Southern University of Science and Technology

Computer Networking Lab Report

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■ *Procedure and Result：Homework#2*

➢ Q1:

List the four broad classes of services that a transport protocol can provide. For each of the service classes, indicate if either UDP or TCP (or both) provides such a service.

A1:

a) Reliable data transfer/Flow control——TCP
b) Throughout (a certain value for throughput will be maintained)—— Neither
c) Timing(Data can be transferred within a specified amount of time)——Neither
d) Confidentiality (via encryption). Neither

➢ Q2:

Suppose within your Web browser you click on a link to obtain a Web page. The IP address for the associated URL is not cached in your local host, so a DNS lookup is necessary to obtain the IP address. Suppose that n DNS servers are visited before your host receives the IP address from DNS; the successive visits incur an RTT of RTT_1, . . ., RTT_n. Further suppose that the Web page associated with one HTML file, and the HTML file references eight very small objects on the same server. Let RTT_0 denote the RTT between the local host and the server containing these objects. Assuming zero transmission time of the objects. Please calculate the time which elapses from when the client clicks on the link until the client receives the object under the following circumstance.

a) Non-persistent HTTP with no parallel TCP connections?
b) Non-persistent HTTP with the browser configured for 5 parallel connections?
c) Persistent HTTP?

A2:

a) $18RTT_0 + RTT_1+...+ RTT_n$
b) $6RTT_0 + RTT_1+...+ RTT_n$
c) $3RTT_0 + RTT_1+...+ RTT_n$

- **Q3:**

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 μ_s.

a) Suppose that $\mu_s/N \leq d_{min}$ .Specify a distribution scheme that has a distribution time of NF/μ_s.

b) Suppose that $\mu_s/N \geq d_{min}$. Specify a distribution scheme that has a distribution time of F/d_{min}.

c) Conclude that the minimum distribution time is in general given by $max\{NF/\mu_s, F/d_{min}\}$.

A3:

a) Since the combined rates sent by the server does not sxceed μ_s,so the average rate sent to each client is μ_s/N. Since $\mu_s/N \leq d_{min}$, and the server transfers a file of F bits to N peers at the same time, therefore, the file transfer time is $F/(\mu_s/N) = NF/\mu_s$

b) Since the combined rates sent by the server does not sxceed μ_s,so the average rate sent to each client is μ_s/N. Since $\mu_s/N \geq d_{min}$, and the server transfers a file of F bits to N peers at the same time, therefore, the file transfer time is F/d_{min}.

c) The average rate sent to each client is μ_s/N. Since he server transfers a file of F bits to N peers at the same time, so the download rate is $min\{\mu_s/N, d_{min}\}$ .Then the file transfer time is $F/min\{\mu_s/N, d_{min}\}$= $max\{NF/\mu_s, F/d_{min}\}$.

- **Q4:**

Consider distributing a file of F bits to N peers using a P2P architecture. Assume a fluid model. For simplicity assume that d_{min} is very large, so that peer download bandwidth is never a bottleneck.

a) Suppose that $\mu_s \leq (\mu_s + \mu_1 + \cdots + \mu_n)/N$. Specify a distribution scheme that has a distribution time of F/μ_s.

b) Suppose that $\mu_s \geq (\mu_s + \mu_1 + \cdots + \mu_n)/N$. Specify a distribution scheme that has a distribution time of $NF/(\mu_s + \mu_1 + \cdots + \mu_n)$.

c) Conclude that the minimum distribution time is in general given by $max\{F/\mu_s, NF/(\mu_s + \mu_1 + \cdots + \mu_n)\}$

A4:

a) Divide the file into N parts,then μ_k part of file has the size of $\frac{\mu_k}{\mu_1+\cdots+\mu_n}F$, and the transfer rate is $\frac{\mu_k}{\mu_1+\cdots+\mu_n}\mu_s$.Meanwhile the aggregate forwarding rate by peer is $(N-1)\frac{\mu_k}{\mu_1+\cdots+\mu_n}\mu_s$,which is smller than μ_k .Thus the distribution time is F/μ_s.

b) Divide the file into N parts,then μ_k part of file has the size of $\frac{\mu_k}{\mu_1+\cdots+\mu_n}F$, and the transfer rate is $\frac{\mu_k}{\mu_1+\cdots+\mu_n}\mu_s$.Meanwhile the aggregate forwarding rate by peer is $(N-1)\frac{\mu_k}{\mu_1+\cdots+\mu_n}\mu_s$,which is larger than μ_k.So the peer receive the file from the server and other N-1 peers,Thus the distribution time is $NF/(\mu_s+\mu_1+\cdots+\mu_n)$.

c) According to what is explained above , it is clearly that no matter $\mu_s \leq (\mu_s+\mu_1+\cdots+\mu_n)/N$ or $\mu_s \geq (\mu_s+\mu_1+\cdots+\mu_n)/N$,the time will not exceed both results, so it is given by $max\{F/\mu_s, NF/(\mu_s+\mu_1+\cdots+\mu_n)\}$.

- **Q5:**

Consider a DASH system for which there are N video versions (at N different rates and qualities) and N audio versions (at N different rates and qualities). Suppose we want to allow the player to choose at any time any of the N video versions and any of the N audio versions.

a) If we create files so that the audio is mixed in with the video, so server sends only one media stream at given time, how many files will the server need to store (each a different URL)?

b) If the server instead sends the audio and video streams separately and has the client synchronize the streams, how many files will the server need to store?

A5:

a) N^2

b) $2N$