

# Computer Networking

by kushwah ~~for kushwah~~

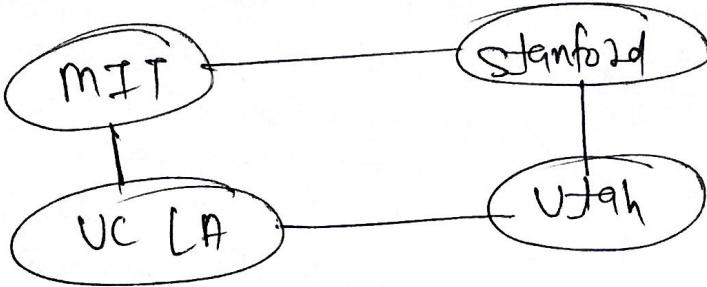
@Abhishekraj ①

# Computer Network  $\Rightarrow$  A computer network is a set of computers sharing resources located on or provided by network nodes.

How It started  $\Rightarrow$

An American organisation name "A.R.P.A" invented these own arpanet for communication with each other.

A.R.P.A  $\Rightarrow$  Advanced Research Project Agency

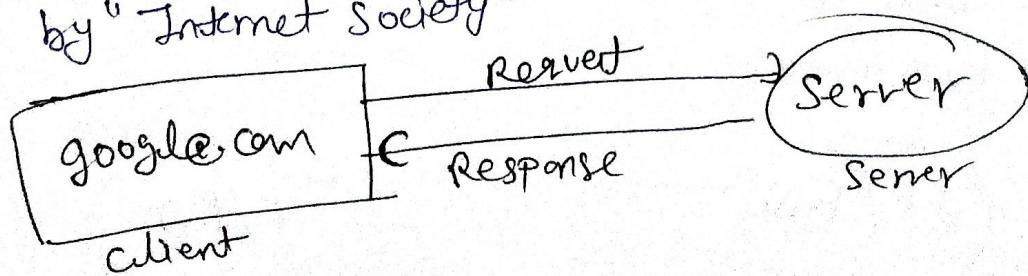


# Protocols  $\Rightarrow$  is an established set of rules that determine how data is transmitted between different devices in the same network.

Note -> world first web page is world wide web

Essential Protocols allows connected devices to communicate with each other, regardless of any differences in their internal processes, structure or design.

And all the protocols made and changed by "Internet Society"



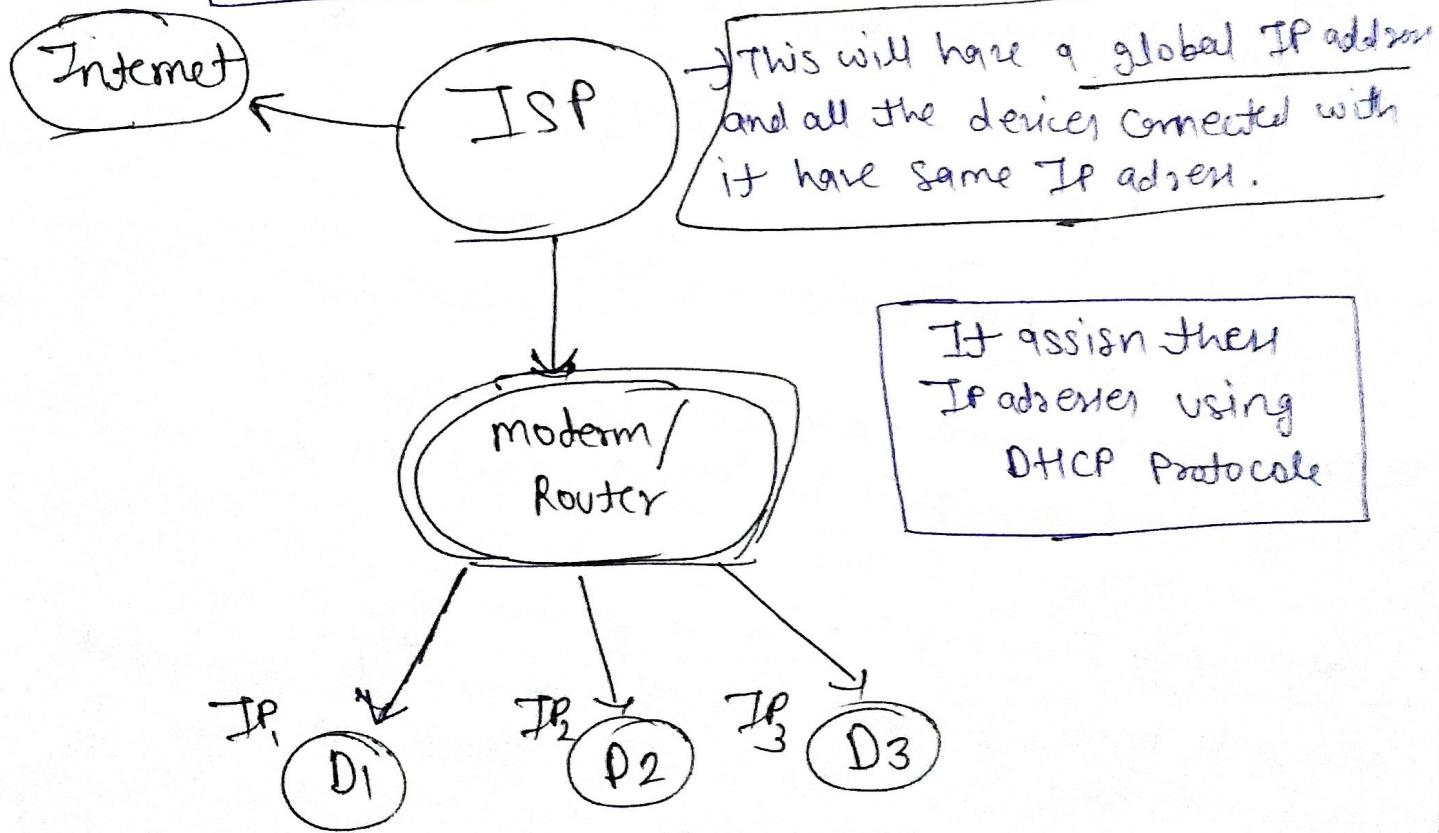
These are some basic protocols →

- ① TCP
- ② UDP
- ③ HTTP

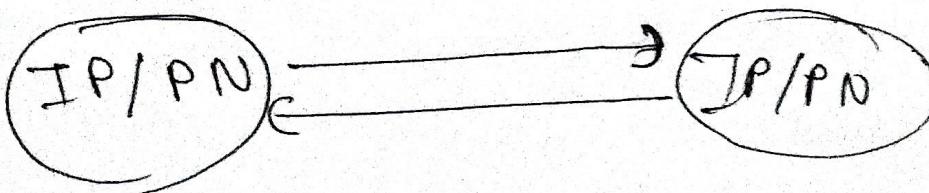
# Packets → A small amount of data sent over transmission control protocol / Internet protocol (TCP/IP) network.

IP Address =) is a unique iden that identifies a device on the internet or a local network.

\$ curl command ifconfig.me — s



- ★ IP Address decide which device to send the data
- ★ but what application to send the data, we know by Port-number.



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# Port-Number  $\Rightarrow$  Port number is a 16 bit number. (3)  
You can have 16 ~~shell~~ shell and every shell will  
have 0 and 1

$$\text{Total} = 2^{16} \approx 65,000$$

- \* Port between 0 - 1023 bit are ~~not~~ reserved  
Port numbers.

# How we measure Speed  $\Rightarrow$

$$1 \text{ mbps} = 1000000 \text{ bits/sec}$$

$$1 \text{ gbps} = 10^9 \text{ bits/sec}$$

$$1 \text{ kbps} = 1000 \text{ bits/sec}$$

- \* we all are connected by submarine cables.  
That's the fastest route for the internet.

# How computer get connected  $\Rightarrow$

- ① Physically  $\Rightarrow$  optical fibre cables, coaxial cable etc  
② wireless  $\Rightarrow$  wifi, Bluetooth, 3G, 4G, LTE, 5G etc

① LAN  $\rightarrow$  Local Area Network.  
eg. Small house or in a small area.

- \* we can connect them ethernet connectors.  
\* wifi works too.

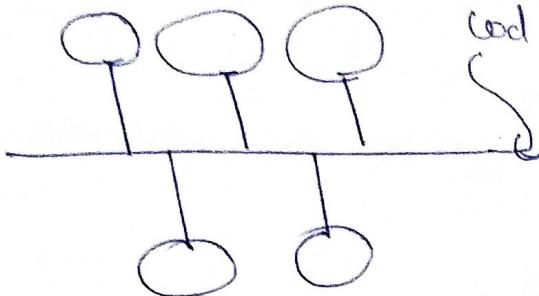
② MAN  $\Rightarrow$  Metropolitan Area Network  
Across a City

③ WAN  $\Rightarrow$  Wide Area Network.  
Across ~~countries~~  
Countries  
 $\Rightarrow$  optical fibre cables

(#) Topologies →

① BUS Topology →

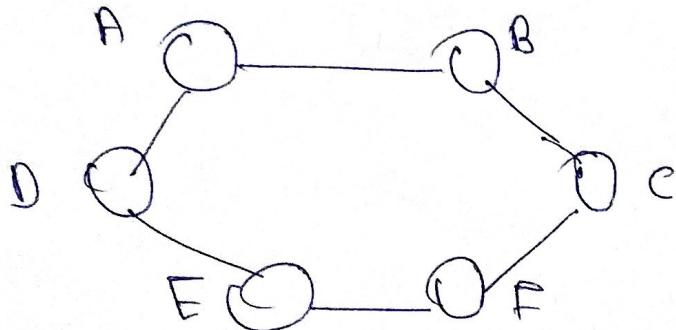
Every system in this connected to  
end or back bone



\* If this link get broken then it can spoil entire connection.

\* only one person can send data at a particular time.

② Ring Topology → Computer connected in a ring by  
from each other.



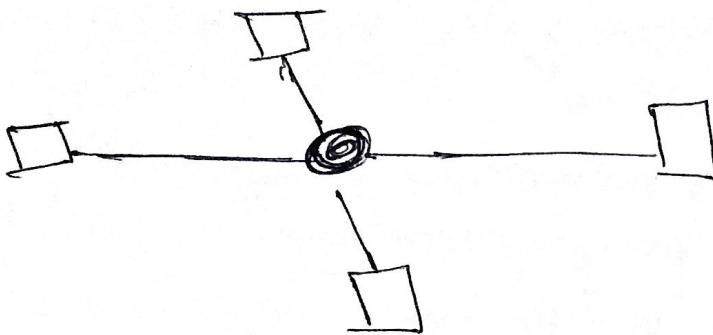
\* Every system communicates with one another.

\* if one of the cable break, you won't be able to send data.

\* lot of unnecessary calls are made

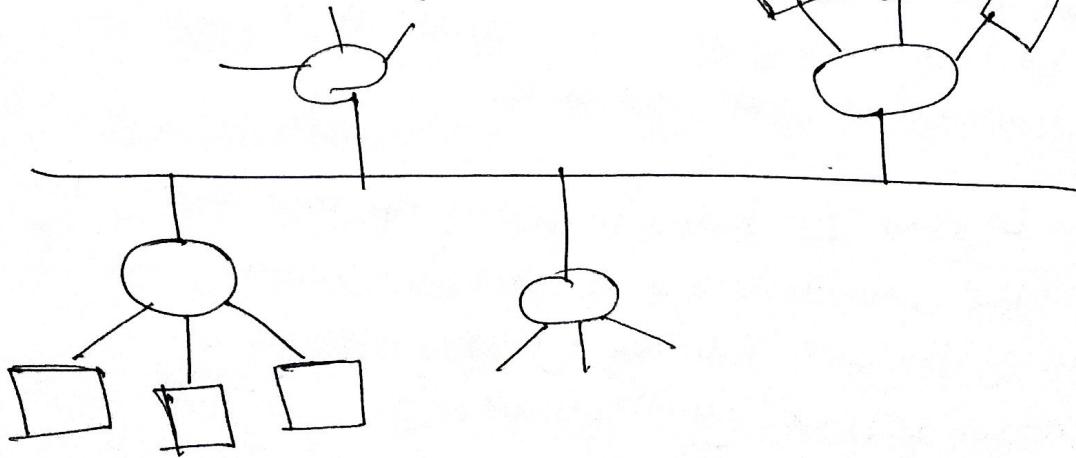
e.g. If you call data A to F then B and C too be called.

(3) Star Topology → These will be one main computer and all other computer will be connected to it.



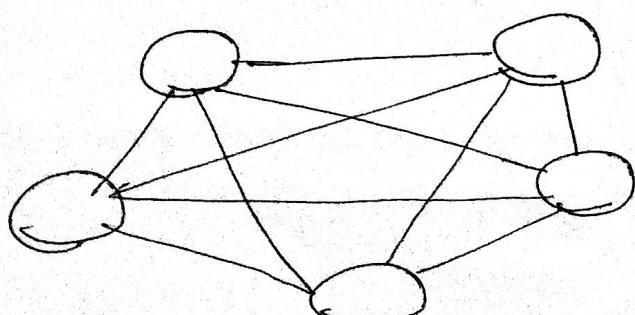
\* If Central device fails, then your network will go down.

(4) Tree Topology ⇒ It's a combination of Bus and Star topology.



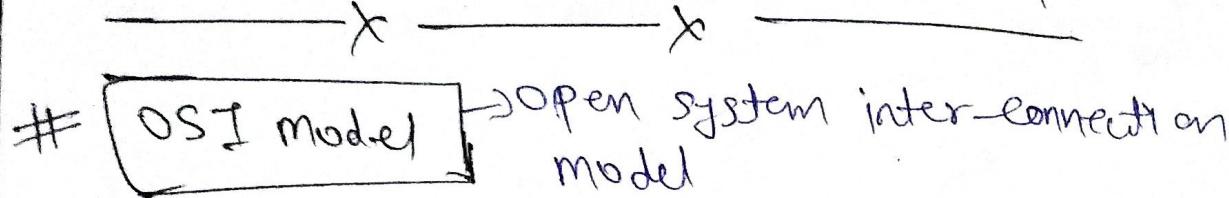
(5) Mesh Topology ⇒ Every single computer will be connected to every single computer.

- \* very expensive
- \* so much wire used
- \* scalability issues.



⑤ Network Layer

## Structure of The Network



① Application → It's implemented in software.  
eg. Browser, messaging application.

You sent your msg Application layer  
to presentation

⑥ Application  
Presentation  
Session  
Transport  
Network  
Data Link  
Physical

② Presentation → this layer is going to convert these  
characters into machine code and process called  
translation.

It's also provide extraction.

It's basically going to assume that if I send the  
data downward it will take of it.

③ Session Layer → It helps in setting up and managing  
the connection and it enables sending and  
receiving the data followed by termination of  
connected session. [Authentication]  
eg. → some time we use for login and password

\* Data that will be received by session layer, it converted  
into segments. and every segment contain port number,  
sequence number

Flow control → transport layer control the amount of  
data they has been ~~not~~ transport.

\* It ~~not~~ helps in error control

## ⑤ Network Layer $\Rightarrow$

It works for the transmission of revenue data segment from one computer to the another computer that is located into different network.

- \* where it is router layer (in the network layer)
- \* Logical addressing  $\Rightarrow$  IP addressing happening in this layer.
- \* Every computer has their own IP address  
This assign the sender and receiver IP address to every segment and form a IP packet  
So the every IP packet reach the correct position.
- \* and also it perform routing
- \* load balancing also having here

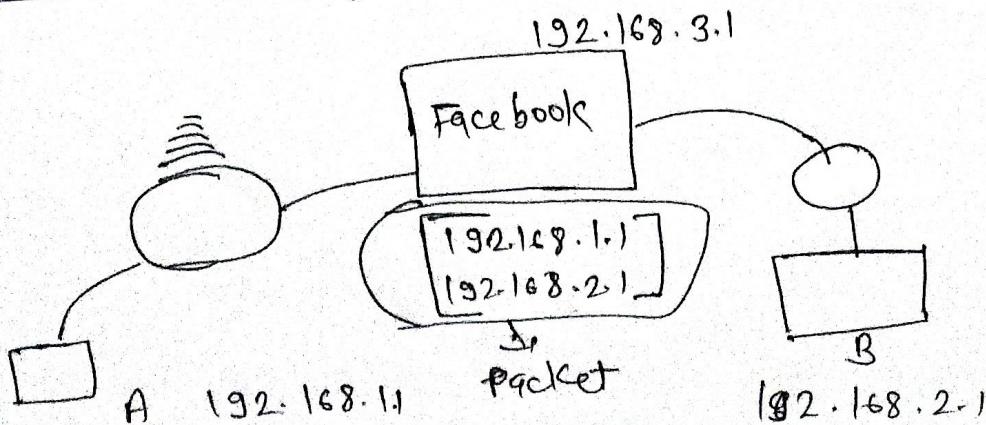
## ⑥ Data Link Layer $\Rightarrow$

Data Link layer basically allows like you to directly communicate with the computers and hosts.

It actually doing two kind of addressing  $\Rightarrow$

① Logical addressing  $\Rightarrow$  that way in network layer  
Physical addressing  $\Rightarrow$  that way IP addressing

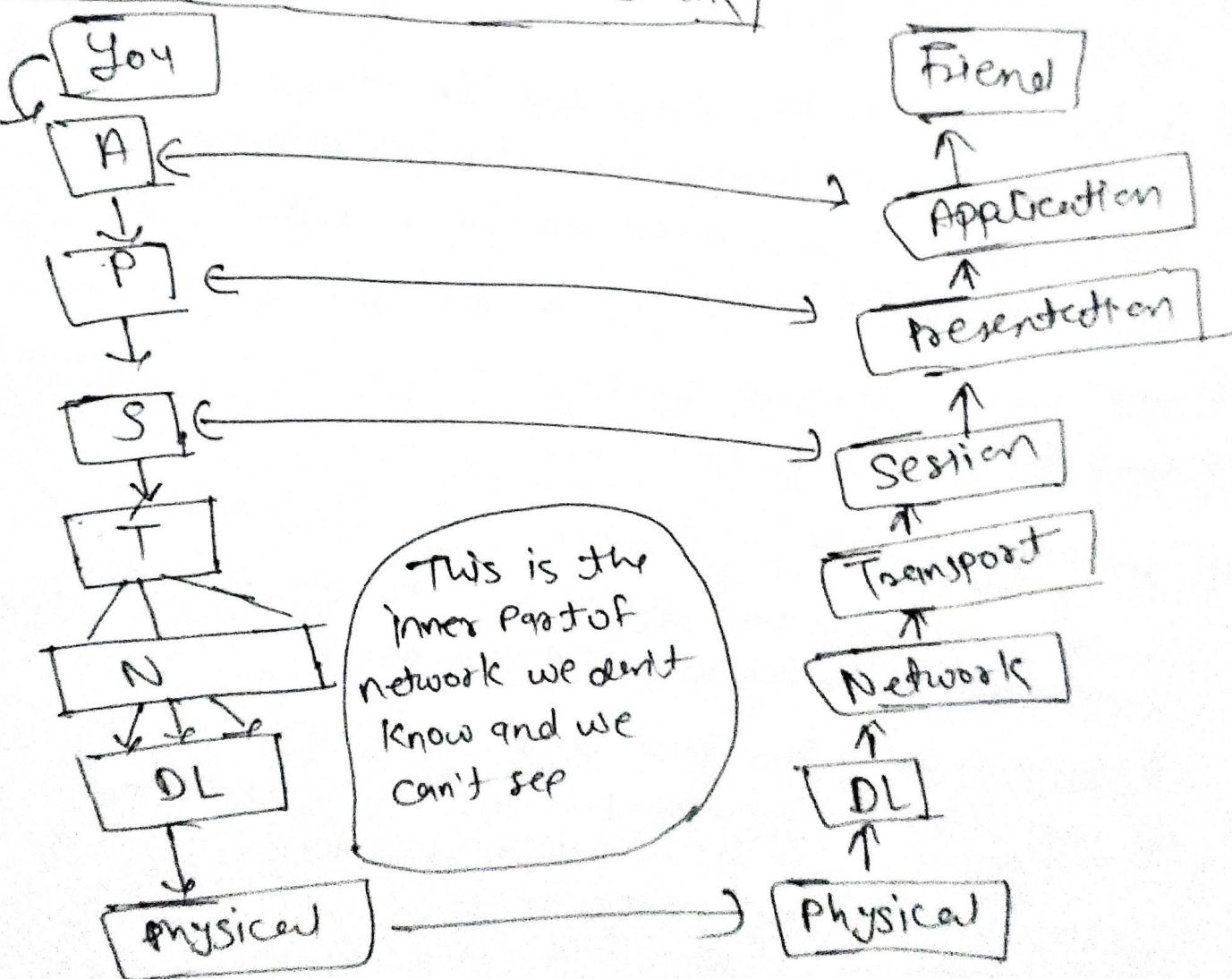
② Physical addressing  $\Rightarrow$  P.T.O.



Mach addres  $\Rightarrow$  is a 12 digit alpha numeric number of the network interface of your computer. (8)

⑦ Physical layer  $\Rightarrow$  It contain the hardware and here you have mechanical use. It's transmit bit in electrical signals.

So the actual structure of Network



Transport Layer

Another Model: TCP/IP model

In this model, they reduced layers from 7 to 5.

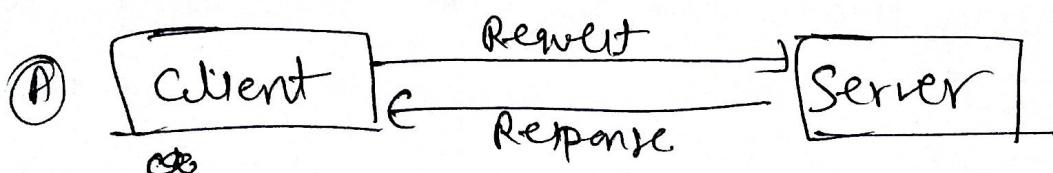
- ① Application
- ② Transport
- ③ Network
- ④ Data Link
- ⑤ Physical.

This model is more used practically  
and ODI model used for conceptually

Detail of Layer =

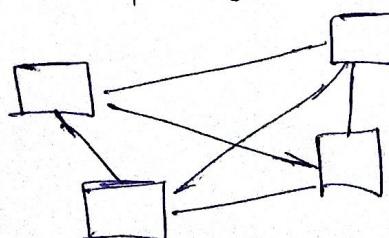
① Application Layer =

- Ⓐ This is the main layer where user interact with each other.
- Ⓑ It consists of application (web browser, msg, WhatsApp)



Ⓑ P2P → Peer to Peer

⇒ various devices, they get connected from each other.



⇒ every single computer can be used by client and server.

## Network Device we use $\Rightarrow$

①

Repeater  $\Rightarrow$  It's at the physical layer.

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Its job is to generate the signal over the same network before the signal become too weak or corrupted so as to extend the length to which the signal can be transmitted over the same network.

$\star$  An important point to be noted about repeater is that they do not amplify the signal.

$\star$  It is a 2 port device

②

Hub  $\Rightarrow$  Is basically a multiport repeater.

$\star$  A hub connects multiple wires coming from different branches.

$\star$  Active Hub  $\rightarrow$  which have their own power supply

$\star$  Passive Hub  $\rightarrow$  which supply from active hub.

③ Bridge

④ Switch

⑤ Router

⑥ Gateway

⑦ Brouter

Google these topic to learn in detail ]

#Protocol => we already define Protocol before

(11)

Now we will see type of Protocols

[Web Protocol] =>

[TCP/IP]:

- ★ HTTP
- ★ DHCP
- ★ FTP
- ★ SMTP
- ★ POP3 ↳ IMAC
- ★ SSH
- ★ VNC

Program :

WhatsApp

Process =>

Send a message

Record a video

Thread =>

set up a PPT

Open Camera

[Ports] => Ports tell which Application we are using.

[IP Address] => It tells us on which device we are working from.

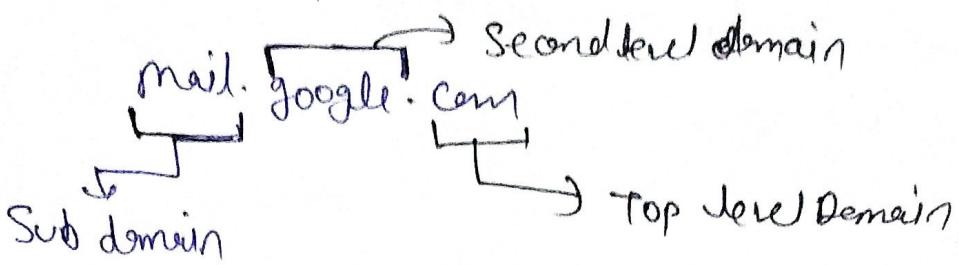
Coolie

Third Party Coolie

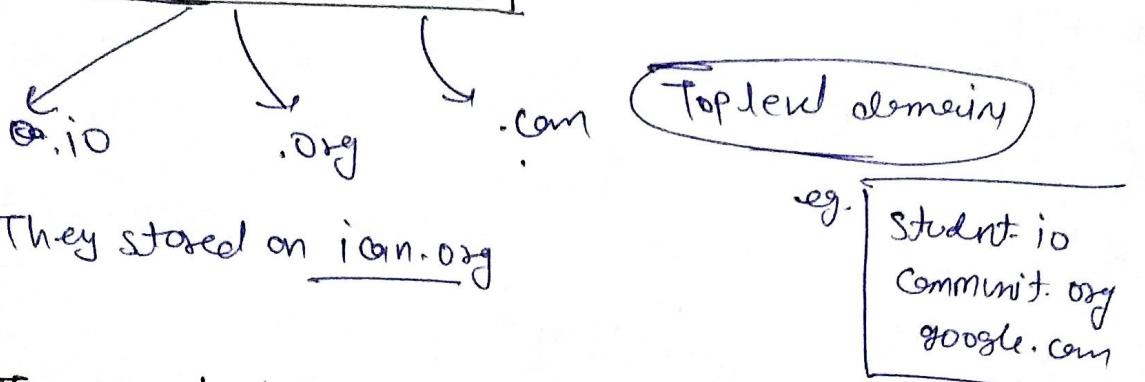
google it

DNS  $\Rightarrow$  Domain Name System.

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Root DNS server



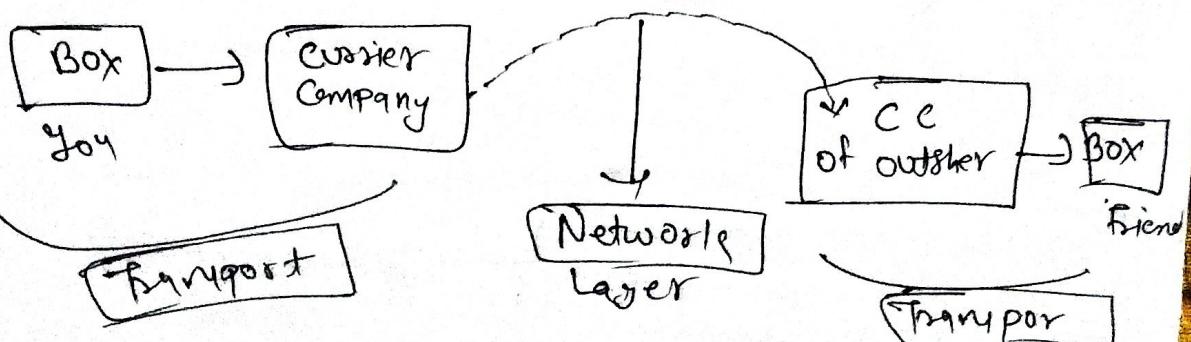
★ They stored on icann.org

② Transport Layer : TCP/IP



$\Rightarrow$  It's providing us an extraction.

$\Rightarrow$  on your device there is transport layer is.



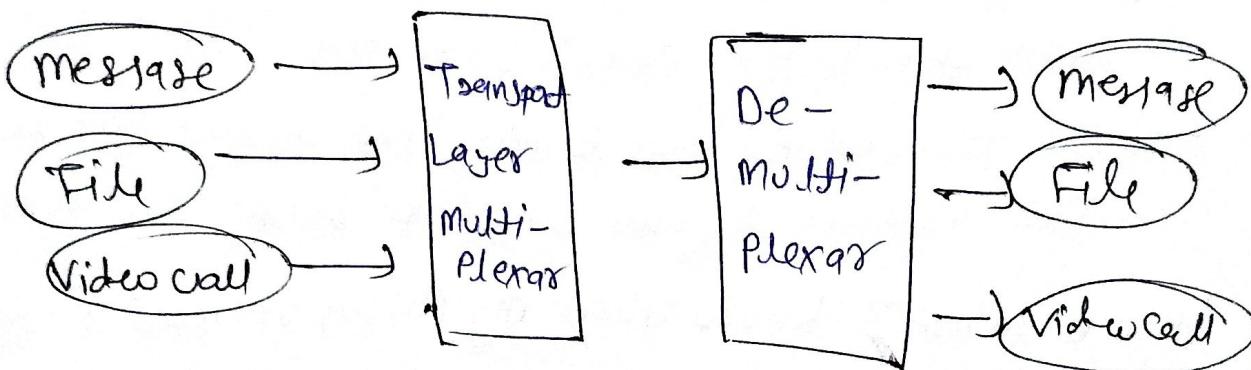
Transport Layer Protocols =

(13)

Use cases of transport layer

Multiplexing  $\Rightarrow$  allows us to send all these messages and things to a lot of destination via one medium  
 $\Rightarrow$  Transport Layer has a multiplexer

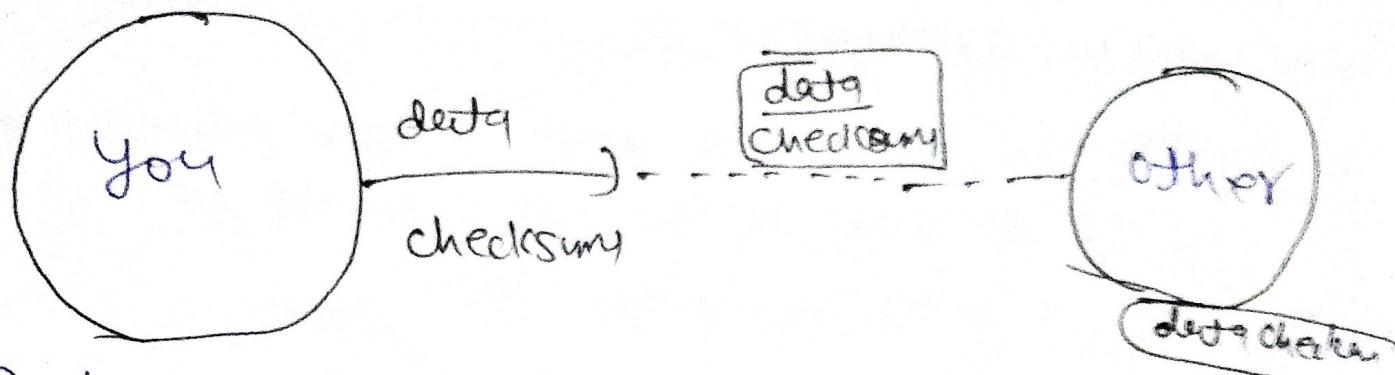
De-Multiplexer  $\Rightarrow$  It is opposite of multiplexers and send the whole data to particular destination.



- ★ Data travels in packets.
- ★ Transport Layer will attach these ~~Sockets~~ Socket port Number.
- ★ That's why it knows from where these data coming from and where it wants to send.
- $\Rightarrow$  Transport Layer also takes care of Congestion Control. (Congestion = Traffic)
- $\Rightarrow$  Congestion control algorithm built in TCP

## # Checksums ⇒

(14)



- when you send a file then your device attach a "data checksum" with it and the other place data checksum check your file.
- It is used for not breaking the message you send coz network signals travel in binary (0,1) form.

How would I know that my packets received by my friend?

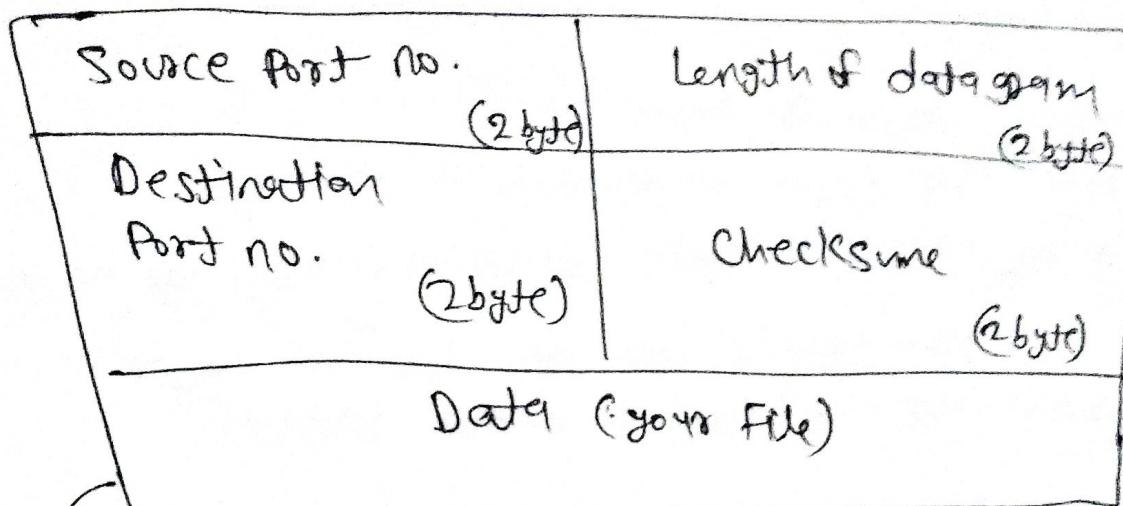
# Timer ⇒ Tcp timers are used to avoid excessive delays during communication.

# UDP ⇒ User datagram Protocol

- Your data may not be delivered
- Data may change on the way
- Data may not be in the order.
- It is a connection less protocol
- UDP uses checksum

3-way Handsh. →

## UDP Paket



Header → total size = 8 byte

Total data you can send =

$$2^{16} - 8 = 65,536 \text{ bytes}$$

\* UDP is Faster that's why we use it.

## Use cases =>

- \* It's very Fast
- \* Video call application
- \* DNS → UDP
- \* In gaming

3-way hand shake →

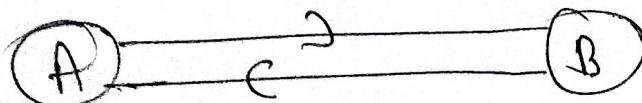
## \* TCP - Transmission Control Protocol

RE  
tk

- Transport Layer Protocol
- Application layer sends lots of raw data
- TCP segments this data - (divide in chunks, add header)
- It may also collect the data Network layer.  
Check video of Kernel on Computer Network.
- Congestion Control
- Takes care of:
  - ① when data does not arrive
  - ② maintain the order of data

### Features =

- \* Connection oriented
- \* Error Control
- \* Congestion Control
- \* Full Duplex ⇒ Two computers connect with each other and you both can send files at the same time.

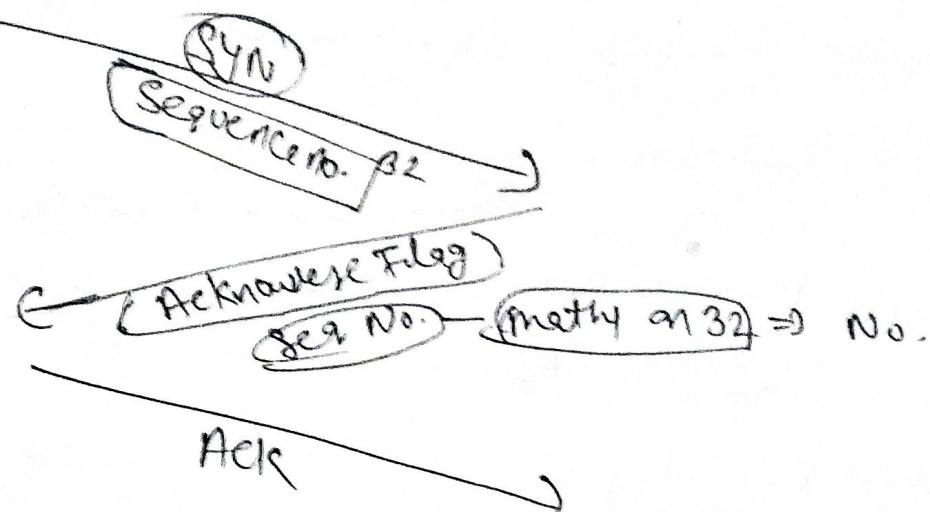


3-way hand shake  $\Rightarrow$

(1)

Client

Server



## Network Layer

- $\Rightarrow$  In Network layer, data travel in Packets.
- $\rightarrow$  Here we work with Routers.
- $\rightarrow$  Many Routers connected with each other.
- $\rightarrow$  It will contain the network layer address (of the destination, of the person who is sending and what you are sending)

## Control Panel:

Router  $\longrightarrow$  Node  
Link  $\longrightarrow$  Edge

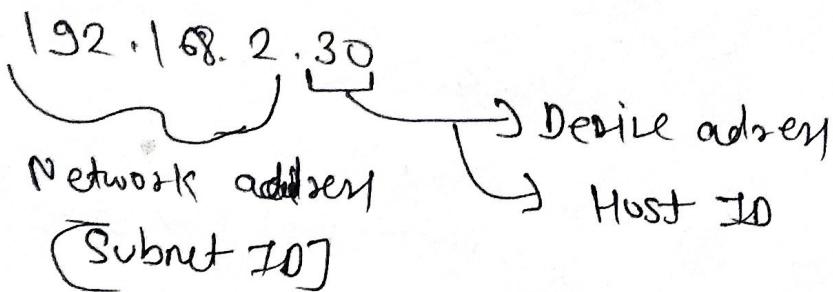
$\leftarrow$  These are two type of Router  $\Rightarrow$

- ① static Routing
  - & manually add all routes.
- ② Dynamic Routing

## Internet Protocols (IP)

(14)

IP v4 → 32 ~~bits~~ bits number with 4 words.  
IP v6 → 128 bits (future version)



## Reserved Address ⇒

[127.0.0.0/8]

ex =) Local Host : 127.0.0.1  
loop back address

Packets ⇒ Header is of 20 bytes

IP version, length, identification no., Flag, protocol  
checksum, address ~~etc~~, TTL, etc

Header contains

## Middle Boxes:

① Firewall → Global Internet

→ Your Trusted Network

Filters out IP packets based on various rules

- Address
- Modify packets.
- Port no.
- Flags
- Protocols

These are two type of firewalls

① Stateless

② Stateful → more efficient

↳ It see the packet and maintain for future

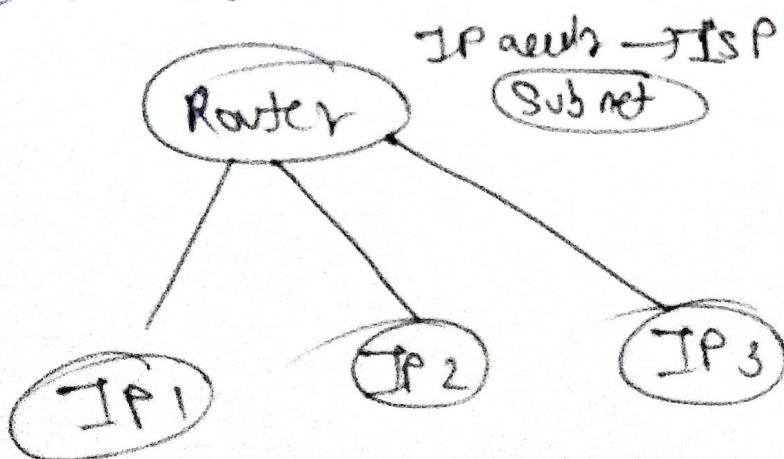
## Network Address Translation

Google it the theory man. on wiki-Pedia

Let's learn the last layer =) 😊

### Data Link Layer

→ Data Packets we received from the network layer  
Link layer is responsible to send this data to connected devices



→ Every device that will have an IP add thy  
have data link layer add too.

- Address
- Modify packets.
- Port no.
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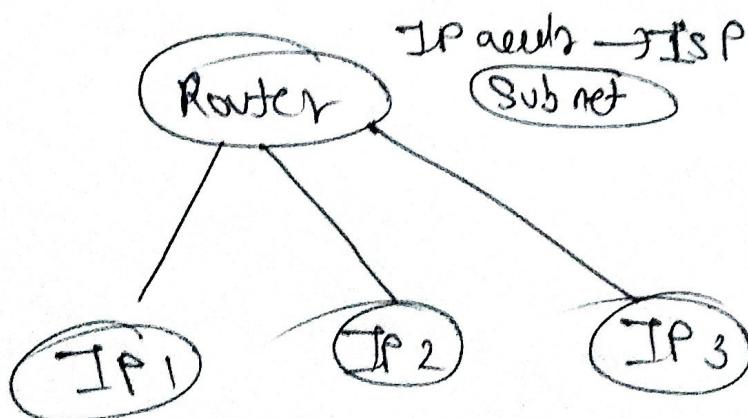
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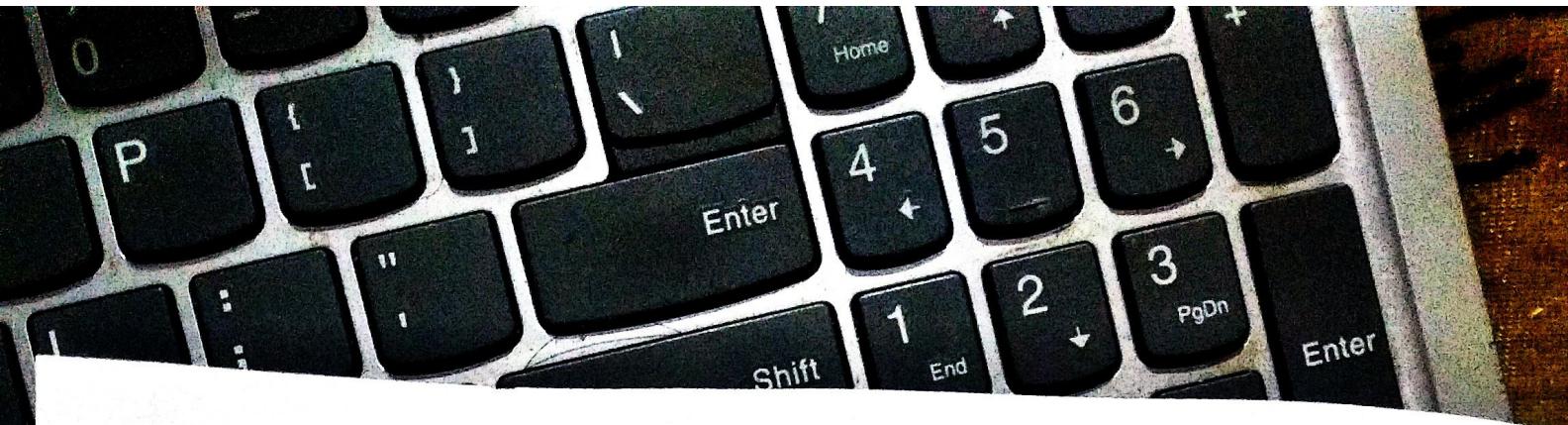
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You can read about these too =)

- 
- ① Framing
  - ② Error Detection.