Assignment #1

Higher Layer Protocols

Anton Claes

0300042110

CEG4188

University of Ottawa

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Question 1

We have two hosts A and B connected with a R bps link, m meters long, and with a propagation speed of s m/s.

a. Ignoring processing and queing delays, we have a total delay $d_{total} = d_{prop} + d_{trans}$, with : $d_{trans} = L/R$ and $d_{prop} = m/s$ So the total end to end delay is

$d_{e2e} = L/R + m/s = \frac{Ls+Rm}{Rs}$

b. d_{prop} is the time needed for a bit to go accros the whole link. If $d_{prop} > d_{trans}$ then at $t = d_{trans}$ it has crossed $\frac{d_{trans}}{d_{prop}}\%$ of the link, so it is at position $\frac{d_{trans}}{d_{prop}} \cdot m$ from the beginning of the link.

c. $d_{trans} = L/R$ and $d_{prop} = m/s$, so if we want d_{trans} and d_{prop} to be equal :

$d_{trans} = L/R = d_{prop} = m/s \Rightarrow m = \frac{Ls}{R}$

With a propagation speed of $s = 2.5 * 10^8 m/s$, a length $L = 120 bits$ and a link rate of $R = 56 kbps$ we have $m = \frac{2.5*10^8*120}{56*10^3} = 53.6 km$.

So for the propagation delay and transmission delay to be equal, the link must be 53.6 km long.