CS & IT ENGINEERING

COMPUTER NETWORKS

Flow Control

Lecture No-6

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TOPICS TO BE COVERED

- Concept of Pipelining
- sliding window
- GB-N

1. Lost data PKt

2. Lost Ack

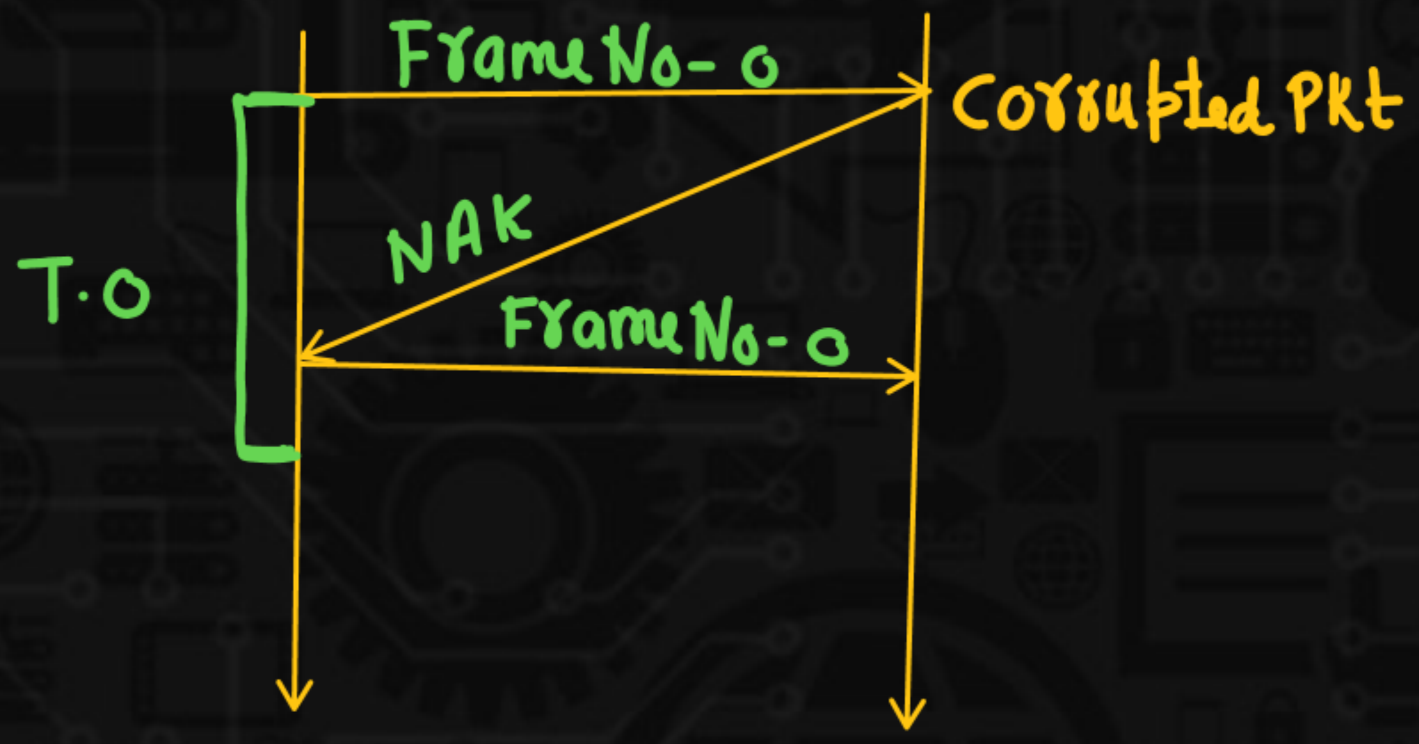
3. delay Ack

   i) case I

   ii) case II

   iii) case III

4. Damage PKt or Corrupted PKt



4. $T_d = 1\,sec,\ P_d = 100\,sec,\ Q_d = 0,\ Pr_d = 0,\ T_d\,Ack = 0$

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

$$\eta = \frac{T_d}{T_d + 2 * P_d + \underset{0}{\cancel{Q_d}} + \underset{0}{\cancel{Pr_d}} + \underset{0}{\cancel{T_d(Ack)}}}$$

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

$P_d \uparrow \ T_d \downarrow \ \eta \downarrow$

$$\eta = \frac{1}{1 + 2 * 100} = \frac{1}{201} = 0.0049$$

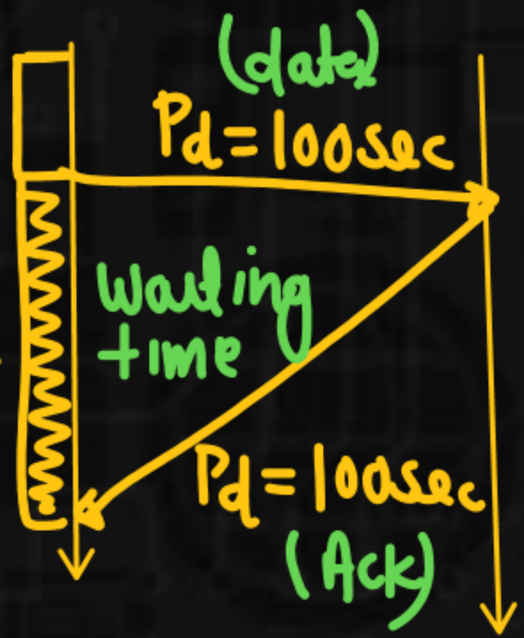
$$= 0.49\,\% \ (< 1\,\%)$$

Note

① In stop & wait protocal efficiency is Low when Propagation delay is High and Transmission delay is Low

Useful time $\Rightarrow T_d = 1\,sec$

Waiting time $\Rightarrow 200\,sec$



(5) $T_d = 100$ sec, $P_d = 1$ sec, $Q_d = 0$, $Prd = 0$, $T_{d(ACK)} = 0$

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

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

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

$$\eta = \frac{100}{102}$$

$$\eta = 0.9830$$

$$\eta = 98.3\%$$

· In stop & wait Protocol efficiency is High when transmission delay is High and Propagation delay is Low

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

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

$$\eta = \frac{1}{1 + 2 * \frac{P_d}{T_d}}$$

$P_d \downarrow \quad T_d \uparrow \quad \eta \uparrow$

6. In stop & wait Protocal efficiency is Low when distance is High and Packet size is less

7. In stop & wait Protocal efficiency is Low when distance is High and Bandwidth is High

8. In stop & wait Protocal efficiency is High when Packet size is High and distance is Low

9. $$\eta = \frac{T_d}{T_d + 2 * P_d}$$

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

$$\eta = \frac{1}{1 + 2 * \frac{d}{v} * \frac{B}{L}}$$

$$\begin{pmatrix} v \rightarrow \text{Fixed} \\ B \rightarrow \text{Fixed} \end{pmatrix}$$

$d \uparrow$ $\eta \downarrow \rightarrow$ gt is good For LAN

$L \uparrow$ $\eta \uparrow \rightarrow$ gt is good For Large PKt

MCQ

Suppose two hosts are connected by a point-to-point link and they are configured to use Stop-and-Wait protocol for reliable data transfer. Identify in which one of the following scenarios, the utilization of the link is the lowest.

efficiency

[GATE-2023] $\boxed{2023 \rightarrow 1M}$

(A) Longer $\underbrace{\text{link length}}_{\text{distance}}$ and lower $\underbrace{\text{transmission rate}}_{\text{Bandwidth}}$

(B) Longer link length and higher transmission rate

(C) Shorter link length and lower transmission rate

(D) Shorter link length and higher transmission rate

concept of Pipelining

Assume

$Q_d = 0$

$P_{rd} = 0$

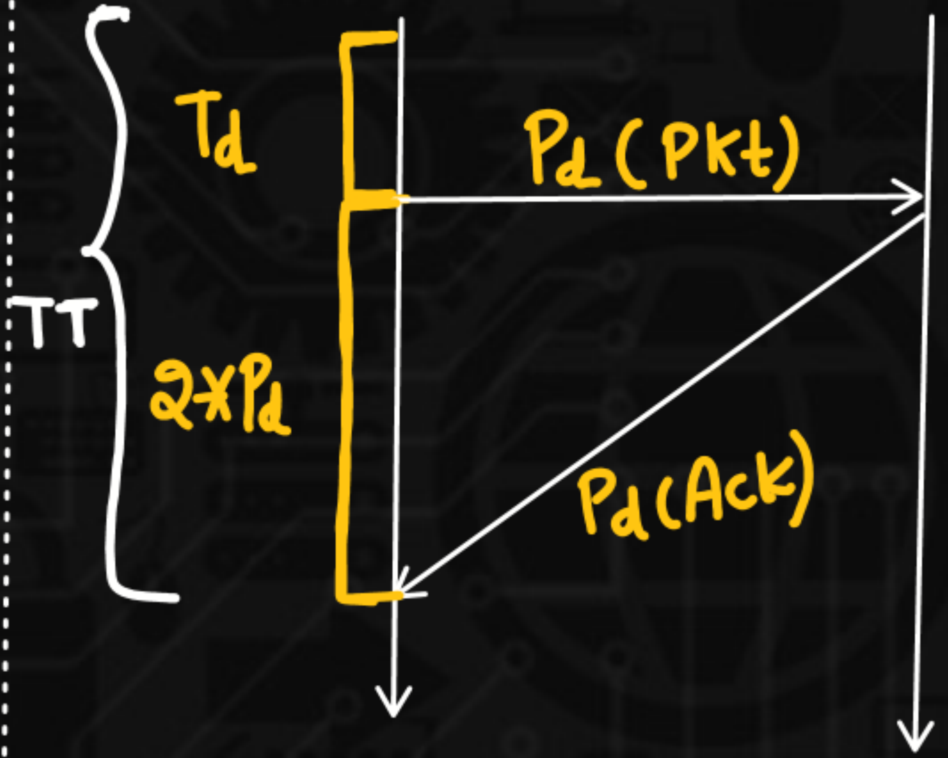
$T_{d(Ack)} = 0$

$$\text{Total time} = T_{d(frame)} + 2 * P_d + \underset{0}{\cancel{Q_d}} + \underset{0}{\cancel{P_{rd}}} + \underset{0}{\cancel{T_{d(Ack)}}}$$

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

T_d sec $\longrightarrow$ 1 Packet

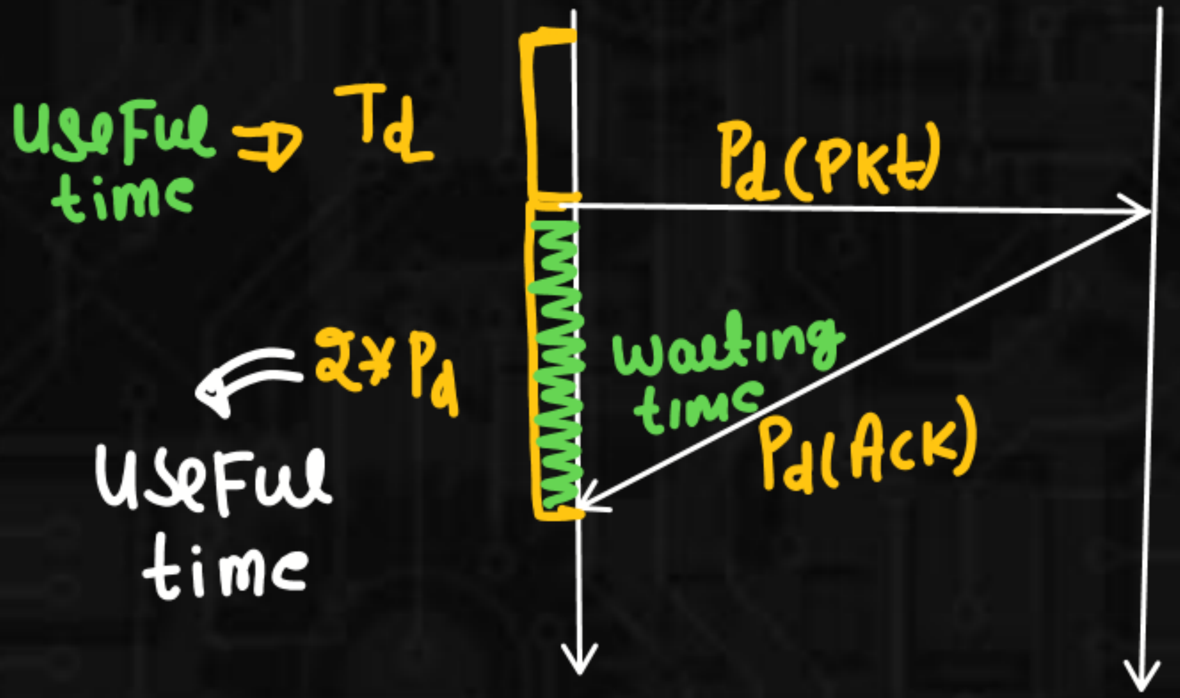
1 sec $\longrightarrow$ $\frac{1}{T_d}$ Packet



$$(T_d + 2 * P_d)\text{ sec} \longrightarrow \frac{T_d + 2 * P_d}{T_d}$$

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

$$= (1 + 2a)\text{ pkt}$$


Useful time ⇒ Td
Pd(Pkt)
2 * Pd
Waiting time
Pd(Ack)
Useful time

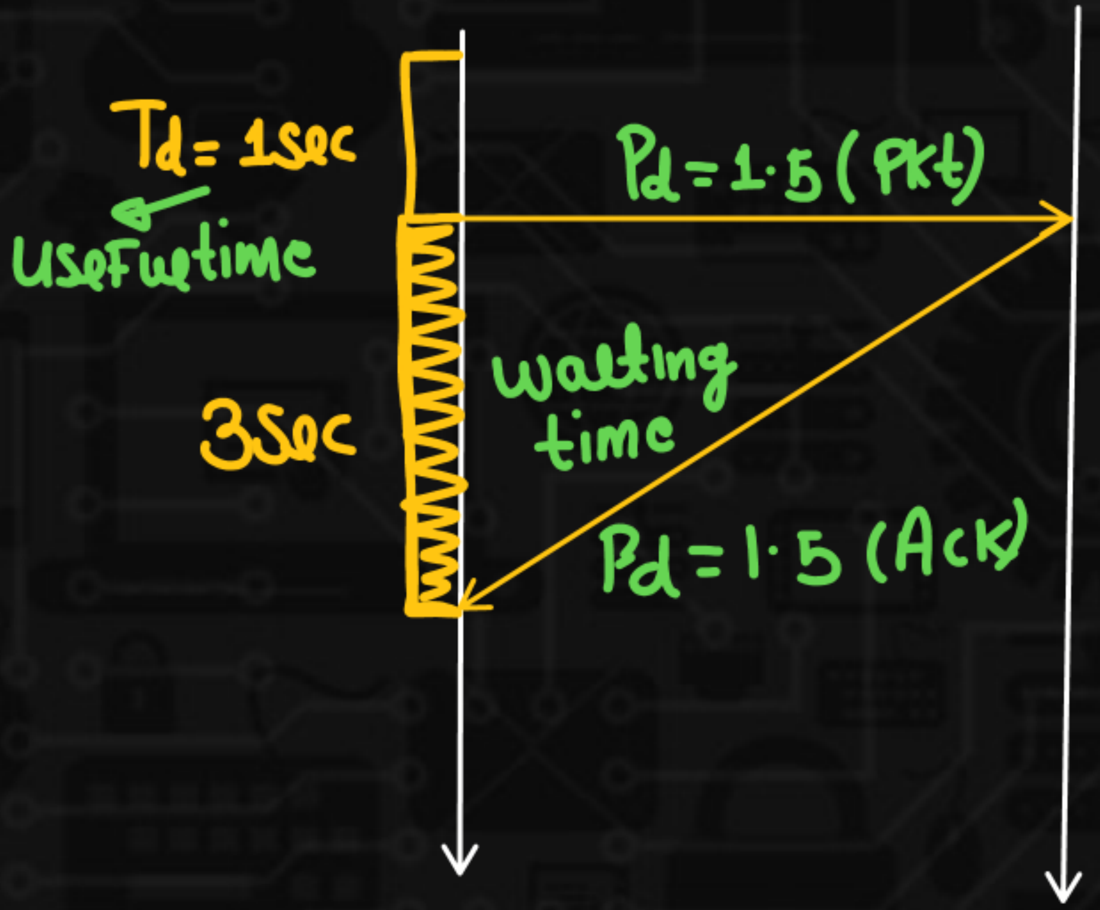
Q: $T_d = 1sec$, $P_d = 1.5sec$, $\eta = ?$

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

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

$$= \frac{1}{1 + 2 * 1.5}$$

$$= \frac{1}{4}$$



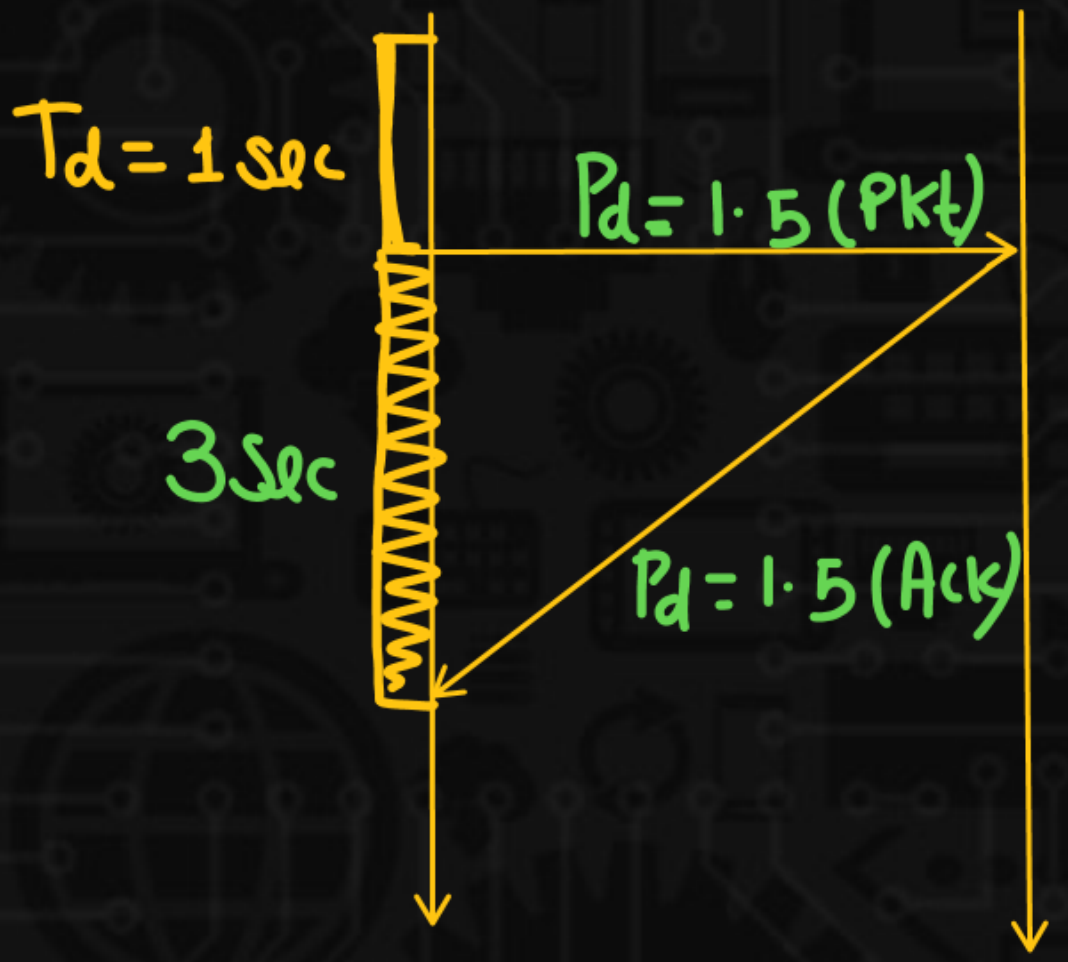
$$\eta = \frac{\text{Useful time}}{\text{total time}} = \frac{1}{1+3} = \frac{1}{4} = 25\%$$

Q: $T_d = 1$ sec, $P_d = 1.5$ sec

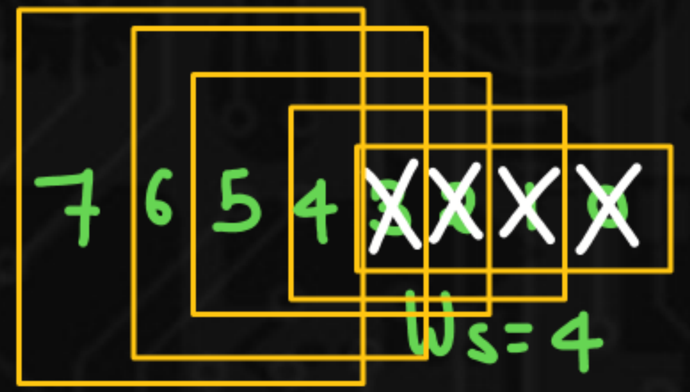
Maximum window size $= (1+2a)$ Pkt

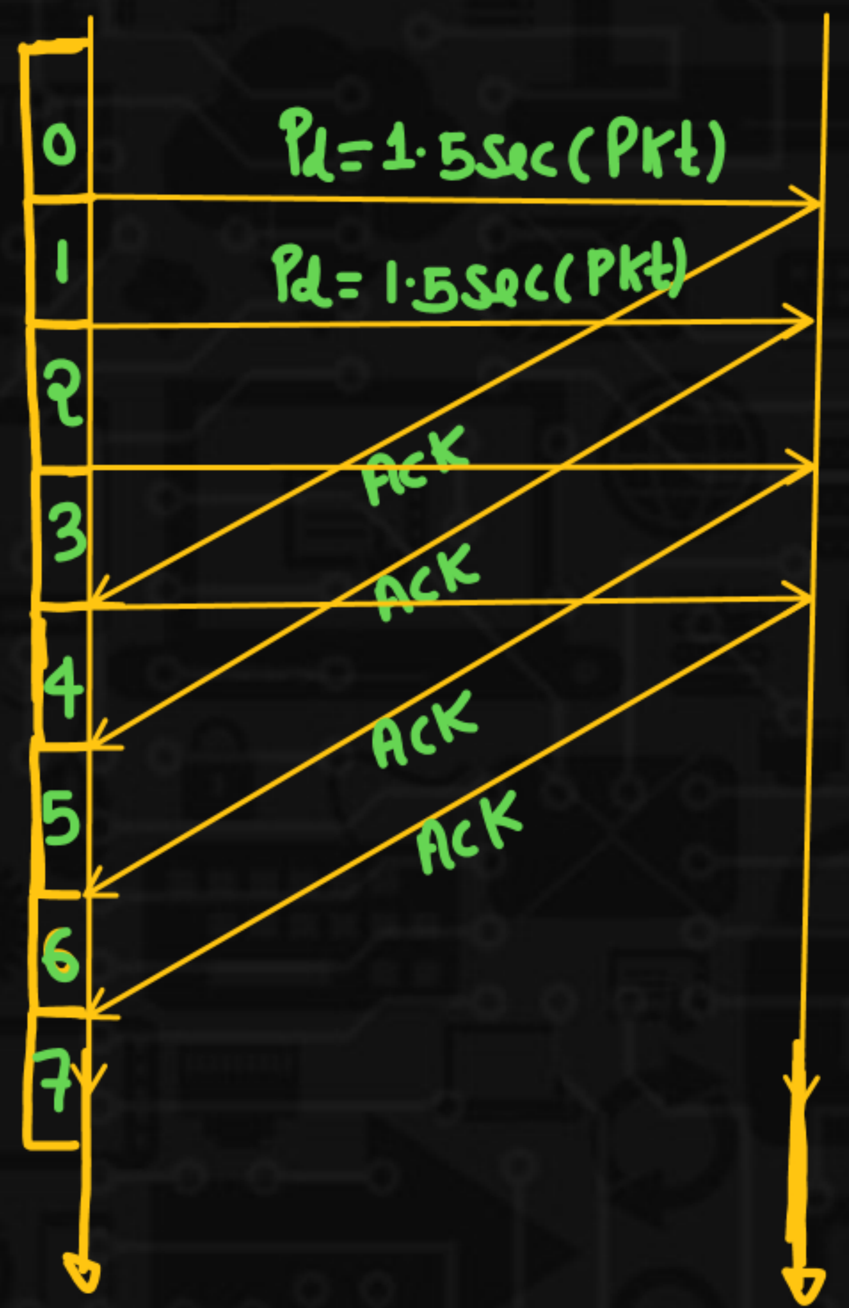
$= 1 + 2 * \frac{1.5}{1}$

$= 4$ Pkt



Sliding window





11 10 9 8 $\boxed{7\ 6\ 5\ 4}$ 3 2 1 0

Next to be transmitted

Transmitted but Not Acknowledged

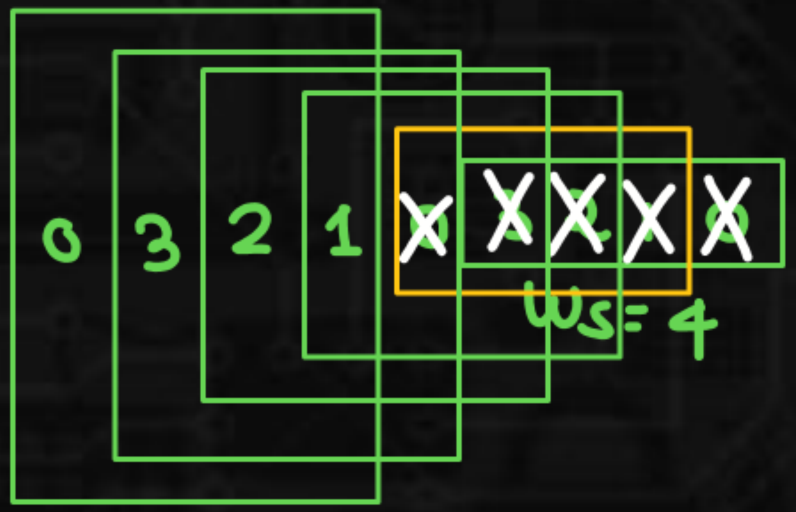
Transmitted & Acknowledged

Q $T_d = 1\,sec$, $P_d = 1.5\,sec$

maximum window size $= (1+2a)$ pkt

$= 1 + 2 * \frac{1.5}{1}$

$= 4$ pkt



minimum seq No required
$= 4$

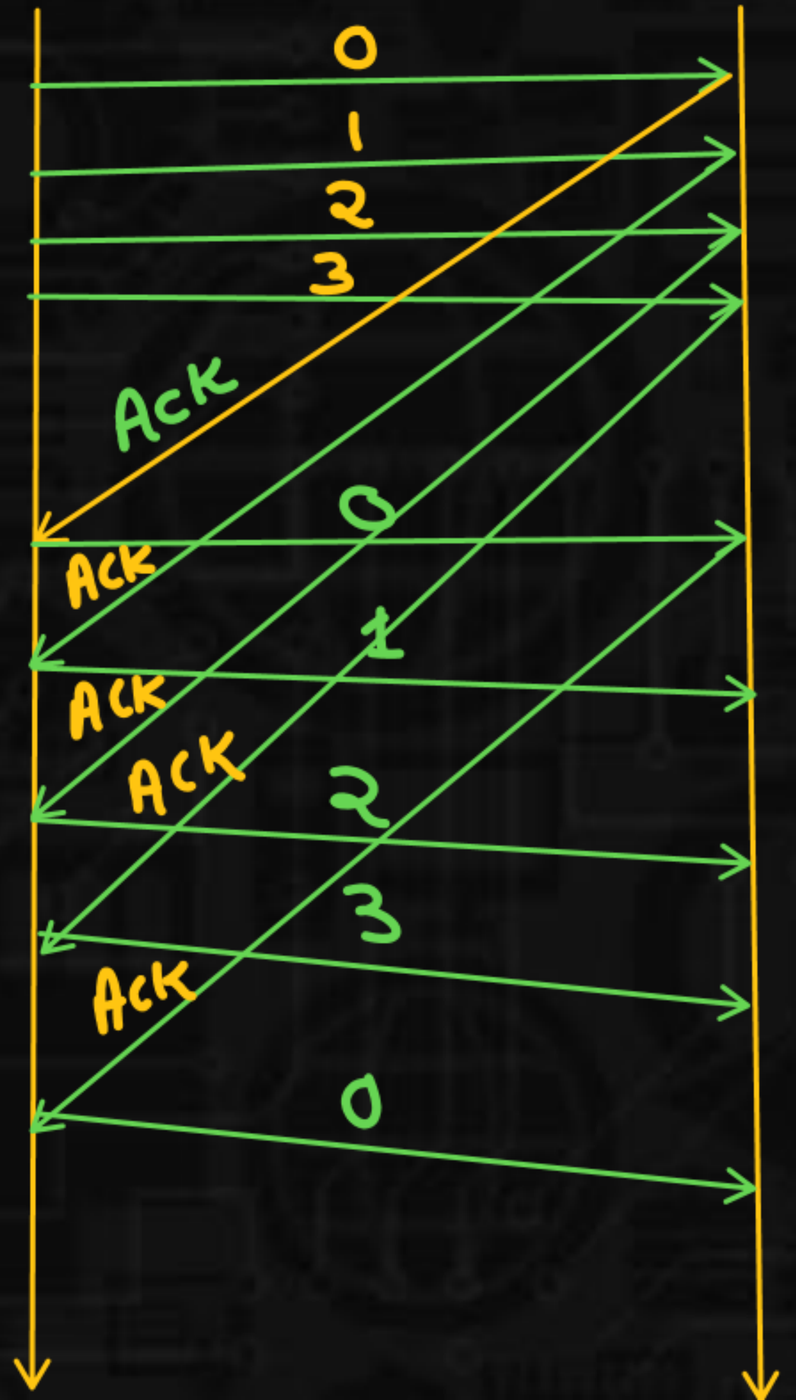
min Number of bits required in the sequence Number field $= 2$ bit →

$00 \to 0$
$01 \to 1$
$10 \to 2$
$11 \to 3$

$= \lceil \log_2(1+2a) \rceil$

$= \lceil \log_2 4 \rceil$

$= \lceil \log_2 2^2 \rceil = \lceil 2 \log_2 2 \rceil = 2$ bit



Maximum window size = $(1+2a)$ PKt

minimum sequence Number required = $(1+2a)$

minimum No. of bits required in the sequence Number field = $\lceil \log_2(1+2a) \rceil$


THANK YOU
GW
SOLDIERS !