$Q7$.Hosts A and B are each connected via two routers R 1 and R 2. Each link has a propagation delay of 220 microseconds. Processing delay at router is 600 microseconds . Bandwidth of each link is denoted by K , S and R in following diagram

$$A \longrightarrow R_1 \longrightarrow R_2 \longrightarrow B$$

If message size is 100KB .Calculate the time elapsed between the transmission of the first bit of data and the reception of the last bit of the data in the following cases

(a)if value of K,S and R is 10Mbps, 20Mbps , 30Mbps respectively

(i) If message switching technique is used.

$$T = t_{t_s} + t_{t_k} + t_{t_r} + t_p + t_k$$

$$t_{t_s} = \frac{10 * 8 * 1024}{10 * 10^6} = 81920 microsec$$

$$t_{t_k} = \frac{10 * 8 * 1024}{20 * 10^6} = 40960 microsec$$

$$t_{t_r} = \frac{10 * 8 * 1024}{30 * 10^6} = 27306.66 microsec$$

$$t_{p_r} = 600 * 2$$

$$t_p = 220 * 3 = 660$$

$$T = 81920 + 40960 + 2730.66 + 660 + 1200$$

$$T = 1520466.66 microsec$$

(ii) Assume packet header size is negligible

(a) If packet switching technique is used and packet size is 8000 bits

The value of k,s and r is increase order then we will consider of the last bit of last packet.

$$T = t_{t_k} + t_p + t_{t_s} + t_{t_r} + t_{p1}$$

$$t_{t_k} = \frac{100 * 8 * 1024}{10 * 10^6} = 81920 microsec$$

$$t_p = t_{p_k} + t_{p_s} + t_{p_r} = 220 + 220 + 220 = 660 miocrosec$$
$$t_{p1} = t_{p1_{r_1}} + t_{p_{l_{r_2}}} = 600 + 600 = 1200 microsec$$

$$t_{t_{1_s}} = \frac{packetsize}{5} = \frac{3200}{20 * 10^6} = 160 microsec$$

$t_{t_{l_r}} = \frac{lastpacketsize}{R} = \frac{3200}{30 * 10^6} = 106.66 microsec$

$T = 81920 + 660 + 1200 + 160 + 106.66$

$T = 83986.66 microsec$

(b) if packet switching technique is used and packet size is 12000

as we did at ques A

number of place is

$\frac{8 * 1024 * 100}{12000} = 68 full and 1 of 3200 bits$

the last packet has same size with second question of part A so time will be the same

$T = 83986.66 microsec$

(iii) Assume packet header size is 800 bits

$t_{t_b} = t_{t_k} + t_{t_s} + T_p + T_{p_r}$

$T_p = 440 microsec$

$T_{p_r} = 1200 microsec$

$t_{t_k} = \frac{12800}{30 * 10^6} = 426.66 microsec$

$t_{t_s} = \frac{12000}{20 * 16^6} = 640 microsec$

$message = 12800 * 68 + 4000 = 874400 microsec$

$t_{t_b} = 426.66 + 640 + 440 + 1200 = 2706.66 microsec$

$T = 2706.66 + \frac{874400}{10 * 10^6} + 220 = 90366.66 microsec$

(a)If packet switching is used and packet size is 80000bits

$T = t_{t_k} + T_p T_{p_r} t_{t_{l_s}} t_{t_{l_r}}$

$new size of packet is 8000 + 800 = 8800 bits$

$size of last packet is 3200 + 800 = 40000 bits$

$t_{t_k} = \frac{8800 * 102}{10^7} + \frac{1000}{10^7} = 90160 microsec$

$$t_{t_{l_s}} = \frac{4000}{20 * 10^6} = 200 microsec$$

$$t_{t_{l_r}} = \frac{4000}{30 * 10^6} = 133.3 microsec$$

$$T = 90160 + 660 + 1200 + 200 + 133.3$$

$$T = 92353.3 microsec$$

(b) If packet switching technique is used and packet size is 12000bits

$$numberofplace = \frac{8 * 1024 * 100}{12000} = 68 full and 1 of 3200 bits$$

The last packet has same size with last packet so TIME will be the same

$$T = 83986.66 microsec$$