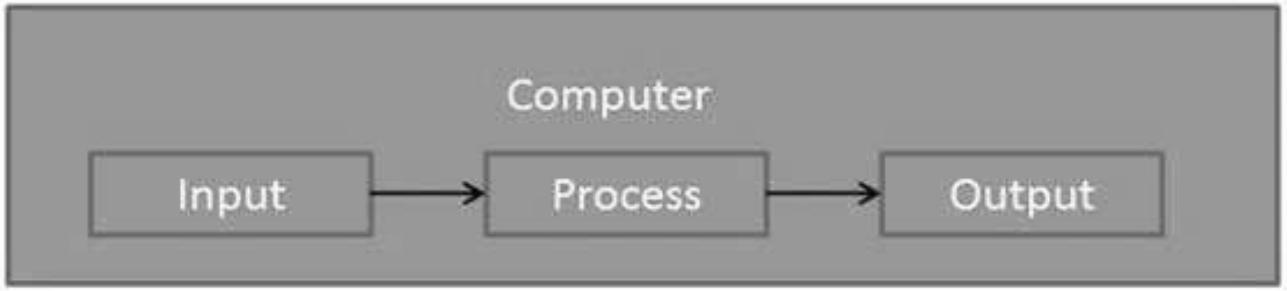
Computer Fundamentals

Functionalities of a Computer

- **Step 1** – Takes data as input.
- **Step 2** – Stores the data/instructions in its memory and uses them as required.
- **Step 3** – Processes the data and converts it into useful information.
- **Step 4** – Generates the output.
- **Step 5** – Controls all the above four steps



Advantages of Computers

- **High Speed**
- **Accuracy**
- **Storage Capability**
- **Diligence**
  - It can work continuously without any error and boredom.
  - It can perform repeated tasks with the same speed and accuracy.
- **Versatility**
- **Reliability**
- **Automation**
- **Reduction in Paper Work and Cost**

Application

- Business
- Banking
- Insurance
- Education
- Marketing
- Healthcare
- Engineering Design
- Military
- Communication
- Government Services

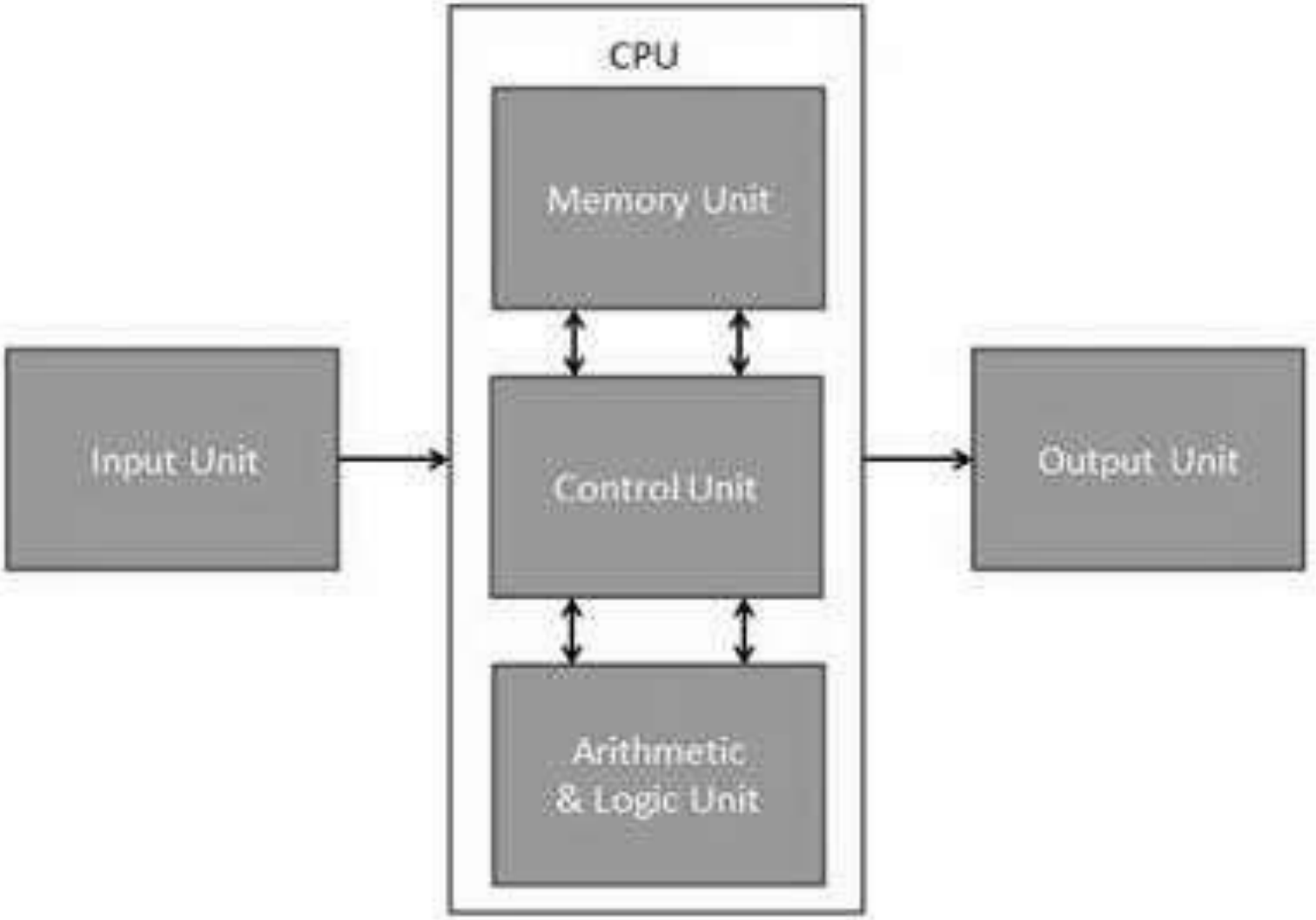
Generation & Description

- **First Generation**
  - The period of first generation: 1946-1959. Vacuum tube based.
- **Second Generation**
  - The period of second generation: 1959-1965. Transistor based.
- **Third Generation**
  - The period of third generation: 1965-1971. Integrated Circuit based.
- **Fourth Generation**
  - The period of fourth generation: 1971-1980. VLSI microprocessor based.
- **Fifth Generation**
  - The period of fifth generation: 1980-onwards. ULSI microprocessor based.

Computers can be broadly classified by their speed and computing power

- **PC (Personal Computer)**
  - It is a single user computer system having moderately
  - powerful microprocessor
- **Workstation**
  - It is also a single user computer system, similar to personal computer however has a more powerful microprocessor
- **Mini Computer**
  - It is a multi-user computer system, capable of supporting hundreds of users simultaneously.
- **Main Frame**
  - It is a multi-user computer system, capable of supporting hundreds of users simultaneously. Software technology is different from minicomputer.
- **Supercomputer**

  It is an extremely fast computer, which can execute hundreds of millions of instructions per second.


CPU
Memory Unit
Input Unit
Control Unit
Output Unit
Arithmetic
& Logic Unit

Input Unit

- This unit contains devices with the help of which we enter data into the computer.
- This unit creates a link between the user and the computer.
- The input devices translate the information into a form understandable by the computer.

Input Devices

- Keyboard
- Mouse
- Joy Stick
- Light pen
- Track Ball
- Scanner
- Graphic Tablet
- Microphone
- Magnetic Ink Card Reader (MICR)
- Optical Character Reader (OCR)
- Bar Code Reader
- Optical Mark Reader (OMR)

CPU (Central Processing Unit)

- CPU is considered as the brain of the computer.
- CPU performs all types of data processing operations.
- It stores data, intermediate results, and instructions (program).
- It controls the operation of all parts of the computer.
- CPU itself has the following **three** components:
  - **ALU (Arithmetic Logic Unit)**
  - **Memory Unit**
  - **Control Unit**

Output Unit

- The output unit consists of devices with the help of which we get the information from the computer.
- This unit is a link between the computer and the users.
- Output devices translate the computer's output into a form understandable by the user

Output devices

- Monitors
- Graphic Plotter
- Printer
- Speaker

Memory

- Memory is primarily of three types –
  - Cache Memory
  - Primary Memory/Main Memory
  - Secondary Memory

Cache Memory

- Cache memory is a very high speed semiconductor memory which can speed up the CPU.
- It acts as a buffer between the CPU and the main memory.
- It is used to hold data and program which are most frequently used by the CPU.

Cache Memory

- **Advantages**
- Cache memory is faster than main memory.
- It consumes less access time as compared to main memory.
- It stores the program that can be executed within a short period of time.
- It stores data for temporary use.

Primary Memory (Main Memory)

- Primary memory holds only those data and instructions on which the computer is currently working.
- It has a limited capacity and data is lost when power is switched off.
- It is generally made up of semiconductor device.
- These memories are not as fast as registers.
- The data and instruction required to be processed resides in the main memory.
- It is divided into two subcategories
  - RAM and ROM

Secondary Memory

- This type of memory is also known as external memory or non-volatile.
- It is slower than the main memory.
- These are used for storing data/information permanently.
- CPU directly does not access these memories, instead they are accessed via input-output routines.
- The contents of secondary memories are first transferred to the main memory, and then the CPU can access it.

For example, harddisk, CD-ROM, DVD, etc.

RAM (Random Access Memory

- RAM (Random Access Memory) is the internal memory of the CPU for storing data, program, and program result. It is a read/write memory which stores data until the machine is working.
- As soon as the machine is switched off, data is erased
- RAM is of two types –
- ·Static RAM (SRAM)
- · Dynamic RAM (DRAM)

Read Only Memory(ROM)

- ROM stands for Read Only Memory.
- The memory from which we can only read but cannot write on it.
- This type of memory is non-volatile.
- The information is stored permanently in
- such memories during manufacture.
- A ROM stores such instructions that are required to start a computer.
- This operation is referred to as bootstrap.
- ROM chips are not only used in the computer but also in other electronic items like washing machine and microwave oven.
- **PROM (Programmable Read Only Memory)**
- **EPROM (Erasable and Programmable Read Only Memory)**
- **EEPROM (Electrically Erasable and Programmable Read Only Memory)**

Advantages of ROM

- The advantages of ROM are as follows:
- ・Non-volatile in nature
- ・Cannot be accidentally changed
- ・Cheaper than RAMs
- ・Easy to test
- ・More reliable than RAMs
- ・Static and do not require refreshing
- ・Contents are always known and can be verified

Motherboard

- The motherboard serves as a single platform to connect all of the parts of a computer together. It connects the CPU, memory, hard drives, optical drives, video card, sound card, and other ports and expansion cards directly or via cables.
- It can be considered as the backbone of a computer.

Memory Units

- **Bit (Binary Digit)**
  - A binary digit is logical 0 and 1 representing a passive or an active state of a component in an electric circuit.
- **Nibble** A group of 4 bits is called nibble.
- **Byte** A group of 8 bits is called byte.
- A byte is the smallest unit, which can represent a data item or a character.
- **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.**

  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 computer words.

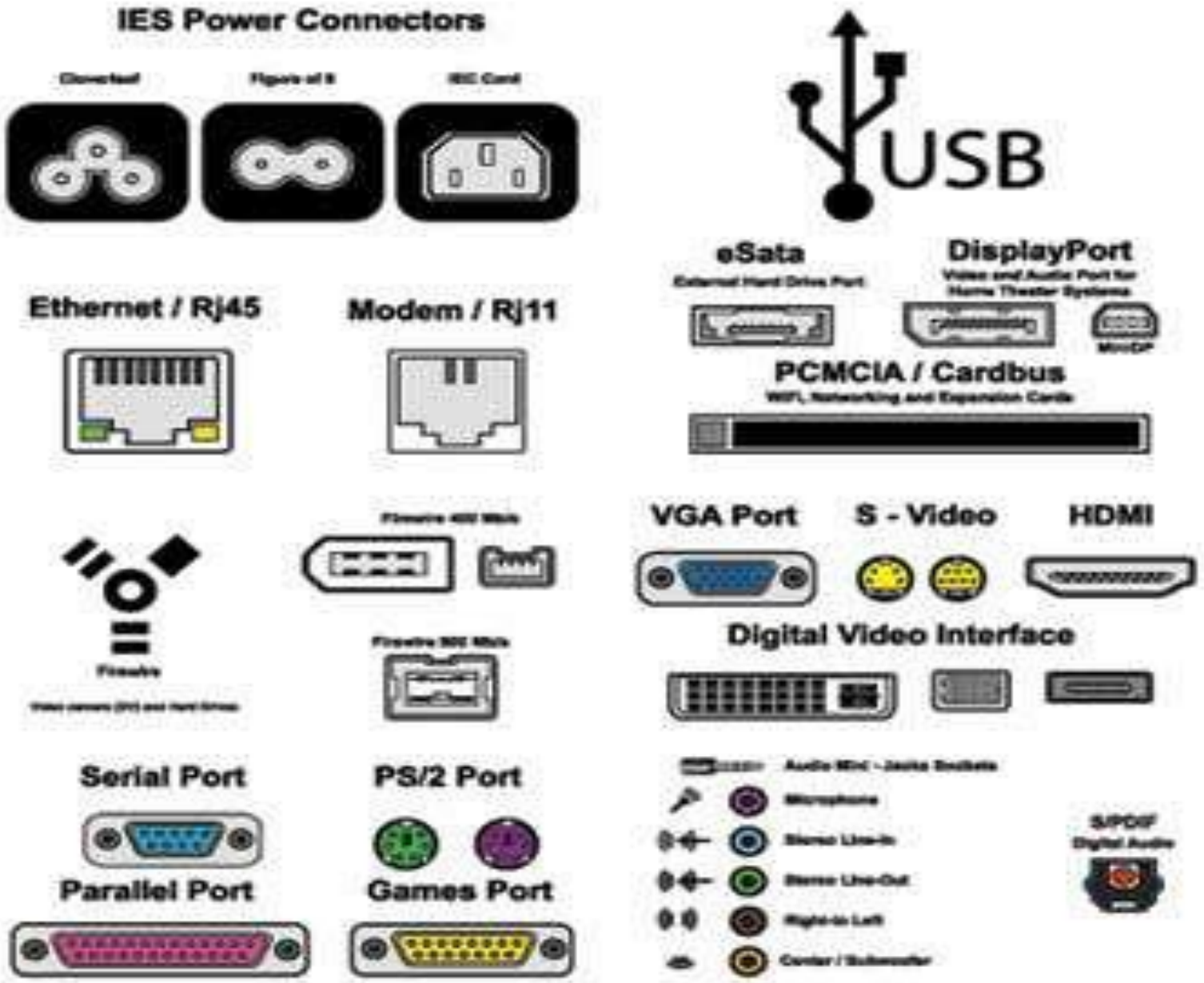
- Kilobyte (KB) 1 KB = 1024 Bytes
- Megabyte (MB) 1 MB = 1024 KB
- GigaByte (GB) 1 GB = 1024 MB
- TeraByte (TB) 1 TB = 1024 GB
- PetaByte (PB) 1 PB = 1024 TB

Port

- A port is a physical docking point using which an external device can be connected to the computer.
- It can also be programmatic docking point through which information flows from a program to the computer or over the Internet.

Characteristics of Ports

- A port has the following characteristics:
- External devices are connected to a computer using cables and ports.
- Ports are slots on the motherboard into which a cable of external device is plugged in.
- Examples of external devices attached via ports are the mouse, keyboard, monitor, microphone, speakers, etc.


IES Power Connectors
USB
eSata
DisplayPort
Ethernet / Rj45
Modem / Rj11
PCMCIA / Cardbus
VGA Port
S - Video
HDMI
Digital Video Interface
Serial Port
PS/2 Port
Parallel Port
Games Port

Serial Port

- Used for external modems and older computer mouse
- Two versions: 9 pin, 25 pin model
- Data travels at 115 kilobits per second

Parallel Port

- Used for scanners and printers
- Also called printer port
- 25 pin model
- IEEE 1284-compliant Centronics port

PS/2 Port

- Used for old computer keyboard and mouse
- Also called mouse port
- Most of the old computers provide two PS/2 port, each for the mouse and keyboard
- IEEE 1284-compliant Centronics port

Universal Serial Bus (or USB) Port

- It can connect all kinds of external USB devices such as external hard disk, printer, scanner, mouse, keyboard, etc.
- It was introduced in 1997.
- Most of the computers provide two USB ports as minimum.
- Data travels at 12 megabits per seconds.
- USB compliant devices can get power from a USB port.

VGA Port

- Connects monitor to a computer's video card.
- Similar to the serial port connector

Power Connector

- Three-pronged plug.
- Connects to the computer's power cable that plugs into a power bar or wall socket.

Firewire Port

- Transfers large amount of data at very fast speed.
- Connects camcorders and video equipment to the computer.
- Data travels at 400 to 800 megabits per seconds.
- Invented by Apple.
- It has **three** variants: 4-Pin FireWire 400 connector, 6-Pin FireWire 400 connector, and 9-Pin FireWire 800 connector.

Ethernet Port

- Connects to a network and high speed Internet.
- Connects the network cable to a computer.
- This port resides on an Ethernet Card.
- Data travels at 10 megabits to 1000 megabits per seconds depending upon the network bandwidth.

Game Port

- Connect a joystick to a PC
- Now replaced by USB

Hardware

- It represents the physical and tangible components of a computer, i.e. the components that can be seen and touched.
- Examples of Hardware are the following:

・ Input devices – keyboard, mouse, etc.

・ Output devices – printer, monitor, etc.

・ Secondary storage devices – Hard disk, CD, DVD, etc.

・ Internal components – CPU, motherboard, RAM, etc.

- Hardware and software are mutually dependent on each other.

Both of them must work together to make a computer produce a useful output.

- Software cannot be utilized without supporting hardware.
- Hardware without a set of programs to operate upon cannot be utilized and is useless.

Software

- Software is a set of programs, designed to perform a well-defined function.
- A program is a sequence of instructions written to solve a particular problem.
- There are **two** types of software -
- **・System Software**
- **・Application Software**

System software

- The is a collection of programs designed to operate, control, and extend the processing capabilities of the computer itself.
- System software is generally prepared by the computer manufacturers.
- These software products comprise of programs written in low-level languages, which interact with the hardware at a very basic level.
- System software serves as **the interface between the hardware and the end users.**
- Some examples of system software are
- Operating System,
- Compilers,
- Interpreter,
- Assemblers.

Application Software

- Application software products are designed to satisfy a particular need of a particular
- environment.
- All software applications prepared in the computer lab can come under the category of Application software.

Number System

- **Binary Number System**
- Base 2. Digits used : 0, 1
- **Octal Number System**
- Base 8. Digits used : 0 to 7
- **Hexa Decimal Number System**
- Base 16. Digits used: 0 to 9,
- Letters used : A- F

Data

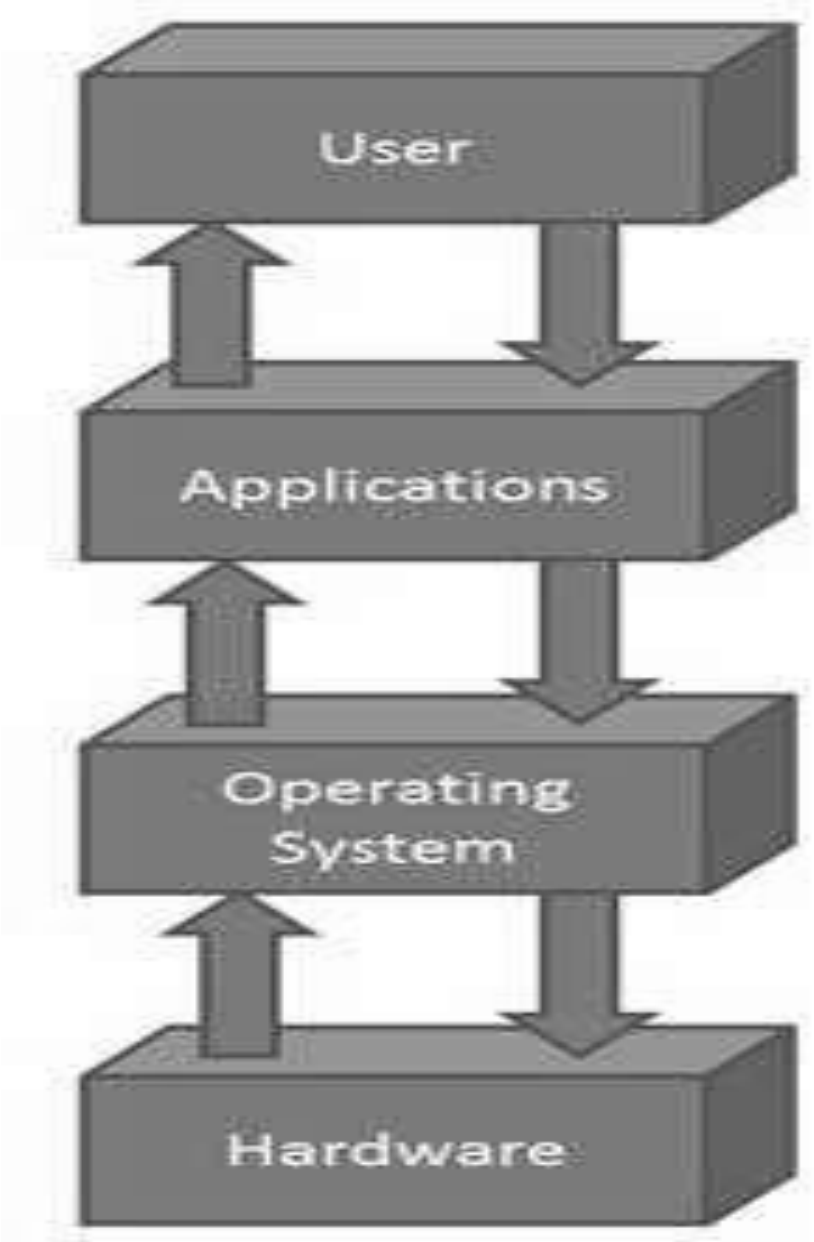
- Data can be defined as a representation of facts, concepts, or instructions in a formalized manner, which should be suitable for communication, interpretation, or processing by human or electronic machine

Information

- Information is organized or classified data, which has some meaningful values for the receiver.
- Information is the processed data on which decisions and actions are based.
- For the decision to be meaningful, the processed data must qualify for the following characteristics:
- **・ Timely – Information should be available when required.**
- **・ Accuracy – Information should be accurate.**
- **・ Completeness – Information should be complete.**

Operating System

- The Operating System is a program with the following features:
- An operating system is a program that acts as an interface between the software and the computer hardware.
- It is an integrated set of specialized programs used to manage overall resources and operations of the computer.
- It is a specialized software that controls and monitors the execution of all other programs that reside in the computer, including application programs and other system software.


User
Applications
Operating System
Hardware

Objectives of Operating System

・To make the computer system convenient to use in an efficient manner.

・To hide the details of the hardware resources from the users.

・To provide users a convenient interface to use the computer system.

- ・To act as an intermediary between the hardware and its users, making it easier for
- the users to access and use other resources.
- ・To manage the resources of a computer system.
- ・To keep track of who is using which resource, granting resource requests, and
- mediating conflicting requests from different programs and users.
- ・To provide efficient and fair sharing of resources among users and programs.

Characteristics of Operating System

- ▪ **Memory Management** – Keeps track of the primary memory, i.e. what part of it is in use by whom, what part is not in use, etc. and allocates the memory when a
- process or program requests it.
- ▪ **Processor Management** – Allocates the processor (CPU) to a process and deallocates the processor when it is no longer required.
- ▪ **Device Management** – Keeps track of all the devices. This is also called I/O controller that decides which process gets the device, when, and for how much
- time.
- ▪ **File Management** – Allocates and de-allocates the resources and decides who gets the resources.

Characteristics of Operating System

- **· Security** – Prevents unauthorized access to programs and data by means of
- passwords and other similar techniques.
- **· Job Accounting** – Keeps track of time and resources used by various jobs and/or users.
- **· Control Over System Performance** – Records delays between the request for a service and from the system.
- **· Interaction with the Operators** – Interaction may take place via the console of the computer in the form of instructions. The Operating System acknowledges the same, does the corresponding action, and informs the operation by a display screen.
- **· Error-detecting Aids** – Production of dumps, traces, error messages, and other debugging and error-detecting methods.
- **· Coordination Between Other Software and Users** – Coordination and
- assignment of compilers, interpreters, assemblers, and other software to the
- various users of the computer systems.

Computer Network

- A computer network is a system in which multiple computers are connected to each other to share information and resources.