DATA COMMUNICATION

- Data Communication is the **exchange** of **Information** from one **entity** to the other using a **Transmission Medium**".

LOCAL and REMOTE Data Communication

LOCAL

Data communication is considered to be local if the communicating devices are present in the same building or a similarly restricted geographical area

REMOTE

Data Communication is considered remote, if the devices are farther apart.

Data Communication System

- For Data Communication to occur, the communicating devices must be a part of a communication system made up of some specific kind of hardware and software. This type of a system is known as a **"DATA COMMUNICATION SYSTEM"**

Elements of Data Communication Systems

- Any system is made up of more than one component. Similarly, a data communication system is made up of 5 components as shown in the

- Message
- Sender
- Receiver
- Medium
- Protocol

MESSAGE

- Information or Data to be communicated can be text, numbers, video or any combination of these. In short anything that can be represented using binary bits
- **Data Communication Messages include**
- **Files**(meaningful collections of records)
- **Data/information requests** (database queries, Web page requests, etc.)
- **Responses** to requests and commands or error messages
- **Status messages** (about the network's functional status)
- **Control messages** transmitted between network devices to control network traffic
- **Correspondence** among network users

SENDER

Device that sends the data message can be a Computer, Workstation, Video camera etc. As already discussed, the data from the sender might not be in the appropriate format for the transmission medium and will need to be processed.

RECEIVER

Device that receives the message can be a computer, workstation, Television, etc. At times, the data received from the transmission medium may not be in a proper form to be supplied to the receiver and it must be processed.

PROTOCOL

Set of Rules Governing Communication. It represents an Agreement between communication devices. Without Protocol, two devices may be connected but they will not be able to communicate.

EXAMPLE: Consider the communication between two individuals. They can only communicate provided they both speak the same language.

Notes

Standards

A standard provides a model for development that makes it possible for a product to work regardless of the individual manufacturer

TRANSMISSION MEDIA:

- Is a pathway over which data or information is conveyed from the sender to the receiver.

- **CATEGORIES OF TRANSMISSION MEDIA**
- There are two main categories of transmission media and these include:

Guided Media (physical transmission media)

- Guided Media, are those media that provide a physical means or channel from one device to another.
- Examples include;
- **Twisted Pair Cable**

Twisted pair comes in two forms:

1. Unshielded Twisted Pair (UTP) cable
2. Shielded Twisted Pair (STP) cable

Advantages of UTP are:

- Its cheap, flexible and easy to install
- Higher grades of UTP are used in many LAN technologies including Ethernet and Token Ring

Advantages of STP are:

- The metal casing prevents the penetration of EM noise
- It also can eliminate a phenomenon called Crosstalk, which is the undesired effect of one circuit (or channel) on another circuit (or channel) It occurs when one line picks up some of the signals traveling down another line.
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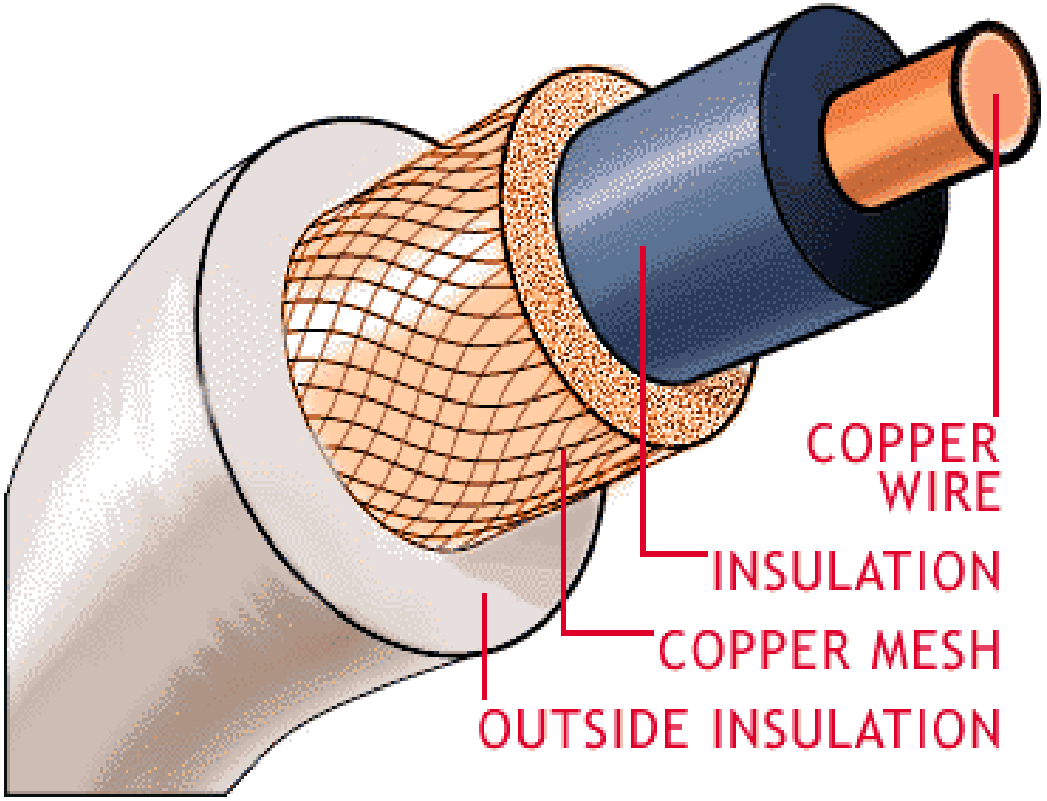
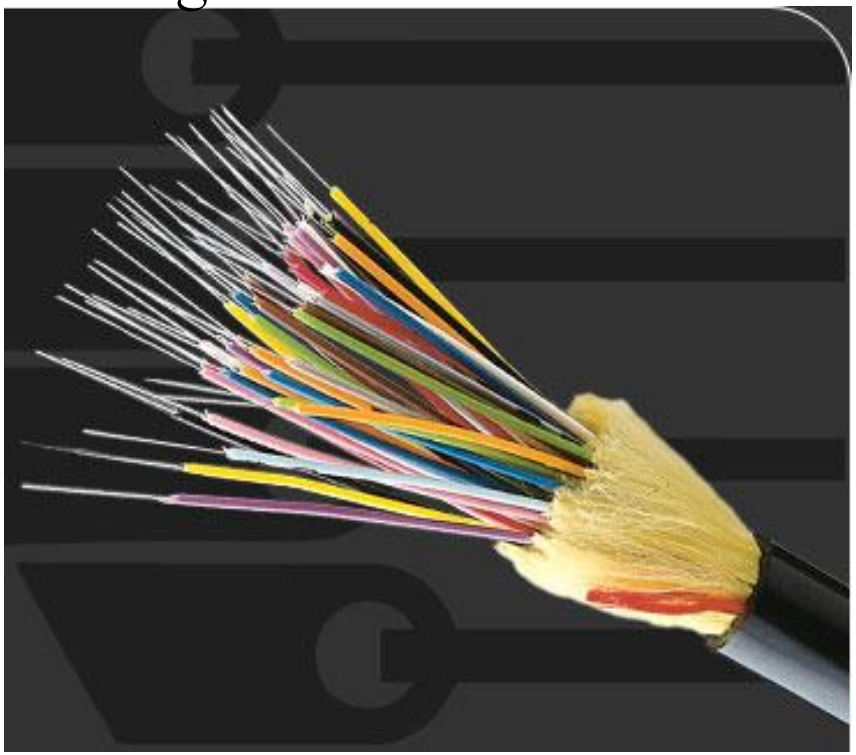
Coaxial Cable

Instead of having two wires, coaxial cable has a central core conductor of solid or stranded wire (usually copper) enclosed in an insulating sheath



Optical Fiber

Until this point we have discussed conductive (metal) cables that transmit signals in the form of current Optical fiber is made of glass or plastic It transmits signals in the form of light



UNGUIDED MEDIA (non physical transmission media)

- Unguided Media or Wireless Communication: Is where Electromagnetic waves are sent from one point to another without a physical conductor Instead signals are broadcast through the air to a receiver capable of receiving them.
- **OR:**
- Wireless communication technology, is one where the transfer of information over a distance is done without the use of cables (wires) as a medium.

- Wireless technology is mostly applied in Local area networks, extended local area network, and connecting a network to another network.

- **SOME ADVANTAGES OF USING WIRELESS COMMUNICATION:**
- Wireless technology overcomes the inconvenience of using too many wires for communication.
- .Wireless is appropriate to use in places where cabling is practically impossible.
- .Wireless increases flexibility and mobility at the work place because workers can sit anywhere with their computers without being limited by the extent of cable connections.
- Examples Include; Bluetooth, Infra-Red, satellite, Radio waves, Wi-Fi

Radio waves Transmission

- The Radio waves have frequencies between 3khz and1Ghz
- Radio waves are Omni direction
- Radio waves can penetrate buildings easily, so that are widely used for communication both indoors outdoors.
- They are also absorbed by rains
- At high frequency, radio wave tends to travel in straight line and bounces off the obstacles.

Micro waves Transmission

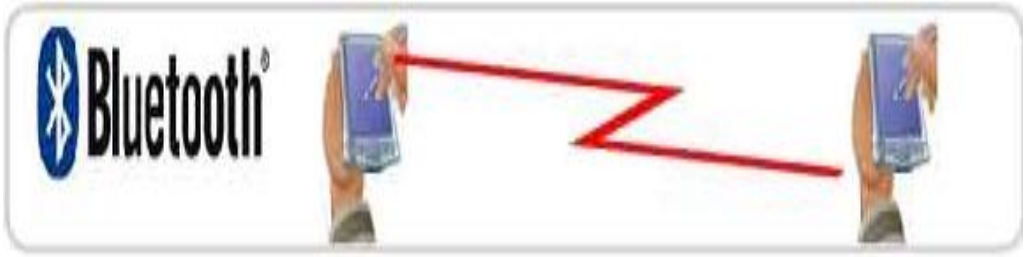
- Micro waves are electromagnetic waves having frequency between 1 GHZ and 300 GHZ.
- There are two types of micro waves data communication system : terrestrial and satellite
- Micro waves are widely used for one to one communication between sender and receiver, cellular phone, satellite networks and in wireless LANs.

Infrared Waves

- Electromagnetic waves having frequencies from 300 GHz to 400 THz are called IR waves or Infrared waves.
- IR waves are used for short range communication and use line of sight propagation.
- Infrared waves cannot pass through solid objects, like walls and can easily be contained in a room.
- They are cheap, easy to build and do not require any government license to use them.
- IR waves offer very large bandwidth for use.

Bluetooth

- This is a wireless technology that enables exchange of data over a short distance(about 10 metres) among Bluetooth enabled devices using short wavelength radio transmissions.



satellite

- This is a specialized wireless receiver/transmitter that is launched by a rocket and placed in the orbit.
- Modern satellites can receive and re-transmit thousands of signals to the earth stations simultaneously.

Wi-Fi (wireless fidelity)

- This is a technology that allows an electronic device to exchange data wirelessly over a computer network, including high speed internet connections
- Devices that can use Wi-Fi include PCs, Smartphone, tablets, PDAs etc. These connect to a network resource through a wireless access point called Hotspot


wifinotes.com
To Internet
Cable/ADSL Modem
Click on the image to read article completely.
PC with Ethernet connection
PC with USB Wireless Adapter
Notebook with wireless adapter card

Data communication tools

- These are tools that are used in data communication.
- There are two categories of data communication tools i.e. electronic and manual communication tools
- Electronic tools include mobile phones, computers, emails, social networks, Skype
- Manual tools include manual drums, bells, messengers

Comparison between manual and electronic data communication tools

manual	Electronic
Does not require subscription or payment for usage in communication	Requires some kind of payment or subscription or for the services
They are cheap to maintain and service	Their maintenance and servicing costs are high
Drum and bell communication is limited to a small range i.e. it covers a small area like gathering of people	Mobile phone, email and social network communication covers a larger geographical area
It is a very slow means of communication for instance a messengers or carriers carry messages from the source to the recipient	It is very fast and efficient means of communication

Services offered by data communication tools include:

1. **E-mail:** messages distributed by electronic means from one computer user to one or more recipients via a network. e.g. yahoo, Gmail, rocket mail, Hotmail etc.
2. **video teleconference** is a set of telecommunication technologies which allow two or more locations to communicate by simultaneous two-way video and audio transmissions. Whereas **Videoconferencing** (or video conference) means to conduct a conference between two or more participants at different sites by using computer networks to transmit audio and video data. Devices used include, video camera, microphone, and speakers mounted on his or her computer. e.g. Skype, google+

3. **Newsgroup** is
   a discussion group on a specific topic that is maintained on a computer
   network especially the Internet: *cooking, dating, pets newsgroups.*
4. **Instant Messaging** (IM) is a type of online chat which offers real-time text transmission over the Internet e.g. facebook messenger, whatsapp, yahoo messenger
5. **Chatroom** A site on a computer network where online conversations are held in real time by a number of users. e.g. America online, classic movies

Techniques of data communication

- There are two possible techniques of sending data from the sender to the receiver i.e
- Parallel transmission
- Serial transmission

Parallel transmission

- In parallel transmission each bit of character or data has a separate channel and all bits of character are transmitted simultaneously. Here the transmission is parallel character by character. Sender-receiver

Serial transmission

- In serial transmission, the data is sent as one bit at a time having a signal channel for all the bits i.e. sender receiver

Types of serial transmission

On serial transmission it is very essential to know exactly where one character ends and the next begins. The necessary synchronization that helps determine which bit is the first bit of the incoming character may be synchronous or asynchronous

Asynchronous serial transmission

- Computer communication that occurs one bit at a time with start and stop bits at the beginning and at the end of each character. In this type of transmission there is no fixed time relationship with one character

Advantages of Asynchronous serial

- The type of transmission is very simple.
- This type of transmission is cheaper.

Disadvantages.

- The type of transmission is slow

SYNCHRONOUS TRANSMISSION

- In this method a clock signal is used and the sending as well as the receiving devices are synchronized with this clock signal.
- It doesn't use start and stop bits but the character are sent in character groups called block.

Advantages

- It is very fast as compared to Asynchronous series transmission

Disadvantages

- It uses more expensive and complex equipments.

MODES OF DATA COMMUNICATION

- The manner in which data is transmitted from one locating to another is called data transmission mode. There are 3ways or modes for transmitting data from one location to another.
- These are:

i. Simplex
ii. Half duplex
iii. Full duplex

HALF DUPLEX

- In half duplex mode, data can be transmitted in both directions but only in one direction at a time. During any transmission, one is the transmitter and the other is the receiver.
- So each time for sending or receiving data, direction of data communication is reversed, this slows down data transmission rate. In half duplex mode, transmission of data can be confirmed e.g. fax machine.

ADVANTAGES.

- Costs less than full duplex
- Enables for two way communication.

DISADVANTAGES.

- Costs more than simplex.
- Only one device can transmit at a time.

SIMPLEX MODE

- In this mode, data is transmitted in only one direction. A terminal can send only data and cannot receive it or can not only receive data but cannot send it.
- Simplex mode is usually used for a remote device that is meant only to receive data. It is not possible to confirm successful transmission of data in simplex mode.
- Speakers, radio and television broadcasting are examples of simplex transmission, on which the signal is sent from transmission to your T.V antenna and there is no return signal.

ADVANTAGES

- Cheapest communication method.

DISADVANTAGES

- Only allows for communication in one direction.

FULL DUPLEX

- In this mode, data can be transmitted in both directions simultaneously. It is a faster mode for transmitting data because of no time wastes in switching directions.
- Examples of full duplex is telephone set in which both the users can talk and listen at the same time.

ADVANTAGES

- Enables two way communication simultaneously.

DISADVANTAGES

- T he most expensive method in terms of equipments because of two bandwidth channels required.

COMPUTER NETWORK

Is a collection of two or more computing devices that are linked together to share resources like printers and CD/DVD drives, exchange files or allow electronic communication

Advantages of setting up a network

- **Speed**. Networks provide a very rapid method for sharing and transferring files.
- **Cost**. Networkable versions of many popular software programs are available at considerable savings when compared to buying individually licensed copies
- **Security**. Files and programs on a network can be designated as "copy inhibit,"
- **Centralized Software Management**. One of the greatest benefits of installing a network at a school is the fact that all of the software can be loaded on one computer
- **Resource Sharing**. Sharing resources is another area in which a network exceeds stand-alone computers.

Disadvantages of setting up a network

- **Expensive to Install**. Although a network will generally save money over time, the initial costs of installation can be prohibitive
- **Requires Administrative Time**. Proper maintenance of a network requires considerable time and expertise
- **File Server May Fail.** Although a file server is no more susceptible to failure than any other computer, when the files server "goes down," the entire network may come to a halt
- **Cables May Break**

Categories of Networks

There are three main categories of networks:

- Local area network (LAN)
- Metropolitan area network (MAN)
- Wide area network (WAN)

1. LAN

- A LAN is usually privately owned and Links the devices in a single office, Building or a campus.
- LAN can be as simple as two PCs and a printer in someone's home office or it can extend throughout a company and include complex equipment too. Currently LAN size is limited to a few kilometers

2. MAN

- Designed to extend over an entire city.
- It may be a single network e.g. Cable TV Network **OR** Interconnection of a No. of LANs into a larger network.

3. WAN

- This is a computer network that covers a large geographical area and it usually spans an unlimited number of miles by utilizing Public or Leased networks instead of having their own hardware as in the case of LANs and MANs.
- The world's biggest WAN is the internet.

INTRANET AND EXTRANET

- INTRANET
- A network of networks within the organization used to share company resources and information amongst employees and departments
- EXTRANET
- Extranet are extensions to, or segments of, of private intranet networks that have been built in many corporations for information sharing between organization through internet

NETWORK MODELS

There are basically two types of network models;

- Client-Server Model
- Peer-to-Peer Model

Peer-to-Peer Model [P2P]

- **P2P** is an approach to computer *networking* where all computers share equivalent responsibility for processing data. I.e. there is decentralization.

Advantages	Disadvantages
No need for a network operating system	Because each computer might be being accessed by others it can slow down the performance for the user
Does not need an expensive server because individual workstations are used to access the files	Files and folders cannot be centrally backed up
No need for specialist staff such as network technicians because each user sets their own permissions as to which files they are willing to share.	Files and resources are not centrally organized into a specific 'shared area'.They are stored on individual computers and might be difficult to locate if the computer's owner doesn't have a logical filing system.

Much easier to set up than a client-server network - does not need specialist knowledge	Ensuring that viruses are not introduced to the network is the responsibility of each individual user
If one computer fails it will not disrupt any other part of the network. It just means that those files aren't available to other users at that time.	There is little or no security besides the permissions. Users often don't need to log onto their workstations.

Client-Server Model

- **Client-server model,** Is a computer network model in which many clients (remote computers) request and receive service from a centralized server (host computer).

Advantages

1. A client server can be scaled up to many services that can also be used by multiple users.
2. Security is more advanced than a peer-to-peer network, you can have passwords to own individual profiles so that nobody can access anything when they want.
3. All the data is stored onto the servers which generally have far greater security controls than most clients. Server can control the access and resources better to guarantee that only those clients with the appropriate permissions may access and change data.

Disadvantages

1. More expensive than a peer-to-peer network you have to pay for the startup cost.
2. When the server goes down or crashes all the computers connected to it become unavailable to use.
3. When you expend the server it starts to slow down due to the Bit rate per second.
4. When everyone tries to do the same thing it takes a little while for the server to do certain tasks.

Network Components

- These are devices that are found on a network. These are going to vary depending on the size and purpose why the network is being setup.

Servers

- Network servers are computers that provide different services to a computer network such as logon authentication, internet access, disk space, printing access, CD/DVD-ROM access, database access, antivirus and other software application etc

Cabling

- There are different types of network cables are involved in a computer network such as coaxial cable, Ethernet cable UTP/STP and fiber optic cable.

Network Interface Card (NIC)

- Also known as network adapter or Network Card (NIC).
- Network card is a necessary component of a computer without which a computer cannot be connected over a network.
- Most of branded computers have network card pre-installed.

Switch/HUB

- A Switch is a type of device which acts as the central point among computers and other devices that are part of a network.
- A Switch is equipped with holes called ports.
- computers and other devices are connected to a Switch using network cables.

Router

- Is device that translates information from one network to another network.
- Routers select the best path to route a message based on the destination address and origin (IP address)
- Now-a-days router comes in wireless modes using which computers can be connected without any physical cable.

Bridge

A bridge is a device that allows you to segment a large network into two smaller, more efficient networks.

Modems

Modem is a network device that performs two functions modulation and demodulation i.e. it converts the digital data into the analog signals and the analog data into digital.

Gateway

A network gateway is a computer, software or device that is directly connected with the external network i.e. internet. All the incoming and outgoing traffic of a network passes through the gateway.