Computer Network

Data-Link Layer

Lecture : 17

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TCP/IP

TCP/IP Layer	Hardware	Software/Protocols
Application	None	HTTP, FTP, SMTP, POP3, IMAP, DNS, SSH
Transport	None	TCP, UDP
Internet	Routers	IP (IPv4/v6), ICMP, IGMP, ARP, RARP Routing(DVR(RIP), LSR(OSPF), BGP)
Data Link	Switches, Bridges, NICs	Ethernet (MAC framing), Wi-Fi (802.11 MAC), PPP, Frame Relay, HDLC
Physical	Cables (fiber, coaxial, twisted pair), Hubs, Repeaters, Connectors (RJ-45), Amplifier	ONLY physical standards (IEEE 802.3 for wiring, IEEE 802.11 PHY for Wi-Fi)

Data-Link Layer

Responsibility
Framing
Error Detection
Error Recovery
Flow Control
Access Control
Addressing
Link Management
Framing and Encapsulation

Error Recovery : P. Checker, H.D, CheckSum, CRC

Detection

correction

Flow Control → SW, GBN, SR

S.W

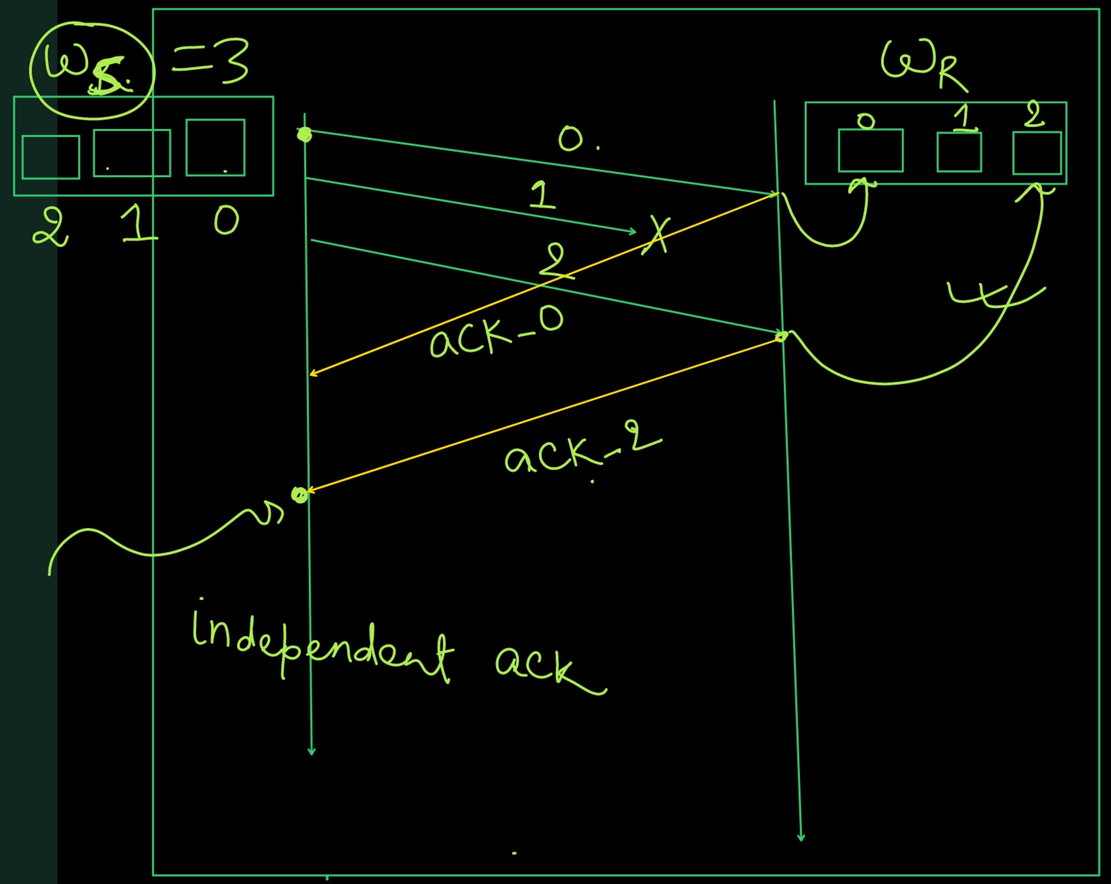
Addressing {MAC}: 48 H.D : {

Framing and Encapsulation

Packet / info

Flow Control: Selective Repeat

Sender Window Size : N
Receiver Window Size : N



$$\eta = \frac{W \times T_t}{C \cdot T}$$

In Case of Error : Silent ack vs Nack vs Timeout

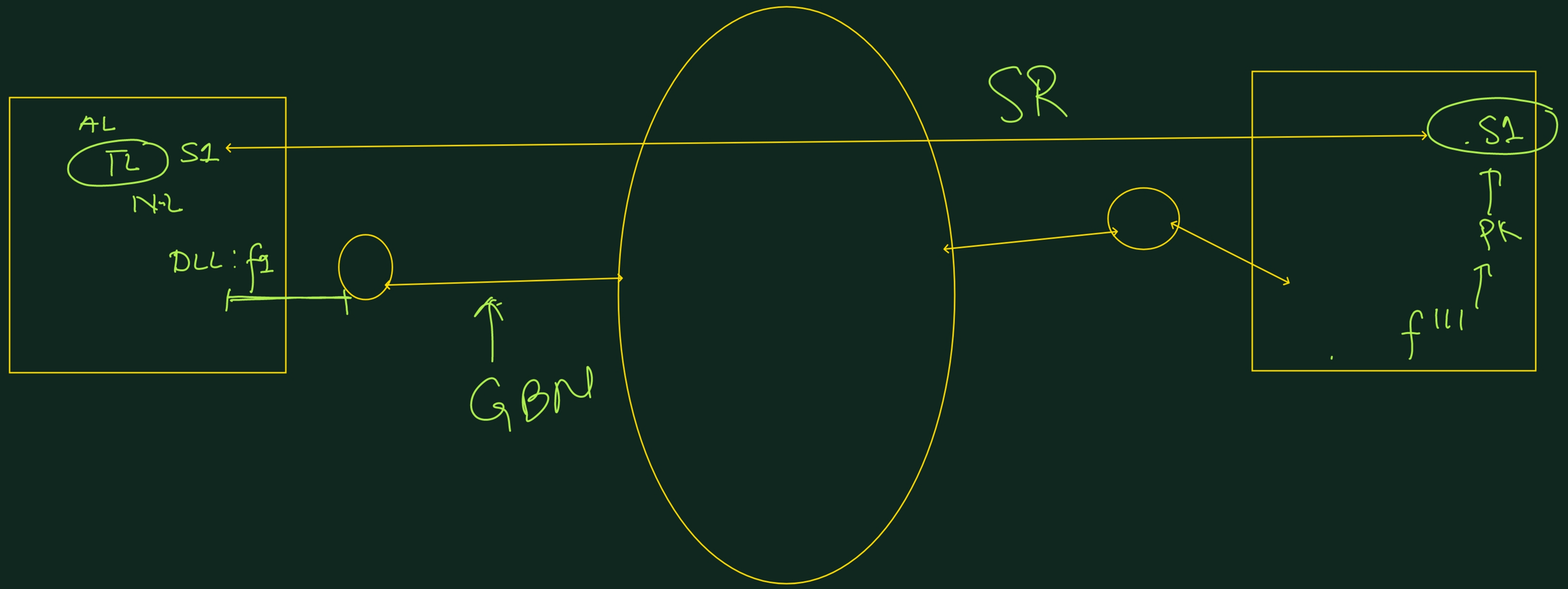
Depends upon Implementation

Go-Back-N does **not use NACKs**.

- If a frame is lost or corrupted, the receiver **discards it silently** and continues sending **ACK for the last correctly received in-order frame**.
- The sender detects the missing frame via **timeout**.

Selective Repeat (SR):

- Uses **per-frame ACKs**.
- May optionally use **NACKs** to **speed up** retransmission.
- But **timeouts** are still the fallback for lost/corrupted frames.
- **NAKs are not mandatory**, just an optimization.

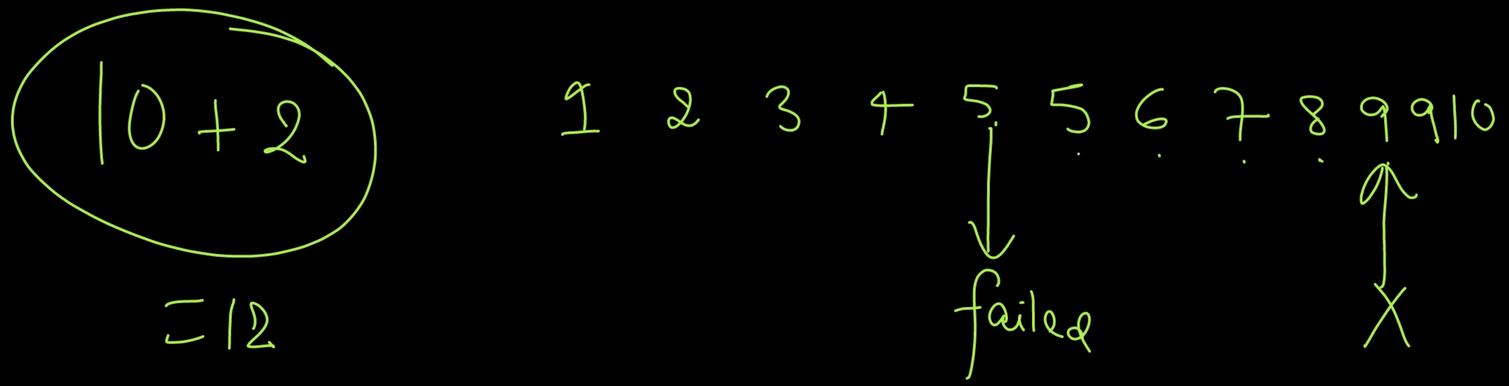

AL
T2
S1
N-2
DLL : f1
GBN
SR
S1
PK
f111

In Case of Error : Silent ack vs Nack vs Timeout

Test Case

- Sender in a wireless LAN connected via routers and receivers are in other LAN.
- Sender will prefer Selective repeat while router to router will prefer GoBack N.
- Wireless medium(BW low, error high)
- Router to router(BW high, error low)

A sender has to transmit 10 packets, and every 5th packet transmitted gets lost. What is the total number of transmissions required using selective repeat with a window size of 3 (GB3)?



Sliding Window: Window Size, Sequence Number

Consider a 128×10^3 bits/second satellite communication link with one way propagation delay of 150 milliseconds. Selective retransmission(repeat) protocol is used on this link to send data with a frame size of 1 kilobyte. Neglect the transmission time of acknowledgement. The minimum number of bits required for the sequence number field to achieve 100% utilization is _____.

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$W_R + W_S \leq Seq No.$

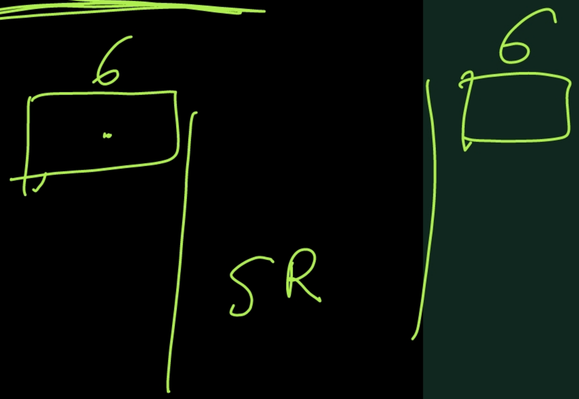
$\eta = 1 = \frac{W \cdot T_t}{T_t + 2T_p}$

$W = ? = 6$

$6 + 6 \leq Seq N$

$12 \leq Seq No$

$\log_2 12 = 4$



Sliding Window: Window Size, Sequence Number

A sender uses the Stop-and Wait ARQ protocol for reliable transmission of frames. Frames are of size 1000bytes and the transmission rate at the sender is 80Kbps(1Kbps=1000 bits/second). Size of an acknowledgement is 100bytes and the transmission rate at the receiver is 8Kbps. The one-way propagation delay is 100milliseconds.
Assuming no frame is lost, the sender throughput is _____bytes/second.

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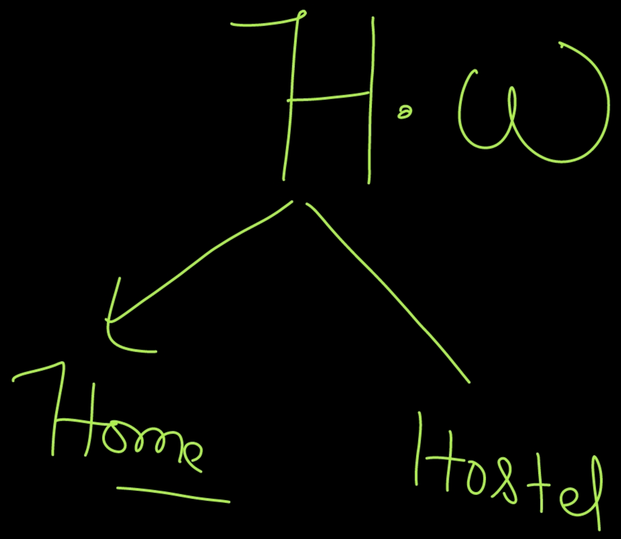
2500



	Stop N Wait	Go Back N	Selective Repeat
Efficiency			
Buffer: Requirement			
No of Retransmissions			
Sequence Number: Bits			
Computational Complexity: CPU			
Band-Width Requirement			
Implementation			

Thank You