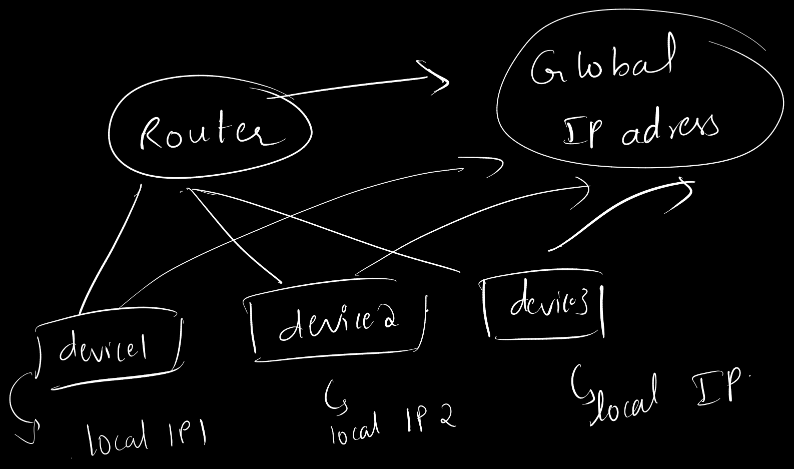
IP Address:

- Router assigns local IP using DHCP (Dynamic Host Configuration protocol)



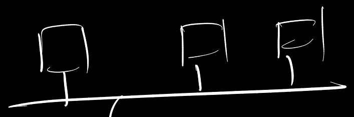
- say its D1 made a request to google the router decides it by NAT (Network Access Translator)
- Which device is decided by IP adress and which application to send is decided by port number.
- PORT number is a 16-bit number Total ports possible are 2^{16}
- Web pages use HTTP Protocol.

Say some rules set by very cool people at Internet society.

- 0-1023 ⇒ Reserved ports for HTTP stuff.
- 1024 - 49152 ⇒ Applications
-

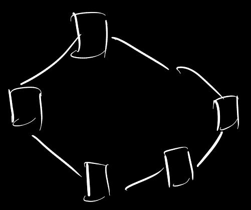
Topology:

1) Bus Topology :



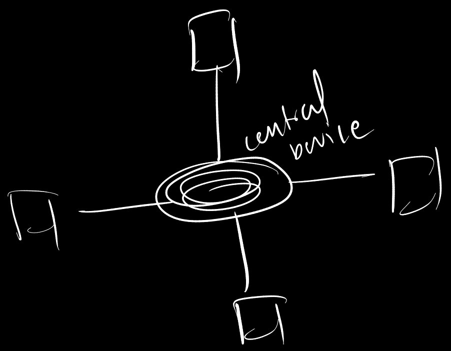
↳ if link break all are disconnected

2) Ring Topology



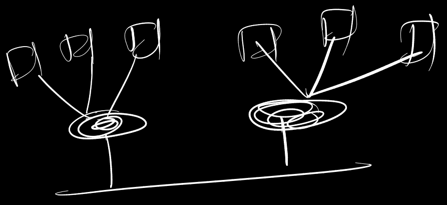
→ unecessary transfer
→ if one link break its useless

3) Star Topology



⇒ If central device stop the connection is gone.

4) Tree (Star + Bus)

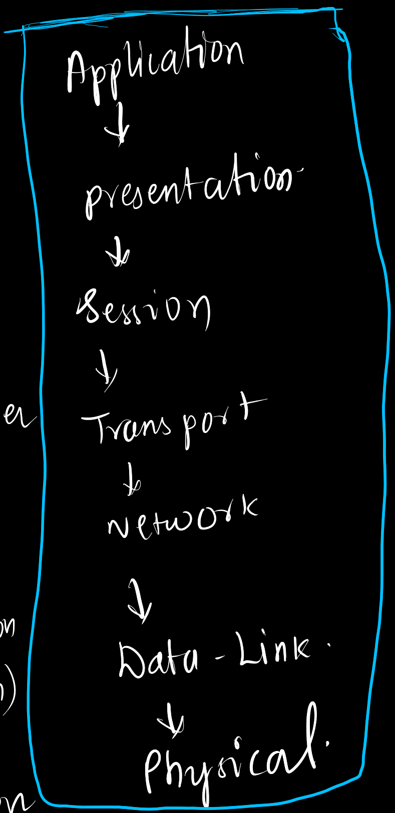


5) Mesh → every single comp connected to every other comp.

⇒ Expensive
⇒ less Scalability

Structure of the Network:

⇒ OSI MODEL (Open System Inter Connection):



- There are 7 layers

- Example: A whatsapp msg.

  1) Whatsapp se msg sending (Application layer)

  2) Application layer ⟶ Presentation layer

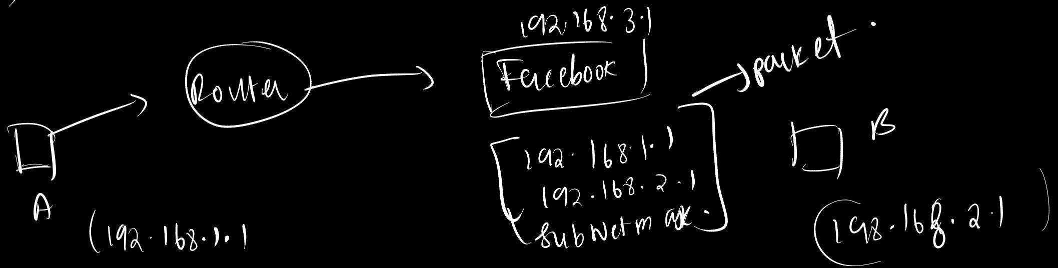
  3) Presentation Layer converts ASCII to something else (Encryption + compression + translation)

4) Session layer ⇒ Authentication, Authorisation stuff. It just establishes & terminates sessions

5) Transport Layer ⇒ i) Segments (divides into small parts)
ii)

6) Network Layer ⇒ sends to computer on other networks say the router lives in the layer. IP adressing of senders & recievers and forms IP packet and also routing

7) Data Link ⇒ recieves data packet from network layer.



8) Handles Logical addressing, & physical adressing

TCP/IP Model: (Pratically more used in real world) It contains lesser steps compared to OSI model.

1. Application
2. Transport
3. Network
4. Datalink
5. Physical.

1) Application Layer:

i) User interaction

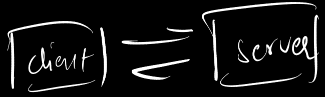
ii) where: devices

iii) Protocols

iv) Client- Server Architecture.

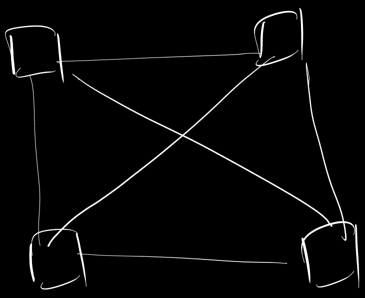
⇒ Collection of servers are called data centers

⇒ Client- Server Architecture



⇒ Peer to Peer (P to P) Architecture:

Eg: Bit-torrent



Key advantage

1) scalable

2) Decentralized

3) Every Comp acts as client & server.

⇒ **Protocols:**

TCP/IP :

- ☆ HTTP
- ☆ DHCP.
- ☆ FTP (File transfer Protocol)
- ☆ SMTP (Simple Mail Transfer Protocol) (for sending EMAIL)
- ☆ POP3 & IMAP (Recieving EMAIL)
- ☆ SSH (To login to someone's comp using terminal)
- ☆ UDP (stateless ⇒ Data maybe lost)

☆ **Sockets** : Used to send msg's from one comp → other.

☆ **Ports** : Tells which application. Say we know to send data chrome but to which tab will be determined by "Ephermeral Ports". It basically assigns itself random ports.

☆ **HTTP** : It is a client server protocol. It tells how to request data and how to send data. This is basically a application Layer protocol. HTTP uses TCP (Transmission Control Protocol) inside it. ↳ stateless ↳ at transport layer

☆ Cookies:

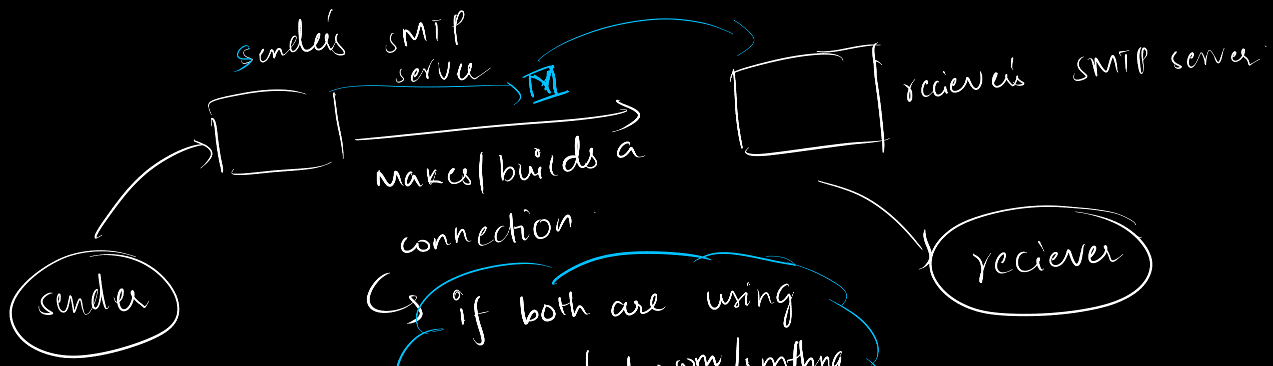
A unique string stored in browser. Login data is stored in cookies and then it is sent in headers everytime it makes a request to backend.

⇒ How Email Works:

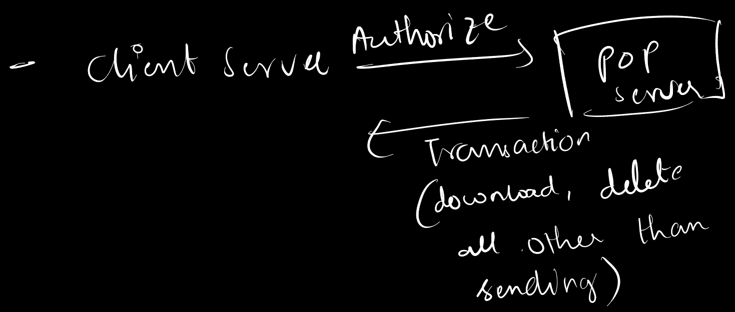
Application Layer : SMTP, POP3 ⟶ how to send & recieve

Transfer : TCP protocol.

Eg:



↳ if both are using gmail.com/yahoo.com/smthng same connection is not made / Required



Transaction (download, delete all other than sending)

so basically gmail has two seperate servers SMTP & POP.

⇒ IMAP : Allows to use emails on multiple devices. So the Syncing thing on diff devices.

⇒ DNS (Domain Name System):

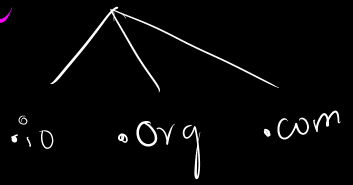
Used to find the IP address associated with a URL.

mail. google. com → Top level domain

↳ sub-domain

↳ secondlevel domain

✯ Root DNS Servers: (Top level domains)



→ First point of contact

→ Stored / Mainted by ICANN.

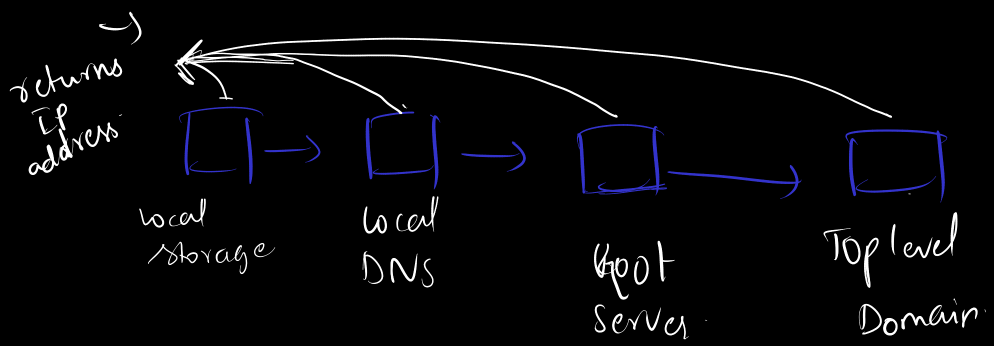
IP Searching Process:

→ First checks in the device's storage

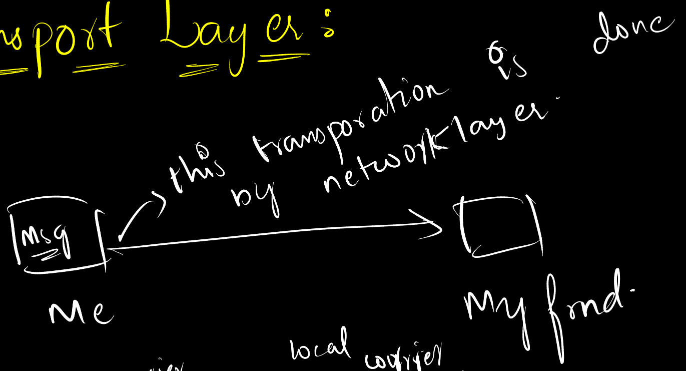
→ Look it up in the local DNS server (ISP, Router)

They know every website we visit even in incognito mode

→

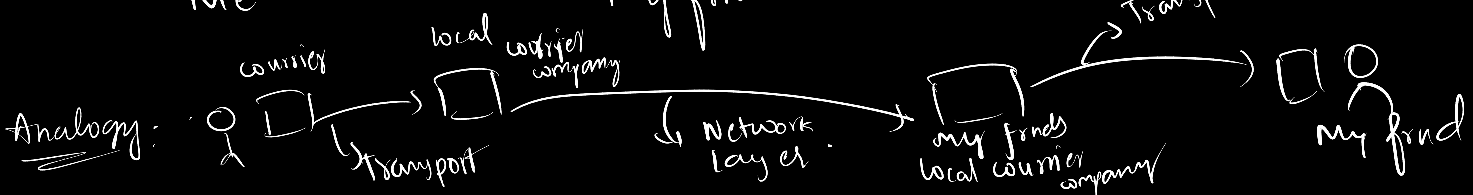


2) Transport Layer:



⇒ Transport layer just transports data from network layer to application within the computer

Analogy:



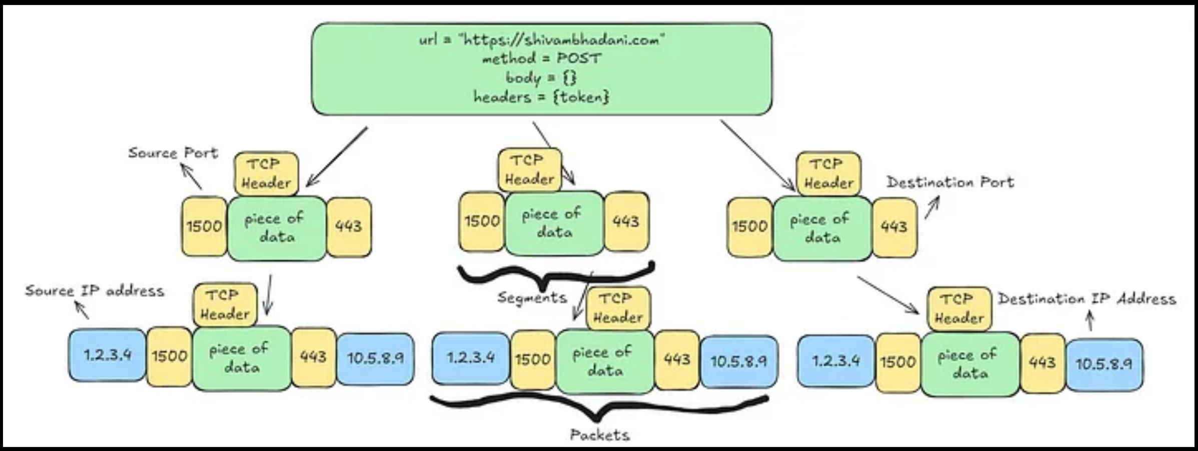
⋆ How axios.post() works undahood.

→ when we send the data along with URL it's first broken into small units → Y: Cuz we can't transfer large data at one go through cables, wires or wifi

→ Each unit needs the recievers port and sender's port data for the transimission of data to be successful.

→ Each unit is called a Segment.

segment □ + IP adress of source & destination → Packet


url = "https://shivambhadani.com"
method = POST
body = {}
headers = {token}

- Every packet sent by sender will be recieved. To make sure that happens we use acknowledgement. So kind of like replying I've recieved packet 1, packet 2, etc.. and I have not recieved.

too works

Note: TCP works on 3 way handshake

→ Sending data over TCP has 3 steps:

i) Connection Establishment (3 way handshake)

ii) Transfer data

iii) Connection Termination (4 way handshake)

FLAG Bits: SYN, ACK, SYN-ACK, FIN,

★ 3-way Handshake:

i) Client side sends SYN (synchronize) bit. (SYN=1 (set) ACK=0 (unset)) → kind of like switches.

ii) Server side SYN-ACK (Acknowledge)

iii) Client side ACK

Analogy: Client: I want to establish a connection will initialise all my msgs to X

server: I acknowledge it. It will initialise all msg to Y.

Client: Accepted.

→ A random number (Seq) is generated at the start and from the messages are numbered by +1.

→ Y: random number → solves confusion on multiple connections.
→ Extra layer of security

★ 4 way Hand Shake:

- client sends a FIN to indicate it wants to close connection
- server ⇒ ACK
- server ⇒ FIN.
- Client ⇒ FIN

Congestion: → y needed to learn: it might damage connections b/w comps

When a network is overloaded by large data being transferred by multiple devices, then there might be packets loss, time delay, or the breakdown of entire network sometimes.

★ How does TCP handle it:

It uses some jargon (algo's) to figure out how much load can the network take and adjust the transmission speed accordingly

There are 4 phases in TCP congestion control:

1) Slow Phase
2) Congestion Avoidance
3) Fast retransmit
4) Fast Recovery.