Problem 1

Please see hints and resources at the end of this question before you attempt it this problem.

In this problem you will analyze data in from an “oix-route-views” file. To get such a file go to

http://archive.routeviews.org/oix-route-views/ then to one of the 2015 subdirectories. Choose a

file from that subdirectory.

a) Tell us which file you picked and describe briefly exactly what type of information is.

I choosed the 2015-09-06-0200 file. There are 6 types of information in the file including Network, Next Hop, Metric, LocPrf, Weight, Path.

The Network is the IP Address. And the Next Hop is the next IP Address which it connects to.

Metric is used for routers to make routing decision. The information like path length, hop count, path cost and so on decides the metric.

LocPrf is the local preference of the router, which also helps router to make routing decision.

Weight is also something to make routing decision. In some situation, the Highest Weight is the first thing to consider.

Path is the AS path which indicate all the AS this routing go through. And the lowest AS path length is the best choice. The ‘i’ means the end of the AS Path.

b) Analyzing the file, list all the IP prefixes that Georgia Tech announces. Does GT own any IP addresses that do not show up in this data?

Following is the prefixes that GT owns:

128.61.0.0/19

128.61.32.0/19

128.61.64.0/18

128.61.128.0/17

130.207.0.0/16

143.215.0.0/16

192.76.181.0/24

204.152.10.0/23

Yes. Following IPV6 addresses doesn’t contain in this file:

2610:148::/32

2001:468:300::/48

c) List the ASes that GT is connected to. Identify AS# and organization/company.

All the ASes that GT is connected to is following:

AS174 COGENT-174 - Cogent Communications, US left

AS209 CENTURYLINK-US-LEGACY-QWEST - Qwest Communications Company, LLC, US left

AS209 CENTURYLINK-US-LEGACY-QWEST - Qwest Communications Company, LLC, US right

AS1299 TELIANET TeliaSonera AB, SE left

AS10490 SOUTHERN-CROSSROADS-SOX - Georgia Institute of Technology, US left

AS47065 GENI-BGPMUX - BBN Technologies Corp. - Global Environment for Network Innovations (GENI), US right

d) For IP addresses advertised by Georgia Tech find and list all instances of AS prepending in the data. Does this information tell you anything about the preferences of the AS doing the pre-pending? Be as explicit as possible.

\* 128.61.0.0/19 216.18.31.102 0 0 0 6539 577 209 2637 2637 2637 2637 i

\* 128.61.0.0/19 206.24.210.80 0 0 0 3561 209 2637 2637 2637 2637 i

\* 128.61.32.0/19 154.11.98.225 0 0 0 852 11164 10490 2637 2637 i

\* 128.61.32.0/19 96.4.0.55 0 0 0 11686 10490 2637 2637 i

\* 128.61.32.0/19 213.144.128.203 1 0 0 13030 11164 10490 2637 2637 i

\* 128.61.32.0/19 216.18.31.102 0 0 0 6539 577 209 2637 2637 2637 2637 i

\* 128.61.32.0/19 206.24.210.80 0 0 0 3561 209 2637 2637 2637 2637 i

\* 128.61.32.0/19 203.62.252.83 0 0 0 1221 4637 174 2637 2637 2637 i

\* 128.61.32.0/19 216.218.252.164 0 0 0 6939 10490 2637 2637 i

\* 128.61.64.0/18 154.11.98.225 0 0 0 852 11164 10490 2637 2637 i

\* 128.61.64.0/18 96.4.0.55 0 0 0 11686 10490 2637 2637 i

\* 128.61.64.0/18 213.144.128.203 1 0 0 13030 11164 10490 2637 2637 i

\* 128.61.64.0/18 216.18.31.102 0 0 0 6539 577 209 2637 2637 2637 2637 i

\* 128.61.64.0/18 206.24.210.80 0 0 0 3561 209 2637 2637 2637 2637 i

\* 128.61.64.0/18 203.62.252.83 0 0 0 1221 4637 174 2637 2637 2637 i

\* 128.61.64.0/18 216.218.252.164 0 0 0 6939 10490 2637 2637 i

\* 128.61.128.0/17 216.18.31.102 0 0 0 6539 577 209 2637 2637 2637 2637 i

\* 128.61.128.0/17 206.24.210.80 0 0 0 3561 209 2637 2637 2637 2637 i

\* 130.207.0.0/16 216.18.31.102 0 0 0 6539 577 209 2637 2637 2637 2637 i

\* 130.207.0.0/16 206.24.210.80 0 0 0 3561 209 2637 2637 2637 2637 i

\* 143.215.0.0/16 216.18.31.102 0 0 0 6539 577 209 2637 2637 2637 2637 i

\* 143.215.0.0/16 206.24.210.80 0 0 0 3561 209 2637 2637 2637 2637 i

\* 192.76.181.0/24 162.243.188.2 0 0 0 393406 1299 2637 2637 2637 i

\* 192.76.181.0/24 85.114.0.217 0 0 0 8492 20764 8732 1299 2637 2637 2637 i

\* 192.76.181.0/24 105.16.0.247 0 0 0 37100 1299 2637 2637 2637 i

\* 192.76.181.0/24 5.101.110.2 0 0 0 202018 2914 1299 2637 2637 2637 i

\* 192.76.181.0/24 129.250.0.11 6 0 0 2914 1299 2637 2637 2637 i

\* 192.76.181.0/24 192.241.164.4 0 0 0 62567 1299 2637 2637 2637 i

\* 192.76.181.0/24 95.85.0.2 0 0 0 200130 2914 1299 2637 2637 2637 i

\* 192.76.181.0/24 66.185.128.1 118 0 0 1668 1299 2637 2637 2637 i

\* 192.76.181.0/24 198.129.33.85 0 0 0 293 209 2637 2637 2637 i

\* 192.76.181.0/24 203.189.128.233 0 0 0 23673 1299 2637 2637 2637 i

\* 192.76.181.0/24 195.208.112.161 0 0 0 3277 3267 1299 2637 2637 2637 i

\* 192.76.181.0/24 89.149.178.10 10 0 0 3257 1299 2637 2637 2637 i

\* 192.76.181.0/24 212.66.96.126 0 0 0 20912 174 1299 2637 2637 2637 i

\* 192.76.181.0/24 168.209.255.56 0 0 0 3741 174 1299 2637 2637 2637 i

\* 192.76.181.0/24 194.153.0.253 1000 0 0 5413 1299 2637 2637 2637 i

\* 192.76.181.0/24 96.4.0.55 0 0 0 11686 3356 1299 2637 2637 2637 i

\* 192.76.181.0/24 213.144.128.203 1 0 0 13030 2828 209 2637 2637 2637 i

\* 192.76.181.0/24 154.11.98.225 0 0 0 852 209 2637 2637 2637 i

\* 192.76.181.0/24 134.222.87.1 650 0 0 286 1299 2637 2637 2637 i

\* 192.76.181.0/24 67.17.82.114 2523 0 0 3549 1299 2637 2637 2637 i

\* 192.76.181.0/24 195.22.216.188 100 0 0 6762 1299 2637 2637 2637 i

\* 192.76.181.0/24 12.0.1.63 0 0 0 7018 1299 2637 2637 2637 i

\* 192.76.181.0/24 147.28.7.2 0 0 0 3130 1239 1299 2637 2637 2637 i

\* 192.76.181.0/24 147.28.7.1 0 0 0 3130 2914 209 2637 2637 2637 i

\* 192.76.181.0/24 80.91.255.137 0 0 0 1299 2637 2637 2637 i

\* 192.76.181.0/24 206.24.210.80 0 0 0 3561 209 2637 2637 2637 i

\* 192.76.181.0/24 216.221.157.162 0 0 0 40191 3257 209 2637 2637 2637 i

\* 192.76.181.0/24 144.228.241.130 0 0 0 1239 1299 2637 2637 2637 i

\* 192.76.181.0/24 216.18.31.102 0 0 0 6539 577 209 2637 2637 2637 i

\* 192.76.181.0/24 45.61.0.85 0 0 0 22652 5580 209 2637 2637 2637 i

\* 192.76.181.0/24 4.69.184.193 0 0 0 3356 209 2637 2637 2637 i

\* 192.76.181.0/24 173.205.57.234 0 0 0 53364 3257 1299 2637 2637 2637 i

\* 192.76.181.0/24 103.247.3.45 0 0 0 58511 2764 7545 1299 2637 2637 2637 i

\* 192.76.181.0/24 217.192.89.50 0 0 0 3303 209 2637 2637 2637 i

\* 192.76.181.0/24 203.62.252.83 0 0 0 1221 4637 209 2637 2637 2637 i

\* 192.76.181.0/24 208.51.134.246 2504 0 0 3549 1299 2637 2637 2637 i

\* 192.76.181.0/24 203.181.248.168 0 0 0 7660 2516 209 2637 2637 2637 i

\* 192.76.181.0/24 216.218.252.164 0 0 0 6939 1299 2637 2637 2637 i

\* 192.76.181.0/24 137.164.16.84 0 0 0 2152 209 2637 2637 2637 i

\* 192.76.181.0/24 202.232.0.3 0 0 0 2497 209 2637 2637 2637 i

\* 204.152.10.0/23 162.243.188.2 0 0 0 393406 1299 2637 2637 2637 i

\* 204.152.10.0/23 85.114.0.217 0 0 0 8492 20764 8732 1299 2637 2637 2637 i

\* 204.152.10.0/23 105.16.0.247 0 0 0 37100 1299 2637 2637 2637 i

\* 204.152.10.0/23 5.101.110.2 0 0 0 202018 2914 1299 2637 2637 2637 i

\* 204.152.10.0/23 198.129.33.85 0 0 0 293 6939 1299 2637 2637 2637 i

\* 204.152.10.0/23 129.250.0.11 6 0 0 2914 1299 2637 2637 2637 i

\* 204.152.10.0/23 95.85.0.2 0 0 0 200130 6453 1299 2637 2637 2637 i

\* 204.152.10.0/23 192.241.164.4 0 0 0 62567 1299 2637 2637 2637 i

\* 204.152.10.0/23 66.185.128.1 118 0 0 1668 1299 2637 2637 2637 i

\* 204.152.10.0/23 203.189.128.233 0 0 0 23673 1299 2637 2637 2637 i

\* 204.152.10.0/23 195.208.112.161 0 0 0 3277 3267 1299 2637 2637 2637 i

\* 204.152.10.0/23 89.149.178.10 10 0 0 3257 1299 2637 2637 2637 i

\* 204.152.10.0/23 212.66.96.126 0 0 0 20912 1267 1273 1299 2637 2637 2637 i

\* 204.152.10.0/23 168.209.255.56 0 0 0 3741 3356 1299 2637 2637 2637 i

\* 204.152.10.0/23 194.153.0.253 1000 0 0 5413 1299 2637 2637 2637 i

\* 204.152.10.0/23 96.4.0.55 0 0 0 11686 3356 1299 2637 2637 2637 i

\* 204.152.10.0/23 213.144.128.203 1 0 0 13030 1299 2637 2637 2637 i

\* 204.152.10.0/23 154.11.98.225 0 0 0 852 174 2637 2637 2637 2637 2637 i

\* 204.152.10.0/23 134.222.87.1 650 0 0 286 1299 2637 2637 2637 i

\* 204.152.10.0/23 67.17.82.114 2523 0 0 3549 1299 2637 2637 2637 i

\* 204.152.10.0/23 195.22.216.188 100 0 0 6762 1299 2637 2637 2637 i

\* 204.152.10.0/23 206.24.210.80 0 0 0 3561 1299 2637 2637 2637 i

\* 204.152.10.0/23 216.221.157.162 0 0 0 40191 3257 1299 2637 2637 2637 i

\* 204.152.10.0/23 12.0.1.63 0 0 0 7018 1299 2637 2637 2637 i

\* 204.152.10.0/23 45.61.0.85 0 0 0 22652 6453 1299 2637 2637 2637 i

\* 204.152.10.0/23 147.28.7.2 0 0 0 3130 1239 1299 2637 2637 2637 i

\* 204.152.10.0/23 80.91.255.137 0 0 0 1299 2637 2637 2637 i

\* 204.152.10.0/23 147.28.7.1 0 0 0 3130 2914 1299 2637 2637 2637 i

\* 204.152.10.0/23 144.228.241.130 0 0 0 1239 1299 2637 2637 2637 i

\* 204.152.10.0/23 216.18.31.102 0 0 0 6539 577 1299 2637 2637 2637 i

\* 204.152.10.0/23 173.205.57.234 0 0 0 53364 3257 1299 2637 2637 2637 i

\* 204.152.10.0/23 4.69.184.193 0 0 0 3356 1299 2637 2637 2637 i

\* 204.152.10.0/23 103.247.3.45 0 0 0 58511 6939 1299 2637 2637 2637 i

\* 204.152.10.0/23 217.192.89.50 0 0 0 3303 3320 1299 2637 2637 2637 i

\* 204.152.10.0/23 203.62.252.83 0 0 0 1221 4637 174 2637 2637 2637 2637 2637 i

\* 204.152.10.0/23 208.51.134.246 2504 0 0 3549 1299 2637 2637 2637 i

\* 204.152.10.0/23 216.218.252.164 0 0 0 6939 1299 2637 2637 2637 i

\* 204.152.10.0/23 137.164.16.84 0 0 0 2152 3356 1299 2637 2637 2637 i

\* 204.152.10.0/23 203.181.248.168 0 0 0 7660 2516 209 1299 2637 2637 2637 i

\* 204.152.10.0/23 202.232.0.3 0 0 0 2497 701 1299 2637 2637 2637 i

The lowest AS Path length is the second important factor for the BGP routing. Our AS does pre-pending to increase the length of the AS path, which could avoid routing through this path. So according to my data, most of pre-pending of GT connects to 1299 and some of the pre-pending connects to the 209. And few connect to 10490 and 174. So GT prefer 10490 and 174 than 209 and especially 1299. So GT makes the AS path to 1299 longer in order to make BGP select other AS path.

e) UMass Lowell’s AS number 46905. Determine from the same file which IP addresses they own and which ASes they are connected to.

Following is the prefixes that UMass owns:

129.63.0.0/16

129.63.33.0/24

129.63.70.0/24

129.63.71.0/24

129.63.78.0/24

129.63.89.0/24

129.63.94.0/24

129.63.147.0/24

129.63.148.0/24

129.63.150.0/24

129.63.155.0/24

129.63.158.0/24

129.63.199.0/24

129.63.208.0/24

129.63.209.0/24

129.63.213.0/24

129.63.220.0/24

129.63.221.0/24

129.63.222.0/24

129.63.223.0/24

129.63.224.0/24

129.63.225.0/24

129.63.226.0/24

129.63.227.0/24

129.63.228.0/24

129.63.230.0/24

129.63.231.0/24

129.63.232.0/24

129.63.236.0/24

129.63.237.0/24

129.63.238.0/24

129.63.240.0/24

129.63.241.0/24

129.63.242.0/24

129.63.243.0/24

129.63.244.0/24

129.63.245.0/24

129.63.246.0/24

129.63.247.0/24

129.63.248.0/24

129.63.249.0/24

129.63.250.0/24

129.63.253.0/24

129.63.254.0/24

All the ASes that UMass is connected to is following:

AS1968 UMASSP-DOM - University of Massachusettes, US

f) Compare UMass Lowell’s connectivity, BGP advertising and IP address ownership with GT’s. Do you see any issues with what UMass Lowell is doing?

First, almost all the IP address of the UMass starts from 129.63.0.0/16. But there appear new routes as 129.63.c.0/24, which indicates BGP misconfiguration. For example, 129.63.0.0/16 293 10578 1968 46905 i turns to 129.63.33.0/24 293 10578 1968 46905 46905 i, which is a self-aggregation.

And, the UMass As all connects to the AS1968, which means this connectivity is not strong and good for the fault-tolerant.

Problem 2

In this assignment we will try to understand the correlation between the number of routers and the number of ASes on an Internet path. For this you will use traceroute.org. Follow this procedure:

1- Pick 6 traceroute.org servers. Perform a traceroute from each of the servers to a location of your choosing on the Internet. Try a university or company web server. Make sureyour traceroutes are completing to the very end of the path.

I use my IP address in Gatech (128.61.72.67) as the destination. And the 6 traceroute.org server are University of Southern California, Princeton University,

Stanford University, T1 Shopper, GIGANews, NetPlex.

USC:

traceroute to 128.61.72.67 (128.61.72.67), 30 hops max, 40 byte packets

rtr30-rtr33-fw26-fw27-gw-30.mgmt.usc.edu (10.1.133.2) 3.887 ms 1.559 ms \*

v255-gw-6 (128.125.251.149) 1.397 ms 0.934 ms 1.085 ms

fw6-rtr6 (128.125.255.147) 1.051 ms 1.170 ms 0.868 ms

rtr-border-cal-fw6 (128.125.251.226) 1.302 ms 1.626 ms 1.290 ms

lax-hpr.losnettos-hpr.cenic.net (137.164.27.241) 9.314 ms 1.213 ms 2.597 ms

137.164.26.201 (137.164.26.201) 2.797 ms 2.469 ms 2.351 ms

et-1-0-0.111.rtr.hous.net.internet2.edu (198.71.45.20) 34.503 ms 34.092 ms 34.254 ms

et-10-0-0.105.rtr.atla.net.internet2.edu (198.71.45.12) 59.148 ms 60.190 ms 58.848 ms

sox-to-i2-100g.sox.net (143.215.193.3) 59.383 ms 58.796 ms 59.401 ms

bcdc-gw1-to-sox.sox.gatech.edu (143.215.194.102) 60.594 ms 61.504 ms 60.906 ms

143.215.254.89 (143.215.254.89) 61.324 ms 62.418 ms 63.040 ms

143.215.253.129 (143.215.253.129) 61.124 ms 60.716 ms 61.291 ms

Princeton:

traceroute to 128.61.72.67 (128.61.72.67), 30 hops max, 40 byte packets

1 core-87-router (128.112.128.2) 1.230 ms 0.544 ms 0.677 ms

2 border-87-router (128.112.12.142) 70.462 ms 48.885 ms 0.799 ms

3 local1.princeton.magpi.net (216.27.98.113) 3.066 ms 4.279 ms 2.826 ms

4 216.27.100.18 (216.27.100.18) 31.799 ms 31.154 ms 31.514 ms

5 et-5-0-0.104.rtr.atla.net.internet2.edu (198.71.45.6) 45.929 ms 47.485 ms 46.477 ms

6 sox-to-i2-100g.sox.net (143.215.193.3) 44.516 ms 47.282 ms 48.332 ms

7 bcdc-gw1-to-sox.sox.gatech.edu (143.215.194.102) 44.453 ms 48.972 ms 47.430 ms

8 143.215.254.89 (143.215.254.89) 47.016 ms 47.310 ms 46.328 ms

9 143.215.253.129 (143.215.253.129) 43.952 ms 46.069 ms 49.611 ms

Stanford:

traceroute to 128.61.72.67 (128.61.72.67), 30 hops max, 40 byte packets

1 rtr-serv03-serv03-webserv2.slac.stanford.edu (134.79.202.130) 0.471 ms 0.396 ms 0.395 ms

2 rtr-core2-p2p-serv03.slac.stanford.edu (134.79.253.73) 0.508 ms 0.510 ms 0.421 ms

3 rtr-fwcore2-trust-p2p-core2.slac.stanford.edu (134.79.254.146) 0.883 ms 0.802 ms 0.670 ms

4 rtr-core2-p2p-fwcore2-untrust.slac.stanford.edu (134.79.254.149) 0.804 ms 0.643 ms 0.821 ms

5 \* \* \*

6 sunncr5-ip-c-slac.slac.stanford.edu (192.68.191.233) 1.684 ms 2.238 ms 1.608 ms

7 elpacr5-ip-a-sunncr5.es.net (134.55.37.42) 25.450 ms 25.897 ms 25.540 ms

8 houscr5-ip-a-elpacr5.es.net (134.55.40.198) 39.943 ms 39.847 ms 39.959 ms

9 nashcr5-ip-a-houscr5.es.net (134.55.39.50) 59.977 ms 56.134 ms 55.917 ms

10 atlacr5-ip-a-nashcr5.es.net (134.55.38.73) 62.338 ms 62.167 ms 62.174 ms

11 198.124.218.2 (198.124.218.2) 62.113 ms 62.108 ms 61.781 ms

12 bcdc-gw1-to-sox.sox.gatech.edu (143.215.194.102) 69.516 ms 69.637 ms 69.553 ms

13 143.215.254.89 (143.215.254.89) 69.958 ms 70.144 ms 70.087 ms

14 143.215.253.129 (143.215.253.129) 70.432 ms 70.013 ms 69.943 ms

T1 Shopper:

traceroute to 128.61.72.67 (128.61.72.67), 20 hops max, 40 byte packets

1 208.64.252.229.uscolo.com (208.64.252.229) 0.516 ms 0.499 ms 0.500 ms

2 204.9.204.70.uscolo.com (204.9.204.70) 0.340 ms 0.377 ms 0.417 ms

3 98.158.149.197.uscolo.com (98.158.149.197) 1.048 ms 1.085 ms 1.135 ms

4 xe-10-2-0.edge6.LosAngeles1.Level3.net (4.31.61.169) 5.289 ms 5.306 ms 5.337 ms

5 ae-4-90.edge1.LosAngeles9.Level3.net (4.69.144.202) 0.423 ms ae-2-70.edge1.LosAngeles9.Level3.net (4.69.144.74) 0.390 ms ae-4-90.edge1.LosAngeles9.Level3.net (4.69.144.202) 0.411 ms

6 Telia-level3-4x10G.LosAngeles.Level3.net (4.68.70.130) 153.677 ms 150.408 ms 150.247 ms

7 dls-b21-link.telia.net (80.91.254.168) 155.692 ms dls-b21-link.telia.net (62.115.139.8) 155.331 ms dls-b21-link.telia.net (62.115.139.4) 155.532 ms

8 atl-bb1-link.telia.net (213.155.137.74) 151.066 ms 151.072 ms (80.91.246.73) 152.644 ms

9 213.248.94.221 (213.248.94.221) 151.259 ms (213.248.94.220) 151.130 ms 213.248.94.221 (213.248.94.221) 151.346 ms

10 130.207.254.5 (130.207.254.5) 151.127 ms 151.137 ms 151.166 ms

11 143.215.254.89 (143.215.254.89) 151.428 ms 151.400 ms 151.437 ms

12 143.215.253.129 (143.215.253.129) 151.354 ms 151.296 ms 151.289 ms

GIGANews:

traceroute to 128.61.72.67 (128.61.72.67), 30 hops max, 60 byte packets

1 216.166.98.2 (216.166.98.2) 15 ms 216.166.98.3 (216.166.98.3) 28 ms 216.166.98.2 (216.166.98.2) 15 ms

2 216.166.96.138 (216.166.96.138) 0 ms 216.166.96.142 (216.166.96.142) 0 ms 216.166.96.140 (216.166.96.140) 0 ms

3 ash-b2-link.telia.net (62.115.44.181) 0 ms ash-b1-link.telia.net (62.115.42.153) 0 ms ash-b2-link.telia.net (62.115.44.181) 0 ms

4 ash-bb4-link.telia.net (80.91.245.67) 15 ms ash-bb3-link.telia.net (80.91.252.45) 14 ms ash-bb3-link.telia.net (62.115.113.208) 14 ms

5 atl-bb1-link.telia.net (213.155.134.131) 27 ms atl-bb1-link.telia.net (62.115.137.75) 28 ms atl-bb1-link.telia.net (80.91.254.161) 26 ms

6 213.248.94.220 (213.248.94.220) 13 ms 213.248.94.221 (213.248.94.221) 13 ms 213.248.94.220 (213.248.94.220) 15 ms

7 130.207.254.5 (130.207.254.5) 15 ms 13 ms 13 ms

8 143.215.253.129 (143.215.253.129) 15 ms 14 ms 18 ms

9 143.215.253.129 (143.215.253.129) 14 ms 14 ms 14 ms

NetPlex:

traceroute to 128.61.72.67 (128.61.72.67), 30 hops max, 40 byte packets

1 internal-router2.ntplx.net (204.213.176.102) 1.372 ms

2 204.213.179.129 (204.213.179.129) 177.148 ms

3 12.248.143.17 (12.248.143.17) 4.263 ms

4 12.122.156.26 (12.122.156.26) 7.080 ms

5 12.122.156.18 (12.122.156.18) 6.097 ms

6 cgr1.n54ny.ip.att.net (12.122.130.109) 6.285 ms

7 192.205.34.54 (192.205.34.54) 5.264 ms

8 nyk-bb1-link.telia.net (80.91.254.9) 5.867 ms

9 ash-bb3-link.telia.net (62.115.137.62) 12.023 ms

10 atl-bb1-link.telia.net (80.91.252.214) 26.530 ms

11 213.248.94.220 (213.248.94.220) 27.454 ms

12 130.207.254.5 (130.207.254.5) 34.800 ms

13 143.215.254.89 (143.215.254.89) 35.270 ms

14 143.215.253.129 (143.215.253.129) 32.545 ms

2- For each Traceroute path try to determine the number of ASes that the path is going over. (Hint: the names of routers sometimes helps or you can you RIS at RIPE to learn who own which IP addresses).

USC Path:

AS47 "USC-AS - University of Southern California,US"

AS2153 "CSUNET-NE - California State University, Office of the Chancellor,US"

AS11537 "ABILENE - Internet2,US"

AS2637 "GEORGIA-TECH - Georgia Institute of Technology,US"

Princeton Path:

AS88 "PRINCETON-AS - Princeton University,US"

AS10466 "MAGPI - MAGPI c/o University of Pennsylvania,US"

AS11537 "ABILENE - Internet2,US"

AS2637 "GEORGIA-TECH - Georgia Institute of Technology,US"

Stanford Path:

AS3671 "SLAC - SLAC National Accelerator Laboratory,US"

AS293 "ESNET - ESnet,US"

AS291 "ESNET-EAST - ESnet,US"

AS2637 "GEORGIA-TECH - Georgia Institute of Technology,US"

T1 Shopper:

AS32743 "USCOLO-ASN - U.S. COLO, LLC,US"

AS3356 "LEVEL3 - Level 3 Communications, Inc.,US"

AS1299 "TELIANET TeliaSonera AB,SE"

AS2637 "GEORGIA-TECH - Georgia Institute of Technology,US"

GIGANews:

AS30094 "GIGANEWS - Giganews, Inc.,US"

AS1299 "TELIANET TeliaSonera AB,SE"

AS2637 "GEORGIA-TECH - Georgia Institute of Technology,US"

NetPlex:

AS6062 "NETPLEX - NETPLEX,US"

AS7018 "ATT-INTERNET4 - AT&T Services, Inc.,US"

AS1299 "TELIANET TeliaSonera AB,SE"

AS2637 "GEORGIA-TECH - Georgia Institute of Technology,US"

3- Plot a graph with the number of ASes on the path on the x-axis and the number of routers on the same path on the y-axis.

Problem 3 – BGP/IGP Synchronization

1- Use the reading list and other Internet resources to find out what the IGP/BGP

Synchronization problem is. Make sure to cite your sources.

Because EBGP is responsible for exchanging the IP prefixes while the IBGP would advertise those IP Prefixes. But IBGP doesn’t mean the physical connectivity. So there might be some situation that an AS advertises some IP that it can never arrive to other ASes.

So the synchronization states that if your AS passes traffic from another AS to a third AS, BGP should not advertise a route before all the routers in your AS have learned about the route via IGP. BGP waits until IGP has propagated the route within the AS. Then, BGP advertises the route to external peers.

Sources:

<http://www.cisco.com/c/en/us/support/docs/ip/border-gateway-protocol-bgp/26634-bgp-toc.html#synch>

<https://www.nanog.org/meetings/nanog50/presentations/Sunday/NANOG50.Talk33.NANOG50-BGP-Techniques.pdf>

2- Use an example with actual IP addresses and prefixes to illustrate a) a routing problem that occurs if synchronization does not take place, b) how synchronization fixes this routing problem.

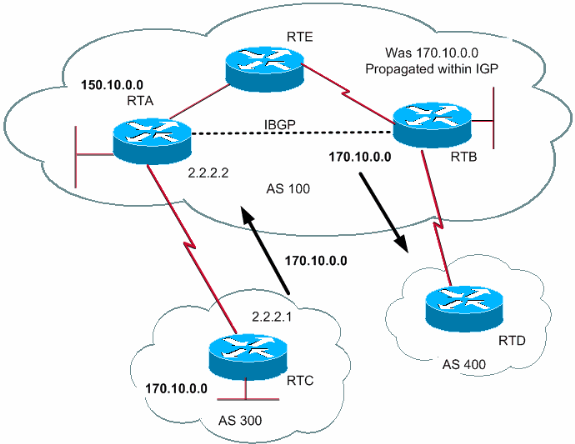


Figure1: routing problem example(source: <http://www.cisco.com/c/en/us/support/docs/ip/border-gateway-protocol-bgp/26634-bgp-toc.html#synch>)

If the synchronization does not take place: In figure1, after RTC announce the 170.10.0.0 to RTA through the EBGP, RTA would advertise 170.10.0.0 to RTB through IBGP. If RTB advertise 170.10.0.0 directly to RTD through EBGP, RTD would think that it could get to 170.10.0.0 through RTB. While RTB should get to RTA through the RTE, RTE doesn’t know how to route to 170.10.0.0, which cause the routing problem.

While the synchronization means RTB would announce the 170.10.0.0 to RTD only after all the routers hear it via IGP. Specifically, RTB would wait to hear the 170.10.0.0 via IGP then it will announce to RTD.

Problem 4 – Repeating Detour Results

In this problem your goal is to repeat the latency experiment in the “Detour” paper we discussed in class. More specifically, you should perform a set of experiments with which you can plot a graph similar to the one shown in Figure 2 in the paper.

a) Re-read the methodology discussed in the paper (starting at the end of page 52 of the paper). Then develop and describe a methodology of your own with which you will perform the required experiment. Note that by necessity, I expect that your methodology will not be as comprehensive as the one presented in the paper. For example, you cannot average over 35 days worth of data. Also it is OK for the purposes of your experiment to work with fewer servers than they use in the paper. Around 5-8 servers is fine so long as you get enough data for the tasks below.

I would like use the 6 servers (which used in the problem 2) to trace the latency between each 2 of them and the latency through the third server. For example, first measure the latency of the USC to Princeton University, and then measure the latency of USC to Stanford to Princeton, USC to T1 Shopper to Princeton, USC to GIGANews to Princeton, USC to NetPlex to Princeton. And then compare all these latency. So there would be 4 compares for each 2 servers.

And I would repeat this track for 2 times which are in the different time of a day.

b) Describe the “raw data” that your experiment provides. Which servers did you use? What are the delays you measured (show the pair-wise delay matrix).

I used following 6 servers:

USC, Princeton, Stanford, T1 Shopper, GIGANews, NetPlex.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | USC | Princeton | Stanford | T1 Shopper | GIGANews | NetPlex |
| USC | 0 | 102.969 | 14.565 | 7.626 | 64.974 | 77.181 |
| Princeton | 102.969 | 0 | 109.961 | 70.686 | 10.716 | 15.995 |
| Stanford | 14.565 | 109.961 | 0 | 11.511 | 64.099 | 79.968 |
| T1 Shopper | 7.626 | 70.686 | 11.511 | 0 | 89.094 | 72.494 |
| GIGANews | 64.974 | 10.716 | 64.099 | 89.094 | 0 | 14.030 |
| NetPlex | 77.181 | 15.995 | 79.968 | 72.494 | 14.030 | 0 |

Table 1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | USC | Princeton | Stanford | T1 Shopper | GIGANews | NetPlex |
| USC | 0 | 104.363 | 10.510 | 1.952 | 63.486 | 75.958 |
| Princeton | 104.363 | 0 | 109.142 | 70.098 | 10.231 | 15.453 |
| Stanford | 10.510 | 109.142 | 0 | 11.507 | 63.895 | 80.725 |
| T1 Shopper | 1.952 | 70.098 | 11.507 | 0 | 89.097 | 74.577 |
| GIGANews | 63.486 | 10.231 | 63.895 | 89.097 | 0 | 78.599 |
| NetPlex | 75.958 | 15.453 | 80.725 | 74.577 | 78.599 | 0 |

Table2.

c) Use your data to plot a graph similar to the one shown in Figure 2 of the paper. Compare your results with those in the paper. Are they similar or different? Explain any differences.

Figure1.

Figure1 is made according to the Table1. Most of this figure is similar to the figure in the paper. After I review my data, I found when the GIGANews try to traceroute to the NetPlex. It cannot trace to the final destination for some reason, which causes the latency of the GIGANews to NetPlex is a quite low and it seems to be a great way to route.

Figure2.

Figure2 is made according to the Table2.

Figure3.

Figure3 is the combination of the Figure1 and Figure2. And this Figure3 is quite similar to the figure in the paper. As we can see most of our default routing is better than alternative routing. While the only difference might be that my figure is so smoothly, I think it is because my data is not big enough to plot a smooth graph.