

CNS

computers

What is networking ?

- informally connected group or association of different entities like a person, computer, radio station.
- system of peripherals or computers interconnected with each other and has a standard communication channel.
- exchange different types of information & data
 - to share diff. info. & data.

Why computer network is so important ? - communicat.

- Internet is a network of network connecting all diff. network-enabled devices which enable data and information met sharing betw. them and that makes computer network a core part of our life and technical interview.

How are Network types classified ?

- classify and divided based on the area of distribution of network.

Distance	Region	
1m	Square meter	- personal area network.
10 m	Room	
100 m	Building	local area network.
1 km	campus	
10 km	city	- metropolitan area network
100 km	country	
1000 km	continent	wide area network.
10,000 km	planet	- The internet (Global area network).

i) PAN (Personal Area Network) :-

- let device connect and communicate over the range of person.

E.g. connecting bluetooth devices.

ii) LAN (Local Area Network) :-

- privately owned network operates within & nearby single building like home, office or factory

iii) MAN (Metropolitan Area Network) :-

- It connects & covers the whole city
- e.g. T.V. cable connection over the city

iv) WAN (Wide Area Network) :-

- It spans a large geographical area, often country or continent
- e.g. The internet is largest WAN

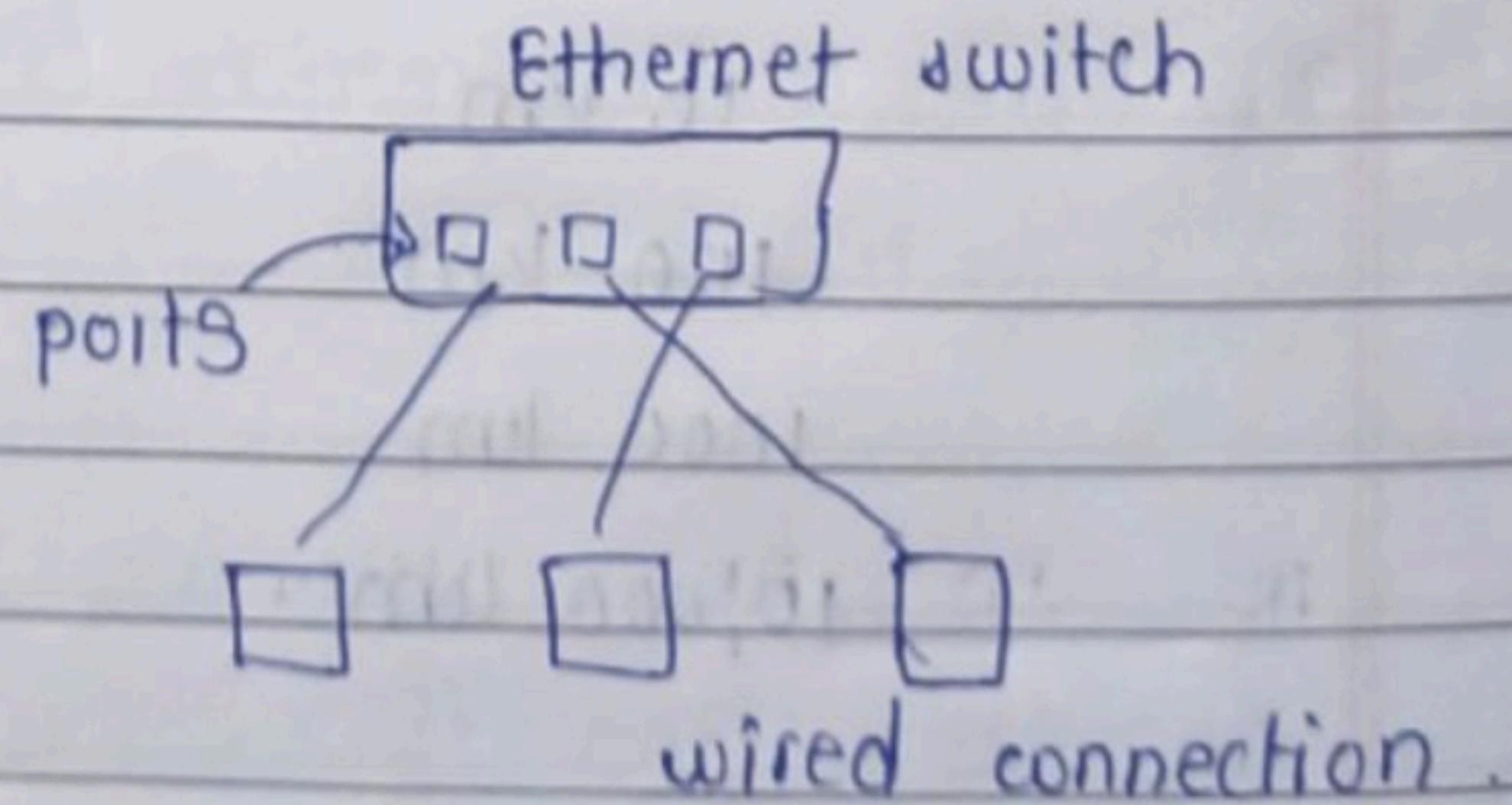
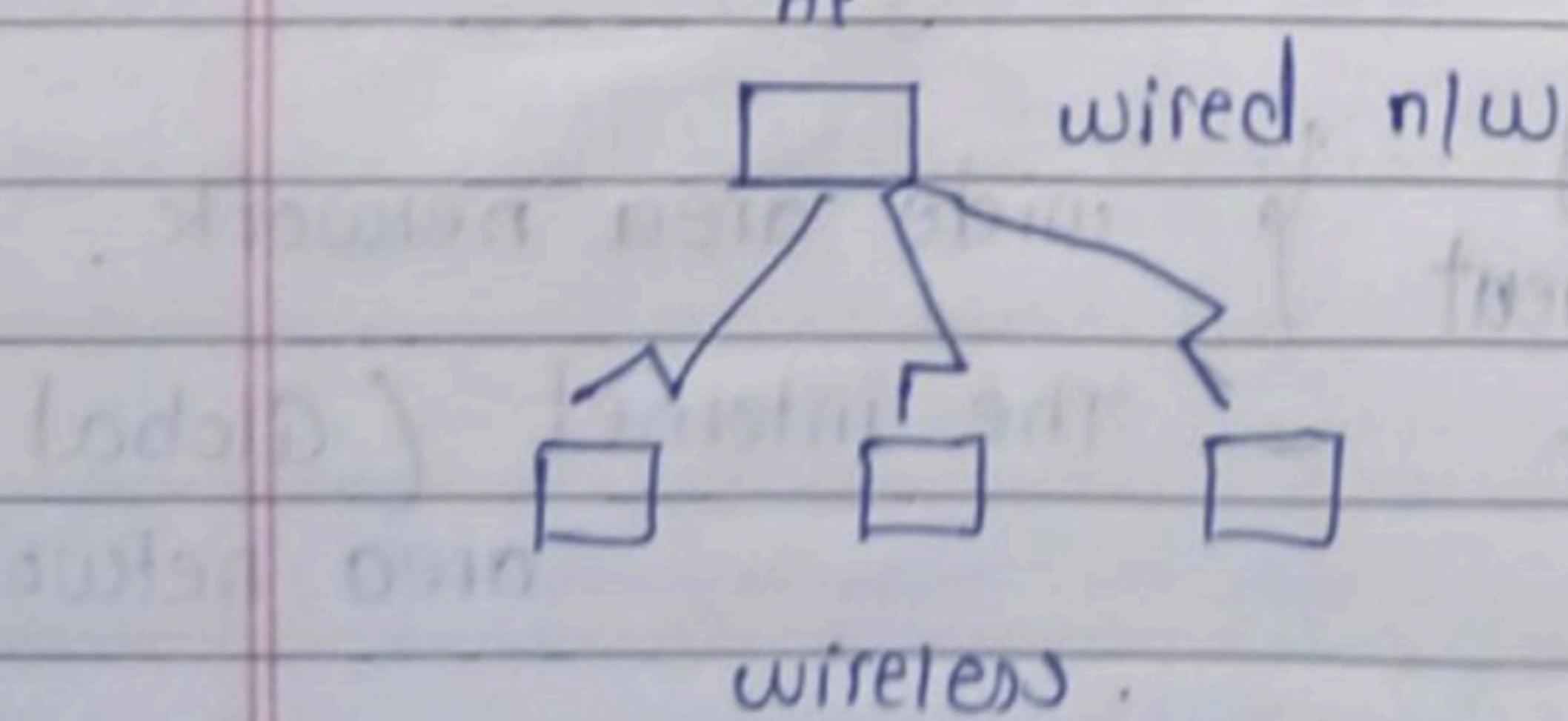
v) GAN (Global Area Network) :-

- Internet which connects the globe using satellites

Explain LAN ?

- LAN is widely used to connect computers / laptop & consumers electronics which enables them to share resources (printer, fax machine) and exchange information
- when LAN used by companies or organizations they are called "enterprise network"

- Types:
 - i) Wired
 - ii) wireless



VPN (Virtual Private Network) :-

- private network (WAN) build on internet.
- create secured tunnel (protected network) betⁿ different networks wing internet (public network)
- By VPN client can connect to organizations network remotely.

• Advantages :-

- i) wed to connect offices in different geographical locations remotely and is cheaper when compared to WAN.
- ii) secure transaction and confidential data transfer betⁿ multiple offices located in different geographical locations
- iii) keep organization information secured against any potential threats or intrusions by wing virtualization
- iv) VPN encrypts the internet traffic and disguises the online identity

Types of VPN :-

- (i) Access
- (ii) site-to-site
- (iii) Internet
- (iv) Extranet

i) Access VPN :-

- provide connectivity to remote mobile users and telecommutes.
- low cost.

- provide wide range of connectivity

ii) Site - to - site VPN :-

- wed in large company having branches in different locations to connect the network of one office to another in different location.

iii) Internet VPN :-

- wed for connecting remote offices in difference geographical locations wing internet connectivity & servers with same accessibility policies as private WAN.

• shared infrastructure over an internet

iv) Extranet VPN:-

- used for connecting remote offices in different geographical locations to share shared infrastructure over an internet, suppliers, customers, partners and other entities and connect them using dedicated connection.

any communicating device in n/w.

What are nodes and links ?

Node:-

any communicating device in a network is called "Node".

- it is point of intersection in network.
- it send & receive data and information within a network.
- e.g. computers, laptops, printers, servers

connectivity b/w two nodes in network.

Link:-

link or edge refer to connectivity between two nodes in network.

- connectivity (wired or wireless)

What is network topology ?

physical layout of network,

connecting different nodes using links.

connectivity between computers, devices, cables, etc.

• Types:-

i) BUS (iv) Mesh

ii) star (v) Tree

iii) Ring (vi) Hybrid

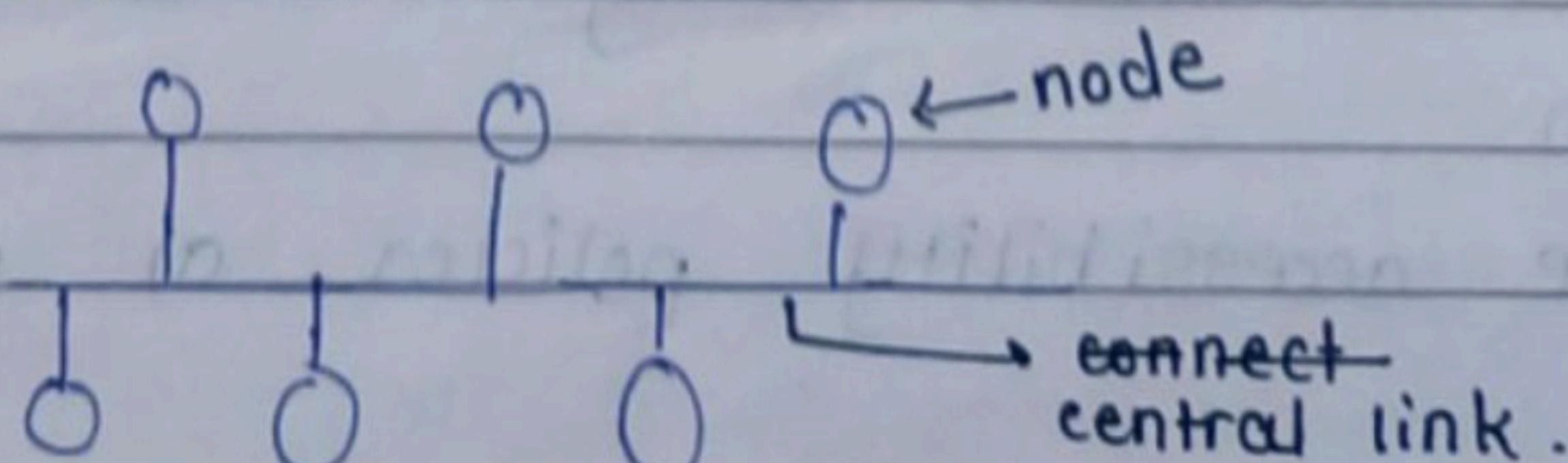
i) Bus :-

all nodes connected using central link (bus).

- All nodes are connected using central link known as bus.

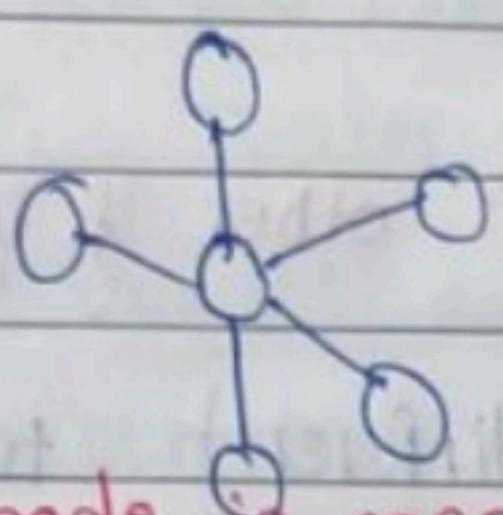
- used to connect a smaller number of devices

- if main cable gets damaged it will damage the whole network.



iii) Star :- Robust, Easy to troubleshoot.
 All nodes connected to one single node (central node)

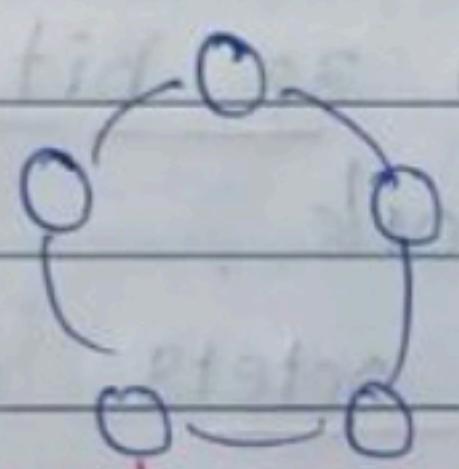
- All nodes are connected to one single node known as central node.
- more robust → (one that performs well when attacked)
- if central node fails complete network is damaged
- Easy to troubleshoot (find wof on crisis).
- mainly used in home and office networks



centre node fails
whole network fail

iii) Ring :- Each node is connected to exactly two nodes
 one node damage → whole n/w damage

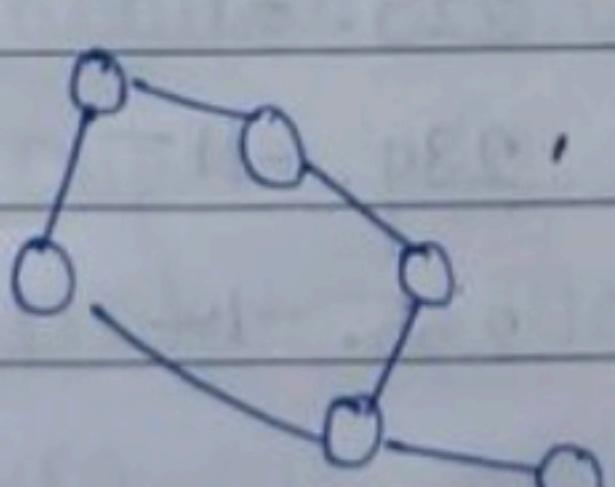
- Each node is connected to exactly two nodes forming a ring structure.
- If one node damaged, it will damage the whole n/w
- rarely used, expensive, hard to install



one node damage then damage
whole network.

iv) Mesh :- Each node connected to one or more nodes.
Robust

- Each node is connected to one or more nodes.
- robust as failure in one link only disconnects that node.
- rarely used & install, management difficult.

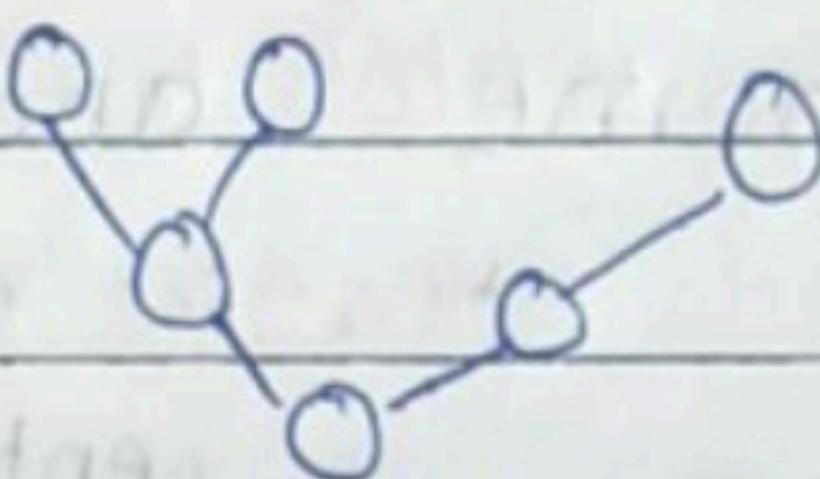


fail one link then only disconnect
that node

(Star) all smaller star network connected to single bus.

vi) Tree :-

- combination of star and bus topology.
- also known as extended bus topology.
- all smaller star network connected to single bus.
- if main bus fails, the whole network is damaged.



vii) Hybrid :- pick strength from other & ignore drawbacks of particular topology.

- It is combination of different topologies to form new topology.
- pick the strengths from other & ignore drawbacks of particular topology.

What is IPv4 address? What are the different classes of IPv4?

- An IP address is a 32 bit dynamic address of a node in the network.
- IPv4 address has 4 octets of 8 bit each with each number with a value up to 255.

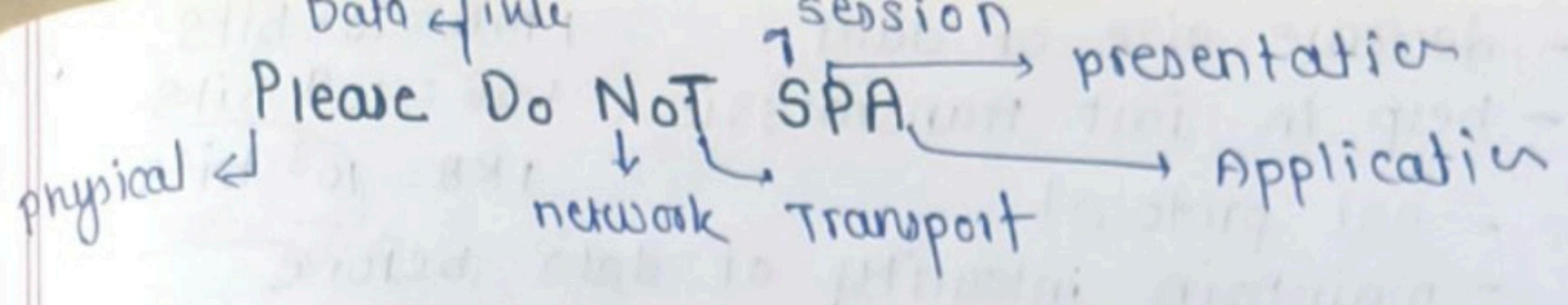
IPv4 class start End range

← A	0.0.0.0	127.255.255.255	large network
← B	128.0.0.0	191. -11 -	medium size n/w
C	192. -11 -	223. -11 -	LAN
D	224.0.0.0	239. -11 -	Reserved for multicasting
E	240. -11 -	255. -11 -	study & R&D.

What is private and special IP address?

i) Private :-

- These are specific IPs that are reserved specially.



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for private we only.

- can not be used for devices on internet as they are non-routable.

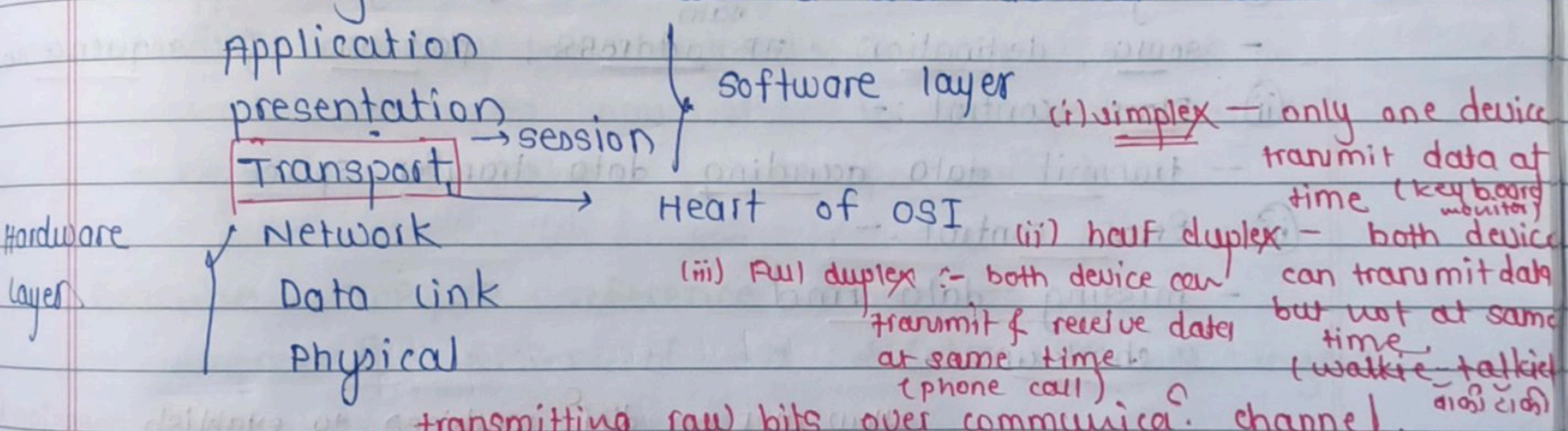
ii) special :-

- IP range from 127.0.0.1 to 127.255.255.255 are network testing addresses (loopback addresses)

→ Open System Interconnection. (based on ISO std.)

Describe OSI Reference Model : - connecting system that are open for communication with other.

- "open system Interconnections" is network architecture model based on ISO standards.
- deals with connecting the systems that are open for communication with other system.
- create a new layer if a different abstraction is needed.
- Each layer should have a well-defined function



(i) simplex - only one device transmit data at time (keyboard monitor)

(ii) half duplex - both device

(iii) full duplex :- both device can transmit data & receive data at same time (phone call) (walking talking)

i) Physical :- unit - Bit.

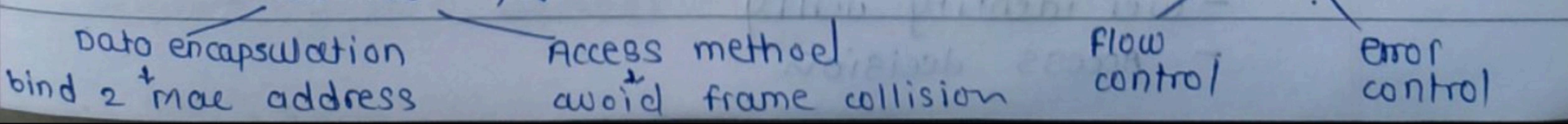
- transmitting raw bits over a communication channel and use ethernet protocol.

- The available transmission modes are simplex, Half Duplex & Full duplex. → detect error code.

ii) Data link :- unit Exchange : Frame

- transform a raw transmission facility into a line that appears free of undetected transmission errors

- Detect error code.



- Data compression: - decrease size of data. $1\text{ MB} = 10^6 \text{ bits}$ $1\text{ GB} = 10^9 \text{ bits}$ $1\text{ KB} = 10^3 \text{ bits}$ $1\text{ MB} \rightarrow 1\text{ MB}$
- Encryption / Decryption: - SSL protocol
- maintain integrity of data before transmission

P → • Encryption / Decryption: - SSL protocol

iii) Network :- unit Exchanged - Packet

- control operation of subnet
- take care of feedback messaging through TCP/IP

- Function :
 - i) logical Addressing
 - ii) Path determination
 - iii) Routing

iv) Transport :- Unit EX: TPDU (Transmission Protocol Data Unit)

- accept data from above layer split it up into smaller units if needed, pass these to the network layer
- & ensure that all the pieces arrive correctly at other end.

segmentation - Take care of segmentation & Reassembly

Flow control → Function :-

Error control

i) segmentation :- $\square \rightarrow \square \square \square \rightarrow$ segment

- source, destination, IP address, port no. & sequence no.

ii) Flow control :-

- transmit data according data transfer space

iii) Error control :-

- missing data find
- checksum

v) Session :- SPDU.

- allow user on different machines to establish session b/w them.
- It sends out dummy packets from the client to server when client is idle.

• Function :-

i) Termination connection :-

- client-server connection, NETBIOS API

ii) Authentication :- user identity verify

- user identity verify

- Access decision

i) Terminal connection
ii) Authentication
iii) Session management

iii) Session Management :- *keep track of file download*

- keep track on file download

vii) Presentation :- PPDU *translates msg from common form to encoded format*

- connected with syntax & semantics of the information transmitted

- It translates a message from a common form to encoded format.

• Function :-

- i) convert text into binary.
- ii) translation
- iii) data compression
- iv) encryption - decryption

i) convert text → binary
 ii) translation
 iii) data compression
 iv) Encryption / Decryption

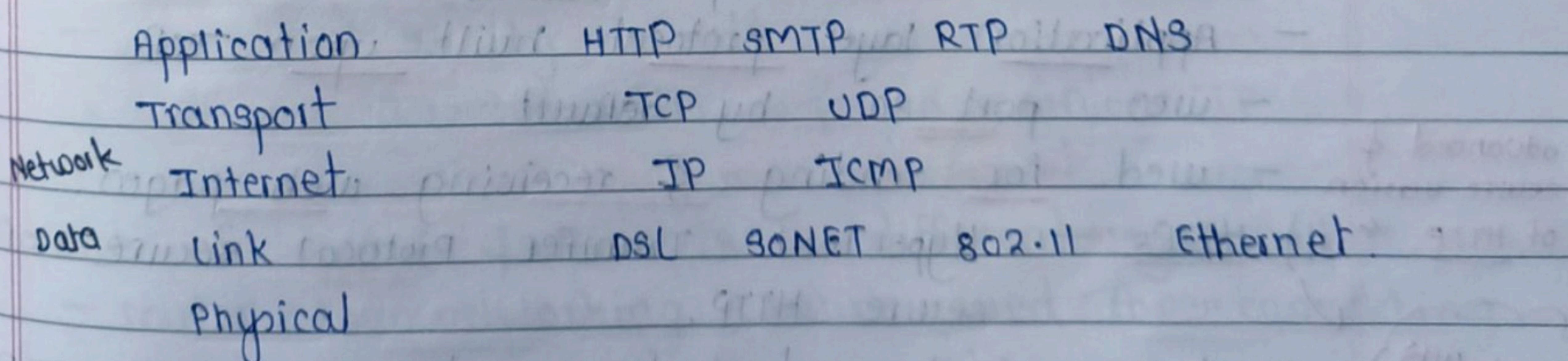
send data of any size to transport layer

viii) Application :- APDU

- contain variety of protocols.
- sends data of any size to transport layer
- Network application (whatsapp, chrome)

Describe TCP / IP reference model :-

- compressed version of OSI model with 4 layers.



i) Link :-

- decides which links such as serial lines or classic Ethernet must be used to meet the needs of connectionless internet layer.

ii) Internet :- delivers IP packets where they are supposed to be delivered.

- holds whole architecture together
- delivers IP packets where they are supposed to be delivered.

OSI

TCP / IP

- | | |
|---|---|
| - 7 layers | - 4 layers |
| - Fixed boundaries and functionality for each layer | - Fixed architecture with no strict boundaries b/w layers |
| - low reliability | - High reliability |
| - vertical layer approach | - horizontal layer approach |

What are HTTP and HTTPS protocols?

port 80

i) HTTP :- Hyper Text Transfer Protocol

- define set of rules and standards on how the information can be transmitted on www.
- helps web browser & web services for communication
- stateless protocol (commands are independent with previous command)
- Application layer protocol built upon TCP
- uses port 80 by default.
- used for sending & receiving web pages.

advanced &
secure version
of HTTP.

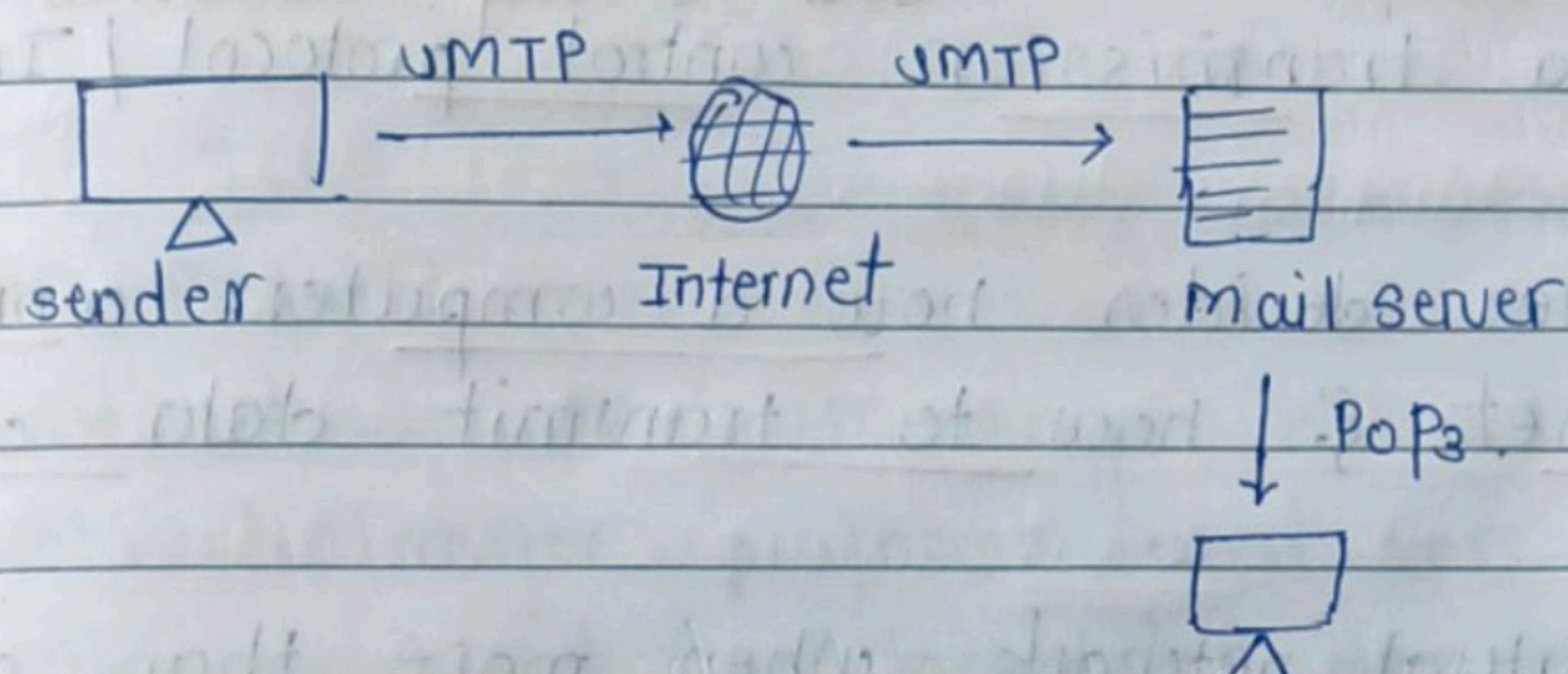
ii) HTTPS :- HyperText Transfer Protocol secure or secure HTTP.

port 443

- It is an advanced and secured version of HTTP
- provide security, secure transaction
- uses port 443 by default.

SMTP :- set rules for communication b/w servers
 - II - that helps SW to transmit email over internet.

- simple Mail Transfer Protocol.
- set the rules for communication between servers.
- set of rules helps the software to transmit emails over the internet.
- support both End-to-End and store & forward methods.



DNS :- decentralized & hierarchical naming system for device connected to internet.

- Domain Name system
- device services directory of the internet.
- decentralized and hierarchical naming system for device connected to internet.
- Translates domain name to their corresponding IPs.
- use port 53 by default.

Use of router & how is it different from gateway?

- router is networking device used for connecting two or more network segments.
- It directs the traffic in the network.
- Transfer information & data link web pages, emails, images, videos, etc. from source to destination in the form of packets.

Gateway — send data bef. two dissimilar nw.
Router — — — — — similar.

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- It operates at network layer.
- Gateway are also used to route and regulate the network traffic but,
- they can send data between two dissimilar network while
- router can only send data to similar n/w.

#

What is TCP protocol ?

set of rules decides how computer connected to internet & how to transmit data over n/w

uses 3 way handshake model

- TCP is a transmission control protocol / Internet protocol.
- set of rules decides how a computer connects to the internet & how to transmit data over the network.
- creates virtual network when more than one computer is connected to the network.
- uses 3 way handshake model
- more reliable.

#

UDP Protocol :-

multitasking & broadcasting

simple transmission without any handshaking

- user Datagram Protocol and is based on Datagram
- used for multitasking & broadcasting
- same as TCP except three way handshaking & error checking,
- simple transmission without any handshaking
- less reliable.

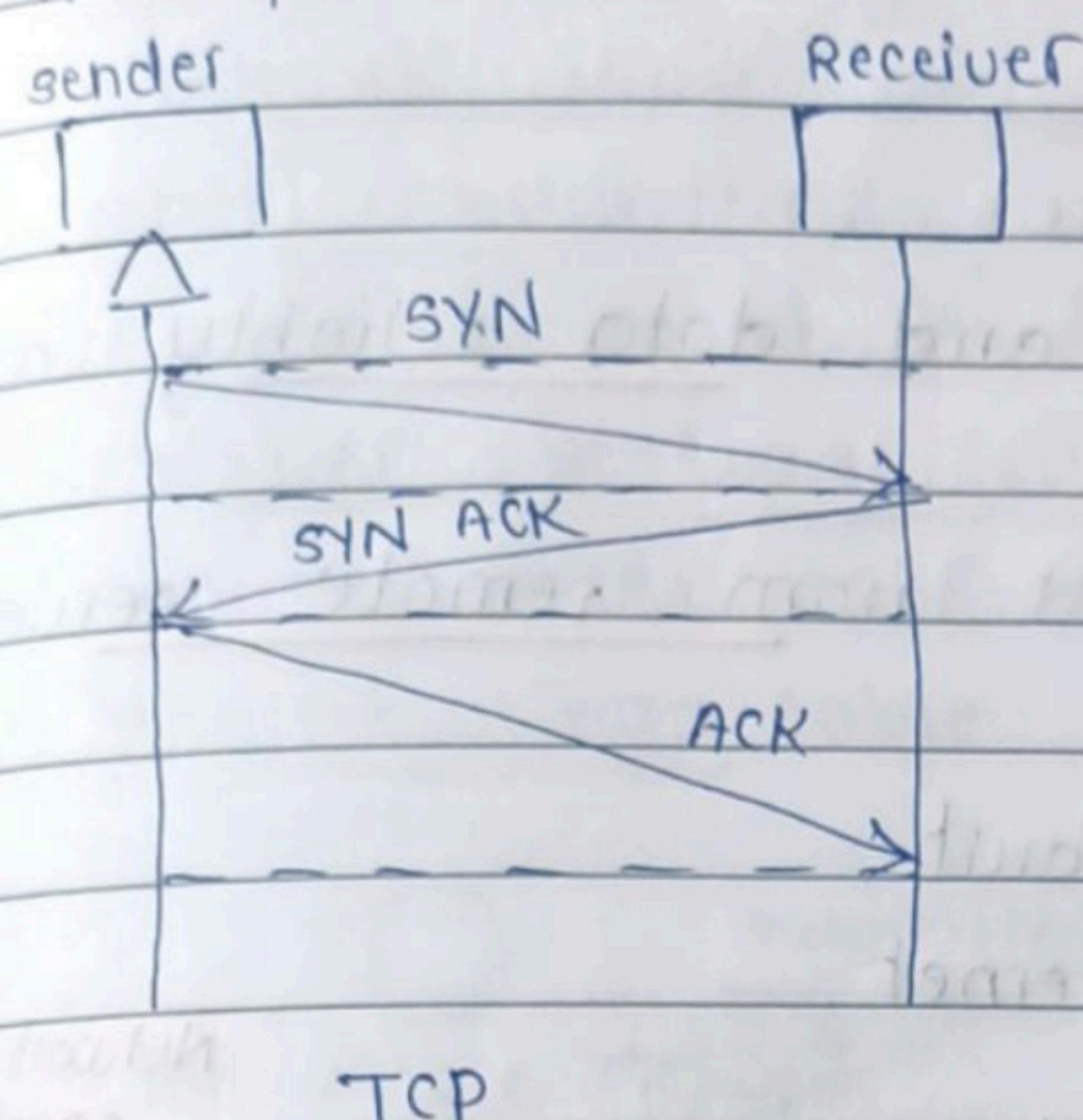
TCP/IP

- connection oriented
- more reliable
- slower transmission
- packet order can be rearrange
- heavy weight
- error checking mechanism
- Transport layer

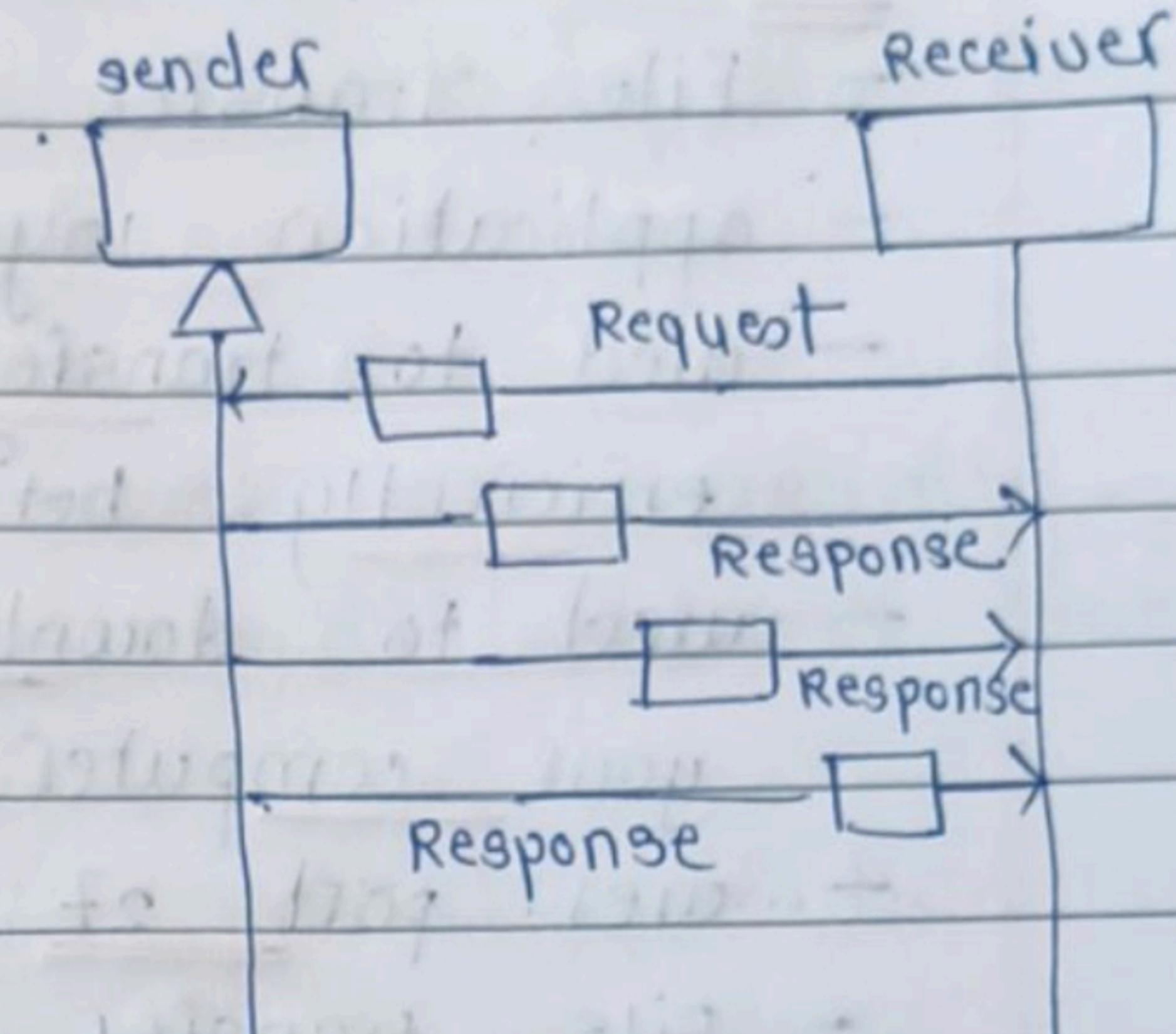
UDP

- connectionless
- less reliable
- fast transmission
- packet order is not fixed
- light weight
- No error checking mechanism.

- HTTP, FTP, SMTP, HTTPS



- DNS, SNMP, TFTP



TCP

UDP

ICMP Protocol :-

*error handling
used by routers*

- Internet control message protocol.
- Network layer protocol used for error handling
- Mainly used by network devices like routers
- diagnosing network connection issue & crucial for error reporting and testing :-
- we port 7 by default.

wed to auto configure device

auto assign IP to enable them for communication

DHCP Protocol :-

- Dynamic Host configuration protocol.
- application layer protocol used to auto-configure devices.
- Enabling to use the TCP and UDP based protocols.
- auto assign the IPs enable them to communication over IP network.
- resolve 'DNS'.
- we port 67 by default.

ARP Protocol :-

convert logical address to physical address

- Address Resolution Protocol.
 - network-level protocol used to convert the logical address (ip add.) to physical address (MAC add.)
- LA (IP address) → [ARP] → PA (MAC address)

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#

FTP Protocol :- transfer files & data download files from remote servers to your computer.

- File Transfer Protocol
- application layer protocol
- used to transfer files and data reliably and efficiently betⁿ hosts.
- used to download files from remote servers to your computer.
- uses port 21 by default.
- file transfer over internet.

unique identifier of device.

Network Interface
card - physical

#

MAC address & how is it related to NIC?

- MAC: Media Access Control address
- 48-bit or 64-bit unique identifier of devices in the network
- Physical address is embedded with network interface card (NIC) - used at data link layer
- NIC is hardware component in networking devices which a device can connect to the network.

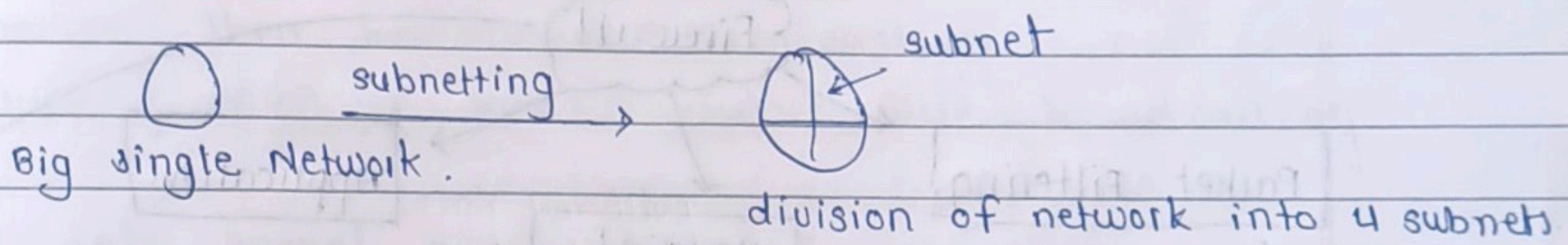
MAC address vs IP address

MAC address	IP address
- Media Access control	- Internet protocol
- <u>6 or 8-byte</u> hexadecimal no.	- <u>4 (IPv4) or 16 (IPv6)</u> byte address
- <u>embedded with NIC</u>	- obtained from network
- <u>physical address</u>	- logical address
- <u>operates at data link layer</u>	- at <u>network layer</u>
- helps to <u>identify the device</u> .	- identify device, connectivity on network

- Half duplex :— communication in both directions, but only one direction at a time, not simultaneously in both directions.
- Full duplex :— same as half-duplex but supports simultaneously in both directions.

subnet :— network inside a network / high routing efficiency & enhance security.

- Network inside a network achieved by the process called subnetting.
- Divide network into subnets.
- higher routing efficiency & enhance security.
- reduce time to extract the host address from the routing table.



HUB

- operate physical layer
- half-duplex transmission
- Ethernet devices can be connected
- less complex, less intelligent, cheaper
- less speed up to 100 MBPS
- collision cannot avoid.

switch

- operate data link layer.
- fully-duplex transmission.
- LAN devices can be connected.
- Intelligent, effective.
- support high speed in GBPS.
- collision can avoid.

to view & configure
n/w interface

ipconfig → (microsoft os)

- Internet Protocol configuration.
- command used in Microsoft operating system to view & configure network interface.

— II —

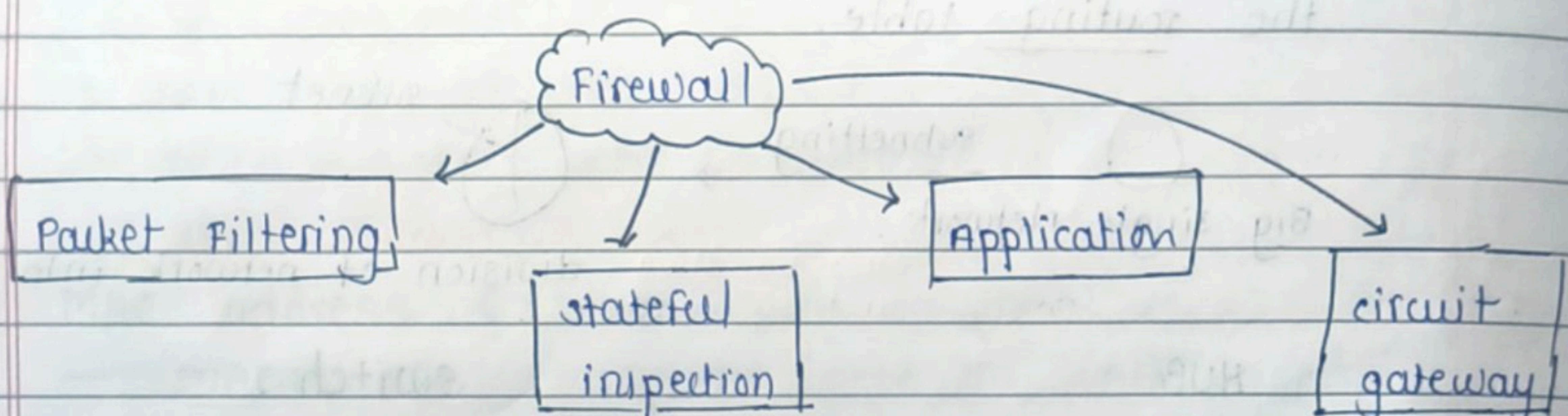
ifconfig → (MAC, Linux OS)

- Interface configuration.
- command used in MAC, Linux operating system to view & configure network interface.

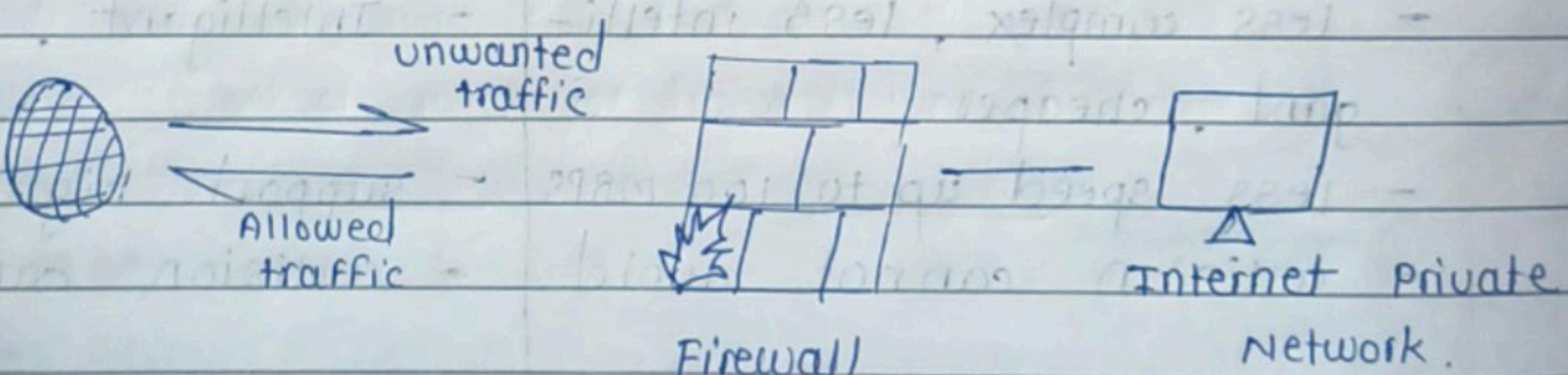
wall b/w internet & networking device

network security system

- # **Firewall** :- monitor incoming & outgoing traffic & blocks the same
- Firewall is network security system.
- used to monitor incoming & outgoing traffic & blocks the same based on firewall security.
- act as a wall between internet (public network) & networking device (private)



- It is either hardware device, software program or combination of both.
- adds layers of security to network.



- # **Unicasting** :- msg to single node from source to establish new connecting.

- if message is sent to single node from the source then it is known as "unicasting".

- This is commonly used in network to establish a new connecting.

- # **Anycasting** :- msg to any node from source to get content from any of the servers.

- If message is sent to any of the node from the source then it is known as anycasting.

- mainly used to get content from any of the servers in content delivery system.

- # Multicasting :- ^{msg to subset of nodes}
 - If message is send to the subset of nodes from the source then it is known as multicasting
 - send some data to multiple receivers.

- # Broadcasting :- ^{msg to all nodes}
 - If msg is send to all the nodes in a network from a source then known as broadcasting
 - DHCP & ARP in local network we broadcasting

How data travel over internet ?

- 1) Data creation :-
 - creation like video, photo, audio, etc.
- 2) Data Packaging :-
 - data divides into small parts & encapsulate each part.

S	D	P	S	A	+ Acknowledgement
source IP	↓	↓	↓	destination IP	Receipt
					sequence No's
					Data
- 3) sending data from source :-
 - data send from device local Network like mobile to Router
- 4) Routing with local network :-
 - It first check IP address जो same local network था आहे की नाही
 - अरे same network था असेल तर IP वरती direct transfer होतो जसेल तर NAT Technology we करत न private ला public made convert करते

Private $\xrightarrow{\text{NAT}}$ Public

Analog :— continuous range of value to represent CLASSMATE

Digital :— discontinuous range of value i.e. discrete of 1.

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5) Reaching destination network :—

- find best way to reach destination.

6) Data transfer across internet :—

- router to router data transfer.

7) Arrival at destination NW.

- check destination and send to that IP address device.

8) Reassembly at destination :—

- arrange data packets according to sequence no.

- then send into port no.

9) Acknowledgement :—

- successfully transmit ack receipt (receiver)

at send करते ack भेजते हैं।

#

sequence No :—

- packet ordering

- detection of missing / duplicate packets.

#

Protocol :— set of rule for transmission of data

- set of rule for transmission of data

#

key point of IP address :—

- unique identifier

- two version

IPv4 - 32 bit

IPv6 - 128 bit.

- Hierarchical structure

Network portion (Identify Network)

Host portion (Identify device)

- Public vs Private IP address.

#

Port No. :— we to identify application.

- use to identify app

i) well known port :— 0-1023

e.g. HTTP - 80, HTTPS - 443, FTP = 21

2) Registered Port :- 1024 - 49151

- used for specific application / services it reserved port no.

3) Dynamic Port or Private Port :-

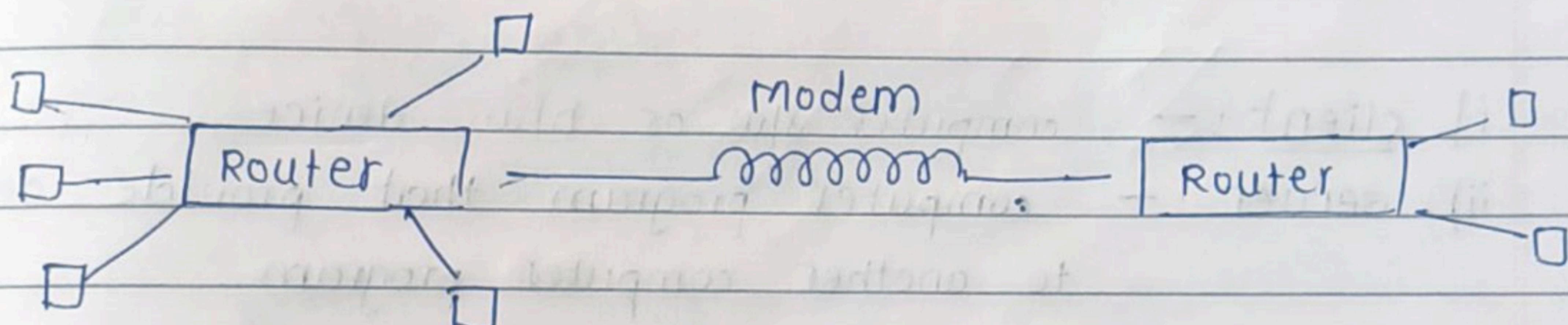
- 49152 - 65535

- available to use by any type of application.

Modems and Routers :-

i) Modems :- bridge / connection betw. LAN & global local internet convert analog to digital & vice versa. internet

- create bridge / connection between LAN and global internet.



- convert analog signal to digital & digital data to back to analog signal.

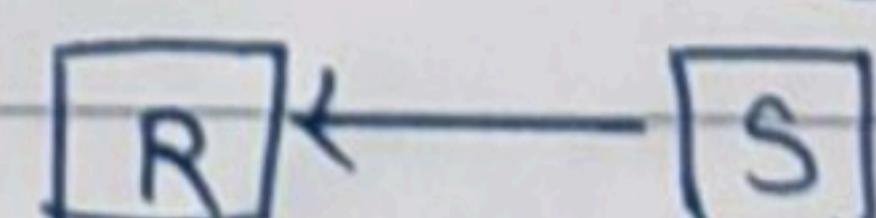
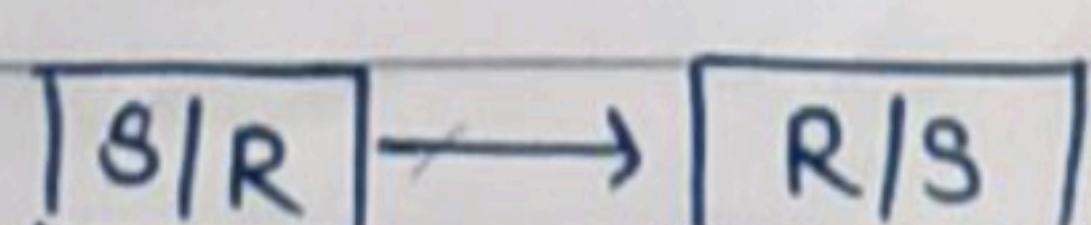
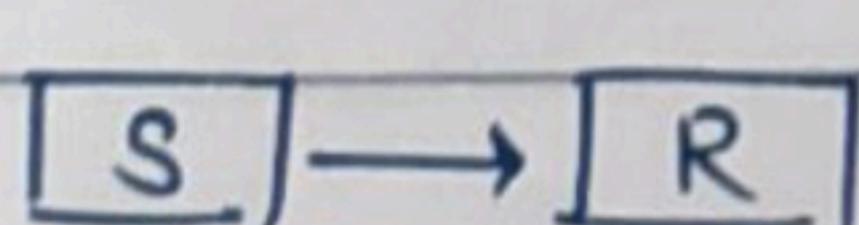
ii) Router :- connectivity to different devices.

- Manage LAN.

- Facilitates internet connectivity multiple device.

- NAT Tech is also included in Router.

- Transmission made in data communication :-



- simplex mode

- communication is only one direction.

- Half-duplex

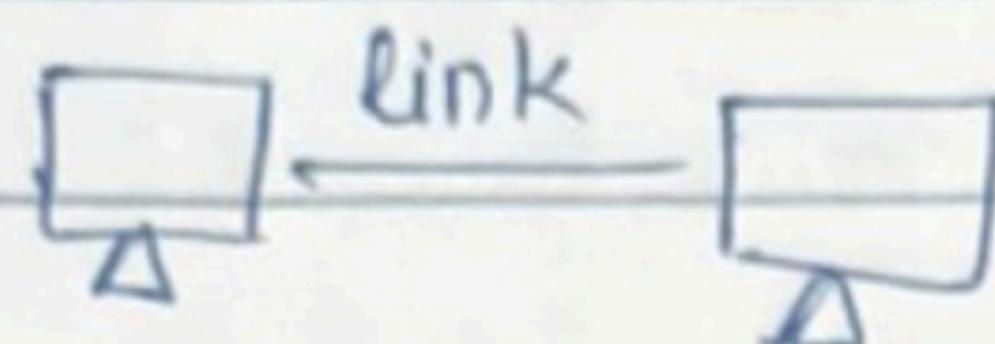
- both direction but only one at time

- full-duplex

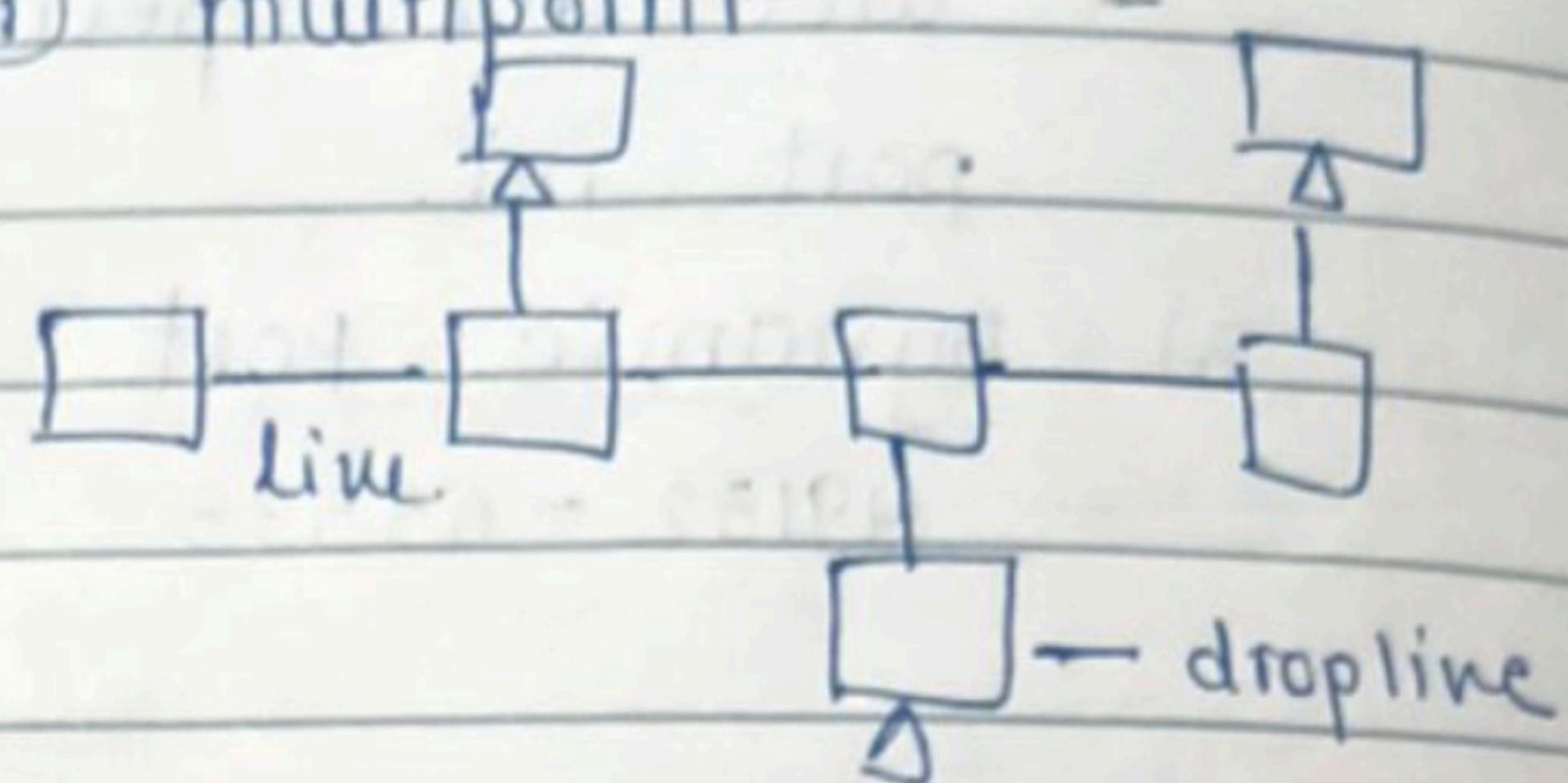
- both station can transmit & receive the same time.

Types of connections:-

i) Point - to - Point



ii) multipoint



Transmission media:-

Guided

- twisted pair cable
- coaxial cable
- Fibre optic

No physical medium required

- wireless transmission media

Radio wave

micro wave

infrared wave

i) client :- computer sw or hw device.

ii) server :- computer program that provide service to another computer program.

iii) Jitter :-

- Time delay in latency between transmission and reception of data packets over network

iv) Frame :-

- unit of data