

Fundamentals of a computer system

After studying this chapter you will be able to understand;

- features of a computer,
- classification of computers,
- functions and devices of a computer system,
- basic components of a computer,
- computer ports and,
- computer network.

2.1 What is a computer?

First chapter described how computer systems can make day-to-day work efficient.

A computer can be described as an electronic device, which accepts or collects data, processes them according to the given instructions and produces the desired output.

Computer has become an essential device in our lives. Some of these features of a computer can be described as follows;

Speed	A computer takes only a few seconds to perform calculations. It executes more than one million instructions per second.
Accuracy	A computer provides correct output when correct instructions and data are given.
Efficiency	A computer never gets tired. It can work round the clock with the same level of accuracy.
Versatility	A computer can be used to perform many tasks simultaneously. This is one of the special features of a computer.
Storing and Retrieving	A computer is used to store large number of data and information in a relatively small unit and we can retrieve them easily and quickly when needed.

2.2 Classification of computers

As described in the first chapter, a computer can be used to perform various tasks such as prepare documents, control machineries or to check illnesses.

Hence, computers can be classified as follows;

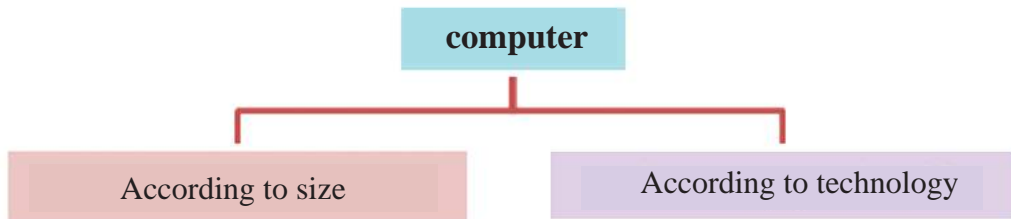


Figure 2.1 - Computer types

2.2.1 Classification according to size

(i) Super Computers

These computers have higher computing power. They are large in size, expensive and rare. (Figure 2.2) These are used for scientific and engineering functions and to solve complex mathematical problems. For example, these computers are used in institutes like NAZA, large scale businesses and for military purposes.



Figure 2.2 - Super Computers

(ii) Mainframe Computers

These have relatively less computing power and less expensive than the super computers. In mainframe computers, a number of users get connected to one computer using a number of terminals sharing, saving and retrieving data. (Figure 2.3 and 2.4) These are used in large scale businesses and in e-business. This type of computers are used even today in some large commercial institutions.

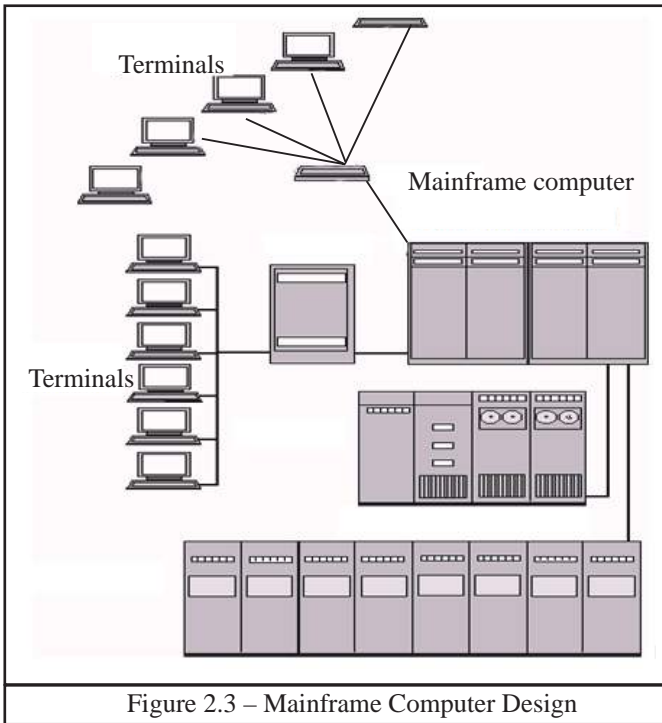


Figure 2.3 – Mainframe Computer Design



Figure 2.4 - Mainframe Computer

(iii) Mini Computers

These are slower, less powerful and less expensive than Mainframe computers and are also called common purpose computers. These are easy to use. A few users get connected to the central computer here through a few terminals to share data and information. Some banking systems use mini computers. (Figure 2.5 and 2.6)

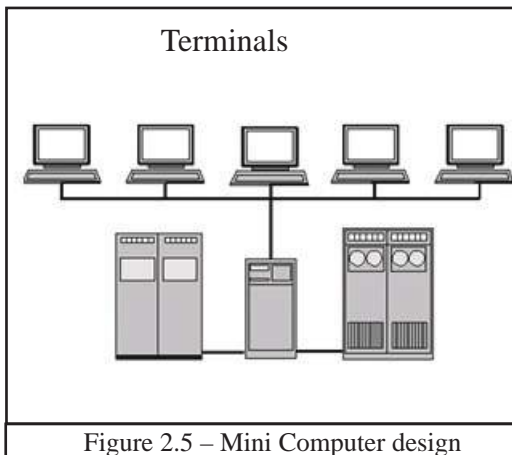


Figure 2.5 – Mini Computer design

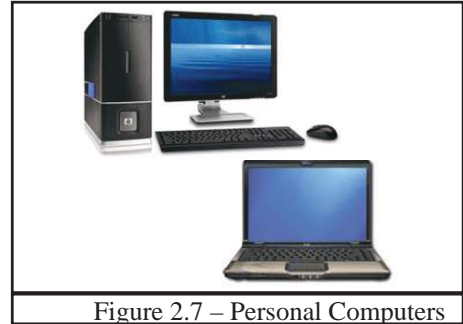


Figure 2.6 - Mini Computer

(iv) Personal Computers/ Micro Computers

This is a small computer meant for personal use. This consists of a small memory capacity, is smaller in size, is less speedy and is less expensive. Further, this consumes little electricity (Figure 2.7).

Laptop computers and personal computers are some examples for this category

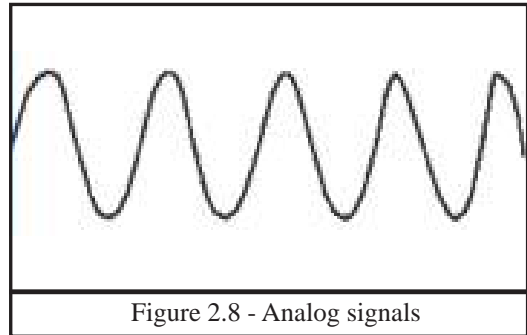


2.2.2 Classification according to technology

Computers can be classified according to the technology used. These are,

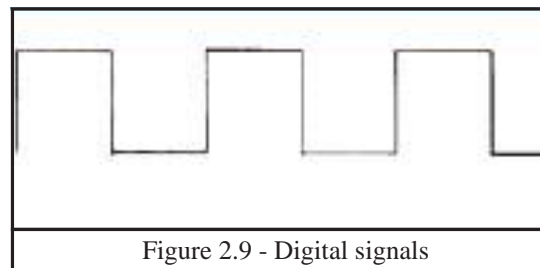
(I) Analog Computers

These computers use analog signals such as environmental parameters (speed, pressure, and temperature). Speedometers, road lamps with sensors, meteorological machines can be given as examples. (Figure 2.8)



(II) Digital Computers

The computers used in day-to-day life are called digital computers. These computers use digital signals, using electricity. (Figure 2.9)

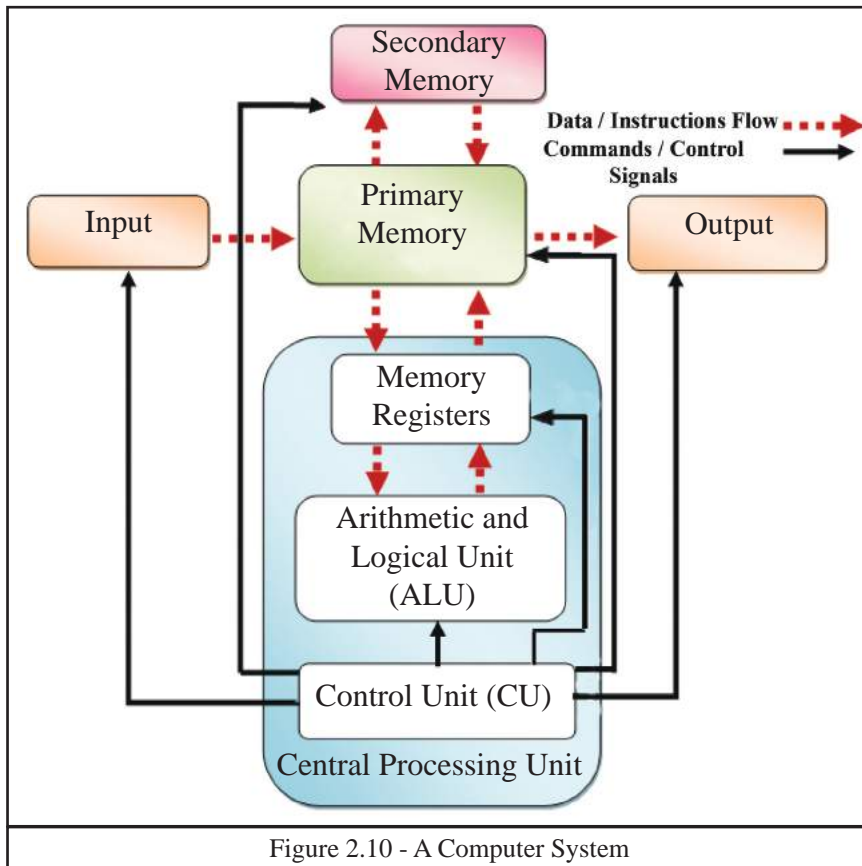


(III) Hybrid Computers

This is a combination of analog and digital computers. The ECG machine used in hospitals to check the function of the heart is an example for hybrid computers. This machine identifies the function of the heart beat which is an analog signal. Then it is converted to a digital signal and these converted signals are printed by this machine.

2.3 Function of a Computer System

The main functions of a computer system is to input data, process and store data, and to produce information when needed. Several components are used for such functions. The following is the function of a computer system;



Data and instructions fed to the computer via an input device are stored in the primary memory. The data and instructions are used by the CPU for processing. The processed data are stored in the Primary Memory as information and send to the output device. The data and information which is to be stored are send to Secondary Storage device. The stored information can be sent an output device through Primary Memory. Control Unit sends the control signals to all the devices attached to the computer system.

The flow of the data and instruction is indicated by a dotted line and the control signals are indicated by a solid line in the diagram above.

2.4 Basic Components of a computer system

Certain devices are essential for the function of the computer system.

2.4.1 Input Devices

Data and instructions are fed to the computer system using input devices. There are many input devices. The following are some of the input devices.

(I) Keyboard

This is the most common input device. Though it is designed with the format of a conventional type writer, it provides keys for additional functions.

Normally keyboards come in two sizes. That is from 101/102 keys to 104/108 keys. The functions of the keys in the keyboard are given below in Figure 2.11.

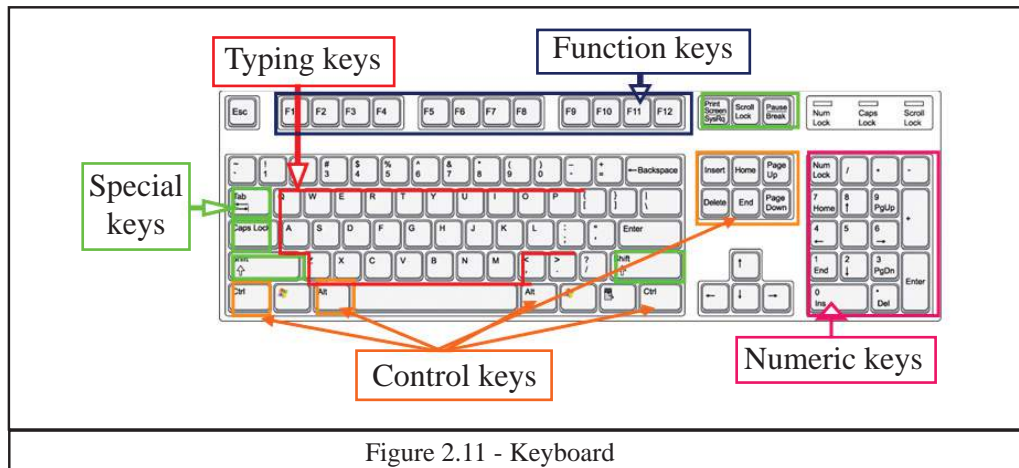


Figure 2.11 - Keyboard

(II) Pointing Devices

Example 1 - Mouse

This is the most popular pointing device used. Mouse provides input via buttons. The mouse contains a left button and a right button. Mouse has a wheel to roll up and down in the screen. Laptop computers use, a touch pad or a mouse is as the pointing device. (Figure 2.12)

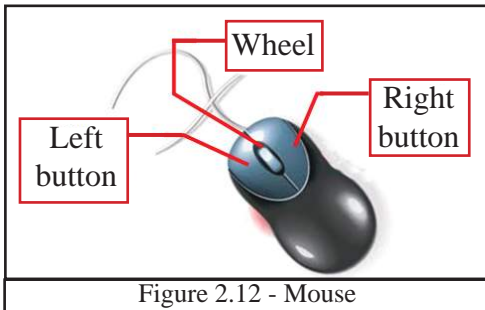


Figure 2.12 - Mouse

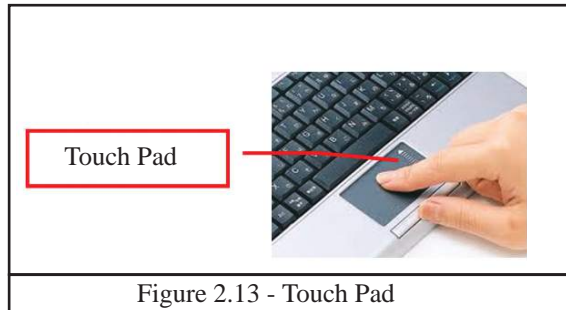


Figure 2.13 - Touch Pad

Example 2 - Touch screen

This is the input and output device in the modern computers and mobile phones. Data is fed by touching the screen. It also acts as a pointing device. (Figure 2.14)



Figure 2.14 - Touch Screen

Example 3 - Joy Stick

This is also a pointing device used in computer games which can move the cursor. (Figure 2.15)



Figure 2.15 - Joy Stick

Example 4 - Light pen

Light pen is used to select menu items on the screen or to draw/write on the screen. (Figure 2.16) The appearance is similar to a normal pen. This is used in Computer Aided Designs (CAD).

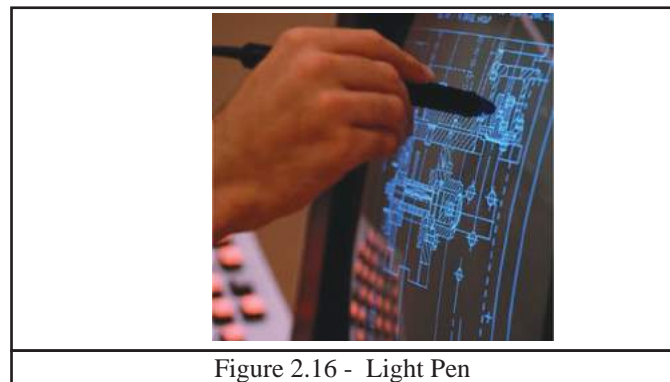


Figure 2.16 - Light Pen

(III) Imaging and Video Input Devices

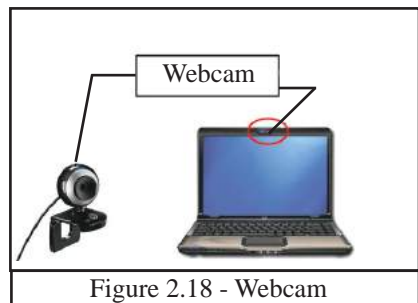
Example 1 - Digital Camera

This is the input device used to input photographs and videos to the computer. Display screen serves as the output device of the camera. (Figure 2.17)



Example 2 - Webcam

The webcam is used to view a user connected to the computer through internet or to capture videos. (Figure 2.18) It is positioned on top of the laptop monitor, and for desktop computers, can be connected externally.



Example 3 - Closed Circuit TV (CCTV)

The images or videos captured by cameras are fed as input to the computers. (Figure 2.19) CCTVs are commonly used to maintain road safety and the security of premises.



(IV) Scanners

Example 1 - Flatbed Scanners

This is an input device which functions like a photocopying machine. The scanned image or document is captured by the laser beams and converted to digital data. The scanned picture / document can be saved in the computer. (Figure 2.20)



Example 2 - Bar Code Reader

This device is used to read the bar codes. (Figure 2.21) The bar code is converted to an alphanumeric value by the bar code reader and is fed to the computer connected to it.



Figure 2.21 - Barcode Reader

Example 3 - Magnetic Ink Character Reader - MICR

This is available in banks. It is used to check the accuracy of a cheque. This device reads numbers printed at the bottom of the cheque, its data such as bank code, bank account number and feed them to the computer. (Figure 2.22)



Figure 2.22 - MICR

Example 4 - Optical Character Recognition - OCR

This is used to capture text in a document and to edit that captured text in the document. (Figure 2.23) This is commonly used in libraries and in government institutes.



Figure 2.23 - OCR

Example 5 - Optical Mark Recognition - OMR

This is an input device which recognizes marks made using a pencil or a pen. It is commonly used to check forms filled in pen or pencil, correct MCQs of exam papers. It can read the marks and feed that data to the computer. (Figure 2.24)

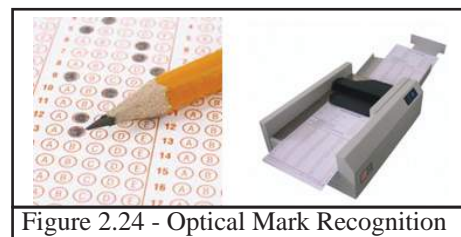


Figure 2.24 - Optical Mark Recognition

Example 6 - Automated Teller Machine - ATM

ATMs have made bank transactions convenient for customers. (Figure 2.25) ATM machine reads the numbers in the debit or credit cards inserted into the machine and connect to the computer. Once the bank account number is read through the ATM, one system connects with the bank's computer for processing the transaction.



Figure 2.25 - Automated Teller Machine (ATM)

(v) Microphone

Microphone is used to feed sound to a computer. (Figure 2.26)



Figure 2.26 - Microphone

2.4.2 Output Devices

There are several methods of producing the processed information by a computer system. Some of them are,

- (i) Soft copy
- (ii) Hard copy
- (iii) Sound

(i) Soft Copy

The output on the screen is called a soft copy. The soft copy output can be provided on the following devices.

- **Monitor/ Screen**

This is also called Visual Display Unit (VDU). There are several types of monitors available today.

A - Cathode Ray Tube (CRT) Monitor

This type of monitor, is large in size and consumes more electricity. (Figure 2.27)

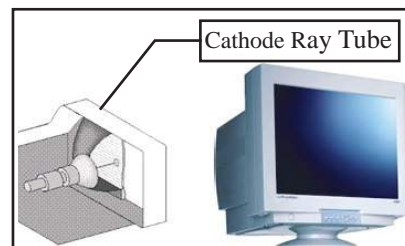


Figure 2.27 - Cathode Ray Tube with screen

B - Liquid Crystal Display - LCD

This is a flat screen type technology. LCD displays utilize two sheets of polarizing material with a liquid crystal solution between them. (Figure 2.28) LED consumes less electricity.



Figure 2.28 - Liquid Crystal Display

C - Light Emitting Diode - LED

LED screens are designed using light emitting diodes. (Figure 2.29) LED displays have better brightness and they are used for symbols, billboards and name boards in common places and roads. This has become a popular medium today due to its low electricity consumption.



Figure 2.29 - Light Emitting Diode

- **Multimedia Projector**

This is the device used to get information output to a wide screen so that several people can view it at the same time. This can be used as a visual aid by a teacher to display presentations, to conduct business meetings or to watch videos for entertainment. (Figure 2.30)



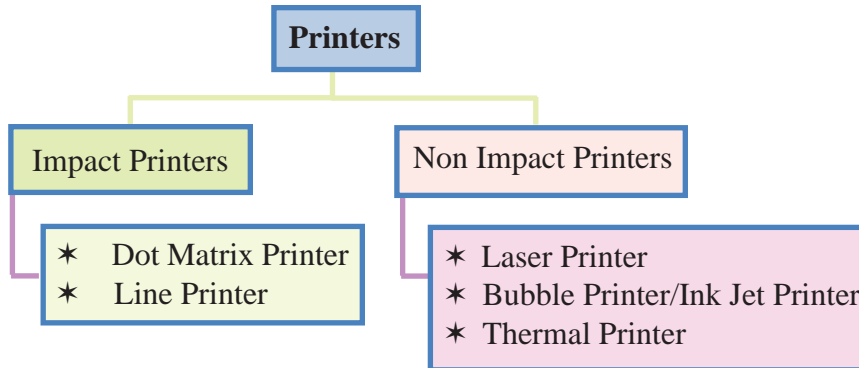
Figure 2.30 - Multimedia Projector

(ii) Hard Copy

Hard copies are tangible computer outputs. The following are devices which provide hard copy output.

❖ Printers

There are two main types of printers. These are,



1. Impact Printers

Impact printers are a primary level device in the printing technology. Impact printer refers to a class of printers that have a head or needle which strike against an ink ribbon to make a mark on the paper. Its function it is noisy. However, since the ink ribbon used is not expensive, this is used in banks and shops for printing receipts etc. The following are some of the impact printers.

Example 1 - Dot Matrix Printer

Letters are printed on the paper as small dots here when the printer's head strikes on the inked ribbon with needle like tips. (Figure 2.31)

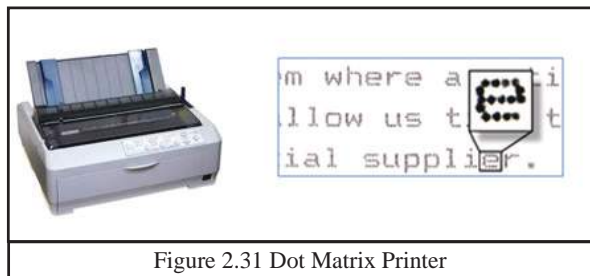


Figure 2.31 Dot Matrix Printer

Example 2 - Line Printer

This is a fast printer which prints one row at a time. This can print about 3000 lines per minute. (Figure 2.32)



Figure 2.32 - Line Printer

2. Non Impact Printers

Non impact printers does not operate by striking a head against a ribbon. Hence, it is not noisy. The printouts are better quickly. Running cost of these printers are more expensive than impact printers. The following are some of the non impact printers.

Example 1 - Laser Printers

Laser printer utilizes a laser beam to produce an image (through a mirror) on a drum. The light of the laser alters the electrical charge on the drum and apply toner (dried ink) in the cartridge. (Figure 2.33 and 2.34)

There are laser printers which print about four A4 size papers per minute. Both black and white, as well as colour laser printers are available. The laser printer produces clear and quality printouts.

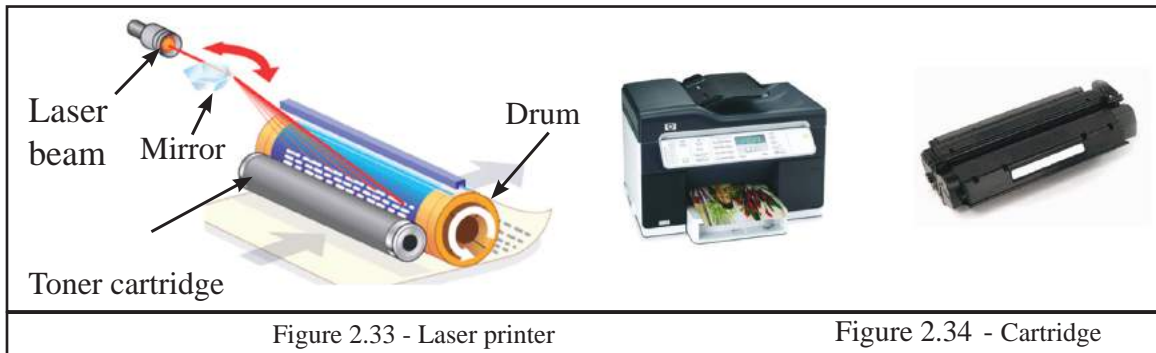


Figure 2.33 - Laser printer

Figure 2.34 - Cartridge

Example 2 - Bubble/Ink Jet Printer

Liquid ink stored in tanks is kept in the cartridge and ink is deposited on paper through small nozzles and produce the print. (Figure 2.35)



Figure 2.35- Ink Jet Printer

Example 3 - Thermal printers

Heat is used to print the document. It is commonly used in businesses to print receipts in devices such as like ATM, and in printing labels (Figure 2.36).



Figure 2.36 - Thermal printers

Example 4 - Plotter

This is commonly used in computer based planning (architectural designs, town planning, designing sailing boats etc). A plan is drawn by moving a pen on the paper.



Figure 2.37- Plotter

(iii) Sounds

The device which gives a sound output is called speaker. Speaker devices are designed for personal and common purpose.



Figure 2.38 - Speaker

2.4.3 Central Processing Unit - CPU

This is the main component of a computer system. It is also called the brain of the computer as well as it functions according to the given commands. CPU manages the operating system and application software. CPU consists of three main components. The functions of those are as follows;

1. Arithmetic and Logical Unit (ALU)	Perform all mathematical and logical functions.
2. Control Unit (CU)	Controls all devices of a computer system.
3. Memory Registers	Positioned in the Central Processing Unit. Temporarily stores data needed for the function of ALU.

Main Components of Central Processing Unit

Computer Speed

The unit used to measure clock speed of a computer is Hertz (Hz) and the units used to measure computer speed are Megahertz (MHz) and Gigahertz (GHz).

2.4.4 Computer Memory

Several computer memory or storage devices are used to store data and information and the functions of each are different. Computer memory can be classified as follows.

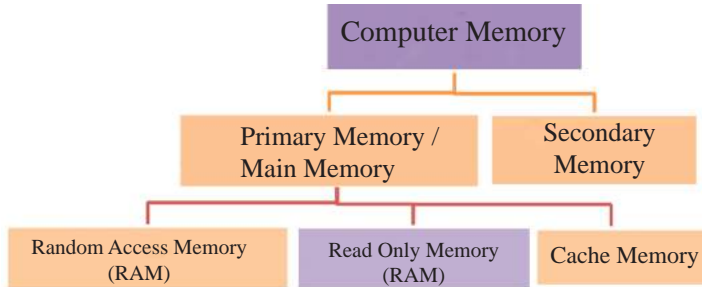


Figure 2.39 – Computer Networks

(I) Primary Memory

The memory that can be directly accessed by the Central Processing Unit is called primary memory/storage. There are three types of Primary Memory.

* Random Access Memory (RAM)

This memory temporarily stores data. (Figure 2.40) The data stored in RAM will be deleted when the computer is switched off. Therefore this is also called volatile memory. Data coming from input devices as well as data sent to output devices are held in RAM.

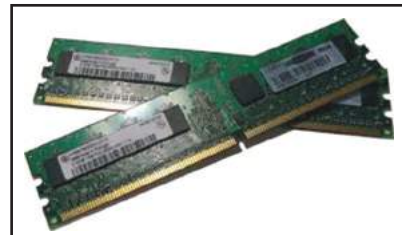


Figure 2.40 - Random Access Memory

* Read Only Memory (ROM)

The data in Read Only Memory is not erased when the computer is switched off. Therefore it is a Non-volatile Memory. The commands required for booting up a computer are stored in ROM.

These commands are called BIOS (Basic Input Output System). Computer Manufacturing companies store these commands in a ROM with a smaller capacity and is connected to the mother boars (Figure 2.41).



Figure 2.41 - Read Only Memory

* Cache Memory

Though this is smaller in capacity than other memory, it is faster. This is also called CPU Memory. This acts as the mediator between CPU (Central Processing Unit) and Primary Memory. The data frequently used by are stored here. (Figure 2.42)

The Central Processing Unit checks cache memory first to see whether the required data is available for processing. However, if the required data is not available then the data is fetched to cache memory from RAM for processing.

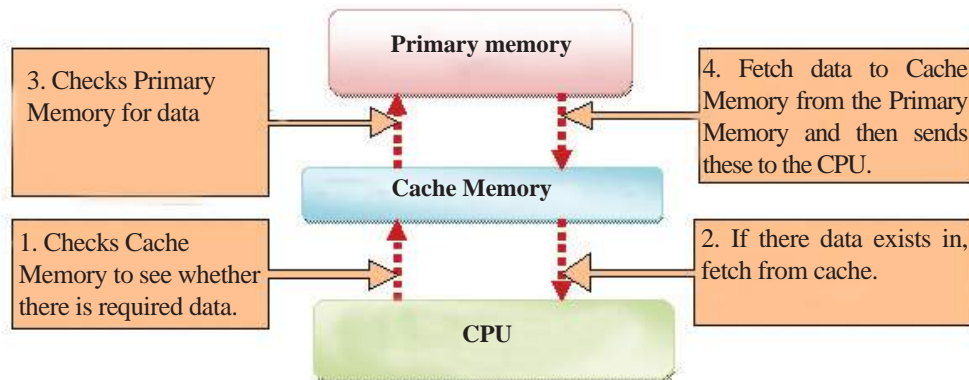


Figure 2.42 - Cache Memory

(II) Secondary Memory

Secondary Memory or the Secondary Storage is the device which stores data and information permanently. This is also called External Storage. There are internal storage devices as well as external portable secondary storage devices. Secondary memory is called non-volatile memory since it does not erase when electricity is not available. (Figure 2.43) These can be classified as follows.

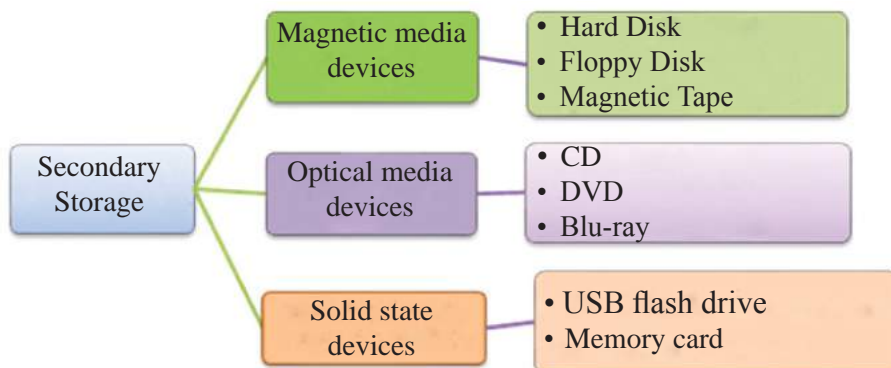


Figure 2.43 - Secondary Memory

1. Magnetic Media Devices

Data is stored here by using magnetic field.

Example 1 - Hard disk Drive

The Hard Disk Drive (HDD), which is commonly used to store data and information, is located inside the computer. However, there are external hard disks as well. Today there are hard disks with large capacity due to the development of the technology. The user can read and write the data stored in HDD. Therefore, this medium is called Read / Write Memory. The capacity of a hard disk ranges from 250 GB to 4 TB. The maximum capacity will increase with technological development.

Hard Disk is made of several components.

1. **Platter** – This is a metallic, aluminum or ceramic disk and data can be stored on both sides using magnetic media. There can be several platters in a hard disk.
2. **Spindle** – Holds the platter and rotates it.
3. **Head** – Reads the magnetic data in the platter and writes on the platter. There are two heads for a platter; one on top and one on bottom.
4. **Actuator arm** – Moves the head. Enables reading and writing data anywhere in the platter.
5. **Power connector** – Connects the Hard Disk to power which is needed for its function.
6. **IDE connector** – Transmits data to the platter
7. **Actuator** – An electronic device which moves the arm connected to it. This is operated by a motor.

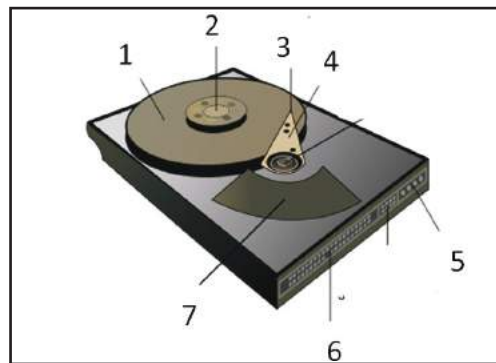
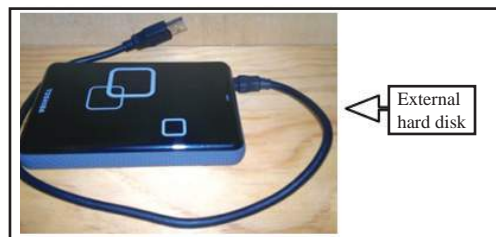
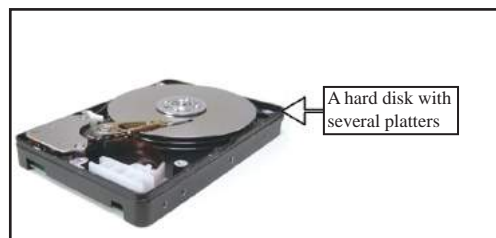


Figure 2.44 - Hard Disk



Example 2 - Magnetic Tape

Used mostly in sever computers for back up due to its larger storage capacity. But tape is not used in day today life as it is slow in reading and writing (Figure 2.45).

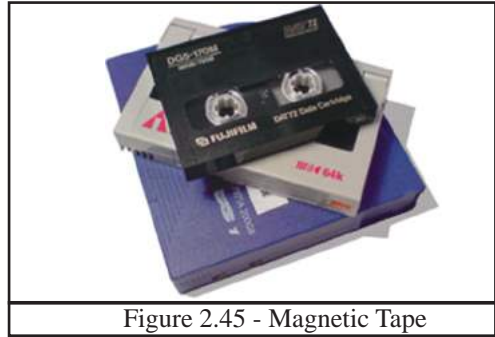





Figure 2.45 - Magnetic Tape

Example 3 - Optical media

Since data stored digitally on a disk is read and written by laser beam, it is called optical media. Optical media is commonly used to carry data and information and there are several types. The followings are some of them;

Device	Type	Size	Image
CD-ROM (Compact Disc - Read Only Memory)	Used only to read data and information	650 - 900 MB	
CD-R (Compact Disc -Write once)	Can be used to write data and information once until the capacity is filled.		
CD-RW (Compact Disc Re-Writable)	Data which is written on the disk can be erased and re-written.		
DVD-ROM Digital Versatile Disc - Read Only Memory	Used only to read data and information.	4.7 - 9.4 GB	
DVD-R (Digital Versatile Disc - Write Once)	Can be used to write data and information once until the capacity is filled.		
DVD – RW (Digital Versatile Disc - Rewritable)	Data which is written on the disk can be erased and re-written.		
Blue ray (BD) R (Recordable)	Can be used to write data and information once until the capacity is filled.	25 - 128 GB	
Blue-ray RE (Recordable Erasable)	More data can be re-written many times until the capacity is filled.		
Blue - ray 3D	Used to record vedio.		

3. Solid State Devices

Since these devices contain solid parts and does not contain moving parts they are called Solid State Devices. They are used to read and write data and information.

Example 1 - USB Flash Drive

This has become a very popular secondary storage device due to its easy portability and the ability to read and write data fast.



Figure 2.46 - USB Flash Drive

Example 2 - Memory Card

This has the same function of USB flash drive. However, the method of connecting to the computer is different and it is smaller in physical size. This is used in digital cameras, mobile phones and computer gaming devices.

E.g. - SD Card (Secure Digital Card)

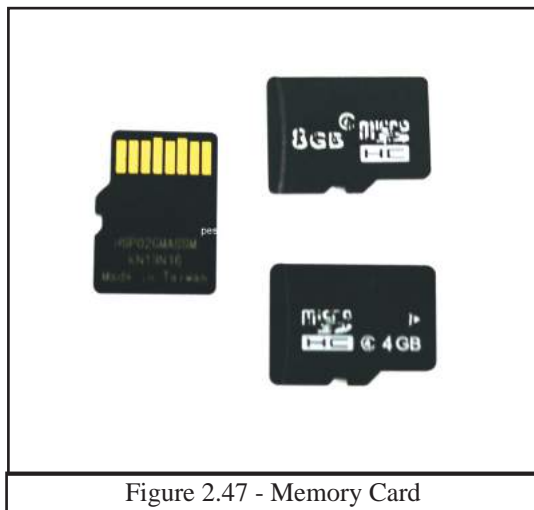


Figure 2.47 - Memory Card

Activity



Write advantages and disadvantages of Magnatic media, Optical media and Solid state media.

2.5 Computer Ports

The interfaces which connect computer with its devices or with other computers are called ports. (Figure 2.48) Ports are positioned in the front or back of the computer. There are symbols to identify posts. All the ports are connected to the motherboard.

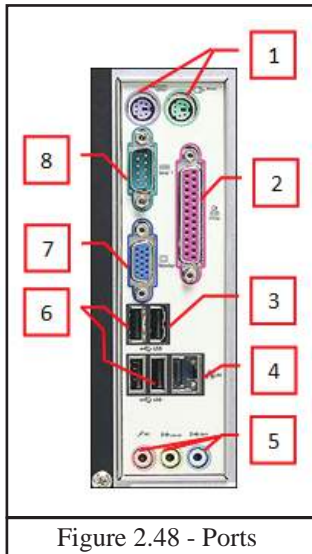


Figure 2.48 - Ports



Figure 2.49 - How ports are connected to the Motherboard

1. PS/2 ports	5. Audio ports
2. Parallel port	6. USB port
3. HDMI port	7. Video port
4. RJ 45 port	8. Serial ports

1. PS/2 Port

Used to connect the keyboard and the mouse to the computer system. The purple port is for the keyboard and the green port is for the mouse. (Figure 2.50) However, USB port is mostly used today to connect the keyboard and the mouse to the computer system.

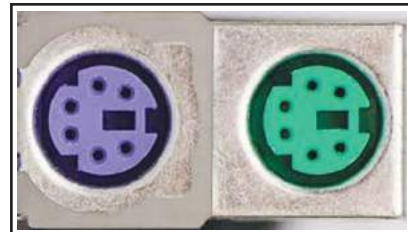


Figure 2.50 -PS/2 Ports

2. Parallel Port

Used to connect the printer to the computer system. This consists of 25 holes. (Figure 2.51) However, USB port is mostly used today to connect printers to computer systems.

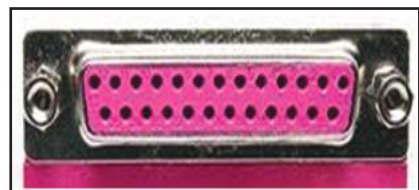


Figure 2.51- Parallel Port

3. HDMI (High - Definition Multimedia Interface) port

This port can be seen especially in laptops. (Figure 2.52) It connects the monitor, multimedia projector, digital TVs, and digital speakers to the computer.



Figure 2.52 - HDMI Port

4. RJ 45 Port

This port connects computer of a computer network to the network router, network switch. (Figure 2.53)

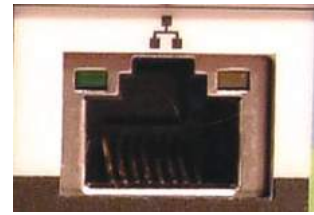


Figure 2.53 - RJ 45 port

5. Audio Ports/ Jacks

This port connects audio media like microphones, speakers and head phones to the computer system. (Figure 2.54)

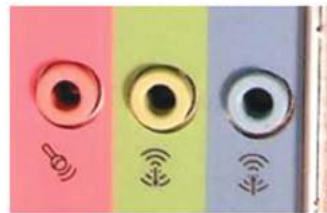


Figure 2.54 - Audio Ports/ Jacks

Blue – Line In

Green – Line Out, Head Phone

Pink – Microphone

6. USB (Universal Serial Bus Port)

This port is used to connect many types of input and output devices to the computer. (Figure 2.55)



Figure 2.55 - Universal Serial Bus Port

7. Video port - VGA (Video Graphics Adaptor)

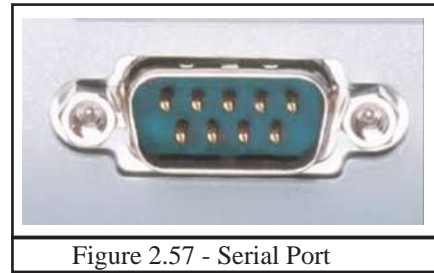
This is also called the Graphic Port. This connects the monitor, or multimedia projector to the computer system. (Figure 2.56) The port consists of 15 holes.



Figure 2.56 - Video port

8. Serial port

This port connects devices such as modem to the computer. Today, USB port is used instead of the serial port. (Figure 2.57)



Activity



Observe and identify the ports in the computer in the laboratory.

2.5 Data Communication

Transmitting data and information is called data communication. Data transmission can be carried out between two or more computers or devices such as printers. Data transmission needs a connection between a sender and a receiver. Creating such a connection is called networking.

2.5.1 Basic components required for data communication

The following are the basic components that are needed for data communication.

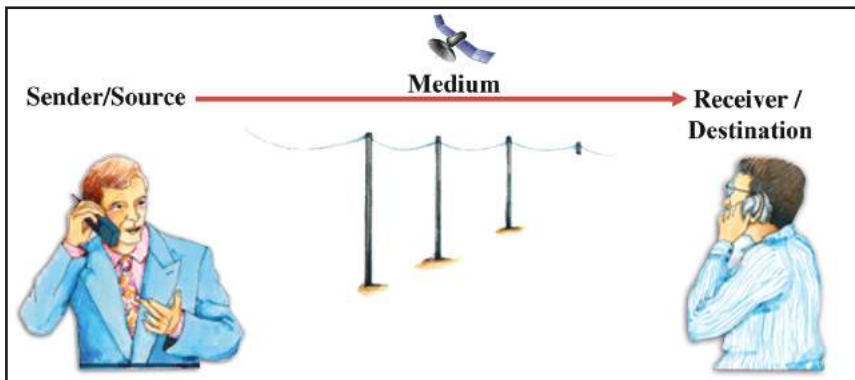


Figure 2.58

- Sender / Source – the person or the object which sends data
- Medium – medium used to transmit data (telephone wires / wireless)
- Receiver/ destination – the person or the object which receives data

2.5.2 Data Transmission Modes

There are several modes of data transmission between sender and receiver.

1) Simplex Mode

Data is transmitted from the sender to the receiver only. Getting print outs, watching television, and listening to radio can be given as examples

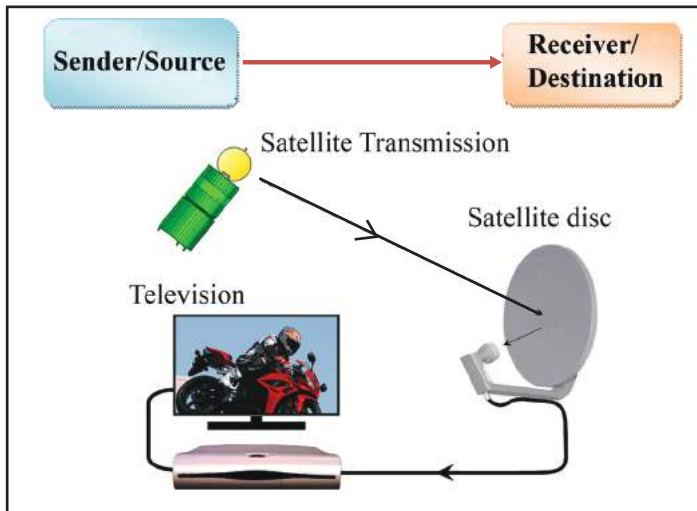
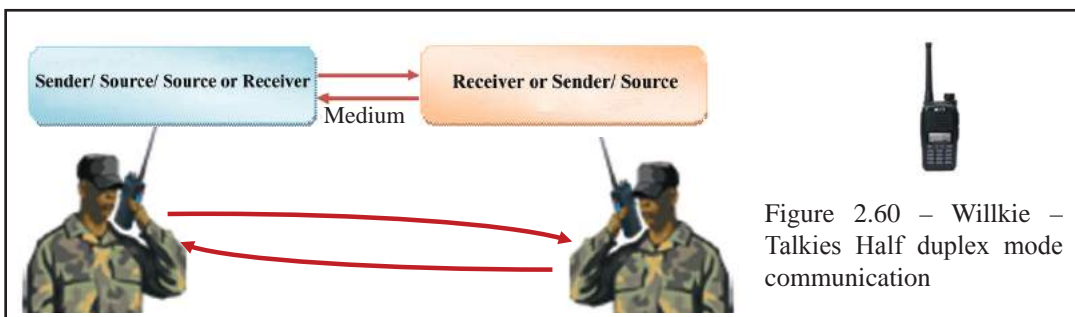


Figure 2.59 - Simple mode communication

2) Half- duplex Mode

Here, data is transmitted to one direction at a time. This means after data is transmitted from sender / source to the receiver, the receiver can transmit data back to the sender / source. Browsing internet to get information and walkie-talkie used by security forces can be given as examples.



3) Full Duplex Mode

Data is transmitted to both sides at the same time is called Full duplex. Telephone conversation is an example for full duplex mode communication.

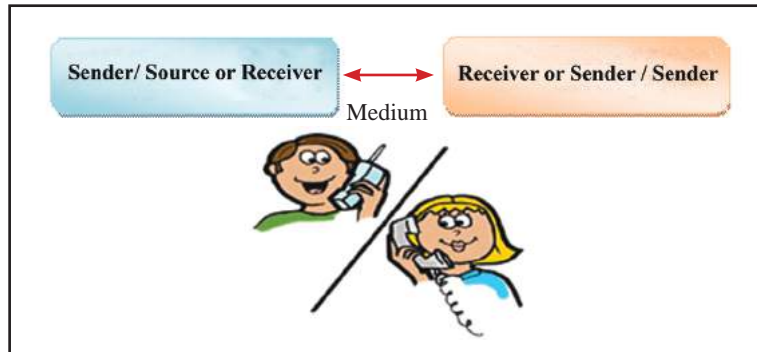


Figure 2.61 - Full Duplex Mode communication

2.5.3 Data Transmission Media

This is another important feature when creating connections among systems. There are two types of data transmission medium. Those are called Guided/Wired and Unguided/Wireless. The following are some examples. (Figure 2.62)

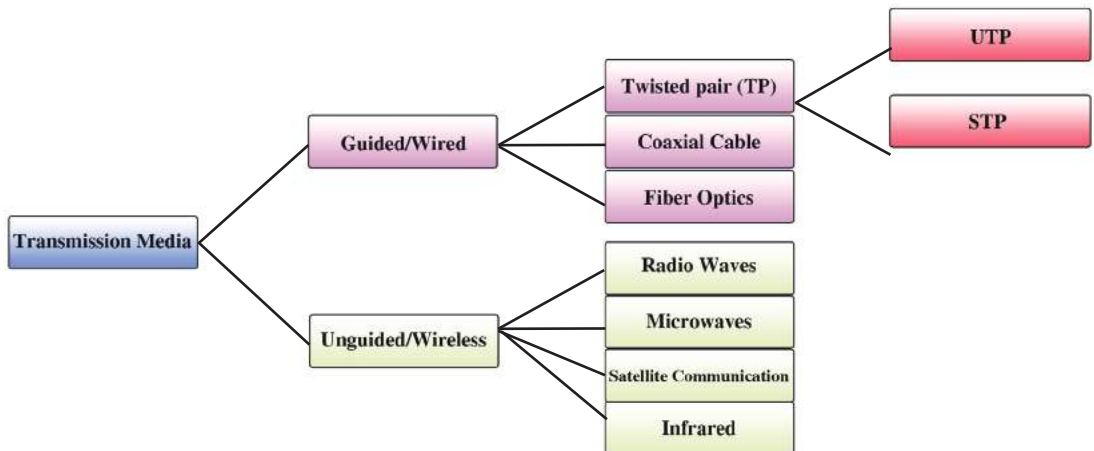


Figure 2.62 - Data Transmission Mediums

(i) Guided / Wired

If the medium used for data transmission is a physical medium, it is called guided or wired.

Example 1 - Twisted Pair

Pairs of twisted copper wire are used for data transmission. There are two types.

1. Unshielded Twisted Pair (UTP)

The twisted copper wire pairs used for telephone connections. These are very flexible and low-priced. However, it is difficult to transmit data for a long distance through UTP wires. It is suitable for maximum of 100 meters.

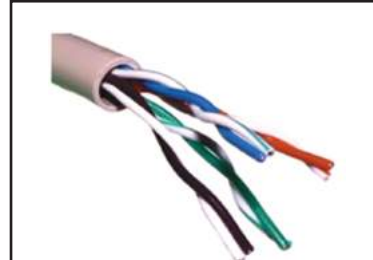


Figure 2.63 - Unshielded Twisted Pair

2. Shielded Twisted Pair (STP)

STP is a better quality and secure data transmission medium. However it is expensive. (Figure 2.64)

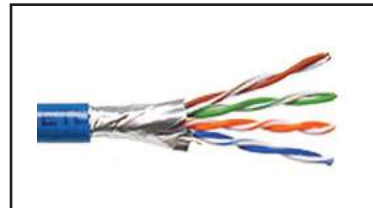


Figure 2.64 - Shielded Twisted Pair

Example 2 - Coaxial Cable

This consists of an electronic cable pair. The outer cable which is like a braided copper net produces electromagnetic field around the central cable. These two cables are separated by a plastic shield. These cables are expensive and used for TV antenna and CCTV.

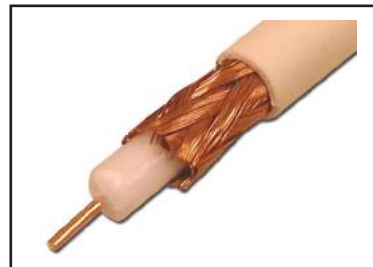


Figure 2.65 - Coaxial Cable

Example 3 - Fiber Optics cable

Fiber Optics cable consists of a pair of cables. There is a plastic jacket to separate the two cables. Core is a glass tube and there is glass cladding around it. (Figure 2.66). The data transmission is carried out by while reflecting light. These are used in modern telephone networks. The cable is relatively more expensive.

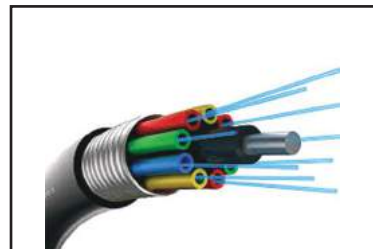


Figure 2.66 - Fiber Optics

Activity



Write down advantages and disadvantages of copper wire and optical fiber.

(ii) Unguided/Wireless Media

Data is transmitted as signal through the air without using physical medium is called unguided/wireless media.

Example 1 - Radio waves

Data transmission is performed using radio waves. Wifi and Bluetooth are examples for radio waves based communication.

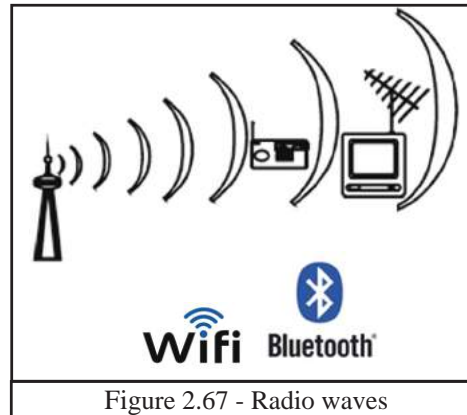


Figure 2.67 - Radio waves

Example 2 - Microwaves

Microwaves travel in a linear mode. Figure 2.68) Transmission center is positioned facing each other. The distance between centers are decided based on geographical factor of the area.

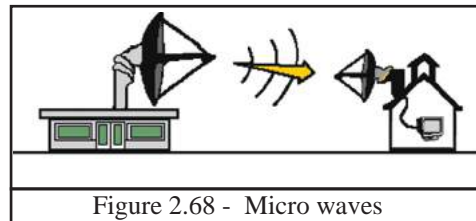


Figure 2.68 - Micro waves

Microwaves are used in Satellite communication to transmit data as transponders. (Figure 2.69) Satellite centers, which are positioned in the sky above 36000 km, capture data transmitted as microwaves through satellite towers positioned in the Earth and then transmit the data back to the required tower. Using this method, data can be transmitted to any distance. This is also used in internet communication.

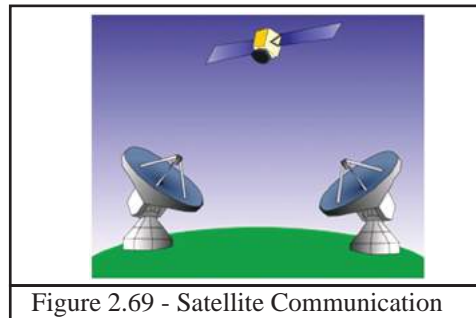


Figure 2.69 - Satellite Communication

Example 3 - Infrared

Infrared data transmission is used in TV remote controllers, wireless keyboards and mouse etc.

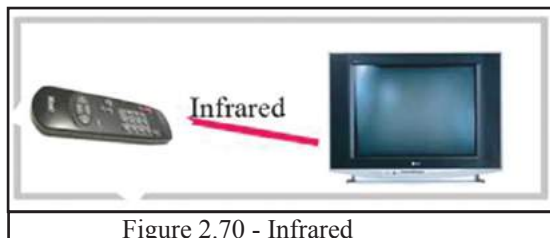


Figure 2.70 - Infrared

2.5.4 Computer network devices

There should be two or more computers to build a computer network. Connection devices used to connect computers with each other.

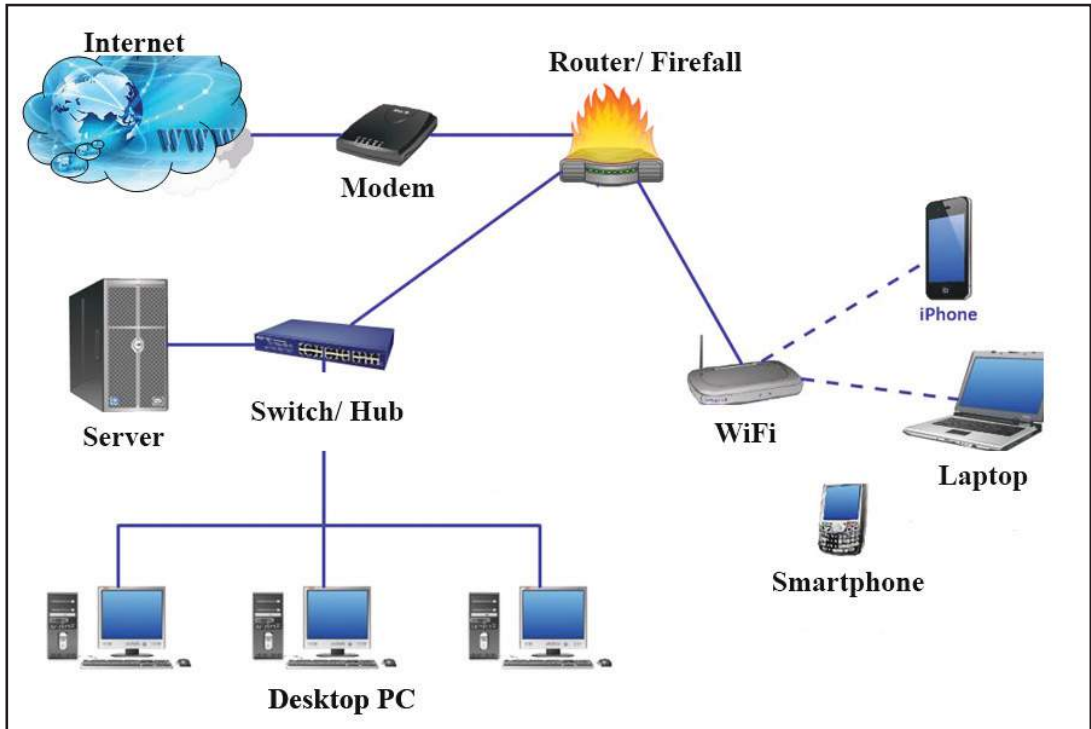


Figure 2.71

(i) Network Interface Card (NIC)

NIC has an RJ45 port and is built into the mother board in modern computers. In the port NIC was a separate code to be plugged to the mother board.



Figure 2.72 - Network interface card

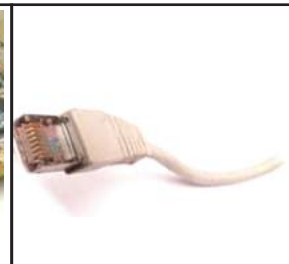
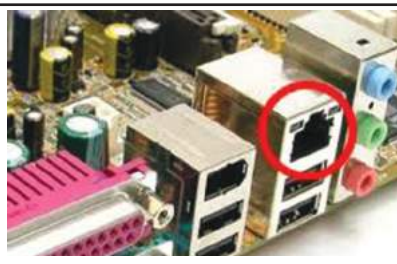


Figure 2.73 - RJ 45 connector

(ii) Switch/Hub

Switch/Hub acts as the mediator to build a connection between two or more computers. (Figure 2.74) A guided/wired transmission media is used. One end is connected to port in the computer and the other end is connected to the port in the Switch / Hub.



Figure 2.74 - Switch / Hub

Differences between the switch and hub

- The main difference is the data transmission speed. Hub sends the transmitted data to all computers but switch sends data to the relevant computer only. Here hub may create an unnecessary network data congestion.
- In data transmission, hub uses half duplex mode and the switch uses full duplex mode.

(iii) Wireless Fidelity - Wi-Fi

Wi-Fi adapter has become the most popular media in computer networking. This allows the users to build a computer network easily and internet connections for mobile phones and laptop computers using radio waves.



Figure 2.75 - Wi - Fi

(iv) Router

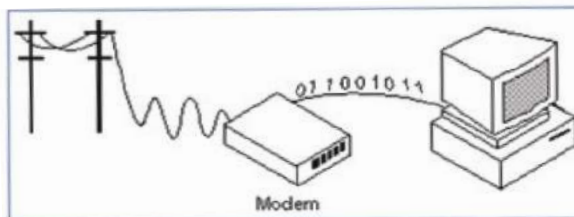
Router is the device used to build a connection between two or more computer networks. It is also called a Gateway. This finds out the most suitable ports for data transmission in network communication.



Figure 2.76 - Router

(v) Modem

The modem is used to connect the computers of a computer network or a personal computer at home to the internet. The modem acts as a data translator. Digital signals sent from the computer is translated to analog signals and the analog signals send to the computer from the internet is translated to digital signals. This is called **MOD**ulation and **DEM**odulation. Hence, 'MODEM' is a combination of these two words. There are different types of MODEMS. Those are internal, external and wireless modems. Today's routers have a modem inbuilt in the device.



Modulation - Demodulation

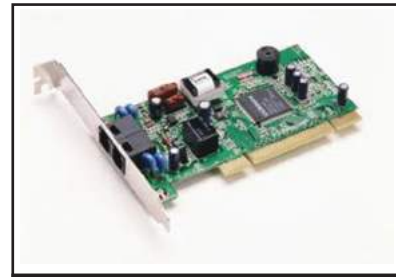


Figure 2.77 – Internal Modem



Figure 2.78 – External Modem



Figure 2.79 – Wireless Modem

(vi) Firewall

Firewall is a network security. Instructions to control the data and instruction transmission between internet and computer network are built into the system. A firewall operates as a secured barrier between internet and network. Firewalls exist in both forms as software and hardware.

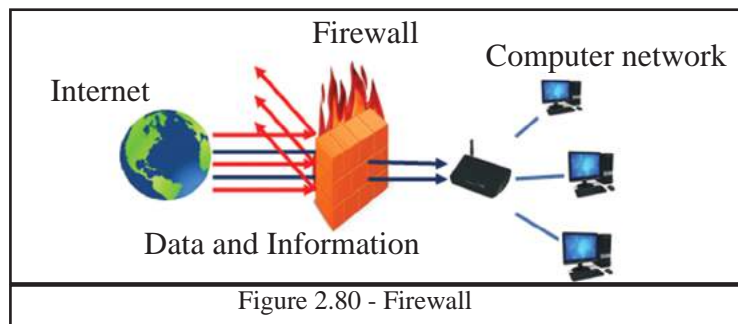


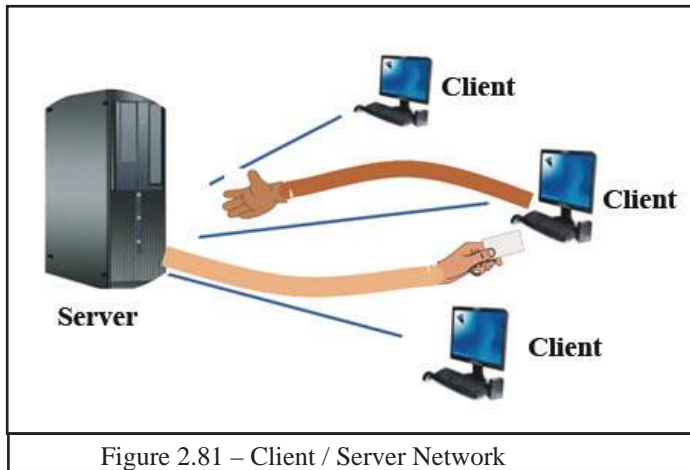
Figure 2.80 - Firewall

Activity



Briefly explain the importance of a firewall.

2.5.5 Client/Server network

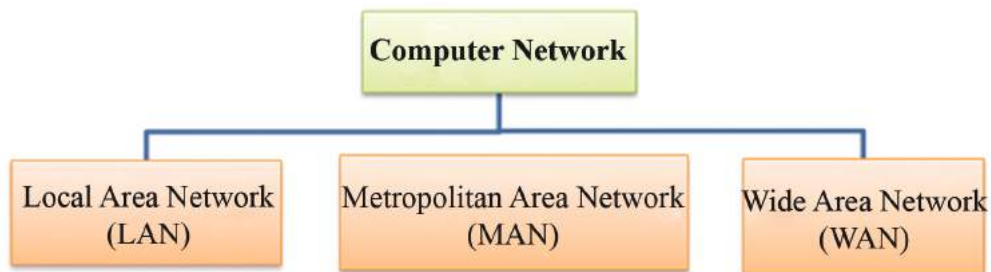


A server computer responds to the client computer connected to the server. A network operating system is installed to the server. The one who requests data or information via internet or from an area network is called a client and the one who provides data and information is called the server.

2.5.6 Types of Computer Network

- **Computer Networks**

Computer networks can be classified according to geographical distribution of computers in the network.



(i) Local Area Network (LAN)

A LAN connects computers inside a room or several rooms in a building. (Figure 2.83) A computer network built in a school, university, a small scale business or an office can be given as examples.

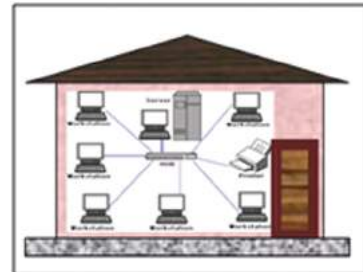


Figure 2.83 - LAN

(ii) Metropolitan Area Network - (MAN)

MAN is a combination of several Local Area Networks which covers less than 16 miles. Examples include banking networks, institutes and universities with branches. (Figure 2.84)

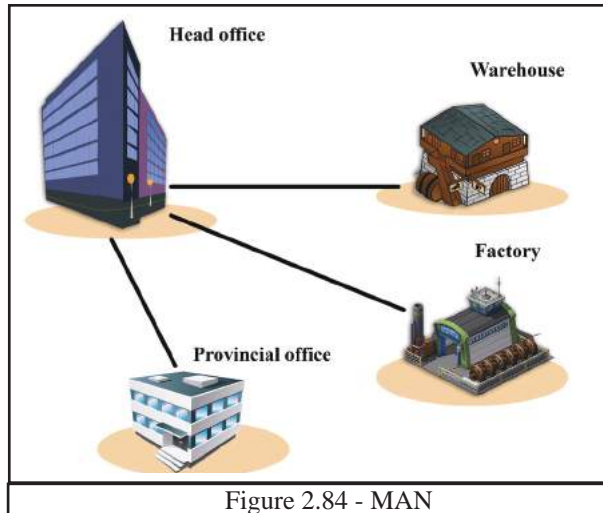


Figure 2.84 - MAN

(iii) Wide Area Network - WAN

These networks cover a wide area. This can be within or outside a country. The best example for WAN is the Internet. (Figure 2.85)

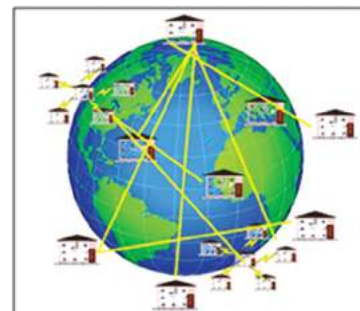


Figure 2.85 - WAN

Activity



Provide two examples for LAN, MAN and WAN.

2.5.7 Network Topology

Network topology is the pattern of connection in designing computer network. There are different types of network topologies. Those are,

i) Star Topology

This is a commonly used design and built by centralizing a switch/hub and computers. (Figure 2.86)

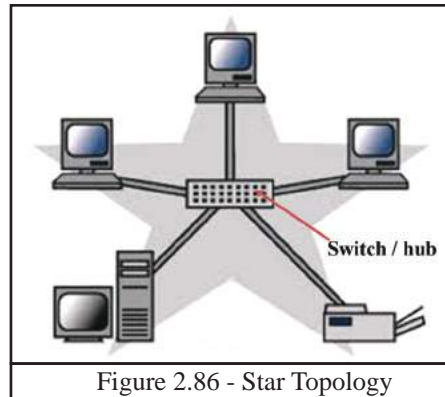


Figure 2.86 - Star Topology

ii) Bus Topology

Here, all the connections are established through a main cable. (figure 2.87) This cable is called the backbone because any issue with the network affects all the computers in the network. This design is easy in networking and fewer cables are required. However, a limited number of computers can be connected.

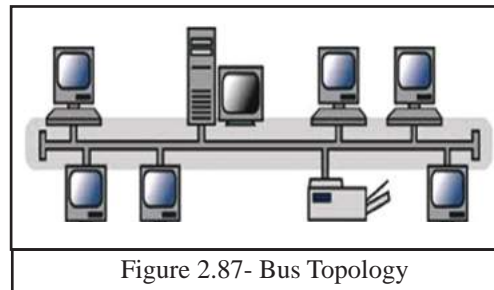


Figure 2.87- Bus Topology

ii) Ring Topology

Here, computers are positioned in a ring/bangle and connected through cables. Data or information move in a circular manner. The breakdown of one computer or cable can lead to the breakdown of the entire network.

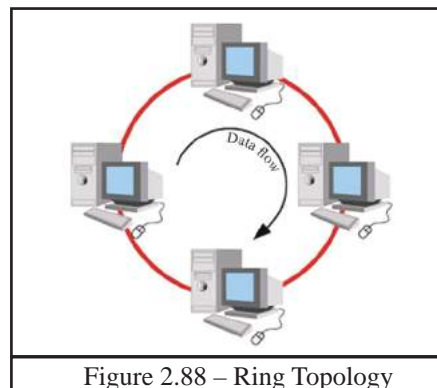


Figure 2.88 – Ring Topology

iv) Tree Topology

Tree topology has characteristics of both bus and star topologies. In this design several star topologies are connected to a bus backbone cable. (Figure 2.89) One of the advantages of this is the ability to control each network individually.

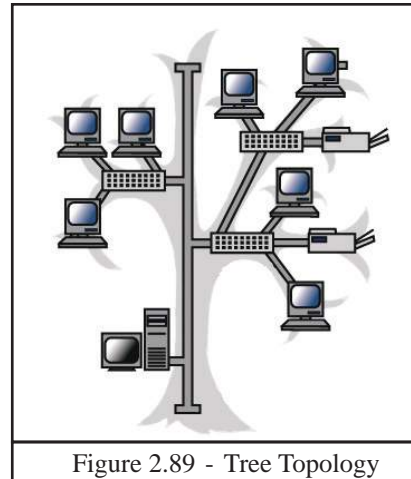


Figure 2.89 - Tree Topology

v) Mesh Topology

All the computers in the network are connected with each other. (Figure 2.90) Since this is a complex connection pattern, it is costly and difficult to control. However, a breakdown of one computer does not affect the connections in the network. Mesh networking can be found on internet.

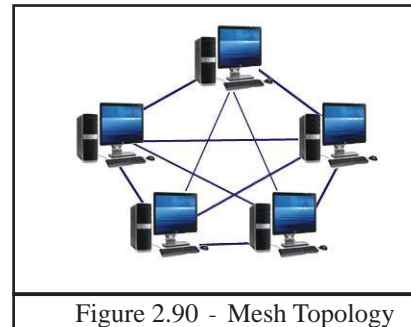




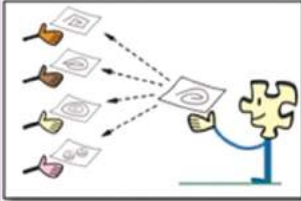



Figure 2.90 - Mesh Topology

2.5.8 Benefits of Networkings






Data and information can be shared between computers.



The main advantage of networking is sharing data and information between computers. Data and information in a server, can be accessed by clients connected to the server.

<p>Less storage space</p> 	<p>This saves space as well because the same data is not stored in several computers unnecessarily.</p>
<p>Ability to share resources</p> 	<p>The devices like printer, scanner and modem can be connected to network and shared by multiple users.</p>
<p>Ability to control central software</p> 	<p>Software can be installed on a server computer and shared by many users through client computers.</p>
<p>Ability to connect at any where and at any time</p> 	<p>By connecting to internet, a user can access his / her documents and data at any where and any time (24×365).</p>
<p>Security</p> 	<p>Only the authorized clients can access the server computer. Data and information in a network can be made secure.</p>
<p>Electronic mail</p> 	<p>E-mail is a convenient method of sharing information between computers.</p>

2.5.9 Disadvantages of Networking

<p>Possible security issues</p> 	<p>One major disadvantage of networking is the difficulty in securing data. Server can be accessed through any computer connected to the network. Hence it is difficult to secure it from the hackers (people who try to gain access to data without permission).</p>
<p>Breakdown of network</p> 	<p>In some topologies, breakdown of a computer or a cable can affect the function of the other computers of the network.</p>
<p>Virus</p> 	<p>If one of the computes in the network gets a virus attack, this can spread to other computers as well.</p>
<p>Computer break downs</p> 	<p>Due to defects or breakdown of the server, the other the clients can be affected.</p>
<p>Training requirements</p> 	<p>The need for a person who is specialized in network administration.</p>

Summary

- A computer is an electronic device which accepts or collects data, processes them according to the instructions given and produces desired output.
- Characteristics of a computer are speed, accuracy, efficiency, versatility and storing and retrieving ability.
- Classification of computers
 - According to size - Super Computers, Mainframe computers, Mini computers, Personal Computers / Micro Computers / Mini Computers
 - According to technology - Analogue Computers, Digital Computers, Hybrid Computers
- Basic components of a computer
 - Input devices
 - Output devices
 - Central Processing Unit : Arithmetic and Logical Unit (ALU), Control Unit, Memory Registers
 - Primary Memory / Main Memory
 - Secondary storage
- External devices are connected to a computer through ports.
- Basic components of data transmission are sender/source, media, receiver/destination.
- Modes of data transmission
 - Simplex-mode
 - Half-duplex mode
 - Full muplex mode
 - Data transmission medium
 - There are two types – guided and unguided / wireless
- Connectivity devices such as switches, routers, modems are necessary to build a network.
- Types of computer networks – LAN, MAN, WAN
- Computer network topology includes
 - Star topology
 - Bus topology,
 - Ring topology
 - Tree topology
 - Mesh topology
- There are advantages as well as disadvantages of computer networking.