

Lab Exercise 1: Tools of the Trade

zid: z5228006 name: MINGLANG XIE

Exercise 1: nslookup

1. The IP address of the website www.koala.com.au:

- 129.94.242.2#53
- 172.67.219.46
- 104.18.60.21
- 104.18.61.21

In my opinion, website may be replicated on multiple servers, with each server running on a different end system, and each having a different IP address. This allow for load balancing, and website replies to the requests with one of the listed Ips and the client thus can connect to the website. However, the IP address not always the same, so the load isn't concentrated always on the same server.

```
wagner % nslookup www.koala.com.au
Server:      129.94.242.2
Address:     129.94.242.2#53

Non-authoritative answer:
Name:   www.koala.com.au
Address: 172.67.219.46
Name:   www.koala.com.au
Address: 104.18.60.21
Name:   www.koala.com.au
Address: 104.18.61.21
```

2. The name of the IP address 127.0.0.1 is "the loopback address/localhost". The address is used to establish an IP connection to the same machine or computer being used by the end-user. The localhost refers to the internal interface used by the machine to send a packet to itself. TCP/IP send information locally but not on the network, it's always used for testing purpose.

```
wagner % nslookup 127.0.0.1
Server:      129.94.242.2
Address:     129.94.242.2#53

1.0.0.127.in-addr.arpa name = localhost.
```

Exercise 2: Use ping to test host reachability

| host | reachable by ping | Reachable from the Web |
|-----------------------|-------------------|------------------------|
| www.unsw.edu.au | Yes | Yes |
| www.getfittest.com.au | No | No |
| www.mit.edu | Yes | Yes |
| www.intel.com.au | Yes | Yes |
| www.tpg.com.au | Yes | Yes |
| www.hola.hp | No | No |
| www.amazon.com | Yes | Yes |

| | | |
|---------------------|-----|-----|
| www.tsinghua.edu.cn | Yes | Yes |
| www.kremlin.ru | No | Yes |
| 8.8.8.8 | Yes | No |

```
wagner % ping www.unsw.edu.au
PING cdn.prod65.unsw.adobecqms.net (13.226.107.113) 56(84) bytes of data.
64 bytes from server-13-226-107-113.syd4.r.cloudfront.net (13.226.107.113): icmp_seq=1 ttl=244 time=1.24 ms
```

```
wagner % ping www.getfittest.com.au
ping: unknown host www.getfittest.com.au
```

```
wagner % ping www.mit.edu
PING e9566.dscb.akamaiedge.net (23.77.154.132) 56(84) bytes of data.
64 bytes from a23-77-154-132.deploy.static.akamaitechnologies.com (23.77.154.132): icmp_seq=1 ttl=56 time=1.41 ms
```

```
wagner % ping www.intel.com.au
PING e19235.dsca.akamaiedge.net (104.98.21.56) 56(84) bytes of data.
64 bytes from a104-98-21-56.deploy.static.akamaitechnologies.com (104.98.21.56): icmp_seq=1 ttl=56 time=1.20 ms
```

```
wagner % ping www.tpg.com.au
PING www.tpg.com.au (203.26.27.38) 56(84) bytes of data.
64 bytes from www.tpg.com.au (203.26.27.38): icmp_seq=1 ttl=119 time=1.66 ms
```

```
wagner % ping www.hola.hp
ping: unknown host www.hola.hp ↵
```

```
wagner % ping www.amazon.com
PING d3ag4hukkh62yn.cloudfront.net (99.86.215.39) 56(84) bytes of data.
64 bytes from server-99-86-215-39.syd4.r.cloudfront.net (99.86.215.39): icmp_seq=1 ttl=244 time=1.21 ms
```

```
wagner % ping www.tsinghua.edu.cn
PING www.tsinghua.edu.cn (166.111.4.100) 56(84) bytes of data.
64 bytes from www.tsinghua.edu.cn (166.111.4.100): icmp_seq=1 ttl=42 time=242 ms
```

```
wagner % ping www.kremlin.ru
PING www.kremlin.ru (95.173.136.71) 56(84) bytes of data.
AC
--- www.kremlin.ru ping statistics ---
34 packets transmitted, 0 received, 100% packet loss, time 33768ms
```

```
wagner % ping 8.8.8.8
PING 8.8.8.8 (8.8.8.8) 56(84) bytes of data.
64 bytes from 8.8.8.8: icmp_seq=1 ttl=115 time=1.28 ms ↵
```

www.getfittest.com.au and www.hola.hp are not reachable by ping and the Web browser, thus these websites does not exist.

www.kremlin.ru was not reachable by using ping, but it is reachable from the Web browser, this is because the organizations disable their network from replying to ICMP echo request packets which are used by ping. It's always used because of security measure.

Exercise 3: Use traceroute to understand network topology

- There are 21 routers between my workstation and www.columbia.edu (22 hops, which the last hop we have reached the webserver), there are 4 routers along the path are part of the UNSW network. Between et-1-3-

```
wagner % traceroute www.columbia.edu
traceroute to www.columbia.edu (128.59.105.24), 30 hops max, 60 byte packets
 1 cserouter1-server.cse.unsw.edu.au (129.94.242.251) 0.188 ms 0.164 ms 0.144 ms
 2 129.94.39.17 (129.94.39.17) 0.954 ms 0.953 ms 0.951 ms
 3 libudnex1-v1-3154.gw.unsw.edu.au (149.171.253.34) 1.854 ms 1.851 ms 1.851 ms
 4 libcr1-po-6.gw.unsw.edu.au (149.171.255.201) 1.242 ms 1.242 ms 1.242 ms
 5 libcr1-po-5.gw.unsw.edu.au (149.171.255.165) 1.147 ms 1.147 ms 1.147 ms
 6 libcr1-po-6.gw.unsw.edu.au (149.171.255.201) 1.219 ms 1.219 ms 1.219 ms
 7 et-1-3-0.pel.sxt.bkvl.nsw.aarnet.net.au (113.197.15.149) 2.482 ms 2.278 ms 2.267 ms
 8 et-0-0-0.pel.sxt.bkvl.nsw.aarnet.net.au (113.197.15.99) 95.253 ms 95.140 ms 95.154 ms
 9 et-2-1-0.bdr1.a.sea.aarnet.net.au (113.197.15.201) 146.725 ms 146.728 ms 146.685 ms
10 abillene-1-lo-jmb-706.sttlwa.pacificwave.net (207.231.240.8) 146.889 ms 146.690 ms 146.676 ms
11 ae-1.4079.rtsw.minn.net.internet2.edu (162.252.70.173) 179.387 ms 179.429 ms 179.298 ms
12 ae-1.4079.rtsw.eqch.net.internet2.edu (162.252.70.106) 187.258 ms 187.236 ms 187.226 ms
13 ae-0.4079.rtsw.clev.net.internet2.edu (162.252.70.163) 191.819 ms 187.531 ms 187.347 ms
14 ae-1.4079.rtsw.clev.net.internet2.edu (162.252.70.130) 193.196 ms 193.167 ms 193.203 ms
15 buf-9208-12-CLEV.nysernet.net (199.109.11.33) 196.677 ms 196.543 ms 196.520 ms
16 syr-9208-buf-9208.nysernet.net (199.109.7.193) 199.746 ms 200.066 ms 199.955 ms
17 nyc111-9204-syr-9208.nysernet.net (199.109.7.94) 215.691 ms 208.869 ms 208.889 ms
18 nyc-9208-nyc111-9204.nysernet.net (199.109.7.165) 209.141 ms 209.080 ms 209.122 ms
19 columbia.nyc-9208.nysernet.net (199.109.4.14) 209.008 ms 208.868 ms 209.457 ms
20 cc-core-1-x-nyser32-gw-1.net.columbia.edu (128.59.255.5) 209.543 ms 209.139 ms 209.279 ms
21 cc-core-1-x-cc-core-1.net.columbia.edu (128.59.255.21) 209.451 ms 209.437 ms 209.393 ms
22 www-1tm.cc.columbia.edu (128.59.105.24) 209.294 ms 209.152 ms 209.048 ms
wagner %
```

0.pe1.sxt.bkvl.nsw.aarnet.net.au (113.197.15.149) and et-0-0-0.pe1.a.hnl.aarnet.net.au (113.197.15.99), the round-trip times from my machine to the routers change from 1.9ms to 95.1ms. which means it packets cross the Pacific Ocean. However, according to my research of the IP address, the router address change from Australia to America is between et-2-1-0.bdr1.a.sea.aarnet.net.au (113.197.15.201) and abilene-1-lo-jmb-706.sttlwa.pacificwave.net (207.231.240.8), because these are very likely part of AARNET PoP (Point of Presence) that are physically located in Honolulu and Seattle (hostnames have “hnl” and “sea”). Therefore, Between et-1-3-0.pe1.sxt.bkvl.nsw.aarnet.net.au (113.197.15.149) and et-0-0-0.pe1.a.hnl.aarnet.net.au (113.197.15.99) the address cross the Pacific Ocean physically.

2. There are 5 hops are identical on all 3 paths, at the sixth router IP address 138.44.5.0 the paths from my machine to these three destinations diverge. The sixth router belongs to the AARNET network.

No, the number of hops on each path is not proportional to the physical

```
wagner % traceroute www.ucla.edu
traceroute to www.ucla.edu (164.67.228.152), 30 hops max, 60 byte packets
 1 cserouter1-server.cse.unsw.EDU.AU (129.94.242.251) 0.107 ms 0.099 ms 0.088 ms
 2 129.94.39.17 (129.94.39.17) 0.862 ms 0.813 ms 0.845 ms
 3 ombudnex1-v1-3154.gw.unsw.edu.au (149.171.253.35) 1.471 ms libudnex1-v1-3154.gw.unsw.edu.au (149.171.253.34) 1.558 ms 1.504 ms
 4 ombcr1-po-6.gw.unsw.edu.au (149.171.255.169) 1.147 ms 1.220 ms ombcr1-po-5.gw.unsw.edu.au (149.171.255.197) 1.207 ms
 5 unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105) 1.833 ms 1.847 ms 1.836 ms
 6 138.44.5.0 (138.44.5.0) 2.448 ms 1.860 ms 1.845 ms
 7 et-1-3-0.pe1.sxt.bkvl.nsw.aarnet.net.au (113.197.15.149) 3.147 ms 3.059 ms 2.995 ms
 8 et-0-0-0.pe1.a.hnl.aarnet.net.au (113.197.15.99) 95.337 ms 95.356 ms 95.343 ms
 9 et-2-1-0.bdr1.a.sea.aarnet.net.au (113.197.15.201) 146.708 ms 146.553 ms 146.528 ms
10 cenichpr-1-is-jmb-778.snvaca.pacificwave.net (207.231.245.129) 163.057 ms 163.144 ms 163.819 ms
11 svl-aggl0-hpr--svl-hpr3--100g.cenic.net (137.164.25.106) 164.171 ms 164.264 ms 163.488 ms
12 hpr-lax-aggl0--svl-aggl0-100ge.cenic.net (137.164.25.73) 160.610 ms 159.873 ms 159.762 ms
13 * * *
14 bd1lf1.anderson--cr00f2.csb1.ucla.net (169.232.4.4) 160.921 ms bd1lf1.anderson--cr001.anderson.ucla.net (169.232.4.6) 161.008 ms
15 cr00f1.anderson--rtr1lf4.mathsci.ucla.net (169.232.8.185) 161.106 ms 160.966 ms 160.254 ms
wagner % traceroute www.u-tokyo.ac.jp
traceroute to www.u-tokyo.ac.jp (210.152.243.234), 30 hops max, 60 byte packets
 1 cserouter1-server.cse.unsw.EDU.AU (129.94.242.251) 0.185 ms 0.162 ms 0.143 ms
 2 129.94.39.17 (129.94.39.17) 0.984 ms 0.909 ms 1.019 ms
 3 ombudnex1-v1-3154.gw.unsw.edu.au (149.171.253.35) 1.340 ms libudnex1-v1-3154.gw.unsw.edu.au (149.171.253.35) 1.688 ms
 4 ombcr1-po-5.gw.unsw.edu.au (149.171.255.197) 1.120 ms libcr1-po-6.gw.unsw.edu.au (149.171.255.169) 1.120 ms
 5 unswbr1-te-1-9.gw.unsw.edu.au (149.171.255.101) 1.119 ms 1.242 ms 1.123 ms
 6 138.44.5.0 (138.44.5.0) 2.186 ms 1.761 ms 1.779 ms
 7 et-0-3-0.pe1.bkvl.nsw.aarnet.net.au (113.197.15.147) 1.843 ms 2.027 ms 2.890 ms
 8 ge-4-0.0.bb1.a.pao.aarnet.net.au (202.158.194.177) 155.138 ms 155.125 ms 155.121 ms
 9 paloalto0.iij.net (198.32.176.24) 156.464 ms 156.412 ms 156.494 ms
10 osk004bb01.IIJ.Net (58.138.88.189) 269.206 ms osk004bb00.IIJ.Net (58.138.88.185) 269.206 ms
11 osk004ip57.IIJ.Net (58.138.106.162) 278.074 ms osk004ip57.IIJ.Net (58.138.106.166) 278.074 ms
12 210.130.135.130 (210.130.135.130) 269.406 ms 269.362 ms 278.243 ms
13 124.83.228.58 (124.83.228.58) 289.840 ms 269.465 ms 278.247 ms
14 124.83.252.178 (124.83.252.178) 275.317 ms 275.409 ms 275.375 ms
15 158.205.134.26 (158.205.134.26) 292.912 ms 293.083 ms 292.967 ms
wagner % traceroute www.lancaster.ac.uk
traceroute to www.lancaster.ac.uk (148.88.65.80), 30 hops max, 60 byte packets
 1 cserouter1-server.cse.unsw.EDU.AU (129.94.242.251) 0.201 ms 0.171 ms 0.147 ms
 2 129.94.39.17 (129.94.39.17) 0.880 ms 0.875 ms 0.993 ms
 3 ombudnex1-v1-3154.gw.unsw.edu.au (149.171.253.35) 1.477 ms libudnex1-v1-3154.gw.unsw.edu.au (149.171.253.34) 1.426 ms 1.772 ms
 4 libcr1-po-5.gw.unsw.edu.au (149.171.255.165) 1.159 ms ombcr1-po-6.gw.unsw.edu.au (149.171.255.197) 1.194 ms libcr1-po-6.gw.unsw.edu.au (149.171.255.101) 1.149 ms
 5 unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105) 1.195 ms unswbr1-te-1-9.gw.unsw.edu.au (149.171.255.101) 1.226 ms unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105) 1.231 ms
 6 138.44.5.0 (138.44.5.0) 1.470 ms 1.348 ms 1.346 ms
 7 et-2-0-5.bdr1.sing.sin.aarnet.net.au (113.197.15.233) 92.710 ms 92.890 ms 92.788 ms
 8 138.44.226.7 (138.44.226.7) 263.823 ms 263.781 ms 263.802 ms
 9 janet-gw.mxl.lon.uk.geant.net (62.40.124.198) 263.812 ms 263.815 ms 263.763 ms
10 ae29.londpg-sbr2.ja.net (146.97.33.2) 264.379 ms 264.335 ms 264.348 ms
11 ae31.erdiss-sbr2.ja.net (146.97.33.22) 268.144 ms 268.012 ms 267.968 ms
12 ae29.manckh-sbr2.ja.net (146.97.33.42) 269.807 ms 269.931 ms 269.854 ms
13 ae25.manckh-ban1.ja.net (146.97.35.50) 269.908 ms 270.028 ms 269.986 ms
14 lancaster-uni.ja.net (146.97.40.178) 287.978 ms 287.914 ms 287.908 ms
```

distance. From Sydney to Tokyo is closer to from Sydney to LA, but from Sydney to Tokyo takes about 15 hops while from Sydney to LA also takes 15 hops.

3.

- i. The IP address of my machine is 129.94.242.251, the IP address of www.speedtest.com.sg is 202.150.221.170

Traceroute from my machine to www.speedtest.com.sg:

```
wagner % traceroute www.speedtest.com.sg
traceroute to www.speedtest.com.sg (202.150.221.170), 30 hops max, 60 byte packets
 1 cserouter1-server.cse.unsw.edu.au (129.94.242.251) 0.162 ms 0.139 ms 0.108 ms
 2 129.94.39.17 (129.94.39.17) 0.880 ms 0.857 ms 0.909 ms
 3 ombudnex1-v1-3154.gw.unsw.edu.au (149.171.253.35) 1.313 ms libudnex1-v1-3154.gw.unsw.edu.au (149.171.253.34) 1.842 ms 1.812 ms
 4 libcr1-po-5.gw.unsw.edu.au (149.171.255.165) 1.131 ms libcr1-po-6.gw.unsw.edu.au (149.171.255.201) 1.201 ms ombcr1-po-5.gw.unsw.edu.au (149.171.255.105) 1.131 ms
 5 unswbr1-te-1-9.gw.unsw.edu.au (149.171.255.101) 1.161 ms unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105) 1.131 ms unswbr1-te-1-9.gw.unsw.edu.au (149.171.255.101) 1.161 ms
 6 138.44.5.0 (138.44.5.0) 3.278 ms 2.779 ms 2.752 ms
 7 et-0-3-0.pe1.alxd.nsw.aarnet.net.au (113.197.15.153) 1.995 ms 1.848 ms 1.708 ms
 8 xe-0-2-7.bdr1.a.lax.aarnet.net.au (202.158.194.173) 148.005 ms 147.967 ms 147.898 ms
 9 singtel.as7473.any2ix.coresite.com (206.72.210.63) 147.713 ms 147.656 ms 147.745 ms
10 203.208.171.117 (203.208.171.117) 148.933 ms 148.105 ms 148.386 ms
11 203.208.172.145 (203.208.172.145) 246.684 ms 203.208.177.110 (203.208.177.110) 328.298 ms 203.208.172.145 (203.208.172.145) 246.168 ms
12 203.208.158.17 (203.208.158.17) 322.250 ms * 322.308 ms
13 202-150-221-170.rev.ne.com.sg (202.150.221.170) 210.634 ms 213.776 ms 203.208.177.110 (203.208.177.110) 321.541 ms
```

Traceroute from www.speedtest.com.sg to my machine:

```
traceroute to 129.94.242.2 (129.94.242.2), 30 hops max, 60 byte packets
 1 ge2-8.r01.sin01.ne.com.sg (202.150.221.169) 0.183 ms 0.205 ms 0.233 ms
 2 10.11.34.146 (10.11.34.146) 0.394 ms 0.471 ms 0.513 ms
 3 aarnet.sgix.sg (103.16.102.67) 209.115 ms 209.140 ms 209.120 ms
 4 et-7-3-0.pe1.nsw.brwy.aarnet.net.au (113.197.15.232) 204.830 ms 204.857 ms 204.838 ms
 5 138.44.5.1 (138.44.5.1) 206.835 ms 206.807 ms 206.878 ms
 6 ombcr1-te-1-5.gw.unsw.edu.au (149.171.255.106) 209.249 ms 209.269 ms 209.320 ms
 7 libudnex1-po-2.gw.unsw.edu.au (149.171.255.198) 200.423 ms 200.496 ms 200.722 ms
 8 ufw1-ae-1-3154.gw.unsw.edu.au (149.171.253.36) 209.909 ms 209.894 ms 209.837 ms
 9 129.94.39.23 (129.94.39.23) 212.393 ms 212.366 ms 212.408 ms
```

- ii. The IP address of my machine is 129.94.242.251, the IP address of www.telstra.net is 203.50.5.178

Traceroute from my machine to www.telstra.net:

```
wagner % traceroute www.telstra.net
traceroute to www.telstra.net (203.50.5.178), 30 hops max, 60 byte packets
 1 cserouter1-server.cse.unsw.edu.au (129.94.242.251) 0.134 ms 0.101 ms 0.091 ms
 2 129.94.39.17 (129.94.39.17) 0.867 ms 0.836 ms 0.869 ms
 3 ombudnex1-v1-3154.gw.unsw.edu.au (149.171.253.35) 1.624 ms 1.577 ms 1.787 ms
 4 ombcr1-po-6.gw.unsw.edu.au (149.171.255.169) 1.113 ms libcr1-po-5.gw.unsw.edu.au (149.171.255.165) 1.170 ms ombcr1-po-6.gw.unsw.edu.au (149.171.255.105) 1.178 ms
 5 unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105) 1.193 ms unswbr1-te-1-9.gw.unsw.edu.au (149.171.255.101) 1.178 ms unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105) 1.193 ms
 6 138.44.5.0 (138.44.5.0) 1.224 ms 1.276 ms 1.285 ms
 7 et-1-1-0.pe1.rsby.nsw.aarnet.net.au (113.197.15.12) 1.665 ms 1.748 ms 1.762 ms
 8 xe-0-0-3.bdr1.rsby.nsw.aarnet.net.au (113.197.15.31) 1.491 ms 3.011 ms 2.993 ms
 9 HundredGigE0-1-0-4.ken-edge903.sydney.telstra.net (139.130.0.77) 2.570 ms 2.564 ms 2.685 ms
10 bundle-ether2.chw-edge903.sydney.telstra.net (203.50.11.175) 2.310 ms 2.186 ms bundle-ether17.ken-core10.sydney.telstra.net (203.50.11.122) 13.110 ms
11 bundle-ether17.chw-core10.sydney.telstra.net (203.50.11.176) 2.636 ms 4.259 ms bundle-ether10.win-core10.melbourne.telstra.net (203.50.11.125) 15.980 ms
12 bundle-ether8.exi-core10.melbourne.telstra.net (203.50.11.125) 15.980 ms 15.651 ms 15.639 ms
13 bundle-ether2.exi-nrcrouter101.melbourne.telstra.net (203.50.11.209) 15.066 ms 15.079 ms 14.332 ms
14 www.telstra.net (203.50.5.178) 13.580 ms 14.338 ms 13.678 ms
```

Traceroute from www.telstra.net to my machine:

```
1 gigabitethernet3-3.exi2.melbourne.telstra.net (203.50.77.53) 0.294 ms 0.200 ms 0.242 ms
2 bundle-ether3-100.win-core10.melbourne.telstra.net (203.50.80.129) 1.114 ms 1.603 ms 2.117 ms
3 bundle-ether12.ken-core10.sydney.telstra.net (203.50.11.122) 13.110 ms 12.598 ms 12.736 ms
4 bundle-ether1.ken-edge903.sydney.telstra.net (203.50.11.173) 11.986 ms 11.973 ms 11.986 ms
5 aar3533567.lnk.telstra.net (139.130.0.78) 13.234 ms 25.093 ms 11.484 ms
6 et-7-1-0.pe1.brwy.nsw.aarnet.net.au (113.197.15.13) 11.860 ms 11.846 ms 11.860 ms
7 138.44.5.1 (138.44.5.1) 12.109 ms 12.101 ms 11.988 ms
8 libcr1-te-1-5.gw.unsw.edu.au (149.171.255.102) 12.108 ms 12.099 ms 12.110 ms
9 ombudnex1-po-1.gw.unsw.edu.au (149.171.255.202) 12.486 ms
10 ufw1-ae-1-3154.gw.unsw.edu.au (149.171.253.36) 12.723 ms 12.723 ms 12.735 ms
11 129.94.39.23 (129.94.39.23) 12.859 ms 12.849 ms 12.860 ms
```

Exercise 4: Use ping to gain insights into network performance