Comp 2322 Computer Networking

Homework One

Due time: 11:59pm, February 5, 2024, Monday

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Q1. (a) Transmission delay $= \frac{L}{R_1} + \frac{L}{R_2} + \frac{L}{R_3}$

Propagation delay $= \frac{d_1}{s_1} + \frac{d_2}{s_2} + \frac{d_3}{s_3}$

Total end-to-end delay $= \frac{L}{R_1} + \frac{L}{R_2} + \frac{L}{R_3} + \frac{d_1}{s_1} + \frac{d_2}{s_2} + \frac{d_3}{s_3} + 2d_{proc}$

(b) Total end-to-end delay $= 3 \times \frac{1000 \times 8}{4 \times 10^6} + \frac{4200 \times 10^3}{3 \times 10^8} + \frac{2400 \times 10^3}{3 \times 10^8} + \frac{3000 \times 10^3}{3 \times 10^8}$

$+ 2 \times 1 \times 0.001$

$= 0.006 + 0.014 + 0.008 + 0.01 + 0.002$

$= 0.04$ sec

$= 40$ msec

Q2. (a) If $R_s \le R_c$ (the bottleneck link is the first link), the packet inter-arrival time depends on the time of the first transmission.

The inter-arrival time $t = \frac{L}{R_s}$

If $R_s > R_c$ (the bottleneck link is the second link), the packet inter-arrival time depends on the time of second transmission.

The inter-arrival time $t = \frac{L}{R_c}$

(b) Yes, ~~Because~~ As the time slot for second packet arrive ~~to~~ at the second link is $T_1 = \frac{2L}{R_s} + d_{prop}$. And the time slot for first packet to finish its transmission in second link finish is ~~$T_2 = \frac{L}{R_s} +$~~ $T_2 = \frac{L}{R_s} + d_{prop} + \frac{L}{R_c}$. The $R_c < R_s$, so $\frac{2L}{R_s} + d_{prop} < \frac{L}{R_s} + d_{prop} + \frac{L}{R_c}$.

which means, when second packet arrive the second link, the first packet are not finish the transmission, so the second packet queues at the input queue of the second ~~que~~ link.

(c) If $R_c < R_s$, queuing occurs.

So $T + \frac{L}{R_s} + d_{prop} \geq \cancel{\frac{L}{R_s}}\ d_{prop} + \frac{L}{R_c}$ (if we want no queuing)

$T \geq \frac{L}{R_c} - \frac{L}{R_s}$