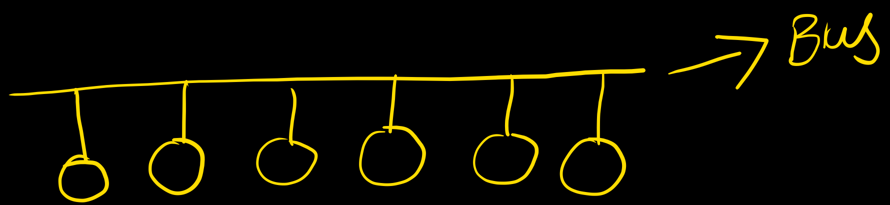
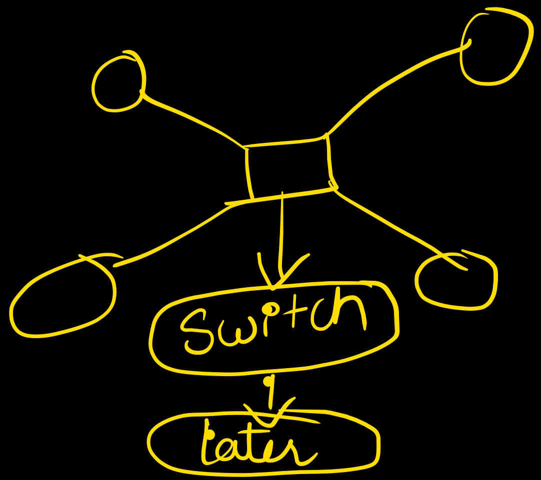
Ethernet: → (IEEE 802.3)

1) Topology → Bus.



In gate exam → Bus → Gate → Bus

But in present world → Star → Interviews



2) Access control method: → CSMA/CD

↓

already discussed

3) No ack are used

4) Bandwidth → 10 Mbps → 100 Mbps → 1 Gbps

10 Mbps ↓ Standard ethernet

100 Mbps ↓ Fast ethernet

1 Gbps ↓ Gigabit ethernet

In exam, they will give Bandwidth.

Ethernet deals with → DLL

AL — message

TL — segment

NL — Datagram

ethernet ← DLL — Frame → Framing → Frame Format

PL — IPDU

Framing ↓ discussed

Frame Format of ethernet :

PL header		DLL Frame				
Preamble	SFD	DA	SA	length	Data	CRC
7 B	1 B	6 B	6 B	2 B	Variable Size	4 B

↓ important ↓ mug up.

CRC
→ Cyclic Redu check.

length → No need of SFD

SFD
↳ Start Frame delimiter

DA → Destination physical address → MAC

SA → Source physical address → MAC

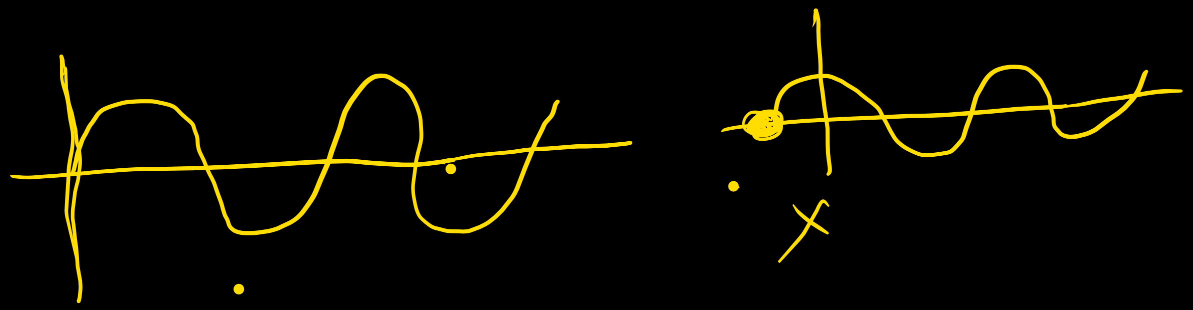
length → length of the frame

Preamble: $\underbrace{101010\ldots\ldots10}_{\text{7 Bytes}}$

SFD – Start Frame delimiter.

$$\underbrace{10101011}_{\text{1 Byte}}$$

Pre and **SFD** → Synchronization and indication start of frame.



DA and SA :→ mac addresses → 48 bit numbers

Hexa decimal number system

Ex: → MAC : 0001 | 0010 | 1010 | 1011 | 0111 | .... | .... | 48 bits

1 2 A B 7 ......

Hexa ← 12 : AB : 74 : 56 : 78 : 91

Representation of mac add.

Types of mac add

- unicast → Least significant bit of I Byte → 0
- multicast → least significant bit of I Byte is 1
- Broadcast → ~~All~~ All 1s

I Byte ← 1A : 2B : 3C : 41 : 56 : 78 → unicast address

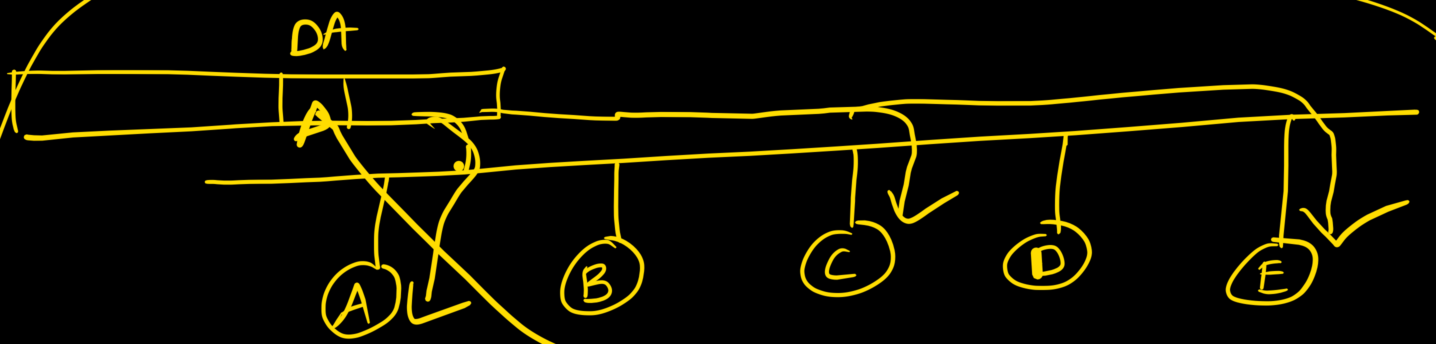
00011010 → LSb

I Byte ← A3 : 71 : 47 : 68 : 94 : 76 → multicast add

10100011 → LSb

FF : FF : FF : FF : FF : FF → BC add

Every host will get a unicast address



→ Not in syllabus

unicast
one - one

10101010.... 7 byte
10101011 → [illegible]

we can create groups.

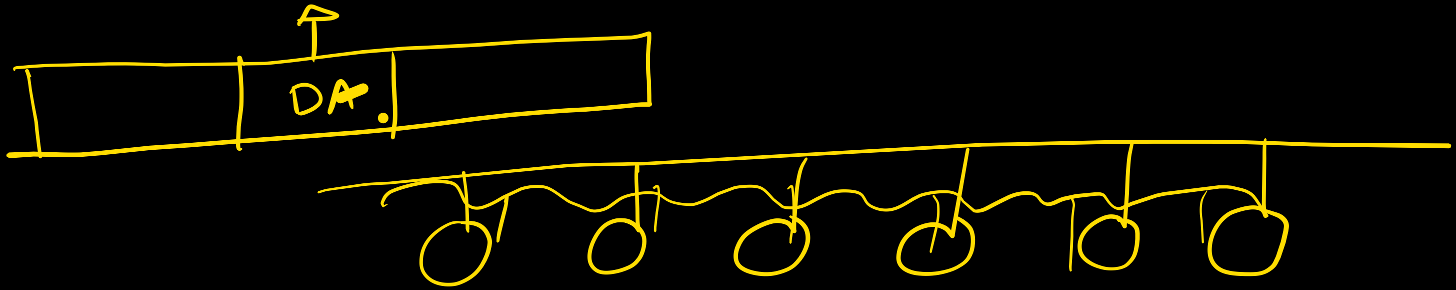
Group : A C E

↓

mc add A1 : B2 : C3 : B4 : 8A : 91

Broadcast add:

FF:FF:FF:FF:FF:FF



To all hosts.

all host will take the pack.

BC add at IP : 255.255.255.255.

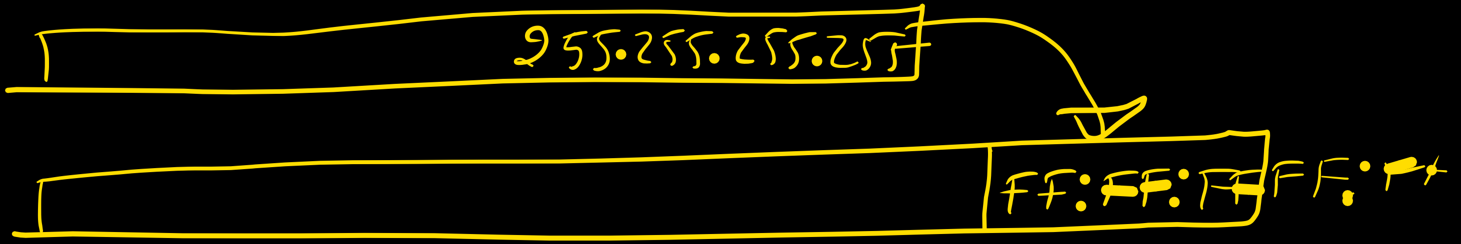
∴ IP broadcasting → MAC broadcasting

Both DB as well as limited BC.

AL

TL

NL



DLL

PL

Ethernet uses

0000 - 0

0001 - 1

0010 - 2

0011 - 3

⋮

1001 - 9

1010 - A

1011 - B

1100 - C

⋮

1111 - F

Ethernet uses CSMA/CD:

$\therefore$ Formula $L \geq 2 * T_p * BW$

In standard ethernet Length of frame $\geq$ 64 B $\rightarrow$ min frame size $\leftarrow$ min data

min frame size

mug up

maximum data in ethernet is 1500 B $\rightarrow$ max data

max frame size

6	6	2		4
DA	SA	Length	Data	CRC

$\rightarrow$ 64

Preamble + SD $\rightarrow$ PL

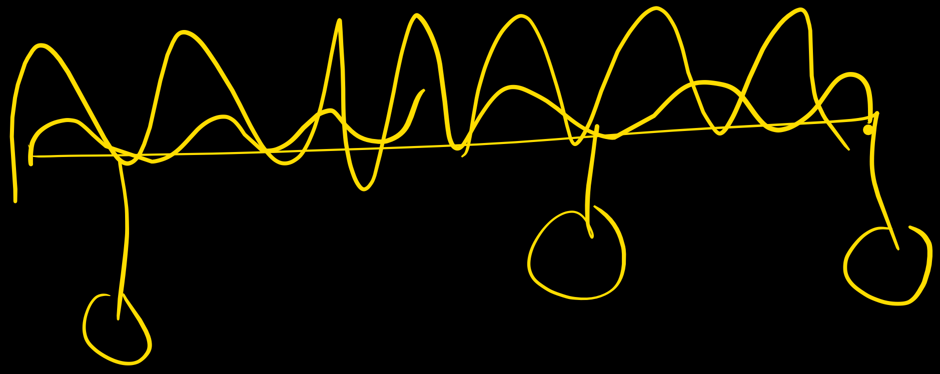
min frame size = 64 B $\rightarrow$ min data size = $(64) - (6+6+2+4)$
$= 46$

maximum Data size = 1500 B

$\therefore$ maximum Frame size = $1500 + (6+6+2+4)$
$= 1518$ B

Why minimum Frame size is needed

→ detect collision

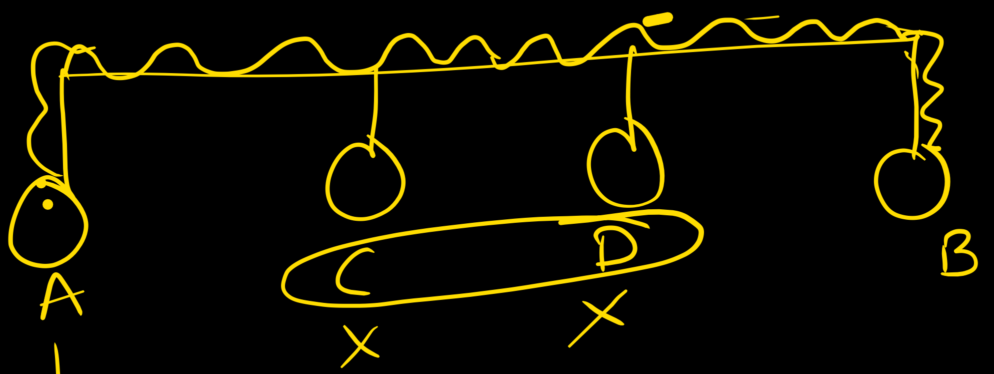


$L \geq 2 * T_p * BW$

↓

1500 B

why maximum frame size is needed



if A never stops. → monopolisation

avoid

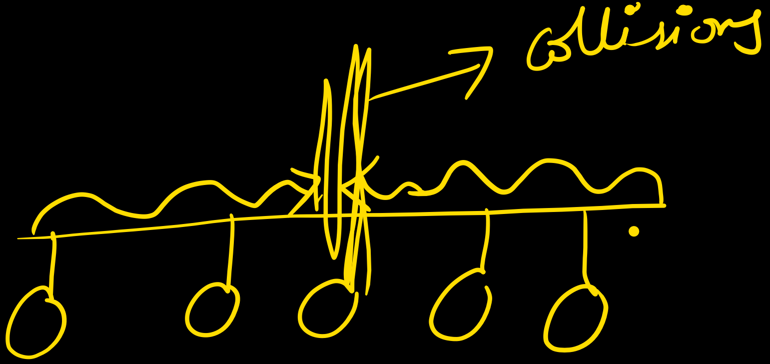
limit on data

only $\boxed{1500\,B}$

email → Hyd students
→ Seminar in hyd colleges
→ help me → hyderabad
Break 5 min:

B

Disadvantages of ethernet:



Lot of Collisions.

Not suitable for Real time application.

like: Time Critical

→ 10:30 am → no guarantee

Data 10:00 Because Collisions

Ethernet is not suitable for <u>interactive applications</u>.

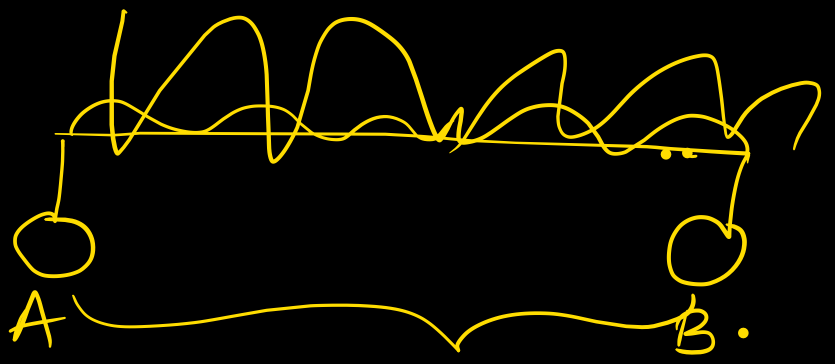
Ex: Chat → Hi.

$\underbrace{\text{H i}}_{\text{2 Bytes}}$

But in ethernet min data size → 46B

2B → 2B + $\underbrace{44B}_{\text{Dummy}}$ → waste

Ethernet is not suitable for client-server:



Backoff algo → No priority to A & B.

In C-S ⇒ Server should get high priority

Token Ring was used to overcome disadvantages

But Token Ring is not in syllabus.

~~TOKEN RING~~

CSMA/CA

avoidance

Not in gate

Switching :

Confusion in terminology

Switch → Concept → anything that connect multiple devices

Swich → Device → working at DLL.

what is switch.

↳ depends on the context

For example

Switch → general name

devices

Router → Switching

Gateway → Switching

Bridge → Switching

Switch → Specific device.

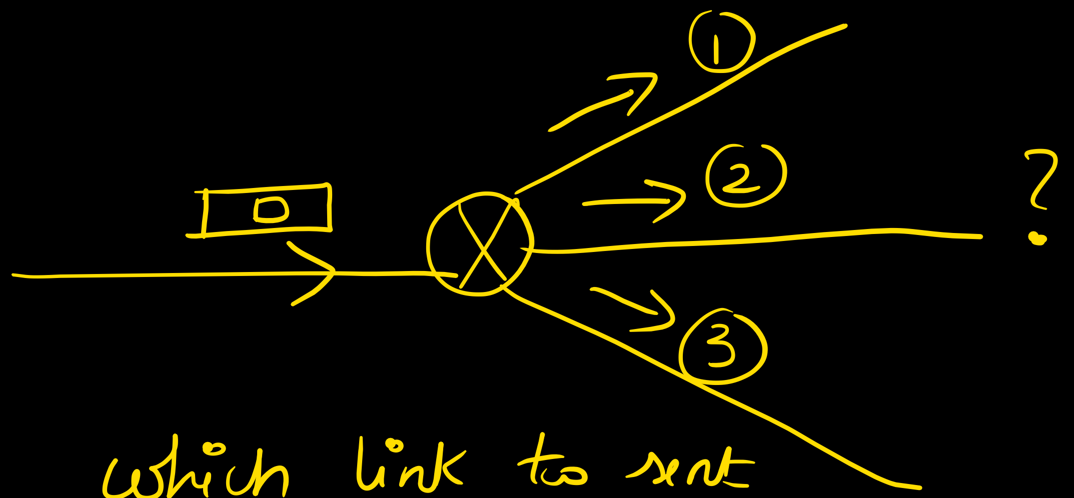
Switch → Switching

Firewall → Switching.

Context

It will clear in question

what is Switching



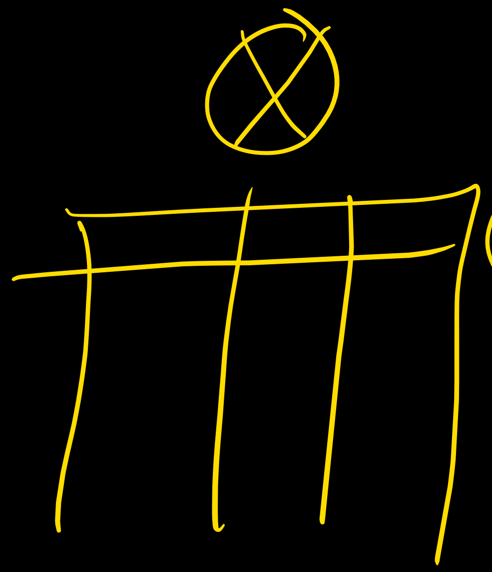
which link to sent
is switching

At a router, Routing table will
help in switching

Routing

VS

Switching



RT

using RT, Router will do switching

Preparing & building RT is called Routing

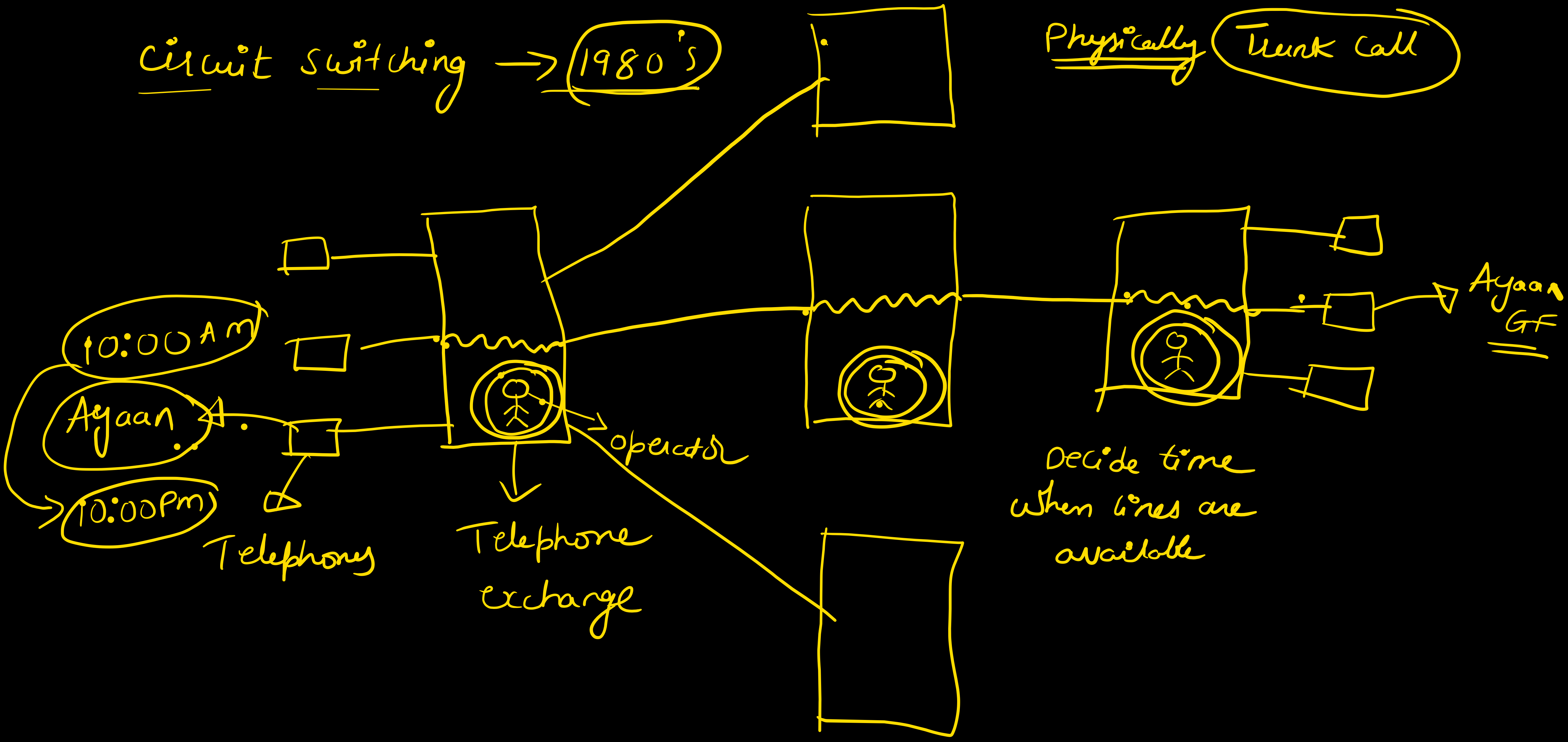
From $\longrightarrow$ June / July $\rightarrow$ classes will be both morning and evening:

6.00 am - 8 am

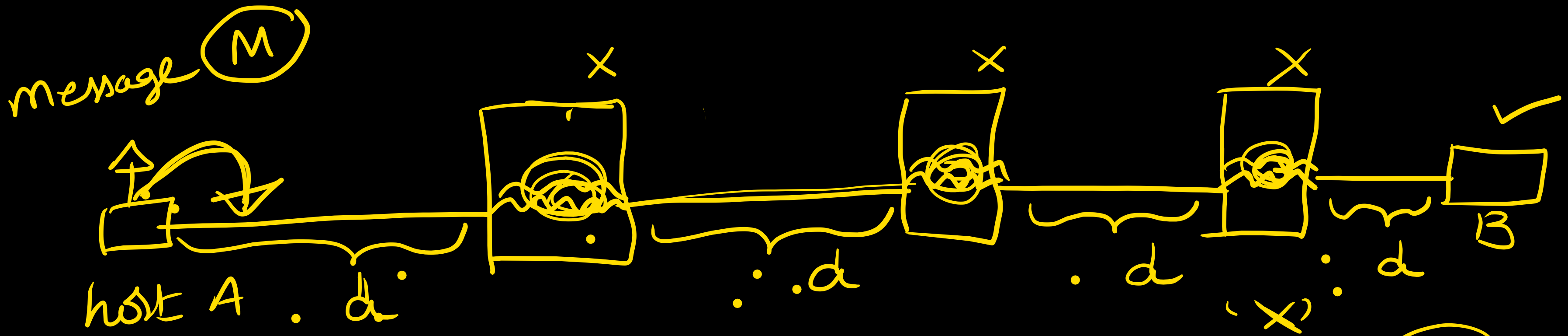
Switching

- Circuit Switching
- Packet Switching
  - Virtual Circuits
  - Datagrams
- message switching

Circuit switching → 1980's



Circuit Switching



hops → 4   4d

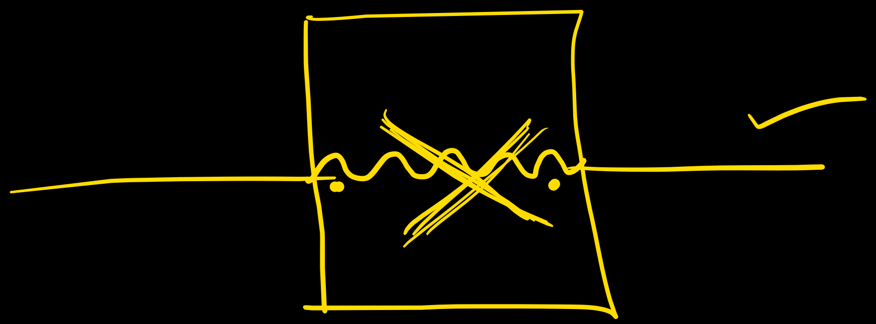
Transmission → only one

Bw: B

Distance of each node is 'd'

velocity = 'v'

$$\text{Total time} = \text{Setup time} + \frac{m}{B} + \frac{x\,d}{v} + \text{Tear down time}$$

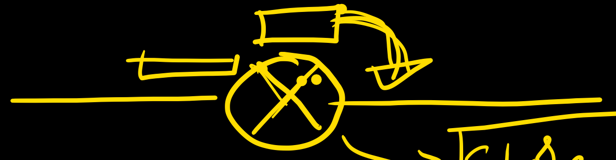


Packet Switching

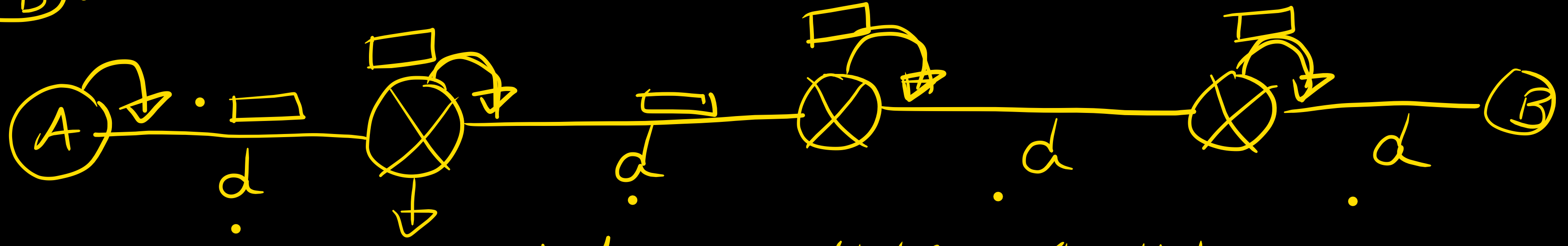
M ✓

B ✓

switch



Store and forwards ✓



No need of physical intervention multiplexing is done programatically

Hops – 4 Hops

Trans 4 T_t

$$\boxed{TT = X\frac{m}{B} + \frac{Xd}{v}}$$

$X \rightarrow$ hops

Cir switching : $TT = \text{Setup time} + \frac{m}{B} + \frac{x\,d}{v} + \text{Teardown time}$

Packet Switche : $TT = \frac{Xm}{B} + \frac{X\,d}{v}$

CS	PS
Setup time + Teardown	$(X-1)\frac{m}{B}$

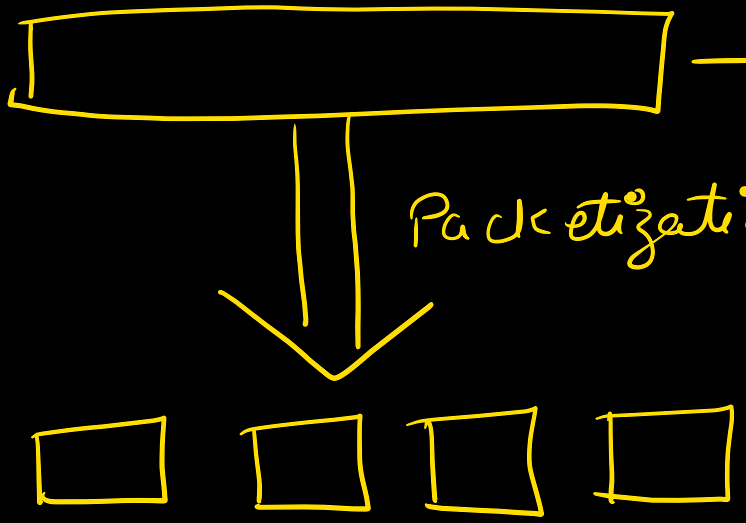
extra

which one is better

$m\uparrow\uparrow\uparrow \rightarrow$ CS is better

$m\downarrow\downarrow\downarrow \rightarrow$ PS is better

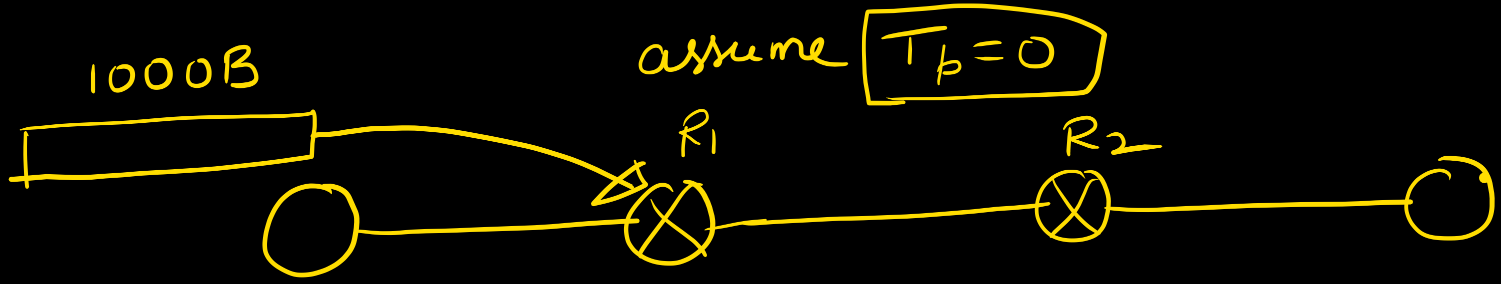
Paketisation :



→ Big message

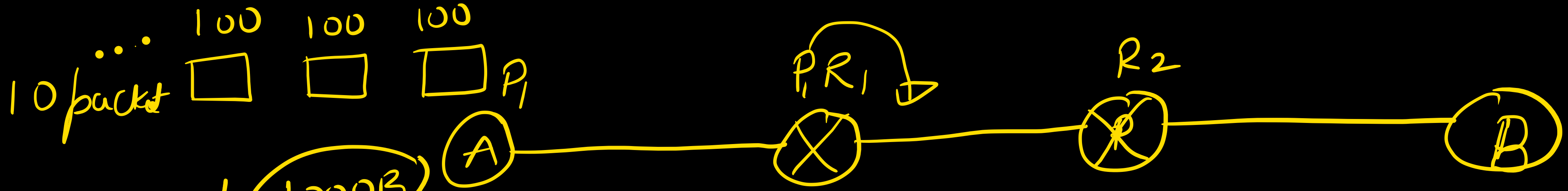
Packetization → improves efficiency of N/w's

→ multiple packets



- At $t = 0ms$ → Transmission starts
- At $t = 10ms$ → R_1 Recieves 100 B
- At $t = 20ms$ → R_1 Rec 200B
- At $t = 30 ms$ → R_1 Rec 300B
- ⋮
- At $t = 100ms$ → R_1 Rec 1000B.

R_1 & R_2 are idle.



Total 1000B

Packetisation

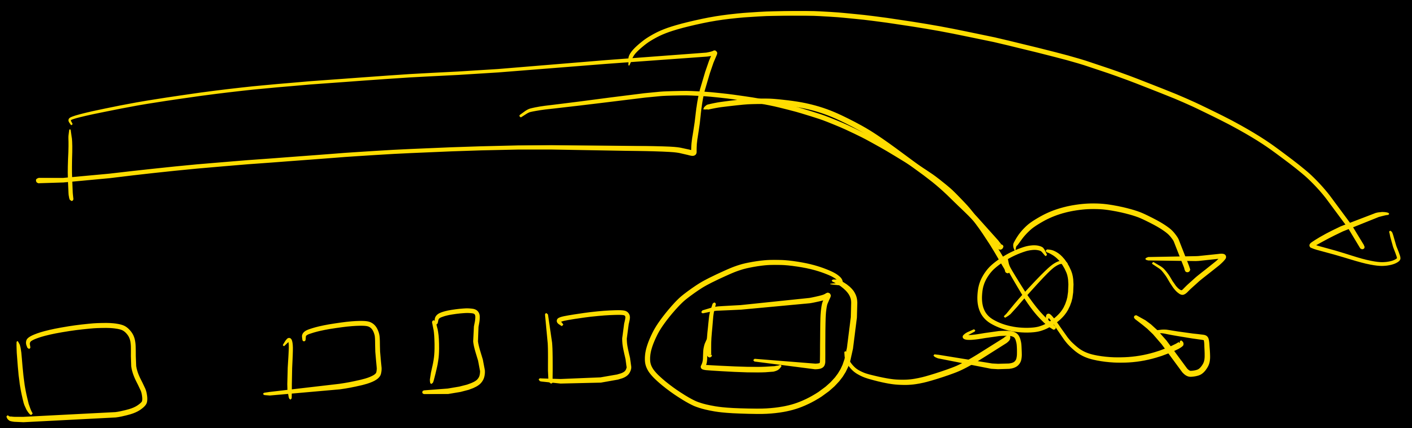
At t = 0 P1 Starts

At t = 10 ms P1 is rec by R1 and R1 starts transmi P1

At t = 20 ms $P_2 \to R_1$ $P_1 \to R_2$

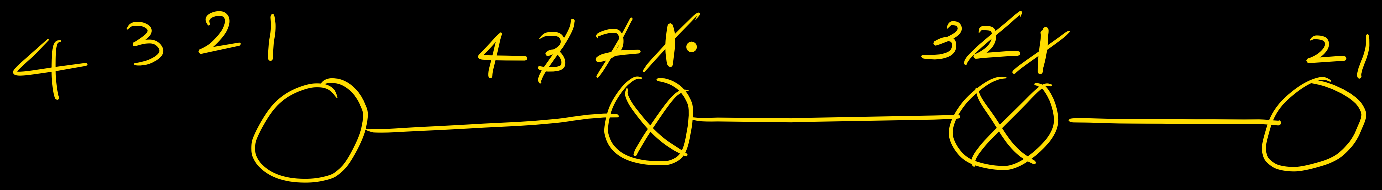
At t = 30 $P_3 \to R_1$ $P_2 - R_2$ $P_1 - B$.

Both Routers are busy



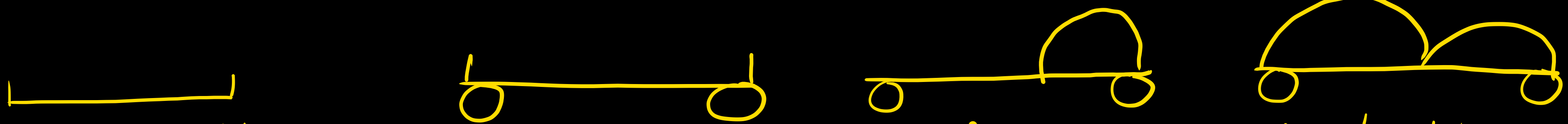
Router need full packet before they start transmitting. In case of small packets → Router can transmit early.

Indirectly → Packetisation → Pipeling.



Kind of pipeline.

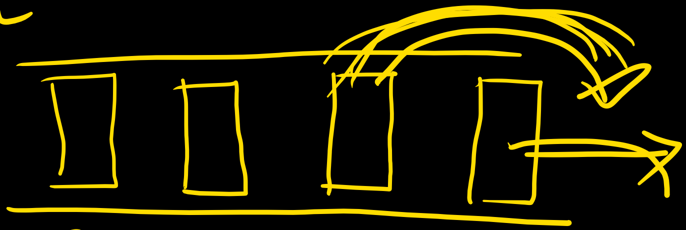
Example → building cars



Base = 1 hr   adding wheels = 1 hours   engine 1 hr   body 1 hr

Totally = 4 hours. → 10 cars → 40 hours.

Totally 10 car →



B   W   E   B

1   1   1   1

For I car → 4 hr

Every 1 hour → one car will come out

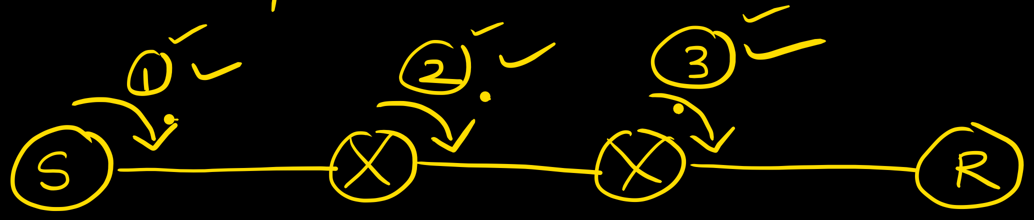
9 → 9 hours

4 + 9 = 13 ✓

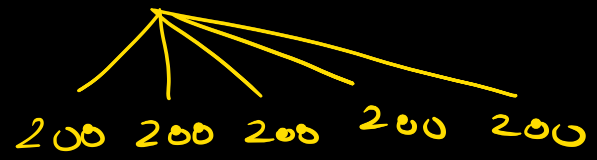
Case I:

Data = 1000 Bytes, BW = 1 MBps   Header = 100B

assume $T_p = 0$.



(Packetisation)



Packet size = Data + header size

$= 1000 + 100 = 1100$

$$T_t = \frac{L}{B} = \frac{1100}{10^6} = 1.1\,ms$$

$$TT_t = 3 * T_t = \underline{3.3\,ms}$$

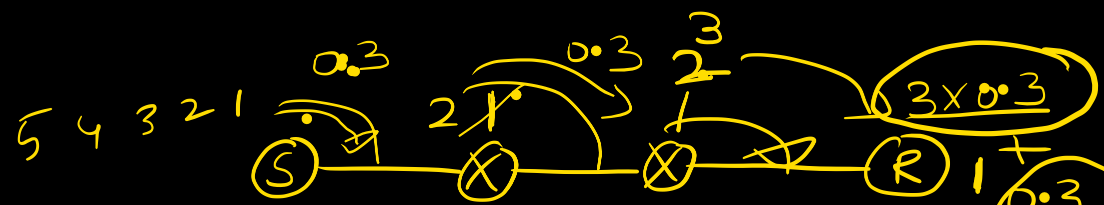
Case II :

packets = 5 Data in each packet = $\frac{1000}{5} = 200\,B$

BW = 1 MBps Header = 100 B $T_p = 0$

$\therefore$ Packet Size = $\underbrace{200\,B}_{D} + \underbrace{100\,B}_{H} = 300\,B$

$T_t = \frac{300}{10^6} = 0.3\,ms$



3×0.3
$+$
0.3
$+$
0.3
$+$
0.3
$+$
0.3

$3 \times 0.3\,ms$

remaining 4 packets − 4×0.3

Total time = $\underbrace{3 \times 0.3}_{1\ \text{Packet}} + 4 \times 0.3$

$= 2.1\,ms$

Case III :

\# packets = 10 $\therefore$ Data in packet $= \frac{1000}{10} = 100B$

BW = 1 MBps , Header = 100B

$PS = \underset{D}{100} + \underset{H}{100} = 200B$; $T_t = \frac{200}{10^6} = 0.2\ ms$

$I \to \underline{3 \times 0.2}\ ms$

9×0.2 : 0.2
: 0.2
:

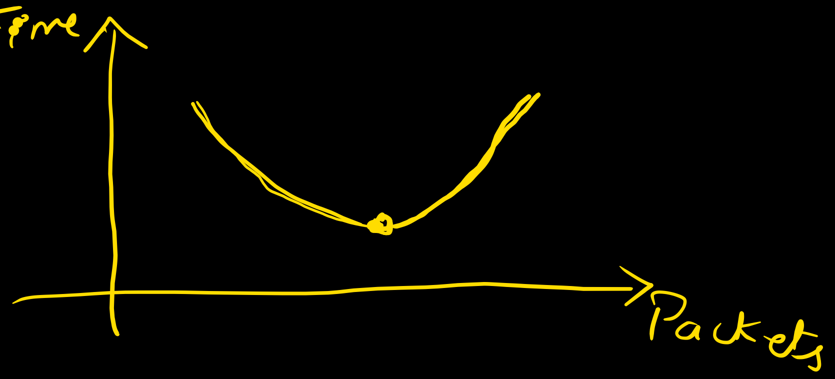
$$T_t = 3 \times 0.2 + 9(0.2) = 2.4\ ms$$

1 m - 3.3

5 Pac - 2.1

10 Pac - 2.4

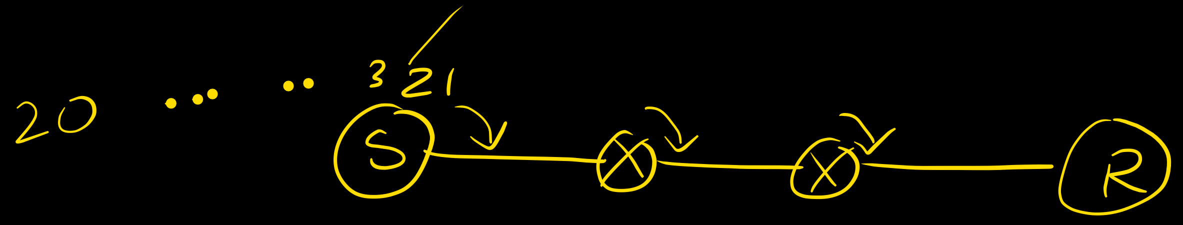
20 Pack - 3.3



Case IV : # packets = 20

Data = $\frac{1000}{20}$ = 50   BW = 1 mbps   HS = 100B   PS = 150B

$T_t = \frac{150}{10^6} = 0.15$ ms



I – 0.4 ms

19 × 0.15 = 1.85 ms

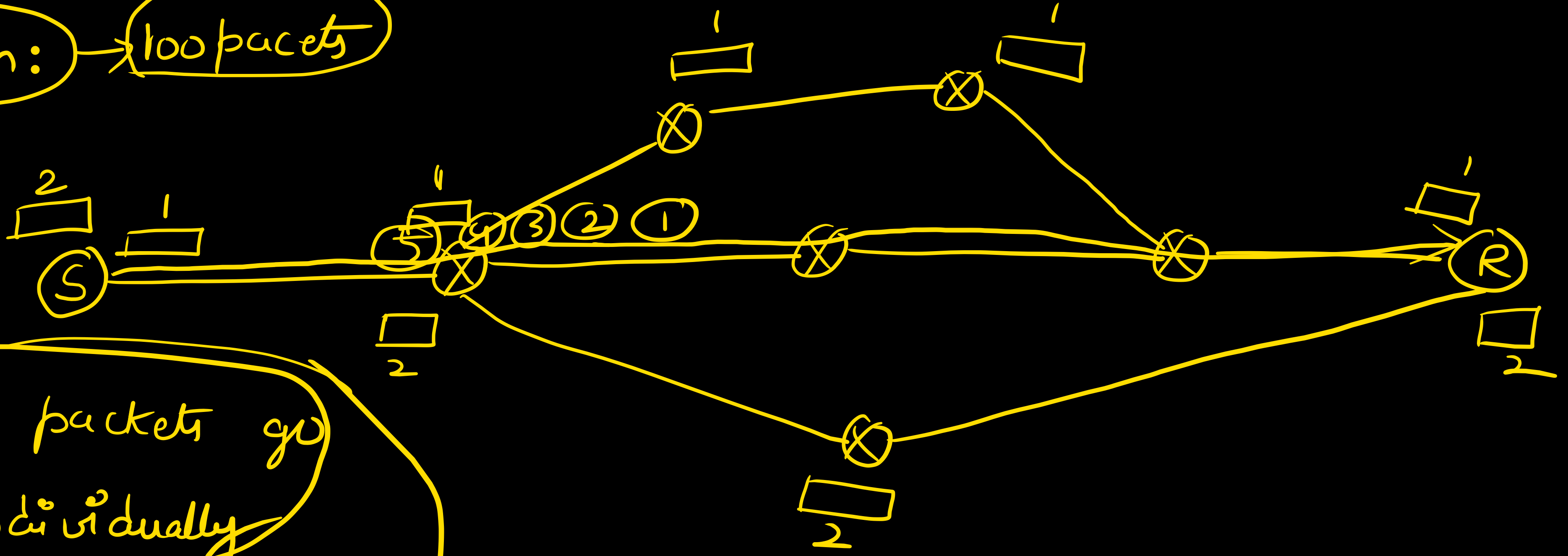
$\boxed{T_t = 3.3 \text{ ms}}$

Packet Switching

- Virtual Circuits
- Datagrams

In virtual cir

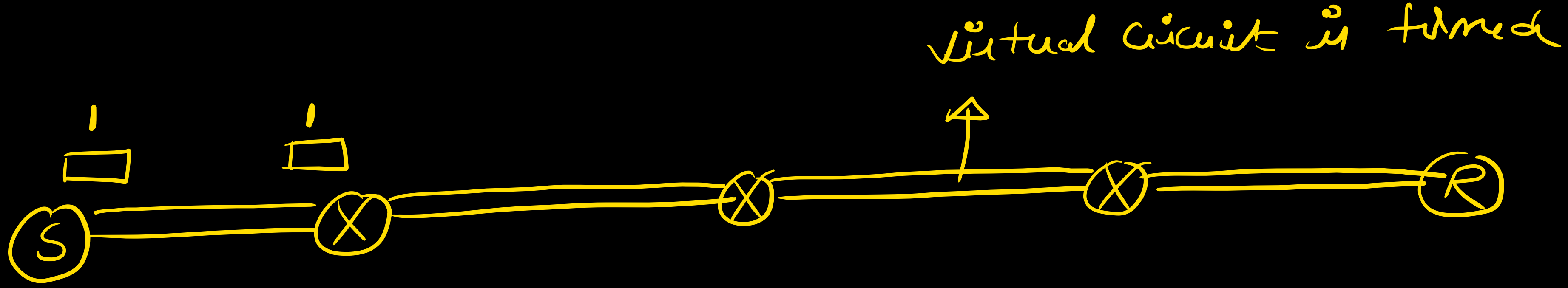
Datagram: 100 pacets



Datagram
all packets go individually

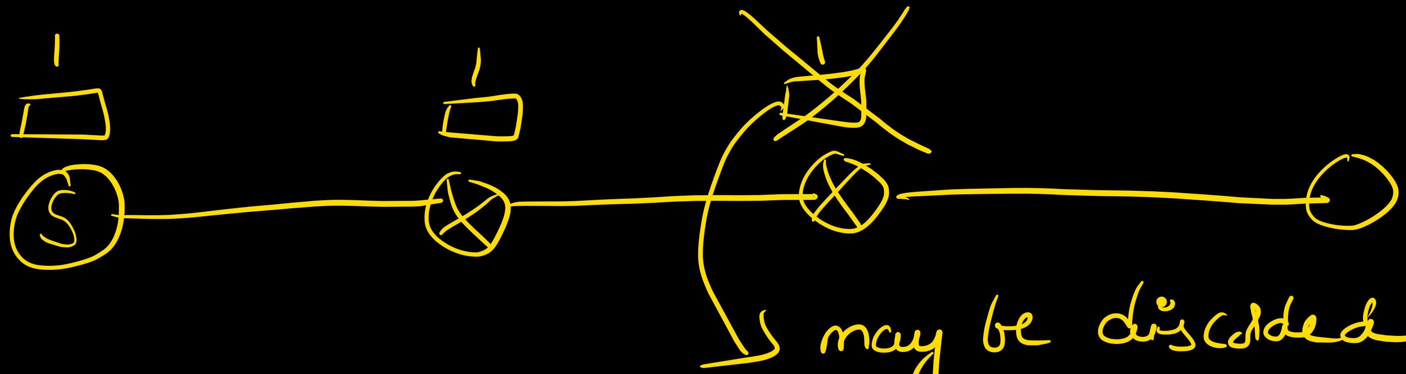
VC
all packets follow I packet

In virtual circuits :



First packet will make Router to reserve BW, Buffer and CPU for all following packets.

In datagram :

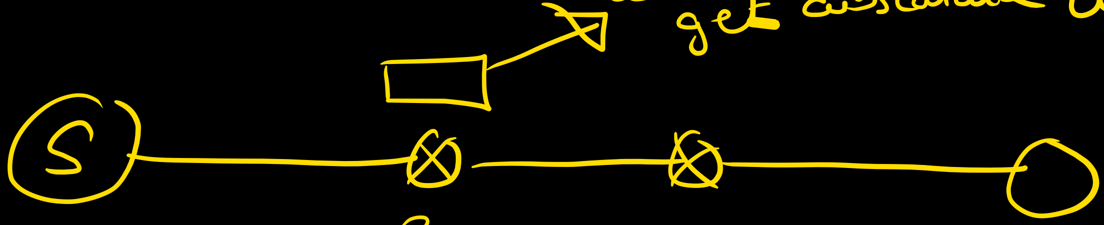


may be discarded

why? Because BW & Buffer & CPU may not be available

In VC :

will never get discarded



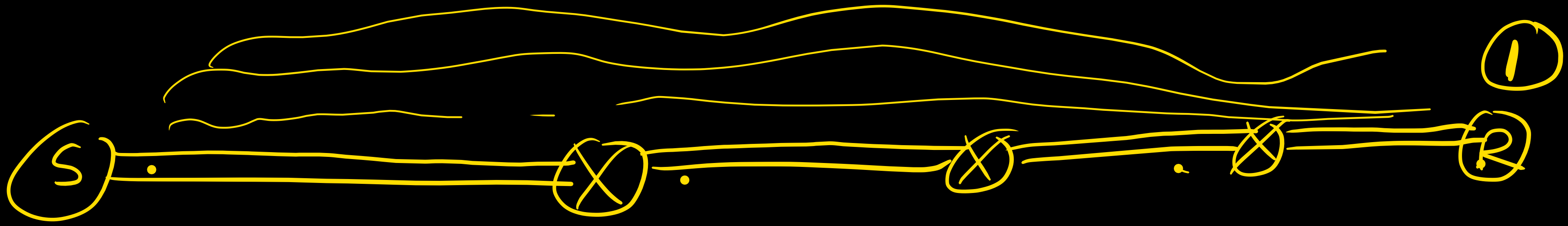
BW
Buff
CP

} Reserved

If you are writing Email. → <u>data gram</u>

If ~~you~~ you are Calling on a telephon → Virtual circuit.

what happens in telephone



BW
Buff
CP

} Reserve on all the Router

BW
Buff
CPU

$\left.\begin{array}{l} \text{BW} \\ \text{Buff} \\ \text{CPU} \end{array}\right\} \times$ Resou

Whasapp call → Data gram → no Reservation

low clarity.

Data loss

out of order

$\underline{\underline{\text{VOIP}}}$ → voice over internet protocol

Data gram

Virtual C → Datagram