4320

HW 1

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1.A. 1000 kB file RTT = 50ms $\frac{1000000\ B}{1000\ B} = 1000$ packets

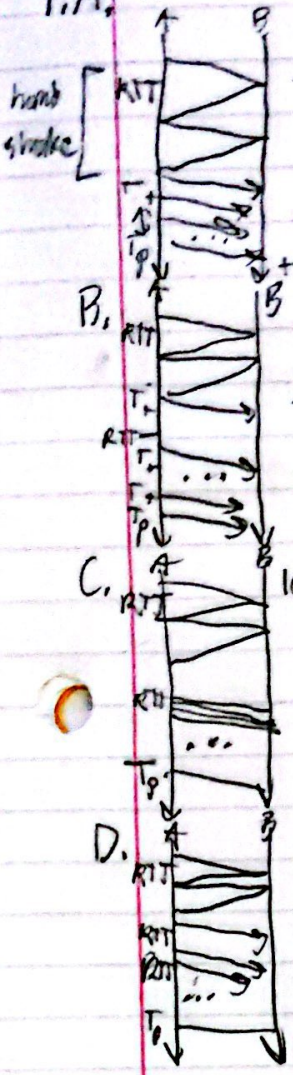
$T_p = 25ms$ $T_t = 1024 \cdot 8 / 1.5 \times 10^6 = 0.005461333\overline{3}\ s$

$\rightarrow 5.461333\overline{3}\ ms$

$T = 2RTT + 1000T_t + T_p$

$T = 2(50ms) + 1000(5.461333\overline{3}) + 25ms$

$T = 5.586.333ms = 5.586333\overline{3}\ s$



B. 1000 kB file RTT = 50ms $\frac{1000000\ B}{1000\ B} = 1000$ packets

$P_p = 25ms$ $T_t = 1024 \cdot 8 / 1.5 \times 10^6 = 5.461333\overline{3}ms$

$T = 2RTT + 999(T_t + RTT) + T_t + T_p$

$T = 2(50ms) + 999(55.461333\overline{3}) + 5.461333\overline{3} + 25$

$T = 55.563333\overline{3}\ s$

C. 1000 kB file RTT = 50ms $\frac{1000000\ B}{1000\ B} = 1000$ packets

$T_p = 25ms$ $T_t = 0ms$ Bursts: $1000/20 = 50$ bursts

$T = 2RTT + 50RTT + T_p$

$T = 2(50ms) + 50(50ms) + 25ms$

$T = 2.625\ s$

D. 1000 kB file RTT = 50ms $\frac{1000000\ B}{1000\ B} = 1000$ packets

$T_p = 25ms$ $T_t = 0ms$ $2^n - 1$ packets $\rightarrow n = 10$ $2^{10} - 1 = 1024 > 1000$ packets

$T = 2RTT + 9RTT + T_p$

$T = 2(50ms) + 9(50ms) + 25ms$

$T = 575ms = 0.575\ s$

2. $50000m = D$ $S = 2 \times 10^8 \frac{m}{s}$ 100 byte packets $\rightarrow$ 800 bits/packet

Prop Delay $= D/S = 50000m / 2 \times 10^8 \frac{m}{s} = 0.25ms$

Transmission Delay $= 800\ bits/packets / 0.25ms = 3200 \frac{bits}{ms} = 3200000 \frac{bits}{s}$

B. 512 byte packet $= 4096$ bits packet

$4096\ bits / 0.25ms = 16384 \frac{bits}{ms} = 16384000 \frac{bits}{s}$

3. A. 1×10^9 bits/s $D = 385{,}000{,}000$ m $S = 3 \times 10^8$ m/s

$RTT_{min}/2 = D/S = 385{,}000{,}000 / 3 \times 10^8 = 1.28333$ s

$\downarrow \cdot 2 = RTT_{min} = 1.28333 \cdot 2 = 2.5666$ s

B. 2.5666 s $\cdot 1 \times 10^9$ bits/s $= 2566666666$ bits

C. Delay x Bandwith value indicates how many bits the sender can send before receiving acknowledgment that the receiver received the first bit. So, it represents the maximum amount of unacknowledged data. It also let's us know how much data can be sent before receiving a response.

*D. $\frac{25\,MB \cdot 1024 \frac{kB}{MB} \cdot 1024 \frac{byte}{kB} \cdot 8 \text{ bits/byte}}{1 \times 10^9 \text{ bits/s}} = \frac{209715200}{1{,}000{,}000{,}000} = 0.2097152$ s

$\rightarrow 0.2097152 + 2(1.28333) = 2.776381866$ s

↑ for request send then data return

4. A. $1920 \cdot 1080 \cdot 24 \cdot 30 = 1492992000 \frac{bits}{s}$

B. $8 \cdot 8000 = 64000 \frac{bits}{s}$

C. $260 \cdot 50 = 13000 \frac{bits}{s}$

D. $24 \cdot 88200 = 2116800 \frac{bits}{s}$