Centre for Differently Abled Persons
Bharathidasan University

III BCA – VI SEMESTER

DATA COMMUNICATION AND NETWORKS
(20UCA6CC8)

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UNIT - I

LINE CONFIGURATION

- Line configuration refers to the way two or more communication devices attached to a link.
- Line configuration is also referred to as connection.
- A Link is the physical communication pathway that transfers data from one device to another.

- For communication to occur, two devices must be connected in same way to the same link at the same time.
- There are two possible line configurations
  - Point-to-Point
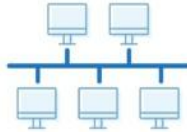 - Multipoint

TOPOLOGY

- Network topology refers to how various nodes, devices, and connections on your network   are physically or logically arranged in relation to each other.
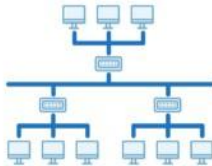
Network Topology Types

1 Point to point

2 Bus

3 Ring

4 Star

5 Tree

6 Mesh

7 Hybrid

There are two approaches to network topology:

Physical

- The physical network topology refers to the actual connections (wires, cables, etc.) of how the network is arranged.

- Setup, maintenance, and provisioning tasks require insight into the physical network

Logical

- The logical network topology is a higher-level *idea* of how the network is set up

- It including which nodes connect to each other and in which ways, as well as how data is transmitted through the network

- Logical network topology includes any virtual and cloud resources

TRANSMISSION MODES

- Transmission mode means transferring of data between two devices.

- It is also known as communication mode.

- Buses and networks are designed to allow communication to occur between individual devices that are interconnected

Three types of transmission mode:-
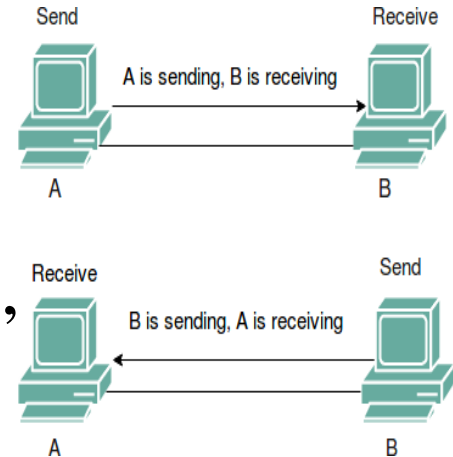
- Simplex Mode
- Half-Duplex Mode
- Full-Duplex Mode
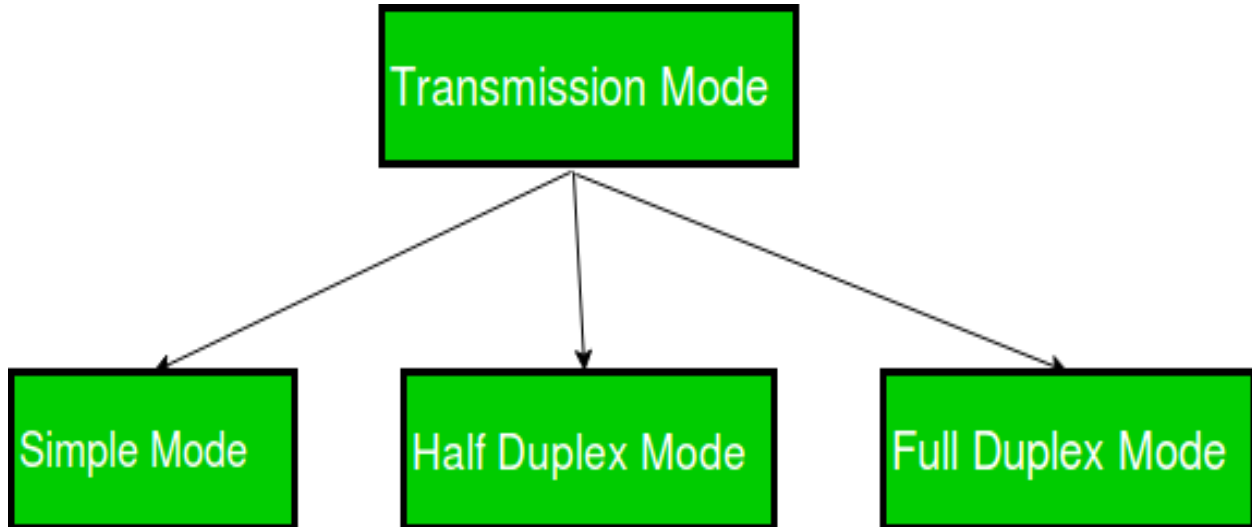
Simplex Mode

- In Simplex mode,the communication is unidirectional, as on a one-way street.

- Only one of the two devices on a link can transmit, the other can only receive.

- The simplex mode can use the entire capacity of the channel to send data in one   direction.

Example: Keyboard and traditional monitors.
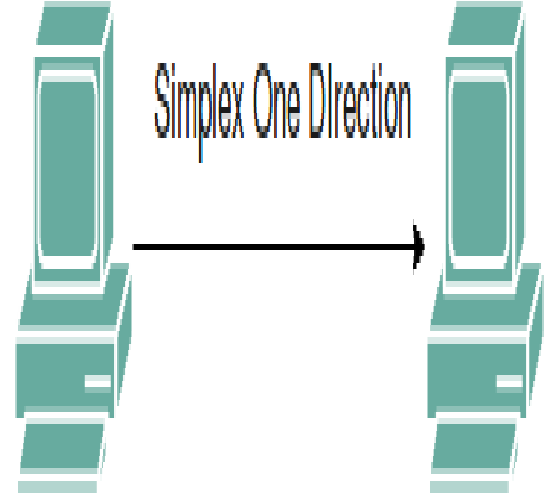
Half-Duplex Mode

o In half-duplex mode, each
   station can both transmit and
   receive, but not at the same
   time.

o When one device is sending,
   the other can only receive,
   and vice versa.

Full-Duplex Mode

- In full-duplex mode, both stations can transmit and receive simultaneously.

- Full-duplex mode is used when communication in both direction is required all the time.

- Example: Telephone Network.
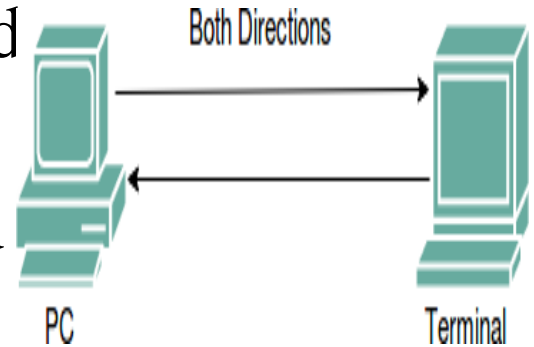
CATEGORIES OF NETWORK

- One way to categorize the different types of computer

- network designs is by their scope or scale.

- Common examples of area network types are:

  - Local Area Network (LAN)

  - Metropolitan Area Network (MAN)

  - Wide Area Network (WAN)

  - Wireless

  - Inter Network (Internet)
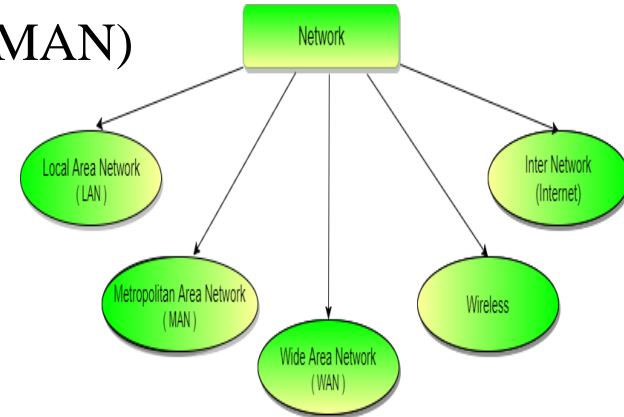
WIRELESS NETWORK

- Wireless networks are computer networks that are not connected by cables of any kind.

- The use of a wireless network enables enterprises to avoid the costly process of introducing cables into buildings or as a connection between different equipment locations.

Four main types of wireless networks:

Wireless Local Area Network (LAN):
- o Links two or more devices using a wireless distribution method, providing a connection through access points to the wider Internet

Wireless Metropolitan Area Networks (MAN):
- o Connects several wireless LANs.

Wireless Wide Area Network (WAN):
- o Covers large areas such as neighbouring towns and cities

Wireless Personal Area Network (PAN):
- o Interconnects devices in a short span, generally within a person's reach

OSI MODEL

- OSI stands for **Open System Interconnection**

- It is a reference model that describes how information from a software application in one computer moves through a physical medium to the software application in another computer.

- OSI consists of seven layers, and each layer performs a particular network function.

- It was developed by the International Organization for Standardization (ISO) in 1984

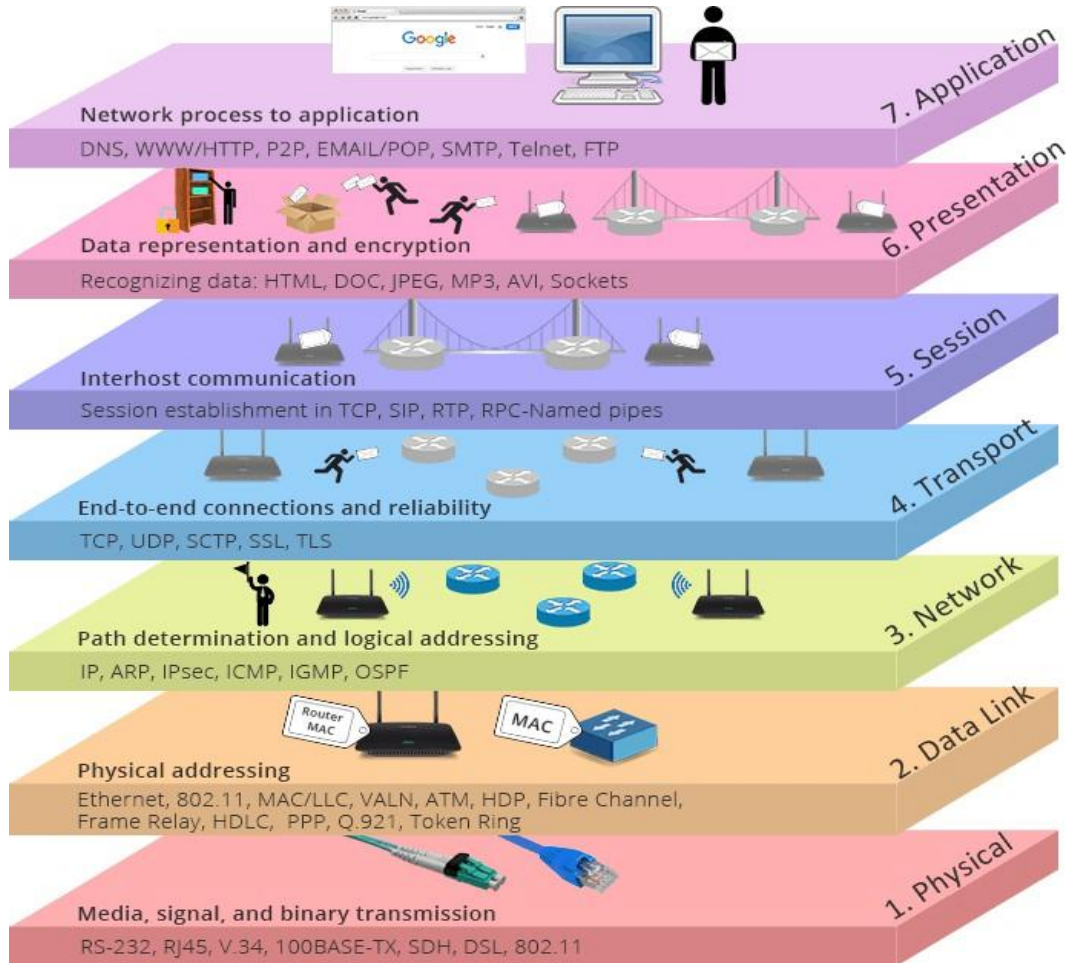- It divides the whole task into seven smaller and manageable tasks.
  Each layer is assigned a particular task.
  Each layer is self-contained, so that task assigned to each layer can be performed independently.
   There are the seven OSI layers.

- Physical Layer
- Data-Link Layer
- Network Layer
- Transport Layer

- Session Layer
- Presentation Layer
- Application

Network process to application

DNS, WWW/HTTP, P2P, EMAIL/POP, SMTP, Telnet, FTP

7. Application

Data representation and encryption

Recognizing data: HTML, DOC, JPEG, MP3, AVI, Sockets

6. Presentation

Interhost communication

Session establishment in TCP, SIP, RTP, RPC-Named pipes

5. Session

End-to-end connections and reliability

TCP, UDP, SCTP, SSL, TLS

4. Transport

Path determination and logical addressing

IP, ARP, IPsec, ICMP, IGMP, OSPF

3. Network

Physical addressing

Ethernet, 802.11, MAC/LLC, VALN, ATM, HDP, Fibre Channel, Frame Relay, HDLC, PPP, Q.921, Token Ring

2. Data Link

Media, signal, and binary transmission

RS-232, RJ45, V.34, 100BASE-TX, SDH, DSL, 802.11

1. Physical

FUNCTIONS OF THE LAYERS:

1.Application layer:

❖File transfer, access, and management (FTAM):

    o An application layer allows a user to access the files in a remote computer, to retrieve the files from a computer and to manage the files in a remote computer.
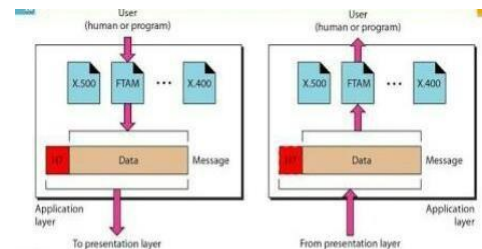
Mail services:

- An application layer provides the facility for email forwarding and storage.

- Directory services:

- An application provides the distributed database sources and is used to provide that global information about various objects

Presentation layer:

Translation:

    The processes in two systems exchange the information in the form of character strings, numbers and so on.

Encryption:

    Encryption is needed to maintain privacy. A process of converting the sender-transmitted information into another form and sends the resulting message over the network.
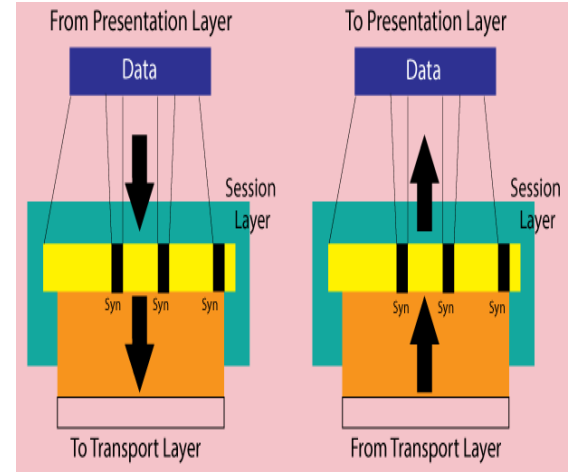
Compression:

Data compression is a process of compressing the data, i.e., it reduces the number of bits to be transmitted.
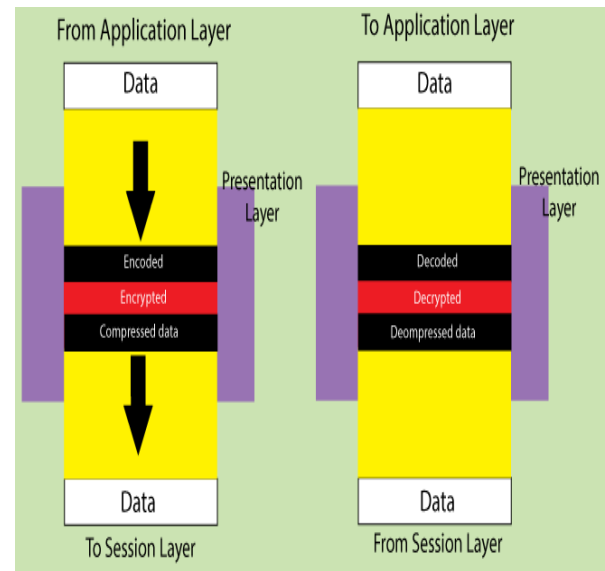
3. Session layer:

❖ Dialog control:

    o Session layer acts as a dialog controller that creates a dialog between two processes or we can say that it allows the communication between two processes which can be either half-duplex or full-duplex.

❖ .

Synchronization:

- Session layer adds some checkpoints when transmitting the data in a sequence.

- If some error occurs in the middle of the transmission of data, then the transmission will take place again from the checkpoint.

- This process is known as Synchronization and recovery.

- The transmission of data from source to the destination not only from one computer to another computer but also from one process to another process.
- The transport layer adds the header that contains the address known as a service-point address or port address.

Segmentation and reassembly:

o When the transport layer receives the message from the upper layer,

o It divides the message into multiple segments, and each segment is assigned with a sequence number that uniquely identifies each segment.

o When the message has arrived at the destination, then the transport reassembles the message based on their sequence numbers.
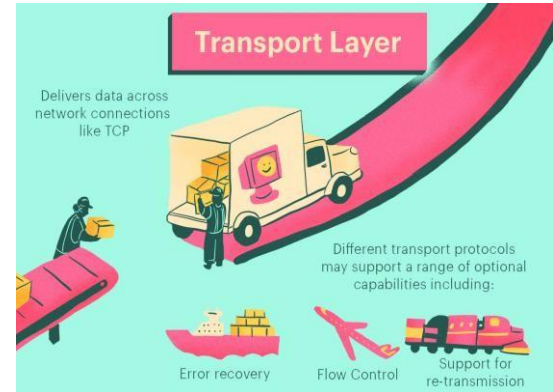
Connection control:

o Transport layer provides two services Connection-oriented service and connectionless service.

Flow control:

- o The transport layer also responsible for flow control but it is performed end-to-end rather than across a single link.

Error control:

- o The transport layer is also responsible for Error control.
- o Error control is performed end-to-end rather than across the single link.
- o The sender transport layer ensures that message reach at the destination without any error.

- A connectionless service treats each segment as an individual packet, and they all   travel in different routes to reach the destination.
- A connection-oriented service makes a connection with the transport layer at the   destination machine before delivering the packets.
- In connection-oriented service, all the packets travel in the single route.

5.Network Layer:
❖ Internetworking:
- An internetworking is the main responsibility of the network layer.
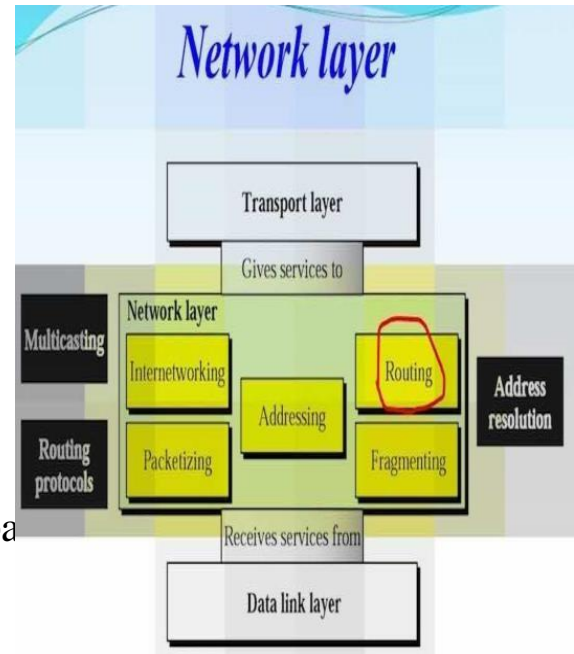- It provides a logical connection between different devices.

❖ <u>Addressing</u>:
  o A Network layer adds the source and destination address to the header of the   frame.
  o Addressing is used to identify the device   on the internet.

❖ <u>Routing</u>:
  o Routing   determines   the   best optimal path out of the multiple paths from source to   the destination.

❖ Packetizing:
  o A Network Layer receives the pa[...] from the upper layer and converts them into packets.
  o This process is known as Packetizing. It   is achieved by internet protocol (IP).

Network layer

Transport layer

Gives services to

Network layer

Multicasting

Internetworking

Routing

Addressing

Address resolution

Routing protocols

Packetizing

Fragmenting

Receives services from

Data link layer

6.Data-link layer

❖Framing:
- o It translates the physical's raw bit stream into packets (Frames).
- o The Data link layer adds the header and trailer to the frame.
- o The header which is added to the frame contains the hardware destination and source address.

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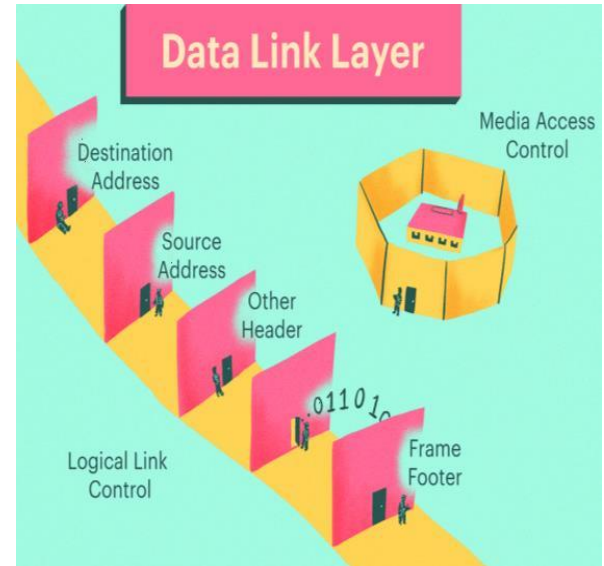
❖ **Physical Addressing:**
  o The Data link layer adds a header to the frame that contains a destination address.
  o The frame is transmitted to the destination address mentioned in the header.

❖ **Flow Control:**

  o It is the technique through which the constant data rate is maintained on both the sides so that no data get corrupted.
  o It ensures that the transmitting station such as a server with higher processing speed does not exceed the receiving station, with lower processing speed

❖ **Error Control:**
- o Error control is achieved by adding a calculated value CRC (Cyclic Redundancy Check)
- o It is placed to the Data link layer's trailer which is added to the message frame   before it is sent to the physical layer.

❖ **Access Control:**
- o When two or more devices are connected to the same communication channel,   then the data link layer protocols are used to determine which device has control   over the link at a given time.
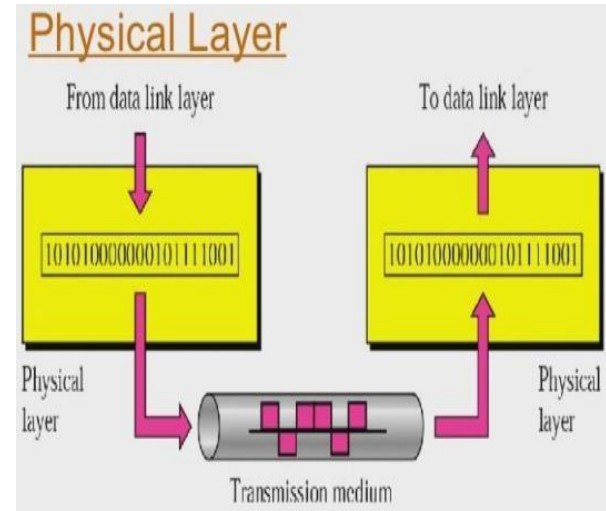
7.Physical layer:

❖ Line Configuration:

- o It defines the way how two or more devices can be connected physically.

❖ Data Transmission:

- o It defines the transmission mode whether it is simplex, half-duplex or full-duplex mode between the two devices on the network.
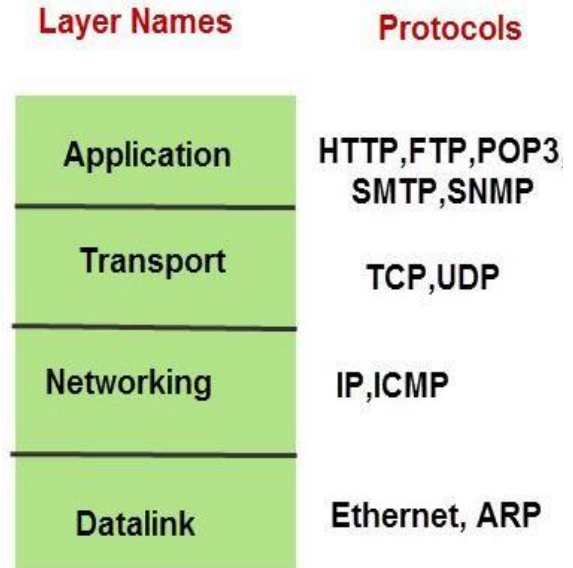

Physical Layer

From data link layer   To data link layer

1010100000001011111001   1010100000001011111001

Physical layer   Physical layer

Transmission medium

❖Topology:
- o It defines the way how network devices are arranged.

❖Signals:
- o It determines the type of the signal used for transmitting the information.

Layer Names	Protocols
Application	HTTP,FTP,POP3 SMTP,SNMP
Transport	TCP,UDP
Networking	IP,ICMP
Datalink	Ethernet, ARP

TCP/IP Networking Model

TCP/IP PROTOCOL SUITE

❖A protocol is a set of rules that govern how systems communicate.

❖For networking they govern how **data** **is transferred** from one system to another.

❖A protocol suite is a collection of protocols that are designed to work together.

❖The TCP/IP protocol suite consists of many protocols that operate that one of 4 layers.

THANK YOU