Question 1

Hosts A and B are each connected via two routers R 1 and R 2 and a with 10 8 bits per second links. Each link has a propagation delay of 120 microseconds. Processing delay at router is 500 microseconds.

$$S \longrightarrow R_1 \longrightarrow R_2 \longrightarrow B$$

If message size is 10 KB.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 message switching technique is used.

message switching:

$t_t = \dfrac{messagesize}{datarate}$

$t_t = \dfrac{10 * 1024 * 8}{10^8} = 819.2us$

the message arrives on R_1 at $t_1 = t_t + 120us$

$r_1 t_1 = 819.2 + 120 = 839.2us$

$themessageatr_2 t_2 = t_1 + 500 + t_t + t_t$

$themessageatBt_3 = t_2 + 500 + 120 + 819.2$

$T = 3817.2us$

$$T = 3t_t + t_{p_{r1}} + t_p + t_{p_{r2}} + t_p + t_p$$

$T = 3t_t + 2t_p + 3t_p$

$T = 3 * 819 + 2 * 500 + 3 * 120 = 3817us$

(b) Assume packet header size is negligible .

i) $If packet switching technique is used and 8 packets of same size are used.$

$T = t_t + t_p + t_{p_{R1}} + t_p + t_{t_1} + t_{p_{R2}} + t_p + t_{t_1}$

$$packetsize = \frac{10 * 1024 * 8}{8} = 10240bits$$
$t_{t1} = \frac{10240}{10^8} = 102.4us$

$$T = 819.2 + 120 + 500 + 120 + 102.4 + 500 + 120 + 102.4 = 2384us$$

ii)$If packet switching technique is used and 32 packets of same size are used.$

$packetsize = \frac{10 * 1024 * 8}{32} = 2560bits$

$t_{t_1} = \frac{2560}{10^8} = 25.6us$

$$T = t_t + 3t_p + 2t_p + 2t_1$$

$t = 819.2 + 3 * 120 + 2 * 500 + 2 * 25.6 = 2230.4us$

iii)$If packet switching technique is used and 64 packets of same size are used.$

$$packetsize = \frac{10 * 1024 * 8}{64} = 1.280 bits$$
$$t_{t_1} = \frac{1.280}{10^8} = 12.8us$$
$$T = t_t + 3t_p + 2t_p + 2t_1$$
$$t = 819.2 + 3 * 120 + 2 * 500 + 2 * 12.8 = 2179.2us$$

(C) Assume packet header size is 200 bits

i) $If packet switching technique is used and 8 packets of same size are used.$

$$packetsize = 10240 + 200 = 10440 bits$$
$$t_{t_1} = \frac{10440}{10^8} 104.4 us and t_t = 104.4 * 8 = 835.2us$$
$$T = t_t + 2t_p + 3t_p + 2t_{t1}$$
$$t = 835.2 + 2 * 500 + 3 * 120 + 2 * 104.4 = 2.404us$$

i) $If packet switching technique is used and 32 packets of same size are used.$

$$packetsize = 2560 + 200 = 2760 bits$$
$$t_{t_1} = \frac{2760}{10^8} = 27.6 us and t_t = 27.6 * 32 = 883.2us$$
$$T = t_t + 2t_p + 3t_p + 2t_{t1}$$
$$t = 883.2 + 2 * 500 + 3 * 120 + 2 * 27.6.4 = 1415.2us$$

i) $If packet switching technique is used and 64 packets of same size are used.$

$$packetsize = 1280 + 200 = 1480 bits$$

$$t_{t_1} = \frac{1480}{10^8} = 14.8$$

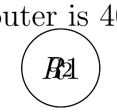
$usandt_t = 14.8 * 64 = 947.2us$

$T = t_t + 2t_p + 3t_p + 2t_{t1}$

$t = 947.2 + 2 * 500 + 3 * 120 + 2 * 14.8 = 1389.6us$

Question 3

Hosts A and B are each connected via router R 1 and a with 5MBps links. Each link has a propagation delay of 5 milliseconds/KM. Processing delay at router is 400 milliseconds .



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 message switching technique is used.

$t_t = 19.5ms$

$data = 100 * 8 = 800kbits$

$datarate = 5 * 1024 * 8 = 40960kb/s$

$$t_t = \frac{data}{datarate} = \frac{800}{40960} = 19.5us$$

$= 2t_t + t_p + t_p$

$t_p = 30 * 5 + 40 * 50 = 350ms = 400us$

$T = 2 * 19.5 + 350 + 400 = 789us$

(b) Assume packet header size is negligible.

i) $If packet switching technique is used and 4 packets of same size are used$

$packetsize = \frac{800}{4} = 200kbits$

$$t = T_t + t_p + t_p + t_{t1}$$
$$t_{t1} = \frac{data}{datarate} = \frac{200}{40960} = 4.88ms$$
$$T = 19.5 + 350 + 400 + 4.88 = 774.38ms$$

ii) $If packet switching technique is used and 64 packets of same size are used$

$packetsize = \frac{800}{64} = 12.5kbits$

$$t = T_t + t_p + t_p + t_{t1}$$
$$t_{t1} = \frac{data}{datarate} = \frac{12.5}{40960} = 0.3ms$$
$$T = 19.5 + 350 + 400 + 0.3 = 769.8ms$$

iii) $If packet switching technique is used and 128 packets of same size are used$

$packetsize = \frac{100}{128} = 0.78125kb$

$$t = T_t + t_p + t_p + t_{t1}$$
$$t_{t1} = \frac{data}{datarate} = \frac{0.78125}{5.20} = 0.15ms$$
$$T = 19.5 + 350 + 400 + 0.15 = 768.65ms$$

(c) Assume packet header size is 400 bits

i)$If packet switching technique is used and 4 packets of same size are used.$

$messagesizeis 100 * 1024 = 102400b$

$$packetsize = \frac{messagesize}{packet} + header = \frac{102400}{4} + 400 = 26000bits$$

$t = T_{ti} + t_p + t_p + t_{t1}$

$t_{t1} = \frac{26000}{5*2^{20}} = 4.95 and t_{ti} = 4.95 * 4 = 19.8ms$

$T = 19.8 + 350 + 400 + 4.95 = 774.75ms$

ii)$If packet switching technique is used and 64 packets of same size are used.$

$messagesize = 81900$

$$packetsize = \frac{messagesize}{packet} + header = \frac{819200}{64} + 400 = 13200bits$$

$t = T_{tii} + t_p + t_p + t_{t1}$

$t_{t1} = \frac{13200}{5*2^{20}*8} = 0.31 and t_{tii} = 64 * 0.31 = 20.1ms$

$T = 20.1 + 350 + 400 + 0.31 = 770.41ms$

iii)$If packet switching technique is used and 128 packets of same size are used.$

$messagesize = 81900$

$$packetsize = \frac{messagesize}{packet} + header = \frac{819200}{128} + 400 = 6800bits$$

$t = T_{tiii} + t_p + t_p + t_{t1}$

$t_{t1} = \frac{6800}{5*2^{20}*8} = 0.16 and t_{tiii} = 128 * 0.16 = 20.7ms$

$T = 20.7 + 350 + 400 + 0.16 = 770.9ms$

Q5. Hosts A and B are each connected via three routers R 1 , R 2 and R 3 and a with 5MBps links. Each link has a propagation delay of 500 millisecond/KM. Processing delay at router is 500 microseconds.

$$\begin{tikzcd} S \arrow[r] & R_1 \arrow[r] & R_2 \arrow[r] & R_3 \arrow[r] & B \end{tikzcd}$$

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 message switching technique is used.

$$T = t_t + t_{p_{r1}} + t_{p_{r1}} + t_t + t_{p_{r1-r2}} + t_{p_{r2}} + t_t + t_{p_{r2-r3}} + t_{p_{r3}} + t_t + t_{p_{r3b}}$$
$$T = 4t_t + t_p + t_p$$
$$t_p = t_{pr_{R1}} + t_{pr_{R2}} + t_{pr_{R3}} = 500*300+500*40+500*45+500*60 = 87500/10^3$$
$$t_p = t_{pr_{R1}} + t_{pr_{R2}} + t_{pr_{R3}} + t_{p_{R3B}} = 500*300+500*40+500*45+500*60+500*3 =$$
$$131250000 * 10^3$$
$$t_t = \frac{data}{datarate} = \frac{100}{5*2^{10}} = 19531.25us$$
$$T = 4*19531.25 + 131250000 + 87500*10^3 = 87579625us$$

(b) Assume packet header size is negligible.

i) $If packet switching technique is used and Packet size is 1000 bits$

$writesomthing$

$$T = t_t + t_{pr_{R1}} + t_{pr_{R1}} + t_{t1} + t_{pR1R2} + t_{p1_{R2}} + t_{t1} + t_{pR2R3} + t_{pr_{R3}} + t_{t1} + t_{p_{r3B}}$$

$$T = t_t + T_p + T_{pr} + 3t_{t1}$$

$t_t : isthegiventakenbyAall......thepackettoR_1$

$t_{t1} : thistakebyroutertolastpacket.$

$$numberofpacket = \frac{100 * 2^{10} * 8}{1000} = 819 fullpacketandthelast200bits$$

$$t_t = 15531.25us$$

$$t_{t1} = \frac{lastpacketsize}{datarate} = \frac{200}{5 * 2^{20} * 8} = 4.76us$$

$$t_p = t_{pAR1} + t_p$$

$$distance(t_p) = 500ms/km$$

$$t_p = 87500 * 10^3 us$$

$$t_{t1} = 3 * 500 = 1500us$$

$$T = 15531.25 + 87500 * 10^3 + 3 * 4.76 = 87521045.53us$$

ii) $IfpacketswitchingtechniqueisusedandPacketsizeis2000bits.$

$wewillmakethesamemessagebutherethepacketsizeof200bits.$

$$numbeofpacket = \frac{100 * 2^{10} * 8}{2000}$$

$$t = t_t + t_p + t_{pr} + 3t_{t1}$$

$409fulland1of1200bits$

$$t_{t1} = \frac{1200}{5 * 2^{20} * 8} = 28.6us$$

$$t_t = 19931.25$$

$$t_p = 87500 * 10^3 us$$

$t_{pr} = 1500us$

$T = 19531.75 + 87500 * 10^3 + 1500 + 28.6 * 3 = 87521117.05us$

iii) $If packet switching technique is used and Packet size is 3000 bits.$

$as the same thing Q5(b)i$

$number of packet = \frac{100 * 2^{10} * 8}{3000}$

$273 full and 1 of 200 bits as the packet is the same Q5(b) - i$

$T also is same$

$T = 8752104.53us$

(c) Assume packet header size is 200 bits.

i) $If packet switching technique is used and Packet size is 1000 bits.$

$there will consider header we have to add if all of packet, we will calculate by to Q5(b - i) number of packet zero is 819 full and 1 of 200 bits$

$$t_t = \frac{819 * (1000 + 200)}{5 * 2^{20} * 8} + \frac{200 + 200}{5 * 2^{20} * 8} = 0233441.3us$$

$t_t is time A taken to and the last bits of last packet transmiting time.$

$t_t + t_p + t_{pr} + t_{t1}$

$t_p = 87500.10^3 us$

$t_{pr} = 1500us$

$$t_1 = \frac{200 + 200}{5 * 2^{20} + 8} = 9.53us$$

$$T = 23441.3 + 87500 * 10^3 + 1500 + 3 * 9.53 = 87524.9413us$$

ii) $If packet switching technique is used and Packet size is 2000 bits.$

$$T = t_t + t_p + t_{pr} + t_{t1}$$

$$t_{t1} = \frac{1200 + 200}{5 * 2^{20} * 8} = 33.3us$$

$$t_t = 409\frac{2000 + 200}{5 * 2^{20} * 8} + 33.3 = 23486.2us$$

$$T = 23486 + 87500 * 20^3 + 1500 + 3 * 33.3 = 87525086us$$

iii) $If packet switching technique is used and Packet size is 3000 bits.$

$packetsize = 2 + 3 full and 1 of 200 bits$

$$T = T_t + t_p + t_{pr} + 3t_{tr}$$

$$t_{t1} = \frac{300 + 200}{5 * 2^{20} * 8} = 9.53us$$

$$t_t = 273 * \frac{3000 + 200}{5 * 2^{20} * 8} + t_{t1} = 20828.24 + 9.53 = 20837.77us$$

$$T = 208337.77 + 87500 * 10^3 + 1500 + 3 * 9.53$$

$$T = 87522366.37us$$