

QUIZ 1 - ANSWER

1. Suppose there is exactly one packet switch between a sending host and a receiving host. The transmission rates between the sending host and the switch and between the switch and the receiving host are R_1 and R_2 , respectively. Assuming that the switch uses store-and-forward packet switching, what is the total end-to-end delay to send a packet of length L ?

Answer: end-to-end delay = $L/R_1 + L/R_2$

Explanation: At time t_0 the sending host begins to transmit. At time $t_1 = L/R_1$, the sending host completes transmission and the entire packet is received at the router (no propagation delay). Because the router has the entire packet at time t_1 , it can begin to transmit the packet to the receiving host at time t_1 . At time $t_2 = t_1 + L/R_2$, the router completes transmission and the entire packet is received at the receiving host (again, no propagation delay).

2. Consider sending a packet from source host to a destination host over a fixed route. List the delay components in the end-to-end delay. Which of these delays are constant and which are variable?

Answer: The delay components are processing delays, transmission delays, propagation delays, and queuing delays. All of these delays are fixed, except for the queuing delays, which are variable.

3. How long does it take a packet of length 1000 bytes to propagate over a link of distance 2,500 km, propagation speed 2.5×10^8 m/s, and transmission rate 2 Mbps? More generally, how long does it take a packet of length L to propagate over a link of distance d , propagation speed s , and transmission rate R bps? Does this delay depend on packet length? Does this delay depend on transmission rate?

Answer: $t_{\text{prop}} = d/s = 2500 \times 10^3 / (2.5 \times 10^8) = 10.00$ msec; no; no

4. Suppose Host A wants to send a large file to Host B. The path from Host A to Host B has 3 links, of rates $R_1 = 500$ kbps, $R_2 = 2$ Mbps and $R_3 = 1$ Mbps.

- a) Assuming no other traffic in the network, what is the throughput for the file transfer?

Answer: The min throughput available = 500 kbps

- b) Suppose the file is 4 million bytes. Dividing the file size by the throughput, roughly how long will it take to transfer the file to Host B?

Answer: File size/throughput = $4 \times 10^6 \times 8 / (500 \times 10^3) = 64$ s

- c) Repeat (a) and (b), but now with R_2 reduced to 100 kbps.

Answer: 100kbps; 320 seconds