Tutorial 2

Question 1

Consider an application that transmits data at a steady rate of L bps. When the application starts, it will run for a long period of time. Would a packet-switched network or circuit-switched network be more appropriate for this application? Why?

Question 2

Consider two hosts A and B, connected by a single link of rate R bps. A and B are separated by d meters. The propagation speed along the link is s m/s. Host A is to send a packet of size L bits to host B.

(a) Suppose host A begins to transmit the packet at time $t = 0$. At time $t = d_{trans}$ (transmission delay), where is the last bit of the packet?

(b) Suppose d_{prop} (propagation delay) is greater than d_{trans}. At time $t = d_{trans}$, where is the first bit of the packet?

(c) Suppose d_{prop} is less than d_{trans}. At time $t = d_{trans}$, where is the first bit of the packet?

(d) Suppose $s = 2.5 \times 10^8$ m/s, $L = 120$ bits, and $R = 56$ Kbps. Find d so that $d_{prop} = d_{trans}$.

Question 3

Consider two hosts A and B, connected by links of rate 1.5 Mbps. Each link is 309 Km long. The propagation speed along the link is 2×10^8 m/s. There are 3 routers between hosts A and B. Each router spends 1.5 ms to perform error detection. Assume there is no congestion in the network. Host A is to send a 1,200-byte packet to host B.

(a) At what time the last bit of the packet leaves host A?

(b) At what time the last bit of the packet reaches the first router?

(c) What is the total end-to-end delay for the packet to reach host B?

Question 4

Suppose there are 120 client-server pairs. Each server link has the rate of 10 Mbps. Each client link has the rate of 100 Mbps. The network link has the rate of 1 Gbps. What is the maximum end-to-end throughput between the server and client?