COMP9331 – lab1

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Exercise 1: nslookup

1. Which is the IP address of the website www.koala.com.au? In your opinion, what is the reason of having several IP addresses as an output?

   Ans:

   Two IP address of www.koala.com.au :

   104.18.61.21 & 104.18.60.21

   Different IP means different location. In this case, this website owns two

   servers.

   For security and stability issue, several servers can ensure that service is stable while servers do not respond (e.g. backup).

2. Find out name of the IP address 127.0.0.1. What is special about this IP address?

   Ans:

   The name of 127.0.0.1 is localhost.

   127.0.0.1 is a lookback address of lookback adaptor connected to network chip in user's machine. For example, if I ran a web server on my PC listening to 127.0.0.1, then while I send the request from browser, it would go through the lookback adaptor to the server. Finally, the server would send the response back through lookback address 127.0.0.1.

   Reference: https://en.wikipedia.org/wiki/Loopback

Exercise 2: Use ping to test host reachability

If you observe that some hosts are not reachable, then can you explain why? Check if the addresses unreachable by the ping command are reachable from the Web browser.

Ans:

Host chart:

Host name	ping	Browser (safari)
www.unsw.edu.au	reachable	reachable
www.getfittest.com.au	unknown host	unreachable
www.mit.edu	reachable	reachable

www.intel.com.au	reachable	reachable
www.tpg.com.au	reachable	reachable
www.hola.hp	unknown host	unreachable
www.amazon.com	reachable	reachable
www.tsinghua.edu.cn	reachable	reachable
www.kremlin.ru	Request timeout	reachable
8.8.8.8	reachable	unreachable

1.Unknown Hosts case:

If the Domain Name System (DNS) configuration is OK and connected to the internet, it means that the destination hosts or servers cannot be resolved. It turns out that both ping and browser cannot reach the hosts.

2.Request timeout case:

Request timeout is caused by the firewall blocking from the hosts. In this case, ping request (packet of Internet Control Message Protocol ICMP) would be blocked by the firewall of host server or your local router (try to ping like www.google.com if it failed). It turns out that only browser can reach the host.

3. Case of 8.8.8.8:

8.8.8.8 is Google Public DNS and not a Web server. There is no web serve runing on 8.8.8.8 so that browser cannot access this IP.

Exercise 3: Use traceroute to understand network topology

1. Run traceroute on your machine to www.columbia.edu. How many routers are there between your workstation and www.columbia.edu ? How many routers along the path are part of the UNSW network? Between which two routers do packets cross the Pacific Ocean?
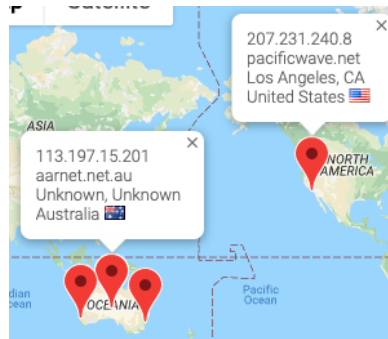
Ans:

```
z5219960@vx1:/tmp_amd/reed/export/reed/3/z5219960$ 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)  0.085 ms  0.061 ms  0.070 ms
 2  129.94.39.17 (129.94.39.17)  0.818 ms  0.842 ms  0.862 ms
 3  ombudnex1-vl-3154.gw.unsw.edu.au (149.171.253.35)  1.551 ms libudnex1-vl-3154.gw.unsw.edu.au (149.171.253.34)  1.213 ms ombudnex1-vl-3154.
gw.unsw.edu.au (149.171.253.35)  1.529 ms
 4  libcr1-po-5.gw.unsw.edu.au (149.171.255.165)  1.126 ms  1.068 ms ombcr1-po-6.gw.unsw.edu.au (149.171.255.169)  1.063 ms
 5  unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105)  1.177 ms  1.258 ms unswbr1-te-1-9.gw.unsw.edu.au (149.171.255.101)  1.157 ms
 6  138.44.5.0 (138.44.5.0)  1.804 ms  2.297 ms  2.248 ms
 7  et-1-3-0.pe1.sxt.bkvl.nsw.aarnet.net.au (113.197.15.149)  2.245 ms  2.177 ms  2.203 ms
 8  et-0-0-0.pe1.a.hnl.aarnet.net.au (113.197.15.99)  95.090 ms  94.969 ms  95.000 ms
 9  et-2-1-0.bdr1.a.sea.aarnet.net.au (113.197.15.201)  146.606 ms  146.543 ms  146.522 ms
10  abilene-1-lo-jmb-706.sttlwa.pacificwave.net (207.231.240.8)  146.663 ms  146.633 ms  146.580 ms
11  et-4-0-0.4079.rtsw.miss2.net.internet2.edu (162.252.70.0)  157.533 ms  157.201 ms  157.341 ms
12  et-4-0-0.4079.rtsw.minn.net.internet2.edu (162.252.70.58)  180.713 ms  180.809 ms  180.679 ms
13  et-1-1-5.4079.rtsw.eqch.net.internet2.edu (162.252.70.106)  188.627 ms  188.511 ms  188.442 ms
14  ae-0.4079.rtsw3.eqch.net.internet2.edu (162.252.70.163)  194.026 ms  188.822 ms  188.753 ms
15  ae-1.4079.rtsw.clev.net.internet2.edu (162.252.70.130)  197.083 ms  197.025 ms  196.992 ms
16  buf-9208-I2-CLEV.nysernet.net (199.109.11.33)  201.300 ms  203.780 ms  203.766 ms
17  syr-9208-buf-9208.nysernet.net (199.109.7.193)  204.616 ms  205.550 ms  205.499 ms
18  nyc111-9204-syr-9208.nysernet.net (199.109.7.94)  213.895 ms  214.299 ms  234.574 ms
19  nyc-9208-nyc111-9204.nysernet.net (199.109.7.165)  213.879 ms  214.085 ms  213.834 ms
20  columbia.nyc-9208.nysernet.net (199.109.4.14)  213.739 ms  213.939 ms  213.737 ms
21  cc-core-1-x-nyser32-gw-1.net.columbia.edu (128.59.255.5)  214.107 ms  214.052 ms  214.060 ms
22  cc-conc-1-x-cc-core-1.net.columbia.edu (128.59.255.21)  249.939 ms  247.816 ms  223.513 ms
23  caho.columbia.edu (128.59.105.24)  215.169 ms  214.038 ms  213.997 ms
```

There are 22 routers between my workstation and www.columbia.edu.

The first 5 routers are part of UNSW network (hostname includes unsw.edu.au).

Packet crossing Pacific Ocean from the 9th router (et-2-1-0.bdr1.a.sea.aarnet.net.au) and the 10th router(abilene-1-lo-jmb-706.sttlwa.pacificwave.net).

Reference: https://www.yougetsignal.com/tools/network-location/

2. Run traceroute from your machine to the following destinations: (i) www.ucla.edu (ii) www.u-tokyo.ac.jp and (iii) www.lancaster.ac.uk . At which router do the paths from your machine to these three destinations diverge? Find out further details about this router. Is the number of hops on each path proportional the physical distance?

Ans:

```
z5219960@vx1:/tmp_amd/reed/export/reed/3/z5219960$ 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)  0.105 ms  0.096 ms  0.079 ms
 2  129.94.39.17 (129.94.39.17)  0.847 ms  0.849 ms  0.840 ms
 3  libudnex1-vl-3154.gw.unsw.edu.au (149.171.253.34)  1.607 ms ombudnex1-vl-3154.gw.unsw.edu.au
(149.171.253.35)  1.478 ms  1.503 ms
 4  libcr1-po-6.gw.unsw.edu.au (149.171.255.201)  1.118 ms  1.126 ms  1.156 ms
 5  unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105)  1.132 ms  1.132 ms  1.151 ms
 6  138.44.5.0 (138.44.5.0)  1.400 ms  1.355 ms  1.354 ms
 7  et-1-3-0.pe1.sxt.bkvl.nsw.aarnet.net.au (113.197.15.149)  2.183 ms  2.200 ms  2.104 ms
 8  et-0-0-0.pe1.a.hnl.aarnet.net.au (113.197.15.99)  96.253 ms  96.338 ms  96.271 ms
 9  et-2-1-0.bdr1.a.sea.aarnet.net.au (113.197.15.201)  146.623 ms  146.587 ms  146.602 ms
10  cenichpr-1-is-jmb-778.snvaca.pacificwave.net (207.231.245.129)  163.584 ms  164.633 ms  163.
031 ms
11  hpr-lax-hpr3--svl-hpr3-100ge.cenic.net (137.164.25.73)  160.050 ms  160.070 ms  160.050 ms
12  * * *
13  bd11f1.anderson--cr00f2.csb1.ucla.net (169.232.4.4)  162.495 ms  160.446 ms  160.433 ms
14  cr00f1.anderson--dr00f2.csb1.ucla.net (169.232.4.55)  160.308 ms cr00f2.csb1--dr00f2.csb1.uc
la.net (169.232.4.53)  160.985 ms cr00f1.anderson--dr00f2.csb1.ucla.net (169.232.4.55)  160.446
ms
```

Traceroute to www.ucla.edu

```
z5219960@vx1:/tmp_amd/reed/export/reed/3/z5219960$ 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)  0.118 ms  0.110 ms  0.094 ms
 2  129.94.39.17 (129.94.39.17)  0.899 ms  0.904 ms  0.879 ms
 3  ombudnex1-vl-3154.gw.unsw.edu.au (149.171.253.35)  1.861 ms libudnex1-vl-3154.gw.unsw.edu.au (149.171.253.34)  1.463 ms ombudnex1-vl
-3154.gw.unsw.edu.au (149.171.253.35)  1.802 ms
 4  ombcr1-po-5.gw.unsw.edu.au (149.171.255.197)  62.726 ms ombcr1-po-6.gw.unsw.edu.au (149.171.255.169)  62.723 ms libcr1-po-5.gw.unsw.
edu.au (149.171.255.165)  1.111 ms
 5  unswbr1-te-1-9.gw.unsw.edu.au (149.171.255.101)  1.133 ms  1.159 ms  1.173 ms
 6  138.44.5.0 (138.44.5.0)  2.086 ms  1.604 ms  1.600 ms
 7  et-0-3-0.pe1.bkvl.nsw.aarnet.net.au (113.197.15.147)  1.743 ms  1.775 ms  1.765 ms
 8  ge-4_0_0.bb1.a.pao.aarnet.net.au (202.158.194.177)  156.265 ms  156.284 ms  156.290 ms
 9  paloalto0.iij.net (198.32.176.24)  157.508 ms  157.505 ms  157.523 ms
10  osk004bb01.IIJ.Net (58.138.88.189)  270.541 ms  270.543 ms osk004bb00.IIJ.Net (58.138.88.185)  287.956 ms
11  osk004ip57.IIJ.Net (58.138.106.162)  279.191 ms osk004ip57.IIJ.Net (58.138.106.166)  279.180 ms osk004ip57.IIJ.Net (58.138.106.162)
 279.099 ms
12  210.130.135.130 (210.130.135.130)  270.529 ms  279.491 ms  279.259 ms
13  124.83.228.58 (124.83.228.58)  288.107 ms  288.037 ms  288.018 ms
14  124.83.252.178 (124.83.252.178)  285.272 ms  276.617 ms  285.509 ms
15  158.205.134.26 (158.205.134.26)  285.210 ms  285.219 ms  293.940 ms
```
Traceroute to www.u-tokyo.ac.jp

```
z5219960@vx1:/tmp_amd/reed/export/reed/3/z5219960$ 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)  0.110 ms  0.085 ms  0.079 ms
 2  129.94.39.17 (129.94.39.17)  0.867 ms  0.825 ms  0.825 ms
 3  ombudnex1-vl-3154.gw.unsw.edu.au (149.171.253.35)  1.276 ms libudnex1-vl-3154.gw.unsw.edu.au (149.171.253.34)  1.362 ms  1.471 ms
 4  libcr1-po-5.gw.unsw.edu.au (149.171.255.165)  1.093 ms libcr1-po-6.gw.unsw.edu.au (149.171.255.201)  1.061 ms ombcr1-po-6.gw.unsw.edu.au (
149.171.255.169)  1.112 ms
 5  unswbr1-te-1-9.gw.unsw.edu.au (149.171.255.101)  15.607 ms  15.527 ms unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105)  15.538 ms
 6  138.44.5.0 (138.44.5.0)  1.251 ms  1.310 ms  1.391 ms
 7  et-2-0-5.bdr1.sing.sin.aarnet.net.au (113.197.15.233)  92.582 ms  92.840 ms  92.775 ms
 8  138.44.226.7 (138.44.226.7)  256.190 ms  256.086 ms  256.122 ms
 9  janet-gw.mx1.lon.uk.geant.net (62.40.124.198)  256.241 ms  256.244 ms  256.327 ms
10  ae29.londpg-sbr2.ja.net (146.97.33.2)  256.807 ms  256.807 ms  256.788 ms
11  ae31.erdiss-sbr2.ja.net (146.97.33.22)  261.120 ms  260.618 ms  260.580 ms
12  ae29.manckh-sbr2.ja.net (146.97.33.42)  263.306 ms  262.535 ms  262.445 ms
13  ae24.lanclu-rbr1.ja.net (146.97.38.58)  264.591 ms  264.664 ms  264.521 ms
14  lancaster-university.ja.net (194.81.46.2)  285.507 ms  285.497 ms  285.422 ms
15  is-border01.bfw01.rtr.lancs.ac.uk (148.88.253.202)  265.172 ms  265.160 ms  265.105 ms
16  bfw01.iss-servers.is-core01.rtr.lancs.ac.uk (148.88.250.98)  272.110 ms  268.388 ms  266.806 ms
17  * * *
18  www.lancs.ac.uk (148.88.65.80)  265.273 ms !X  265.233 ms !X  265.259 ms !X
```
Traceroute to www.lancaster.ac.uk

All of them have the same first two router IP and diverge from the 3rd router.

This is what I found for this IP address while using whois command:

```
role:          NSWUNIVERSITY Hostmaster
address:       University of New South Wales
address:       SYDNEY, NSW 2052
country:       AU
phone:         +61 2 9385 3333
fax-no:        +61 2 9385 1112
e-mail:        hostmaster@unsw.edu.au
admin-c:       NH302-AP
tech-c:        NH302-AP
nic-hdl:       NH302-AP
mnt-by:        MAINT-AU-NSWUNIVERSITY
last-modified: 2012-03-22T06:45:10Z
source:        APNIC
```

It seems like this router is the hostmaster of UNSW network.

It's responsible for managing domain name records within the Domain Name System or any individual computer.

The number of hops refer to number of intermediate routers which transport the data between source address and destination address. The number of hops can roughly measure the physical distance.

Reference: https://en.wikipedia.org/wiki/Hop_(networking)

3. Several servers distributed around the world provide a web interface from which you can perform a traceroute to any other host in the Internet. Here are two examples: (i) http://www.speedtest.com.sg/tr.php and (ii) https://www.telstra.net/cgi-bin/trace . Run traceroute from both these servers

towards your machine and in the reverse direction (i.e. from your machine to these servers). You may also try other traceroute servers from the list at www.traceroute.org . What are the IP addresses of the two servers that you have chosen. Does the reverse path go through the same routers as the forward 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?

Ans:

```
traceroute to 129.94.242.114 (129.94.242.114), 30 hops max, 60 byte packets
 1  ge2-8.r01.sin01.ne.com.sg (202.150.221.169)  0.140 ms  0.145 ms  0.176 ms
 2  10.15.62.210 (10.15.62.210)  0.234 ms  0.282 ms  0.303 ms
 3  aarnet.sgix.sg (103.16.102.67)  199.442 ms  199.459 ms  199.481 ms
 4  et-7-3-0.pe1.nsw.brwy.aarnet.net.au (113.197.15.232)  208.247 ms  208.146 ms  208.221 ms
 5  138.44.5.1 (138.44.5.1)  213.700 ms  213.641 ms  213.740 ms
 6  ombcr1-te-1-5.gw.unsw.edu.au (149.171.255.106)  208.236 ms  208.190 ms  208.219 ms
 7  ombudnex1-po-2.gw.unsw.edu.au (149.171.255.170)  213.967 ms  214.009 ms  214.077 ms
 8  ufw1-ae-1-3154.gw.unsw.edu.au (149.171.253.36)  208.859 ms  208.905 ms  208.960 ms
 9  129.94.39.23 (129.94.39.23)  200.523 ms  200.457 ms  200.509 ms
```

Traceroute from www.speedtest.com.sg to my IP

```
z5219960@vx1:/tmp_amd/reed/export/reed/3/z5219960$ 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)  0.112 ms  0.092 ms  0.064 ms
 2  129.94.39.17 (129.94.39.17)  0.804 ms  0.795 ms  0.827 ms
 3  libudnex1-vl-3154.gw.unsw.edu.au (149.171.253.34)  1.913 ms  1.863 ms  1.804 ms
 4  ombcr1-po-6.gw.unsw.edu.au (149.171.255.169)  17.601 ms libcr1-po-6.gw.unsw.edu.au (149.171.255.201)  28.211 ms ombcr1-po-6.gw.unsw.edu.au
(149.171.255.169)  17.568 ms
 5  unswbr1-te-1-9.gw.unsw.edu.au (149.171.255.101)  1.133 ms  1.125 ms unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105)  1.115 ms
 6  138.44.5.0 (138.44.5.0)  1.243 ms  1.265 ms  1.252 ms
 7  et-0-3-0.pe1.alxd.nsw.aarnet.net.au (113.197.15.153)  1.673 ms  1.752 ms  1.735 ms
 8  xe-0-2-7.bdr1.a.lax.aarnet.net.au (202.158.194.173)  147.575 ms  147.583 ms  147.583 ms
 9  singtel.as7473.any2ix.coresite.com (206.72.210.63)  147.613 ms  147.683 ms  177.598 ms
10  203.208.172.165 (203.208.172.165)  320.921 ms 203.208.172.153 (203.208.172.153)  325.343 ms 203.208.178.185 (203.208.178.185)  319.607 ms
11  203.208.153.121 (203.208.153.121)  235.136 ms 203.208.177.110 (203.208.177.110)  333.925 ms 203.208.171.85 (203.208.171.85)  242.451 ms
12  * * *
13  202-150-221-170.rev.ne.com.sg (202.150.221.170)  209.779 ms  212.286 ms 203.208.177.110 (203.208.177.110)  326.838 ms
z5219960@vx1:/tmp_amd/reed/export/reed/3/z5219960$
```

Traceroute from my IP to www.speedtest.com.sg

```
 1  gigabitethernet3-3.exi2.melbourne.telstra.net (203.50.77.53)  116.153 ms  0.454 ms  0.615 ms
 2  bundle-ether3-100.win-core10.melbourne.telstra.net (203.50.80.129)  1.860 ms  1.729 ms  2.117 ms
 3  bundle-ether12.ken-core10.sydney.telstra.net (203.50.11.122)  13.602 ms  11.848 ms  12.356 ms
 4  bundle-ether1.ken-edge901.sydney.telstra.net (203.50.11.95)  15.731 ms  13.348 ms  11.983 ms
 5  aarnet6.lnk.telstra.net (139.130.0.78)  11.605 ms  11.725 ms  11.610 ms
 6  xe-5-2-2.pe1.brwy.nsw.aarnet.net.au (113.197.15.32)  11.855 ms  11.847 ms  11.731 ms
 7  138.44.5.1 (138.44.5.1)  11.982 ms  11.975 ms  11.983 ms
 8  ombcr1-te-1-5.gw.unsw.edu.au (149.171.255.106)  11.980 ms  11.973 ms  11.983 ms
 9  ombudnex1-po-2.gw.unsw.edu.au (149.171.255.170)  12.360 ms  12.352 ms  12.226 ms
10  ufw1-ae-1-3154.gw.unsw.edu.au (149.171.253.36)  12.603 ms  12.602 ms  12.603 ms
11  129.94.39.23 (129.94.39.23)  12.856 ms  12.727 ms  12.857 ms
```

Traceroute from www.telstra.net to my IP

```
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)  0.113 ms  0.103 ms  0.094 ms
 2  129.94.39.17 (129.94.39.17)  40.472 ms  0.876 ms  0.881 ms
 3  ombudnex1-vl-3154.gw.unsw.edu.au (149.171.253.35)  1.396 ms libudnex1-vl-3154.gw.unsw.edu.au (149.171.253.34)  77.013 ms ombudnex1-vl-3154
.gw.unsw.edu.au (149.171.253.35)  1.380 ms
 4  libcr1-po-5.gw.unsw.edu.au (149.171.255.165)  1.107 ms  1.136 ms  60.699 ms
 5  unswbr1-te-1-9.gw.unsw.edu.au (149.171.255.101)  1.163 ms  1.153 ms unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105)  1.218 ms
 6  138.44.5.0 (138.44.5.0)  1.453 ms  60.576 ms  1.282 ms
 7  xe-0-0-0.bdr1.rsby.nsw.aarnet.net.au (113.197.15.33)  1.457 ms  60.517 ms  1.664 ms
 8  gigabitethernet3-11.ken37.sydney.telstra.net (139.130.0.77)  48.150 ms  76.041 ms  48.030 ms
 9  bundle-ether2.chw-edge901.sydney.telstra.net (203.50.11.103)  2.236 ms  3.407 ms bundle-ether13.ken-core10.sydney.telstra.net (203.50.11.9
4)  2.780 ms
10  bundle-ether10.win-core10.melbourne.telstra.net (203.50.11.123)  14.085 ms bundle-ether13.chw-core10.sydney.telstra.net (203.50.11.98)  22
.087 ms  21.358 ms
11  203.50.6.40 (203.50.6.40)  86.247 ms  86.180 ms bundle-ether8.exi-core10.melbourne.telstra.net (203.50.11.125)  13.104 ms
12  bundle-ether2.exi-ncprouter101.melbourne.telstra.net (203.50.11.209)  14.474 ms  14.356 ms  14.390 ms
13  www.telstra.net (203.50.5.178)  82.695 ms  33.171 ms  82.225 ms
```

Traceroute from my IP to www.telstra.net

```
 1  TPDB-3516.hinet.net (210.65.161.22) 0 msec 4 msec 0 msec
 2  TPDT-3012.hinet.net (220.128.2.146) 4 msec 4 msec 4 msec
 3  tpdt-3022.hinet.net (220.128.25.138) 0 msec 0 msec 0 msec
 4  r4103-s2.tp.hinet.net (220.128.2.13) 0 msec 4 msec
    r4103-s2.tp.hinet.net (220.128.2.109) 0 msec
 5  r4003-s2.tp.hinet.net (220.128.3.145) 4 msec 4 msec 0 msec
 6  ntt-hk-gw.hinet.net (211.72.233.93) 28 msec
    211-72-233-73.HINET-IP.hinet.net (211.72.233.73) 28 msec
    ntt-hk-gw.hinet.net (211.72.233.93) 24 msec
 7  ae-10.r24.tkokhk01.hk.bb.gin.ntt.net (129.250.6.93) 28 msec 28 msec 28 msec
 8  ae-6.r20.sngpsi07.sg.bb.gin.ntt.net (129.250.7.66) 64 msec 64 msec 60 msec
 9  ae-1.r01.sngpsi07.sg.bb.gin.ntt.net (129.250.3.100) 60 msec 64 msec 68 msec
10  ae-1.a01.sngpsi03.sg.bb.gin.ntt.net (129.250.7.83) 68 msec
    ae-2.a01.sngpsi03.sg.bb.gin.ntt.net (129.250.7.85) 64 msec
    ae-1.a01.sngpsi03.sg.bb.gin.ntt.net (129.250.7.83) 68 msec
11  xe-0-0-6-2.a01.sngpsi03.sg.ce.gin.ntt.net (116.51.27.146) 232 msec 236 msec 228 msec
12  et-7-3-0.pe1.nsw.brwy.aarnet.net.au (113.197.15.232) 232 msec 240 msec 240 msec
13  138.44.5.1 236 msec 236 msec 240 msec
14  libcr1-te-1-5.gw.unsw.edu.au (149.171.255.102) 228 msec 228 msec 228 msec
15  ombudnex1-po-1.gw.unsw.edu.au (149.171.255.202) 240 msec
    libudnex1-po-1.gw.unsw.edu.au (149.171.255.166) 236 msec
    ombudnex1-po-1.gw.unsw.edu.au (149.171.255.202) 236 msec
16  ufw1-ae-1-3154.gw.unsw.edu.au (149.171.253.36) 236 msec 236 msec 236 msec
17  129.94.39.23 228 msec 228 msec 228 msec
```

Traceroute from traceroute.hinet.net to my IP

```
traceroute to traceroute.hinet.net (203.69.42.196), 30 hops max, 60 byte packets
 1  cserouter1-server.cse.unsw.EDU.AU (129.94.242.251)  0.102 ms  0.072 ms  0.058 ms
 2  129.94.39.17 (129.94.39.17)  0.891 ms  0.806 ms  0.806 ms
 3  ombudnex1-vl-3154.gw.unsw.edu.au (149.171.253.35)  1.519 ms  1.373 ms libudnex1-vl-3154.gw.unsw.edu.au (149.171.253.34)  1.420 ms
 4  libcr1-po-6.gw.unsw.edu.au (149.171.255.201)  1.091 ms ombcr1-po-5.gw.unsw.edu.au (149.171.255.197)  1.383 ms libcr1-po-6.gw.unsw.edu.au (149.171.255.201)  1.378 ms
 5  unswbr1-te-1-9.gw.unsw.edu.au (149.171.255.101)  220.863 ms unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105)  220.912 ms  220.903 ms
 6  138.44.5.0 (138.44.5.0)  1.623 ms  1.274 ms  1.265 ms
 7  et-0-3-0.pe1.bkvl.nsw.aarnet.net.au (113.197.15.147)  1.772 ms  1.841 ms  1.717 ms
 8  ge-4_0_0.bb1.a.pao.aarnet.net.au (202.158.194.177)  174.663 ms  174.614 ms  174.612 ms
 9  pa-r11.hinet.net (198.32.176.195)  174.943 ms  174.877 ms  174.878 ms
10  r11-la.us.hinet.net (202.39.84.30)  174.920 ms  174.874 ms  174.902 ms
11  r4002-s2.tp.hinet.net (202.39.91.46)  317.807 ms  317.801 ms  317.881 ms
12  r4102-s2.tp.hinet.net (220.128.6.86)  313.994 ms r4102-s2.tp.hinet.net (220.128.6.82)  318.044 ms  317.993 ms
13  tpdt-3022.hinet.net (220.128.7.70)  228.954 ms tpdb-3021.hinet.net (220.128.13.94)  238.553 ms tpdt-3022.hinet.net (220.128.14.94)  238.980 ms
14  tpdt-3011.hinet.net (220.128.24.89)  236.660 ms chch-3032.hinet.net (220.128.19.181)  237.809 ms  237.795 ms
15  tchn-3011.hinet.net (220.128.16.25)  242.510 ms chch-3031.hinet.net (220.128.19.82)  233.119 ms tchn-3011.hinet.net (220.128.16.73)  237.398 ms
16  tcwh-3301.hinet.net (220.128.18.109)  231.094 ms  236.898 ms tcwh-3301.hinet.net (220.128.16.113)  238.866 ms
17  203-75-72-249.HINET-IP.hinet.net (203.75.72.249)  239.154 ms  239.319 ms  232.760 ms
```

Traceroute from my IP to traceroute.hinet.net

```
 1  211.76.96.254   0.329 ms   0.328 ms   0.303 ms
 2  211.76.96.166   0.345 ms   0.412 ms   0.419 ms
 3  210.176.136.13  1.374 ms   2.682 ms   1.313 ms
 4  202.84.225.146  3.117 ms   3.974 ms   3.981 ms
 5  202.84.138.73   16.467 ms  17.332 ms  17.383 ms
 6  202.84.140.93   46.261 ms  45.618 ms  45.368 ms
 7  202.84.244.41   44.904 ms  45.044 ms  45.030 ms
 8  202.147.33.174  211.375 ms  211.399 ms  211.289 ms
 9  113.197.15.232  218.201 ms  218.250 ms  218.277 ms
10  138.44.5.1      220.693 ms  220.577 ms  255.658 ms
11  149.171.255.106  221.780 ms  221.673 ms  221.716 ms
12  149.171.255.170  218.831 ms  218.906 ms  218.700 ms
13  149.171.253.36  231.978 ms  232.034 ms  231.926 ms
14  129.94.39.23    231.791 ms  231.828 ms  231.748 ms
```

Traceroute from sla.ebix.net.tw to my IP

```
traceroute to sla.ebix.net.tw (211.76.96.235), 30 hops max, 60 byte packets
 1  cserouter1-server.cse.unsw.EDU.AU (129.94.242.251)  0.134 ms  0.108 ms  0.087 ms
 2  129.94.39.17 (129.94.39.17)  0.861 ms  0.871 ms  0.824 ms
 3  libudnex1-vl-3154.gw.unsw.edu.au (149.171.253.34)  1.358 ms ombudnex1-vl-3154.gw.unsw.edu.au (149.171.253.35)  1.455 ms  1.453 ms
 4  libcr1-po-5.gw.unsw.edu.au (149.171.255.165)  1.132 ms ombcr1-po-5.gw.unsw.edu.au (149.171.255.197)  1.078 ms libcr1-po-5.gw.unsw.edu.au (149.171.255.165)  1.109 ms
 5  unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.165)  1.141 ms  1.130 ms  1.138 ms
 6  138.44.5.0 (138.44.5.0)  1.229 ms  1.264 ms  1.207 ms
 7  et-0-3-0.pe1.bkvl.nsw.aarnet.net.au (113.197.15.147)  1.791 ms  1.800 ms  1.788 ms
 8  ge-4_0_0.bb1.a.pao.aarnet.net.au (202.158.194.177)  174.624 ms  174.683 ms  174.655 ms
 9  public-peering-twgate.net (198.32.176.160)  174.610 ms  174.649 ms  174.593 ms
10  5-60-41-175.TWGATE-IP.twgate.net (175.41.60.5)  301.630 ms 229-60-41-175.TWGATE-IP.twgate.net (175.41.60.229)  311.614 ms  300.815 ms
11  203.78.181.134 (203.78.181.134)  300.873 ms  300.837 ms  313.987 ms
12  46-58-41-175.TWGATE-IP.twgate.net (175.41.58.46)  236.406 ms  225.654 ms  226.135 ms
```

Traceroute from my IP to sla.ebix.net.tw

I chose two hosts from Taiwan, traceroute.hinet.net (203.69.42.196) and sla.ebix.net.tw (211.76.96.235).

For case of traceroute.hinet.net:

> traceroute from traceroute.hinet.net goes through Taiwan, Hong Kong, Singapore and then Australia. In reverse case, it goes through United States and then Taiwan.

For case of sla.ebix.net.tw:

> Forward path goes through Taiwan – Hong Kong – Japan – Australia

> Reverse path goes through Australia – United States – Taiwan.

Obviously, the reverse path does not go through the same routers as the forward path.

It is obvious that the same routers come up with different IP address while using traceroute. Load Balance of router allows host server containing multiple IP addresses with the same hostname for providing reliable access of web service.

Reference: https://en.wikipedia.org/wiki/Network_Load_Balancing

Exercise 4: Use ping to gain insights into network performance

1. For each of these locations find the (approximate) physical distance from UNSW using Google Maps and compute the shortest possible time T for a packet to reach that location from UNSW. You should assume that the packet moves (i.e. propagates) at the speed of light, $3 \times 10\ 8$ m/s. Note that the shortest possible time will simply be the distance divided by the propagation speed. Plot a graph where the x-axis represents the distance to each city (i.e. Brisbane, Manila and Berlin), and the y-axis represents the ratio between the minimum delay (i.e. RTT) as measured by the ping program (select the values for 50 byte packets) and the shortest possible time T to reach that city from UNSW. (Note that the y-values are no smaller than 2 since it takes at least 2*T time for any packet to reach the destination from UNSW and get back).

Can you think of at least two reasons why the y-axis values that you plot are greater than 2?
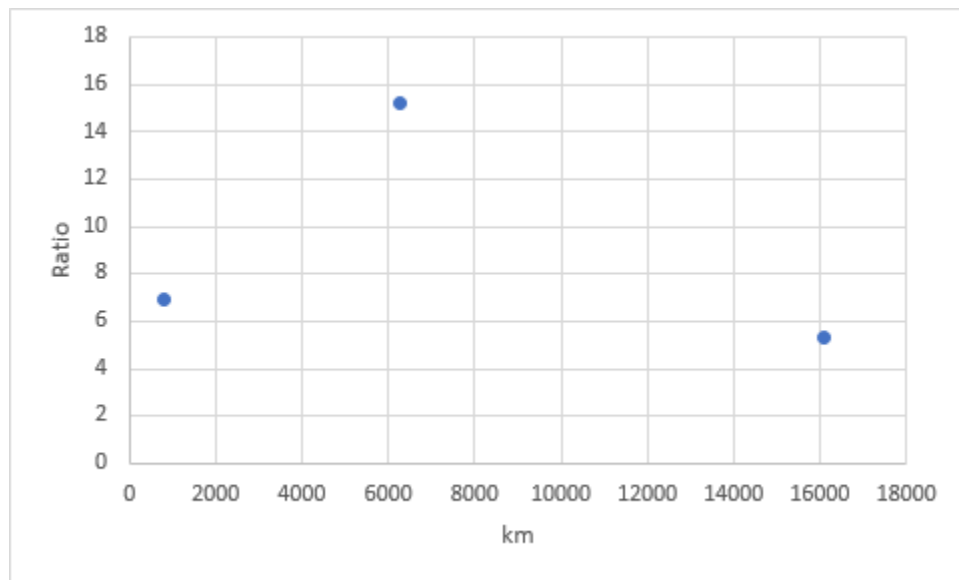
Ans:

Shortest possible time T:

UNSW – UQ: 797.5 km / (3*10^8) = 2.66ms

UNSW – DLSU: 6270.5km / (3*10^8) = 20.9ms

UNSW – TU Berlin: 16104.9km / (3*10^8) = 53.6ms

Ratio is always greater than 2 because:

1.There are some delays might occur like processing, queuing, transmission and propagation.

2.Transporting message through routers and wires does not go in shortest distance. It always goes extra distance for transporting message in the real world.

2. Is the delay to the destinations constant or does it vary over time? Explain why.

Ans:

It changes over time. When the router suddenly receiving massive packet, the queuing delay might affect the delay time to destination.

3. Explore where the website for www.epfl.ch is hosted. Is it in Switzerland?

    Ans:

      The nearest host of www.epfl.ch located in United States while using ping function calling from Australia. Because DNS would send back the resolution for nearest host server.

      But if we use whois command to get the information of www.epfl.ch, we would see that the registered host is in Switzerland.

```
refer:          whois.nic.ch

domain:         CH

organisation: SWITCH The Swiss Education & Research Network
address:        Werdstrasse 2
address:        Zurich   CH-8021
address:        Switzerland

contact:        administrative
name:           SWITCH TLD Administration
organisation: SWITCH The Swiss Education & Research Network
address:        Werdstrasse 2
address:        Zurich   CH-8021
address:        Switzerland
phone:          +41 44 268 15 40
fax-no:         +41 44 268 15 78
e-mail:         tld-admin@switch.ch
```

4. The measured delay (i.e., the delay you can see in the graphs) is composed of propagation delay, transmission delay, processing delay and queuing delay. Which of these delays depend on the packet size and which do not?
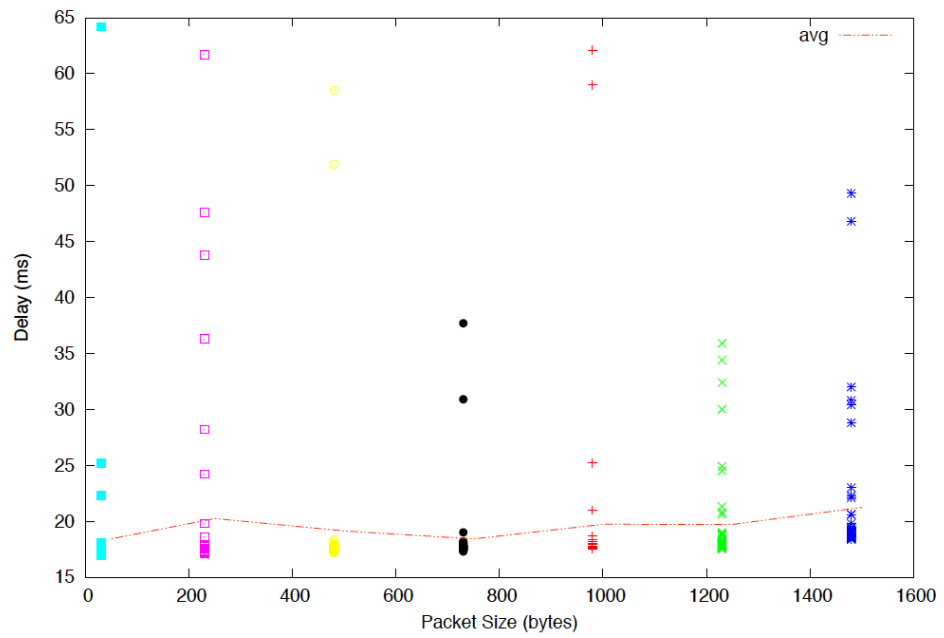
    Ans:

      Transmission and processing – packet size dependent

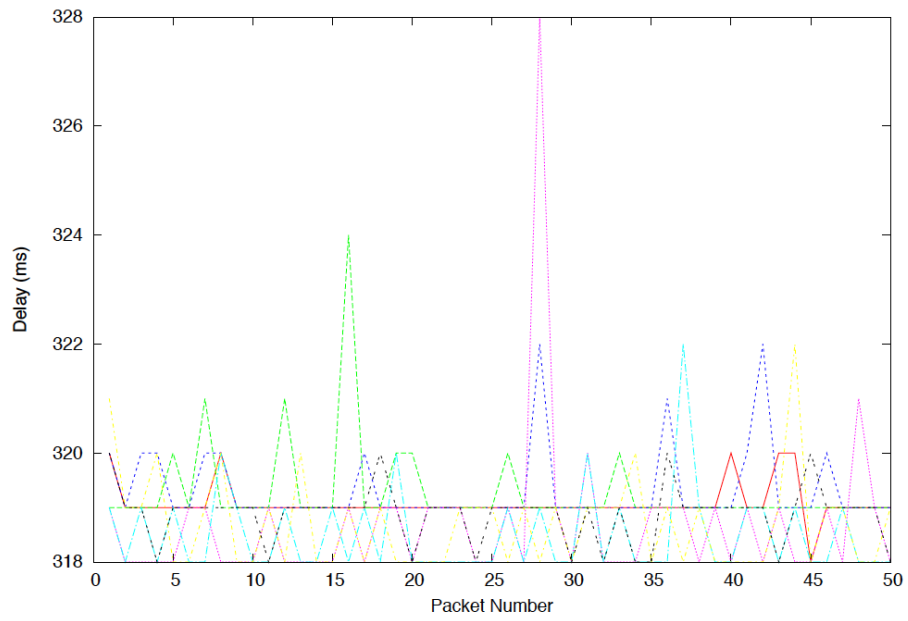   Queuing and propagation – packet size independent
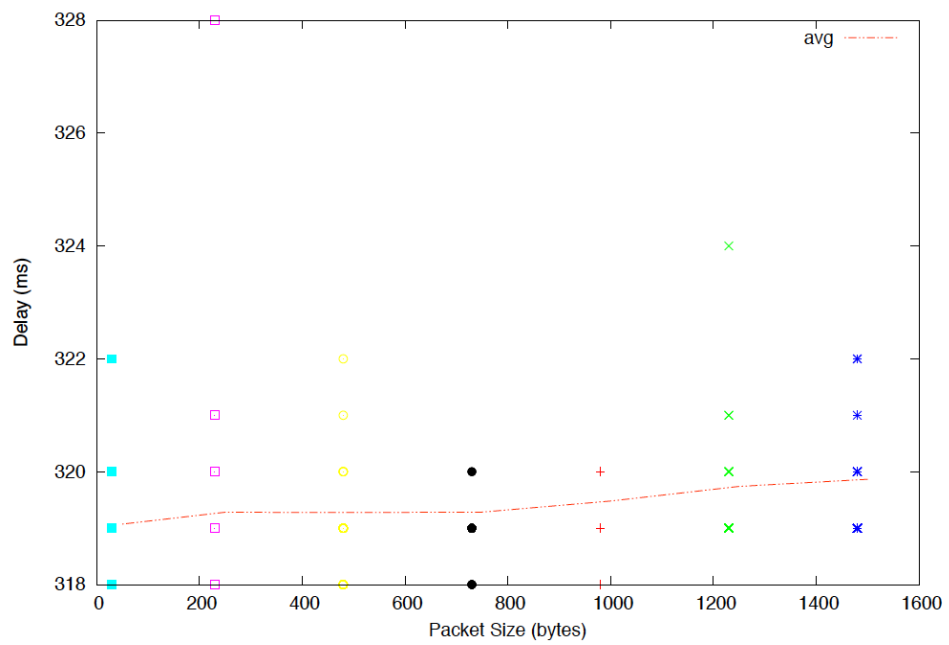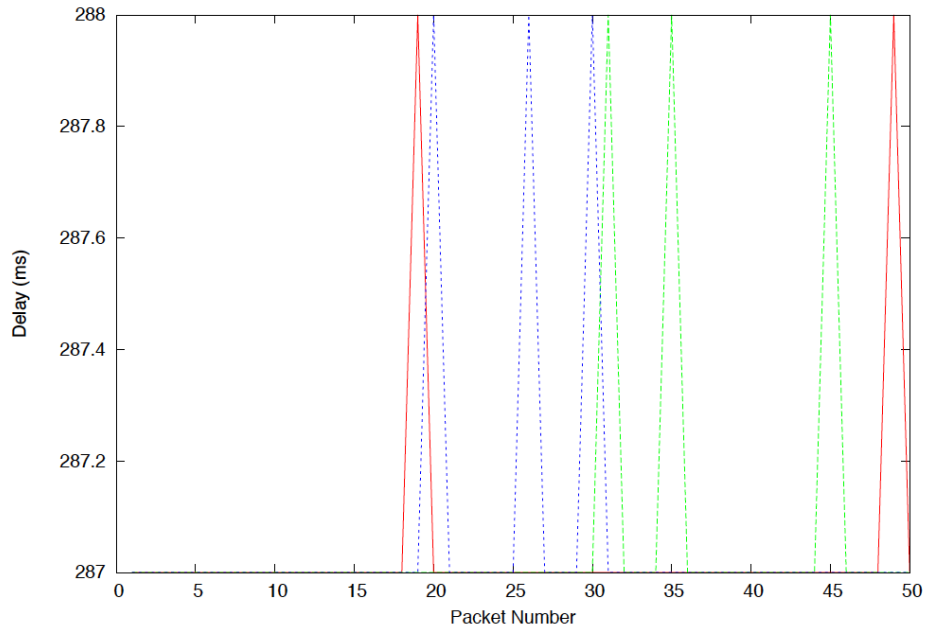
    Graphs:
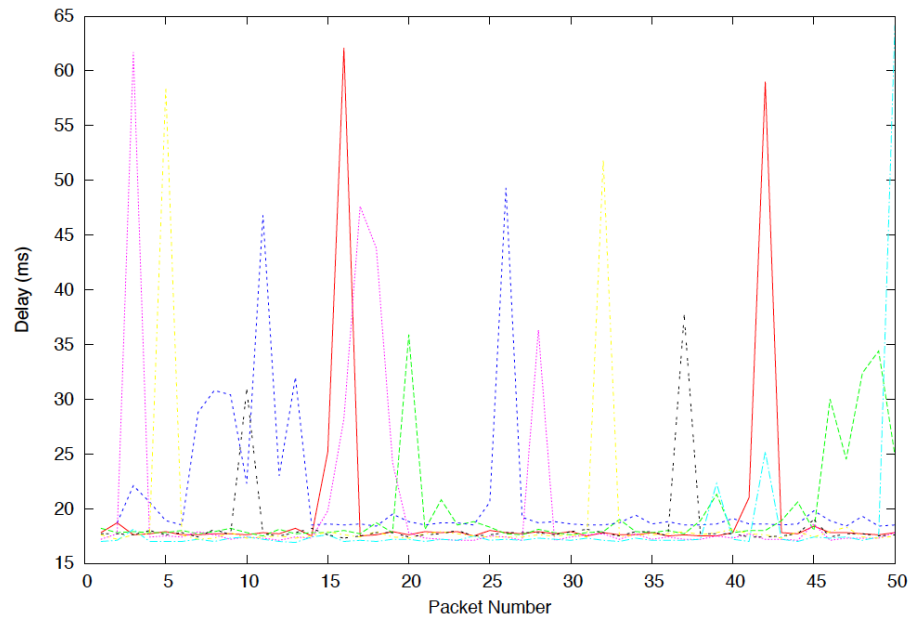
www.uq.edu.au_delay

www.uq.edu.au_scatter

www.dlsu.edu.ph_delay

www.dlsu.edu.ph_scatter

www.tu-berlin.de_delay

www.tu-berlin.de_scatter