Chapter 1:

Hardware Concepts

Informatics Practices

Class XI (CBSE Board)

Revised as per CBSE Curriculum 2015

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Learning Objectives

In this presentation, you will learn about-

- Functional Units of computer
- Processing Unit
- Primary Memory
- Various Input devices
- Various Output devices
- Secondary storage units
- Communication Buses & Ports
- Types of computers
- E-Waste and disposal
- Evolution of computers
- Generations of modern computers

What is Computer?

- A computer is an electronic device that processes input data and produces result as per given instructions called Program.
- In general, Computer is a Data Processing Device which convert data into information at very high speed.

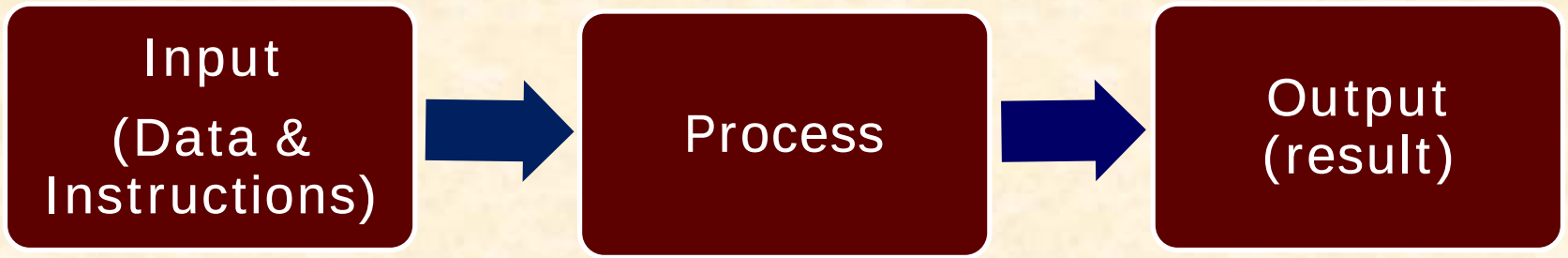
Data V/S Information

Data	Information
The term Data refers raw facts and figures. Ex. 'Raman' , 10 etc.	Information is processed data, that gives some idea/knowledge. Ex. "Raman is in class 6"
Data is irrelevant to user because data alone can not give any conclusion.	Information is meaningful and useful to user.

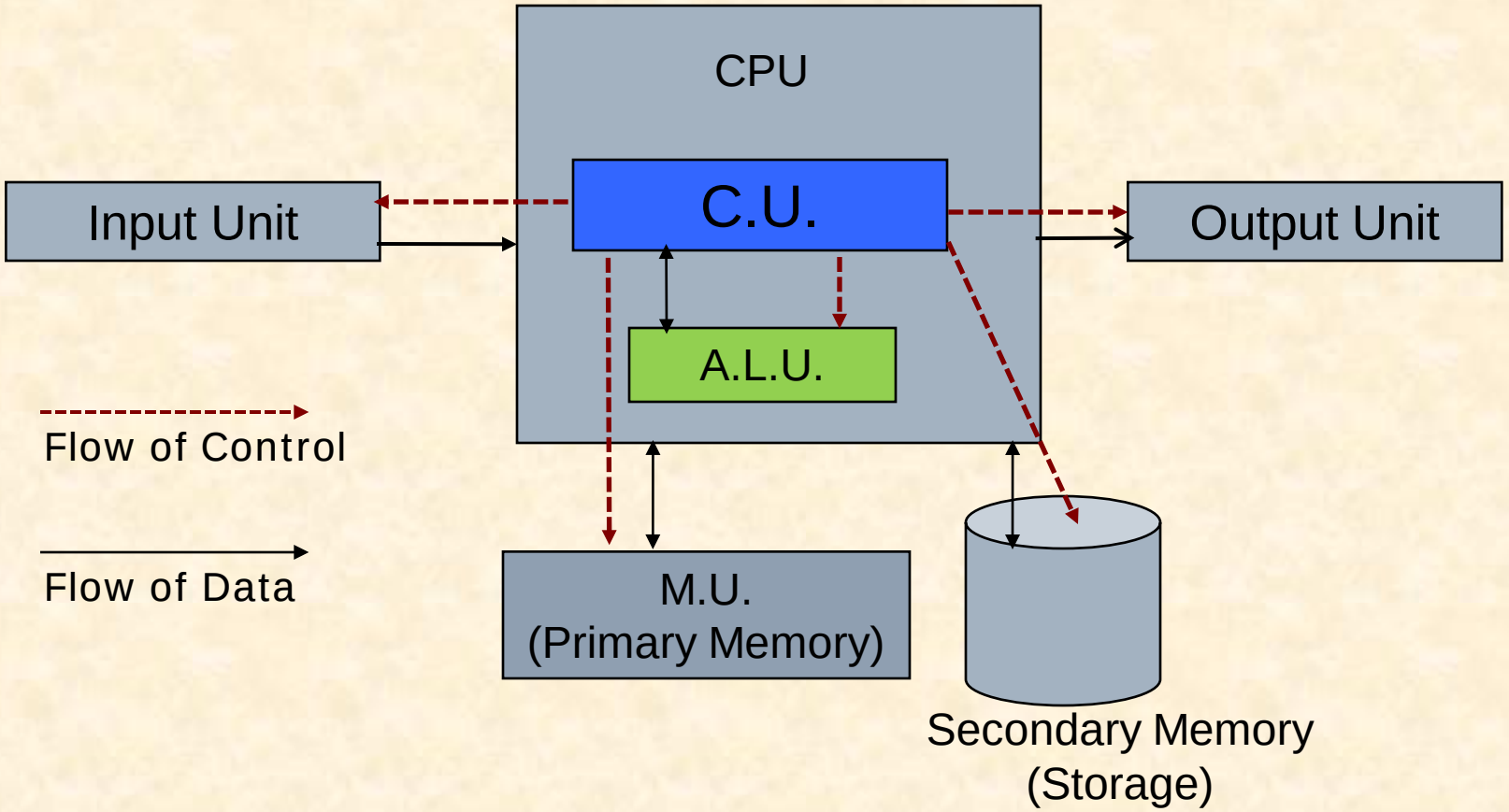
Function of Computer

A computer performs the following major functions-

- It accepts data or Instructions as Input
- It processes data as per instruction
- It gives result (information) as output
- It controls operations of a computer
- It stores data and result.



Functional Diagram of a computer



All the Input & Output devices around the system is also called Peripherals

Central Processing Unit (CPU)

It is the brain of computer system. It controls and guides all the connected devices. It is divided in to two major parts-

- Control Unit: It controls the operation of all the devices and guides the flow of data and control.
- Arithmetic Logic Unit (ALU): This unit performs all the arithmetical (+,-,x,/) and logical (>,<.<=,>=,<>) calculations.

Both CU and ALU are designed in a single Circuit known as Microprocessor in PCs.
Intel is the largest manufacturer of Microprocessor Chip. Some famous series of Intel Processors are Pentium, Celeron, Xeon, Core2Duo etc.

Input Devices

Input device are used enter data, instructions (commands) and user response into the computer.

The following devices are used as input device-

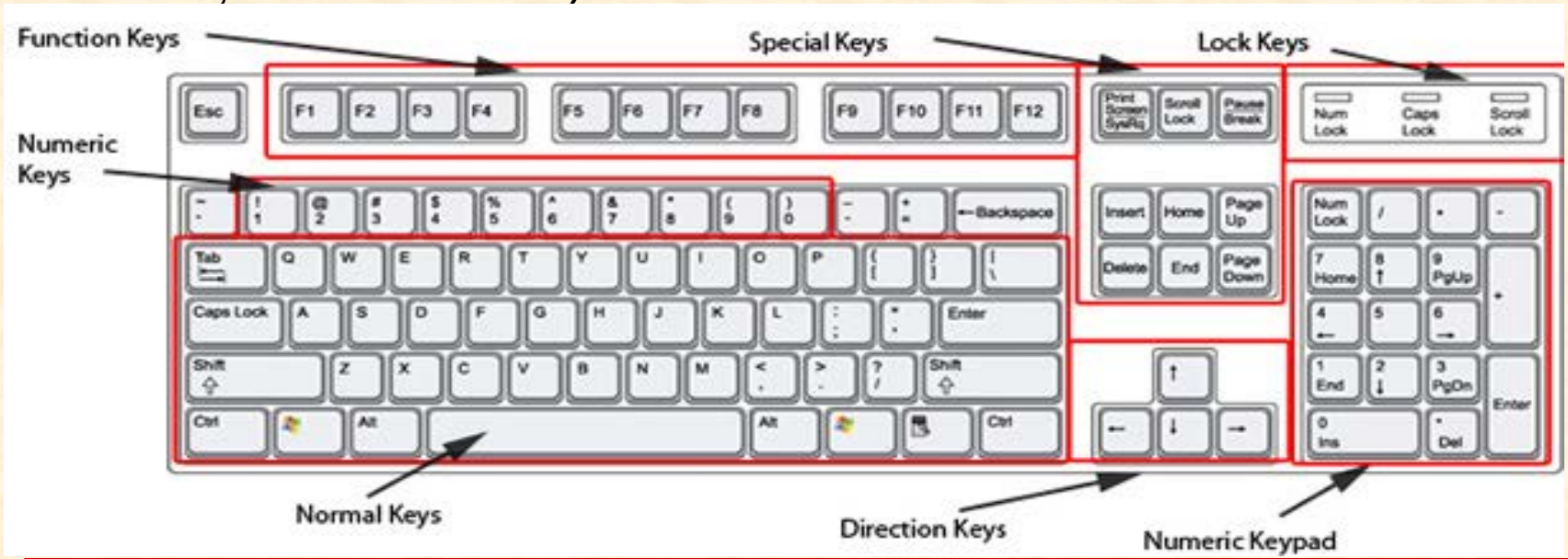
- Key Board
- Mouse
- Joystick
- Touch Screens
- Light Pen
- Graphic Tablet
- Microphone
- MICR
- OCR
- OMR
- Smart card Reader
- Scanner
- Bar Code Reader
- Biometric Sensor
- Digital / Web Camera

Keyboard

Keyboard is the most common input device used to enter text, numbers and instructions. It contains several keys or switches which corresponds to a symbol written on it.

Generally, a keyboard contains the following types of keys.

- ⇨Alphabet Keys (A-Z)
- ⇨ Number Keys (0-9)
- ⇨Direction Keys
- ⇨ Function Keys (F1 – F12)
- ⇨Other Keys (Spacebar, Tab, Shift, Alt, Ctrl, Del, Backspace Caps Lock, Num Lock etc.)



Mouse

Mouse is a handheld pointing device used to select or point an object displayed on the monitor. The motion of mouse simulates the motion of Mouse pointer on the screen. Generally, it contains Left , Right and Scroll Button.
Mechanical Mouse – contains rubber ball on its underside.
Optical Mouse – contains optical sensor to detect motion.

Some common operation with mouse are-

- Left Click or Click
- Double Click
- Right Click
- Drag & Drop
- Scroll

Joystick

Joystick is an input device consisting a stick that is used to move object in an angle or direction. It is generally used in playing video games.

Microphone

Microphone or Mic are used to input audio data into computer. Generally it is used for sound or voice recording.

Web Camera

Web Camera or Webcam is used to capture images or video while Video Chatting or Conferencing.

Graphic Tablet

Graphic Tablet or Tablet is an input device that allow enter drawing and sketches into computer. It consists of an electronically sensitive surface on which anything can be written or drawn using stylus or pen. Most commonly it is used to enter digital signatures, sketching and writing something while teaching with computers in classrooms.

Light Pen

Light pen is an input device in the form of a light-sensitive stylus attached with a computer's CRT monitor. The light pen was used in early days when Touch-screen technology was not available. It is used as pointing device to select the objects, or used to draw and write something on the screen.

Touch Screen

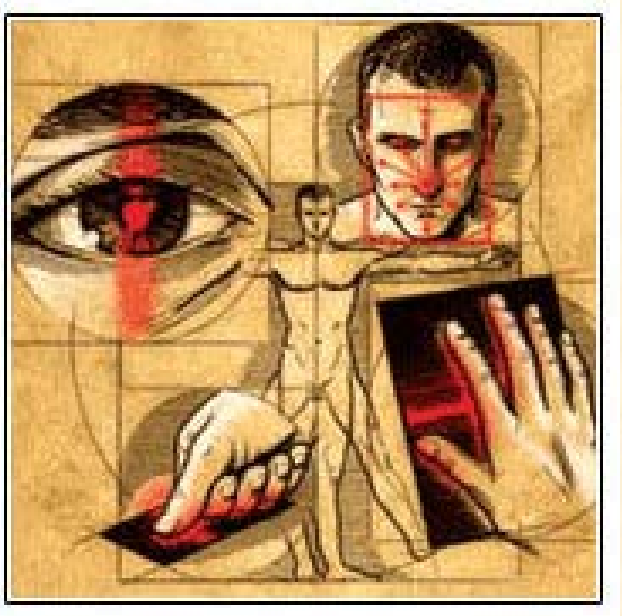
It is a touch-sensitive display screen which allow interacting with the computer without using mouse or any other pointing devices. The touch screen is used in ATM Terminal in Banks, Enquiry terminal at Railway Stations and Airports, Smart phones etc.

Smartcard Reader

Smartcards are plastic card containing Magnetic strips (memory) or Microchip to hold some personal data or some security information. Generally these cards are used in companies and organizations as ID-card for identification and Authentication purpose. Smartcard reader is used to access stored information in Smartcard.

Biometric Sensors

Biometric Devices are used for identifying a person's identity using some unique biological properties of a human-beings like Finger print or Retina scan, voice or face recognition etc. Generally, these devices are used to identify a person, mark attendance of employees in organizations or to provide restricted entry for secured area.



Scanner

Scanner is an input device that optically scans images, printed text or an object and converts it to a digital image. It works like a digital Photocopier device and generally used for storing, editing or re-printing of image or document.

Scanners comes in following types-

Hand-held Scanner - Small sized scanner rolled over the object.

Drum Scanner - Medium sized scanner with rolling drum like fax.

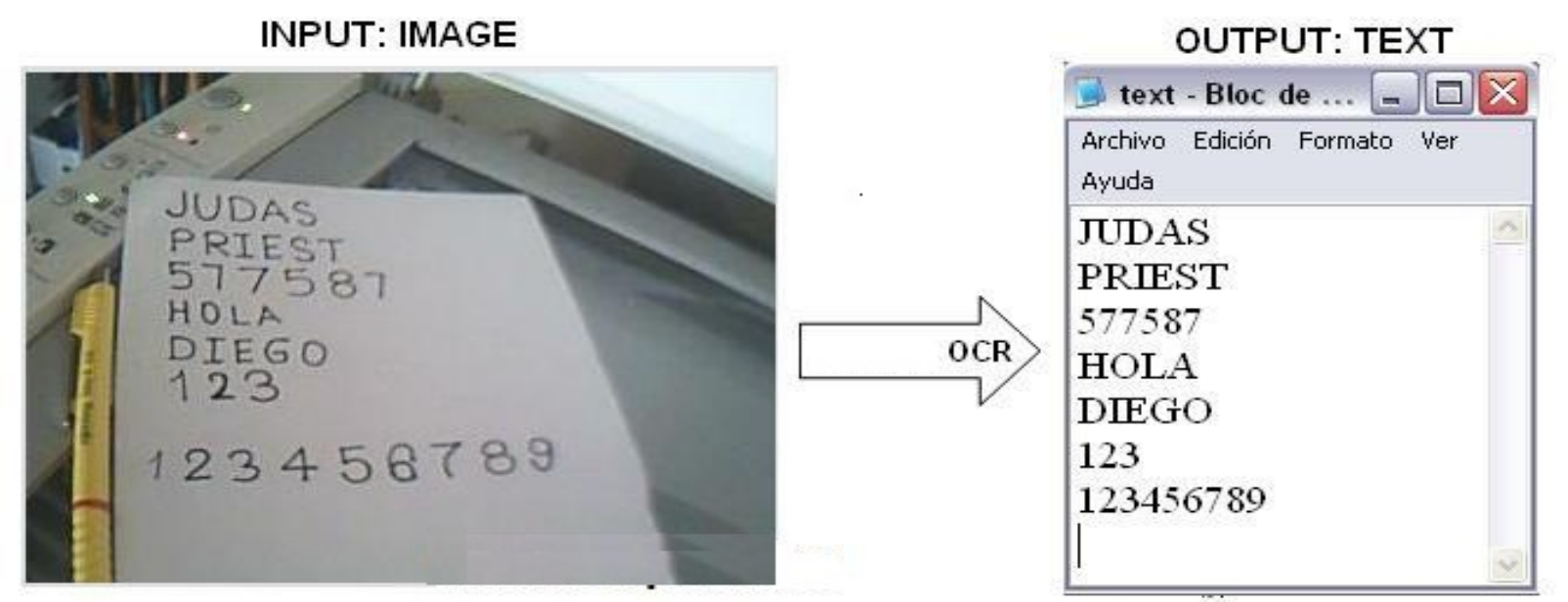
Flatbed Scanner - Large sized scanner with flat surface.

Hand-held Scanner

Flatbed Scanner

Optical Character Reader (OCR)

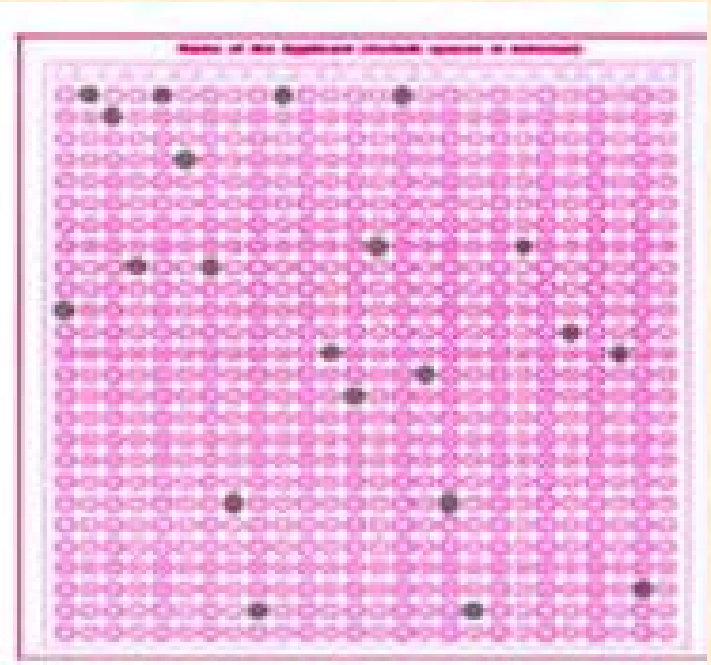
OCR device is used to convert images of text into computer editable text. OCR are capable of reading books and documents into electronic file to facilitate computerized record-keeping system in an office, or to publish on-line books. Modern OCR can recognize hand-written with good accuracy.
Generally, it is used with Scanner device (as OCR software) to convert scanned text image into editable text/document file.

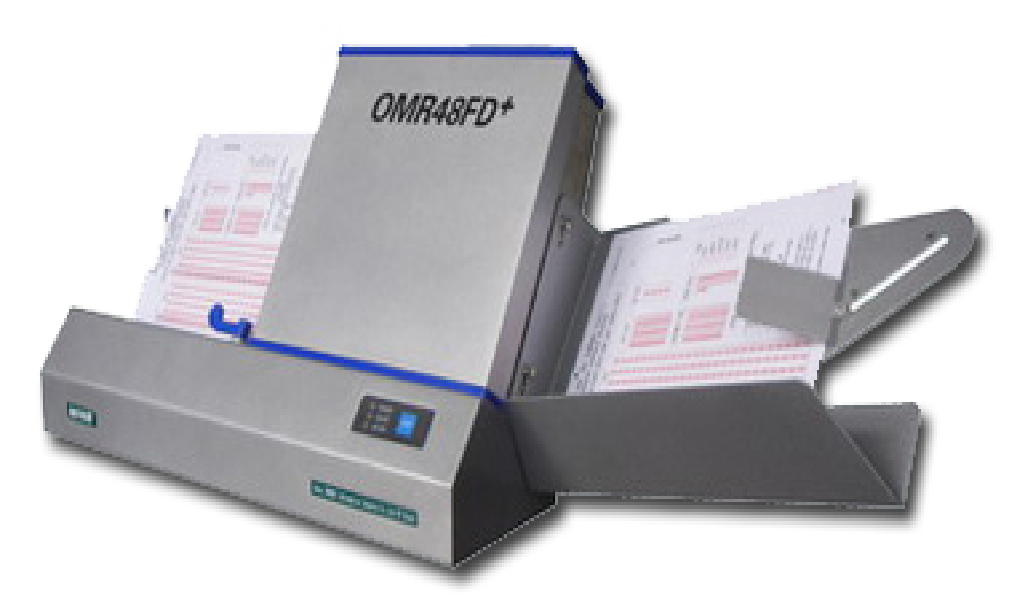


Optical Mark Reader (OMR)

OMR device is used to scan marked points on special preprinted forms. Marks can be made with dark pencil or pen in definite shape (circle or box) in OMR sheet that are scanned and process by the computer.

Generally, it is used to evaluate Objective-types answer scripts in public examinations or processing of Survey forms.





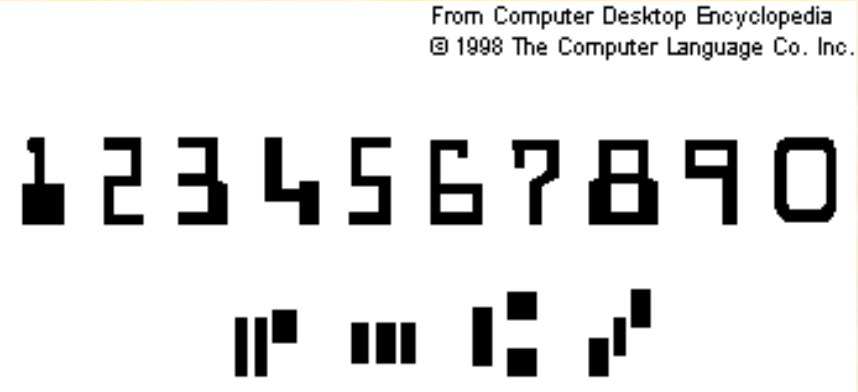
Barcode Reader

Barcode is a pattern of printed bars (strips) on various types of products. These strips contains product information like price, weight, date of manufacturing, date of expiry etc. in encoded form.

Optical Barcode Reader (OBR) reads these barcode to input product details into the computer. This device consists of a light source (laser), a lens and light sensor which reads barcode image. Generally, it is used in shops, shopping malls and Library etc.

Magnetic Ink Character Reader (MICR)

MICR device is used to read characters printed using special magnetic ink in special font or style. These characters are used in Bank cheques and Postal orders. MICR device is mainly used in banks to read cheque number, IFSC code etc. pre printed on cheque leaves. This device saves time and ensures accuracy of data entry.



Output Devices

Output devices produce output (result) in human understandable form.

The following devices are commonly used as output device -

- Monitor or Visual Display Unit (VDU)
- Printer (Dot Matrix, Inkjet, Laser)
- Plotters
- Speakers
- Projector

Monitor

Monitor or VDU is most common output device. It looks like TV screen and available in various types and size. The picture on monitor is made up tiny dots called Pixels. The quality of a picture depends on its Resolution (total number of pixels) i.e. more pixels, the greater quality.

CRT (Cathode Ray Tube) Monitor:
These monitor contains a glass tube with phosphorus coating, which is lighted when electron strikes. It works like Television.

Liquid Crystal Display (LCD) / TFT Monitor:
It contains Liquid Crystals to create tiny pixels. It is also called Thin Film Transistor (TFT) monitor. It is smaller, lighter and consumes less power than CRT monitors. Now days, Plasma display is also popular.

Printer

Printer is an output device that produces text and images on paper in printed form. Printers come in different varieties based on Quality, Speed and Technology. Some common types are-

Dot Matrix Printer:

It prints character or images by tiny dots on the paper like Type-Writer. These dots are produced by a moveable Printing head containing matrix of Pins, which strikes on the inked-Ribbon and leaves impression (dots) on the paper.
It is called Impact Printer since dots are formed by impact of inked-ribbon and paper.

- It has low operating cost and can produce carbon copies.
- It is noisy, slow and produces low quality Black & White output.
- Mostly used in Banks and Offices.

Printer

Inkjet / Desk-Jet Printer:

These printers can produce coloured printouts. It prints character by using controlled stream (jet) of liquid ink, which produces tiny droplets of ink on the paper. These coloured droplets forms text or images on paper.
It is called Non-Impact Printer since droplets are formed silently by Jet of Ink stored in the cartridge.

- It is quite in operation and produces B&W or coloured output in good quality of resolution.
- It is little costlier and Ink-cartridge can dry out, if left unused for long period of time.
- Not suitable for creating carbon copy printout.
- Most suited for home and small offices.

Printer

Laser Printer:

These printers use laser technology to produce printed document and works like Photo copier. The image of document is formed on copier drum with the help of laser beam, which electrically charges the drum surface. This charges surface attracts Tonner ink (dry ink), which is permanently fused on the paper with heat and pressure. It prints at very fast speed i.e. 10-20 ppm (Pages per Minute).

- It is fast, quite and produces good quality output in high resolution (600-1200 dpi-dots per inch) at low running cost.
- It is expensive to buy and repair.
- Not suitable for creating carbon copy printout.
- Most suited for offices.

Plotter

Plotters are the printing device that produces good quality drawings and graphics. These devices mostly used for printing Maps, charts or Engineering drawings. There are two types of plotters-

Drum Plotter: It usage rotating drum to print images on the paper.

Flatbed Plotter: It usage moving Pens on fixed paper on flatbed surface. The pen mounted on a ink-carriage can move in all four directions to draw the image.

Flatbed Plotter

Drum Plotter

Speaker

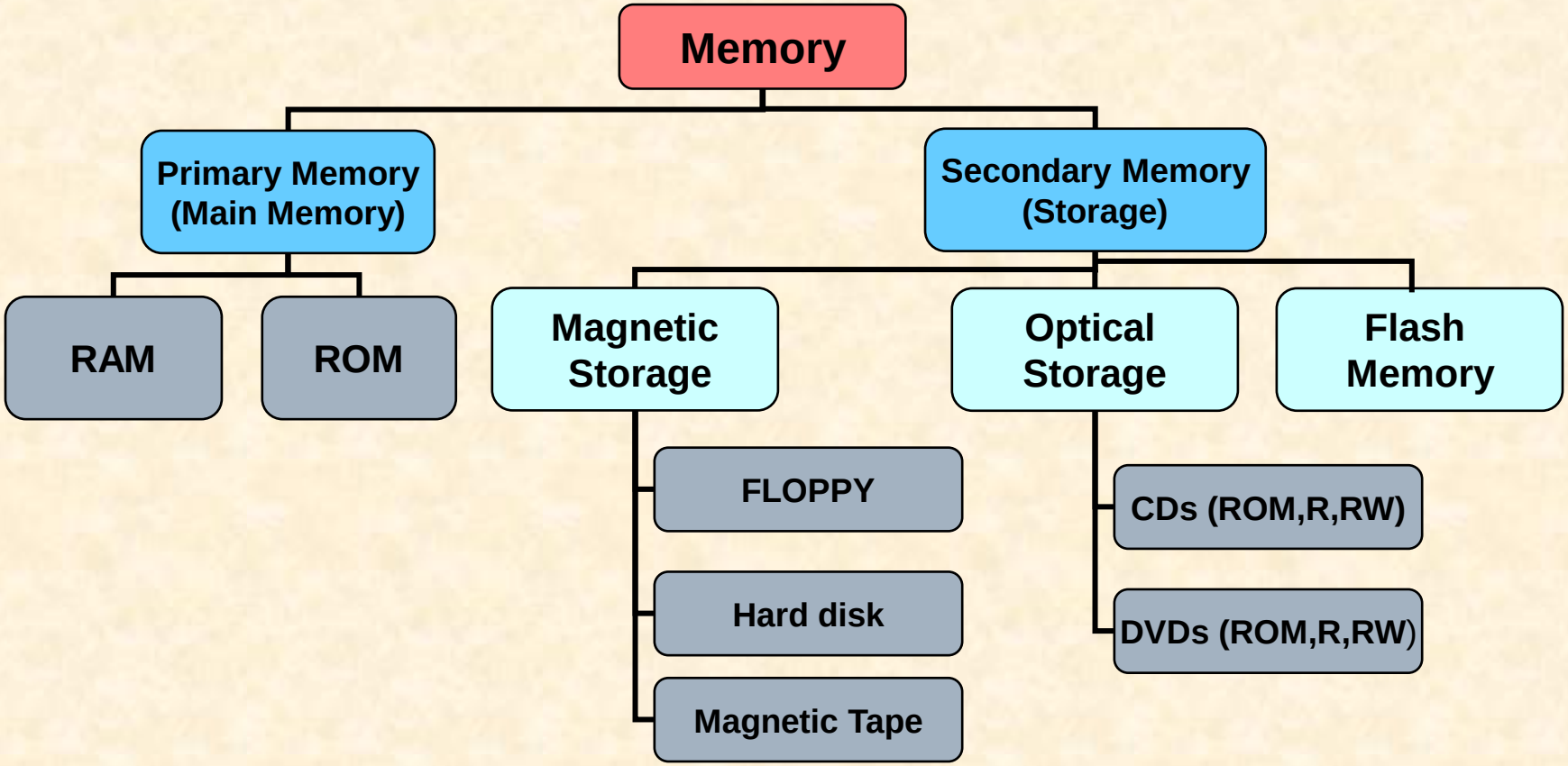
A speaker device generates sound while playing audio files or audio track. It requires Sound Card to be installed in Computer. Sound card generally produces two point Stereo port (Left & Right) to connect speaker. An advanced sound card may have 2.1 or 4.1 channel output to provide Dolby and Surround Sound effect.

Projector

A Projector or LCD Projector is an output which enlarges the display and projects it on plain wall or surface to provide larger vision. It is used to show a video or Presentations in meetings or classrooms.

Memory Devices

Memory devices are used to store data, information and programs temporarily or permanently.-



Primary Memory

The Primary or main memory of computer is used for storing data and programs. The main memory unit is divided into-

Random Access Memory (RAM):

It is used to hold data and instructions temporarily, while operation of computer. It is Volatile memory i.e. data will be lost, if power is switched off.

Read Only Memory (ROM):

It is used to store the program or instructions provided by the manufacturer (Firmware), which is used to carry POST (Power On Self Test) function for basic hardware and to load Operating System in the RAM (Booting). It is permanent and Non-volatile memory.

RAM chip

ROM chip

Secondary Memory (Storage)

The Secondary storage, or Auxiliary Storage devices are used to store a large amount of data. These storage devices are also used to store and carry data from one place to another.
As per technology, they are divided into three categories.

Magnetic Storage:

Magnetic Storage devices uses Magnetic flux to represent and store data in binary form (i.e. 0 or 1). These magnetic flux are created when data is being written on the media. **Floppy**, **Magnetic Tape** and **Hard disk** drive belong in this category.

Optical Storage:

Optical storage technology uses Laser beam to read or write data on the media like CD or DVD. Laser beam creates Pits on the media while writing by burning the surface. **CD**s, **DVD**s and **Blu-Ray** Disk belong in this category.

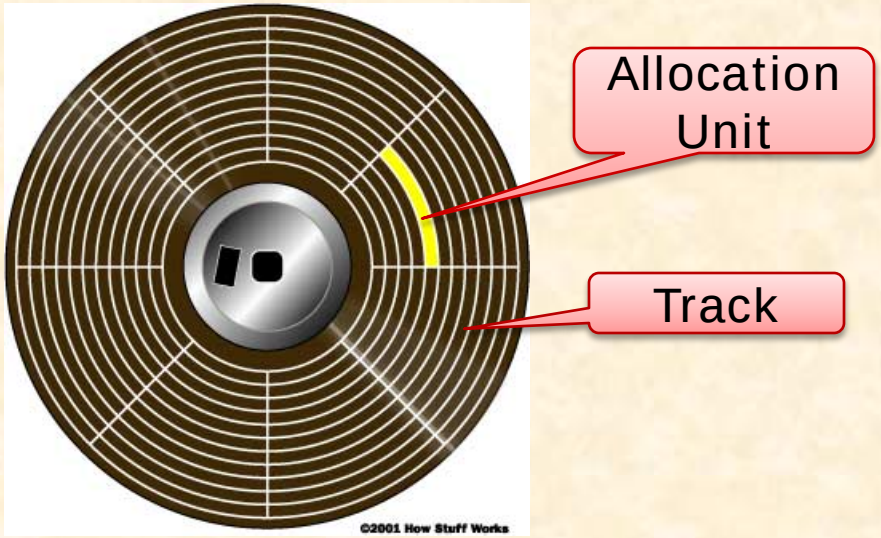
Flash Memory:

It is Chip-based technology, which stores data like ROM chip. The chip devices consumes very less power to write or access stored data. **Memory Cards**, **Pen Drives** and other Smart chips belong in this category.

Floppy Disk (Magnetic Disk)

Floppy Disk or Diskette is oldest portable data storage device used in early days. The floppy disk consists of a thin and flexible film coated with magnetic material, which is sealed in rectangular-shaped cover. Floppy disk is available in different sizes like 5 ¼" and 3 ½" diameter offering 720 KB to 1.44 MB storage capacity.

Floppy disk stores data in concentric circles called tracks which is divided in sectors. A cross area of track and sector is called Allocation unit, which can store 1 KB data. Generally, a floppy contains 9 sectors and 80 tracks.

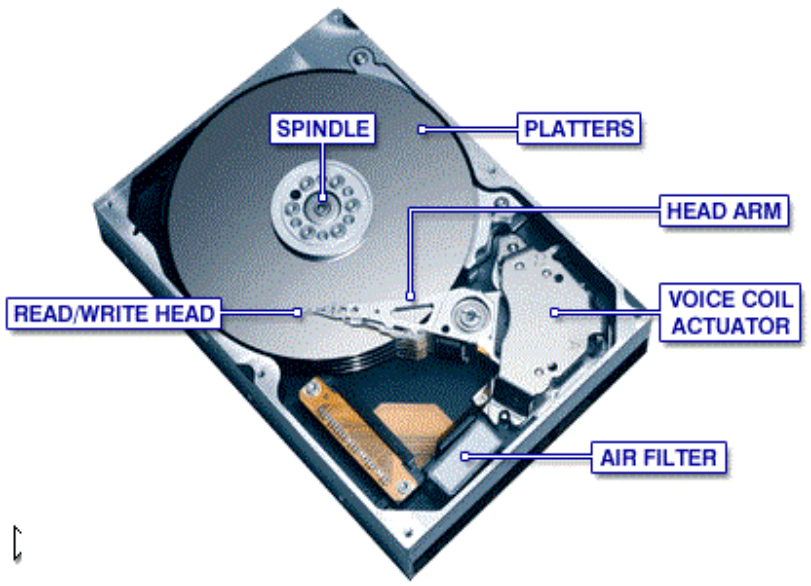


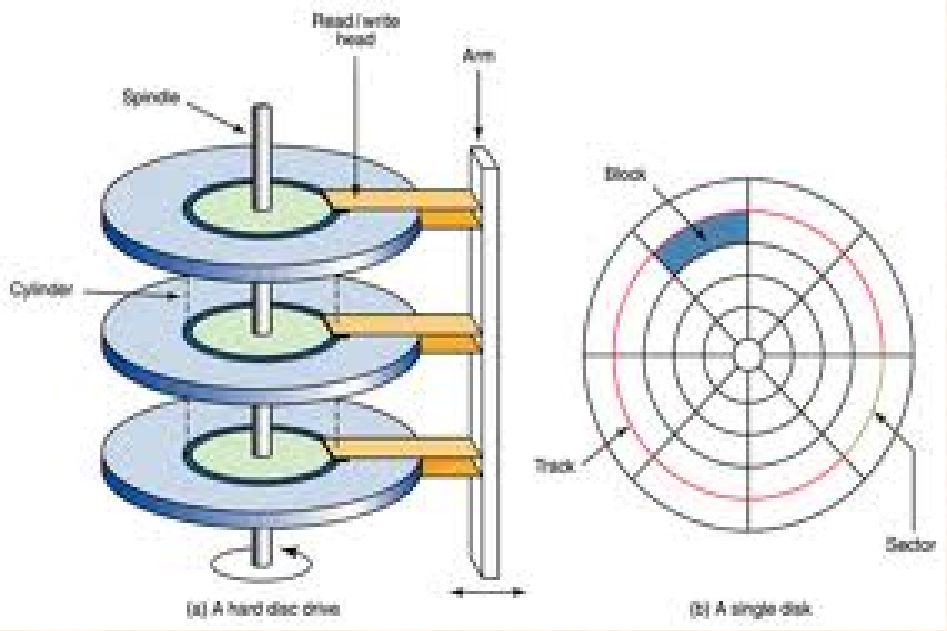
Magnetic Tape

Magnetic Tape is similar to Audio Cassette, which contains a thin strips of bronze metal coated tape rolled within it. Generally, it is used for archival or back-up purpose, because it can store large amount of data. The size of storage depends on the length of the tape. Magnetic tape is more durable to Floppy or Magnetic disk.

Hard Disk

Hard disk is a permanent (non-volatile) storage with high storage capacity ranging from 1GB to 1 TB (Tera Bytes). It contains multiple rotating disk/plate with Read/Write head. Each Plate contains circular tracks which form Cylinders. Hard disk offers high storage with faster access to data.
Generally, Hard disk is fixed inside the computer to store Operating system and user's Data files.



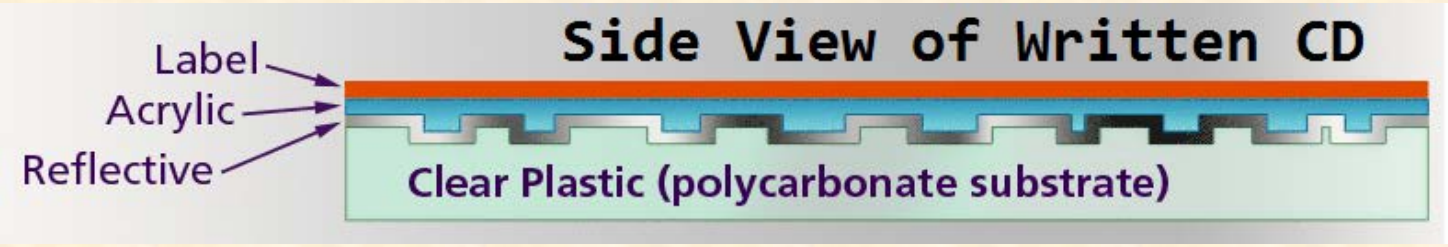


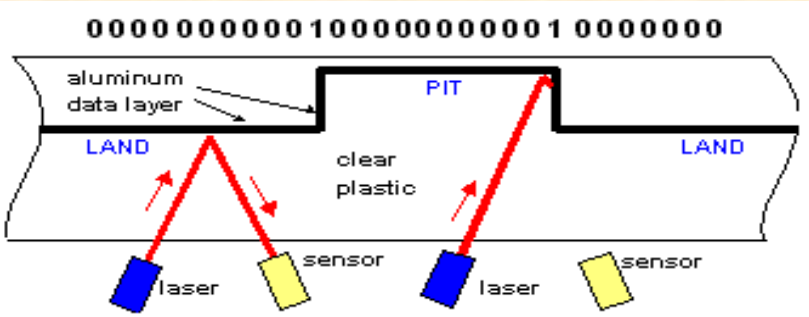
Compact Disk (Optical Disk)

Compact Disk (CD) is optical storage media, which can be used to store data file, audio tracks and Video files. It is 120mm polycarbonate disk which can store upto 700 MB data. Data is written by Laser Beam by making Pits and Plane on the media, which can be read by laser beam by sensing its reflection.

CDs are available in three types-

1. **CD-ROM :** Data written at manufacturing time.
2. **CD-R** (Recordable): Blank media, data can be written only once.
3. **CD-RW** (Rewritable): Data can be erased and re-written.





The data transfer speed of a CD is represented by **Nx**, where **x** means 150KB/second.
So, 48x = 48x150 i.e. 7200 Kbps.

DVD (Optical Disk)

Digital Versatile Disk (DVD) is also an optical storage media similar to CDs, which offers faster speed and more storage to store data file, audio and Video files. A DVD can store data from 4.7 GB to 17 GB. Storage capacity of a DVD depends on the layer and side. It is 20 times faster than CD.

DVDs are also available in three types-

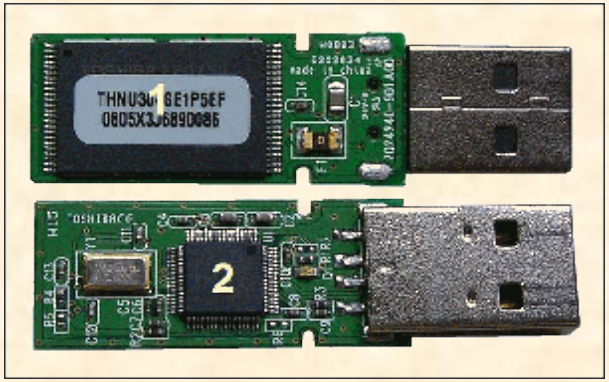
1. **DVD-ROM :** Data written at manufacturing time.
2. **DVD-R** (Recordable): Blank media, data can be written only once.
3. **DVD-RW** (Rewritable): Data can be erased and re-written.

DVD Storage capacity		
Sides	Layer	Capacity
1	1	4.7 GB
1	2	8.5 GB
2	1	9.4 GB
2	2	17 GB

Blu-Ray Disk (BD) is next generation optical storage media, which offers faster speed and more storage to record, store, and play High Definition Video, Digital Audio and data files. It can store upto 25 GB data.

Flash Memory (Memory Card)

Flash Memory is Chip based (Solid state) memory, which can store data permanently. Generally, it is integrated with USB connector, which requires low power to read or write data. It is cheaper, small and lightweight, removable, rewritable and portable storage media. Memory cards, Memory stick, Multimedia card (MMC) and Pen drives are example of Flash Memory.



Types of Memory Card

Now days, Memory cards are commonly used as portable and removable storage, which can store various type of data like Image, graphics, Audio (music), Video or data files. It is used in Computers, Mobile Phones, Digital Camera or any other Electronic devices. It is available in different types and size. Some commonly used memory cards are-

Smart Media Card :

Used in Digital Cameras, Music Player, Cellular Phones, Digital Voice Recorder etc.

Extreme Digital Card (xD)

Requires less power and offers 9-10 MB/Sec W/R speed.

Multimedia Card (MMC)

Low powered, small sized and reliable. Used in Mobile phones.

Secure Digital Card (SD)

Secure & reliable with write protection feature. (Mini/Micro/SDHC)

Compact Flash Card

Used in Digital Camera, MP3 player as embedded memory.

Memory Stick

Suitable for small AV electronic products. It is high capacity, low power consumption and reliable. (Soni PRO, Duo etc.)

Memory Measurement

All the data/ information processed and stored in the form of **Bi**nary Digi**t** or BIT (i.e. either 0 or 1) inside computer or storage devices.

Therefore the smallest unit of memory is a **BIT**.

- 4 Bit = 1 Nibble
- 8 Bit = 1 Byte (1 Character)
- 2^{10} (1024) Byte = 1 Kilo Byte (KB)
- 2^{10} (1024) KB = 1 Mega Byte (MB)
- 2^{10} (1024) MB = 1 Giga Byte (GB)
- 2^{10} (1024) GB = 1 Tera Byte (TB)
- 2^{10} (1024) TB = 1 Peta Byte (PB)

Communication Bus

Bus is a collection of wires, used to transfer data, instruction or address in the form of electrical signals from one unit to another.

- Three types of buses are :

1. Address Bus:

This type of bus connects Processor to Memory to carry address of memory to be read/write. The size of bus specifies the number of memory locations that can be addressed i.e. 64-bit address bus can address 2^{64} memory locations.

2. Data Bus:

It is Bi-directional bus connects processor and other units/ devices (memory & I/O devices) to carry data.

3. Control Bus:

It carries the signals to/from control-unit and all the devices attached. Its size represents the capacity of Micro processor. The 32-bit or 64-bit processors are commonly used.

Communication Ports

Ports are connecting points or slot which are used to connect external devices to the computers.

Types of Ports:

1. Serial Port (COMmunication Port):

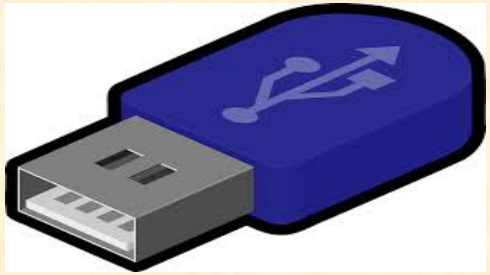
It is 9-pin/25-pin sized connector transmits 8 bit data serially. Generally used to connect Mouse and Modem etc. Mostly obsolete and replaced by USB port.

2. Parallel Port (LPT):

It is 25-pin connector which transmits data in parallel way. Generally used for Printer, Scanner, Tape drive etc.

3. USB Port:

It is 9-pin sized connector used to connect various devices like Printer, Mouse, Joystick, Camera, Pen drive etc.



Communication Ports cont....

4. Blue Tooth:

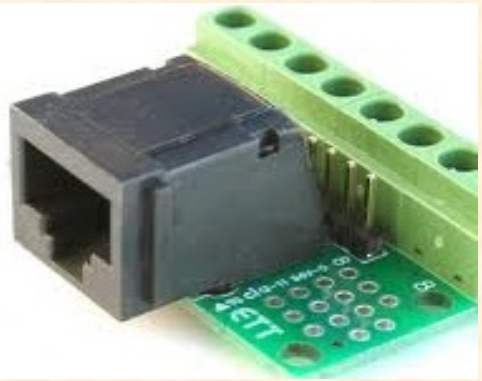
It is telecommunication industry specification used to connect Mobile/PDAs and computers that makes wireless communication upto 10 mt.

5.Network Port (RJ-45 Port):

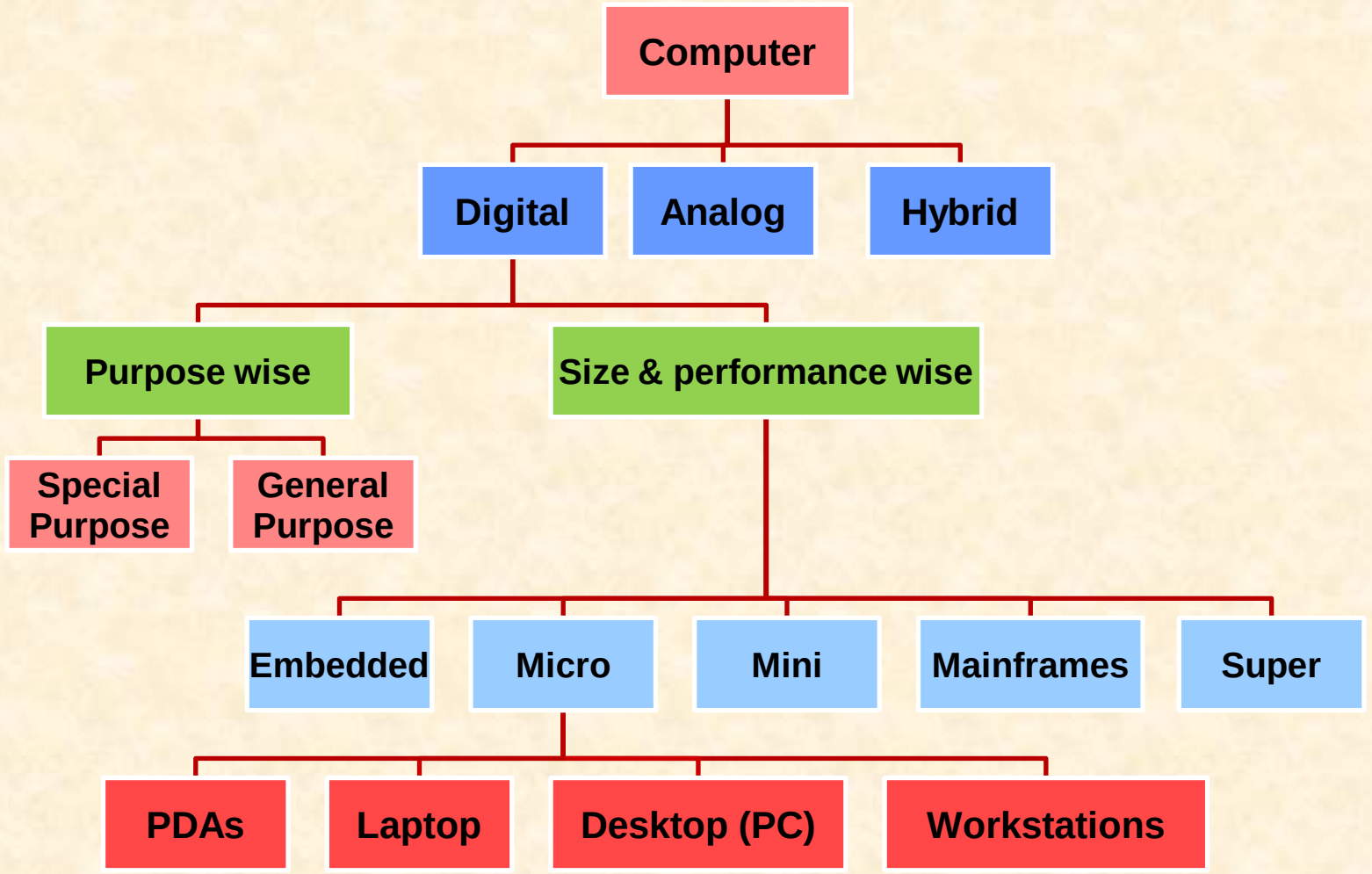
A Network Port is 8-wire port which used to connect Ethernet (LAN) devices like Network Switch or MODEM.

6. Phone Port (RJ-11 Port):

A phone port is a 6-wire port which allows to connect telephone line or equipments to facilitate voice calling.



Types of Computers



E-Waste and Disposal

What is e-Waste?

- Electronic-waste may be defined as discarded or unusable electrical-electronic devices like computers, mobile phones, television sets, and other electronic home appliances.
- It includes used electronics devices which are destined for reuse, resale, salvage, recycling, or disposal.
- It is also termed as **e-Scrap** or **Waste Electronic Equipment** (**WEE**).

Impact of e-Waste?

- The processes of dismantling and improper disposing of e-waste may cause environmental impacts leading to serious health and pollution problems.
- Liquid and atmospheric releases (poisonous gases) mixed up in groundwater, soil, and air and therefore affect land and sea animals (both domestic and wild), and humans through crop's yields, drinking water and breathing.

E-Waste and Disposal

Disposal of e-Waste:

- Donate your old PCs and peripherals, which are usable and in working condition, to a school, Educational Institutes or needy people for learning. (visit www.donateyourpc.in)
- If your computers are out of order, you may return them back (Buy Back) to the manufacturer or seller company to purchase new one.
- Non-repairable PCs/peripherals/TVs/Monitor/Printer/ Cables/ Mother Boards/phones/digital cameras/radios and Batteries etc. may be given to Recycling Agencies for proper disposal or re-cycling to reduce pollution and harmful environment effects.
- Donate non-functional devices to Service Centers, so that they can utilize some functional parts while repairing others.
- Do not through unserviceable electronic product in open area or sell to street garbage collector (‘Kabadi wala’), because they have no proper disposal system.

Evolution of Computers *

- Abacus (3000 BC)
- Napier's Bones (1622)
- Pascal's Adding Machine (1642)
- Leibnitz's Calculator (1671)
- Jacquard's Loom (1801)
- Babbage's Difference Engine (1822)
- Babbage's Analytical Engine (1833)
- Hollerith's Machine (1887)
- Mark I (1943)- the first general purpose computer by Prof. Howard Aiken (USA)

* Recommended for recall of facts/knowledge

Generations of Modern Computers

- **First Generation (1945-55)**
  - Vacuum tubes used.
  - Big sized and high electricity consumption
  - Machine Level Language (MLL) is used

  Example: ENIAC, EDVAC, EDSAC, UNIVAC
- **Second Generation (1956-65)**
  - Transistors are used
  - More reliable, Faster and smaller in size
  - Core Memory, Magnetic Tape and Disk used
  - Assembly Level Language is introduced.

  Example: IBM 1401, IBM 1620, CDC 3600
- **Third Generation (1966-75)**
  - Integrated Circuits (IC) used.
  - Smaller, Faster and more reliable.
  - Low Electricity Consumption
  - High Level Language (HLL) is used

  Example: IBM 360, ICL-2900, PDP 11

Generations of Modern Computers

- **Fourth Generation (1976-90)**
  - VLSI Circuits, Microprocessor used.
  - More Smaller (Portable) , reliable, Faster
  - Used in daily-life, Business applications, Multimedia, Virtual Reality etc.

  Example: Microcomputer by IBM and Apple.
- **Fifth Generation (1990- Present)**
  - ULSI (Ultra Large scale Integrated Circuits may used.
  - More Smaller, Faster and more reliable.
  - Based on Artificial Intelligence (AI)
  - Used in Parallel Processing, Super conductor applications.
  - Quantum Computing and Nano Technology is being used.

  Example: Robotics

* Recommended for recall of facts/knowledge