# CS & IT ENGINEERING

COMPUTER NETWORKS

Flow Control

**Lecture No-6**

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(3) If Propagation delay is very High in the comparision of transmission delay then stop and wait Protocal Become useless

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

efficiency $= \dfrac{useful\ time}{total\ time}$

$= \dfrac{T_d(F)}{T_d(F) + 2 * P_d}$

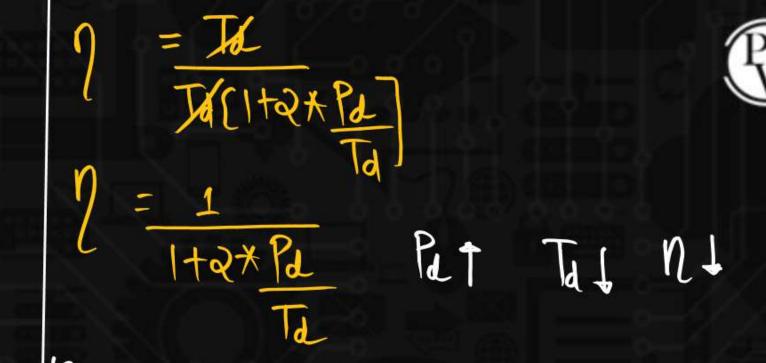$= \dfrac{1 \sec}{1 + 2*100 \sec}$

$= \dfrac{1}{201} = 0.0049 = 0.49\% \ (< 1\%)$

efficiency $= \dfrac{useful\ time}{total\ time}$

$= \dfrac{1 \sec}{1 \sec + 200 \sec}$

$= \dfrac{1}{201} = 0.0049 = 0.49\%$

OR

→ useful time

S $\quad$ R

$T_d = 1 \sec$ $\quad$ $P_d(F) = 100 \sec$

$\Big\} 2*P_d$

$200 \sec$ ← waiting time

$P_d(A) = 100 \sec$
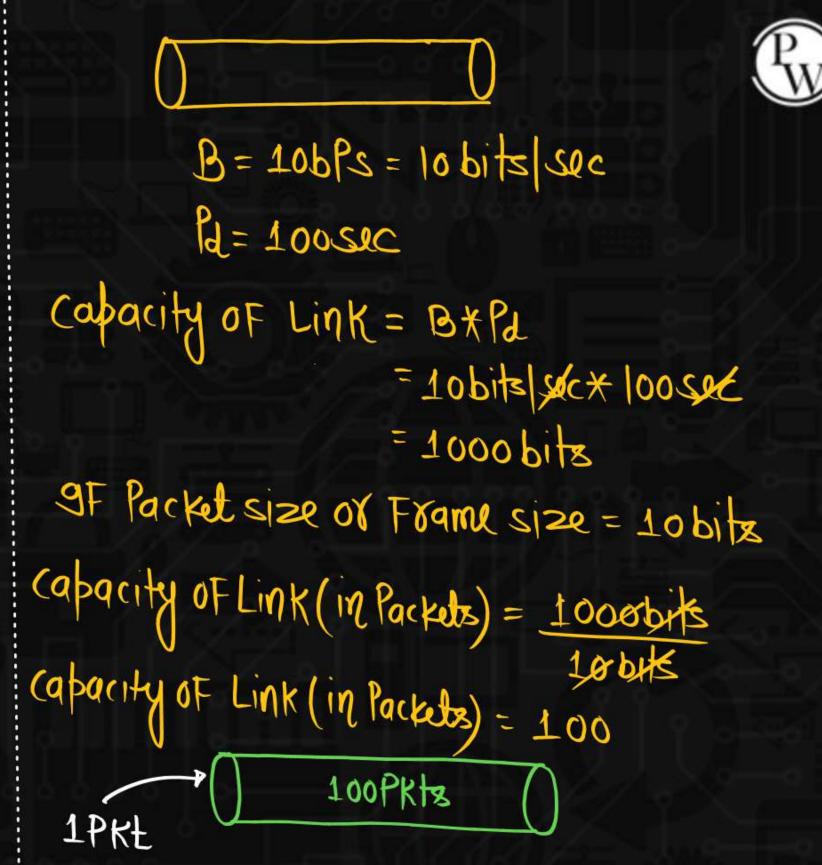
(4) gF (Bandwidth and delay) Product is **very High** then stop and wait Protocal Become **useless** OR gF **capacity** of Link is very High then stop & wait Protocal Become useless.

Assume $Qd = 0$, $Prd = 0$, $T_d(A) = 0$

$$\text{Total time} = T_d(F) + 2 * P_d + Qd + Prd + T_d(A)$$

$$\text{Total time} = T_d(F) + 2 * P_d + 0 + 0 + 0$$

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

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

$$= \frac{T_d(F)}{T_d(F) + 2 * P_d}$$

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

$$\frac{1}{1 + 2 * \underbrace{P_d * B}_{L}} \uparrow \quad \eta \downarrow$$

capacity of Link

$B = 10 bps = 10 bits/sec$

$P_d = 100 sec$

capacity of Link $= B * P_d$
$$= 10 bits/sec * 100 sec$$
$$= 1000 bits$$

gF Packet size or Frame size $= 10 bits$

capacity of Link (in Packets) $= \frac{1000 bits}{10 bits}$

capacity of Link (in Packets) $= 100$

1PKt → [ 100PKts ]

efficiency $= \dfrac{1}{100}$

$\boxed{\text{efficiency} = 1\,\%}$

(5) efficiency $= \dfrac{\text{useful time}}{\text{total time}}$

$= \dfrac{T_d(F)}{T_d(F) + 2 * P_d + \cancel{Q_d} + \cancel{P_d} + \cancel{T_d(A)}}$

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

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

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

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

"In the stop & wait Protocol efficiency is low when propagation delay is High and transmission delay is Low"

(6) $T_d(F) = 100 \text{ sec}, \; P_d = 1 \text{ sec}, \; Q_d = 0, \; P_{rd} = 0, \; T_d(A) = 0$

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

$= \dfrac{T_d(F)}{T_d(F) + 2 * P_d}$

$= \dfrac{100 \text{ sec}}{100 \text{ sec} + 2 * 1 \text{ sec}}$

$= \dfrac{100 \text{ sec}}{102 \text{ sec}}$

$= 0.9803$

$\boxed{\eta = 98.03 \, \%}$

" In stop & wait Protocol efficiency is High when Transmission delay is High and Propagation delay is Low "

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

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

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

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

(7) In stop and wait Protocal efficiency is Low when distance is High and Packet size is Less.

(8) In stop and wait Protocal efficiency is Low when distance is High and Bandwidth is High

(9) In stop & wait Protocal efficiency is High when Packet size is High and distance is Low

(10)

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

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

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

$B \rightarrow$ Fixed

$v \rightarrow$ Fixed

$d \uparrow$  $\eta \downarrow \rightarrow$ It is Better only LAN not For WAN

$L \uparrow$  $\eta \uparrow \rightarrow$ It is Better For Large Packet size

**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

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(A) Longer link length and lower transmission rate ( Bandwidth )
(distance)

(B) Longer link length and higher transmission rate

(C) Shorter link length and lower transmission rate

(D) Shorter link length and higher transmission rate
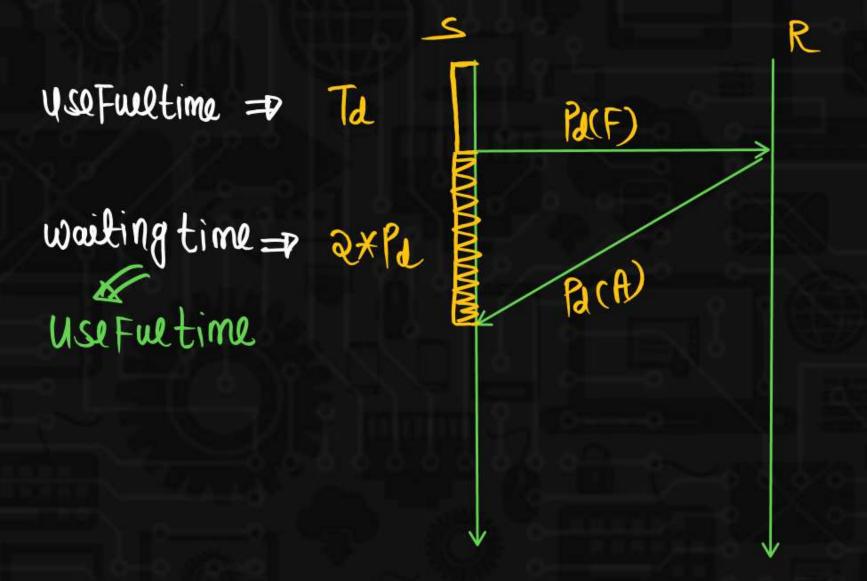
# Concept of piplining

Assume
$Q_d = 0$
$P_{od} = 0$
$T_d(Ack) = 0$
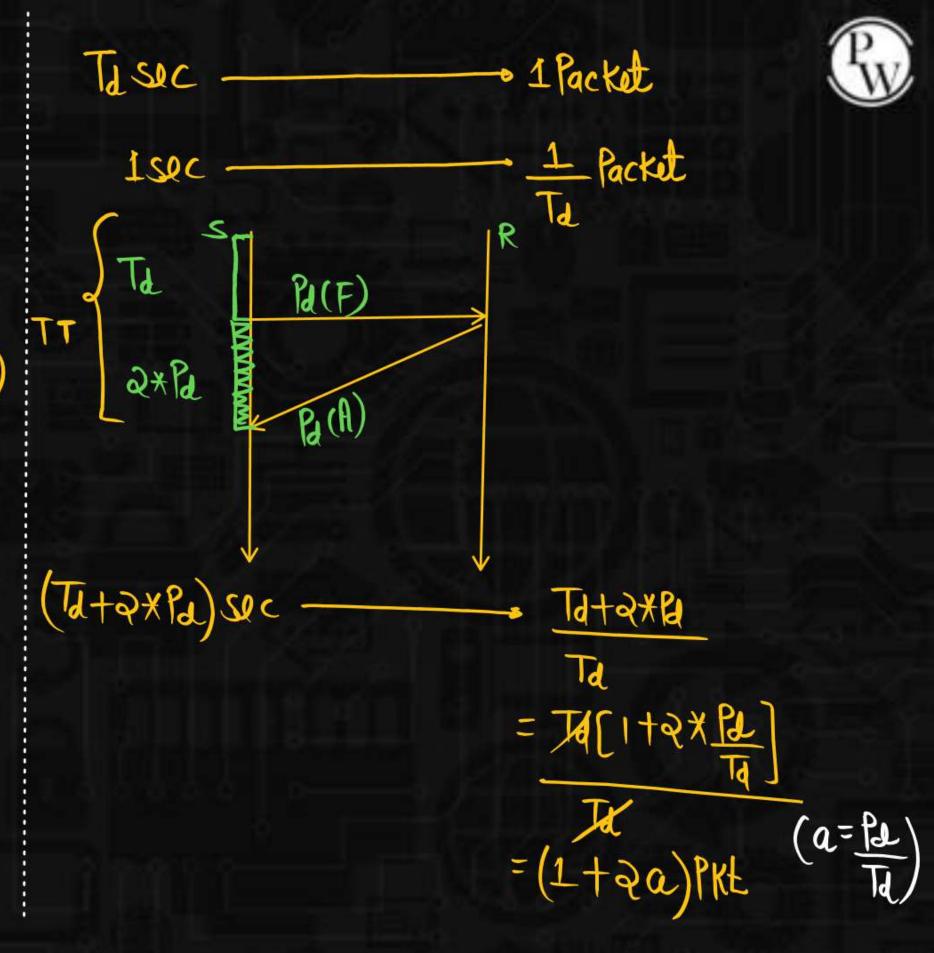
Total time $= T_d(F) + 2 * P_d + \cancel{Q_d} + \cancel{P_{od}} + \cancel{T_d(Ack)}$

$\downarrow 0 \quad \downarrow 0 \quad \downarrow 0$

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

$T_d$ sec $\longrightarrow$ 1 Packet

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



$TT \begin{cases} T_d \\ \\ 2 * P_d \end{cases}$

$P_d(F)$

$P_d(A)$

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

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

$= (1 + 2a)$ Pkt $\qquad \left(a = \dfrac{P_d}{T_d}\right)$

$$\eta = \frac{1}{1+2a}$$

Useful time $\Rightarrow$ $T_d$

waiting time $\Rightarrow$ $2 * P_d$

Useful time

S                 R

$P_d(F)$

$P_d(A)$

Q: $T_{d(F)} = 1\,sec$, $P_d = 1.5\,sec$, $Q_d = 0$, $P_{od} = 0$, $T_{d(A)} = 0$

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

$$\eta = \frac{T_{d(F)}}{T_{d(F)} + 2 * P_d}$$

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

$$\eta = \frac{1}{4} = 25\%$$

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

waiting time $\Rightarrow 3\,sec$

$P_{d(F)} = 1.5\,sec$

$P_{d(A)} = 1.5\,sec$

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

$$= \frac{1}{1+3} = \frac{1}{4} = 25\%$$

Q: $T_d(F) = 1\,sec$, $P_d = 1.5\,sec$, $Q_d = 0$, $P_{6d} = 0$, $T_d(A) = 0$

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

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

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

$$= 1 + 3 = 4\,Packet$$

useful $\Rightarrow$ $T_d = 1\,sec$

Waiting time $\Rightarrow 3\,sec$

S

R

$P_d(F) = 1.5\,sec$

$2 * P_d$

$P_d(A) = 1.5\,sec$

10 9 8 | 7 | 6 | 5 | 4 | X̶ | X̶ | X̶ | X̶ |

$W_s = 4$

0

$Pd(F) = 1.5 sec$

1

$Pd(F) = 1.5 sec$

2

3 sec

3

$Pd(A) = 1.5 sec$

$Pd(A) = 1.5 sec$

4

ACK

5

ACK

6

7

11  10  9  8   | 7  6  5  4 |  3  2  1  0
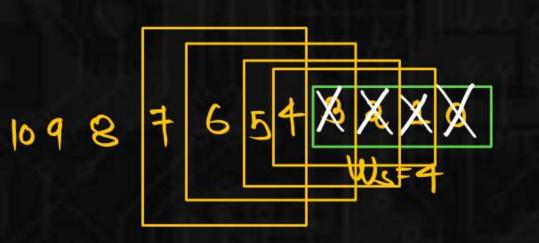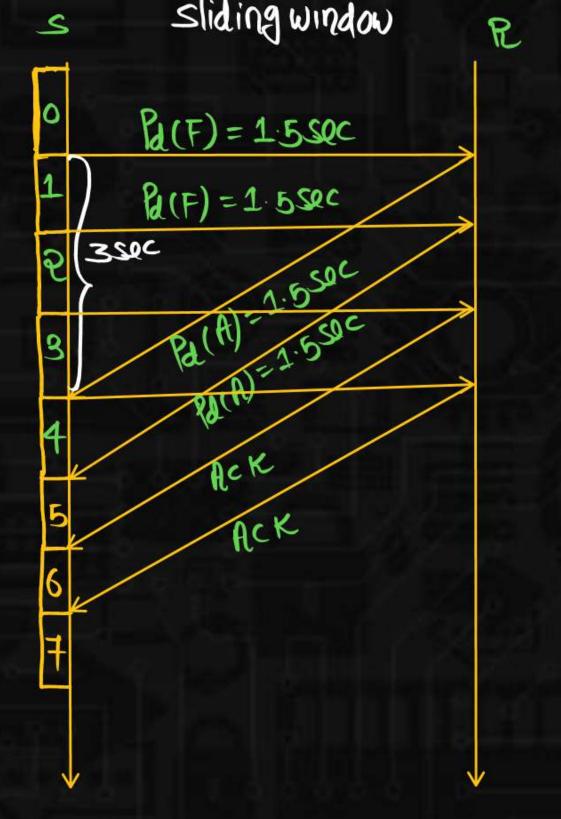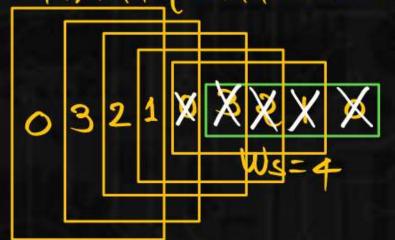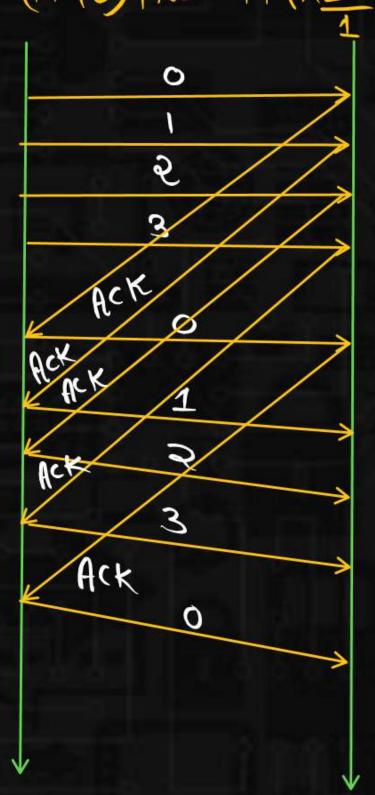
Next to be
transmitted

transmitted
but not
Acknowledged

transmitted
and
Acknowledged

**Q:** $T_d(F) = 1\,sec,\ P_d = 1.5\,sec,\ G_d = 0,\ P_d = 0,\ T_d(Ack) = 0$

maximum window size $= (1+2a)\,Pkt = 1+2*\dfrac{1.5}{1} = 4\ Pkts$

0 3 2 1 ✗ ✗ ✗ ✗ ✗

$Ws = 4$

0
1
2
3
Ack
0
Ack
Ack
1
Ack
2
3
Ack
0

minimum sequence No required = 4

minimum No. of bits required
in the sequence No. field = 2bits

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

$= \lceil \log_2 4 \rceil = \lceil \log_2 2^2 \rceil$

$= \lceil 2 \log_2 2 \rceil$

$= 2\ bits$

(P W)

## Note

① maximum window size $= (1+2a)$

② minimum sequence No. required $= (1+2a)$

③ minimum No. of bits required in the sequence No.
   field $= \lceil \log_2 (1+2a) \rceil$