UNIT 7

Hardware Troubleshooting

After general conception of the major computer components it is important to concentrate on the troubleshooting the computer as a whole. Systematic approach to hardware troubleshooting is very vital for any successful hardware technician.

Lesson 1: Troubleshooting Approach, Hardware Problems

1.1 Learning Objectives


Objectives

Upon completion of this lesson of the Unit you will be able to:

- Organize the hardware troubleshooting approach systematically.
- Know the common causes and symptoms of hardware troubleshooting.

Earlier Units introduced various parts of the computer. More specifically by this time you know about i) Motherboard & Processor ii) Memory and Storage and iii) Peripheral Devices in the preceding Units. Now it is time to turn the attention to troubleshooting the the hardware problems of a computer in general. Following Unit will explore more about the specific troubleshooting of a computer such as operating system and networking.

1.2 Troubleshooting Approaches

Computer is a very smart and useful device but it may not work as expected due to many reasons. To solve such problems a hardware troubleshooter should proceed in systematic way as outlined below:

- *Logical thinking.* After all a computer is a logical machine, if it does not work properly there must be some causes behind it. The first task of a troubleshooter is to identify these cases and their explanations for the problem.
- *Never accept the problem description at face value or on assumption.* You should ask for a demonstration of the problem. Ask exactly what was happening at the time the problem occurred. Try to collect all information regarding the problem so that you can reproduce the problem. The hardest problems of all are those that does not happen very often and sometimes very tough to demonstrate at a desired time.
- *First consideration: the most obvious one.* This is an effective strategy because obvious things are easy to check, and if they are the real causes then the problem is quickly solved. *For instance,* your monitor is not displaying anything, so first check if the cable connection is correctly working.
- *Problem Isolation.* In the area of troubleshooting the most valuable step is the isolation of the problem in the system. It deals with non-trivial problems. When a device malfunctions, it is important to observe whether it misbehaves in the same way with all other programs that use the device. Then replace the device with a good one. At the same time try to use the suspected device to another good machine. After these tests, you will be able to isolate the problematic component of the system more accurately.
- *Gather additional information.* The use of on-line search and any other sources are helpful in this context. But you should not accept any on-line solution readily. Investigate more if this is the same problem (with your computer) as you have searched in the Internet.
- *Do not panic.* Remember a computer is a very sophisticated, advanced and complex system. So, some problems may seem very hard to detect even after a number of repeated trials in many ways. And it is, of course, disheartening. In this case, there is a change you will be psychologically biased towards a number specific approaches and you are ignoring some

other way of looking the problem. Take a break, have a cup of tea and relax for sometimes. Then come back again to start it with a fresh mind.

1.3 Hardware Problem Symptoms and Causes

Before we get into specific components, let us find out the *common hardware symptoms and causes.*

1.3.1 Excessive Heat

When computer runs substantial amount of heat is generated from various electronic components. This has already been discussed in Unit 2. There are two generic approaches to reduce heat inside computers: i) *heat sink* and ii) *case fan* and *fan* for other components such as processor.

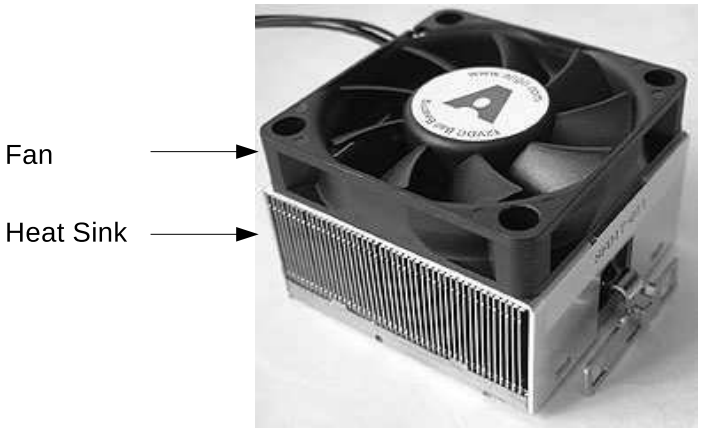

Figure 7 .1: Heat Sink for Processor

Any component with its own processor will have a *heat sink.* It is typically made of aluminum or other metal and attached to the processor as shown in Figure 7 .1. Heat sink absorbs heat as much as it can to reduce the processor temperature. The processor has also a fan attached to it. Generally a processor temperature should not exceed 50-55 degrees Celsius under heavy load. There is a thumb-rule for processor temperature: *powerful processor produces higher temperature.* Table 2 shows the average temperature for different processors.

If you put your hand at the back of your computer while it is running you will feel warm air coming out from inside the case. This is due a *case fan* which takes hot air from the inside the case and blow it out to reduce overall

Figure 7 .2: Case fan for cooling

Table 2: Temperature range for different processors

Processor	Average Temperature
Intel Core 2 Duo	45° C - 55° C
Intel Core i3	50° C - 60° C
Intel Core i5	50° C - 62° C
Intel Core i7	50° C - 65° C

temperature of the computer components inside the case.

1.3.2 Noise

There is always noise from the running computer. Some noise are *normal* while others are *symptom of danger* for your computer. The POST beep, noise from the hard drive and power supply always creates noise. These are normal noise. Remember that the components that move are likely to generate noise because of their movement and rotation. If excessive noise come from any of such components they should be thoroughly examined and tested.

1.3.3 Odors and Smoke

Sometimes, bad smells or smokes come from inside the computer. Although inside the case the components get heated, but they should never be hot enough to melt plastic components. Unfortunately it happens very often. On the other hand, power problem can generate smoke inside the case. When you smell an odd odor or see smoke you should immediately shutdown the

computer and look for the damage inside the case.

1.3.4 Status Light Indicators

Status light indicators attached to the hardware devices help to identify problems. For instance, when you power on the system, the power light should appear. If it does not appear, something is wrong with the system. Same principle applies for external hard drives, printers and wireless routers. Always apply the first rule of troubleshooting: *check the cable connections first.*

Apart from power indicators, there are other several types of hardware devices that have higher number of status indicating LED. These hardware include network hub, router, switch and so on. Figure 7 .3 shows the LED layout for Cisco 3800 Series Router. Table 3 describes the meanings of SYS LEDs that stands for system status of the router. And you will notice here LED color and style (solid or blinking) are both indicators of different status.

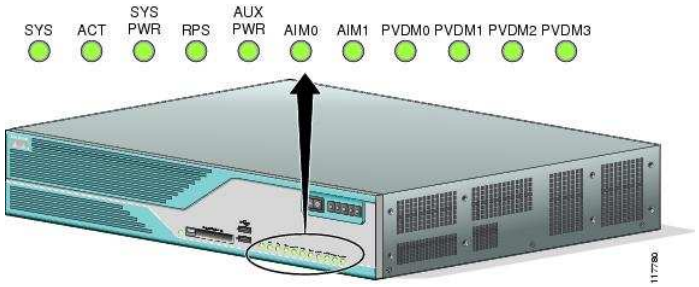

Figure 7 .3: LED layout for Cisco 3800 Series Router

Table 3: LES Spec. for Cisco 3800 Series

LED	Color	Meaning
SYS	Off	Router not receiving power
	Steady green	Normal operation
	Blinking green	Booting state immediately after power-up
	Amber	Powered but malfunctioning

1.4 Exercise

1.4.1 Multiple Choice Question

1. In hardware troubleshooting which step is the most valuable?

   a) Logical thinking

b) Do not rely on some assumptions
c) Collecting more information about the problem
d) Problem isolation

2. Which processor does produce maximum temperature?

a) Intel Core Two duo
b) Intel i3
c) Intel i5
d) Intel i7

3. Which of the following statement is true about noise?

a) Components with rotation and movement release noise
b) All components of a computer produce noise
c) Only larger components produce noise
d) Each noise is a symptom of hardware problem for a computer

1.4.2 Analytical Question

1. Briefly describe various hardware problem symptoms and their possible causes.

Lesson 2: Troubleshooting at the Startup

2.1 Learning Objectives

Upon completion of this lesson of the Unit you will be able to:

- Deal the problems with particular components and devices.


Objectives

2.2 Troubleshooting at the Startup

When a system has problems starting, it may display error messages at startup.

2.2.1 POST Routines Failure

Write with bullets what it does from the following.

Every computer has a set of basic computer instructions in its firmware called basic input/output system (BIOS). BIOS has a diagnostic process called the power-on self-test (POST). Many steps are performed by POST of the BIOS such as:

- Check the processor status
- Check the RAM and Hard Drive
- Check the presence of video card
- Check the other hardware functionality

If POST encounters any problem it is normally detected by beep sounds with some error codes called *beep codes*. Determining the point failure is a good clue to start a successful troubleshooting.

Beep Code: If the BIOS POST is not successful, the beep code (sound) can determine the source of the problem. This is a number of beeps from the computer's speaker, *not from the external speaker of your system*. Single beep indicates successful POST. In case of more beeps, indicating a problem, you should observe:

- The number of beeps
- Duration of the beeps
- Pattern of the beeps

Each BIOS has its own beep codes. Table 4 and 5 present the beep codes for AMI BIOS.

Table 4: Beep Codes for AMI BIOS

Beeps	Error	Meaning
1 short	DRAM refresh failure	The programmable interrupt timer or programmable interrupt controller has probably failed
2 short	Memory parity error	A memory parity error has occurred in the first 64K of RAM. The RAM IC is probably bad
3 short	Base 64K memory failure	A memory failure has occurred in the first 64K of RAM. The RAM IC is probably bad
4 short	System timer failure	The system clock/timer IC has failed or there is a memory error in the first bank of memory
5 short	Processor error	The system CPU has failed
6 short	Gate A20 failure	The keyboard controller IC has failed, which is not allowing Gate A20 to switch the processor to protected mode. Replace the keyboard controller
7 short	Virtual mode processor exception error	The CPU has generated an exception error because of a fault in the CPU or motherboard circuitry
8 short	Display memory read/write error	The system video adapter is missing or defective
9 short	ROM checksum error	The contents of the system BIOS ROM does not match the expected checksum value. The BIOS ROM is probably defective and should be replaced
10 short	CMOS shutdown register read/write error	The shutdown for the CMOS has failed

Table 5: Beep Codes for AMI BIOS (Cont..)

Beeps	Error	Meaning
11 short	DRAM refresh failure	The shutdown for the CMOS has failed
1 long, 2 short	Failure in video system	An error was encountered in the video BIOS ROM, or a horizontal retrace failure has been encountered
1 long, 3 short	Memory test failure	A fault has been detected in memory above 64KB
1 long, 8 short	Display test failure	The video adapter is either missing or defective
2 short	Hardware Failure	One of the hardware tests have failed in POST
1 long	POST has passed all tests	Successful Test

POST card: POST process can also be launched from external POST card to determine a problem during startup. POST card is a circuit board (normally fits into ISA or PCI slot) that generates *numeric codes* as the boot process goes on. Each numeric value corresponds to a specific hardware being checked. For instance, codes such as 01 and 08 represent processor and RAM testing namely according to AT&T BIOS POST Codes. Complete list of codes is beyond the scope of this book. Table 6 presents a number of the most widely used error codes for AT&T BIOS. The codes are in hexadecimal numbers. Note that both *test* and *error* are indicated by the codes.

Table 6: Few POST Codes for AT&T BIOS

Code	Meaning
01	CPU Test
02	System I/O port test
0C	Keyboard controller test
0E	Battery power test
13	Primary display error
18	Internal memory address test
1F	Internal memory error

2.2.2 STOP (Blue Screen) Errors at Startup

When you turn on your computer instead of seeing the Windows Login screen you might have seen an unexpected blue screen as shown in Figure 7 .5. This

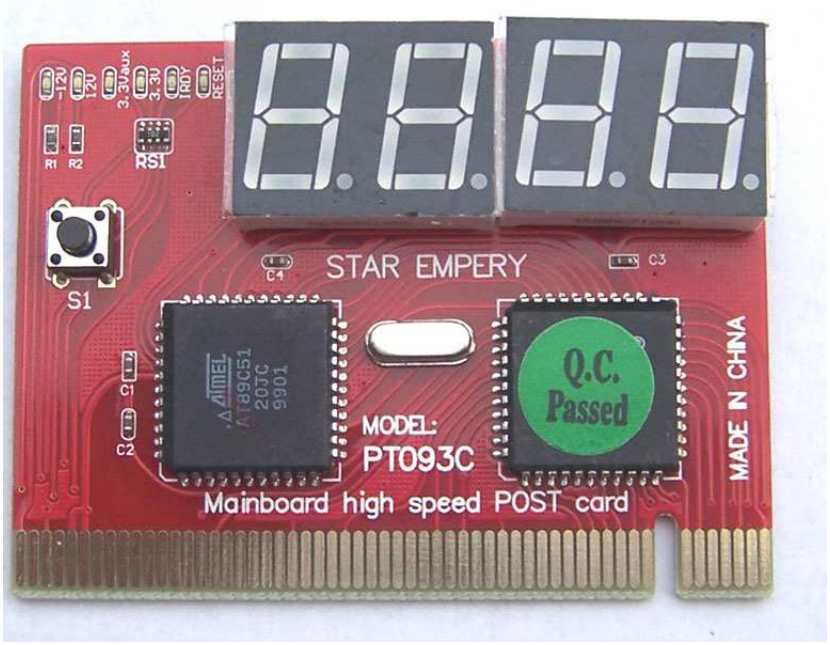

Figure 7 .4: POST Card

is termed as *STOP error* or *Blue Screen* or *BSOD (Blue Screen of Death)*.

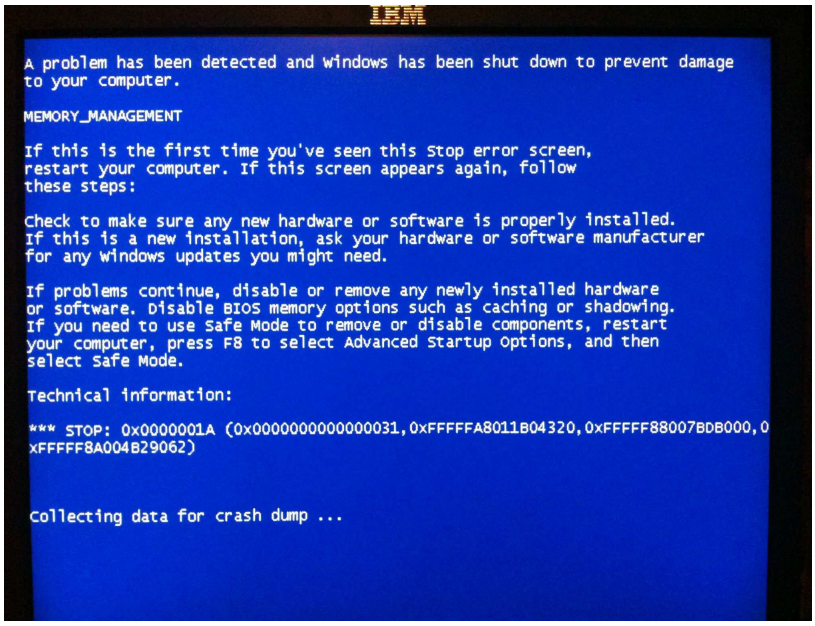

Figure 7 .5: Blue Screen

Causes of Blue-screen error: Blue-screen errors can be caused by many problems as such corrupt applications, corrupt device drivers, or memory problems and so on.

Table 7: STOP error messages

Error No.	Error Name	Explanation
0xA	IRQL_NOT_LESS_OR_EQUAL	Check device drivers or services used by backup or antivirus utilities.
0xD1	DRIVER_IRQL_NOT_LESS_OR_EQUAL	Check device drivers or services used by backup or antivirus utilities.
0x1E	KMODE_EXCEPTION_NOT_HANDLED	Illegal or unknown instruction; check the driver referenced in the error message.
0x24	NTFS_FILE SYSTEM	Test the hard disk for errors.
0x2E	DATA_BUS ERROR	Test memory modules; disable memory caching in system BIOS; check hardware configuration.
0x50	PAGE_FAULT_IN_NONPAGED AREA	Check printer drivers.
0x7B	INACCESSIBLE_BOOT_DEVICE	Incorrect or missing hard disk device driver.

Solution: After an BSOD error occurred, you should record the error number listed after the STOP message, such as `STOP: 0x0000001E`. If available record the name of the error, such as `KMODE_EXCEPTION_NOT_HANDLED`. Now you can search the error code and name on the official website of the Microsoft Support Site (`http://support.microsoft.com`) for recommended solution. Table 7 represents a few such STOP error messages.

2.2.3 Other BIOS Issues

BIOS performs POST routine to check the different components status. Besides this, BIOS may experience some other issues as depicted below:

- **Problem:** BIOS may be *out-of-date.* This is not a critical issue for the existing hardware components since it will continue to support these hardware. It becomes an issue when you want to install a new hardware and the BIOS does not support it, for instance installing a larger hard drive.

  Solution: BIOSs are normally written to an EEPROM. It can be *updated* using appropriate software. This process of BIOS updating is termed as *flashing the BIOS.* Each manufacturer has its own method for flashing of BIOS.

- **Problem:** Sometimes BIOS fails to retain the computer's settings such as time & date and hard drive configuration. Each BIOS uses a battery

(like the battery of a watch) on the motherboard to store the settings when the machine is powered off. When the battery fails BIOS also fails to preserve its system settings.

Solution: Simply replace the battery to solve the problem.

- **Problem:** Along with the system settings mentioned above the BIOS also stores the *boot sequence* for the system. Boot sequence determines which is the drive to start up the operating system. The system can be booted from the First hard drive, the Second hard drive or from CD ROM. If the computer is attempting to boot from the wrong device, the boot sequence must be changed appropriately in the BIOS.

  Solution: You need to change the boot order from the BIOS. Follow these simple steps for changing the boot order of your computer:

  i) Reboot the system.

  ii) Look for the message telling you to press a certain key to enter the BIOS (usually something like F2, F1, F12).

  iii) Once you are in the BIOS, find the menu with the boot sequence and set it to the desired order. It should look like Figure 7 .6.

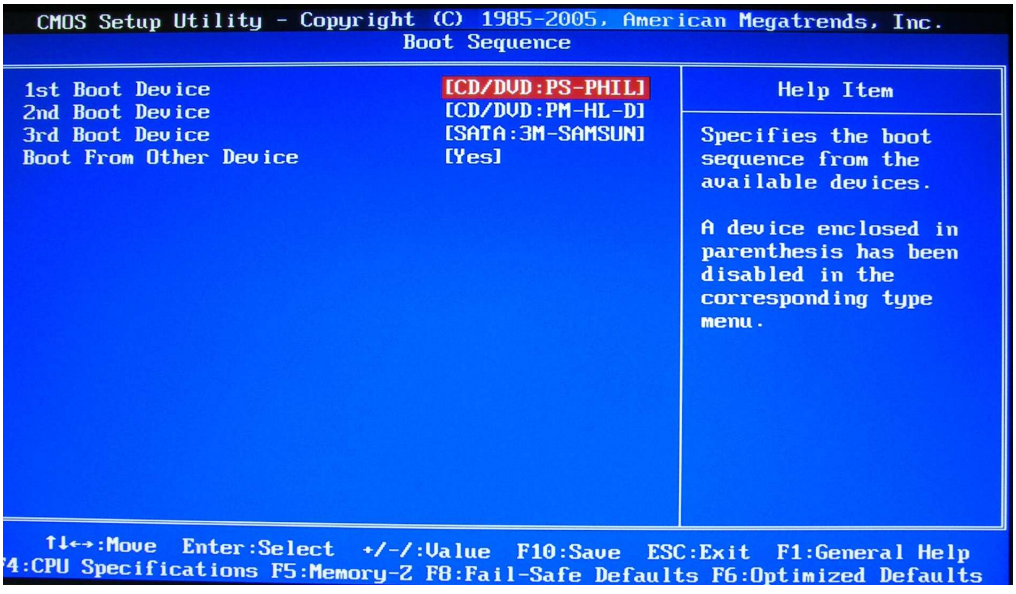

Figure 7 .6: Boot Sequence in BIOS

2.3 Exercise

2.3.1 Multiple Choice Question

1. Which of the followings is not performed by POST process of BIOS?

   a) Check the processor status

   b) Check the Internet connection

   c) Check the RAM and Hard Drive

   d) Check the presence of video card

2. Suppose the system clock of your computer is not working and you want to be sure about the problem. Which of the following is the right indication for it?

   a) 1 short beep

   b) 2 short beeps

   c) 3 short beeps

   d) 4 short beeps

3. What does the POST Code 13 stand for?

   a) Keyboard controller test

   b) Primary display error

   c) Battery power test

   d) Internal memory address test

2.3.2 Analytical Question

1. *The beep (i.e. sound) can determine the source of the problem specially at the start up of the computer* - Explain it with suitable example.

Lesson 3: Troubleshooting Different Components


Objectives

Upon completion of this lesson of the Unit you will be able to:

- Deal the problems with particular components and devices.