HW 2

Problem 1

Given: 10-m link → T_R : 150 bits/s

Packets : 100,00 bits long ; control packets : 200 bits long

N parallel connections w/ $1/N$ bandwith each

Objects are 100k bits or 100,000 bits long

P_D : propagation delay from client to server

Parallel downloads allows multiple simultaneous connections

so: $N = 10$, $1/10$ bandwidth; $T_R / N = 15$ bits/s

Given a 3-way handshake between client and server

$$\left(\frac{200}{150} + P_D + \frac{200}{150} + P_D + \frac{200}{150} + P_D + \frac{100{,}000}{150} + P_D\right.$$

$$\left. + \frac{200}{\frac{150}{10}} + P_D + \frac{200}{\frac{150}{10}} + P_D + \frac{200}{\frac{150}{10}} + P_D + \frac{100{,}000}{\frac{150}{10}} + P_D\right)$$

$= 7377 + 8P_D$ sec for non-persistent connections

For persistent connections

$$\left(\frac{200}{150} + P_D + \frac{200}{150} + P_D + \frac{200}{150} + P_D + \frac{100{,}000}{150} + P_D + 10\left(\frac{200}{150} + P_D + \frac{100000}{150} + P_D\right.\right.$$

$= 7351 + 2 + P_D$ sec.

if data is transmitted over coble at speed of light, then $P_D = 3 \times 10^9$ s

∴ persistant does not produce significant gain over non-persistant

Problem 2 given: N, $F = 15$ Gbits, $u_s = 30$ Mbps, $d_{min} = 2$ Mbps

Formula is $D_{cs} = \max\left\{\frac{NF}{u_s}, \frac{F}{d_{min}}\right\}$ $D_{p2p} = \max\left\{\frac{F}{u_i}, \frac{F}{d_{min}}, \frac{NF}{\left(u_s + \sum_{i=1}^{N} u_i\right)}\right\}$

Client : server

	N=10	N=100	N=1000
u = 200 Kbps	7680	51200	512000
u = 600 Kbps	7680	51200	512000
u = 1 Mbps	7680	51200	512000

Peer to Peer

	N=10	N=100	N=1000
u = 200 Kbps	78643.2	78643.2	78643.2
u = 600 Kbps	26214.4	26214.4	26214.4
u = 1 Mbps	15360	15360	15360

15 Gbits = 15360 Mbits

200 Kbps = 0.1953125 Mbps

600 Kbps = 0.5859375 Mbps

1 Mbps = 1 Mbps

1

$$\frac{F}{u_1}$$

$= 78643.2$

2

$$\frac{F}{d_{min}}$$

$= 7690$

3

$$\frac{NF}{\left(u_2 + \sum_{i=1}^{N} u_i\right)}$$

$= 4807.04156479$

$N = 10$

$\leq N \leq$ Step:

5 $u_2 = 30$

-10 30

6 $d_{min} = 2$

-10 10

7 $F = 15360$

-10 15360

8 $u_1 = 0.1953125$

-10 10

9