

# Computer Networks

## ONLINE I hardware

- Network hardware ✓
- Network Software ✓
- OSI ✓
- TCP / IP Reference models ✓
- Example networks: ARPANET ✓  
Internet ✓

## Physical layers:

- Guided Transmission media ✓
- Twisted pairs ✓
- Coaxial cable ✓
- Fiber optics ✓
- Wireless Transmission ✓

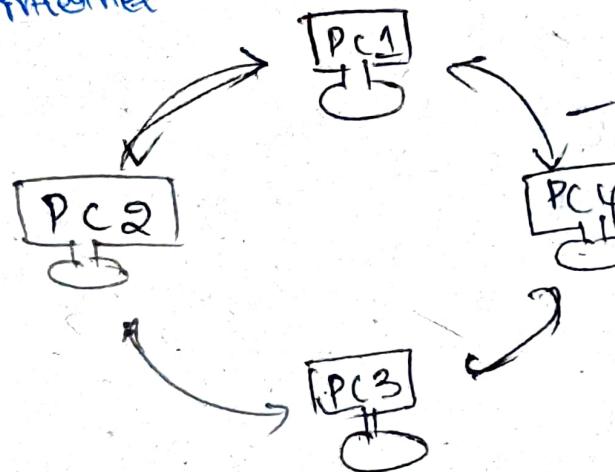
## Data link layer:

- Design issues
- framing
- Error detection & correction

N/w: A N/w is a collection of different types of entities.

Computer N/w: It is a collection of autonomous computers <sup>↑ independent</sup> connected to one another.

Ex: internet

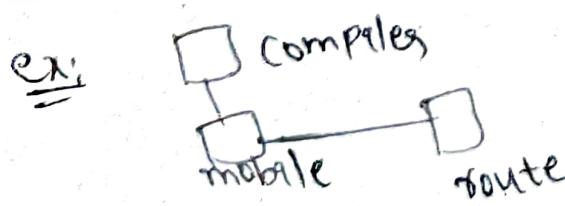


→ A link is wired / wireless

→ Content of PC1 is visible to PC2

→ they can communicate & share information.

CN: A set of communication elements connected by communication links



→ Communication elements: computers, printers, mobile routers, switches...

→ Communication links: wireless (radio, satellite)

links

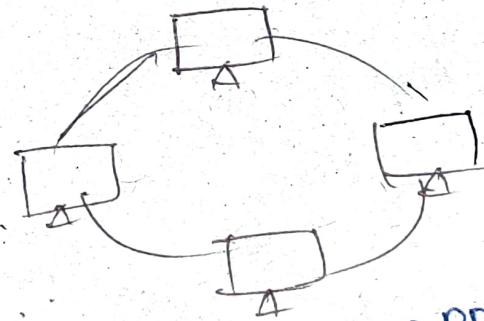
## Definition of CN:

- A CN is a system in which multiple computers are connected to each other to share information & resources.
  - A CN is a set of devices connected through links
  - A N/w is made up of H/w as well as S/w components.
  - Communicating n/w are made as nodes (or) workstations
- Nodes: If sending & receiving info takes place in device  
on computer, printer, mobiles

## Applications of CN

1. Business Applications
2. Home Applications
3. Mobile Uses
4. Social Issues

⇒ A group of computers which are connected to each other for the purpose of sharing their resources is called CN



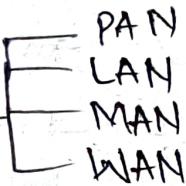
→ The first Computer Network is ARPANET

-ARPANET: Advanced Research Projects Agency Network

# Types of Network :

→ There should be more than one computer, then we call it as N/w.

Types



the goal is sharing inf'm  
connectivity

## 1. PAN : Personal Area Network

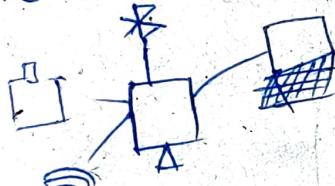
→ ~~BB~~ ~~com~~ ~~cover~~

→ If the N/w is covering small distance, then it comes under PAN.

Ex: Bluetooth

Range : < 10m

Use: Home (for personal use)



## 2. LAN : Local Area Network

= Connection of computers in limited range (Building, College, Bank)

Purpose : Sharing the resources  
data, Printer, S/w app's

\* High Security  
\* lack of Privacy

Range < 150 meter

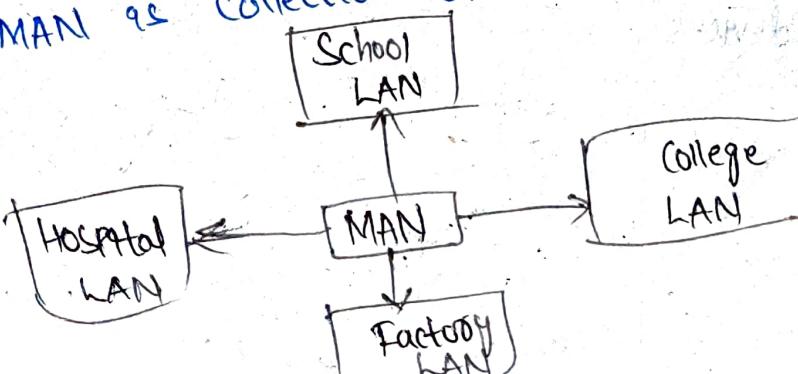
Use: Office (Building)

## 3. MAN : Metropolitan Area Network

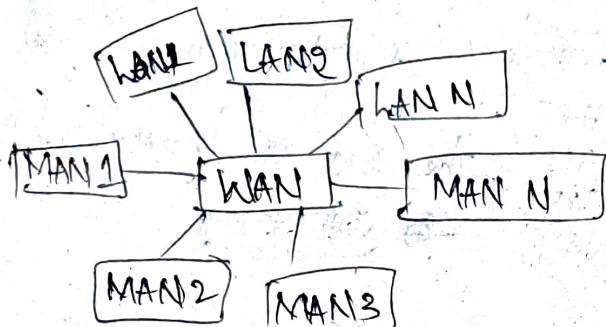
→ MAN as collection of LAN

Range : < 50 km

Use: within city



## 4. WAN: Wide Area Network



→ Less Security

→ Data Sharing using Router

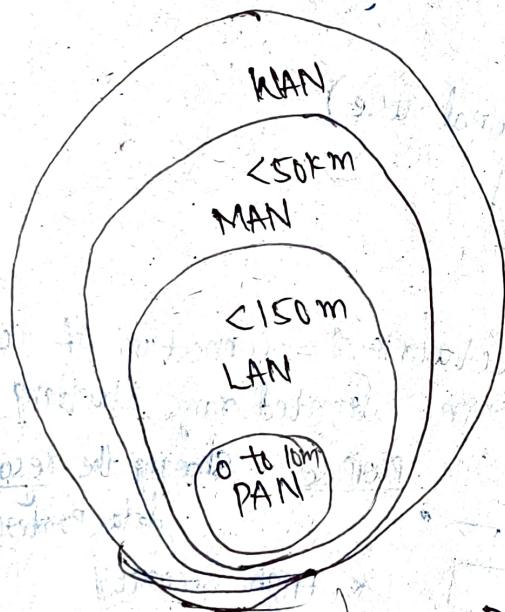
→ Ex: Internet

→ Connection will be among diff cities (or) states

→ A WAN is a connection of LAN & MAN N/w

Range: Not fixed

Use: Use for countries (or)  
all around world



### Adv

- Open to everyone
- File Sharing
- Security
- Backup & Storage
- Easy to add new devices

### Dis

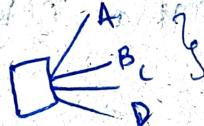
- No device required
- More traffic
- High Speed Internet
- Cost

N/w H/W : → In N/w the data is transmitted in the form of packets.

- the basic computer h/w components that are needed to set up a n/w
- they are :
  1. Hub
  2. Switch
  3. Router
  4. Bridge
  5. Gateway
  6. Modem
  7. Repeater
  8. Access Point.

### 1. Hub :

- It is used to connect multiple devices
- The data will be transmitted to all the devices which are connected to the hub.
- We can't select manually & transmit the data.



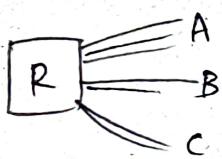
### 2. Switch :

- A switch is an intelligent form of Hub.
- It is also used to connect multiple devices
- We can select few devices & transmit the data.
- It will send the data to the selected devices.



### 3. Router :

→ It is the advance form of Switch



→ If a device is having multiple ways to receive the data  
- then router will decide the best (or)  
shortest path (or) efficient Path

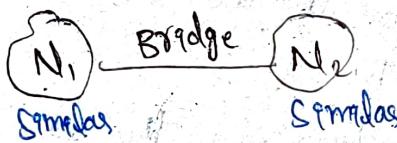
→ In order to route the data, the router will select the optimised (or) efficient Path

→ It is advance form of switch where the efficient route (or) Path will be selected to transmit the required packets.

Q

### 4. Bridge

→ A Bridge can join two ~~diff~~ similar networks

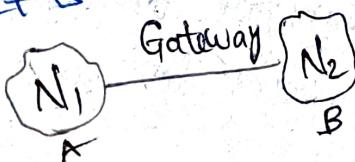


→ The N/W's should be similar i.e. N<sub>1</sub>, N<sub>2</sub> should have similar h/w configuration & use similar SW / protocols.

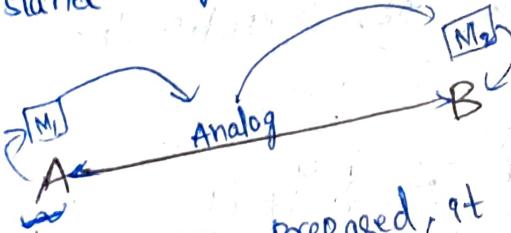
### 5. Gateway:

used to connect different type of networks

→ It is used to



- 6) Modem: → It is an electronic device  
→ Modem stands for Modulator-Demodulator  
Modulation: Process of converting the ~~digital~~<sup>digital</sup> signals into ~~analog~~<sup>analog</sup> signals.  
- It is done by Modulator  
Demodulation: Conversion of analog signals into digital signals  
- Done by Demodulator.

- There are 2 types of signals: Analog Signal used in telephone line  
Digital Signal.
- In order to transmit the data, the data must be in Analog form.
  - But the devices which are connected in N/W, they can understand Digital form.
- 
- Whatever the user prepares, it is in digital form, at Q5  
converted into analog form by a modem

## 7. Repeater:

→ It is an electronic device which is used to amplify the signal, so that it can reach to the longer distance.

## 8. WiFi booster



$$A \rightarrow B \rightarrow C$$

## 8. Access Point:

→ It is used to establish connection to multiple devices either in the form base (or) wireless.

## 9. Network Interface Cards (NIC)

→ NIC is a component of the computer to connect it to a n/w

→ ~~NIC~~ N/w cards are of 2 types;

- Internal N/w Cards
- External N/w Cards

## 10. N/w cables:

→ N/w cables are the transmission media to transfer the data from one device to another.

## Network Software

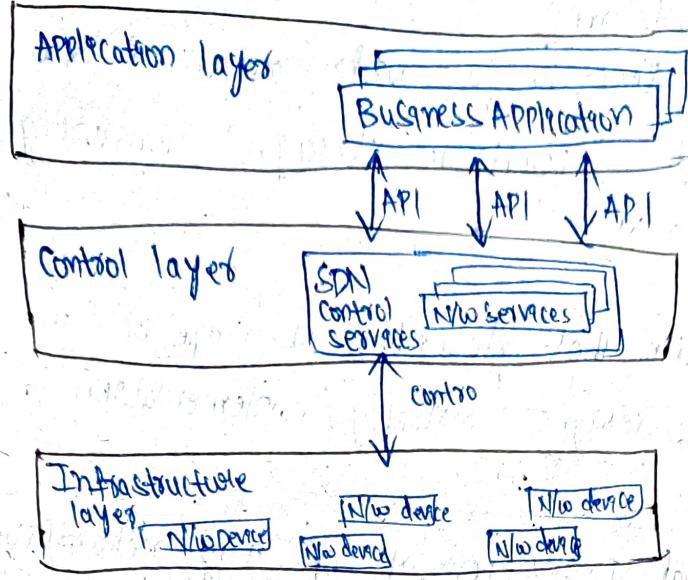
- It is an umbrella term
- It is used to describe a wide range of SW that streamlines the operations, design, monitoring & implementation of CN

(or)

Def: It is a broad term that describes a range of SW that helps with the design, monitoring, implementation & operation of CN.

- It is a fundamental part/element of any networking system.
- N/w SW can help with many tasks like:
  - Managing & monitoring
  - Managing data flow
  - Enabling communication.
- It is an advanced, robust & secure alternative to traditional networking.

# Components of N/w S/w



1. Application layer: The first component of the application

layer or application plane.

- It refers to the applications & services running on it.
- It is a program that conveys n/w information, status of n/w.
- This is done through the control layer, via API.
- It also consists of one or more API drivers.

2. Control layer.

- It lies at the center of the architecture.
- It is one of the most imp components of the 3 layers.
- Also called as Controller (or) Control Plane (or) brain of the whole system.
- The control of the infrastructure layer is done via the controller.
- This layer is the intermediately layer that facilitates communication b/w the top & bottom layers through API.

### 3. Infrastructure Layer:

- Also called as Data Plane
- It consists of the actual I/O devices (both physical & virtual)
- the data plane physically to
- they are primarily responsible for moving or forwarding the data packets, after receiving from the control layer.
- the API ties all three components together.
- Communication b/w these three layers through northbound and southbound APIs
- The Northbound API ties communication b/w the application and the control layers.
- The Southbound API ties communication b/w the infrastructure and the control layers.

## OSI

- OSI - Open System Interface
- Developed by ISO in 1984
- ISO created 7 layer architecture which is used to transmit data from one system to another.
- It is a layered architecture.

### The design principle of OSI reference model

1. Where different abstractions are needed, a layer has to be created.
2. Each layer should perform a well defined function.
3. Functions of layer should be international standard.
4. To minimize the information flow across the interface.
5. The no. of layers should not too large or not too small.

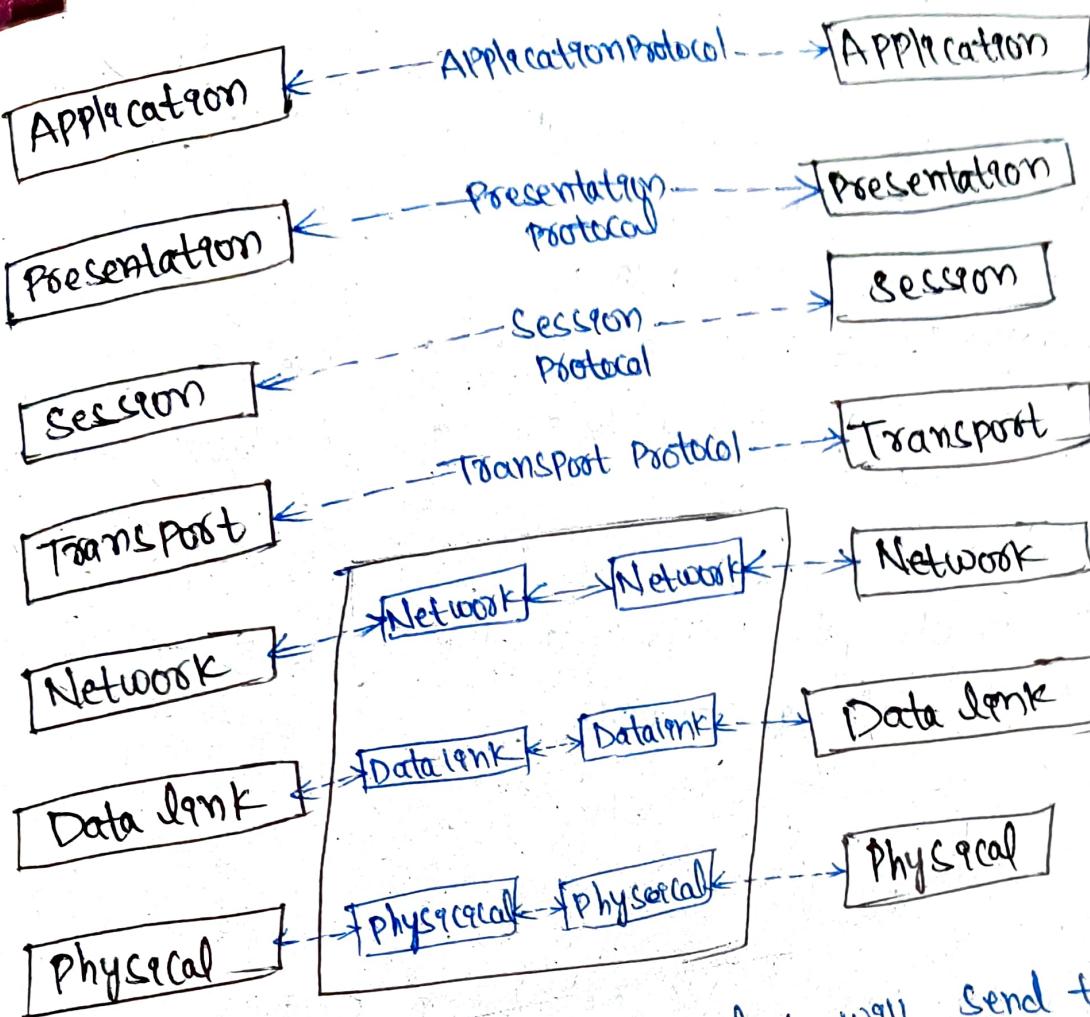
Protocols - rules & regulations (which are used to establish communication b/w sender & receiver)

- upto n<sup>th</sup> layer i.e. Physical, Data link, N/w layers are responsible for transmission of data.

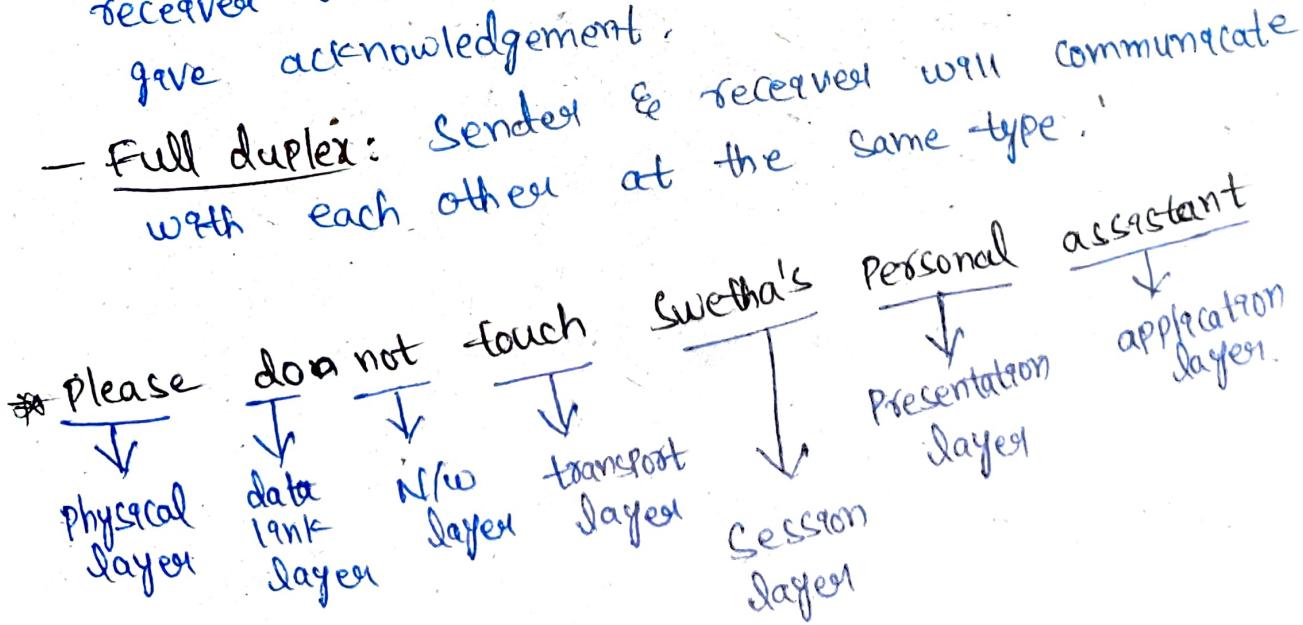
### 1. Physical Layer:

- It is responsible for establishing connection.  
**(Ex:** If a sender want to send msg to the receiver, then there should be a physical connection established that may be wire connection or wireless connection).

→ will decide whether the communication is full duplex.



- Simplex communication: only sender will send the msg
- received will not respond to that
- Half duplex: if sender will send the msg, after the received receive msg then receiver will respond (or) give acknowledgement.
- Full duplex: sender & receiver will communicate with each other at the same time.



## 2. Data link layer

- It is responsible for detection of errors in the transmission media.
- It transmit error-free data.
- \* Physical layer: It is the lowest level / layer in OSI model.
  - It is responsible for establishing connection.

## 3. N/w layer:

- It will route the data to the correct place
  - with the help of routers.

## 4. Transport layer: It is 4<sup>th</sup> layer in OSI

- It provides reliable delivery

## 5. Session layer: It is used to establish sessions - to manage sessions - to terminate sessions

## 6. Presentation layer:

- It is responsible for translation, encryption,

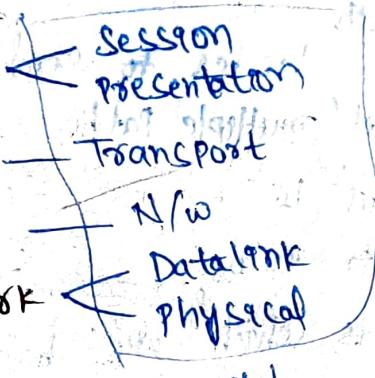
## 7. Application layer:

- It provide services to user.
- through this layer user can interact.

## TCP/IP Model

- It is the implementation of OSI Reference Model.
- It is 4 layered architecture

- Application layer
- Transport layer
- Internet layer
- Host-to-Network



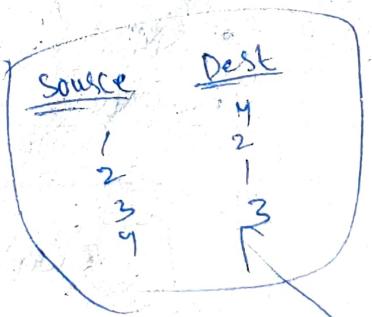
Host-to-Network layer

- used for physical transmission of data
- It is responsible for defining a protocol (e.g. Ethernet)
- It defines a protocol to connect host

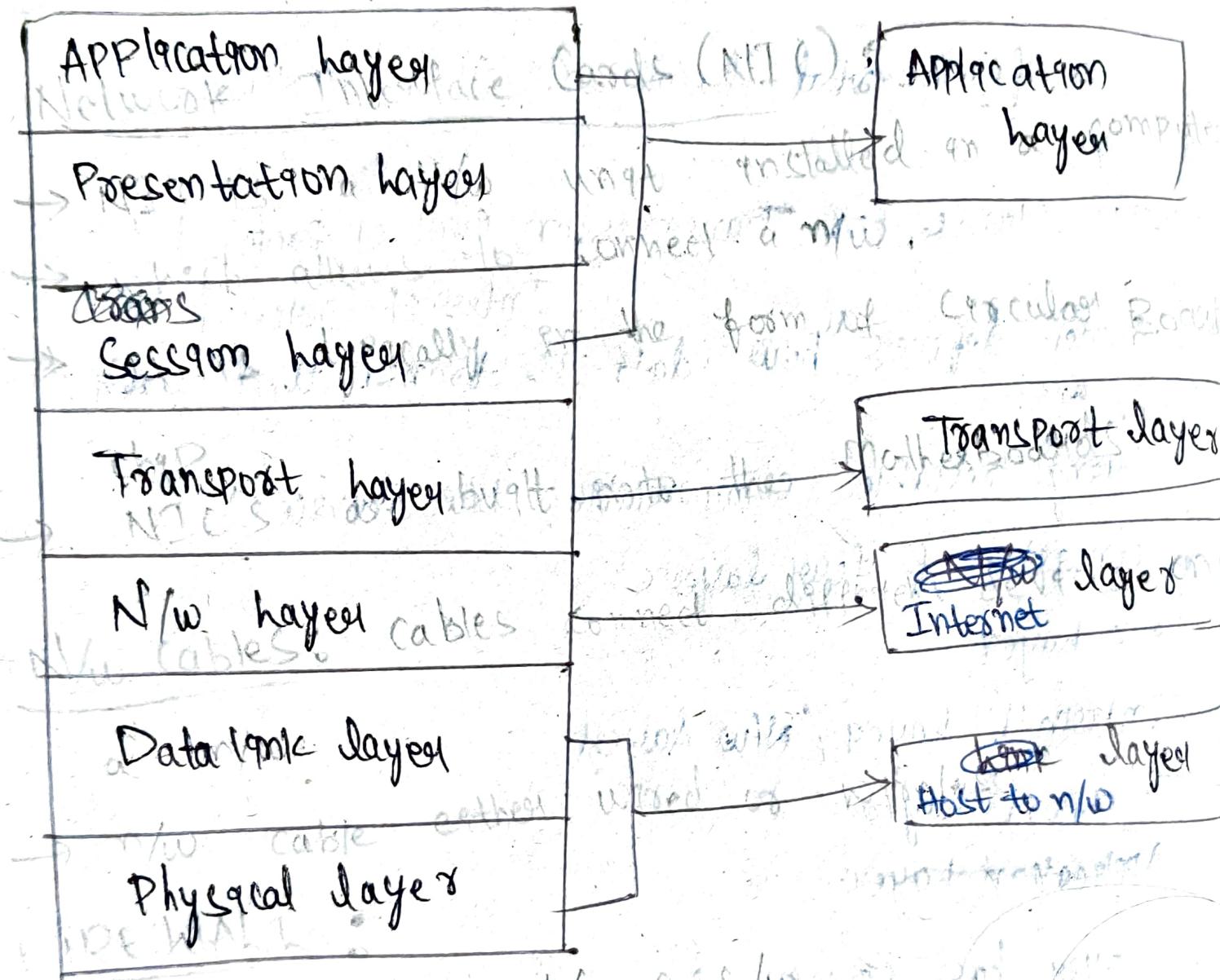
## Internet layer

### Functions

- Packets delivery
  - Routing packets
  - congestion control
- the main protocol is IP Protocol
- It is responsible to transmit the packets independently.
- receive in the order that they have sent



→ To reduce the amount of latency



→ It protects the hardware & software  
→ It provides security to the information

\* Bit control: No. of bits per second.

\* Transmission mode: flow of data in b/w two connected devices.

→ In a bus topology, all the information is sent to all the devices.

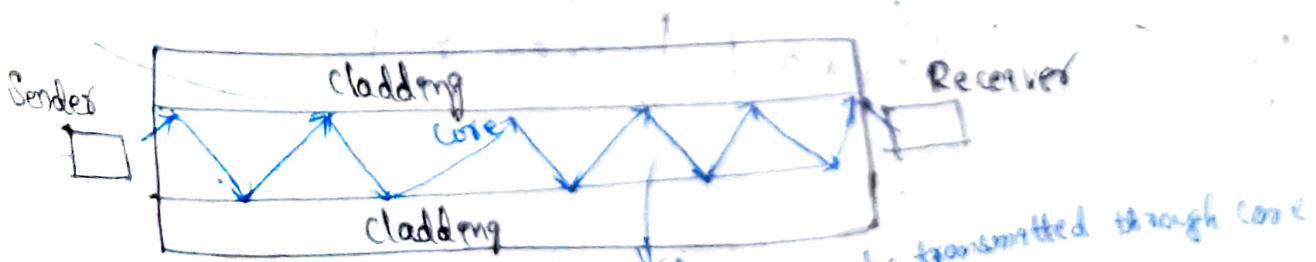
## Guided Media

- It provides a medium from one device to another.
  - Guided media includes twisted-pair cable, coaxial cable and fiber-optic cable.
  - It is defined as the physical medium through which the signals are transmitted
- ```

graph TD
    GM[Guided (wired)] --> TPC[twisted pair cable]
    GM --> CC[Coaxial Cable]
    GM --> FOC[Fiber optic cable]
  
```

Fiber Optic Cable → it works on concept of reflection of light.

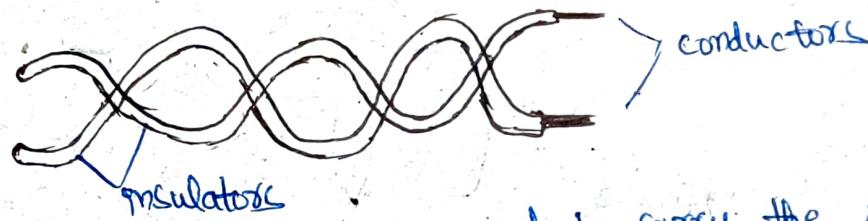
- It is made of glass or plastic and transmits signals in the form of light.
- Optical fibers use reflection to guide light through a channel.
- A glass or plastic core is surrounded by a cladding of less glass or plastic.
- the difference in density of the two materials must be such that a beam of light moving through the core is reflected off instead of being refracted into it.
- It works on the concept of reflection of light.
- The beam of light which is travelling in the optical fiber will perform reflection, bcs of the reflection that data will directly transmitted to receiver.



→ To protect core, a cladding layer is added.

## Twisted Pair cable

- It consists of pairs of wires that form the circuit to transmit data.
- These are a type of guided media.
- It was invented by Alexander Graham Bell.
- It have two conductors that are generally made up of copper and each conductor has insulation.
- These two conductors are twisted together, thus giving the name twisted pair cables.



- One of the conductors is used to carry the signal.
- The other is used as a ground reference only.
- In the first twist, one conductor is near to noise source.
- And the other is far from the source.
- But in the next twist, the reverse happens & the resultant noise is very less.
- Hence the balance in signal quality is maintained and the receiver receives very less or no noise.
- The quality of signal in twisted pair cables depends upon the no. of twists per unit length of the cable.

Types: 1. Unshielded Twisted Pair Cables (UTP)  
2. Shielded Twisted Pair Cables (STP)

## Applications:

- These are used in telephone lines.
- DSL lines make use of these cables.
- LAN also make use of these cables.
- RJ-45 is a very common application of twisted pair cables.
- They can be used for both analog and digital transmission.