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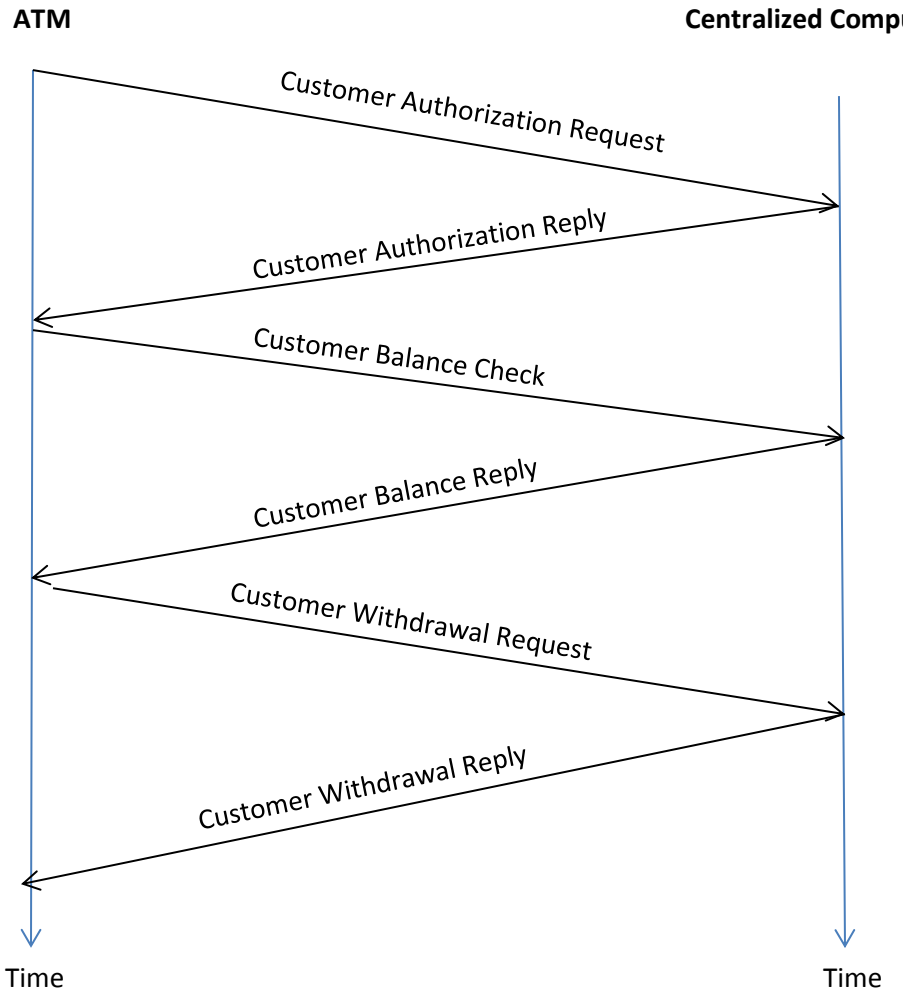
CS4480
HW 1

P1) Fields inside of () change front login attempt to login attempt.

1. ATM requests customer authorization
    a. ATM to Centralized Computer (CC).
        i. userlogin
        ii. (username)
        iii. (password)
    b. CC to ATM. [ATM displays login success or error message on receipt of message]
        i. userlogin
        ii. (accepted/rejected)
        iii. (Error message if rejected)
        iv. (Unique Session ID if accepted)
2. ATM requests a balance check of the account
    a. ATM to CC
        i. balancecheck
        ii. (Session ID)
    b. CC to ATM [ATM displays the balance in the account]
        i. balancecheck
        ii. (Balance amount)
3. ATM requests a withdrawal from the account
    a. ATM to CC
        i. accountwithdrawal
        ii. (Session ID)
        iii. (Withdrawal amount)
    b. CC to ATM [ATM dispenses money if withdrawal accepted, error otherwise]
        i. accountwithdrawal
        ii. (accepted/rejected)
        iii. (Error message if rejected)
        iv. (New balance if accepted)


ATM
Centralized Computer
Customer Authorization Request
Customer Authorization Reply
Customer Balance Check
Customer Balance Reply
Customer Withdrawal Request
Customer Withdrawal Reply
Time
Time

P6)

1. P6
    a. d_{prop} = m/s
    b. d_{trans} = L/R
    c. d_{e2e} = m/s + L/R
    d. At t=d_{trans}, the last bit of the packet is just about the leave the host.
    e. At t=d_{trans} and d_{prop}>d_{trans}, the first bit is propagating through the link at s*d_{trans}.
    f. At t=d_{trans} and d_{prop}<d_{trans},, the first bit is at Host B.
    g. For d_{prop}=d_{trans}, m/s = L/R. Rearrange: m =sL/r. Values: m = 2.5E8*120/56E3. m=535714.

P10)

- Each link has d_{prop} = d/s, and d_{trans} = L/R. Additionally, there are two processing delays.
- Total end-to-end delay = d1/s1 + d2/s2 + d3/s3 + L/R1 + L/R2 + L/R3 + 2d_{proc}
- Substitute in values for above equation (Note that L is converted to bits, and all R are same)
- End-to-end delay = 5E6/2.5E8 + 4E6/2.5E8 + 1E6/2.5E8 + 3*12E3/2E6 + 2*0.003
- End-to-end delay = 0.064s

P18) Raw Trace Information is at the end of this assignment

	http://www.uaa.alaska.edu/	www.msu.ru (inter-continental)
Hour 1 Average Delay (standard deviation)	73.33 (0.58)	191 (1)
Hour 2 Average Delay (standard deviation)	74.67 (2.89)	196.33 (8.39)
Hour 3 Average Delay (standard deviation)	75.33 (2.08)	202.67 (10.69)
Hour 1 Router Count	14	26
Hour 2 Router Count	14	26
Hour 3 Router Count	14	26
Hour 1 ISP Count	2	3
Hour 2 ISP Count	2	3
Hour 3 ISP Count	2	3

a) See table.
b) See table, the number of routers never changed.
c) See table. For the intra-continental traceroute, the largest delay is about tied between changing over from Comcast.net to gci.net and going on Comcast.net's network between Colorado and Washington State. For the inter-continental traceroute, the largest delay is not a connection between ISPs, but a trip in the cogentco.com ISP. This may likely be the signal crossing the Atlantic Ocean. Interesting enough the signal travels this way instead of through Siberia.
d) See above table / c. Overall, the intra-continental connection was faster and the variation between attempts was generally lower. The number of routers was also much lower. The isp counts between the two routes was surprisingly similar though, with only one additional ISP for covering a much larger distance.

P31)

a) d_{trans} = L/R. We must send the packet through the source and two switches. $D_{transTotal}$ = 3L/R, or 3*8E6/2E6 = 12s.

b) $D_{1stP1stS}$ = L/R, or 10000/2E6 = 0.005s for the first packet to get to the first switch. The second packet will be at the first switch at 0.01s.

c) The total movement for each packet is 3L/R, with 800 packets, this is 12s total. The result is the same as sending one huge packet. So there is no gross throughput advantage. However, the destination starts to receive small packets; the data may be able to start to be used right away. For instance, when streaming a video, the destination can start to play the video with the information it has, and doesn't have to wait for the entire video of data.

d) Using small packets allows other traffic to intermingle with this traffic. Additionally, if there are multiple routes from point A to point B, theoretically packets could take different routes to increase throughput if the bandwidth limitations weren't at the endpoints.

e) One drawback is that the message must be broken into parts, and reassembled. This uses computer power at both ends. Additionally, each router must read 800 packet headers instead of just one. This may add some processing time that wasn't accounted for earlier on. Finally, the host and destination might need to check whether each individual packet arrived instead of whether just one packet arrived.

Raw Traceroute information for P18

Traces at 11:21

Tracing route to www-virtual.uaa.alaska.edu [137.229.141.83] over a maximum of 30 hops:

1	<1 ms	<1 ms	<1 ms	DD-WRT [192.168.11.1]
2	19 ms	19 ms	40 ms	67.182.220.1
3	12 ms	11 ms	11 ms	te-0-7-0-1-sur02.saltlakecity.ut.utah.comcast.net [68.87.220.117]
4	10 ms	10 ms	12 ms	te-0-0-0-0-sur01.saltlakecity.ut.utah.comcast.net [68.86.180.94]
5	13 ms	10 ms	11 ms	te-0-0-0-4-ar03.saltlakecity.ut.utah.comcast.net [68.86.180.73]
6	23 ms	23 ms	23 ms	pos-0-9-0-0-cr01.denver.co.ibone.comcast.net [68.86.90.233]
7	61 ms	46 ms	48 ms	pos-0-9-0-0-cr01.seattle.wa.ibone.comcast.net [68.86.88.66]
8	45 ms	52 ms	47 ms	be-13-pe03.seattle.wa.ibone.comcast.net [68.86.84.110]
9	46 ms	45 ms	60 ms	as8047.seattle.wa.ibone.comcast.net [173.167.56.6]
10	88 ms	73 ms	74 ms	218-129-165-209.gci.net [209.165.129.218]
11	*	*	*	Request timed out.
12	*	*	*	Request timed out.
13	73 ms	76 ms	74 ms	149-170-165-209.klf.static.gci.net [209.165.170.149]
14	73 ms	74 ms	73 ms	www-virtual.uaa.alaska.edu [137.229.141.83]

Trace complete.

Tracing route to www.msu.ru [93.180.0.18] over a maximum of 30 hops:

1	<1 ms	<1 ms	<1 ms	DD-WRT [192.168.11.1]
2	109 ms	10 ms	29 ms	67.182.220.1
3	11 ms	27 ms	13 ms	te-0-7-0-1-sur02.saltlakecity.ut.utah.comcast.net [68.87.220.117]
4	14 ms	14 ms	15 ms	te-0-3-0-2-ar02.sandy.ut.utah.comcast.net [69.139.231.41]
5	16 ms	14 ms	12 ms	162-151-9-149-static.hfc.comcastbusiness.net [162.151.9.149]
6	25 ms	37 ms	27 ms	pos-0-2-0-0-cr01.denver.co.ibone.comcast.net [68.86.90.225]
7	23 ms	25 ms	25 ms	te3-5.ccr01.den03.atlas.cogentco.com [154.54.10.33]
8	32 ms	25 ms	54 ms	te7-1.ccr02.den01.atlas.cogentco.com [154.54.45.185]
9	43 ms	42 ms	42 ms	te0-2-0-7.ccr22.mci01.atlas.cogentco.com [154.54.82.214]
10	47 ms	47 ms	46 ms	te0-3-0-2.ccr22.ord01.atlas.cogentco.com [154.54.6.213]
11	61 ms	62 ms	68 ms	te0-3-0-3.ccr22.yyz02.atlas.cogentco.com [154.54.42.6]
12	77 ms	78 ms	80 ms	te0-3-0-5.ccr22.ymq02.atlas.cogentco.com [154.54.42.230]
13	145 ms	160 ms	145 ms	te0-4-0-6.ccr22.lpl01.atlas.cogentco.com [154.54.44.214]
14	156 ms	154 ms	155 ms	te0-3-0-3.ccr22.ams03.atlas.cogentco.com [154.54.37.125]
15	158 ms	157 ms	157 ms	te0-6-0-5.ccr21.ams04.atlas.cogentco.com [130.117.2.66]
16	156 ms	155 ms	170 ms	te3-1.mag01.ams04.atlas.cogentco.com [154.54.73.206]
17	175 ms	194 ms	175 ms	149.6.151.154
18	189 ms	190 ms	191 ms	tele-1-gw.sth.runnet.ru [194.85.40.242]
19	191 ms	191 ms	191 ms	kt12-1-gw.spb.runnet.ru [194.85.40.141]
20	197 ms	196 ms	196 ms	tv11-1-gw.msk.runnet.ru [194.85.40.137]
21	196 ms	191 ms	192 ms	m9-3-gw.msk.runnet.ru [194.85.40.221]

22 189 ms 190 ms 190 ms msu.msk.runnet.ru [194.190.254.118]
23 192 ms 193 ms 194 ms 93.180.0.146
24 223 ms 217 ms 209 ms 93.180.0.158
25 188 ms 205 ms 188 ms 93.180.0.170
26 190 ms 191 ms 192 ms www.msu.ru [93.180.0.18]
Trace complete.

Traces at 12:36

Tracing route to www-virtual.uaa.alaska.edu [137.229.141.83] over a maximum of 30 hops:
1 <1 ms <1 ms <1 ms DD-WRT [192.168.11.1]
2 32 ms 40 ms 28 ms 67.182.220.1
3 21 ms 11 ms 10 ms te-0-7-0-1-sur02.saltlakecity.ut.utah.comcast.net [68.87.220.117]
4 17 ms 10 ms 11 ms te-0-0-0-0-sur01.saltlakecity.ut.utah.comcast.net [68.86.180.94]
5 16 ms 10 ms 31 ms te-0-0-0-4-ar03.saltlakecity.ut.utah.comcast.net [68.86.180.73]
6 24 ms 23 ms 39 ms pos-0-9-0-0-cr01.denver.co.ibone.comcast.net [68.86.90.233]
7 51 ms 63 ms 51 ms pos-0-9-0-0-cr01.seattle.wa.ibone.comcast.net [68.86.88.66]
8 50 ms 44 ms 47 ms be-13-pe03.seattle.wa.ibone.comcast.net [68.86.84.110]
9 46 ms 49 ms 44 ms as8047.seattle.wa.ibone.comcast.net [173.167.56.6]
10 73 ms 94 ms 78 ms 218-129-165-209.gci.net [209.165.129.218]
11 * * * Request timed out.
12 * * * Request timed out.
13 73 ms 73 ms 78 ms 149-170-165-209.klf.static.gci.net [209.165.170.149]
14 73 ms 73 ms 78 ms www-virtual.uaa.alaska.edu [137.229.141.83]
Trace complete.

Tracing route to www.msu.ru [93.180.0.18] over a maximum of 30 hops:
1 <1 ms <1 ms <1 ms DD-WRT [192.168.11.1]
2 38 ms 25 ms 29 ms 67.182.220.1
3 12 ms 11 ms 14 ms te-0-7-0-1-sur02.saltlakecity.ut.utah.comcast.net [68.87.220.117]
4 16 ms 14 ms 15 ms te-0-3-0-2-ar02.sandy.ut.utah.comcast.net [69.139.231.41]
5 15 ms 15 ms 15 ms 162-151-9-149-static.hfc.comcastbusiness.net [162.151.9.149]
6 27 ms 28 ms 23 ms pos-0-2-0-0-cr01.denver.co.ibone.comcast.net [68.86.90.225]
7 103 ms 224 ms 218 ms te3-5.ccr01.den03.atlas.cogentco.com [154.54.10.33]
8 280 ms 223 ms * te7-1.ccr02.den01.atlas.cogentco.com [154.54.45.185]
9 46 ms 42 ms 43 ms te0-2-0-7.ccr22.mci01.atlas.cogentco.com [154.54.82.214]
10 50 ms 49 ms 54 ms te0-3-0-2.ccr22.ord01.atlas.cogentco.com [154.54.6.213]
11 64 ms 63 ms 69 ms te0-3-0-3.ccr22.yyz02.atlas.cogentco.com [154.54.42.6]
12 77 ms 79 ms 85 ms te0-3-0-5.ccr22.ymq02.atlas.cogentco.com [154.54.42.230]
13 145 ms 145 ms 146 ms te0-4-0-6.ccr22.lpl01.atlas.cogentco.com [154.54.44.214]
14 154 ms 158 ms 160 ms te0-3-0-3.ccr22.ams03.atlas.cogentco.com [154.54.37.125]
15 162 ms 157 ms 157 ms te0-6-0-5.ccr21.ams04.atlas.cogentco.com [130.117.2.66]
16 155 ms 172 ms 154 ms te3-1.mag01.ams04.atlas.cogentco.com [154.54.73.206]

17 179 ms 179 ms 177 ms 149.6.151.154
18 200 ms 188 ms 210 ms tele-1-gw.sth.runnet.ru [194.85.40.242]
19 190 ms 193 ms 194 ms kt12-1-gw.spb.runnet.ru [194.85.40.141]
20 200 ms 196 ms 196 ms tv11-1-gw.msk.runnet.ru [194.85.40.137]
21 196 ms 191 ms 191 ms m9-3-gw.msk.runnet.ru [194.85.40.221]
22 188 ms 189 ms 188 ms msu.msk.runnet.ru [194.190.254.118]
23 192 ms 193 ms 199 ms 93.180.0.146
24 194 ms 196 ms 193 ms 93.180.0.158
25 189 ms 188 ms 189 ms 93.180.0.170
26 192 ms 191 ms 206 ms www.msu.ru [93.180.0.18]
Trace complete.

Traces at 13:31

Tracing route to www-virtual.uaa.alaska.edu [137.229.141.83] over a maximum of 30 hops:
1 <1 ms <1 ms <1 ms DD-WRT [192.168.11.1]
2 32 ms 19 ms 30 ms 67.182.220.1
3 18 ms 10 ms 10 ms te-0-7-0-1-sur02.saltlakecity.ut.utah.comcast.net [68.87.220.117]
4 10 ms 11 ms 12 ms te-0-0-0-0-sur01.saltlakecity.ut.utah.comcast.net [68.86.180.94]
5 11 ms 15 ms 31 ms te-0-0-0-4-ar03.saltlakecity.ut.utah.comcast.net [68.86.180.73]
6 34 ms 26 ms 35 ms pos-0-9-0-0-cr01.denver.co.ibone.comcast.net [68.86.90.233]
7 48 ms 49 ms 47 ms pos-0-9-0-0-cr01.seattle.wa.ibone.comcast.net [68.86.88.66]
8 45 ms 46 ms 46 ms be-13-pe03.seattle.wa.ibone.comcast.net [68.86.84.110]
9 46 ms 45 ms 50 ms as8047.seattle.wa.ibone.comcast.net [173.167.56.6]
10 90 ms 73 ms 77 ms 218-129-165-209.gci.net [209.165.129.218]
11 * * * Request timed out.
12 * * * Request timed out.
13 74 ms 74 ms 75 ms 149-170-165-209.klf.static.gci.net [209.165.170.149]
14 77 ms 76 ms 73 ms www-virtual.uaa.alaska.edu [137.229.141.83]
Trace complete.

Tracing route to www.msu.ru [93.180.0.18] over a maximum of 30 hops:
1 <1 ms <1 ms <1 ms DD-WRT [192.168.11.1]
2 38 ms 24 ms 22 ms 67.182.220.1
3 13 ms 14 ms 11 ms te-0-7-0-1-sur02.saltlakecity.ut.utah.comcast.net [68.87.220.117]
4 18 ms 14 ms 16 ms te-0-3-0-2-ar02.sandy.ut.utah.comcast.net [69.139.231.41]
5 14 ms 15 ms 15 ms 162-151-9-149-static.hfc.comcastbusiness.net [162.151.9.149]
6 24 ms 27 ms 24 ms pos-0-2-0-0-cr01.denver.co.ibone.comcast.net [68.86.90.225]
7 24 ms 23 ms 27 ms te3-5.ccr01.den03.atlas.cogentco.com [154.54.10.33]
8 28 ms * * te7-1.ccr02.den01.atlas.cogentco.com [154.54.45.185]
9 43 ms 42 ms 44 ms te0-2-0-7.ccr22.mci01.atlas.cogentco.com [154.54.82.214]
10 47 ms 48 ms 51 ms te0-3-0-2.ccr22.ord01.atlas.cogentco.com [154.54.6.213]
11 72 ms 63 ms 62 ms te0-3-0-3.ccr22.yyz02.atlas.cogentco.com [154.54.42.6]

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 12    79 ms    79 ms    78 ms  te0-3-0-5.ccr22.ymq02.atlas.cogentco.com [154.54.42.230]
 13   150 ms   146 ms   144 ms  te0-4-0-6.ccr22.lpl01.atlas.cogentco.com [154.54.44.214]
 14   154 ms   157 ms   155 ms  te0-3-0-3.ccr22.ams03.atlas.cogentco.com [154.54.37.125]
 15   158 ms   162 ms   158 ms  te0-6-0-5.ccr21.ams04.atlas.cogentco.com [130.117.2.66]
 16   153 ms   156 ms   174 ms  te3-1.mag01.ams04.atlas.cogentco.com [154.54.73.206]
 17   180 ms   176 ms   174 ms  149.6.151.154
 18   188 ms   189 ms   190 ms  tele-1-gw.sth.runnet.ru [194.85.40.242]
 19   191 ms   198 ms   193 ms  kt12-1-gw.spb.runnet.ru [194.85.40.141]
 20   199 ms   197 ms   196 ms  tv11-1-gw.msk.runnet.ru [194.85.40.137]
 21   194 ms   191 ms   191 ms  m9-3-gw.msk.runnet.ru [194.85.40.221]
 22   189 ms   189 ms   193 ms  msu.msk.runnet.ru [194.190.254.118]
 23   220 ms   196 ms   198 ms  93.180.0.146
 24   200 ms   194 ms   193 ms  93.180.0.158
 25   192 ms   190 ms   188 ms  93.180.0.170
 26   212 ms   191 ms   205 ms  www.msu.ru [93.180.0.18]
Trace complete.
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