Configuring Router Software

This chapter describes procedures for configuring Cisco 1600 series routers, and contains the following sections:

- Software Configuration Quick Reference Cards
- Software Configuration Quick Reference Cards
- Configuring the ISDN BRI Line
- Cisco IOS Software
- Using the Enable Secret and the Enable Passwords
- Configuring the Router

Note To configure a Cisco 1600 series router, the router should be connected, though the port labeled CONSOLE, to a terminal, or to a PC running terminal emulation software. For instructions on how to make this connection, refer to the section "Connecting the Console" in the chapter "Installing the Router."

Software Configuration Quick Reference Cards

The Cisco 1600 series routers are shipped with quick reference cards that contain detailed configuration examples based on both ClickStart software, a WWW browser-based configuration tool, and on Cisco Internetwork Operating System (Cisco IOS) software. Refer to these cards for start-to-finish configuration examples.

Configuring the Router with a PC

If you are configuring the router using a PC (not a dumb terminal), you need a type of communications software called *terminal emulation* software. This software enables the PC to send commands to the router. Table 5-1 lists some common names of this type of software, based on the type of PC you are using.

Table 5-1   Terminal Emulation Software

PC Operating System	Software
Windows 3.1	Terminal (included with Windows software)
Windows 95	HyperTerm (included with Windows software)
Macintosh	ProComm, VersaTerm (supplied separately)

Terminal emulation software allows you to change settings based on the type of device that is connected to the PC, in this case a router. To enable your PC to communicate to the router, configure the software settings to the following:

- Baud—9600

- Data bits—8

- Parity—no

- Stop bits—1

You can now configure the router using the PC.

Configuring the ISDN BRI Line

If you are using one of the router models with an ISDN BRI interface, or you have installed an ISDN BRI WAN interface card in your router, you must order an ISDN BRI line to operate with your router.

If you have not ordered your ISDN BRI line, refer to the section "Ordering and Configuring an ISDN BRI Line" in the chapter "Preparing to Install the Router" for general guidelines about ordering the line.

Cisco IOS Software

The router runs Cisco Internetwork Operating System (Cisco IOS) software. Using the software's many features is easier if you have more information at hand. We recommend the following publications:

- *Cisco IOS Configuration Guide*
- *Cisco IOS Command Reference*

These publications are available in the following forms:

- As printed publications
- On the Cisco Connection Documentation, Enterprise Series CD-ROM
- At the World Wide Web URL http://www.cisco.com

Configuration Modes

You configure Cisco 1600 series routers using the Cisco command interpreter, called the EXEC. You must log into the router before you can enter an EXEC command. For security purposes, the EXEC has two levels of access to commands, user EXEC mode and privileged EXEC mode. The commands available in user EXEC mode are a subset of those available in privileged EXEC mode.

Using the Enable Secret and the Enable Passwords

Because many privileged-level EXEC commands are used to set operating parameters, you should password-protect these commands to prevent unauthorized use.

You use two commands to do this:

- **enable secret** *password* (a very secure encrypted password)

- **enable** *password* (a less secure, nonencrypted password)

You must enter an enable secret password to gain access to privileged-level commands.

For maximum security, the passwords should be different. If you enter the same password for both during the setup process, the router accepts the passwords, but warns you that they should be different.

An enable secret password can contain from 1 to 25 uppercase and lowercase alphanumeric characters. An enable password can contain any number of uppercase and lowercase alphanumeric characters. In both cases, a number cannot be the first character. Spaces are also valid password characters; for example, "two words" is a valid password. Leading spaces are ignored; trailing spaces are recognized.

If you lose or forget your enable password, see the section "Recovering a Lost Enable Password" in the appendix "Troubleshooting."

Configuring the Router

When you install a new WAN interface card, or if you want to change the configuration of an existing interface, you must enter configuration mode to configure the interfaces. If you replace a module that was already configured, the router recognizes the new module interfaces and brings them up in the existing configuration.

Before you configure an interface, have the following information available:

- Protocols you plan to route on each new interface.

- IP addresses and IP subnet masks of your network, if you will configure the interfaces for IP routing.

- Whether the new interfaces will use bridging.

- ISDN switch type (Cisco 1603, Cisco 1604, and ISDN BRI WAN interface cards only).

- ISDN Service Profile Identifiers (SPIDs), if they have been assigned to your ISDN line by the telephone company (Cisco 1603, Cisco 1604, and ISDN BRI WAN interface cards only).

- Network information for the central site router, such as IP address, IPX address, AppleTalk address, and ISDN telephone number. (You might only require a some of these items, depending on what type of network is being used at the central site.)

You can configure the router according to any of the following procedures:

- Configuring the Router Using Configuration Mode
- Configuring the Router Using AutoInstall
- Configuring the Router Manually Using the Setup Facility

Follow the procedure that best fits the needs of your network configuration.

Note You must obtain network addresses from your system administrator or your network plan before you can complete router configuration.

Configuring the Router Using Configuration Mode

You can configure the router manually if you prefer not to use AutoInstall or the setup facility. Take the following steps to configure the router manually:

Step 1 Connect a console by following the instructions in the section "Connecting the Console" in the chapter "Installing the Router." Power up the router.

Step 2 When asked if you would like to enter the initial dialog, answer **no**:

```
Would you like to enter the initial dialog? [yes]: no
```

You now enter the normal operating mode of the router.

Step 3 After a few seconds, you see the user EXEC prompt (Router>). Type **enable** to enter enable mode:

```
Router> enable
```

Note   Configuration changes can be made only in enable mode.

The prompt changes to the privileged EXEC (enable) prompt (Router#):

```
Router#
```

Step 4   Enter the command **config terminal** to enter configuration mode:

```
Router# config terminal
```

You can now enter changes to the configuration. Press **Ctrl-Z** to exit configuration mode.

To see the current operating configuration, including any changes you have just made, enter the command **show running-config** at the enable prompt:

```
Router# show running-config
```

To see the configuration in nonvolatile random-access memory (NVRAM), enter the command **show startup-configuration** at the enable prompt.

```
Router# show startup-config
```

The results of the **show running-config** and **show startup-config** commands differ from each other if you have made changes to the configuration, but have not yet written them to NVRAM.

To write your changes to NVRAM, making them permanent, enter the command **copy running-config startup-config** at the enable prompt:

```
Router# copy running-config startup-config
********
```

The router is now configured to boot with the configuration you entered.

Configuring the Router Using AutoInstall

The AutoInstall process is designed to configure the router automatically after connection to your WAN. In order for AutoInstall to work properly, a Transmission Control Protocol/Internet Protocol (TCP/IP) host on your network must provide the required configuration files. The TCP/IP host can reside anywhere on the network as long as the following two conditions are satisfied:

1 The host must be on the remote side of the router's connection to the WAN.

2 User Datagram Protocol (UDP) broadcasts to and from the router and the TCP/IP host must be enabled.

This functionality is coordinated by your system administrator at the site where the TCP/IP host is located. You should not attempt to use AutoInstall unless the required files have been installed on the TCP/IP host.

Take the following steps to prepare your router for the AutoInstall process:

Step 1   Attach the appropriate WAN cable, depending on the router model you are using, to the router.

Step 2   Turn ON power to the router.

The router loads the operating system image from Flash memory. If the remote end of the WAN connection is connected and properly configured, the AutoInstall process begins.

Step 3   If AutoInstall succeeds, you might want to write the configuration data to the router's NVRAM. To do this, enter the **copy running-config startup-config** command at the enable (Router#) prompt:

```
Router# copy running-config startup-config
```

This step saves the configuration settings that the AutoInstall process created. If you fail to do this, your new configuration will be lost the next time you reload the router.

Configuring the Router Manually Using the Setup Facility

The router attempts to run AutoInstall whenever you start it if the WAN connection is connected on both ends and the router does not have a configuration stored in NVRAM. It can take several minutes for the router to determine that configuration files are not set up on a remote TCP/IP host. After the router has determined that AutoInstall is not configured, it defaults to the setup facility.

If you do not plan to use AutoInstall, do not connect the router's WAN cable to the WAN interface. The router will then not attempt to run the AutoInstall process. It will boot instead from Flash memory and the setup facility will start immediately.

Note You can run the setup facility any time you are at the enable prompt (Router#) by entering the command **setup**.

Configuring Global Parameters

When you first start the setup facility, you must configure the global parameters, which control systemwide settings.

Note The screen displays shown in this section might vary from those displayed on your console, depending on the configuration of your router.

Take the following steps to enter global parameters:

Step 1 Connect a console by following the instructions in the section "Connecting the Console" in the chapter "Installing the Router."

Step 2 Power up the router. The router boots from Flash memory. After about 30 seconds, copyright and router hardware information are displayed on the console screen. You then see a message similar to the following one:

```
Notice: NVRAM invalid, possibly due to write erase.
--- System Configuration Dialog ---

At any point you may enter a question mark '?' for help.
```

```
Refer to the 'Getting Started' Guide for additional help.
Use ctrl-c to abort configuration dialog at any prompt.
Default settings are in square brackets '[]'.
```

Step 3 Enter **yes** (the default) or press **Return** when asked if you would like to enter the configuration dialog and if you would like to see the current interface summary.

```
Would you like to enter the initial configuration dialog? [yes]:

First, would you like to see the current interface summary? [yes]:

Any interface listed with OK? value "NO" does not have a valid
configuration

Interface     IP-Address      OK?  Method    Status   Protocol
Ethernet0     unassigned      NO   not set   up       down
Serial0       unassigned      NO   not set   down     down
```

Note   Depending on the Cisco 1600 series model that you are using, the second interface shown in the preceding output may be serial or BRI.

Step 4 Decide which protocols you want to support on the Ethernet interface. For IP-only installations, you can accept the default values for most of the questions.The following steps show how to configure a typical configuration using IP, IPX, and AppleTalk, including when to enter a value other than the default value.

```
Configuring global parameters:

  Enter host name [Router]: router
```

Step 5 Enter the enable secret password, the enable password, and the virtual terminal password:

```
The enable secret is a one-way cryptographic secret used
instead of the enable password when it exists.

  Enter enable secret : shovel
```

```
The enable password is used when there is no enable secret
and when using older software and some boot images.

  Enter enable password : trowel
    Enter virtual terminal password: pail
```

Enter **yes** to accept Simple Network Management Protocol (SNMP) management or **no** to refuse it:

```
  Configure SNMP Network Management? [no]:
```

SNMP is the most widely supported open standard for network management.

Step 6   If you are using IP routing, enter **yes** (the default) or press **Return** to configure IP:

```
Configure IP? [yes]:
```

Step 7   If you are using IP routing, you must also select one of two interior routing protocols: Interior Gateway Routing Protocol (IGRP) or Routing Information Protocol (RIP):

```
Configure IGRP routing? [yes]:
      Your IGRP autonomous system number [1]: 15
```

Step 8   Respond to the prompts as follows to enable routing on IPX and AppleTalk:

```
Configure IPX? [no]: yes

Configure AppleTalk? [no]: yes
    Multizone networks? [no]: yes

Configure LAT? [yes]: no
```

Step 9   If your router model has an ISDN network interface (Cisco 1603 or Cisco 1604) you are prompted to select the ISDN switch type. The type appropriate for your router depends on the ISDN provider's equipment.

Enter the ISDN switch type:

```
Enter ISDN BRI Switch Type [none]: basic-ni1
```

Note For a list of ISDN BRI switch types that you can enter in Step 9, refer to Table B-1 in the appendix "Configuring the ISDN Line."

This completes the procedure for configuring global parameters. To configure parameters for a LAN or WAN interface on a port module, see the configuration note for the port module.

Checking and Saving Your Settings

To check the settings you have configured, enter the command **show running-config** at the enable (Router#) prompt:

```
Router# show running-config
```

To store the configuration, enter the command **copy running-config startup-config** at the enable (Router#) prompt:

```
Router# copy running-config startup-config
```

This command saves the configuration settings that the setup facility created. If you fail to do this, your new configuration will be lost the next time you reload the router.

Network Statistics

When you have finished configuring the network interfaces, use the **show interface** command to check network interface statistics. Options to the **show interface** command include *interface*—the type of interface (for example, serial)—and *unit*—the unit number of the interface.

The following example shows the output of **show interface** *serial 0*:

```
Router> show interface serial 0
Serial0 is down, line protocol is down
  Hardware is QUICC Serial
  Internet address is 5.0.0.1/8
  MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec, rely 255/255, load 1/255
  Encapsulation HDLC, loopback not set, keepalive set (10 sec)
  Last input never, output never, output hang never
```

```
Last clearing of "show interface" counters never
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
   0 packets input, 0 bytes, 0 no buffer
   Received 0 broadcasts, 0 runts, 0 giants
   0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
   0 packets output, 0 bytes, 0 underruns
   0 output errors, 0 collisions, 10 interface resets
   0 output buffer failures, 0 output buffers swapped out
   0 carrier transitions
   DCD=down  DSR=down  DTR=up  RTS=down  CTS=down
```

To display the current internal status of an interface module, use the **show controller** command with the *interface* and *unit* options.

The following example shows the output of the **show controller** *serial 0* command from a Cisco 1601:

```
Router# show controller serial 0
HQUICC Serial unit 0
idb at 0x2302118, driver data structure at 0x2303E30
SCC Registers:
General [GSMR]=0x2:0x00000030, Protocol-specific [PSMR]=0x0
Events [SCCE]=0x0000, Mask [SCCM]=0x001F, Status [SCCS]=0x0000
Transmit on Demand [TODR]=0x0, Data Sync [DSR]=0x7E7E
Interrupt Registers:
Config [CICR]=0x00368460, Pending [CIPR]=0x05004400
Mask   [CIMR]=0x58000052, In-srv  [CISR]=0x00000000
Command register [CR]=0x680
Port A [PADIR]=0x1000, [PAPAR]=0xFEF3
       [PAODR]=0x0000, [PADAT]=0xF59E
Port B [PBDIR]=0x00F10E, [PBPAR]=0x0010CE
       [PBODR]=0x000000, [PBDAT]=0x0248DD
Port C [PCDIR]=0x0086, [PCPAR]=0x0008
       [PCSO]=0x0E30,  [PCDAT]=0x0F49, [PCINT]=0x0000
DTE V.24 (RS-232) serial cable attached.

SCC GENERAL PARAMETER RAM (at 0xFF00F00)
Rx BD Base [RBASE]=0x700, Fn Code [RFCR]=0x18
Tx BD Base [TBASE]=0x740, Fn Code [TFCR]=0x18
Max Rx Buff Len [MRBLR]=1524
Rx State [RSTATE]=0x0, BD Ptr [RBPTR]=0x700
Tx State [TSTATE]=0x0, BD Ptr [TBPTR]=0x740
```

```
SCC HDLC PARAMETER RAM (at 0xFF00F38)
CRC Preset [C_PRES]=0xFFFF, Mask [C_MASK]=0xF0B8
Errors: CRC [CRCEC]=0, Aborts [ABTSC]=0, Discards [DISFC]=0
Nonmatch Addr Cntr [NMARC]=0
Retry Count [RETRC]=0
Max Frame Length [MFLR]=1524
Rx Int Threshold [RFTHR]=0, Frame Cnt [RFCNT]=0
User-defined Address 0000/0000/0000/0000
User-defined Address Mask 0x0000

buffer size 1524
BRGC1=101B0
BRGC2=0
BRGC3=140FA
BRGC4=0
modem_signal_addr FF01566
MASK: DSR=10000, DTR=20000,RTS=80000.CTS=4000000,DCD=8000000
txbrgc=FF015FC, rxbrgc=FF015FC
BRG [DTE]: rx_sicr_clk=7, tx_sicr_clk=6
BRG [DCE]: rx_sicr_clk=7, tx_sicr_clk=3
CLK SRC: sync=4000, async=4000
RX ring with 8 entries at 0xFF00700, Buffer size 1524
Rxhead = 0xFF00700 (0), Rxp = 0x2303E4C (0)
00 pak=0x2307B24 buf=0x2798EE8 status=9000 pak_size=0
01 pak=0x2307978 buf=0x2798830 status=9000 pak_size=0
02 pak=0x23077CC buf=0x2798178 status=9000 pak_size=0
03 pak=0x2307620 buf=0x2797AC0 status=9000 pak_size=0
04 pak=0x2307474 buf=0x2797408 status=9000 pak_size=0
05 pak=0x23072C8 buf=0x2796D50 status=9000 pak_size=0
06 pak=0x230711C buf=0x2796698 status=9000 pak_size=0
07 pak=0x2306F70 buf=0x2795FE0 status=B000 pak_size=0

TX ring with 4 entries at 0xFF00740, tx_count = 0
tx_head = 0xFF00740 (0), head_txp = 0x2303EA8 (0)
tx_tail = 0xFF00740 (0), tail_txp = 0x2303EA8 (0)
00 pak=0x0000000 buf=0x0000000 status=0000 pak_size=0
01 pak=0x0000000 buf=0x0000000 status=0000 pak_size=0
02 pak=0x0000000 buf=0x0000000 status=0000 pak_size=0
03 pak=0x0000000 buf=0x0000000 status=2000 pak_size=0
QUICC SCC specific errors:
0 input aborts on receiving flag sequence
0 throttles, 0 enables
0 overruns
0 transmitter underruns
0 transmitter CTS losts
```

Note that in the preceding example, the cable type is shown as data terminal equipment (DTE) V.24 (RS-232) serial cable. If the cable is data communications equipment (DCE), the output of the **show controller** command displays the clock rate.

For complete command descriptions and instructions, refer to the *Cisco IOS Configuration Guide* and the *Cisco IOS Command Reference* publications. For in-depth WAN configuration description and instructions, refer to the *Wide-Area Networking Configuration Guide* publication.