

## A+ Core1 Cram Notes

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# 1. Hardware

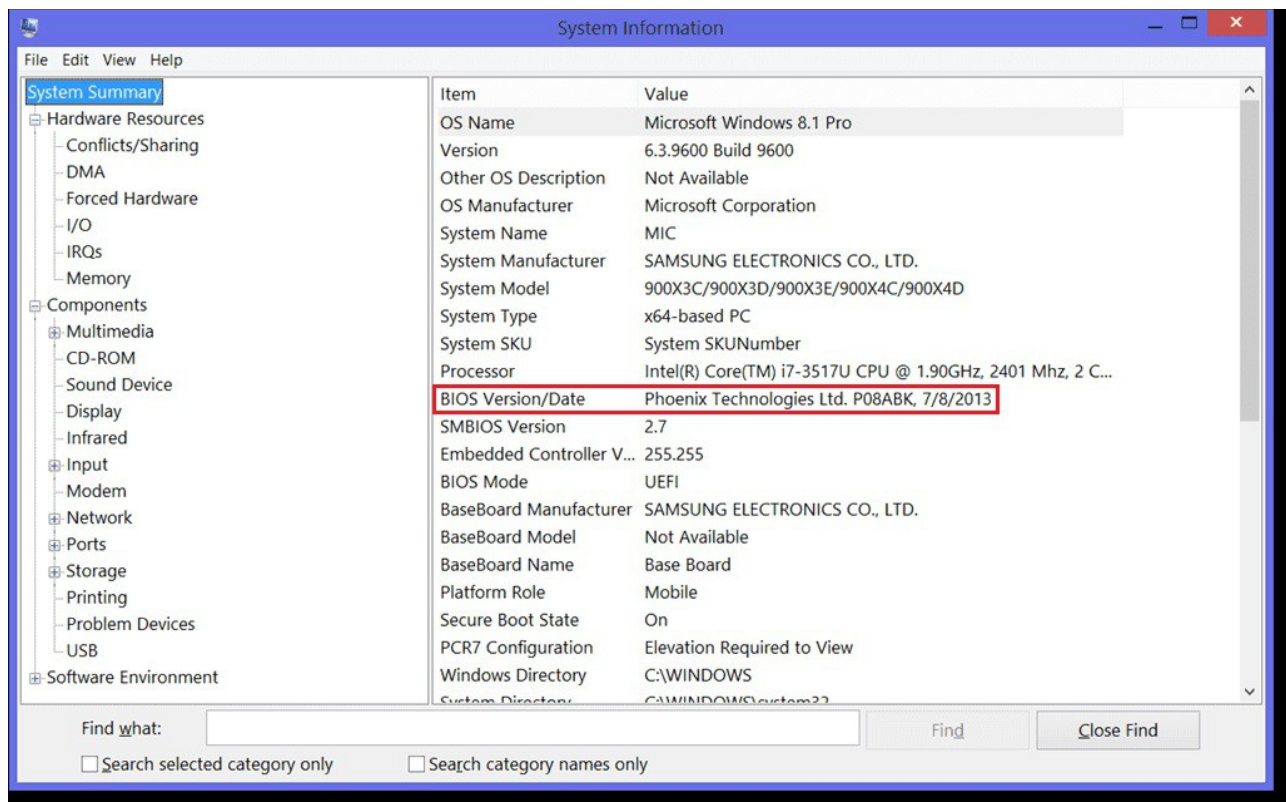
## 1.1 BIOS Tools on a PC

The BIOS is the Basic Input/Output System. This is a chip which resides on the Motherboard within ROM (Read Only Memory) on older systems, or within some Flash memory on a more modern system. The BIOS is usually referred to as 'firmware'. It contains instructions which allow the motherboard to initialize the hardware components and perform the POST (Power On Self Test), before moving forward to the boot process and loading the main operating system such as Windows or Linux.

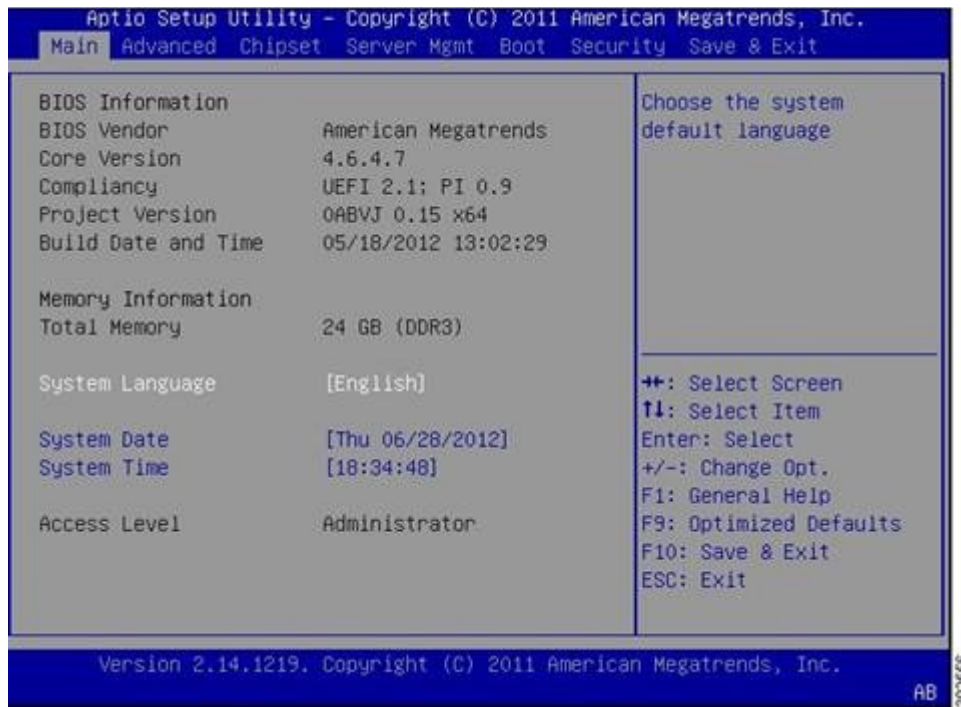
**Boot sequence** is the order in which a computer searches for nonvolatile data storage devices containing program code to load the operating system (OS). Typically, a Macintosh system uses ROM and Windows uses BIOS to start the boot sequence. Once the instructions are found, the CPU takes control and loads the OS into system memory.

The devices that are usually listed as boot order options in the BIOS settings are hard disks, optical drives, flash drives, etc. The user is able to change the boot sequence via the CMOS setup. Boot sequence is also called as boot order or BIOS boot order.

You may find the BIOS version on a Windows computer by running msinfo32 command at the command prompt. It will bring up the following window:



As can be seen in the above screenshot, BIOS info is given under System Summary. BIOS has a Setup utility stored in the BIOS flash memory. The configured data is provided with context-sensitive Help and is stored in the system's battery-backed CMOS RAM. To get into the BIOS on your Windows computer you need to press F2 just after you turn on the computer. A typical BIOS snap shot is shown below:



**The following are some of the things that you can do with BIOS settings:**

- Change the Boot Order
- Create a BIOS Password
- Change the Date and Time
- Change Floppy Drive Settings
- Change Hard Drive Settings
- Change CD/DVD/BD Drive Settings
- View Amount of Memory Installed
- Enable or Disable the Quick Power On Self Test (POST)
- Enable or Disable the CPU Internal Cache
- Enable or Disable the Caching of BIOS
- Change CPU Settings
- Change Memory Settings
- Change System Voltages
- Enable or Disable RAID
- Enable or Disable Onboard USB
- Enable or Disable Onboard IEEE1394
- Enable or Disable Onboard Audio
- Enable or Disable Onboard Floppy Controller
- Enable or Disable Onboard Serial/Parallel Ports

- Enable or Disable ACPI
- Change the Power Button Function
- Change Power-on Settings
- Change Fan Speed Settings

If the CMOS setup is not properly setup the computer may ignore or not look at the CD-ROM as a bootable option. Verify in the CMOS that your settings are properly set to boot from the CD-ROM drive.

Generally, these settings will be under the boot options. Setup your boot options similar to the below example.

1 Floppy / LS120  
 2 CD-ROM  
 3 Network (if available)  
 4 Hard Disk Drive

The best way to find the perfect resolution to suit you and your monitor is to experiment. To change the screen resolution, first right-click on the desktop and then left click on Screen resolution from the menu that appears. When using LCD/LED monitors, it is recommended to set for the native resolution of the monitor for best performance.



*Usually, a sector contains 512 bytes. To find out the size of a hard disk, use the formula: (# of cylinders X # of sectors X # of heads) X 0.5 KB*

#### **To obtain BIOS string ID:**

1. Power off the system
2. Either unplug your keyboard or hold down one of the keys on the keyboard
3. Power-on the system and you should get a keyboard error
4. The string in the lower left hand corner of your computer screen represents the BIOS String ID.

It is also possible to read the BIOS information by going to the BIOS set-up of the PC by pressing appropriate key (usually Del key) during boot up.

#### **The general errors and the corresponding failures are shown below:**

100-199: System board failures  
 200-299: Memory failures  
 300-399: Key board failures  
 400-499: Monochrome video problems  
 500-599: Color video problems

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600-699: Floppy disk errors  
1700-1799: Hard disk problems.

It is most likely that the USB is not enabled in the BIOS. This is the first thing to be checked while configuring USB port. If the keyboard is USB keyboard, and you are unable to enter BIOS configuration, it may need to be replaced with a conventional keyboard for the purpose of changing/ verifying the BIOS settings. Note that USB interface need to be enabled in the BIOS.

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## 1.2 Motherboard Components, their properties and purpose

The motherboard is the computer's main circuit board. It's a thin plate that holds the CPU, memory, connectors for the hard drive and optical drives, expansion cards to control the video and audio, and connections to your computer's ports (such as USB ports). The motherboard connects directly or indirectly to every part of the computer.

This motherboard was developed by intel in 1995. ATX is the most common motherboard design. Several ATX-derived designs have been specified that use the same power supply

**ATX (Advanced Technology Extended)** is a full size board measuring 12" wide by 9.6" deep. ATX has 6-pin mini keyboard connector. Also, it has double row single power supply connector providing +/-5V, +/-12V, and +3.3V.

**MicroATX** is a small motherboard size of 9.6" x 9.6". Compared to full size ATX, microATX have smaller number of I/O slots. For example, full ATX can have 5 PCI slots, whereas MicroATX can have up to 3/4 PCI stots only. The chief advantages over ATX is reduced size, and power requirements. The microATX form factor was developed as a natural evolution of the ATX form factor to address new market trends and PC technologies. The microATX form factor improves upon the previous specification in several key areas.

**ITX:** ITX is the smaller version of the motherboard. The user will find only a few expansion slots that are because of its small size. Also, one can find the ITX mini as well which have only one expansion slot. Since the space on this motherboard is less, so one might find very less features on this motherboard. The mounting points which would be found by the user are same as the ones he would find in Micro ATX or the ATX. So, one can fit them one by one in the same type of case. So, many manufactures actually build the case in the way that whatever motherboard is used, it can get fit into the case. SO basically, the Mini ITX gives an edge to the user if he wants to have the motherboard which covers only a small room.

**Mini-ATX** motherboards were designed with Mobile on Desktop Technology which adapt

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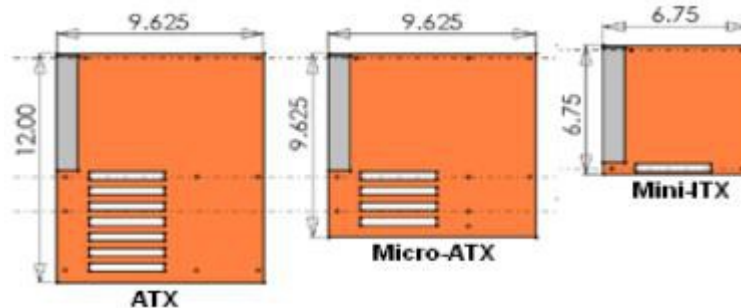


mobile CPUs for lower power requirements and less heat generation. Mini-ATX motherboards use surface-mount technology and solid state capacitors.

**Given below are the main differences between ATX and Micro ATX boards:**

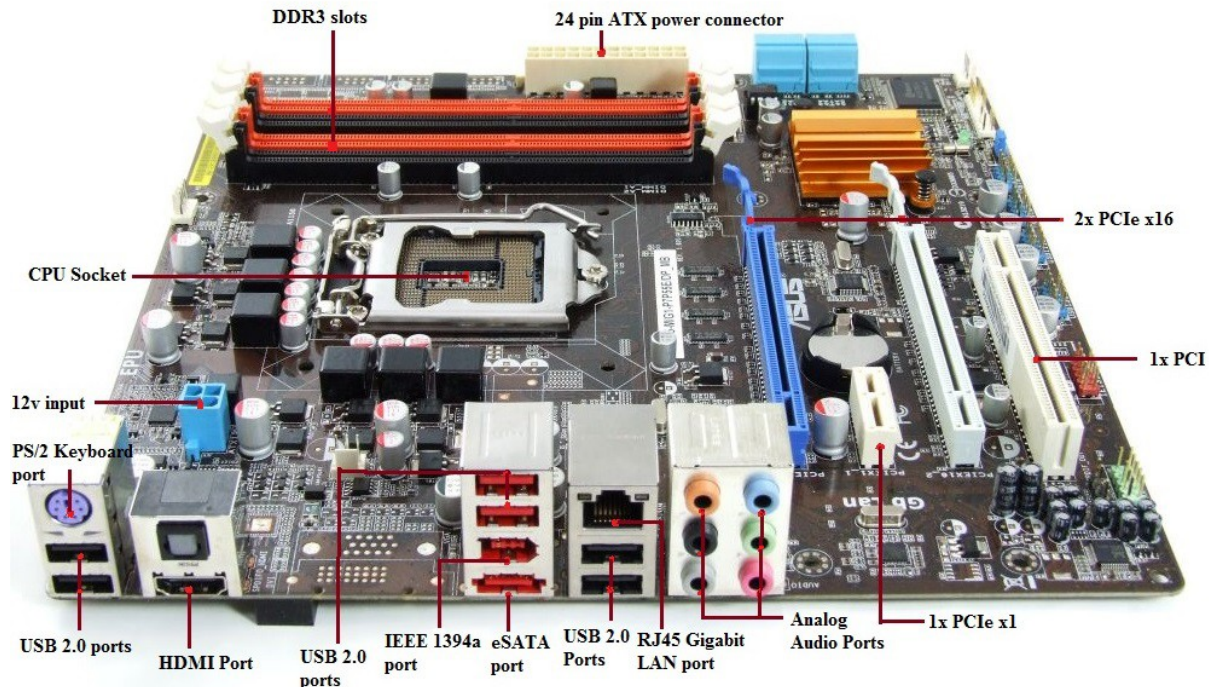
1. ATX is larger than Micro ATX
2. ATX boards typically have more expansion slots than Micro ATX boards.
3. A Micro ATX board can be installed in an ATX chassis but not the other way around.
4. A Micro ATX chassis has fewer drive bays than an ATX chassis.
5. AT style systems use two power connectors, P8 and P9 to connect to the motherboard. ATX systems use only one P1 connector to connect to the motherboard.
6. ATX is a hardware (motherboard) specification of desktop computers introduced by the Intel Corporation in 1995 as advancement from the existing AT specification.
7. MicroATX is a hardware specification introduced based on the ATX specification standard; therefore, it is compatible with the peripherals and add-on devices used for ATX computers. The power supply, I/O panel, and connectors are the same.
8. MicroATX is smaller than the standard ATX configuration. It has less expansion slots and fan headers than a standard ATX.
9. Chassis of a micro ATX is smaller, but microATX motherboard can be installed in a standard ATX board too.

**The relative sizes of ATX, Micro ATX and Mini-ITX are shown below:**



Further, Mini ITX is limited to one PCI-e slot, and up to 2 memory slots. For most PC applications, Mini-ITX is sufficient unless you want to go for more PCI-e slots or do heavy gaming (display-intensive).





**Motherboard Components:** A typical Micro ATX motherboard with constituent components is given below:

The ATX standard has two different versions of the main power cable: the original 20 pin cable, and the newer 24 pin cable. The main ATX connector is a 20-pin connector. The four pins carrying power are 3.3 V, 3.3 V, 5 V, and 5 V. This allows the motherboard to pull about 20 to 30 watts.

The 24-pin ATX connector is simply the 20-pin connector along with the extra 4-pin connector on the side. This provides the 4 pins carrying power as ATX 20-pin connector plus an additional 4 pins with 5 V standby, 12 V, 12 V, and 3.3 V.

1. **ICH9:** ICH9 is Intel's own 'southbridge' chipset and it stands for I/O Controller Hub 9. The northbridge and southbridge are also known as MCH (Memory Controller Hub) and ICH, respectively.
2. **SPDIF:** SPDIF also written as S/PDIF, stands for Sony/Phillips Digital Interface, and is an interface to transmit digital audio. Among the two consumer-level interfaces to transmit audio in digital format: SPDIF and HDMI (High-Definition Multimedia Interface) . SPDIF transmits only audio, but HDMI also carries digital video signal.
3. **PCIe:** PCIe is an updated version of the PCI protocol. PCIe cards can always operate in PCIe slots with the same or more lanes than the card. For example, an x8 card can operate in a slot with x8, x16, or x32 lanes.
4. **TPM:** The TPM would be mostly utilized by applications that require or are related to

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security, such as encryption/decryption, and authentication. Trusted Platform Module (TPM) is a microchip that is built into a computer. It is used to store cryptographic information, such as encryption keys. Information stored on the TPM can be more secure from external software attacks and physical theft.

1. BitLocker uses the TPM to help protect the Windows operating system and user data and helps to ensure that a computer is not tampered with, even if it is left unattended, lost, or stolen.
2. BitLocker can also be used without a TPM. To use BitLocker on a computer without a TPM, you must change the default behavior of the BitLocker setup wizard by using Group Policy, or configure BitLocker by using a script. When BitLocker is used without a TPM, the required encryption keys are stored on a USB flash drive that must be presented to unlock the data stored on a volume.

**5. USB (Universal Serial Bus) Port:** There are usually a couple of these ports located on each motherboard used for connecting pen drives and external hard drives, like Ipods or Mp3 players.

**6. RJ-45 (Registered Jack 45):** It is commonly used for an Ethernet or serial connection with an 8 position 8 conductor (8P8C) jack.

**7. Audio ports:**

- a) Line In port (light blue): This port connects a tape, CD, DVD player or other audio sources.
- b) Line Out port (lime): This port connects a headphone or a speaker. In 4-channel, 6-channel, and 8-channel mode, the function of this port becomes Front Speaker Out.
- c) Microphone port (pink): This port connects a microphone.
- d) Side Speaker Out port (gray): This port connects to the side speakers in an 8-channel audio configuration.
- e) Rear Speaker Out port (black): This port connects to the rear speakers on a 4-channel, 6-channel, or 8-channel audio configuration.
- f) Center/Subwoofer port (yellow orange): This port connects the center/subwoofer speakers

**8. PCI Express x16:** A graphics interface offers increased bandwidth and scalability over the previous AGP8X generation. PCI Express x16 allows up to 4 GB/s of peak bandwidth per direction, and up to 8 GB/s concurrent bandwidth.

**9. PCI Express x4:** A graphics interface allows up to 800 MB/s of peak bandwidth per direction.

**10. PCI (Peripheral Component Interconnect) Slot:** Supports peripherals like sound cards, DVD decoders, and graphic accelerators with 32 bits at 33Mhz capabilities. There are usually anywhere from 1 to 6 PCI slots available on the motherboard.

**11. Printer Header:** It is parallel port used to connect scanners and printers.

**12. COM(Communication) Port:** The port designed to connect your mouse and modem.

**13. IDE Connector:** Responsible for connecting the IDE cord used for hard disks, CD drives, and DVD drives.

**14. CPU slot:** To install the CPU, just slide it straight down into the slot. Special notches in the slot make it impossible to install them incorrectly. So remember if it does not go easily, it is probably not correct. Be sure to plug in the CPU fan's power.

**15. SATA Controller:** Motherboard will typically have SATA controller for connecting SATA enabled devices such as Hard disks

**16. CMOS (Complementary Metal-Oxide-Semiconductor):** It is also called as non-volatile BIOS memory is the term usually used to describe the small amount of memory on a computer motherboard that stores the BIOS settings. The CMOS is usually powered by a CR2032 cell battery. Most CMOS batteries will last the lifetime of a motherboard (up to 10 years in most cases) but will sometimes need to be replaced. Incorrect or slow system date and time and loss of BIOS settings are major signs of a dead or dying CMOS battery. The Complementary Metal-Oxide Semiconductor(CMOS) allows the computer to store the Real Time Clock (RTC)and other device information even after the computer is switched off and on. This is achieved by using a battery just for CMOS. If you notice that the time is constantly incorrect, even after adjusting correctly, the most likely cause is that the CMOS battery has become weak and need to be replaced.

**17. 24 - pin ATX Power connector:** The ATX standard has two different versions of the main power cable, the original 20 pin cable, and the newer 24 pin cable. The main ATX connector is a 20-pin connector. The four pins carrying power are 3.3 V, 3.3 V, 5 V, and 5 V. This allows the motherboard to pull about 20 to 30 watts. The 24-pin ATX connector is simply the 20-pin connector along with the extra 4-pin connector on the side. This provides the 4 pins carrying power as ATX 20-pin connector plus an additional 4 pins with 5 V standby, 12 V, 12 V, and 3.3 V. The below shows the 24-pin ATX power connector.

**CPU Socket:** The CPU socket is the array of hundreds of holes or metal plates to which a

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computer's central processing unit connects. The CPU socket supplies power to the processor and allows data to be sent to and from the processor from the computer's memory.

**Add-on Card Connectors:** Many motherboards have connectors for computer add-on cards. These connectors are long slots into which the cards are inserted. There are several types of add-on card connectors. Some of the most common include Peripheral Component Interconnect Express (PCIe) and Accelerated Graphics Port (AGP), used mainly for video cards, and conventional Peripheral Component Interconnect (PCI), used for other types of add-on cards such as sound cards and storage controllers.

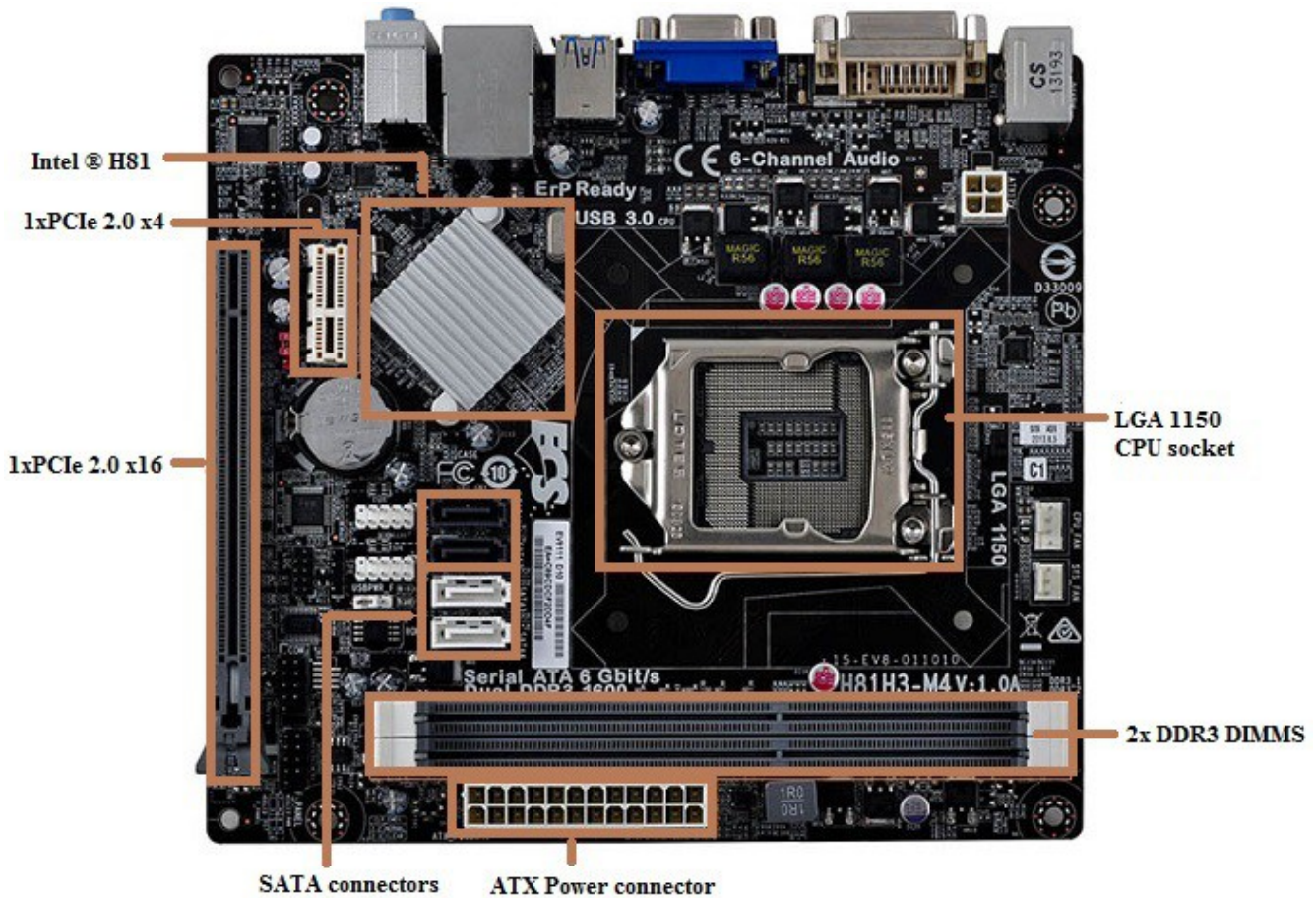
**RAM Slots:** A memory slot, memory socket, or RAM slot is what allows computer memory (RAM) to be inserted into the computer. Depending on the motherboard, there may be two to four memory slots (sometimes more on high-end motherboards) and are what determine the type of RAM used with the computer. The most common types of RAM are SDRAM and DDR for desktop computers and SODIMM for laptop computers, each having various types and speeds.

**Chipset:** North Bridge connects directly to the CPU, whereas the South Bridge is connected to the North Bridge

- The northbridge typically handles communications among the CPU, in some cases RAM, and PCI Express (or AGP) video cards, and the southbridge.
- The southbridge is one of the two chips in the core logic chipset on a personal computer (PC) motherboard, the other being the northbridge. The southbridge typically implements the slower capabilities of the motherboard in a northbridge/southbridge chipset computer architecture.
- A southbridge chipset handles all of a computer's I/O functions, such as USB, audio, serial, the system BIOS, the ISA bus, the interrupt controller and the IDE channels.

**Mini ITX:** Various components of Mini-ITX motherboard are as shown in the below figure





**Example:** SanDisk Extreme SSD, which supports SATA 6Gb/s interface and when connected to SATA 6Gb/s port, can reach up to 550/520MB/s sequential read and sequential write speed rates respectively. However, when the drive is connected to SATA 3 Gb/s port, it can reach up to 285/275MB/s sequential read and sequential write speed rates respectively.

**Express Card:** Express card is an interface to allow peripheral devices to be connected to a computer, usually a laptop computer. Formerly called NEWCARD, the Express Card standard specifies the design of slots built into the computer and of cards which can be inserted into Express Card slots. The cards contain electronic circuitry and connectors to which external devices can be connected. The Express Card standard replaces the PC Card (also known as PCMCIA) standards.

**PCI Express (Peripheral Component Interconnect Express):** Officially abbreviated as PCIe, is a high-speed serial computer expansion bus standard designed to replace the older PCI, PCI-X, and AGP bus standards.

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NIC, Network Interface Card is the one that interfaces your PC to the LAN. NIC sits in your PC on one of the slot available on the motherboard.

- Advanced Configuration and Power Interface (ACPI) specification provides an open standard for device configuration and power management by the operating system.
- The specification is central to Operating System-directed configuration and Power Management (OSPM), a system implementing ACPI, which removes device management responsibilities from legacy firmware interfaces.
- The Advanced Host Controller Interface (AHCI) is a technical standard defined by Intel that specifies the operation of Serial ATA (SATA) host bus adapters in a non-implementation-specific manner.

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### **1.3 Identify common PC connector types and associated cables**

### **1.4 Various PC connection interfaces, their characteristics and purpose**

### **1.5 Various memory(RAM) types and their features**

### **1.6 Install and configure PC expansion cards**

### **1.7 Install and configure storage devices and use appropriate media**

### **1.8 Install various types of CPUs and apply the appropriate cooling methods**

### **1.9 Install a power supply based on given specifications**

### **1.10 Compare and contrast types of display devices and their features**

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## 1.11 Install and configure common peripheral devices

## 1.12 Compare and contrast differences between the various print technologies and the associated imaging process

## 1.13 Given a scenario, select the appropriate components for a custom PC configuration, to meet customer specifications or needs

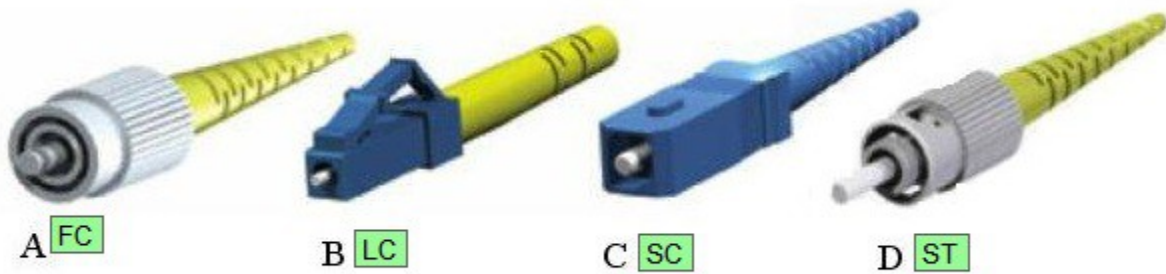
## 2.0 Networking

### 2.1 Identify the various types of network cables and connectors

The connector types commonly used for Fiber Optic networking are SC,ST, or MIC connectors. IDC/UDC is used in Token Ring networks. RJ-45, BNC connectors are commonly used in Ethernet networking.

1. **ST connectors:** ST connectors are the most common type of commercial fiber optic connector. These connectors utilize an exposed plastic tube housing the optical fiber. This requires a connection to a matching cable on the other side, incorporating a connector that mates to the other. These combine in a spring-loaded twist, reminiscent of BNC connectors, and are noted for their reliability.
2. **SC connectors:** SC connectors have the ferrule that houses the fiber mostly concealed. Probably the most similar commercial equivalent of To slink, SC connectors does not require a mating cable on the other side. Instead, these snap-on connectors simply push into their jacks with a click.
3. **FC connector:** FC connector is similar to ST connectors, these fiber optic connector's screws into their mating jacks. Additionally, the tube surrounding the optical fiber is typically shrouded in ceramic or metal, as opposed to being fully exposed. The inner ring of the connector is keyed to ensure positive mating to its corresponding jack.





4. **LC cables latch:** LC cables latch release into their jacks in a manner similar to Ethernet connectors. Smaller in form than SC connectors, their durability is not compromised, nor is cost increased. Instead of snapping or thermo forming the connector to the cable, it is glued. This makes it a popular connector for field use.

**Twisted Pair:**

RJ -11: These connectors are used to link modem/phone to the phone line. They have only two pins that get into the modem.

RJ -14 : RJ-14 connectors are dual-line phone jacks that can accommodate up to two phone lines.

RJ -45: RJ - 45 cable is widely used for attaching UTP cable in LAN environment. These connectors have eight pins.

**T568A** and **T568B** are the two color codes used for wiring eight-position RJ45 modular plugs. Both are allowed under the ANSI/TIA/EIA wiring standards. The only difference between the two color codes is that the orange and green pairs are interchanged.

Color codes are provided on some motherboards to ensure that a technician identify LIKE memory slots to insert memory sticks.

The fig. below shows the color codes used in T568A and T568B



**Coaxial cables:** Coaxial cables are high-frequency transmission cables made up of a single solid-copper core. Data is transferred electrically over the inner conductor and has 80 times more transmission capacity than twisted pair cables. This type of cable is commonly used to deliver TV signals (its higher bandwidth makes it more suitable for video applications) and to connect computers in a network. Along with stable transmission of data, coaxial cables also have anti-jamming capabilities and can effectively protect signals from being interfered. The cost is slightly higher than twisted pair but still considered more economical than fiber.

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## 2.2 Compare and contrast the characteristics of connectors and cabling

## 2.3 Explain the properties and Characteristics of TCP/IP

# 3.0 Mobile devices

## 3.1 Laptop hardware and components.

**Hard drives:** Laptop hard drives commonly have a 2½" form factor. The most common form factor for desktop hard drives is 3½". Laptop hard drives use the same drive technologies as their desktop counterparts, such as serial and parallel ATA. As with desktop hard drives, laptop hard drives are available in both solid-state and conventional varieties. Unlike desktop hard drives, laptop hard drives do not have separate power connectors. Some features are given below.

- 2.5" drives are more readily available than the 1.8 and a whole lot less expensive. Plus the vast majority of laptops take 2.5 drives. The 1.8 drives are found in some of the 10 inch display laptops.
- Ultraportable laptops use 1.8" drives because they weigh less and consume less power. However, they suffer from slow rotation speed and access time. 2.5" drives are much better performance wise because they have larger caches and higher rotation speeds.

**Displays:** LCD screens require a backlight system to operate, there are two backlight systems in use today:

- a. CCFL and

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b. LED

a. **CCFL:** Cold Cathode Fluorescent Light, is an older backlight method, which utilizes a daylight specter fluorescent tube and an inverter which powers it.

b. **LED:** Light Emitting Diode is a backlighting system which does not use an inverter, and instead of a fluorescent tube it uses a strip of LEDs.

So in essence there are two types of laptop screens: LCD-CCFL and LCD-LED: these screens are not interchangeable.

LEDs do not require backlighting like LCDs. LCDs work by selectively blocking areas of the backlight to make the images that you see, while LEDs generate light themselves. Because LEDs do not require backlighting, they consume much less power than LCDs.

Plasma display panels consume most power because of the inherent architecture of the Plasma panels. On the other hand, LED displays consume least power relative to plasma and CCFL.

**OLED(Organic Light Emitting Diode):** OLED are thinner and lighter than other screen types, making them an excellent choice for handheld devices. OLEDs are designed with a layer of organic compounds sandwiched between two light-emitting electrodes. CRT monitors are big, bulky, and use a cathode ray tube. Plasma displays, popular in home big-screen TV systems are made of small cells of ionized gas and provide excellent contrast ratio. LCDs use liquid crystal displays and are frequently used in laptop computers.

**Common problems with laptop displays:**

**1. Display not working:** If the external display is working properly and the problem is only with the internal laptop display, the most likely problem is with the inverter which powers the LCD display. Some times, an outline of an image can be viewed on a laptop screen, but it is very dim and the screen appears almost black. Such problems are almost always due to bad inverter and LCD.

**2. Dead pixel:** Dead pixel usually requires replacement of the LCD screen, and it is very expensive. If the laptop is new, check with your manufacturer for warranty replacement.

**3.** The inverter board is responsible for converting low voltage DC power to high voltage AC, necessary to light up the backlight bulb. If the inverter board is bad, the LCD screen (backlight bulb) will not light up when you turn on the laptop, but you still should be able to see a very dim image on the screen. Most commonly (say 80% of the time) it's the inverter, 10% it's the ccfl tube in the LCD panel, and 10% it's the motherboard or the VGA cable.

**4.** Digital displays offer best quality when operated at native resolution.

5. A dim screen can be caused by four things:

1. The LCD inverter which causes the LCD panel to light up
2. The CCFL fluro tube in the LCD panel
3. The motherboard supplying signal & voltage to the inverter
4. A damaged video cable between the laptop and the screen e. An LCD-LED display uses backlight and not a CCFL bulb. Therefore, the problem is most likely with backlight failure.

### **Internet connectivity problems**

Laptops, being mobile, usually participate on more than one network, and often use a static IP address at one location and a dynamically assigned IP address at another. For example, your computer might use dynamic addressing (DHCP) at the office but need to use a static IP address when at home to connect to a broadband ISP. This often results in connectivity problems.

Windows XP Professional solves this problem by allowing the user to configure the computer to first try DHCP, and then, if the attempt fails, to try alternate static IP address settings.

**Bluetooth connectivity problem:** Laptops with wireless networking capabilities usually provide a shortcut key to enable and disable the wireless radio. This feature is usually accessed by using a key combination of the function (Fn) key and one of the F keys at the top of the keyboard. Sometimes this key can also activate and deactivate the Bluetooth function of your computer.

### **How to replace the laptop battery**

1. Turn off your laptop and disconnect the AC adapter.
2. Release the latch or other attachment devices that hold your battery in place.
3. Slide the old battery out of its compartment or storage bay.
4. Take the replacement battery out of the box.
5. Slide it into the notch or bay.

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## **3.2 Laptop function keys**

## **3.3 Characteristics of various types of other mobile devices.**

## 4. Hardware and Network Troubleshooting

### 4.1 Troubleshoot common problems related to motherboards, RAM, CPU and power with appropriate tools

1. On a personal computer, the general errors and the corresponding failures are shown below:

100-199: System board failures  
200-299 : Memory failures  
300-399 : Key board failures  
400-499: Monochrome video problems  
500-599 : Color video problems  
600-699 : Floppy disk errors  
1700-1799: Hard disk problems.

2. Some of the frequently encountered error codes and their corresponding error messages on a PC are given below.

<b>Error Code</b>	<b>Error Message</b>
161	CMOS battery failure: Replace the CMOS battery
164	Memory size error : If the error occurs after memory upgrade, run SETUP program.
201	Memory test failed : RAM chips failed, one or more may need to be replace.
301	Keyboard error: You may have to check the key board

**3. Toner Probe:** A toner probe is an electronic test instrument to help trace wires. One part (the tone generator) induces a tone on a pair of wires, and with the other you part (the tone probe) you can detect the tone at the other end to trace where the wires go. You can trace wires through walls using a tone probe, and determine which pair is carrying the signal you induced at the other end.



**4. Cable Tester :** A cable tester is used to verify that all of the intended connections exist and that there are no unintended connections in the cable being tested. When an intended connection is missing it is said to be "open". When an unintended connection exists it is said to be a "short" (as in short circuit). If a connection "goes to the wrong place" it is said to be "miswired" (the connection has two faults: it is open to the correct contact and shorted to an incorrect contact).



**5. Difference between a Toner Probe and Cable Tester:** The main difference between a cable tester and a toner probe is that in the former, you have access to the both ends of the cable at the same time, and you normally to Open or Short testing (to determine right pins are connected), and in the latter, you dont have simultaneous physical access to both ends of the cable. An AT computer will have two interrupt controllers. The second interrupt controller needs to deliver the interrupts through the primary interrupt controller. IRQ2 had been identified for this purpose on the primary and IRQ9 on the secondary interrupt controllers. In other words, IRQ2 and IRQ9 are cascaded.

**6. AT style systems:** AT style systems use two power connectors, P8 and P9 to connect to the motherboard. ATX systems use only one P1 connector to connect to the motherboard.

**7. Keyboard Error:** If you are getting a keyboard error, you need to do one of the following things:

- a. Check if the keyboard needs to be cleaned
- b. Check if the keyboard cable has become loose
- c. Check if one or more of the keys are stuck
- d. If required, replace the keyboard.

**8. Battery backup:** The battery is supposed to provide backup in the event of any power failure, typically up to 2 hours or more.

**9. Hardware Compatibility List:** The best ways to find whether a new hardware is supported by your Windows OS is to check the manufacturer's documentation first, and then the Hardware Compatibility List (HCL).

**10. Inverter board:** The inverter board is responsible for converting low voltage DC power to high voltage AC, necessary to light up the back-light bulb. If the inverter board is bad, the LCD screen (back-light bulb) will not light up when you turn on the laptop, but you still should be able to see a very dim image on the screen.

**11. Pagnation Error:** If your error is typical, it will result in random BSOD (Blue Screen of Death) crashes but between crashes, the computer will be usable. Recommended sequence of steps to troubleshoot in a Windows 10 computer:

**1. First check the hard drive for errors:**

1. Open a CMD window as an administrator.
2. Type or paste 'chkdsk /f /r' and hit Enter.
3. Allow the process to complete.

**2. Then perform a system file check.**

1. Open a CMD window as an administrator.
2. Type or paste 'sfc /scannow' and hit Enter.
3. Allow the process to complete.

If problem persists, check Windows updates and drivers as they are often the cause of Page Fault in Non paged Area errors.

1. Navigate to Settings, Update & security.
2. Click 'Check for updates' in the Windows update tab.
3. Allow the process to complete.
4. Navigate to Control Panel, Hardware and Sound, Device Manager.
5. Select hardware, right click and 'Update Driver Software'. Make sure you check



- graphics and audio drivers as well as any third party webcam, printer and other drivers.
6. Reboot and retest.

If the BSOD still occurs, check the Windows page file.

1. Right click 'This PC' in Windows Explorer and select Properties.
2. Click 'Advanced system settings'.
3. In the Advanced tab click Settings in the Performance box.
4. Click Change in the Virtual memory box and uncheck 'Automatically manage paging files for all drives'.
5. Set a custom size for the page file.
6. Click Ok.
7. Reboot.

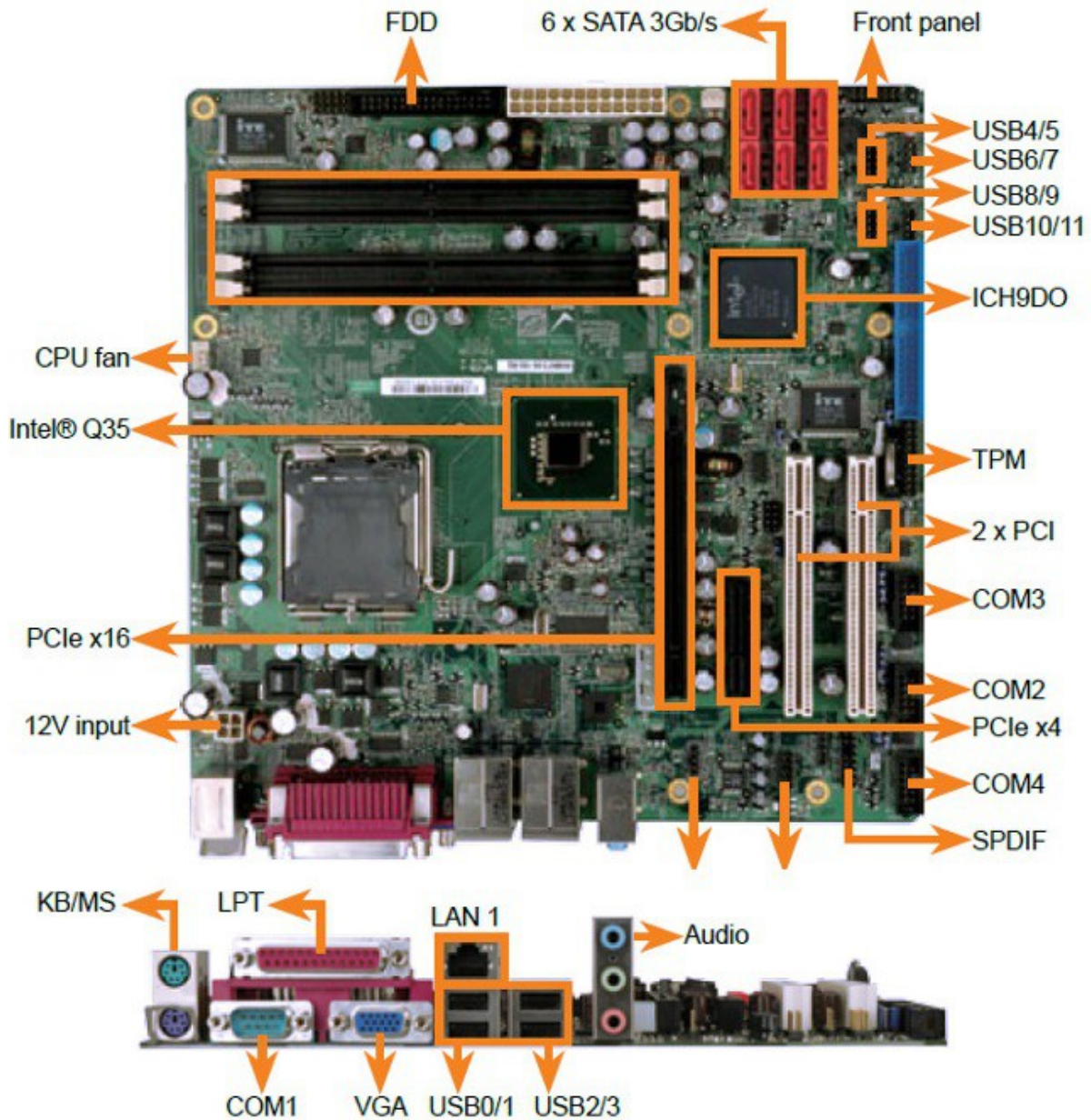
Finally, if none of those software methods work, check your RAM (physical memory). If your computer has multiple sticks of RAM, remove one and retest. If the fault persists, change the memory slot and retest. If the error keeps occurring, consider replacing your RAM.

**12. Date and Time Not Set error:** Date and Time Not Set is the most common error that occurs when the BIOS battery is drained. You need to replace the CMOS battery.

**13. Sporadic Movement of Mouse:** The most likely cause for sporadic movement of mouse is dirt. If dirt has entered the mouse, clean the dirt with IPA, or cotton wetted in soap water.

**14. Conflicting IRQs:** The most likely problem is conflicting IRQs(Interrupt Request Line). Since the mouse is working until the modem is used, the IRQ/IO address of modem may be conflicting with that of the mouse.

**15.** The motherboard displayed has the following expansion slots:



1. **PCI slots:** 5 (distinguished by white color, usually the number of PCI slots available on a motherboard varies from 3 to 6)
2. **ISA slots:** 2 (distinguished by black color, longer than PCI slots, placed next to PCI slots.)
3. **AGP slot:** 1 ( The single slot, next to 5 white PCI slots is AGP slot in brown color. Note that there will be only one AGP slot)

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16. To obtain BIOS string ID:
- Power off the system
  - Either unplug your keyboard or hold down one of the keys on the keyboard
  - Power-on the system and you should get a keyboard error
  - The string in the lower left hand corner of your computer screen represents the BIOS String ID.
17. It is also possible to read the BIOS information by going to the BIOS set-up of the PC by pressing appropriate key (usually Del key) during boot up.
18. Various POST (Power On Self Test) error codes and their description is as below:
- Code 01: Undetermined problem
  - Code 02: Power Supply error
  - Code 1xx: System board errors
  - Code 2xx: Memory (RAM) errors
  - Code 3xx: Keyboard errors
  - Code 6xx: Diskette Drive errors
- x is any single digit integer.
19. The following are true about backup:
- Full backup:** Here all files that have been chosen for backup are backed up, irrespective of whether the archive bit is set or not set. Archive bit is set (ON) after backup.
  - Incremental backup:** Here only the files that have been created or have changed since the previous full or incremental backup will be backed up. The archive bit is set after a file is backed up. Incremental backup will backup files that have changed since previous full or incremental backup.
  - Differential backup:** Here, the files that have changed or created since the last full backup will be backed up. Note that, unlike Incremental backup, the archive bit is not set on a differential backup. The result of this is that the next differential backup will include files that were backed up during earlier Differential backups.
20. UPS usually contains a filter to smooth the noise, and this filter is called noise filter.
21. x86 (32-bit) operating systems have a memory limit of 4GB. If you intend to use greater than 4GB of memory, you need to upgrade to x64 bit operating system.
22. Startup Repair can prevent a time-consuming re-installation by diagnosing and repairing

problems that prevent Windows from starting.

**Startup Repair:** Startup Repair is designed to start automatically if Windows detects a startup problem. The Startup Repair tool in Windows 7 can help fix problems that prevent Windows from starting up.

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## 4.2 Troubleshoot wired and wireless networks with appropriate tools

## 4.3 Troubleshoot hard drives and RAID arrays with appropriate tools

## 4.4 Troubleshoot common video and display issues

## 4.5 Troubleshoot printers with appropriate tools

# 5. Virtualization and Cloud Computing

## 5.1 Compare and contrast cloud computing concepts

**Common Cloud Models:** There are many different service models available for the cloud, with more being defined all the time. The three most common models are Software as a Service, Platform as a Service, and Infrastructure as a Service. Each provides a different level of manageability and customization for your solution.

1. **SaaS:** SaaS, or software as a service, is a cloud service that revolves around, easily the largest and most well known cloud-based service, SaaS uses the cloud to deliver software to users, which is then usually accessed via your Web browser. Unlike physical software that you install on your computer, SaaS solutions are hosted on a provider's servers. SaaS helps deliver an application that can be widely distributed and accessed. An example of this would be Google's Gmail. This email-based application is fully managed and accessed over the internet.

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**2. PaaS:** PaaS, or Platform as a Service providers offer you a higher level of management and control by providing access to a framework from the operating system, up. The underlying architecture of the host hardware network components and OS are typically managed by the vendor, who also take care of maintenance and support. This aspect makes it a great deployment service for developers who are free to concentrate on developing and not on maintenance.

**3. IaaS:** IaaS, or infrastructure as a service, is essentially cloud-based computers and resources. The most popular and well known type of IaaS is the virtual machine which is a digital version of a computer or server that is accessed over an Internet connection. The infrastructure is physically kept off site, and usually managed by a provider, but you access and interact with it as if it is located on your computer or in your office.

### **Public vs. Private vs. Hybrid vs. Community:**

Cloud computing offers notable advantages for businesses of all sizes. Moving all or part of a company's computer resources to the cloud involves deciding which cloud services and which type of cloud best suits the company's needs. There are two fundamentally different types of clouds, public and private. Each has its own advantages and disadvantages. However, cloud computing is continually evolving and cloud-service providers (CSPs) may offer hybrid clouds that combine features of both the public and private models. Community clouds are a recent variant of hybrid clouds that are built to serve the specific needs of different business communities.

**Public Clouds:** In a public cloud, individual businesses share on premise and access to basic computer infrastructure (servers, storage, networks, development platforms etc.) provided by a CSP. Each company shares the CSP's infrastructure with the other companies that have subscribed to the cloud. Payment is usually pay-as-you-go with no minimum time requirements. Some CSPs derive revenue from advertising and offer free public clouds.

Public clouds are usually based on massive hardware installations distributed in locations throughout the country or across the globe. Their size enables economies of scale that permit maximum scalability to meet requirements as a company's needs expand or contract, maximum flexibility to meet surges in demand in real time, and maximum reliability in case of hardware failures. Public clouds are highly cost effective because the business only pays for the computer resources it uses.

The main disadvantage of public clouds is that advanced security and privacy provisions are beyond their capabilities. For example, public clouds cannot meet many regulatory compliance requirements because their tenants share the same computer infrastructure. In addition, large CSP's often implement their public clouds on hardware installations located outside the United States which may be a concern for some businesses.

Public clouds are well suited for hosting development platforms or web browsers, for big data processing that places heavy demands on computer resources, and for companies that do not have advanced security concerns.



**Private Clouds:** In a private cloud, a business has access to infrastructure in the cloud that is not shared with anyone else. The business typically deploys its own platforms and software applications on the cloud infrastructure. The business's infrastructure usually lies behind a firewall that is accessed through the company intranet over encrypted connections.

Private clouds have the significant advantage of being able to provide enhanced levels of security and privacy because computer infrastructure is dedicated to a single client. In addition, private cloud CSPs are more likely to customize the cloud to meet a company's needs.

An important disadvantage of private clouds for some companies is that the company is responsible for managing their own development platforms and software applications on the CSP's infrastructure. While this gives the business substantial control on the software side, it comes at the cost of having to employ IT staff that can handle the company's cloud deployment. Recognizing this disadvantage, some CSPs provide software applications and a virtual desktop within a company's private cloud.

Private clouds have the additional disadvantages that they tend to be more expensive and the company is limited to using the infrastructure specified in their contract with the CSP.

**Hybrid Cloud:** In a hybrid cloud, a company's cloud deployment is split between public and private cloud infrastructure. Sensitive data remains within the private cloud where high security standards can be maintained. Operations that do not make use of sensitive data are carried out in the public cloud where infrastructure can scale to meet demands and costs are reduced.

Hybrid clouds are well suited to carrying out big data operations on non-sensitive data in the public cloud while keeping sensitive data protected in the private cloud. Hybrid clouds also give companies the option of running their public-facing applications or their capacity intensive development platforms in the public portion of the cloud while their sensitive data remains protected.

**Community Clouds:** Community clouds are a recent variation on the private cloud model that provide a complete cloud solution for specific business communities. Businesses share infrastructure provided by the CSP for software and development tools that are designed to meet community needs. In addition, each business has its own private cloud space that is built to meet the security, privacy and compliance needs that are common in the community.

Community clouds are an attractive option for companies in the health, financial or legal spheres that are subject to strict regulatory compliance. They are also well-suited to managing joint projects that benefit from sharing community-specific software applications or development platforms.

The recent development of community clouds illustrates how cloud computing is evolving. CSPs can combine different types of clouds with different service models to provide businesses with attractive cloud solutions that meet a company's needs.

**Shared resources:** Devices in a cloud data center are virtual machines (Vms) that share the resources of the underlying host. Virtual machines represent virtual instances of an operating

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system that exist as files on the physical host. One of the benefits of hypervisor- driven virtualization is the ability of the hypervisor to recognize momentary needs for more resources by one of the Vms and react by shifting some percentage of the resource in contention to the overloaded VM.

**Internal vs. External:** Regardless of whether the solution is public or private, the shared resources might be located either externally or internally. In an internal solution, all the resources are located in an organization's data center and are owned by the organization. In an external solution, all the resources are located at the service provider's data center and are owned by the service provider.

**Virtual desktop:** Virtual desktop infrastructures (VDIs) host desktop operating systems within a virtual environment in a centralized server. Users access the desktops and run from the server. There are three models for implementing VDI.

**Centralized:** All desktop instances are stored in a single server, requiring significant processing power on the server.

**Hosted:** Desktops are maintained by a service provider. This model eliminates capital cost and is instead subject to operation cost.

**Remote Virtual Desktops:** An image is copied to the local machine, making a constant network connection unnecessary.

**Virtual NIC:** Virtual network interface cards (vNICs) are software packages that act in the place of a physical network interface card (NIC) for a VM. Virtual NICs and virtual switches alone can form a virtual network for only virtual machines and the host physical machine, but if any communicating required between the virtual network and the physical network , the virtual NIC must be configured to communicate with the physical NIC of the underlying host.

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## 5.2 Given a scenario, set up and configure client-side virtualization