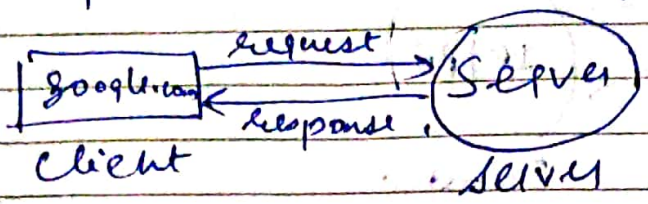
DEVOPS

CELEBRO™ DATE PAGE

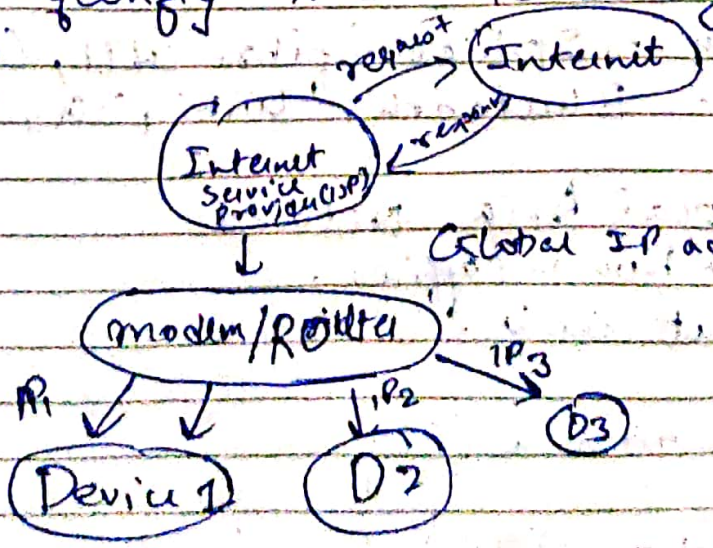
⇒ Computer Networking.



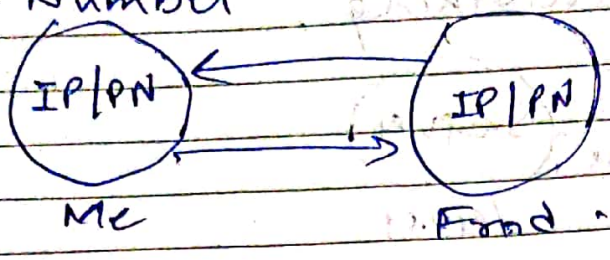
* TCP (Transmission control Protocol)
  ↳ It ensures the data will reach completely
* UDP (User Datagram Protocol)
  ↳ 100% of the data will reach.
* HTTP (Hyper Text Transfer Protocol)
  ↳ used by WWW.
  ↳ How client - server architecture works is given here.
  ↳ used by web pages.
* IP Address (Internet Protocol)

google.com ⟶ x.x.x.x
(0-255)

⇒ curl ifconfig.me to see your IP address



★ Port Number



IP address - which computer is located (determines)
Port number - Application used to communicate
↳ 16 bit number.
∴ Total port number = $2^{16} \simeq 65000$

Port no. for
HTTP - 80
MongoDB :- 27017

Port no: 1 - 1023 (reserved ports)
1024 - 49152 (some application / registered)
remaining we can use.

★ 1 mbps = 1 mega bits per sec = 10^6 bits/s
1 gbps = giga " = 10^9 bits/s
1 kbps = 10^3 bits/s.

★ Physically - Optical fibre cable, Co-axial cable
Wireless - Bluetooth, WiFi, 3G, 4G LTE, 5G

★ LAN - Local Area Network
Small house / offices.
Ethernet cable, WiFi.

MAN - Across a city

WAN - Wide Area Network, Across Countries.
SONET Frame relay Optical fibre cables

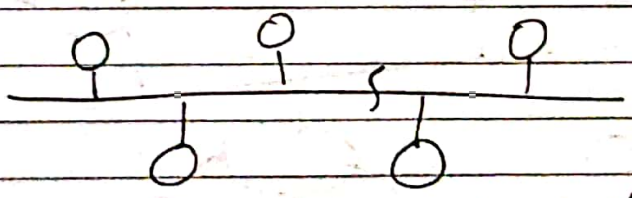
★ Modem - Converts analog signal into digital signals and vice versa.
↳ Transfers digital data through wires and cable in analog signal. And then convert it back to digital at receiving end.

Router - Routes data packets based on their IP addresses.

★ Tier 1 internet service provider - Tata [TOP]
Tier 2 — Airtel.

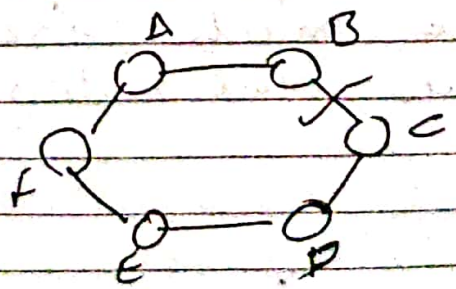
★ Topologies -

1) Bus -



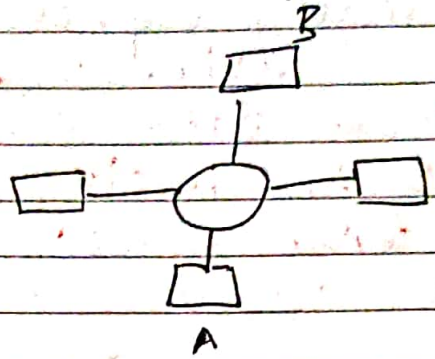
Only one person can send data at a time
if one link gets broken, it spoils entire network

2) Ring -



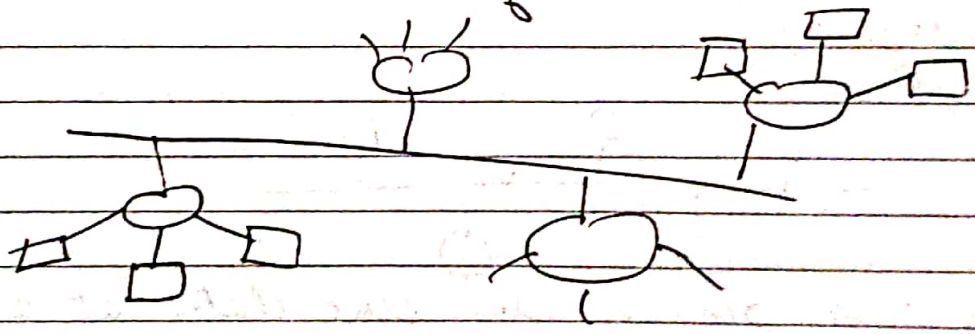
If you want to send data from A to D it will have to go through B & C, no direct link.
If one link breaks, spoils.

3) Star

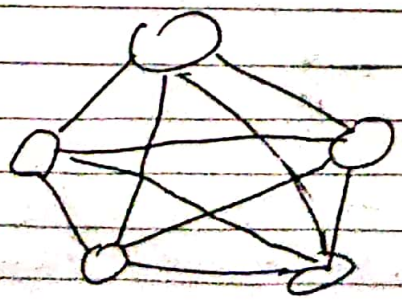


All computers are connected w/ a center device.
If main device fails, the network will go down.

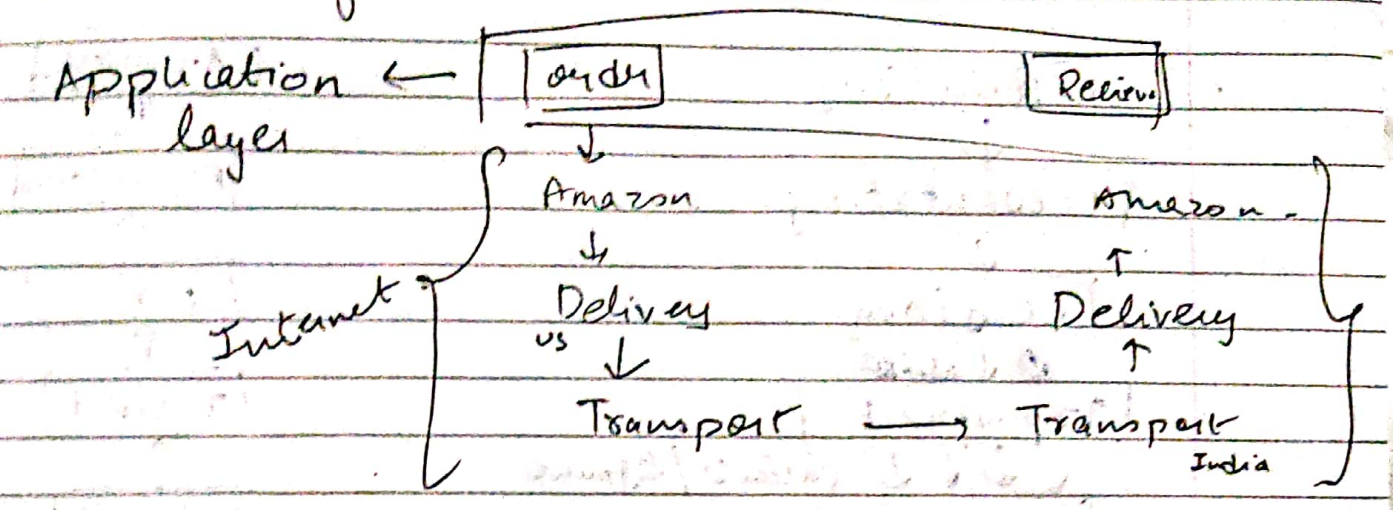
4) TREE (Combination of bus & star topology)



5) MESH - every single computer is connected to every single computer.
→ expensive, so much wire
→ scalability issues, while adding new computers



★ Structure of a network.



★ OSI model (Open Systems Interconnection Model)

(concept based)

It describes how information from one software application in one computer moves physically to software application of another computer).

Application → software

↓

Presentation (converts data into machine language/ binary) (Also encrypted).

↓

Session (communication b/w the devices) reports errors.

↓

Transport (how data will be transferred (UDP/TCP) (faster)

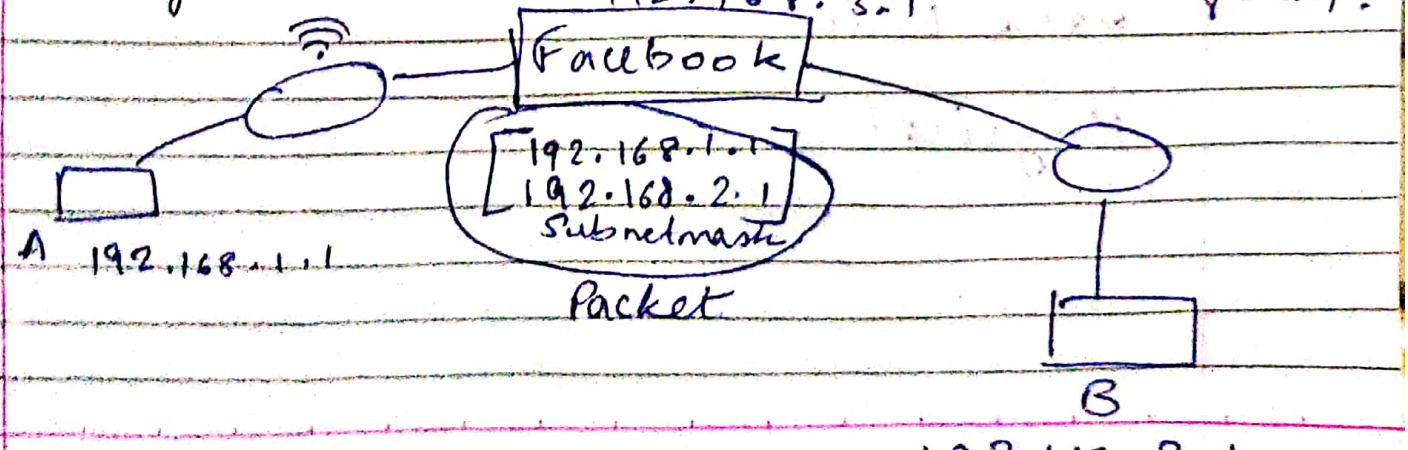
↓

Network → Router converts logical address into physical address.

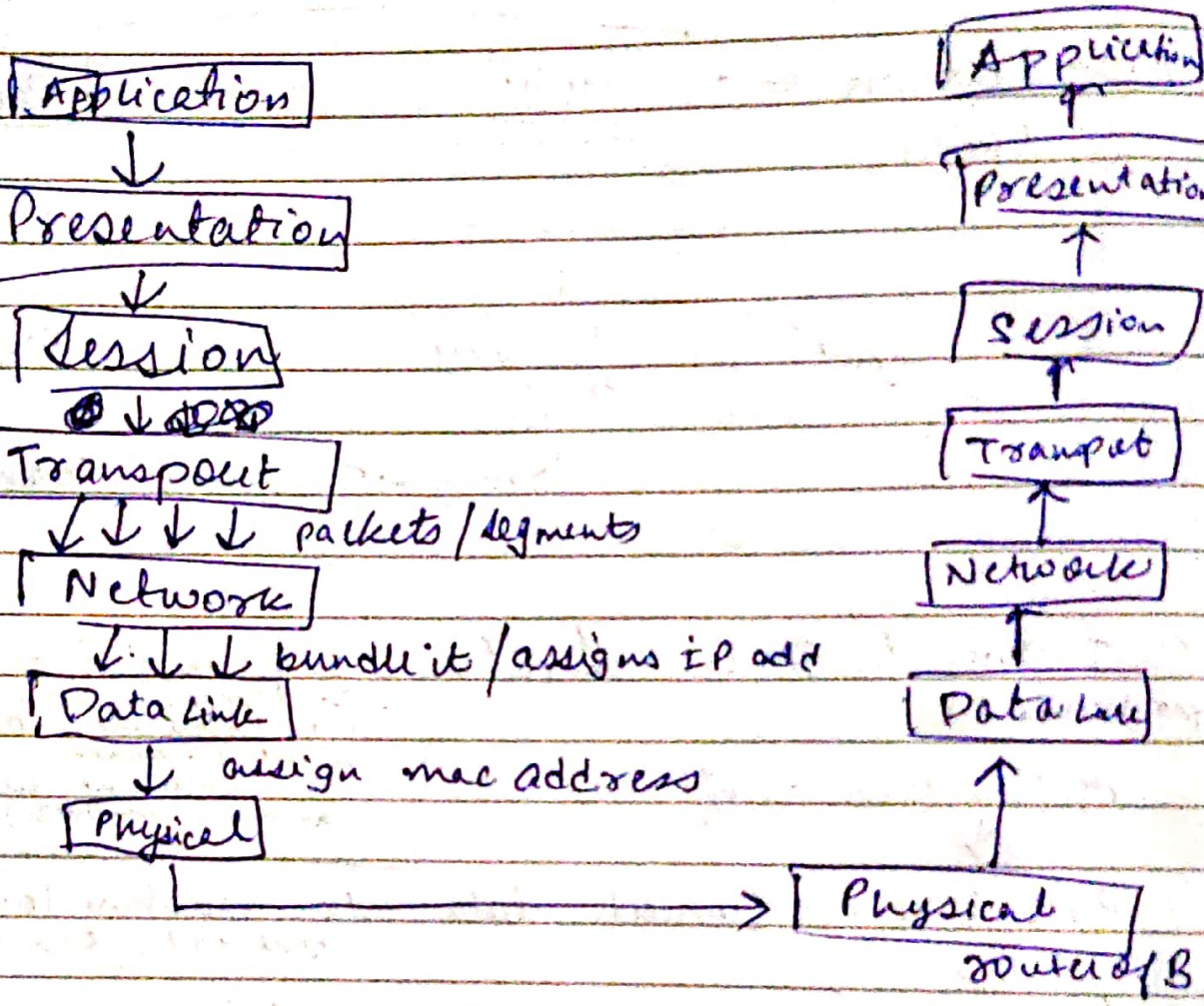
↓

Data Link (used to transfer data from one node to another)

Physical (transmit data in electrical or mechanical form).



From A to B



* TCP/IP model (practical/used more)

Application

Transport

Network

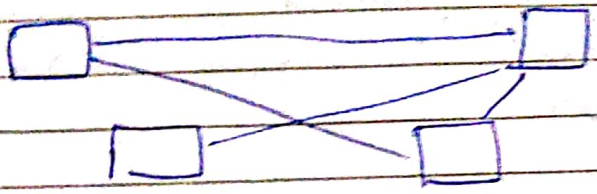
Data Link

Physical

★ Application Layer

- Users interact with this
  e.g. - whatsApp, browser etc.
- Protocols.

★ Peer to Peer Architecture



Every computer works as client & Server.

★ Protocols

⇒ Web Protocols
- TCP/IP:
  i) HTTP
  ii) DHCP Dynamic Host Configuration Protocol
  iii) FTP (not used anymore) File Transfer Protocol
  iv) SMTP
  v) POP3 & IMAP
  vi) SSH.
  vii) VNC
- Telnet - Port 23, data not encrypted
- UDP

Application/Program : WhatsApp

Process (Feature) — Sending a message — Set up page

Record a video — Open Cam

Thread (Core task at a time)

* Sockets : Interface b/w process & internet

* Ports : which application we are working with

Ephemeral ports -
(application layer)

* HTTP - Client, Server Protocol
  ↳ Uses TCP (Transport layer)
  ↳ Stateless

methods -

1. GET - requesting data (requesting youtube video)
2. POST - giving something to server (filling form)
3. PUT - puts data at specific position
4. DELETE - delete data

Status Codes

100-199 range → Informational
200-299 range → Success
300-399 range → redirecting
400-499 range → client error
500-599 range → server error.

* Cookies : unique string
  Saved in browser.

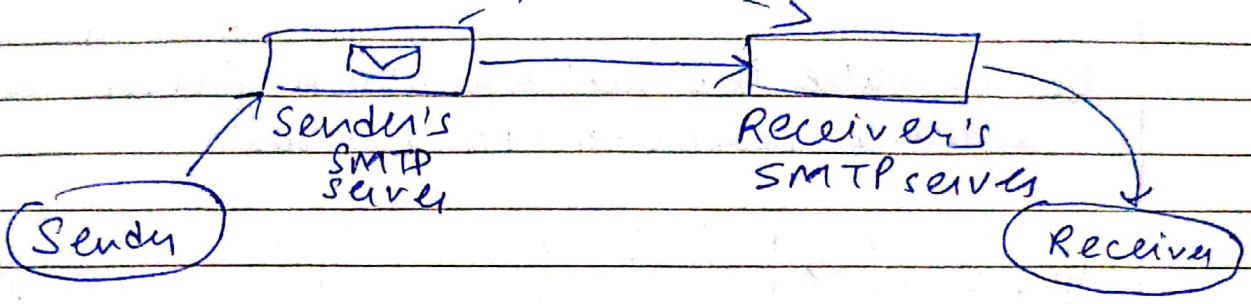
tag → set-cookie : contains expire date

* Third Party Cookies

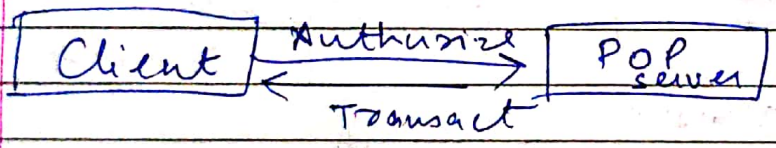
★ How Email Works

→ SMTP (Simple Mail Transfer Protocol), POP 3 (Post Office Protocol) (Port 110)

after connection is established



- Internally it uses TCP.
- If both are using same SMTP server lets say gmail.com, then the transfer happens directly.



→ IMAP

★ Domain Name System (DNS): Used to easily locate resources over a network

DNS is used to find IP address of a website's server.

mail.google.com
- mail: sub domain
- google: second level domain
- .com: top level domain

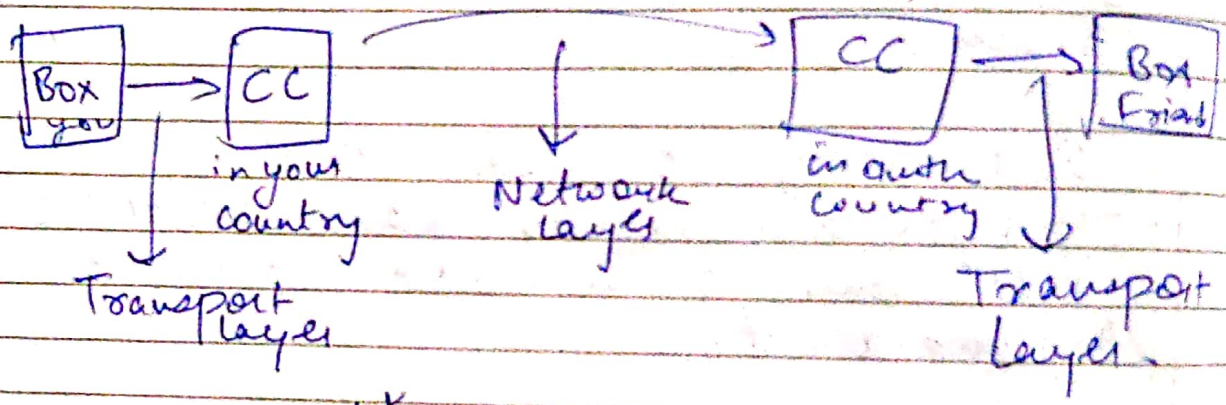
→ Root DNS Servers.

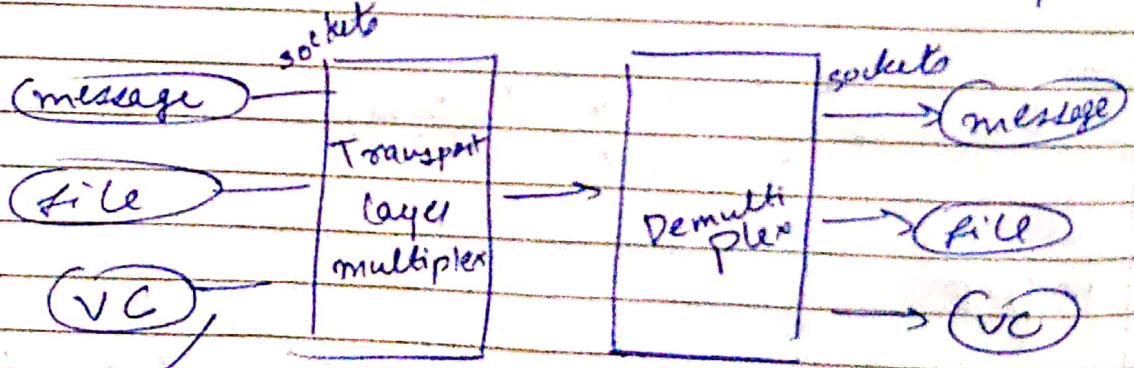
- .io → student.io
- .org → commonclassroom.org
- .com → google.com

google.com: Top level domain
Second level domain

* Transport Layer.

To take the information from one ~~network~~ computer to another





data travels in packets

↓

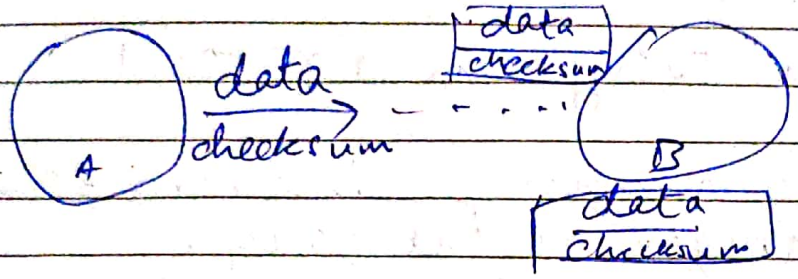
Transport layer will attach these socket pair nos.

Gathering data from multiple application processes of the sender, enveloping the data with a header, and sending them as a whole to the intended receiver

⇒ Sockets - Gateway b/w two application & the network.

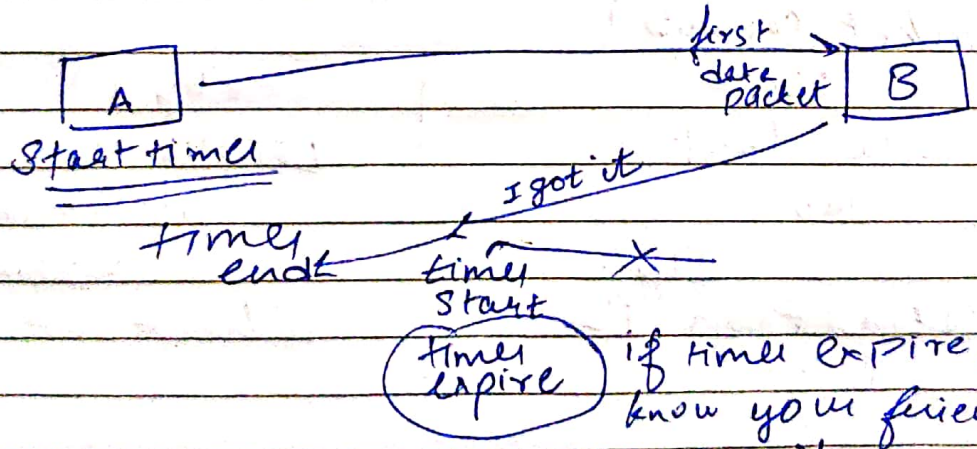
- Transport layer also takes care of congestion control (traffic).
- Congestion control algorithms are built in TCP.

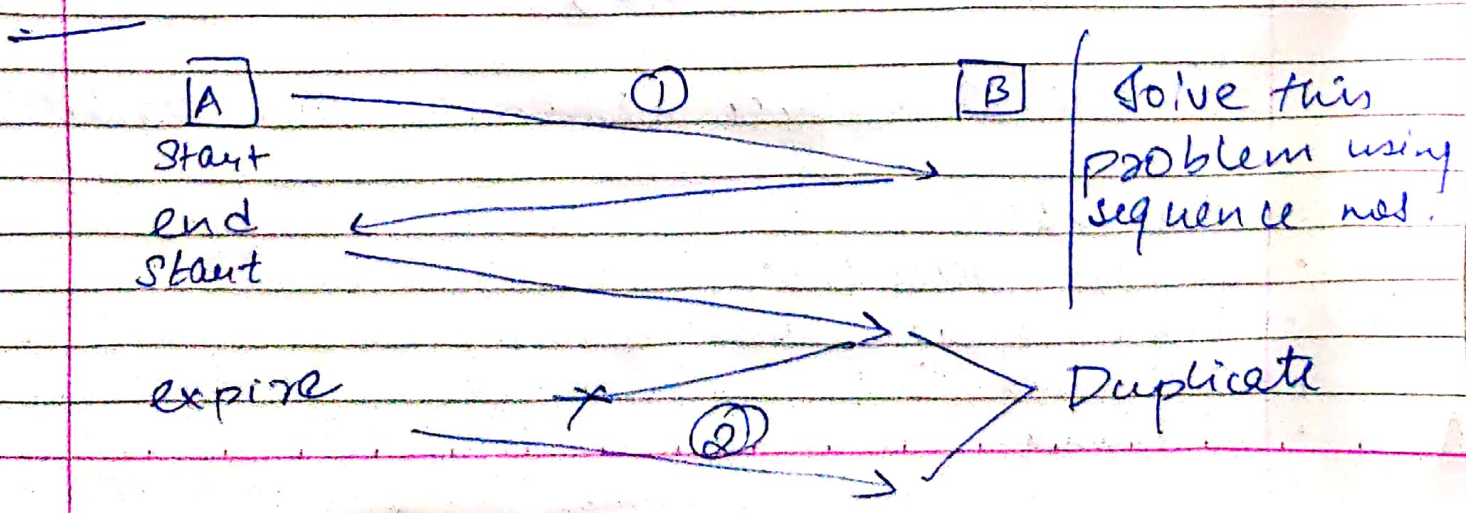
⇒ Checksums:



If value of checksum is changed from A to B something is wrong (error) else everything is cool.

⇒ Timers:





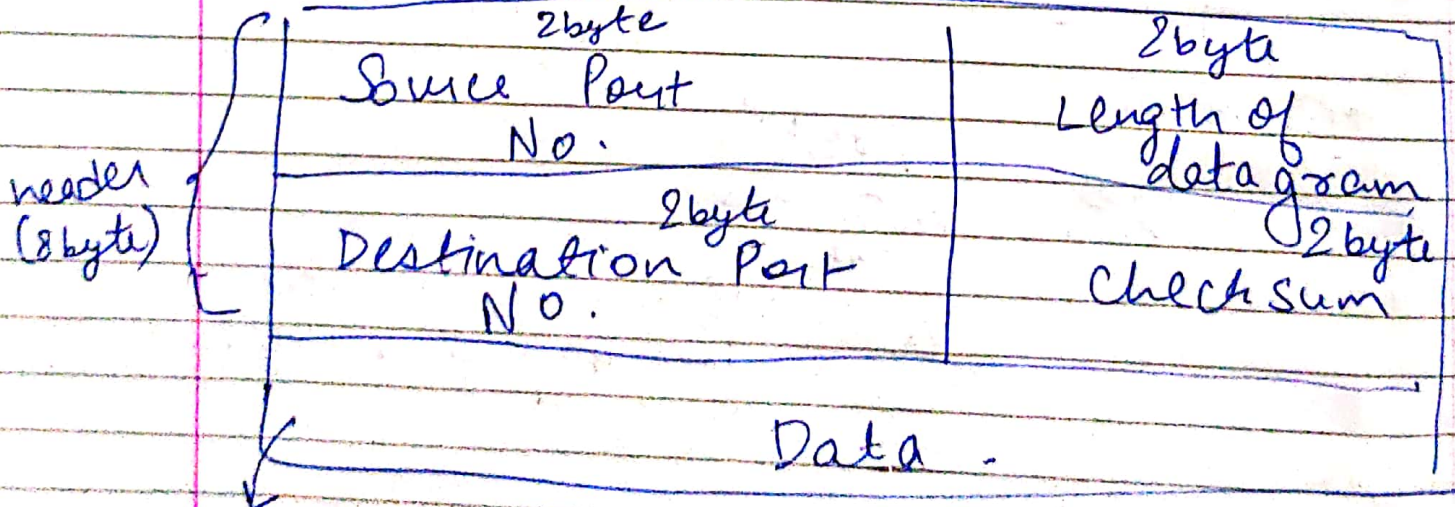
★ Protocols.

HTTP - Application Layer Protocol
UDP & Transport layer protocol
TCP
IP - Network layer protocol
DHCP - Data Link layer

⇒ UDP (User Datagram Protocol)

- Data may or may not be delivered; data may change on the way.
- Data may not be in order.
- connectionless protocol.
- UDP uses check sums, but if error is found it will ignore it.

UDP Packet (Segments)



$2^{16} - 8 \approx 65000$ byte (Data in one packet).

⇒ Use Cases

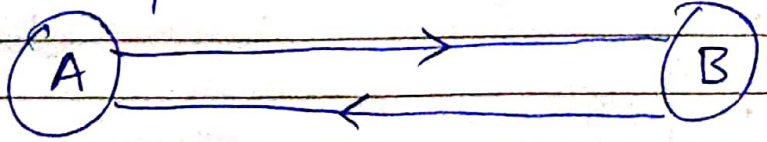
- It is very fast
- Used in Video conferencing
- DNS → UDP
- Gaming

⇒ Transmission Control Protocol (TCP)

- Application layer sends lots of raw data, TCP segment → divides data in chunks, adds headers.
- It may also collect the data network layer.

⇒ Congestion Control
- Takes care of two things:
  i) when data doesn't arrive
  ii) maintains the order of data using sequence number.

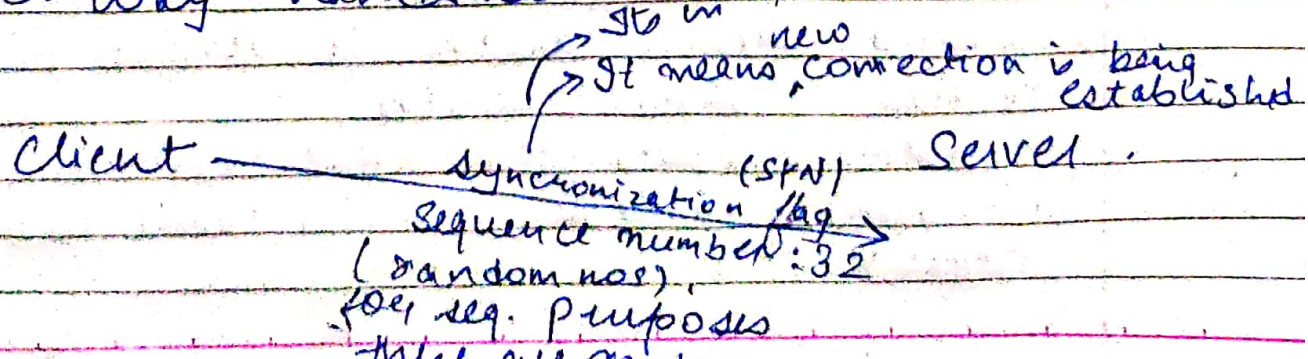
⇒ Features/differences from UDP
- Connection Oriented protocol
- Has error control
- Congestion control
- Full Duplex.



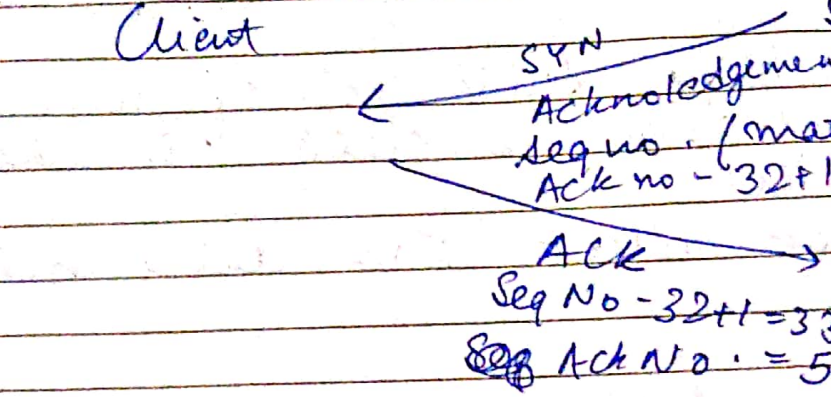
both can send files simultaneously

- One TCP connection is only b/w two computers.

⇒ Three way handshake : the header.

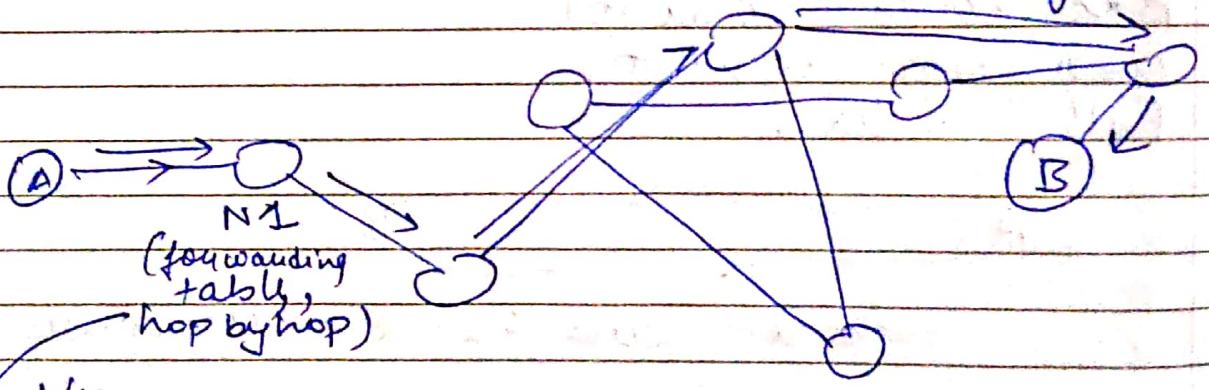


Reset flag
finish flag
checksum



⇒ All flags are in header of a packet.

★ Network Layer.	In Transport layer data is in segments
Here we work with routers.	Network Layer → Packets Data Link → frames



b/w
In A to B there are many routers, each of them has their own network address

→ hoping from router to router till it reaches final router.
→ contains one path / It is a data structure.
forwarding table & routing table are inside router.

hoping happens at internet service provider.

All wired I/O devices start with same network address.

Let's say IP address : 192.168.2.30 | (8) → Subnet that is fixed

192.168.2 → network address / Subnet ID

30 → device address.

⇒ Control Plane : Graph (Links → Edges, Routers → Nodes)
Used to build routing table

① Static Routing - manually.
② Dynamic Routing -

★ IP addresses (Internet Protocol)

IPv4 → 32 bit, 4 words [Each word is 8 bit]
IPv6 → 128 bit.
(future)

Class of IP addresses (to tell which category it belongs to).

A	0.0.0.0	127.255.255.255
B	128.0.0.0	191. "
C	192.0.0.0	223. "
D	224.0.0.0	239. "
E	240.0.0.0	255. "

★ Packets : Header (20 bytes)
IPv, length, identification no., flags, protocol, checksum, address, & TTL (Time to Live) etc.

We know that packets hop from one network to another, but sometimes they may stuck in a loop, that's where this comes into picture. These are the no. of hops are allowed eg 60, so after 60 hops it will end / dropped.

✱ IPv4	IPv6
32 bits $\rightarrow 2^{32}$ unique IP address $\simeq 4.3$ billion	128 bits $\rightarrow 2^{128} = 3.4 \times 10^{38}$
	Cons: Not Backward compatible ISPs would have to shift, lot of hardware work.
x:x:x:x ↳ 0–255 (8 bit)	a:a:a:a:a:a:a:a ↓ Hexadecimal (16 bit)
127.0.0.0/8 → prefix suffix not	ABFE:F001:3210:9182::/60
	1:0000:0000:0000:9 = 1:0:0:0:9 = 1::9 full of zeroes.

✱ Middle Boxes - device apart from computer router that work with packets

① Firewall → Two types → Global
→ your network.

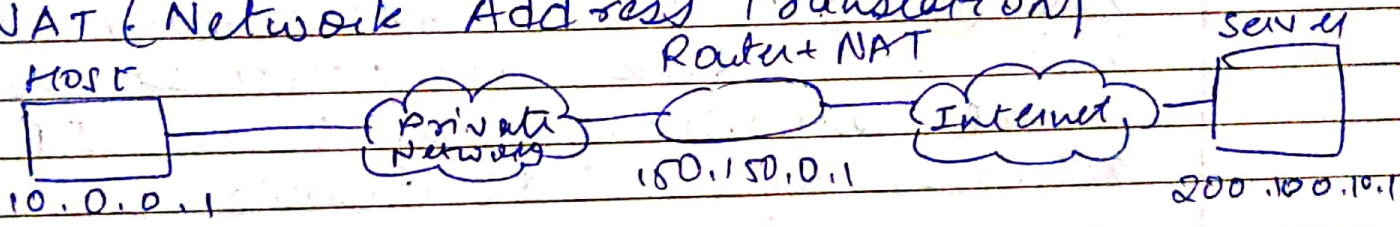
This filters IP packets based on various rules like
- → addresses
- → modify packets
- → port nos.
- → flags
- → protocols.

Stateless firewall - does not maintain state

Stateful firewall - has state
Check memory, more efficient.

It is in both network & transport layer.

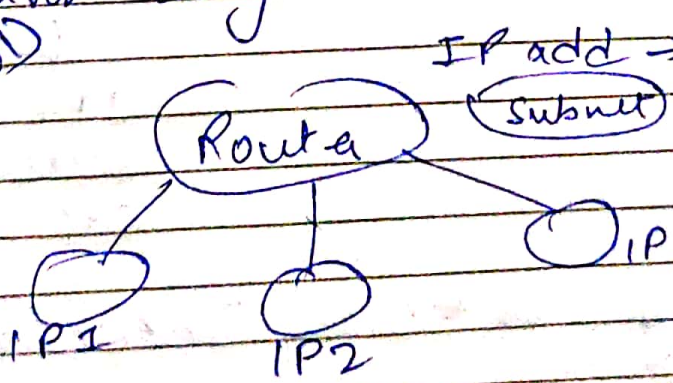
② NAT (Network Address Translation)

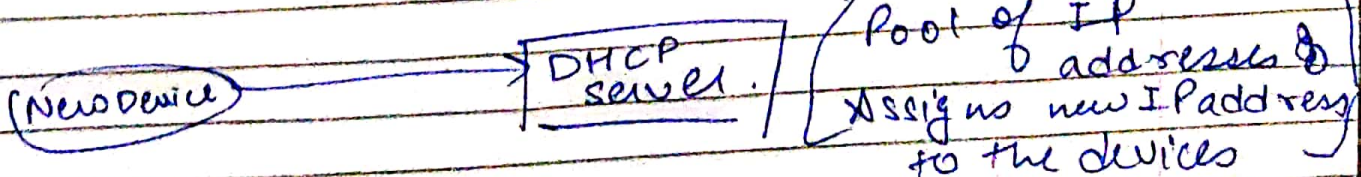


It changes IP address of host / source to reduce / slow down use of IP address as IPv4 are now limited.

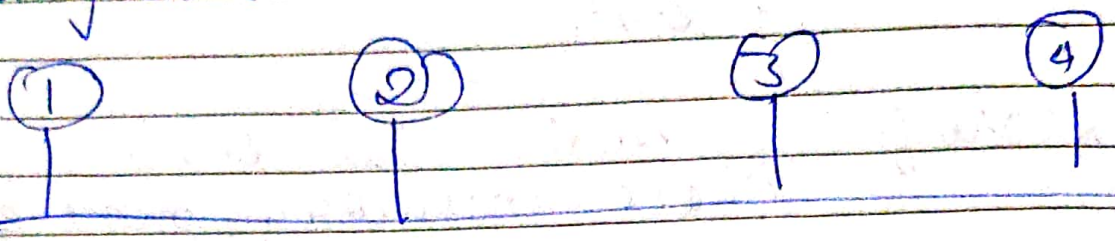
★ Data link Layer

DHCP (Dynamic Host Configuration Protocol)





Many devices connected in LAN:



Cache (ARP cache)

If ① wants to send data to ④, it will check in its cache if it has data link layer address for ④. If it will not have to it will ask all other devices in the network if they have IP address of destination.

ARP → Address resolution Protocol.

data link layer address → MAC address

↓

Used by all IEEE devices like bluetooth, ethernet etc.

Framing & Error Detection.