CSCI-UA 480: Computer Networks Assignment 3

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1 Using Traceroute

1.1

The traceroute works by continuously sending out probing packets with increasing the Time to Live field (initialized to 1), and listening for ICMP time exceed signal so that it knows which gateway the probing packet ends at. In each iteration, it increases TTL field, sends out 3 probing packets, and reports the gateways (not necessarily the same) and RTTs.

1.2

The asterisk means we do not receive response (timeout with default value 5 seconds) for the probing packet we send out.

1.3

My laptop had trouble with traceroute 139.130.4.5, so I connected to NYU VPN.

```
Kai@MacBook-Pro-9 ~ % traceroute www.cs.nyu.edu
traceroute to cs.nyu.edu (128.122.49.30), 64 hops max, 52 byte packets
 1  10.2.204.254 (10.2.204.254)  6.607 ms  4.434 ms  7.101 ms
 2  10.2.0.5 (10.2.0.5)  3.672 ms  2.684 ms  3.051 ms
 3  192.168.1.1 (192.168.1.1)  6.860 ms  2.529 ms  2.854 ms
 4  1.140.35.58.broad.xw.sh.dynamic.163data.com.cn (58.35.140.1)  33.019 ms  5.771 ms  6.007 ms
 5  101.95.91.101 (101.95.91.101)  10.931 ms
    101.95.91.229 (101.95.91.229)  7.154 ms
    61.152.50.5 (61.152.50.5)  5.660 ms
 6  61.152.24.42 (61.152.24.42)  13.789 ms  11.588 ms
    202.101.63.242 (202.101.63.242)  11.008 ms
 7  * * 202.97.50.158 (202.97.50.158)  27.585 ms
 8  202.97.90.53 (202.97.90.53)  20.847 ms
x    202.97.33.134 (202.97.33.134)  10.183 ms
    202.97.33.154 (202.97.33.154)  11.260 ms
 9  202.97.6.2 (202.97.6.2)  170.576 ms *
    202.97.58.194 (202.97.58.194)  177.779 ms
10  202.97.50.58 (202.97.50.58)  174.788 ms  163.285 ms
    202.97.50.74 (202.97.50.74)  147.030 ms
11  218.30.54.101 (218.30.54.101)  161.434 ms  650.056 ms  147.255 ms
12  89.149.128.166 (89.149.128.166)  199.267 ms  218.486 ms  264.514 ms
13  ip4.gtt.net (209.120.137.218)  206.456 ms  284.208 ms *
14  * * *
15  128.122.254.108 (128.122.254.108)  371.668 ms
    128.122.254.110 (128.122.254.110)  209.239 ms  206.372 ms
16  nyufw-outside-ngfw-vl3080.net.nyu.edu (128.122.254.116)  204.803 ms  322.676 ms  215.446 ms
17  * * *
18  128.122.1.1 (128.122.1.1)  206.958 ms  234.658 ms  315.289 ms
19  * * *
20  cs.nyu.edu (128.122.49.30)  206.622 ms  215.792 ms  236.983 ms
```

Figure 1: traceroute www.cs.nyu.edu

```
Kai@MacBook-Pro-9 ~ % traceroute gaia.cs.umass.edu
traceroute to gaia.cs.umass.edu (128.119.245.12), 64 hops max, 52 byte packets
 1  10.213.32.209 (10.213.32.209)  20.990 ms  12.030 ms  5.405 ms
 2  10.213.33.137 (10.213.33.137)  10.799 ms  8.179 ms  6.407 ms
 3  10.213.33.150 (10.213.33.150)  8.950 ms  6.022 ms  5.659 ms
 4  10.122.117.209 (10.122.117.209)  9.550 ms  7.290 ms  7.018 ms
 5  10.117.219.101 (10.117.219.101)  195.363 ms  199.091 ms  204.265 ms
 6  10.117.219.102 (10.117.219.102)  210.481 ms  201.166 ms  198.343 ms
 7  ae10-1414.cr4-nyc2.ip4.gtt.net (209.120.137.217)  199.100 ms  195.890 ms  195.817 ms
 8  ae7.cr1-nyc2.ip4.gtt.net (89.149.129.218)  196.211 ms  197.810 ms  197.856 ms
 9  * * *
10  be3363.ccr42.jfk02.atlas.cogentco.com (154.54.3.125)  211.680 ms  195.360 ms
    be3362.ccr41.jfk02.atlas.cogentco.com (154.54.3.9)  202.765 ms
11  be3472.ccr32.bos01.atlas.cogentco.com (154.54.46.33)  386.858 ms  202.618 ms *
12  te0-3-1-10.rcr51.orh01.atlas.cogentco.com (154.54.3.198)  204.109 ms
    te0-2-1-10.rcr51.orh01.atlas.cogentco.com (154.54.27.54)  214.462 ms
    te0-3-1-10.rcr51.orh01.atlas.cogentco.com (154.54.3.198)  232.670 ms
13  38.104.218.14 (38.104.218.14)  201.903 ms  225.550 ms  210.447 ms
14  69.16.0.8 (69.16.0.8)  210.092 ms  405.144 ms  406.880 ms
15  69.16.1.0 (69.16.1.0)  310.112 ms  744.452 ms  211.197 ms
16  core2-rt-et-8-3-0.gw.umass.edu (192.80.83.113)  313.902 ms
    core1-rt-et-8-3-0.gw.umass.edu (192.80.83.109)  245.624 ms  223.218 ms
17  n5-rt-1-1-et-0-0-0.gw.umass.edu (128.119.0.8)  292.892 ms
    n5-rt-1-1-et-10-0-0.gw.umass.edu (128.119.0.10)  229.725 ms
    n5-rt-1-1-et-0-0-0.gw.umass.edu (128.119.0.8)  262.396 ms
18  cics-rt-xe-0-0-0.gw.umass.edu (128.119.3.32)  212.657 ms  295.105 ms  225.041 ms
19  nscs1bbs1.cs.umass.edu (128.119.240.253)  301.183 ms  207.230 ms  306.122 ms
20  gaia.cs.umass.edu (128.119.245.12)  210.360 ms !Z  306.814 ms !Z  229.694 ms !Z
```

```
Kai@MacBook-Pro-9 ~ % traceroute 139.130.4.5
traceroute to 139.130.4.5 (139.130.4.5), 64 hops max, 52 byte packets
 1  10.2.204.254 (10.2.204.254)  3.484 ms  3.034 ms  5.316 ms
 2  10.2.0.5 (10.2.0.5)  2.519 ms  9.963 ms  2.509 ms
 3  192.168.1.1 (192.168.1.1)  4.645 ms  2.580 ms *
 4  1.140.35.58.broad.xw.sh.dynamic.163data.com.cn (58.35.140.1)  7.605 ms  11.173 ms  10.060 ms
 5  101.95.91.225 (101.95.91.225)  9.873 ms
    61.152.51.1 (61.152.51.1)  14.313 ms  18.986 ms
 6  101.95.120.110 (101.95.120.110)  7.932 ms  9.534 ms
    61.152.24.34 (61.152.24.34)  9.070 ms
 7  202.97.50.146 (202.97.50.146)  17.991 ms *  16.123 ms
 8  202.97.74.1 (202.97.74.1)  21.506 ms
    202.97.90.29 (202.97.90.29)  7.853 ms
    202.97.74.1 (202.97.74.1)  21.109 ms
 9  202.97.89.142 (202.97.89.142)  166.526 ms *  205.109 ms
10  202.97.50.233 (202.97.50.233)  173.629 ms  180.650 ms  167.422 ms
11  213.248.92.129 (213.248.92.129)  181.406 ms  175.767 ms
    218.30.54.182 (218.30.54.182)  212.390 ms
12  * las-b21-link.telia.net (62.115.136.46)  199.740 ms  195.670 ms
13  telstra-svc071036-lag000214.c.telia.net (213.248.92.107)  175.604 ms  170.099 ms  170.701 ms
14  202.84.143.29 (202.84.143.29)  184.204 ms  197.416 ms  185.286 ms
15  i-10406.sydo-core04.telstraglobal.net (202.84.141.226)  240.627 ms  241.002 ms  331.121 ms
16  203.50.13.93 (203.50.13.93)  359.873 ms  362.981 ms  372.940 ms
17  bundle-ether1.ken-core10.sydney.telstra.net (203.50.6.96)  392.182 ms  398.674 ms  401.692 ms
18  * 203.50.11.221 (203.50.11.221)  401.194 ms  407.152 ms
19  139.130.4.5 (139.130.4.5)  357.000 ms  667.669 ms  528.055 ms
Kai@MacBook-Pro-9 ~ %
```

Figure 2: traceroute gaia.cs.umass.edu and 139.130.4.5

1.4

For www.cs.nyu.edu, we have 101.95.91.101 (Shanghai) – 61.152.24.42 (Shanghai) – 202.97.6.2 (Beijing) – 89.149.128.166 (NYC) – 128.122.1.1 (NYU)

For gaia.cs.umass.edu, we have 209.120.137.217 (NYC) – 154.54.3.125 (NYC) – 38.104.218.14 (Worcester, Massachusetts) – 128.119.0.8 (UMass, Amherst) – 128.119.3.32 (UMass, Amherst)

For 139.130.4.5, we have 101.95.91.225 (Shanghai) – 202.97.50.146 (Liaoning, China) – 213.248.92.129 (Illinois, Chicago) – 213.248.92.107 (Illinois, Chicago) – 203.50.6.96 (Sydney, Australia)

2 Interdomain vs. intradomain routing

2.1

Interdomain routing is how packets can be transmitted from a router in one domain to a router in another domain.

2.2

Intradomain routing is how packets can be trasmitted from a router to another router within the same domain.

2.3

An interdomain algorithm aims to discover paths across different domains, and propagate that information to routers within the domain.

2.4

An intradomain algorithm aims to compute the "shortest path" between any two routers within the same domain.

2.5

Because they focus on different aspect of routing. Intradomain algorithm needs to handle routing among all routers within a domain (local), while interdomain algorithm needs to handle routing between different domains (global). They basically form a hierarchy.

2.6

The most important factor is the business need for the ISP. Local preference can be driven by business needs (such as the Kenyan ISP example discussed in lecture), and minimizing the length of path is not necessarily correlated with improved performance since it does not capture information about internal topology of each domain.

3 Transit and peer relationships

3.1

A (provider domain) provides Internet service for B (customer domain), or the other way around.

3.2

A and B agree to carry each other's traffic.

3.3

The South African ISP "does not advertise path to its servers to Kenyan ISP". [1]

References

[1] Sivaraman Anirudh. *Lecture 9: Interdomain routing*. 2020. URL: https://cs.nyu.edu/~anirudh/CSCI-UA.0480-062/lectures/lec9.pdf.