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Assignment 1

CSCI4171

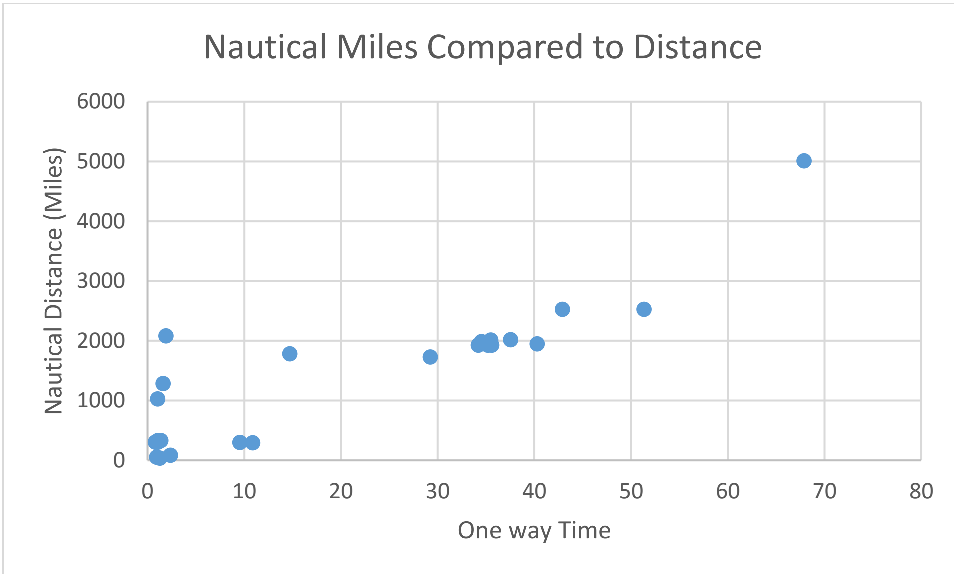
1. A) Traceroute works by sending out a UDP datagram out towards the designated destination. Each datagram sent is set with an incrementing time to live starting with a time to live of 1. This will cause the datagrams to “die” at the first router. The router then replies with an IMCP message stating that the packet died. The TTL is then increased to 2 which allows the message to reach the second router. This process continues until the TTL is too high or if the datagrams reach the designated destination. When the packets get then they try to access an invalid port so the destination sends back an IMCP message that sates that the port is unreachable. The time that IMCP messages are received are recorded along with the router/destination names and displayed to show the round trip time to each one.

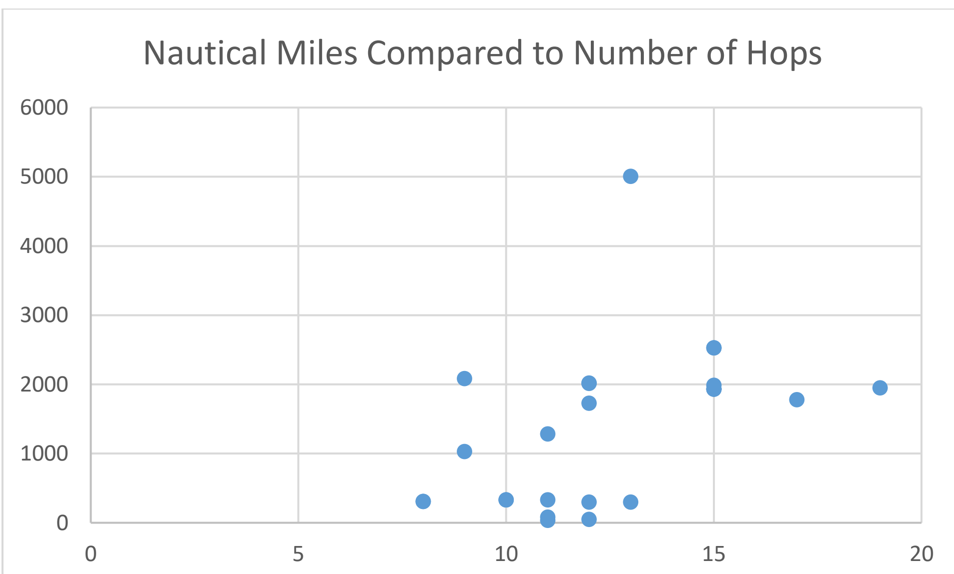
   b) The parameters generated by the traceroute command are

   - The number of visited routers up until the current router
   - The name of each visited router
   - The IP address of each router
   - The time takes to get to the router (x3)

   c) Some important parameters are

   - -f defines the first time to live, the default is 1
   - -g adds an IP source route gateway to the outgoing packet, it is not usually useful though because most routers disable this functionality
   - -i the interface that the packets will be sent through, the default is to use a routing table
   - -m defines the max time to live, the default is 30
   - -n shows numerical addresses, does not look up hostnames
   - -p the destination port
   - -q probes per hop, default is 3
   - -s specifies the source address for the packets
   - -4, -6 forces either IPv4 tracing or IPv6 tracing





d) It is plain to see that longer distances make the one-way trip time longer. Most of the short distances measured had a low one-way trip time. The furthest server had the longest trip time by a large amount.

The other graph does not really show much about the relation of hops to distance. It is mostly spread out. The furthest server has 14 hops but the most hops is from a server 1950 miles away which is 3000 miles closer to the source than the furthest server.

Assignment 1

Assumed 1 KB = 1000 bits from q3 - q5.

$S = 2.5 \times 10^8$ $L = 100$ bits

$D_{prop} = D_{trans}$ $R = 28$ Kbps

$m/s = L/R$

$$m / 2.5 \times 10^8 \text{ meters/sec} = \frac{100 \text{ bits}}{28 \text{Kbps}}$$

$$m / 2.5 \times 10^8 = \frac{100 \text{ bits}}{28000 \text{ bits/s}}$$

$m / 2.5 \times 10^8 = .00357s$

$m = .00357s \times 2.5 \times 10^8$

$= 892500m$ or 892.5 Km

(4) Only looking at transmission delay. To push each packet onto the link is $(F+h)/R$. Since a header is added, the length of the packet increases by h bits. It is the same for each link and the is Q links. Including set up time it takes $t_s + Q * (F+h)/R$

(b) Similar to last question but no set up time an 2h of header bits instead of h.

(1KB = 1000 b for this question)

∴ It takes $Q * (F + 2h) / R$

(5) $D_{prop} = \frac{20\,000 \text{ Km}}{2.5 * 10^8 \text{ m/s}}$

$= \frac{20\,000\,000 \text{ m}}{2.5 \times 10^8 \text{ m/s}}$

$= .08 s$

$D_{trans} = \frac{800\,000 \text{ bits}}{2 \text{ Mbps}}$

$= \frac{.8 \text{ Mb}}{2 \text{ Mbps}}$

$= .4 s$

No dproc or dqueue

∴ delay $= .08s + .4s = .48s$

delay for acknoledgement is 100ms per packet or .1s
Each packet then has to travel the link so only one packe on the link per ACK. D_{trans} is reduced since packet size is 40,000bits instead of 800000.

$$D_{trans} = \frac{.04 \text{ Mb}}{2 \text{ Mbps}}$$

$$= .02s$$

\# of packets that travel the link

$$\text{Total delay} = 20(.1 + .08) + .02s$$

$$= 3.62s$$

D_{trans} is only once since it can be tranferes to the link, while the other packet is travelling.

(6) $D_{prop} = 40ms$ $\quad D_{trans} = \frac{1KB}{10Mbps}$

$$= \frac{.0078 \text{ mb}}{10 \text{ Mbps}}$$

$$= .00078s$$

(a) data can be sent continuously so $D_{trans} = \frac{1.5 \text{ MB}}{10 \text{ Mbps}} = 1.2s$

$$\text{total delay} = 2RTT + D_{trans} + D_{prop} = .16 + 1.2 + .04$$

$$= 1.4s$$

(b) D_{trans} is .00078s again

total delay = 2RTT + Dtrans + (#packets * dprop)

= .16 + .00078 + (1.5MB/1Kb * .04)

= .16078 + 1536 * .04

= .16078 + 61.44s

= 61.60078s

(c) $2RTT + D_{trans} + \lceil 1536/20 \rceil * .04$ = total delay

total delay = .16 + .00078 + 77 * .04

= .16078 + 3.08s

= 3.24078s

(d) packes are sent in $2^{(n-1)}$ per RTT.

total delay = .16 + .00078 + n(.04)

$n = 10 \quad \sum_{1}^{10} 2^{n-1} = 2047$

number of packets that need to be sent is 1536 and by going through 10 RTTs the max # of sent packets is 2047 which is greater than 1536.

∴ Total delay = .16 + .00078 + .4 = .56078s

7. a) $s, r_{11}, S, D, 50000, 21$

b) $r_{14}, r_{21}, S, D, 50000, 21$

c) $r_{22}, r_{34}, S, D, 50000, 21$

d) $r_{31}, d, S, D, 50000, 21$

e) $r_{11}, s, D, S, 21, 50000$

f) $r_{21}, r_{14}, D, S, 21, 50000$

g) $r_{34}, r_{22}, D, S, 21, 50000$

h) $r_{14}, r_{21}, S, D, 22, 50001$

i) $r_{22}, r_{34}, S, D, 22, 50001$

j) $r_{31}, d, S, D, 22, 50001$

k) $r_{11}, s, D, S, 50001, 22$

l) $r_{21}, r_{14}, D, S, 50001, 22$