EE 450 HW #2 Yuhang Xiao

P23.

a.

$$d_1 = \frac{L}{R_s} + d_{prop} + \frac{L}{R_c} + d_{prop}$$

$$d_2 = 2\frac{L}{R_s} + d_{prop} + \frac{L}{R_c} + d_{prop}$$

inter-arrival time $= d_2 - d_1 = \frac{L}{R_s}$

b.

It's possible. Because when the last bit of first packet finishes the transmission of the second link, we have

$$d = \frac{L}{R_s} + d_{prop} + \frac{L}{R_c}$$

Meanwhile, when the last bit of the second packet arrives the router, we have

$$d' = \frac{2L}{R_s} + d_{prop}$$

Given $R_c < R_s$, we have $d - d' > 0$, which means the second packet can't start transmitting because the first packet is still transmitting.

Thus, to ensure no queuing, $d' + T = d$

$$\Rightarrow T = d - d' = \frac{L}{R_c} - \frac{L}{R_s}$$

P31.

a. To the first packet switch,

$$d_{\text{first switch}} = \frac{10^6}{5\times10^6} = 0.2\ s$$

To the destination host,

$$d_{e\text{-}to\text{-}e} = 3\cdot\frac{10^6}{5\times10^6} = 0.6\ s$$

b. First packet to the first switch,

$$d_{1\text{-}to\text{-}1} = \frac{10^4}{5\times10^6} = 2\ ms$$

Second packet to the first switch,

$$d_{2\text{-}to\text{-}1} = 2\cdot\frac{10^4}{5\times10^6} = 4\ ms$$

c. Use segmentation.

$$d'_{e\text{-}to\text{-}e} = 100\cdot\frac{10^4}{5\times10^6} + \frac{10^4}{5\times10^6} + \frac{10^4}{5\times10^6}$$

$$= 0.204\ s$$

Find $d'_{e\text{-}to\text{-}e} < d_{e\text{-}to\text{-}e} = 0.6s$. So use message segmentation can reduce the transport time effectively because switches don't have to wait the huge file to arrive, then forward the message

P7.

Time to receive IP address,

$RTT_1 + \cdots + RTT_n$

Time to see up TCP link and receive the object

$2RTT_0$

Total time : $2RTT_0 + RTT_1 + \cdots + RTT_n$

P8.

a. every object need a TCP connection and transport time, that's $2RTT_0$

Thus, total time $= 18RTT_0 + RTT_1 + \cdots + RTT_n$

b. Two times of parallel connections can transport all objects, each uses $2RTT_0$

total time $= 6RTT_0 + RTT_1 + \cdots + RTT_n$

c. every object needs RTT_0 without pipelining,

total time $= 10RTT_0 + RTT_1 + \cdots + RTT_n$

with pipelining,

total time $= 3RTT_0 + RTT_1 + \cdots + RTT_n$

P10.

$$d_{prop} = \frac{10}{3\times 10^8} = \frac{1}{3}\times 10^{-7}\ s$$

Now, each object is wrapped into one packet, we have

Non-persistent HTTP with parallel:

$$d = 3\left(\frac{200}{150} + d_{prop}\right) + \frac{10^5}{150} + d_{prop} + 3\left(\frac{200}{15} + d_{prop}\right) + \frac{10^5}{15} + d_{prop}$$

$$= 44 + \frac{22000}{3} + 8 d_{prop}$$

$$\approx 7377.33\, s$$

persistent HTTP:

$$d' = 3\left(\frac{200}{150} + d_{prop}\right) + \frac{10^5}{150} + d_{prop} + 10\left(\frac{200}{150} + d_{prop} + \frac{10^5}{150} + d_{prop}\right)$$

$$= 4 + \frac{40}{3} + \frac{22000}{3} + 24 d_{prop}$$

$$\approx 7350.67\, s$$

Because $d' \approx d$, so persistent HTTP doesn't have significant gains over non-persistent HTTP.
Note that d_{prop} is negligible, so this is also true for persistent HTTP with pipelining.

P27.

a. $$d_{pack} = \frac{8L}{128 \times 10^3} = \frac{L}{16 \times 10^3} = \frac{L}{16} \text{ ms}$$

b.

$$d_{pack,1} = \frac{1500}{16} = 93.75 \ ms \ > 20 ms$$

$$d_{pack,2} = \frac{50}{16} = 3.125 \ ms \ < 20 ms$$

c.

$$d_{trans,1} = \frac{L+40}{R} = \frac{8 \times 1500 + 40}{622 \times 10^6} = 19.36 \ \mu s$$

$$d_{trans,2} = \frac{L+40}{R} = \frac{8 \times 50 + 40}{622 \times 10^6} = 0.71 \ \mu s$$

d.

Smaller packet size has less store-and-forward delay and will not cause unpleasant echo.