

A+ Essentials 220-801 Cram Notes

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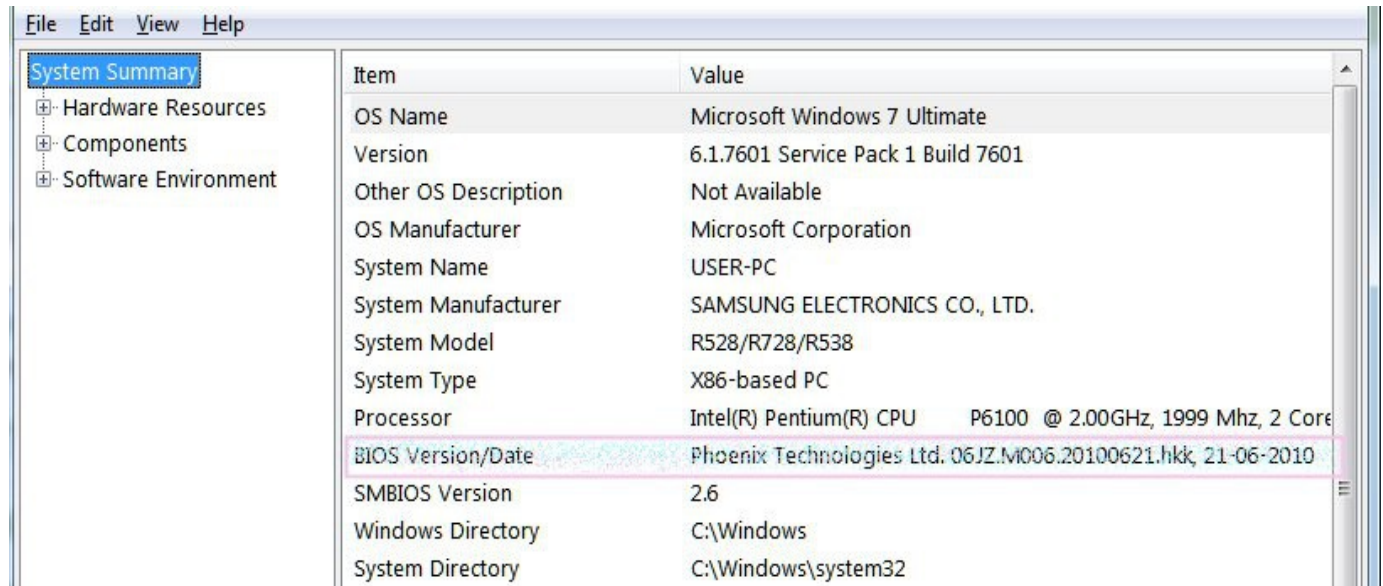
6.6 Aero Interface

1. PC Hardware

1.1 Configure and apply BIOS settings:

1.1.1

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:

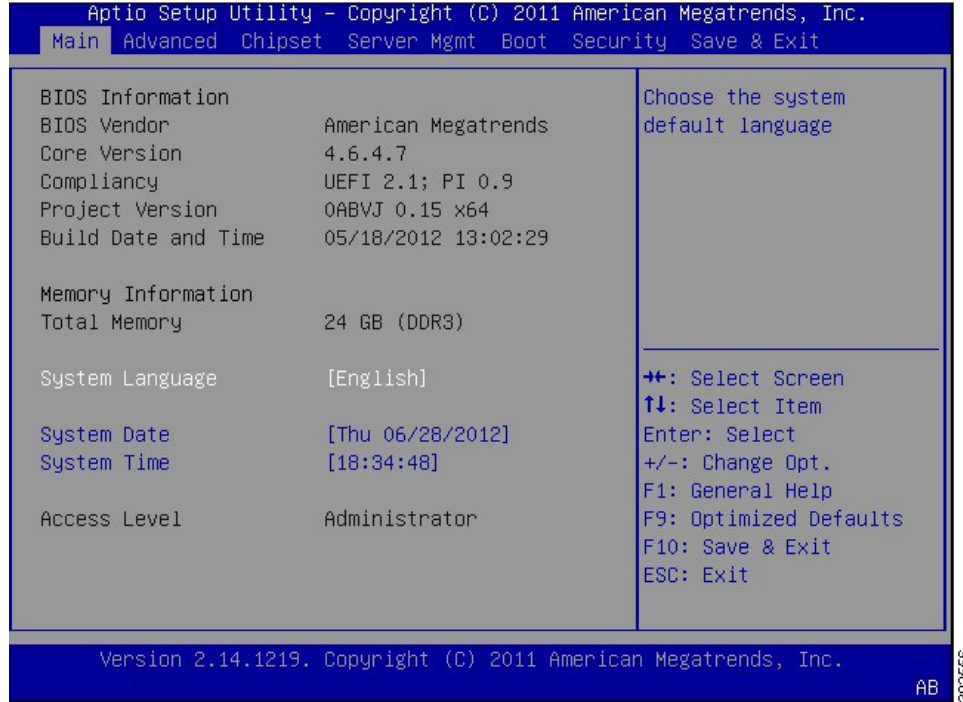


Item	Value
OS Name	Microsoft Windows 7 Ultimate
Version	6.1.7601 Service Pack 1 Build 7601
Other OS Description	Not Available
OS Manufacturer	Microsoft Corporation
System Name	USER-PC
System Manufacturer	SAMSUNG ELECTRONICS CO., LTD.
System Model	R528/R728/R538
System Type	X86-based PC
Processor	Intel(R) Pentium(R) CPU P6100 @ 2.00GHz, 1999 Mhz, 2 Core
BIOS Version/Date	Phoenix Technologies Ltd. 06JZ.M006.20100621.hkk, 21-06-2010
SMBIOS Version	2.6
Windows Directory	C:\Windows
System Directory	C:\Windows\system32

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:



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

- a) Change the Boot Order – You may configure the computer to boot from CDROM, Harddisk, or USB drive.
- b) Create a BIOS Password – This feature is useful to prevent un-authorized access to BIOS configuration menu.
- c) Change the Date and Time
- d) Change Floppy Drive, Hard Drive, or CD/DVD/BD Drive Settings.
- e) View Amount of Memory Installed
- f) Enable or Disable the Quick Power On Self Test (POST)
- g) Enable or Disable the CPU Internal Cache
- h) Enable or Disable the Caching of BIOS
- i) Change CPU Settings
- j) Change Memory Settings
- k) Change System Voltages
- l) Enable or Disable RAID
- m) Enable or Disable Onboard USB
- n) Enable or Disable Onboard IEEE1394
- o) Enable or Disable Onboard Audio
- p) Enable or Disable Onboard Floppy Controller
- q) Enable or Disable Onboard Serial/Parallel Ports

- r) Enable or Disable ACPI
- s) Change the Power Button Function
- t) Change Power-on Settings
- u) Change Fan Speed Settings

2. The computer power-on self-test (POST) tests the computer to make sure it meets the necessary system requirements and that all hardware is working properly before starting the remainder of the boot process. The causes for an error message like: 'NTLDR is Missing, Press any key to restart', may be due to any of the following reasons:

- a. Computer is booting from a non-bootable source.
- b. Computer hard disk drive is not properly setup in BIOS.
- c. Corrupt NTLDR and/or NTDETECT.COM file.
- d. Attempting to upgrade from a Windows 95, 98, or ME computer that is using FAT32.
- e. Corrupt boot sector / master boot record.
- f. Loose or Faulty IDE/EIDE hard disk drive cable.

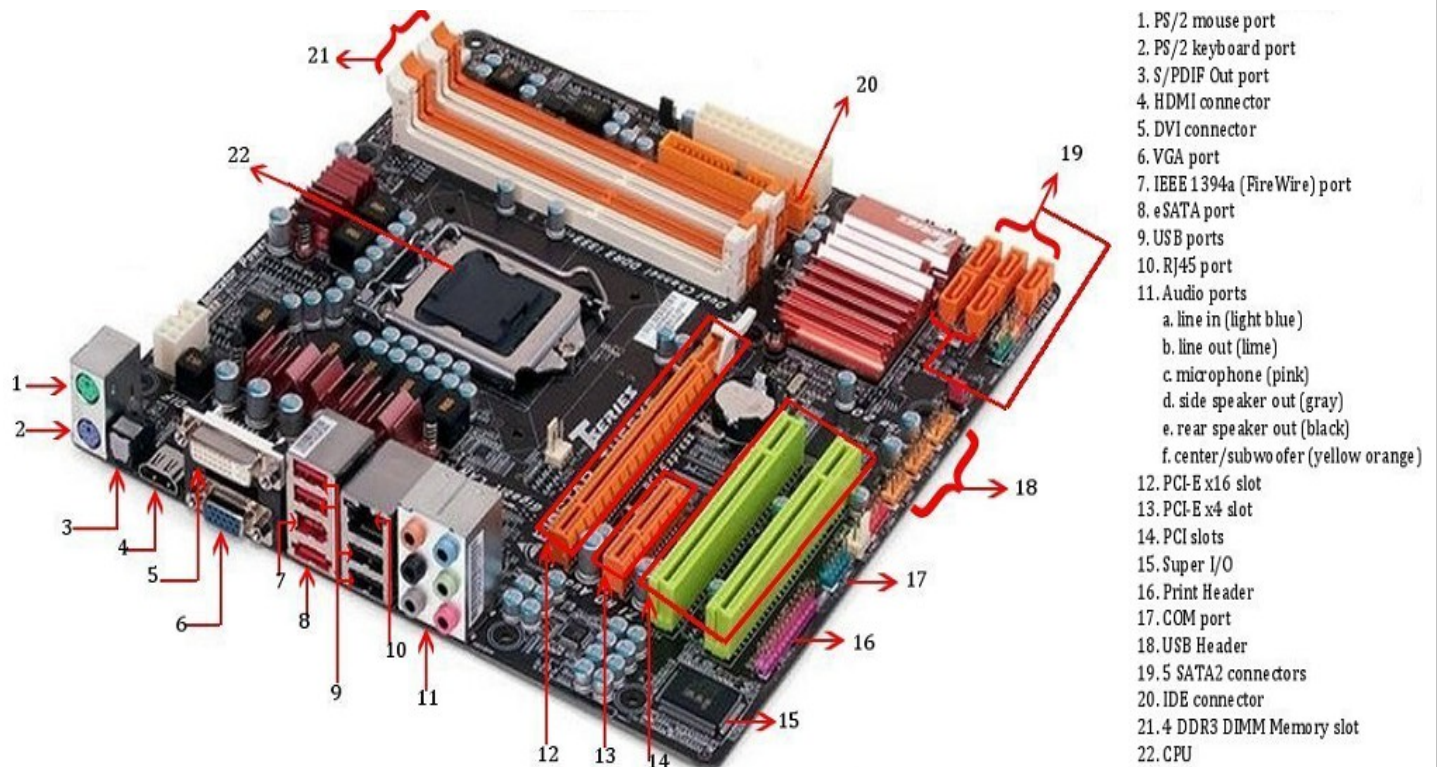
1.2 Differentiate between motherboard components, their purposes, and properties

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 slots only. The chief advantages over ATX is reduced size, and power requirements.

Components

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



MicroATX motherboard

1. PS/2 mouse port (green). This port is for a PS/2 mouse.
2. PS/2 keyboard port (purple). This port is for a PS/2 keyboard.
3. S/PDIF Outport: It stands for Sony/Phillips Digital Interface, and is an interface to transmit digital audio.
4. HDMI connector: Stands for "High-Definition Multimedia Interface." HDMI is a digital interface for transmitting audio and video data in a single cable. It is supported by most HDTVs and related components, such as DVD and Blu-ray players, cable boxes, and video game systems.
5. DVI (Digital Visual Interface) connector: It is used to send digital information from a computer to a digital display, such as a flat-panel LCD monitor.
6. VGA connector (Video Graphics Array) :VGA cables carry an analog signal as opposed to a digital signal (ones and zeroes). Using higher frequencies, it's possible to reach a relatively high range of video resolutions. However, video quality directly responds to cable quality, and doubly so on higher resolutions. Due to this, the quality of a VGA image can variate notable across different makes of cables.
7. Firewire header (IEEE 1394): A serial bus used to exchange digital and audio data with high performance abilities.
8. eSATA (External Serial Advanced Technology Attachment): It is an external interface for SATA technologies. It competes with FireWire 400 and universal serial bus (USB) 2.0 to provide fast data transfer speeds for external storage devices.

9. 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.

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

11. 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.

12. PCI Express x16 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.

13. PCI Express x4 graphics interface allows up to 800 MB/s of peak bandwidth per direction.

14. 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.

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

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

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

18. 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.

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

20. Power supply plug in:

The Power supply, as its name implies, provides the necessary electrical power to make the pc operate. the power supply takes standard 110-V AC power and converts into +/-12-Volt, +/-5-Volt, and 3.3-Volt DC power.

The power supply connector has 20-pins, and the connector can go in only one direction.

1. Given below are important bus types and their characteristics:

Bus Type	Data bus width	Speed	Bandwidth	Comments
ISA	16-bit	8.3MHz	15.9MBPS	Use jumpers to configure
EISA	32-bit	8.3MHz	31.8MBPS	Backward compatible with ISA, uses software/ jumpers for configuration
VESA or VL bus	32-bit	33MHz	127.2MBPS	Backward compatible with ISA cards
PCI	32-bit	33MHz	127.2MBPS	Supports Plug and Play
64-bit PCI	64-bit	66MHz	508.6MBPS	Supports Plug and Play
PCMCIA	32-bit	33MHz	-	Used in laptops, also know as PC card
AGP	32-bit	Speed of Processor	-	Used in video cards

2. Common Buses and their Max Bandwidth

Common Buses	Max Bandwidth
PCI	132 MB/s
AGP 8X	2,100 MB/s
PCI Express 1x	250 [500]* MB/s
PCI Express 2x	500 [1000]* MB/s
PCI Express 4x	1000 [2000]* MB/s
PCI Express 8x	2000 [4000]* MB/s

PCI Express 16x	4000 [8000]* MB/s
PCI Express 32x	8000 [16000]* MB/s
IDE (ATA100)	100 MB/s
IDE (ATA133)	133 MB/s
SATA	150 MB/s
Gigabit Ethernet	125 MB/s
IEEE1394B[Firewire]	100 MB/s

northbridge

The northbridge typically handles communications among the CPU, in some cases RAM, and PCI Express (or AGP) video cards, and the southbridge. Northbridge is directly connected to AGP video, thus providing higher transfer rates.

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.

1.3 Compare and contrast RAM types and features

1. There are basically two important types of RAM (Short for Random Access Memory):
 - a. SRAM - Static RAM being expensive, primarily used for Cache memory. DRAM, being cheaper, is used for main memory. SRAM is widely used for Level 1, Level 2 or Level 3 cache memory. Level 1 cache is internal to the processor, and level 2 and level 3 caches are external to the processor, it resides on the motherboard.
 - b. DRAM: Dynamic RAM holds its data if it is continuously accessed by special logic called a refresh circuit. If the memory is not refreshed regularly, then the DRAM will lose its contents. This refreshing action is why the memory is called dynamic.
All PCs use DRAM for their main system memory, instead of SRAM, even though DRAMs are slower than SRAMs and require the overhead of the refresh circuitry. The reason that DRAMs are used is that they are much cheaper and take up much less space.

2. RAM is much faster than ROM is, due to the nature of how it stores information. For this reason, RAM is often used to shadow the BIOS ROM to improve performance when executing BIOS code. PROM (Programmable ROM) is also a version of ROM and is slower compared to RAM.
3. The computer main memory usually consists of some type of DRAM. Types of DRAM Packages and DRAM Memory are explained below:
 - a. 168 pin DIMM (SDRAM): It can run at much higher clock speeds than conventional memory. SDRAM actually synchronizes itself with the CPU's bus and is capable of running at 133 MHz and twice as fast EDO DRAM .
 - b. 184 pin DIMM (DDR-SDRAM): It supports data transfers on both edges of each clock cycle, effectively doubling the memory chip's data throughput. DDR-SDRAM is also called SDRAM II. DDR stands for Double Data Rate.
 - c. 240 DIMM (DDR2-SDRAM): It supports higher speeds than it's predecessor DDR SDRAM. DDR2 SDRAM is a double data rate synchronous dynamic random-access memory interface. It supersedes the original DDR SDRAM specification and has itself been superseded by DDR3 SDRAM. DDR2 is neither forward nor backward compatible with either DDR or DDR3.
 - d. 240 DIMM (DDR3-SDRAM): It supports speeds faster than DDR2 SDRAM. DDR3 SDRAM, an abbreviation for double data rate type three synchronous dynamic random access memory, is a modern kind of dynamic random access memory (DRAM) with a high bandwidth interface, and has been in use since 2007. DDR3 SDRAM is neither forward nor backward compatible with any earlier type of random access memory (RAM) due to different signaling voltages, timings, and other factors
4. PC ratings and corresponding DDR bandwidth are given below:

DDR266 = PC2100
DDR333 = PC2700
DDR400 = PC3200
DDR2-400 = PC2-3200
DDR2-533 = PC2-4200
DDR2-667 = PC2-5300
DDR2-800 = PC2-6400
DDR3-800 = PC3-6400
DDR3-1066 = PC3-8500
DDR3-1333 = PC3-10600
DDR3-1600 = PC3-12800
DR400 memory is also referred to as PC3200 memory. 400MHz DDR2 memory would be listed as PC2-3200, and so on.
5. The first 3 octets of a MAC address provide the manufacturer of the NIC (Network Interface Card).

For example, consider the MAC address given below:

00-22-75-76-D7-91

00-22-75 will uniquely identify the manufacturer of the NIC, which in this case turns out to be Belkin International Inc.

However, please note that identifying the manufacturer is only half a job, and you may need to try different drivers from that manufacturer to troubleshoot the problem

6. Dual-channel-enabled memory controllers in a PC system architecture utilize two 64-bit data channels. Dual channel should not be confused with double data rate (DDR), in which data exchange happens twice per DRAM clock. The two technologies are independent of each other and many motherboards use both, by using DDR memory in a dual-channel configuration. Dual-channel architecture requires a dual-channel-capable motherboard and two or more DDR, DDR2 SDRAM, or DDR3 SDRAM memory modules.

7. Error-correcting code memory (ECC memory)

a. ECC is a type of computer data storage that can detect and correct the more common kinds of internal data corruption.

b. ECC memory is used in most computers where data corruption cannot be tolerated under any circumstances, such as for scientific or financial computing. Error-Correcting Code (ECC) memory is often seen in high-end motherboards that provide important services or software functions. Unlike normal parity memory, ECC memory can find and fix errors.

c. ECC memory generally costs more, so you usually see motherboards designed for ECC memory when there's a specific need. ECC memory maintains a memory system effectively free from single-bit errors: the data that is read from each word is always the same as the data that had been written to it, even if a single bit actually stored, or more in some cases, has been flipped to the wrong state.

d. ECC memory is used where the data needs to be very accurate, and the memory is required to have self correcting capability. It adds cost to the memory module and used in server level computers where data accuracy is very important. Some non-ECC memory with parity support allows errors to be detected, but not corrected; otherwise errors that may occur are not detected.

1.4 Install and configure expansion cards.

In general, you will follow these steps to install an expansion card in your PC:

- a. If you're not using a PnP-compatible expansion card or operating system, determine the available system resources (IRQs, I/O addresses, and so forth). Configure the DIP switches or jumpers on the card, as necessary, to assign it available system resources.

- b. If you're using a PnP-compatible card and operating system, the vendor might direct you to run an installation utility before installing the device. This installation program puts the necessary drivers in a location where Windows can find them when you're done installing the device. If appropriate, run that setup program now.
- c. Shut down your PC, unplug it, remove peripheral cables, and open the case.
- d. Locate an empty and available expansion slot of the correct type.
- e. Remove the slot cover for that slot. These covers are generally either screwed in place or held by spring-clips.
- f. If necessary, temporarily move or remove wires or other expansion cards that are in the way so that you can access the slot.
- g. If you need to connect wire assemblies to the expansion board - not to its back slot cover plate, but to the board itself - connect that end of the wire assembly before installing the card. In this way, you can easily reach the connector and be sure you're installing the wire assembly in its correct orientation. Connect the other end after you have installed the card.
- h. Begin inserting the end of the edge connector that's farthest from the slot cover. Then, gently push the card into place in the slot. This will help you line up the connector correctly. Inserting the card at an angle like this is usually easier than pushing it straight into the slot.
- i. Fix the card in place with screws or clips, as appropriate to your case design.
- j. Connect any wiring assemblies, including those you temporarily removed to install this card. Close the case, connect peripherals, and start the system.
- k. Depending on your operating system, version, and adapter card technology, configure the card. If you're using PnP-compatible components, PnP will handle this for you.
- l. If necessary, install required drivers. If you have to install drivers yourself, you will most likely need to configure them to use same hardware resources you configured the card to use.
- m. When you're done, some devices and operating system versions will also require you to restart your computer. This fully loads the drivers and configures the operating system to support the new device.

1.5 Install and configure storage devices and use appropriate media.

1. The speeds achievable by using different technologies is given below:

- USB 1.1 – 15 Mbps
- FireWire (1394a) – 400 Mbps
- USB 2.0 – 480 Mbps
- FireWire 800 (1394b) – 800 Mbps
- SATA 1.5 – 1.5 Gbps
- SATA 3.0 – 3.0 Gbps

2. IDE hard disks

- a. An IDE hard disk can have one Primary partition and one Extended partition. An Extended partition can be divided into one or more logical partitions. After partitioning the hard disk, each partition needs to be formatted.
- b. The File System Boot Sector is the first physical sector on any logical volume.
- c. The first physical sector on any bootable hard disk contains Master Boot Record, MBR.
- d. The command FDISK will destroy all the data on a partition or drive on to which it is run.
- e. The primary partition can be made bootable, by marking partition as active.

3. Floppy drive

- a. A floppy cable will have 34 wires, and the wire with red stripe signifies wire going to pin number 1 of the connector.
- b. If the floppy cable is reversed, the drive light will be continuously ON. Try reversing the cable.
- c. The floppy ribbon cable is distinguished easily from that of an IDE cable by a small twist in the cable. The purpose of the twist is to differentiate between floppy drive A and floppy drive B
- d. Note that the floppy disk drive is not accessible only after some changes to the BIOS set-up. It is possible that the Floppy disk is disabled during the changes. Therefore, check the BIOS settings, before proceeding further.

Characteristics of a floppy drive:

1. The ribbon cable connecting the floppy drive to the motherboard is 34 wires wide.
2. There can be a maximum of two floppy drives in a PC

When you have two hard disk drives, the following two combinations are possible:

1. Install the drives one each on primary and secondary controllers and designate both as Masters.
2. Install both the drives on the primary controller and designate one as Master and the other as Slave.

The storage capacity of various types of floppy:

Size	Type	Storage
5 1/4"	DSHD	1.2MB
3 1/2"	DSDD	720KB
3 1/2"	DSHD	1.44MB
3 1/2"	DSED	2.88MB

4. CD-R

a. Stands for CD- Recordable. You can record data onto a CD-R only once. CD-RW stands for CD-ReWritable, and as the name suggests, you can record data any number of times onto a CD-RW (subject to wear and tear). CD-R is represented by two speeds (AxB), the former is the write speed and the latter is the read speed. The read speed is always higher than the write speed. Some typical CD-R speeds are 4X24, 8X32, 16X32 etc.

b. When recording a CD-R as a back-ground process while working with another application in the fore-ground.if the CD was improperly burned, and became un-usable most common causes of the problems is buffer under-run. If the source device is unable to keep the burner loaded with data, it may lead to improperly burned CDs, and hence rendering the CD useless. Some CD drives such as Sanyo CD-RW come with burn proof technology. If you intend to work on the computer while the CD is written, use CD drives that take care of buffer under-run.

5. DVD

a. Also known as Digital Versatile Disc or Digital Video Disc, is an optical disc storage media format. Its main uses are video and data storage. DVDs are of the same dimensions as compact discs (CDs), but store more than six times as much data.

b. DVD comes in single layer (SL) or dual layer (DL). They are also distinguished as single sided (SS) or double sided (DS). There are four possible combinations:

- DVD-S (12 cm, SS/SL): 4.37 GB capacity
- DVD-9 (12 cm, SS/DL): 7.95 GB capacity
- DVD-10 (12 cm, DS/SL): 8.74GB capacity
- DVD-18 (12 cm, DS/DL): 15.90GB capacity.

c. Further, DVD-S stores about two hours of video, where as DVD-18 can store up to eight hours of video.

d. Storage capacity of DVD: 4.7GB (single-layer) and 8.5GB (dual-layer)

e. MS –DEFRAG utility is used to defragment the hard disk, you can run Microsoft defragment

utility by issuing a command "DEFRAG".

6. Firewire

a. A standard FireWire connection will support 100,200 and 400 Mbps. The important features of IEEE1394 (also known as FireWire 400) are:

1. 100 Mbit/s, 200Mbit/s, and 400Mbit/s supported.
2. Works without control, devices communicate peer-to-peer.
3. Cable up to 4.5 m.
4. Up to 63 devices supported.
5. Power supply to external devices is 1.25A/12V (max.).
6. The only computer bus used in digital video cameras

7. The IEEE 1394b specification supports data rates up to 400 Mbit/s in half-duplex mode, and even higher in full duplex. It can support optical connections up to 100 metres in length.

8. SCSI Types

SCSI Type	Transfer speed	Bus
SCSI-1	5MBPS	8 bit bus
Fast Wide SCSI	20MBPS	16 bit bus
Wide Ultra SCSI	40MBPS	16 bit bus
Ultra2 SCSI	40MBPS	8 bit bus
Wide Ultra2 SCSI	80MBPS	16 bit bus
Ultra3 SCSI or Ultra 160	160MBPS	16 bit bus
Ultra320	320 MBPS	16 bit bus

SCSI ID - 0=bootable drive, 7=controller, 1-6=any other devices

Wide-Ultra SCSI - 16 devices, 0=bootable drive, 15=controller

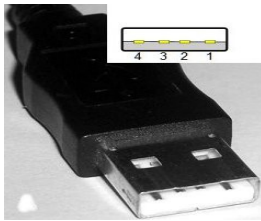
Each device in a SCSI chain need to have unique ID. For a 16-bit Wide SCSI, there are 16 possible SCSI Ids, 0-15. A standard 8-bit SCSI can support only 8 devices (including SCSI card), the Ids allowed are 0-7.

SCSI bus termination: If the termination is not done, a SCSI devices on the bus will not function properly. This is due to reflection of the signals at the end of the bus. To prevent this, both ends of the SCSI bus need to be terminated. If one end of the SCSI bus is terminated, you may find intermittent problems. Never terminate the bus at a device connected in between.

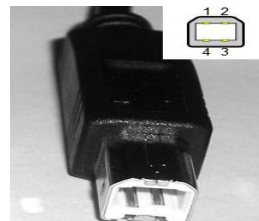
9. USB (Universal Serial Bus):

a. USB supports up to 127 devices simultaneously.

- b. USB enables you to daisy chain up to 127 USB devices. A USB hub is used for this purpose.
- c. USB devices can be plugged in without turning on/off power. i.e, USB devices are hot swappable.
- d. The important features of USB 2.0 are given below:
 - 1. Mbit/s 12Mbit/s 480Mbit/s supported.
 - 2. USB controller is required to control the bus and data transfer.
 - 3. Cable up to 5 m.
 - 4. Up to 127 devices supported.
 - 5. Power supply to external devices is 500 mA/5V (max).
 - 6. Full compatibility with USB 1.1 devices.
- e. To achieve proper USB connectivity six basic system elements must be present
 - 1. Support from the BIOS
 - 2. Support from the Operating System
 - 3. Physical USB ports
 - 4. A USB Device
 - 5. The correct USB cable for the device
 - 6. Drivers either from the OS and/or the peripheral maker
- f. USB 2.0 has a raw data rate at 480Mbps, and it is rated 40 times faster than its predecessor interface, USB 1.1, which has 12Mbps max speed.



USB Type A



USB Type B



USB mini Type A



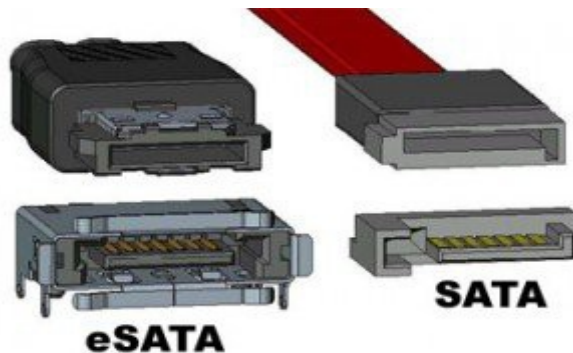
USB mini Type B

10. eSATA

- a. External Serial Advanced Technology Attachment or eSATA is an external interface for SATA technologies. It is faster compared to USB 2.0 or PATA technologies, and suitable for backing up large amounts of data using external hard drive.
- b. Even though eSATA is part of the SATA interface specifications, it uses a very different

physical connector from the internal SATA connectors. The reason for this is to better shield the high speed serial lines used to transfer the signals from EMI protection. It also provides a 2m overall cable length compared to the 1m for internal cables. As a result the, the two cable types can not be used interchangeably.

c. eSATA is hot swappable. Other drives IDE, EIDE, AND PATA does not support hot swap.



11. Blue-ray

a. Storage capacity of blue-ray: 25GB (single-layer) and 50GB (dual-layer)

b. Blue-ray drives are usually compatible with CD/DVD drives, but not the other way round.

12. SSD (Solid State Drives) access data stored in the drive using direct access. Since there are no mechanical rotating components that are found in conventional hard drives, the data access would be much faster.

1.6 Differentiate among various CPU types and features and select the appropriate cooling method

1. Processor package types:

a. 8088, 8086 processors used 40 pin DIPs. 80286, 80386, 80486, and some Pentium computers (60MHz, 66MHz) used PGA (Pin Grid Array).

b. Pentium chips (75 MHz and above) used SPGA (Staggered PGA). Pentium II CPUs use cartridge type mounting method, called "slot-1".

CPUs and features:

Processor	Socket type	Register	Data Bus	Address Bus
8088	DIP	16 bit	8 bit	20 bit
80286	LLC/PGA/PLCC	16 bit	16 bit	24 bit

80386SX	PGA	32 bit	16 bit	24 bit
80386DX	PGA	32 bit	32 bit	32 bit
80486SX	PGA	32 bit	32 bit	32 bit
80486DX	PGA/SQFP	32 bit	32 bit	32 bit
Pentium	Socket 5 SPGA/ Socket 7 SPGA.	64 bit	64 bit	32 bit
Pentium Pro	Socket 8 SPGA	64 bit	64 bit	32 bit
Pentium II	SEC Slot 1			
Pentium III	SECC-2 / PPGA or FC-PGA			
Pentium IV	socket 423/socket 478/ socket 775	64	64	36 bit*
Pentium Dual Core	Socket 775 (LGA775)	64	64	64 bit*
Pentium Quad Core	Socket 775 (LGA775)	64	64	64 bit*

c. 32-bit operating systems like Windows XP can support only 32 bits of addressing space, and hence only 4GB of memory can be used. By using 64-bit operating systems, 16 Exa bytes (EB) of RAM can be used. 36 bits of address space can access up to 64GB of memory.

d. CPU models 80486SX, and above contain on board cache memory.

Address Bus Size	Maximum RAM
32 bits	4GB
36 bits	64GB
40 bits	1TB.

44 bits	16TB
64 bits	16 EB (Exa Bytes)

e. A computer may reboot because of CPU overheating. Ensure that you have sufficient ventilation for proper airflow, and that the CPU fan is working.

2. Hyperthreading

a. It is an Intel invention for their processor cores that allows the CPU to present the Operating System with two "virtual" CPUs, each with its own set of resources. This new technology allows multiple processing threads to run in parallel on a single chip. The Operating System and associated hardware need to support hyper-threading for using this feature. For each processor core that is physically present, the operating system addresses two virtual or logical cores, and shares the workload between them when possible. The main function of hyper-threading is to decrease the number of dependent instructions on the pipeline.

b. Requirements for the HT enabled system:

- Intel Pentium 4 processor at 3.06 GHz or higher
- An Intel® chipset that supports HT Technology
- System BIOS that supports HT Technology and has it enabled
- An operating system that includes optimizations for HT Technology

c. Only Operating Systems Windows XP and above support Hyper-threading.

3. Bits and Bytes

1 KB = 1024 bytes

1 MB = (1024 X 1024) bytes

= (1024 X 1 KB) bytes

= 1,048,576 bytes

1 GB = (1024 X 1024 X 1024)bytes

= (1024 X 1 MB) bytes

= (1024 X 1024 X 1 KB) bytes

= 1,073,741,824 bytes

KB stands for Kilobyte

MB stands for Megabyte

GB stands for Gigabyte

Byte is represented by "B" as in MB

Bit is represented by "b" as in kbps

One byte is 8 bits

The Slot 1 package replaces the Socket 7 and Socket 8 used by previous Pentium processors. Slot 1 is a 242-contact daughter card slot that accepts a microprocessor packaged as a Single Edge Contact (SEC) cartridge. A motherboard can have one or two Slot 1s. More recently, Slot 2 package has been developed and used by recent processors.

4. File system

- a. FAT :Under FAT file system, the maximum size of a cluster is 32 KB and the maximum number of clusters is 65536. Therefore, the maximum size of a partitions is the number of clusters multiplied by the max size of the cluster, which is equivalent to 2 GB. Remember that 1 KB = 1024 bytes.
- b. NTFS: New Technology File System (NTFS) is a file system that was introduced by Microsoft to provide superior features like encryption, compression, and user permissions. NTFS is the primary file system used in Microsoft's Windows NT, Windows 2000, Windows XP, Windows 2003, Windows Vista, and Windows 7 operating systems.
- c. You can't apply file level permissions on a FAT file system. Only NTFS allows file permissions. Remember that the NTFS file permissions are always in effect to all users and processes.
- d. Windows 98 and Windows 95 OEM Release 2 support FAT32. Note that Windows NT does not support FAT32. NT supports only FAT16 and NTFS. Windows 2000 supports FAT16, FAT32, and NTFS.
- e. DOS standard FAT16 support drives up to 2 GB. FAT32 supports drives up to 2TB (Terabytes).

5. Intel socket

- a. Popular Intel socket types include LGA 1156/Socket H, LGA775, LGA 1155/1156, rPGA 988A, Socket G1, etc. Popular AMD socket types include LGA 940, Socket FM1, Socket AM3, Socket G34, etc.
- b. Socket LGA775 motherboards run Intel's Celeron (single-core), Pentium 4 (single-core), Pentium D (dual-core) and Core 2 Duo (dual-core) desktop processors.
- c. LGA775: Intel Pentium 4, Intel Pentium D, Intel Celeron, Intel Core 2 Duo, Intel Core 2 Quad, Intel Xeon
- d. 775: Intel Pentium 4, Intel Celeron
- e. 1156: : Intel Core i7, Intel Core i5, Intel Core i3, Intel Xeon, Intel Pentium, Intel Celeron
- f. 1366: Intel Core i7 (900 series), Intel Xeon (35xx, 36xx, 55xx, 56xx series)

1.7 Compare and contrast various connection interfaces and explain their purpose.

1. Bluetooth is widely used for communication between smart phones and other accessories or between PDAs and information kiosks. The typical coverage for Bluetooth devices is up to 30 feet. It can be used for personal area networking devices like keyboards and headphones
2. High-Definition Multimedia Interface (HDMI) connectors are used to connect compatible digital items (DVD players and conference room projectors, for example).
3. DVI differs from everything else in that it includes both digital and analog signals at the same time, which makes it popular for LCD and plasma TVs. Any TV that has DVI D/I input should also have a separate audio jack next to the DVI socket, probably a mini-jack
4. VGA connections and cables are analog in nature
5. DisplayPort is a digital interface standard produced by the Video Electronics Standards Association (VESA), used for audio and video.

1.8 Install an appropriate power supply based on a given scenario.

1. DC voltages commonly found in a PC:
 - a. +5, and +12 volts are the DC voltages commonly found on PCs. 80386 / 486 operate at +5v
 - b. Pentium and above operate at +3.3v
 - c. Power supply wires - yellow=+12v, blue=-12v, red=+5v, & white=-5v
2. One good way of determining a bad power supply is that the fan will not rotate. Also, the computer will not boot and the LED s indicating the power and disk activity will be OFF.
3. ATX12V 2.0 power supply provides four different voltages:
4. 3.3Volts, 5Volts, 12Volts and -12Volts. Previous versions of ATX12V used to provide -5V, and it has been discontinued in version 2.x.
5. ATX 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. Uninterrupted Power Supply (UPS)
 - a. An UPS is required for any critical and un-interrupted use of computers. It has the following benefits:
 1. Provide protection against small surges
 2. Filters noise from entering the computer
 3. Provide power to the computer during line power failure
 4. Give stable power to computer, even when the line power is unstable.
 - b. Note that the UPS can give un-interrupted power only for a fixed amount of time under a given load, in the absence of line voltage
7. Some PCI Express Graphics cards require extra power. High-end graphics cards will consume from

75 watts up to 150 watts of power. The PCI Express x16 connector can deliver up to 75 watts. In order to achieve 75W, an ATX12V power supply with a 2x12 main power connector is recommended. 25W-75W graphics cards are powered through the desktop board's PCI Express x16 connector. For additional power requirement, a new connector on the graphics card has been designed to supply up to 150 watts. This means an entirely new power supply will be required for some new graphics cards.

8. When selecting a power supply, two issues become important. You need to supply the total wattage required by all the devices and the motherboard of the PC, and you must ensure that it has the connector types required by your devices.

9. SATA: The SATA power connector is 15 pins, with 3 pins designated for 3.3 V, 5 V, and 12 V, with each pin carrying 1.5 amps. This results in a total draw of 4.95 watts + 7.5 watts + 18 watts, or about 30 watts.

10. A Molex connector is used to provide power to drives of various types. It has four pins, two of which have power, one 12 V and the other 5 V. These are standard for IDE (PATA) or older SCSI drives. The total power demands are from 5 to 15 watts for IDE and 10 to 40 watts for SCSI.

4/8-pin 12 V: With the introduction of the Pentium 4, the motherboard required more power. Supplemental power connections were provided to the motherboard in 4-, 6- (discussed later in this section), or 8-pin formats. These were in addition to the 20-pin connector (discussed later in this section) that was already provided.

11. There is a 4-pin square mini version of the ATX connector, which supplies 2 pins with 12 V, and an 8-pin version (two rows) that has four 12 V leads. These connect to other items, like the processor, or other components, like a network card that may need power that exceeds what can be provided with the ATX connection to the board.

12. PCIe 6/8-pin: PCIe slots also draw more power and require power in addition to the main 20-pin connector (discussed next). These additional connectors can be 6 pins and may also contain an additional 2-pin connector on the side for cases where the connection required is 8-pin.

13. 20-pin: The main ATX connector, referenced earlier, 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.

14. 24-pin: The 24-pin ATX connector is simply the 20-pin connector discussed earlier along with the extra 4-pin connector on the side. This provides the 4 pins carrying power as discussed earlier plus an additional 4 pins with 5 V standby, 12 V, 12 V, and 3.3 V.

1.9 Evaluate and select appropriate components for a custom configuration, to meet customer specifications or needs

1. 32-bit Operating systems (especially, workstation Operating Systems such as XP) usually support only up to 4GB of memory due to address bus limitation. It is recommended to go for 64-bit operating

system if you want to use more than 4 GB of memory.

2. SLI technology is designed for PCI Express and not AGP. This new bus has superior bandwidth (two to four times AGP 8X), support for isochronous data transport, and the capability to drive multiple high-speed graphics devices like running video games.

3. Computers used for graphic design, computer-aided design (CAD) applications, and computer-aided manufacturing (CAM) require much more horsepower than the standard PC. Specifically, they require multiple or more powerful processors, more robust video cards, and significantly more memory.

4. SATA hard disks may be used for building RAID arrays.

5. Dynamic disks are not supported in portable computers and on external USB devices. The primary reason being that dynamic disks are used for enabling RAID configuration or back configuration, which requires two or more disks to be present. Usually, portable computers and USB hard disk drives come with single hard drive.

6. RAID Level 10 requires a minimum of 4 drives to implement. RAID 10 is implemented as a striped array whose segments are RAID 1 arrays. RAID 10 has the same fault tolerance as RAID level 1. If a disk fails replace the failed disk and see if the RAID builds up. For single disk failures, usually, RAID 10 heals itself.

7. The hardware on the machine must have enough memory, hard drive space, and processor capability to support the virtualization. You also need the software to make virtualization possible.

8. Home Server

a. A home server is a server located in a private residence providing services to other devices inside and/or outside the household through a home network and/or the Internet. Such services may include file and/or printer serving, video/audio serving, web serving (on the network or internet), web caching, account authentication and backup services.

b. Windows Home Server is based on Windows Server 2003 R2 and is intended to be a solution for homes with multiple connected PCs to offer file sharing, automated backups, print server, and remote access.

c. Important features of a Home Server are given below:

1. Centralized backup: Backup individual computers at a central location.
2. Health monitoring - Monitor health of individual computers
3. File sharing - Enables file sharing over the home network
4. Printer sharing - Enables printer sharing over the network
5. Remote access gateway - Allows remote access to any connected PC on the network, including the server itself, over the Internet.
6. Media streaming - Can stream media to an Xbox 360 or other devices supporting Windows Media Connect.
7. Selective data redundancy - Guards against a single drive failure by duplicating

selected data across multiple drives.

8. Expandable storage - Provides a unified single and easily expandable storage space, removing the need for drive letters.

9. Server backup - Backs up files which are stored within shared folders on the server to an external hard drive.

d. When combining various servers into a single physical box, it is important to consider the server hardware requirements, such as CPU, Memory, Power Supply, Expansion Slots, Hard Disk Capacity, etc.

9. StickyKeys is designed for people who have difficulty holding down two or more keys at a time. When a shortcut requires a key combination such as Ctrl+P, StickyKeys allows you to press one key at a time instead of pressing them simultaneously.

10. Character Map: You can use Character Map to copy and paste special characters into your documents, such as the trademark symbol, special mathematical characters, or a character from the character set of another language.

11. Pointer trails can help people who struggle to track the movement of the pointer on both modern TFT screens and traditional 'tube' CRT screens.

12. A screen magnifier is software that interfaces with a computer's graphical output to present enlarged screen content.

13. When discussing thin and thick clients, you should understand that a thick client is a PC that has all the capabilities of a standard PC. It runs all applications locally from its own hard drive. A thin client is one that has minimal capabilities and runs the from a remote server

14. Wake-On-Lan requires a few settings as below:

a. An ATX motherboard with an onboard, 3-pin "WOL" connector and ATX power supply.

b. A network card that can support WOL with its cable to the motherboard properly installed.

c. In the BIOS Power Management, you must enable the LAN Wakeup option.

d. Then take a look at your network card settings, (right click mouse on "My Computer" icon on your desktop, select Manage -> "Device Manager") in "Device Manager" open properties of your "Network Card" and select "Power Management" tab. You need to check appropriate boxes enabling the Network Card to bring the computer out of standby.

1.10 Given a scenario, evaluate types and features of display devices

1. When you are installing a different SVGA monitor, it is unlikely that the new monitor has the same

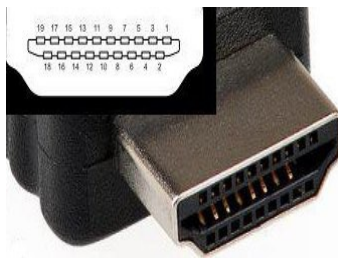
capabilities as the old one. As a result, the image on the screen may not be readable. In such instances, change the video resolution to Standard VGA before installing the new monitor. You can change the resolution appropriately after the image on the screen is readable with the new monitor. It may also be necessary to load appropriate device driver, if you are installing a different display adapter.

2. If the LCD screen changes colors, like turning green and then blue or red, it is likely that you have a cable problem. First check the monitor cable whether it is loose. Then try to twist the monitor and see if there is any problem. If the problem occurs, it may be necessary to replace the LCD monitor cable.

3. You need more brightness when a projector is used in environment where there is plenty of light in the room. Higher lumens provide more brightness, but more expensive.

1.11 Identify connector types and associated cables

1. High-Definition Multimedia Interface (HDMI) connectors are used to connect compatible digital items (DVD players and conference room projectors, for example). HDMI theoretical cable length limit is 16 feet (5 meters).



2. If you want to receive TV signals on the HTPC (Home Theater PC), you will need a TV tuner card. These can be installed internally in a slot or they can be external units connected with the USB port. They also can be analog, digital, or both (although broadcast analog TV has been discontinued in the United States since 2009). If recording the TV content is required, the card must also be a video capture card.

3. In cases where it is desired to watch one stream of content while recording another stream, a card that has two tuners in it must be used. These are called combo tuners.

4. PATA (IDE)-- Parallel advanced technology attachment (originally called ATA and sometimes known as IDE or ATAPI) was the most dominant desktop computer storage interface from the late 1980s until recently, when the SATA interface took over. PATA hard drives are still being utilized today, especially in external hard drive boxes, but they're becoming rare. Some cheaper high-end server storage devices have also used PATA. Like SCSI, PATA has also gone through many revisions. The most recent version of PATA is UDMA/133 which supports a throughput of 133 MB/s.



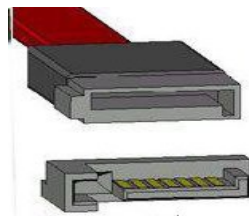
5. Although PATA supports two devices per connector in a master/slave configuration, the performance penalty of sharing a PATA port is severe and not recommended if performance is important to the user. The 40-pin connector and cabling is also extremely wide, which is difficult to use in a high-density environment and tends to block proper airflow. The size of the connector also presents problems for smaller 2.5" hard drives, which require a special shrunken connector.

6. SATA And ESATA-- Serial advanced technology attachment is the official successor to PATA. So far, there have been two basic versions of SATA, with SATA-150 and SATA-300. The numbers 150 and 300 represent the number of MB/s that the interfaces support. SATA doesn't have any performance problems due to cable/port sharing, but that's because it doesn't permit sharing at all.

eSATA Connector



SATA Connector



1.12 Install and configure various peripheral devices

1. Key boards come with two types of connectors. They are:
 - a. DIN-5, DIN-5 has 5 pins and used with AT style keyboards.
 - b. Mini DIN-6, also known as PS/2 connector, has around port with 6 pins, one of which being a

square pin used for alignment.

2. A USB hard disk usually requires lot of power, and it is recommended to use additional USB adapter or external power source to power the USB hard drive. In this case, because the USB hard drive is working on other computers, it is likely that the user's USB is unable to provide sufficient power to the drive. It happens primarily if the USB port does not conform to the 2.0 standard. Upgrading the computer with USB 2.0 card will help him use the USB hard drive.
3. When installing a third party application, ensure that the following recommendations are fulfilled:
 - a. You have administrative rights to the computer
 - b. Get latest Windows updates
 - c. Disable any conflicting software; you can use MSCONFI utility to troubleshoot the problem in XP, Vista, or Windows 7.
 - d. Make sure your folder names don't contain strange characters
 - e. Additionally, if you are installing unsigned software, you will be prompted whether you are willing to go ahead with the installation. You must accept to the risks to complete the installation.
4. After installing a bar code reader, you need to scan in program codes to configure the reader
5. You can synchronize an iOS device with home computer using USB or Wi-Fi connectivity.
6. If the mechanical mouse pointer suddenly moving with irregular movement/sporadic movement the main reason is dirt. If dirt has entered the mouse, clean the dirt with IPA, or cotton wetted in soap water.

2. Networking

2.1 Identify types of network cables and connectors

1. Shielded cables usually comprise of one or two insulated wires that are surrounded by an aluminum Mylar foil or a woven braided shield. The foiled shield of the cable ensures better signal transmission by eliminating irregular power frequency and external radio interference. Mostly, power cables which carry high-voltage of electricity are shielded for greater protection and better electric transmission. Shielded cables exhibit better interference rejection characteristics compared to unshielded cables.
2. The IEEE 1394 interface is a serial bus interface standard for high-speed communications frequently used by personal computers, as well as in digital audio, and digital video, The interface is also known by the brand names of FireWire (Apple), i.LINK (Sony), and Lynx (Texas Instruments).
3. A punch down tool, also called a punch down tool is used widely by network technicians. It is used for inserting wire into insulation-displacement connectors on punch down blocks or patch panels.
4. A crimping tool is a tool designed to crimp or connect a connector to the end of a cable. For example, network cables and phone cables are created using a crimping tool to connect the RJ-45 and RJ-11

connectors to the end of the cable.

5. RG-6 may be used for both analog and digital television transmission.

2.2 Categorize characteristics of connectors and cabling

1. Cat 5 can go up to speeds of 100mbps, and it is not designed for meeting gigabit speeds. Cat 5e (e for enhanced) can reach up to 1 gbps, but it is not certified to be used at gigabit speeds. Cat 6 cable is designed to be used at 1gbps, and is recommended for this purpose. Cat 6a and Cat 7 cables can go up to 10gbps, but expensive.

2.3 Explain properties and characteristics of TCP/IP

1. TCP/IP

a. TCP/IP is the medium of transport when your are accessing the Internet.

b. Some important TCP/IP port numbers are as given below:

1. FTP: 21, stands for File Transfer Protocol is a client server protocol Your Windows machine, running FTP client can communicate with the Unix Server running FTP server daemon, and transfer files to and from your computer.
2. Telnet: 23, stands for Telnetting from a remote terminal to a Telnet Server
3. SMTP: 25, stands for Simple Mail Transfer Protocol
4. HTTP/WWW: 80, stands for Hyper Text Transfer Protocol
5. POP3: 110, stands for Post Office Protocol
6. HTTPS: 443, stands for HTTP Secure

c. TCP/IP is the protocol used when you are Telnetting to a remote host. HTTP is used for accessing the World Wide Web services.

d. Some of the important commands useful in trouble shooting TCP/IP networks are:

1. Ipconfig: Displays TCP/IP configuration values, including IP address, subnet mask, and default gateway. Available options with ipconfig command are given below:

- /? Display this help message
- /all Display full configuration information.
- /release Release the IPv4 address for the specified adapter.
- /release6 Release the IPv6 address for the specified adapter.
- /renew Renew the IPv4 address for the specified adapter.
- /renew6 Renew the IPv6 address for the specified adapter.

- /flushdns Purges the DNS Resolver cache.
- /registerdns Refreshes all DHCP leases and re-registers DNS names
- /displaydns Display the contents of the DNS Resolver Cache.
- /showclassid Displays all the dhcp class IDs allowed for adapter.
- /setclassid Modifies the dhcp class id.
- /showclassid6 Displays all the IPv6 DHCP class IDs allowed for adapter
- /setclassid6 Modifies the IPv6 DHCP class id.

2. nslookup provides the IP address of the remote computer after querying the dns server for the IP config information.

3. Ping: This command can be used to verify whether the target ip address or host name is present. You need to specify the target IP address or host name. You can ping the loop back address at 127.0.0.1. A response ensures that the TCP/IP stack is installed properly on your computer.

4. Route: Displays and manipulates route information.

5. Tracert: Determines the route packets take to reach the specified destination.

e. To see TCP/IP configuration on a Windows 95 / 98 computer, use WINIPCFG. It will display your IP address, subnet mask, default gateway, hardware MAC address.

f. To see TCP/IP configuration on an NT machine, use IPCONFIG. It will also display the IP configuration information on an NT machine. To get more details, use IPCONFIG/ALL.

g. To verify that client computer is configured properly with appropriate IP address, subnet mask , and default gateway use Ipconfig/all command.

h. If indicator light on network switch is blinking rapidly even when all other computer nodes are disconnected it is very likely that the switch port or the switch is bad.

2. SMTP is used to upload mail to the mail server. POP3 is used for downloading mail from a mail server to a client machine running POP3 client.

3. Both PPP and SLIP can be used for dial up connections. However, SLIP can't be used where the IP address need to be assigned dynamically. The advantage of PPP is multi protocol support, that it can support TCP/IP, IPX, AppleTalk etc. SLIP can support only TCP/IP and IP addresses need to be assigned manually.

4. WINS server resolves the NetBIOS names to IP addresses. A Windows network running TCP/IP need to be configured with WINS (or LMHOSTS file on each computer) for NetBIOS name resolution.

5. HOSTS file and DNS (Domain Name Server) are used for resolving FQDNs (Fully Qualified Domain Names) to IP addresses.

6. Networking utilities

- a. NBTSTAT: This utility displays current NetBIOS over TCP/IP connections, and display NetBIOS name cache.
- b. NETSTAT: Displays protocol statistics and current TCP/IP connections since the server was last booted.
- c. TRACERT: Used to determine which route a packet takes to reach its destination from source.
- d. IPCONFIG: Used to display Windows IP configuration information.
- e. NSLOOKUP: This utility enables users to interact with a DNS server and display resource records.
- f. ROUTE: Used to display and edit static routing tables.
- g. Netsh is a command-line scripting utility that allows us to, either locally or remotely, display or modify the network configuration of a computer. Netsh also provides a scripting feature that allows us to run a group of commands in batch mode against a specified computer.

7. A user can start a DHCP client service by going to Control Panel or using My Computer as below:
control Panel -> Administrative Tools -> Services -> DHCP client Services -> Start

My Computer -> Manage -> Services and Applications -> Services -> DHCP client Services -> Start

8. APIPA stands for Automatic Private IP Addressing. A feature of Microsoft Windows, APIPA is a DHCP failover mechanism. With APIPA, DHCP clients can obtain IP addresses when DHCP servers are nonfunctional. APIPA exists in all popular versions of Windows except Windows NT. When a DHCP server fails, APIPA allocates IP addresses in the private range 169.254.0.1 to 169.254.255.254. Clients verify their address is unique on the network using ARP. When the DHCP server is again able to service requests, clients update their addresses automatically.

2.4 Explain common TCP and UDP ports, protocols, and their purpose

1. The ISP provides the information on the SMTP, and POP server addresses. You need to feed this information to the mail client while configuring to send and receive e-mail.
2. Given below are the basic commands that are used with FTP:
 1. get to copy one file from the remote machine to the local machine
 2. mget to copy multiple files from the remote machine to the local machine;
 3. put to copy one file from the local machine to the remote machine
 4. mput to copy multiple files from the local machine to the remote machine;
 5. 'p' is used to request help or information about the FTP commands, and ls is used to list directory contents.
3. Remote Desktop Protocol (RDP)

- a. The minimum requirement for setting up Remote Desktop host running RDP (Remote Desktop Protocol) is Windows XP Professional or later. The minimum requirements for the Client computer is Windows 9x or above. A Windows XP Home can act as client but not as a host. Note that the computer that offers the local resources to a remote user is called a host computer or simply the host. The computer that connects to the host computer is called a client computer or simply, client. The host computer runs remote desktop (RDP).
- b. RDP servers are built into Windows operating systems; an RDP server for Linux also exists. By default, the server listens on TCP port 3389.
- c. Remote Desktop uses Remote Desktop Protocol (RDP), which in turn uses port 3389. By configuring the router to forward traffic on port 3389 to the host computer running RDP, one should be able to access the host remotely. If the host computer is on a publicly accessible IP address, there is no need for port forwarding. Remote client can access the host directly using host's public IP address. The port forwarding is usually configured on the router that communicates with the external network (Internet)
- d. To enable RDP on Windows XP Professional computer Right-click My Computer, click Properties, and then click the Remote tab. Turn on Remote Desktop by selecting the check box Allow users to remotely connect to this computer. Designate users by clicking the Select Remote Users... button.

2.5 Compare and contrast wireless networking standards and encryption types

1. Wireless Networking

The generic standard that defines wireless LAN technologies is 802.11. Specifically, the following standards exist:

- a. 802.11: applies to wireless LANs and provides 1 or 2 Mbps transmission in the 2.4 GHz band.
- b. 802.11a: an extension to 802.11 that applies to wireless LANs and provides up to 54 Mbps in the 5GHz band. This higher frequency compared to 802.11b shortens the range of 802.11a networks. Because 802.11a and 802.11b utilize different frequencies, the two technologies are incompatible with each other.
- c. 802.11b (initially referred to as 802.11 or Wi-Fi): an extension to 802.11 that applies to wireless LAN and provides up to 11 Mbps transmission in the 2.4 GHz band.
- d. 802.11g: applies to wireless LANs and provides 20+ Mbps in the 2.4 GHz band. 802.11g is backwards compatible with 802.11b.
- e. 802.11n support data rates of over 100 Mbps. 802.11n also offers somewhat better range over

earlier Wi-Fi standards due to its increased signal intensity. 802.11n equipment will be backward compatible with 802.11g gear.

2. The 802.11n high throughput (HT) standard defines three modes of operation: a legacy (non-HT) mode, a greenfield (HT-only) mode, and a mixed mode where HT protection mechanisms ensure that transmissions can be detected by both old 802.11a/b/g devices and new 802.11n devices.
3. In mixed mode, HT protection requires that 802.11n devices send a legacy preamble, followed by an HT preamble. The legacy preamble lets 802.11a/b/g devices to avoid transmitting over HT frames sent by 802.11n devices.
4. These HT protection mechanisms significantly reduce an 802.11n WLAN's throughput, but they are necessary to avoid collisions between older 802.11a/b/g devices and newer 802.11n devices. If you knew that no legacy devices were present, you could configure your access point (AP) to operate in greenfield (HT-only) mode, eliminating this overhead.
5. Bluetooth Class 3 supports speeds up to 1m at 2.4GHz (1mW power output max)
6. Bluetooth Class 2 supports speeds up to 10m at 2.4GHz (2.5mW power output max)
7. Bluetooth Class 1 supports speeds up to 100m at 2.4GHz (100mW power output max)
8. WPA, short for Wi-Fi Protected Access, is a Wi-Fi standard that was designed to improve upon the security features of WEP (Wired Equivalent Privacy). The technology is designed to work with existing Wi-Fi products that have been enabled with WEP.
9. To secure the router from unauthorized access you need to change the default login/password on a router soon after the router is installed. Secondly, ensure to set encryption such as WPA2 so that only authorized users will be able to access the wireless network
10. WEP, short for Wireless Equivalent Protection, is a security protocol designed to provide protection equivalent to wired LANs. WPA is an improved security protocol compared to WEP.
11. Infrared technology allows computing devices to communicate via short-range wireless signals. With infrared, computers can transfer files and other digital data bidirectionally. Infrared communications span very short distances. Place two infrared devices within a few feet (no more than 5 meters) of each other when networking them. Unlike Wi-Fi and Bluetooth technologies, infrared network signals cannot penetrate walls or other obstructions and work only in the direct "line of sight."

2.6 Install, configure, and deploy a SOHO wireless/wired router using appropriate settings

1. SSID, short for service set identifier, a unique identifier attached to the header of packets sent over a WLAN. The SSID differentiates one WLAN from another, so all access points and all devices attempting to connect to a specific WLAN must use the same SSID. WEP together with SSID, provides basic protection for the wireless network.
2. To limit the number of computers to a known few, configuring MAC filtering is a very good option. This is configured on the wireless router and not on the client computers. Any wireless network, SSID

needs to be configured on the wireless router. Note that if the router broadcasts SSID, then the clients will automatically learn about the wireless network. If the SSID broadcast is disabled on the router, you need to configure the clients with proper SSID (same as that of the router SSID).

3. For local administrators, only the built-in administrator account can be used to perform a remote install. Since this account is disabled by default, please use the "net user administrator /active:yes" command from the command console. This will enable this account to install applications remotely.

4. QoS stands for quality of service. In SOHO environment, QoS is normally set at router level. If you want to enforce QoS policies in your network, make sure you use a router, which is equipped with QoS software.

5. Adding the port exception

- a. Click Start, click Run, type wscui.cpl, and then click OK.
- b. In Windows Security Center, click Windows Firewall.
- c. Click the Exceptions tab, and then click Add Port to display the Add a Port dialog box.
- d. Type a descriptive name for the port exception and the port number that your program uses, and then select either the TCP or UDP protocol.
- e. Click OK to close the Add a Port dialog box.

6. NAT (Short for Network Address Translation) is used to map internal IP addresses to external IP addresses. Typically, a router or a Firewall is used for this purpose.

7. Turning OFF SSID is the easiest thing to do to prevent people outside of the premises from accessing a wireless network. Note that for WPA encryption, you need to configure it on the wireless router and on all the workstations. To enable MAC filtering, you need to gather the MAC addresses of all client computers, and feed it into the wireless router.

8. If you use a disk drive that was previously configured as a dynamic drive in another computer, it may show up as foreign drive. You need to import the foreign drive to show up in the drive manager as local.

2.7 Compare and contrast Internet connection types and features

1. ISDN: ISDN BRI (Basic Rate Interface) will have two B channels, each can carry data up to 64Kbps, aggregating to 128 Kbps.
2. Infrared technology allows computing devices to communicate via short-range wireless signals. With infrared, computers can transfer files and other digital data bidirectionally. Infrared communications span very short distances. Place two infrared devices within a few feet (no more than 5 meters) of each other when networking them. Unlike Wi-Fi and Bluetooth technologies, infrared network signals cannot penetrate walls or other obstructions and work only in the direct "line of sight."
3. A DSL model most commonly uses normal telephone line (Twisted Pair or TP) for connecting to the

Internet.

4. As the name implies, in asynchronous digital subscriber service (known as ADSL), the download speeds are much greater than the upload speeds. This is done based on the usage trends of Internet. Most users tend to download much more than what usually upload.

2.8 Identify various types of networks

LAN (Local Area Network): A LAN connects network devices over a relatively short distance. A networked office building, school, or home usually contains a single LAN, though sometimes one building will contain a few small LANs (perhaps one per room), and occasionally a LAN will span a group of nearby buildings. In TCP/IP networking, a LAN is often but not always implemented as a single IP subnet. In addition to operating in a limited space, LANs are also typically owned, controlled, and managed by a single person or organization. They also tend to use certain connectivity technologies, primarily Ethernet and Token Ring.

WAN (Wide Area Network) : As the term implies, a WAN spans a large physical distance. The Internet is the largest WAN, spanning the Earth. A WAN is a geographically-dispersed collection of LANs. A network device called a router connects LANs to a WAN. In IP networking, the router maintains both a LAN address and a WAN address. A WAN differs from a LAN in several important ways. Most WANs (like the Internet) are not owned by any one organization but rather exist under collective or distributed ownership and management. WANs tend to use technology like ATM, Frame Relay and X.25 for connectivity over the longer distances.

PAN (Personal Area Network) : is a computer network organized around an individual person. Personal area networks typically involve a mobile computer, a cell phone and/or a handheld computing device such as a PDA. You can use these networks to transfer files including email and calendar appointments, digital photos and music. Personal area networks can be constructed with cables or be wireless. USB and FireWire technologies often link together a wired PAN, while wireless PANs typically use Bluetooth or sometimes infrared connections. Bluetooth PANs are also sometimes called piconets. Personal area networks generally cover a range of less than 10 meters (about 30 feet). PANs can be viewed as a special type (or subset) of local area network (LAN) that supports one person instead of a group.

MAN (Metropolitan Area Network): is a network that interconnects users with computer resources in a geographic area or region larger than that covered by even a large local area network (LAN) but smaller than the area covered by a wide area network (WAN). The term is applied to the interconnection of networks in a city into a single larger network (which may then also offer efficient connection to a wide area network). It is also used to mean the interconnection of several local area networks by bridging them with backbone lines. The latter usage is also sometimes referred to as a campus network.

Topologies:

A topology is physical and logical network layout. Physical layout include actual layout of cables and other network devices where as Logical layout include the way in which the network appears to the devices that use it.

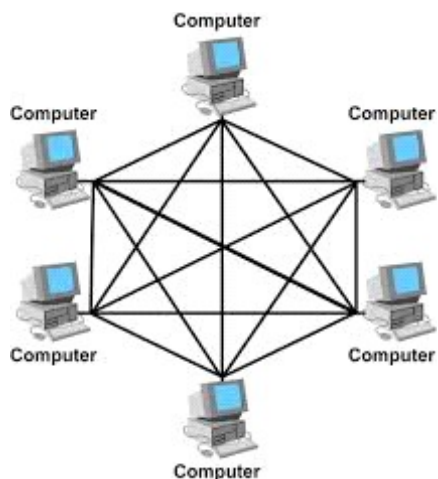
Mesh : In this topology each computer is connected to every other. This topology is rarely used.

Advantages:

- It provide multiple paths between two devices so if one path fails other can be used.
- Network can be expanded without disruption to current uses

Disadvantages

- It has high level of redundancy
- wiring is very complicated
- Cabling cost is very high
- Finding fault in cabling is very tricky



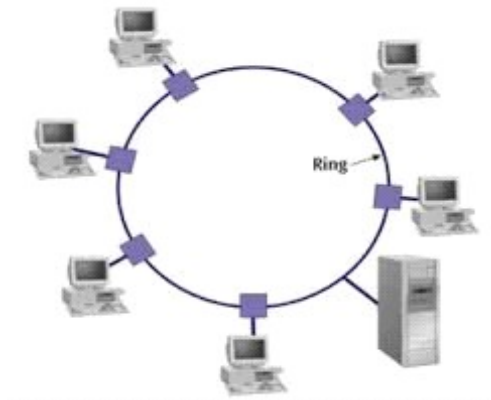
Ring : In this topology each network computer and device are connected to each other forming a large circle (or similar shape). Each packet is sent around the ring until it reaches its final destination. Typically FDDI, SONET or Token Ring technology are used to implement a ring network.

Advantages:

- Any fault in cable can be found easily.
- These networks are comparatively easy to install.

Disadvantages:

- Expansion will cause disruption in current network
- Single fault in cable will disrupt entire network.



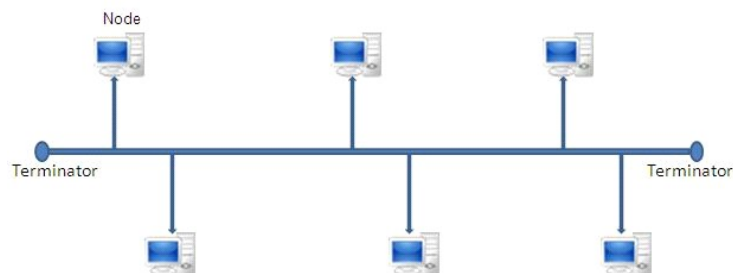
BUS : Bus networks use a common backbone to connect all devices. A single cable, the backbone functions as a shared communication medium that devices attach or tap into with an interface connector. A device wanting to communicate with another device on the network sends a broadcast message onto the wire that all other devices see, but only the intended recipient actually accepts and processes the message.

Advantages:

- Easy to implement
- Less cable is used
- No specialized network equipment is needed.

Disadvantages

- Single fault in cable will disrupt entire network.
- Expansion will cause disruption in current network
- Troubleshooting is difficult.



Star: In Star topology, all the components of network are connected to the central device called “hub” which may be a hub, a router or a switch. All the data on the star topology passes through the central device before reaching

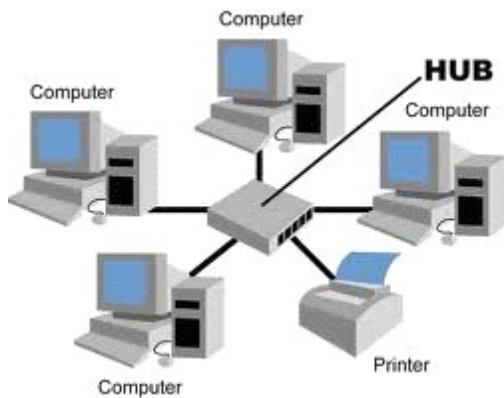
the intended destination. Hub acts as a junction to connect different nodes present in Star Network, and at the same time it manages and controls whole of the network. Depending on which central device is used, “hub” can act as repeater or signal booster. Central device can also communicate with other hubs of different network. Unshielded Twisted Pair (UTP) Ethernet cable is used to connect workstations to central node.

Advantages:

- Gives better performance compared to BUS
- New devices can be added easily.
- Centralized management makes monitoring the network is easier.
- Single node failure will not affect entire network.

Disadvantages

- If central device (Hub) fails whole network goes down.
- Use of central device increase overall cost.
- Performance of network depends on capacity of central device.



Hybrid: It is an integration of two or more different topologies to form a resultant topology. This combination of topologies is done according to the requirement of the organization.

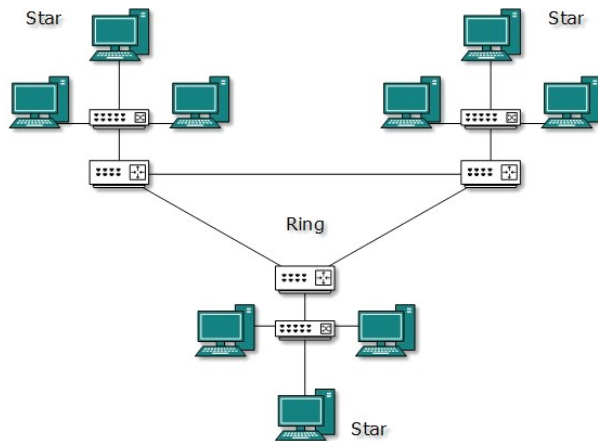
For example an office can use a star topology in each of its department and ring topology to connect these departments.

Advantages:

- Fault detection is easier.
- Size of the network can be increased easily without disruption to current network.
- It is very flexible as network can be designed according to requirements and available resources.

Disadvantages

- Overall cost of network is high as it requires lot of cables, many network devices like HUB to connect various networks.
- Design becomes more and more complex as number of networks increase



2.9 Compare and contrast network devices, their functions, and features

1. Most commonly used network devices are hubs, switches (or bridges), and routers.
 - a. Router: A router for Internet sharing is normally configured using web browser. High-end routers may provide option for terminal connectivity, wherein you can connect a terminal, and issue commands for configuring the router.
 - b. Hub: A hub is basically a multi-port repeater. When it receives a packet, it repeats that packet out each port. This means that all computers that are connected to the hub receive the packet whether it is intended for them or not. It's then up to the computer to ignore the packet if it's not addressed to it. This might not seem like a big deal, but imagine transferring a 50 MB file across a hub. Every computer connected to the hub gets sent that entire file (in essence) and has to ignore it.
 - c. Bridge: A bridge is a kind of repeater, but it has some intelligence. It learns the layer 2 (MAC) addresses of devices connected to it. This means that the bridge is smart enough to know when to forward packets across to the segments that it connects. Bridges can be used to reduce the size of a collision domain or to connect networks of differing media/topologies, such as connecting an Ethernet network to a Token Ring network.
 - d. Switch: A switch is essentially a multi-port bridge. The switch learns the MAC addresses of each computer connected to each of its ports. So, when a switch receives a packet, it only forwards the packet out the port that is connected to the destination MAC address. Remember that a hub sends the packet out every port, and you can see how much more efficient this is.

2.10 Given a scenario, use appropriate networking tools

- a) An assortment of Phillips-head, flathead, and Torx screwdrivers, as well as varying sizes of nut drivers.
- b) Several types of small parts used on circuit boards, including various sizes of screws and nuts; extra jumpers (the tiny devices used to make connections between the pins on certain circuitry); screws; and stand-offs, small washer-type parts made of a nonconducting material, often nylon, used to ensure that a motherboard does not come in contact with a computer case.
- c) Several sizes of slot covers, the metal brackets that cover the openings (slots) in the back of a PC for accommodating expansion cards. A slot cover serves to keep dust out when an expansion slot is empty and helps cooling airflow.
- d) A parts grabber, also called an extending extractor. This pen-sized tool has a plunger at one end, which, when pressed, causes small, hooked prongs to extend from the other end of the tool. These are useful for retrieving dropped objects, such as jumpers or screws, from inside a computer. Be very careful not to touch any circuitry when using one.
- e) An extension magnet, a long-handled tool with a magnet on the end. Use it like a parts grabber, only it has a magnet that attracts small objects that contain iron. This is handy for picking up objects that fall on the floor, but the potential dangers may not be worth the convenience. Never use an extension magnet near a computer or any peripherals that contain magnetic storage because the magnet can damage data.
- f) A flashlight for illuminating dark places.
- g) A small container for holding extra screws and other small parts (a pill bottle works well).
- h) An ESD wrist strap to use when working on any component except the power supply, monitor, and laser printers.
- i) An ESD mat provides a static charge with a path to ground and is designed for the desktop or floor of a workspace. While this mat may not fit in your toolkit, it is something that should be available at any PC technician's workbench.
- j) Field replaceable units (FRUs) should be included in your hardware toolkit. An FRU is any component that you can install into a system onsite. This includes such items as memory modules, heat sinks, CMOS batteries, various adapter cards, hard drives, optical drives, keyboards, mice, fans, AC adapters, spare cables and connectors, power supplies, and even spare motherboards. Of course, all of this depends on the scope of your job and how cost-effective it is to have these items on hand.

- k) A multimeter is indispensable in determining power problems from a power outlet or from the power supply. You'll use this handheld device to measure the resistance, voltage, and/or current in computer components using two probes (one negative, one positive) that you touch to power wires in the equipment you are testing.
- l) A power supply tester is a specialized device for testing a power supply unit, and is a bit safer to use than a multimeter for this purpose. A power supply tester comes with connectors compatible with the output connectors on a standard power supply, rather than with just the simple probes of a multimeter. An LCD display or LEDs show the test results.
- m) A cable tester will detect if a cable can connect properly end to end and determine if there is a short. Several types of cable testers are available, such as those for copper Ethernet and phone cables, fiber-optic cable testers, and coaxial cable testers. A toner probe is a cable tester that generates a tone on one end of a cable and evaluates the signal received on the other end.
- n) A loopback plug, a plug wired to send signals back to a specific port type (serial, parallel, USB, etc.) or device, such as an Ethernet adapter, as a test of the device. It reroutes the sending pins from the port or device to the receiving pins, thus allowing you to test the ability to send and receive without connecting to an external device or network.
- o) A digital camera will enable you to document the condition of a computer before you begin troubleshooting. One important way we use a digital camera is to document the cabling and connections—both external and internal—before making any changes, so that we can reconnect all components correctly. A camera is also handy for capturing low-level error messages that cannot be captured otherwise.
- p) Wire cutters for cutting various types of wires, but especially for Ethernet cables.
- q) A punch down tool is a hand tool with a screwdriver-type handle and one or more specialized blades used for inserting various types of wire into appropriate wiring panels. The wiring may be for electrical power or network cabling.
- r) A crimper, also called a crimp tool, resembles a pair of pliers, but is used to terminate a multistranded cable into a connector, clamping each wire in place in the connector so that the wires line up with the wires in the connector.
- s) A cable stripper is a cross between a pair of pliers and scissors and is designed to strip the insulation from around the wires in a cable.
- t) A POST card is an adapter card used to run a special diagnostic test on a computer as it powers up. These tests go beyond those performed by the computer's own BIOS-based testing that occurs as it starts up.

3. Laptops

3.1 Install and configure laptop hardware and components

1. Nickel Cadmium battery

a. The nickel cadmium battery, known as NiCad, used to be the most common type of laptop battery. NiCad batteries could easily be ruined by being left on the charger after they had reached full charge, or by being recharged before they were completely dead. The latter problem, called the "memory effect," meant that if you recharged your laptop battery before it had run completely down, it would remember the point at which you put it back on the charger, and only discharge that far the next time you used it.

b. Nickel Cadmium battery is not environmentally friendly and not as efficient as Nickel / Metalhydride or Lithium Ion. Nickel / Metal hydride, though environmentally friendly, not as efficient as Lithium Ion. Lithium Ion battery is environmentally friendly and very efficient.

2. Nickel metal hydride battery

a. The nickel metal hydride (NiMH) laptop battery could hold considerably more power than NiCad, but they still had something of a memory effect, although to a lesser extent

3. Lithium ion battery

a. Lithium ion (Li-Ion) is the latest technology for laptop batteries. They are considerably lighter and does not exhibit memory effect. The Li-Ion laptop battery lasts considerably longer than its predecessors. If your laptop supports Li-Ion battery, then it is a recommended choice.

4. Passive matrix displays are most commonly used and cheaper than Active matrix displays. Also, passive matrix displays consume less power. However, the advantages of active matrix display are that they can handle faster screen image transition, and display is clearly viewable, even from slant angles.

5. Laptops most widely use PCMCIA cards, also referred to as PC cards.

6. Normally, desktop processors consume higher power compared to laptop processors. Laptop processors are optimized for lesser power consumption, so that the heat produced is also less. This is to take care of poor ventilation conditions in a laptop computer.

7. While doing any hardware up gradation on a laptop (such as adding more memory, etc), remember to remove the battery in addition to unplugging of AC mains.

8. If the battery of a new laptop is giving less output time when fully charges first check AC adapter. If there is no problem with the AC adapter, the next best choice would be to re-calibrate the battery.

9. ExpressCard is an interface to allow peripheral devices to be connected to a computer, usually a laptop computer. Formerly called NEWCARD, the ExpressCard standard specifies the design of slots built into the computer and of cards which can be inserted into ExpressCard slots. The cards contain electronic circuitry and connectors to which external devices can be connected. The ExpressCard

standard replaces the PC Card (also known as PCMCIA) standards.

10. 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.

11. When installing SODIMM memory chip, one needs to turn off the laptop and unplug the power supply to prevent any damage due to static.

12. The second RAM slot is typically located under the keyboard of the laptop.

13. The upgradable components in a laptop include:

a. Processor: It could be upgraded to a higher speed, but it would be very expensive. You need to check with the manufacturer whether they have a faster compatible processor.

b. Memory: This is easily upgradable. But usually, laptops come with at least 2GB of memory. Note that 32-bit Operating Systems recognize only 2GB and it's not recommended to use higher memory capacity unless you go for a 64-bit laptop.

c. Video card: It almost always not possible to upgrade a video card. Choose the laptop carefully when buying, taking in to consideration your audio/video requirements.

d. Network card: Again, network card is not usually replaceable in a laptop.

Hard disk: Yes, you can upgrade the hard disk in a laptop with bigger capacity hard disk. This is relatively easy task.

14. Manufacturer's manual should be consulted before attempting to disassemble a laptop for board upgrade. Usually, the battery, hard drive, DVD drive, memory are among the first to be disassembled. <http://www.insidemylaptop.com/disassemble-hp-pavilion-dv4-laptop/>

15. Although you can easily pull out a PC Card from the PC slot in your laptop, that's not the best way to treat your laptop's hardware. Instead, follow these steps:

Click the Safely Remove Hardware icon on the system tray, and then pull the PC Card out from its slot. Some times, you have to find a small button to the right of the card. Pushing the button in a little makes it pop out about a half-inch or so. Then press the button back into the laptop to help push out the PC Card.

16. To configure any of the power options, you first have to go to Start, then Control Panel, and then click on Power Options. In the Power Options properties dialog, there are six tabs: Power Schemes, Alarms, Power Meter, Advanced, and Hibernate. In the Advanced tab you will be able to configure the action that would take place when the laptop lid is closed.

17. For accessing the Internet using static IP addressing, you need to configure the IP address, subnet mask, default gateway (if required by the ISP), and DNS server information.

3.2 Compare and contrast the components within the display of a laptop

1. 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.
2. Most laptop computers require a function key or software command to activate/deactivate the laptop video output signal. Usually, the activation/deactivation command acts as a toggle switch: repeat the command to display the image on the internal laptop display, the external display (projector) or both displays simultaneously. Examples: Acer: Fn+F5, Dell: Fn+F8 will activate/deactivate laptop/external display.
3. Digital displays offer best quality when operated at native resolution.
4. A dim screen can be caused by four things:
 - a. The LCD inverter which causes the LCD panel to light up
 - b. The CCFL fluro tube in the LCD panel
 - c. The motherboard supplying signal & voltage to the inverter
 - d. 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 likey with backlight failure.
5. 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.
6. 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.
7. Laptop computer screens are equipped with a "Function" key as well as numerous hot keys for fast adjustments of various features on the computer, such as increasing or decreasing the brightness of the laptop screen. Dimming the screen is desirable when working in direct sunlight or to create a more soothing display that's easier on the eyes. The precise key sequence varies on different laptop models, but involves a combination of the function and arrow keys.
 - a. Press the Function ("Fn") key on the laptop keyboard and continue holding it down. This key is usually on the lower, left side of the keyboard.
 - b. Press and release the left arrow key to dim the laptop screen one increment, or hold the key to dim the screen as low as it will go. The arrow key may also be printed with a sunburst icon. Alternatively, on some laptops press one of the numbered F keys on the top row to dim the screen. The correct key will usually be printed with a filled-in sunburst icon, while the F key to brighten the screen will have a hollow sunburst icon.
 - c. Press the right arrow key to brighten the screen or use the numbered F key at the top of the screen
8. Plasma display panels consume most power because of the inherent architecture of the Plasma panels. On the other hand, OLED displays, which have recently come to market, consumes least power.

9. A disk enclosure is essentially a specialized chassis designed to hold and power disk drives while providing a mechanism to allow them to communicate to one or more separate computers. Drive enclosures provide power to the drives therein and convert the data sent across their native data bus into a format usable by an external connection on the computer to which it is connected. Note that a SCSI adaptor will not solve the problem as it would not supply the power and other signals that may be necessary to proper functioning of the hard drive.

3.3 Compare and contrast laptop features

1. 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. 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.
2. 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.
3. Sometimes this key can also activate and deactivate the Bluetooth function of your computer. If on a clean install Bluetooth is not working instead of reinstalling the OS, it is always better to install the correct driver for the device. Go to device manager, and update the Bluetooth driver. Windows XP SP2 supports Bluetooth and there is no need to update the Operating System to Windows 7.
4. Laptop antenna is almost always located in the display section of the laptop. This is because, the screen is lifted and provides better propagation of rf waves, which is a requirement for 802.11 specification. But the exact location within the laptop display bezel may change from one laptop manufacturer to another.
5. If any HotKey is not working as expected it is recommended to install the Hotkey drivers from the manufacturer's website.
6. If a notebook cellular card was activated by the cellular operator, but was not recognized by the Operating System then check if feature is supported in laptop BIOS. It is most likely that the cellular card is disabled in the BIOS. Please check the BIOS and enable the card. Note that all notebook computers may not support this feature.

4. Printers

4.1 Explain the differences between the various printer types and summarize the associated imaging

process

1. Laser printers

a. The following are the 6 steps in the ElectroPhotographic (EP) print process of Laser Printer:

1. **Cleaning:** Cleaning the photosensitive drum includes residual toner left on the drum and removing the electrical charges left out on the drum. The physical cleaning is done with a rubber blade and the electrical charge cleaning is done with erasure lamps.
2. **Charging:** The next step in printing, is to charge the photo sensitive drum with high negative charge, this is done with the help of a corona wire.
3. **Writing:** A laser (type 3) sweeps the entire length of the drum, creating the static image of the matter to be printed. The places where the laser travel, the highly charges are neutralized. Other places of the drum, it remains highly negatively charged.
4. **Developing:** Now drum gets in close proximity to the toner. Because the toner is negatively charged, it gets attracted to the areas where the drum is neutral. It will not be attracted to the places where the drum is highly negatively charged. Thus the image of the page to be printed formed on the photosensitive drum.
5. **Transferring:** Now, the toner on the drum gets attracted toward the paper, by using highly positive charges developed on the surface of the paper. The "transfer corona" is used to generate highly positive charge on the paper surface and to attract the toner from the drum. Thus the image of the page to be printed formed on the paper. But still, the toner is loose and can get easily smeared.
6. **Fusing:** In order to permanently bond the toner particles to the paper, the paper is passed through rollers. One of the rollers, the non stick roller is heated by a high intensity lamp, generating the heat necessary to bond the toner to the surface of the paper.

b. Problems associated with laser printers and probable causes:

1. **Speckled pages:** The causes for this may be
 - a. The failure to clean the drum after printing properly, or
 - b. The drum might have developed scratches.
2. **Blank pages:** The causes for white pages may be
 - a. . The toner would have dried out, replace the toner.
 - b. The transfer corona, that is responsible for transferring the toner to the drum might have failed.
 - c. The High Voltage Power Supply (HVPS) failure will also result in white pages.
3. **Ghosted Images:** Ghosting occurs when previously printed pages are printed again, though much lighter than the present image. The most likely cause is that the erasure lamp might not be working properly, thus leaving some charges representing the earlier image left on the photosensitive drum before new image is written. Also check the cleaning blade, which is

responsible for scraping the residual toner.

4. Smudged images: If the fusing fails, the toner will not bond with the paper. Check the halogen lamp responsible for heating.

c. Typically, a laser printer maintenance kit consists of fuser fixing assembly, pickup rollers, transfer roller, gloves, and instruction manual.

2. Impact printers

a. Impact printers are capable of printing multipart forms, since they can give necessary impact to print to multiple forms simultaneously.

b. ECP (Extended Capability Port) has less control overhead and best suited for transferring large chunks of data, such as between the computer and laser printer.

3. InkJet Printers

a. InkJet Printers is the generic name given for contact less printing using ink. Friction feed is most commonly used with laser printers, and Inkjet printers. One needs to check the calibration for the inkjet printer if it is not printing properly. If it doesn't help, then check the ink cartridge if it requires replacement.

4. Thermal printers

a. Thermal printers require a special kind of paper, called thermal paper. This paper is sensitive to heat, and the printing is produced by thermal heat applied on the paper by the print head.

4.2 Given a scenario, install, and configure printers

1. Printer parallel ports come in the following varieties

a. Unidirectional: Here, the data travels only from the computer to the peripheral (printer) device.

b. Bi-directional: Here, the data travels both from the computer to the peripheral device and vice-verse.

c. ECP (Extended Capability Port): ECP mode offers bi-directional data transfer, as well as DMA for data transfer.

d. EPP (Enhanced Parallel Port): In addition to bi-directional features, it offers an extended control code set

e. The port that a printer is using can be found by going to Control Panel -> Printers and right click on appropriate printer. Choose Ports tab to view the port (like COM1, COM2, USB001, etc.) that the printer is using.

2. Cable lengths

a. Serial cable maximum length is 50 feet.

- b. Parallel cable maximum length is 10 feet.
- c. Longer cable lengths may lead to some errors & garbage characters.

3. RJ – cables

- a. RJ-11: These connectors are used to link modem / phone to the phone line. They have only two pins that get into the modem.
- b. RJ-14: RJ-14 connectors are dual-line phone jacks that can accommodate up to 2 telephone line.
- c. RJ-45: RJ-45 cable is widely used for attaching UTP cable in LAN environment. These connectors have eight pins.
- d. The widely used interface cables have the following pin count:
 - floppy-34 pin
 - IDE-40 pin
 - SCSI-50 pin
 - SCSI Ultra wide-68 pin

4. Ultra IDE cable has 80 wires, and handles better speeds compared to IDE cable with 40 wires. The additional wires are introduced to reduce noise and thereby improving speed

5. Thin co-axial and thick co-axial cables have conductive grounding sheath surrounding the center conductor. Therefore, the electromagnetic interference (EMI) is significantly less.

6. Cat 6 cabling is recommended for Gigabit Ethernet networking.

7. Centronics cable, used for parallel printing will have a male DB-25 connector at one end and a female 36 pin connector at the other end.

8. The default spool folder is located at: Systemroot\System32\spool\printers. For example, if the OS is residing on C drive, the default location will be: “C:\\Windows\System32\spool\printers”. You can access this location through:

Start -> Printers -> File -> Server Properties -> Advanced tab. Type in the new spool location over the default location.

9. While connecting a printer using USB if Operating System is not recognizing the USB port you need to make sure that the USB interface is enabled in the BIOS. Note that Windows 95, Windows NT4.0 (Upto service pack 4) do not support USB. Also, make sure that the motherboard BIOS supports USB.

10. A network printer can be added to Windows XP computer by going to Control Panel (classic view), Printers and Faxes applet, This will initiate Add Printer wizard. In Category View, choose Printers and Other Hardware hyperlink and select Add Printer option.

11. When a printer is installed on a network, default printer permissions are assigned that allow all users to print. Because the printer is available to all users on the network, you might want to limit access for

some users by assigning specific printer permissions. For example, you could give all non-executive users in a department the Print permission and give all managers the Print and Manage Documents permissions. You can also deny print permission to all others. In this way, all non-executive users and managers can print documents, but managers can also change the print status of any document sent to the printer.

12. If you share a printer with users running other versions of Windows (Windows 98, XP, Vista, etc), you can install additional printer drivers on your computer so those users can connect to your printer without being prompted to install the drivers missing from their systems.

13. Scanner installation process is much like a print device. Because so many of these now are USB, plugging them in will install the driver. In cases where that does not work (usually when it is a very new model and the operating system is older), use the installation disc to install the driver.

Monitors, speakers, and projectors normally do not require a driver to perform.

14. A scanner driver is usually called TWAIN. The Twain driver will always have another name, for example, Microtek calls theirs ScanWizard, and HP calls it as DeskScan or PrecisionScan. The TWAIN driver comes with the scanner, and knows how to operate this one brand of scanner hardware. Each scanner manufacturer provides their own TWAIN driver for their hardware.

15. Windows XP provides three levels of printing security permissions: Print, Manage Printers, and Manage Documents. When multiple permissions are assigned to a group of users, the least restrictive permissions apply. However, when Deny is applied, it takes precedence over any other permission.

a. Print: The user can connect and print document. By default, the Print permission is assigned to all members of the Everyone group.

b. Manage Printers: The user has complete administrative control of the printer. The user can pause and restart the printer, change spooler settings, share a printer, change printer permissions, and change printer properties. By default, the Manage Printers permission is assigned to members of the Administrators and Power Users groups.

c. Manage Documents: The user can pause, resume, restart, cancel, and rearrange the order of documents submitted by all other users. The user cannot, however, send documents to the printer or control the status of the printer. By default, the Manage Documents permission is assigned to members of the Creator Owner group.

16. In Windows 7 Operating System, most printers and other peripheral devices are automatically detected and drivers are installed. Therefore, first you must see if the OS itself recognizes the device and installs the drivers. If you are prompted to locate the driver, the browse to the driver location and direct the installation.

4.3 Given a scenario, perform printer maintenance

1. If a laser printer is printing at slow speeds, it is likely that the memory is not sufficient. Installing additional memory may speed up printing.

2. If a user complains that he is not able to print to a network printer. He is not even able to ping the

network printer from his PC first verify whether the printer network card indicators are okay. If not, check whether the cable is plugged in properly.

3. When communicating across a serial cable, the most probable cause that the screen is dumping garbled characters is that the communication settings are not correct. Check the speed, parity, start/stop bits etc. If this is all correct, then you need to check the cable. Check whether you need a straight / cross cable, and the pin connections.

4. If two accounts are created on a PC by network admin with same privileges but only one of the account is able to use the attached printer then most likely the problem is that the default printer has changed to virtual printer for the other account who is not able to use the printer.

5. Operational Procedures

5.1 Given a scenario, use appropriate safety procedures

1. When working on computers, use special ESD wrist strap. Do not directly ground yourself with a piece of wire. An ESD wrist strap has built-in resistor to prevent electric shock. Use specially designed grounded ESD mats. Do not wear synthetic clothing. Place all electronic components into anti static bags. Anti static bags can be reused. Keep your workplace clean.

2. When attending to the computer maintenance or repair (other than the monitor), ensure that you work in a static free environment. Always wear wrist strap. You should not wear clothes/shoes that produce static charges.

3. Having an anti-static work station is the most appropriate solution when working with sensitive components. However, under emergencies, it may not always be possible to wear a wrist strap or have an anti static work station. The least a technician could do to minimize static under these circumstances is to touch a metal part in the PC (typically ground point) case. It is assumed here that the PC case is grounded, which is typically the case.

4. Screw drivers are very likely to be magnetized, and you need to be cautious when using the same near magnetic media.

5.2 Explain environmental impacts and the purpose of environmental controls

1. By causing irreversible mechanical damage to the hard drives, it may be ensured that the data is permanently lost. Even if you format, it is possible to recover data using special tools, and therefore it is not recommended under circumstances where hard drive contain sensitive information.

2. A hard disk should never be low level formatted at the customer premises. It is highly recommended that it is done at the manufacturer's or at any authorized center. It is very cumbersome to change the partition sizes, once the hard disk is partitioned and used. It may require backing up all the data and restoring after repartitioning.

3. Keeping the hard disk free of any dust, and enabling good airflow around the hard disk will enhance the life of the hard disk.

5.3 Given a scenario, demonstrate proper communication and professionalism

1. The following are the best practices that a computer technician should exercise:

- a. Maintain a positive attitude
- b. Listen and do not interrupt the customer
- c. Be culturally sensitive
- d. Be on time (if late contact the customer)
- e. Avoid distractions like personal calls, taking co-workers, etc.
- f. Avoid arguing with customers and/or being defensive
- g. Follow-up with the customer about any installation or repair activity
- h. Properly document any activity

2. If customer calls you because a solution that was earlier suggested by another technician did not appear to have solved the problem ask the customer to explain the problem. It is possible that you would be able to resolve the same without escalation. Decide if you need to escalate the issue after carefully reviewing the problem.

3. If a user calls to report that a notice pops up on their screen whenever they try to download video clips from a website. The notice says "The streaming media is limited to 60 minutes per day, please confirm". You have recently implemented a filter to allow only 60 min of streaming media per day per user computer. You need to maintain the professionalism when conversing with a user.

4. If a user reports that he had not heard from a help desk technician for the past two days, after the initial complaint was made assure the customer that the problem will be escalated, and would return the call at the earliest.

5. A PC may have multiple problems. Solving one problem doesn't mean that all the problems (or the main concern) has been solved. One needs to investigate and fix the problems that the user had reported. In the event of any difficulty in solving the problem, escalate the same to higher levels. Sfc /scannow will inspect all of the important Windows files on your computer, including Windows DLL files. If System File Checker finds an issue with any of these protected files, it will replace it. You must be logged in as a user with administrator rights in order to run the sfc /scannow command.

5.4 Explain the fundamentals of dealing with prohibited content/activity

1. Chain of custody (CoC) refers to the chronological documentation or paper trail, showing the seizure, custody, control, transfer, analysis, and disposition of physical or electronic evidence. Chain of custody ensures that the evidence is not tampered with when presented in a court.

2. If a user's PC has been confiscated for prohibited use before giving the PC to another department the

technician needs to document change of custody

3. If you are attending to the maintenance of a clients computers and you notice that one of the systems have a lot of inappropriate content. You need to report the matter using proper channel first. Any inappropriate material should be reported to the management for necessary action. The reporting structure needs to be maintained in an organization.

6. ANNEXURE

Note : As per new syllabus topic Operating system has been moved to A+ Practical Application syllabus. This information is provided for your quick reference.

6.1 MS DOS

The following DOS utilities are useful in proper maintenance of PCs.

SCANDISK

ScanDisk is a utility program that was added to DOS Version 6.0. SCANDISK is a better compared to CHKDSK. SCANDISK can fix errors on data storage devices such as hard disks, floppy disks, RAM drives etc, and DoubleSpace compressed drives. It analyzes and repairs damage to the following:

1. Physical clusters
2. File allocation table (FAT)
3. Lost clusters
4. Cross-linked files
5. Directory tree
6. MS-DOS Boot sector
7. DBLSPACE volume header, file structure, compression structure.

CHKDSK (Check Disk)

CHKDSK command, one of DOS commands, examines your hard drive for error conditions and reports the total size of the disk, how many files are stored there, and the space remaining. CHKDSK also reports the total amount of conventional memory in your system and the amount of conventional memory available. Note that CHKDSK can't report extended memory.

DFRAG

The DFRAG.EXE is included with DOS6.0 and later. DEFRAG utility arranges the clusters of data on the hard drive to achieve better performance by placing all of the clusters for a given file together in a contiguous order. DEFRAG does not do any repair on your disk, and errors, if any will remain on the disk.

BACKUP

DOS has a backup utility since version 2.0.

.COM, .EXE, .BAT files are executable files.

Important DOS files used during BOOT Up are:

A. AUTOEXEC.BAT

1. It does: Modifies the PC environment (PATH, SET, and other commands)
2. Default Attributes: Nil
3. Is it required for OS Start up: NO

B. CONFIG.SYS

1. It does: Loads low level device drivers and does performance tuning
2. Default Attributes: Nil
3. Is it required for OS Start up: NO

C. IO.SYS

1. It does: Loads basics Input/ Output routines for the processor
2. Default Attributes: Hidden / System/ Read Only
3. Is it required for OS Start up: YES

D. MSDOS.SYS

1. It does: Defines System File locations
2. Default Attributes: Hidden / System/ Read Only
3. Is it required for OS Start up: YES

E. COMMAND.COM

1. It does: The file contains internal command set and error messages
2. Default Attributes: Nil
3. Is it required for OS Start up: YES
4. Responsible for displaying the command prompt in a DOS based computer.

F. HIMEM.SYS

1. HIMEM.SYS must be loaded before EMM386.EXE
2. HIMEM.SYS is used to address the extended memory

G. EMM386.EXE

1. EMM386.EXE allows access to Upper Memory Area. Please note that the conventional memory of 1 MB is divided into 1. Lower Memory Area 640 KB, and 2. Upper Memory Area 384KB (1024KB-640KB).

H. ANSI.SYS

1. The files AUTOEXEC.BAT, CONFIG.SYS, ANSI.SYS are not required for OS start-up. However, the files IO.SYS, MSDOS.SYS, COMMAND.COM are required for OS start-up.
2. To bypass the CONFIG.SYS, and AUTOEXEC.BAT files during boot process of DOS, you need to press F5. F8 allows you to selectively bypass commands in AUTOEXEC.BAT, and CONFIG.SYS.

DOS allows you to set the following attributes using ATTRB command:

1. System
2. Hidden
3. Read-only
4. Archive

'+' sets an attribute

'-' clears an attribute

Examples:

The command ATTRIB +H myfile.txt will make the file myfile.txt hidden. The other attributes that can be set using ATTRIB command are System, Read Only, and Archive.

The command ATTRIB C:\private.txt +h +r will mark the file private.txt as both hidden and read only.

DOS, Windows 3.1 Windows 95/ 98 operating systems have the following characteristics:

1. Each can have only one primary partition per hard disk
2. The primary partition is automatically assigned a drive letter
3. Each hard disk can have only one Extended partition
4. You can create one or more logical drives in the Extended partition.
5. The drive letters are assigned manually to logical drives.

The standard DOS partition cluster sizes are as given below:

- 16MB-127MB: 2KB cluster size
- 128MB-255MB: 4KB cluster size
- 256MB-511MB: 8KB cluster size
- 512MB-1023MB: 16KB cluster size
- 1024MB-2048MB: 32KB cluster size

Note that due to DOS limitation, the FAT on each hard drive partition can have 64K (65535) individual addresses. Therefore, it is clear, depending on the size of partition, this number dictates the size of each

cluster. We arrive at 32KB cluster size by dividing 2048(MB) with 64(KB).

The Windows 95/98 system files include the following:

- A. IO.SYS
- B. MSDOS.SYS
- C. WIN.INI
- D. COMMAND.COM
- E. SYSTEM.INI
- F. SYSTEM.DAT
- G. USER.DAT

- MSDOS.SYS, WIN.INI, SYSTEM.INI are text files.

- SYSTEM.DAT, USER.DAT files are part of windows Registry and can be edited using REGEDIT or REGDT32 utility. Registry files can't be read with standard text editors.

- Further, USER.DAT file corresponds to HKEY_LOCAL_USER and SYSTEM.DAT corresponds to HKEY_LOCAL_MACHINE.

HKEY_LOCAL_MACHINE is the hive where the information specific to the machine will be stored. The information may include, network settings, hardware drivers etc.

HKEY_LOCAL_USER hive stores data specific to user configuration, such as desktop color schemes, screen savers, wall paper, and user specific application settings.

Using FDISK, the following activities can be carried out:

1. Create Partitions: You can create primary and extended partitions. Extended partition holds one or more (Up to 23) logical drives.
2. Set Active Partition: FDISK allows you to mark the primary partition as active partition.
3. Delete Partition: You can delete a partition by using FDISK
4. Display Partition Information.

DOS COMMANDS

MEMMAKER can be used to manage the system memory optimally. Windows 95 and above automatically manage the memory, where as DOS requires manual memory management using utilities like MEMMAKER. The DOS command MEM can only display the contents of memory, but itself can't manage the memory.

When you power on the DOS machine, you see a message, "Starting MS-DOS". If you press F5 key during this short period, you can bypass AUTOEXEC.BAT and CONFIG.SYS files.

Given below are common DOS commands that you use frequently:

1. PATH: The command sets or displays a path for executable files. For example, "PATH=C:\; C:\DOS; C:\PROG; C:\MYFILES " command indicates DOS to first search ROOT, then

C:\DOS, then C:\PROG, and finally C:\MYFILES for executable files.

2. SET: Displays, sets, or removes DOS environment variable.

3. PROMPT: Changes the DOS command prompt. The prompt can be made up of normal characters and the following special codes:

\$p Current drive and path

\$l < (less than sign)

\$d Current date

\$t Current time

\$_ Carriage return

Syntax: PROMPT [text]

For example, to set the prompt to current date, followed by the current drive path, issue the command:

```
PROMPT= $p$d
```

The file load order to start DOS is :

- IO.SYS
- MSDOS.SYS
- CONFIG.SYS
- COMMAND.COM
- AUTOEXEC.BAT

Note that CONFIG.SYS, and AUTOEXEC.BAT are optional to load DOS. IO.SYS, MSDOS.SYS, COMMAND.COM are required.

When you format a disk with a "/s" switch (say "format a:/s"), the following files get transferred:

1. IO.SYS
2. MSDOS.SYS
3. COMMAND.COM

If you want to format a drive and also make it bootable, you need to format with /s switch.

6.2 Windows 95

1. The minimum published requirements for running Windows 95 is 386 processor with 4 MB of RAM. Though it may be sufficient, the performance will be very poor and some applications may not run at all. A recommended configuration is a Pentium processor with 32 MB of RAM.

2. Booting Windows 95 in safe mode loads the drivers for Keyboard, Mouse, and standard VGA graphics adapter.

3. Windows 95 Version A supported only FAT16 file system. The maximum hard disk partition supported by FAT16 is only 2 GB. However, Windows 95 Version B and Windows 98 support FAT32 and therefore, can support partitions upto 2TB (Tera bytes).
4. SYSTEM.DAT and USER.DAT comprise of Windows 95 Registry. These are the files where most of the user and system configuration information is stored. The Windows Registry files are stored in \Windows directory by default.
5. Windows 95 makes a backup of the Registry after every successful reboot. The Registry back up files are named: USER.DA0, SYSTEM.DA0. The original Registry files are named: USER.DAT, SYSTEM.DAT. It may be noted, that in the event of boot failure, you can delete the original USER.DAT AND SYSTEM.DAT files and the back up files can be renamed to DAT files and the system can be rebooted successfully.
6. While booting Windows 95, if you press F8, boot menu will be displayed. Windows 95 provides three different modes that the system can be started.
 - a. Normal Mode: Normal Mode is the mode Windows 95 starts by default. It provides full functionality.
 - b. Safe Mode: Safe Mode is a diagnostic mode of Windows 95 that starts Windows 95 without any network, CD ROM, and other drivers. The only device drivers loaded in Safe mode are:
 - Keyboard
 - VGA Display
 - Mouse Drivers
 - c. Command Prompt: Command Prompt mode is provided to run some old DOS applications that need to be run under DOS only. These applications are primarily the ones which access hardware, that Windows 95 does not allow to be accessed otherwise. Command Prompt mode is also useful for running FDISK and MSD
7. The log file BOOTLOG.TXT records all the devices and drivers that the Operating System attempts to load. BOOTLOG records the status of the devices and drivers.
8. ScanDisk can be used to check disk drives for errors. The /f switch allows ScanDisk to automatically fix the errors.
9. HKEY_CURRENT_CONFIG stores the hardware settings.

The six register keys available in Windows 95/98 Registry are:

- A. HKEY_CLASSES_ROOT
- B. HKEY_CURRENT_USER
- C. HKEY_LOCAL_MACHINE
- D. HKEY_USERS
- E. HKEY_CURRENT_CONFIG

F. HKEY_DYN_DATA

10. Adding \$ sign to the end of the share name makes the share invisible over the network.

6.3 Windows 2000

1. Hardware requirements:

Hardware component	Windows 2000 Prof.	Windows 2000 Ser/ Ad Ser.
Processor	Pentium/133MHz	Pentium/133MHz
Memory	64MB	256MB
HD space	640MB	1GB
Display	VGA or better	VGA or better
Network card	Optional	Optional
CD ROM Drive	Required	Required (unless loading from network)

2. When you install Windows 2000 in the same folder as that of Windows 95/ Windows 98/ Windows NT, the operating system gets upgraded to Windows 2000.
3. TCP/IP protocol stack is installed by default when you install Windows 2000 on a computer.
4. You can use Regional Options to support additional languages on your computer. With the support of additional languages, you will be able to edit documents written in those languages. You can also set locale specific to any region using this Option.
5. The Windows 2000 Performance tool is composed of two parts:
 - a. System Monitor: With System Monitor, you can collect and view real-time data about memory, disk, processor, network, and other activity in chart (graph), histogram, or report form
 Some of the important System Monitor counters are:

1. Memory>Available Mbytes: measures the amount of physical memory that is available. Typically > 4MB. If less than 4 MB, consider adding more memory.
2. Memory>Pages/Sec: Shows the number of times that the disk has been accessed, because requested information was not available in memory. If the value of the counter is not below 20, you should add more memory. A value of 4 or 5 is typical.
3. Paging File>%Usage: Indicates the % of allocated page file utilization. Should be less than 99%.
4. Processor>%Processor Time: measure the time that the processor is busy. Should be typically less than 80%
5. Processor>Interrupts/Sec: Indicates the average number of hardware interrupts that the

processor receives each second. If more than 3,500, you can suspect a program or faulty hardware.

6. PhysicalDisk>%Disk Time: Measures the amount of time that the physical disk is busy servicing read or write requests. If more than 90%, you can improve the performance by adding another disk channel.

7. PhysicalDisk>%Current Disk Queue Length: indicates the number of pending disk requests that need to be processed. The value should be less than 2. The disk problems might arise from less memory, resulting in usage of excessive paging. Ensure that the memory is sufficient before attending to the disk problem.

8. LogicalDisk > %Free Space counter: Indicates the amount of logical disk's free disk space. Typical value is 10% or above.

b. Performance Logs and Alerts: Through Performance Logs and Alerts you can configure logs to record performance data and set system alerts to notify you when a specified counter's value is above or below a defined threshold.

6. Event Viewer maintains logs about program, security, and system events. You can use Event Viewer to view and manage the event logs, gather information about hardware and software problems, and monitor Windows 2000 security events.

7. To open Event Viewer, click 'Start', point to 'Settings', and then click 'Control Panel'. Double-click 'Administrative Tools', and then double-click Event Viewer.

8. Encrypting File System (EFS) keeps your documents safe from intruders who might gain unauthorized physical access to your sensitive stored data by stealing your laptop or Zip disk, or by other means.

9. You need to ensure the following before the upgrade:

a. The hardware is adequate for upgrading to Windows 2000 Professional

b. Also, check the hardware, software adequacy by running "Winnt32.exe / checkupgradeonly". Note that the switch "checkupgradeonly" will output a report on the adequacy of hardware and software. It will also warn you if any applications need upgrade packs, which may be obtained from respective application vendors, if available. If the software upgrade pack is not installed for any application, the application may be rendered unusable!

10. If you are creating a Striped volume on a new Windows 2000 machine, it can only be created on dynamic disks. However, if you are upgrading a Windows NT computer to Windows 2000, any existing stripe set will be supported.

11. For creating Stripe set with parity, we need at least 3 disk volumes.

12. Placing the paging file on different physical disks is optimal. This will improve faster access to the Paging file, and also distribute the load.

13. Microsoft Internet Explorer and Windows Explorer can be used for assigning Share and NTFS permissions on a Windows 2000 computer.

14. To insert a new file extension, you use Windows explorer, and select the application. Then, Tools -> Folder Option -> File Types. Configure the extension appropriately.
15. Windows 2000 Operating systems support 5 different volume types:
- Simple volumes :A simple volume consists of a formatted disk on a single hard disk.
 - Spanned volumes: A Spanned volume consists of disk space on more than one hard disk.
 - Striped volumes: A Striped volume has disk space on 2 or more disks. The disk spaces must be same on all disks. Fastest disk access among all volume types. RAID level 0.
 - Mirrored volumes: A mirrored volume consists of a Simple volume that is mirrored in total, onto a second dynamic disk. Provides highest level of fault tolerance. RAID level 1
 - RAID-5 volumes: A RAID-5 volume consists of identical sized disk space located on three or more dynamic disks. Here any single disk failures can be recovered. RAID level 5
 - Note that Windows 2000 Professional doesn't support Disk Mirroring, RAID-5 volumes, where as other Windows 2000 Operating Systems (2000 Server, Advanced Server) support.
16. Fault tolerance boot disk is a floppy disk that enables you to boot a computer in the event that the first disk in a mirrored volume fails. If you mirror the installation folder in a Windows 2000 Server, you will not be able to boot because boot.ini points to the first volume. Therefore, you need to create a fault tolerance boot disk that contain an appropriately edited Boot.ini file, that points to the mirrored volume.
17. By default, you can start recovery console (in Windows 2000) using,
- The Windows 2000 Professional Setup Disks
 - From the CD ROM drive using Windows 2000 Professional CD (if the CD –ROM drive is bootable).
 - Also, you can have “Recovery Console” as a start up option by typing `\i386\winnt32.exe /cmdcons` at the command prompt, after switching to the CD ROM drive letter.
18. Windows 2000 provides two versions of Registry Editor
- Regedt32.exe (32-bit): Regedt32.exe is automatically installed in the `systemroot\system32` folder.
 - Regedit.exe (16-bit): Regedit.exe is automatically installed in the `systemroot` folder. c. Regedit.exe is primarily used for its search capabilities as it doesn't support all functions and data types.
19. On a Windows 2000 computer, the default spool folder is located at: `Systemroot\System32\spool\printers`. For example, if the OS is residing on C drive, the default location will be: “`C:\WINNT\System32\spool\printers`”. You can access this location through: Start -> Printers -> File -> Server Properties -> Advanced tab. Type in the new spool location over the default location.

20. Up-grade to Windows 2000:
- You can upgrade Windows 95/98, Windows NT 3.51 Work Station, Windows NT 4.0 WS can be upgraded to Windows 2000 Professional.
 - You can't upgrade Windows 3.1 and Windows for workgroups to Windows 2000 Professional. If you need to install 2000 Prof. On Windows 3.x, you need to upgrade first to Windows 95/98 or NT and then upgrade to 2000 Prof. It is easy to do a clean install of Windows 2000 on Windows 3.x machines.
21. By default, Windows 2000 stores a user's profile in the C:\Documents and Settings\user_name folder on the computer the user logs on. When a new user logs on, his initial user profile is an exact copy of either the local or domain-wide "default user" profile folder. The local default user profile folder is located in %root%\Documents and Settings.
22. If you have installed Windows 2000 in C drive, it is C:\Documents and Settings.
23. Pressing F8 during boot process in Windows 2000 desk top bring up the following options:
- Safe Mode:** Safe Mode loads only the drivers necessary to get the desk top up and running. The drivers loaded with Safe Mode include mouse, monitor, keyboard, hard drive, and standard video driver.
 - Safe Mode with Networking:** Safe Mode with Networking is same as Safe Mode with networking enabled.
 - Safe Mode with Command prompt:** Safe Mode with Command Prompt option loads the command prompt instead of Windows 2000 graphical interface.
 - Enable Boot Logging**
 - Enable VGA Mode:** Enable VGA Mode option loads a standard VGA driver. This option is good if you have any problem with newly installed video driver.
 - Last Known Good Configuration:** Last Known Good Configuration enables the desk top to load the configuration that was stored when it was booted successfully last time. This option can't take care of any hardware related problems.
 - Debugging Mode:** The Debugging Mode option runs the Kernel Debugger, if that utility is installed.
 - Boot Normally:** The Boot Normally is same as not pressing the F8 key. The Windows boots normally
24. You can access Task Manager by pressing <Alt> <Ctrl> . The applications tab lists all the applications that are currently running on the computer. The current status of the application is also displayed as either "Running" or "not responding" or "stopped".
25. Blue screen messages are also called STOP messages. You will not be allowed to proceed, when a blue screen message appears. The most likely cause of blue screen messages are:
- Boot sector virus

- b. IRQ/ IO address conflicts.
 - c. You can check for any boot sector virus, and also for any conflicting IRQ / IO addresses.
26. You can configure support for multiple displays on your Windows 2000 computer. This is done through the use of Control Panel -> Display -> Settings. A Windows 2000 computer can support up to ten display monitors at the same time. Use additional video cards as required.
27. On a Windows 2000 computer, disk quotas can be used on NTFS volumes. Windows Explorer can be used to configure and monitor disk quotas.
28. On a Windows computer, you can use the View tab in Folder Options applet in the Control Panel to show / hide files and folders that have “Hidden” attribute set. You can also use Windows Explorer -> Tools -> Folder Options -> View tab.
29. If you want to install Windows 2000 on the same partition as that of Windows 98, install 2000 Professional either on the FAT file systems or on the FAT32 for dual boot. Windows 98 supports FAT (FAT16) and FAT32. It doesn't support NTFS file system.
30. The various file systems supported by Windows 2000 are:
- a. FAT: Also called FAT16, supported by all Microsoft Operating Systems.
 - b. FAT32: Also supported by Win 95 OSR2 and Win98
 - c. NTFS: This is not supported by Win95/98
 - d. CDFS (Compact Disk File System, used to access CDs)
 - e. UDF (Universal Disk Format, used to access DVDs)
31. If you want to have dual boot between Windows NT 4 and Windows 2000, ensure that Service Pack 4 is installed on Windows NT 4. This is required since Windows 2000 upgrades the NTFS to NTFS 5. NT4 requires Service Pack 4 to read and write to NTFS 5.
32. If you encrypt a folder on an NTFS volume, all files and sub folders created in the encrypted folder are automatically encrypted. Therefore, it is recommended that you use encryption at the parent folder level.
33. Also note that you can't encrypt a file or folder that is compressed. If you want to encrypt a file or folder that is compressed, you need to first decompress the file or folder and then encrypt. Only NTFS volumes support file or folder encryption.
34. You don't need to have a network card installed for successful installation of Windows 2000 Professional. You can use loop back adapter for this purpose and proceed with the installation. Network card can be installed at a later time, when required.
35. In Windows 2000 computer, Disk Management is used to create, manage, and delete simple volumes, spanned volumes, mirrored volumes, striped, and stripe set with parity volumes. Disk Administrator is NT 4 tool and is not available in Windows 2000.
36. Only Windows NT Server 4 and Windows NT Server 3.51 can be upgraded to Windows 2000 Server. Windows NT Workstation 4.0 or Windows 95/98 can't be upgraded to 2000 Server.

6.4 Windows XP

1. In Windows XP computer, you can use Start -> Windows Update to connect to the Microsoft site. Windows Update is a catalog of items such as drivers, patches, the latest help files, and Internet products that you can download to keep your computer up to date. You must be logged on as an administrator or a member of the Administrators group in order to access the Product Updates section of Windows Update for downloading help files.
2. XP Professional supports multiple processors, multiple monitors (up to 9), Group Policy, Encrypting File System, Dynamic Disks, IIS, a built in backup program, and advanced networking capabilities (such as IPSec.) All of these features are missing from XP Home Edition. Another important distinction between the two versions is that XP Home Edition cannot join a Windows NT/2000/2003 domain.
3. Windows XP Operating System comes in the following flavors:
 - a. Windows XP Home: The basic XP OS intended for home users
 - b. Windows XP Professional: The XP OS intended for business users
 - c. Windows XP Media Center Edition: Windows Media Center provides a large-font, remotely accessible interface ("10-foot user interface") for television viewing on the computer as well as recording and playback, a TV guide, DVD playback, video playback, photo viewing, and music playback.
 - d. Windows XP Table PC: This edition is intended for specially-designed notebook/laptop computers called tablet PCs. Windows XP Tablet PC Edition is compatible with a pen-sensitive screen, supporting handwritten notes and portrait-oriented screens.
4. Boot process (F8) in Windows XP desk top bring up the following options:
 - a. Safe Mode: This option uses a minimal set of device drivers and services to start Windows. The drivers loaded with Safe Mode include mouse, monitor, keyboard, hard drive, and standard video driver.
 - b. Safe Mode with Networking: This option uses a minimal set of device drivers and services to start Windows together with the drivers that you must have to load networking.
 - c. Safe Mode with Command Prompt: This option is the same as Safe mode, except that Cmd.exe starts instead of Windows Explorer.
 - d. Enable VGA Mode: This option starts Windows in 640 x 480 mode by using the current video driver (not Vga.sys). This mode is useful if the display is configured for a setting that the monitor cannot display.

Note: *Safe mode and Safe mode with Networking load the Vga.sys driver instead.*

- e. Last Known Good Configuration: This option starts Windows by using the previous good configuration.
- f. Directory Service Restore Mode: This mode is valid only for Windows-based domain controllers. This mode performs a directory service repair.
- g. Debugging Mode: This option turns on debug mode in Windows. Debugging information can be sent across a serial cable to another computer that is running a debugger. This mode is configured to use COM2.
- h. Enable Boot Logging: This option turns on logging when the computer is started with any of the Safe Boot options except Last Known Good Configuration. The Boot Logging text is recorded in the Ntbtlog.txt file in the %SystemRoot% folder.
- i. Starts Windows Normally: This option starts Windows in its normal mode.
- j. Reboot: This option restarts the computer.
- k. Return to OS Choices Menu: On a computer that is configured to starting to more than one operating system, this option returns to the Boot menu.

5. You can configure support for multiple displays on your Windows XP computer. This is done through the use of Control Panel -> Display -> Settings. A Windows XP computer can support up to ten display monitors at the same time. Use additional video cards as required.

6. The Device Manager (It can be accessed using Add/Remove Hardware in XP) lists all the hardware devices installed on your system. You can also update any existing drivers, as well as change the hardware settings. You use Add/Remove Hardware to install new hardware. Accessibility options are primarily used to configure the keyboard, display, and mouse options on a computer to accommodate the users who are physically handicapped. The Add/ Remove Programs is used to install/uninstall 3rd party software. This is also used for installing/uninstalling Windows XP optional components.

7. Features supported by XP

- a. On readable/writable disks, Microsoft Windows XP Professional supports the NTFS file system and three file allocation table (FAT) file systems: FAT12, FAT16, and FAT32. On CDROM and DVD media, Windows XP Professional supports two file systems: Compact Disc File System (CDFS) and Universal Disk Format (UDF).
- b. While installing XP, if you have a standard desktop PC that uses integrated drive electronics (IDE) disk drives, then these will be detected during setup. If, however, you use SCSI disks or have Redundant Array of Independent Disk (RAID) storage systems, you will see, shortly after the reboot, the following line of text displayed at the bottom of the screen:
“Press F6 if you need to install a third party SCSI or RAID driver...”

c. Pressing F6 will start a dialog that allows you to configure and install the drivers for your SCSI or other disk subsystem controllers. This option is usually used on server platforms that use large-capacity, high-speed, fault-tolerant disk subsystems. For most PCs, however, you won't need to use this option.

6.5 Windows Vista

1. Certain versions of Windows Vista uses BitLocker Drive Encryption. BitLocker Drive Encryption is a full disk encryption feature included with the Ultimate and Enterprise editions of Microsoft's Windows Vista and Windows 7 desktop operating systems.
2. In order for BitLocker to operate, the hard disk requires at least two NTFS-formatted volumes: one for the operating system (usually C:) and another with a minimum size of 100MB from which the operating system boots. BitLocker requires the boot volume to remain unencrypted, so the boot should not be used to store confidential information.
3. Windows Sidebar is a pane on the side of the Microsoft Windows Vista desktop where you can keep your gadgets organized and always available. Gadgets are mini programs that give you information at a glance and provide access to frequently used tools. Windows Sidebar helps you to organize your gadgets. The Windows sidebar is also available in Windows 7 Operating System.
4. The parental controls built into Windows Vista help parents determine which games their children can play, which programs they can use, and which websites they can visit, and when. Parents can restrict computer use to specific times and trust that Windows Vista will enforce those restrictions, even when they're away from home.
5. Windows Vista introduces Sync Center, which enables users to synchronize their data with other computers and devices from one common user interface. There are several ways to interact with Sync Center, one of which is as a provider of synchronization information. Synchronization information consists of a synchronization engine, and the data that it synchronizes.
6. Driver Verifier is included in Windows 7, Windows Vista, Windows 2000, Windows XP, and Windows Server 2003 to promote stability and reliability. You can use this tool to troubleshoot driver issues. You can start the tool by going to Run > verifier.exe Specifically, in the version of Driver Verifier included in Windows Vista:
 - a. You can start verification of any driver without rebooting, even if Driver Verifier is not already running.
 - b. You can start the verification of a driver that is already loaded.
 - c. You can activate or deactivate most Driver Verifier options without rebooting.

6.6 Aero Interface

1. Windows Vista and Windows 7 feature a user interface termed as Aero by Microsoft. This is the default interface used by Vista. Aero interface is characterized by the following features:

- a. .Glass-like translucent design
- b. .Dynamic windows: When you minimize a window, it animates to its place on the taskbar, so it's easier to find when you need it.
- c. High dots-per-inch (dpi) support: Windows Aero supports high-resolution monitors, so you can get a laptop or flat-screen monitor that's smaller in size but shows visually richer, displaying high-resolution, easy-to-read images.
- d. Live taskbar thumbnails: In Windows Aero, live taskbar thumbnail images display the actual contents of both windows that are currently open and those that are minimized in the taskbar. When you rest your mouse pointer on a tile on the taskbar, you'll see the "live" contents of that window without having to bring it to the foreground.
- e. Other features include Windows Flip 3D, and smooth scrolling desktop.

2. Windows Vista Home Basic, Vista Home Premium, and Vista Starter provide only limited support for EFS (Encrypted File System), whereas Vista Business, and Vista Ultimate provide full support for EFS. Upgrade to Windows Vista Ultimate. You can upgrade to Windows Vista Ultimate from Windows XP Home, XP Professional, XP Media Center, and XP Tablet PC, Windows 2000 Professional can't be upgraded to Windows Vista directly.

3. The following reserved characters can't be used in Windows file names:

- < (less than)
- > (greater than)
- : (colon)
- " (double quote)
- / (forward slash)
- \ (backslash)
- | (vertical bar or pipe)
- ? (question mark)
- * (asterisk)

4. Windows XP Mode for Windows 7 makes it easy to install and run your applications for 32-bit Windows XP directly from your Windows 7 32-bit or 64-bit based PC. It utilizes virtualization technology such as Windows Virtual PC to provide a Virtual Windows XP environment for Windows 7. Windows XP Mode provides only Windows 7 Professional, Ultimate, or Enterprise users the flexibility to run many older productivity applications in a virtual Windows XP environment on a Windows 7-based PC.

5. The editions below support the Aero Feature:

- a. Windows Vista Home Premium

- b. Windows Vista Business Edition
- c. Windows Vista Ultimate Edition

Similarly, Aero desktop is available in the

- a. Windows 7 Home Premium,
- b. Windows 7 Professional,
- c. Windows 7 Ultimate, and
- d. Windows 7 Enterprise

6. In windows 7, Sync Center allows you to check the results of your recent sync activity if you've set up your computer to sync files with a network server (often called offline files). When you sync with a network server, you can access files by keeping synced copies of those files on your computer, even when the network server is unavailable. Sync Center can tell you if the files synced successfully or if there are any sync errors or warnings.

7. To launch sync center, just open your control panel, then click sync center.