Unit 6 BIOS

Structure:

6.1 Introduction
- Objectives

6.2 BIOS
- Power-On-Self-Test (POST)
- Routines

6.3 BIOS features
- AMI BIOS
- Awards BIOS
- Microid Research BIOS (MR BIOS)
- Identifying the BIOS chip

6.4 BIOS and boot sequences

6.5 BIOS shortcmings and compatibility issues
- Device drivers
- BIOS shadowing
- Direct Control
- BIOS bugs

6.6 Troubleshooting

6.7 Summary

6.8 Glossary

6.9 Terminal Questions

6.10 Answers

6.1 Introduction

In the previous unit you have seen how settings are important for the efficient execution of the PC. You have come to know that there are different parameters which are used by BIOS to start the computer. Each set of components such as chipset are designed in various ways based on the requirement. To understand the complexity of the technology by the computer BIOS is used. *BIOS*which stands for *Basic Input Output System* is present in the RAM and used as an interface between computer hardware and operating system. BIOS give the standard set of functions to access the operating system. Therefore, each computer has different BIOS with the same set of functions.

In this unit you will study the working of typical BIOS. You will study how to identify BIOS versions through some examples. You will also study various features that can be supported by BIOS. BIOS isnot only meant to support motherboard but also various components. Whenever a new video card is developed which is not known to the BIOS then a BIOS RAM chip subsystems such as video and drive controller is designed. During the system initialisation the first step is to locate if any valid BIOS ROMs are present in the upper memory which are referred as adapter BIOS. In a computer you can fit up to six or more BIOS ROMS like:

- System BIOS
- Video adapter firmware
- Drive controller BIOS
- Network adapter board BIOS
- Modem card firmware
- SCSI adapter BIOS

Objectives:

After studying this unit you will be able to:

- Explain the working of BIOS.
- Identify various features of BIOS.
- List the boot sequences for various BIOS versions
- get various shortcomings and issues related to BIOS
- Identify the basic problems in BIOS and resolve through troubleshooting.

6.2 BIOS

BIOS or BASIC Input Output System is an electronic program that instructs the computer to start operation.It is a collection of instructions located in the ROM chip that are designed to manage themselves even when there is disk failure.BIOS occupy 128KB of upper memory space (as you studied in unit 2 UMA is the space of real mode memory which is dedicated to handle memory requirements of the physical computer system) in the motherboard. The main function of BIOS dependson three sections. They are POST, CMOS Setup routine and the system services routines. The typical working of Motherboard BIOS function is as shown in Figure 6.1.

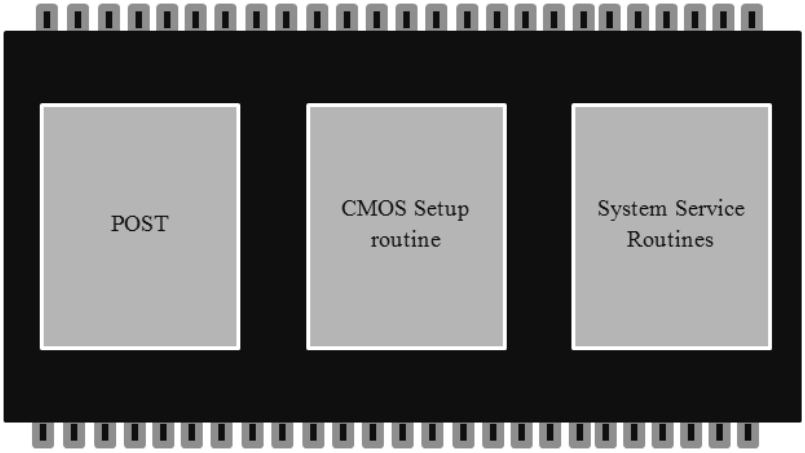

Figure 6.1: Function of Motherboard BIOS

BIOS instruct the POST to perform the checking operations to verify that all the components required to boot the system are available and working properly. It instructs the Setup routine to configure the hardware and RAM. It instructs the Service routines to form a layer between hardware and operating system

6.2.1 Power-On-Self-Test (POST)

Power-On-Self-Test is a routine that is run to ensure that all the components and functions of the computer are working correctly to start the computer successfully. The POST only checks the system for availability of resources; however, POST also manages the initialization of computer system entirely. It performs the following steps, along with a check for availability of resources.

- Initialization of all the activities for the PC is done by POST.
- System RAM and ROM instructions need to undergo a low-level diagnostic and reliability test which is done by POST.
- POST checks the CPU, motherboard start up, CMOS for system configuration data (the 128 bytes of CMOS)
- POST sets up the index interrupt vectors for the CPU ranging from 0000h to 02FFh, i.e. ranging from 0 bytes to 768 bytes. Address 0000h to 02FFh is the on-chip expanded RAM area, totally 768 bytes.This area canbe accessed by external direct addressing mode with instruction.
- POST then sets up a BIOS stack area ranging from 0300h to 03FFh, i.e., 769 bytes to 1023 bytes.

- POST loads the BDA in low memoryranging from 0400h to 04FFh., i.e., 1024 bytes to 512 KB
- POST detects the optional equipment if any.

Lastly, after performing all the checks and managing, POST proceeds to boot the operating system in an available disk.

6.2.2 Routines

Once the hardware and system configuration is carried out you might require an engine which can help you in system configuration and providing accessibility to the various resources. Therefore, routines are required. Routines are the set of sequences of a big Computer program; in this case it is BIOS program. It consists of standard unvarying procedure. Routines are classified into two types:

- CMOS setup routines
- System Service routines

CMOS setup routines

CMOS setup routines are the set of instructions in the BIOS RAM which is used to alter and test the CMOS settings. This routine helps in setting the parameters for hardware drives and used to establish the attributes required for your computer and to store them. This routine helps you in hard drive installation. In the older computers CMOS setup routines are provided as an external utility which was on the floppy disk. In modern computers these routines are built in the motherboard BIOS itself. System setup is very helpful when the POST encountersa mismatch while comparing the hardware setting information with the CMOS RAM. If the settings do not match the boot process is halted and display *system setup* error. The CMOS setup varies based on the BIOS manufacturers.

System Service Routines

System services are the functions that separate hardware and operating system. A system is a collection of different types of chipsets, motherboards designs, bus architectures, processors, etc. System services allow them to work on a single operating system. Interrupts are used to invoke services. Interrupts are the signals that help in stopping the operation of the CPU and see what it has to do as its next function by sending the control to another memory address. In this memory address it usually has a subroutine meant for a specific operation. Once this operation is complete the interrupt returns

its control back to where the PC had left before the interrupt occurred. Interrupts can be produced from three major sources:

- The CPU
- A hardware condition
- A Software condition

The CPU produces an interrupt which is known as processor interrupts. This interrupt is caused when a program turns out to be unusual, unexpected or erroneous. For example, since any number divided by zero is infinity, whenever a program tries to divide a number by ZERO, the CPU will take it as integer value and generate INT 00h, which causes an error message as “Divide by zero” error. INT 00h is executed after an attempt to divide by zero or when the quotient does not fit in the destination.

Hardware interrupts are generated when any external device requires special attention form the CPU to perform a specific function. IRQs are asserted with logical level to invoke this kind of interrupt. When this happens CPU interrupts its current activity and gets busy in the hardware activity caused by the interrupt. When this task is completed CPU resumes its original task. For example, whenever you press a key in the keyboard, it asserts a logical level corresponding to INT 09h. This invokes keyboard handling routine. INT 09h is called after every key press and release and during the time when a key is being held.

Software interrupt is generated when a CPU needs to check the hardware device. For example, whenever you press “PRNTSCN” (print-screen) button, it generates INT 05h. the interrupt will simply store the video or text buffer to the printer port. INT 05h is executed when Shift+PrintScreenis pressed and when the BOUND instruction detects a bound failure.

System service gives functionality to the computer devices where the setup makes the system configured to the various devices.

Self Assessment Questions

1. _____ is present in RAM that acts as an interface between computer hardware and operating system.
2. BISO instructs the service routine to configure the hardware and RAM (true/false)
3. POST stands for _____.
4. Which are the two types of routines?

6.3 BIOS Features

Due to the advance in technology there is vast change in motherboard, chipset, video, drives, etc. Therefore BIOS also needs to improve its technology so that it can gel with the resources of the system. Inorder to improve BIOS we must befamiliar with the major features of BIOS. BIOS offers the following features given in the Table 6.1.

Table 6.1: BIOS Features

Resources Support	BIOS features
CPU support	• Should support wide range of CPUs specifically based on the manufacturers like Intel, AMD Cyrix. • Look for Pentium series.
Chipset support	• Should support the new chipset families like Intel's Core 2 and AMD CPUs • This support is very important because chipset is responsible for motherboard designers to implement the other features like memory architecture,BUS architecture, etc.
Memory Support	• Should support the modern memory and auto-size itself • Parity and error checking and correction (ECC) should be supported. • BIOS can support upto 4GB of RAM
Drive support	• Should support 32-bit disk transfers. • BIOS should also support removable media drives like zip (medium-capacity removable disk storage system) or SyQuest (it is a removable mass storage system that comes in 44 Mb and 80 Mb sizes and a product of SyQuest Co.) drives. • BIOS may also support RAID functions
Power Management Support	• Should support the ACPI (Advanced Configuration and Power Interface is a standard specification provides an open standard for unified operating system-centric device configuration and power management)specification. • Power management is very much important for desktop and lower version of the system to avoid wastage of energy. • Should support DPMS (Display Power management Signalling is a specific standard used to reduce the power consumption in the monitor) for monitors and other display devices

I^2/O support	• I^2/O support means an Intelligent I/O support. This is responsible for allowing the dynamic assignment to the port and resources of I/O devices.
Plug-and-Play support	• Should be able to identify and configure PnP (Plug and Play is an option for the computer that gives it a feature of automatically discovering the hardware components as soon as it is connected to new component without the intervention of manual installation or configuration)devices. • Communicates with windows to determine system resources and to support signals communicating with PCI buses.
USB Support	• Should support complete compatibility with all the USB (Universal Serial BUS is a specification used by the system to transfer data between the computer and the external digital device.) hardware and hubs • Should support both Universal and Open HCI (A host controller interface (HCI) is a register-level interface that enables a host controller for USB or any hardware to communicate with a hostcontroller driver in software.)standards
ParallelPort Support	• Should support full range of port modes which includes Standard Parallel port, bidirectional mode, enhanced capabilities port(ECP), Enhanced parallel port (EPP)
PCI and AGP support	• Should support full specification of all version of PCI or AGP.
Antivirus support	• Should provide antivirus facility. • Should save the master boot record from being changed.

You are aware that BIOS is classified depending upon the type of its manufacturers. Some of them are discussed here.

6.3.1 AMI BIOS

AMI stands for American Megatrends Incorporation which played a leading role in the development of BIOS and its different versions for PC. In this kind of BIOS the code appears in the lower portion of the POST display. The code indicates the relative age of the BIOS. The following code indicates an Older BIOS which was manufactured between 1986 and 1990:

DINT-1123-040990-K8

The format used in the above code is AAAA-BBBB-DDMMYY-Kx where

- ***AAAA*** is the BIOS types which also include chip identification code
- ***BBBB*** is the AMI customer Reference number which is the code of the motherboard manufacturers.
- ***DDMMYY*** is the date on which the BIOS is released which is given in day/month/year format.
- ***Kx*** indicates the keyboard BIOS code and x indicates the level of its revision.

If you consider recent AMI BIOS, the code usedis A#-BBBB-CCCCCC-DDDDDDDD-EEEEEE-FFFFFFFF-G format in which

- **A** is the CPU types which identifies the CPU vintage, where 8086 is represented by zero, 8088 by 1, 80286 by 2, 80386 by 3, 80486 by 4, Pentium by 5 and so on and # represents the size of the BIOS where 0= 64KB and 1=128KB
- **BBBB** represents the version number that you can use to identify the current BIOS on the system.
- **CCCCCC** represents the AMI customer Reference number which is the code of the motherboard manufacturers.
- **DDDDDDDD**defines the key operating attributes of the BIOS and is a set of eight logical flags. They are:
  - Halt on error during POST
  - Initialize CMOS RAM at every boot
  - Keyboard controller output pin 23, 24 blocked
  - Mouse support in BIOS and keyboard controller
  - Wait in case of POST error
  - Display floppy error during POST
  - Display video error during POST
  - Display keyboard error during POST
- **EEEEEE**is the format for date on which the BIOS is released. This is given in (day/month/year) format.
- **FFFFFFFF**is the BIOS types which also includes chip identification code
- **G**indicates the keyboard BIOS code and indicates the level of its revision.

6.3.2 Awards BIOS

Awards BIOS is another important manufacturer of BIOS. Like AMI, Award BIOS code also appears in the lower portion of the POST display during memory count up. At this point you can note down the BIOS number, the BIOS date, and the version. You must copy it exactlyhence you can use pause key to do this. This can be used to identify the chipset type and motherboard manufacturer. The Award BIOS uses the following format in its code:

AAAAABBCD

Where

AAAAA represents the type of chipset used in the motherboard which is the first five characters. For example, 2C4S0 which represent AMD Elan 470 chipset (it is a type chipset versions which uses AWARD BIOS).

BB represents motherboard manufacturer. These are a combination of sixth and seventh characters. For example, XA represents ADLink technology motherboards.

C represents the model of the motherboard. Based on the chipset manufacturer can use same model number for representing this.

D represents the constant value which has no meaning as major. It is 00.

6.3.3 Microid Research BIOS

Microid Research BIOS is also known as MR BIOS. The BIOS identification string is situated at the top right corner of the summary screen. If you look at the BIOS code you can directly identify the motherboard model and manufacturer as it directly relates to them. For example, C&T_300 represents the MR BIOS which are designed for Chips & Technologies using CS8230 as its processor.(This can be more understandable if you go through the table which specifies the identification strings for MR BIOS is any manual for MR BIOS. You can get this table in the fifth edition of the book written by Bigelow's troubleshooting, repairing and maintain PCs.)

6.3.4 Identifying the BIOS chip

Identifying the BIOS type is also important. When it comes to replacing the chip or motherboard you must identify the BIOS manufacturer. The best way is to check for the sticker which shows the name of the manufacturer. You need to peel off the sticker and you will find the manufacturer code.

Activity 1:

Try to collect some more formats of BIOS code representation and using the specification manual try to identify the manufacturer.

Hint: Refer the concept of symptom of motherboard in the book on troubleshooting, maintaining, and repairing PCs by S. J. Bigelow

Self Assessment Questions

5. BIOS features depends on _____.
6. State whether the following statements are true or false.
   a. BIOS should give support of parity and error checking and correction to memory.
   b. BISO supports ACPI specification for disk drives.
   c. I^2/O support is responsible for allowing the dynamic assignment to the port and resources of I/O devices.
7. _____ is the code format followed by AMI BIOS.
8. According to AMI BIOS in the code format A#-BBBB-CCCCCC-DDDDDDDD-EEEEEE-FFFFFFFF-G, EEEEEE represents _____ format.

6.4 BIOS and Boot Sequences

Booting the BIOS starts with a series of steps where the process starts from switching the power-on to loading the operating system. Though the BIOS follows similar method, it works a bit differently with respect to eachnew version.

BIOS perform the following test as its general procedure:

1. Disable NMI: BIOS disables the non-maskable interrupt line to the CPU. The problem if any in CMOS RAM chip or its circuitry causes failure. In some of the BIOS video is disabled along with parity / DMA and NMI; then the DMA chips are initialized, failure at this point is normally due to the PIT(programmable interrupt timer) or DMA chips.
2. PIT test: memory refresh requires very importantly a test on Programmable Interrupt timer (PIT). Failure indicates that there is some problem with PIT chip.

3. Power-on delay: the soft and hard reset bits will get reset in the system. Here the failure indicates that the keyboard controller or system clock generator chip has a problem.
4. Initialize chipsets: BISO initializes the motherboard in the system. The failure here indicates that there may be some problem caused by chipset, BIOS or clock generator chip.
5. BIOS ROM checksum: ROM contents undergo checksum test and adds the factory preset value which is equal to 00h. 00h is a default value set to the ROM for checking the error free BIOS ROM. If error occurs this value is not equal to default value. The failure indicates that BIOS ROM is defective and hence not equal to 00h.
6. Keyboard test: buffer space is set for the commands by sending the command to the keyboard controller. A failure indicates that there is some problem with keyboard controller chip. In some BIOS thekeyboard and keyboard controller (KBC) are initialized. Problems here are due to keyboard connection faults, or a failure of the KBC chip.
7. CMOS shutdown check: CMOS RAM test, CMOS checksum calculation and updating of CMOS diagnostic byte are done by BIOS. The problem can occur in the RTC/CMOS chip or CMOS battery.
8. Disable video: it disables the video controller chip. The failure indicates that there is problem in video controller board itself.
9. Memory test: check for amount of availability of memory. Problem indicates that there is some fault in the memory chip.The first 356KB of memory is tested with any diagnostic routines in the chipsets. A fault at this point is normally due to defective memory chips, SIMMs or DIMMs.
10. Check memory refresh: it uses PIT to refresh memory
11. Check low address lines. The system checks the first 16 address lines controlling the first 64KB of RAM. A problem with this test typically means a fault in an address line.
12. Check low 64KB RAM. The system now checks the first 64KB of system RAM. A problem here is usually the result of a bad Ram chip
13. Initialize support chips: BIOS proceeds to initialize the programmable interrupts timer (PIT), the programmable interrupt controller (PIC), and

the Direct Memory Access (DMA) chips. A fault here would be located in one of those locations.

14. Load INT vector table: BIOS loads the system's interrupt vector table into the first 2KB of system RAM
15. Check the keyboard controller (KBC). BIOS reads the keyboard controller buffer at I/O port 60th. A failure here indicates a fault in the keyboard controller chip.
16. Video tests. The system checks for the type of video adapter in use, then tests and initializes the video memory and adapter. A problem with this test typically indicates a fault with the video memory or adapter, respectively. Video memory is tested on "Mono" and "CGA" adapters (if installed). Check the adapter card if trouble occurs here.
17. Load the BDA: The system now loads the BIOS data area (BDA) into conventional memory
18. Test memory: BIOS checks all memory below IMB. A problem here is typically the fault of one or more RAM modules, the keyboard controller chip, or a bad data line.
19. Check DMA registers. BIOS performs a register-level check of the DMA controller(s) using binary test patterns. The failure indicates the problem in DMA chips.
20. Check the keyboard: The system performs a final check of the keyboard interface. A failure indicates the fault of the keyboard
21. Hard Drive test. Test and initialize the hard disk controller and drive. If there is trouble here, there may be an improper setup, a bad controller, or a defective hard drive.
22. Perform high-level tests: it test high-level devices as the floppy and hard disks, serial adapters, parallel adapters, mouse adapter, and so on. The failure results in corresponding text messages display.
23. Load the OS: It loads the operating system by triggering the INT19th which is a routine. A failure indicates with an error message such as "Non-system disk".
24. Security. The system will ask for the password (if one has been configured). If this does not happened, check the CMOS data or the CMOS RAM chip. For Example, a CMOS password may have been cleared if the CMOS backup battery has been removed."

Self Assessment Questions

9. _____ sequence loads the BIOS data area into conventional memory in AMI BIOS.
10. Interrupt vectors are initialized by _____ table.

6.5 BIOS shortcomings and compatibility issues

When we start troubleshooting the problems first we must be aware of the kind of problem and the reason of that problem. Though hours are spent in building and installing BIOS there are still shortcomings inBIOS. You should have a clear knowledge on the weakest area of BIOS before youstart troubleshooting it.

6.5.1 Device Drivers

Device drivers are the devices that act like aliaison between computer hardware and the operating systems. They are required to connect the components to the operating system and make them work efficiently. The general components that need drivers are mouse, keyboard, video card, sound card, Ethernet, wireless card, card readers, card slots, etc. Some of the device drivers are default in the operating system. They get downloaded as default drivers automatically whenever related device is installed in the system.

6.5.2 BIOS shadowing

BIOS chips are extremely slow speed devices. Therefore there was a necessity of read only memory so that BIOS data must be maintained even when power goes off. Dues to the proximity of slow access time the permanent storage chips were not acceptable. Therefore It was necessary to accelerate the access time of BIOS ROM. Thus came the concept of shadowing.

BIOS shadowing is a process that copies the content of ROM into RAM memory which helps in improving the speed of the system. The setting is normally enabled in ROM. Through the use of CMOS routine it can be set on or off. System BIOS ROM is most commonly shadowed. Apart from the ROM BIOS the most commonly shadowed BIOS is Video BIOS. Since the routines of the video card are executed very often this can be shadowed by storing the content of video ROM into thesystem RAM memory. By doing this you can improve the performance of the system.

6.5.3 Direct Control

Direct Control is a concept which is still being revived by the software developers so that they can give the direct control of the applications to the hardware. If the applications are directly worked by PC hardware, it helps in increase of system performance. BIOS must be able to ensure that the hardware component should be compatible with the operating system and any application software even after the variations. This is still been a research area on which all the software developers are working just to increase the system performance. Though working with hardware is not a new concept still lot of improvements need to find result.

6.5.4 BIOS Bugs

BIOS Bugs are the accidental errors or omissions inBIOS codes.When the BIOS is manufactured it is duplicated into number of copies and motherboard manufacturer purchases it unknowingly. When a bug is present in the BIOS, the system gets locked or results in the crash of the motherboard or certain other operations. Bugs are very harmful to the system. It is very easy to switch off the application that contains a bug. But if the BIOS has bug in it, then you cannot switch off the computer rather you need to replace the motherboard.

While updating any versions of BIOS on the PC you need to ensure that the working matches with your current motherboard. For example if you are using Phoenix BIOS, it may have some symptom that resembles the symptom of problem which was already appeared. Then, in that case you can take up BIOS upgrading which saves the data, for instance.

Self Assessment Questions

11. _____ is a process that copies the content of ROM into RAM memory which helps in improving the speed of the system.
12. _____ are accidental errors in BIOS codes.

Activity 2:

Consider a situation when an error occurs in the BIOS. What are the stepsyou will follow to rectify it?

6.6 Troubleshooting

You have seen that the system can generate a number of error messages when any problem occurs. When you start the computer it undergoes Power-On-Self-Test (POST) which conducts a number of tests to check for the availability of peripherals and ensure their correct working. POST generates two types of error messages. They are:

- Beep codes
- POST codes

Beep codes are generated during the POST process as the first step of general process of checking the system which is called as initial program loading, booting or boot strapping. If you find a beep code in the system after the POST then it means that some problem has been encountered that has not been able to display on the monitor. These beep codes are generated through the speakers after the video system has been executed. You can find out the meaning by following the steps given below:

1. Hear the beep code switch on the computer
2. Listen carefully the beep code to identify the type of the beep code
3. You need to guess the meaning of the beep sound according to the number of beeps heard. For example if you hear “beep-beep-beep” beep code it has different meaning than “beep-beep” beep code.
4. After recognizing the beep code the method used to troubleshoot the problem depends on the type of the BIOS manufacturer.

When the BIOS start with the Self-Test of the components on the motherboard, it goes through several steps of checking, testing and initializing the hardware components. Before entering each step, the BIOS writes a 2 digit hexadecimal identifying code (FF: which resembles the final code or 01 indicating the initialization) to an external address. This code is commonly referred to as a POST code. The meaning of the codes varies widely. These codes are useful during the manufacturing process to help identify problems. To the consumer, they are useful in cases where the system won't boot up and the video screen does not work, or if you are attempting to make modifications. If the BIOS detects a problem, execution stops at the problem place, and the last code in the output will indicate what the failure is.

***POST code* is a single byte hexadecimal character.** The hexadecimal codes output by the BIOS change rapidly during a normal startup process as different milestones in the boot process are reached. These codes provide vital clues about what has gone wrong when your system won't boot and you don't have a beep code or onscreen messages to help you. To monitor these codes, you need a POST card. These cards are available in versions that plug into either ISA or PCI expansion slots. The simplest ones have a two-digit LED area that displays the hex codes, whereas more complicated (and expensive) models also have additional built-in tests.

A POST code directly corresponds to the checking going on in the POST. Whenever a particular operations during POST stops with a POST code then that post code can be a reference to determine the problem. The POST code can be read using POST reader card. By comparing the POST code or beep code with the corresponding meaning in BIOS, you can determine the problem and rectify it.

Another important aspect is to troubleshoot the *BIOS bugs*. Bug are very harmful to the computer as it destroy the complete working of the system if a single setting is missed. Whenever a bug is present in the BIOS, the only way is to eliminate the bug by updating the chip or by flashing the BIOS. You can also update BIOS file to get the missing settings back.Replacing a motherboard is the last option to eliminate a bug in the BIOS

Activity 3:

1. How do you rectify if your EISA configuration is not complete?
2. How do you rectify the floppy disc controller failure?
3. Find out what INTR #1 error is.

Hint: Refer the concept of symptom of motherboard in the book on troubleshooting, maintaining, and repairing PCs by S. J. Bigelow

Self Assessment Questions

13. POST generates _____ and _____.

6.7 Summary

BIOS stand for Basic Input Output System and are added on ROM chips to provide an interface between the raw PC hardware and standardized

operating system. In general BIOS contains three major sections like POST (Power-On-Self-Test), Setup and System Routines. POST performs a low level diagnostic and reliability test of all the main components of the system. When the POST encounters a problem then it stops and the CMOS Setup will come up with an error message. System service routines are the functions that form the layer between hardware and the operating system. Whenever there is necessity and a specific function has to be carried out always see that the operating system is interfaced with Interrupts which are the small programs that make the running application and take the control to required module.

There are specific types of features which help the BIOS in controlling and testing the various components of the system. Some of the major areas that need support from BIOS are CPU, Chipset, Memory, drive, power management, I^2/O, PnP, Parallel port, etc.

BIOS will differ in its featuresdepending on the manufacturers. Some of the prominent manufacturers of BIOS are AMI, Award, Phoenix, etc. You also studied the various format used in BIOS code by various manufacturers. Like the BIOS code, boot sequences also vary with manufacturers. You have discussed on the shortcomings and compatibility issues of BIOS which threw light on device drivers, shadowing, direct control and bugs. These issues and problems caused in BIOS can be rectified using the error messages which are displayed during or after the completion of the POST. There are two types of error codes that are generated. Beep code and POST code. Beep codes are formed by the speakers of the system and POST codes are single byte hexadecimal characters. Whenever there is a problem in the system it is identified with the help of beep code or POST code by referring to the manufacturer’s manual.

6.8 Glossary

Term	Description
ECC	Error Checking and Correcting is a permit that can detect single and dual bit errors, and can correct single bit errors.
RAID	Redundant array of independent disk is a method of storing data on multiple hard disks in different places which allows performing overlapping of I/O operation increasing performance.

Parity	Parity is a error detection form that uses a single bit to represent the odd or even quantities of '1's and '0's in the data.
ACPI	Advanced Configuration and Power Interface is a standard specification provides an open standard for unified operating system-centric device configuration and power management.
DPMS	Display Power management Signalling is a specific standard used to reduce the power consumption in the monitor
Intelligent I/O	This has the capability to assign the input/output devices to a port freely available.
PnP	It is an option for the computer that gives it a feature of automatically discovering the hardware components as soon as it is connected to new component without the intervention of manual installation or configuration.
USB	Universal Serial BUS is a specification used by the system to transfer data between the computer and the external digital device.
Antivirus	It is a software which is used to protect computers from any kind of malware, virus, Trojan horse, etc that may cause harm to the computer.
Drive	It is a mechanism to read and write data on the storage types. It may be hard disk drive or floppy disk drive.

6.9 Terminal Questions

1. Explain the working of motherboard BIOS in detail.
2. What are the features of BIOS?
3. Given the code (2A6LGTJ10). Identify the chipset and BIOS manufacturer of this code.
4. List the boot sequence of Phoenix Technologies.
5. How do you troubleshoot any problem in BIOS?

6.10 Answers

Self Assessment Questions

1. BIOS
2. False
3. Power-On-Self-Test
4. Setup routine and system routine
5. Manufacturer of the BIOS

6. a. True
   b. False
   c. True
7. AAAA-BBBB-DDMMYY-Kx
8. DD/MM/YY
9. Load the BDA
10. Vector
11. BIOS shadowing
12. BIOS bugs
13. Beep code and POST code

Terminal Questions

1. Refer Section 6.2, Motherboard BIOS
2. Refer Section 6.3, BIOS features
3. Refer Section 6.3.2, BIOS features and also refer the manual for specification on Award BIOS.
4. Refer Section 6.4, BIOS and Boot sequences
5. Refer Section 6.6, Troubleshooting

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