University Of Florida

Computer Networks

CNT5106C

Fall-2015 - Oct, 6 2015

HW-1

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Solutions

Problem-1

General case for sending one packet,

Delay (d) = N*L/R

For p packets delay = d’

Now, one packet * d’ =d*p

Therefore, 1*d’= (N*L*P)/R

Hence➔ d’= NLP/R.

Problem-2:

a). Users= 3*1000/150 = **20**

b). since each user is transmitting 10 percent of the time, the probability that a user is transmitting at any instance = 10/100 = **0.1**

c). success prob= 0.1 for a given user

Therefore probability for a user not transmitting = 1-p= 0.9

Total user =120

Using binomial distribution prob = ${}^{total}C_n\ (0.1)^n * (0.9)^{120-n}$

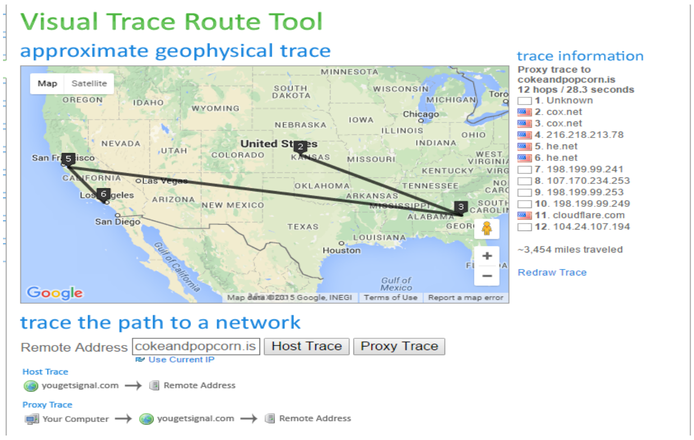
d). P[21 or more transmitting] = 1 - P[20 or less transmitting]

$\rightarrow 1 - \sum_{i=0}^{20} \binom{120}{i} * 0.1^i * 0.9^{120-i}$ Where $\binom{120}{i}$ means ${}^{120}C_i$

Problem-3:

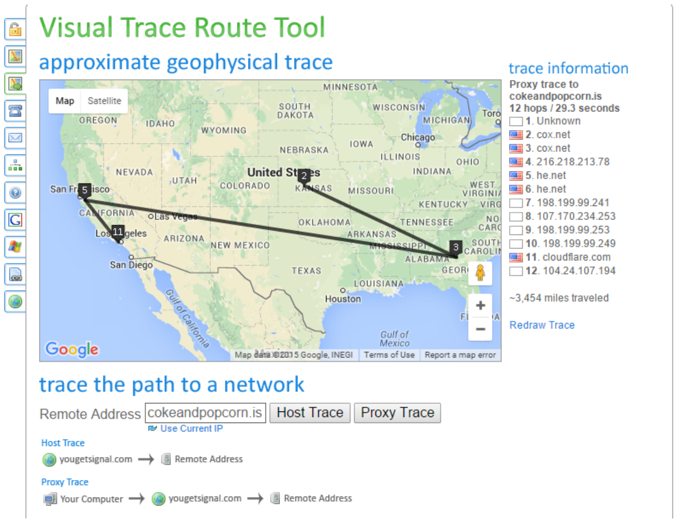
a)

At 5 am :



Round Trip : 28.3sec , No of Hops = 12

At 7am :



Round trip : 29.3sec , No of hops : 12

At 10 am:

Round trip : 28.2secs No of hops :12

Finding average for these 3 hours Tracing over facebook webservers can be computed as :

$$AVG_{RT} = (28.3+29.3+28.2) / 3 = 28.6sec$$

Now computation for Standard deviation could be shown as :

= 0.60828

b) No of Routers on 1st observation at 5am : 12 hops

----------------------2nd -----------------7am : 12 hops

----------------------3rd -----------------10am :12 hops

And for some distance in all the three observations , traced path is exactly same , however after jumping over some hops , Traceroute showed that there was a change in the path followed.

c) 1st observation :   No of different ISPS on the path Traced : 6

2nd Observation: No of different ISPS on the path Traced : 6

3rd observation :   No of different ISPS on the path Traced : 6

Yes the largest delays occur at the peering interfaces between adjacent ISPs. It took 5 hops in the Adjacent ISP peer to move to next ISP .

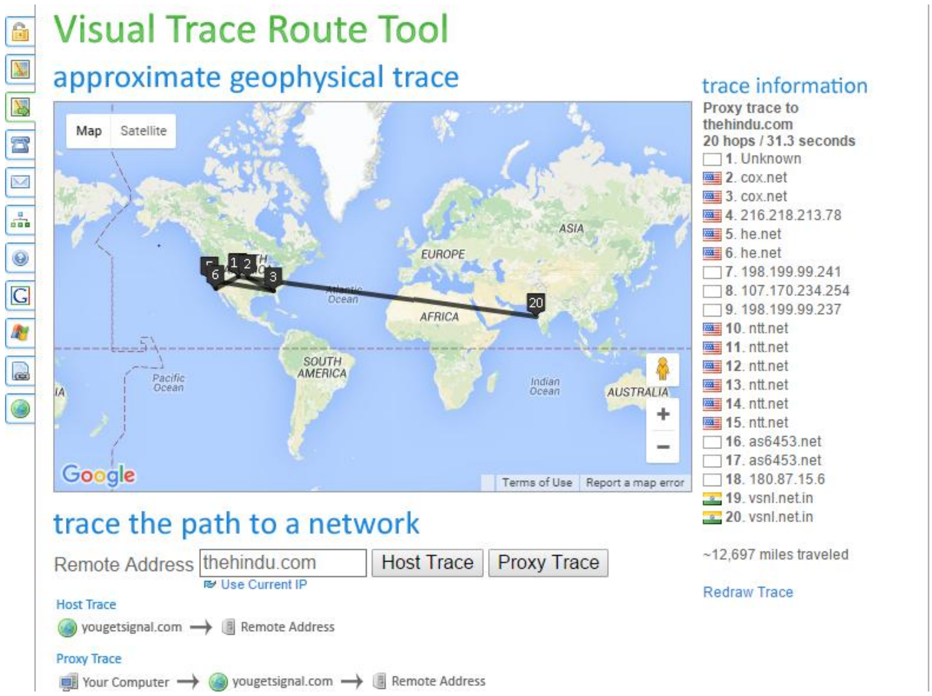
d) a-) At 2pm :

Round trip : 50.4 sec   No of hops: 20

At 5pm :

Round trip : 36.0sec   No of hops : 20

At 8 pm:



Round trip : 31.3 sec   No of hops :20

Ergo , finding average for these 3 hours Tracing over facebook webservers can be computed as :

$$AVG_{RT} = (50.4+36+31.3) / 3 = 39.2 \text{ sec}$$

Now computation for Standard deviation could be calculated similarly as we did before :

$$SD_{RT} = 9.952$$

b) No of Routers on 1st observation at 2pm : 20 hops

---------------------2nd ----------------5pm : 20 hops

---------------------3rd ----------------8pm :20 hops

And for some distance in all the three observations , traced path is exactly same , however after jumping over some hops , Traceroute showed that there was a change in the path followed.

c) 1st observation :   No of different ISPS on the path Traced : 10

2nd Observation: No of different ISPS on the path Traced : 10

3rd observation :   No of different ISPS on the path Traced : 10

Yes the largest delays occur at the peering interfaces between adjacent ISPs. It took 10 hops in the adjacent ISP peer's network to move to next different ISP .

d) Comparing both Intra continent and Inter continent networks , we can conclude that Comparing the two it seems that the only real difference i see is change in time for differing continents, which makes sense ,as well as the increased isp back and forth. Both have the strange change around midnight however.

<u>Problem-4:</u> : Skype is a proprietary VoIP system using its own protocol based on peer-to-peer (P2P) networking essentially, it works by creating ad-hoc, direct communication between two computers on the Internet in a similar way to file-sharing systems such as KaZaa (developed by Niklas Zennström and Janus Friis—the same people who developed

Skype). Apart from a logon server that grants access to the network, assigns unique usernames, and so on, Skype is completely decentralized and distributed: there's no centralized "Skype control system." At any given moment, there are something like 15–30 million Skype users logged on worldwide.

When you sign on to Skype, your computer becomes one node in a global network of equal peers. Each Skype user runs a piece of software called a client that allows them to send messages to other Skype users, make calls, send files, and play real-time games. Each of the clients becomes an active part of the network and, whether it's actively sending messages or not, helps the network as a whole to locate and route traffic to other users. Within the network, some of the users with highest bandwidth and best connectivity, known as supernodes, act as traffic hubs. The network as a whole is made up of supernodes connected to one another, with each supernode linking to many ordinary nodes.

Unlike other instant messaging programs (such as the Yahoo! and Microsoft Live Messengers and AOL's AIM), Skype is much more adept at communicating through firewalls by random selecting theports it will use. As a consequence, it's much harder for system administrators to detect and block Skype than traffic between other Internet chat programs. Skype also uses encrypted communication between peers, which also makes it highly secure—and relatively hard for random eavesdroppers or law-enforcement agencies to monitor.

Problem-5: The total amount of time to get the IP address is RTT1 + RTT2+....+ RTTn .

Once the IP address is known, RTTO elapses to set up the TCP connection and another RTTO elapses to request and receive the small object.

The total response time is 2RTTo+RTT1+RTT2+ RTTn

Problem-6: a).➔ $RTT_1 + \ldots.. + RTT_n + 2\ RTT_0 + 8 * 2\ RTT_0$

➔ $18RTT_0 + RTT_1 + \ldots\ldots + RTT_n$

b).➔ $RTT_1 + \ldots.. + RTT_n + 2\ RTT_0 + 2 * 2\ RTT_0$

➔ $6RTT_0 + RTT_1 + \ldots\ldots + RTT_n$

c).➔ $RTT_1 + \ldots.. + RTT_n + 2\ RTT_0 + \quad RTT_0$

➔ $3RTT_0 + RTT_1 + \ldots\ldots + RTT_n$

Problem-7: Yes, we can use dig to query that Web site in the local DNS server. For example, “dig facebook.com” will return the query time for finding facebook.com. If facebook.com was just accessed a couple of seconds ago, an entry for faceboo k.com is cached in the local DNS cache, so the query time is 0msec. Otherwise, the query time is large**.**

Problem-8:a)Consider a distribution scheme in which the server sends the file to each client, in parallel, at a rate of a rate of us /N. Note that this rate is less than each of the client’s download rate, since by assumption u_s /N ≤ dmin. Thus each client can also receive at rate us /N. Since each client receives at rate us /N, the time for each client to receive the entire file is F/(u_s /N) = NF/ u_s . Since all the clients receive the file in NF/ u_s , the overall distribution time is also NF/ u_s

b)Consider a distribution scheme in which the server sends the file to each client, in parallel, at a rate of dmin. Note that the aggregate rate, N dmin, is less than the server’s link rate us , since by assumption u_s /N ≥ dmin. Since each client receives at rate dmin, the time for each client to receive the entire file is F/ dmin. Since all the clients receive the file in this time, the overall distribution time is also F/ dmin.

c) We know that :

DCS ≥ max {NF/us , F/dmin} (Equation 1)

Suppose that us /N ≤ dmin. Then from Equation 1 we have DCS ≥ NF/u_s .

But from (a) we have DCS ≤ NF/u_s . Combining these two gives: DCS = NF/u_s when u_s /N ≤ dmin. (Equation 2)

We can similarly show that: DCS =F/dmin when u_s /N ≥ dmin (Equation 3). Combining Equation 2 and Equation 3 gives the desired result

<u>Problem-9:</u>A circuit-switched network can guarantee a certain amount of end-to-end bandwidth for the duration of a call. Most packet-switched networks today (including the Internet) cannot make any end-to-end guarantees for bandwidth.

<u>Problem-10:</u>:

$$delay = \frac{100*10^3}{2.5*10^8} = 0.004\sec$$

Therefore the bandwidth-delay product is:

<u>Problem-11:</u> Before the HTTP GET request can be sent for the web document, the HTTP client needs to obtain the IP address of the HTTP server hosting the document. So a DNS request is sent out to obtain the hostname to IP address mapping. Recall that DNS runs over UDP. Once the mapping is obtained, the HTTP client first establishes a TCP connection with the server (Recall that HTTP runs over TCP). Following the TCP connection establishment a GET request for the web document is sent over this connection.

In summary, the following are the protocols that are used:

Application layer protocols: DNS and HTTP

Transport layer protocols: UDP for DNS; TCP for HTTP

<u>Problem-12:</u> When a node wants to join any network, it first discovers the IP address of one or more nodes already in the network. It then sends join messages to these nodes. When the node receives confirmations, it becomes a member of the of network. Nodes maintain their logical links with periodic refresh messages.

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