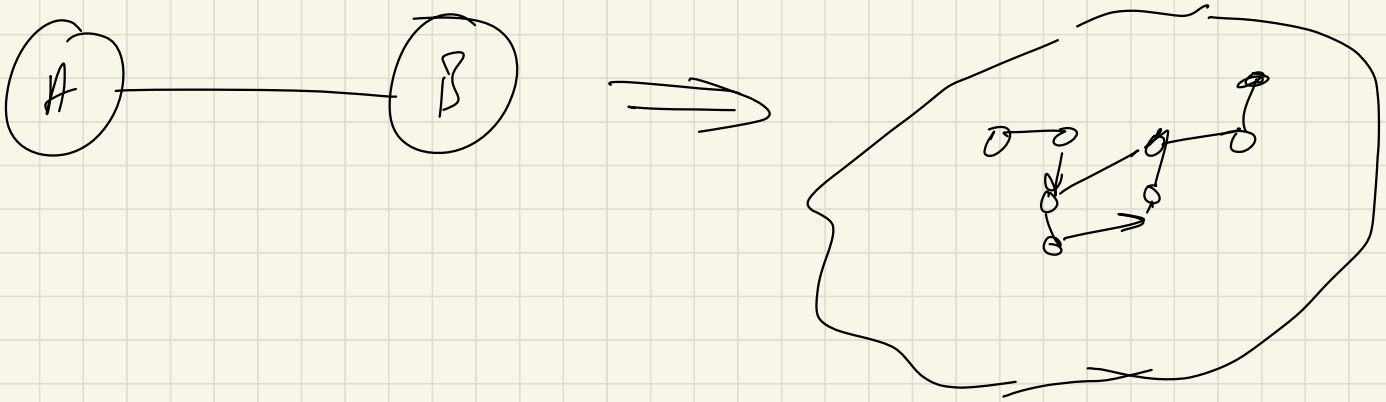
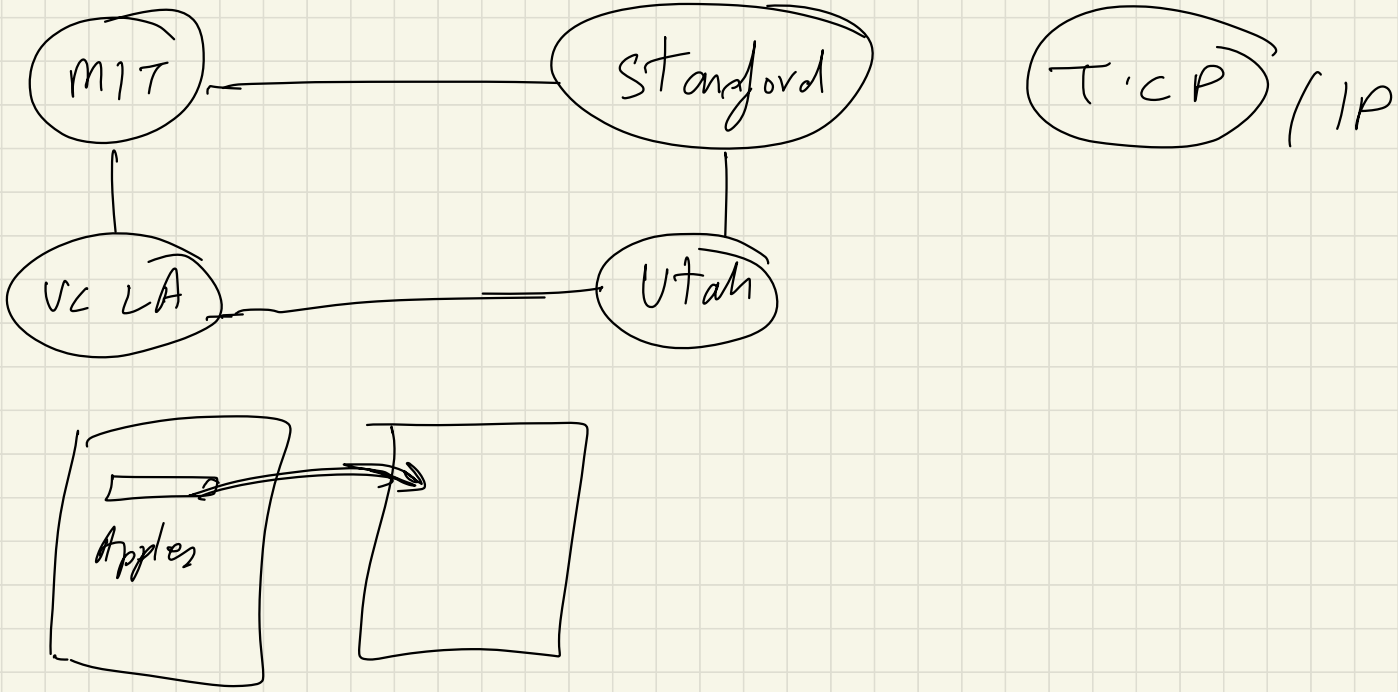
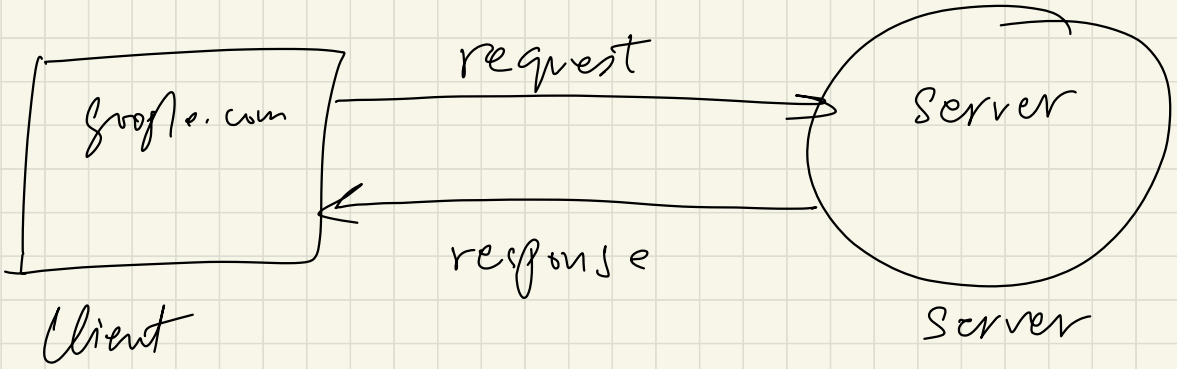
Computer Networking Course



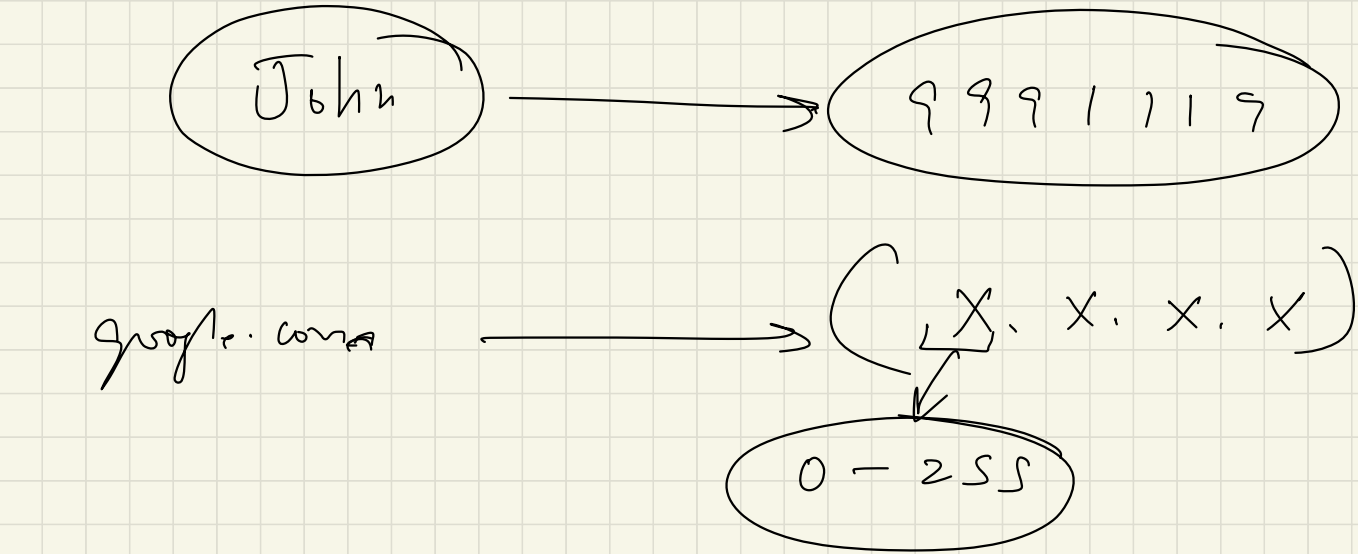
How did it start?

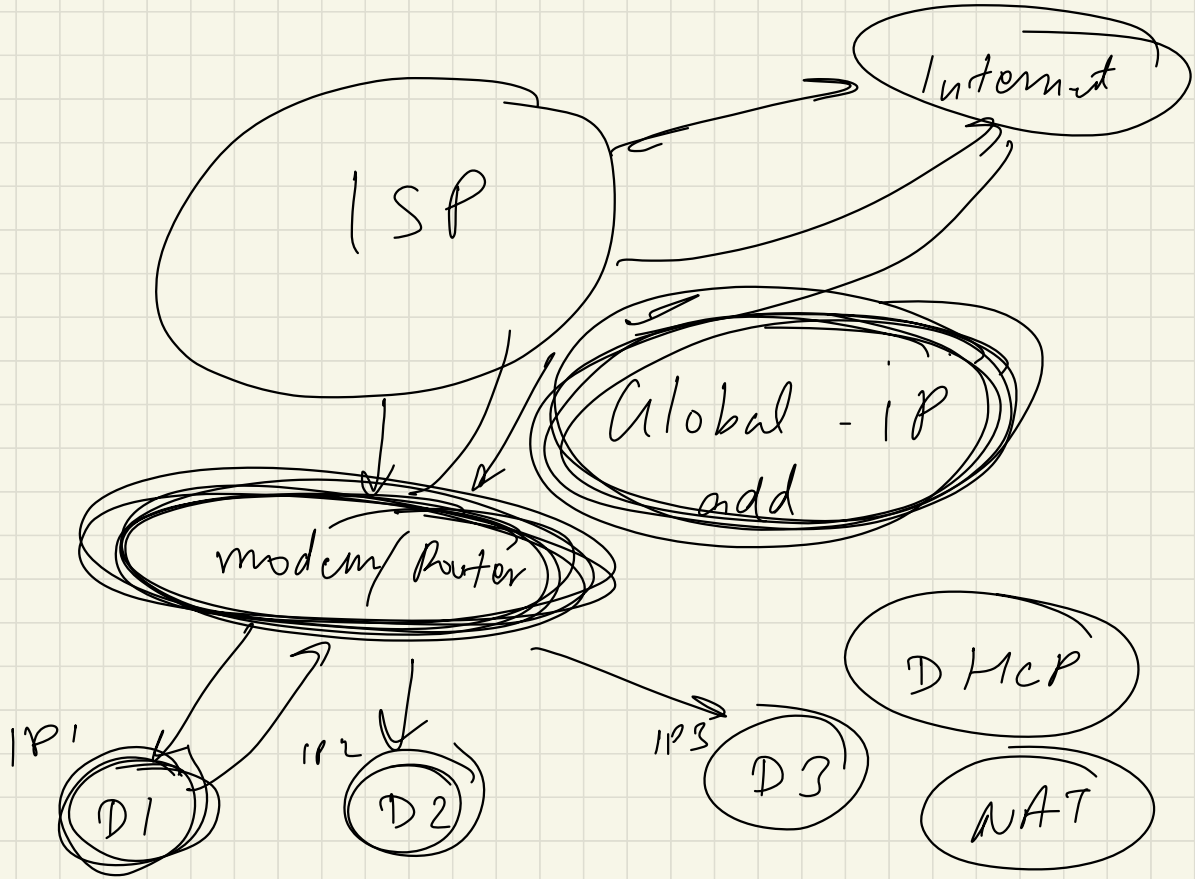




TCP, UDP, HTTP

Packets


John
9991119
google.com
(X. X. X. X)
0 - 255
$ curl ifconfig.me -s


Internet
ISP
Global - IP
add
modem/Router
DHCP
NAT
IP1
IP2
IP3
D1
D2
D3

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

HTTP = 80

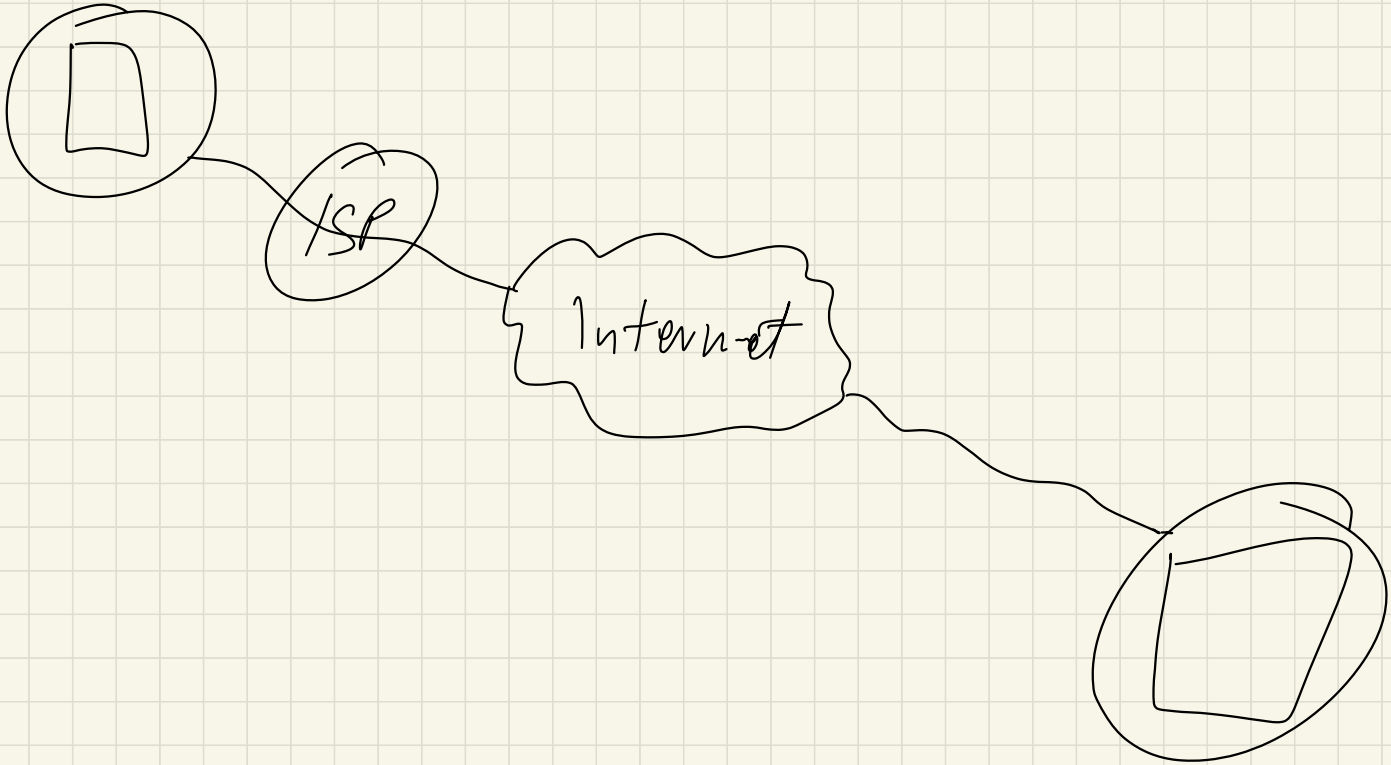
MongoDB = 27017

SQL = 1433

0 — 1023
reserved ports.

1024 — 49152
applications

remaining → you can use.


ISP
Internet

1 mbps = 1000000 bits/s

1 gbps = 10^9 bits/s

1 kbps = 1000 bits/s

Physically: optical fibre cables, Coaxial Cables

Wireless: Bluetooth, wifi, 3G, 4G LTE, 5G

LAN : Small house / Office

Ethernets, wiji

MAN : Across a city

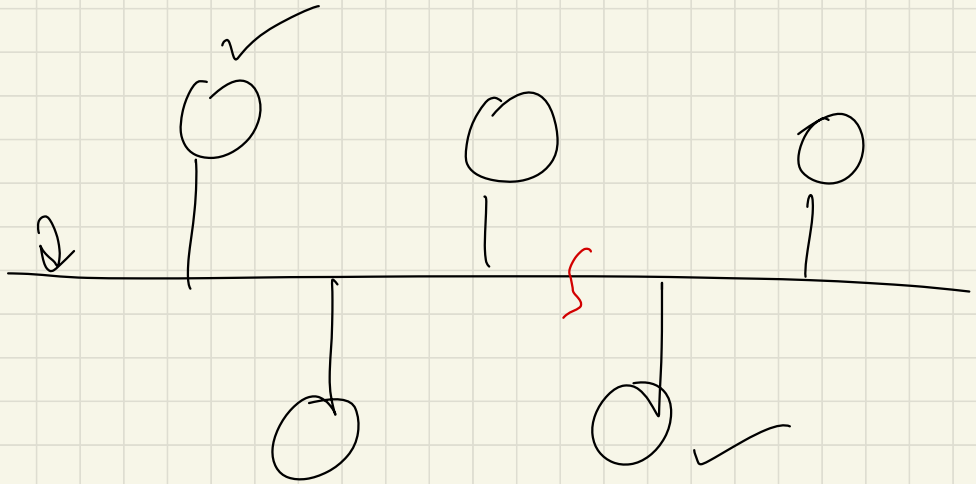
WAN : Across countries

optical fibre cables.

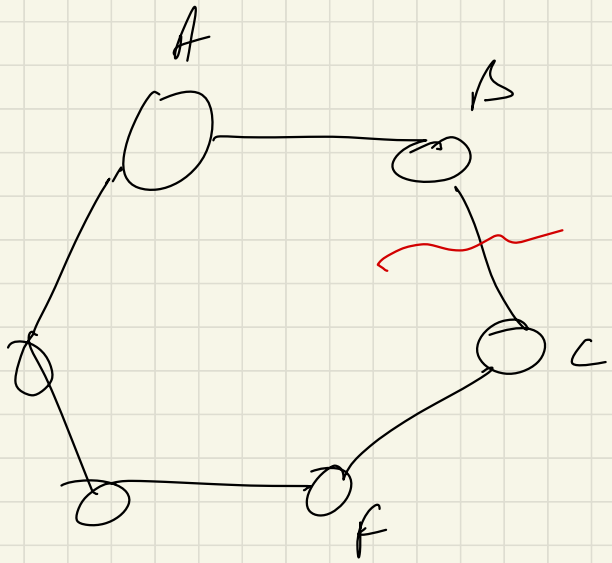
1. SONET
2. frame relay

Topologies:

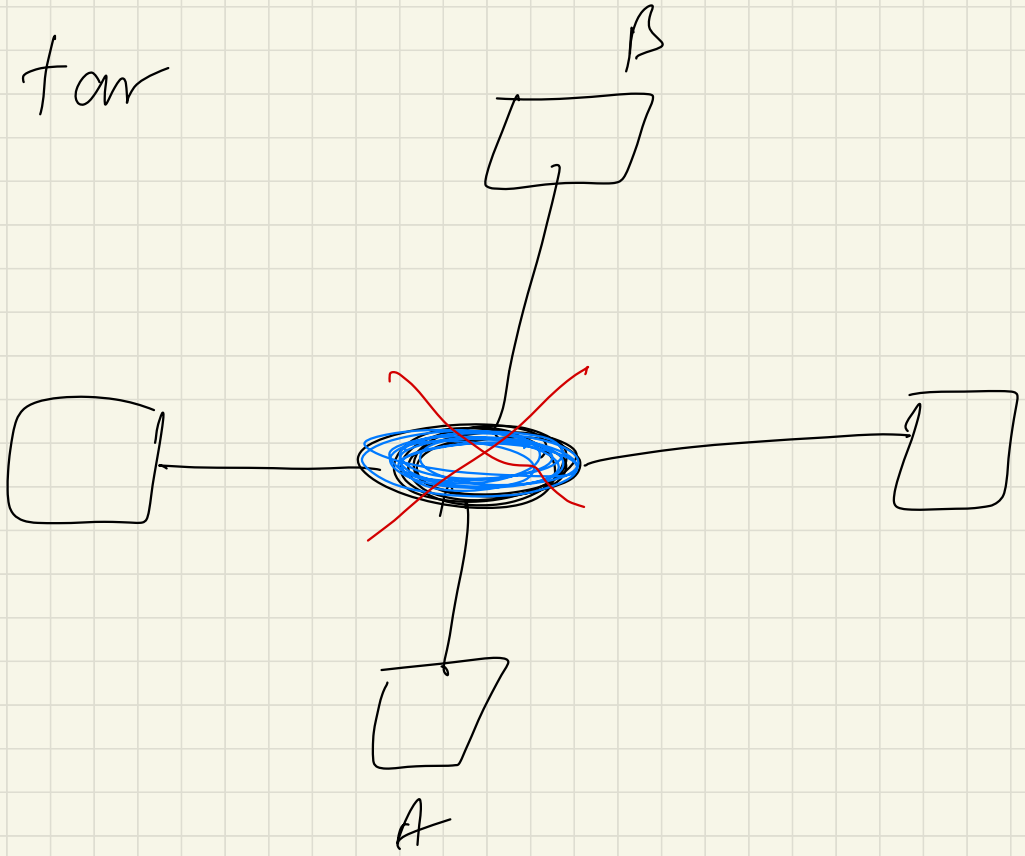
1. BUS



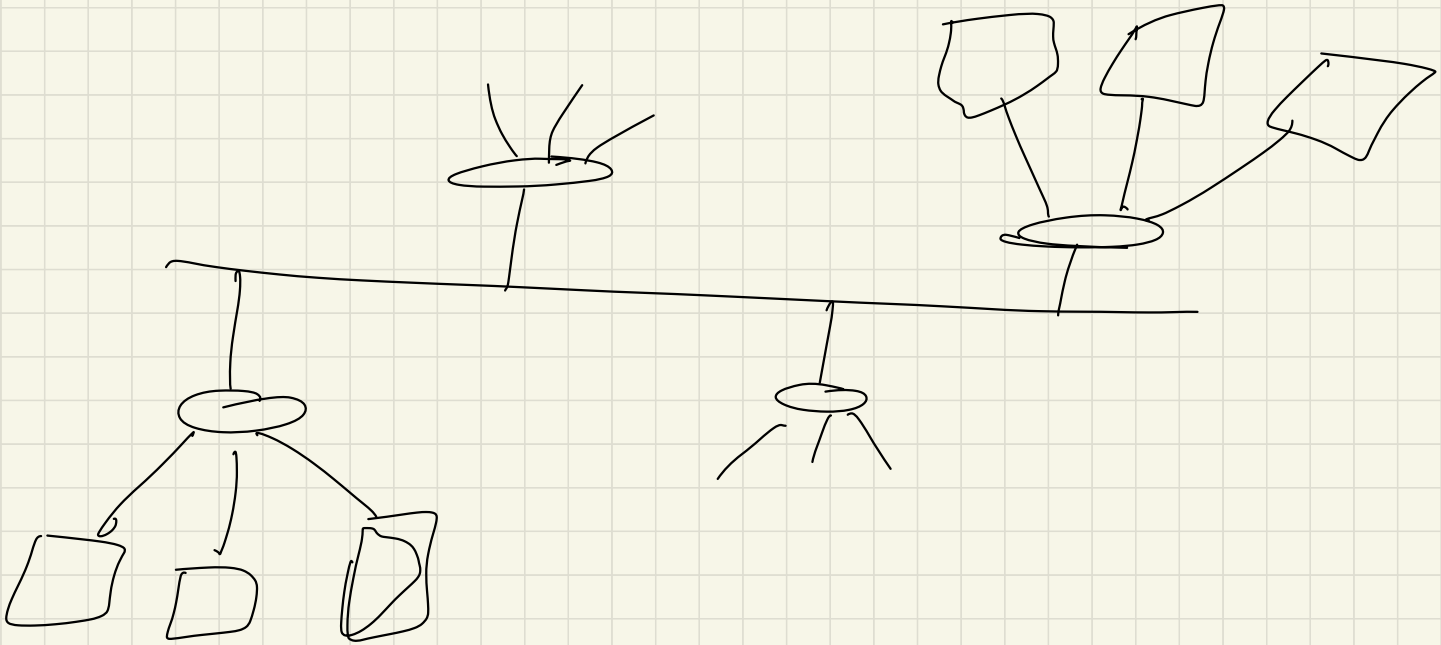
(2) Ring



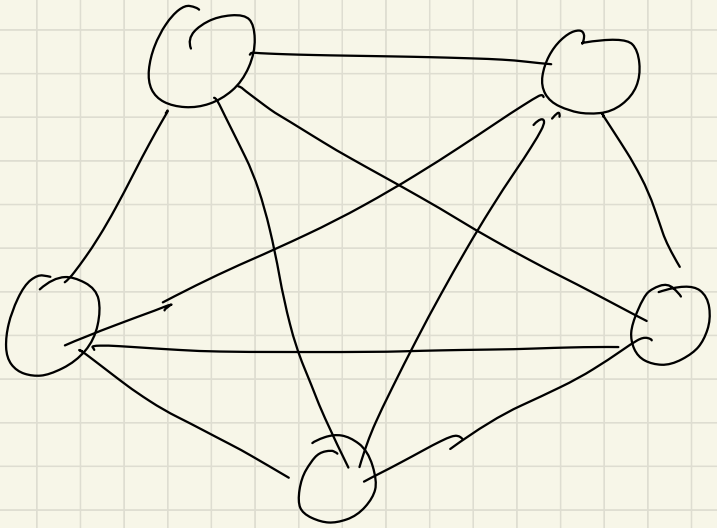
(3) Star



④ Tree (Bus - star)

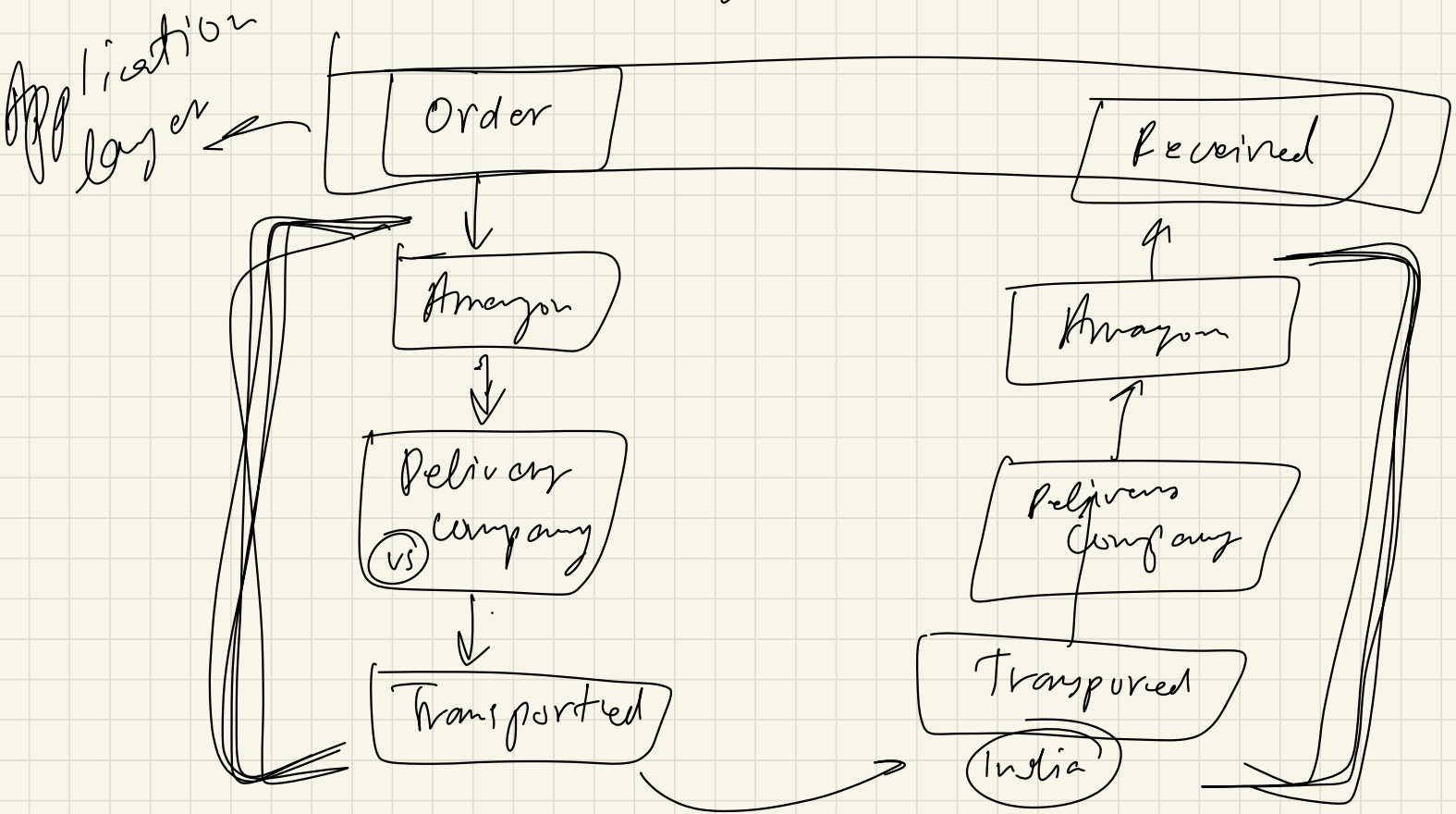


5 Mesh



- Expensive
- Scalability issues

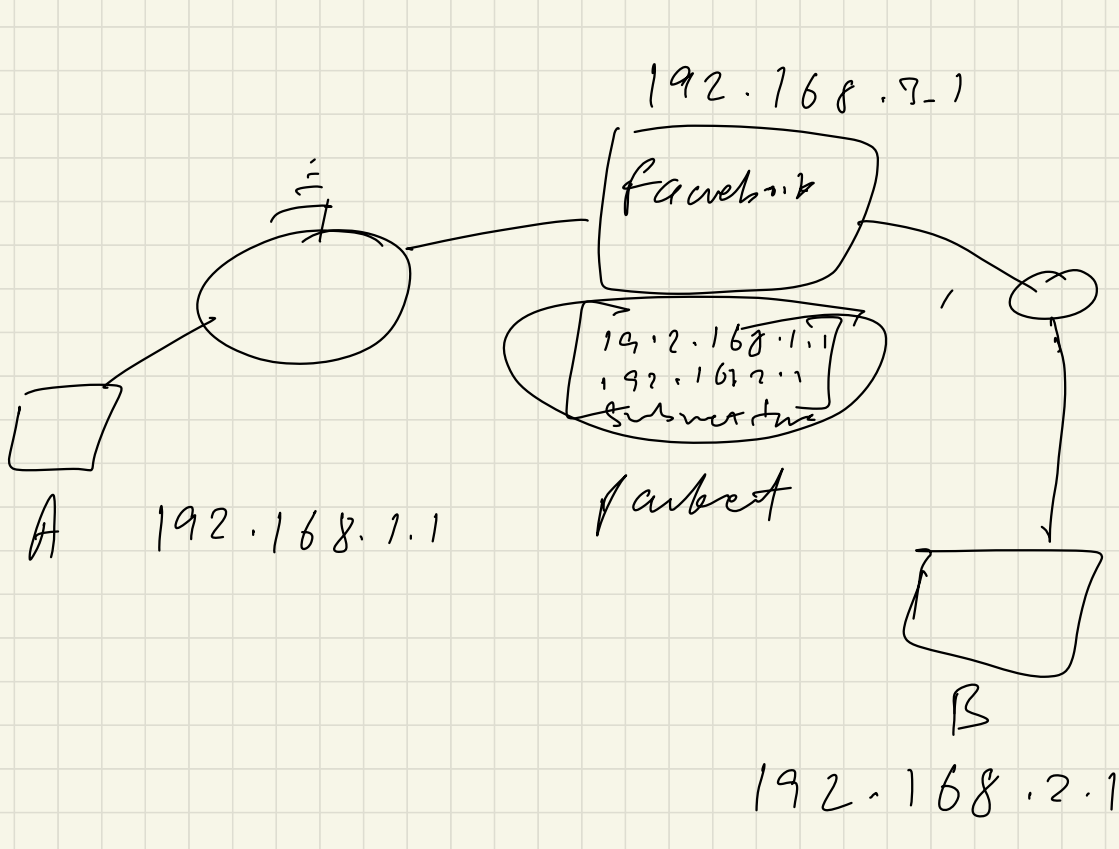
Structure of the Network

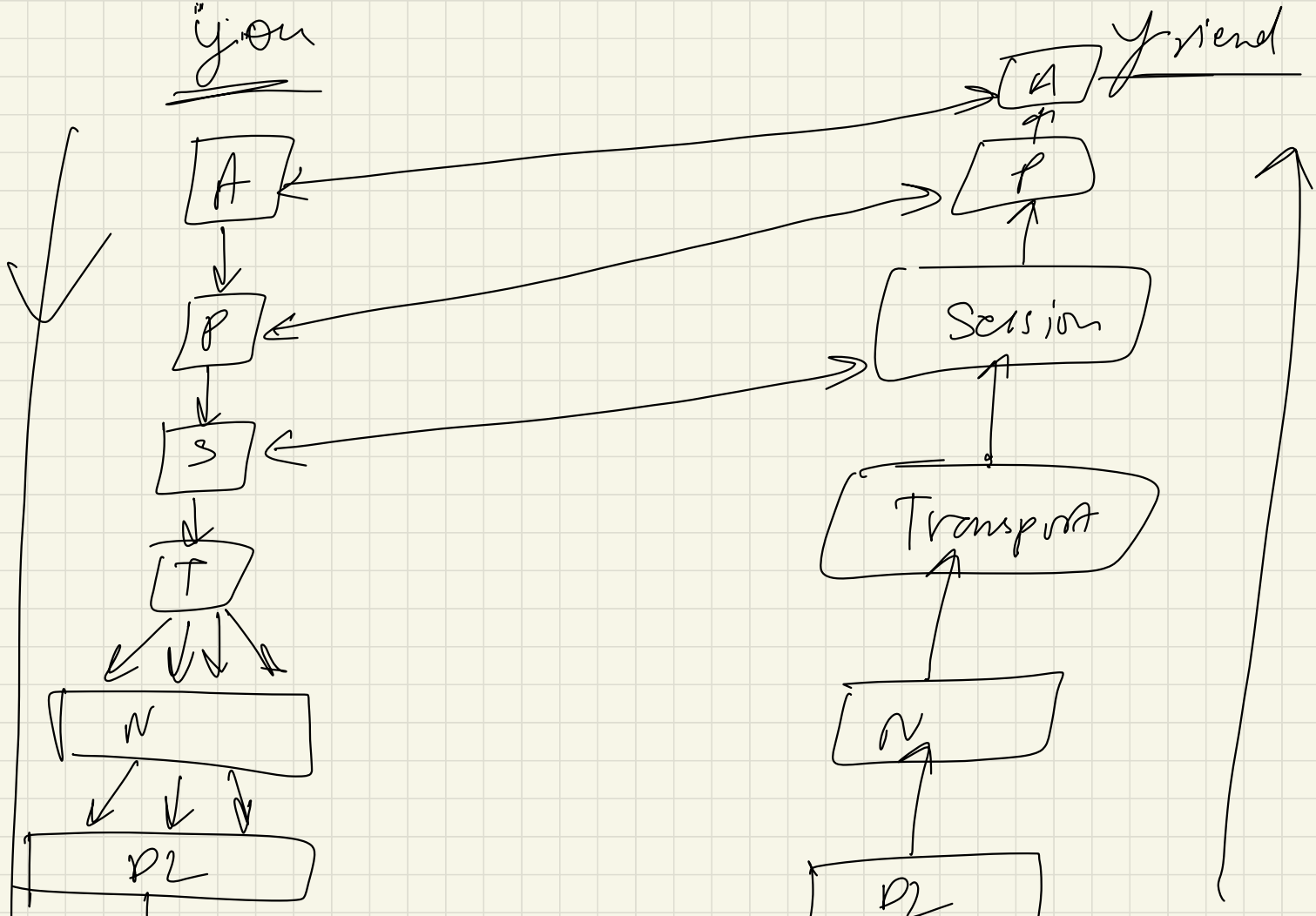


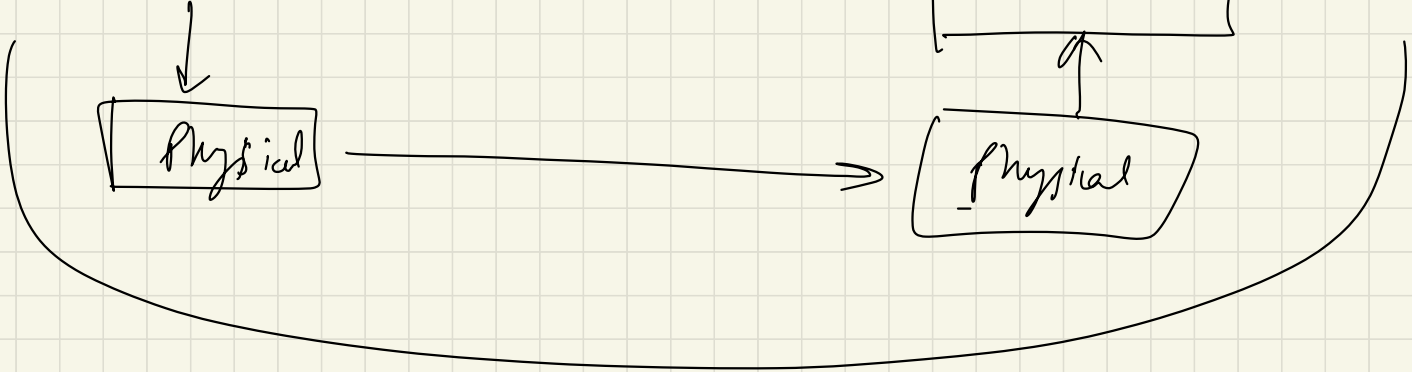
OSI Model

// make your own notes from video.

Application
↓
Presentation
↓
Session
↓
Transport
↓
Network
↓
Data Link
↓
Physical




A
P
S
T
N
P2
A
P
Session
Transport
N
P2



Another model : TCP/IP model

Application

Transport

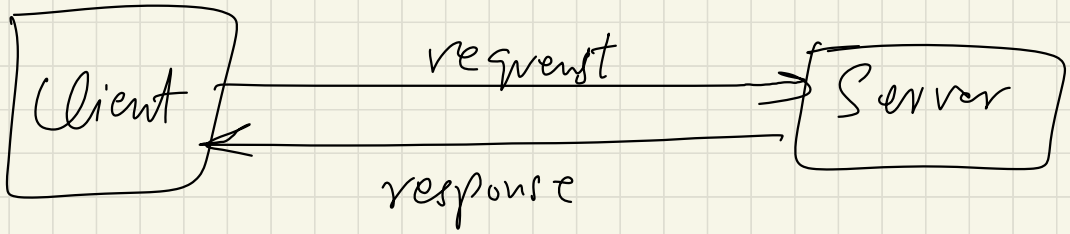
Network

Data Link

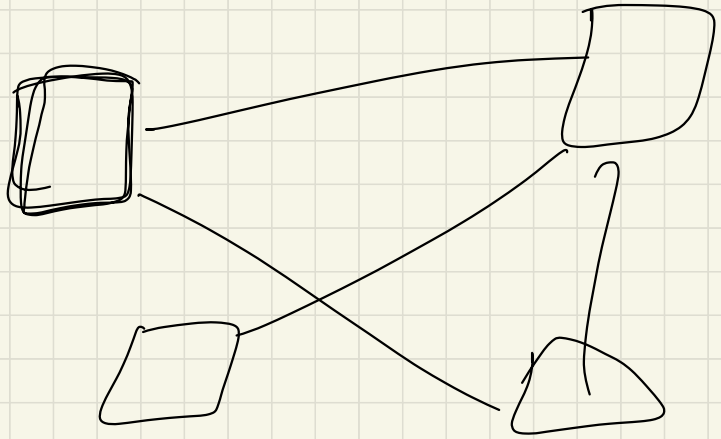
Physical

(1) Application layer :

- Users interact
- Whasapp, Browsers, etc.
- where : Devices.
- Protocols
- Client - Server Architecture

① 

② P2P



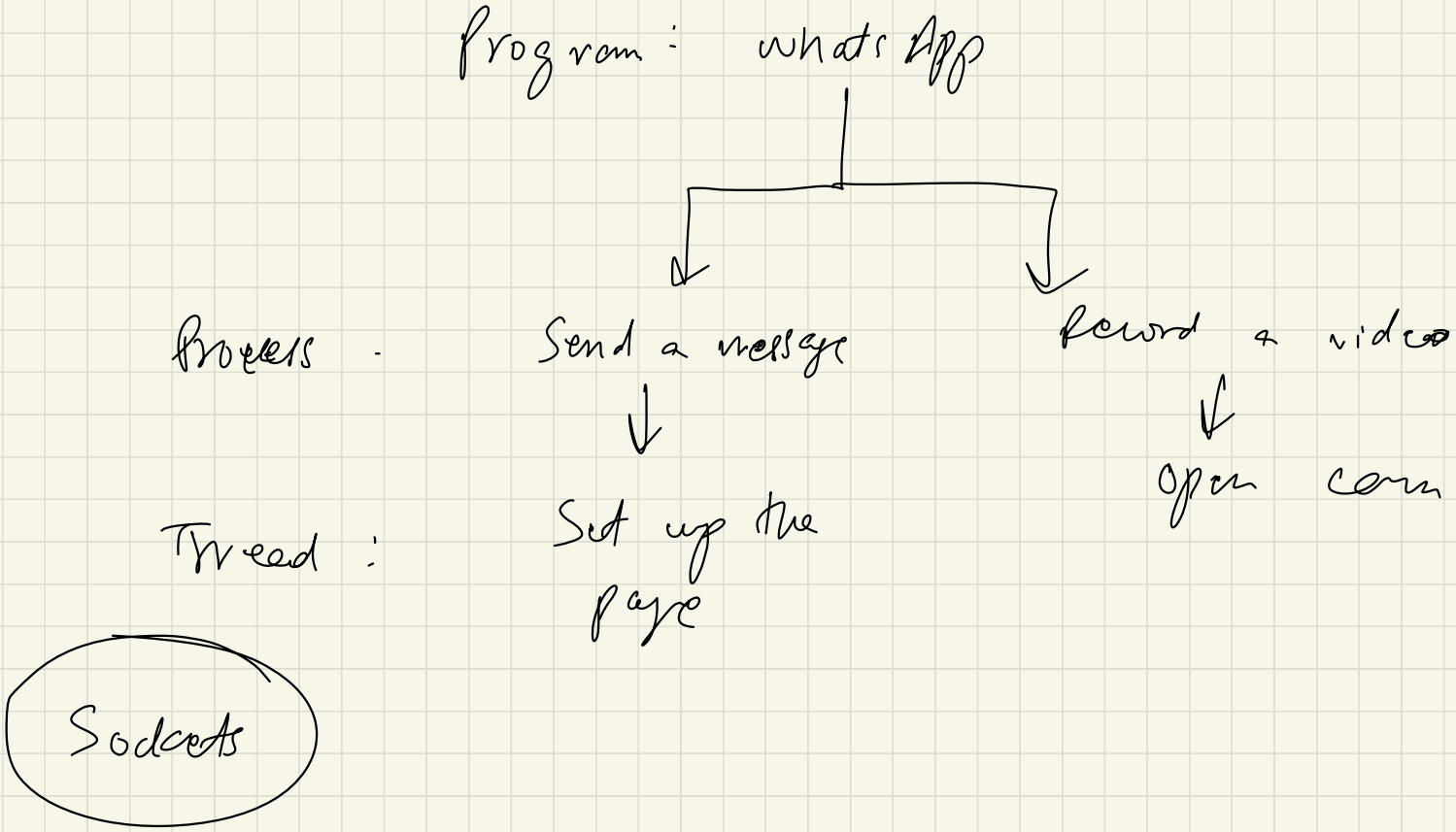
Protocols:

Web protocols:

TCP/IP:

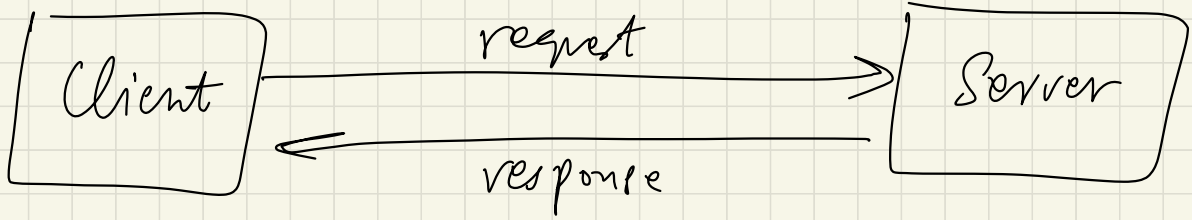
- HTTP
- DHCP
- FTP
- SMTP
- POP3 & IMAC
- SSH
- VNC
- Telnet : Port 23

UDP : Stateless connection



Ports: Ephemeral ports.

HTTP



application layer.

HTTP user TCP → Transport layer

→ stateless

HTTP methods:

1. GET
2. POST
3. PUT
4. DELETE

Status Codes:

- 1xx → Informational
- 2xx → Success
- 3xx → redirecting
- 4xx → Client error
- 5xx → Server error

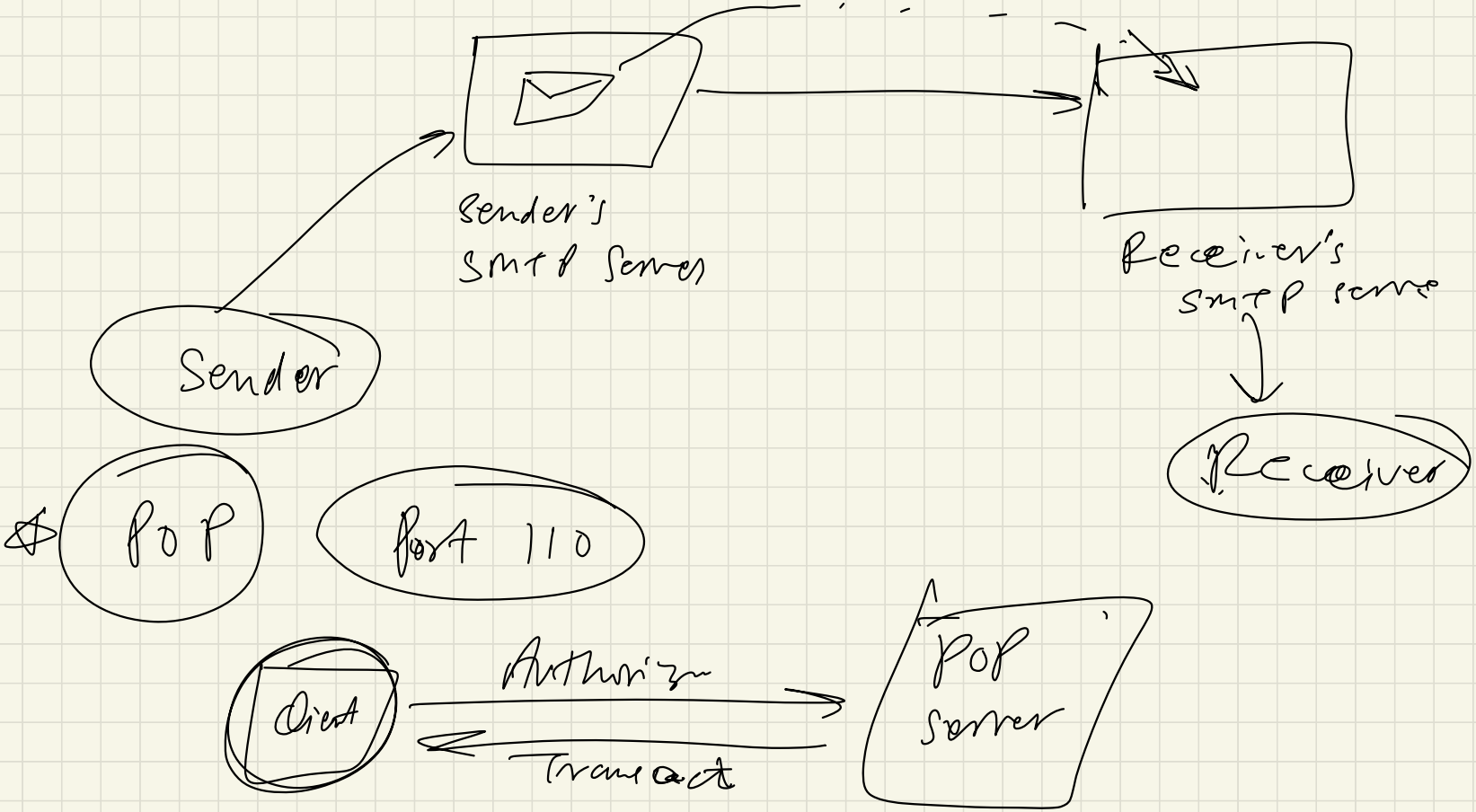
Cookies: Unique String.

Stored in my browser.

⇒ Third party cookies

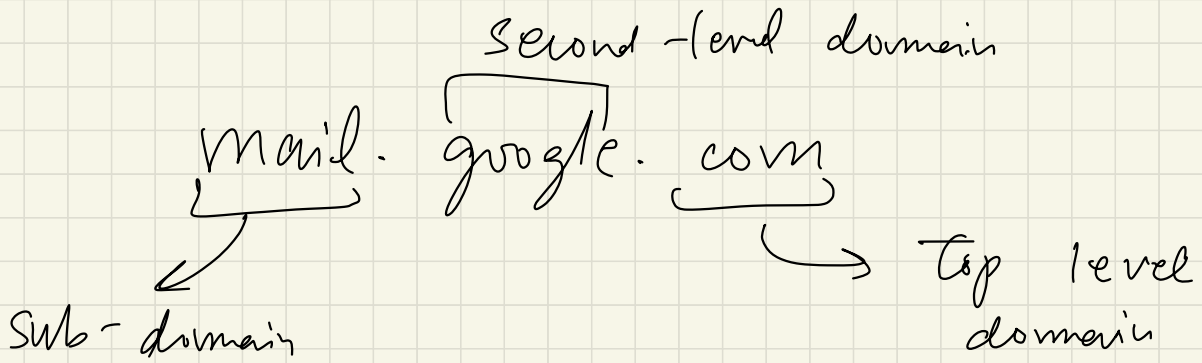
How email works?

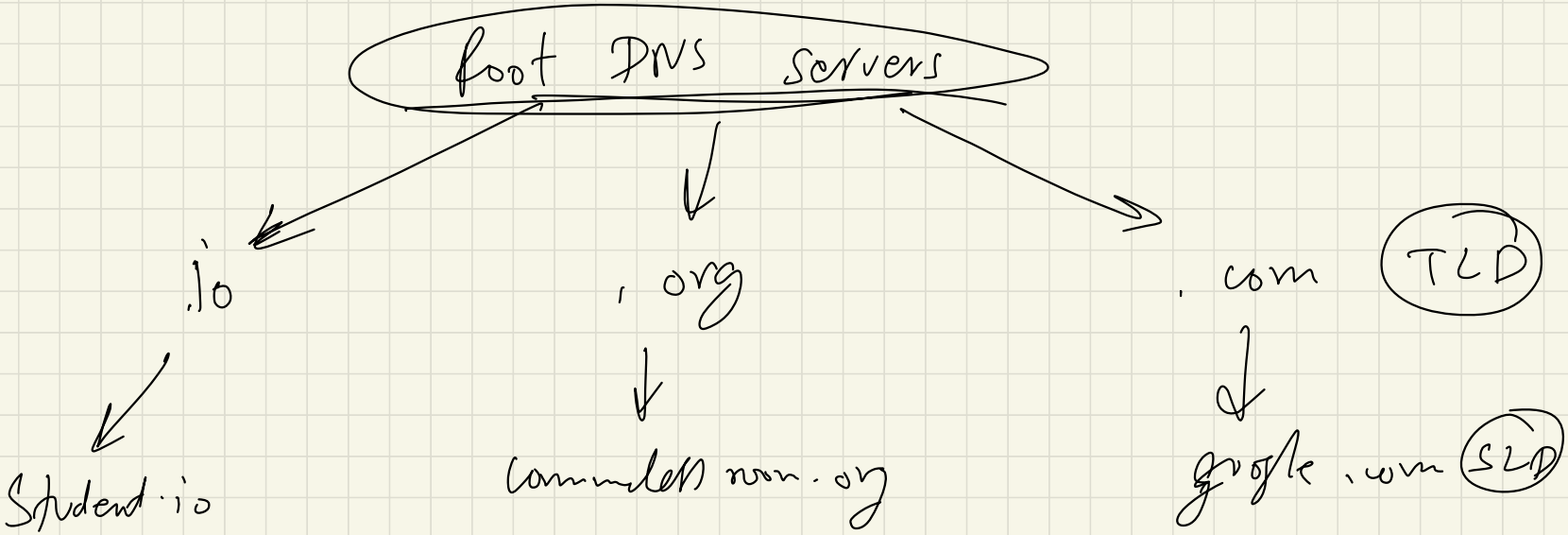
SMTP, POP3

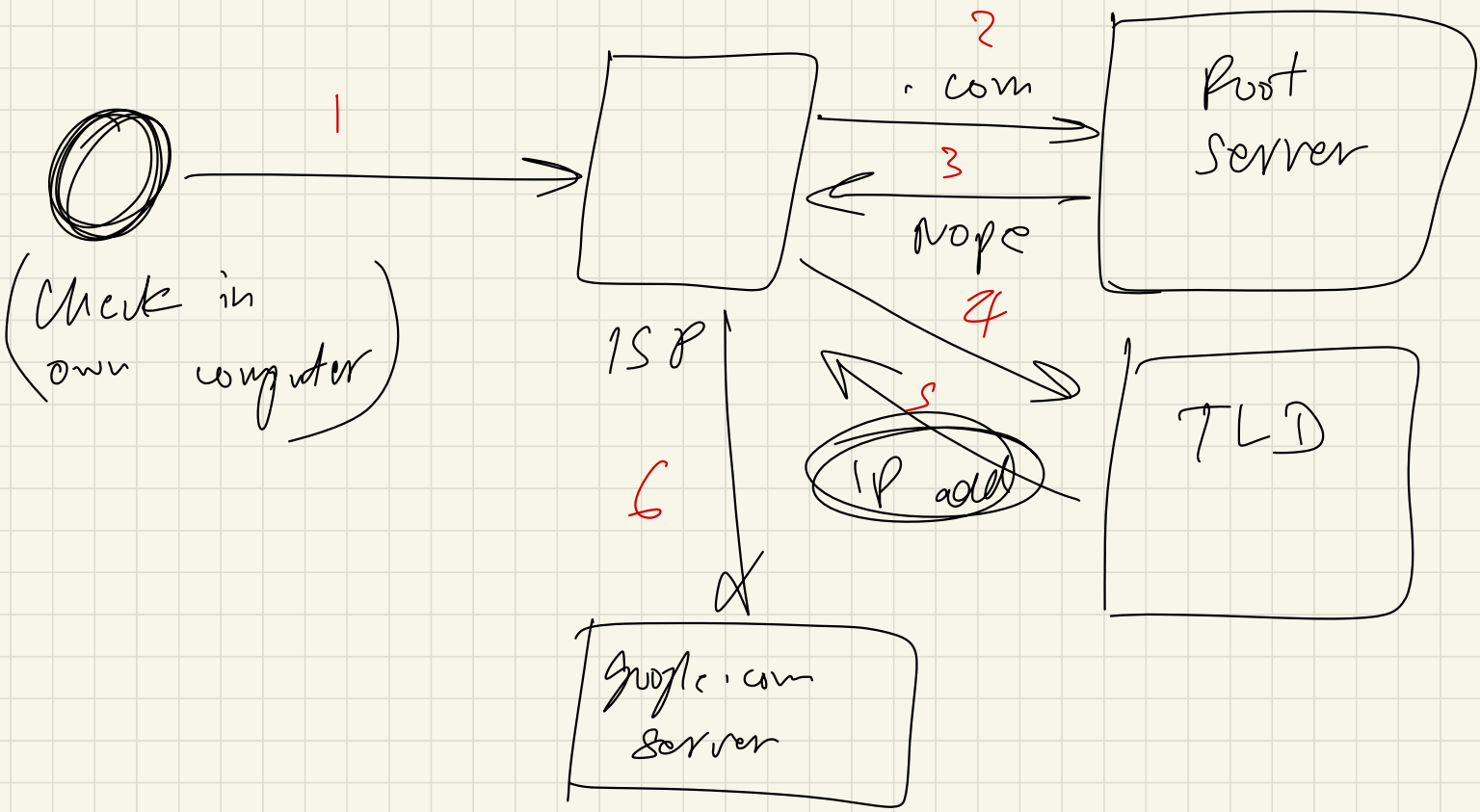

Sender's
SMTP Server
Receiver's
SMTP server
Sender
Receiver
POP
Port 110
Client
Authorize
Transact
POP
Server

IMAP

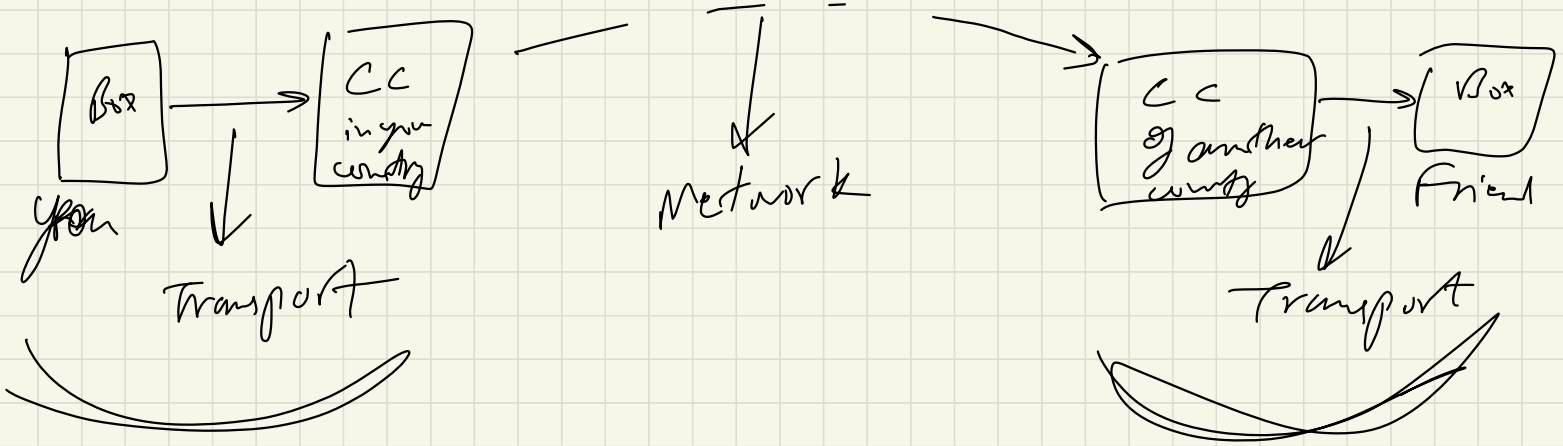
DNS : Domain Name System

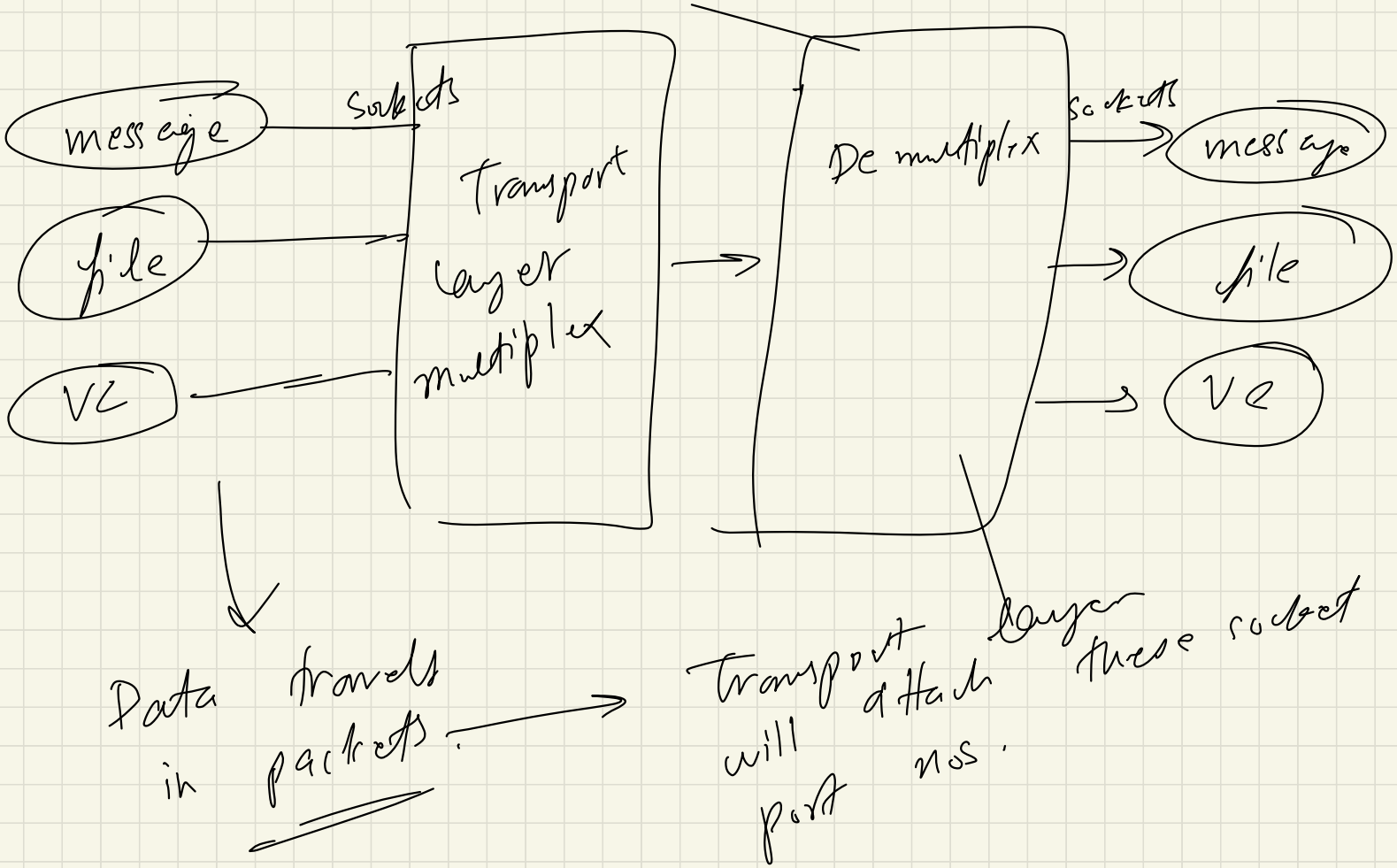



Root DNS servers
.io
.org
.com
TLD
Student.io
commonlounge.org
google.com
SLD


1
(Click in own computer)
2
.com
Root Server
3
nope
ISP
4
5
IP add
TLD
6
google.com server

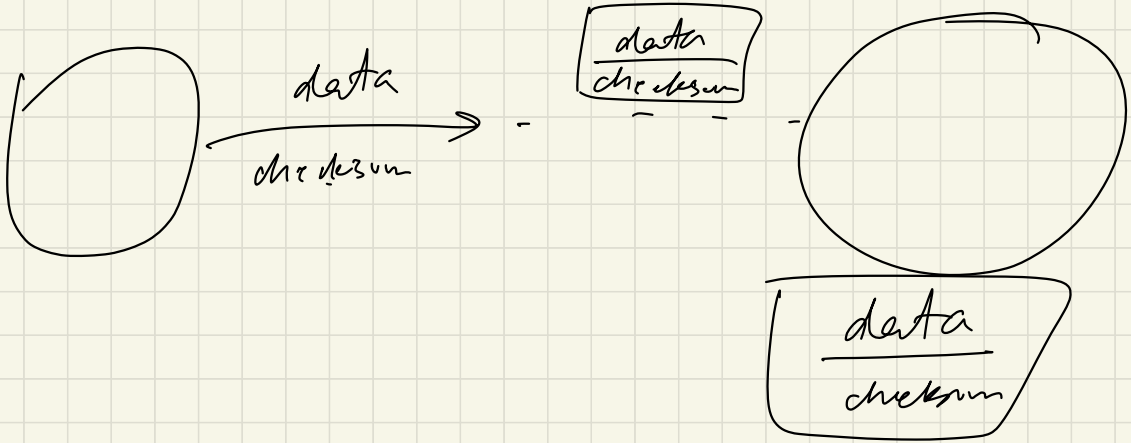
② Transport layer



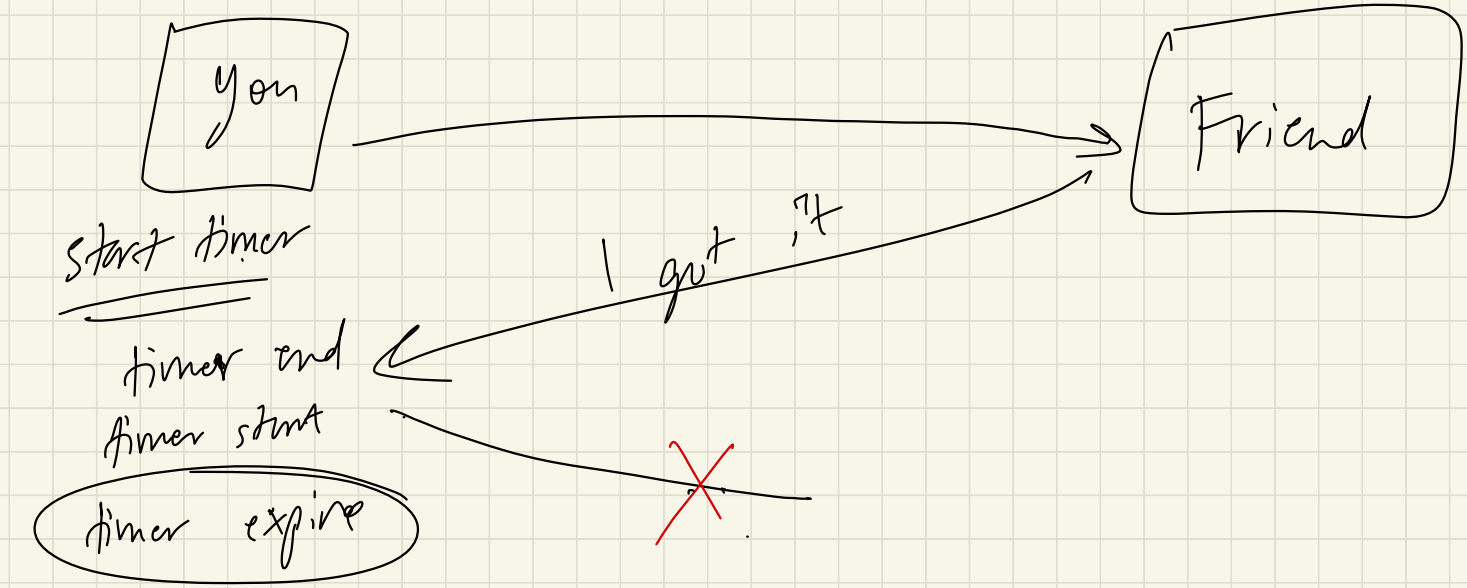

message
file
VC
sockets
Transport layer multiplex
De multiplex
sockets
message
file
VC
Data travels in packets.
Transport layer will attach these socket port nos.

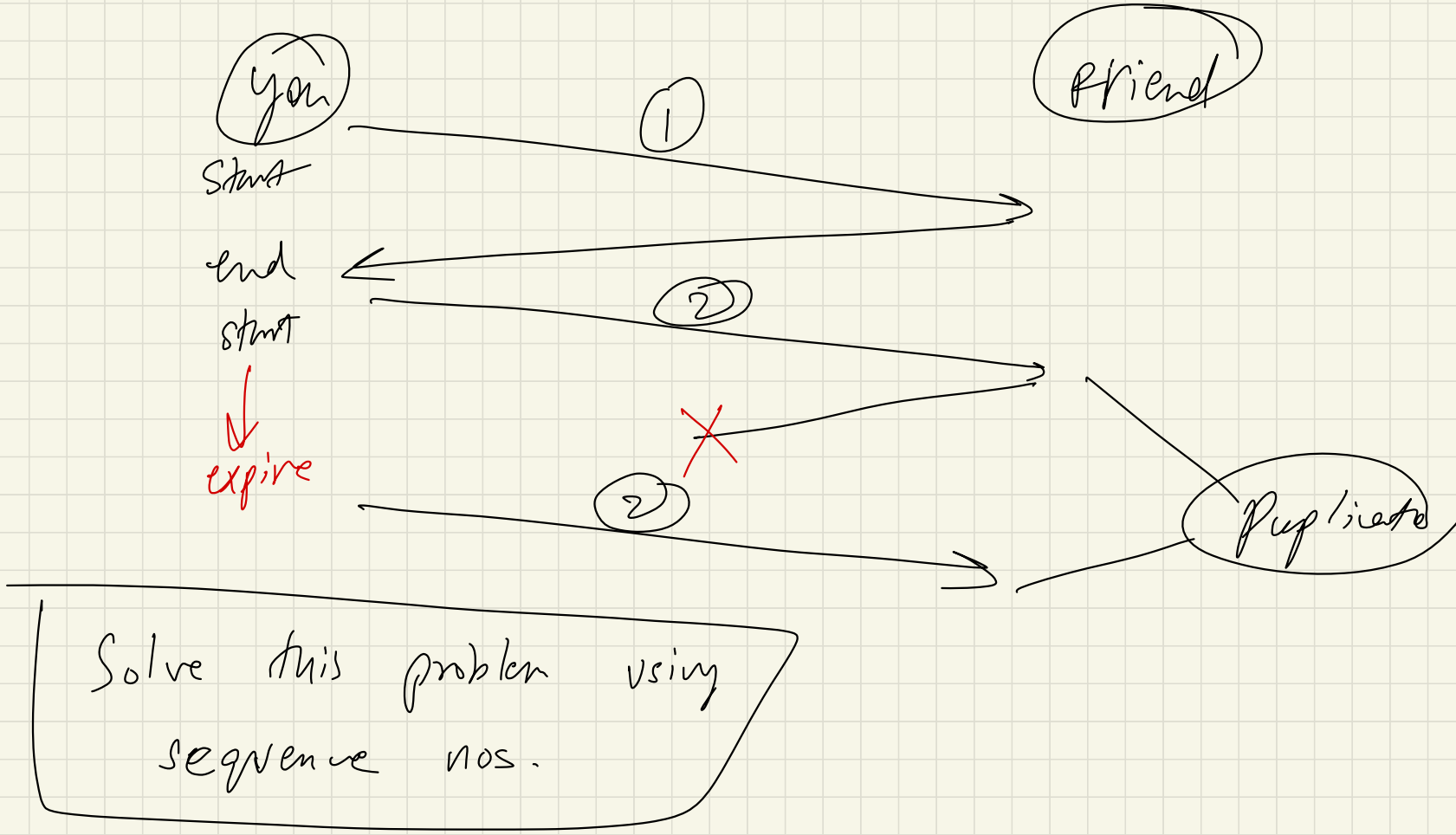
- Transport layer also takes care of congestion control.
- Cong. control algorithms built in TCP.

Checksums:



Timers:


you
Friend
start timer
I got it
timer end
timer start
timer expire


You
Start
end
start
expire
1
2
2
Friend
Duplicate
Solve this problem using sequence nos.

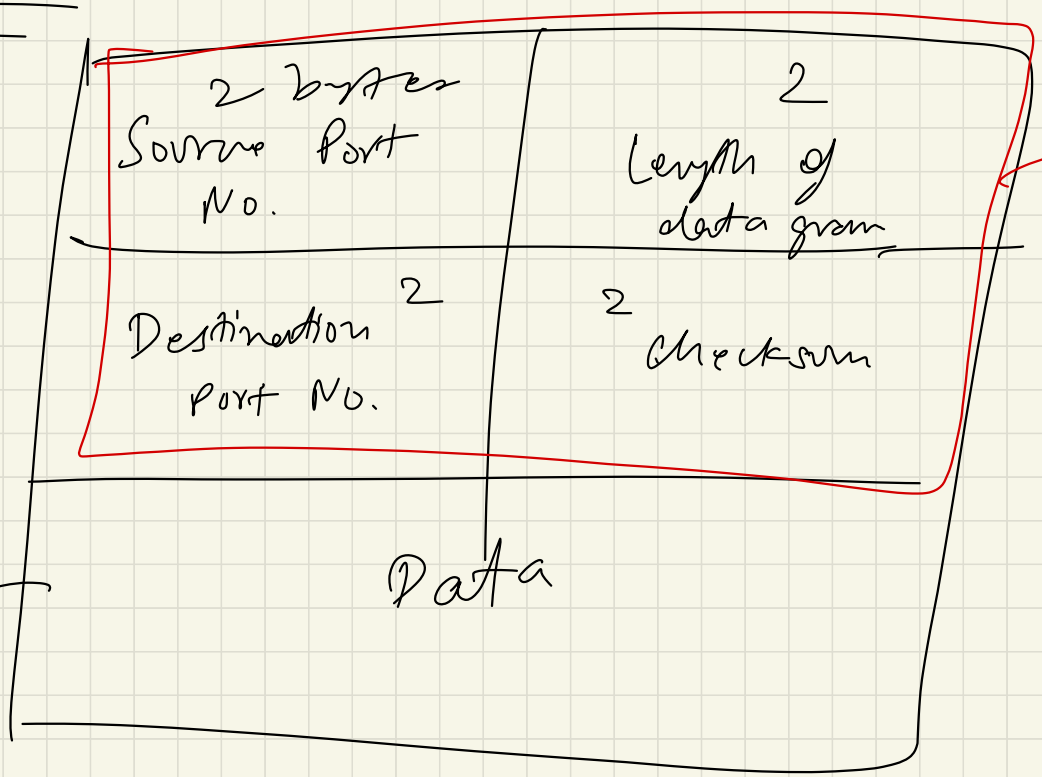
UDP – User Datagram Protocol

- Data may or may not be delivered.
- Data may change
- Data may not be in order

Connectionless

UDP uses checksums.

UDP Packet:



Total size

16

$= 2$

16

$2 - 8$

$= 65,536$ bytes

Uses Cases :

- Its very fast
- Video conf apps
- DNS → UDP
- Gaming

TCP – Transmission Control Protocol

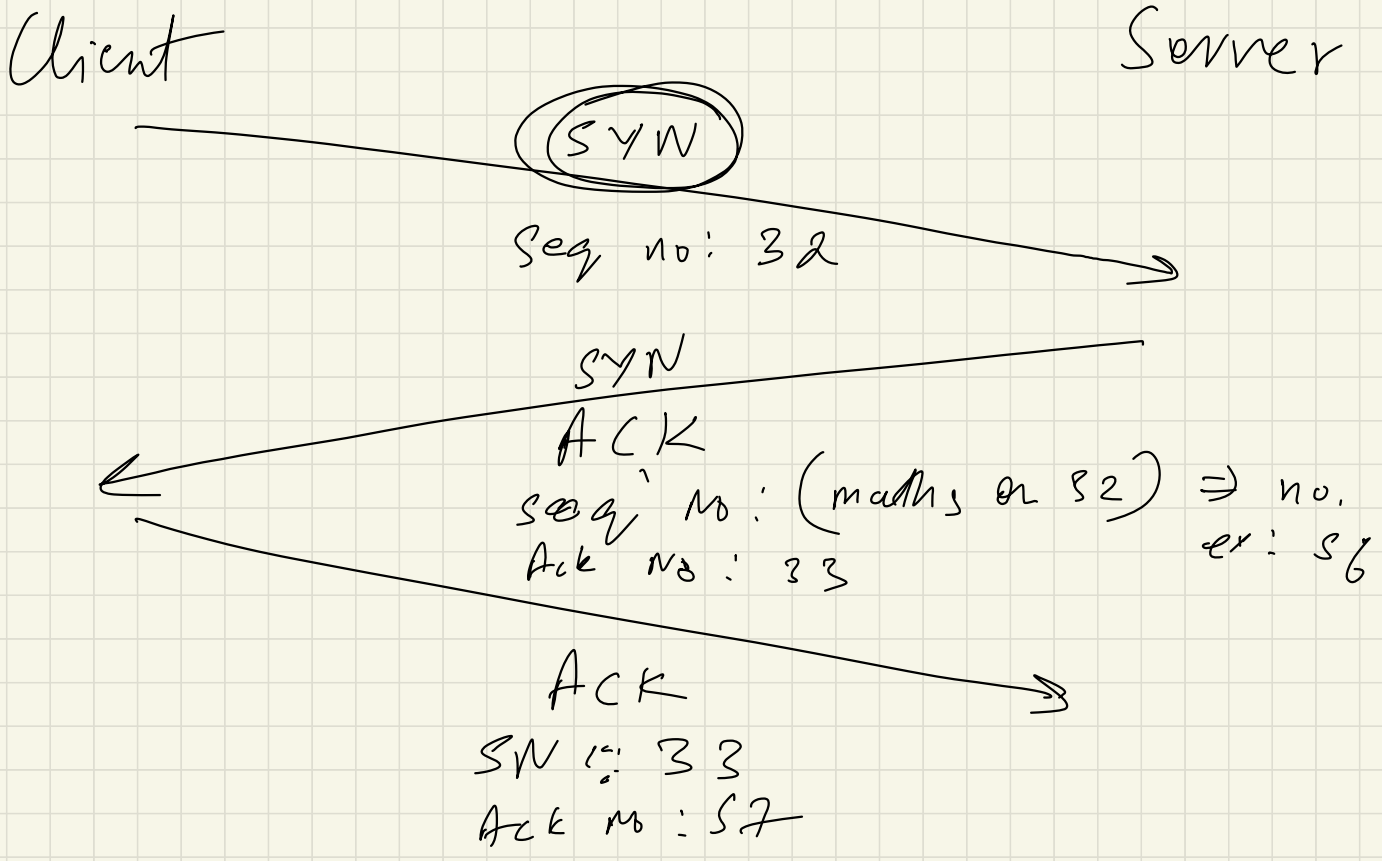
* Transport layer Protocol
* Application layer sends lots of raw data.
  TCP segments this data → divide in chunks, add headers. It may also called the data network layer → check video
* Congestion Control
* takes care of:
  – when data does not arrive

- maintains the order of data.

Features:

- Connection oriented
- Error control
- Congestion control
- Full Duplex

3 - way Handshake



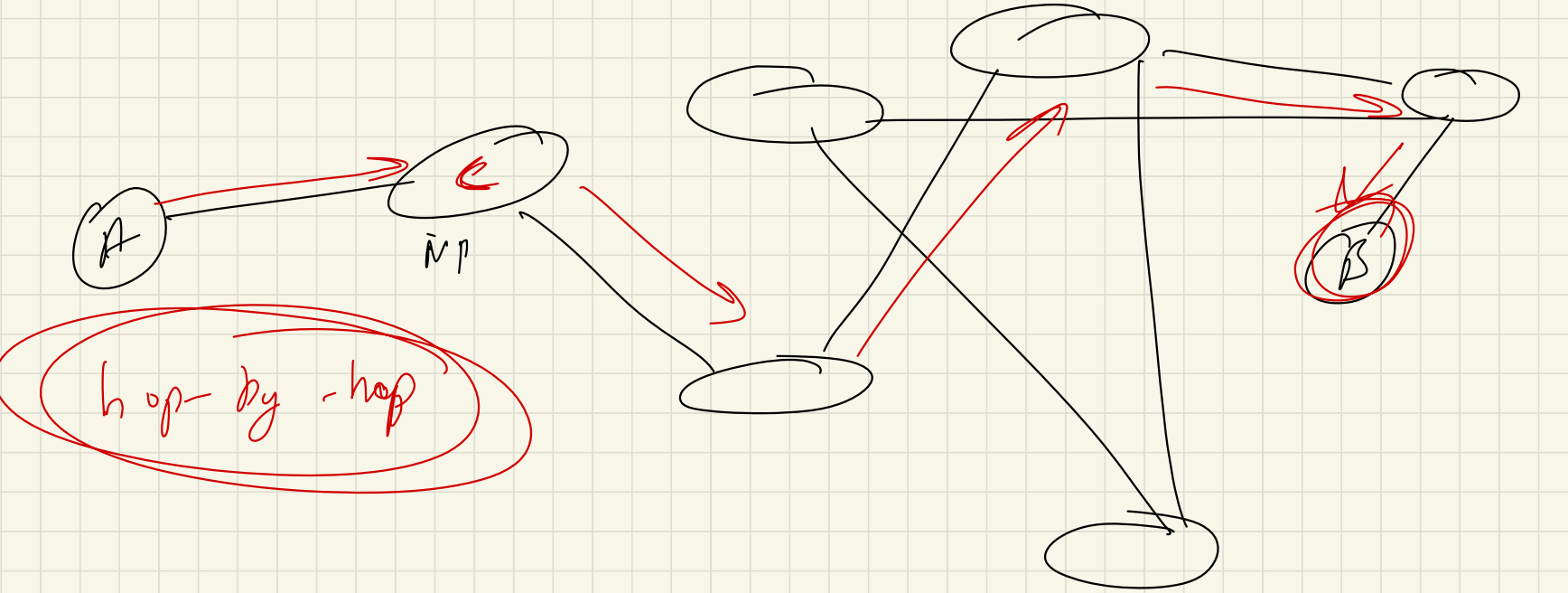
Network Layer

Here we work with routers.

Transport → segments

Network → packets

Data link → frames



192.168.2.30

network address
Subnet ID

device address
Host ID

Control Plane:

Routers ⟶ Nodes

Links ⟶ Edges

① Static Routing

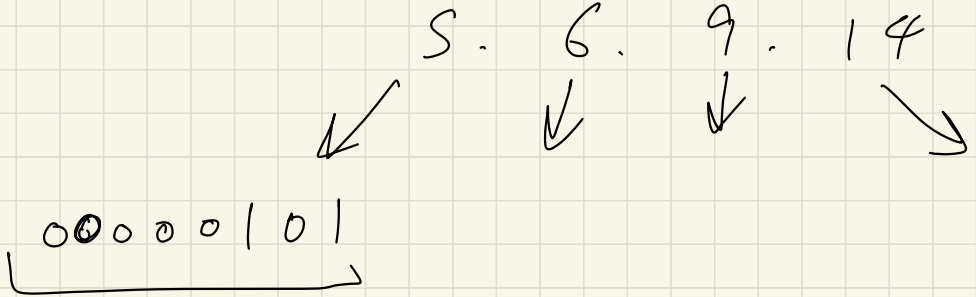
- Manually

(2) Dynamic Routing

Internet Protocol (IP):

IPv4 → 32 bit, 4-words

IPv6 → 128-bits



Class of IP addresses:

A	0.0.0.0	—	127.255.255.255
B	128.0.0.0	—	191.255.255.255
C	192.0.0.0	—	223.255.255.255
D	224.0.0.0	—	239.255.255.255
E	240.0.0.0	—	255.255.255.255

255. 255. 0. 0

12.0.0.0/31

192.0.1.0/24

start end

192.0.1.0 192.0.1.255

256

Reserved addresses:

127.0.0.0/8

Ex: localhost : 127.0.0.1

loopback addresses

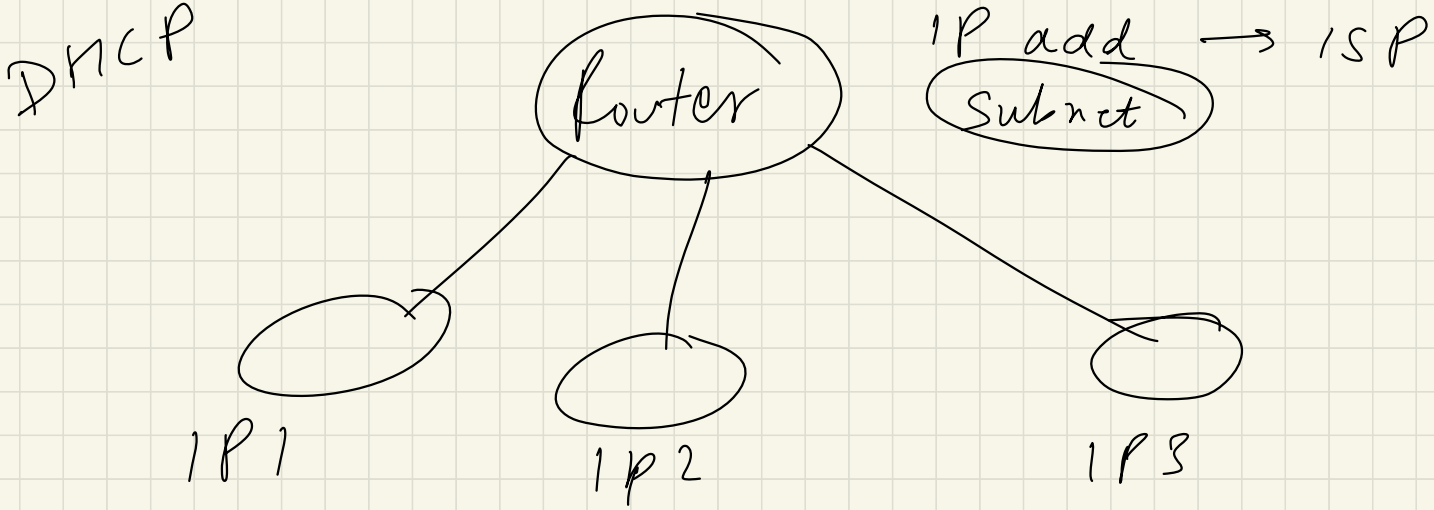
Packets: Header is of 20 bytes.

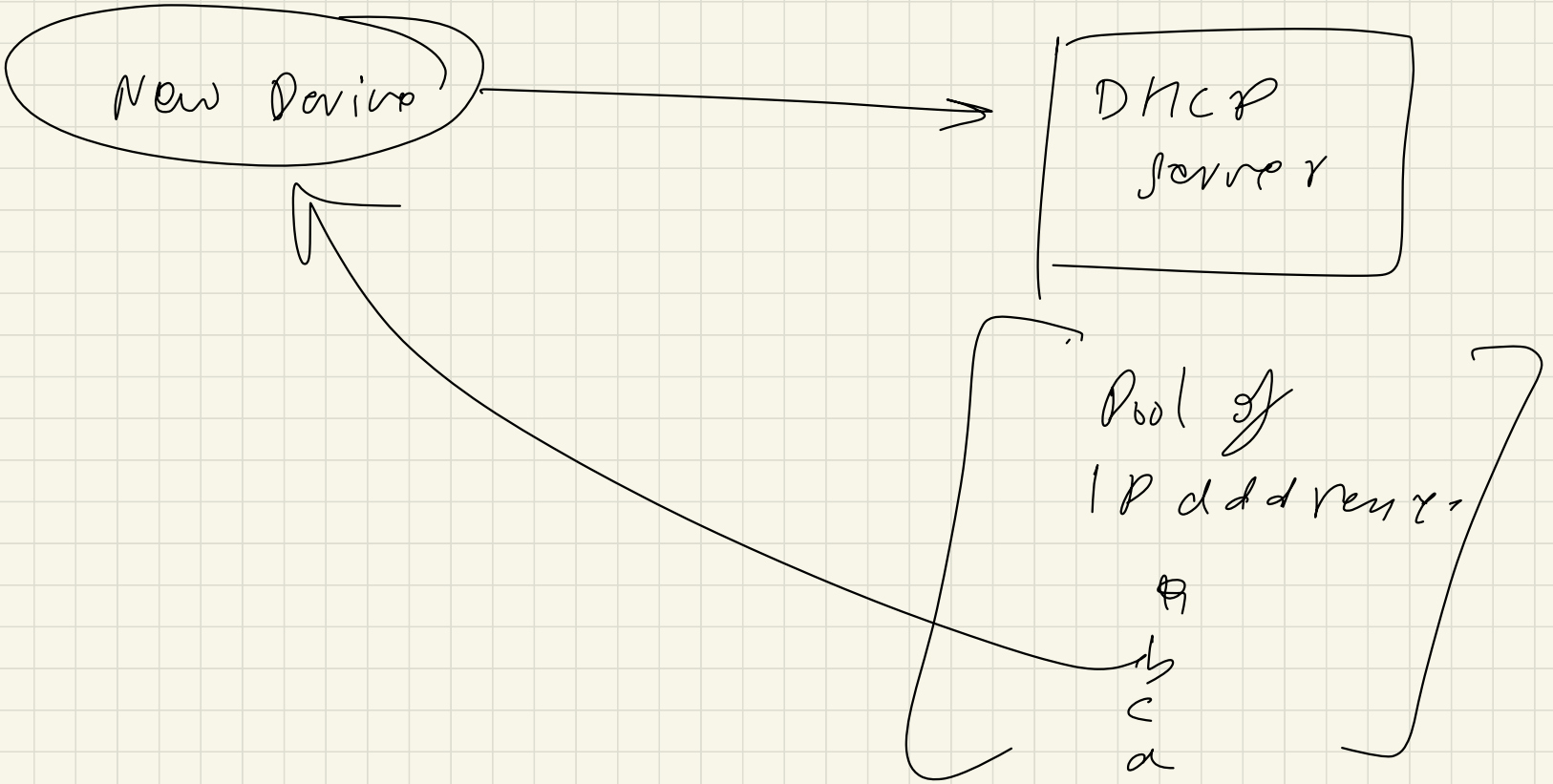
IPV, length, Identification, flags, protocols, checksum, address, TTL, etc.

Google

Data Link Layer

DHCP




New Device
DHCP
Server
Pool of
IP addresses
b
c
d

Many devices connected in LAN :

data link layer add MAC address

cache

ARP cache

Address resolution protocol

frame

DLLA of sender

& IP add of destination

- framing
- Error Detection