CHAPTER 4

Configuring the Router

This chapter describes the procedures for configuring the model 2520, model 2521, model 2522, and model 2523 routers, and contains the following sections:

- Booting the Router for the First Time
- Configuring the Router
- Specifying the Boot Method
- Checking the Configuration Settings
- Getting More Information

This chapter provides minimum software configuration information; it is not meant to provide comprehensive router configuration instructions. Detailed software configuration information is available in the Cisco IOS configuration guide and command reference publications (available on the documentation CD that came with your router or you can order printed copies.)

To configure the multiport serial routers, a terminal must be connected to the console port.

Booting the Router for the First Time

Each time you power on the router, it goes through the following boot sequence:

1. The router goes through power-on self-test diagnostics to verify basic operation of the CPU, memory, and interfaces.
2. The system bootstrap software (boot ROM image) executes and searches for a valid Cisco IOS image (router operating system software). The source of the Cisco IOS image (Flash memory or a Trivial File Transfer Protocol [TFTP] server) is determined

by the configuration register setting. The factory-default setting for the configuration register is 0x2102, which indicates that the router should attempt to load a Cisco IOS image from Flash memory.

3. If after five attempts a valid Cisco IOS image is not found in Flash memory, the router reverts to boot ROM mode (which is used to install or upgrade a Cisco IOS image).
4. If a valid Cisco IOS image is found, then the router searches for a valid configuration file.
5. If a valid configuration file is not found in NVRAM, the router runs the System Configuration Dialog so you can configure it manually. For normal router operation, there must be a valid Cisco IOS image in Flash memory and a configuration file in NVRAM.

The first time you boot your router, you will need to configure the router interfaces and then save the configuration to a file in NVRAM. Proceed to the next section, "Configuring the Router," for configuration instructions.

Configuring the Router

You can configure the router following one of the procedures:

- Using Configuration Mode—Recommended if you are familiar with Cisco IOS commands.
- Using AutoInstall—Recommended for automatic installation if another router running Cisco IOS is installed on the network. This configuration method must be set up by an advanced Cisco IOS user.
- Using the Setup Facility—Recommended if you are not familiar with Cisco IOS commands.

Proceed with the procedure that best fits the needs of your network configuration and Cisco IOS experience level.

Note You need to obtain the correct network addresses from your system administrator or consult your network plan to determine correct addresses before you can complete the configuration of your multiport serial router.

Using Configuration Mode

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

Take the following steps to manually configure the router in configuration mode:

Step 1 Connect a terminal by following the instructions described in the section "Connecting the Console Terminal and Modem" in the chapter "Installing the Router" and then power up the router.

Step 2 When asked if you would like to enter the initial dialog, answer **no** to go into the normal operating mode of the router:

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

Step 3 After a few seconds you will see the user EXEC prompt (Router>). Type **enable** to enter the enable mode. Configuration changes can only be made in enable mode:

```
Router> enable
```

The prompt changes to the privileged EXEC mode prompt:

```
Router#
```

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

```
Router# config terminal
```

You can now make any changes you want to the configuration. Press **Ctrl-Z** to exit configuration mode.

To see the currently operating configuration, enter the **show running-config** command at the enable prompt:

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

To see the configuration in NVRAM, enter the **show startup-config** command at the enable prompt.

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

To make your changes permanent, enter the **copy running-config startup-config** command at the enable prompt:

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

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

The router is now configured and will boot with the configuration you have entered.

Using AutoInstall

The AutoInstall process is designed to configure the multiport serial router automatically after connection to the WAN. In order for AutoInstall to work properly, a Transmission Control Protocol/Internet Protocol (TCP/IP) host on the network must be preconfigured to provide the required configuration files. The TCP/IP host can exist anywhere on the network providing the following two conditions are maintained:

1. The host must be on the remote side of the multiport serial router's synchronous serial connection to the WAN.
2. User Datagram Protocol (UDP) broadcasts to and from the multiport serial router and the TCP/IP host must be enabled.

Refer to the configuration guide for additional information.

Note AutoInstall only works on synchronous serial connections.

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

Step 1 Attach the synchronous serial cable 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.

If the AutoInstall process is successfully completed, continue to Step 3 to write the configuration data to the multiport serial router's nonvolatile random-access memory (NVRAM). If the Autoinstall process is not successfully completed, contact your system administrator for assistance.

Step 3 At the enable prompt, enter the **copy running-config startup-config** command:

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

This command saves the configuration settings that the AutoInstall process created in the router. If you fail to do this, the configuration is lost the next time you reload the router.

Using the Setup Facility

If you do not plan to use AutoInstall, do not connect the multiport serial router's WAN and (serial) cable to the channel service unit/data service unit (CSU/DSU). This prevents the router from attempting to run the AutoInstall process. 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 AutoInstall is not set up to a remote TCP/IP host.

Once the router has determined that AutoInstall is not configured, it defaults to the setup facility. If the WAN cable is not connected, the router boots from Flash memory and goes into the setup facility.

Note You can run the setup facility any time from the enable prompt (#) by entering the **setup** command.

Configuring the Global Parameters

You use the setup facility to configure the global parameters, which are used for controlling system-wide settings. Take the following steps to enter the global parameters:

Step 1 Connect a terminal by following the instructions in the section "Connecting the Console Terminal and Modem" in the chapter "Installing the Router" and then boot the router to the user EXEC prompt (Router>).

Step 2 After booting from Flash memory, the following information appears after about 30 seconds.

Note The messages displayed vary, depending on the Cisco IOS release and feature set you selected. The screen displays in this section are for reference only and may not exactly reflect the screen displays on your console.

When the following information is displayed, you have successfully booted the router:

```
System Bootstrap, Version X.X(Xa), SOFTWARE
Copyright (c) 19XX-19XX by Cisco Systems
2500 processor with 16384 Kbytes of main memory

Loading igs-c-l.110-0.7 at 0x3000040, size = 3865444 bytes [OK]

F3: 3779532+85880+173868 at 0x3000060
              Restricted Rights Legend

Use, duplication, or disclosure by the Government is
subject to restrictions as set forth in subparagraph
(c) of the Commercial Computer Software - Restricted
Rights clause at FAR sec. 52.227-19 and subparagraph
(c) (1) (ii) of the Rights in Technical Data and Computer
Software clause at DFARS sec. 252.227-7013.

           Cisco Systems, Inc.
           170 West Tasman Drive
           San Jose, California 95134-1706


Cisco Internetwork Operating System Software
IOS (tm) 3000 Software (IGS-C-L), Version 11.0(5), SOFTWARE
Copyright (c) 19XX-19XX by cisco Systems, Inc.
Compiled Mon 19-Jun-XX 23:22 by
Image text-base: 0x030200E4, data-base: 0x00001000

Cisco 2500 (68030) processor (revision C) with 16380K/2048K bytes of
memory.
Processor board ID 2685538369
```

```
SuperLAT software copyright 1990 by Meridian Technology Corp).
TN3270 Emulation software (copyright 1994 by TGV Inc).
X.25 software, Version 2.0, NET2, BFE and GOSIP compliant.
Bridging software.
Authorized for Enterprise software set.  (0x0)
1 Ethernet/IEEE 802.3 interface.
2 Serial network interfaces.
8 low-speed (sync/async) network interfaces.
32K bytes of non-volatile configuration memory.
4096K bytes of processor board System flash (Read ONLY)

Notice: NVRAM invalid, possibly due to write erase.

         --- System Configuration Dialog ---


At any point you may enter a question mark '?' for help.
Use ctrl-c to abort configuration dialog at any prompt.
Default settings are in square brackets '[]'.
```

Step 3 Enter **yes** or press **Return** (the default) when you are 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
Serial1      unassigned      NO   not set    down    down
Serial2      unassigned      NO   not set    down    down
Serial3      unassigned      NO   not set    down    down
```

Step 4 Choose the supported protocols on the Ethernet or Token Ring interface. For IP-only installations, accept the default values for most of the questions.

A typical configuration using IP, IPX, and AppleTalk follows:

```
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** or **no** to accept or refuse SNMP management:

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

The Simple Network Management Protocol (SNMP) is the most widely supported open standard for network management. It provides a means to access and set the configuration and run-time parameters of a multiport serial router. SNMP defines a set of functions used to monitor and control network elements.

Step 6 Determine if you are using DECnet on the router. If you are configuring for DECnet, enter the appropriate values for your area number, node number, and area routing:

```
Configure DECnet? [no]:
```

Step 7 In most cases, you use IP routing. For IP routing, you must also select one of two interior routing protocols: Interior Gateway Routing Protocol (IGRP) or Routing Information Protocol (RIP).

Enter **yes** or press **Return** (the default) to configure IP, and then select an interior routing protocol for IP:

```
Configure IP? [yes]:
  Configure IGRP routing? [yes]:
    Your IGRP autonomous system number [1]: 15
Configure CLNS? [no]:
Configure bridging? [no]:
Configure IPX? [no]: yes
Configure XNS? [no]:
Configure Apollo? [no]:
```

Step 8 Enter the ISDN BRI switch type for the router. The ISDN switch type appropriate for the router depends on the ISDN provider's equipment. Table 4-1 lists the ISDN switch types.

```
Enter ISDN BRI Switch Type [none]: basic-5ess
```

Table 4-1 ISDN Switch Types

Country:	ISDN Switch Type	Description
Australia	basic-ts013	Australian TS013 switches
Europe	basic-1tr6	German 1TR6 ISDN switches
	basic-nwnet3	Norwegian NET3 ISDN switches (phase 1)
	basic-net3	NET3 ISDN switches (UK and others)
	basic-net5	NET5 switches (UK and Europe)
	vn2	French VN2 ISDN switches
	vn3	French VN3 ISDN switches
	basic-1tr6	German 1TR6 ISDN switches
	basic-nwnet3	Norwegian NET3 ISDN switches (phase 1)
Japan	ntt	Japanese NTT ISDN switches
New Zealand	basic-nznet3	New Zealand NET3 switches

Table 4-1 ISDN Switch Types (Continued)

Country:	ISDN Switch Type	Description
North America	basic-5ess	AT&T basic rate switches
	basic-dms100	NT DMS-100 basic rate switches
	basic-ni1	National ISDN-1 switches

Configuring the ISDN BRI Interface

This section explains how to configure the ISDN BRI interface. If an ISDN BRI WAN module is not installed in your router, skip this section and proceed with the next section, "Configuring the Ethernet or Token Ring Interfaces."

The ISDN BRI interface is configured to allow connection to ISDN WANs. Take the following steps to configure the ISDN BRI interface:

Step 1 Press **Return** or enter **yes** to configure the ISDN BRI port:

```
Configuring interface BRI0:
Is this interface in use? [yes]
Configure IP on this interface? [yes]
IP address for this interface: 172.16.71.1
Number of bits in subnet field [0]: 8
lass B network is 172.16.0.0, 8 subnet bits; mask is
    255.255.255.0
  Configure AppleTalk on this interface? [no]: yes
    Extended AppleTalk network? [no]: yes
    AppleTalk starting cable range [0]: 1
    AppleTalk ending cable range [1]: 2
    AppleTalk zone name [myzone]:
    AppleTalk additional zone name: otherzone
    AppleTalk additional zone name:
  Configure IPX on this interface? [no]: yes
    IPX network number [1]: B000
```

In this example, routing is enabled on AppleTalk and IPX; IP has already been selected:

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

Configure LAT? [yes]: no
Configure IPX? [no]: yes
```

Configuring the Ethernet or Token Ring Interfaces

Take the following steps to configure the Ethernet or Token Ring interface to allow communication over a LAN. To configure the interface parameters, you need to know the Ethernet or Token Ring interface network addresses. In the following example, the system is being configured for an Ethernet LAN using IP.

Step 1 Respond as follows (using your own address and subnet bits) to the setup prompts:

```
Configuring interface Ethernet0:
  Is this interface in use? [yes]:
 Configure IP on this interface? [yes]:
    IP address for this interface: 172.16.72.1
    Number of bits in subnet field [0]: 8

   Class B network is 172.16.0.0, 8 subnet bits; mask is 255.255.255.0
```

Step 2 Enter **yes** if you are using AppleTalk on the interface, enter **yes** to configure for extended AppleTalk networks, and then enter the cable range number. Enter the zone name, and any other additional zones that are associated with the local zone:

```
Configure AppleTalk on this interface? [no]: yes
    Extended AppleTalk network? [no]: yes
    AppleTalk starting cable range [0]: 1
    AppleTalk ending cable range [1]: 2

    AppleTalk zone name [myzone]:
    AppleTalk additional zone name: otherzone
    AppleTalk additional zone name:
```

Step 3 If IPX is enabled on this interface, enter the unique IPX network number:

```
Configure IPX on this interface? [no]: yes
    IPX network number [1]: B001
Configure XNS on this interface? [no]
```

Configuring the Synchronous Serial Interfaces

The synchronous serial interfaces are configured to allow connection to WANs through a CSU/DSU. All serial ports on the multiport serial router are initially configured as synchronous ports. When the initial configuration is completed, configure the serial ports you plan to use as asynchronous ports using the **physical-layer** command in configuration mode. Take the following steps to configure the serial port(s):

Step 1 Enter **yes** to configure serial port 0:

```
Configuring interface Serial0:
  Is this interface in use? [no]: yes
```

Step 2 Determine what protocols you want on the synchronous serial interface and enter the appropriate responses:

```
Configure IP unnumbered on this interface? [no]: no
    IP address for this interface: 172.16.73.1
    Number of bits in subnet field [8]:
Class B network is 172.16.0.0, 8 subnet bits; mask is 255.255.255.0

Configure AppleTalk on this interface? [no]: yes
    Extended AppleTalk network? [yes]:

    AppleTalk starting cable range [2]: 3
    AppleTalk ending cable range [3]: yes

    AppleTalk zone name [myzone]: ZZ Serial
    AppleTalk additional zone name:

Configure IPX on this interface? [no]: yes
    IPX network number [2]: B000
```

Step 3 Configure the second synchronous serial interface:

```
Configuring interface Serial1:
  Is this interface in use? [no]: yes

Configure IP unnumbered on this interface? [no]: yes
    IP address for this interface: 172.16.74.2
    Number of bits in subnet field [8]:
Class B network is 172.16.0.0, 8 subnet bits; mask is 255.255.255.0

 Configure AppleTalk on this interface? [no]: yes
    Extended AppleTalk network? [yes]:
    AppleTalk starting cable range [2]: 4
    AppleTalk ending cable range [3]: 4

    AppleTalk zone name [myzone]: ZZ Serial
    AppleTalk additional zone name:

 Configure IPX on this interface? [no]: yes
    IPX network number [2]: B002
```

Step 4 Continue to configure the remaining serial port(s) using similar parameters.

The multiport serial router is now configured properly and is ready to use. Enter the **setup** command to modify the parameters after the initial configuration. Enter the **configure** command to perform more complex configurations. For additional information, refer to the publication Cisco IOS command reference publication.

Step 5 Check the router settings by entering the **show running-config** command at the enable prompt:

```
Router# show running-config
.
.
.
configuration register is 0x2102
```

Step 6 Store the configuration, or changes to the startup configuration, by entering the **copy running-config startup-config** command at the enable prompt:

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

Entering this command saves the configuration settings that the setup process created in the router. If you fail to do this, the configuration is lost the next time the router is loaded.

Setting Asynchronous Serial Ports

The ports you plan to use as low-speed asynchronous serial ports must be reconfigured after the initial setup because the ports are initially configured as low-speed synchronous serial ports.

Take the following steps to configure a synchronous serial port to be an asynchronous serial port:

Step 1 Connect a terminal by following the instructions in the section "Connecting the Console Terminal and Modem" in the chapter "Installing the Router" and then power up the router.

Step 2 Enter the **config terminal** command at the enable prompt to enter configuration mode:

```
router# config terminal
```

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

Step 3 Enter the **interface** command to select the port you are configuring:

```
interface serial 2
```

Step 4 Enter the **physical-layer** command to change the port to asynchronous:

```
physical-layer async
```

Step 5 Enter the IP address, the asynchronous mode, and routing method:

```
ip address 172.16.2.2 255.0.0.0
async mode dedicated
async default routing
```

Setting Synchronous Serial Ports

Take the following steps to configure a low-speed asynchronous serial port to be a low-speed synchronous serial port:

Step 1 Connect a terminal by following the instructions in the section "Connecting the Console Terminal and Modem" in the chapter "Installing the Router" and then power up the router.

Step 2 Enter the **config terminal** command at the enable prompt to enter configuration mode:

```
Router# config terminal
```

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

Step 3 Enter the **interface** command to select the port you are configuring:

```
interface serial 2
```

Step 4 Enter the **physical-layer** command to set the port to synchronous:

```
physical-layer sync
```

Setting Half-Duplex Mode

Low-speed serial ports that are set as DCE can be set to use either controlled carrier mode or constant carrier mode.

Controlled carrier mode sets the interface to deactivate DCD until a transmission is sent to the interface. DCD is then activated, and the interface waits an amount of time you configure, and then transmits the data. After the transmission, the interface waits for a period of time and then deactivates DCD.

Constant carrier mode (the default for low-speed interfaces) activates DCD at all times.

Take the following steps to enable controlled carrier mode:

Step 1 Connect a terminal by following the instructions in the section "Connecting the Console Terminal and Modem" in the chapter "Installing the Router" and then power up the router.

Step 2 Enter the **config terminal** command at the enable prompt to enter configuration mode:

```
Router# config terminal
```

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

Step 3 Enter the **half-duplex** command to reset the port from constant carrier mode to controlled carrier mode:

```
interface serial 2
half-duplex controlled carrier
```

Step 4 Enter the **no half-duplex** command to return to constant carrier mode:

```
interface serial 2
no half-duplex controlled carrier
```

Step 5 Enter the **half-duplex timer** command to specify the time that the interface delays when in controlled carrier mode. For example, to configure the DCD drop delay, enter the following commands, using appropriate values for your system:

```
interface serial 2
half-duplex timer dcd-drop-delay 100 ms
```

The amount of time is specified in milliseconds.

Step 6 Enter the **timer** command to tailor the delay times for the router ports. Table 4-2 lists the **timer** commands and their default settings.

Table 4-2 Half-Duplex Timer Commands

Timer	Syntax	Default Setting (Milliseconds)
CTS delay	**half-duplex timer cts-delay**	100
CTS drop timeout	**half-duplex timer cts-drop-timeout**	5000
DCD drop delay	**half-duplex timer dcd-drop-delay**	100
DCD transmission start delay	**half-duplex timer dcd-txstart-delay**	100
RTS drop delay	**half-duplex timer rts-drop-delay**	100

Table 4-2 Half-Duplex Timer Commands (Continued)

Timer	Syntax	Default Setting (Milliseconds)
RTS timeout	**half-duplex timer rts-timeout**	2000
Transmit delay	**half-duplex transmit-delay**	0

Specifying the Boot Method

You can enter multiple boot commands in the configuration in NVRAM to provide backup methods for loading the Cisco IOS image onto the router. The router boots using the first boot command that succeeds. If you enter multiple boot commands, the router executes them in the order they are entered. There are two ways to load the Cisco IOS image: from Flash memory or from a TFTP server on the network.

1. Flash memory

   Information stored in Flash memory is not vulnerable to network failures that might occur when you load system software from servers. In the following example, replace *filename* with the filename of the Cisco IOS image:

```
Router> enable
Password: enablepassword
Router# configure terminal
Router (config)# boot system flash filename
Router (config)# Ctrl-Z
Router# copy running-config startup-config
Building configuration ...
[OK]
Router# exit
Router>
```

2. TFTP server

   If Flash memory is not available, or if Flash memory does not contain a valid Cisco IOS image, you can specify that system software be loaded from a TFTP server on your Ethernet network as a backup boot method for the router. In the following example, replace *filename* with the filename of the Cisco IOS image, and replace *ipaddress* with the IP address of the TFTP server:

```
Router> enable
```

```
Password: enablepassword
Router# configure terminal
Router (config)# boot system tftp filename ipaddress
Router (config)# Ctrl-Z
Router# copy running-config startup-config
Building configuration ...
[OK]
Router# exit
Router>
```

For more information about the **configure terminal** command, refer to the command reference publication.

Checking the Configuration Settings

Enter the **show version** command to check the software version (third line from the top in the following display) and configuration register setting (at the end of the following display):

```
Router> show version
Cisco Internetwork Operating System Software
IOS (tm) XX00 Software (XXX-X-X), RELEASE SOFTWARE XX.X(XXXX) [XXX]
Copyright (c) 1986-199X by cisco Systems, Inc.
Compiled Tue XX-XXX-XX 13:07 by XXXXX
Image text-base: 0x03032810, data-base: 0x00001000

ROM: System Bootstrap, Version X.X(XXXX) [XXXXX], RELEASE SOFTWARE
ROM: XX00 Bootstrap Software (XXX-BOOT-X), Version XX.X(XXXXX) [XXXXX]

Router uptime is 4 minutes
System restarted by power-on
System image file is "flash:XXX/XXX-X-X.Nov14", booted via flash

cisco XXXX(68030) processor (revision X) with 4092K/2048K bytes of memory.
Processor board ID 00000000
Bridging software.
SuperLAT software copyright 199X by Meridian Technology Corp).
X.25 software, Version X.X, NET2, BFE and GOSIP compliant.
TN3270 Emulation software (copyright 199X by TGV Inc).
1 Ethernet/IEEE 802.3 interface.
2 Serial network interfaces.
No module installed for Serial Interface 0
No module installed for Serial Interface 1
```

```
32K bytes of non-volatile configuration memory.
8192K bytes of processor board System flash (Read ONLY)

Configuration register is 0x2102

Router>
```

Getting More Information

For more information about router software configuration, refer to the Cisco IOS configuration guide and command reference publications. These publications are available on the documentation CD that accompanied your router. To order the documentation CD, or paper documentation, refer to the information packet publication that accompanied your router.