

COMPUTER HARDWARE

Computer hardware refers to the physical parts or components of a computer such as monitor, keyboard, computer data storage, hard drive disk, mouse, system unit (graphic cards, sound cards, memory, mother board and chips), etc. all of which you can actually touch. **Computer hardware** is the physical components (**devices**), which are the building blocks of personal computers. These are installed into a computer case, or attached to it by a cable or through a port. In the latter case, they are also referred to as **peripherals**. A combination of hardware and software forms a usable computing system.

Hardware of a modern personal computer:

- | | |
|------------------------|---------------------|
| 1. Monitor | 2. Mother board |
| 3. CPU | 4. RAM |
| 5. Expansion cards | 6. Power supply |
| 7. Optical disc drives | 8. Hard disks drive |
| 9. Keyboard | 10. Mouse |



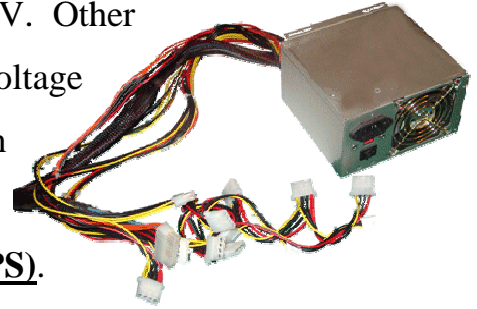
Modern personal computer

Basics of Computer Hardware that runs inside your computer

Personal Computer Case: A **computer case** also known as a "**computer chassis**", "**tower**", "**system unit**", "**base unit**" or simply "**case**" and sometimes incorrectly referred to as the "**CPU**" or "**hard drive**" is the enclosure that contains most of the components of a **computer** (usually excluding the display, keyboard and mouse). Cases are usually constructed from **steel** (often SECC - Steel, Electro galvanized, Cold-rolled, and Coil) or **aluminum**. **Plastic** is sometimes used, and other materials such as **glass**, **wood** and even **Lego** blocks have appeared in home-built cases.

Power supply

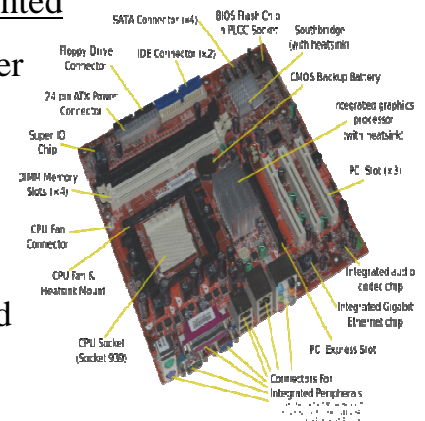
A power supply unit (**PSU**) converts alternating current (AC) electric power to low-voltage DC power for the internal components of the computer. Some power supplies have a switch to change between 230 V and 115 V. Other models have automatic sensors that switch input voltage automatically, or are able to accept any voltage between those limits. Power supply units used in computers are nearly always **Switch Mode Power Supplies (SMPS)**.



The **SMPS** provides regulated direct current power at the several voltages required by the motherboard and accessories such as disk drives and cooling fans.

Motherboard

A circuit board that allows the CPU to interact with other parts of the computer is called **Motherboard** (its also known as the **main board, system board, planar board** or **logic board**). **Motherboard** is the main **Printed Circuit Board (PCB)** found in computers and other expandable systems. It holds many of the crucial electronic components of the system, such as the **Central Processing Unit (CPU)** and **memory**, and provides connectors for other **Peripherals**. Unlike a **backplane**, a motherboard contains significant sub-systems such as the processor.



Motherboard specifically refers to a PCB with expansion capability and as the name suggests, this board is the "mother" of all components attached to it, which often include sound cards, video cards, network cards, hard drives or other forms of persistent storage; TV tuner cards, cards providing extra USB or FireWire slots and a variety of other custom components.

Note: Number of organizations use to manufacturing Motherboard PC's among which Intel, Acer, Asus are famous.

Heat sink

Heat sink is used to disperse the heat produced inside the computer by the CPU and other parts by increasing surface area.



Fan

Fan keeps your computer cool. If interior portion of your computer becomes too hot, it can result in damaging of the parts.



The three main components of a computer -

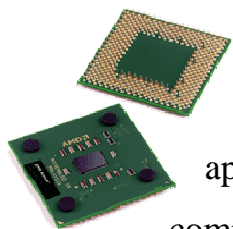
CPU: Central Processing Unit coordinates all actions that occur in the system and executes program instructions.

Memory: Memory is used to store information.

I/O Devices: Input / Output Devices which allow you to obtain or display data.

Central Processing Unit (CPU)

CPU or processor is the brain of any computer. It controls all activities inside the computer. Basically it performs 2 types of operations - arithmetic and logical operations (internally), operations are performed on 2 types of devices - I/O and memory devices. The **CPU** performs most of the calculations which enable a



computer to function, and is sometimes referred to as the "brain" of the computer. It is cooled by a heat sink and fan. The processor approximately 1.5 in X 1.5 in., does all the computation / work for the computer. You can recognize this processor from its built-in heat sink and PCI-like contacts. To install this processor you simply push it down into the contacts.

Note: Quite a few organizations manufacture PC processors, among which Intel Corporation, AMD Corporation are famous.

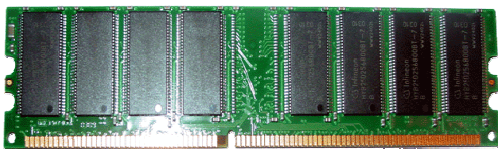
Memory Devices or Memory

Although memory is technically any form of electronic storage, it is used most often to identify fast, temporary forms of storage. Generally, accessing information kept in the hard drive takes time. However, the same can be accessed quickly when the information is kept in memory. The CPU can access it much more quickly. The CPU stores all information in the computer's memory.

There are two memory types - **RAM and ROM**

Note: Quite a few organizations manufacture RAM's for PC's among which Transcend, Kingston, Micron companies are famous.

RAM (Random Access Memory)

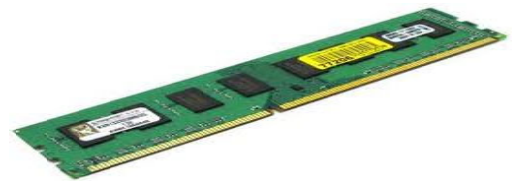


This volatile type is a read and write memory device. Content stored in the RAM would be erased when power is shut off. The information of ongoing programs is stored in RAM for temporary purpose. RAM is volatile and non-permanent memory type.

The types of RAM -

DRAM (Dynamic RAM): DRAM is similar to a capacitor, as it tends to lose its contents and hence requires to be refreshed. This is the Computer RAM.

SRAM (Static RAM): It is faster than DRAM and



doesn't require to be refreshed. SRAM is quite costly and hence only a limited amount is used as CACHE memory in the computer.

DDR (Double Data Rate SDRAM): DDR doubles the rate of data transfer of standard SDRAM by transferring data on the up and down tick of a clock cycle. It is incompatible with SDRAM physically, but uses a similar parallel bus, making it easier to implement than RDRAM, which is a different technology.

ROM (Read Only Memory)

Read Only Memory or ROM can be programmed using a programmer and then it acts as a “read only” device. This device is used as the textbook for the CPU in the computer and is called ROM BIOS. It stores all the basic information of programming the devices present inside the system as well as the POST (Power On Self Test) sequence which supports in OS Booting process. AMIBIOS and AWARD BIOS are the most common ROM BIOSs.



Note: Number of organizations manufacturing ROMs, among which Transcend, Kingston, Micron companies are famous.

The Types of ROM

PROM (Programmable Read Only Memory): PROM or **one-time programmable ROM** can be written to or **programmed** via a special device called a **PROM programmer**. Typically, this device uses high voltages to permanently destroy or create internal links within the chip. A PROM can only be programmed once.

EPROM (Erasable and Programmable Read Only Memory): EPROM can be erased by exposure to strong ultraviolet light (typically for 10 minutes or longer), then rewritten with a process that again needs higher than usual voltage applied. But most EPROM chips exceeds 1,000 cycles of erasing and reprogramming.

FLASH ROM: (or simply **flash**) is a modern type of EEPROM invented in 1984. Flash memory can be erased and rewritten faster than ordinary newer designs feature very high endurance (exceeding 1,000,000 cycles). Modern **NAND flash** makes efficient use of silicon chip area, resulting in individual ICs with a capacity as high as 32 **GB** as of 2007, allowed **NAND flash** to replace **magnetic** in some applications (such as **USB flash drives**). Flash memory is sometimes called flash ROM or flash.

EEPROM (Electrically EPROM): EEPROM is based on a similar semiconductor structure to EPROM, but allows its entire contents (or selected **banks**) to be electrically erased and then rewritten electrically, so that they need not be removed from the computer (or camera, MP3 player, etc.). Writing or **flashing** an EEPROM is much slower (milliseconds per bit) than reading from a ROM.

EAPROM (Electrically Alterable ROM): EAPROM is a type of EEPROM that can be modified one bit at a time. Writing is a very slow process and again needs higher voltage (usually around 12 V) than is used for read access. EAPROMs are intended for applications that require infrequent and only partial rewriting. EAPROM may be used as non-volatile storage for critical system setup information in many applications.

DVD:

DVD is a digital optical disc storage format, invented and developed by Philips, Sony, Toshiba, and Panasonic in 1995. DVDs offer higher storage capacity than compact discs while having the same dimensions. Pre-recorded DVDs are mass-produced using molding machines that physically stamp data onto the DVD. Such discs are known as DVD-ROM, because data can only be read and not written or erased. Blank recordable DVD discs (DVD-R and DVD+R) can be recorded once using a DVD recorder and then function as a DVD-ROM. Rewritable DVDs (DVD-RW, DVD+RW, and DVD-RAM) can be recorded and erased multiple times.



DVD-ROM: DVD-ROM is a device that is used to read DVDs / CDs. If capable of writing to the DVD, then it is often referred to as a DVD-burner or a DVD-RW. Figure of SAMSUNG DVD-RW shown below.

Note: There are quite a few makers of DVD-RWs for PCs and Sony and Samsung are famous among them.

CD-ROM:

A device used to read CD-ROMs. If capable of writing to the CD-ROM, then they are usually referred to as a 'burner' or CD-RW.

Compact Disc

Compact disc, or **CD** for short, is a digital optical disc data storage format. The format was originally developed to store and play back sound recordings only (CD-DA), but was later adapted for storage of data (CD-ROM). Several other formats were further derived from these, including write-once audio and data storage (CD-R), rewritable media (CD-RW), Video Compact Disc (VCD), Super Video Compact Disc (SVCD). The Compact Disc is an



evolution of Laser Disc technology. Prototypes were developed by Philips and Sony independently from the mid-to-late 1970s.

Note: Sony, Samsung, Amkette are the famous CD manufacturers.

Floppy Drive:

A device that is used to read/write to floppy diskettes. Figures of floppy diskettes are shown below.

Note: Quite a few organizations are manufacturing Floppy Drives for PC among which SONY, SAMSUNG, ACER are famous.



HARD DISK DRIVES

The hard disk drive is the main, and usually largest, data storage device in a computer. The operating system, software titles and most other files are stored in the hard disk drive. HDD (abbreviation), hard drive, hard disk, fixed drive, fixed disk,



fixed disk drive, hard drive is sometimes referred to as the "C drive" due to the fact that Microsoft Windows designates the "C" drive letter to the primary partition on the primary hard drive in a

computer by default. Hard disks are popular because their price to performance ratio is very good. For very high performance, SCSI (Small Computer Systems Interface) is the ideal option, if price is not a criterion. The Latest trend is SATA 1 and SATA 2. SATA hard disc has double the speed of hard disc. HDD of Western Digital Figure shown below.

Note: Number of organizations use to manufacturing FLOPPY DRIVES for PC among which SONY, SAMSUNG, WESTERN DIGITAL, ACER are famous.

Thumb Drive or Flash Drive

Floppy Drives were replaced by Thumb Drive/Flash Drive, which is re-writable and holds memory without power supply. **USB flash drive** is a data storage device that includes flash memory with an integrated **Universal Serial Bus (USB)** interface. USB flash drives are typically removable and rewritable, and physically much smaller than an optical disc. Most weigh less than 30 grams.



As of January 2013; drives of up to 512 gigabytes (GB) are available. Figure of SanDisk Cruzer Micro 4GB USB flash drive shown below.

Note: Number of organizations use to manufacturing Flash Drives for PC among which Sony, Samsung, Transcend, SanDisk are famous

I/O DEVICES

Apart from passive memory devices, there are certain controllers in the system, which assist the CPU in performing various operations. These are referred to as I/O devices. These devices include Interrupt controller, Timer, Ports, DMA Controller, Floppy Drive Controller, CRT Controller etc.

Buses & Expansion Slots

These are the means through which communication between various devices of the computer takes place and the types are as mentioned below. Used to add / improve functionality to the computer

MCA BUS (Micro Channel Architecture BUS)

Micro Channel Architecture was a proprietary 16 or 32-bit parallel computer bus introduced by IBM in 1987 which was used on PS/2 and other computers until the mid-1990s. In IBM products, it superseded the ISA bus and was itself subsequently superseded by the PCI bus architecture. MCA bus is available either in 16 bit or 32 bit

versions. It was developed in a new line of computers called the PS/2 (personal system 2).

EISA BUS

EISA has a 32-bit Address and Data bus and 10MHZ CLK speed. **Extended Industry Standard Architecture** (in practice almost always shortened to **EISA** and frequently pronounced "eee-suh") is a bus standard for IBM PC compatible computers. It was announced in September 1988 by a consortium of PC clone vendors as a counter to IBM's use of its proprietary Micro Channel architecture (MCA) in its PS/2 series.

VL BUS / VESA LOCAL BUS

The **VESA Local Bus** (usually abbreviated to **VL-Bus** or **VLB**) was mostly used in personal computers. VESA (**Video Electronics Standards Association**) Local Bus worked alongside the ISA bus; it acted as a high-speed conduit for memory-mapped I/O and DMA, while the ISA bus handled interrupts and port-mapped I/O. It is a 32-bit bus which was positioned local to the CPU and hence its name. Therefore it could support high bus speeds (that of the CPU).

PCI BUS

PCI has many benefits over other bus types. First of all, it supports 64 bit and 32-bit data paths. So it can be used both for 486 and Pentium based systems. PCI can run up to 33MHZ speed and has the advantage of being isolated from the CPU. INTEL developed this bus.

PCMCIA: (PC Memory Card International Association)

The PCMCIA was first designed for expanding the memory in small, handled computers. PCMCIA'S bus width is only 16 bits, but a 32-bit version is on its way.

There are three types of cards namely - Type 1 (3.3 m thick) - used for memory card.- Type 2 (5 mm thick)- used for modem and LAN adapter.- Type 3 (10.5 mm0 thick) - used for most common applications like PC hard disk Cards.

ADD ON CARDS or Expansion Cards: Used to add / improve functionality to the computer. These are cards plugged on to the main board, the mother board (The one that houses the CPU & RAM / ROM Bios). Each performs specific functions of interfacing the Motherboard to peripheral device like mouse, Monitor etc. Some Add-ons are discussed below.

Sound Card: Used to input and output sound under program control. Sound cards provide better sound quality than the built in sound control provided with most computers. Figure of Sound Card shown below but nowadays sound cards exists in built-in present day Motherboard. Figure of Sound Card shown here.



Display Adapter:

These interface the main board or Motherboard with the monitor and there are several types of cards. The variations are in resolution, number of colors supported. Used to convert the logical representation of an image to a signal that can be used as input for a monitor. Figure of Display card shown below but nowadays Display card exists built-in with latest (present) day Motherboard. The figure of Display card shown here.



Network Card:

A **Network Card** also known as a **network interface card (NIC)**, (or **network adapter or LAN adapter**) is a computer hardware component that connects a computer to a computer



network. It is used to provide a computer connection over a network. Transmit data at 10/100/1000 Mb/s. Realtech is one of famous manufacturer of NIC. Figure of **Network Card** is shown here.

PCI Express (Peripheral Component Interconnect Express)

It is new generation of graphics cards, officially abbreviated as **PCIe**. Most computer use the PCI-express graphic card now.

EGA (Enhanced Graphics Adapter)

The **Enhanced Graphics Adapter (EGA)** is an IBM PC computer display standard specification. EGA produces a display of 16 simultaneous colors from a palette of 64 at a resolution of up to 640×350 pixels (640 X 350 modes). The EGA card includes a 16 kb ROM to extend the system BIOS for additional graphics functions.

VGA (Video Graphics Adapter)

Advanced versions of SVGA / TVGA which start from a resolution of 640 X 480 pixel PCs usually use a **VGA (Video Graphics Array)** analog connector (also known as a D-Sub connector) that has 15 pins in three rows. Because a VGA (analog) connector does not support the use of digital monitors, the Digital Video Interface (DVI) standard was developed. Typically blue in color. Figure of VGA Adapter shown here.



AGP (Accelerated Graphics Port)

Introduced in the Celeron / P II based systems, this caters to the demanding multimedia applications with its high performance. The **Accelerated Graphics Port** is a high-speed point-to-point channel for attaching a video card to a computer's motherboard, primarily to assist in the acceleration of 3D computer graphics. Originally it was designed as a successor to PCI type connections since 2004.

Ports: PORTS are used for connecting peripheral devices to your computer, which are described in detail in below.

SERIAL PORT



Communication external to the computer is done serially (bit after bit) through this port. It is used to connect communication devices like mouse, modem etc. Often used to connect an older mice, older external modems and older digital cameras, etc, to the computer. The serial port has been replaced by USB in most cases 9-pin connector. Small and short, often gray in color. Transmits data at 19 Kb/s. Figure of **SERIAL PORT** shown here.

PARALLEL PORT

8 Bit data transfer takes place between the computer and an external device. It is typically used to connect a printer. Most often used to connect a printer to the computer. 25-pin connector. Long and skinny, often pink in color. Transmits data at 50-100 Kb/s. Figure of **SERIAL PORT** shown here.



USB PORT



Universal Serial Bus now used to connect almost all peripheral devices to the computer. USB 1.1 transmits data at 1.5 Mb/s at low speed, 12 Mb/s at full speed. USB 2.0 transmits data at 480 Mb/s. Figure of **USB PORT** shown here.

GAME PORT: It is used to connect a joystick for playing games. IDE (Integrated/Intelligent Drive Electronics) Interface: This interface is used to communicate with IDE Hard disks.

Fire wire / IEEE 1394 Port: Often found on Apple Computers. Often used with digital camcorders. Fire wire transmits data at 400 Mb/s. Fire wire 1394B (the new fire wire) transmits data at 3.2 Gb/s. Figure of **Fire wire / IEEE 1394 Port** shown **here**.



PS/2 Port: Sometimes called a mouse port was developed by IBM. It is used to connect a computer mouse or keyboard. Most computers come with two PS/2 ports. Figure of **PS/2 Port** shown **here**.



Ethernet Port: This port is used for networking and fast internet connections. Data moves through them at speeds of either 10 megabits or 100 megabits or 1 gigabit (1,000 megabits) depending on what speed the network card in the computer supports. Little monitor lights on these devices flicker when in use. Figure of **Ethernet Port** shown **here**.



MODEL QUESTIONS

1. Personal computer hardware are ----- components. (**physical**)
2. A Power Supply Unit converts alternating current (AC) into low-voltage **DC power**.
3. ----- is a circuit board that allows the CPU to interact with other parts of the computer (**Motherboard**)
4. ----- is used to store information. (**Memory**)

5. CPU or Processor is the ----- of any computer. **(brain)**
6. There are two memory types – One is RAM and another is **ROM**
7. RAM is ----- (non-permanent). **(volatile memory)**
8. DRAM (Dynamic RAM) is similar to a **capacitor**.
9. SRAM (Static RAM) is used as ----- memory. **(CACHE)**
10. DDR has doubles the rate of data transfer of standard **SDRAM**
11. ROM can be programmed using a programmer and then it acts as a ----- device. **(read only)**
12. Floppy drives replace ----- flash drive is re-writable and holds memory without a power supply. **(Flash drive)**
13. ----- is a computer hardware component that connects computer to a computer network. **(Network Card)**
14. ----- sometimes called a mouse port, was developed by IBM **(PS/2 PORT)**
15. ----- devices are required for users to communicate with the computer. **(Input / Output)**

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