Chapter-1

Inside the PC: Core Components

DEFINITION OF COMPUTER

- A computer is a programmable machine that receives input, manipulates and provides output in a useful format.

- Computers are machines that perform tasks or calculations according to a set of instructions, or programs. The first fully electronic computers, introduced in the 1940s, were huge machines that required teams of people to operate.

Hardware, Software and Firmware

- **Hardware :**

  - The **physical components** of computers are called hardware such as input devices, output devices, processing devices, memory devices etc.

  - It provides support to software for proper functioning.

  - Registers, CPU, Hard Disk, Floppy Disk, Printers, and Mouse etc which are touchable, visible, replaceable electromechanical and electronic part of computer are hardware.

FIGURE 1-7
Typical computer hardware.

Hardware, Software and Firmware

- **Software :**

- Software is the **collection of program and other associated documents** that helps to control, manage and integrate the components of computer system to accomplish a specific task.

- It is a **non-touchable, viable set of instructions** coded in computer languages. It is a vital part of computer, without it computer is nothing.

- Examples are operating system, compiler and interpreter, application software etc.

Hardware, Software and Firmware

- **Firmware :**

- Firmware is a **pre-written program** that is stored in ROM.

- It configures the computer and not easily modified by users.

- The instructions coded in BIOS (Basic Input Output Service) are example of Firmware. Firmware ROM contains loader program to load a program into memory.

History of Computer

- Computers can be divided into five generations depending upon the technologies used. These are:

Generation & Description
First Generation The period of first generation: Vacuum tube based.
Second Generation The period of second generation: Transistor based.
Third Generation The period of third generation: Integrated Circuit based.
Fourth Generation The period of fourth generation: VLSI microprocessor based.
Fifth Generation The period of fifth generation: ULSI microprocessor based

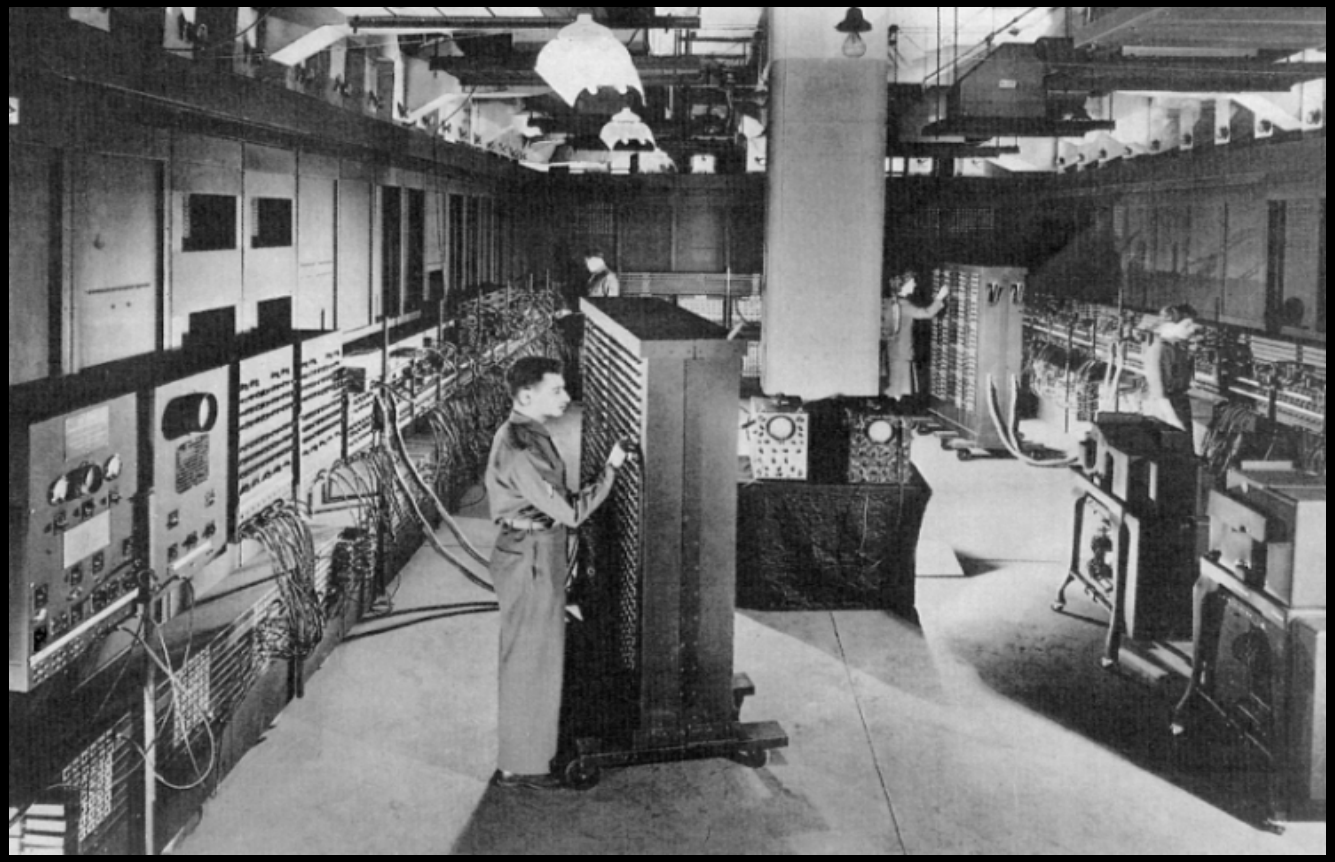
History of Computer

- **First Generation (1942 – 1955):**

  - The **vacuum tube technology** was used in first-generation computers.

  - Mark-1m, ENIAC, EDSAC, EDVAC, UNIVAC-1 etc. machines belong to the first generation of computers.

  - The **machine language** only was used in first-generation computers.



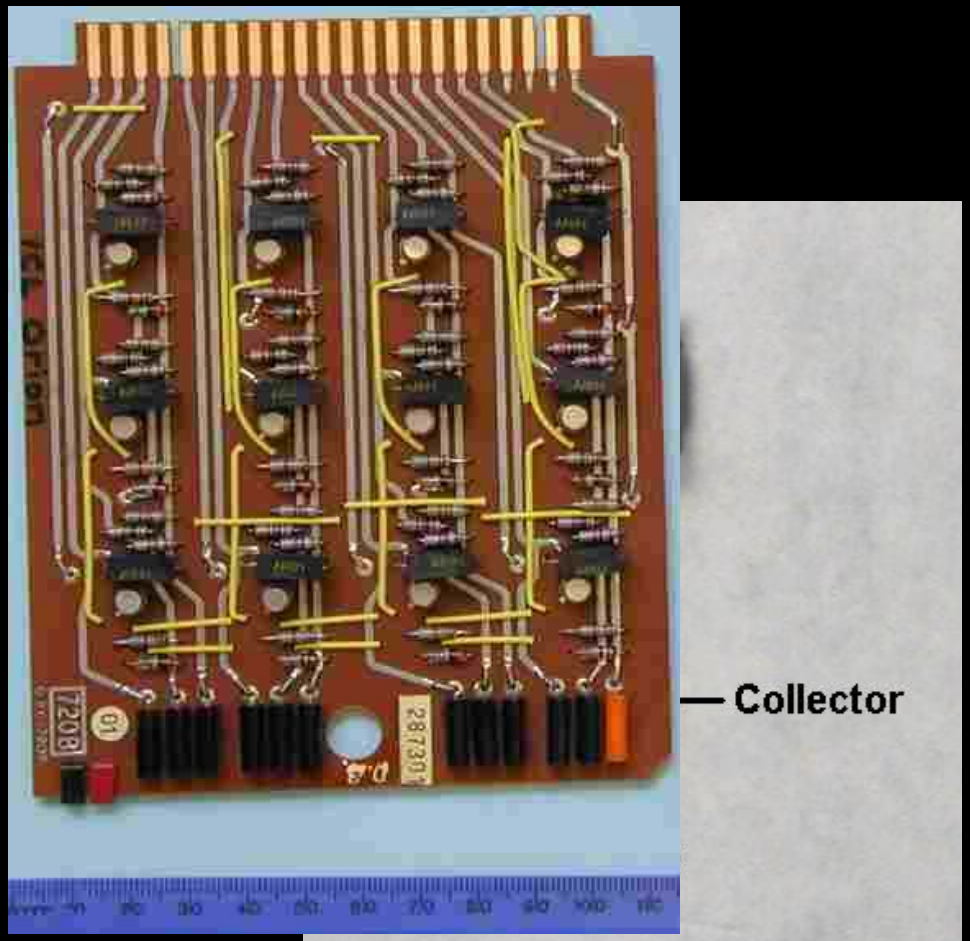
History of Computer

- **Second Generation (1955 – 1964):**

  - The **transistor technology** was used in second-generation computers.

  - The transistor is smaller in size and more reliable than vacuum tube.

  - The programming **assembly language** was also introduced in second-generation of computers.

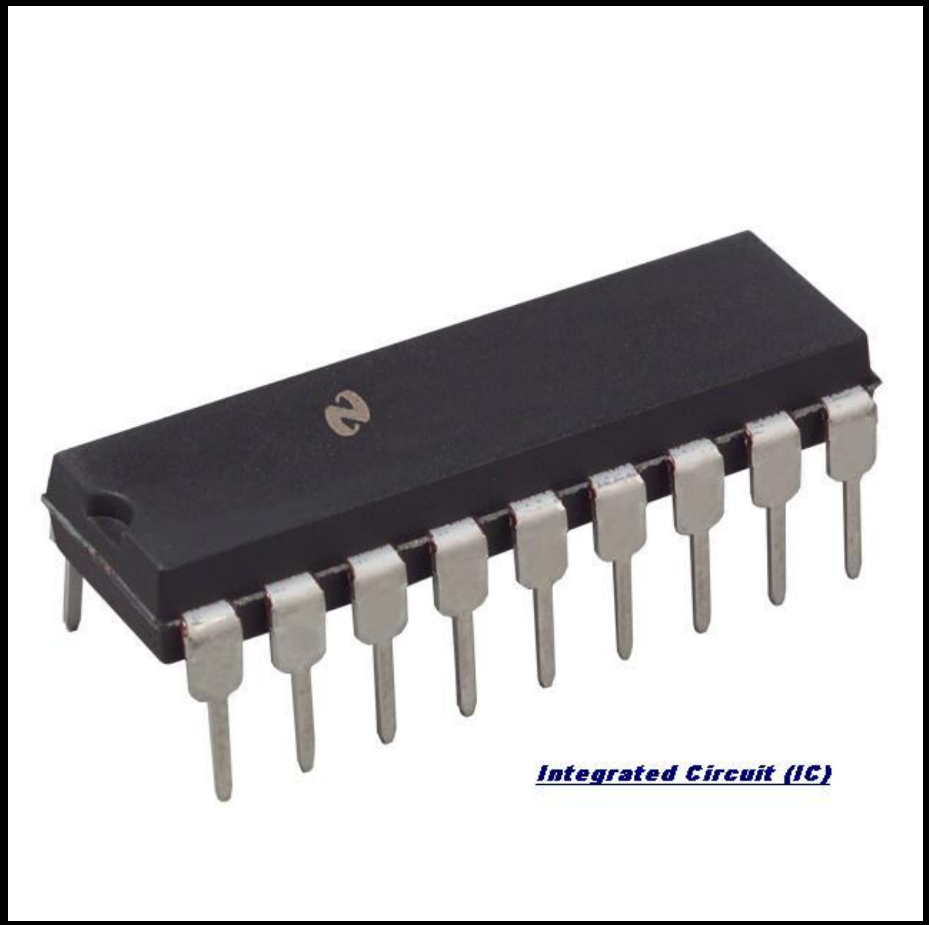

Collector

History of Computer

- **Third Generation (1964 – 1975):**

  - The IC (Integrated Circuits) technology was used in third-generation computers.

  - In a small IC chip (5 mm square size) a circuit is designed having large number of electronic components like transistors, capacitors, diodes, resistors etc.



Integrated Circuit (IC)

History of Computer

- **Fourth Generation (1975 onwards):**

  - The **microchip technology** was introduced in fourth-generation of computers.

  - With the advancement in IC technology, LSI (Large Scale Integration) chips were developed.

  - After LSI, the VLSI (Very Large Scale Integration) was developed and the development of microprocessor possible. Using VLSI technology, the entire CPU is designed on a single silicon chip.


IBM

History of Computer

- **Fifth Generation (In Progress):**

  - The main drawback of first to fourth generation computers is that the computers have not their own **thinking power**. These are totally depending upon the instructions given by the users.

  - Fifth generation computers are supposed to be the ideal computers, but do not exist. The scientists are working to design such computer.


Artificil
Intelligence

CLASSIFICATION OF COMPUTER

- Computers can be classified in the following categories:

1. Mainframe Computers
2. Minicomputers
3. Microcomputers
4. Supercomputers

CLASSIFICATION OF COMPUTER

1. Mainframe Computers

Mainframe computers are very large, often filling an entire room. They can store enormous of information, can perform many tasks at the same time, can communicate with many users at the same time, and are very expensive.


Blue Gene/P

CLASSIFICATION OF COMPUTER

2. Minicomputers

Minicomputers are much smaller than mainframe computers and they are also much less expensive.

- They possess most of the features found on mainframe computers, but on a more limited scale. They can still have many terminals, but not as many as the mainframes. They can store a tremendous amount of information, but again usually not as much as the mainframe.

CLASSIFICATION OF COMPUTER

3. Microcomputers

- Microcomputers are the types of computers we are using.
- These computers are usually divided into desktop models and laptop models.

- They are terribly limited in what they can do when compared to the larger models discussed above because they can only be used by one person at a time, they are much slower than the larger computers, and they can not store nearly as much information, but they are excellent when used in small businesses, homes, and school classrooms.

Microcomputer Types

Desktop

Desktop computers are small enough to fit on top of or alongside a desk yet are too big to carry around

Notebook or Laptop

Notebook computers, also known as laptop computers, are portable, lightweight, and fit into most briefcases

Tablet PC

A tablet PC is a type of notebook computer that accepts your handwriting. This input is digitized and converted to standard text that can be further processed by programs such as a word processor.

Netbooks

Netbooks Its like laptops, but Smaller Lighter Less expensive

Handheld

Are the smallest and are also known as palm computers. These systems typically combine pen input, writing recognition, personal organizational tools, and communication capabilities

Media center system units

Media center system units blur the line between desktop computers and dedicated entertainment devices

CLASSIFICATION OF COMPUTER

4. Supercomputers

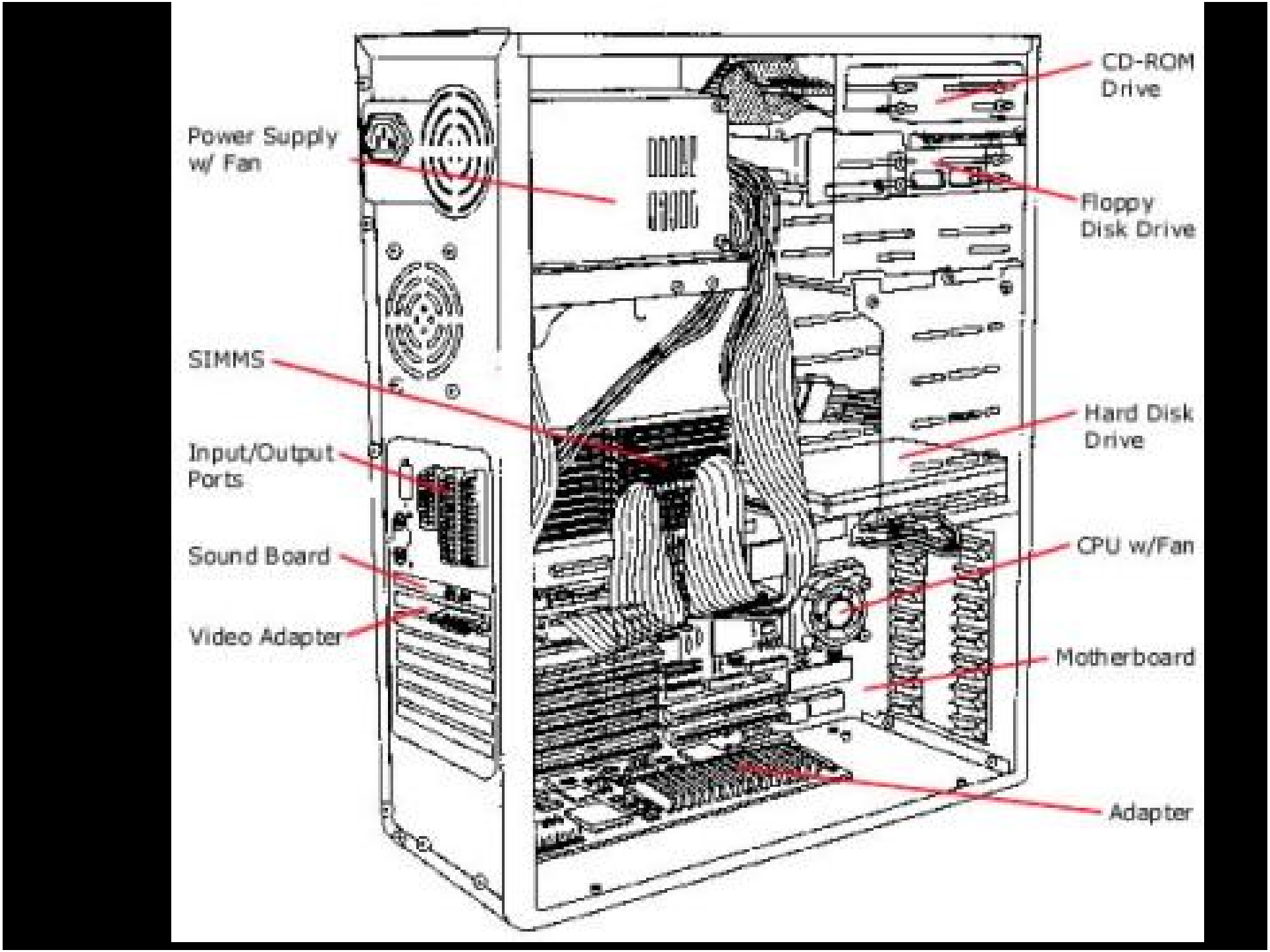
- Supercomputers are very expensive and are employed for specialized applications that require immense amounts of mathematical calculations.
- For example, weather forecasting requires a supercomputer. Other uses of supercomputers include animated graphics, fluid dynamic calculations, nuclear energy research, and petroleum exploration.

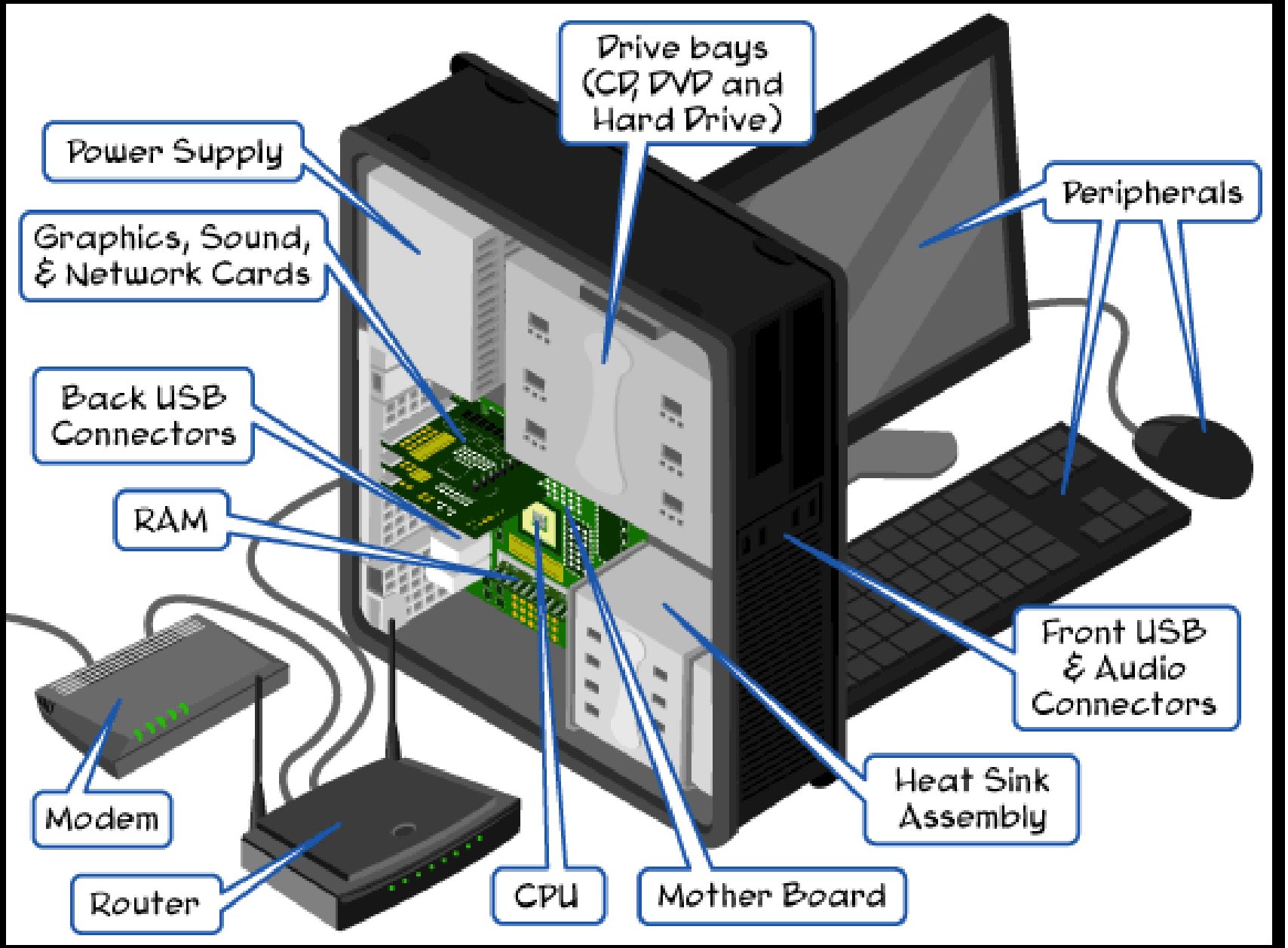

ПЛАТФОРМЫ

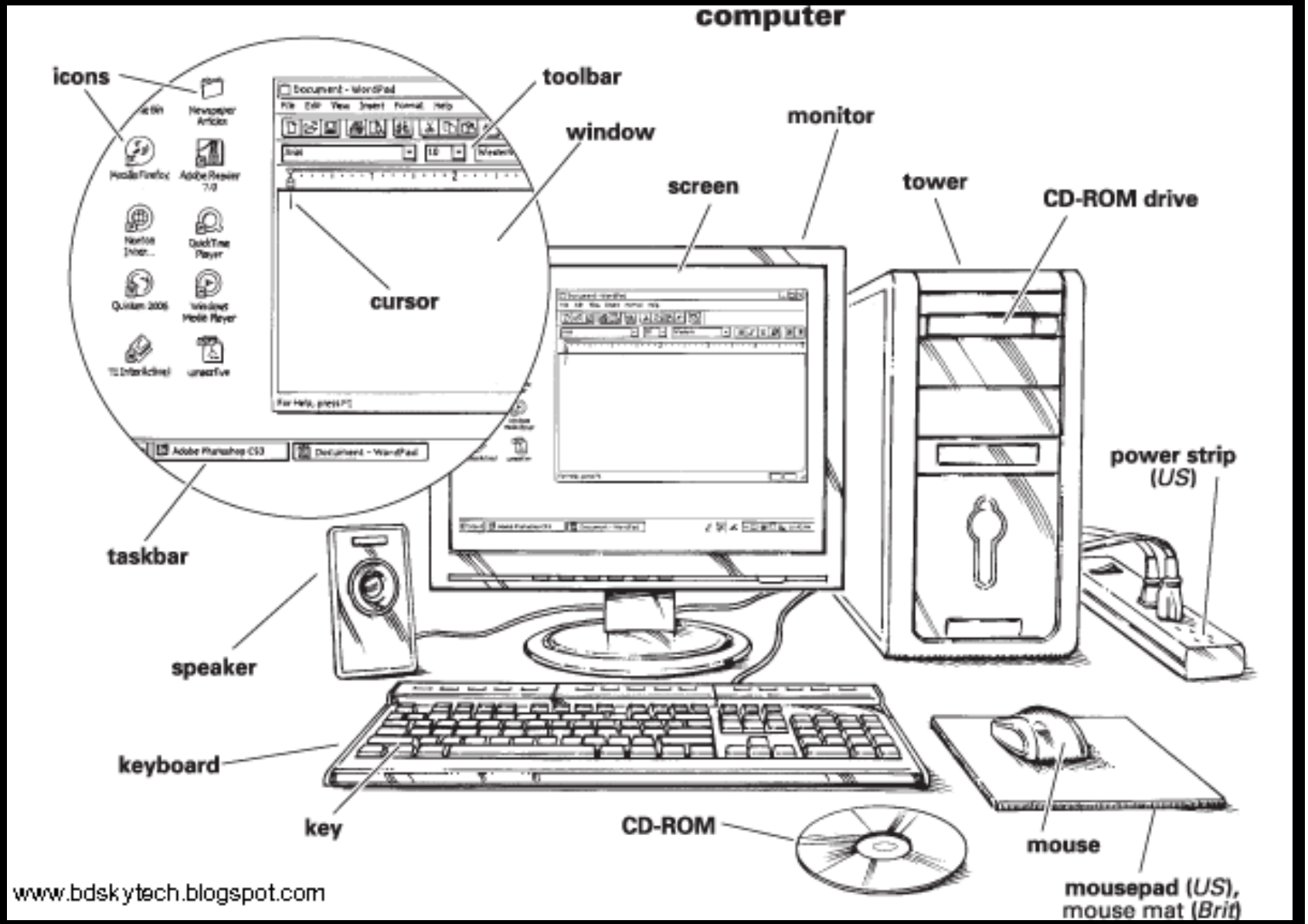
PC Configuration

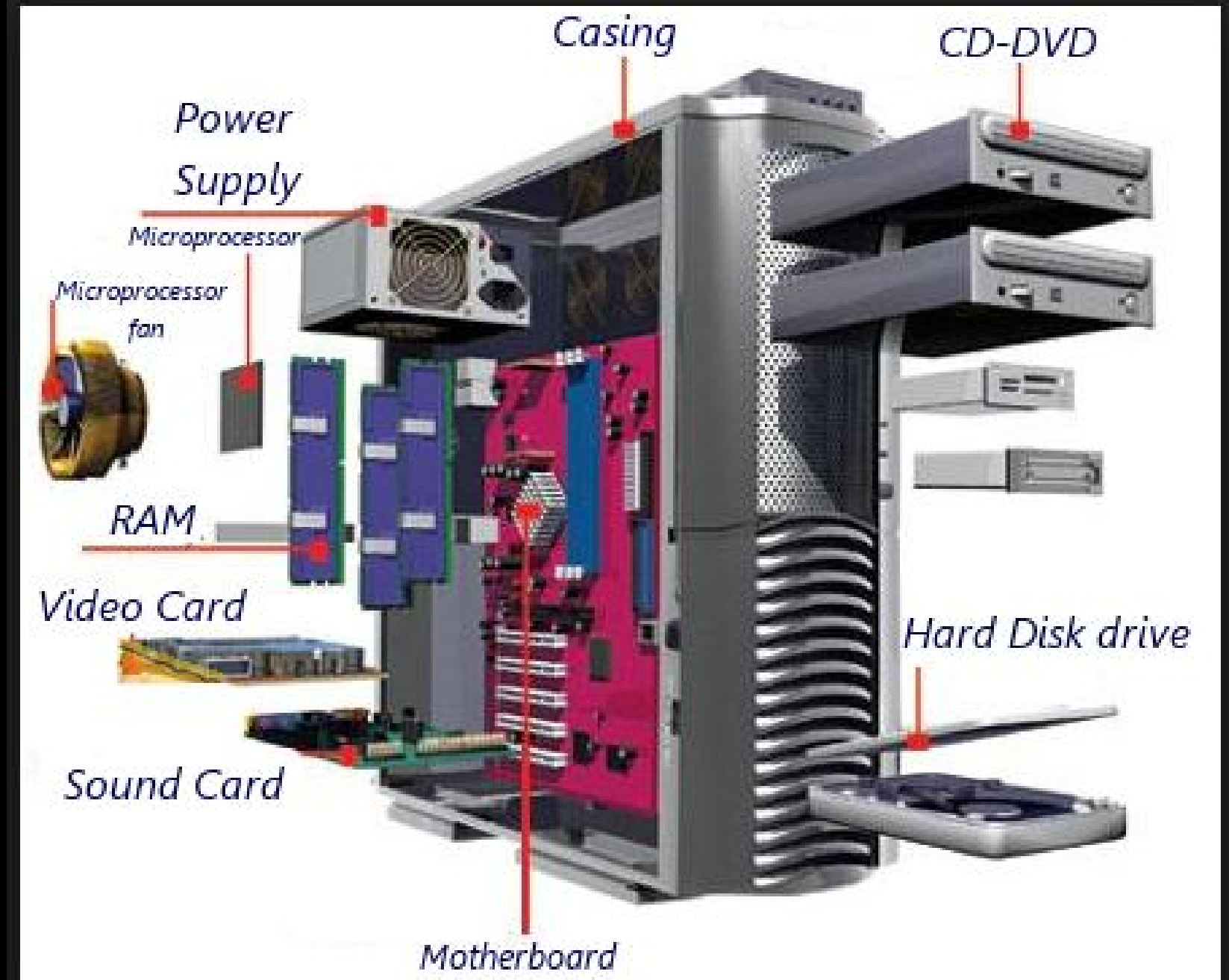
The basic components of a computer are:

- Microprocessor: Central Processing Unit
- Power Supply
- Motherboard
- Memory Module
- Storage Devices: HD,FD and CD-Drive
- Input Unit (Keyboard & Mouse)
- Output Unit (Monitor)
- Printer


Power Supply
w/ Fan
SIMMS
Input/Output
Ports
Sound Board
Video Adapter
CD-ROM
Drive
Floppy
Disk Drive
Hard Disk
Drive
CPU w/Fan
Motherboard
Adapter


Drive bays (CD, DVD and Hard Drive)
Power Supply
Graphics, Sound, & Network Cards
Peripherals
Back USB Connectors
RAM
Front USB & Audio Connectors
Heat Sink Assembly
Modem
Router
CPU
Mother Board


computer
icons
toolbar
window
monitor
screen
tower
CD-ROM drive
cursor
power strip
(US)
taskbar
speaker
keyboard
key
CD-ROM
mouse
mousepad (US),
mouse mat (Brit)
www.bdskytech.blogspot.com


Casing
CD-DVD
Power
Supply
Microprocessor
Microprocessor
fan
RAM
Video Card
Hard Disk drive
Sound Card
Motherboard

Label the internal components of a computer system.

Drag each letter to the circle of the picture that matches the definition. Press the Submit button to see your score.








(A) Memory. Electronic components that store instructions while they are being processed by the CPU.

(B) Power Supply. Unit that provides electrical power to the electronic components of the computer.

(C) Floppy Disk Drive. Device used to read and write to floppy diskettes.

(D) CPU. Central Processing Unit. The component that interprets instructions for operating the computer.

(E) Video Card. Electronic device that outputs data to the monitor or CRT.

(F) Hard Disk. Storage device containing multiple platters that store magnetic data.

(G) CD/DVD. Optical storage disc. Uses lasers to write data on the disc.

(H) Audio Card. Electronic device that outputs audio signals to the speakers.

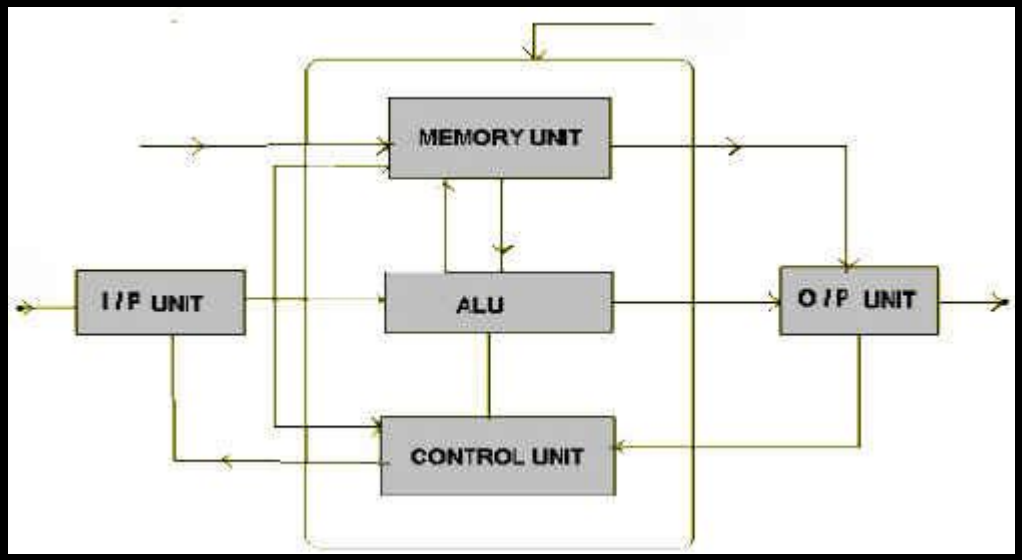
RESET

SUBMIT

Score: 0

BASIC PARTS OF COMPUTER

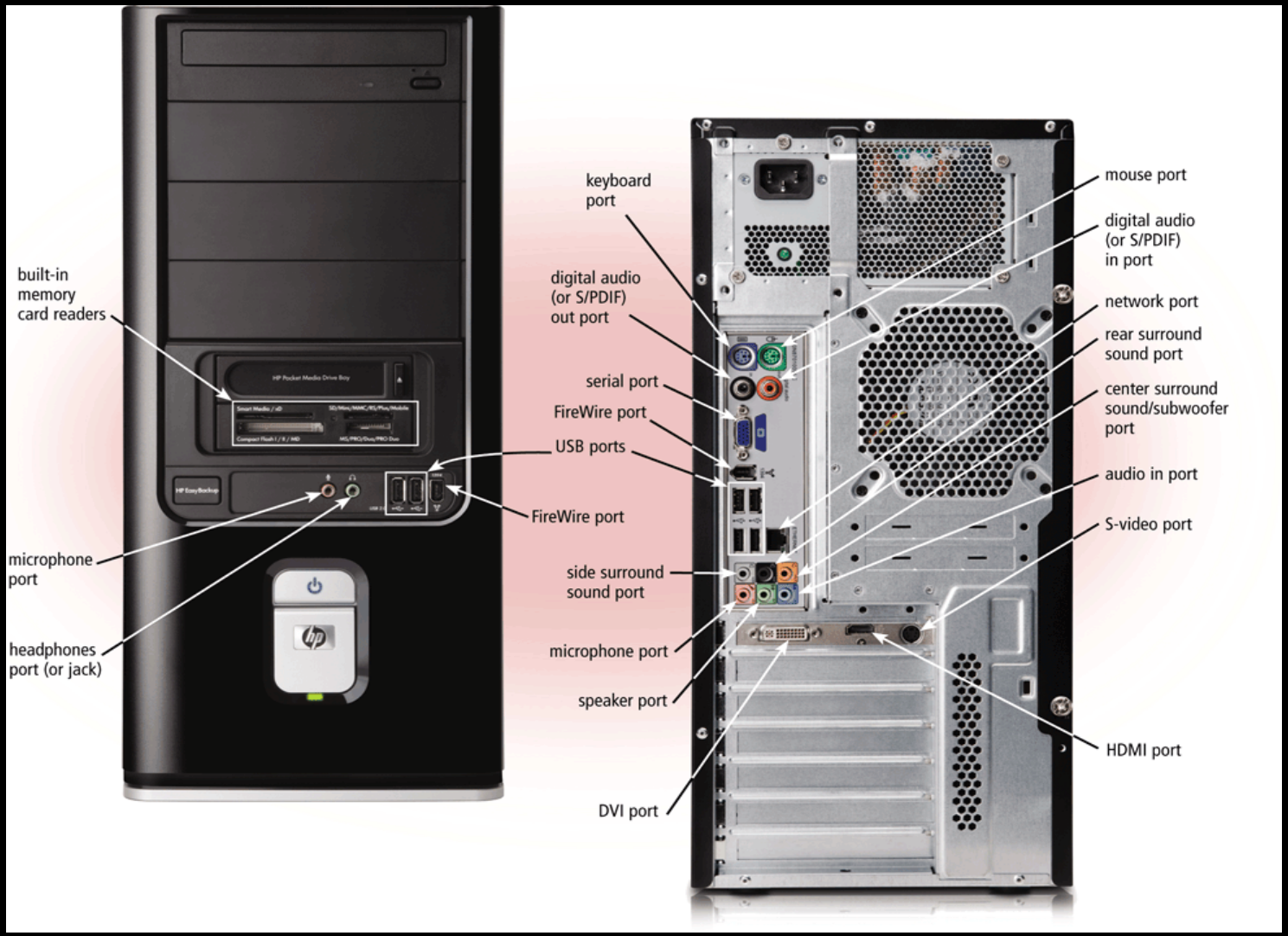
These are shown in figure:

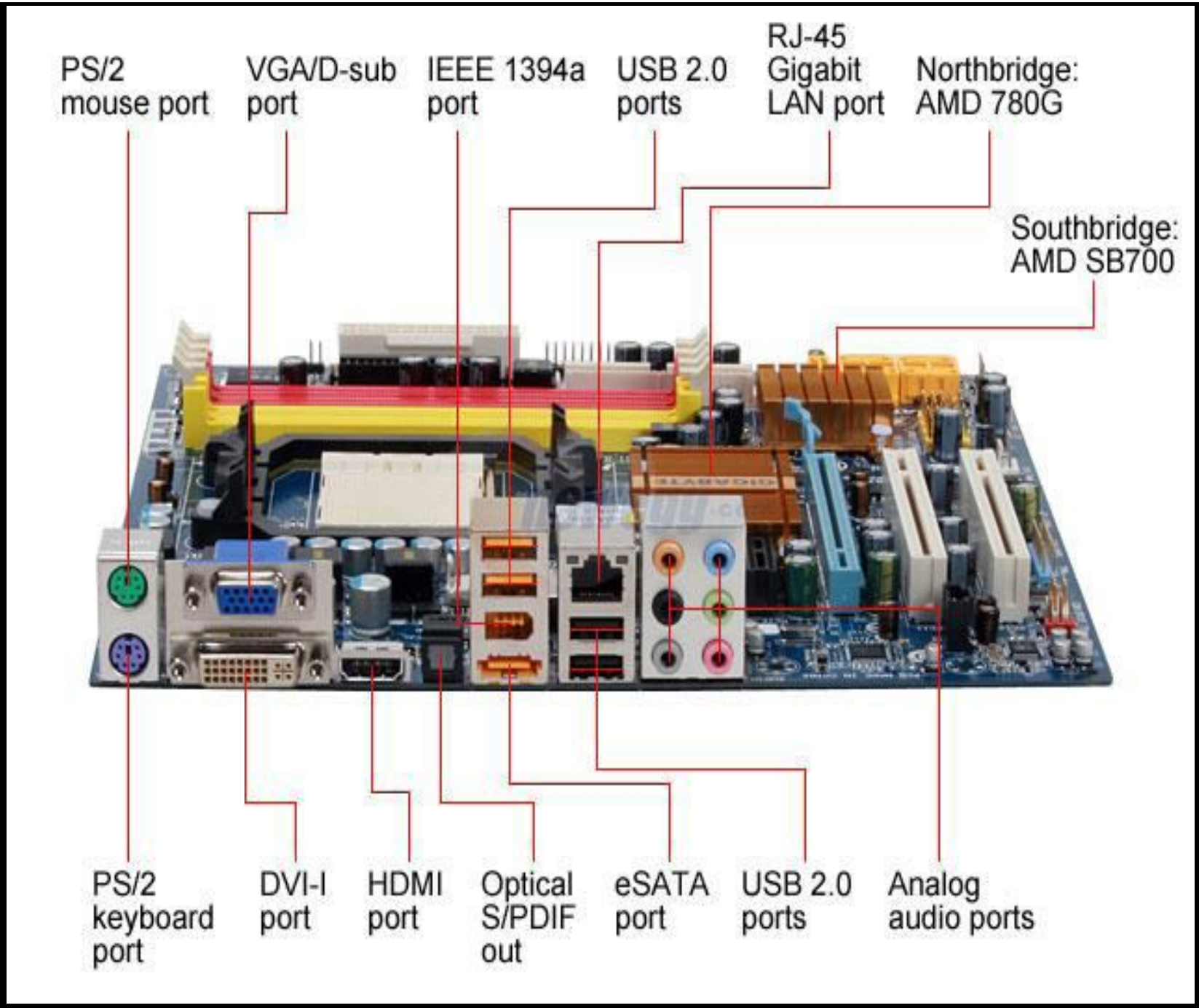


General Faults of Computer Sys.

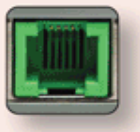
- Computer is not starting, Nothing displays on the screen.
- Opening more than one window, causes the system to hang.
- Keyboard do not give any response.
- Mouse do not give any response.
- Printer is not printing.
- The network doesn’t seem to work.
- The computer starts partially.
- The computer is unable to connect to internet.

Identify various types of ports and its connecting devices




PS/2 mouse port
VGA/D-sub port
IEEE 1394a port
USB 2.0 ports
RJ-45 Gigabit LAN port
Northbridge: AMD 780G
Southbridge: AMD SB700
PS/2 keyboard port
DVI-I port
HDMI port
Optical S/PDIF out
eSATA port
USB 2.0 ports
Analog audio ports

Port Types

Type	Picture	Type	Picture	Type	Picture
Audio in		HDMI port		Serial	
Cable TV		Headphones		Side surround sound	
Center surround sound/subwoofer		Keyboard		S/PDIF in	
Composite video in		Microphone		S/PDIF out	
Digital Video Interface (DVI)		Monitor		Speaker	
eSATA port		Mouse		S-video	
FireWire		Network		Telephone line in	
FM reception		Rear surround sound		USB	

TYPES OF MOTHERBOARD

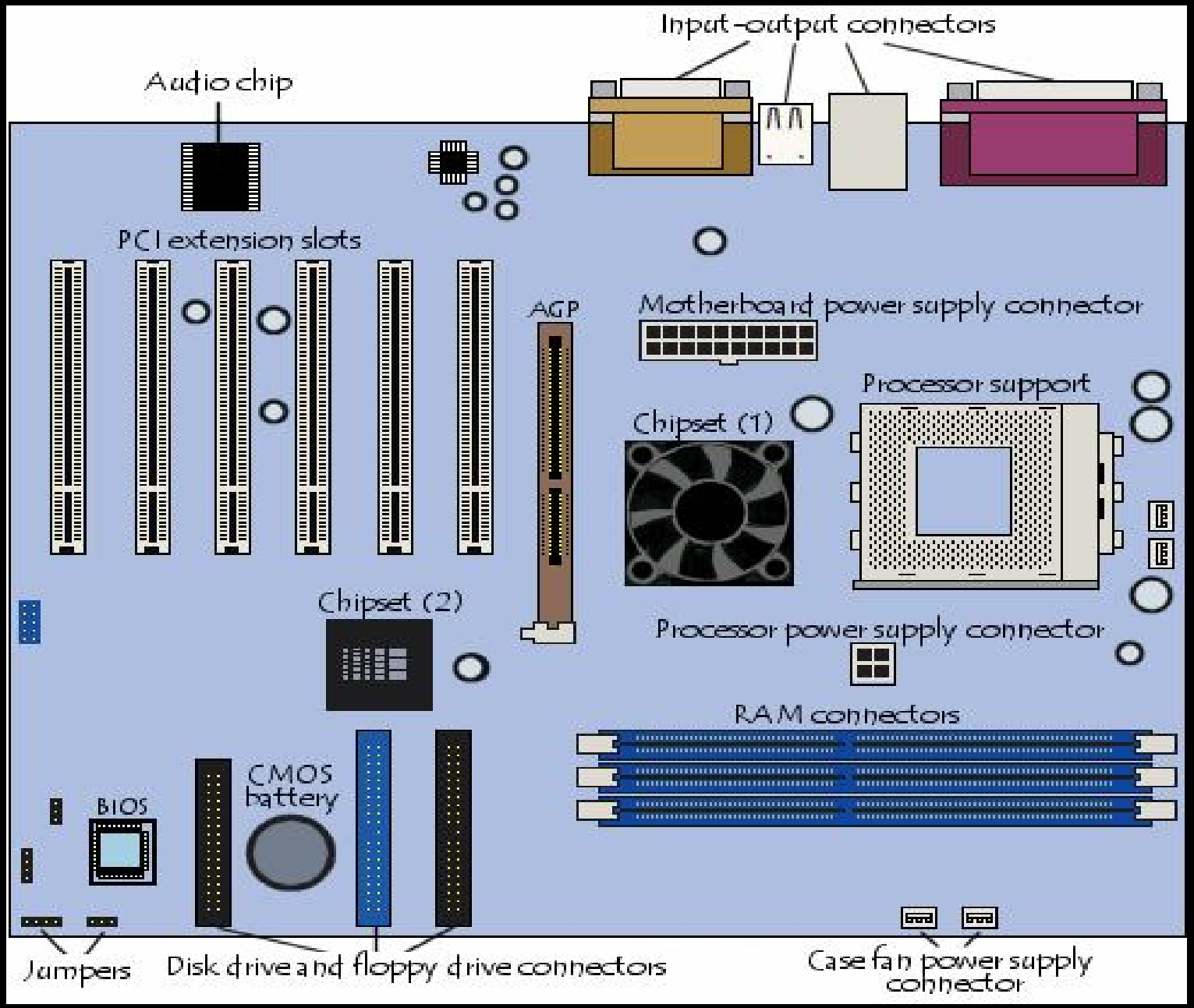
- **Motherboard:** A computer motherboard is nothing but **the circuit board or the circuit** which controls the entire functioning of the computer.

- All the components that form the computer are connected to the motherboard.

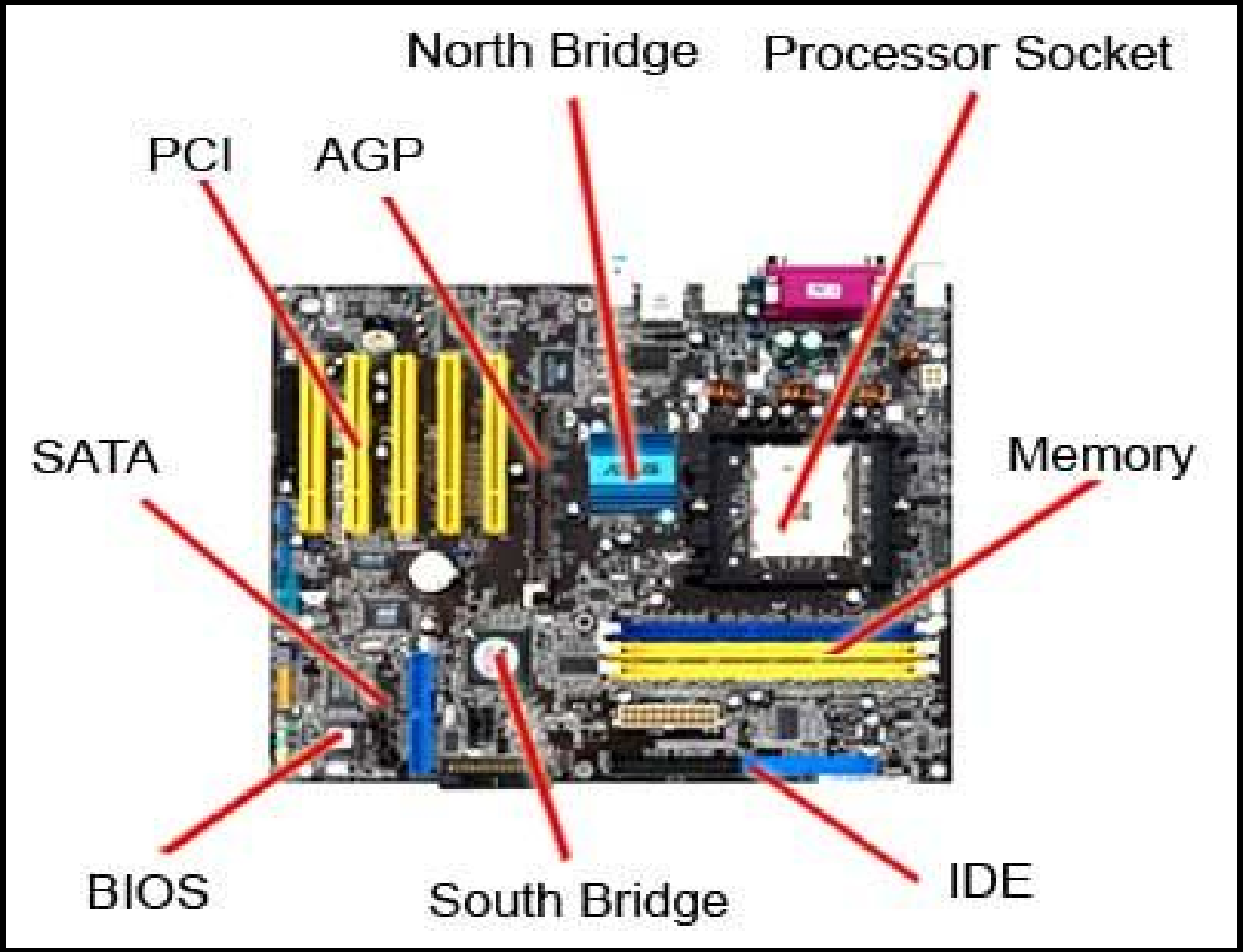
- The computer processor, which is the most important component, is mounted on the motherboard. All other components like the computer keyboard, computer monitor, computer mouse, hard drives, etc. are connected to the motherboard through cables.

MOTHERBOARD

Only Draw motherboard layout [3M](Nov-2014)



MOTHERBOARD



Form Factor

- The term "form factor" is normally used to refer to the motherboard's geometry, dimension arrangement, and electrical requirements.

TYPES OF MOTHERBOARD

- Different types of the motherboard based on their Dimensions are:

1. Full AT – Motherboard
2. Baby AT - Motherboard
3. ATX - Motherboard

1. Full AT – Motherboard

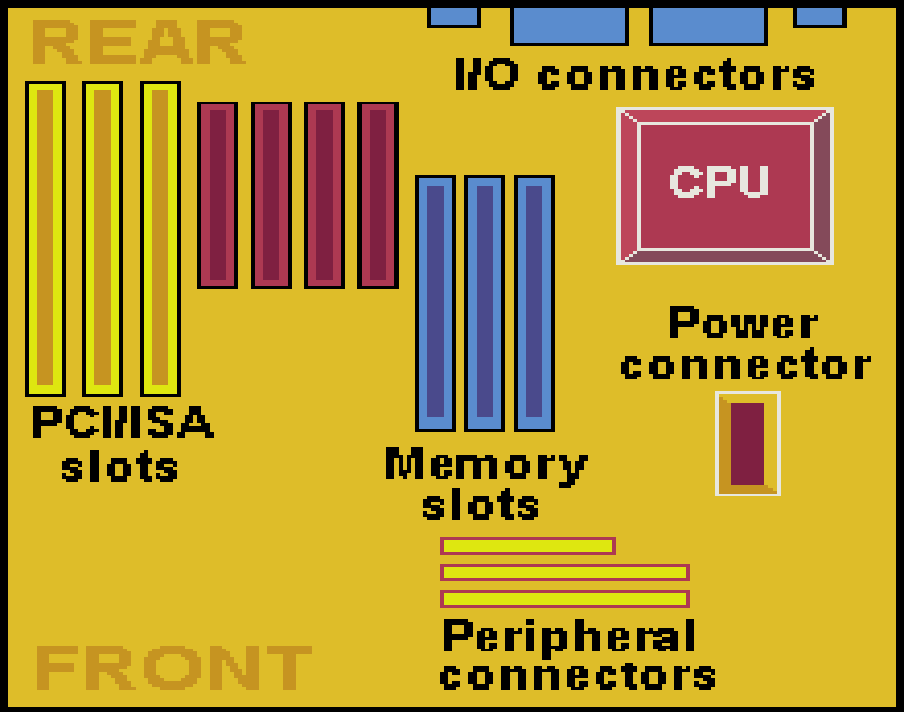
- This was the first type of motherboard, which were **12 inches wide and 11 inches** long.
- This motherboard suffered from a lot of problems like access to component , heating problem.

2. Baby AT – Motherboard

- This motherboard was **10 inches wide and 8.5 inches** long and specially made for classic **Pentium processor.**
- The DIN keyboard connector at the top right corner of this motherboard makes recognizing this motherboard a relatively simple task.

3. ATX – Motherboard

- The ATX (Advanced Technology Extended) motherboard is **20 inches wide and 7.5 inches** long and specially made for **Intel processor.**
- The **i/o ports and USB ports** are directly integrated into the motherboard.

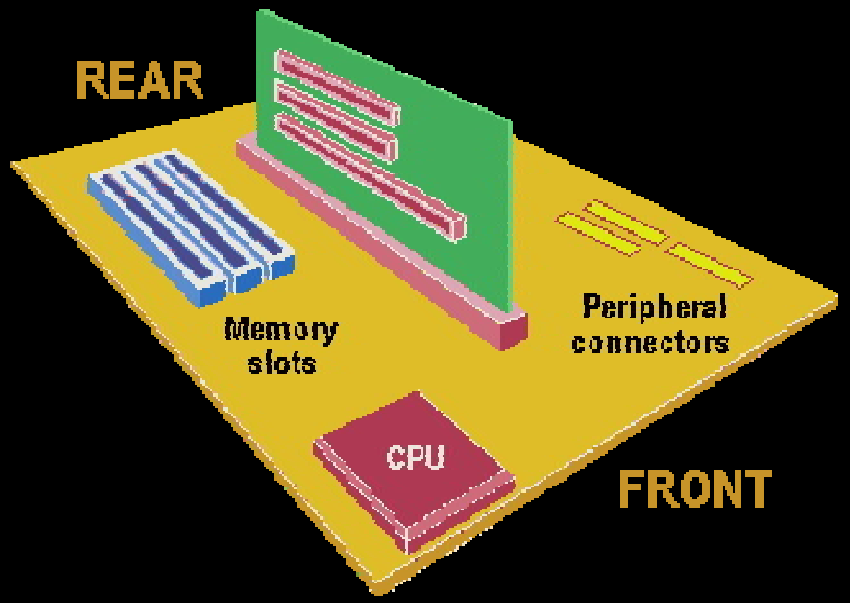


4. LPX – Motherboard

LPX is a motherboard form factor originally developed by Western Digital

The LPX motherboard is 9" wide x 13" deep

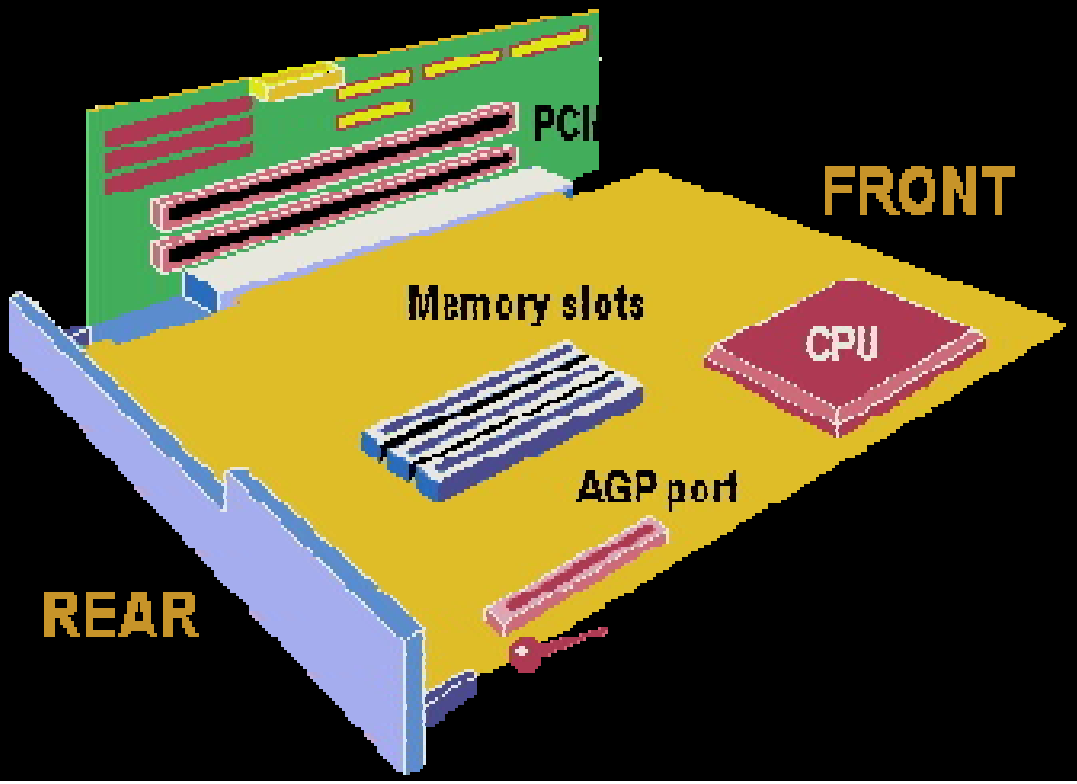
Expansion slots are located on a central riser card, allowing cards to be mounted horizontally.



5. NLX – Motherboard

NLX is a motherboard form factor originally developed by Intel 9" wide x 13.6" deep.

All expansion slots, power cables and peripheral connectors are located on an edge-mounted riser card



6. BTX – Motherboard

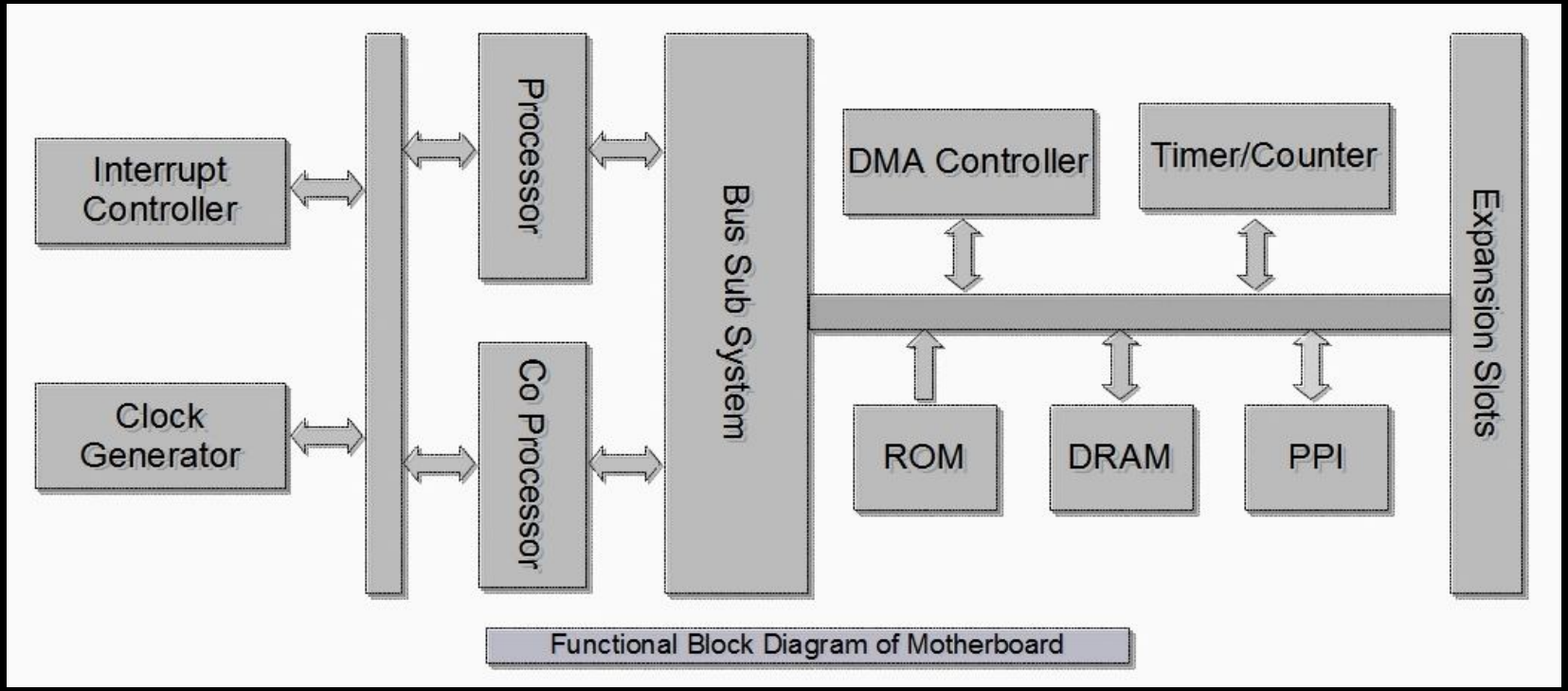
The BTX format (Balanced Technology extended), supported by Intel, is a format designed to improve upon the arrangement of components, so as to optimize air circulation, acoustics, and heat dissipation.

The various connectors (memory slots, expansion slots) are aligned in parallel, in the direction in which air circulates.

BLOCK DIAGRAM

Draw a Functional Block Diagram of Motherboard. [3M](Dec-2015)

- The block diagram of the motherboard is as shown below:



BLOCK DIAGRAM

- Processor:

- The processor is **single integrated circuits** which perform arithmetic as well as logical operations.
- It is also referred as a central processing unit, is a brain of computer.
- The processor having two main section control unit and arithmetic & logical unit (ALU).
- Intel, AMD, Cyrix and VIA are the major processor manufacture company.

BLOCK DIAGRAM

- **Co-Processor :**

- A co-processor is used with the main processor to help the main processor in doing **mathematical operations**.
- The primary advantage of using this chips is to increase the execution speed of the processor.
- It is also known as math processor, numeric co-processor or numeric processor unit.
- In the newer processor the co-processor is build in the main processor chip.

BLOCK DIAGRAM

- **Clock Generator:**

- All the logic elements in the computer are design to operate synchronously.

- This synchronous operation helps the machine keep track of every bit that it can process.

- These timing controls are generated by clock generator’s logic.

BLOCK DIAGRAM

- **Interrupt Controller :**

- The interrupt are useful for pay attention to some critical condition in computer to processor.

- Interrupt are generated to capture the microprocessor's attention and temporarily divert it to a different process.

- The interrupt controller handles the 8 makeable interrupt.

BLOCK DIAGRAM

- **Bus System :**

- Bus is nothing but it is set of wires or track on the motherboard.

- In motherboard from one component to other component information pass through bus.

- There are different buses in the mother board but common are data, address and control bus.

BLOCK DIAGRAM

- DMA Controller :

- To speed up the system performance, the main processor is required to be relieved from time consuming jobs like moving of data from one place to other place.
- The DMA controller handles these tasks separately.
- DMA controller receives the instruction from CPU, it performs the all the operation related to data moving and after the completion of the operation the DMA inform the CPU that operation has been finished.

BLOCK DIAGRAM

- **Timer / Counter Logic :**

- There are three main timers on motherboard:
  - Timer 0: Used to interrupt the processor.
  - Timer 1: Used to generate DMA request signal for performing refresh cycles.
  - Timer 2: Used to generate various tones by the speaker.

BLOCK DIAGRAM

- **ROM & RAM:**

- The PC memory is a block where any bytes of information is directly stored.

- RAM store information temporarily while ROM stores permanently.

- The ROM stores the POST and BIOS information while RAM stores information about processes.

BLOCK DIAGRAM

- **Peripherals Interface :**

- The PPI used to connect all peripheral devices.

- It has a parallel and serial interface to connect the devices.

BLOCK DIAGRAM

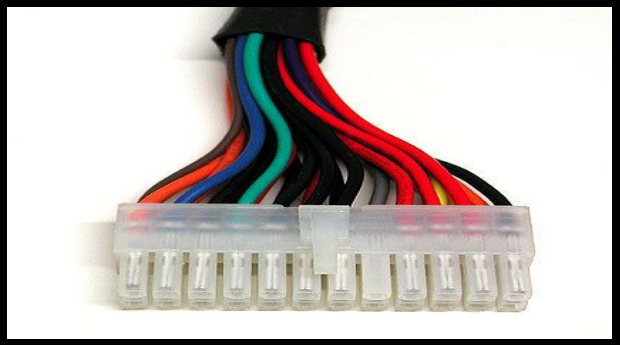
- **Expansion Slots :**

- Expansion slots are long thin connector on the motherboard, near the back of the computer, on which one can connect the expansion cards such as display cards, sound cards, network cards etc.

CONNECTOR

- Many cables and plugs inside the cabinet must be connected to the motherboard.

- These cables and plugs are connected to the motherboard using connectors.

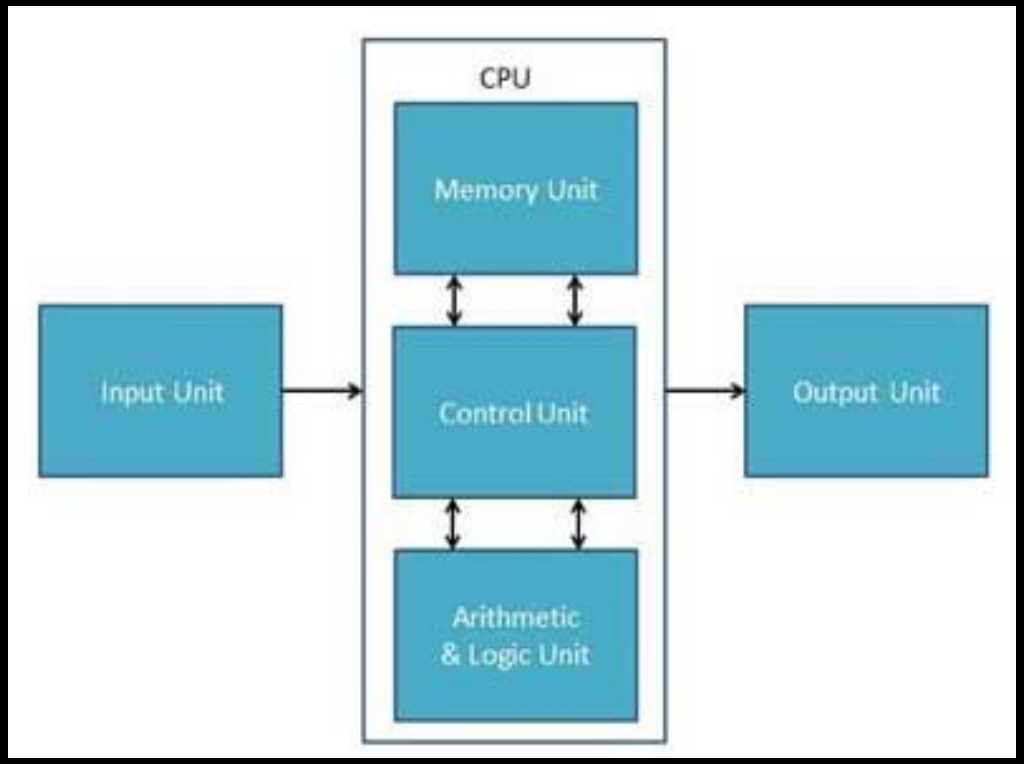


Central Processing Unit (Microprocessor)

- The Central Processing Unit (CPU) is responsible for interpreting and executing most of the commands from the computer's hardware and software.
- CPU is made of chip. A CPU chip is any small electronic device that contains an integrated circuit (IC).

- CPU chips or central processing unit chips are used in digital computers and are the semiconductor component where most calculations take place.
- The CPU attaches directly to a CPU "socket" (or sometimes a "slot") on the motherboard. The CPU is inserted into the socket pin-side-down and a small lever helps to secure the processor.

- CPU (Microprocessor) itself has the following three components.
- Memory or Storage Unit:
- Control Unit
- ALU (Arithmetic Logic Unit)



Arithmetic Logic Unit (ALU)

- There is electronic circuitry in arithmetic logic unit which executes all arithmetic and logical operations.
- The unit can compare numbers, letters, or special characters.
- There can be more than one Arithmetic logic unit in a CPU, and these ALUs can also be used for the purpose of maintaining timers that help run the computer.

Control Unit (CU)

- There is circuitry in the control unit which uses electrical signals to instruct the whole computer system for carrying out or executing, already stored program instructions.
- Its name clearly shows that it controls and co-ordinates computer components.
- In fact it regulates the flow of information through the processor.
- In short, it can be said, this component receives, decodes, stores results and manages execution of data that flows through the CPU.

Registers / TheMemoryUnit

- Registers are temporary storage areas which are responsible for holding the data that is to be processed.
- They store the instructions and data in a processor. This data is further used by Control Unit.
- There are some registers that are set aside for specific tasks; these generally include a program counter, stack, and flags.

PC	CPU's	Year	Number of transistors
1st. Generation	8086 and 8088	1978-81	22.000
2nd. Generation	80286	1984	128.000
3rd. Generation	80386DX and 80386SX	1987-88	250.000
4th. Generation	80486SX, 80486DX, 80486DX2 and 80486DX4	1990-92	1.200.000
5th. Generation	Pentium	1993-95	3.100.000
	IBM/Cyrix 6X86	1996	--
	AMD K5	1996	--
	Pentium MMX	1996-97	--
Improved 5th. Generation	AMD K6 Cyrix 6x86MX	1997	8.800.000
		1997	5.700.000
6th. Generation	Pentium Pro	1996	5.500.000
	Pentium II	1997	7.500.000

CPU Performance Properties

List Features of CPU. Explain any one. [3M](May-2015)

Property	Description
CPU Speed	The number of operations that can be done per second.
Word Size	The largest number that can be operated on in one operation.
Data Path	The largest number that can be transported into chip in one operation
Internal cache Memory	The amount of internal, high speed memory that the chip includes.

CPU Speeds

The speed of a computer is used as a means of measuring how well it operates, the megahertz / gigahertz value of a computer is an important measure of its power.

All other things being equal , a faster clock means faster execution and better performance.

Word Size

- Word size is the number of bits the processor can interpret and execute at a given time.
- Any computer can be programmed to manipulate any size number, but the bigger the number, the longer it takes.
- The largest number that the computer can manipulate in one operation is determined by its word size.

Data path

- Data path is the hardware that performs all the required operations, for example, ALU, registers, and internal buses.
- A data path is a set of functional units that function to process data.
- The central processing unit (CPU) in a computer contains data paths that route data between these functional units. A larger data path can also be created by joining data paths together.

Internal Cache Memory

- Cache memory is a very high speed semiconductor memory, which can speed up CPU.
- It is used to hold those parts of data and program which are most frequently used by CPU.
- The parts of data and programs are transferred from disk to cache memory by operating system, from where CPU can access them.

CISC

- The term "CISC" (complex instruction set computer or computing) refers to computers designed with a full set of computer instructions that were intended to provide needed capabilities in the most efficient way.

The main characteristics of CISC microprocessors are:

- Extensive instructions.
- Complex and efficient machine instructions.
- Micro encoding of the machine instructions.
- Extensive addressing capabilities for memory operations.
- Relatively few registers.

RISC

- RISC or Reduced Instruction Set Computer is a type of microprocessor architecture that utilizes a small, highly-optimized set of instructions

  - Reduced instruction set.
  - Less complex, simple instructions.
  - Hardwired control unit and machine instructions.
  - Few addressing schemes for memory operands with only two basic instructions LOAD and STORE.
  - Many symmetric registers which are organized into a register file.

CISC vs RISC processor

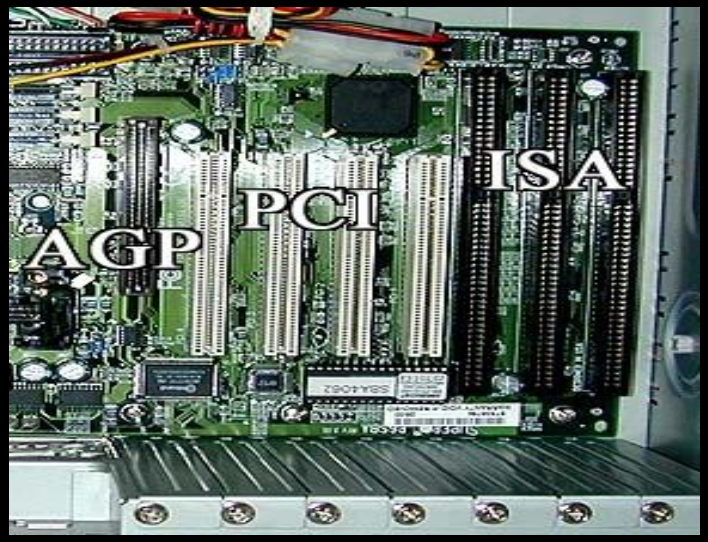
Differentiate CISC vs RISC Processor. [4M](May-2015)

CISC	RISC
Emphasis on hardware	Emphasis on software
Includes multi-clock complex instructions	Single-clock, reduced instruction only
Memory-to-memory: "LOAD" and "STORE" incorporated in instructions	Single-clock, reduced instruction only
Small code sizes, high cycles per second	Low cycles per second, large code sizes
Transistors used for storing complex instructions	Spends more transistors on memory registers

Expansion Buses

- An expansion bus allows various devices to communicate with each other.

It refers to pathways that power, data, and control signals use to travel from one component to another in the computer.



Types of buses/Bus Organization

- Processor Bus: data and control signals to and from processor travel through Memory Bus: data and control signals to and from primary memory (RAM)
- Input Output Bus: data and control signals to and from input and output devices
- An expansion bus allows for computer expansion with the use of an expansion board

Expansion buses architectures

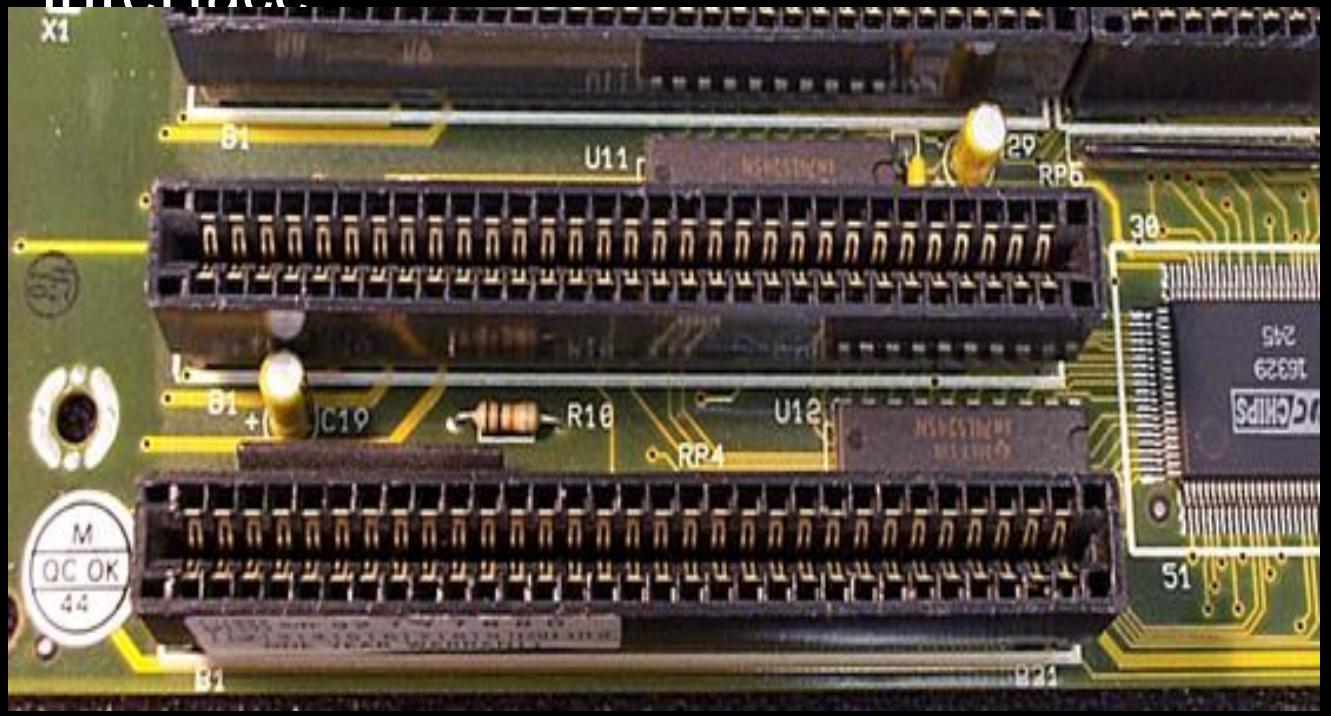
1) PC Bus (8-bit ISA)
2) AT Bus (16-bit ISA)
3) EISA:-Extended Industry Standard Architecture
4) MCA Bus
5) VESA Local (VL) Bus
6) Peripheral Component Interconnect-PCI
7) Accelerated Graphics Port-AGP
8) USB-Universal Serial Bus
9) IEEE 1394 Fire Wire

Explain ISA & PCI bus in brief. [4M](May-2015)

List bus standard and explain any one in detail. [4M](Nov-2014)

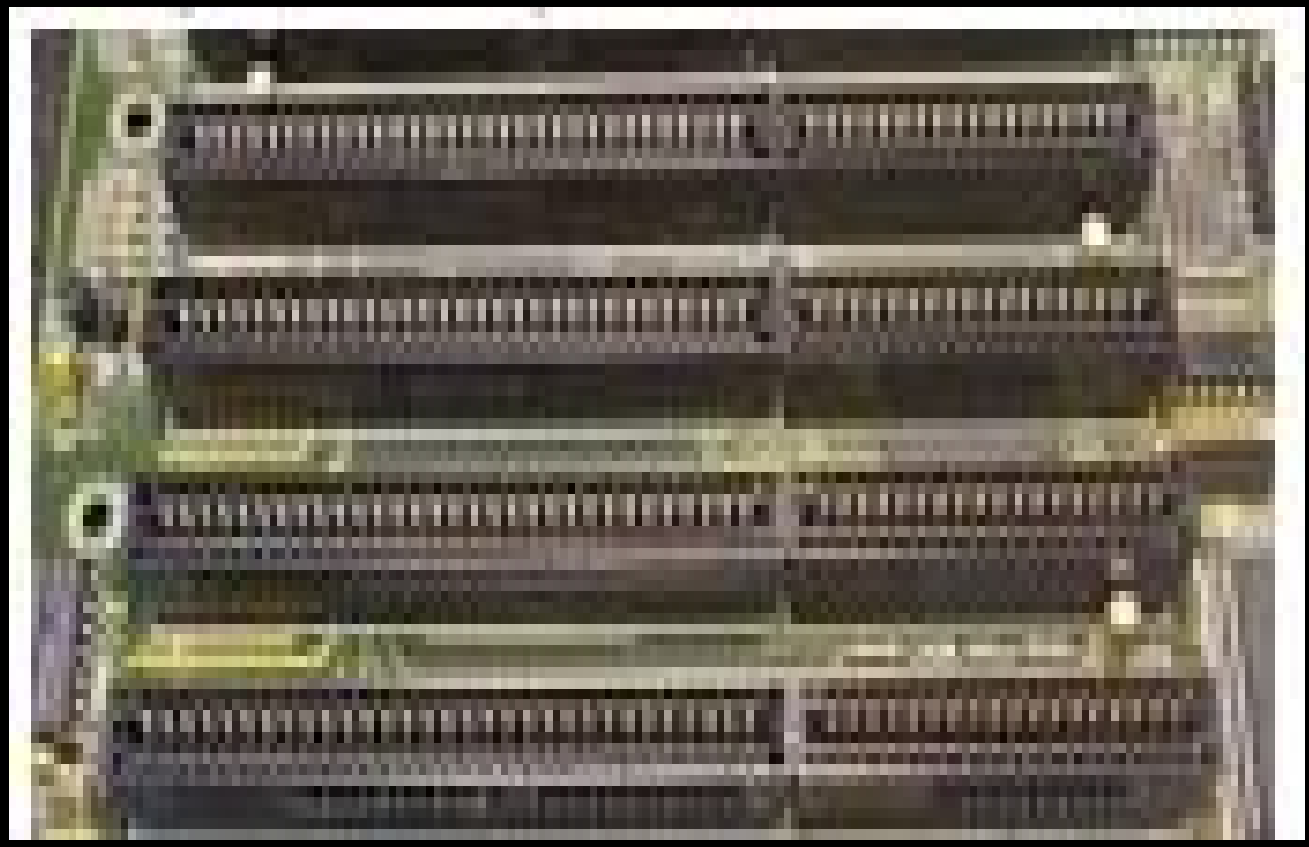
1) PC Bus (8-bit ISA)

- by IBM 8 bit proprietary bus, which allowed only IBM to create peripherals and the actual interface



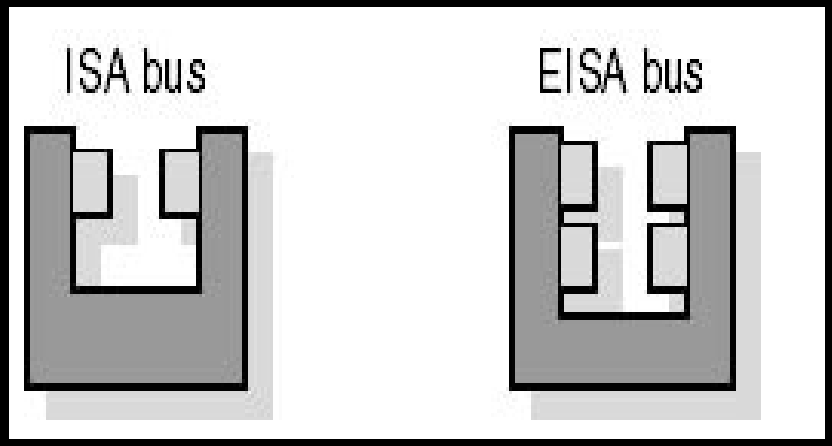
AT Bus (16-bit ISA)

- The AT bus is a 16-bit bus running at a speed of 8.33 MHz



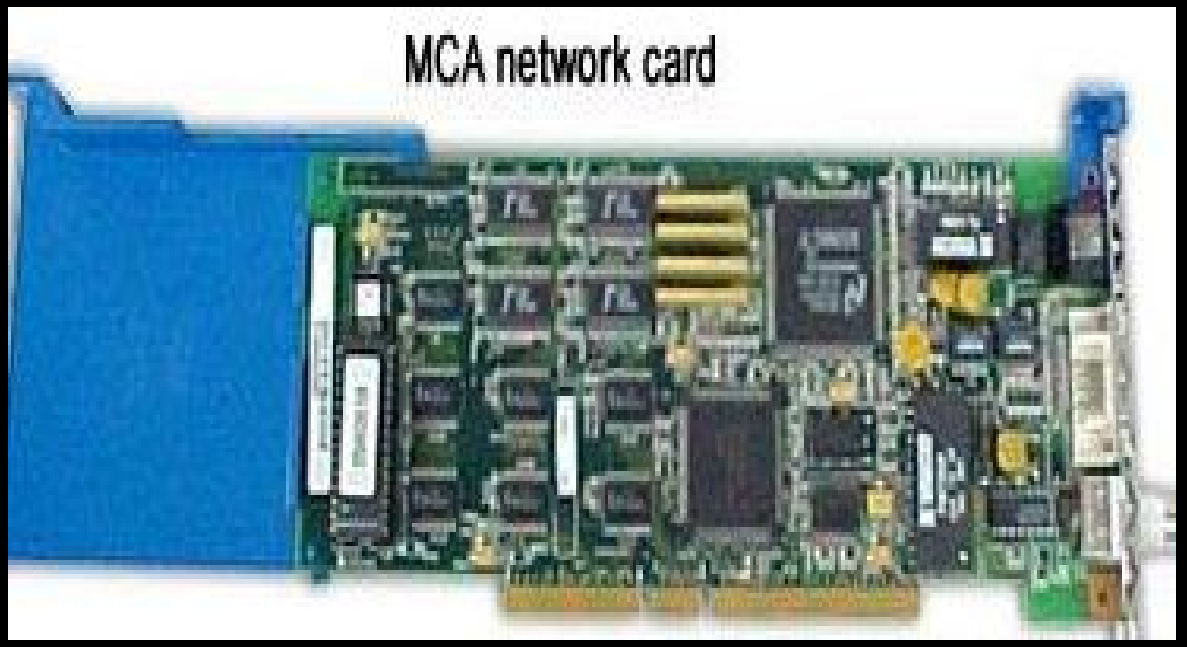
EISA:-Extended Industry Standard Architecture

- known as Extended ISA, announced to compete with the IBM MCA bus
- designed by nine competitors
- The EISA bus provided 32-bit slots at an 8.33 MHz cycle rate



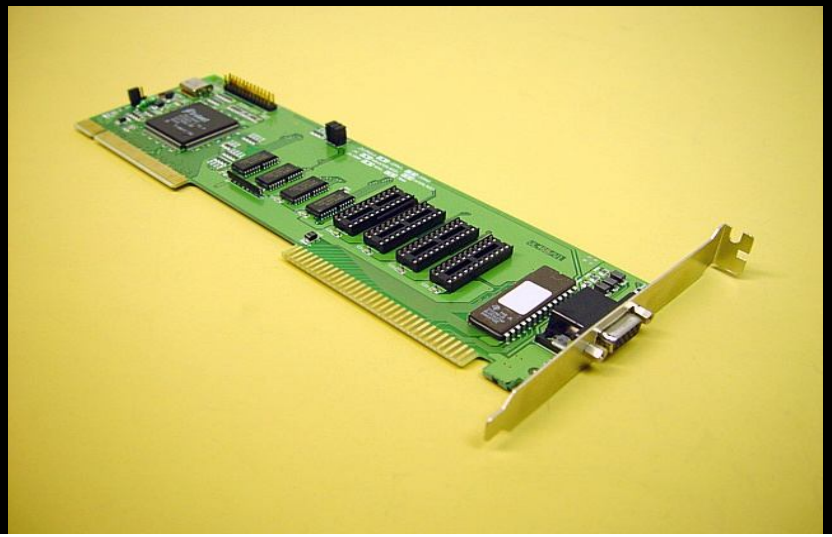
MCA(Micro Channel Architecture) **Bus**

- by IBM , a 32-bit bus, 10MHz,
- Automatically configure cards
- a proprietary bus and required licensing fees



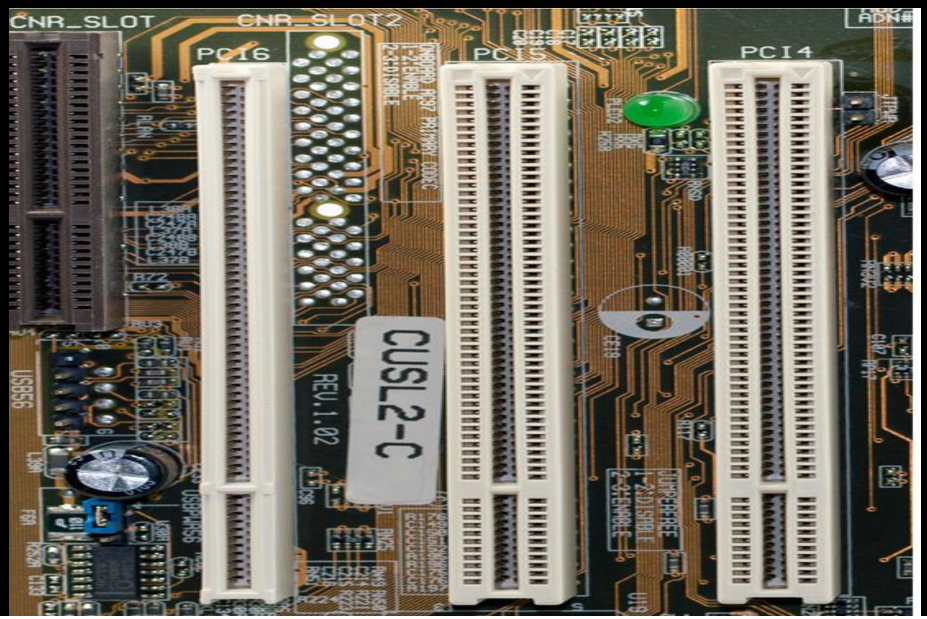
VESA Local (VL) Bus

- Video Electronics Standards Association
- provides faster data flow
- data flows at almost the speed of the microprocessor
- supports 32-bit data flow at 50 MHz



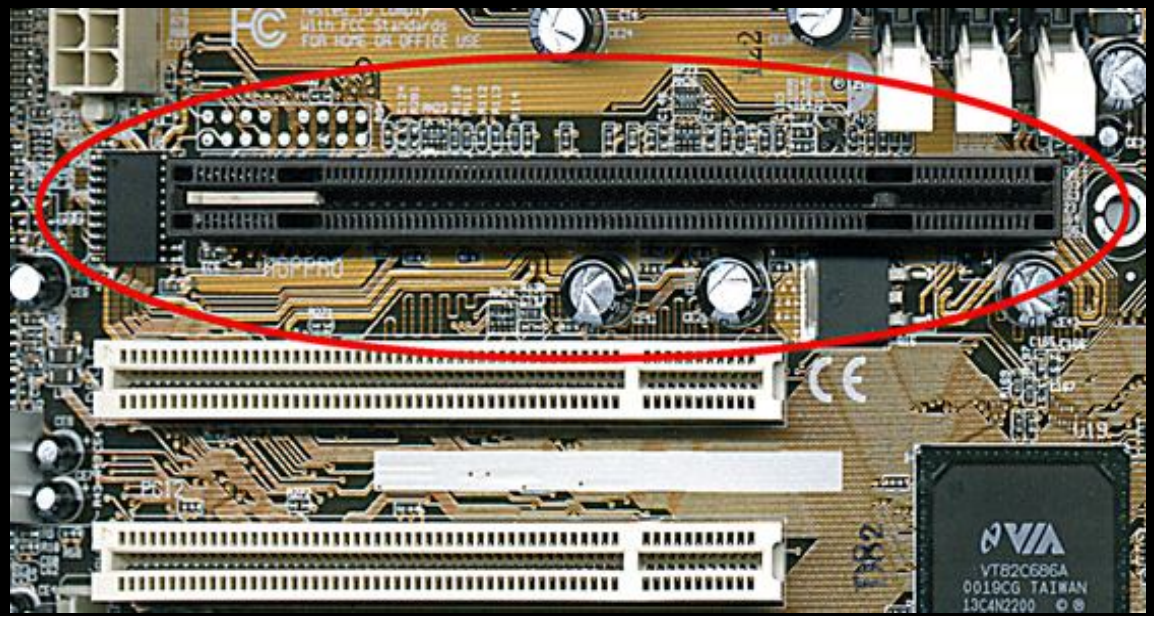
6) Peripheral Component Interconnect-PCI

- by Intel in1992
- 32-bit, 64 bit computer bus, (133MBps)
- most commonly used during the late 1990's and early 2000's
- overcomes the limitations of ISA, EISA, MCA, and VLB



7) Accelerated Graphics Port-AGP

- designed for Video cards and 3D accelerators
- 32-bits wide and runs at 66 MHz
- allows the graphics controller direct access to the system memory
- allows 3-D textures to be stored in main memory rather than video memory



8) USB-Universal Serial Bus

- by Intel, Compaq, Microsoft and other computer companies
- transfer rates of 12 Mbps by USB 1.x
- capable of supporting up to 127 peripheral devices

USB...

- USB is hot swappable. means that devices can be added and removed easily while the computer is still running without having to reboot.
- the USB connects external peripherals such as mouse, printers, modems, keyboards, joysticks, scanners, and digital cameras to the computer

IEEE 1394 Fire Wire

- serial expansion bus promoted by Apple
- used for storage and video cameras
- application for networking, video, and audio
- high-speed bidirectional serial transmission ports

IEEE 1394 Fire Wire...

- compatible devices include internal and external hard drives, digital camcorders, web cameras, MP3 players (Apple's iPod), and scanners and printers, hubs, repeaters, and SCSI

  - connect high speed devices
  - hot swappable
  - can daisy chain up to 63 devices
  - designed primarily for multimedia devices.

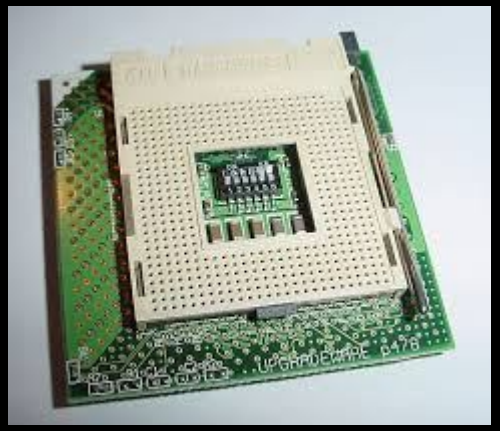
Slot

- A slot or expansion slot is an opening located inside a computer onthe motherboard or riser board that allows additional boards to be connected to it.
- For example, if you wanted to install a new video card in the computer you'd purchase a video expansion card and install that card into the compatible expansion slot.

- Different types of Computer expansion slots given below:
- **AGP - Video card**
- **AMR - Modem, Sound card**
- **CNR - Modem, Network card, Sound card**
- **EISA - SCSI, Network card, Video card**
- **ISA - Network card, Sound card, Video card**
- **PCI - Network card, SCSI, Sound card, Video card**
- **PCIe - Video card**

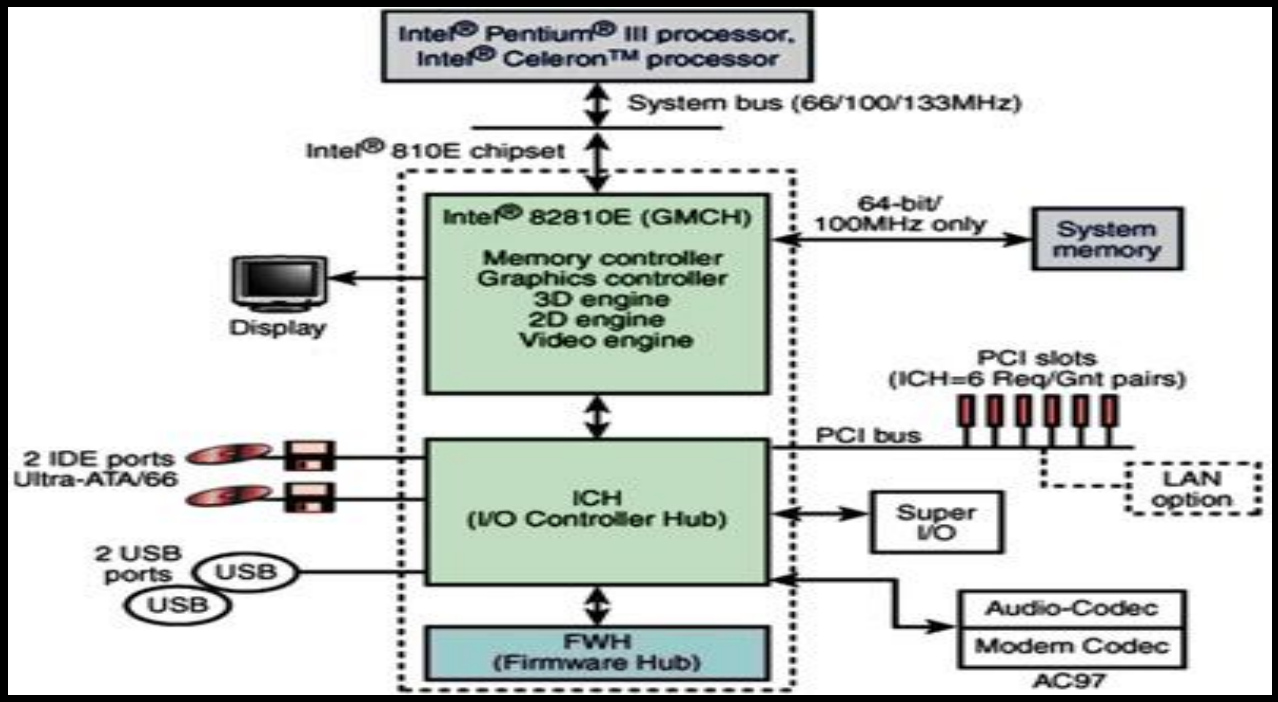
Socket

- A CPU socket or processor socket is a connection that allows computer
- processors to be connected to a motherboard.



System Controller

- A controller is a hardware device or a software program that manages or directs the flow of data between two components.
- Controllers may be cards, microchips or separate hardware devices for the control of a peripheral device



Examples of controllers

- graphics card
- video RAM
- video controller
- game controller
- flash controller
- BIOS

BIOS

- BIOS stands for BASIC INPUT OUTPUT SYSTEM, which is also known as a SYSTEM BIOS or ROM BIOS.

- The BIOS is firmware, which is stored on a non-volatile ROM chip on the motherboard and designed to be the first code run by a PC when powered on.

BIOS ROM

BIOS ROM

CMOS Battery

BIOS Services

- BIOS power on self Test (POST)
- Bootstrap loader
- BIOS Setup utility program
- System service routines
- **(i) BIOS Power on Self Test (POST)**

While booting the system, BIOS first performs POST. It is a built-in diagnostic program that checks hardware to ensure that everything is present and is working properly.

(ii) Bootstrap Loader

Bootstrap loader boots the operating system. The BIOS contains a program known as bootstrap loader whose responsibility is to search and start the operating system boot program.

(iii) BIOS Setup Utility Program

A non volatile memory (NVRAM) is used to store information about the computer system. During installation of a system, the user run BIOS setup program and enter the correct parameters.

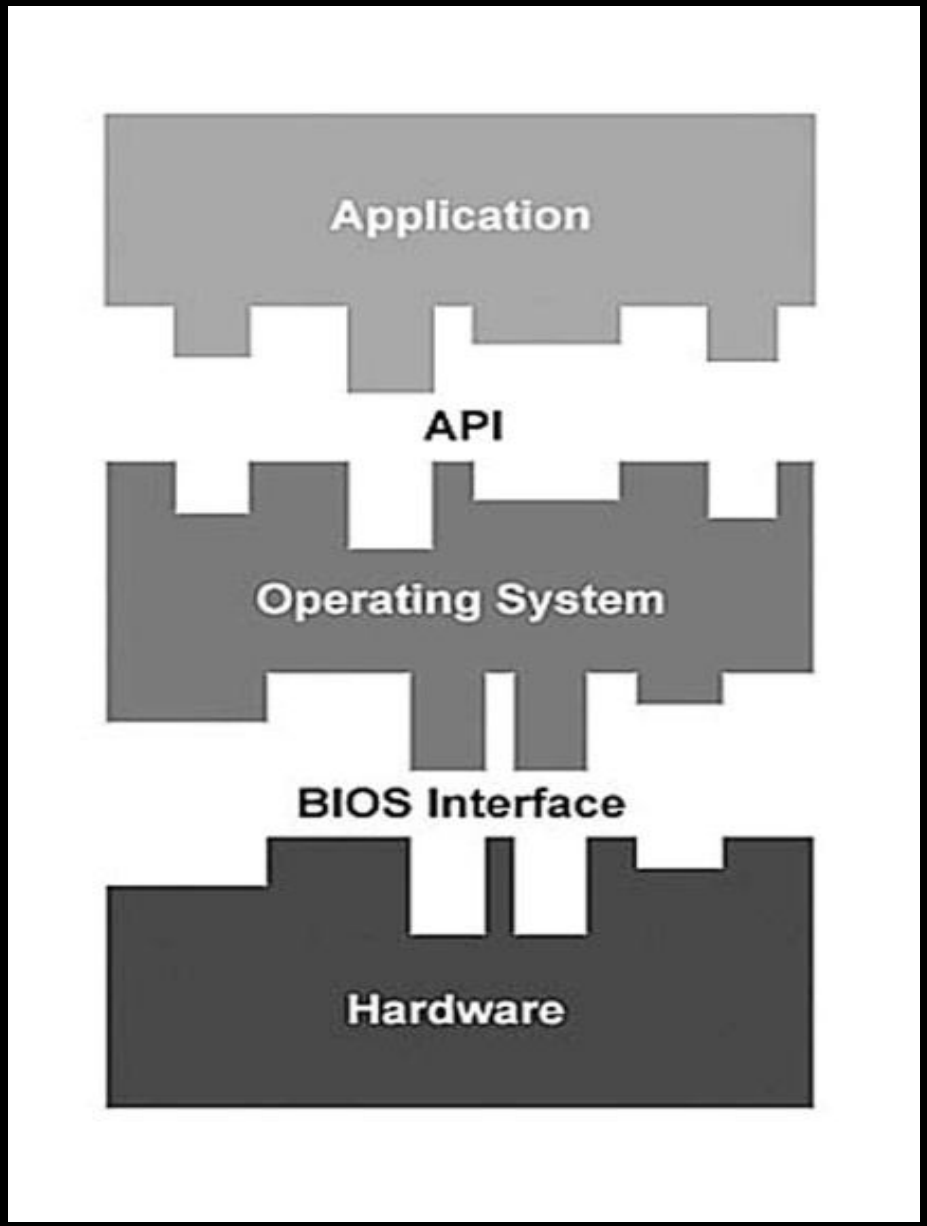
- The settings of memory, disk types and other settings are stored in NVRAM and not in BIOS chip itself.
- To construct NVRAM, the material required is CMOS
- The system's configurations therefore are also termed as CMOS settings, which we can set using BIOS set up program.
- The BIOS reads the parameters from CMOS RAM as and when required.
- CMOS settings can be maintained by battery backup either by using capacitor or by a battery built into NVRAM chip.

(iv)System Service Routines

- The BIOS provides various software routines (subprograms) that can be called by higher-level software such, as DOS, Windows, or their applications, to perform different tasks.
- every task that involves accessing the system hardware has traditionally been controlled using one or more of the BIOS programs.
- This includes actions like reading and writing from the hard disk, processing information received from devices, etc.
- BIOS services are accessed using software interrupts.

BIOS Interaction

- BIOS are interface between software and hardware that allows software and hardware to communicate and interact with each other.
- The motherboard BIOS is the most important component of the BIOS layer. This is because it contains all the software needed to get the computer started.
- It also comes with basic diagnostics and configuration utilities.


Application
API
Operating System
BIOS Interface
Hardware

CMOS RAM

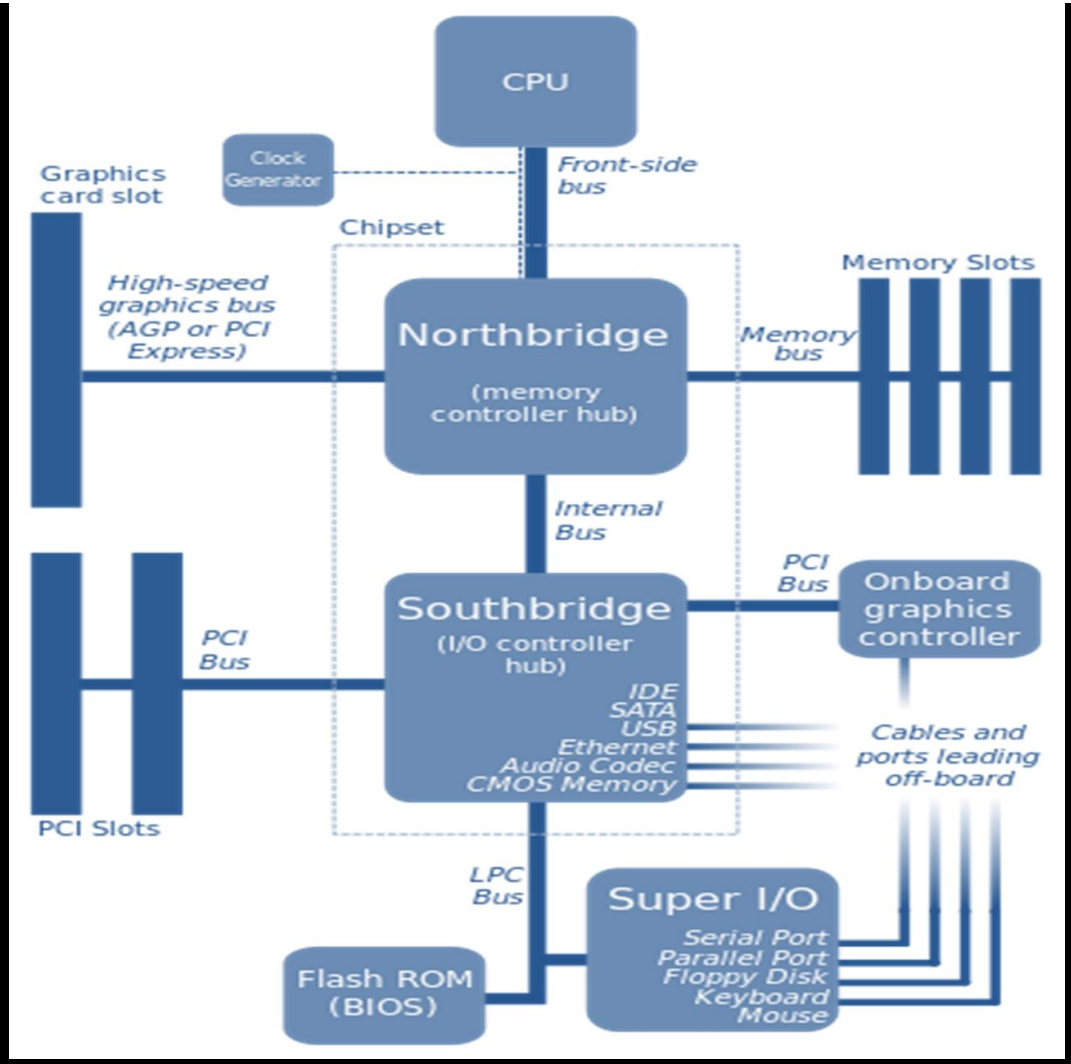
- CMOS RAM, CMOS is short for Complementary Metal-Oxide Semiconductor.
- CMOS is an on-board semiconductor chip powered by a CMOS battery inside computers that stores information such as the system time and date and the system hardware settings for your computer.

Chipset

- The chipset is an electronic circuit whose job is to coordinate data transfers between various components of the computer.
- A chipset controls the system bus structures and facilitates the movement of data and instructions between the Processor, cache memory and internal and external peripheral devices.
- Two main chips in chipset are Memory Control Hub (Northbridge) and Input Output Control Hub (Southbridge):

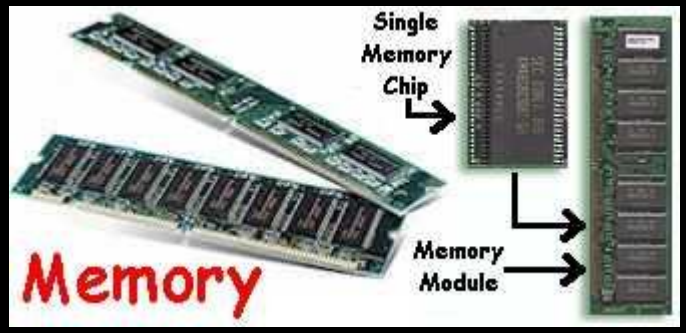
- The **NorthBridge (also called the memory controller) is in charge of** controlling transfers between the processor and the RAM, which is why
- it is located physically near the processor The Northbridge links the CPU to very high-speed devices, especially main memory and graphics controllers.
- The **SouthBridge (also called the input/output controller or expansion** controller) handles communications between slower peripheral devices.
- It is also called the **ICH (I/O Controller Hub).**

- The Southbridge connects to lower-speed peripheral buses (such as PCI). In many modern chipsets, the Southbridge actually contains
- some on-chip integrated peripherals, such as Ethernet, USB, and audio devices.


CPU
Clock Generator
Front-side bus
Graphics card slot
Chipset
Memory Slots
High-speed graphics bus (AGP or PCI Express)
Northbridge
(memory controller hub)
Memory bus
Internal Bus
PCI Bus
Onboard graphics controller
Southbridge
(I/O controller hub)
PCI Bus
IDE
SATA
USB
Ethernet
Audio Codec
CMOS Memory
Cables and ports leading off-board
PCI Slots
LPC Bus
Super I/O
Serial Port
Parallel Port
Floppy Disk
Keyboard
Mouse
Flash ROM (BIOS)

System Memory

- A memory refers to the physical devices used to store programs(sequences of instructions) or data on a temporary or permanent basis for use in a computer or other digital electronic device.



Types of Memory

- Primary Memory / Volatile Memory.
- Primary Memory is internal memory of the computer. RAM AND ROM both form part of primary memory.
- **Random Access Memory (RAM): The primary storage is referred to as** random access memory (RAM) because it is possible to randomly select and use any location of the memory directly store and retrieve data.

- There are primarily two forms of RAM: Static RAM (SRAM) and Dynamic RAM (DRAM).
- *Static RAM: The most expensive of the lot, SRAM uses bistable latching* circuitry to store one bit each, and hence is faster than its counterpart.
- Its high price prevents it from being widely used in everyday computing machines, but many modern machines use SRAM as the processor's cache register.
- *Dynamic RAM: Widely used in modern computers as primary memory,* DRAM is slower than SRAM, but is inexpensive due to its one transistor one capacitor paired assembly of memory storage.

- **Read Only Memory (ROM): There is another memory in computer, which** is called Read Only Memory (ROM). Again it is the ICs inside the PC that form the ROM. The storage of program and data in the ROM is permanent.
- **PROM: There is another type of primary memory in computer, which is** called Programmable Read Only Memory (PROM).
- Once the programmers' are written it cannot be changed and remain intact even if power is switched off. Therefore programs or instructions written in PROM or ROM cannot be erased or changed.

- **EPROM: This stands for Erasable Programmable Read Only Memory**
- EPROM chip can be programmed time and again by erasing the information stored earlier in it.
- Information stored in EPROM exposing the chip for some time ultraviolet light and it erases chip is reprogrammed using a special programming facility.
- When the EPROM is in use information can only be read.
- **Cache Memory: The speed of CPU is extremely high compared to the** access time of main memory.

- Therefore the performance of CPU decreases due to the slow speed of main memory.
- To decrease the mismatch in operating speed, a small memory chip is attached between CPU and Main memory whose access time is very close to the processing speed of CPU. It is called CACHE memory.
- **Registers: The CPU processes data and instructions with high speed;** there is also movement of data between various units of computer.
- It is necessary to transfer the processed data with high speed. So the computer uses a number of special memory units called registers.

- **2. Secondary Memory / Non-Volatile Memory: Secondary memory is** external and permanent in nature. The secondary memory is concerned with magnetic memory. Secondary memory can be stored on storage media like floppy disks, magnetic disks, magnetic tapes, This memory can also be stored optically on Optical disks - CD-ROM.
- **Magnetic Tape: Magnetic tapes are used for large computers like** mainframe computers where large volume of data is stored for a longer time.
- Tapes consist of magnetic materials that store data permanently.

- It can be 12.5 mm to 25 mm wide plastic film-type and 500 meter to 1200 meter long which is coated with magnetic material.
- The deck is connected to the central processor and information is fed into or read from the tape through the processor. It’s similar to cassette tape recorder.
- **Magnetic Disk: You might have seen the gramophone record, which is** circular like a disk and coated with magnetic material. Magnetic disks used in computer are made on the same principle. It rotates with very high speed inside the computer drive. Data is stored on both the surface of the disk.

- **Optical Disk: With every new application and software there is greater** demand for memory capacity.
- It is the necessity to store large volume of data that has led to the development of optical disk storage medium.

Memory Size

- The amount of information a computer can store in memory.
- Bytes are used to measure both computer memory (RAM) and the storage capacity of floppy disks, CD-ROM drives, and hard drives.

Following are the main memory storage units:

Sr. No.	Unit	Description
1	Bit (Binary Digit)	A binary digit is logical 0 & 1 representing a passive or an active state of a component in an electric circuit.
2	Nibble	A group of 4 bits is called nibble.
3	Byte	A group of 8 bits is called byte. A byte is the smallest unit, which can represent a data item or a character.
4	Word	A computer word like a byte, is a group of fixed number of bits processed as a unit which varies from computer to computer but is fixed for each computer. The length of a computer word is called word-size or word length and it may be as small as 8 bits or may be as long as 96 bits. A computer stores the information in the form of the computer words.

Memory Speed

Few higher storage units are the following:

Sr. No.	Unit	Description
1	Kilobyte (KB)	1 KB = 1024 Bytes
1	Megabyte (MB)	1 MB = 1024 KB
1	GigaByte (GB)	1 GB = 1024 MB
1	TeraByte (TB)	1 TB = 1024 GB
1	PetaByte (PB)	1 PB = 1024 TB

- The speed of the memory will determine the rate at which the CPU can process data. The higher the clock rating on the memory, the faster the system is able to read and write information from the memory.

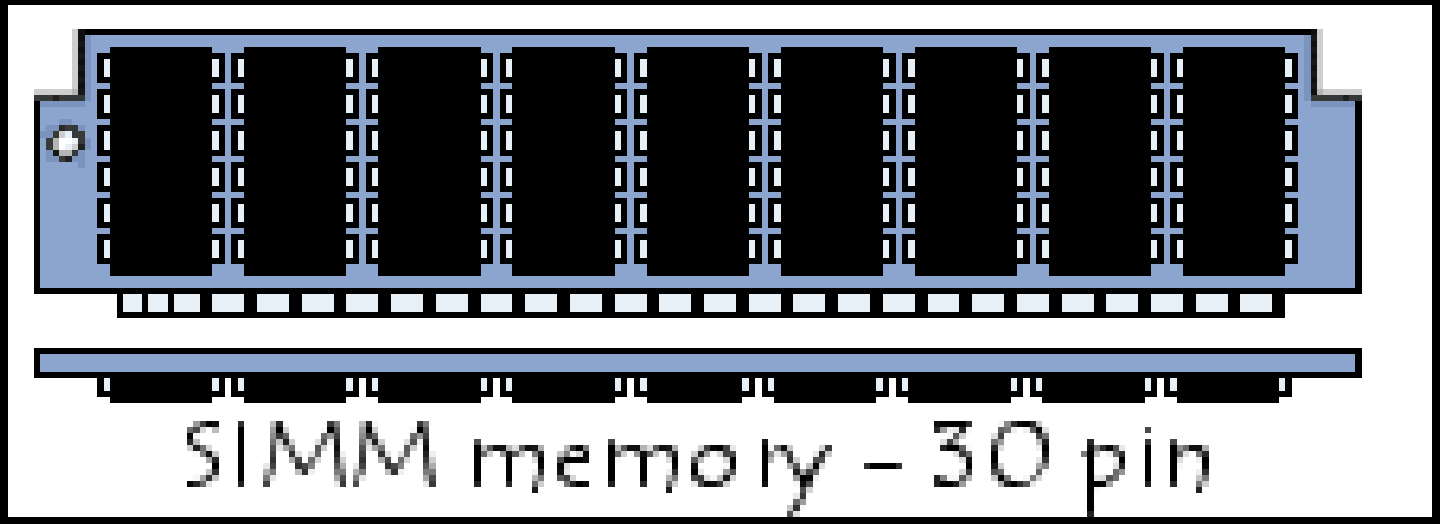
Memory Shapes

- There are many type of random access memory. They exist in the form of memory modules that can be plugged into the mother board.
- Memories existed in the form of chips called DIP (Dual Inline Package).
- Nowadays, memories generally exist in the form of modules, which are cards that can be plugged into connectors for this purpose.

1) SIMM (single in-line memory module)

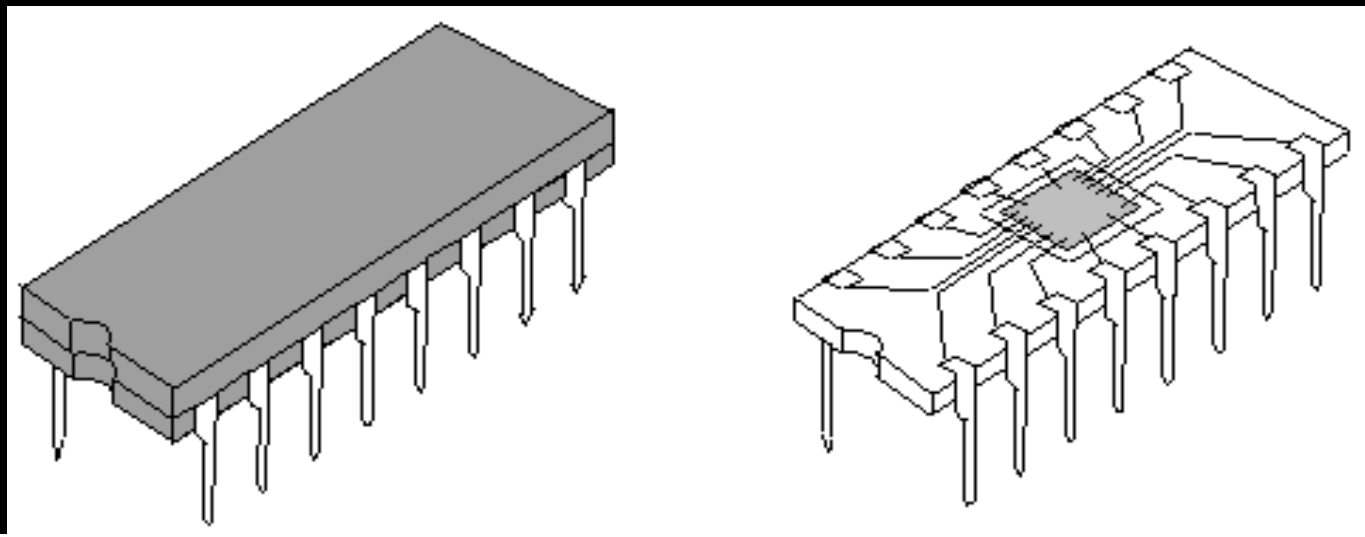
- A SIMM (single in-line memory module) is a module containing one or several random access memory (RAM) chips on a small circuit board with pins that connect to the computer motherboard.
- These are printed circuit boards with one side equipped with memory chips.
- The memory chips on a SIMM are typically dynamic RAM (DRAM) chips. An improved form of RAM called Synchronous DRAM (SDRAM) can also be used.

- connectors:
- SIMM modules with 30 connectors (dimensions are 89x13mm) are 8-bit memories with which first-generation PCs were equipped (286, 386).
- SIMM modules with 72 connectors (dimensions are 108x25mm) are memories able to store 32 bits of data simultaneously. These memories are found on PCs from the 386DX to the first Pentiums.



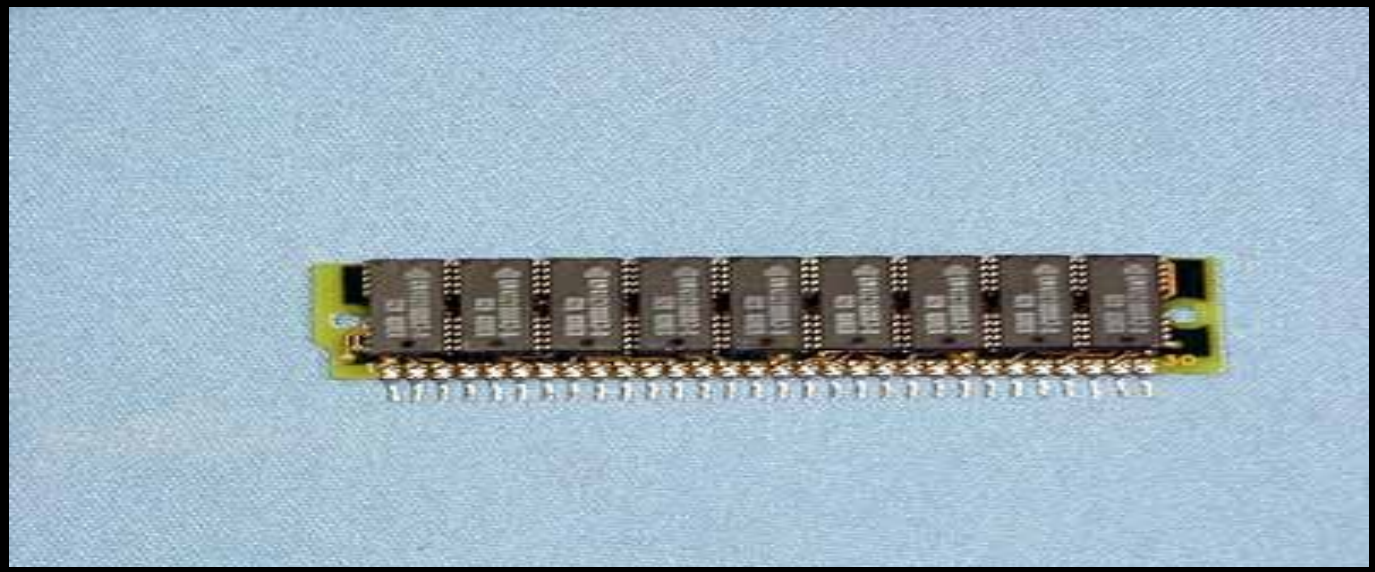
2) DIP

- Most memory chips are packaged into small plastic or ceramic packages called dual inline packages or DIPs.
- A DIP is a rectangular package with rows of pins running along its two longer edges.
- These are the small black boxes you see on SIMMs, DIMMs or other larger packaging styles.



3) SIPP

- A SIPP or single in-line pin package was a type of random access memory.
- It consisted of a small printed circuit board upon which were mounted a number of memory chips.
- It had 30 pins along one edge which mated with matching holes in the motherboard of the computer.

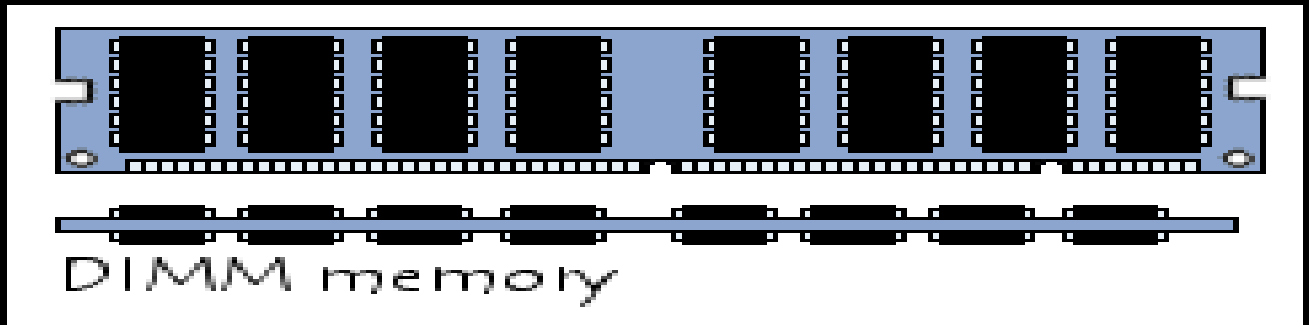


4) ZIG line Package

- The zig-zag in-line package or ZIP was a short-lived packaging technology or integrated circuits, particularly dynamic RAM chips.
- . A ZIP is an integrated circuit encapsulated in a slab of plastic with 20 or 40 pins, measuring (for the ZIP-20 package) about 3 mm x 30 mm x 10 mm.

5) DIMM line Package

- DIMM format (Dual Inline Memory Module) is 64-bit memories.
- DIMM modules have memory chips on both sides of the printed circuit board and also have 84 connectors on each side, giving them a total of 168 pins.
- . In addition to having larger dimensions than SIMM modules (130x25mm), these modules have a second notch to avoid confusion



6) RIMM line package

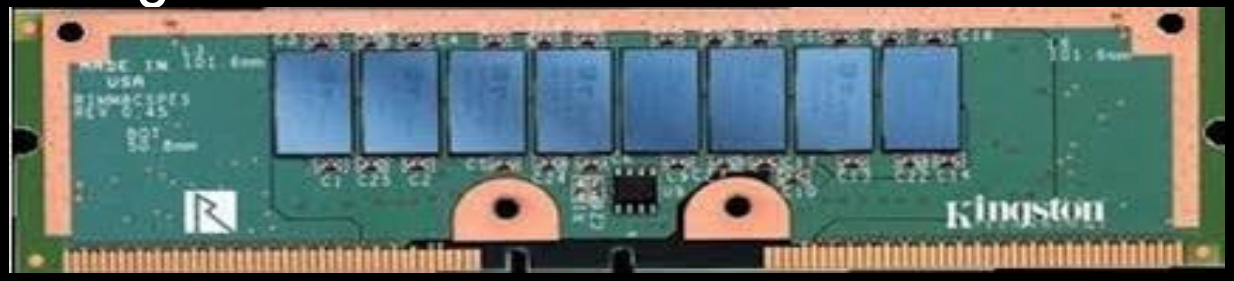
- RIMM may refer to Rambus In-line Memory Module, a packaging for RDRAM.
- RIMM is the memory module used with Rambus Dynamic Random Access Memory (RDRAM) chips. RIMM are 64-bit memories developed by Rambus.
- They have 184 pins. These modules have two locating notches to avoid risk of confusion with the previous modules.

Memory Module

- A memory module is a circuit board that contains DRAM integrated circuits that is installed into the memory slot on a computer motherboard.
- Memory modules come in different sizes and have several different pin configurations.
- **Dynamic RAM (DRAM)**
- DRAM must be continually refreshed in order for it to maintain the data.
- This is done by placing the memory on a refresh circuit that rewrites the data several hundred times per second.
- DRAM is used for most system memory because it is cheap and small. All DRAMs are made up of memory cells.

- These cells are composed of one capacitor and one transistor.
- **SDRAM**
- Alternatively referred to as SDR-RAM, SDRAM is short for Synchronous DRAM and is a type of DIMM memory that synchronizes itself with the computer's system clock to provide synchronization between the memory and the computer processor.
- **DDR SDRAM**
- Double data rate synchronous dynamic random access memory (DDR SDRAM) is a class of memory integrated circuits used in computers.
- The DDR SDRAM interface makes higher transfer rates possible by more strict control of the timing of the electrical data and clock signals.

- **SLDRAM**
- Short for Synchronous Link DRAM, a type of memory being developed by the now defunct Sync Link Consortium.
- SLDRAM was intended to be an enhanced version of SDRAM that used a multiplexed bus to transfer data to and from chips rather than fixed pin settings.



DRDRAM-Direct Rambus DRAM

- DRDRAM works more like an internal bus than a conventional memory subsystem.
- It is based around what is called the Direct Rambus Channel, a high-speed 16-bit bus running at a clock rate of 400 MHz.

- **Fast Page Mode (FPM) DRAM**
- Fast page mode or FPM memory is slightly faster than conventional DRAM.
- While standard DRAM requires that a row and column be sent for each access, FPM works by sending the row address just once for many accesses to memory in locations near each other, improving access time.

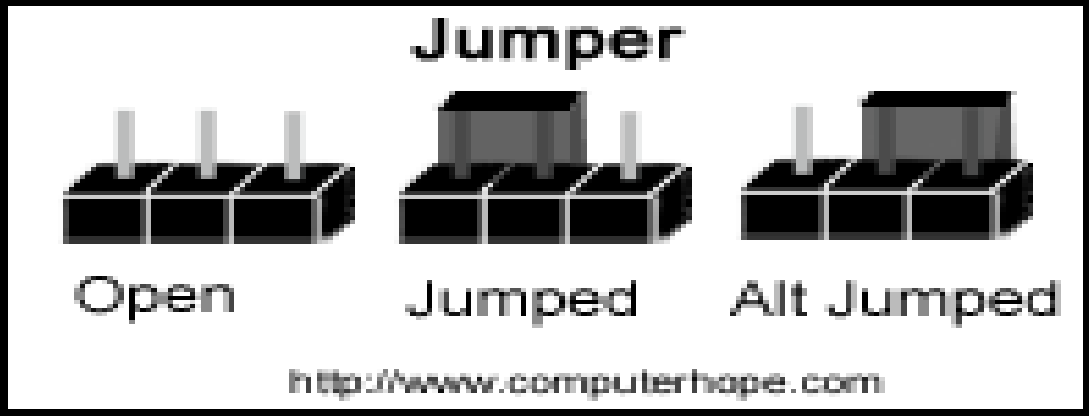
- **Extended Data out (EDO) DRAM)**
- A type of DRAM designed to access nearby memory locations faster than FPM DRAM. In EDO, a new data cycle is started while the data output of the previous cycle is still active.
- This process of cycle overlapping, called pipelining, increases processing speed by about 10 nanoseconds per cycle, increasing computer performance by about 5 percent compared to performance using FMP.
- Extended Data Out is also known as Hyper Page Mode enabled DRAM.

EDO DRAM (SIMM)

JUMPER

- Jumpers consist of a set of small pins that can be covered with a small plastic box (**jumper block**), which is used to close an electrical circuit to allow the electricity to flow through certain sections of the motherboard.

JUMPER


Jumper
Open
Jumped
Alt Jumped
http://www.computerhope.com


www.computerhope.com

JUMPER

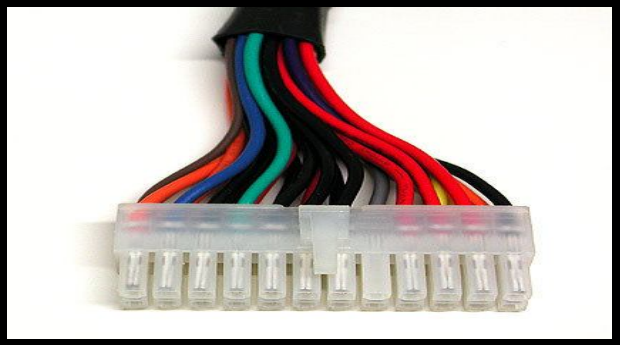
- Jumpers are used to configure the settings for computer peripherals such as the motherboard, hard drives, modems, sound cards, and various other components.

- For example, if your motherboard supported intrusion detection, a jumper can be set to enable or disable this feature.

CONNECTOR

- Many cables and plugs inside the cabinet must be connected to the motherboard.

- These cables and plugs are connected to the motherboard using connectors.



CMOS SETUP

- CMOS (Complementary Metal Oxide Semiconductor) contains the system configuration and allow to the option to set the system parameters.

- **Entering to CMOS setup :** Every time you start your computer, a message appear on the screen before the operating system is loaded. The message prompt you to hit the “<DEL>” key if you want to run CMOS setup.

CMOS SETUP

- **Standard CMOS Fearures:**

- Here you can setup the basic BIOS features such as date, time, type of floppy etc.
- Use the arrow keys to move around and press enter to select the required option.
- You can specify what IDE devices you have such as hard drive, CD-ROM etc. The easiest way to setup the IDE devices is by leaving it set to auto.
- This allows the BIOS to detect the devices automatically so you don't have to do it manually. At the bottom, it also displays the total memory in your system.

CMOS SETUP

- **Advanced CMOS Fearures:**
- **-** There are numerous advance settings which you can select if required. For most cases leaving the default setting should be adequate. As you can see the first boot device is set to floppy. This ensures that the floppy disk is read first when the system boots, and therefore can boot from windows boot disk. The second boot device is the Hard disk and third is set to LS120. If you want to boot from a bootable CD then you can set the third boot device to CD/DVD-ROM

CMOS SETUP

- **Advanced Chipset Fearures:**
- Here you can setup the contents of the chipset buffers. It is closely related to the hardware and is therefore recommended that you leave the default setting unless you know what you are doing.
- Having an incorrect setting can make your system unstable.

CMOS SETUP

- **Integrated Peripheral:**
- This menu allows you to change the various I/O devices such as IDE controllers, serial ports, parallel port, keyboard etc.

CMOS SETUP

- **Power Management Setup:**
- The power management allows you to setup various power saving features, when the PC is in standby or suspend mode.

CMOS SETUP

- **PCI configuration:**
- This menu allows you to configure your PCI slots.
- It is recommended that you leave the default settings.

CMOS SETUP

- **PC Health Status:**
- This menu displays the current CPU temperature, the fan speeds, voltages etc.
- You can set the warning temperature which will trigger an alarm if the CPU exceeds the specified temperature.

CMOS SETUP

- **Load Optimized Default:**
- This option loads the BIOS default settings, but runs the system at optimal performance. From the dialog box Choose "Y" followed by enter to load Optimized Defaults.

CMOS SETUP

- **Set Password:**
- To password protect your BIOS you can specify a password.
- Make sure you don't forget the password.
- The only way you can access the BIOS is by resetting it using the reset jumper on the motherboard.

CMOS SETUP

- **Save & Exit:**
- To save any changes you made to the BIOS you must choose this option. From the dialog box choose "Y".
- **Exit without Saving:**
- If you don't want to save changes made to the BIOS, choose "N" from the dialog box.