Using Cisco IOS Software

This chapter provides useful information as you prepare to configure a Cisco 7304 Shared Port Adapter (SPA) using the Cisco IOS software. It includes the following sections:

Accessing the CLI Using a Router Console

This section describes how to access the command-line interface (CLI) using a directly-connected console, using Telnet, or by using a modem to obtain a remote console:

For more detailed information about configuring and accessing a router through various services, refer to the *Cisco IOS Terminal Services Configuration Guide* and *Cisco IOS Terminal Services Command Reference* publications.

For more information about making the console cable connections, refer to the *Cisco 7304 Router Installation and Configuration Guide*.

Accessing the CLI Using a Directly-Connected Console

This section describes how to connect to the console port on the router and use the console interface to access the CLI.

Connecting to the Console Port

Before you can use the console interface on the router using a terminal or PC, perform the following steps:

Step 1   Configure your terminal emulation software with the following settings:

- 9600 bits per second (bps)
- 8 data bits
- No parity
- 2 stop bits

Note   These are the default serial communication parameters on the router. For information about how to change those defaults to meet the requirements of your terminal or host, refer to the *Cisco IOS Terminal Services Configuration Guide*.

Step 2   Connect a terminal or PC to the console port using a rollover cable.

To make this connection, attach one end of an RJ-45 to RJ-45 rollover cable to the router console port. Attach the other end of the cable to an ASCII terminal or a PC running terminal emulation software. The ASCII terminal or PC port might require an RJ-45-to-DB-9 or an RJ-45-to-DB-25 adapter.

Using the Console Interface

To access the CLI using the console interface, complete the following steps:

Step 1   Attach the terminal hardware to the console port on the router (after you configure your terminal emulation software with the proper settings), and verify that the following prompt appears:

```
Press Return for Console prompt
```

Step 2   Press **Return** to enter user EXEC configuration mode. The following prompt appears:

```
Router>
```

Step 3   From user EXEC configuration mode, enter the **enable** command as shown in the following example:

```
Router> enable
```

Step 4   At the password prompt, enter your system password. The following example shows entry of the password called "enablepass":

```
Password: enablepass
```

Step 5   When the enable password is accepted, verify that the privileged EXEC configuration mode prompt appears:

```
Router#
```

Step 6   You now have access to the CLI in privileged EXEC configuration mode. Enter the necessary commands to complete your desired tasks.

Step 7   To exit the console session, enter the **quit** command as shown in the following example:

```
Router# quit
```

Accessing the CLI from a Remote Console Using Telnet

This section describes how to connect to the console interface on a router using Telnet to access the CLI.

Preparing to Connect to the Router Console Using Telnet

Before you can access the router remotely using Telnet from a TCP/IP network, you must configure the router to support virtual terminal lines (vtys) using the **line vty** global configuration command. You also should configure the vtys to require login and specify a password.

> **Note**   To prevent disabling login on the line, be careful that you specify a password with the **password** command when you configure the **login** line configuration command. If you are using authentication, authorization, and accounting (AAA), you should configure the **login authentication** line configuration command. To prevent disabling login on the line for AAA when you configure a list with the **login authentication** command, you must also configure that list using the **aaa authentication login** global configuration command. For more information about AAA services, refer to the *Cisco IOS Security Configuration Guide* and *Cisco IOS Security Command Reference* publications.

In addition, before you can make a Telnet connection to the router, you must have a valid host name for the router or have an IP address configured on the router. For more information about requirements for connecting to the router using Telnet, information about customizing your Telnet services, and using Telnet key sequences, refer to the *Cisco IOS Terminal Services Configuration Guide.*

Using Telnet to Access a Console Interface

To access a console interface using Telnet, complete the following steps:

Step 1   From your terminal or PC, enter one of the following commands:

- **connect** *host* [*port*] [*keyword*]
- **telnet** *host* [*port*] [*keyword*]

where *host* is the router host name or an IP address, *port* is a decimal port number (23 is the default), and *keyword* is a supported keyword. For more information, refer to the *Cisco IOS Terminal Services Command Reference*.

> **Note**   If you are using an access server, you also will need to specify a valid port number with the host name or IP address, such as **telnet 172.20.52.40 2003**.

The following example shows the **telnet** command to connect to the router named "Router":

```
unix_host% telnet Router
Trying 172.20.52.40...
Connected to 172.20.52.40.
Escape character is '^]'.
unix_host% connect
```

Step 2   At the password prompt, enter your login password. The following example shows entry of the password called "mypass":

```
User Access Verification

Password: mypass
```

Note   If no password has been configured, press **Return**.

Step 3   From user EXEC configuration mode, enter the **enable** command as shown in the following example:

```
Router> enable
```

Step 4   At the password prompt, enter your system password. The following example shows entry of the password called "enablepass":

```
Password: enablepass
```

Step 5   When the enable password is accepted, verify that the privileged EXEC configuration mode prompt appears:

```
Router#
```

Step 6   You now have access to the CLI in privileged EXEC configuration mode. Enter the necessary commands to complete your desired tasks.

Step 7   To exit the Telnet session, use the **exit** or **logout** command as shown in the following example:

```
Router# logout
```

Accessing the CLI from a Remote Console Using a Modem

To access the router remotely using a modem through an asynchronous connection, you need to configure the auxiliary (AUX) port and attach a modem to it.

For more information about making a modem connection using the AUX port on the Cisco 7304 router, refer to the *Cisco 7304 Router Installation and Configuration Guide*.

For detailed guidelines on making a connection to the router using a modem, and using reverse Telnet, refer to *Configuring a Modem on the AUX Port for EXEC Dialin Connectivity* located at the following URL:

http://www.cisco.com/warp/public/471/mod-aux-exec.html

Using Keyboard Shortcuts

Commands are not case-sensitive. You can abbreviate commands and parameters if the abbreviations contain enough letters to be different from any other currently available commands or parameters. You can scroll through the last 20 commands stored in the history buffer, and enter or edit the command at the prompt.

Table 1-1 lists the keyboard shortcuts for entering and editing commands.

Table 1-1   Keyboard Shortcuts

Keystrokes	Purpose
Ctrl-B or the **Left Arrow** key[1]	Move the cursor back one character
Ctrl-F or the **Right Arrow** key[1]	Move the cursor forward one character
Ctrl-A	Move the cursor to the beginning of the command line
Ctrl-E	Move the cursor to the end of the command line
Esc B	Move the cursor back one word
Esc F	Move the cursor forward one word

1. The arrow keys function only on ANSI-compatible terminals such as VT100s.

Using the History Buffer to Recall Commands

The history buffer stores the last 20 commands you entered. History substitution allows you to access these commands without retyping them, by using special abbreviated commands.

Table 1-2 lists the history substitution commands.

Table 1-2   History Substitution Commands

Keystroke or Command	Purpose
Ctrl-P or the **Up Arrow** key[1]	Recall commands in the history buffer, beginning with the most recent command. Repeat the key sequence to recall successively older commands.
Ctrl-N or the **Down Arrow** key[1]	Return to more recent commands in the history buffer after recalling commands with **Ctrl-P** or the **Up Arrow** key. Repeat the key sequence to recall successively more recent commands.
Router# **show history**	While in EXEC mode, list the last several commands you have just entered.

1. The arrow keys function only on ANSI-compatible terminals such as VT100s.

Understanding Command Modes

You use the CLI to access Cisco IOS software. Because the CLI is divided into many different modes, the commands available to you at any given time depend on the mode that you are currently in. Entering a question mark (**?**) at the CLI prompt allows you to obtain a list of commands available for each command mode.

When you log in to the CLI, you are in user EXEC mode. User EXEC mode contains only a limited subset of commands. To have access to all commands, you must enter privileged EXEC mode, normally by using a password. From privileged EXEC mode, you can issue any EXEC command—user or privileged mode—or you can enter global configuration mode. Most EXEC commands are one-time commands. For example, **show** commands show important status information, and **clear** commands clear counters or interfaces. The EXEC commands are not saved when the software reboots.

Configuration modes allow you to make changes to the running configuration. If you later save the running configuration to the startup configuration, these changed commands are stored when the software is rebooted. To enter specific configuration modes, you must start at global configuration mode. From global configuration mode, you can enter interface configuration mode and a variety of other modes, such as protocol-specific modes.

ROM monitor mode is a separate mode used when the Cisco IOS software cannot load properly. If a valid software image is not found when the software boots or if the configuration file is corrupted at startup, the software might enter ROM monitor mode.

Table 1-3 describes how to access and exit various common command modes of the Cisco IOS software. It also shows examples of the prompts displayed for each mode.

Table 1-3   Accessing and Exiting Command Modes

Command Mode	Access Method	Prompt	Exit Method
User EXEC	Log in.	`Router>`	Use the **logout** command.
Privileged EXEC	From user EXEC mode, use the **enable** EXEC command.	`Router#`	To return to user EXEC mode, use the **disable** command.
Global configuration	From privileged EXEC mode, use the **configure terminal** privileged EXEC command.	`Router(config)#`	To return to privileged EXEC mode from global configuration mode, use the **exit** or **end** command.
Interface configuration	From global configuration mode, specify an interface using an **interface** command.	`Router(config-if)#`	To return to global configuration mode, use the **exit** command. To return to privileged EXEC mode, use the **end** command.
ROM monitor	From privileged EXEC mode, use the **reload** EXEC command. Press the **Break** key during the first 60 seconds while the system is booting.	`>`	To exit ROM monitor mode, use the **continue** command.

For more information on command modes, refer to the "Using the Command-Line Interface" chapter in the *Cisco IOS Configuration Fundamentals and Network Management Configuration Guide*.

Getting Help

Entering a question mark (**?**) at the CLI prompt displays a list of commands available for each command mode. You can also get a list of keywords and arguments associated with any command by using the context-sensitive help feature.

To get help specific to a command mode, a command, a keyword, or an argument, use one of the following commands:

Command	Purpose
`help`	Provides a brief description of the help system in any command mode.
*abbreviated-command-entry***?**	Provides a list of commands that begin with a particular character string. (No space between command and question mark.)
abbreviated-command-entry<**Tab**>	Completes a partial command name.
?	Lists all commands available for a particular command mode.
command **?**	Lists the keywords or arguments that you must enter next on the command line. (Space between command and question mark.)

Finding Command Options Example

This section provides an example of how to display syntax for a command. The syntax can consist of optional or required keywords and arguments. To display keywords and arguments for a command, enter a question mark (**?**) at the configuration prompt or after entering part of a command followed by a space. The Cisco IOS software displays a list and brief description of available keywords and arguments. For example, if you were in global configuration mode and wanted to see all the keywords or arguments for the **arap** command, you would type **arap ?**.

The <cr> symbol in command help output stands for "carriage return." On older keyboards, the carriage return key is the **Return** key. On most modern keyboards, the carriage return key is the **Enter** key. The <cr> symbol at the end of command help output indicates that you have the option to press **Enter** to complete the command and that the arguments and keywords in the list preceding the <cr> symbol are optional. The <cr> symbol by itself indicates that no more arguments or keywords are available and that you must press **Enter** to complete the command.

Table 1-4 shows examples of how you can use the question mark (**?**) to assist you in entering commands. The table steps you through configuring an IP address on a serial interface on a Cisco 7206 router that is running Cisco IOS Release 12.0(3).

Table 1-4   Finding Command Options

Command	Comment
| ```
Router> enable
Password: <password>
Router#
``` | Enter the **enable** command and password to access privileged EXEC commands. You are in privileged EXEC mode when the prompt changes to `Router#`. |
| ```
Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#
``` | Enter the **configure terminal** privileged EXEC command to enter global configuration mode. You are in global configuration mode when the prompt changes to `Router(config)#`. |
| ```
Router(config)# interface serial ?
  <0-6>     Serial interface number
Router(config)# interface serial 4 ?
  /
Router(config)# interface serial 4/ ?
  <0-3>     Serial interface number
Router(config)# interface serial 4/0 ?
<cr>
Router(config)# interface serial 4/0
Router(config-if)#
``` | Enter interface configuration mode by specifying the serial interface that you want to configure using the **interface serial** global configuration command. Enter **?** to display what you must enter next on the command line. In this example, you must enter the serial interface slot number and port number, separated by a forward slash. When the <cr> symbol is displayed, you can press **Enter** to complete the command. You are in interface configuration mode when the prompt changes to `Router(config-if)#`. |

Table 1-4   Finding Command Options (continued)

Command	Comment
| ```
Router(config-if)# ?
Interface configuration commands:
  .
  .
  .
  ip               Interface Internet Protocol config commands
  keepalive        Enable keepalive
  lan-name         LAN Name command
  llc2             LLC2 Interface Subcommands
  load-interval    Specify interval for load calculation for an
                   interface
  locaddr-priority Assign a priority group
  logging          Configure logging for interface
  loopback         Configure internal loopback on an interface
  mac-address      Manually set interface MAC address
  mls              mls router sub/interface commands
  mpoa             MPOA interface configuration commands
  mtu              Set the interface Maximum Transmission Unit (MTU)
  netbios          Use a defined NETBIOS access list or enable
                   name-caching
  no               Negate a command or set its defaults
  nrzi-encoding    Enable use of NRZI encoding
  ntp              Configure NTP
  .
  .
  .
Router(config-if)#
``` | Enter **?** to display a list of all the interface configuration commands available for the serial interface. This example shows only some of the available interface configuration commands. |
| ```
Router(config-if)# ip ?
Interface IP configuration subcommands:
  access-group       Specify access control for packets
  accounting         Enable IP accounting on this interface
  address            Set the IP address of an interface
  authentication     authentication subcommands
  bandwidth-percent  Set EIGRP bandwidth limit
  broadcast-address  Set the broadcast address of an interface
  cgmp               Enable/disable CGMP
  directed-broadcast Enable forwarding of directed broadcasts
  dvmrp              DVMRP interface commands
  hello-interval     Configures IP-EIGRP hello interval
  helper-address     Specify a destination address for UDP broadcasts
  hold-time          Configures IP-EIGRP hold time
  .
  .
  .
Router(config-if)# ip
``` | Enter the command that you want to configure for the interface. This example uses the **ip** command.<br><br>Enter **?** to display what you must enter next on the command line. This example shows only some of the available interface IP configuration commands. |

Table 1-4   Finding Command Options (continued)

Command	Comment

`Router(config-if)# ip address ?`
`  A.B.C.D          IP address`
`  negotiated       IP Address negotiated over PPP`
`Router(config-if)# ip address`
	Enter the command that you want to configure for the interface. This example uses the **ip address** command.
	
	Enter **?** to display what you must enter next on the command line. In this example, you must enter an IP address or the **negotiated** keyword.
	
	A carriage return (<cr>) is not displayed; therefore, you must enter additional keywords or arguments to complete the command.

`Router(config-if)# ip address 172.16.0.1 ?`
`  A.B.C.D          IP subnet mask`
`Router(config-if)# ip address 172.16.0.1`
	Enter the keyword or argument that you want to use. This example uses the 172.16.0.1 IP address.
	
	Enter **?** to display what you must enter next on the command line. In this example, you must enter an IP subnet mask.
	
	A <cr> is not displayed; therefore, you must enter additional keywords or arguments to complete the command.

`Router(config-if)# ip address 172.16.0.1 255.255.255.0 ?`
`  secondary        Make this IP address a secondary address`
`  <cr>`
`Router(config-if)# ip address 172.16.0.1 255.255.255.0`
	Enter the IP subnet mask. This example uses the 255.255.255.0 IP subnet mask.
	
	Enter **?** to display what you must enter next on the command line. In this example, you can enter the **secondary** keyword, or you can press **Enter**.
	
	A <cr> is displayed; you can press **Enter** to complete the command, or you can enter another keyword.

`Router(config-if)# ip address 172.16.0.1 255.255.255.0` `Router(config-if)#`	In this example, **Enter** is pressed to complete the command.

Using the no and default Forms of Commands

Almost every configuration command has a **no** form. In general, use the **no** form to disable a function. Use the command without the **no** keyword to reenable a disabled function or to enable a function that is disabled by default. For example, IP routing is enabled by default. To disable IP routing, use the **no ip routing** command; to reenable IP routing, use the **ip routing** command. The Cisco IOS software command reference publications provide the complete syntax for the configuration commands and describe what the **no** form of a command does.

Configuration commands can also have a **default** form, which returns the command settings to the default values. Most commands are disabled by default, so in such cases using the **default** form has the same result as using the **no** form of the command. However, some commands are enabled by default and

have variables set to certain default values. In these cases, the **default** form of the command enables the command and sets the variables to their default values. The Cisco IOS software command reference publications describe the effect of the **default** form of a command if the command functions differently than the **no** form.

Saving Configuration Changes

Use the **copy system:running-config nvram:startup-config** command to save your configuration changes to the startup configuration so that the changes will not be lost if the software reloads or a power outage occurs. For example:

```
Router# copy system:running-config nvram:startup-config
Building configuration...
```

It might take a minute or two to save the configuration. After the configuration has been saved, the following output appears:

```
[OK]
Router#
```

On most platforms, this task saves the configuration to NVRAM. On the Class A Flash file system platforms, this task saves the configuration to the location specified by the CONFIG_FILE environment variable. The CONFIG_FILE variable defaults to NVRAM.

Filtering Output from the show and more Commands

You can search and filter the output of **show** and **more** commands. This functionality is useful if you need to sort through large amounts of output or if you want to exclude output that you need not see.

To use this functionality, enter a **show** or **more** command followed by the "pipe" character (|); one of the keywords **begin**, **include**, or **exclude**; and a regular expression on which you want to search or filter (the expression is case-sensitive):

command | {**begin** | **include** | **exclude**} *regular-expression*

The output matches certain lines of information in the configuration file. The following example illustrates how to use output modifiers with the **show interface** command when you want the output to include only lines in which the expression "protocol" appears:

```
Router# show interface | include protocol

FastEthernet0/0 is up, line protocol is up
Serial4/0 is up, line protocol is up
Serial4/1 is up, line protocol is up
Serial4/2 is administratively down, line protocol is down
Serial4/3 is administratively down, line protocol is down
```

For more information on the search and filter functionality, refer to the "Using the Command-Line Interface" chapter in the *Cisco IOS Configuration Fundamentals and Network Management Configuration Guide*.

Finding Support Information for Platforms and Cisco IOS Software Images

Cisco IOS software is packaged in feature sets consisting of software images that support specific platforms. The feature sets available for a specific platform depend on which Cisco IOS software images are included in a release. To identify the set of software images available in a specific release or to find out if a feature is available in a given Cisco IOS software image, you can use Cisco Feature Navigator or the software release notes.

Using Cisco Feature Navigator

Use Cisco Feature Navigator to find information about platform support and Cisco IOS software image support. Access Cisco Feature Navigator at http://tools.cisco.com/ITDIT/CFN/jsp/index.jsp. You must have an account on Cisco.com. If you do not have an account or have forgotten your username or password, click **Cancel** at the login dialog box and follow the instructions that appear.

Using Software Advisor

To see if a feature is supported by a Cisco IOS release, to locate the software document for that feature, or to check the minimum software requirements of Cisco IOS software with the hardware installed on your router, Cisco maintains the Software Advisor tool on Cisco.com at
http://www.cisco.com/cgi-bin/Support/CompNav/Index.pl

You must be a registered user on Cisco.com to access this tool.

Using Software Release Notes

Cisco IOS software releases include release notes that provide the following information:

- Platform support information
- Memory recommendations
- New feature information
- Open and resolved severity 1 and 2 caveats for all platforms

Release notes are intended to be release-specific for the most current release, and the information provided in these documents may not be cumulative in providing information about features that first appeared in previous releases. Refer to Cisco Feature Navigator for cumulative feature information.