Basic input/output services (BIOS) provide the primary interface between the operating system’s device drivers and most of its hardware. Although a modern BIOS is automated and tolerant of misconfiguration, a good PC technician must be comfortable with situations in which the BIOS may need some maintenance or repair.

A PC needs the BIOS to tell it how each basic component is supposed to communicate with the system. At the beginning of the PC revolution, many different manufacturers developed BIOS for PCs, but over the years the BIOS business has consolidated primarily to only two brands: AMI (American Megatrends, Inc.) and Phoenix Technologies (which absorbed the former third brand, Award Software). Both of these manufacturers provide a utility called the CMOS setup program (CMOS stands for complementary metal-oxide semiconductor, which is why everyone says “CMOS”) that enables you to reconfigure BIOS settings for boot device order, amount of memory, hard disk drive configuration, and so on. Most of these configurations are automated, but as a PC tech, you’re the one who people will call when “automatic” stops working!

As an example for the lab exercises in this chapter, suppose that the company you’re working for is planning a mass upgrade from its current OS, Windows Vista, to Windows 7. You’ve tested the upgrade process on a few lab machines and have found that systems with an out-of-date BIOS are having problems upgrading successfully. In preparation for the Windows 7 installation, besides upgrading any older BIOS versions you find, you’ll disable any BIOS-level antivirus functions. You’re also aware that the prior IT manager did not use consistent CMOS passwords, so you may need to reset the passwords on a few machines.

The lab exercises in this chapter will teach you to identify, access, and configure system BIOS.

→ Note

You might have heard about a replacement for BIOS called the Unified Extensible Firmware Interface (UEFI). Since 2010, the BIOS firmware of PCs started to be replaced by UEFI. Think of UEFI as a super-BIOS, doing the same job as BIOS, but in a 64-bit environment with a lot of added functionality. While UEFI was introduced years ago, you still won’t find it on every PC. Because of this, plus the fact that most UEFI setup screens work just like their BIOS counterparts, this chapter only specifically covers BIOS. If you have a UEFI system, you should still be able to complete the lab exercises.
10 MINUTES

Lab Exercise 8.01: Identifying BIOS ROM

Having received your orders to do the big OS upgrade, your first task is to check the BIOS types and versions on every machine in your office, and then visit each BIOS maker’s Web site to determine whether more recent versions are available.

The system BIOS is stored on nonvolatile memory called BIOS ROM. BIOS makers often (but not always) label their BIOS ROM chips prominently on the motherboard. In this exercise, you’ll look at two different ways to identify your BIOS ROM chip.

Cross-Reference

For details on the two big companies that manufacture BIOS on modern systems, refer to the "Modify CMOS: The Setup Program" section in Chapter 8 of Mike Meyers’ CompTIA A+ Guide to Managing and Troubleshooting PCs.

Learning Objectives

In this lab, you’ll learn two ways to identify your BIOS.

At the end of this lab, you’ll be able to

- Locate the BIOS ROM chip on the motherboard
- Identify the BIOS manufacturer
- Determine the BIOS creation date and version

Lab Materials and Setup

The materials you need for this lab are

- A working PC
- An anti-static mat
- A notepad

Getting Down to Business

The first thing you’ll do is remove your PC case cover and locate the BIOS ROM chip. Next, you’ll make note of the BIOS information displayed during system startup.
Warning

Any time you take the cover off your PC, remember to follow all proper safety and ESD avoidance precautions.

Step 1  Remove the case from your PC and locate the system BIOS ROM chip. Some motherboards label their chip with the name of the BIOS manufacturer. Compare your system BIOS ROM chip to the one in Figure 8-1.

Read the manufacturer's label if you can, and answer the following questions:

Who made the BIOS? ____________________________

What year was the BIOS written? ____________________________

Are there any other numbers on the label? Record them. ____________________________

Does it look like you could easily remove the system BIOS chip, or does it look soldered to the motherboard? ____________________________

Step 2  Replace the PC case cover and start the system. Be sure the monitor is turned on. When the first data appears on the screen, press the PAUSE/BREAK key on the keyboard. This suspends further operation until you press ENTER. Newer systems actually have instructions somewhere on the screen that indicate which key or keys to press to get into boot options, CMOS setup, and so forth.
Figure 8-2 shows an example of what you may see. At the top of the screen is the BIOS manufacturer's name and version number. At the bottom of the screen is the date of manufacture and the product identification number.

Make note of the following information:

Who made the BIOS?

What version is the BIOS?

What year was the BIOS written?

Hint

Not all BIOS display the same type of information. Some BIOS makers modify the BIOS to show nothing more than their logos during the boot process.
**Step 3** Press ENTER on the keyboard to continue booting. Once the system is up and running, go online and find out whether a more recent version of the BIOS is available. Your first stop should be the PC maker’s Web site. If it does not have this information available, try the motherboard manufacturer’s Web site or the BIOS maker’s Web site.

---

**Warning**

Do not “flash” your system BIOS at this time!

---

**15 MINUTES**

**Lab Exercise 8.02: Accessing BIOS via the CMOS Setup Program**

Once you’ve assessed the BIOS on each machine, but before you proceed with the Windows 7 installation, make sure the BIOS is properly configured using the special program for this purpose.

You don’t access the hundreds of individual programs contained in the system BIOS directly, or from anywhere within the Windows OS. Instead, you use a utility that interfaces with the BIOS programs to enable you to reconfigure settings. This utility is the CMOS setup program.

**Learning Objectives**

In this lab, you’ll go into CMOS and explore your BIOS configuration settings.

At the end of this lab, you’ll be able to

- Enter the CMOS setup program
- Navigate the display screens of the system setup utility

**Lab Materials and Setup**

The materials you need for this lab are

- A working PC whose BIOS settings you have permission to change

**Getting Down to Business**

In the following steps, you’ll reboot your PC and access the boot options or CMOS setup program. Each BIOS maker has its own special way to do this, so how you go about it depends on which BIOS your system has installed. Common methods include the following:

- Press DELETE during the boot process.
- Press F1, F2, F10, or F12 during the boot process.
Lab Exercise 8.02: Accessing BIOS via the CMOS Setup Program

• Press CTRL-ALT-INSERT during the boot process.
• Press CTRL-A during the boot process.
• Press CTRL-F1 during the boot process.

Here are four ways for you to determine which method works for your BIOS:

• Check your motherboard or PC documentation.
• Visit your motherboard or PC maker’s Web site.
• Watch the screen display after booting your PC. Most BIOS direct you to press a specific key to enter CMOS.
• Use the trial-and-error method! Boot your system and go down the preceding list, trying each key or key combination until one works. You won’t hurt anything if you get it wrong, but if you hold the wrong key down for too long, you may get a keyboard error message. If this happens, just reboot and try again.

Determine which method you need to use to enter the CMOS setup program. Then reboot your system and use that method to enter CMOS. Which key or key combination did you use to enter your setup program?

Once you’ve entered the CMOS setup program, look at the screen and compare it to Figures 8-3 and 8-4. The Phoenix BIOS shown in Figure 8-3 opens up to an initial menu, whereas the Phoenix-Award BIOS shown in Figure 8-4 opens immediately into the Main screen. Although the screens for different CMOS setup programs may look different, they all contain basically the same functions.

![CMOS Setup Utility - Copyright (C) 1984-2009 Award Software](image)

- MB Intelligent Tweaker(M.I.T.)
- Standard CMOS Features
- Advanced BIOS Features
- Advanced Chipset Features
- Integrated Peripherals
- Power Management Setup
- PC Health Status

CTRL: Quit
F8: Select Item
F11: Save CMOS to BIOS
F12: Load CMOS from BIOS

F10: Save & Exit Setup
F12: Load CMOS from BIOS

F8: Select Item
F11: Save CMOS to BIOS
F12: Load CMOS from BIOS

Change CPU’s Clock & Voltage

**URE 8-3** Award CMOS Main screen
Figure 8-4 Phoenix-Award BIOS opening screen

* Warning

Do not make any changes in BIOS settings during this lab exercise. You’ll make changes in the next two lab exercises.

The CMOS setup program controls the “changeable” BIOS settings. Many settings depend on what hardware you add to the system. The following are some sample entries on your system that you can change or update (there are more, the specifics of which depend on your BIOS):

- Date
- Time
- Hard drive configuration
- Boot sequence
- RAM
- Serial and parallel port assignments
- Enable/disable onboard controllers
- Enable/disable supervisor and user passwords

Step 3 Explore each screen and make notes about what each setting does. Navigation, like the method to enter the CMOS setup program, varies from maker to maker. Most programs are navigable by keyboard only, but some (AMI, for instance) support a mouse. Look at the bottom of the CMOS setup program screen to see how to navigate in your particular CMOS utility.
Hint

Usually the arrow keys and the PAGE UP and PAGE DOWN keys will select and change settings. Sometimes the + and - keys or the SPACEBAR will toggle settings. The CMOS setup program screen usually provides a key to the navigation and selection keys; refer to it as well.

While navigating through the different setup screens, pay particular attention to any password or security menu that enables you to configure administrator/supervisor passwords and user passwords. Do not make any changes at this time; just make a note of where you configure these passwords. You will configure a password in the next lab exercise.

Step 4 Following is a list of common settings found in the CMOS. Know that each BIOS arranges its settings differently. View every screen of your CMOS setup program to locate and record these settings and their location:

- **Drives** Depending on your motherboard configuration, you will either set a primary master/slave drive or, if using SATA, see a list of the different drives attached and their name/type.

- **Onboard Devices** These settings enable you to configure onboard devices such as your USB ports.

- **Performance** Only common on better motherboards, this area enables you to tweak system timings for improved performance (also known as overclocking).

- **Security** This section enables you to set administrator or system passwords.

- **Boot Sequence** This setting enables you to define the order in which your system looks for boot devices.

- **Power Management** This section defines when devices shut down and how they awaken.

Once you’re done exploring, press ESC a couple of times until you get the message “Quit Without Saving (Y/N)?” Press Y, and then press ENTER. The system will boot into your operating system.
30 MINUTES

Lab Exercise 8.03: Configuring and Clearing CMOS Setup Program Passwords

In many professional environments, the IT department doesn't want users to fool with any of the PC's settings, especially detailed items such as the BIOS settings. The IT manager may even devise a password to prevent entry to the CMOS setup program by unauthorized users. Unfortunately, in your organization, the IT manager has resigned and was not very thorough about documenting these passwords.

When a CMOS setup program has been password protected and its password has been subsequently lost, the typical way to clear the password is to shunt a jumper on the motherboard that clears either the password or the entire contents of CMOS.

Learning Objectives

In this lab, you'll learn how to configure CMOS setup program passwords and how to clear the contents of the password and CMOS using the onboard CMOS-clear jumper.

At the end of this lab, you'll be able to

- Set a password using the CMOS setup program
- Locate the CMOS-clear jumper on the motherboard
- Clear passwords and CMOS settings using the CMOS-clear jumper

Lab Materials and Setup

The materials you need for this lab are

- A working PC whose BIOS settings you can change, with access to the CMOS-clear jumper on the motherboard
- An anti-static mat/wrist strap
- A notepad

Getting Down to Business

In the following steps, you'll reboot your PC and access the CMOS setup program using the key combination you verified in Lab Exercise 8.02. You will then navigate to the password or security menu and configure a CMOS setup program password. Then you'll verify the password by rebooting your machine and entering CMOS setup. Finally, you'll open the case and reset the CMOS settings by physically shunting the CMOS-clear jumper.
Warning

Any time you remove the cover from your PC, remember to follow all proper safety and ESD avoidance precautions.

**Step 1**  Reboot your system and use the appropriate key or key combination to enter the CMOS setup program.

**Step 2**  Once you’ve entered the CMOS setup program, navigate to the security or password menu (see Figure 8-5). Select the supervisor password and enter a four- to eight-character password. Save changes and exit CMOS setup.

Record your password here: ____________________

**Hint**

Typically, two types of passwords can be set in CMOS, but a third is now appearing.

The supervisor password restricts access to the CMOS setup program so that only authorized personnel can change or modify BIOS settings. Organizations, especially schools, usually configure a supervisor password to keep curious users from causing system errors.

**Figure 8-5** AMIBIOS supervisor password setup
The user or system password restricts access to the PC itself, and is required every time the system boots (before an operating system is even loaded). This type of password is often used when an individual’s PC is located in a public area.

The hard drive password is the third and newest password you’ll find on some CMOS setups. Hard drive passwords prevent a user from accessing a hard drive unless they know the password.

**Step 3** Reboot the PC and press the key or key combination required to enter the CMOS setup program. If you completed Step 2 correctly, you should be prompted to enter a password. Enter the password you configured in Step 2 and press ENTER. The main menu of the CMOS setup program will appear.

Discard changes and exit the CMOS setup program.

**Warning**

The next step will erase all CMOS settings! While you are in the CMOS setup program, take the time to write down important settings such as the CPU settings, boot order, which integrated peripherals are enabled/disabled, and the power management setup. Although the system should run fine using the default settings, taking notes now will help you get back to any custom settings that may have been configured.

**Step 4** Shut down the PC and unplug the power cord from the wall outlet. Remove the case from the PC and, referring to the PC or motherboard documentation, locate the CMOS-clear jumper. Follow the instructions included with the documentation and move the jumper (see Figure 8-6) to clear the CMOS.

![Image of CMOS-clear jumper on a motherboard](image-url)
A less elegant alternative to using the CMOS-clear jumper is to remove the onboard battery for at least 30 seconds. Does your system have an onboard battery? Can it be removed easily?

**Step 5** Replace the PC case cover, plug the system back in, and start the system. Press the appropriate key(s) to enter the CMOS setup program.

Were you prompted for a password? _____________

Do you need to configure any of the other settings? _____________

**30 MINUTES**

**Lab Exercise 8.04: Configuring BIOS Settings**

If you find any issues when you examine the BIOS settings using the CMOS setup program, you’ll need to reconfigure the settings. Remember also that you’re preparing the PC for an upgrade to Windows 7. BIOS-level virus checking is known to cause problems with the Windows XP/Vista/7 installation process, so Microsoft advises that you disable it.

Many BIOS functions are unchangeable—such as keyboard and floppy drive recognition—and are therefore inaccessible via the CMOS setup program. Other functions are under your control. These include the boot sequence order and the date/time setting, as mentioned previously, but also some potentially hazardous settings such as BIOS shadowing and memory timing.

**Hint**

If you’re not absolutely certain what a particular setting does, the best course of action is to leave it alone! If you have any doubts, you can always exit the CMOS setup program without saving.

**Learning Objectives**

In this exercise, you’ll access the CMOS setup program, navigate to find the various BIOS settings you would commonly need to modify, and practice disabling BIOS-level virus checking.

At the end of this lab, you’ll be able to

- Modify the settings in BIOS

**Lab Materials and Setup**

The materials you need for this lab are

- A working PC whose BIOS settings you have permission to change
- If possible, a BIOS that includes virus checking
CMOS setup program

DELETE key

PAUSE/BREAK key

Phoenix Technologies

1. The system BIOS is stored on nonvolatile memory called ________________.

2. Technicians configure the BIOS using the ________________.

3. Press the ________________ to suspend operation of the POST.

4. ________________ provides the primary interface between the operating system’s device drivers and most of the system’s hardware.

5. A common way to enter CMOS setup is to press the ________________ during startup.