

COMP3331- Lab 1

Exercise 1: nslookup

Answer:

1. There are 3 IP address for www.koala.com.au

- Name: www.koala.com.au
- Address: 104.18.61.21
- Address: 172.67.219.46
- Address: 104.18.60.21

```
z5163479@vx5:~/comp3331/lab1$ nslookup www.koala.com.au
Server:      129.94.242.45
Address:     129.94.242.45#53
```

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

In my opinions, the reasons that several IP address for one domain are:

- Loading balance. If the domain normally has a large number of users, 1 IP address might not be enough to handle it. Multiple IP address can be used to handle higher end-user traffic.
 - Increase website performance. multiple IP addresses means the website hosted at multiple different locations, so user probably receive the response from the IP address that is "nearest to your location". This is done to increase a specific website performance
2. It is "localhost", it is the IP address for the computer I am currently working on.

Exercise 2: Use ping to test host reachability

Answer:

Reachable address:

- www.unsw.edu.au
 - www.mit.edu
 - www.intel.com.au
 - www.tpg.com.au
 - www.amazon.com
 - www.tsinghua.edu.cn
 - 8.8.8.8
- ```
--- www.unsw.edu.au ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1001ms

z5163479@vx7:~/comp3331/lab1$ ping www.mit.edu
PING e9566.dscb.akamaiedge.net (104.116.128.164) 56(84) bytes of data:
64 bytes from a104-116-128-164.deploy.static.akamaitechnologies.com (104.116.128.164): icmp_seq=1 ttl=52 time=12.9 ms
^C
--- e9566.dscb.akamaiedge.net ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms

z5163479@vx7:~/comp3331/lab1$ ping www.intel.com.au
PING e19235.dsca.akamaiedge.net (104.98.24.130) 56(84) bytes of data:
34 bytes from a104-98-24-130.deploy.static.akamaitechnologies.com (104.98.24.130): icmp_seq=1 ttl=56 time=1.17 ms
34 bytes from a104-98-24-130.deploy.static.akamaitechnologies.com (104.98.24.130): icmp_seq=2 ttl=56 time=1.15 ms
^C
--- e19235.dsca.akamaiedge.net ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1001ms

z5163479@vx7:~/comp3331/lab1$ ping www.tpg.com.au
PING 104.154.14.107 56(84) bytes of data:
34 bytes from 104.154.14.107: icmp_seq=1 ttl=54 time=0.007 ms
34 bytes from 104.154.14.107: icmp_seq=2 ttl=54 time=0.007 ms
^C
--- www.tpg.com.au ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1001ms

z5163479@vx7:~/comp3331/lab1$ ping www.tsinghua.edu.cn
PING 159.150.100.150 56(84) bytes of data:
34 bytes from 159.150.100.150: icmp_seq=1 ttl=64 time=0.007 ms
34 bytes from 159.150.100.150: icmp_seq=2 ttl=64 time=0.007 ms
^C
--- 159.150.100.150 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1001ms

z5163479@vx7:~/comp3331/lab1$ ping 8.8.8.8
PING 8.8.8.8 56(84) bytes of data:
34 bytes from 8.8.8.8: icmp_seq=1 ttl=64 time=0.007 ms
34 bytes from 8.8.8.8: icmp_seq=2 ttl=64 time=0.007 ms
^C
--- 8.8.8.8 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1001ms

z5163479@vx7:~/comp3331/lab1$
```

Unreachable address:

- [www.getfittest.com.au](http://www.getfittest.com.au)
- [www.hola.hp](http://www.hola.hp)

these domains are unreachable, since they are invalid domains

**ping unreachable, but browser can:**

- [www.kremlin.ru](http://www.kremlin.ru)

this domain is reachable on browser, but not ping. I think it is because this domain probably disables ping response for some security reason, like denying ping flooding.

### Exercise 3: Use traceroute to understand network topology

1.

Traceroute output:

```

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) 0.084 ms 0.050 ms 0.049 ms

 2 129.94.39.17 (129.94.39.17) 0.818 ms 0.805 ms 0.785 ms

 3 libudnex1-v1-3154.gw.unsw.edu.au (149.171.253.34) 1.530 ms 1.531 ms
 ombudnex1-v1-3154.gw.unsw.edu.au (149.171.253.35) 1.316 ms

 4 ombcr1-po-5.gw.unsw.edu.au (149.171.255.197) 1.205 ms
 libcr1-po-5.gw.unsw.edu.au (149.171.255.165) 1.062 ms
 ombcr1-po-5.gw.unsw.edu.au (149.171.255.197) 1.164 ms

 5 unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105) 1.072 ms 1.100 ms
 unswbr1-te-1-9.gw.unsw.edu.au (149.171.255.101) 1.087 ms

 6 138.44.5.0 (138.44.5.0) 1.230 ms 1.326 ms 1.274 ms

 7 et-1-3-0.pe1.sxt.bkvl.nsw.aarnet.net.au (113.197.15.149) 2.079 ms 2.228 ms 2.217 ms

 8 et-0-0-0.pe1.a.hnl.aarnet.net.au (113.197.15.99) 95.250 ms 95.155 ms 95.152 ms

 9 et-2-1-0.bdr1.a.sea.aarnet.net.au (113.197.15.201) 146.952 ms 146.908 ms 146.907 ms

10 abilene-1-lo-jmb-706.sttlwa.pacificwave.net (207.231.240.8) 160.005 ms 159.986 ms 159.936 ms

11 ae-1.4079.rtsw.minn.net.internet2.edu (162.252.70.173) 192.977 ms 192.969 ms 192.638 ms

12 ae-1.4079.rtsw.eqch.net.internet2.edu (162.252.70.106) 222.026 ms 223.314 ms 221.974 ms

13 ae-0.4079.rtsw3.eqch.net.internet2.edu (162.252.70.163) 200.481 ms 209.920 ms 209.906 ms

14 ae-1.4079.rtsw.clev.net.internet2.edu (162.252.70.130) 211.876 ms 209.875 ms 209.905 ms

15 buf-9208-I2-CLEV.nysernet.net (199.109.11.33) 213.360 ms 213.356 ms 213.344 ms

16 syr-9208-buf-9208.nysernet.net (199.109.7.193) 217.388 ms 217.454 ms 217.406 ms

17 nyc111-9204-syr-9208.nysernet.net (199.109.7.94) 226.443 ms 226.463 ms 226.522 ms

18 nyc-9208-nyc111-9204.nysernet.net (199.109.7.165) 225.913 ms 225.647 ms 225.956 ms

19 columbia.nyc-9208.nysernet.net (199.109.4.14) 225.664 ms 245.498 ms 225.715 ms

20 cc-core-1-x-nyser32-gw-1.net.columbia.edu (128.59.255.5) 226.751 ms 226.750 ms 226.802 ms

21 cc-conc-1-x-cc-core-1.net.columbia.edu (128.59.255.21) 226.251 ms 226.136 ms 226.113 ms
|
22 columbia.edu (128.59.105.24) 226.003 ms 225.975 ms 225.971 ms

```

Answer:

- How many routers are there between your workstation and [www.columbia.edu](http://www.columbia.edu) ?

- 21 routers from the output
- How many routers along the path are part of the UNSW network?
  - 5 routers
- Between which two routers do packets cross the Pacific Ocean?
  - 7 – 8
  - 113.197.15.149 – 113.197.15.99
  - We can observe the delay increase rapidly from 7<sup>th</sup> router to 8<sup>th</sup> router

Traceroute output:

(i) [www.ucla.edu](http://www.ucla.edu)

```
1 traceroute to www.ucla.edu (164.67.228.152), 30 hops max, 60 byte packets
2 1 cserouter1-server.cse.unsw.EDU.AU (129.94.242.251) 0.119 ms 0.087 ms 0.064 ms
3
4 2 129.94.39.17 (129.94.39.17) 0.900 ms 0.858 ms 0.852 ms
5
6 3 ombudnex1-v1-3154.gw.unsw.edu.au (149.171.253.35) 1.592 ms
7 libudnex1-v1-3154.gw.unsw.edu.au (149.171.253.34) 1.401 ms
8 ombudnex1-v1-3154.gw.unsw.edu.au (149.171.253.35) 1.510 ms
9
10 4 libcr1-po-6.gw.unsw.edu.au (149.171.255.201) 1.020 ms
11 ombcr1-po-5.gw.unsw.edu.au (149.171.255.197) 1.114 ms
12 ombcr1-po-6.gw.unsw.edu.au (149.171.255.169) 1.073 ms
13
14 5 unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105) 1.103 ms 1.116 ms
15 unswbr1-te-1-9.gw.unsw.edu.au (149.171.255.101) 1.117 ms
16
17 6 138.44.5.0 (138.44.5.0) 1.255 ms 1.257 ms 1.234 ms
18
19 7 et-1-3-0.pe1.sxt.bkvl.nsw.aarnet.net.au (113.197.15.149) 2.331 ms 2.092 ms 2.067 ms
20
21 8 et-0-0-0.pe1.a.hnl.aarnet.net.au (113.197.15.99) 95.040 ms 95.080 ms 95.054 ms
22
23 9 et-2-1-0.bdr1.a.sea.aarnet.net.au (113.197.15.201) 146.906 ms 146.903 ms 146.901 ms
24
25 10 cenichpr-1-is-jmb-778.snvaca.pacificwave.net (207.231.245.129) 164.179 ms 164.190 ms 164.188 ms
26
27 11 hpr-lax-hpr3--sv1-hpr3-100ge.cenic.net (137.164.25.73) 160.126 ms 160.116 ms 160.057 ms
28 12 * * *
29 13 bd11f1.anderson--cr001.anderson.ucla.net (169.232.4.6) 160.399 ms 161.051 ms 160.311 ms
30 14 cr00f1.anderson--rtr11f4.mathsci.ucla.net (169.232.8.185) 160.687 ms 161.347 ms 161.325 ms
31 15 * * *
32 16 * * *
33 17 * * *
34 18 * * *
35 19 * * *
36 20 * * *
37 21 * * *
38 22 * * *
39 23 * * *
40 24 * * *
41 25 * * *
42 26 * * *
43 27 * * *
44 28 * * *
45 29 * * *
46 30 * * *
47
```

(ii) [www.u-tokyo.ac.jp](http://www.u-tokyo.ac.jp)

```
1 traceroute to www.u-tokyo.ac.jp (210.152.243.234), 30 hops max, 60 byte packets
2 1 cserouter1-server.cse.unsw.EDU.AU (129.94.242.251) 0.083 ms 0.053 ms 0.049 ms
3
4 2 129.94.39.17 (129.94.39.17) 0.858 ms 0.846 ms 0.824 ms
5
6 3 ombudnex1-v1-3154.gw.unsw.edu.au (149.171.253.35) 1.592 ms 1.588 ms
7 libudnex1-v1-3154.gw.unsw.edu.au (149.171.253.34) 1.405 ms
8
9 4 ombcr1-po-6.gw.unsw.edu.au (149.171.255.169) 1.055 ms
0 libcr1-po-6.gw.unsw.edu.au (149.171.255.201) 1.100 ms 1.086 ms
1
2 5 unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105) 1.092 ms
3 unswbr1-te-1-9.gw.unsw.edu.au (149.171.255.101) 1.136 ms
4 unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105) 1.124 ms
5
6 6 138.44.5.0 (138.44.5.0) 1.237 ms 1.355 ms 1.329 ms
7 7 et-0-3-0.pe1.bkvl.nsw.aarnet.net.au (113.197.15.147) 1.716 ms 1.912 ms 1.835 ms
8 8 ge-4_0_0.bb1.a.pao.aarnet.net.au (202.158.194.177) 154.997 ms 154.989 ms 154.957 ms
9 9 paloalto0.iij.net (198.32.176.24) 156.445 ms 156.377 ms 156.462 ms
0
1 10 osk004bb01.IIJ.Net (58.138.88.189) 269.308 ms 269.326 ms 269.269 ms
2
3 11 osk004ip57.IIJ.Net (58.138.106.166) 278.046 ms
4 osk004ip57.IIJ.Net (58.138.106.162) 286.885 ms
5 osk004ip57.IIJ.Net (58.138.106.166) 278.117 ms
6
7 12 210.130.135.130 (210.130.135.130) 270.213 ms 278.252 ms 278.194 ms
8 13 124.83.228.58 (124.83.228.58) 287.093 ms 290.056 ms 290.032 ms
9 14 124.83.252.178 (124.83.252.178) 293.035 ms 284.461 ms 284.453 ms
0 15 158.205.134.26 (158.205.134.26) 292.968 ms 292.929 ms 292.876 ms
1 16 158.205.121.46 (158.205.121.46) 275.433 ms 275.530 ms 275.403 ms
2 17 * * *
3 18 * * *
4 19 * * *
5 20 * * *
6 21 * * *
7 22 * * *
8 23 * * *
9 24 * * *
0 25 * * *
1 26 * * *
2 27 * * *
3 28 * * *
4 29 * * *
5 30 * * *
```



(iii) [www.lancaster.ac.uk](http://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) 0.135 ms 0.094 ms 0.072 ms

 2 129.94.39.17 (129.94.39.17) 0.900 ms 0.852 ms 0.842 ms

 3 ombudnex1-v1-3154.gw.unsw.edu.au (149.171.253.35) 1.301 ms
 libudnex1-v1-3154.gw.unsw.edu.au (149.171.253.34) 1.408 ms
 ombudnex1-v1-3154.gw.unsw.edu.au (149.171.253.35) 1.399 ms

 4 ombcr1-po-5.gw.unsw.edu.au (149.171.255.197) 1.068 ms
 libcr1-po-6.gw.unsw.edu.au (149.171.255.201) 1.049 ms
 ombcr1-po-5.gw.unsw.edu.au (149.171.255.197) 1.049 ms

 5 unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105) 1.429 ms 1.380 ms 1.449 ms

 6 138.44.5.0 (138.44.5.0) 1.232 ms 2.134 ms 2.108 ms

 7 et-1-1-0.pe1.rsby.nsw.aarnet.net.au (113.197.15.12) 1.524 ms 2.882 ms 2.850 ms

 8 xe-1-1-0.pe1.eskp.nsw.aarnet.net.au (113.197.15.199) 9.740 ms 3.232 ms 3.240 ms

 9 et-0-3-0.pe1.prka.sa.aarnet.net.au (113.197.15.42) 19.919 ms 20.036 ms 19.954 ms

10 et-0-3-0.pe1.knsg.wa.aarnet.net.au (113.197.15.45) 45.833 ms 45.824 ms 45.884 ms

11 et-2-1-2.bdr2.sing.sin.aarnet.net.au (113.197.15.247) 91.635 ms 91.597 ms 91.593 ms

12 ae1.bdr1.sing.sin.aarnet.net.au (113.197.15.234) 91.635 ms 91.636 ms 91.611 ms

13 138.44.226.7 (138.44.226.7) 263.012 ms 261.141 ms 261.085 ms

14 janet-gw.mx1.lon.uk.geant.net (62.40.124.198) 259.619 ms 259.518 ms 259.451 ms

15 ae29.londpg-sbr2.ja.net (146.97.33.2) 267.034 ms 260.009 ms 259.975 ms

16 ae31.erdiss-sbr2.ja.net (146.97.33.22) 263.653 ms 263.796 ms 263.731 ms

17 ae29.manckh-sbr2.ja.net (146.97.33.42) 265.387 ms 265.270 ms 265.408 ms

18 ae24.lanclu-rbr1.ja.net (146.97.38.58) 267.853 ms 267.881 ms 267.786 ms

19 lancaster-university.ja.net (194.81.46.2) 285.227 ms 285.217 ms 283.410 ms

20 is-border01.bfw01.rtr.lancs.ac.uk (148.88.253.202) 268.350 ms 268.394 ms 268.345 ms
|
21 bfw01.iss-servers.is-core01.rtr.lancs.ac.uk (148.88.250.98) 274.977 ms 270.866 ms 270.348 ms
22 * * *
23 www.lancs.ac.uk (148.88.65.80) 268.095 ms !X 268.158 ms !X 268.145 ms !X
```

Answer:

- At which router do the paths from your machine to these three destinations diverge?
  - 6th row - 138.44.5.0
  - It belongs to Australian Academic and Research Network, located in Kensington, Western Australia

```

inetnum: 138.44.0.0 - 138.44.255.255
netname: AARNET
descr: Australian Academic and Research Network
descr: Building 9
descr: Banks Street
country: AU
org: ORG-AAAR1-AP
admin-c: SM6-AP
tech-c: ANOC-AP
notify: irrcontact@aarnet.edu.au
mnt-by: APNIC-HM
mnt-lower: MAINT-AARNET-AP
mnt-routes: MAINT-AARNET-AP
7 mnt-irt: IRT-AARNET-AU
status: ALLOCATED PORTABLE
remarks: +-----+
remarks: This object can only be updated by APNIC hostmasters.
remarks: To update this object, please contact APNIC
remarks: hostmasters and include your organisation's account
remarks: name in the subject line.
remarks: +-----+
last-modified: 2017-10-09T13:02:43Z
source: APNIC

irt: IRT-AARNET-AU
address: AARNet Pty Ltd
address: 26 Dick Perry Avenue
address: Kensington, Western Australia
address: Australia
e-mail: abuse@aarnet.edu.au
abuse-mailbox: abuse@aarnet.edu.au
admin-c: SM6-AP
tech-c: ANOC-AP
auth: # Filtered
remarks: abuse@aarnet.edu.au was validated on 2019-12-03
mnt-by: MAINT-AARNET-AP
last-modified: 2019-12-03T21:30:31Z
source: APNIC

organisation: ORG-AAAR1-AP
org-name: Australian Academic and Research Network

```

- Is the number of hops on each path proportional the physical distance?
  - Yes. As you can see, The IP address for 1<sup>st</sup> output is located in US, 2<sup>nd</sup> is located in Japan, 3<sup>rd</sup> is located in UK. And the order of distance between their location and Australia is UK>US>JP.
  - And we can see, apparently, the number of hops for UK is much larger than US and Japan. So, we can conclude it is related to the physical distance.
  - I cannot use the output of US and Japan to make a conclusion for this question, as there are too many asterisks in the output, we cannot count the valid hop from those output.

3.

For this question, I will use 129.94.242.117 as my local computer address. Since I use Vlab for this lab exercise.

[www.speedtest.com.sg/tr.php\(202.150.221.170\) and 129.94.242.117](http://www.speedtest.com.sg/tr.php(202.150.221.170)and129.94.242.117)

- a. <http://www.speedtest.com.sg/tr.php> to 129.94.242.117

```
Traceroute Result:
traceroute to 129.94.242.117 (129.94.242.117), 30 hops max, 60 byte packets
 1 ge2-8.r01.sin01.ne.com.sg (202.150.221.169) 0.209 ms 0.221 ms 0.233 ms
 2 10.11.34.146 (10.11.34.146) 0.375 ms 0.459 ms 0.515 ms
 3 aarnet.sgix.sg (103.16.102.67) 214.901 ms 214.915 ms 214.926 ms
 4 et-5-1-0.pe1.brwy.nsw.aarnet.net.au (113.197.15.5) 219.650 ms 219.665 ms
 et-7-1-0.pe1.brwy.nsw.aarnet.net.au (113.197.15.13) 208.318 ms
 5 138.44.5.1 (138.44.5.1) 218.206 ms 218.272 ms 217.896 ms
 6 ombcr1-te-1-5.gw.unsw.edu.au (149.171.255.106) 207.726 ms 207.994 ms 208.041 ms
 7 libudnex1-po-2.gw.unsw.edu.au (149.171.255.198) 216.324 ms 216.276 ms 216.602 ms
 8 ufw1-ae-1-3154.gw.unsw.edu.au (149.171.253.36) 208.688 ms 208.622 ms 208.556 ms
 9 129.94.39.23 (129.94.39.23) 212.727 ms 212.929 ms 212.400 ms
10 * * *
11 * * *
12 * * *
13 * * *
14 * * *
15 * * *
16 * * *
17 * * *
18 * * *
19 * * *
20 * * *
21 * * *
22 * * *
23 * * *
24 * * *
25 * * *
26 * * *
27 * * *
28 * * *
29 * * *
30 * * *
```

- b. 129.94.242.117 to <http://www.speedtest.com.sg/tr.php>

```
traceroute to 202.150.221.170 (202.150.221.170), 30 hops max, 60 byte packets
 1 cserouter1-server.cse.unsw.EDU.AU (129.94.242.251) 0.205 ms 0.171 ms 0.149 ms

 2 129.94.39.17 (129.94.39.17) 0.826 ms 0.838 ms 0.846 ms

 3 ombudnex1-v1-3154.gw.unsw.edu.au (149.171.253.35) 1.685 ms 1.704 ms 1.649 ms

 4 ombcr1-po-5.gw.unsw.edu.au (149.171.255.197) 1.113 ms 1.100 ms
 libcr1-po-5.gw.unsw.edu.au (149.171.255.165) 1.087 ms

 5 unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105) 1.114 ms
 unswbr1-te-1-9.gw.unsw.edu.au (149.171.255.101) 1.174 ms 1.173 ms

 6 138.44.5.0 (138.44.5.0) 1.234 ms 1.293 ms 1.267 ms

 7 et-0-3-0.pe1.alxd.nsw.aarnet.net.au (113.197.15.153) 1.711 ms 1.698 ms 1.653 ms

 8 xe-0-2-7.bdr1.a.lax.aarnet.net.au (202.158.194.173) 147.634 ms 147.633 ms 147.600 ms

 9 singtel.as7473.any2ix.coresite.com (206.72.210.63) 147.613 ms 147.612 ms 147.640 ms

10 203.208.171.117 (203.208.171.117) 148.041 ms 148.032 ms
 203.208.154.45 (203.208.154.45) 339.988 ms

11 203.208.177.110 (203.208.177.110) 341.340 ms
 203.208.173.73 (203.208.173.73) 331.450 ms
 203.208.177.110 (203.208.177.110) 334.259 ms

12 * * *

13 202-150-221-170.rev.ne.com.sg (202.150.221.170) 213.566 ms 208.863 ms
 203.208.177.110 (203.208.177.110) 329.972 ms
```

<https://www.telstra.net/cgi-bin/trace> (203.50.5.178) and 129.94.242.117

a. [www.telstra.net](http://www.telstra.net) to 129.94.242.117

```
1 gigabitethernet3-3.exi2.melbourne.telstra.net (203.50.77.53) 0.327 ms 0.204 ms 0.242 ms
2 bundle-ether3-100.win-core10.melbourne.telstra.net (203.50.80.129) 1.987 ms 1.602 ms 2.241 ms
3 bundle-ether12.ken-core10.sydney.telstra.net (203.50.11.122) 12.110 ms 12.098 ms 12.612 ms
4 bundle-ether1.ken-edge903.sydney.telstra.net (203.50.11.173) 16.983 ms 12.221 ms 11.985 ms
5 aar3533567.lnk.telstra.net (139.130.0.78) 11.859 ms 11.724 ms 11.611 ms
6 et-7-1-0.pe1.brwy.nsw.aarnet.net.au (113.197.15.13) 11.860 ms 11.849 ms 11.859 ms
7 138.44.5.1 (138.44.5.1) 11.984 ms 12.101 ms 11.986 ms
8 libcr1-te-1-5.gw.unsw.edu.au (149.171.255.102) 12.110 ms 12.097 ms 12.110 ms
9 libudnex1-po-1.gw.unsw.edu.au (149.171.255.166) 12.359 ms 12.348 ms
10 ufw1-ae-1-3154.gw.unsw.edu.au (149.171.253.36) 12.721 ms 12.724 ms 12.734 ms
11 129.94.39.23 (129.94.39.23) 12.861 ms 12.851 ms 12.860 ms
```

- b. 129.94.242.117 to [www.telstra.net](http://www.telstra.net)

```
tracert to 203.50.5.178 (203.50.5.178), 30 hops max, 60 byte packets
 1 cserouter1-server.cse.unsw.EDU.AU (129.94.242.251) 0.120 ms 0.087 ms 0.063 ms

 2 129.94.39.17 (129.94.39.17) 0.869 ms 0.822 ms 0.825 ms

 3 ombudnex1-v1-3154.gw.unsw.edu.au (149.171.253.35) 1.390 ms
 libudnex1-v1-3154.gw.unsw.edu.au (149.171.253.34) 1.493 ms 1.445 ms

 4 ombcr1-po-5.gw.unsw.edu.au (149.171.255.197) 1.104 ms
 libcr1-po-6.gw.unsw.edu.au (149.171.255.201) 1.068 ms
 ombcr1-po-5.gw.unsw.edu.au (149.171.255.197) 1.137 ms

 5 unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105) 1.188 ms 1.133 ms
 unswbr1-te-1-9.gw.unsw.edu.au (149.171.255.101) 1.164 ms

 6 138.44.5.0 (138.44.5.0) 1.313 ms 1.313 ms 1.313 ms

 7 et-1-1-0.pe1.rsby.nsw.aarnet.net.au (113.197.15.12) 1.739 ms 1.564 ms 1.705 ms

 8 xe-0-0-3.bdr1.rsby.nsw.aarnet.net.au (113.197.15.31) 1.499 ms 1.636 ms 1.606 ms

 9 HundredGigE0-1-0-4.ken-edge903.sydney.telstra.net (139.130.0.77) 2.120 ms 2.107 ms 2.218 ms

10 bundle-ether2.chw-edge903.sydney.telstra.net (203.50.11.175) 3.086 ms
 bundle-ether17.ken-core10.sydney.telstra.net (203.50.11.172) 3.383 ms
 bundle-ether2.chw-edge903.sydney.telstra.net (203.50.11.175) 3.093 ms

11 bundle-ether17.chw-core10.sydney.telstra.net (203.50.11.176) 3.905 ms
 bundle-ether10.win-core10.melbourne.telstra.net (203.50.11.123) 13.919 ms
 bundle-ether17.chw-core10.sydney.telstra.net (203.50.11.176) 3.814 ms

12 203.50.6.40 (203.50.6.40) 14.457 ms
 bundle-ether8.exi-core10.melbourne.telstra.net (203.50.11.125) 13.462 ms
 203.50.6.40 (203.50.6.40) 13.936 ms

13 bundle-ether2.exi-ncprouter101.melbourne.telstra.net (203.50.11.209) 13.274 ms 13.037 ms 13.525 ms

14 www.telstra.net (203.50.5.178) 12.384 ms 12.590 ms 12.593 ms
```

#### Answer:

- What are the IP addresses of the two servers that you have chosen
  - I put the IP address in each subtitle
- Does the reverse path go through the same routers as the forward path?
  - No, the number of routers the packet travel is different + different travel path
- If you observe common routers between the forward and the reverse path, do you also observe the same IP addresses? Why or why not?
  - There are not common routers in my traceroute output. Since all the IP address are different.
  - The reason I did not observe common router is because maybe the network travel algorithm makes packets travel by different path, so packets travel through different router.

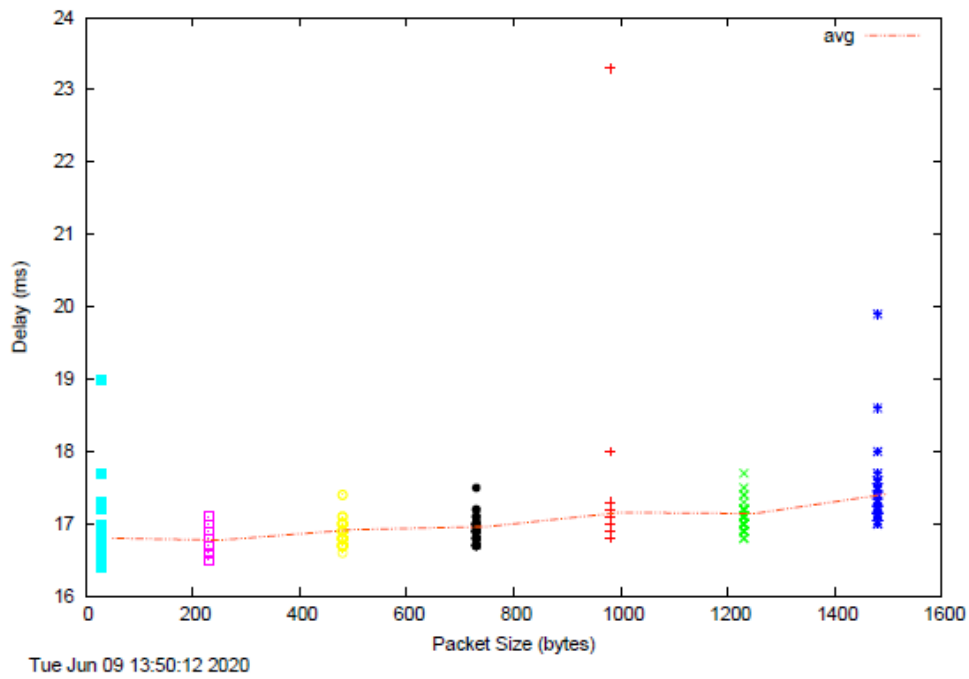
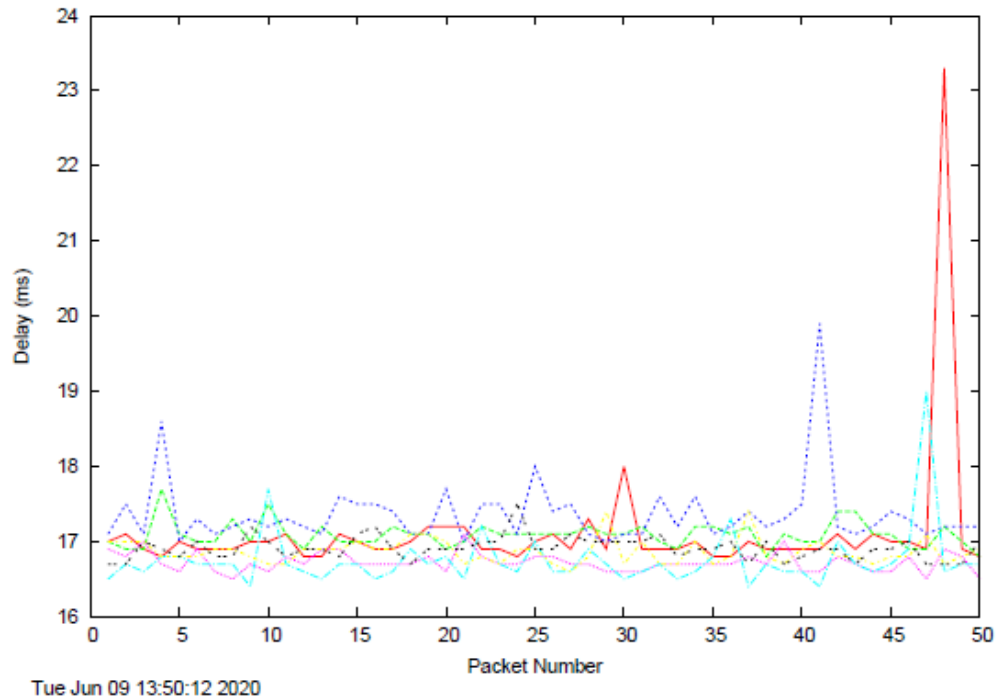




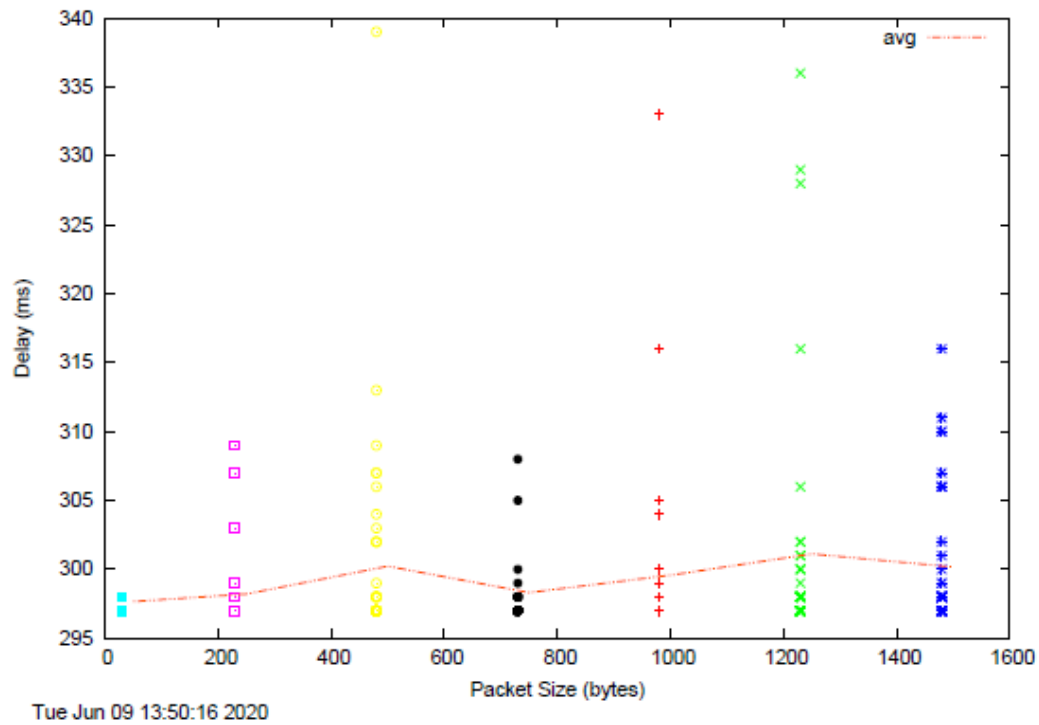
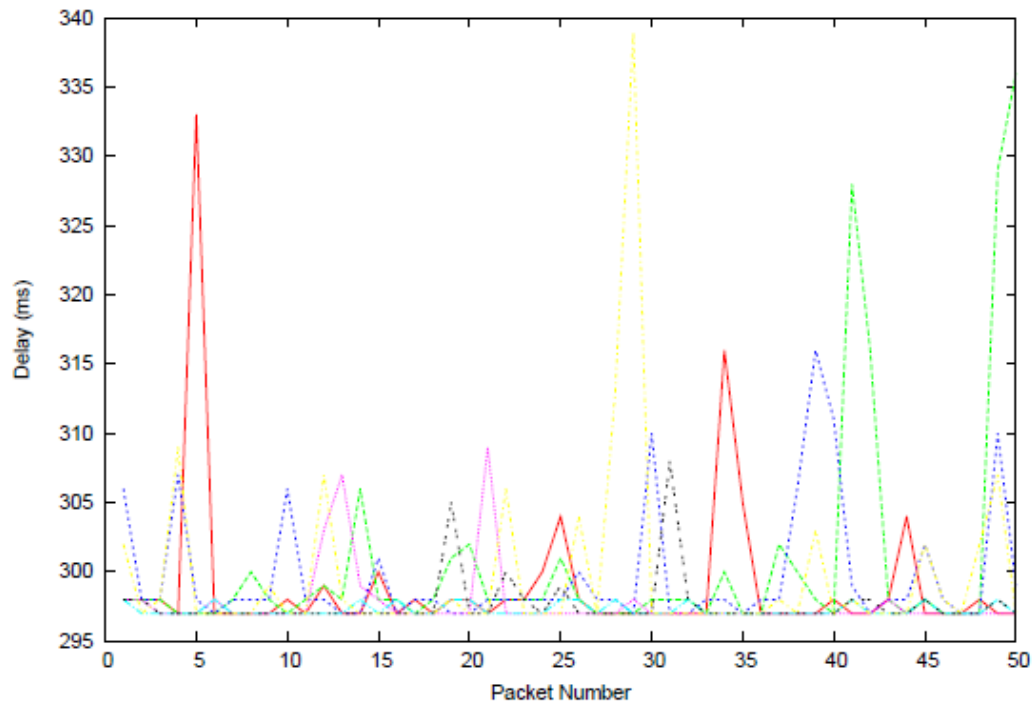
## Exercise 4: Use ping to gain insights into network performance

For this question, I pick (i) [www.uq.edu.au](http://www.uq.edu.au) (ii) [www.dlsu.edu.ph](http://www.dlsu.edu.ph) and (iii) [www.tu-berlin.de](http://www.tu-berlin.de)

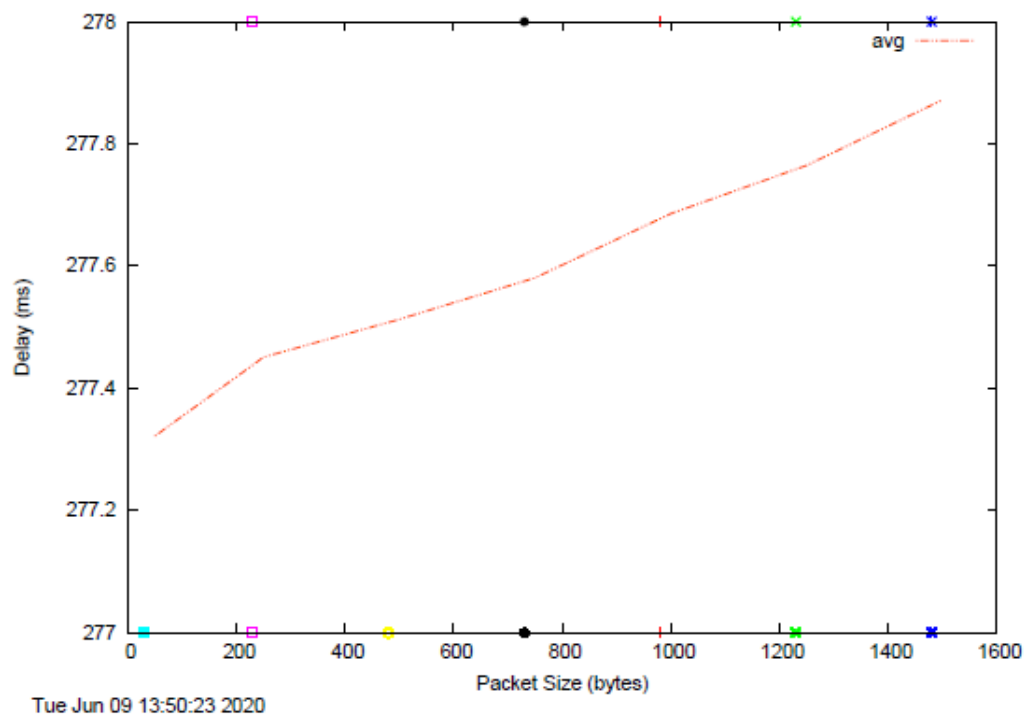
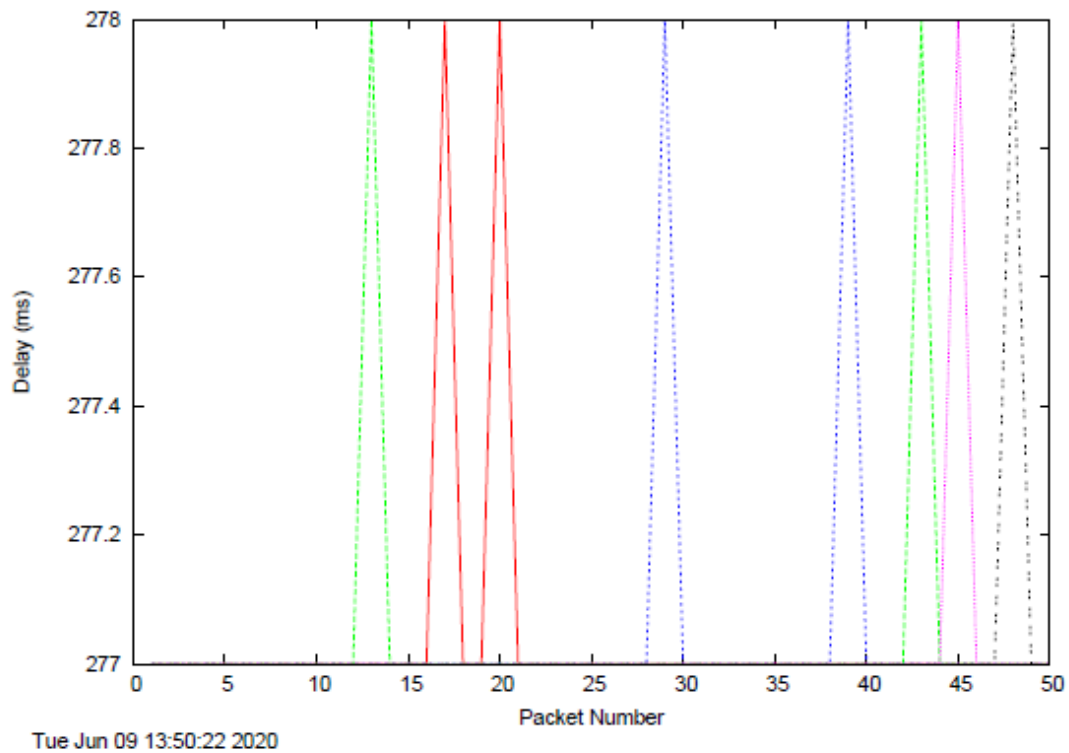
### (i) Graph for [www.uq.edu.au](http://www.uq.edu.au)



(ii) Graph for [www.dlsu.edu.ph](http://www.dlsu.edu.ph)



(iii) Graph for [www.tu-berlin.de](http://www.tu-berlin.de)



1.

Answer:

**Distance from UNSW to:**

(i)Brisbane: 734,280 m (ii)Manila: 6,265,900 m (iii)Berlin:16,084,000m

**Propagation speed  $3 \times 10^8$  m/s**

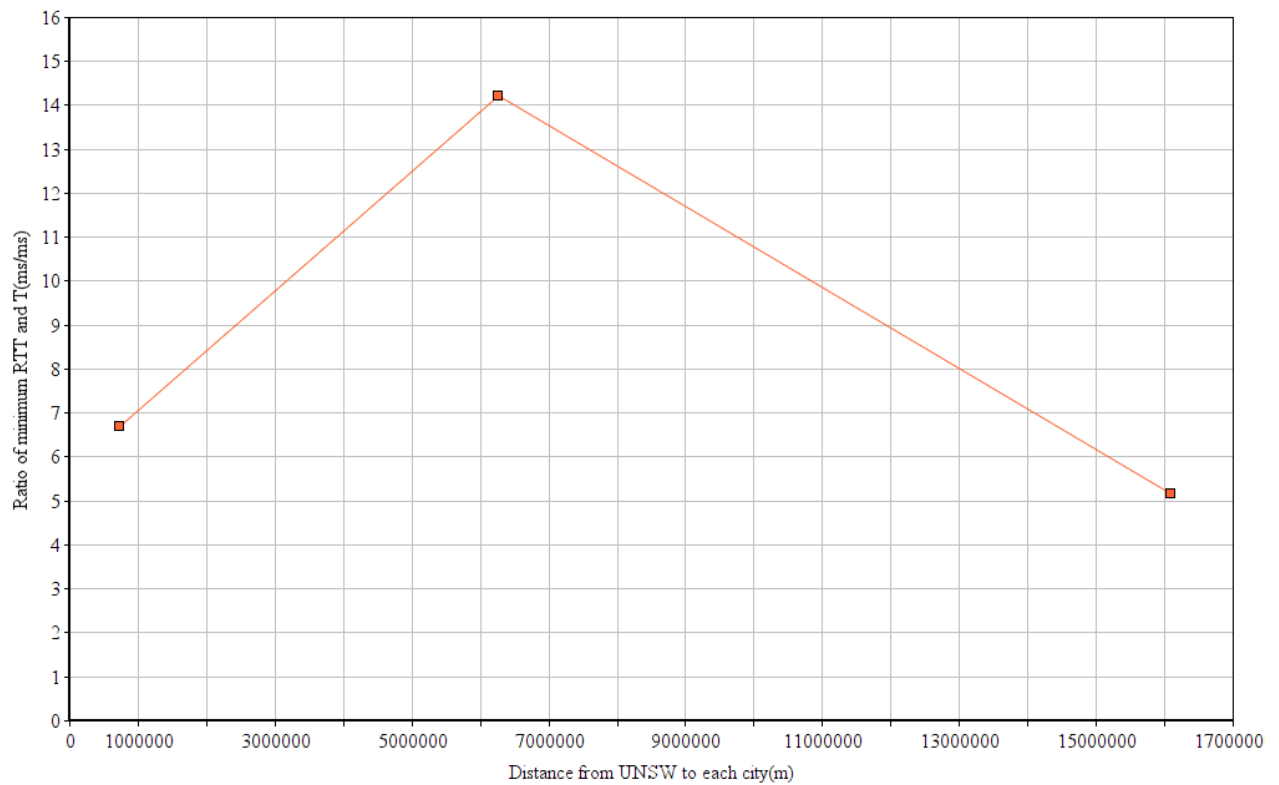
**T:** (i)2.45ms (ii)20.89ms (iii)53.61ms

**Minimum RTT: (from .txt file, I will include those .txt file in submission)**

(i)16.42ms (ii)297.159ms (iii)277.215ms

**Ratio:**

(i)6.7 (ii)14.22 (iii)5.171



- Can you think of at least two reasons why the y-axis values that you plot are greater than 2?
  - Queuing time at each router during the trip. For routers between UNSW and destination, there may be exist some busy routers, so the total queuing time need to be considered.

- Transmission time at each router is also one of the reasons. Each router between UNSW and destination have vary transmission time for the packet download+upload. The transmission time will affect the delay.
- Processing time at each router. Processing time is negligible, but it still affects the delay.

2.

Answer:

The delay is various over time. As the queuing time is one of the most important factors that affect delay. Some routers may be in the evening, and no busy in the morning, so it the packets arrive in the morning, queuing time will be faster.

So, delay vary over time.

3.

Answer:

---

```
z5163479@vx5:~/comp3331/lab1$ nslookup www.epfl.ch
Server: 129.94.242.45
Address: 129.94.242.45#53

Non-authoritative answer:
www.epfl.ch canonical name = www.epfl.ch.cdn.cloudflare.net.
Name: www.epfl.ch.cdn.cloudflare.net
Address: 104.20.228.42
Name: www.epfl.ch.cdn.cloudflare.net
Address: 104.20.229.42
Name: www.epfl.ch.cdn.cloudflare.net
Address: 172.67.2.106
```

[www.epfl.ch](http://www.epfl.ch) is hosted by 3 IP address that I found from 'nslookup'.

And they are all located in US, not in Switzerland (Check by 'whois')

4.

Answer:

**Depend on:**

Transmission delay – transmission delay is the amount of time required to push all the packet's bit into the wire, therefore larger packet need longer transmission time.

**Not Depend on:**

Processing delay – Processing delay is the amount of time that process packet's header, and the size of header is constant. So, the packet size won't affect this delay.

Propagation delay – Propagation delay only depend the distance between source and destination, and the propagation speed

Queueing delay – Queueing delay only depend the congestion level of router when the packets arrive.