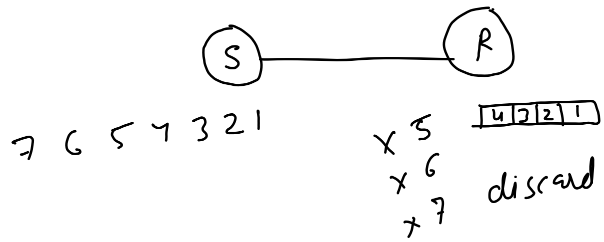
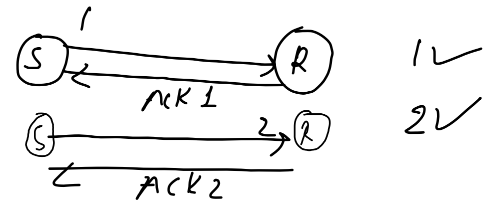
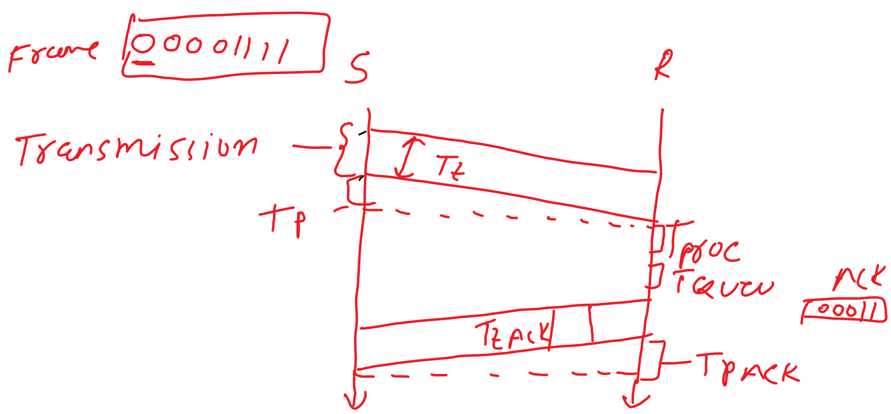
Flow control

Friday, September 27, 2024 1:49 PM



Stop and wait





1 GB

$$T_t = \frac{\text{msg size}}{BW} = \frac{L}{B}$$

$$T_p = \frac{\text{Distance}}{\text{speed}} = \frac{d}{S}$$

$RTT = 2T_p$

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

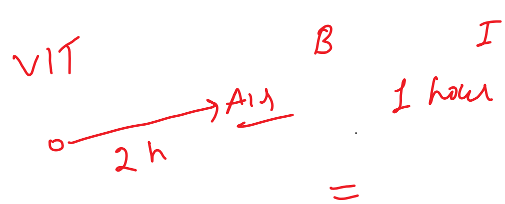
$$\boxed{a = T_p/T_t}$$

Total delay (1 Frame) $= T_{t\,data} + T_{p\,data} + \underbrace{T_{proc} + T_{que}}_{\text{Negligible}} + T_{tACK} + T_{pACK}$

$= T_t + T_p + T_p$

Total Time $= \boxed{T_t + 2T_p}$

$$\eta = \frac{2}{7}$$

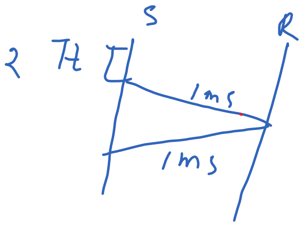


$$\eta = \text{efficiency} = \frac{\text{useful}}{\text{Total delay}}$$

$$= \frac{T_t}{}$$

✓ $T_t = 2ms$ $T_p = 1ms$

$T_t = 2ms$ $\quad T_p = 1ms$



$= \frac{2ms}{4ms}$

$\eta = 50\%$

OR

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

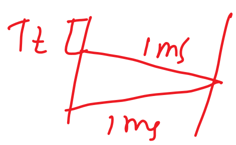
RTT = 2Tp

$= \frac{T_t}{T_t+2T_p}$

$= \frac{1}{1+2T_p/T_t}$

$$\boxed{\eta \ \tfrac{1}{2} = \frac{1}{1+2a} \text{ where } a = \frac{T_p}{T_t}}$$

$T_t = 1ms$ $\quad T_p = 1ms$, $\eta = 1/3$



$= \frac{1}{3}$

* $\eta = 50\%$, $L = ?$

$$\boxed{\text{Throughput} = \eta \times B}$$

$\frac{1}{50} \times 100mbps = 20mbps$

$\eta \geq 50\%$

$\frac{T_t}{T_t+2T_p} \geq \frac{1}{2} \Rightarrow 2T_t \geq T_t + 2T_p$

$T_t \geq 2T_p$

$\frac{L}{B} \geq 2\times\frac{D}{S}$

$L \geq 2\times\frac{D}{S}\times B$

$L \geq 2 \times T_p \times B$

1. A channel has a bit rate of 4 Kbps and one way propagation delay of 20 msec. The channel uses stop and wait protocol. The transmission time of the acknowledgement frame is negligible. To get a channel efficiency of at least 50%, the minimum frame size should be:

$B = 4\ kbps = 4 \times 10^3\ bps$

$T_p = 20\ ms = 20 \times 10^{-3}\ s$

$\eta = 50\%$

$L = ?$ 160 bits ✓

$B =$ $1K = 10^3$

$1M = 10^6$

$1G = 10^9$

$L =$ $1K = 2^{10}$ bits

$1M = 2^{20}$ bits

$1G = 2^{30}$ bits

1. If the bandwidth of the line is 1.5 Mbps, RTT is 45 msec and packet size is 1 KB, then find the link utilization in stop and wait.

$1kb = 10^3$

$KB = 10^3 \times 8$

$B = 1.5\ mbps = 1.5 \times 10^6\ bps$

$RTT = 2T_p \Rightarrow T_p = \frac{45}{2}\ ms$

$L = 1\ KB = 2^{10} \times 8$ bits

$\eta = ?$

$T_t = \frac{L}{B}$

$= \frac{2^{10} \times 8}{1.5 \times 10^6}$

$= 5.46\ ms$

$\eta = ?$

1.5×10^6

$= \underline{5.46\ ms}$

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

$$\eta = \frac{1}{1 + \frac{45\ ms}{5.46\ ms}} \Rightarrow \underline{10.8\ \%}$$

Consider a MAN with average source and destination 20 Km apart and one way delay of 100 µsec. At what data rate does the round trip delay equals the transmission delay for a 1 KB packet?

$d = 20\ km$

$T_p = 100 \times 10^{-6}\ s$

$L = 1\ KB = 2^{10} \times 8\ bps$

$B = ?$

$RTT = T_t$

$2T_p = T_t$

$$2 \times 100 \times 10^{-6} = \frac{L}{B} = \frac{2^{10} \times 8}{B}$$

$$B = \frac{2^{10} \times 8}{2 \times 100 \times 10^{-6}}$$

$$= \frac{1024 \times 8}{200} \times 10^6$$

$$= 40.96\ \underline{m}bps$$

A system uses the Stop-and-Wait Protocol. If each packet carries 1000 bits of data, how long does it take to send 1 million bits of data if the distance between the sender and receiver is 5000 Km and the propagation speed is 2 x 108 m/s? Ignore transmission, waiting, and processing delays. We assume no data or control frame is lost or damaged.

Total data to be transmitted = 10^6 bits
Therefore, number of packets to be transmitted = $10^6 / 10^3 = 1000$
Propagation delay for one packet = Distance / Propagation speed = $(5 * 10^6) / (2*10^8) = 0.025$ s
Propagation delay for one ACK = Distance / Propagation speed = $(5 * 10^6) / (2*10^8) = 0.025$ s
Here, transmission delay is 0.
So, Total time to transmit one packet and receive its ACK = 2 * 0.025 = 0.05 s
Therefore, total time to transmit 1000 packets = 1000 * 0.05 = **50 s**