-255

PA Bay 1 Information:
        Mueslix Serial PA, 8 ports
        EEPROM format version 1
        HW rev FF.FF, Board revision UNKNOWN
        Serial number: 4294967295  Part number: 255-65535-255
```

If the displays indicate that the hardware is not functioning properly, ensure that the network interfaces are properly connected and terminated. If you still have problems bringing up or shutting down an interface, contact a customer service representative for assistance.

To display information about a specific interface, use the **show interfaces** command with the interface type and port address in the format **show interfaces** [*type slot/port adapter/port*].

Following is an example of how the **show interfaces** [*type slot/port adapter/port*] command displays status information (including the physical slot and port address) for the interfaces you specify. In these examples, most of the status information for each interface is omitted, and the eight serial interfaces (0–7) are in chassis slot 3, in port adapter slot 1. (Interfaces are administratively shut down until you enable them.)

```
Router# sh int serial 3/1/0
Serial3/1/0 is up, line protocol is up
  Hardware is cyBus Serial
  Internet address is 1.1.1.0
  MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec, rely 255/255, load 1/255
  Encapsulation PPP, loopback not set, keepalive not set
(display text omitted]

Router# sh int serial 3/1/1
Serial3/1/1 is up, line protocol is up
  Hardware is cyBus Serial
  Internet address is 1.1.1.1
  MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec, rely 255/255, load 1/255
  Encapsulation PPP, loopback not set, keepalive not set
(display text omitted]

Router# sh int serial 3/1/2
Serial3/1/2 is up, line protocol is up
  Hardware is cyBus Serial
  Internet address is 1.1.1.2
  MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec, rely 255/255, load 1/255
  Encapsulation PPP, loopback not set, keepalive not set
(display text omitted]

Router# sh int serial 3/1/3
Serial3/1/3 is up, line protocol is up
  Hardware is cyBus Serial
  Internet address is 1.1.1.3
  MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec, rely 255/255, load 1/255
  Encapsulation PPP, loopback not set, keepalive not set
(display text omitted]
```

```
Router# sh int serial 3/1/4
Serial3/1/4 is up, line protocol is up
  Hardware is cyBus Serial
  Internet address is 1.1.1.4
  MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec, rely 255/255, load 1/255
  Encapsulation PPP, loopback not set, keepalive not set
(display text omitted]

Router# sh int serial 3/1/5
Serial3/1/5 is up, line protocol is up
  Hardware is cyBus Serial
  Internet address is 1.1.1.5
  MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec, rely 255/255, load 1/255
  Encapsulation PPP, loopback not set, keepalive not set
(display text omitted]

Router# sh int serial 3/1/6
Serial3/1/6 is up, line protocol is up
  Hardware is cyBus Serial
  Internet address is 1.1.1.6
  MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec, rely 255/255, load 1/255
  Encapsulation PPP, loopback not set, keepalive not set
(display text omitted]

Router# sh int serial 3/1/7
Serial3/1/7 is up, line protocol is up
  Hardware is cyBus Serial
  Internet address is 1.1.1.7
  MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec, rely 255/255, load 1/255
  Encapsulation PPP, loopback not set, keepalive not set
(display text omitted]
```

With the VIP2 configuration shown in Figure 10, an 8T-V.35 port adapter is in port adapter slot 1. With the **show interfaces** *type slot/port adapter/port* command, use arguments such as the interface type (serial, and so forth) and the slot, port adapter, and port numbers (slot/port adapter/port) to display information about a specific serial interface only.

The following example of the **show interfaces serial** *slot/port adapter/port* command shows all of the information specific to the first 8T-V.35 interface port (interface port 0) in chassis slot 3, port adapter slot 1:

```
Router# sh int serial 3/1/0
Serial3/1/0 is up, line protocol is up
  Hardware is cyBus Serial
  Internet address is 1.1.1.0
  MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec, rely 255/255, load 1/255
  Encapsulation PPP, loopback not set, keepalive not set
  Last input 2d18h, output 00:00:54, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/75/0 (size/max/drops); Total output drops: 0
  Queueing strategy: weighted fair
  Output queue: 0/64/0 (size/threshold/drops)
     Conversations  0/1 (active/max active)
     Reserved Conversations 0/0 (allocated/max allocated)
```

```
5 minute input rate 0 bits/sec, 0 packets/sec
5 minute output rate 0 bits/sec, 0 packets/sec
   16 packets input, 1620 bytes, 0 no buffer
   Received 0 broadcasts, 0 runts, 0 giants
   0 input errors, 0 CRC, 0 frame, 0 overrun, 1 ignored, 0 abort
   3995 packets output, 1147800 bytes, 0 underruns
   0 output errors, 0 collisions, 0 interface resets
   0 output buffer failures, 0 output buffers swapped out
   1 carrier transitions
   RTS up, CTS up, DTR up, DCD up, DSR up
```

For complete VIP2 command descriptions and examples, refer to the publications listed in the section "If You Need More Information" on page 2.

Using the ping and loopback Commands

The *packet internet groper* (**ping**) and **loopback** commands allow you to verify that an interface port is functioning properly and to check the path between a specific port and connected devices at various locations on the network. You can also use the **show compress** command to view the interfaces in the router that are configured for compression.

This section provides brief descriptions of the **ping** and **loopback** commands. After you verify that the system and VIP2 have booted successfully and are operational, you can use these commands to verify the status of interface ports. Refer to the publications listed in the section "If You Need More Information" on page 2, for detailed command descriptions and examples.

The **ping** command sends an echo request out to a remote device at an IP address that you specify. After sending a series of signals, the command waits a specified time for the remote device to echo the signals. Each returned signal is displayed as an exclamation point (!) on the console terminal; each signal that is not returned before the specified timeout is displayed as a period (.). A series of exclamation points (!!!!!) indicates a good connection; a series of periods (.....) or the messages [timed out] or [failed] indicate that the connection failed.

Following is an example of a successful **ping** command to a remote server with the address 1.1.1.10:

```
Router# ping 1.1.1.10 <Return>
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echoes to 1.1.1.10, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/15/64 ms
Router#
```

If the connection fails, verify that you have the correct IP address for the server and that the server is active (powered on), and repeat the **ping** command.

The loopback test allows you to detect and isolate equipment malfunctions by testing the connection between a port adapter interface and a remote device such as a modem or a CSU/DSU. The **loopback** subcommand sends a series of packets out to and through the device (or cable), and back to the port adapter interface. If the packets complete the loop, the connection is good. If not, you can isolate a fault to the remote device or interface cable in the path of the loopback test.

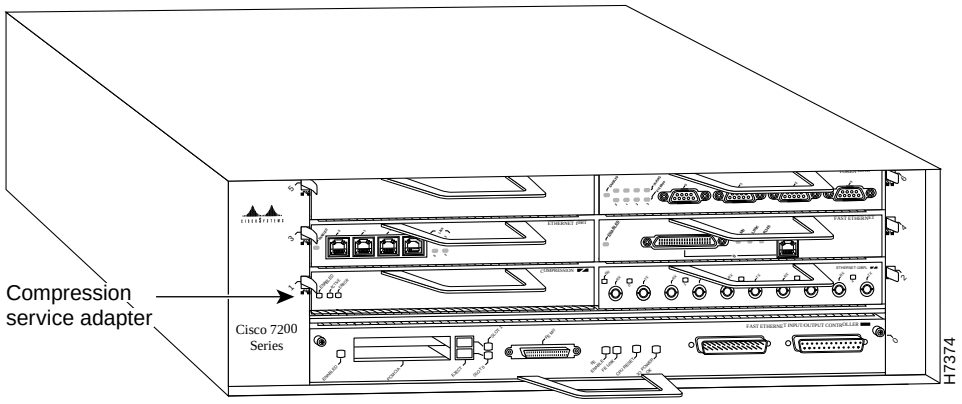
Note You must configure a clock rate on the port *before* performing a loopback test.

For complete descriptions of interface subcommands and the configuration options available for Cisco 7000 and Cisco 7500 series-related interfaces, refer to the publications listed in the section "If You Need More Information" on page 2.

Cisco 7200 Series Routers and the Compression Service Adapter

The CSA is used in the Cisco 7200 series routers and can be installed in any of the available port adapter slots; however, the Cisco 7200 series routers only support one installed CSA. A CSA installed in a Cisco 7200 series router will compress interfaces on serial port adapters installed in any port adapter slot. Figure 11 shows a CSA installed in port adapter slot 1 of a Cisco 7206.

Figure 11 Cisco 7206 with a CSA in Port Adapter Slot 1



The following sections include information that is specific to the CSA and its use in the Cisco 7200 series routers:

- Installing or Replacing a Port/Service Adapter in Cisco 7200 Series Routers, page 25
- Configuring Compression on 7200 Series Interfaces, page 28

Installing or Replacing a Port/Service Adapter in Cisco 7200 Series Routers

The following sections explain how to install and replace a new service adapter or port adapter in a Cisco 7200 series router. The steps for doing so are the same; therefore, the term *adapter* in the following sections applies to service adapters as well as port adapters, unless noted otherwise.

Depending on your circumstances, you might need to install a new adapter in a Cisco 7200 series router or replace a failed adapter in the field. In either case no tools are necessary; all adapters available for the Cisco 7200 series connect directly to the router midplane and are locked into position by a port adapter lever.

When removing and replacing an adapter, you will need an antistatic mat onto which you can place a removed adapter and an antistatic container into which you can place a failed adapter for shipment back to the factory.

Note The Cisco 7200 series routers support OIR; therefore, you do not have to power down the Cisco 7200 series routers when removing and replacing an adapter.

When a port adapter slot in a Cisco 7200 chassis is not in use, a blank port adapter must fill the empty slot to allow the router to conform to EMI emissions requirements and to allow proper air flow across the adapters. If you plan to install an adapter in a slot that is not in use, you must first remove the blank port adapter.

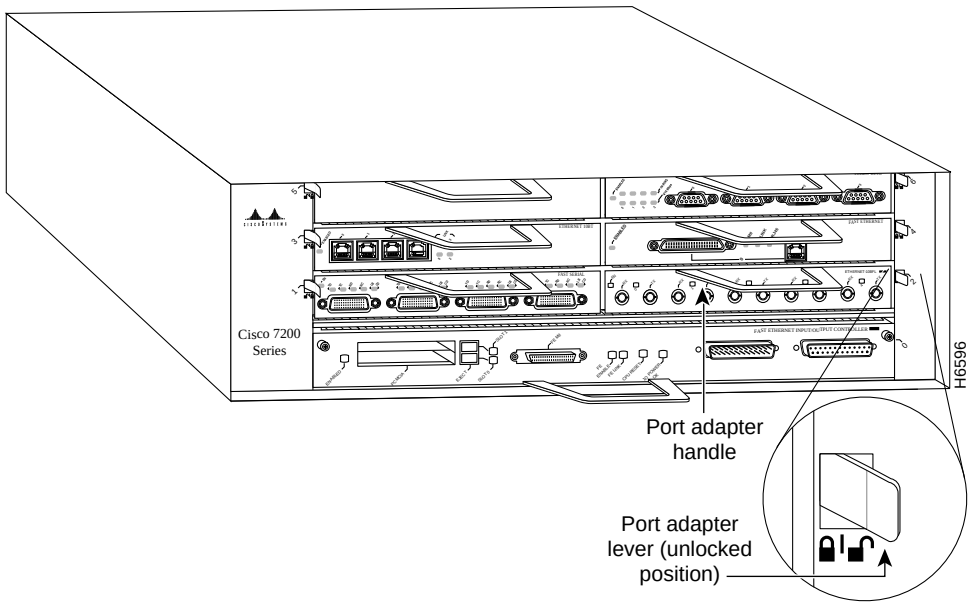
Removing an Adapter

Following is the procedure for removing an adapter from a Cisco 7200 series router:

Step 1 Attach an ESD-preventative wrist strap between you and an unfinished chassis surface.

Step 2 Place the port adapter lever for the desired slot in the unlocked position. The lever remains in the unlocked position. (Refer to Figure 12.)

Figure 12 Placing the Port Adapter Lever in the Unlocked Position (Cisco 7206 shown)



Step 3 Grasp the handle on the adapter and pull the adapter from the midplane, about half way out of its slot. If you are removing a blank adapter or a CSA, pull the blank adapter or CSA from the chassis slot and continue from Step 6.

Note As you disengage port adapters from the router midplane, OIR administratively shuts down all active interfaces on the port adapter. There are no interfaces on a CSA. As you disengage the CSA from the router midplane, software compression is immediately enabled on interfaces that were previously configured for hardware compression. After replacing a new CSA in the slot, hardware compression is enabled on the interfaces configured for compression.

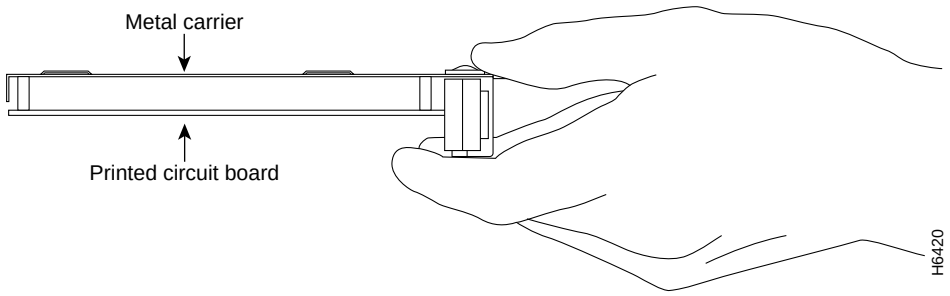
Step 4 and Step 5 apply only to port adapters.

Step 4 With the port adapter half way out of the slot, disconnect all cables from the port adapter.

Step 5 After disconnecting the cables, pull the port adapter from its chassis slot.

Caution Always handle the adapter by the carrier edges and handle; never touch the adapter's components or connector pins. (Refer to Figure 13.)

Figure 13 Handling an Adapter



Step 6 Place the adapter on an antistatic surface with its components facing upward, or in a static shielding bag. If the adapter will be returned to the factory, immediately place it in a static shielding bag.

This completes the procedure for removing an adapter from a Cisco 7200 series router.

Replacing an Adapter

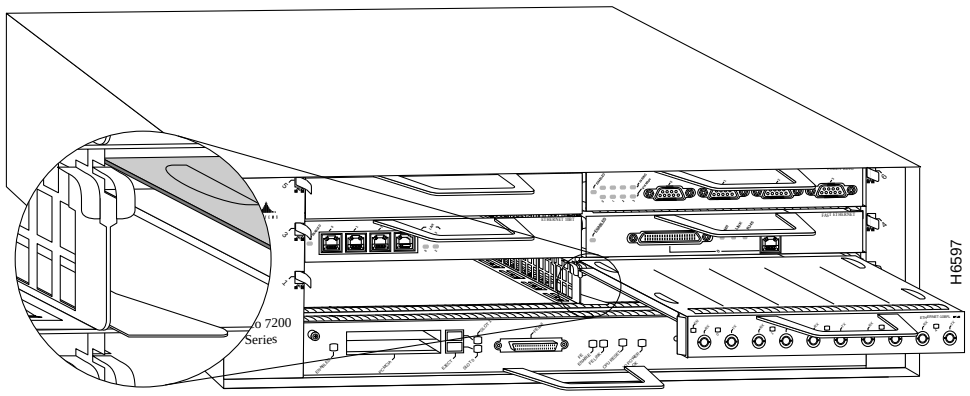
Following is the procedure for installing a new adapter in a Cisco 7200 series router:

Step 1 Attach an ESD-preventative wrist strap between you and an unfinished chassis surface.

Step 2 Use both hands to grasp the adapter by its metal carrier edges and position the adapter so that its components are downward. (Refer to Figure 13).

Step 3 Align the left and right edge of the adapter metal carrier between the guides in the port adapter slot. (Refer to Figure 14.)

Figure 14 Aligning the Adapter Metal Carrier Between the Slot Guides (Cisco 7206 Shown)



Step 4 With the metal carrier aligned in the slot guides, gently slide the adapter half way into the slot. If you are installing a service adapter, carefully slide the service adapter all the way into the slot until you feel the service adapter's connectors mate with the midplane and continue from Step 7.

Caution Do not slide a adapter all the way into the slot until you have connected all required cables. Trying to do so will disrupt normal operation of the router.

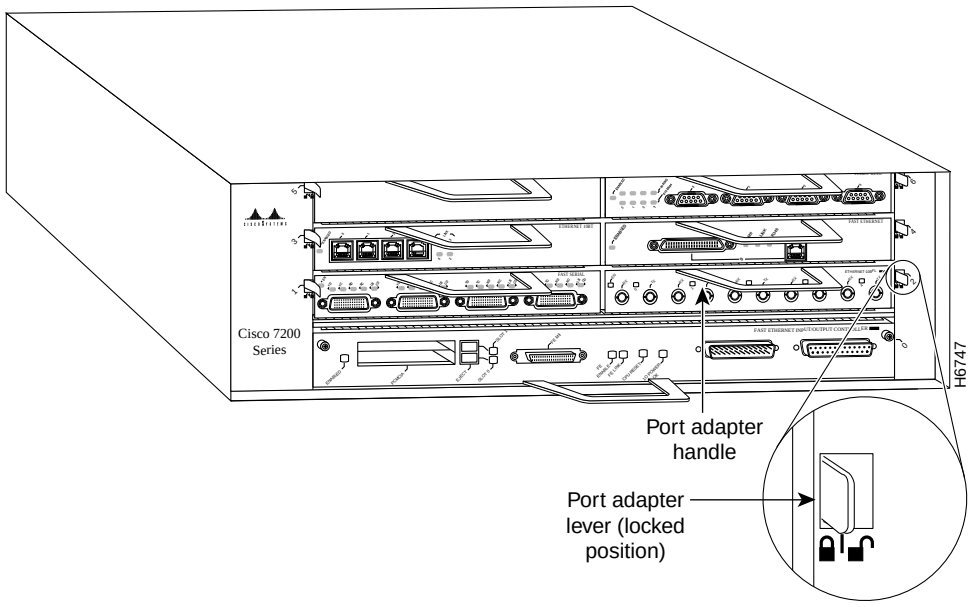
Step 5 With the adapter half way in the slot, connect all required cables to the adapter.

Step 6 After connecting all required adapter cables, carefully slide the adapter all the way into the slot until you feel the adapter's connectors mate with the midplane.

Step 7 After feeling the connector's mate, move the port adapter lever to the locked position. Figure 15 shows the port adapter lever in the locked position.

Note If the port adapter lever does not move to the locked position, the adapter is not completely seated in the midplane. Carefully pull the adapter half way out of the slot, reinsert it, and move the adapter lever to the locked position.

Figure 15 Placing the Port Adapter Lever in the Locked Position (Cisco 7206 shown)



This completes the procedure for installing a new adapter in a Cisco 7200 series router.

Configuring Compression on 7200 Series Interfaces

If you installed a new CSA or if you want to change the configuration of an existing interface, you must enter Configuration mode using the **configure** command. If you replaced a CSA that was previously configured, the system will recognize the new CSA and bring up each interface previously configured for compression.

After you verify that the new CSA is installed correctly (the enabled LED goes on), use the privileged-level **configure** command to configure compression on the new interfaces.

The following sections describe the commands for configuring compression on individual interfaces. Configuration commands are executed from the privileged level of the EXEC command interpreter, which usually requires password access. (See the section "Shutting Down an Interface" on page 16.) Refer to the description that follows and contact your system administrator, if necessary, to obtain access.

Selecting Port Adapter Slot and Interface Port Numbers

The following section describes how to identify port adapter slot and interface port numbers. You must specify these locations when configuring compression on an interface.

Physical port addresses specify the actual physical location of each interface port on the router. (See Figure 16.) This address is composed of a two-part number in the format *port adapter slot number/interface port number*, as follows:

- The first number identifies the chassis slot in which the port adapter is installed.
- The second number identifies the interface ports on each port adapter, which are always numbered in sequence as interface 0 through 3 (on a four interface port adapter).

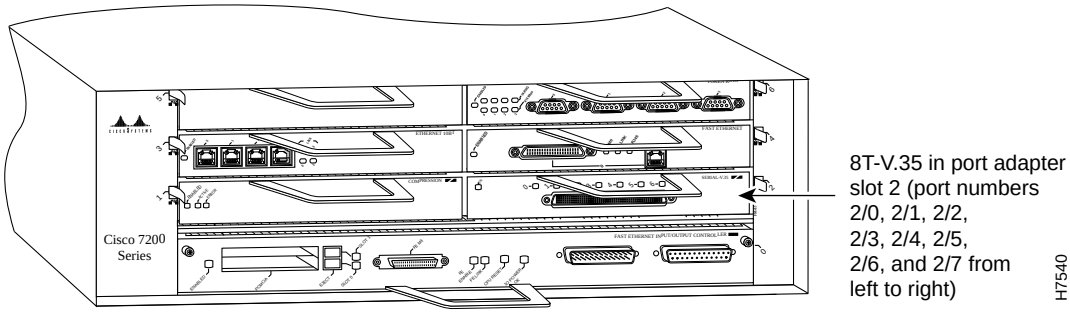
Interface ports on port adapters maintain the same address regardless of whether other port adapters are installed or removed. However, when you move a port adapter to a different slot, the first number in the address changes to reflect the new slot number.

Figure 16 shows the port adapter slot and interface ports of an 8T-V.35 port adapter in slot 2 of a Cisco 7206 router. The port adapter slot numbers start with 1 and continue through 6 for the Cisco 7206 and continue through 4 for the Cisco 7204 (slot 0 is always reserved for the Fast Ethernet port on the I/O controller—if present). The individual interface port numbers always begin with 0. The number of additional ports depends on the number of ports on a port adapter. Port adapters and service adapters can occupy any port adapter slot. There are no restrictions.

Note You can place a CSA in any available slot in a Cisco 7200 series router; however, the Cisco 7200 series routers support only one installed CSA.

For example, the addresses of the interface ports on the 8T-V.35 port adapter in chassis slot 2 are 2/0 through 2/7 (chassis slot 2 and interface ports 0 through 7). If the 8T-V.35 port adapter was in port adapter slot 1, these same interface ports would be numbered 1/0 through 1/7.

Figure 16 Serial Interface Port Number Example



You can identify interface ports by physically checking the port adapter slot/interface port location on the front of the router, or by using software commands to display information about a specific interface or all interfaces in the router.

Using the EXEC Command Interpreter

Before you use the **configure** command to configure the interfaces or change an existing configuration, you must enter the privileged level of the EXEC command interpreter with the **enable** command. The system will prompt you for a password if one has been set.

The system prompt for the privileged level ends with a pound sign (#) instead of an angle bracket (>). At the console terminal, enter the privileged level as follows:

Step 1 At the user-level EXEC prompt, enter the **enable** command. The EXEC prompts you for a privileged-level password, as follows:

```
Router> enable

Password:
```

Step 2 Enter the password (the password is case-sensitive). For security purposes, the password is not displayed.

Step 3 When you enter the correct password, the system displays the privileged-mode system prompt (#) as follows:

```
Router#
```

Proceed to the following section “Shutting Down an Interface” for instructions that explain how to shut down an interface.

Shutting Down an Interface

If you plan to remove an interface that you will not replace, or replace port adapters, shut down (disable) the interfaces to prevent anomalies when you reinstall the new or reconfigured port adapter. When you shut down an interface, it is designated *administratively down* in the **show** command displays.

Follow these steps to shut down an interface:

Step 1 Enter the privileged level of the EXEC command interpreter. (Refer to the previous section for instructions.)

Step 2 At the privileged-level prompt, enter Configuration mode and specify that the console terminal will be the source of the configuration subcommands, as follows:

```
Router# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#
```

Step 3 Specify the port adapter slot and port of the first interface you want shut down by entering the subcommand **interface**, followed by the *type* (**serial**) and *port adapter slot/interface port number*. The example that follows is for an 8T-V.35 port adapter in slot 2:

```
Router(config)# interface serial 2/0
```

Step 4 Enter the **shutdown** command, as follows:

```
Router(config-int)# shutdown
```

Step 5 To shut down additional interfaces, enter the chassis slot, port adapter, and port for each additional interface followed by the **shutdown** command. When you have finished shutting down interfaces, press **Ctrl-Z** (hold down the **Control** key while you press Z) to exit Configuration mode and return to the EXEC command interpreter prompt, as follows:

```
Router(config-int)# int serial 2/1
Router(config-int)# shutdown
Router(config-int)# int serial 2/2
Router(config-int)# shutdown
Ctrl-Z
Router#
```

Step 6 Write the new configuration to memory, as follows:

```
Router# copy running-config startup-config
[OK]
Router#
```

The system displays an OK message when the configuration has been stored.

Step 7 To verify that new interfaces are now in the correct state (shutdown), use the **show interface serial** *port adapter slot/interface port number* command to display the specific interface, or use the **show interfaces** command, without variables, to display the status of all interfaces.

```
Router# show int serial 2/0

Serial 2/0 is administratively down, line protocol is down
  Hardware is M8T-V.35
  [display text omitted]
```

Step 8 To reenable interfaces, repeat the previous steps, but use the **no shutdown** command in Step 4; then write the new configuration to memory, as follows:

```
Router(config)# int serial 2/0
Router(config-int)# no shutdown
Ctrl-Z
Router#

Router# copy running-config startup-config
[OK]
Router# show int serial 2/0

Serial 2/0 is up, line protocol is up
  Hardware is M8T-V.35
  [display text omitted]
```

For complete descriptions of software configuration commands, refer to the publications listed in the section “If You Need More Information” on page 2.

Configuring Interfaces for Compression

A CSA installed in Cisco 7200 series router will compress interfaces on serial port adapters installed in any port adapter slot. For Cisco 7200 series routers that have an installed CSA, there are two methods for configuring PPP compression:

- Software compression—Compression is implemented in the Cisco IOS release software installed in the router's main processor.
- Hardware compression—Compression is implemented in the CSA hardware installed in a port adapter slot. Hardware compression removes compression and decompression responsibilities from the main processor installed in your router.

Use the **compress stac** [*software*] command to configure compression on interfaces. The **compress stac** command used without the *software* variable enables hardware compression on a specified interface; if a CSA is not installed in the router, software compression is enabled on the interface.

If your Cisco 7200 series router has an installed CSA, you can force software compression on an interface using the **compress stac software** command.

Following are instructions for configuring compression on a serial interface. Press the **Return** key after each step unless otherwise noted. At any time you can exit the privileged level and return to the user level by entering **disable** at the prompt as follows:

```
Router# disable

Router>
```

Complete the following steps to configure compression on a serial interface using the **compress stac** [*software*] command:

Step 1 Enter Configuration mode and specify that the console terminal will be the source of the configuration subcommands, as follows:

```
Router# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#
```

Step 2 Specify the port adapter and interface port of the first interface you want to configure for compression by entering the subcommand **interface**, followed by the *type* (**serial**) and *port adapter slot/interface port number.* The example that follows is for an 8T-V.35 port adapter in port adapter slot 2:

```
Router(config)# interface serial 2/0
```

Step 3 Specify PPP encapsulation for the interface as follows:

```
router(config-int)# encapsulation PPP
```

Note Hardware and distributed compression are only supported on PPP links.

Step 4 Enter the **compress stac** [*software*] command as follows:

```
router(config-int)# compress stac
```

Step 5 To configure compression on additional interfaces, enter the port adapter slot and port of each additional interface followed by the **compress stac** [*software*] command. When you have finished configuring compression on interfaces, press **Ctrl-Z** (hold down the **Control** key while you press **Z**) to exit Configuration mode and return to the EXEC command interpreter prompt, as follows:

```
Router(config-int)# int serial 2/1
Router(config-int)# compress stac
Router(config-int)# int serial 2/2
Router(config-int)# compress stac
Ctrl-Z
Router#
```

Step 6 Write the new configuration to memory, as follows:

```
Router# copy running-config startup-config
[OK]
Router#
```

The system displays an OK message when the configuration has been stored.

Step 7 To verify compression is configured on the interfaces use the **show compress** command to display the status of all interfaces in the system. Refer to the following section "Checking the Configuration" for examples of the **show compress** command.

Step 8 To remove compression from the interfaces, repeat the previous steps, but use the **no compress** command in Step 4, then write the new configuration to memory, as follows:

```
Router(config)# int serial 2/0
Router(config-int)# no compress
Ctrl-Z
Router#

Router# copy running-config startup-config
[OK]
```

After removing compression from an interface, the interface will not appear in the output from the **show compress** command. To check the configuration of the interfaces, proceed to the section "Checking the Configuration."

Checking the Configuration

After configuring the interfaces for compression, use the **show** commands to display the status of the interfaces and the **ping** and **loopback** commands to check connectivity.

Using show Commands to Verify Compression and System Configuration

The following steps use **show** commands to verify that the interfaces are configured and operating correctly.

Step 1 Display the system hardware configuration with the **show version** command. Ensure that the list includes the CSA.

Step 2 Display all the interfaces configured for compression and the compression type (hardware or software) with the **show compress** command. Verify that the compression type is configured on the appropriate interface.

Step 3 Display the type of port adapters is installed in your Cisco 7200 series router with the **show diag** command.

Step 4 Specify one of the new interfaces with the **show interfaces** *type port adapter slot/interface* command and verify that the first line of the display specifies the interface with the correct slot number. Also verify that the interface and line protocol are in the correct state: up or down.

Step 5 Display the protocols configured for the entire system and specific interfaces with the **show protocols** command. If necessary, return to Configuration mode to add or remove protocol routing on the system or specific interfaces.

Step 6 Display the running configuration file with the **show running-config** command. Display the configuration stored in NVRAM using the **show startup-config** command. Verify that the configuration is accurate for the system and each interface.

If the displays indicate that the hardware is not functioning properly, ensure that the network interface is properly connected and terminated. If you still have problems, contact a customer service representative for assistance.

The **show version** (or **show hardware**) command displays the configuration of the system hardware (the number of each interface processor type installed), the software version, the names and sources of configuration files, and the boot images. Following is an example of the **show version** command used with a Cisco 7500 series system:

```
Router# show version

Cisco Internetwork Operating System Software
IOS (tm) GS Software (RSP-A), Version 11.1(6) [amcrae 125]
Copyright (c) 1986-1996 by cisco Systems, Inc.
Compiled Sat 10-Aug-96 17:56 by amcrae
Image text-base: 0x600108A0, data-base: 0x60952000

ROM: GS Software (RSP-BOOT-M), Version 11.1(6), RELEASE SOFTWARE (fc1)

gshen_7500 uptime is 5 days, 4 minutes
System restarted by reload
System image file is "rsp-jv-mz", booted via slot0

cisco 7206 (NPE150) processor with 12288K/4096K bytes of memory.
R4700 processor, Implementation 33, Revision 1.0 (Level 2 Cache)
Last reset from power-on
Bridging software.
```

```
SuperLAT software copyright 1990 by Meridian Technology Corp.
X.25 software, Version 2.0, NET2, BFE and GOSIP compliant.
TN3270 Emulation software (copyright 1994 by TGV Inc).
Chassis Interface.
4 Ethernet/IEEE 802.3 interfaces.
2 FastEthernet/IEEE 802.3 interfaces.
4 Token Ring /IEEE802.5 interfaces.
12 Serial network interfaces.
1 Compression port adapter.
125K bytes of non-volatile configuration memory.
1024K bytes of packet SRAM memory.

20480K bytes of Flash PCMCIA card at slot 0 (Sector size 128K).
8192K bytes of Flash internal SIMM (Sector size 256K).
Configuration register is 0x2
```

To determine which interfaces in the router are configured for compression, use the **show compress** command. All interfaces configured for compression are displayed, as well as the type of compression configured on each interface, as shown in the following example (the **show compress** command only displays interfaces that are configured for compression):

```
Router# sh compress
Serial2/0
     Distributed h/w compression enabled
     Compressed bytes sent:      4932 bytes   0 Kbits/sec  ratio: 10.500
     Compressed bytes recv:      5019 bytes   0 Kbits/sec  ratio: 10.019
     restarts: 10
     last clearing of counters: 165828 seconds

 Serial2/1
     Distributed h/w compression enabled
     Compressed bytes sent:      4942 bytes   0 Kbits/sec  ratio: 10.700
     Compressed bytes recv:      5029 bytes   0 Kbits/sec  ratio: 10.009
     restarts: 10
     last clearing of counters: 162528 seconds
Serial2/2
     Distributed h/w compression enabled
     Compressed bytes sent:      4922 bytes   0 Kbits/sec  ratio: 10.720
     Compressed bytes recv:      5019 bytes   0 Kbits/sec  ratio: 10.119
     restarts: 10
     last clearing of counters: 162528 seconds

Serial2/3
     Distributed h/w compression enabled
     Compressed bytes sent:      2836 bytes   0 Kbits/sec  ratio: 8.845
     Compressed bytes recv:      3080 bytes   0 Kbits/sec  ratio: 8.034
     restarts: 9
     last clearing of counters: 162528 seconds
Serial2/4
     Distributed h/w compression enabled
     Compressed bytes sent:      2736 bytes   0 Kbits/sec  ratio: 8.835
     Compressed bytes recv:      3180 bytes   0 Kbits/sec  ratio: 8.014
     restarts: 9
     last clearing of counters: 162528 seconds

Serial2/5
     Distributed h/w compression enabled
     Compressed bytes sent:      2832 bytes   0 Kbits/sec  ratio: 8.622
     Compressed bytes recv:      3088 bytes   0 Kbits/sec  ratio: 8.321
     restarts: 9
     last clearing of counters: 162528 seconds
```

```
Serial2/6
     Distributed h/w compression enabled
     Compressed bytes sent:      2110 bytes   0 Kbits/sec  ratio: 8.845
     Compressed bytes recv:      3432 bytes   0 Kbits/sec  ratio: 8.734
     restarts: 9
     last clearing of counters: 162528 seconds

Serial2/7
     Distributed h/w compression enabled
     Compressed bytes sent:      2829 bytes   0 Kbits/sec  ratio: 8.335
     Compressed bytes recv:      3676 bytes   0 Kbits/sec  ratio: 8.214
     restarts: 9
     last clearing of counters: 162528 seconds
```

To determine the type of port adapters installed in your Cisco 7200 series router, use the **show diag** *slot* command. Specific port adapter information is displayed, as shown in the following example of a CSA in chassis slot 1:

```
Router# sh diag 1
Slot 1:
        Compression engine 768K port adapter, 0 ports
        Port adapter is analyzed
        Port adapter insertion time 00:16:37 ago
        Hardware revision 255.255               Board revision UNKNOWN
        Serial number     4294967295    Part number    255-65535-255
        Test history      0xFF          RMA number     255-255-255
        EEPROM format version 255
        EEPROM contents (hex):
          0x20: FF 09 FF FF FF FF FF FF FF FF FF FF FF FF FF FF
          0x30: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
```

If the previous displays indicate that the hardware is not functioning properly, ensure that the network interfaces are properly connected and terminated. If you still have problems bringing up or shutting down an interface, contact a customer service representative for assistance.

To display information about a specific interface, use the **show interfaces** command with the interface type and port address in the format **show interfaces** [type *port adapter slot/interface port number*].

Following is an example of how the **show interfaces** [*type port adapter slot/interface port number*] command displays status information (including the physical slot and port address) for the interfaces you specify. In these examples, most of the status information for each interface is omitted, and the eight serial interfaces (0–7) are in port adapter slot 2. (Interfaces are administratively shut down until you enable them.)

```
Router# sh int serial 2/0
Serial2/0 is up, line protocol is up
  Hardware is M8T-V.35
  Internet address is 1.1.1.0
  MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec, rely 255/255, load 1/255
  Encapsulation PPP, loopback not set, keepalive not set
(display text omitted]

Router# sh int serial 2/1
Serial2/1 is up, line protocol is up
  Hardware is M8T-V.35
  Internet address is 1.1.1.1
  MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec, rely 255/255, load 1/255
  Encapsulation PPP, loopback not set, keepalive not set
(display text omitted]
```

```
Router# sh int serial 2/2
Serial2/2 is up, line protocol is up
  Hardware is M8T-V.35
  Internet address is 1.1.1.2
  MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec, rely 255/255, load 1/255
  Encapsulation PPP, loopback not set, keepalive not set
(display text omitted]

Router# sh int serial 2/3
Serial2/3 is up, line protocol is up
  Hardware is M8T-V.35
  Internet address is 1.1.1.3
  MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec, rely 255/255, load 1/255
  Encapsulation PPP, loopback not set, keepalive not set
(display text omitted]

Router# sh int serial 2/4
Serial2/4 is up, line protocol is up
  Hardware is M8T-V.35
  Internet address is 1.1.1.4
  MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec, rely 255/255, load 1/255
  Encapsulation PPP, loopback not set, keepalive not set
(display text omitted]

Router# sh int serial 2/5
Serial2/5 is up, line protocol is up
  Hardware is M8T-V.35
  Internet address is 1.1.1.5
  MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec, rely 255/255, load 1/255
  Encapsulation PPP, loopback not set, keepalive not set
(display text omitted]

Router# sh int serial 2/6
Serial2/6 is up, line protocol is up
  Hardware is M8T-V.35
  Internet address is 1.1.1.6
  MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec, rely 255/255, load 1/255
  Encapsulation PPP, loopback not set, keepalive not set
(display text omitted]

Router# sh int serial 2/7
Serial2/7 is up, line protocol is up
  Hardware is M8T-V.35
  Internet address is 1.1.1.7
  MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec, rely 255/255, load 1/255
  Encapsulation PPP, loopback not set, keepalive not set
(display text omitted]
```

With the **show interfaces** *type port adapter slot/interface port number* command, use arguments such as the interface type (serial, and so forth), port adapter slot, and the interface port number (port adapter slot/port) to display information about a specific serial interface only.

The following example of the **show interfaces serial** *port adapter slot/interface port number* command shows all of the information specific to the first 8T-V.35 interface port adapter in port adapter slot 2:

```
Router# sh int serial 2/0
Serial2/0 is up, line protocol is up
  Hardware is M8T-V.35
  Internet address is 1.1.1.0
  MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec, rely 255/255, load 1/255
  Encapsulation PPP, loopback not set, keepalive not set
  LCP Open
  Open: ccp, ipcp, cdp
  Last input 00:00:07, output 00:00:05, output hang never
  Last clearing of "show interface" counters 3d23h
  Queueing strategy: fifo
  Output queue 0/40, 0 drops; input queue 0/75, 0 drops
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     5743 packets input, 1886943 bytes, 0 no buffer
     Received 0 broadcasts, 0 runts, 0 giants
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     5743 packets output, 189253 bytes, 0 underruns
     0 output errors, 0 collisions, 4 interface resets
     0 output buffer failures, 0 output buffers swapped out
     4 carrier transitions     DCD=up  DSR=up  DTR=up  RTS=up  CTS=up
```

For complete VIP2 command descriptions and examples, refer to the publications listed in the section “If You Need More Information” on page 2.

Using the ping and loopback Commands

The *packet internet groper* (**ping**) and **loopback** commands allow you to verify that an interface port is functioning properly and to check the path between a specific port and connected devices at various locations on the network. You can also use the **show compress** command to view the interfaces in the router that are configured for compression.

This section provides brief descriptions of the **ping** and **loopback** commands. After you verify that the router and port adapters have booted successfully and are operational, you can use these commands to verify the status of interface ports. Refer to the publications listed in the section “If You Need More Information” on page 2, for detailed command descriptions and examples.

The **ping** command sends an echo request out to a remote device at an IP address that you specify. After sending a series of signals, the command waits a specified time for the remote device to echo the signals. Each returned signal is displayed as an exclamation point (!) on the console terminal; each signal that is not returned before the specified timeout is displayed as a period (.). A series of exclamation points (!!!!!) indicates a good connection; a series of periods (.....) or the messages [timed out] or [failed] indicate that the connection failed.

Following is an example of a successful **ping** command to a remote server with the address 1.1.1.10:

```
Router# ping 1.1.1.10 <Return>
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echoes to 1.1.1.10, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/15/64 ms
Router#
```

If the connection fails, verify that you have the correct IP address for the server and that the server is active (powered on), and repeat the **ping** command.

The loopback test allows you to detect and isolate equipment malfunctions by testing the connection between a port adapter interface and a remote device such asa modem or a CSU/DSU. The **loopback** subcommand sends a series of packets out to and through the device (or cable), and back to the port adapter interface. If the packets complete the loop, the connection is good. If not, you can isolate a fault to the remote device or interface cable in the path of the loopback test.

Note You must configure a clock rate on the port *before* performing a loopback test.

For complete descriptions of interface subcommands and the configuration options available for Cisco 7200 series-related interfaces, refer to the publications listed in the section "If You Need More Information" on page 2.

Cisco Connection Online

Cisco Connection Online (CCO), formerly Cisco Information Online (CIO), is Cisco Systems' primary, real-time support channel. Maintenance customers and partners can self-register on CCO to obtain additional content and services.

Available 24 hours a day, 7 days a week, CCO provides a wealth of standard and value-added services to Cisco's customers and business partners. CCO services include product information, software updates, release notes, technical tips, the Bug Navigator, configuration notes, brochures, descriptions of service offerings, and download access to public and authorized files.

CCO serves a wide variety of users through two interfaces that are updated and enhanced simultaneously—a character-based version and a multimedia version that resides on the World Wide Web (WWW). The character-based CCO supports Zmodem, Kermit, Xmodem, FTP, and Internet e-mail, and is excellent for quick access to information over lower bandwidths. The WWW version of CCO provides richly formatted documents with photographs, figures, graphics, and video, as well as hyperlinks to related information.

You can access CCO in the following ways:

- WWW: http://www.cisco.com.
- WWW: http://www-europe.cisco.com.
- WWW: http://www-china.cisco.com.
- Telnet: cco.cisco.com.
- Modem: From North America, 408 526-8070; from Europe, 33 1 64 46 40 82. Use the following terminal settings: VT100 emulation; databits: 8; parity: none; stop bits: 1; and baud rates up to 14.4 kbps.

For a copy of CCO's Frequently Asked Questions (FAQ), contact cco-help@cisco.com. For additional information, contact cco-team@cisco.com.

Note If you are a network administrator and need personal technical assistance with a Cisco product that is under warranty or covered by a maintenance contract, contact Cisco's Technical Assistance Center (TAC) at 800 553-2447, 408 526-7209, or tac@cisco.com. To obtain general information about Cisco Systems, Cisco products, or upgrades, contact 800 553-6387, 408 526-7208, or cs-rep@cisco.com.

This document is to be used in conjunction with the *Cisco 7000 Hardware Installation and Maintenance, Cisco 7010 Hardware Installation and Maintenance, Cisco 7505 Hardware Installation and Maintenance, Cisco 7507 Hardware Installation and Maintenance, Cisco 7513 Hardware Installation and Maintenance, Cisco 72xx Installation and Configuration Guide,* and *Versatile Interface Processor (VIP2) Installation, Configuration, and Maintenance* publications.