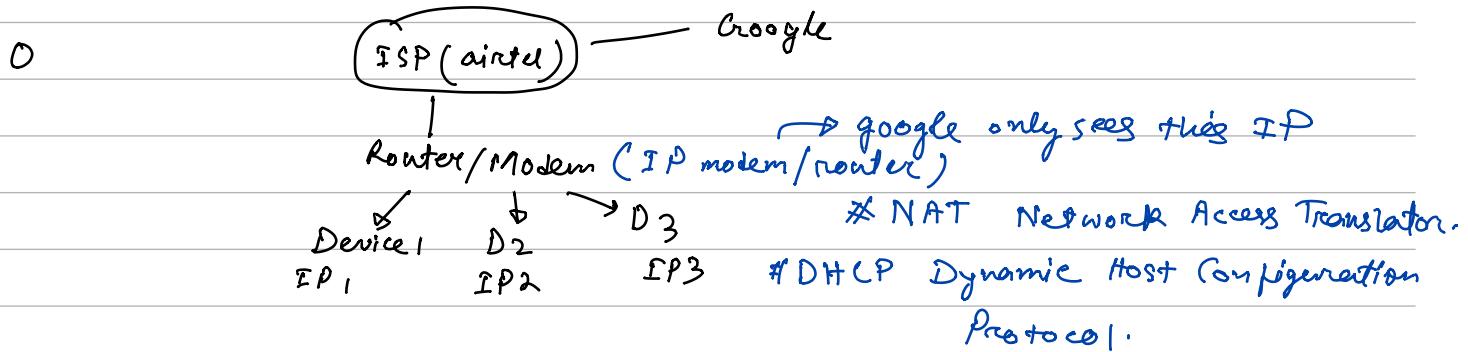


# Network

- ArpaNet → first form of Internet (in US)

- "The Internet Society" decides which algorithms (Rules) to be followed.

Protocols (algorithms) TCP, UDP, HTTP.



O IP - to find the Computer

Port - to find the application 0 - 1023 reserved.

↳ 16 bit Number

$2^{16} \approx 65000$  possible different applications.

1024 - 99152 popular applications

SQL - 1433

remaining we can use.

# Topology

LAN: Local Area Network (house / office)  
(eg Ethernet, wifi)

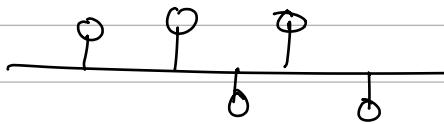
MAN: Metropolitan Area Network (across city)

WAN: Wide area network (across country)

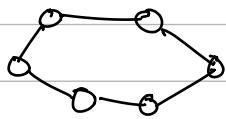
↳ Optical fiber cables.

e.g. SONET - Synchronous Optical Networking  
Frame Relay - Local area Network into broader.

① Bus topology:

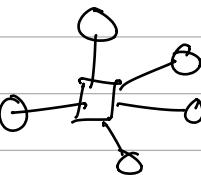


② Ring topology:

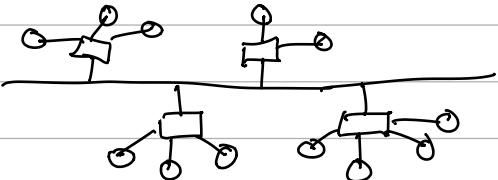


③ Star topology:

all connection through central device.

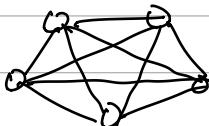


④ Tree topology (Bus + star):



⑤ Mesh :

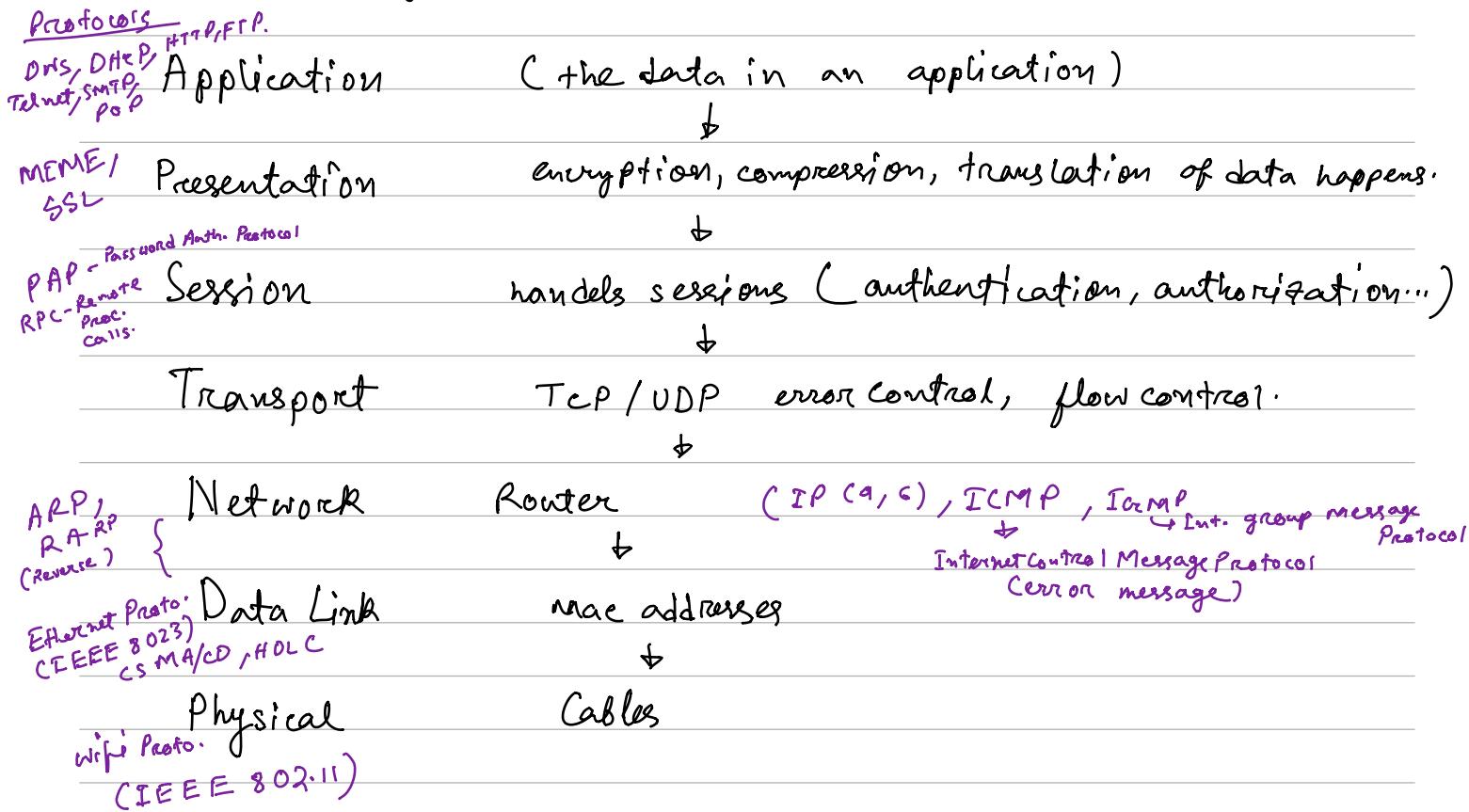
every single computer connected to all other.



# expensive wire  
# Not scalable.

# Structure of Internet

① Open system Interconnection (OSI model)



② TCP/IP model:

Application

Transport

Network

Data link

Physical

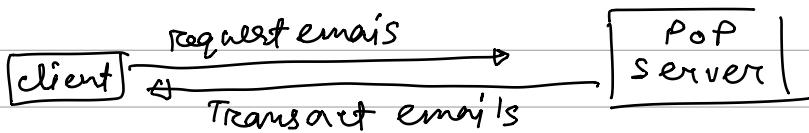
# Telnet (Port 23) terminal emulation (outside TCP/IP)

## Q How Email works?

sending SMTP (Simple mail transfer Protocol)

receiving POP3 (post office Protocol) ↗ MIME (Multipurpose Internet  
mail Extension)  
POP ↗ Port 110

POP



video, audio sending in mail

## ② iMAP (Message Access Protocol)

server stores messages, available in local devices  
for syncing multiple devices.

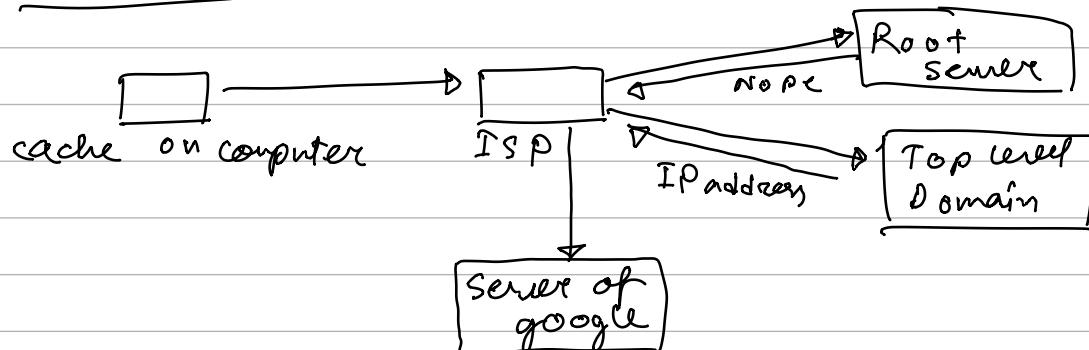
## ① DNS (Domain Name System)

↳ comes under Application layer protocol.

↳ HTTP resolves IP for "google.com" then sends appropriate.

.com .io .org → Root level DNS Server  
google.com → Second " " " →

### DNS Resolve :



○ Ephemeral Ports : ports assigned to different applications that allow client application to connect to server applications.

○ HTTP (application layer protocol)

HTTP uses TCP in Transport layer protocol

✓ HTTP Doesn't have state (doesn't store any information of client)

HTTP methods :

GET : Getting images/text to render the web page.

POST : Username Password

PUT

DELETE

\* HTTPS ; encrypts data using SSL (Secure Socket Layer) or  
( TLS (Transport Layer Security) protocols .  
\* Port 443.

○ Status Code : class of Predefined Codes .

1XX (100-199) : Information codes

2XX Success codes

3XX redirecting

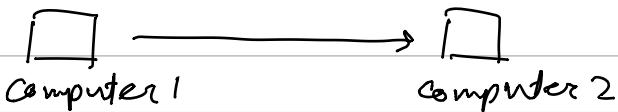
4XX Client side failure

5XX Server error

○ Cookies : \* Stores data till an expiry date.

"set-cookies(...)" \* 3rd party Cookies : For another URL you didn't visit.

# O Transport layer :

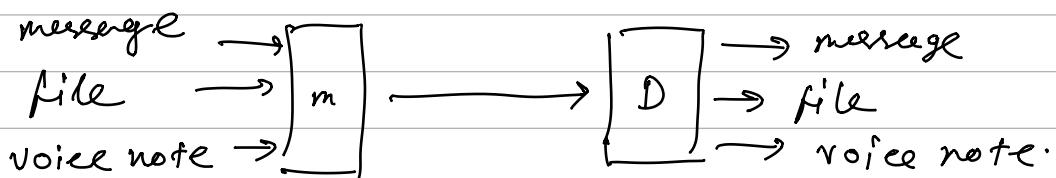


This data transportation method is using Network layer.



within the computer Data from network layer to application is done by transport layer.

## // Transport Layer Multiplexer & De multiplexer.



UDP : (Connection less)

\* Gaining, DNS, Video call uses UDP.

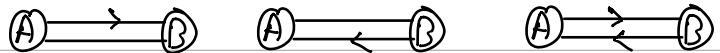
source Port	Dest Port
Length	check Sum
Data	



TCP : takes care of

- 1) when data does not arrive
- 2) maintain order of data.

- ✓ connection oriented
- ✓ error Control
- ✓ Congestion Control
- ✓ Full Duplex



## // 3 way HandShake :-

client

Server

SYN  
seq no: 33

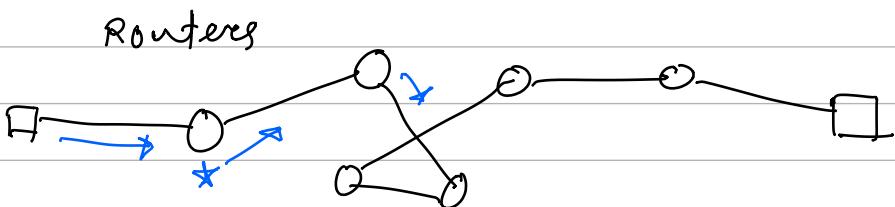
seq no. = function(incoming seq no.)  
= 56 let say.

ACK  
seq no: 56  
ACK no. = 34

ACK  
seq no: 33  
ACK no. = 57

# O Network Layer :

transport L - segments  
 Network L - packets  
 Link L - frames.



Routers forwards the packet according to forwarding Table  
 (hop by hop forwarding)

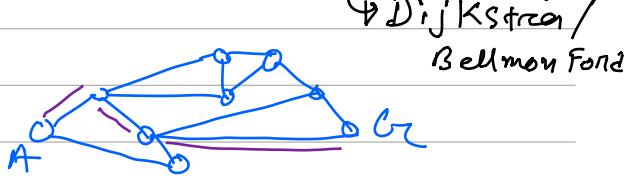
e.g.  $192.168.3.38$   
 Network address.      Device address

✓ Control plane creates the Routing Table.

Routers - nodes  
 links - edges } graph.

# 2 types of Routing Static Routing & Dynamic Routing.

Something like pre defined path  
 if you want to go from Router A to C



Internet Protocol (IP)

↳ IPv4 (32 bit 4 words)  
 ↳ IPv6 (128 bit 6 words)

These routers are not You and your neighbor's routers.

The hops that occur is at blocks of routers determined by the ISP. called Subnets.

○ Subnets: class A, B, C, D, E  
then IETF (Internet Engineering Task Force) changed classes based on regions

Reserved IP addresses:

127.0.0.0 /8 e.g Local Host 127.0.0.1  
(Loopback address)

○ IPv6  $2^{128}$  unique IP addresses possible.

↳ cons:

- not Backward Compatible
- Internet Service Providers need to shift lot of hardware work.

## ○ Middle Boxes:

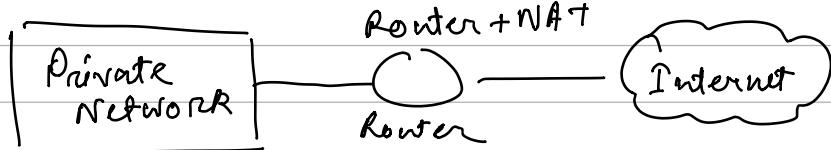
① Firewall: Filters out IP Packets based on various rules.

- based on ✓ Addresses
- ✓ modify Packet
- ✓ Port no.
- ✓ Flags
- ✓ Protocols etc.

= Stateless + Stateful Firewall

↳ (Use cache, more efficient)

② NAT (Network Address Translator)



\* To save IP addresses.

## O Data Link Layer:

DHCP has pool of IP address when new device joins it gives the device an IP.

# Frames contain Data Link Layer of Sender IP of Destination.

uses ARP cache (Address Resolution Protocol)

# DLL Address == MAC Address of the device.

DLL does framing, error handling.