Data Communication

Data Communication is the exchange of information from one entity to the other entity using transmission medium. The exchange of data between two devices via same form of the transmission system.

Elements of Communication over Networks:

1)Devices(Sender/Receiver): These are used to communicate with one to another.

2)Medium: This is how the devices are connected together.

3)Messages: Information that travels over the medium.

4)Rules/Protocols: Governs how messages flow across network.

Network Elements:

Network Devices:

1)Hardware(Devices and Media)

2)Software(Services and Process)

Hardware

Devices:

Two types-

1)End Device- End Device from interface with human network & communication network.

2)Intermediary Device- It provides connectivity between end device. And also manage data.

Software

1)Services: It provides information in response to a request.
Example: Email hosting service and web hosting service.
2)Process: It provides the functionality that directs and moves the message through the network.

Network Types

Personal Area Network (PAN): A network that connects computer, peripherals and other devices within a personal operating space.
Example: Bluetooth

Local Area Network (LAN): It connects computers, peripherals and other devices within a building or in a limited area. It's typical coverage 50 to 300 meters.
Example: Ethernet, Wireless LANs etc.

Metropolitan Area Network (MAN): It is a city wide network. The coverage limitation is not strict but real implementation may have range of up to 50km in urban, suburban or rural area.
Example: Wi Max

Wide Area Network (WAN): A network that spam larger geographical area. LANs separate by a wide area network.
Example: Cellular Networks etc.

Topology

Star Topology : The star topology is a standard and popular network setup. It is also known as a star network in terms. The topology is a network topology in which each piece of the network each attached to a central node. This central node is called a switch or hub.

Advantage:
-It's speed is very high.
-The network is scalable.
-It is the most efficient.
Disadvantage:
-Maintenance cost is very high.
-Central device dependency.
-It is very expensive.

Mesh Topology: In mesh, all the computers are inter connected to every other during a network. Each computer not only sends its own signals but also relays data from other computers.

Advantages:
-Failure during single device wasn't break the network.
-There is no traffic problem as there is a dedicated point to point links for every computer.
-It provides high privacy and security.
Disadvantage:
-Its costly as compared to the other network topologies.
-Installation is extremely difficult in the work.
-Maintenance needs are challenging with a mesh.
-Complex process.

Ring Topology: In a ring topology each device has a dedicated point to point connection with only the two devices on either side of it. A signal is passed a long the ring in one direction from device to device until it reaches it's destination.

Advantages:
-Dataflow in one direction which reduces the chance of packet collisions.

-Equal Access to the resources
-There is no need of server to control the connectivity among the nodes in the topology.
Disadvantages:
-Due to the unidirectional ring, a data packet must have to pass through all the nodes.
-If one work station shuts down, it affects whole network or if a node goes down entire network goes down.
-Difficult to troubleshoot the ring.

Bus Topology: It is a setup of the network where network devices, computers or nodes are directly linked to a single cable. One long cable acts as a backbone to link all the devices in a network.

Advantages:
-It works very efficiently well when there is a small network.
-The length of cable required is less than a star topology.
-It is easy to connect or remove devices in the network without affecting any other device.

Disadvantages:
-Additional device slow the network.
-If the main cable is damaged, the whole work fails or split.
-Packet less is high.

Hybrid Topology: Hybrid topology is a type of network topology in which two or more different topologies are integrated or combined to lay out a network.

Advantages:
-Hybrid topology often include redundant elements, which can enhance network reliability.
-It improves networks performances.
-It can improve whole network flexible.

Disadvantages:
-Cost is high.
-Maintenance is too tricky.
-Design and planning is more time consuming.

Peer To Peer Process:

At the physical layer, communication is direct. In this fig, device A sends a stream of bits to device B. At the higher layer, communication must move down through the layers on a device A, over to device B. Each layer in the sending device adds its own information to the message it to the message it receives from the layer just above it and pass it to the layer just below it.
At layer 1, the entire package is converted to a form that can be transmitted to the receiving device. At the receiving machine, the message is unwrapped layer by layer with each process receiving and remaining the data meant for it.
Example: Layer 2 removes the data meant for it then passes the rest to layer 3 & so on.

Physical Layer: The physical layer coordinates the functions required to carry a bit stream over a physical medium. It deals with the mechanical & electrical specifications of the interface and transmission medium. The physical layer is responsible for movements of individual bits from one hop to the next.

Physical Layer connects with:

1)<u>Physical characteristics of interfaces and medium</u>: The physical layer defines the characteristic of the interface between the device and the transmission medium.

2)<u>Representation of bits</u>: The physical layer consists of a stream of bits with no interpretation.

3)<u>Data rate:</u> The number of bits sent each second is also defined by the physical layer.

4)<u>Synchronization of bits:</u> The sender and receiver not only but must use the same bit rate but also must be synchronized at the bit level.

5)<u>Line Configuration:</u> The physical layer is concerned with the connection of devices to the media. In point to point configuration the device are connected through a dedicated link. In a multipoint configuration, a link is shared among several devices.

6)<u>Physical Topology:</u> The physical topology defines how the devices are connected to make a network.

7)<u>Transmission Mode:</u> The physical layer also defines the direction of transmission between two devices: Simplex, Half Duplex or Full Duplex. In simplex mode is one way communication. In half duplex mode, two devices can send and receive, but not at the same time. In full duplex mode, two devices can send and receive at a time.

Network Layer: The network layer is responsible for the source to destination delivery of a packet. The network layer ensures that each packet gets it's point of origin to final destination.
The network layer is responsible for the delivery of individuals packets from the source host to destination host.

Logical Addressing: The physical addressing independent by the data link layer handles the addressing problem locally. If a packet passes the network boundary, we need another addressing system to help distinguish the source and destination systems. The network layer adds a header to the packet coming from the upper layer and includes logical addressing of the sender and receiver.

Routing: When independent networks or links are connected to create inter networks or a large network, the connecting route or switch the packets to their final destination.

Transport Layer: The transport layer is responsible for process to process delivery of the entire messages. A process is an application program running on a host. The transport layer ensures the whole message arrives intact.
The transport layer is responsible for the delivery of a message from one process to another process.

Parameters	TCP	UDP
Connection	Oriented protocol	Less protocol
Speed	Slower	Higher
Error detection	Yes	No
Acknowledgement	Segments	No Segments
Handshake Protocol	User Protocol—SYN, ACK, SYN-ACK.	No handshake protocol
Reliability	Successful deliverance of data to destination router and therefore reliable.	Deliverance of data to the destination router is not reliable.