Data Communications
Homework 2

1. Consider a short, 10 meter link, over which a sender can transmit at a rate of 150 bits/sec in both directions. Suppose that packets containing data are 100,000 bits long, and packets containing only control (eg. ACK or handshaking) are 1000 bits long. Assume that N parallel connections each get 1/N of the link bandwidth. Now consider the HTTP protocol, and suppose that the object is 100Kbits long, and the initial downloaded object contains 10 referenced objects from the same sender. Would parallel downloads via parallel instances of nonpersistent HTTP make sense in this case ? Now consider persistent HTTP. Do you expect significant gains over the non-persistent case ? Justify and explain your answer.

2. Consider distributing a file of F bits to N peers using a client-server architecture. Assume a fluid model where the server can simultaneously transmit to multiple peers, transmitting to each peer at different rates, as long as the combined rate does not exceed u_s.

(a) Suppose that $u_s/N >= d_{min}$. Specify a distribution scheme that has a distribution time of $F/ \mathrm{d}_{\mathrm{min}}$.
(b) Suppose that $u_s/N <= d_{min}$. Specify a distribution scheme that has a distribution time of NF/ u_s.
(c) Conclude that the minimum distribution time is in general given by $max \{ NF/ u_s, F/ \mathrm{d}_{\mathrm{min}}\}$

3. In this problem we explore designing a hierarchical overlay that has ordinary peers, super peers, and super-duper peers.

a) Suppose each super-duper peer is roughly responsible for 200 super peers, and each super peer is roughly responsible for 200 ordinary peers. How many super-duper peers would be necessary for a network of eight million peers?

b) What information might each super peer store? What information might each super peer store? What information might each super-duper peer store? How might searches be performed in such a three-tier design?

4. Consider distributing a file of F = 10Gbits to N peers. The server has an upload rate of u_s = 40Mbps and each peer has a download of d_i = 2Mbps and an upload rate of u. For N = 10,100, and 1, 000 and u = 400Kbps, 1200 Kbps and 6 Mbps, give the minimum distribution times for each combination of N and u for both client-server distribution and P2P distribution.

Deadline: 19. December. 2011, 23.59

Submission: Please submit your homework to the Online Course System.

Homework Policies:

1. Cheating is strongly discouraged.
2. Late homeworks will be graded as 0.
3. Please comment your source codes.

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