CSCI 361

Writing Assignment 2

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1) Consider the following figure, for which there is an institutional network connected to the Internet. Suppose that the average object size is 1,500,000 bits and that the average request rate from the institution's browsers to the origin servers is 9 requests per second. Also suppose that the Internet delay (i.e., the amount of time it takes from when the router on the Internet side of the access link forwards an HTTP request until it receives the response) is three seconds on average. Assuming that the network delay within the institutional network is small enough to be ignored (i.e., zero delay), the total average response time is thus modeled as the sum of the average access delay (i.e., the delay from Internet router to institution router) and the average Internet delay. The average access delay can be calculated by $\Delta/(1 - \Delta\ \beta)$, where Δ is the average time required to send an object over the access link (i.e., the transmission delay for an object to be sent over the access link) and β is the arrival rate of objects to the access link.

(a) Calculate the total average response time.

- Part I:
    - Δ=1500000 bits / (15*1000*1000 bits.sec^{-1} = 0.1 sec) => Time of transmission
- Part II:
    - $\beta\Delta$=(9 requests/sec) * 0.1 sec/request = 0.9 => Traffic Intensity on Link
- Part III:
    - Average Access Delay = 0.1 / (1-0.9) = 1 second
- Part IV:
    - Total Average Response Time = Total average time + Average Access Delay

      = 3 +1

      = 4 seconds

(b) Now suppose a web cache is installed in the institutional LAN. Suppose the miss rate is 0.4. Calculate the total average response time.

- Miss rate = 40 % = 0.4
- Average access delay = 0.1 / (1-0.9x0.4) = 0.156 seconds
- If the request is satisfied by cache, the response time is approximately near to zero.
- The average response time = 3 seconds + 0.156 seconds = 3.156 seconds => FOR CACHE MISSES
- Now, Total Avg. Response Time = 0.6x0 + 0.4x3.156 = 1.26 seconds

2) Consider distributing a file of F = 40 Gbits to N peers. The server has an upload rate of us = 40 Mbps. The download rate of peer i is 5 Mbps for i=1, 2, …, k with k<N, and is 2 Mbps for i=k+1,k+2,…,N. Also, each peer has an upload rate of u. For N=20, 200, and 2,000 and u=200Kbps, 400 Kbps, and 2 Mbps, prepare a chart giving the minimum distribution time for each of the combinations of N and u for bot client-server distribution and P2P distribution.

- F = 40 Gbits, Upload Rate, (u_s)= 40 Mbps
- Download rate of peer i = 5 Mbps where i = 1, 2, 3… N
- Download rate of peer i (d_{min}) = 2 Mbps for i= k+1, k+2, k+3 … N
- Now,
    - $D_{Client\text{-}Server}$= max {(NF/u_s), (F/d_{min})}
    - D_{P2P} = max {(F/ u_s), (NF/(u_s+ $\sum u_i$)), (F/d_{min})} where, $\sum u_i$, i=1, 2, ..N

    Table Plot

- Client Server:

Upload Speed	N		
	20	200	2000
200 Kbps	20000	200000	2000000
400 Kbps	20000	200000	2000000
2 Mbps	20000	200000	2000000

- P2P:

Upload Speed	N		
	20	200	2000
200 Kbps	20000	100000	181819
400 Kbps	20000	66667	95238
2 Mbps	20000	20000	20000