Assignment 1

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1. $d_{prop} = d/s = \frac{5000\times10^3}{2\times10^8} = 25ms$

2. $d_{trans} = L/R = \frac{2000\times8}{10} = 1600s$

3. $w = s/R$

4. $BIT_{in-flight} = d/w$

5. Bandwidth-delay Product= Data Link's Capacity(b/s)×Round-trip Delay Time (s).

Bandwidth-delay Product= $R \times t_{prop} = 10^7 b/s \times 0.025s = 2.5 \times 10^5 bit$

6. $d = d_{trans} + d_{prop} = L/R + d/s$

$d = \frac{2000\times8bit}{10\times10^6 s} + \frac{1000\times10^3 m}{2\times10^8 m/s} = 1.6ms + 5ms = 6.6ms$

7. $d = d_{trans} + d_{prop} = 3 \times L/R + d/s$

$d = 3 \times \frac{2000\times8bit}{10\times10^6 s} + \frac{1500\times10^3 m}{2\times10^8 m/s} = 3 \times 1.6ms + 7.5ms = 12.3ms$

8. The proppropagation time from S1/S2 to R1= $(500 \times 10^3)/(2 \times 10^8) = 2.5ms$

The transmission time from S1/S2 to R1=$(2000 \times 8)/(10 \times 10^6) = 1.6ms$

There are 2 cases would happen:

(1)The sending interval between S1 and S2 is equal or greater than 2.5ms-1.6=0.9ms. In this case, the delay would not be affected.

(2)The sending interval between S1 and S2 is smaller than 2.5ms-1.6=0.9ms. In this case, the delay would increase because the second arrival should queue for the completement of the first arrial's transmission at R1. The first arrival's delay would have no effect, but the second arrvival should wait for the first arrival's transmission at R1. If this case happens, delay of follwing packets probably would be affected.

To make sure that no packets are lost, we should assume that the router buffer of R1 is large enough.