

3. The IOS software looks for a valid configuration file stored in NVRAM. This file is called startup-config and is only there if an administrator copies the running-config file into NVRAM. (As you already know, the new ISR routers have a small startup-config file preloaded.)
4. If a startup-config file is in NVRAM, the router will copy this file and place it in RAM and call the file running-config. The router will use this file to run the router. The router should now be operational. If a startup-config file is not in NVRAM, the router will broadcast out any interface that detects carrier detect (CD) for a TFTP host looking for a configuration, and when that fails (typically it will fail—most people won't even realize the router has attempted this process), it will start the setup mode configuration process.

# Managing Configuration Register

All Cisco routers have a 16-bit software register that's written into NVRAM. By default, the *configuration register* is set to load the Cisco IOS from *flash memory* and to look for and load the startup-config file from NVRAM. In the following sections, I am going to discuss the configuration register settings and how to use these settings to provide password recovery on your routers.

## Understanding the Configuration Register Bits

The 16 bits (2 bytes) of the configuration register are read from 15 to 0, from left to right. The default configuration setting on Cisco routers is 0x2102. This means that bits 13, 8, and 1 are on, as shown in Table 5.2. Notice that each set of 4 bits (called a nibble) is read in binary with a value of 8, 4, 2, 1.

**TABLE 5.2** The Configuration Register Bit Numbers

Configuration Register	2				1				0				2			
Bit number	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Binary	0	0	1	0	0	0	0	1	0	0	0	0	0	0	1	0



Add the prefix 0x to the configuration register address. The 0x means that the digits that follow are in hexadecimal.

Table 5.3 lists the software configuration bit meanings. Notice that bit 6 can be used to ignore the NVRAM contents. This bit is used for password recovery—something I'll go over with you soon in the section "Recovering Passwords" later in this chapter.



Remember that in hex, the scheme is 0–9 and A–F (A = 10, B = 11, C = 12, D = 13, E = 14, and F = 15). This means that a 210F setting for the configuration register is actually 210(15), or 1111 in binary.

**TABLE 5.3** Software Configuration Meanings

Bit	Hex	Description
0–3	0x0000–0x000F	Boot field (see Table 5.4).
6	0x0040	Ignore NVRAM contents.
7	0x0080	OEM bit enabled.
8	0x101	Break disabled.
10	0x0400	IP broadcast with all zeros.
5, 11–12	0x0800–0x1000	Console line speed.
13	0x2000	Boot default ROM software if network boot fails.
14	0x4000	IP broadcasts do not have net numbers.
15	0x8000	Enable diagnostic messages and ignore NVRAM contents.

The boot field, which consists of bits 0–3 in the configuration register, controls the router boot sequence. Table 5.4 describes the boot field bits.

**TABLE 5.4** The Boot Field (Configuration Register Bits 00–03)

Boot Field	Meaning	Use
00	ROM monitor mode	To boot to ROM monitor mode, set the configuration register to 2100. You must manually boot the router with the <code>b</code> command. The router will show the <code>rommon&gt;</code> prompt.
01	Boot image from ROM	To boot an IOS image stored in ROM, set the configuration register to 2101. The router will show the <code>Router(boot)&gt;</code> prompt.
02–F	Specifies a default boot file name	Any value from 2102 through 210F tells the router to use the boot commands specified in NVRAM.