CHAPTER 4

Configuring the Cisco 2524 and Cisco 2525 Routers

This chapter describes how to configure the Cisco 2524 and Cisco 2525 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 just enough information to get the router up and running. For Cisco IOS Release 11.0 and earlier releases, refer to the *Router Products Configuration Guide* for additional configuration information. For Cisco IOS Release 11.1 and later releases, refer to the *Configuration Fundamentals Configuration Guide*.

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 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 using one of the following procedures:

- Configuration mode—Recommended if you are familiar with Cisco IOS commands.
- AutoInstall—Recommended for automatic installation if another router running Cisco IOS software is installed on the network. This configuration method must be set up by someone with experience using Cisco IOS software.
- System Configuration Dialog—Recommended if you are not familiar with Cisco IOS commands.

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

Timesaver Acquire the correct network addresses from your system administrator or consult your network plan to determine correct addresses before you begin to configure the router.

Using Configuration Mode

You can configure the router manually if you prefer not to use AutoInstall or the System Configuration Dialog. Take the following steps to configure the router manually:

Step 1 Connect a console terminal following the instructions in the section "Connecting the Console Terminal and Modem" in the chapter "Installing the Cisco 2524 and Cisco 2525 Routers," and then power ON the router.

Step 2 When you are prompted to enter the initial dialog, enter **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>). Enter the **enable** command to enter enable mode. You can only make configuration changes in enable mode.

```
Router> enable
```

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

```
Router#
```

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

```
Router# configure terminal
```

You can now enter any changes you want to the configuration.

Step 5 Press **Ctrl-Z** to exit configuration mode.

To see the current 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
```

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

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

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

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

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 be preconfigured to provide the required configuration files. The TCP/IP host may exist anywhere on the network as long as the following two conditions are maintained:

1. The host must be on the remote side of the router's synchronous serial 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 provided on the TCP/IP host. For Cisco IOS Release 11.0 and earlier releases, refer to the publication *Router Products Configuration Guide* for additional information. For Cisco IOS Release 11.1 and later releases, refer to the publication *Configuration Fundamentals Configuration Guide*.

Note AutoInstall works on synchronous serial connections only. The 2-wire switched 56-kbps DSU/CSU module operates on switched 56-kbps circuits only; therefore, you cannot use it for AutoInstall.

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

Step 1 Attach the WAN cable to the router.

Step 2 Turn ON power to the router.

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

If AutoInstall successfully completes, you can write the configuration data to the router's NVRAM. Perform the following step to complete this task.

Step 3 Enter the **copy running-config startup-config** command:

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

Taking this step saves the configuration settings that the AutoInstall process created in the router. If you do not do this, your configuration will be lost the next time you reload the router.

Using the System Configuration Dialog

If you do not plan to use AutoInstall, make sure all the WAN cables are disconnected from the router. This will prevent the router from attempting to the run the AutoInstall process. The router will attempt to run AutoInstall whenever you power it on if there is a WAN connection on both ends and the router does not have a configuration file 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.

If your router does not have a configuration (setup) file and you are not using AutoInstall, the router will automatically start the setup command facility. An interactive dialog called the System Configuration Dialog appears on the console screen. This dialog helps you navigate through the configuration process by prompting you for the configuration information necessary for the router to operate.

Many prompts in the System Configuration Dialog include default answers, which are included in square brackets following the question. To accept a default answer, press **Return**; otherwise, enter your response.

This section gives an example configuration using the System Configuration Dialog. When you are configuring your router, respond as appropriate for your network.

At any time during the System Configuration Dialog, you can request help by typing a question mark (?) at a prompt.

Before proceeding with the System Configuration Dialog, obtain from your system administrator the node addresses and the number of bits in the subnet field (if applicable) of the Ethernet and synchronous serial ports. For more information about Internet Protocol (IP) addresses and subnets, refer to the publication *Internetworking Technology Overview.* (See the section "Getting More Information" at the end of this chapter.)

Take the following steps to configure the router using the System Configuration Dialog:

Step 1 Connect a console terminal to the console connector on the rear panel of your router, and turn ON power to the router. (For more information, refer to the section "Connecting the Console Terminal and Modem" in the chapter "Installing the Cisco 2524 and Cisco 2525 Routers.")

Note The default parameters for the console port are 9600 baud, 8 data bits, no parity, and 2 stop bits.

Step 2 After about 30 seconds, information similar to the following is displayed on the console screen.

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 you see this information, you have successfully booted your router:

```
System Bootstrap, Version X.X(XXXX) [XXXXX XX], RELEASE SOFTWARE
Copyright (c) 1986-1992 by Cisco Systems
2500 processor with 4096 Kbytes of main memory

Notice: NVRAM invalid, possibly due to write erase.

F3: 5797928+162396+258800 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) X000 Software (IGS-J-L), Version XX.X(XXXX) [XXXXX XXX]
Copyright (c) 1986-1996 by Cisco Systems, Inc.
Compiled Fri 20-Oct-95 16:02 by XXXXX
Image text-base: 0x03030FC0, data-base: 0x00001000
Cisco 252X (68030) processor (revision A) with 4092K/2048K bytes of
memory.
Processor board ID 00000000
Bridging software.
SuperLAT software copyright 1990 by Meridian Technology Corp).
X.25 software, Version X.X, NET2, BFE and GOSIP compliant.
TN3270 Emulation software (copyright 1994 by TGV Inc).
Basic Rate ISDN software, Version X.X.
1 Ethernet/IEEE 802.3 interface.
2 Serial network interfaces.
1 ISDN Basic Rate interface.
32K bytes of non-volatile configuration memory.
8192K 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.
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 '[]'.
Would you like to enter the initial configuration dialog? [yes]:
```

Step 3 Press **Return** or enter **yes** to begin the configuration process.

Step 4 When the System Configuration Dialog asks whether you want to view the current interface summary, press **Return** or enter **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
BRI0          unassigned      NO    not set    up         up
Serial0       unassigned      NO    not set    down       down
Serial1       unassigned      NO    not set    down       down
```

Step 5 Configure the global parameters. Choose which protocols to support on the Ethernet interface. For IP installations, you can press **Return** to accept the default values (in brackets) for most of the questions. A typical configuration follows:

```
Configuring global parameters:

  Enter host name [Router]:
```

Next, you are prompted to enter an enable secret password. There are two types of privileged-level passwords:

- Enable secret password (a very secure, encrypted password)
- Enable password (a less secure, nonencrypted password)

The enable password is used when the enable secret password does not exist.

For maximum security, be sure the passwords are different. If you enter the same password for both, the router will accept your entry, but will display a warning message indicating that you should enter a different password.

Step 6 Enter an enable secret password:

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

  Enter enable secret: pail

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

Step 7 Enter the enable and virtual terminal passwords:

```
Enter enable password: shovel
Enter virtual terminal password: vterm1
```

Step 8 Press **Return** to accept Simple Network Management Protocol (SNMP) management, or enter **no** to refuse it:

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

Step 9 In the following example, the router is configured for AppleTalk, IP, and IPX. Configure the appropriate protocols for your router:

```
Configure Vines? [no]:
Configure LAT? [no]:
Configure AppleTalk? [no]: yes
  Multizone networks? [no]: yes
Configure DECnet? [no]:
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 10 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)
	vn2	French VN2 ISDN switches
	vn3	French VN3 ISDN switches
Japan	ntt	Japanese NTT ISDN switches
North America	basic-5ess	AT&T basic rate switches
	basic-dms100	NT DMS-100 basic rate switches
	basic-ni1	National ISDN-1 switches
New Zealand	basic-nznet3	New Zealand NET3 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. To configure the ISDN BRI interface, respond as follows (using your addresses and subnet mask) to the setup prompts, substituting the correct addresses and host names as appropriate:

```
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
```

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 your Ethernet or Token Ring interface network addresses. In this example, the system is being configured for an Ethernet LAN using IP.

Step 1 Respond as follows (using your addresses and subnet mask) to the setup prompts, substituting the correct addresses and host names as appropriate:

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

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

```
Configure AppleTalk on this interface? [no]: yes
  Extended AppleTalk network? [no]: yes
  AppleTalk starting cable range [0]: 3
  AppleTalk ending cable range [1]: 3
  AppleTalk zone name [myzone]:
  AppleTalk additional zone name: otherzone
  AppleTalk additional zone name:
```

Step 3 Determine if you are going to enable IPX on the interface. If so, enter **yes** and then enter the unique IPX network number:

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

Configuring the Synchronous Serial Interfaces

The synchronous serial interfaces are configured to allow connection to WANs. Once the Ethernet or Token Ting port on your router has been configured, take the following steps to configure the synchronous serial interfaces:

Step 1 Press **Return** or enter **yes** to configure serial port 0:

```
Configuring interface Serial0:
  Is this interface in use? [yes]:
```

Step 2 Determine which protocols you want on the synchronous serial interface and enter the appropriate responses. In this example, the system is being configured for IP, AppleTalk, and IPX:

```
Configure IP on this interface? [yes]:
Configure IP unnumbered on this interface? [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]: 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 3 Configure the second synchronous serial interface, for example, as follows:

```
Configuring interface Serial1:
  Is this interface in use? [yes]:
  Configure IP on this interface? [yes]:
  Configure IP unnumbered on this interface? [no]:
    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
    AppleTalk starting cable range [3]: 5
    AppleTalk ending cable range [4]: 5
    AppleTalk zone name [myzone]: ZZ Serial
    AppleTalk additional zone name:
  Configure IPX on this interface? [no]: yes
    IPX network number [3]: B003
```

Step 4 The configuration you enter is now displayed and you are asked if you want to use the displayed configuration. If you enter **no**, you will lose the configuration information you just entered and you can begin the configuration again. If you enter **yes**, the configuration will be entered and saved in the startup configuration:

```
Use this configuration? [yes/no]: yes
Building configuration...
Use the enabled mode 'configure' command to modify this
configuration.


Press RETURN to get started!
```

Configuring ISDN

If you have an ISDN BRI WAN module, configure the BRI port for ISDN. This section explains typical ISDN configurations for one or two B channels. In the examples that follow, the BRI port is configured for IP routing, Challenge Handshake Authentication Protocol (CHAP), and Point-to-Point Protocol (PPP) encapsulation.

Take the following steps to configure the router for a basic ISDN PPP connection on a single B channel or two B channels, substituting the correct addresses and host names as appropriate for your network:

Step 1 Enter enable mode:

```
Router> enable
password: enablepassword
```

Step 2 Enter the **configure terminal** command. Then enter the host name and password that the router will use for CHAP caller identification:

```
Router# config term
Router (config)# username targetrouter password abc
```

Note The username and password must match the username and password already set on the router to which the ISDN connection will be made. The username and password are case sensitive.

Step 3 If you have not already done so, enter the **isdn switch-type** command to configure the ISDN switch type:

```
router (config)# isdn switch-type switch-type
```

Refer to Table 4-1 earlier in this chapter for a list of ISDN switch types.

Step 4 Enter the BRI interface, encapsulation method (PPP), authentication type, target router's IP address and ISDN number to dial, and the dialer group number:

```
Router (config)# interface bri port_number
Router (config-if)# encapsulation ppp
Router (config-if)# ppp authentication chap
Router (config-if)# dialer map ip targetrouter_ipaddress
targetrouter_phonenumber
Router (config-if)# dialer-group groupnumber
```

Note Do not use periods or hyphens when you enter dialing numbers.

Step 5 Some ISDN switch types, such as Basic NI1 or DMS-100 switch service, require you to configure a service profile identifier (SPID). Enter the SPID information as follows, substituting the appropriate entries for your installation:

```
Router (config-if)# isdn spid1 SPID_no phone_number
Router (config-if)# isdn spid2 SPID_no phone_number
```

Step 6 To set up a second B channel for bandwidth on demand, enter the **load-threshold** command to set the ISDN load threshold. The load threshold determines the percentage of network loading at which the second ISDN B channel is triggered. The value ranges from 1 to 255 (100 percent).

```
Router (config-if)# dialer load-threshold 128
```

In this example, the value of 128 means that when the first B channel reaches 50 percent of its bandwidth capacity (128 equals 50 percent of 255), the second B channel will be activated to assist with the bandwidth load.

Step 7 Enter the **access-list** command to configure the ISDN line to come up whenever IP packets are to be sent:

```
Router (config-if)# access-list access-list-number permit ip
sourcerouter-ipnetwork sourcerouter-subnetmask
targetrouter-ipnetwork targetrouter-subnetmask
Router (config)# dialer-list groupnumber list access-list-number
```

Step 8 Configure a static route to allow connectivity to the target router's local network. Enter the network number of the target router's local IP network and subnet mask, and the IP address of the target router's BRI port.

```
Router (config)# ip route targetrouter_ipnetwork subnetmask
targetBRIport_ipaddress
```

Step 9 Enter the **exit** command to exit configuration mode.

Step 10 Enter the **copy running-config startup-config** command to save the configuration to NVRAM.

Configuring Switched 56

This section explains how to configure the 2-wire switched 56-kbps and 4-wire 56/64-kbps DSU/CSU WAN modules for switched 56-kbps circuit-switched service.

You can configure the 2-wire switched 56-kbps DSU/CSU WAN module for switched 56-kbps service, but not Digital Data System ([DDS], which are leased or dedicated lines). The 4-wire 56/64-kbps DSU/CSU WAN module is configured for DDS as the factory default, but it can be configured for either switched 56/64-kbps service or DDS. (See the next section, "Configuring DDS.")

For Cisco IOS Release 11.0 and earlier releases, refer to the *Router Products Command Reference* for more information about the commands in this section. For Cisco IOS Release 11.1 and later releases, refer to the *Configuration Fundamentals Command Reference*.

Take the following steps to configure the 2-wire switched 56-kbps and 4-wire 56/64-kbps DSU/CSU WAN module for circuit-switched service, substituting the correct addresses and host names as appropriate for your network:

Step 1 Enter enable mode:

```
Router> enable
password: enablepassword
```

Step 2 Enter configuration mode:

```
Router# config term
Router(config)#
```

Step 3 Assign an IP address to the serial port on the module:

```
Router(config)# interface serial port_number
Router(config-if)# ip address ipaddress subnetmask
Router(config-if)# no keepalive
```

Step 4 If you have a 2-wire switched 56-kbps WAN module, skip this step and proceed to Step 5. If you have a 4-wire 56/64-kbps DSU/CSU WAN module, set the network type to switched as follows:

```
Router(config-if)# service-module 56k network-type switched
```

Step 5 Set the carrier type, where *carrier* can be **att**, **sprint**, or **other**:

```
Router(config-if)# service-module 56k switched-carrier carrier
```

Step 6 Enter the dialer information:

```
Router(config-if)# dialer in-band
Router(config-if)# dialer string targetrouter_phonenumber
Router(config-if)# dialer-group groupnumber
Router(config-if)# exit
Router(config)# dialer-list groupnumber protocol protocol permit
Router(config)#
```

Step 7 Return to user EXEC mode:

```
Router(config)# exit
Router# exit
Router>
```

Configuring DDS

The 4-wire 56/64-kbps DSU/CSU WAN module is configured for DDS (which are leased or dedicated lines) as the factory default, but it can be configured for either switched 56/64-kbps service or DDS. The DDS configuration is described in this section. To configure the 4-wire 56/64-kbps DSU/CSU WAN module for circuit-switched service, follow the instructions in the previous section, “Configuring Switched 56.”

For Cisco IOS Release 11.0 and earlier releases, refer to the *Router Products Command Reference* for more information about the commands in this section. For Cisco IOS Release 11.1 and later releases, refer to the *Configuration Fundamentals Command Reference*.

Take the following steps to configure the 4-wire 56/64-kbps DSU/CSU WAN module for DDS, substituting the correct addresses and host names as appropriate for your network:

Step 1 Enter enable mode:

```
Router> enable
password: enablepassword
```

Step 2 Enter configuration mode:

```
Router# config term
Router(config)#
```

Step 3 Assign an IP address to the serial port on the module:

```
Router(config)# interface serial port_number
Router(config-if)# ip address ipaddress subnetmask
Router(config-if)# no keepalive
```

Step 4 Set the network type to DDS:

```
Router(config-if)# service-module 56k network-type dds
```

Step 5 Return to user EXEC mode:

```
Router(config-if)# exit
Router(config)# exit
Router# exit
Router>
```

Configuring the Fractional T1/T1 DSU/CSU WAN Module

This section describes how to configure the fractional T1/T1 DSU/CSU WAN module. This module is configured for Extended Superframe Format (ESF) signal format, bipolar eight zero substitution (B8ZS), and full bandwidth as the factory default. Depending on your networking environment, you might need to change these settings.

For Cisco IOS Release 11.0 and earlier releases, refer to the *Router Products Command Reference* for more information about the commands in this section. For Cisco IOS Release 11.1 and later releases, refer to the *Configuration Fundamentals Command Reference*.

Take the following steps to configure the fractional T1/T1 DSU/CSU WAN module for a typical leased-line connection, substituting the correct addresses and host names as appropriate for your network:

Step 1 Enter enable mode:

```
Router> enable
password: enablepassword
```

Step 2 Enter configuration mode:

```
Router# config term
Router(config)#
```

Step 3 Assign an IP address to the serial port on the module:

```
Router(config)# interface serial port_number
Router(config-if)# ip address ipaddress subnetmask
Router(config-if)# no keepalive
```

Step 4 Enter the framing type and line code type, substituting *framing_type* with **sf** (Superframe) or **esf (**Extended Superframe**)** and *linecode_type* with **ami** (alternate mark inversion) or **b8zs (**bipolar eight zero substitution**)**:

```
Router(config-if)# service-module t1 framing framing_type
Router(config-if)# service-module t1 linecode linecode_type
```

Step 5 If you are using fractional T1 service, enter the time slot range and speed. In the following example, the time slot range is from 1 to 20 and the speed is 64-kbps:

```
Router(config-if)# service-module t1 timeslots 1-20 speed 64
```

Step 6 Return to user EXEC mode:

```
Router(config-if)# exit
Router(config)# exit
Router# exit
Router>
```

Specifying the Boot Method

You can enter multiple boot commands in the configuration in NVRAM to provide a backup method 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 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 *Router Products Configuration Guide* publication for Cisco IOS Release 11.0 and earlier releases. Refer to the *Configuration Fundamentals Configuration Guide* for Cisco IOS Release 11.1 and later releases.

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) 1986-1996 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 following publications for Cisco IOS Release 11.0 and earlier:

- *Internetworking Technology Overview*
- *Router Products Configuration Guide*
- *Router Products Command Reference*
- *Configuration Builder Getting Started Guide*
- *CiscoWorks for Windows Getting Started Guide*
- *Troubleshooting Internetworking Systems* (as needed)

For Cisco IOS Release 11.1 and later, refer to the following publications:

- *Internetworking Technology Overview*
- *Configuration Fundamentals Configuration Guide*
- *Configuration Fundamentals Command Reference*
- *Remote Node and Terminal Services Configuration Guide*
- *Remote Node and Terminal Services Command Reference*
- *Wide-Area Networking Configuration Guide*
- *Wide-Area Networking Command Reference*
- *Standard Network Protocols Configuration Guide*
- *Standard Network Protocols Command Reference*
- *Network Protocols Configuration Guide*
- *Network Protocols Command Reference*

These publications are available on UniverCD, Cisco's online library of product information. To order UniverCD, or paper documentation, refer to the *Cisco Information Packet* publication that accompanied your router.