2018 Fall Computer Network

撰寫：資工四 B04705001 陳約廷
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標題：計算機網路 作業三

1. (25%) True or False

   a. False. In HTTP, one request gets one response. So the user will need to send 4 request messages to get 4 response messages.

   b. True. Both webpages are on the same server, www.mit.edu.

   c. False. Connection will close once the first message is recieved. Then with the second HTTP request we will open another connection.

   d. False. It is the time when the request was created.

   e. False. 204 and 304 does not have message body.

2. (25%)
   Time to get IP address: $RTT_1 + RTT_2 + RTT_3 + ... + RTT_n$
   Then when IP address is known by the client, client will send a TCP request to server and recieve a response, which is $RTT_0 * 2$.
   So the total response time is $2RTT_0 + RTT_1 + RTT_2 + RTT_3 + ... + RTT_n$

3. (25%)
   a. Time to get IP address + TCP request & response + 8 object request & response
   = $RTT_1 + RTT_2 + RTT_3 + ... + RTT_n + 2RTT_0 + 16RTT_0$
   = $RTT_1 + RTT_2 + RTT_3 + ... + RTT_n + 18RTT_0$

   b. With 5 parellel connection, 8 small objects take two batch to complete
   = get IP address + TCP request + 2 parellel connections
   = $RTT_1 + RTT_2 + RTT_3 + ... + RTT_n + 2RTT_0 + 2 * 2RTT_0$
   = $RTT_1 + RTT_2 + RTT_3 + ... + RTT_n + 6RTT_0$

   c. With persistent HTTP, the server will return the objects needed after TCP request is responded
   = $RTT_1 + RTT_2 + RTT_3 + ... + RTT_n + 2RTT_0 + RTT_0$
   = $RTT_1 + RTT_2 + RTT_3 + ... + RTT_n + 3RTT_0$

4. (25%)

a.

Define $u = u_1 + u_2 + ... + u_N$, which u_i is the transmission rate of peer i.
Then split the file into N parts, with each part be $(u_i/u) * F$.

The server transmits the i^{th} part to peer i at rate $r_i = (u_i/u) * u_s$, which u_s is the transmission rate of the server.
So by our definition we have $r_1 + r_2 + ... + r_N = u_s$. The total tranmission rate for server does not exceed the limit.

Also have all peers forward the recieved data to each of the other peers.
So for peer i, we have forwarding rate $(N-1) * r_i = (N-1) * (u_i/u) * u_s \le u_i$. The total transmission rate for peer i does not exceed limit.

So in this scheme, peer i will receive $r_i + \Sigma_{j<>i} r_j = u_s$.
Therefore all peers recieve the file in F/u_s time.

b.

Define $u = u_1 + u_2 + ... + u_N$, which u_i is the transmission rate of peer i.
Let $r_i = u_i/(N-1)$, and $r_{N+1} = (u_s - u/(N-1))N$.
Split the file into $N+1$ parts.

The server sends i^{th} part to peer i. at rate r_i.

Each peer also forwards the recieved file at rate r_i to all other $N-1$ peers.

Because the server have extra bandwidth,
server sends the $N+1$ part ar rate r_{n+1} to all N peers, and the peers don't need to forward this part.

The server transmission rate will be
$r_1 + r_2 + ... + r_N + N * r_{N+1} = u/(N-1) + u_s - u/(N-1) = u_s$. The total tranmission rate for server does not exceed the limit.

The peer transmission rate $(N-1) * r_i = u_i$. The total transmission rate for peer i does not exceed limit.

So in this scheme, peer i will receive
$r_i + r_{N+1} + \Sigma_{j<>i} r_j = u/(N-1) + (u_s - u/(N-1))/N = (u_s + u)/N$
Therefore all peers recieve the file in $NF/(u_s + u)$ time.

c. By the upper two parts, we can conclude the minimum distribution time is in general is either

- When $u_s \le (u_s + u_1 + ... + u_N)/N$, transmission time is F/u_s,
- When $u_s \ge (u_s + u_1 + ... + u_N)/N$, transmission time is $NF/(u_s + u)$