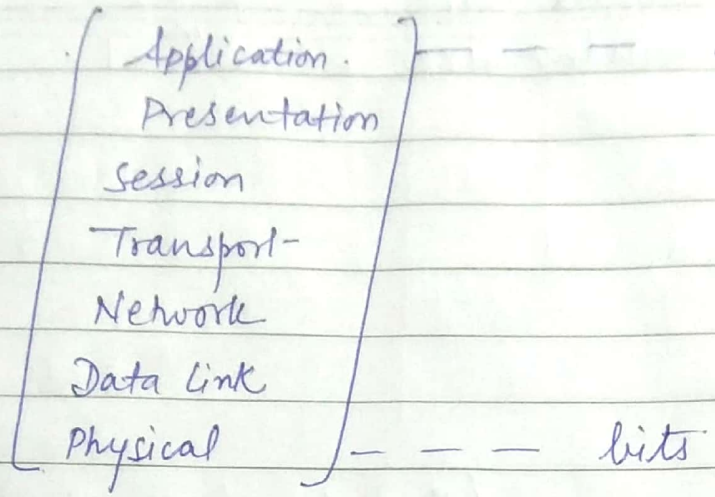
COMPUTER NETWORKS

OSI Model — 7 layer model.



Noiseless channels

- (1) Simplest
- (2) Stop & wait.

Noisy channel

- (1) Stop & wait ARQ
- (2) Go back N
- (3) Selective Repeat ARQ.

Stop and wait ARQ:

uses mod-2 arithmetic as it has either 0 or 1 as data packets.

Go back N ARQ:

Sender window of size = $2^m - 1$

and reciever window size = 1

Selective Repeative ARQ

Sender window size = $2^m - 1$

Reciever window size = $2^m - 1$

basic formulas

① $a = \frac{t_p}{t_{fr}}$

② $t_p = \frac{Dist}{Sp}$ (time for propagation)

③ $t_{fr} = \frac{msg}{Bandwidth}$

Utilizations

⇒ Stop & wait ; $U = \frac{1}{1+2a}$; $a \geq 1$

⇒ Go back N ARQ ; $U = \frac{W}{1+2a}$; $W \geq 2a+1$

Throughput

= U × Bandwidth

Ques: Consider a selective repeat sliding window protocol that uses a frame size of 1 KB to send data on a 1.5 Mbps link with a one-way delay of 50 msec. To achieve a link utilization of 60%, the minimum no. of bits required to represent the sequence number field is ____ ?

Sol^n:-

$M = 1\,KB = 10^3 \times 8$ Mb

$B = 1.5$ Mbps

$T_p = 50$ ms

$U = 60\%$

$a = \frac{t_p}{t_{fr}}$

$t_{fr} = \frac{M}{B} = \frac{8 \times 10^3}{1.5 \times 1}$

$t_{fr} = 5.3$ ms

$a = \frac{500}{53} = \underline{\underline{9.43}}$

For SR protocol $\Rightarrow U = \frac{W}{1+2a}$

$\frac{60}{100} = \frac{W}{1+2a}$

$\frac{60}{100} = \frac{W}{1+2(9.43)}$

$\frac{60}{100} = \frac{W}{1+18.86}$

$\frac{60}{100} = \frac{W}{19.86}$

$W = \frac{60}{100} \times \frac{19.86}{100}$

$W = \frac{1986 \times 6}{1000} = 11.9 \approx \underline{\underline{12}}$.

$\because \quad W = 2^{m-1}$ $\quad \left[2^{m-1} = \frac{2^m}{2^1}\right]$

$\Rightarrow \quad 12 = \frac{2^m}{2}$

$24 = 2^m$

$2^5 = 32$

$m = 5$

Ques: Suppose that a stop and wait protocol used bit rate on 64 Kbit/sec and 20 msec propagation delay. Assume that transmission time for the acknowledgement and processing time at nodes is negligible. Then min. frame size in bytes to achieve 50% utilization?

Sol^n:

$t_p = 20 \text{ msec} = 20 \times 10^{-3} \text{ sec}$

$B = 64 \text{ Kbit/sec} = 64 \times 10^3 \text{ bit/sec}$

$U = 50\%$

$M = ?$

for stop & wait protocol — $U = \frac{1}{1+2a}$

$\frac{1}{2} \quad \frac{50}{100} = \frac{1}{1+2\left(\frac{t_p}{t_{fr}}\right)}$

$$\frac{1}{2} = \frac{1}{1 + 2\left[\frac{20\times10^{-3}}{\frac{M}{64\times10^{3}}}\right]}$$

$$a = \frac{t_p}{t_{fr}}$$

$$t_{fr} = \frac{M}{B}$$

$$\frac{1}{2} = \frac{1}{1 + 2\left[\frac{20\times10^{-3}\times64\times10^{3}}{M}\right]}$$

$$\frac{1}{2} = \frac{1}{1 + 2\left[\frac{20\times64}{M}\right]}$$

$$1 + 2\left[\frac{20\times64}{M}\right] = 2$$

$$2\left[\frac{20\times64}{M}\right] = 2 - 1$$

$$\frac{20\times64}{M} = \frac{1}{2} \Rightarrow M = 2560 \text{ bits}$$

$$M = 320 \text{ bytes}$$

Ques:- A link has transmission speed of 10^6 bit per sec. It uses data packets of size 1000 bytes. Efficiency of stop & wait protocol in this set up is exactly 25%. one way t_p = ____? in msec.

Ans:- $t_p = 12$ msec

Ques:- Consider a network connecting two systems located 8000 Km apart.

$B = 500 \times 10^6$ bits/sec

Speed $= 4 \times 10^6$ m/sec.

It is needed to design Go back N sliding window protocol. Avg packet size is 10^7 bits.

Network is to be used to its full capacity.

Then min. size in bits of sequence number fields is ____?

Ans:- 8