Will Townsend

Dr. E.A. Lu

COSC 370-750

6 March 2021

Homework #2

3) TCP and DNS are needed to successfully retrieve the web document in this scenario.

7) $\max\{RTT_1, RTT_2, \ldots\ , RTT_n\} * RTT_0$ (the initial RTT multiplied with the max RTT of client i $RTT_i\ where\ i \in \mathbb{N}$)

8a) 20*RTT (non-persistent must connect twice per object so (2n+2)RTT)

8b) 6*RTT (non-persistent must connect twice per object but also splits up so x amount of objects can connect in parallel so ((2n/x)+2)RTT)

8c) 9*RTT (persistent only needs to connect once per object so (n+1)RTT)

9)

Total Average Response Time = Average access delay + Average internet delay.

Average access delay = $\frac{\Delta}{1-\beta\Delta}$ where,

Δ = the average time required to send an object over the access link $\approx$.00001882 sec

β = the arrival rate of object to the access link = 53,125 bits/sec

Average Internet Delay = 3 seconds

a) ≈ 3.10037 seconds

b) 0.4(.10037) + 0.6(3) = 0.040148 + 1.8 = 1.840148 seconds

	Client-Server Architecture	P2P Architecture
N=10 & u=300 Kbps	$\max\left\{\frac{10^{10}*15}{3*10^{7}}, \frac{15*10^{9}}{2*10^{6}}\right\}$ 7500 sec	$\max\left\{\frac{10^{9}*15}{3*10^{7}}, \frac{15*10^{9}}{2*10^{6}}, \frac{10^{10}*15}{(3*10^{7})+\sum_{i=1}^{10}3*10^{5}}\right\}$ 7,500 sec
N=10 & u=700 Kbps	Same as Last Calculation	$\max\left\{\frac{10^{9}*15}{3*10^{7}}, \frac{15*10^{9}}{2*10^{6}}, \frac{10^{10}*15}{(3*10^{7})+\sum_{i=1}^{10}7*10^{5}}\right\}$ 7,500 sec
N=10 & u= 2 Mbps	Same as Last Calculation	$\max\left\{\frac{10^{9}*15}{3*10^{7}}, \frac{15*10^{9}}{2*10^{6}}, \frac{10^{10}*15}{(3*10^{7})+\sum_{i=1}^{10}2*10^{6}}\right\}$ 7,500 sec
N=100 & u=300 Kbps	$\max\left\{\frac{10^{11}*15}{3*10^{7}}, \frac{15*10^{9}}{2*10^{6}}\right\}$ 50,000 sec	$\max\left\{\frac{10^{9}*15}{3*10^{7}}, \frac{15*10^{9}}{2*10^{6}}, \frac{10^{10}*15}{(3*10^{7})+\sum_{i=1}^{100}3*10^{5}}\right\}$ 7,500 sec
N=100 & u=700 Kbps	Same as Last Calculation	$\max\left\{\frac{10^{9}*15}{3*10^{7}}, \frac{15*10^{9}}{2*10^{6}}, \frac{10^{10}*15}{(3*10^{7})+\sum_{i=1}^{100}7*10^{5}}\right\}$ 7,500 sec
N=100 & u=2 Mbps	Same as Last Calculation	$\max\left\{\frac{10^{9}*15}{3*10^{7}}, \frac{15*10^{9}}{2*10^{6}}, \frac{10^{10}*15}{(3*10^{7})+\sum_{i=1}^{100}2*10^{6}}\right\}$ 7,500 sec
N=1,000 & u=300 Kbps	$\max\left\{\frac{10^{12}*15}{3*10^{7}}, \frac{15*10^{9}}{2*10^{6}}\right\}$ 500,000 sec	$\max\left\{\frac{10^{9}*15}{3*10^{7}}, \frac{15*10^{9}}{2*10^{6}}, \frac{10^{10}*15}{(3*10^{7})+\sum_{i=1}^{1000}3*10^{5}}\right\}$ 7,500 sec

N=1,000 & u=700 Kbps	Same as Last Calculation	$\max\left\{\frac{10^9 * 15}{3 * 10^7}, \frac{15 * 10^9}{2 * 10^6}, \frac{10^{10} * 15}{(3 * 10^7) + \sum_{i=1}^{1000} 7 * 10^5}\right\}$ 7,500 sec
N=1,000 & u=2 Mbps	Same as Last Calculation	$\max\left\{\frac{10^9 * 15}{3 * 10^7}, \frac{15 * 10^9}{2 * 10^6}, \frac{10^{10} * 15}{(3 * 10^7) + \sum_{i=1}^{1000} 2 * 10^6}\right\}$ 7,500 sec