Basic concepts of Information Technology

Basic components of the Computer System

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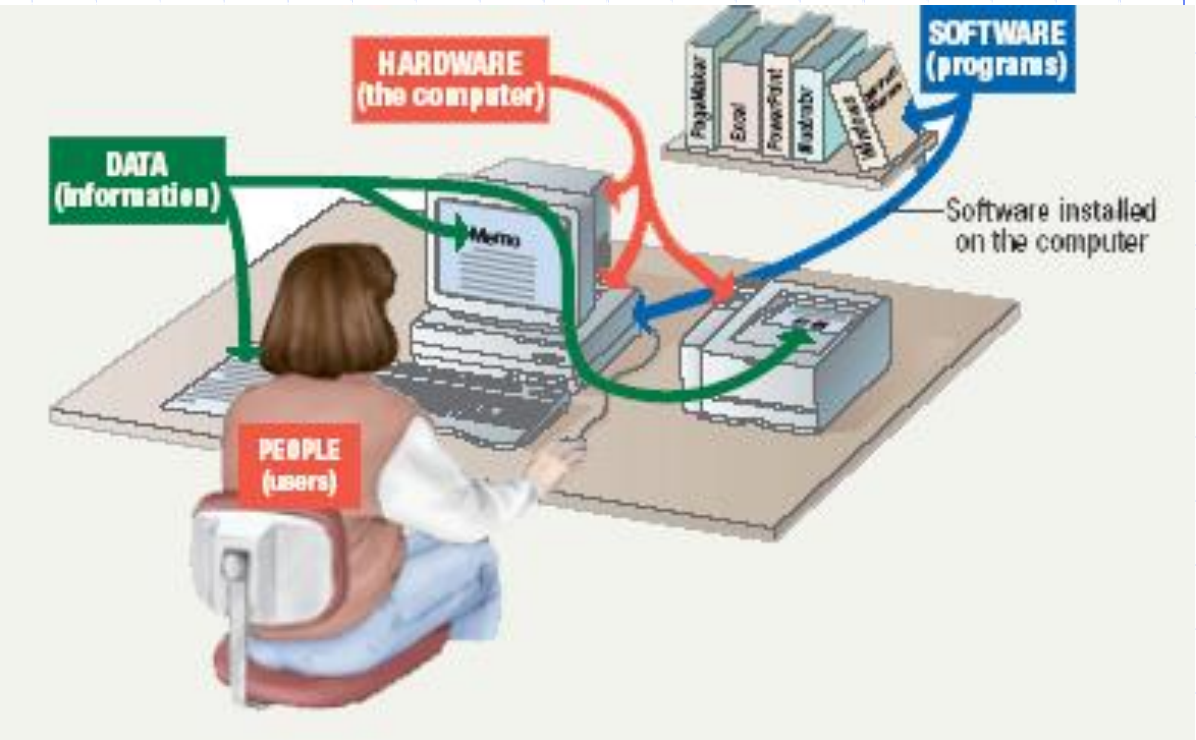
Overview

- The computer system/ Processing cycle
- Basic components:
  - Hardware
    - Processor
    - Memory
    - Secondary Storage
    - Peripheral (Input/Output) devices

Computer System

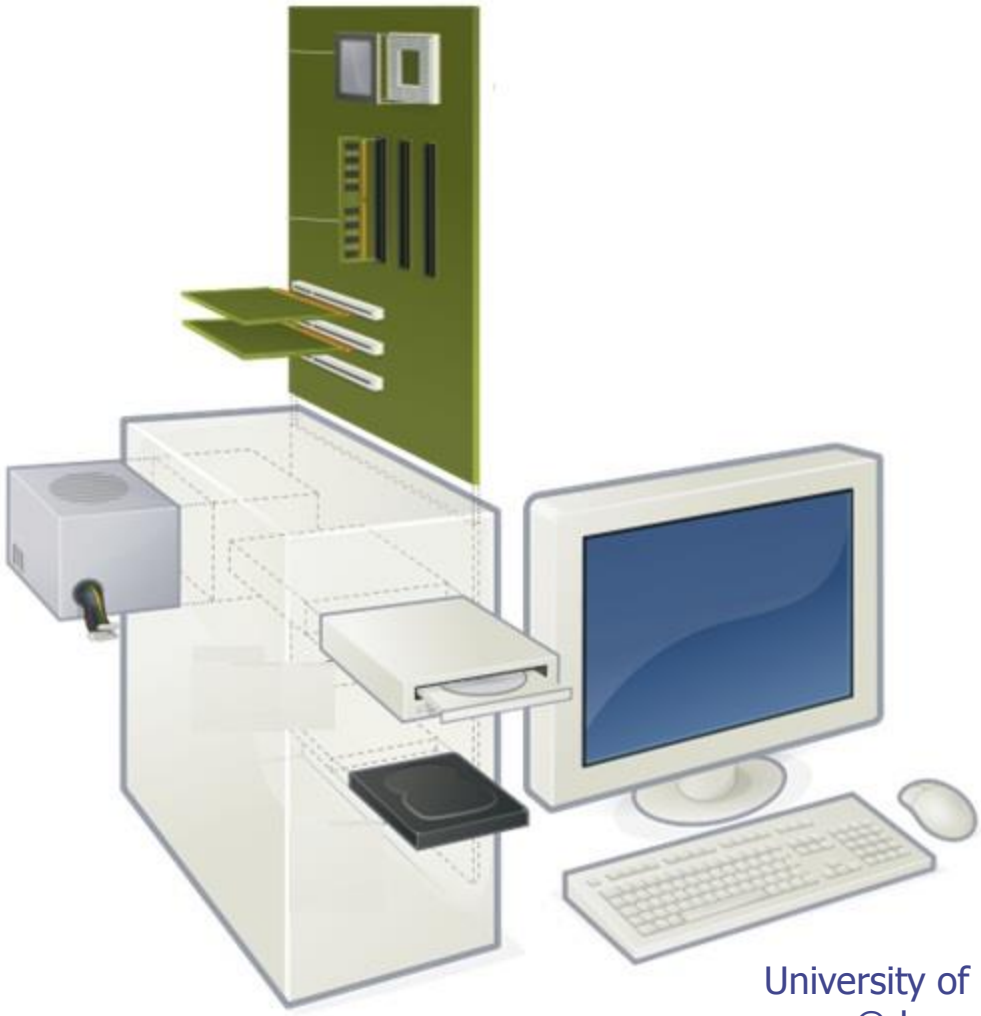
- Hardware
- Software
- Data
- User



Computer System.....

- Hardware
  - Physical elements of a computer
  - Anything that can be touched
- Software
  - A set of electronic instructions that tells the hardware how to perform a task
- Data
  - Pieces of information
  - Computer organize and present data
- Users
  - People operating the computer
  - Instruct the computer what to perform

Personal Computer Hardware

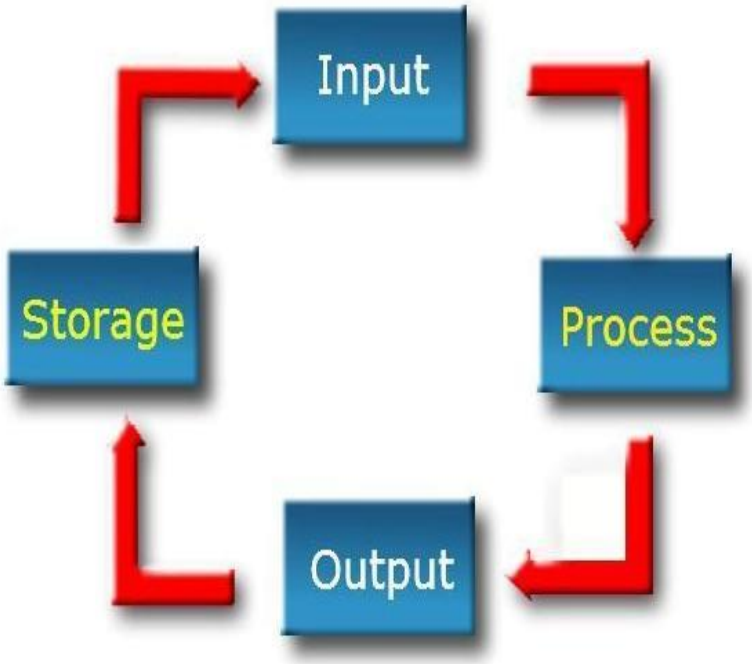


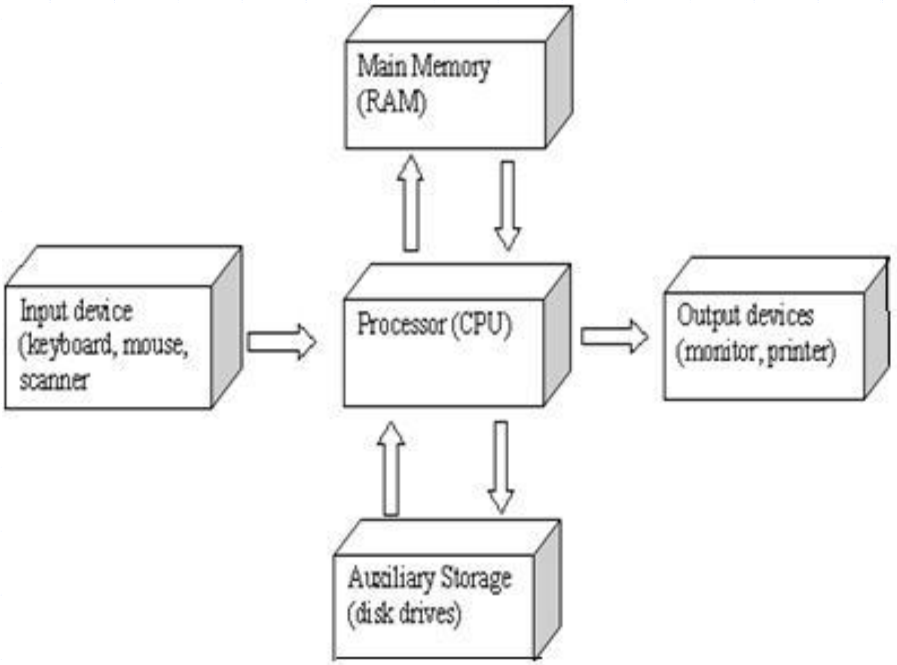
- Case
- Power supply
- Mother board
- CPU
- Expansion cards
- Secondary storage devices
- Input and output peripherals

Microprocessor/CPU

- Brain of the computer
- Composed of thin layers of millions of transistors
- Performs all the calculations and logical operations
- Consists of:
  - ALU - does the arithmetic and logical comparisons that need to be processed Eg:- Addition, subtraction, multiplication, division
  - CU - determines the sequence in which computer programs and instructions are executed
    - Fetching- fetch next program instruction from memory
    - Decoding- decode program instructions into commands computer can process
    - Executing- direct appropriate components to execute instructions
    - Storing – writing instruction results into main memory

Information Processing Cycle





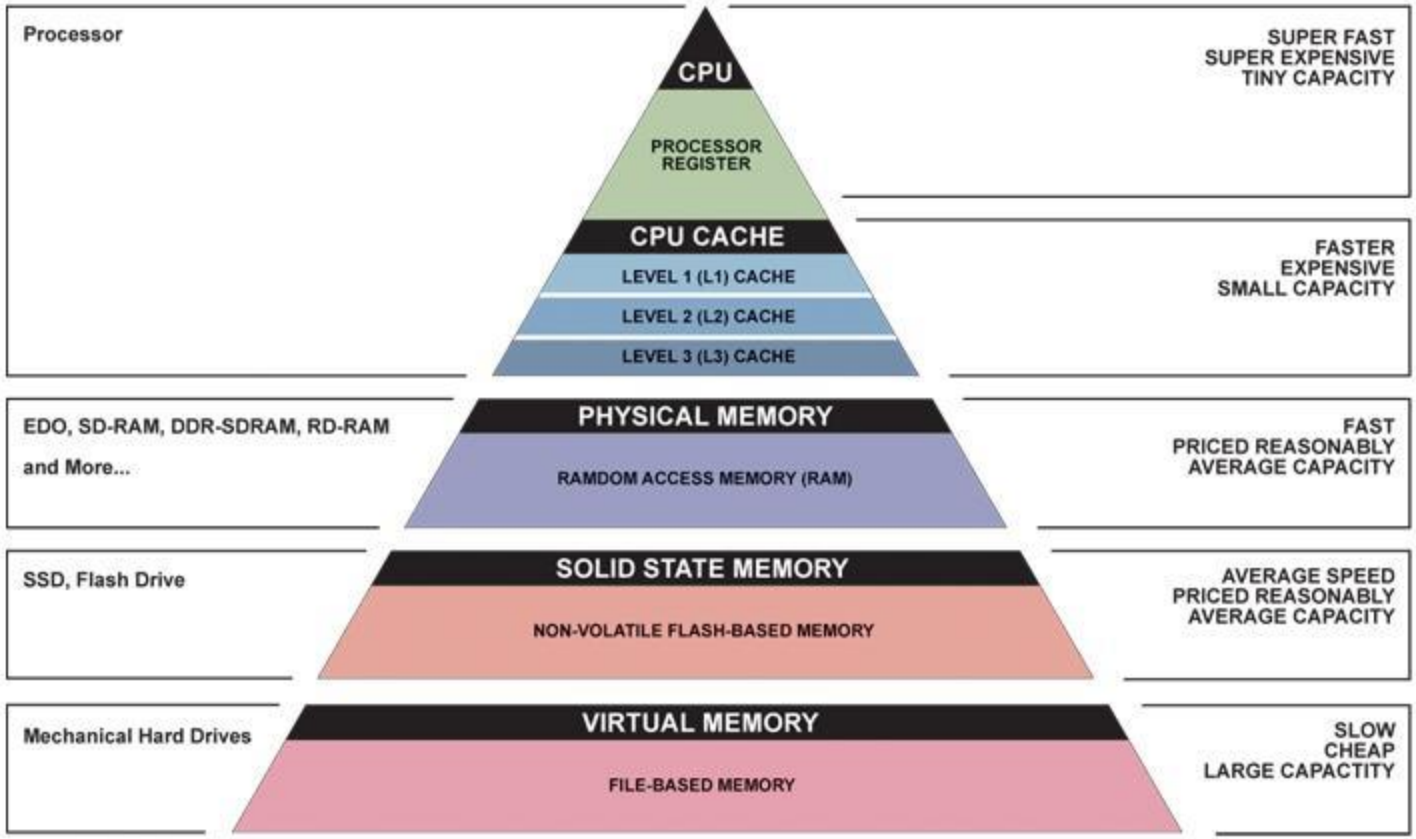
Exercise 1

- Describe the stages of information processing cycle of a computer system.

Memory

- Main memory (RAM)
- Read Only Memory (ROM)
  - ROM
  - PROM : Programmable ROM
  - EPROM : Erasable Programmable ROM
  - EEPROM : Electrically Erasable Programmable ROM
- Cache memory (L1, L2, L3)
- Registers

Memory Hierarchy



▲ Simplified Computer Memory Hierarchy

Random Access Memory

- Main memory/ primary memory/ RAM
- Volatile memory- information is lost if the power is removed
- When the operating system loads from disk when first switch on the computer, it is copied into RAM
- Two main forms:
  - SRAM- very fast and expensive
  - DRAM- slow and less expensive than SRAM

Read Only Memory

- Non-volatile memory, programmed when manufacturing
- Data stored in ROM cannot be modified
- Stores critical programmes:
  - BIOS (Boot program)
  - Error recovery programmes
  - Part of OS
- Variants:
  - PROM- Programmable (allows one time writing after manufacture)
  - EPROM- Erasable programmable (can be erased repeatedly using ultraviolet light and reprogrammed)
  - EEPROM- Electrically erasable programmable (can be electrically/electrical charge erased repeatedly)

Cache memory

- Fast random access memory/CPU cache
- A small memory chip which lies between the CPU and main memory
- Access time is close to processing speed of CPU
- CPU uses this to reduce the average access time to access main memory
- L1 cache- usually built onto the microprocessor chip itself

  L2 cache- on a separate chip (motherboard) that can be accessed more quickly than the main memory

  L3 cache- on a separate chip (motherboard)

Exercise 2

- Compare and contrast features of different levels of caches.

Registers

- A small amount of temporary storage inside CPU; stores the data that is to be executed next
- Can access the content more quickly than storage available elsewhere
- Load data from memory into registers where it is used for arithmetic, manipulated, or tested, by some machine instruction
- Transfer the processed data (information) with high speed
- Normally measured by the number of bits they can hold
  Eg:- 8 bit register, 32 bit register
- Common Registers: Programme counter, Instruction Register

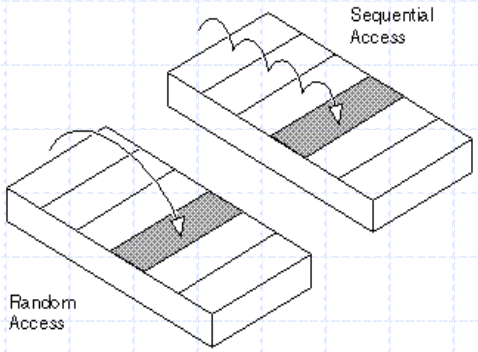
Accessing Data in Memory

- Sequential access

  Records retrieve in the same order in which they are physically stored on the medium

- Random access

  Records retrieve in any order



Secondary Storage

- Known as external storage/auxiliary storage
- Not directly accessed by CPU
- Necessary because primary storage can be used only temporarily (storage devices provide permanent storage)
- Includes:
  - Hard Disk Drive(HDD)
  - Flash memory (pen drive)
  - Optical disks
  - Floppy disks

Hard Disk Drive

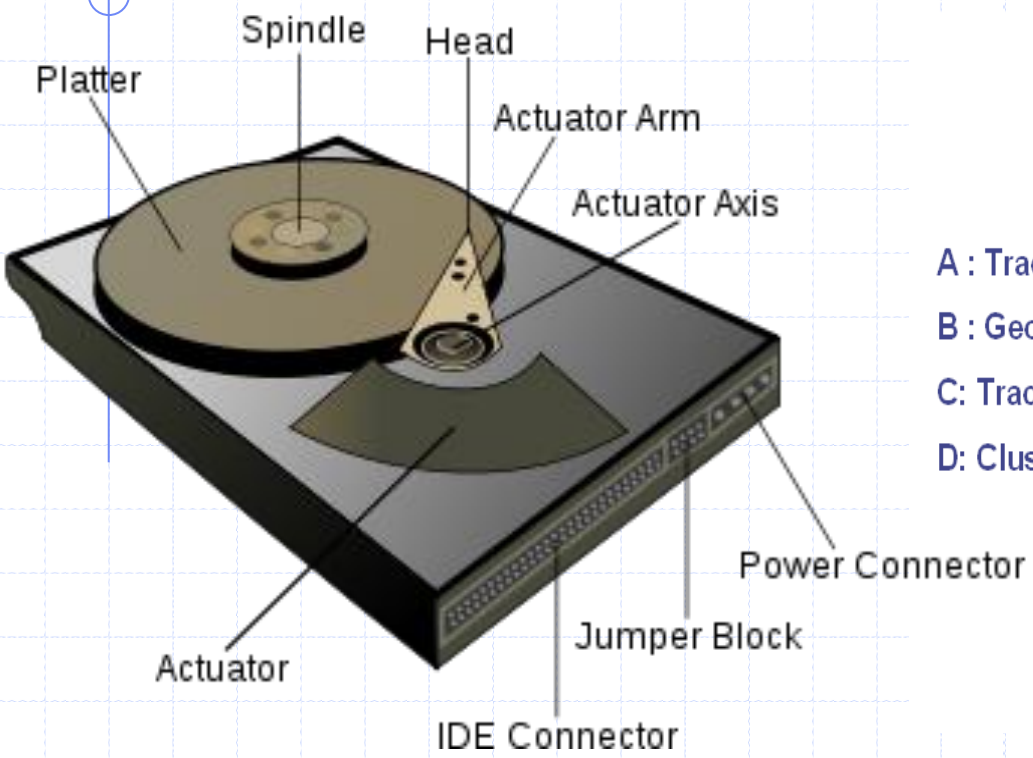
- Non volatile random access digital magnetic data storage
- Provides a large storage capacity

  Eg:- 40GB,80GB,…..,320GB, 500GB, 640GB
- Data is recorded electromagnetically in concentric circles or "tracks" on the disk
- Housed inside the system unit

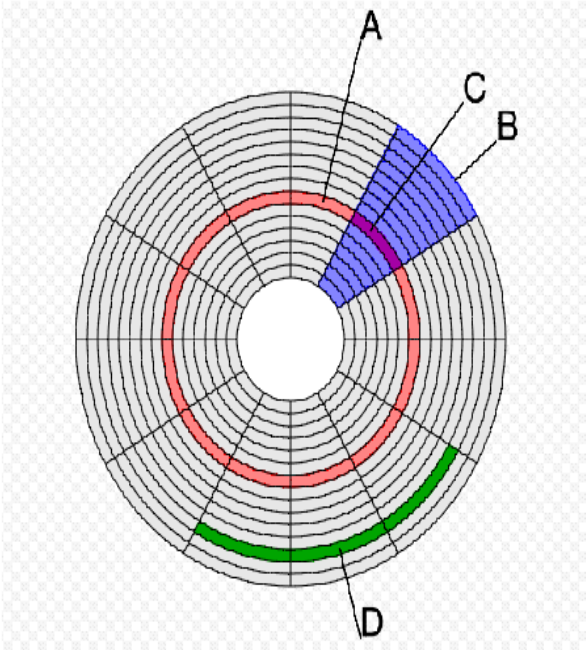
Disk Space/Memory Measurements

- 1 Bit = 0 / 1
- 8 Bits = 1 Byte
- 1024 Bytes = 1 Kilobyte
- 1024 Kilobytes = 1 Megabyte (1,048,576 Bytes)
- 1024 Megabytes = 1 Gigabyte
- 1024 Gigabytes = 1 Terabyte

Hard Disk Drive



The surface of a disk

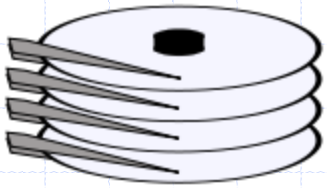


A : Track

B : Geometrical Sector

C: Track Sector

D: Cluster

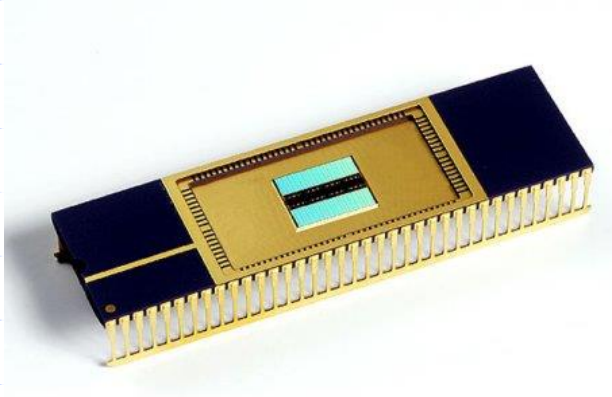


Heads

8 Heads,
4 Platters

Flash memory

- Provides a non-volatile mechanism for portable storage of large amount of data
- Semiconductor memory, stable, can be modified



Floppy Disks

- A disk of thin and flexible magnetic storage medium, sealed in a rectangular plastic carrier lined with fabric that removes dust particles
- Disk capacity (3 $^1/_2$" floppy) is 1.44 MB or 1,440,000 bytes

Optical Disks

- CD/DVD
- Circular disc which encodes binary data on a special material
- Data is recorded by making marks in a pattern that can be read back with the aid of light, usually a beam of laser light precisely focused on a spinning disc.
- Most commonly used for storing music (e.g.CD), video (e.g. DVD), or data and programs for PCs
- Types: CD-R, CD-RW, VCD, SVCD, DVD-R, DVD-RW

CD -R

- "Compact Disc-Recordable"
- Write Once Read Many optical medium
- Uses laser technology to read data that is permanently stored

CD -RW

- "Compact Disc-ReWritable"
- Discs need to be blanked before reuse
- Similar to a CD-R, but rewritable

DVD -R

- "Digital versatile Disks -Recordable" format
- Typically has a storage capacity of 4.71 GB
- Data on a DVD-R cannot be changed, whereas a DVD-RW (rewritable DVD) can be rewritten multiple (1000+) times

Using a CD-ROM Drive

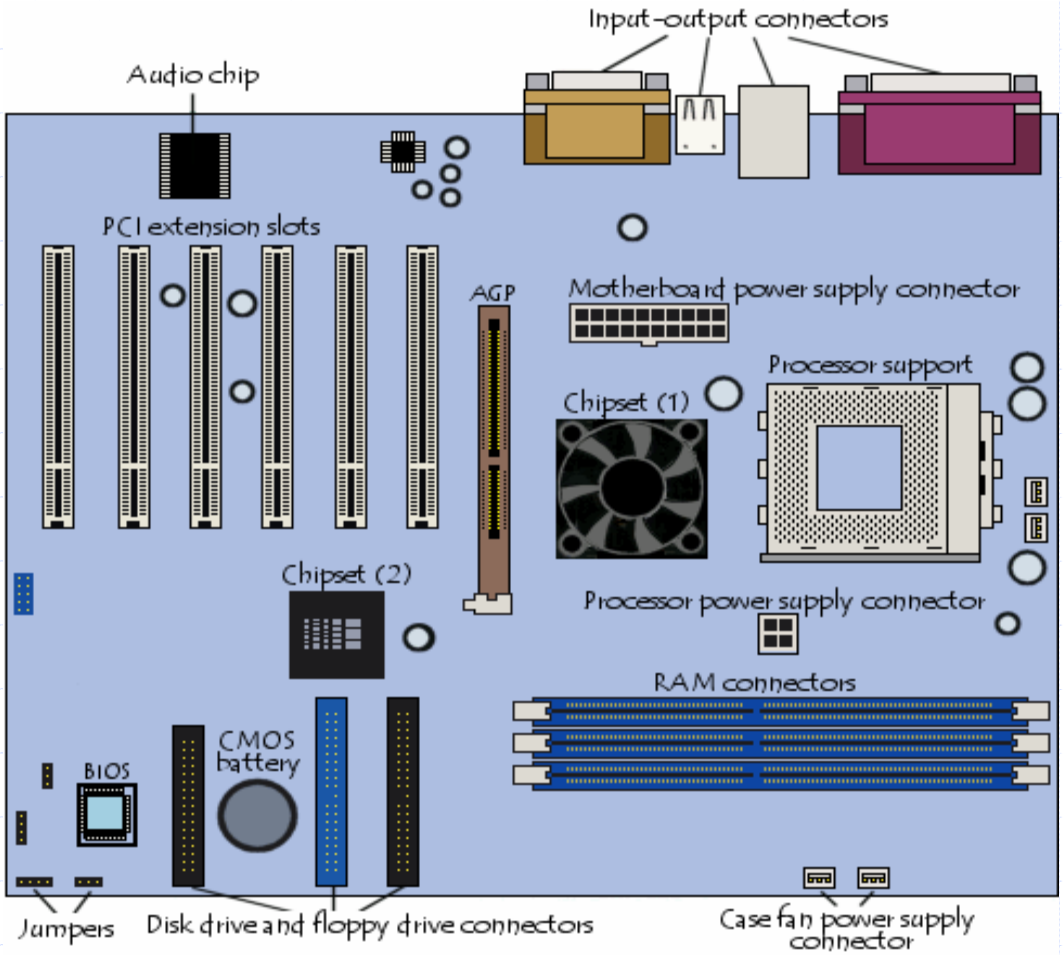
CD-ROM

Drive Tray

Tray-activator button

Indicator Light

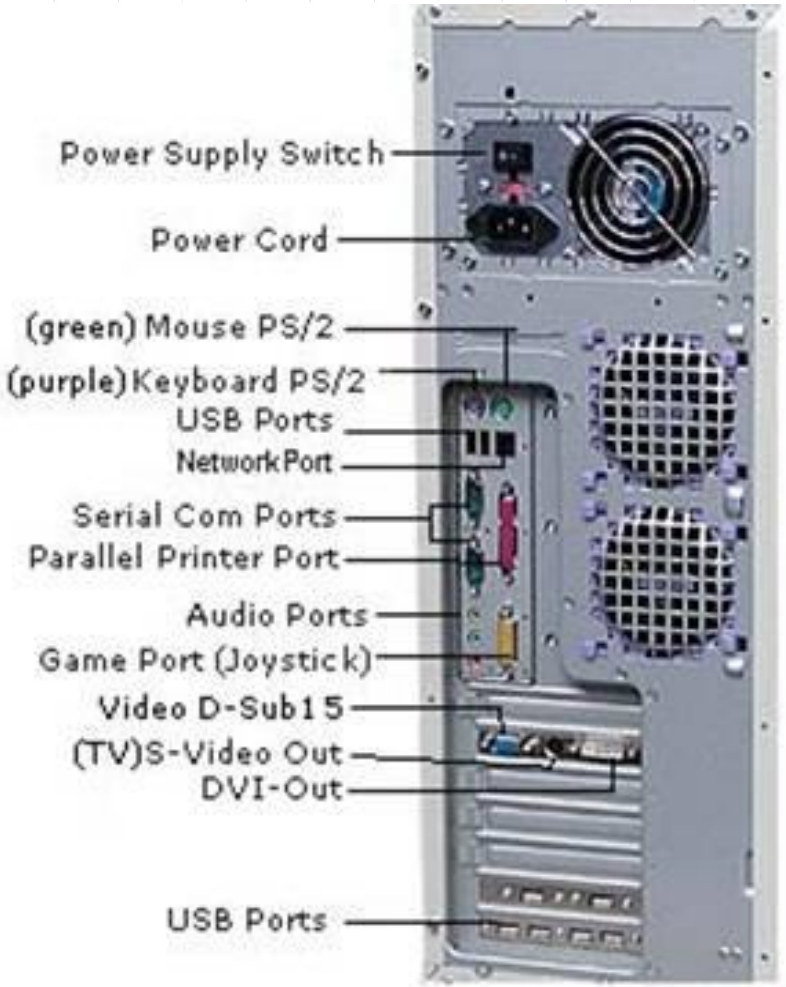
Motherboard

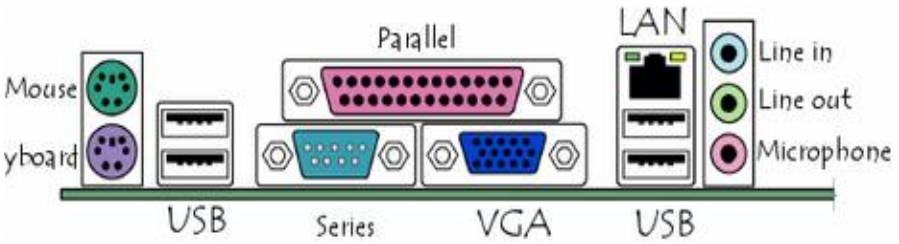


Motherboard

- Electronic circuit board
- Main job is to hold the computer's microprocessor chip and let every essential components connect to it
- Provides communication among:
  - Microprocessor
  - Chipset
  - Memory chips
  - BIOS/ Basic Input Output System
  - System Bus and Expansion Bus

Ports


Power Supply Switch
Power Cord
(green) Mouse PS/2
(purple) Keyboard PS/2
USB Ports
Network Port
Serial Com Ports
Parallel Printer Port
Audio Ports
Game Port (Joystick)
Video D-Sub15
(TV) S-Video Out
DVI-Out
USB Ports


Mouse
yboard
USB
Parallel
Series
VGA
LAN
USB
Line in
Line out
Microphone

Connectors

- A connector is any connector used within computers or to connect computers to networks, printers or other devices

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PS/2 Connector

- The PS/2 connector are use for connecting keyboard and mouse on the modern PCs
- The PS2 mouse connector and port is usually green in colour to distinguish it from the PS2 keyboard, which is purple

USB Port

- Universal Serial Bus: a protocol for transferring data to and from digital devices
- Many digital cameras and memory card readers connect to the USB port on a computer

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Fire-wire IEEE 1394 Port

- A type of cabling technology for transferring data to and from digital devices at high speed
- FireWire are typically faster than those that connect via USB.

RJ45 Ethernet Port

- LAN or (Local Area Network) uses a CAT5 cable and a RJ45 connection
- The CAT 5 cable is also called the Ethernet Cable
- Network connection generally uses a 10/100 Mbps speed. This means it has two different speeds 10 Mbps and 100 Mbps.

DB25 Parallel Port

- The printer connects to your computer with a Parallel connector. This connector has 25 pins.
- Parallel means the device is capable of receiving more than one bit at a time (that is, it receives several bits in parallel).

Homework

1. Write a report on computer processors, including the role of it in a computer system and the evolution of processors.
2. Compare SRAM and DRAM.
3. Write Short Notes on:
   I. PROM
   II. EPROM
4. Give two examples for memory registers and describe them briefly.
5. Briefly describe common ports of the Computer.
6. Compare and contrast memory accessing methods.
7. List basic components in a mother board and explain them briefly.
8. Compare technology, capacity, cost, accessing speed and accessing methods of following storage devices.

   RAM, Cache, HDD, Optical Disks, Tapes, USB drives