

Ethernet frame processing at Receiver:

- 1) Frame Identification
 - 2) Check FCS.
— If incorrect, drop
 - 3) Check Dest
— If DA field \neq My NIC MAC
 or
 \neq all 1's, drop
 - 4) Check type field, call appropriate higher layer protocol.
- ⇒ Preamble is not considered in size of frame.

Q) How to know data length?

- 1) Grab b/w ≥ frames
- 2) Map 8 bits to 1s bits.
first ≥ bits indicate if Data or not.

64 bytes min size 10 Mbps	Say max length ≥ 5 Km
51.2 ms slottime	(with 4 repeater)

64 bytes min size 100 Mbps	≥ 50 m
5.12 ms slottime	

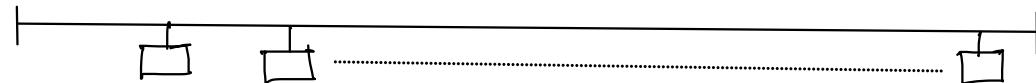
64 bytes 1000 Mbps	≥ 5 m
5.12 ms	

Ethernet in your w/c \Rightarrow NIC (h/w) + S/W (driver)

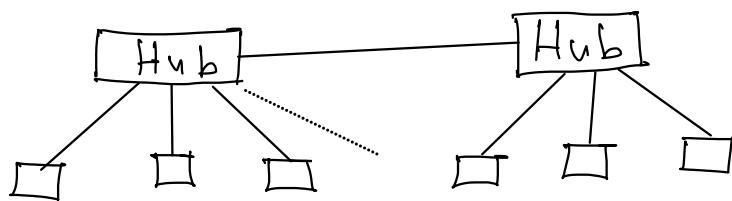
Broadly H/W does \Rightarrow adding, removing preamble/postamble, CRC addition/check framing/deframing, encoding/decoding, actual Xmission etc.

S/W does \Rightarrow frame processing

10-BASE-5

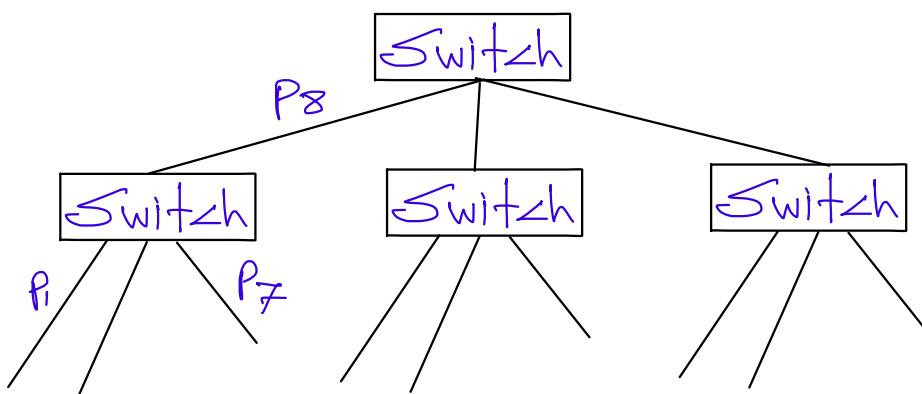


10-BASE-3



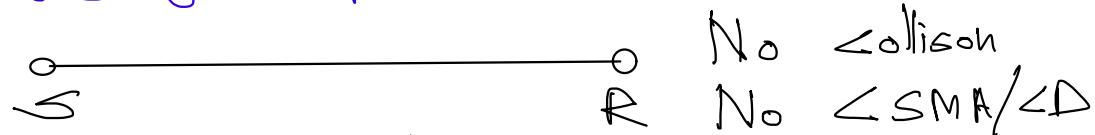
Switched Ethernet:

One port \Rightarrow Find out destination port and send
Learn Sender's MAC addresses.

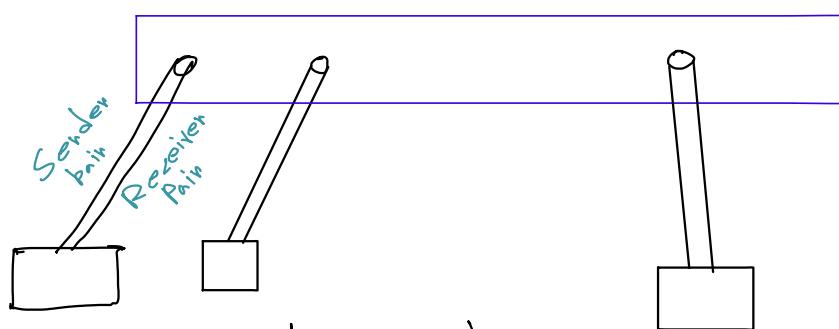


P_1 -MAC
 P_2 -MAC
 :
 P_7 -MAC
 P_8 — Rest

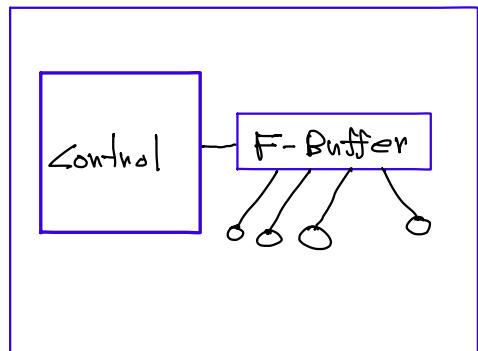
Suppose full duplex point to point link



Extend to switch



Switches also have frame buffers



\Rightarrow With this there is absolutely no collision even if two senders send to the same receiver

\Rightarrow So, switched Ethernet does not need CSMA/CD

Can be a single buffer or one for each port

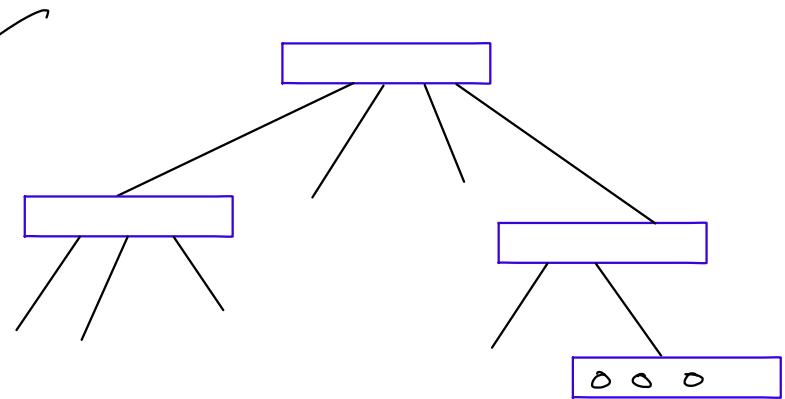
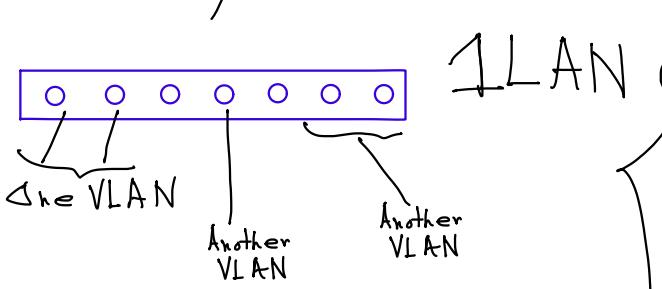
SNMP
MIB

Spanning Tree Protocol:

Q) How should the root know it is root?

Nowadays:- Virtual LAN

Switched Ethernet:-



Step 1:

Configure this

Switch ports to say which port belongs to which VLAN

Ethernet Frame

Step 2: Protocol change

LAN is confusing:-

Specs are very specific. But can be confusing

Gigabit Ethernet:- (Collection of specs)

"Gigabit Ethernet" uses all 4 pairs of UTP
only for 1000Base-T, use all 4 pairs, uses ≥ bit/signal

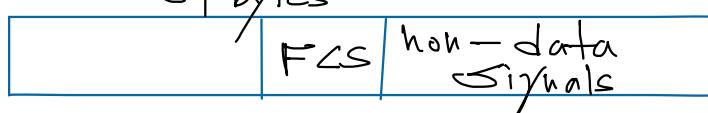
But basic Ethernet frame remained same.

If CSMA/CD, $\approx 10-25m$, if nothing else was changed
|| or impractical

So? Increase frame size

Not in Exam

Carrier extension:- Extend to 512 bytes with non-data symbols



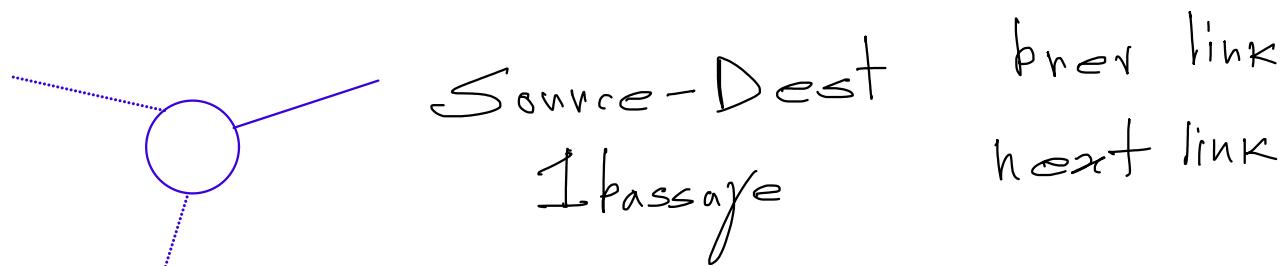
Frame Bursting:- Sends more than 1 frame together

GB Ethernet allowed both
— half duplex & full-duplex

WAN:-

Packet Switching:- \leftarrow store and forward

	All data b/w same Sender-Receiver pair passes through same path	A path is dedicated for a single Sender-Receiver pair
Circuit switching	✓	✓
Virtual Circuits	✓	✗
Datagram	✗	✗



Src IP
Dest IP
Src Port
Dest Port

→ IP addr is Unique (for now)
 Q) So, if MAC address is also assigned to NIC & IP address is also assigned to NIC & if both of them are unique for a NIC,
 Why two?

Private IP:- no packet on the internet will have Src or dst ip = a private IP.

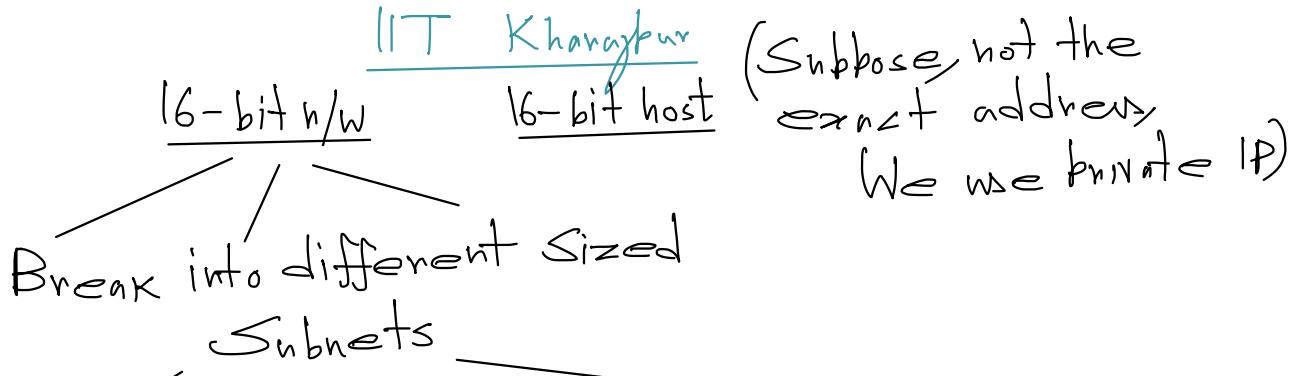
Q) How to specify a h/w?

① 142.13.8.0/24

Subnet mask $\geq 255.255.255.0$

② 142.13.8.0

$\geq \geq 0.100.200.000000$
 \downarrow
 $\geq \geq 0.100.200.00000000 \longrightarrow h/w 1$
 $\geq \geq 0.100.200.10000000 \longrightarrow h/w \geq$
 $\geq \geq 0.100.200.0/25$
 $\geq \geq 0.100.200.(\geq 8/25) \leq_{ach with 128}$
 \downarrow
 $\leq_{IP's}$



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graph TD
    CSE[CSE] --> Subnet1[Subnet]
    EE[EE] --> Subnet2[Subnet]
    R_K[R&K] --> Subnet3[Subnet]

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Subnet allows:

① Setting subnet-wise policies
→ fine-grained security

- b/w we security
 - for ex - Total traffic out of a subnet is
 - < something do not allow packets from subnet X to subnet Y

③ Reduce routing table size at say <1< Router

\Rightarrow All 0 and All 1 can not be used

128.168.100.0/24

Break into 4 equal sized subnets

$102 \cdot 168 \cdot 100 \cdot 80 / 126 \leftarrow \text{Cannot be used}$

$1 \geq 168.100.01 / \geq 6$

$$102 \cdot 168.100.10 / 26$$

172.168.100.11/26 ← Cannot be used

Don't Know
~ if to broadcast
to all or
Within the subnet

Packet Forwarding:- Assume routing table is available

IP Routing Table:

Dest	Next hop	Cost
X.Y.Z.P / (?)	One IP	(int)

Routing vs Forwarding

Fill the Table

Forwarding only when packet is rec'd
 Routing can go on even if no packet.

≥ types of m/c

Sender of IP packet

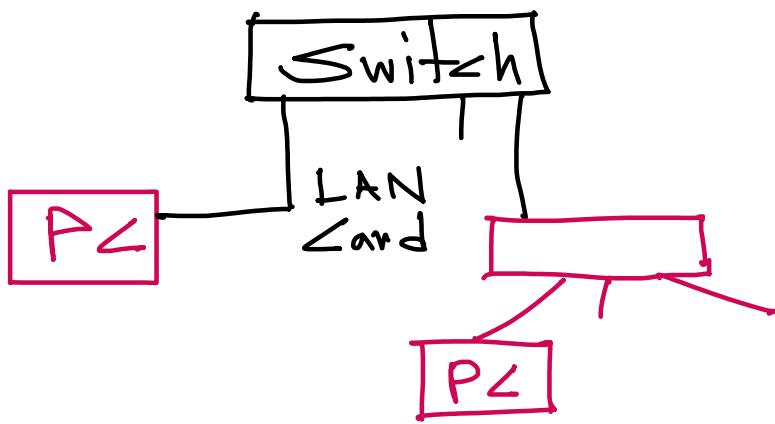
Receiver of IP packet

TCP/UDP
↓
IP

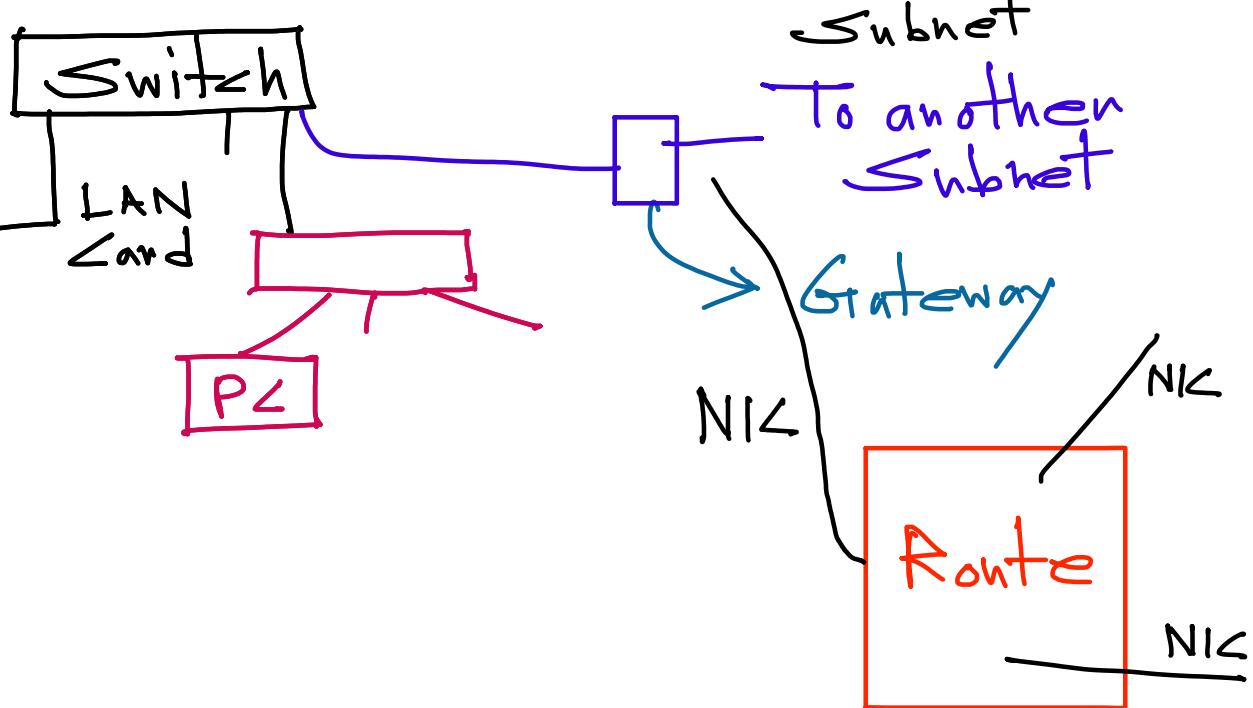
Router
IP ↑
DLL

Final dist
IP ↑
DLL

⇒ If match my own ip,
 Give it to higher layer



⇒ Every Machine will have Routing Table



$\frac{\text{Dest}}{X \cdot Y \cdot Z \cdot P / - (?)}$
 $\frac{\text{Next hop}}{\text{One IP}}$
 $\frac{\text{Cost}}{-}$

How many entries would we need?
 $\xrightarrow{\text{Red Arrow}} \text{Route by network} \quad (\cancel{\text{host}})$
 \downarrow
 $\frac{\text{Dest}}{IP / -}$
 $\frac{\text{Next Hop}}{IP}$
 $\frac{\text{Cost}}{\text{int}}$

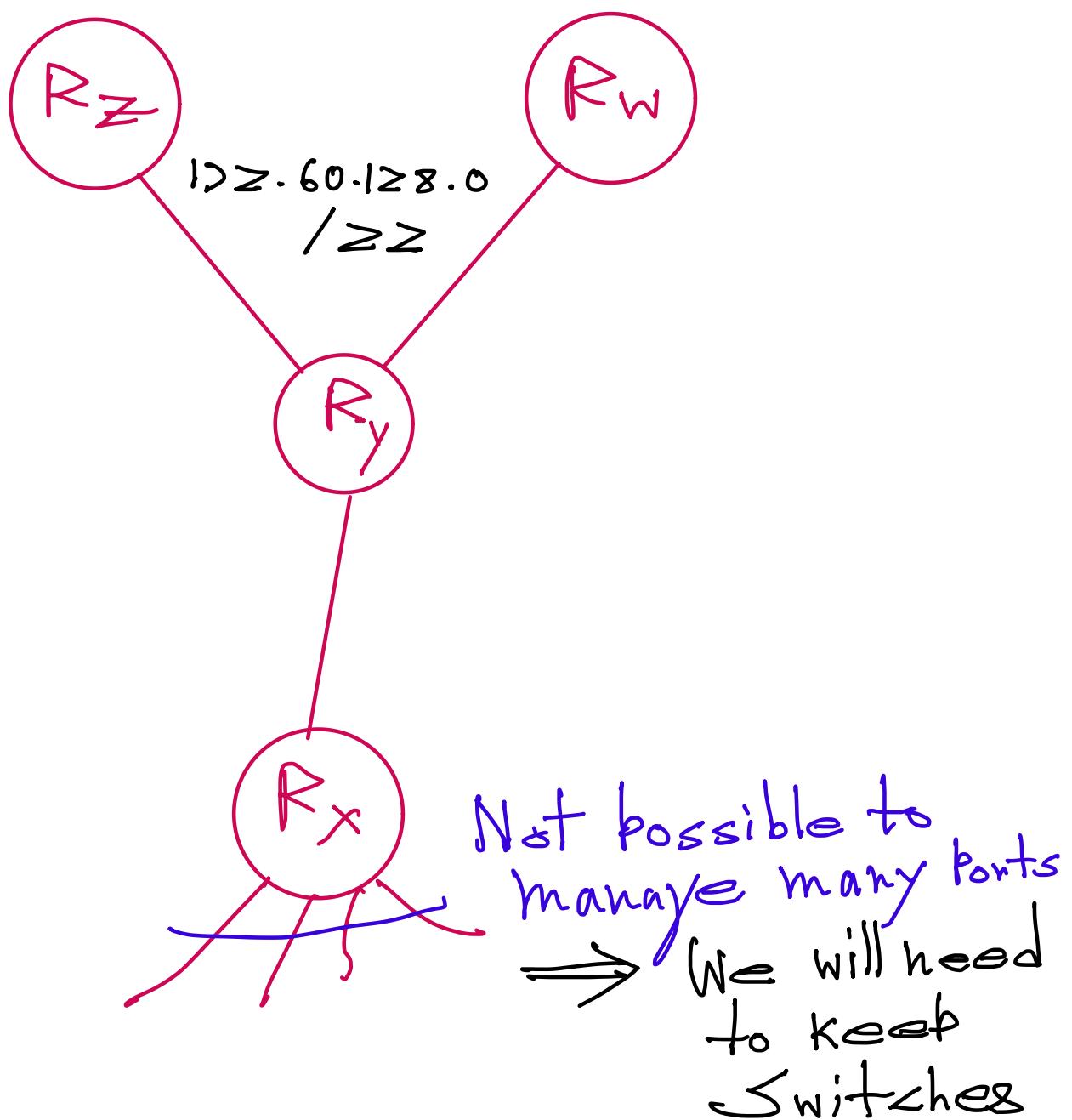
or
 $\frac{\text{Dest}}{\text{Subnet Mask}}$
 $\frac{\text{Next Hop}}{\text{IP}}$
 $\frac{\text{Cost}}{\text{int}}$

Dest Next Hop Interface

⇒ What happens if we get dest not in routing Table?

→ Prob it.

Gateway = Terminology for router
at the Subnet level



- What if
 - Subnet 1, 2, 3, 7, 8 given to IIT KGP
 - Subnet 4, 5, 6 to IIT Jammu?
- How many entries needed in Ry?

$1 \geq 3$

$7 \geq 8$

4 $\boxed{5 \ 6}$

⇒ Longest Prefix match

⇒ Can easily do with 5

⇒ Can we do better? $\begin{cases} 1-8 \rightarrow \text{KGP} \\ 4-5,6 \rightarrow \text{Jammu} \\ \text{Total} \rightarrow 3 \end{cases}$

Matching!

(Dest) & (Mask) === Network
Destination

In-link ⇒ IP is on this Subnet

$0.0.0.0 \quad 0.0.0.0 \Rightarrow$ Default Route

⇒ I know in same Subnet?
→ Send there

⇒ I don't
→ Send Gateway

⇒ Why do we need two address?
MAC and IP