CS & IT ENGINEERING

COMPUTER NETWORKS

Flow Control

Lecture No-5

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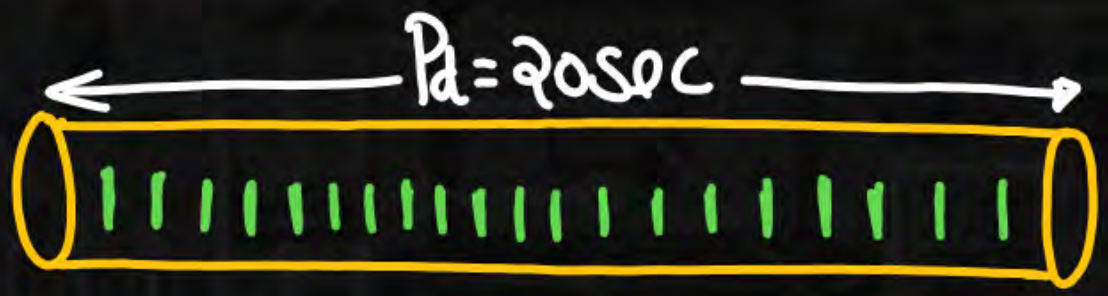
TOPICS TO BE COVERED

1. Capacity of Link/wire/channel
2. Concept of Pipelining
3. Sliding window concept

Go Back-N ARQ

Capacity OF Link|wire|channel



$B = 1\ bPs = 1\ bit/sec$

Capacity OF Link $= 1\ bit/\cancel{sec} * 20\ \cancel{sec}$

Capacity OF Link $= 20$ bits

$$\boxed{\text{Capacity OF Link} = B * P_d}$$

$B = 1\ \text{bits/sec}$

$P_d = 10\ \text{sec}$

$$\text{Capacity of Link} = 1\ \text{bits}/\cancel{\text{sec}} * 10\ \cancel{\text{sec}}$$
$$= 10\ \text{bits}$$

$$\boxed{\text{Capacity of Link} = B * P_d}$$

Q.1 : Bandwidth = 500bPs = 500 bits/sec

P_d = 1 sec

Capacity of Link = ?

Capacity of Link = $B * P_d$

$= 500 \text{ bits}/\cancel{\text{sec}} * 1 \cancel{\text{sec}}$

$= 500 \text{ bits}$

Q.2 Bandwidth = 1 KbPS = 10^3 bits/sec

P_d = 1 sec

capacity of Link = ?

Capacity of Link = $B * P_d$

$= 10^3 \text{ bits}/\cancel{\text{sec}} * 1 \cancel{\text{sec}}$

= 1000 bits

Q.3 Bandwidth = 1 Mbps and P_d = 1 sec and Packet size = 1000 bits then How many Packets can be transit at a time?

Capacity of Link = $B * P_d$

$= 10^6 \text{ bits}/\cancel{\text{sec}} * 1 \cancel{\text{sec}}$

$= 10^6$ bits

No. of Packets $= \dfrac{10^{\cancel{6}} \cancel{\text{bits}}}{1\cancel{000} \cancel{\text{bits}}}$

$\boxed{\text{No. of Packets} = 1000}$

Q.4 If Bandwidth = 1 Mbps and Propagation delay is 1 msec and Packet size is 100 bits. Find Number of Packets needed to maximally Pack the Link?

capacity of Link

Sol^n:

$$\text{Capacity of Link} = B * P_d$$

$$= 10^6 \text{ bits}/\cancel{\text{sec}} * 10^{-3} \cancel{\text{sec}}$$

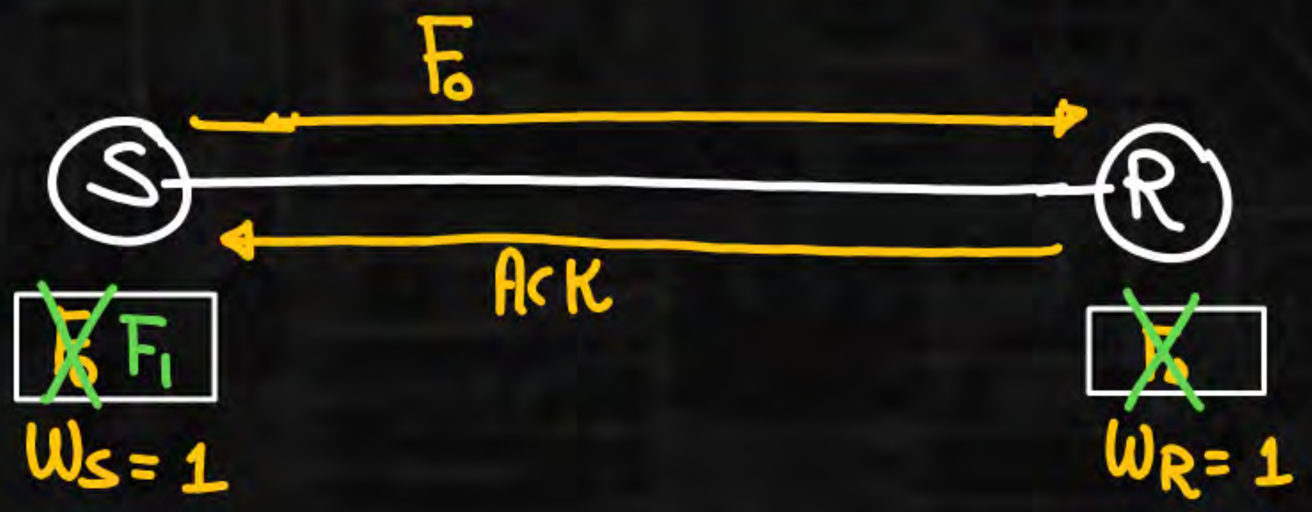
$$= 10^3 \text{ bits}$$

$$= 1000 \text{ bits}$$

$$\text{No. of Packets} = \frac{(\text{Capacity of Link})\text{ bits}}{(\text{Packet size})\text{ bits}} = \frac{1000 \cancel{\text{bits}}}{100 \cancel{\text{bits}}} = 10$$

Important Points about stop & wait Protocal

① stop and wait Protocal is a special category of Protocols where window size = 1 Always



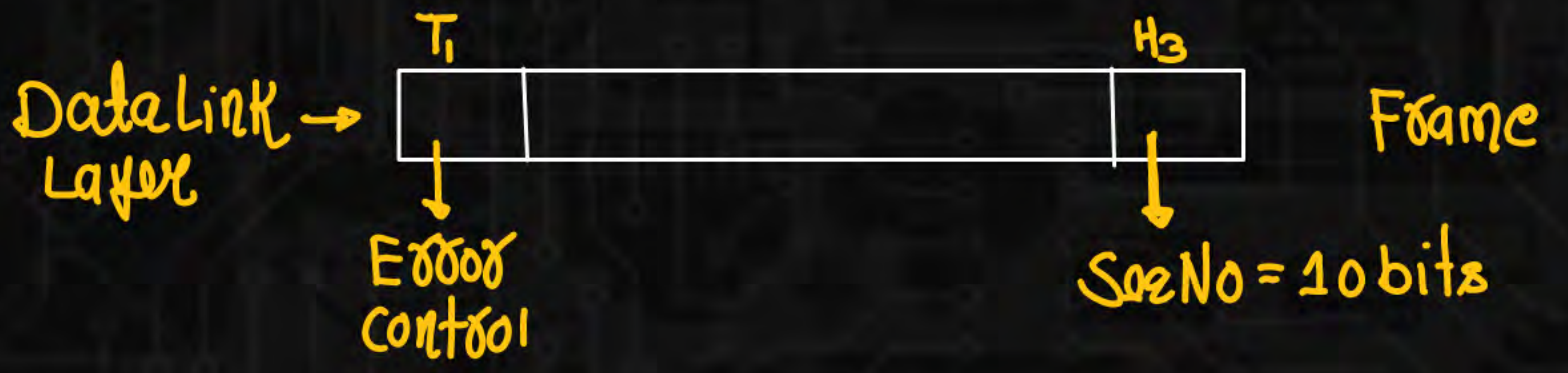
Sender want to send 1000 Frames to Receiver

F_0 F_1 F_2 F_3 . . . . F_{999}

0 1 2 3 999

Total sequence Number required = 1000

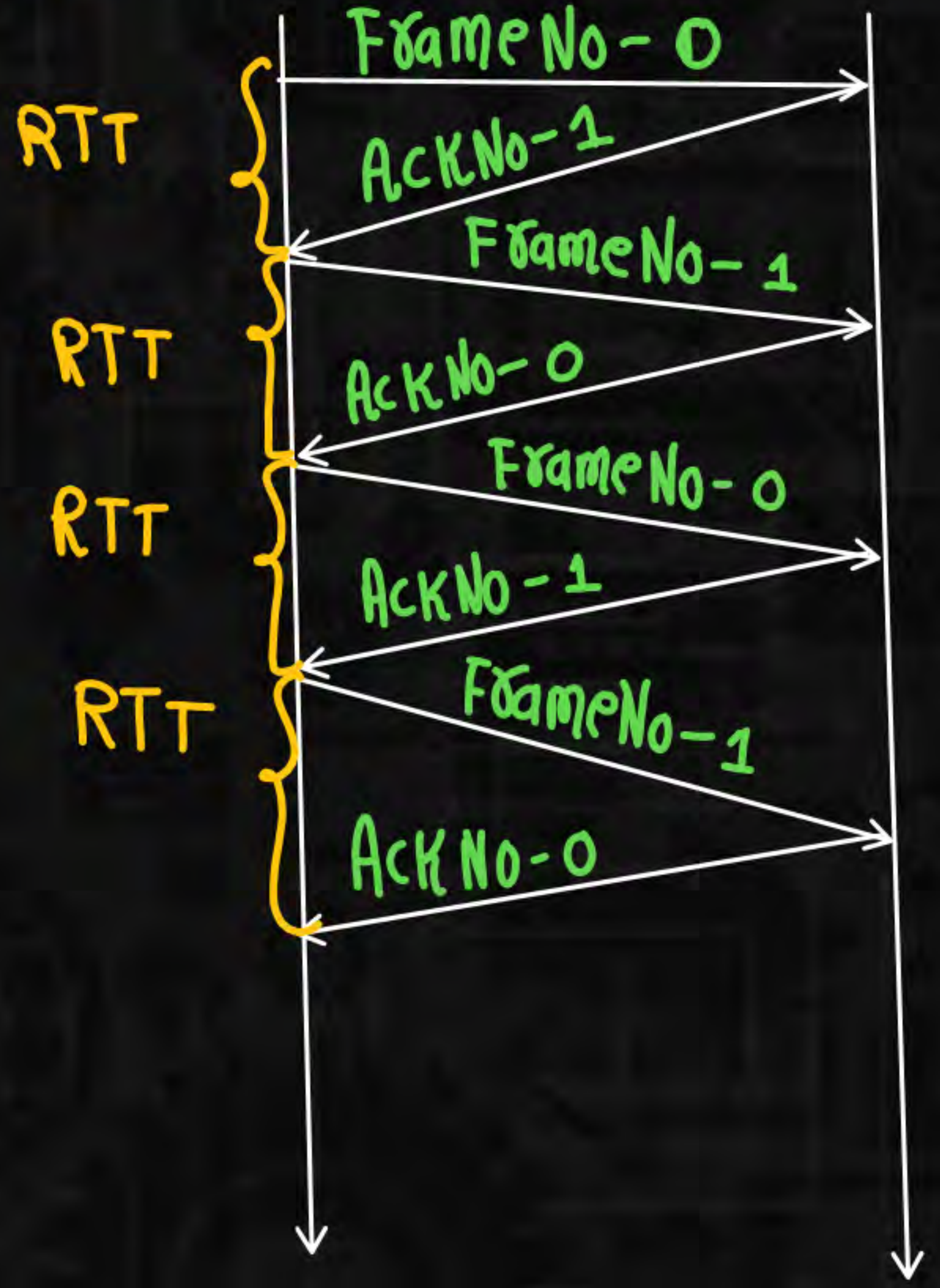
No. of bits required = $\lceil \log_2 1000 \rceil = 10$ bits



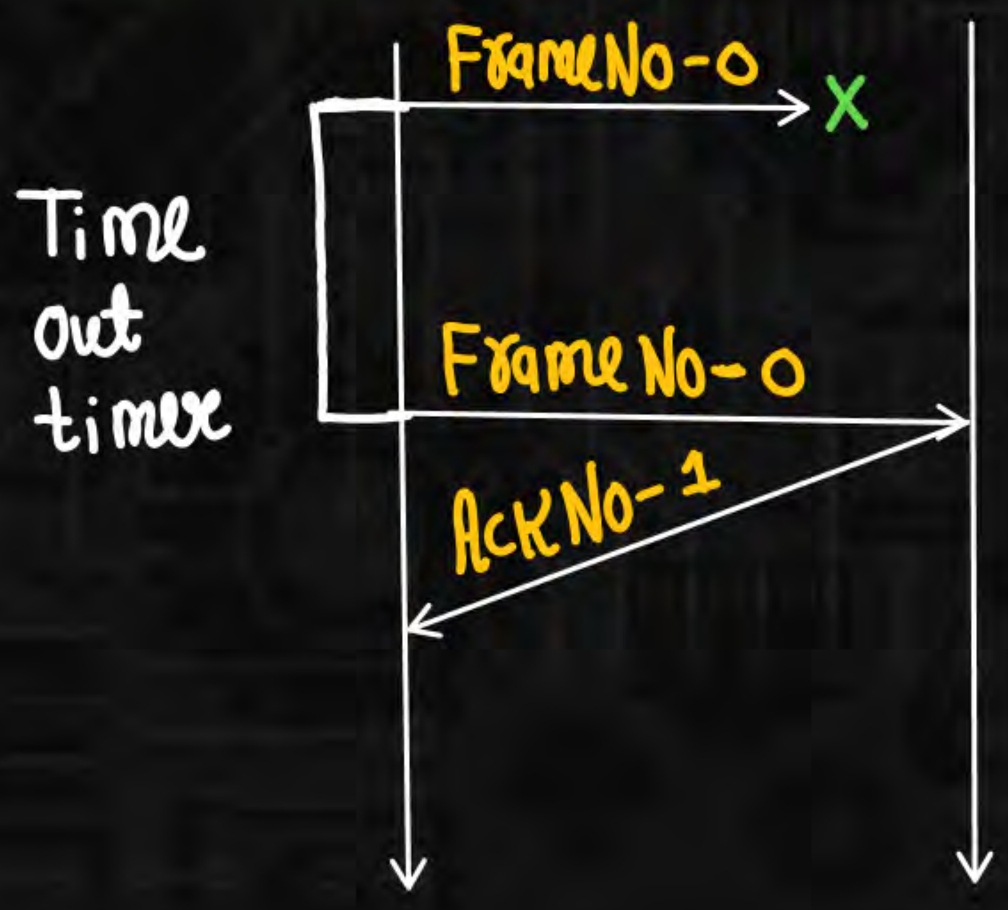
10 bits overhead For one Frame. To send 1000 Frames
total overhead = $10 * 1000 = 10{,}000$ bits

frames	seqNo
F_0	0000000000
F_1	0000000001
F_2	0000000010
F_3	0000000011
F_4	⋮
F_5	
F_6	
F_7	
F_8	
|	
F_{999}	

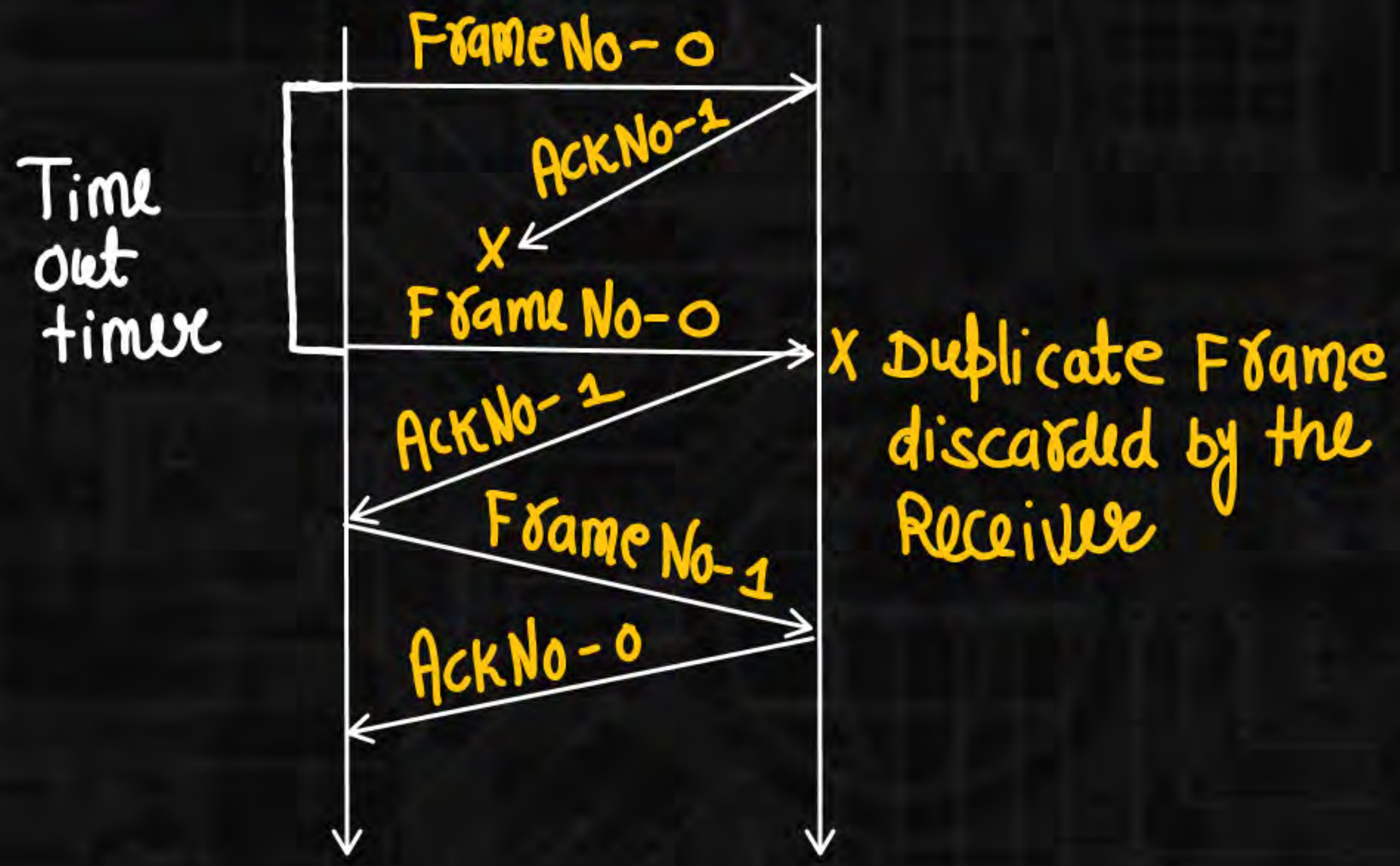
2. Stop and wait Protocol uses two sequence Numbers i.e 0 and 1 irrespective of Number of Packet sender is Having



① Lost Data Pkt (Frame)

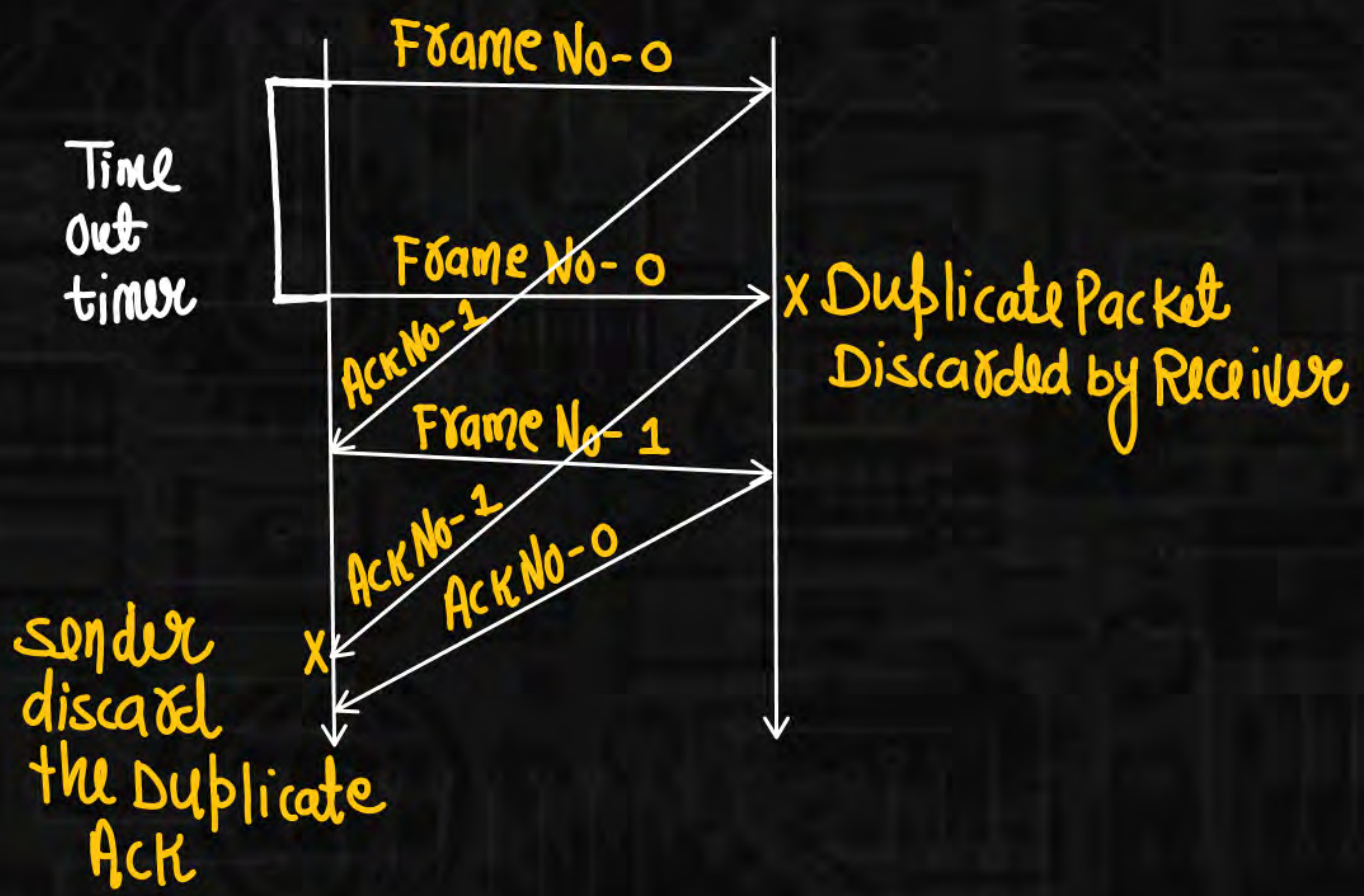


② Lost Ack

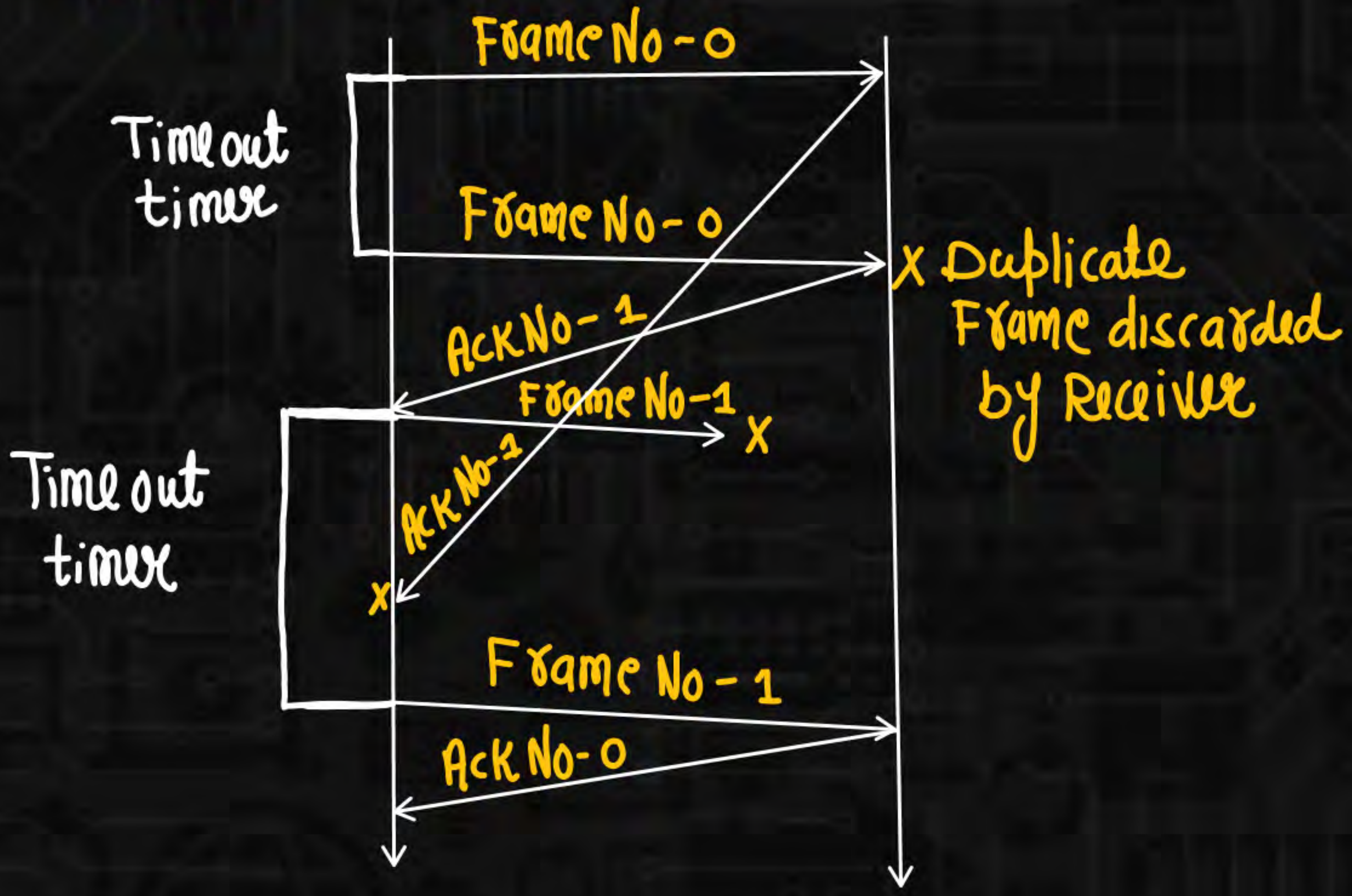


3. Delay ACK

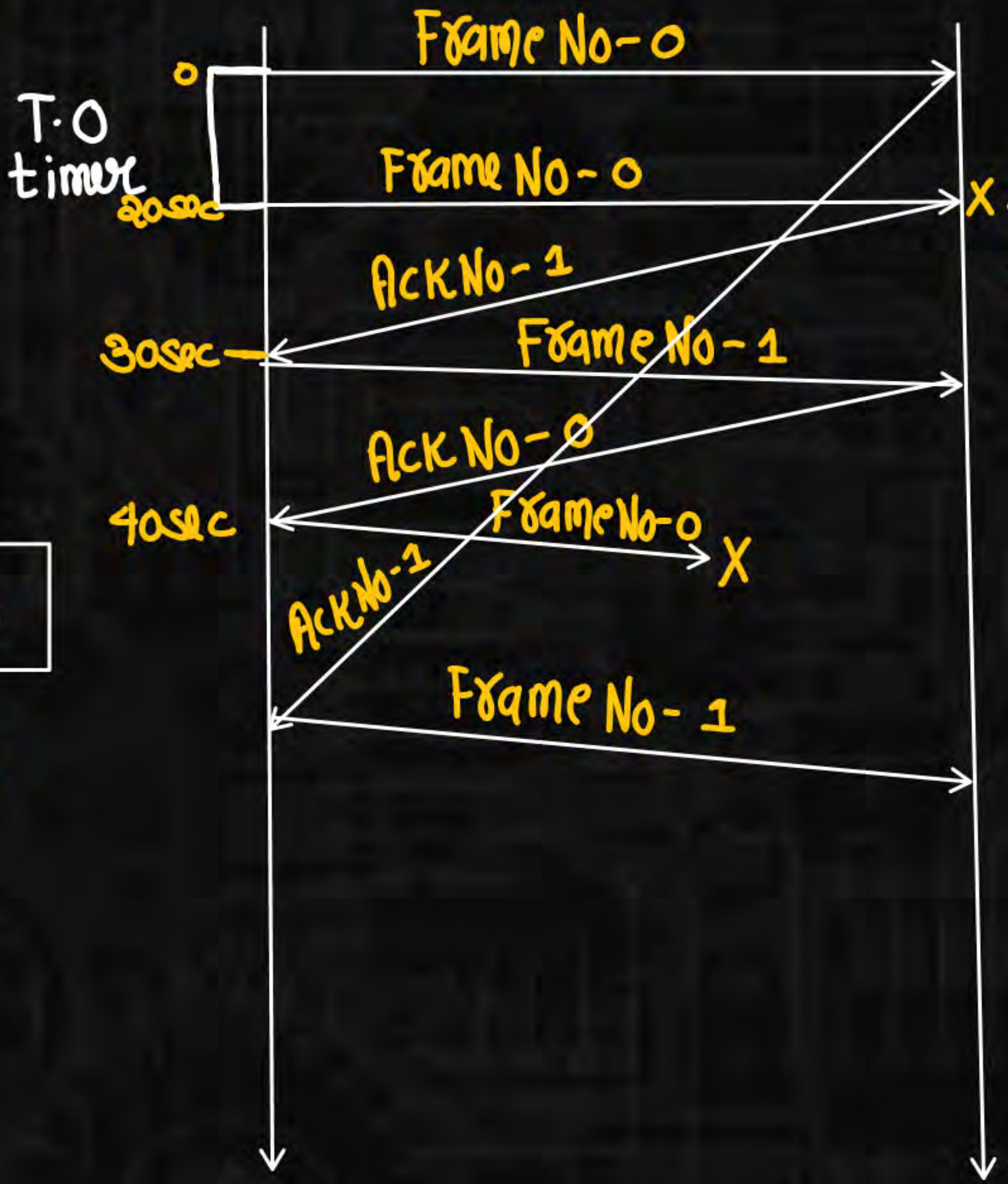
Case I :



Case II


Frame No - 0
Time out timer
Frame No - 0
X Duplicate Frame discarded by Receiver
Ack No - 1
Frame No-1
X
Ack No-1
Time out timer
X
Frame No - 1
Ack No - 0

Case III



$\boxed{TO = 2 * RTT}$

$\boxed{TTL = 2 * T.O}$

Time to Live

$RTT = 10 sec$

$T.O = 2 * RTT$
$= 2 * 10 sec = 20 sec$

$TTL = 2 * T.O$
$= 2 * 20 = 40 sec$

3. If Propagation delay is Very High in the comparision of transmission delay then stop & wait Protocol Become useless

Q: $T_d = 1\,sec$, $P_d = 100\,sec$, $\boxed{Q_d = 0,\ P_{rd} = 0,\ T_d(Ack) = 0}$

$$\text{efficiency} = \frac{\text{useful time}}{\text{total time}}$$

$$= \frac{T_d}{T_d + 2 * P_d}$$

$$= \frac{1}{1 + 2 * 100}$$

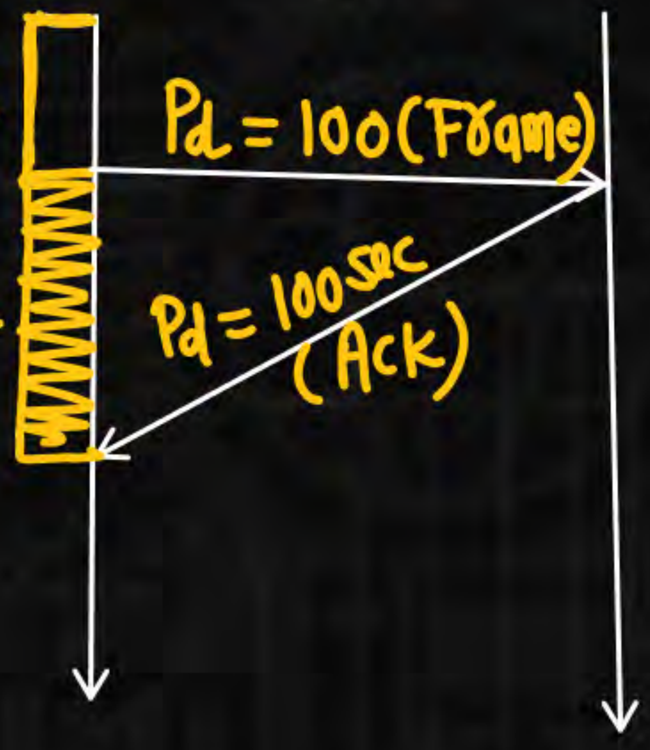
$$= \frac{1}{201} = 0.0049$$

$$= 0.49\% \ (< 1\%)$$

OR

useful time ⇒ $T_d = 1\,sec$

waiting time ⇒ 200 sec



$$\eta = \frac{\text{useful time}}{\text{total time}}$$

$$= \frac{1\,sec}{1 + 200\,sec}$$

$$= \frac{1}{201} = 0.0049$$

$$= 0.49\%$$

4. If (Bandwidth and delay) Product is very High then stop & wait Protocol Become useless OR If capacity of a Link is very High then stop & wait Protocol Become useless

$$\boxed{\text{Assume } Q_d = 0,\ Pr_d = 0,\ T_{d(ACK)} = 0}$$

$$\text{Efficiency} = \frac{\text{useful time}}{\text{total time}}$$

$$= \frac{T_d}{T_d + 2 * P_d}$$

$$= \frac{\cancel{T_d}}{\cancel{T_d}\left[1 + 2 * \frac{P_d}{T_d}\right]}$$

$$\text{Total time} = T_{d(Frame)} + 2 * P_d + \cancel{Q_d}_{0} + \cancel{Pr_d}_{0} + \cancel{T_{d(ACK)}}_{0}$$

$$\text{Total time} = T_d + 2 * P_d$$

$$\eta = \frac{1}{1 + 2 * \frac{P_d * B}{L}} \quad \uparrow \; , \; \eta \downarrow$$

capacity OF Link

Bandwidth = 10bPs

Propagation delay = 100sec

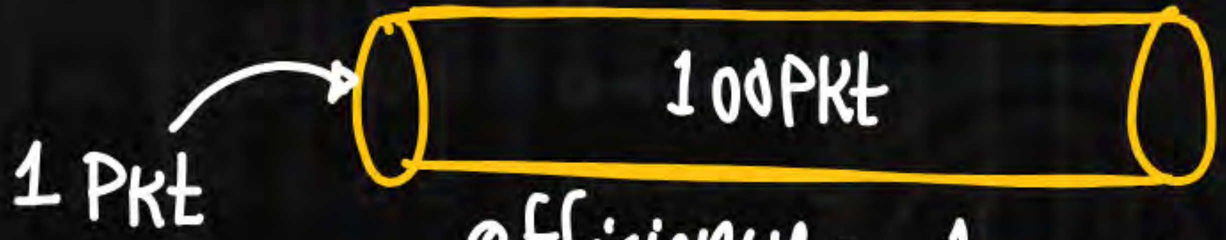
capacity OF Link $= B * P_d$

$= 10 \text{ bits}/\cancel{\text{sec}} * 100 \cancel{\text{sec}}$

$= 1000$ bits

Packet size or Frame size = 10 bits

capacity OF Link(in Pkts) $= \frac{1000 \cancel{\text{bits}}}{10 \cancel{\text{bits}}} = 100$



efficiency $= \frac{1}{100} = 1\%$


THANK YOU
GW
SOLDIERS !