

AS51 Cards

This chapter describes the installation and configuration of the AS51 network application card (NAC), and the AS51 network interface card (NIC).

Note The NAC is inserted into the front of the Cisco Access Server 5100 chassis, and provides the router functions. The NIC is inserted into the rear of the chassis, and provides the physical interface to the modems.

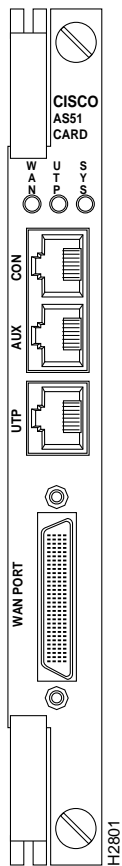
The AS51 NAC and NIC function together to form 16 asynchronous serial ports using the SCSI II-to-DB-50 breakout cable. The AS51 NAC software operates from Flash memory by default. The access server module interfaces include Ethernet 10BaseT, asynchronous serial, and synchronous serial. The AS51 NIC provides two 68-pin asynchronous ports that connect to the modem NICs in the Access Server 5100 chassis.

Note This publication takes you through the initial hardware installation and selected maintenance procedures. Refer to the *Router Products Getting Started Guide* or the *Router Products Configuration Guide* for software configuration and operating information. To order UniverCD, Cisco's library of product information in CD-ROM format, or printed documentation, refer to *Ordering Cisco Documentation*, which is in your warranty pack.

AS51 Network Application Card

The AS51 NAC is shown in Figure 4-1. The NAC has three LEDs, a console port, an auxiliary port, a 10BaseT port, and a serial port.

Figure 4-1 AS51 NAC



AS51 NAC LEDs

There are three LEDs on the AS51 NAC. (See Figure 4-1.) Table 4-1 lists the LEDs and describes their meaning.

Table 4-1 AS51 NAC LEDs

LED	Description
WAN	When this LED is flashing, data is either being transmitted or received through the AS51 NAC synchronous port.
UTP	When on, this LED indicates that data is either being transmitted or being received through the AS51 NAC 10BaseT port.
SYS	When on, this LED indicates that the AS51 NAC is functioning normally.

AS51 NAC Switch Settings

The AS51 NAC has two banks of DIP switches as shown in Figure 4-2. These switches specify the NAC clock frequency, various Ethernet settings, the microprocessor cache state, and the NIC asynchronous controller version. These DIP switches are preset at the factory and should not be changed. Table 4-2 and Table 4-3 list the default settings for the switches.

Figure 4-2 AS51 NAC DIP Switch Locations

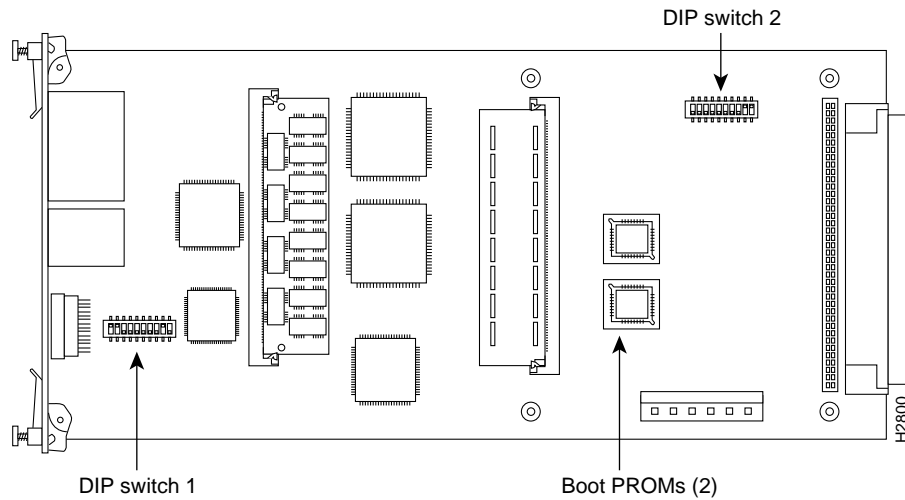


Table 4-2 AS51 NAC DIP Switch 1 Settings

Switch	Default Setting	Description
1-1	On	Clock frequency setting. These switches specify the AS51 NIC clock frequency, and should be set as follows: 20 MHz: off, off 25 MHz: off, on 27 MHz: on, off 30 MHz: on, on
1-2	On	
1-3	Off	
1-4	Off	
1-3	Off	This switch is used to enable/disable the cache on the 68030 microprocessor. If SW1-3 is off, the cache is always enabled. If SW1-3 is on, the cache is always disabled.
1-4	Off	This switch configures the Ethernet transceiver interface if SW1-6 is on. If SW1-6 is on and SW1-4 is off, the 10BaseT interface is configured.

Switch	Default Setting	Description
1-5	Off	This switch configures the 10BaseT receiver termination circuitry. It should be configured based on the type of twisted-pair cabling that is in use. If SW1-5 is off, the cable should be 100-ohm unshielded twisted-pair. If SW1-5 is on, the cable should be 150-ohm shielded twisted-pair.
1-6	Off	This switch is used to configure the Ethernet port on the Level One transceiver device. If SW1-6 is off, the transceiver automatically senses which port is active. The AS51 NAC only has a 10BaseT interface.
1-7	Off	This switch is used to enable/disable the link integrity test. If SW1-7 is off, link integrity testing is enabled. If SW1-7 is on, link integrity testing is disabled. Link integrity testing should only be disabled if the router is connected to prestandard 10BaseT devices that did not implement link integrity.
1-8	Off	This switch is used to adjust the 10BaseT receive squelch threshold. If SW1-8 is off, the normal squelch level is used. If SW1-8 is on, the receive squelch threshold is reduced by 4.5 dB allowing the use of longer cables.
1-9 1-10	On Off	These two switches are configured by the factory depending on the type of Level One Ethernet transceiver on the NAC. The default configuration uses the LXT901. In this configuration SW1-9 should be on and SW1-10 should be off. If the LXT907 is used, the switch settings are reversed. These switches should not be changed from the factory settings under any circumstances.

Table 4-3 AS51 NAC DIP Switch 2 Settings

Switch	Default Setting	Description
2-1	Off	Reserved
2-2	Off	This switch tells the system software that it is running on an AS51 NAC, and should always be set to off. On indicates a Cisco 2500 chassis.
2-3	Off	Reserved
2-4	Off	Reserved
2-5	Off	Reserved

AS51 Network Application Card

Switch	Default Setting	Description
2-6	Off	Reserved
2-7	Off	Reserved
2-8	Off	Reserved
2-9	On	These two switches are used to notify the operating software of the version of asynchronous controller used on the AS51 NIC.
2-10	On	

Installing the AS51 NAC

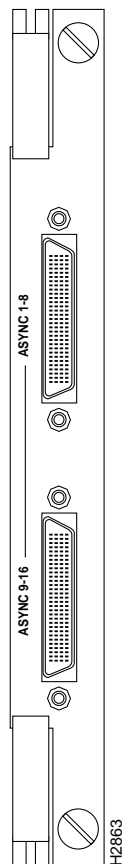
Perform the following steps to install the AS51 NAC:

- Step 1** Unscrew and remove the front cover panel from the desired slot. Save the panel and screws.
- Step 2** If your system has come from the factory assembled, and you want to change any of the AS51 NAC's switch settings, you must remove the NAC. Loosen the captive screws and push the ejector tabs away from each other. The card pops out slightly. Use the tabs or grasp the front panel to slide the card toward you and remove it from the chassis.
- Step 3** Install the AS51 NAC in the upper and lower card guides of the slot. Lift the top ejector tab while sliding the card toward the rear until the card is firmly plugged into the connector on the chassis midplane.
- Step 4** Tighten the captive screws to secure the NAC in place.

AS51 Network Interface Card

The AS51 NIC provides two 68-pin ports, each connecting to the serial port on a quad modem NIC. Figure 4-3 shows the AS51 NIC.

Figure 4-3 **AS51 NIC**



Installing the AS51 NIC

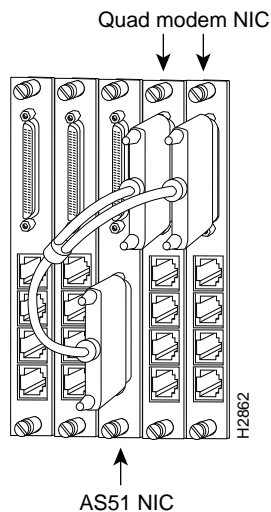
Perform the following steps to install the AS51 NIC:

- Step 1** Remove the safety panel from the selected slot at the rear of the chassis by unscrewing the top and bottom screws of each panel.
- Step 2** Slide the NIC into the slot's upper and lower card guides until its rear connector is firmly positioned in the connector on the chassis midplane.
- Step 3** Tighten the thumb screws that are attached to the rear panel.

Cabling the AS51 NIC to a Quad Modem NIC

Use one 68-pin-to-DB-50 breakout cable to connect each port on the AS51 NIC to the DB-50 connector on an adjacent quad modem NIC. In Figure 4-4, one AS51 NIC port is connected to the DB-50 connectors on two adjacent quad modem NICs. A second breakout cable connects the other AS51 NIC port to the two quad modem DB-50 ports on the left. An Access Server 5100 chassis supports up to 3 AS51s, and 12 quad modems, for a total of 48 modems. For breakout cable specifications, see the "Cable and Port Specifications" appendix.

Figure 4-4 Connecting the AS51 NIC to Quad Modem NICs with a Breakout Cable



Booting the AS51 NAC for the First Time

After installing the AS51 NAC and NIC in your Access Server 5100 chassis, connect a terminal to the console port on the AS51 NAC. See Figure 4-1 for the location of the console port.

Console port configuration parameters are as follows:

- 9600 bps
- No parity
- 8 data bits
- 1 stop bit
- No flow control

Configuring the AS51 NAC

After booting to the monitor prompt (>), you can prepare the AS51 NAC for connection to your network. There are three ways to configure the AS51 NAC:

- Using AutoInstall
- Manually, using the automated setup routine
- Manually, without using the setup routine

If you have an ASCII configuration file already prepared, you can install the AS51 NAC manually without using the setup routine.

Configuring the AS51 NAC

This section describes the following procedures:

- Configuring the AS51 NAC using AutoInstall
- Configuring the AS51 NAC manually using the automated setup routine
- Configuring the AS51 NAC manually without using the automated setup routine

You should follow the procedure that best fits the needs of your Access Server 5100 and network configuration.

Configuring the AS51 NAC Using AutoInstall

The AutoInstall process is designed to configure the AS51 NAC automatically after connection to your network. 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. This TCP/IP host is typically a UNIX-based system. 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 opposite side of the AS51's serial connection to the WAN.
- 2 User Datagram Protocol (UDP) broadcasts between the AS51 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.

Follow these steps to prepare the AS51 NAC for the AutoInstall process:

- Step 1** Shut down the Access Server 5100.
- Step 2** Place the Access Server 5100 in a location that will allow the serial cable to make a connection between the AS51 NAC and the channel service unit/digital service unit (CSU/DSU) without placing a strain on the cable.
- Step 3** Attach the serial cable to the Access Server 5100 and the CSU/DSU.
- Step 4** Power the Access Server 5100 back on, load the terminal emulation software, and bring up a console session.

The AS51 NAC will load the operating system image from Flash memory. If the remote end of the network connection is connected and properly configured, the AutoInstall process will begin.

The AS51 NAC will send a Serial Line Reverse Address Resolution Protocol (SLARP) packet over the serial line. When the packet reaches the opposite end of the network connection, the remote host will reply with the IP address of its serial interface. The AS51 NAC will increment the serial interface address by one and assign this address to its own serial interface. This process will take approximately one minute.

Note The remote host's IP address must have a 1 as the fourth byte—for example, 127.100.21.1.

After the serial interface on the AS51 NAC has been assigned a valid serial interface IP address, it will resolve its host name. It will send a Trivial File Transfer Protocol (TFTP) request on the serial line for the configuration file called network-config. If the TCP/IP host responds with this file, AutoInstall will search the file's contents for the host name associated with its IP address.

If the TCP/IP host does not respond with the network-config file, AutoInstall will broadcast a reverse domain name server (DNS) request containing the IP address for the AS51 NAC serial port that it was assigned over the network. If the DNS services have been set up, AutoInstall will resolve the AS51 NAC's name from this file. After the IP address and host name have been found, AutoInstall will broadcast a TFTP request to the TCP/IP host for

Configuring the AS51 NAC

the file called `hostname-config`. If this file has been set up by the system administrator, it will be downloaded automatically to the AS51 NAC's memory, completing the configuration.

If the AutoInstall feature is not set up, or if your AS51 NAC is unable to locate the appropriate files, you should use the manual configuration with or without the setup utility. (See the following sections “Configuring the AS51 NAC Manually Using the Setup Routine” and “Configuring the AS51 NAC Without Using the Setup Routine.”)

If the AutoInstall completed successfully, you still need to write the configuration data to the AS51 NAC's nonvolatile random-access memory (NVRAM) and reset the configuration registers. Perform the following steps to complete these tasks:

Step 1 Enter the **enable** command to enter enable mode. Configuration changes can only be made in enable mode.

```
Hostname> enable
```

Step 2 Enter the enable password that was configured into the AS51 NAC by the AutoInstall process:

```
Password:*****
```

Step 3 Enter the **write memory** command at the `Hostname#` prompt:

```
Hostname# write memory
```

This will save the configuration settings that the AutoInstall process created in the AS51 NAC. If you fail to do this, your configuration will be lost the next time you reload the AS51 NAC.

Step 4 You can check the value of these settings by entering the **show version** command at the `Hostname#` prompt:

```
Hostname# show version
.
.
.
configuration register is 0x0 (will be 0x2102 at next reload)
```

Configuring the AS51 NAC Manually Using the Setup Routine

If you do not plan to use AutoInstall, do not connect the AS51 NAC's serial cable to the CSU/DSU or the AS51 NAC itself. This will prevent the AS51 NAC from attempting to run the AutoInstall process. The AS51 NAC will attempt to run AutoInstall whenever you start it if the serial cable is connected on both ends and the AS51 NAC does not have a configuration stored in NVRAM. It can take several minutes for your AS51 NAC to determine that AutoInstall is not set up on a remote TCP/IP host. Once the AS51 NAC has determined that AutoInstall is not configured, it will default to the setup routine. If the serial cable is not connected, the AS51 NAC will boot from Flash memory and go into the setup routine.

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

Step 1 When you have booted from Flash memory, the following information will appear after about 30 seconds. When you see this information displayed, you have successfully booted your AS51 NAC:

```
System Bootstrap, Version 4.14(8), SOFTWARE
Copyright (c) 1986-1995 by cisco Systems
2500 processor with 4096 Kbytes of main memory
```

```
Loading master/igs-k-1.102-2 at 0x3000040, size = 4105084 bytes [OK]
```

```
F3: 3946068+158984+308596 at 0x3000060
```

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Cisco Systems, Inc.
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San Jose, California 95134

Configuring the AS51 NAC

```
Cisco Internetwork Operating System Software
IOS (tm) 3000 Software (IGS-K-L), Version 10.2(2), RELEASE SOFTWARE
Copyright (c) 1986-1995 by Cisco Systems, Inc.
Compiled Thu 15-Dec-94 15:00 by kmac
Image text-base: 0x03023478, data-base: 0x00001000
```

```
cisco 2500 (68030) processor (revision 0x00) with 4092K/2048K bytes
of memory.
Processor board serial number 00000000
X.25 software, Version 2.0, NET2, BFE and GOSIP compliant.
Bridging software.
SuperLAT software (copyright 1990 by Meridian Technology Corp).
Authorized for Enterprise software set. (0x0)
1 Ethernet/IEEE 802.3 interface.
2 Serial network interfaces.
16 terminal lines.
32K bytes of non-volatile configuration memory.
4096K bytes of processor board System flash (Read ONLY)
```

--- 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]:**yes**

Step 2 Now you need to configure global parameters. Choose what protocols to support on the Ethernet interface. For IP-only installations, you can accept the default values for most of the questions. A typical configuration follows:

Configuring global parameters:

```
Enter host name [Router]: as5100
Enter enable password: lab
Enter virtual terminal password: lab
Configure SNMP Network Management? [yes]: yes
Community string [public]: public
Configure DECnet? [no]:
Configure IP? [yes]:
Configure IGRP routing? [yes]:
Your IGRP autonomous system number [1]:
Configure IPX? [no]:
Configure XNS? [no]:
```

```
Configure AppleTalk? [no]:
Configure Apollo? [no]:
Configure CLNS? [no]:
Configure Vines? [no]:
Configure bridging? [no]:
Configure Async lines? [yes]:
  Async line speed [9600]:
  Configure for HW flow control? [yes]:
  Configure for modems? [yes/no]: yes
    Configure for default chat script? [yes]: no
  Configure for Dial-in IP SLIP/PPP access? [no]: yes
    Configure for Dynamic IP addresses? [yes]: no
    Configure Default IP addresses? [no]: no
    Configure for TCP Header Compression? [yes]:
    Configure for routing updates on async links? [no]: yes
```

Note You will need to acquire the correct network addresses from your system administrator before you can complete the next two steps.

Step 3 To configure the interface parameters, you need to know your Ethernet interface and subnetwork addresses, as well as the address for your serial port. Respond as follows to the setup prompts:

```
Configuring interface parameters:

Configuring interface Ethernet0:
  Is this interface in use? [yes]: yes
  Configure IP on this interface? [yes]: yes
    IP address for this interface: xxx.xxx.xxx.xxx
    Number of bits in subnet field [0]: 0
    Class B network is 128.1.0.0, 0 subnet bits; mask is 255.255.0.0
```

Step 4 Once the Ethernet port on your AS51 NAC has been configured, you need to configure the serial ports:

```
Configuring interface Serial0:
  Is this interface in use? [yes]: yes
  Configure IP on this interface? [yes]: yes
  Configure IP unnumbered on this interface? [no]: no
    IP address for this interface: xxx.xxx.xxx.xxx
```

Configuring the AS51 NAC

```
Number of bits in subnet field [0]: 0
Class B network is 128.1.0.0, 0 subnet bits; mask is 255.255.0.0

Configuring interface Serial1:
Is this interface in use? [yes]: yes
Configure IP on this interface? [yes]: yes
Configure IP unnumbered on this interface? [no]: no
IP address for this interface: xxx.xxx.xxx.xxx
Number of bits in subnet field [0]: 0
Class B network is 128.1.0.0, 0 subnet bits; mask is 255.255.0.0
Configuring interface Async1:
Configuring interface Async2:
Configuring interface Async3:
Configuring interface Async4:
Configuring interface Async5:
Configuring interface Async6:
Configuring interface Async7:
Configuring interface Async8:
Configuring interface Async9:
Configuring interface Async10:
Configuring interface Async11:
Configuring interface Async12:
Configuring interface Async13:
Configuring interface Async14:
Configuring interface Async15:
Configuring interface Async16:
```

Step 5 At this point, the configuration you have entered is displayed and you are asked if you want to use the displayed configuration. If you answer **no**, you can begin the configuration again and make any changes you want. If you answer **yes**, then this configuration will be entered and saved in the configuration database.

```
Use this configuration? [yes/no]: yes
#####

use the enabled mode 'configure' command to modify this
configuration.
```

The AS51 NAC and asynchronous serial ports are now configured.

Checking Your Settings

You can check the value of the settings you have entered by using the **show version** command at the Hostname> or the Hostname# prompt:

```
as5100# show version
.
.
.
configuration register is 0x0 (will be 0x2102 at next reload)
```

Configuring the AS51 NAC Without Using the Setup Routine

You can configure your AS51 NAC manually if you prefer not to use the setup routine or AutoInstall. Take the following steps to configure the AS51 NAC manually:

Step 1 When you are asked if you would like to enter the initial dialog, answer **no** to go into the normal operating mode of the AS51 NAC:

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

Step 2 After a few seconds you will see the default prompt (Router>). Type **enable** to enter enable mode. Configuration changes can only be made in enable mode:

```
as5100> enable
```

The prompt will change to the enable mode prompt:

```
as5100(config)#
```

Step 3 Enter the **config terminal** command at the enable prompt to enter configuration mode:

```
as5100(config)# config terminal
```

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

To see the currently operating configuration, enter the **write terminal** command at the enable prompt:

```
as5100(config)# write terminal
```

To see the configuration in NVRAM, enter the **show config** command at the enable prompt:

```
as5100(config)# show config
```

For More Information

The results of the **show config** and **write terminal** commands will vary if you have made changes to the configuration in enable mode but have not yet written them to NVRAM.

Remember that to make your changes permanent you must enter the **write memory** command at the enable prompt:

```
as5100(config)# write memory
*****
```

The AS51 NAC is now configured and will boot with the configuration each time it or the Access Server 5100 is booted.

When the AS51 NAC is configured, and cables connected from the 68-pin asynchronous serial ports on the AS51 NIC, use the AS51 NAC console to telnet to each modem. See the chapter “Quad Modems” for more information.

For More Information

For more information on configuring the AS51 NAC software, refer to the following publications:

Configuration Builder Getting Started Guide

Router Products Getting Started Guide

Router Products Configuration Guide

Router Products Command Reference

Troubleshooting Internetworking Systems (as needed)

To order UniverCD, Cisco’s online library of product information, or paper documentation, refer to *Ordering Cisco Documentation*, which is in the warranty pack that accompanied your Cisco Access Server 5100.

The remainder of this chapter provides additional information about the AS51 NAC, including the virtual configuration register, the bootstrap program, troubleshooting, upgrading the boot PROM and Flash memory, and replacing AS51 NAC single in-line memory modules.

For cable specifications, see the appendix “Cable and Port Specifications.”

AS51 NAC Virtual Configuration Register

The AS51 NAC has a 16-bit virtual configuration register written into NVRAM. You might need to change the virtual configuration register settings for several reasons:

- Set and display the configuration register value
- Force the system into the bootstrap program
- Select a boot source and default boot filename
- Enable or disable the break function
- Control broadcast addresses
- Set the console terminal baud rate
- Load operating software from ROM
- Enable booting from a TFTP server

The following information is included in this section:

- Changing configuration register settings
- Virtual configuration register bit meanings
- Enabling booting from Flash memory
- Copying to Flash memory

Table 4-4 lists the meaning of each of the virtual configuration register bits and Table 4-5 describes the boot field names.



Caution Remember that valid configuration register settings might be combinations of settings and not just the individual settings listed in Table 4-4. For example, the factory default value of 0x2102 is a combination of settings.

AS51 NAC Virtual Configuration Register

Table 4-4 Virtual Configuration Register Bit Meanings

Bit No. ¹	Hexadecimal	Meaning
00 to 03	0x0000 to 0x000F	Boot field (see Table 4-5)
06	0x0040	Causes the system software to ignore NVRAM contents
07	0x0080	OEM bit is enabled
08	0x0100	Break is disabled
10	0x0400	IP broadcast with all zeros
11 to 12	0x0800 to 0x1000	Console line speed
13	0x2000	Boot from default ROM software if the network boot fails
14	0x4000	IP broadcasts do not have net numbers
15	0x8000	Enable diagnostic messages and ignore the contents of NVRAM

1. The factory default value for the configuration register is 0x2102. This value is a combination of the following: bit 13 = 0x2000, bit 8 = 0x0100, and bits 00 through 03 (see Table 4-5) = 0x0002.

Table 4-5 Explanation of Boot Field

Boot Field	Meaning
00	Stays at the system bootstrap prompt
01	Boots the system image in system ROM
02 to 0F	Specifies a default network boot filename. Enables boot system commands that override the default network boot filename

Changing Configuration Register Settings

You might need to modify the value of the virtual configuration register for several reasons:

- Recover a lost password.
- Change the console baud rate.
- Enable or disable break.
- Allow you to manually boot the operating system using the **b** command at the bootstrap program (ROM monitor) prompt.
- Force the AS51 NAC to boot automatically from the system bootstrap software (boot ROM image) or from its system image in Flash memory, and read any **boot system** commands that are stored in the configuration file in NVRAM. If the AS51 NAC finds no **boot system** commands, it uses the configuration register value to form a filename from which to netboot a default system image stored on a network server. (See Table 4-6.)

The server creates a default boot filename as part of the automatic configuration processes. To form the boot filename, the server starts with *cisco* and links the octal equivalent of the boot field number, a dash, and the processor-type name. Table 4-6 lists the default boot filenames or actions for the processor.

Table 4-6 **Default Boot Filenames**

Action/File Name	Bit 3	Bit 2	Bit 1	Bit 0
Bootstrap mode	0	0	0	0
ROM software	0	0	0	1
cisco2-igs	0	0	1	0
cisco3-igs	0	0	1	1
cisco4-igs	0	1	0	0
cisco5-igs	0	1	0	1
cisco6-igs	0	1	1	0
cisco7-igs	0	1	1	1

AS51 NAC Virtual Configuration Register

Action/File Name	Bit 3	Bit 2	Bit 1	Bit 0
cisco10-igs	1	0	0	0
cisco11-igs	1	0	0	1
cisco12-igs	1	0	1	0
cisco13-igs	1	0	1	1
cisco14-igs	1	1	0	0
cisco15-igs	1	1	0	1
cisco16-igs	1	1	1	0
cisco17-igs	1	1	1	1

To change the configuration register while running the system software, follow these steps:

Step 1 Enter the **enable** command and your password to enter the privileged level, as follows:

```
router> enable
Password:
router#
```

Step 2 At the privileged-level system prompt (router #), enter the **configure terminal** command. You will be prompted as follows:

```
router# conf term
Enter configuration commands, one per line.
Edit with DELETE, CTRL/W, and CTRL/U; end with CTRL/Z
```

Step 3 To set the contents of the configuration register, enter the **config-register value** command where *value* is a hexadecimal number preceded by 0x (see Table 4-4), as follows:

```
config-register 0xvalue
```

(The virtual configuration register is stored in NVRAM.)

Step 4 Exit configuration mode by pressing **Ctrl-Z**. The new value settings will be saved to memory; however, the new settings do not take effect until the system software is reloaded by rebooting the AS51 NAC.

- Step 5** To display the configuration register value currently in effect and the value that will be used at the next reload, enter the **show version** command. The value will be displayed on the last line of the screen display as in the following example:

```
Configuration register is 0x142 (will be 0x102 at next reload)
```

- Step 6** Reboot the AS51 NAC. The new value takes effect. Configuration register changes take effect only when the server restarts, which occurs when you switch the power off and on or when you issue a **reload** command from the console.

Virtual Configuration Register Bit Meanings

The lowest four bits of the virtual configuration register (bits 3, 2, 1, and 0) form the boot field. (See Table 4-5.) The boot field specifies a number in binary. If you set the boot field value to 0, you must boot the operating system manually by entering the **b** command at the bootstrap prompt as follows:

```
> b [tftp] flash filename
```

See the section “Available Bootstrap Commands” later in this chapter for **b** command options, or refer to the *Router Products Configuration Guide*. This publication is available on UniverCD or a printed copy can be ordered separately.

If you set the boot field value to 0x2 through 0xF, and a valid system boot command is stored in the configuration file, then the AS51 NAC boots the system software as directed by that value. If you set the boot field to any other bit pattern, the AS51 NAC uses the resulting number to form a default boot filename for netbooting. (See Table 4-6.)

In the following example, the virtual configuration register is set to boot the AS51 NAC from Flash memory and to ignore break at the next reboot of the AS51 NAC:

```
router# conf term
Enter configuration commands, one per line.
Edit with DELETE, CTRL/W, and CTRL/U; end with CTRL/Z
config-register 0x102
boot system flash [filename]
^Z
router#
```

AS51 NAC Virtual Configuration Register

Note A **boot system** configuration command in the AS51 NAC configuration in NVRAM overrides the default netboot filename.

Bit 8 controls the console break key. Setting bit 8 (the factory default) causes the processor to ignore the console break key. Clearing bit 8 causes the processor to interpret the break key as a command to force the system into the bootstrap monitor, thereby halting normal operation. A break can be sent in the first 60 seconds while the system reboots, regardless of the configuration settings.

Bit 10 controls the host portion of the IP broadcast address. Setting bit 10 causes the processor to use all zeros; clearing bit 10 (the factory default) causes the processor to use all ones. Bit 10 interacts with bit 14, which controls the network and subnet portions of the broadcast address. Table 4-7 shows the combined effect of bits 10 and 14.

Table 4-7 Configuration Register Settings for Broadcast Address Destination

Bit 14	Bit 10	Net Address	Host Address
Off	Off	Ones	Ones
Off	On	Zeros	Zeros
On	On	Ones	Zeros
On	Off	Ones	Zeros

Bits 11 and 12 in the configuration register determine the baud rate of the console terminal. Table 4-8 shows the bit settings for the four available baud rates. (The factory-set default baud rate is 9600 bps.)

Table 4-8 System Console Terminal Baud Rate Settings

Baud	Bit 12	Bit 11
9600	0	0
4800	0	1
2400	1	0
1200	1	1

Bit 13 determines the server response to a bootload failure. Setting bit 13 causes the server to load operating software from ROM after five unsuccessful attempts to load a boot file from the network. Clearing bit 13 causes the server to continue attempting to load a boot file from the network indefinitely. By factory default, bit 13 is cleared to 0.

Enabling Booting from Flash Memory

To enable booting from Flash memory, set configuration register bits 3, 2, 1, and 0 to a value between 2 and 15 in conjunction with the **boot system flash** *[filename]* configuration command.

To enter configuration mode while you are in the system software image, specify a Flash memory filename from which to boot. Then enter the **configure terminal** command at the enable prompt, as in the following example:

```
router# configure terminal
Enter configuration commands, one per line.
Edit with DELETE, CTRL/W, and CTRL/U; end with CTRL/Z
boot system flash [filename]
```

To disable break and enable the **boot system flash** command, enter the **config-register** command with the value shown in the following example:

```
router# config term
Enter configuration commands, one per line.
Edit with DELETE, CTRL/W, and CTRL/U; end with CTRL/Z
config-reg 0x2102
^Z
router#
```


The configuration register setting 0x2102 tells the system to boot from ROM if netboot fails, disable break, and check for a default netboot filename.

```
router(boot)# reload
...
```

The system is now ready to be configured to boot from the new image you copied to Flash memory. For more information on the **copy tftp flash** command and other related commands, refer to the *Router Products Configuration Guide*.

Note Cisco technical documentation is available on UniverCD or a printed copy of individual technical documents can be ordered separately.

Bootstrap Program

The bootstrap program can help you to isolate or eliminate hardware problems encountered when installing your AS51 NAC. A summary of the bootstrap diagnostic tests and command options is provided in the section “Available Bootstrap Commands” later in this chapter.

Entering the Bootstrap Program

The bootstrap diagnostics help initialize the processor hardware and boot the main operating system software. If you set the software configuration register boot field (bits 3, 2, 1, and 0) to zero, you can start the AS51 NAC in standalone bootstrap mode. The bootstrap mode prompt is an angle bracket (>).

To enable the break key, and to default to booting in bootstrap mode, at the bootstrap prompt (>) set the configuration register to 0x0 by entering the following command:

```
o/r 0x0
```

See Table 4-9 for an explanation of the **o/r** command.

Bootstrap Program

Table 4-9 **o Command Options**

Monitor Command	Function
o	Displays the virtual configuration register currently in effect with a description of the bits
o/r	Resets the virtual configuration register as follows: <ul style="list-style-type: none">• 9600 baud console port speed• Break/abort has no effect• Ignore the system configuration in NVRAM• Boot from ROM
o/r <i>0xvalue</i>	Sets the virtual configuration register to the (hexadecimal) value, <i>value</i>

Note For more information on the virtual configuration register, refer to the section “Changing Configuration Register Settings” earlier in this chapter.

While running the system software, you can reset the configuration register to 0x0 by entering configuration mode and then entering the **config-register** command:

```
config-register 0x0
```

The new configuration register value, 0x0, takes effect after the AS51 NAC is rebooted. If you set the configuration to 0x0, you must manually boot the system each time you reboot the AS51 NAC.



Timesaver Break (system interrupt) is always enabled for 60 seconds after you reboot the system, regardless of whether the break is configured to be off by setting the configuration register. In that 60 seconds, you can break to the bootstrap program prompt.

Available Bootstrap Commands

When you are in bootstrap mode, enter `?` at the `>` prompt to display a list of available commands and options, as follows:

```
?
$ Toggle cache state
B [filename] [TFTP Server IP address | TFTP Server Name]
Load and execute system image from ROM or from TFTP server
C [address] Continue [optional address]
D /S M L V Deposit value V of size S into location L with modifier M
E /S M L Examine location L with size S with modifier M
G [address] Begin execution
H Help for commands
I Initialize
K Displays Stack trace
L [filename] [TFTP Server IP address | TFTP Server Name]
Load system image from ROM or from TFTP server, but do not
begin execution
O Show software configuration register option settings
P Set break point
S Single step next instruction
T function Test device (? for help)
Deposit and Examine sizes may be B (byte), L (long) or S (short).
Modifiers may be R (register) or S (byte swap).
Register names are: D0-D7, A0-A7, SS, US, SR, and PC.
```

The following system bootstrap commands are especially useful:

- **i**—The **i** command causes the bootstrap program to reinitialize the hardware, clear the contents of memory, and boot the system if so directed by the boot field in the virtual configuration register. It is best to use the **i** command before running any tests or booting software.
- **b**—The **b** command with no argument reboots the system and boots the default software from ROM as defined by the lower four bits of the configuration register which form the boot field. You can include a variable, *filename*, to specify a file to be booted over the network using TFTP. You can also include a second variable, *host*, which is the IP address or name of a particular server host. You must enter the **i** command and press **Return** before entering **b**. The various forms of the **b** command follow:
 - **b**—Boots the default system software from ROM
 - **b filename [host]**—Netboots using TFTP

Bootstrap Program

— **b flash**—Boots the first file in Flash memory

— **b flash** *[filename]*—Boots the specified file from Flash memory

To prevent the AS51 NAC from automatically netbooting or booting from anywhere, enter the **o/r 0x0** command.

- **c**—The **c** command allows you to exit bootstrap mode without rebooting the AS51 NAC after you press the break key while running the system software image.
- **h**—The **h** command displays a summary of the bootstrap commands.
- **?**—The **?** command is the same as **h** command.
- **k**—The **k** command displays a stack trace of the last running system software. This stack trace will be useful as a diagnostic reading if there is a problem such as an unexpected system crash.
- **o**—The **o** command displays the virtual configuration register. The **o** command used with the **/r** option will reset the configuration register and cause the system software image to ignore the system configuration information in NVRAM (sets the ignore NVRAM contents bit, 0x0040).

To reset, enter the following at the > prompt:

o/r

Table 4-9 lists additional **o** command options. To automatically reboot the AS51 NAC, enter the **i** command after entering the **o/r** command.

Note To enable the AS51 NAC to read the NVRAM configuration, clear the ignore-NVRAM-contents bit (0x0040) using the **config-register** command after entering the **o/r** command.

- **tm**— The **tm** command runs the memory test. By default, the memory test examines processor main memory.



Caution To avoid losing your configuration, save the configuration in a file on a host in your network before testing it.

To test memory, enter the **t** command with the **m** option at the **>** prompt, as follows:

t m

To use the default addresses and select the default tests, press **Return** after each prompt is displayed.

The time it takes to run a diagnostic test depends on memory size and will require a minimum of ten minutes. If the program encounters memory problems, it will display appropriate error messages on the console terminal. Be sure to reinitialize the AS51 NAC before booting the system by entering **i** at the bootstrap prompt (**>**).

Running the Diagnostic Tests

Follow these steps to run the bootstrap diagnostic tests:

- Step 1** Turn off the Access Server 5100.
- Step 2** Restart the Access Server 5100.
- Step 3** Within 60 seconds, press the break key on the console terminal to force the AS51 NAC into the bootstrap program. Wait for the AS51 NAC to print the two-line banner message and for the angle bracket (**>**) prompt to appear.

Troubleshooting

The Access Server 5100 was extensively tested before being shipped from the factory. However, if your AS51 NAC appears to have problems starting up, read this section to help identify the problem.

If you need to contact a customer service representative for information on how to proceed, have the following information ready before you call:

- Chassis type and serial number
- Maintenance contract number or warranty information

Troubleshooting

- Date you received the Access Server 5100
- Software version level and hardware configuration
- System software configuration
- Brief description of the problem you are having
- Brief explanation of steps you have taken to isolate the problem

The key to problem solving AS51 NAC problems is to try to isolate the problem to a specific subsystem. By comparing what the system is doing to what it should be doing, the task of isolating a problem is greatly simplified.

When problem solving, consider the following subsystems of the AS51 NAC:

- Network interfaces. Use the LEDs related to the network interfaces (Ethernet and synchronous serial) to help identify a failure.
- System cables. This includes all of the interface cables that connect the AS51 NAC to the network.

How to troubleshoot these systems is described in the following subsections.

Troubleshooting the Network Interfaces and Cables

Check for the following symptoms to help isolate the problem:

- A network interface is not recognized by the system.
 - Check the interface cable connection.
 - Check the LED that corresponds to the network interface. LEDs are shown in Figure 4-1.
- A network interface is recognized, but it will not initialize; check the interface cable connection.
- The AS51 NAC will not boot properly or constantly or intermittently reboots. The processor or software are probably causing the problem.

- The AS51 NAC boots, but console screen is frozen.
 - Check the external console connection.
 - Verify the console baud rate in the terminal documentation.
 - The power supply is probably causing the problem.
- The AS51 NAC is receiving power and boots with a particular interface disconnected. The network interface connection is probably causing the problem.
- The AS51 NAC is receiving power, powers on, and boots with a particular cable disconnected. The cable is probably causing the problem.

Reading LED Indicators

Note the activity of the LEDs to judge the activity of the interfaces to which they correspond. If an LED is not on when the interface is active and the interface is correctly connected, a problem might be indicated. If an interface is extremely busy, its LED will always be on. The SYS LED will be on after the system initializes correctly. For LED locations, see Figure 4-1.

Upgrading the NAC Boot PROMs

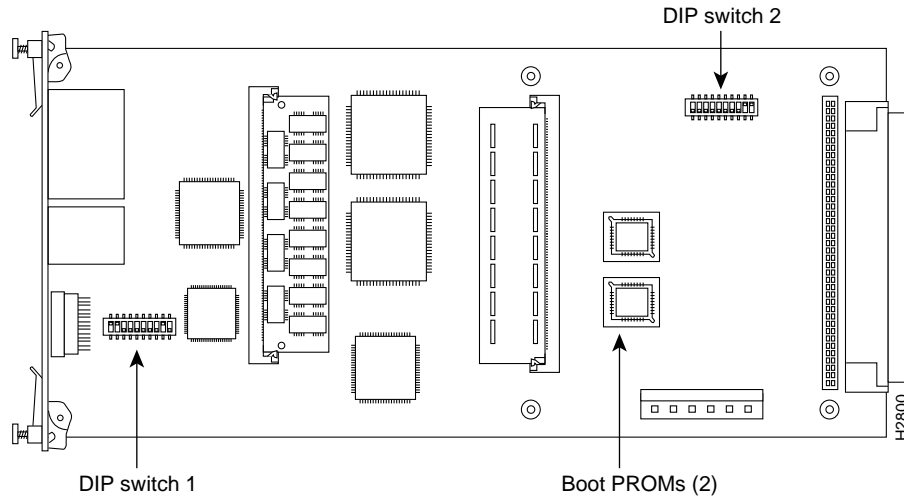
To replace the NAC's boot PROM software with a new software image, the existing boot PROMs must be replaced. Figure 4-5 shows the location of the boot PROMs on the AS51 NAC.

Tools and Equipment Required for Replacing the Boot PROMs

The following tools and equipment are required to replace the boot PROMs:

- EPROM extraction tool or a small, flat-blade screwdriver
- Two boot PROMs

Figure 4-5 Replacing the AS51 NAC Boot PROMs



Replacing the Boot PROMs

Take the following steps to replace the boot PROMs:

- Step 1** Remove the AS51 NAC from the chassis.
- Step 2** Locate the boot PROMs FW1 and FW2 (see Figure 4-5).
- Step 3** Using an EPROM extraction tool or a small flat-blade screwdriver, gently remove the boot PROMs and set them aside (on a nonconductive surface).
- Step 4** Insert the new boot PROMs in their respective sockets in the orientation show in Figure 4-5, being careful not to bend or crush any of the bottom pins. If you inadvertently bend a pin, use needle-nose pliers to straighten it. Align the notch in the new PROM with the notch in the PROM socket, ignoring the orientation of the label.



Caution The correct placement of the boot PROMs is crucial. If the PROMs are installed in the wrong sockets they could be damaged when the system is powered on. To prevent damage to the PROMs from electrostatic discharge (ESD) when handling the system and its components, follow the ESD procedures described in the chapter “Preparing for Installation.” Also, be careful not to damage or scratch the printed circuit card under the PROMs.

Step 5 Replace the AS51 NAC in the chassis.

Installing AS51 NAC DRAM Modules

The AS51 NAC contains primary and shared (or packet) memory. Primary memory size, in kilobytes, is displayed in the system banner on the console screen. Primary and shared memory are 1 MB each of the dynamic random-access memory (DRAM) on the AS51 NAC.

After booting up, your system will indicate in the system banner the amount of primary memory it has. The following example shows a system with 4 MB (4096 KB) of primary memory. (The system does not display shared memory.)

```
System Bootstrap, Version (2.1), SOFTWARE
Copyright (c) 1986-1995 by cisco Systems
AS51 processor with 4096 Kbytes of main memory
>
```

If you use very large routing tables or many protocols, you might need to expand primary memory. This expansion might be necessary with configurations in which the Access Server 5100 is used as a connection device between large external networks and your internal network.

Tools and Equipment Required

The following tools and equipment are required to install DRAM modules:

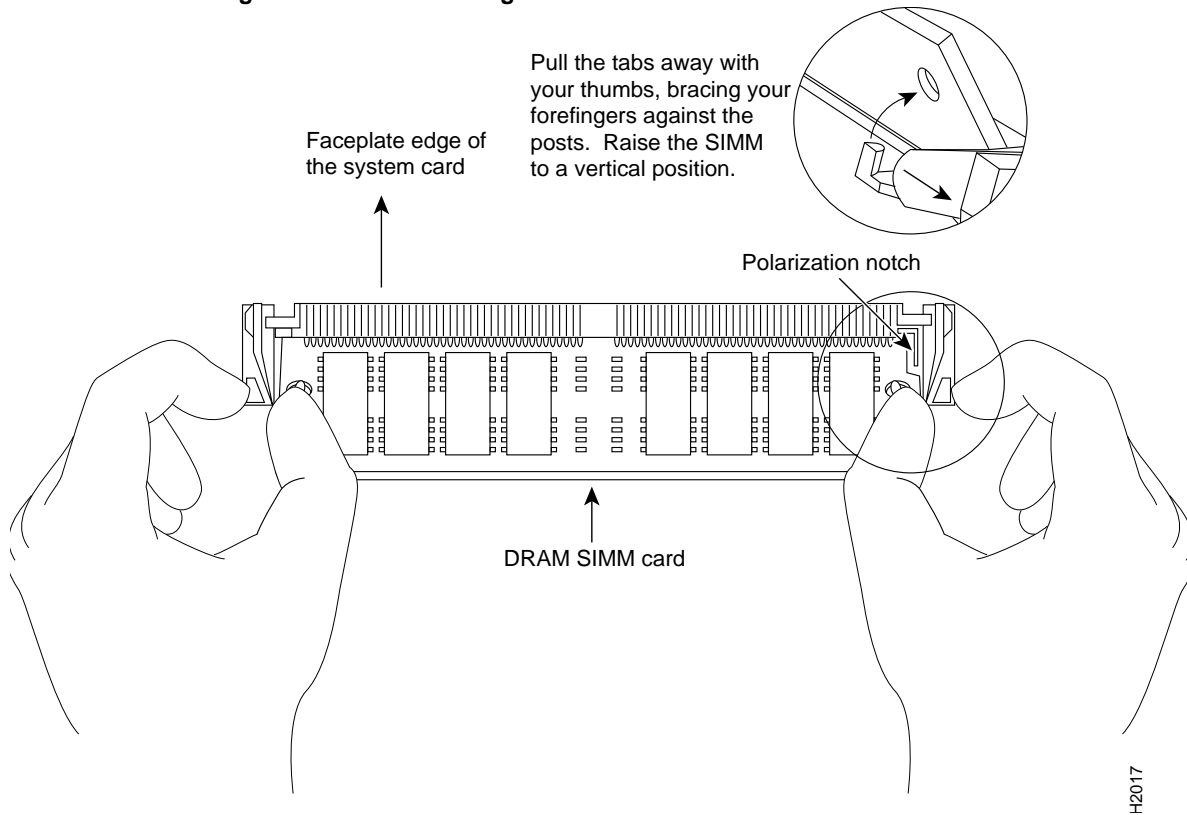
- Medium-size flat-blade screwdriver (1/4 inch [0.625 cm])
- ESD-preventive wrist strap
- The appropriate DRAM SIMM

DRAM SIMM Installation

Take the following steps to install the DRAM SIMM:

- Step 1** Turn OFF power but, to channel ESD voltages to ground, do not unplug the power cord.
- Step 2** Attach an ESD-preventive wrist strap.
- Step 3** Remove the AS51 NAC.
- Step 4** Remove the existing DRAM SIMM by pulling outward on the connectors to unlatch them, as shown in Figure 4-6. Be careful not to break the holders on the SIMM connector.

Figure 4-6 Removing a DRAM SIMM



Caution To prevent damage, do not push on the center of the SIMMs. Handle each SIMM carefully.

Step 5 Position the new DRAM SIMM so that the polarization notch is located at the right end of the SIMM socket.

Replacing the AS51 NAC System-Code SIMM

- Step 6** Insert the new DRAM SIMM by sliding the end with the metal fingers into the SIMM connector socket at approximately a 45-degree angle to the NAC. Gently rock the SIMM back into place until the latch on either side snaps into place. Do not use excessive force because the connector could break.
- Step 7** Replace the AS51 NAC in the chassis.
- Step 8** Connect a console terminal to the AS51 NAC console port.
- Step 9** Turn on the power to the chassis. If error messages relating to memory are displayed, repeat Steps 1 through 7, taking care to firmly seat the SIMM in its socket.

Replacing the AS51 NAC System-Code SIMM

The system code (software) is stored on one Flash memory or PROM SIMM. The 80-pin SIMM must be purchased from Cisco Systems. Contact a customer service representative for more information.

Tools and Equipment Required

The following tools and equipment are required to replace a system code SIMM:

- Medium-size flat-blade screwdriver (1/4 inch [0.625 cm])
- ESD-preventive wrist strap
- The appropriate system-code SIMM

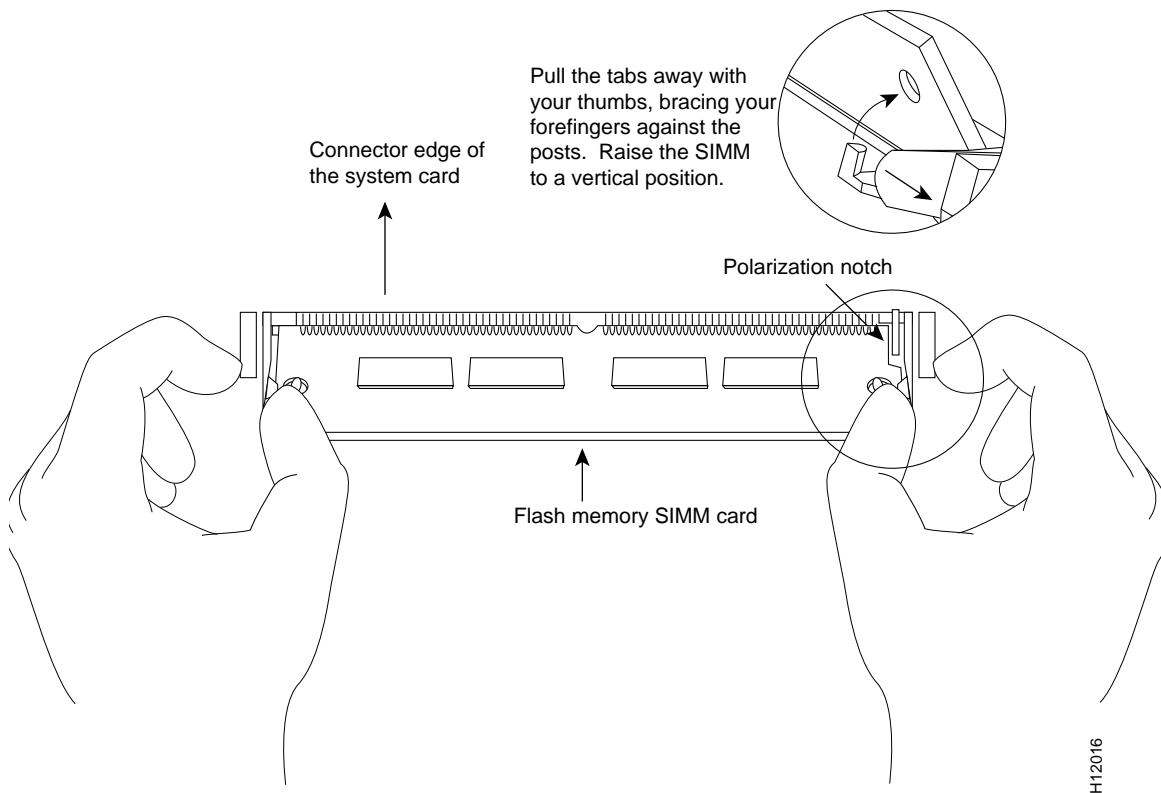
System-Code SIMM Replacement

Following is the procedure for upgrading the system-code Flash memory or PROM SIMM:

- Step 1** Turn OFF power but, to channel ESD voltages to ground, do not unplug the power cord.
- Step 2** Attach an ESD-preventive wrist strap.
- Step 3** Remove the AS51 NAC from the chassis.
- Step 4** Locate the system-code SIMM on the NAC.

Step 5 Remove the existing system-code SIMM by pulling outward on the connectors to unlatch them. The connector holds the SIMM tightly, so be careful not to break the holders on the SIMM connector. See Figure 4-7.

Figure 4-7 Removing and Replacing a System-Code SIMM



Caution To prevent damage, do not push on the center of the SIMMs. Handle each SIMM carefully.

Replacing the AS51 NAC System-Code SIMM

Step 6 Position the new SIMM so that the polarization notch is located at the right end of the SIMM socket.



Caution To prevent damage, note that some Flash memory SIMMs have the components mounted on the rear side; therefore, when inserting the SIMM, always use the polarization notch as a reference and *not* the position of the components on the SIMM.

Step 7 Insert the new SIMM by sliding the end with the metal fingers into the SIMM connector socket at approximately a 45-degree angle to the system card. Gently rock the SIMM back into place until the latch on either side snaps into place. Do not use excessive force because the connector could break.

Step 8 Replace the AS51 NAC in the chassis.

Step 9 Connect a console terminal to the AS51 NAC console port.

Step 10 Turn on the power to the chassis.

If error messages relating to memory display, repeat Steps 1 through 8, taking care to firmly seat the SIMM in the socket.