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## DATA COMMUNICATION:

Data communication is defined as a process in which more than one computer transfers information, instructions to each other and for sharing resources.

### Components of Data communication:

A communication is madeup of the following components;

- **Message:**
A message is a piece of information that is to be transmitted from one person to another. It could be a text file, an audio file, video file etc.

- **sender:**
It is simply a device that sends data messages. It can be a computer, mobile, telephone etc.

- **Reciever:**
It is a device that recieves messages. It can be a computer, telephone workstation etc.

- **Transmission Medium / Communication channels:**
Communication channels are the medium that connect two or more workstations. Workstations can be connected by either wired media or wireless media.

- **Set of rules (Protocol):**
When someone sends the data (The sender), it should be understandable to the reciever also otherwise it is meaningless. For example, Sona sends a message to Huzaifa. If Sona writes in english and Huzaifa didn't understand english, then the conversation is meaningless.

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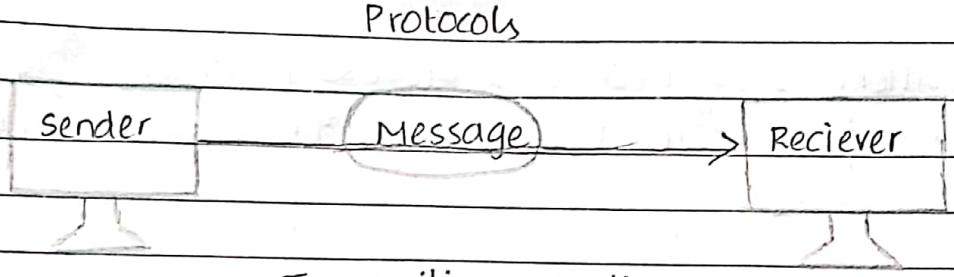


Therefore there are some set of rules (protocols) that is followed by every computer connected to the internet and they are;

- TCP (Transmission control Protocols):

It is responsible for dividing messages into packets on the source computer and reassembling the recieved packet at the destination or recipient computer. It also make sure that packets have the information about the source of the message data, the destination of the message data should be re-assembled, and checks if the messages has been sent correctly to the specific destination.

- IP (Internet Protocol):

IP is responsible for handling the address of the destination computer so that each packet is sent to its proper destination.

VPN (Virtual Private Network):

Using a VPN changes your IP address, the unique address the define your location to new one. By using VPN user can easily keep their online activity private and secure from any data fishers or hacker around the globe.

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- Type of Data communication:

The data communication is divided into three types:

1 Simplex Communication:

It is one-way communication or we can say that unidirectional communication in which one device only sends data and devices uses their entire capacity in transmission. For example, IOT, entering data using a keyboard, Listing music using a speaker, etc.

2 Half Duplex Communication:

It is a two-way communication or we can say that It is a bidirectional communication in which both the devices can send and recieve data but not at the same time. When one device is sending data then another device is only recieving and vice versa. For example, walkie-talkie.

3 FULL-Duplex Communication:

It is a two-way communication or we can say that it is a bidirectional communication in which both the devices can send and recieve data at the same time. For example, mobile phones landlines etc.

- Communication channels:

Communication Channels are the medium that connects two or more workstations. The transmission medium can be grouped in two categories;

- Guided Media
- Unguided Media.

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- **Guided Media:**

In this transmission medium, the physical link is created using wires or cables between two or more devices and then the data is transmitted using these cables in term of signals.

For example

- Twisted Pair Cable
- Coaxial Cable
- Optical fibre cable.

- **Unguided Media:**

The unguided transmission media is a transmission mode in which the signals are propagated from one device to another device wirelessly. signals can wave though the air, water, or vaccum. It is generally used to transmit signals in all directions. Unguided Media is further divided into various parts suchas;

- Microwave
- Radiowave
- Infrared

## Popular Communication Media

Communication between computing devices is handled over two types of paths: parallel and serial. These terms refer to the manner in which signals are transferred with respect to each other. In the case of **parallel communication,** several signals are transferred at the same time, each on a separate "line." Such a technique is capable of transferring data rapidly but requires a relatively complex communication path. Examples include a computer's internal bus where multiple wires are used to allow large blocks of data and other signals to be transferred simultaneously.

In contrast, **serial communication** is based on transferring signals one after the other over a single line. Thus serial communication requires a simpler data path than parallel communication, which is the reason for its popularity. USB and FireWire, which offer relatively high-speed data transfer over short distances of only a few meters, are examples of serial communication systems. For slightly longer distances (within a home or office building), serial communication over Ethernet connections (Section 4.1), either by wire or radio broadcast, are popular.

For communication over greater distances, traditional voice telephone lines dominated the personal computer arena for many years. These communication paths, consisting of a single wire over which tones are transferred one after the other, are inherently serial systems. The transfer of digital data over these lines is accomplished by first converting bit patterns into audible tones by means of a **modem** (short for *modulator-demodulator*), transferring these tones serially over the telephone system, and then converting the tones back into bits by another modem at the destination.

For faster long-distance communication over traditional telephone lines, telephone companies offer a service known as **DSL (Digital Subscriber Line),** which takes advantage of the fact that existing telephone lines are capable of handling a wider frequency range than that used by traditional voice communication. More precisely, DSL uses frequencies above the audible range to transfer digital data while leaving the lower frequency spectrum for voice communication. Although DSL has been highly successful, telephone companies are rapidly upgrading their systems to fiber-optic lines, which support digital communication more readily than traditional telephone lines.

Other technologies that compete with DSL and fiber optics include cable, as used in cable television systems, and satellite links via high-frequency radio broadcast.

## Communication Rates

The rate at which bits are transferred from one computing component to another is measured in **bits per second (bps).** Common units include **Kbps** (kilo-bps, equal to one thousand bps), **Mbps** (mega-bps, equal to one million bps), and **Gbps** (giga-bps, equal to one billion bps). (Note the distinction between bits and bytes—that is, 8 Kbps is equal to 1 KB per second. In abbreviations, a lowercase b usually means *bit* whereas an uppercase B means *byte*.)

For short distance communication, USB and FireWire provide transfer rates of several hundred Mbps, which is sufficient for most multimedia applications.



This, combined with their convenience and relatively low cost, is why they are popular for communication between home computers and local peripherals such as printers, external disk drives, and cameras.

By combining **multiplexing** (the encoding or interweaving of data so that a single communication path serves the purpose of multiple paths) and data compression techniques, traditional voice telephone systems were able to support transfer rates of 57.6 Kbps, which falls short of the needs of today's multimedia and Internet applications, such as YouTube and Facebook. To play MP3 music recordings requires a transfer rate of about 64 Kbps, and to play even low quality video clips requires transfer rates measured in units of Mbps. This is why alternatives such as DSL, cable, and satellite links, which provide transfer rates well into the Mbps range, have replaced traditional audio telephone systems. (For example, DSL offers transfer rates on the order of 54 Mbps.)

The maximum rate available in a particular setting depends on the type of the communication path and the technology used in its implementation. This maximum rate is often loosely equated to the communication path's **bandwidth,** although the term *bandwidth* also has connotations of capacity rather than transfer rate. That is, to say that a communication path has a high bandwidth (or provides **broadband** service) means that the communication path has the ability to transfer bits at a high rate as well as the capacity to carry large amounts of information simultaneously.