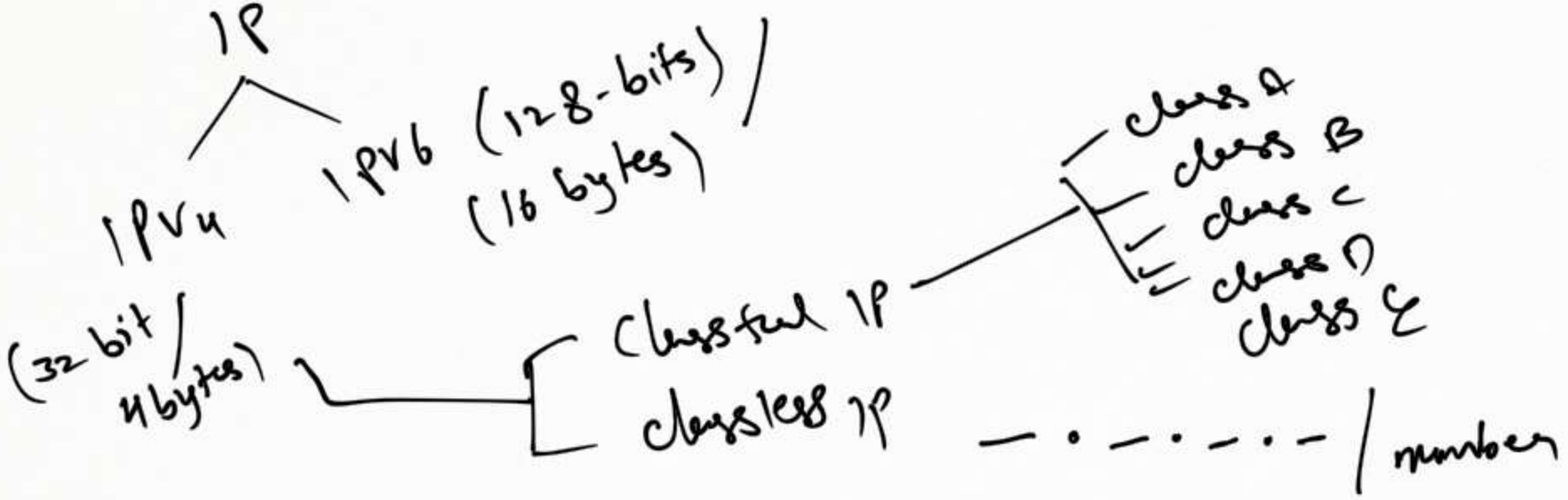
Session - 4

30/6/22

IP address

IP address :- logical existence of a system

IP address = N/W address + Host address



## Classful

| | |
|---|---|
| A | 1 - 126 |
| B | 128 - 191 |
| C | 192 - 223 |
| D | 224 - 239 |
| E | 240 - 255 |

IP address belongs to class C

Ex:- 192.168.1.9

first 8 bits need to recognize.

0 → x

127 → special address (loopback address)

System is sending data to itself. is called as loopback address

class A :- 8 bits n/w bits + 24 bits host bits

class B :- 16 bits n/w + 16 bits host

class C :- 24 n/w bits + 8 host bits

class D :- multicasting

class E :- Future Reference

unicasting

one to one

multicasting

one to few

broadcast

one to all

Ex:- Ip address:- 192.168.1.1

Ip = n/w address + host address

192.168.1.1

Class C

24 bits + 8 bits

3 bytes + 1 byte

⇒ n/w address: 192.168.1.0

⇒ host address:- 0.0.0.1

To get n/w address make all the host bits as zero

To get host address make all the n/w bits as zero.

⇒ In a world, there is no n/w with the n/w address 0 & 127.

why because:- if all the nw bits are zero then will get host address.

:- 127th n/w used for loop back

⇒ In a world, there is no host with host address 0 & all one's

why because:- if all the host bits are zero then will get n/w address.

:- if all the host bits are one then it is broadcasting (all the systems will receive)

| class | n/w bits | host bits | How many n/w's possible. | In a n/w how many host possible. |
|---|---|---|---|---|
| A | 8 | 24 | $2^{8-1} = 2^7 - 2$ <br> $= 128 - 2$ <br> $= 126$ | $2^{24} - 2 =$ <br> $16777216 - 2$ <br> $= 16777214$ |
| B | 16 | 16 | $2^{16-2} = 2^{14}$ <br> $\Rightarrow 16384$ | $2^{16} - 2 \Rightarrow$ <br> $65536 - 2 = 65534$ |
| C | 24 | 8 | $2^{24-3} = 2^{21} \Rightarrow 2097152$ | $2^8 - 2 =$ <br> $256 - 2 = 254$ |

why -2

all zeroes, all one's not possible

0, 127 n/w not possible

Class A

1 – 126

0000 0001

0111 1110

1 bit should not change, Remaing 7 bits can change.

Class B 128 – 191

1000 0000

1011 1111

2 bits should not change

, Remaing 14 bits can change

Total A class

1 n/w ⇒ 16777214 -

126 n/w : 126 * 16777214

⇒ 2113928964

Total class B:

1 n/w :- 65534 ✓

16384 n/w :- 16384 * 65534

= 1073709056

class C :- 1 n/w :- 254 ✓

2097152 n/w :- 2097152 * 254 ⇒ 532676608

public ip
private ip
static ip
dynamic ip

(Internet service provider)
isp providers

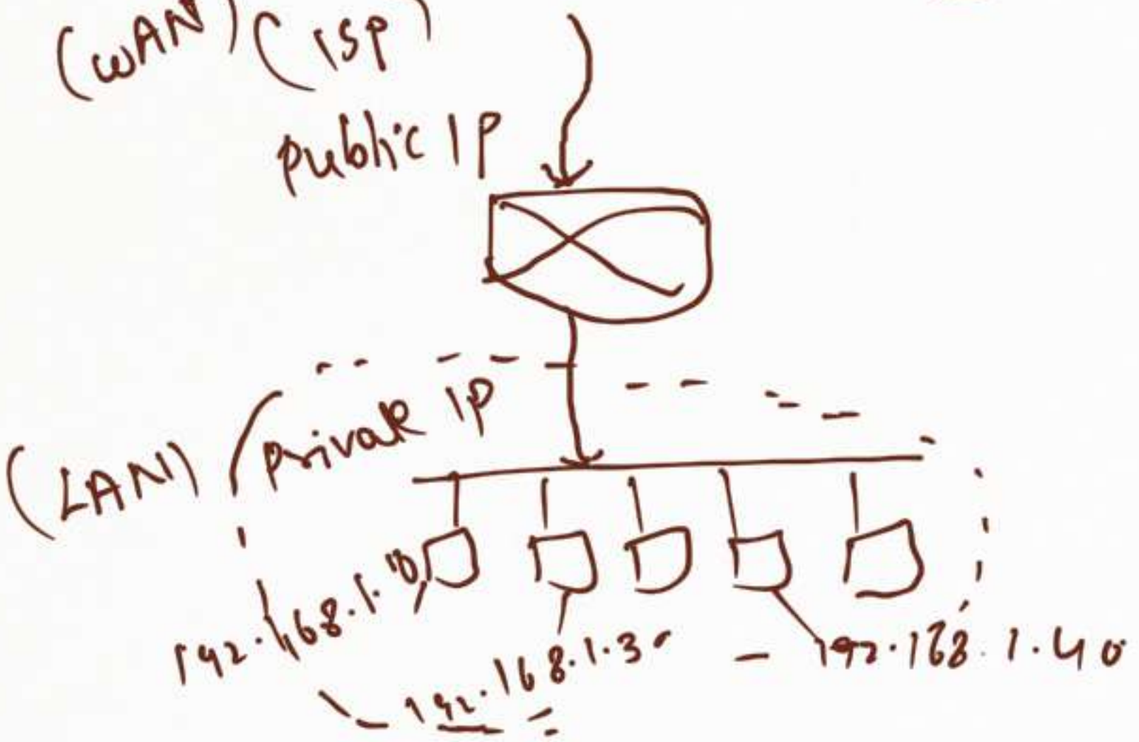
provide internet to us

Public ip :- isp provided ip.

what is my ip ? En google

Privait IP:- In home
10 members.

& using Internet



Static IP :- it is fixed IP, IP address won't change.

office / business purpose.

Dynamic IP :- it is not fixed IP, IP address will change.

home purpose

with respect to user static is good.

with respect to ISP dynamic is good.

Session- 5

1/7/2022

# IP address & DHCP

Subnet :- It is also called as default subnetmask / subnet masking / subnetting

It is used to get n/w address from the Ip address.

Ex :- 192.168.1.1

subnet mask value is fixed for all classes.

A ⇒ 1111 1111 . 0000 0000 . 0000 0000 . 0000 0000

255 . 0 . 0 . 0

B ⇒ 1111 1111 . 1111 1111 . 0000 0000 . 0000 0000

255 . 255 . 0 . 0

C :- 1111 1111 . 1111 1111 . 1111 1111 . 0000 0000

255 . 255 . 255 . 0

Ex:- 192.168.1.15

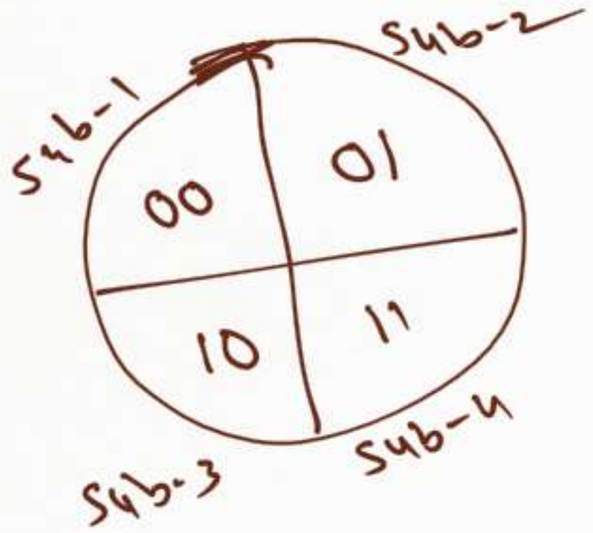
subnet: 255.255.255.0

n/w address:- 192.168.1.0

Q:. is subnet mask value will change?

Ans:- yes, can canchange, if the n/w is devided into sub n/w's.

Subn/w :- dividing a n/w into small subn/w's



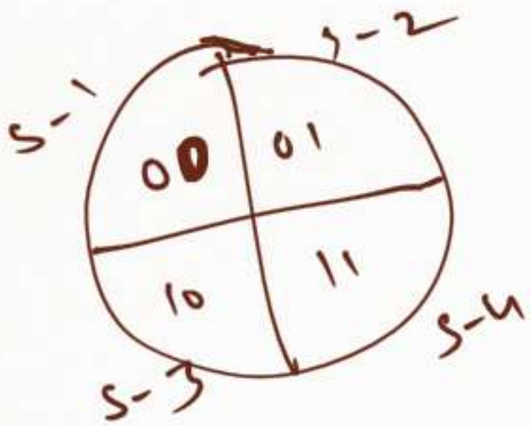

Assume a n/w is divided into 4 subn/w? then to recognize these subn/w, we need two bits!

if n/w divided into 8 subn/w then how many bits required?

Ans!- 3 bits

000, 001, 010, 011, 100, 101, 110, 111

Q:- if class c n/w divided into 4 sub n/w's and one from external world packet received by ip address 192.168.1.57 then which system & which subnetwork receives the data?




class c n/w bits :- 24

To recognize sub n/w bits :- 2

borrow two bits from the host bits.

8 ⇒ 2 sub n/w + 6 host bits

Default subn/w
255.255.255.192

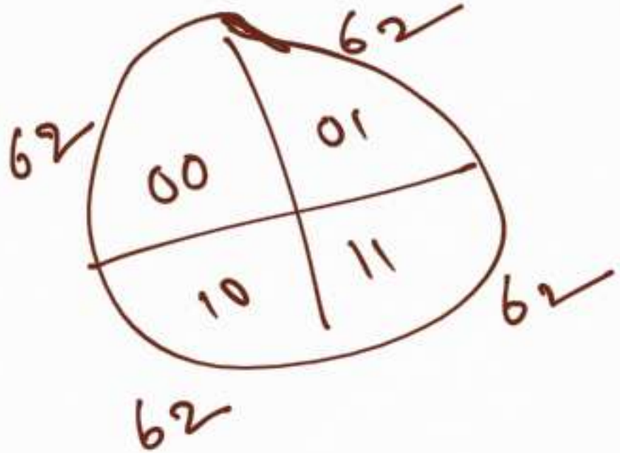
Ex:- 192.168.1.57

Total 26 bits working like n/w bits + 6 bits host bits

(24 + 2)

24 → finding n/w class C

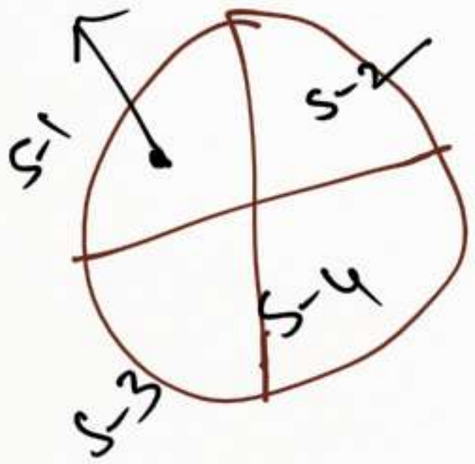
2 → finding subn/w.




Total host:- $2^6 - 2$

$= 64 - 2 = 62$

Ex:- 192.168.1.57




- 192.168.1.00 11 1001
  - 00 → subn/w
  - 11 1001 → host

111001

subn/w → 1

Host = 57

received

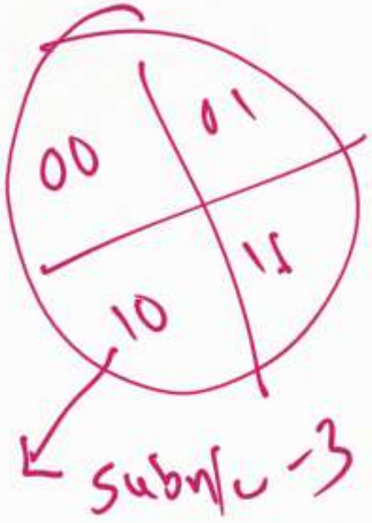
Q:- 192.168.1.187 which subn/w & which host ?

192.168.1.10111011

111011

host

subn/w



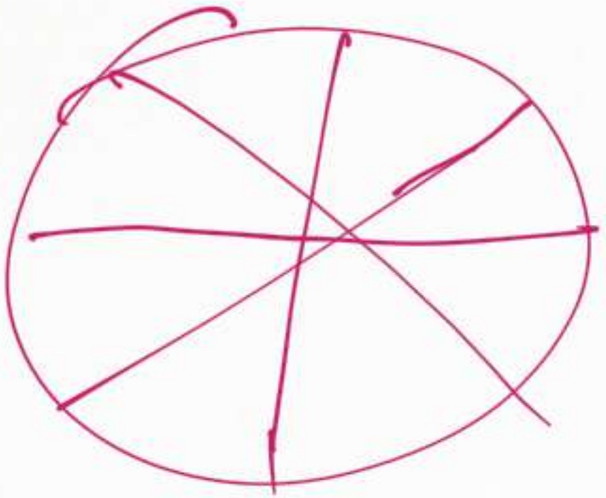

subn/w - 3:-

host:- 59

Assign

① if n/w is divided into 8 subn/w's then external world received packet to 132.168.2.132 then which subn/w & host?

512
132
644



⇒ 16 + 16

16 + 3 + 13 (host)

16 → n/w

3 → (subn/w bits)

132.168.00000010.10000100

subn/w

subn/w :- ①

host :- 644

## classless IP :- ——.——.——.——/number → n/w bits

Ex:- 192.168.1.10/20 → n/w bits

In a n/w, connect 500 systems.

500 systems

——.——.——.——/20 →

In this Example

20 n/w bits

12 host bits

$2^{12} - 2 \Rightarrow 4096 - 2$

$= 4094$ systems can connect.

In classless IP there is no fixed n/w & host bits.

Ex:- 192.168.1.10/20

20 represents n/w bits

Total IP:- 32 bit

32 - 20 = 12

500 × Class C :- 254 × Class B :- 65534 ×

If :- 192.168.1.10/8 ⇒ n/w bits 8 + 24 host

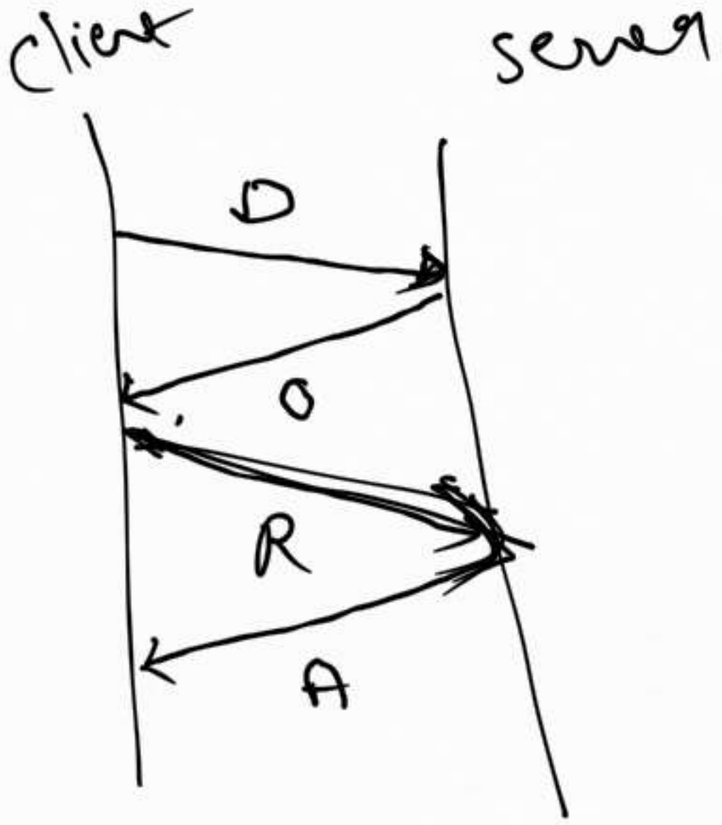
→ 192.168.1.10/20 ⇒ n/w bits 20 + 12 host

192.168.3.10/28 ⇒ n/w bits 28 + 4 host

# DHCP

lease period
(time period)

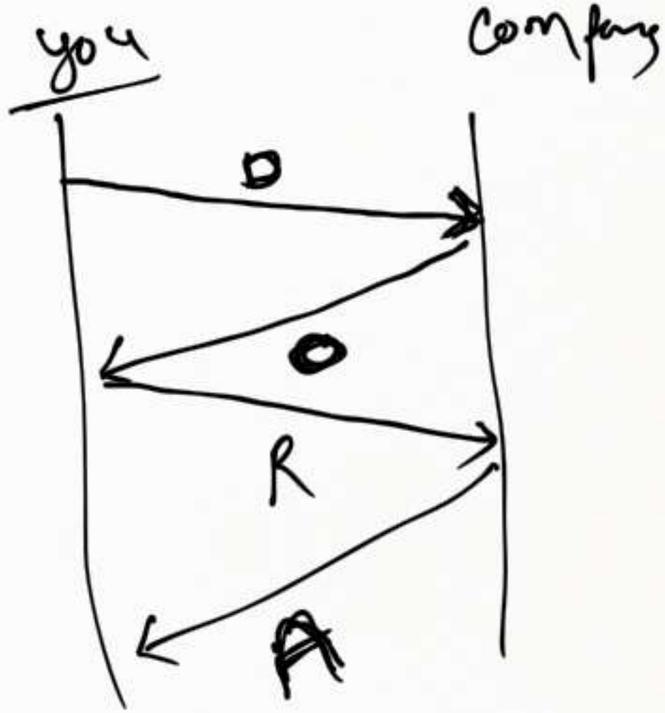
8days




50%.

87.5%.

4days



Session-6

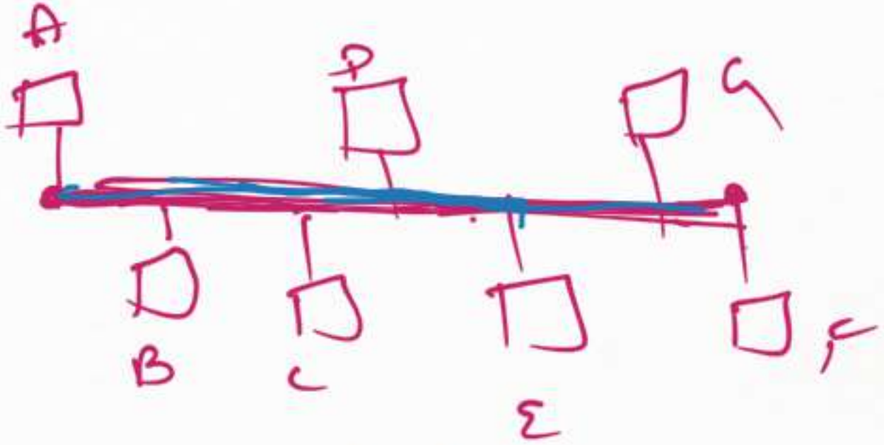
2/7/22

Topology & connecting Devices

Topology :- The way or method of connecting the systems in a n/w

→ bus
→ star
→ Ring
→ mesh
→ Hybrid.

Bus

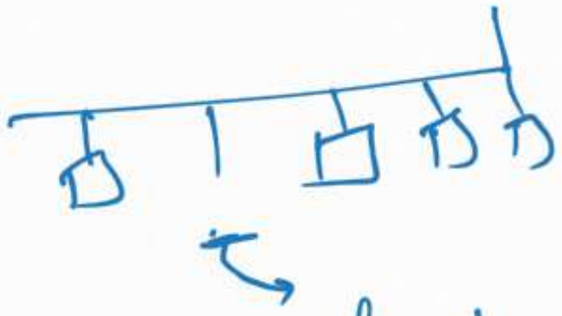



* transmission rate is less (only one can receive & can send)

* Easy to Establishment - * preferble for small n/w

In Bus, if more systems connected then complexity will increase.

→ In Bus, it must be closed circuit.

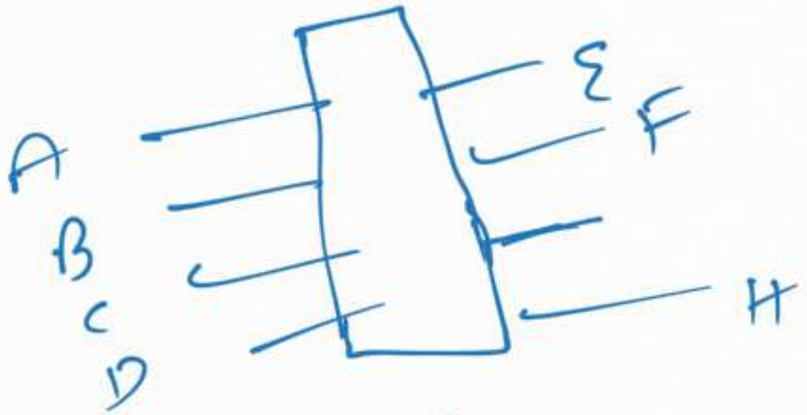


→ if it is not closed circuit then data will loose.

200 systems

Start

All the systems connected to centralized device.

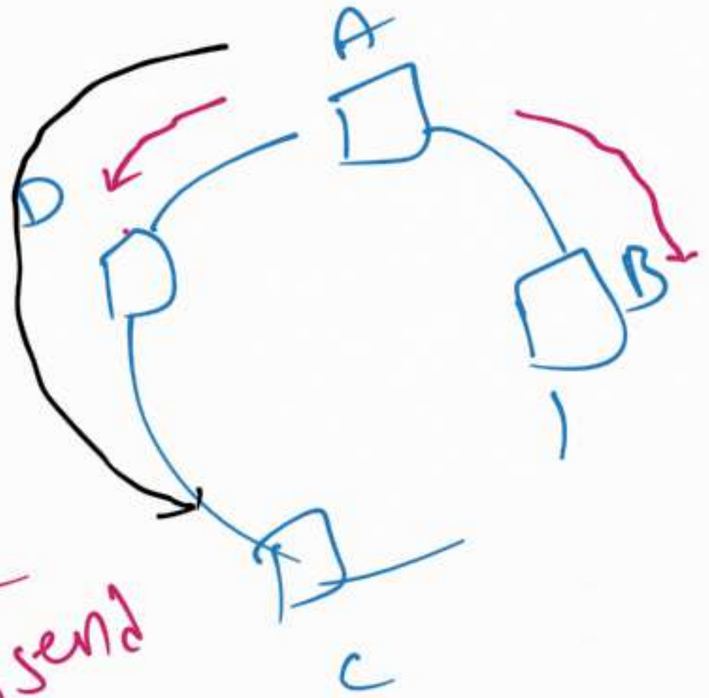



↳ device should work.

→ transmission gate is high

→ no need to be closed circuit

Ring




→ very high transmission rate.

→ Two different directions to reach the destination

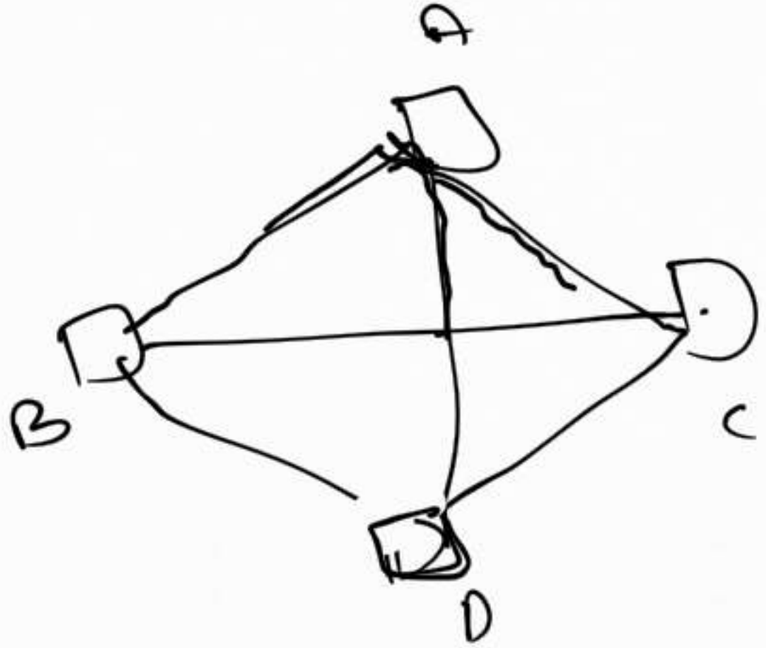
→ each system requires two LAN port.

→ effective.

→ one path is failed then we can use another path to send date.

→ cost will be more

# mesh topology




100 users

→ it is more reliable

→ but cost will be very expensive

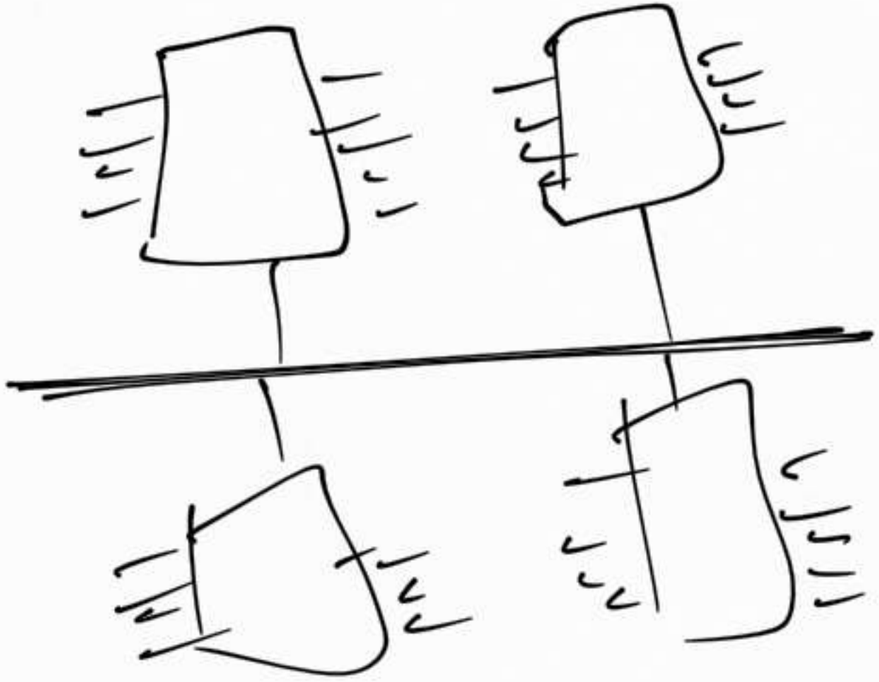
→ There are so many direct & Indirect path available to transfer data.

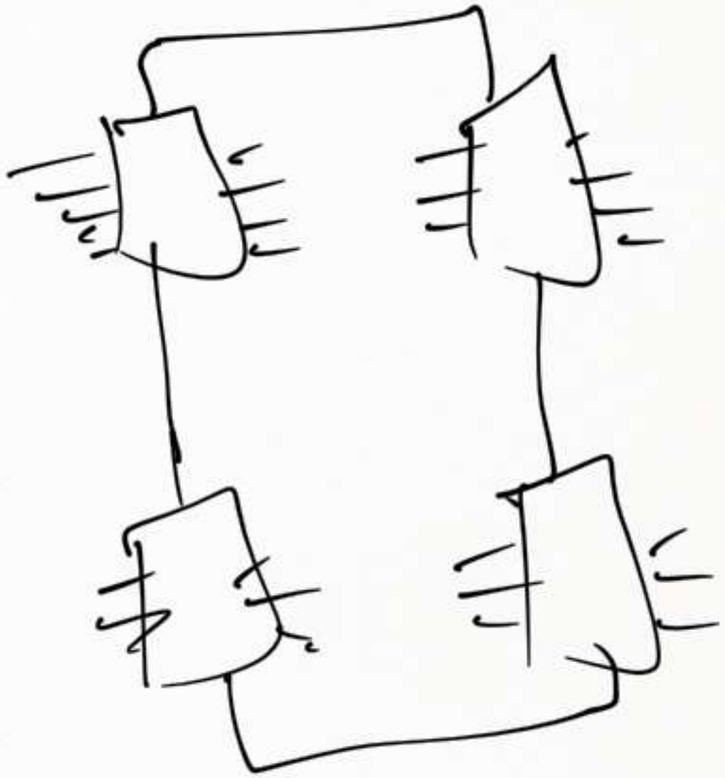
100

100

Hybrid

Star + bus





Ring + Bus.

## Connecting device

To connect multiple systems in a n/w then we need connecting device.

1. Repeater
2. hub
3. switch
4. Bridge
5. Router
6. gateway

~~Repeater~~

# connecting devices

## Intelligent

- h/w + s/w both Involved
- read n/w data
- it can take decision
- can modify n/w

## non-Intelligent

- only h/w
- it won't read n/w data.
- it won't take any decision
- it can't modify n/w data

Repeater = not Intelligent

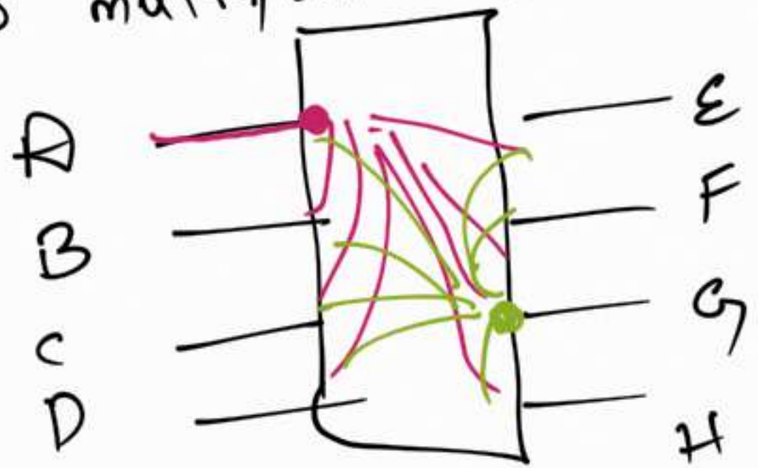
⇒ it won't read n/w data.

⇒ used to extend LAN cables

⇒ It will boostup the signal strength.

Hub :- It is multiport Repeater.

not intelligent




A → H

Transmission rate will less.

→ Traffic congestion is more.

Speed is less.

→ broadcast the data to everyone.

because it doesn't know source & destination address.

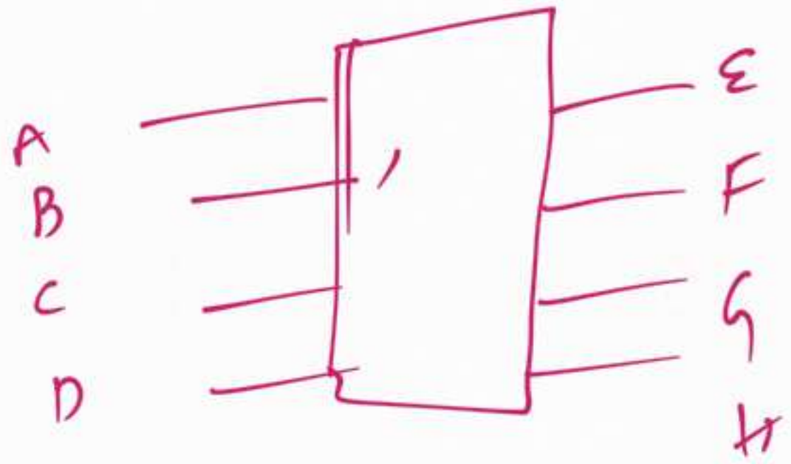
Session

connecting device :- Switch

Router

**Switch** :- it is used to connect the system within a n/w :

Switch is an Intelligent device

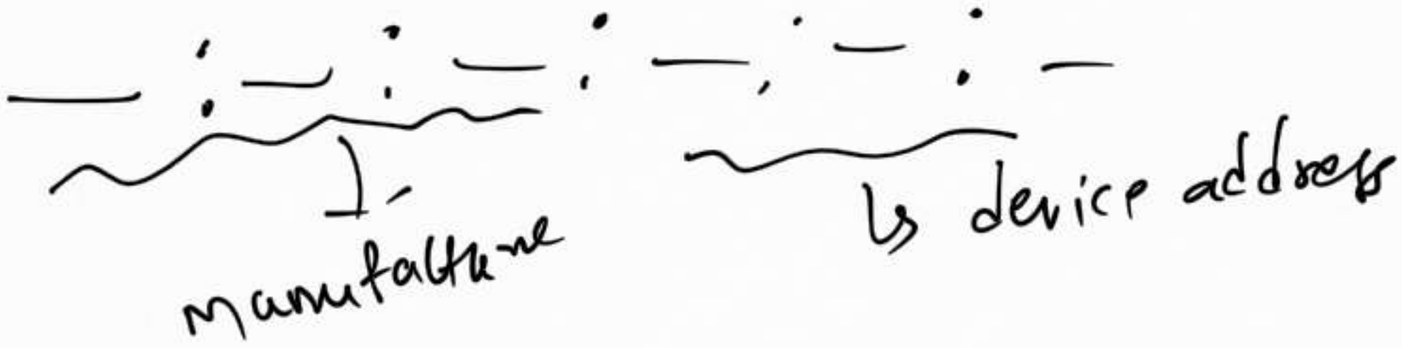



→ switch reads the source physical address & destination device physical address then it decides data belongs to whom.

# physical address / MAC address / ethernet address / hardware address

↳ size is 6 bytes and each byte seperated by :

→ represented in hexa decimal notation.

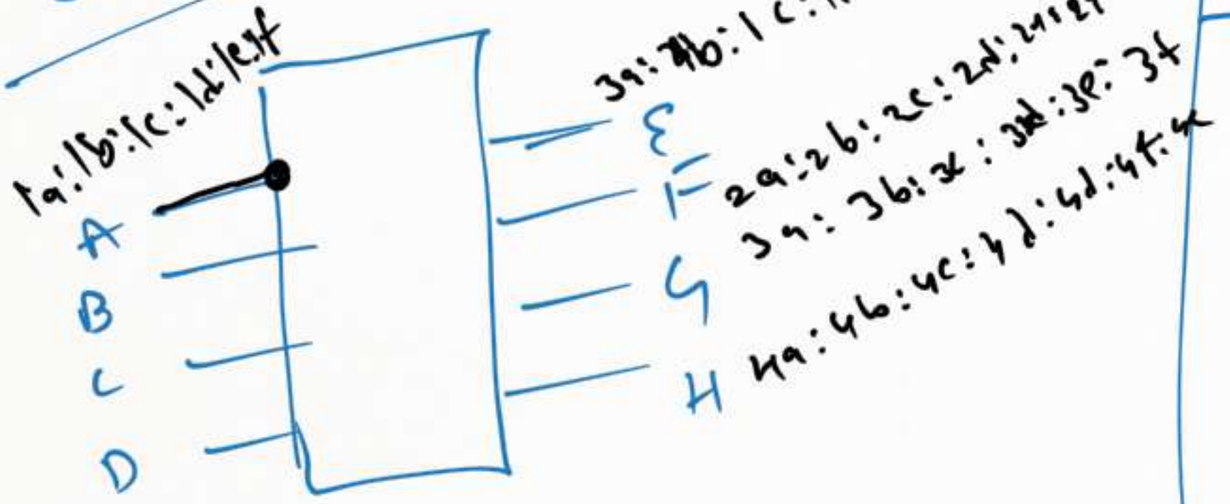



6 bytes
(3b + 3b)
manufacturer device

↳ physical address is used to get physical existance of a system.

↳ the data is travelled through physical media with the help of physical address only but we no need to worry about physical address.

# Switch functionality




A-H

G-C

MAC table

| port | MAC address |
|---|---|
| 1 | A :- (1a:1b:1c:1d:1e:1f) |
| 2 | |
| 3 | |
| 4 | |
| 5 | |
| 6 | |
| 7 | 3a:3b:3c:3d: |
| 8 | |
| . | |

Routers:-

* Routers are used to connect multiple n/w's
* to connect multiple n/w's then must & should Router is required.

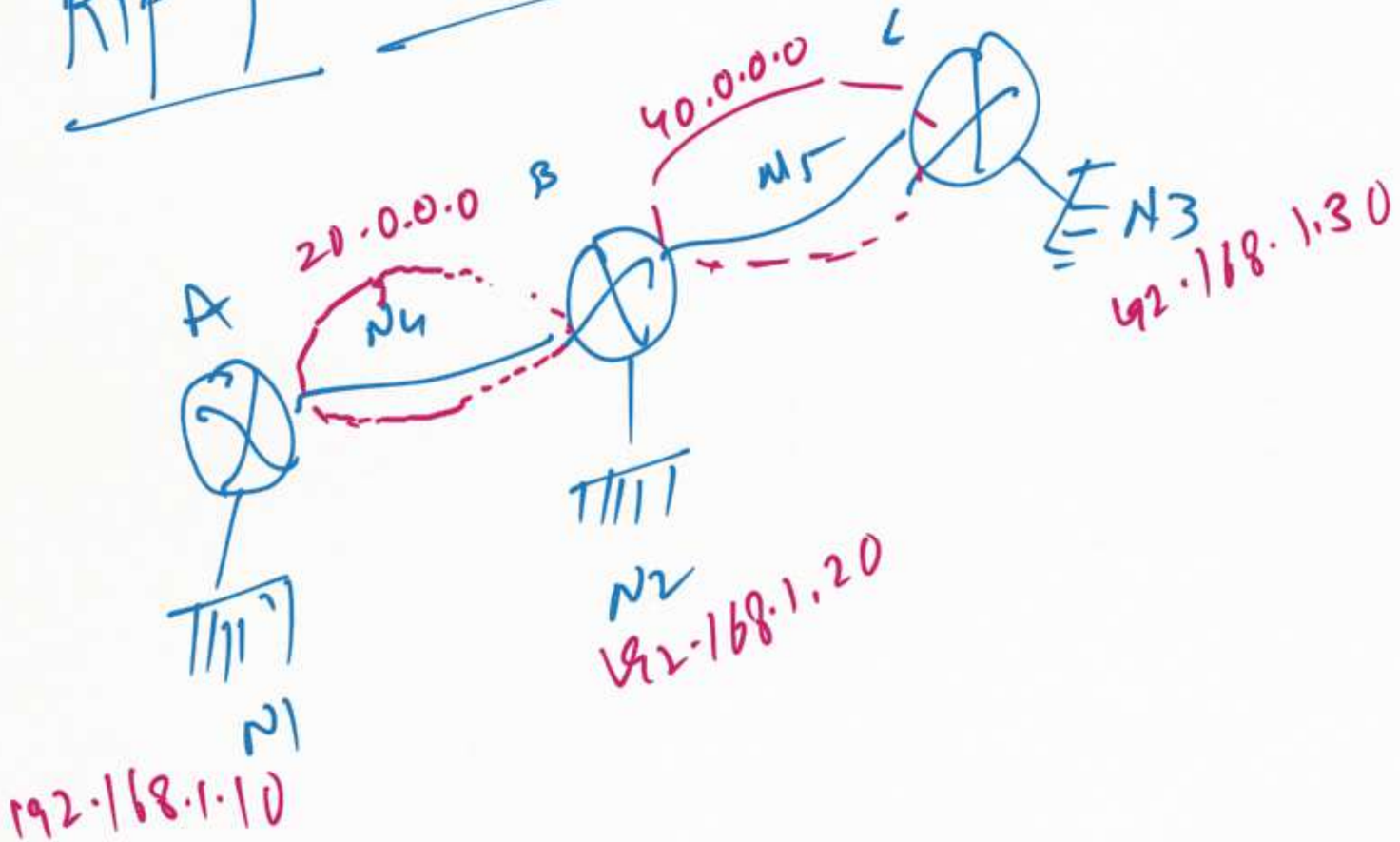
Router can be used b/w public - private
public - public
private - private ..

if Router is connected b/w two different N/w's
i.e either public - private / private - public.

then public IP converted to private IP with the help of NAT (Network Address translation) protocol.

* In Routers, OSPF & RIP protocols available to find the shortest path to destination.

# Rip protocal · functionality




total Routers : 3

Public N/W : 2

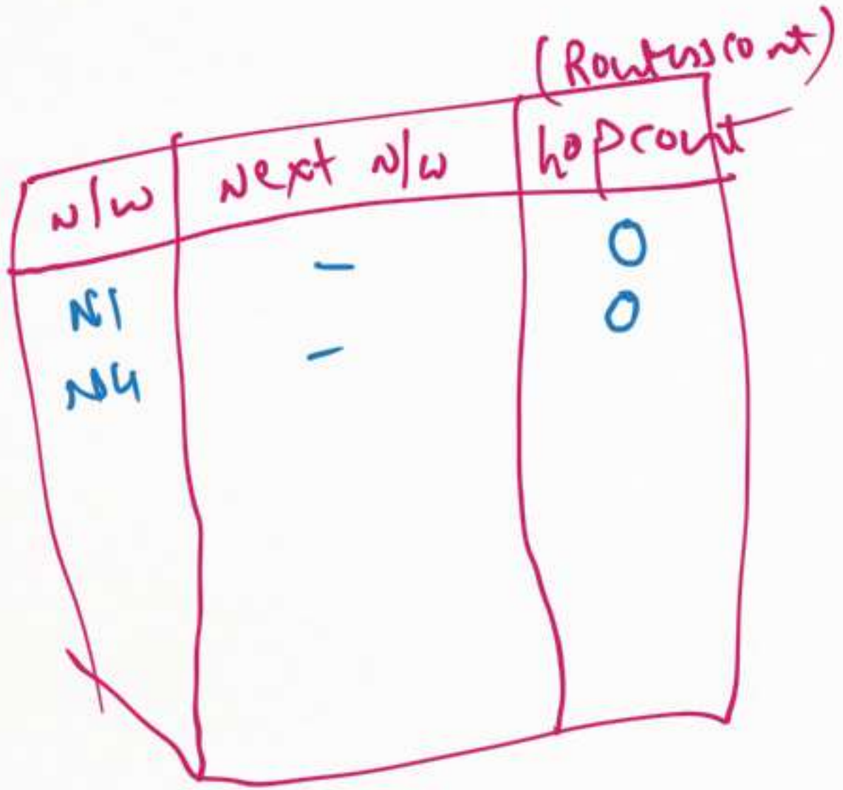
(N4, N5)

private N/W :- 3

(N1, N2 & N3)

Routers will maintain one table is called Routing table.

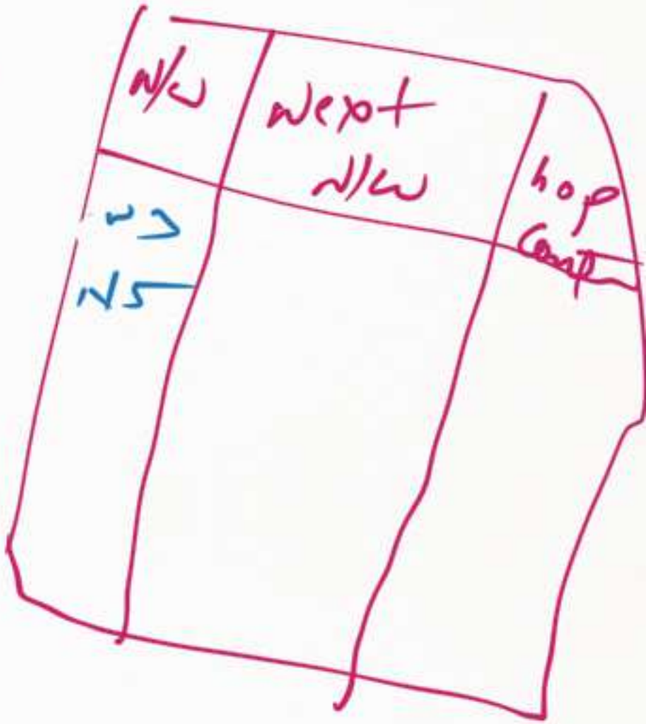
Each Router maintains one table & it will share with other Routers which are directly connected to it.


(Routing table)
n/w
next n/w
hop count
N1
N4
–
–
0
0

A


n/w
next n/w
hop count
N2
N4
N5
–
–
–
0
0
0

B


n/w
next n/w
hop count
N5

C

JOSEL

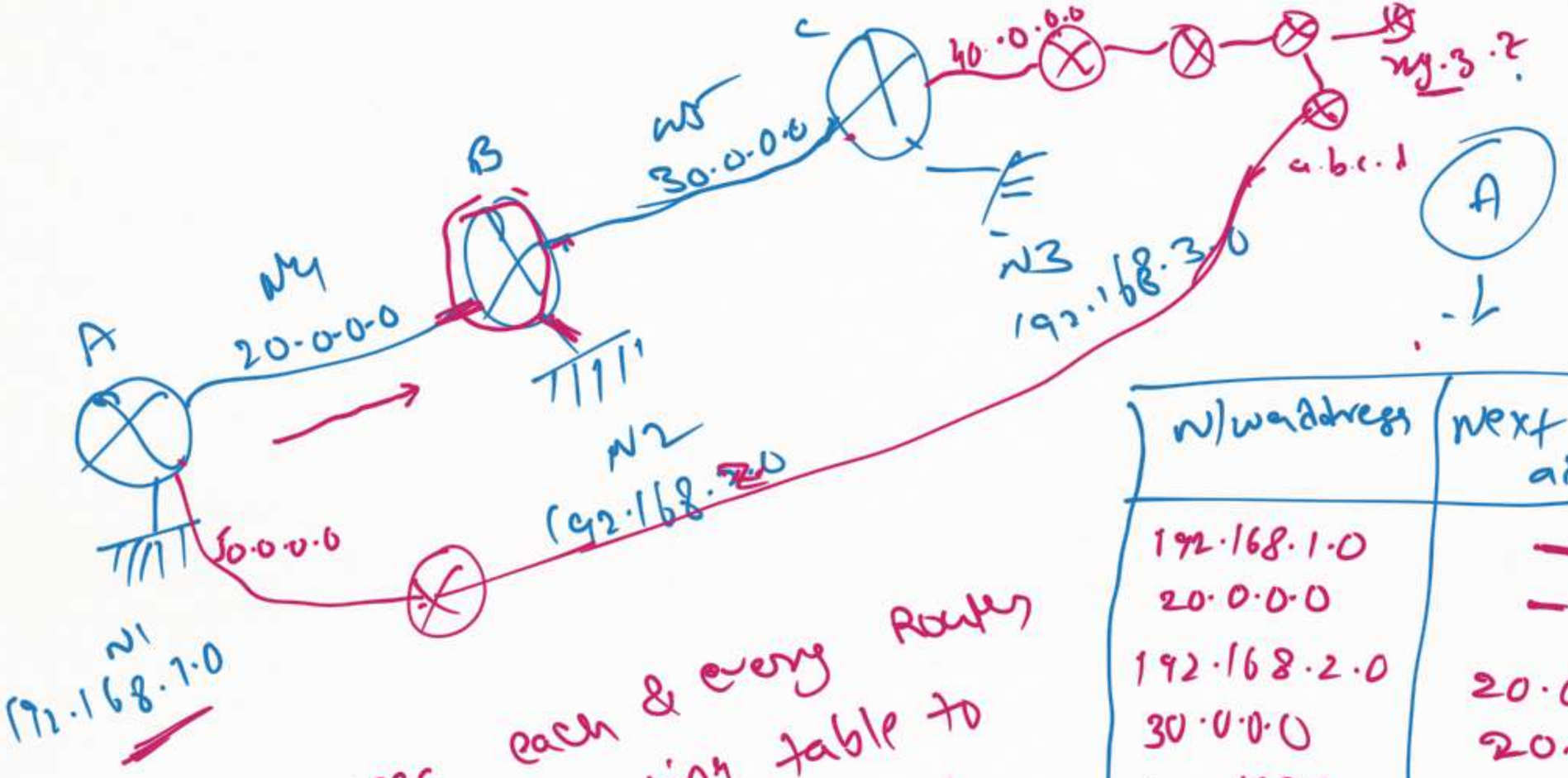
Session

Rip protocol

Bridge

gateway.

MAC




every 30sec each & every Routers advertise their routing table to directly connected routers.

| N/w address | Next N/w address | Hopcount |
|---|---|---|
| 192.168.1.0 | — | 0 |
| 20.0.0.0 | — | 0 |
| 192.168.2.0 | 20.0.0.0 | 1 |
| 30.0.0.0 | 20.0.0.0 | 1 |
| 192.168.3.0 | 20.0.0.0 | 2 |
| a.b.c.d | 50.0.0.0 | 3 |

B

| n/w addrs | next n/w addrs | Hop cont |
|---|---|---|
| 192.168.2.0 | — | 0 |
| 20.0.0.0 | — | 0 |
| 30.0.0.0 | — | 0 |
| 192.168.1.0 | 20.0.0.0 | 1 |
| 192.168.3.0 | 30.0.0.0 | 1 |
| ~~x.y.z.m~~ | ~~30.0.0.0~~ | ~~16~~ |
| a.b.c.d | 30.0.0.0 | 11 |

C

| n/w address | next n/w address | Hopcount |
|---|---|---|
| 192.168.3.0 | — | 0 |
| 30.0.0.0 | — | 0 |
| 192.168.2.0 | 30.0.0.0 | 1 |
| 20.0.0.0 | 30.0.0.0 | 1 |
| 192.168.1.0 | 30.0.0.0 | 2 |
| x.y.z.m | 40.0.0.0 | 15 |
| a.b.c.d | 40.0.0.0 | 10 |

In RIP protocol, the maximum hop count maintained by RIP protocol is 15.

16 hopcount means n/w not Reachable.

(Open shortest path first)

OSPF there is no hopcount limit & if any modifications happend in Routing table then only it will advertice

Bridge :- * Bridge compare to switch it is intelligent.

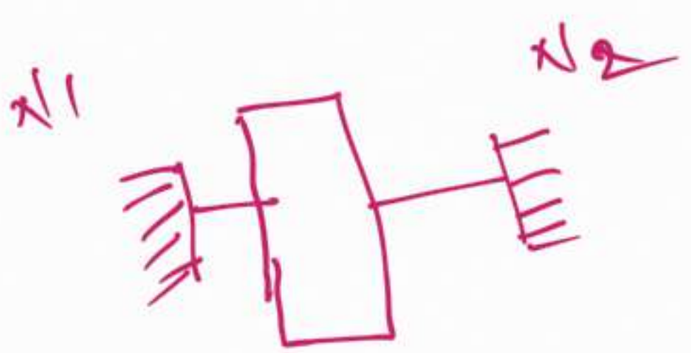
Switch used to connect with in a n/w but
Bridge used to connect multiple n/w's.

Bridge compare with Router it is not Intelligent

* Bridge will not find shortest path to the destination but Routers find shortest path to the destination.

connecting device

## Gateway

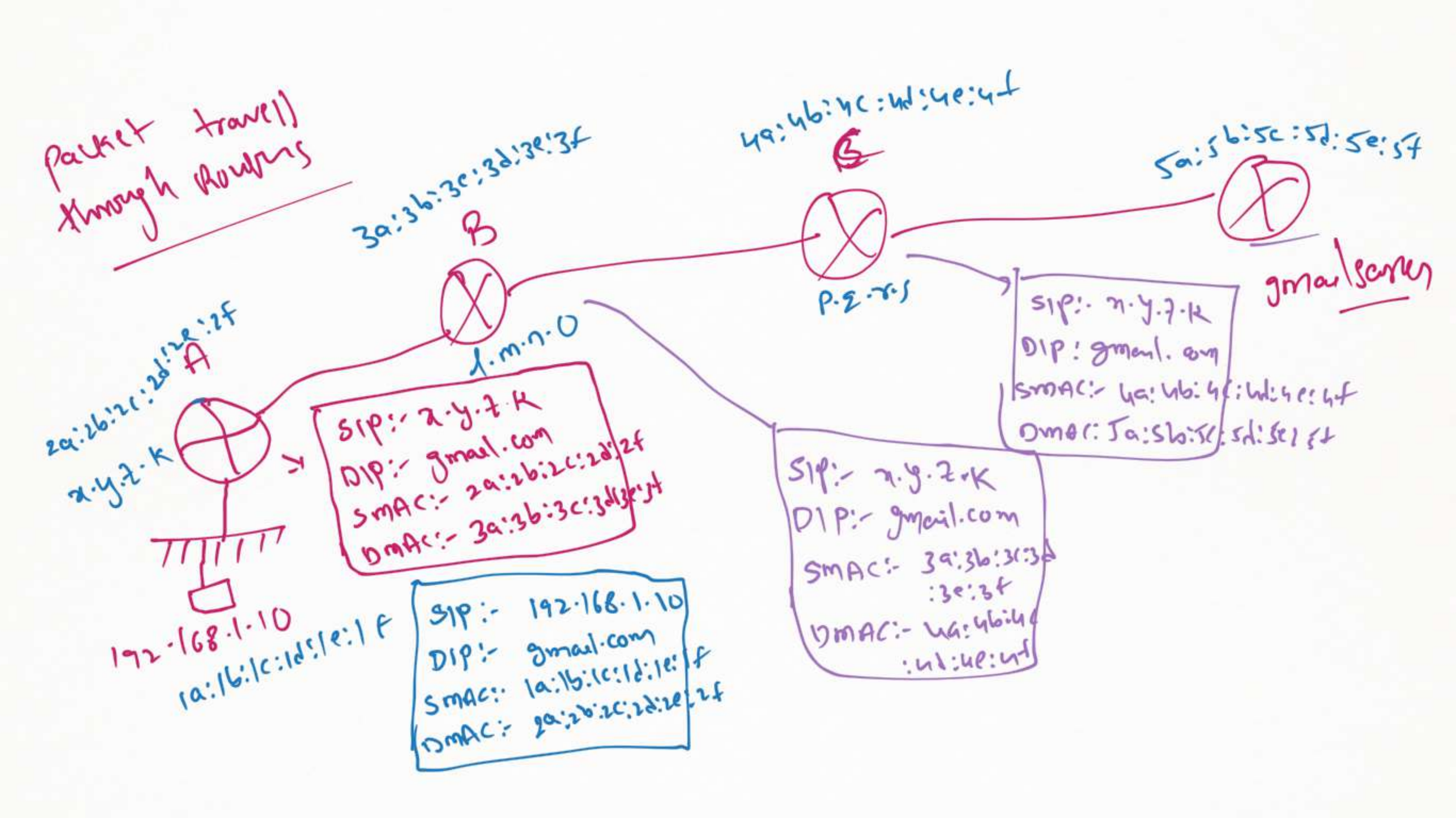



it is used to connect two different nature of n/w's

N1 → Internet

N2 → Gsm

(global system for mobile)

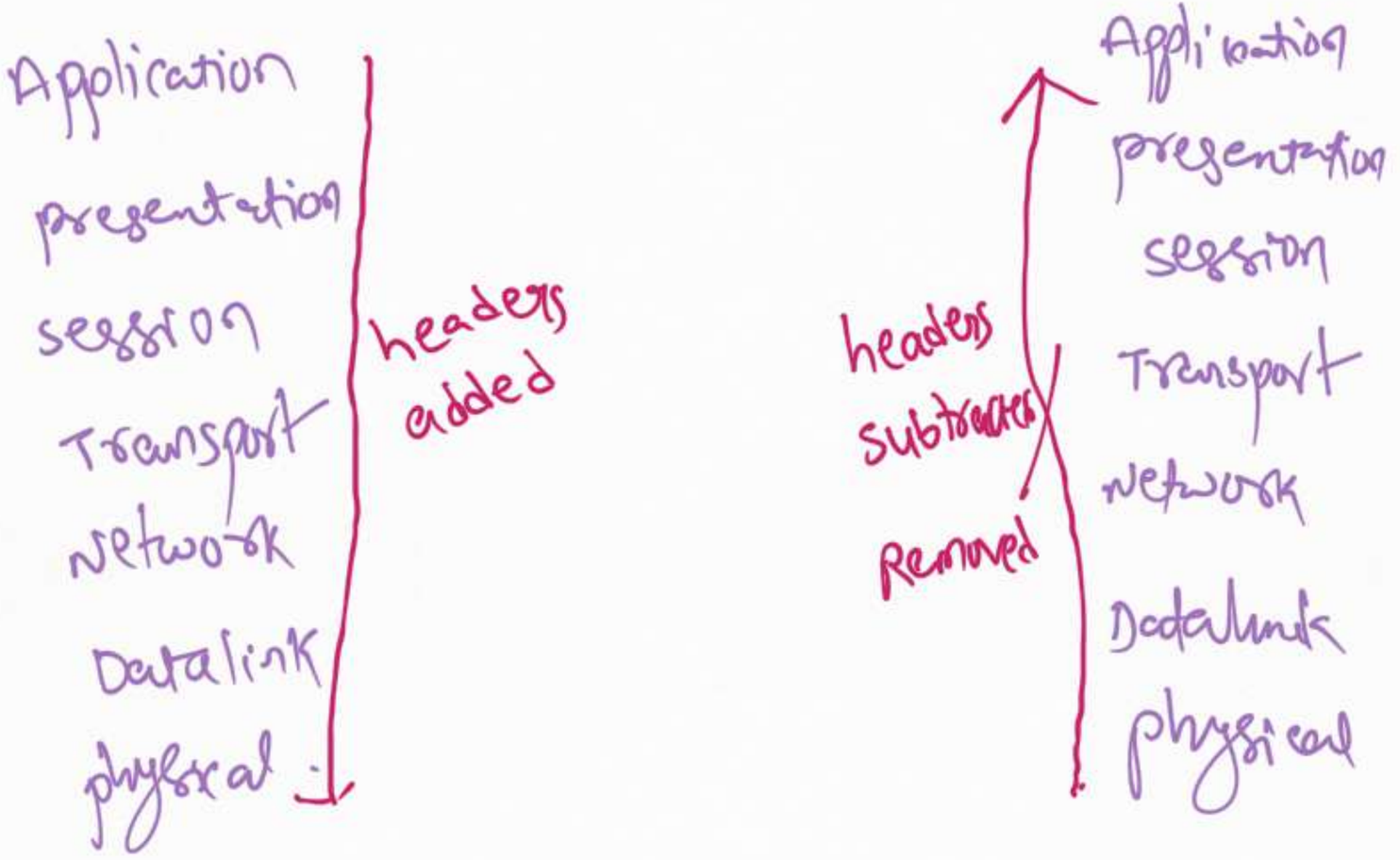

packet travell through routers
49:4b:4c:4d:4e:4f
5
5a:5b:5c:5d:5e:5f
3a:3b:3c:3d:3e:3f
B
gmail server
P.E.R.S
2a:2b:2c:2d:2e:2f
A
1.m.n.0
x.y.z.k
SIP:- x.y.z.k
DIP:- gmail.com
SMAC:- 2a:2b:2c:2d:2f
DMAC:- 3a:3b:3c:3d:3e:3f
SIP:- x.y.z.k
DIP: gmail.com
SMAC:- 4a:4b:4c:4d:4e:4f
DMAC: 5a:5b:5c:5d:5e:5f
SIP:- x.y.z.k
DIP:- gmail.com
SMAC:- 3a:3b:3c:3d:3e:3f
DMAC:- 49:4b:4c:4d:4e:4f
192.168.1.10
1a:1b:1c:1d:1e:1f
SIP:- 192.168.1.10
DIP:- gmail.com
SMAC:- 1a:1b:1c:1d:1e:1f
DMAC:- 2a:2b:2c:2d:2e:2f

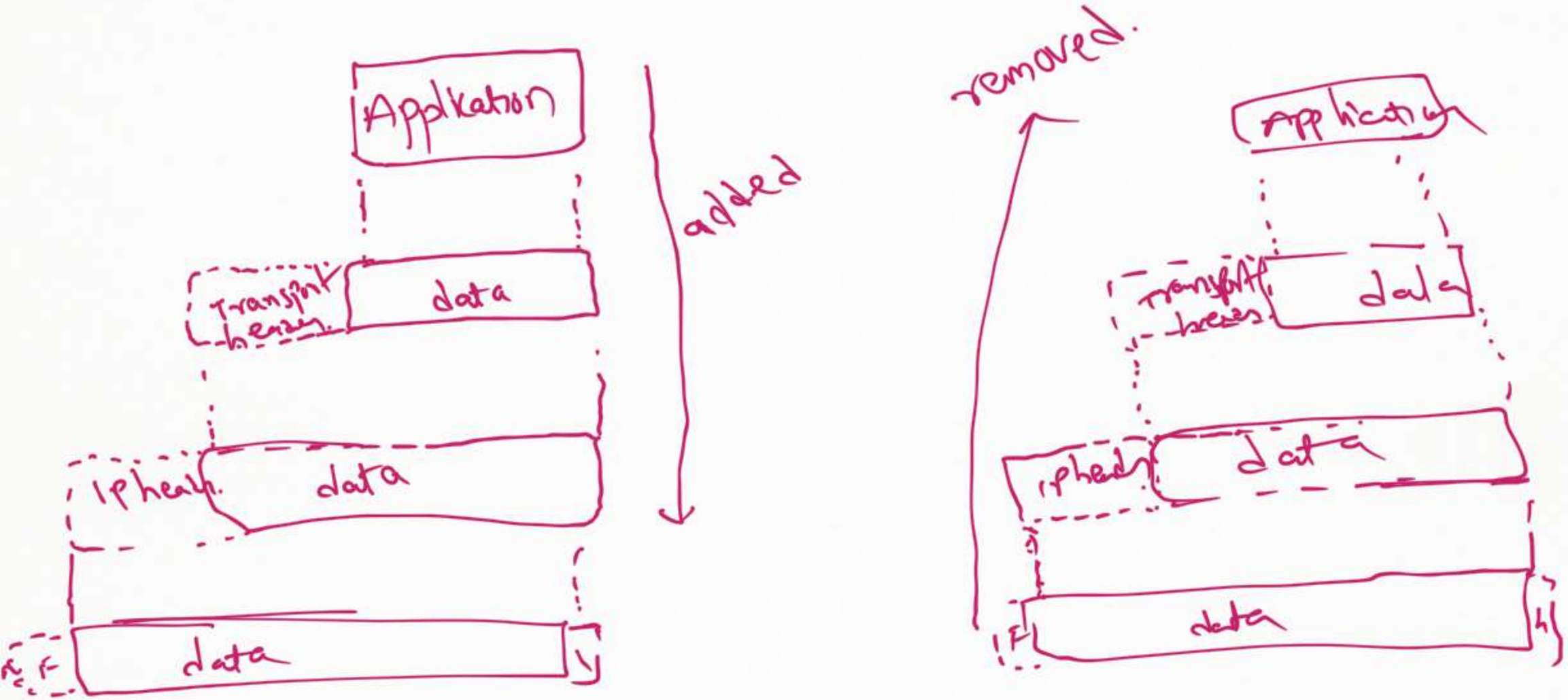
Session

6/7/22

→ ip header

→ UDP header.

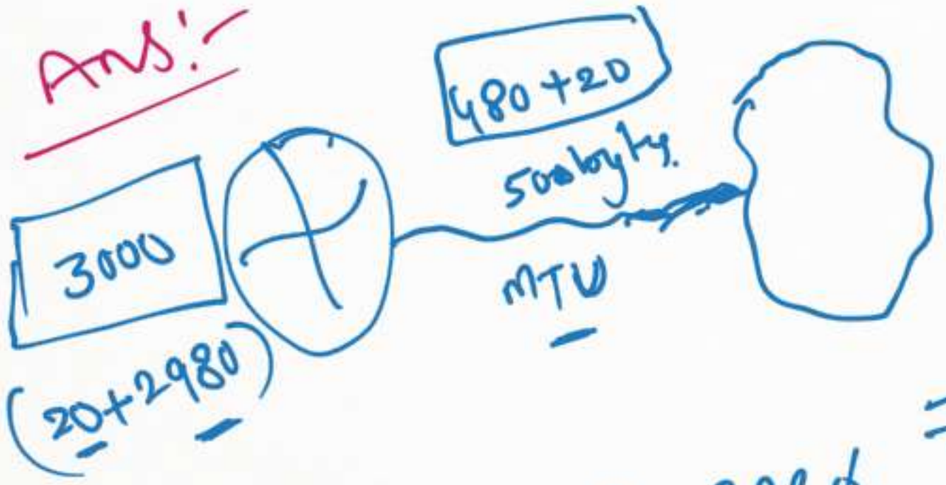

Application
presentation
session
Transport
network
Datalink
physical
headers added
Application
presentation
session
Transport
network
Datalink
physical
headers
Subtracted
Removed

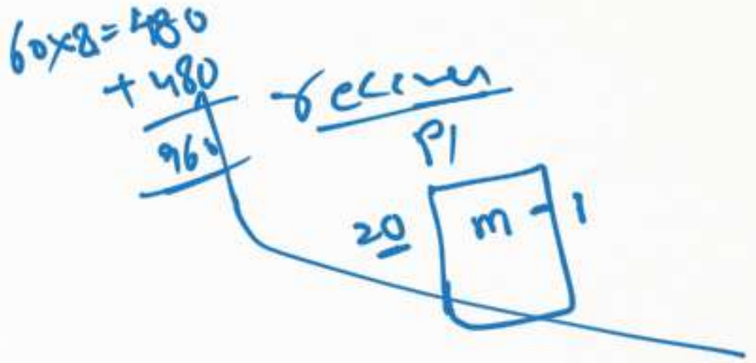

Application
added
data
data
data
removed.
Application
data
data
data

Ipheader :- size 20-60 bytes

* if a Router Recived a packet with 3000 byte size, in that 20 byte are header length. MTU channel capacity is 500 byte then findout how many fragments & offset value.

Ans:-




D 0

$\Rightarrow \frac{2980}{480}$ 7

$\Rightarrow$

| P7 | P6 | P5 | P4 | P3 | P2 | P1 | |
|---|---|---|---|---|---|---|---|
| 100 | 480 | 480 | 480 | 480 | 480 | 480 | - |
| 0 | 1 | 1 | 1 | 1 | 1 | 1 | m |
| 360 | 300 | 240 | 180 | 120 | 60 | 0 | offset |

$\frac{480}{8}$

2980

480 *6 = 2880

366 *8 = 2980

session 7/7/22

→ UDP header

→ TCP header

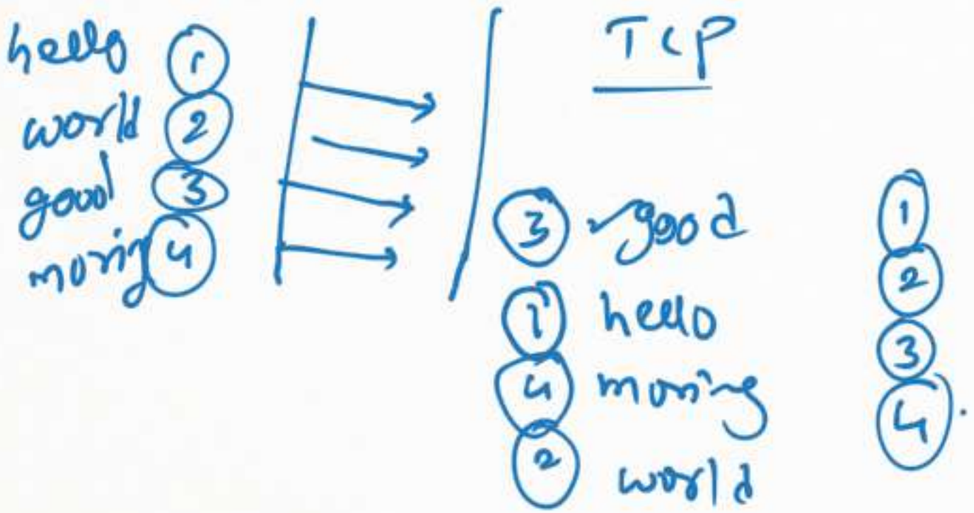
→ UDP vs TCP.

## TCP

1) Transmission control protocol
2) Connection oriented service
3) Reliable communication (ACK)
4) data guarentee available
5) sequence number will follow.

## UDP

1. user datagram protocol
2. Connectionless service.
3. unReliable communication (no ACK)
4. no data guarantee.
5. no sequence number




Re-Arrange the packets according to sequence number.

## TCP

6.) Re-transmission of data is possible

7) For connection establishment it follows 3-way handshaking

→ for closing connection it follows 4-way handshaking

→ for transferring data it follows sliding window mechanism.

## UDP

6. Re-transmission not possible.

7. UDP doesn't follow these methods

## TCP

- → TCP is slower service
- → TCP header size 20-60 bytes
- → TCP is complex protocol

## UDP

- → UDP is faster service.
- → UDP header size is 8 bytes.
- → UDP is simple protocol

PDU (protocol data unit)

The technical name of the data in each layer is called as PDU.

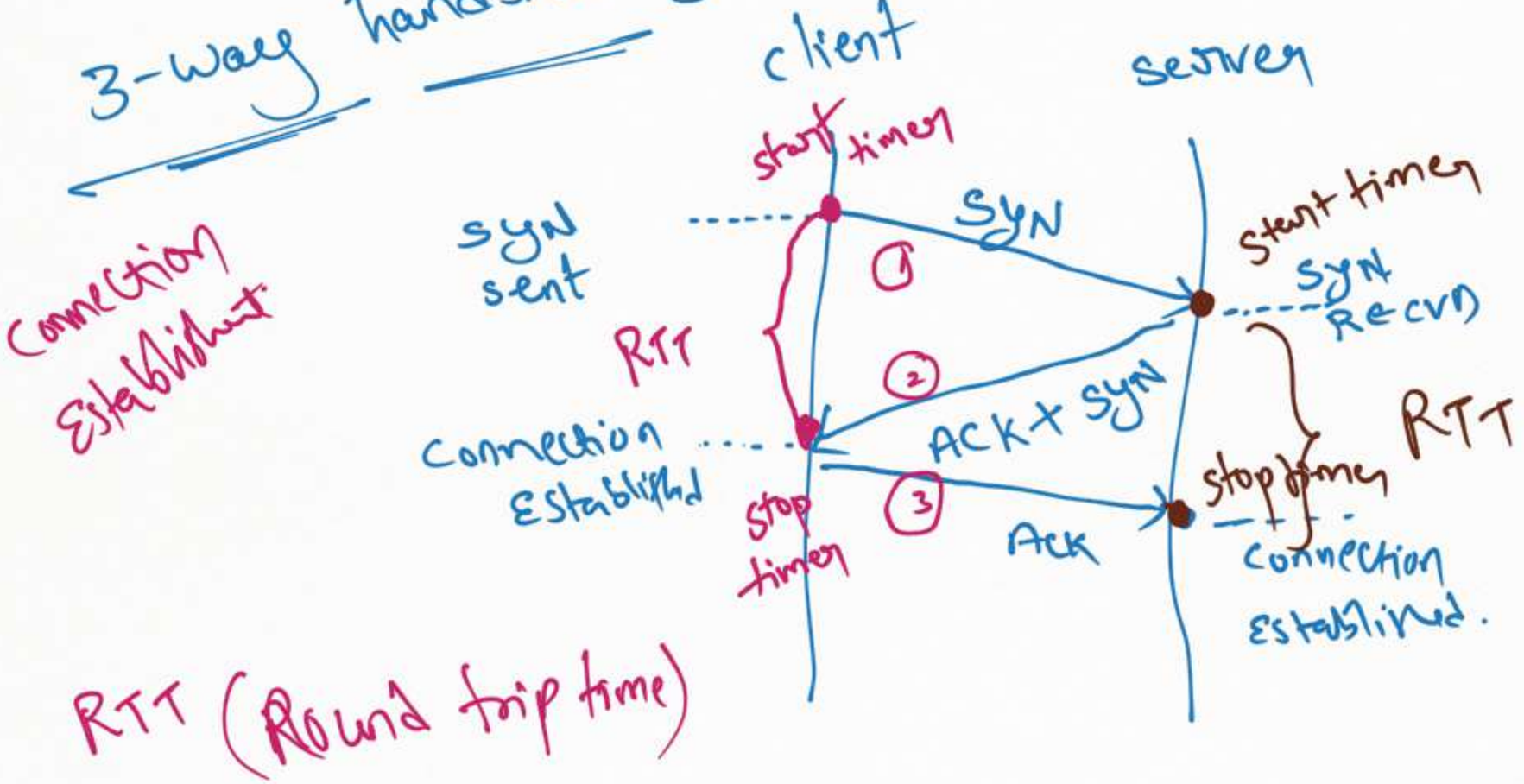
**TCP**

Application → data
Transport → segment
Internet → datagram
physical → frame

**OSI**

App
pre
sess
} data
Tran → segment
Net → packet
Dat → frame
physi → bits

# 3-way handshaking




RTT (Round trip time)

(Round trip time / Round trip delay)

RTT:- it finds in ms (milliseconds)

the amount of the time it takes for a signal to be sent plus the amount of time it takes for acknowledgement of that signal having been received.

(it takes for a network request to go from starting point to destination and back again to source)