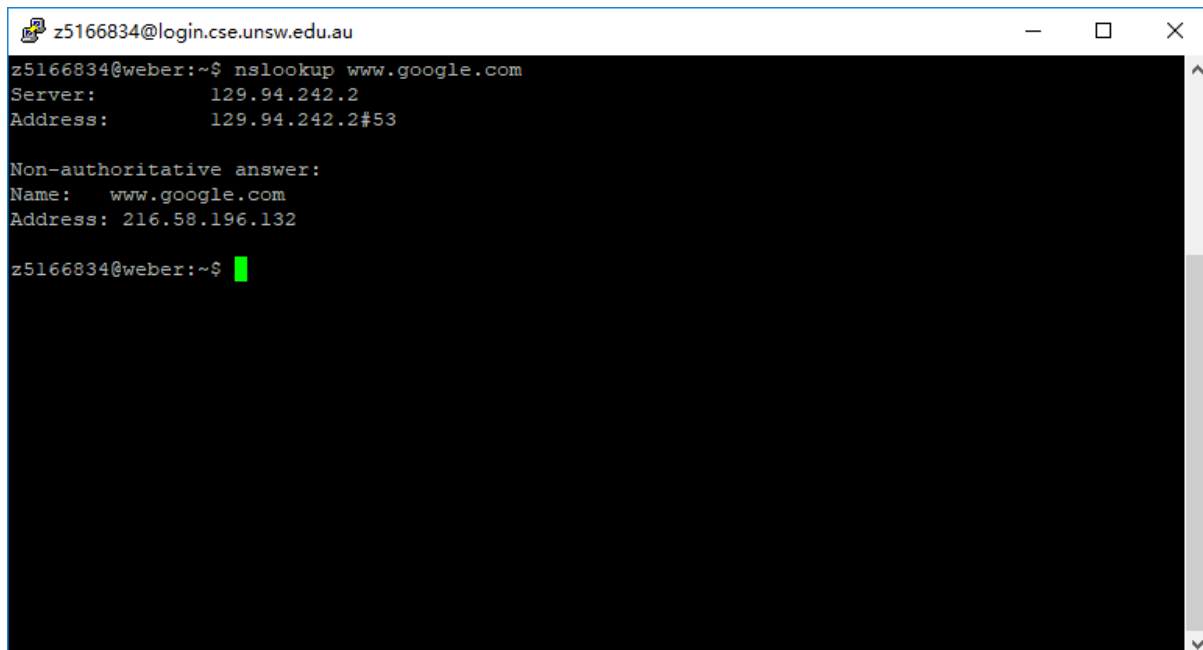


## Exercise 1:

### Q1.

A terminal window titled 'z5166834@login.cse.unsw.edu.au' with standard window controls. The prompt is 'z5166834@weber:~\$'. The command 'nslookup www.google.com' has been executed. The output shows the server as 129.94.242.2 and the address as 129.94.242.2#53. Below this, a 'Non-authoritative answer:' section shows the name as 'www.google.com' and the address as '216.58.196.132'. The prompt returns to 'z5166834@weber:~\$' with a green cursor.

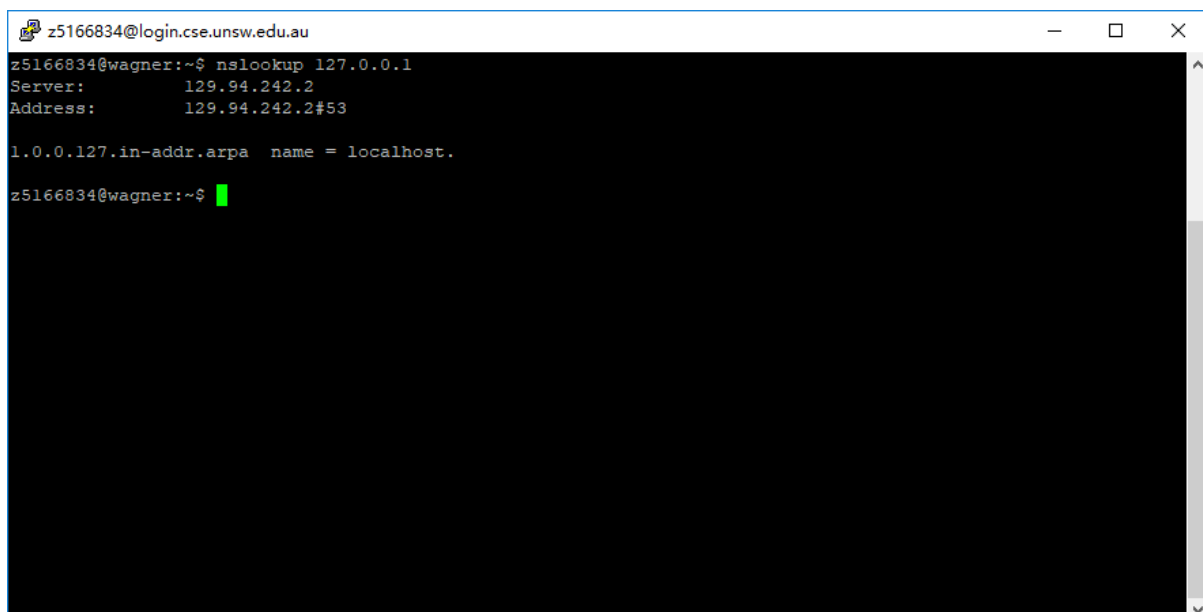
```
z5166834@login.cse.unsw.edu.au
z5166834@weber:~$ nslookup www.google.com
Server:      129.94.242.2
Address:     129.94.242.2#53

Non-authoritative answer:
Name:   www.google.com
Address: 216.58.196.132

z5166834@weber:~$
```

I only get one result when I try to get the corresponding IP address of [www.google.com](http://www.google.com), which is **216.58.196.132**. As to the reason of having several IP addresses, I think this is the result of load distribution, that many websites are replicated over many different servers, and these servers are running on different end systems which have their own IP address. A set of IP addresses has their corresponding canonical hostname. The DNS server will respond to DNS client's request with the whole set of IP addresses but choose one for the client to connect to.

### Q2.

A terminal window titled 'z5166834@login.cse.unsw.edu.au' with standard window controls. The prompt is 'z5166834@wagner:~\$'. The command 'nslookup 127.0.0.1' has been executed. The output shows the server as 129.94.242.2 and the address as 129.94.242.2#53. Below this, it shows '1.0.0.127.in-addr.arpa name = localhost.'. The prompt returns to 'z5166834@wagner:~\$' with a green cursor.

```
z5166834@login.cse.unsw.edu.au
z5166834@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.

z5166834@wagner:~$
```

'localhost' represents the internal interface of the machine which sends a packet to itself. 'localhost' is the name that is used by TCP/IP to refer to the local machine, it

means TCP/IP will not send message through the network but send to itself when seeing 'localhost'. The IP address of every PC stays the same, which is 127.0.0.1.

#### Exercise 2:

# ping [www.cse.unsw.edu.au](http://www.cse.unsw.edu.au)

It is reachable by using ping.

# ping [www.getfittest.com.au](http://www.getfittest.com.au)

Unknown host [www.getfittest.com.au](http://www.getfittest.com.au), it is not reachable. It may be because the host name does not even exist, and it cannot be accessed from the Web browser.

# ping [www.mit.edu](http://www.mit.edu)

It is reachable by using ping.

# ping [www.intel.com.au](http://www.intel.com.au)

It is reachable by using ping.

# ping [www.tgp.com.au](http://www.tgp.com.au)

It is reachable by using ping.

# ping [www.hola.hp](http://www.hola.hp)

It is not reachable, and it cannot be accessed by the Web browser.

# ping [www.amazon.com](http://www.amazon.com)

It is reachable by using ping.

# [www.tsinghua.edu.au](http://www.tsinghua.edu.au)

It is reachable by using ping.

# ping [www.kremlin.ru](http://www.kremlin.ru)

It is not reachable, but it can be accessed by the Web browser. It may be because the host refuses to respond to ping command, or this machine does not support ICMP protocol that is used by ping.

# ping 8.8.8.8

It is reachable by using ping.

### Exercise 3:

#### Q1.

```
z5166834@login.cse.unsw.edu.au
z5166834@weber:~$ 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)  0.223 ms  0.207 ms  0.193 ms
 2 129.94.39.17 (129.94.39.17)  1.136 ms  1.113 ms  1.097 ms
 3 ombudnexpl-v1-3154.gw.unsw.edu.au (149.171.253.35)  2.222 ms libudnexpl-v1-3154.gw.unsw.edu.au (149.171.253.34)  1.659 ms ombud
nexpl-v1-3154.gw.unsw.edu.au (149.171.253.35)  1.733 ms
 4 ombcrl-po-5.gw.unsw.edu.au (149.171.255.197)  1.323 ms ombcrl-po-6.gw.unsw.edu.au (149.171.255.169)  1.338 ms  1.404 ms
 5 unswbr1-te-1-9.gw.unsw.edu.au (149.171.255.101)  1.371 ms  1.422 ms unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105)  1.451 m
s
 6 138.44.5.0 (138.44.5.0)  1.639 ms  1.567 ms  1.550 ms
 7 et-1-3-0.pel.sxt.bkvl.nsw.aarnet.net.au (113.197.15.149)  2.305 ms  2.439 ms  2.570 ms
 8 et-0-0-0.pel.a.hnl.aarnet.net.au (113.197.15.99)  95.408 ms  95.366 ms  95.386 ms
 9 et-2-1-0.bdl.a.sea.aarnet.net.au (113.197.15.201)  146.390 ms  146.433 ms  146.438 ms
10 abilene-1-lo-jmb-706.sttlwa.pacificwave.net (207.231.240.8)  146.715 ms  146.738 ms  146.724 ms
11 et-4-0-0.4079.rtsw.miss2.net.internet2.edu (162.252.70.0)  157.385 ms  157.521 ms  157.430 ms
12 et-4-0-0.4079.rtsw.minn.net.internet2.edu (162.252.70.58)  180.502 ms  180.597 ms  180.477 ms
13 et-1-1-2.4079.rtsw.eqch.net.internet2.edu (162.252.70.106)  193.742 ms  188.482 ms  188.319 ms
14 ae-1.4079.rtsw.clev.net.internet2.edu (162.252.70.130)  196.845 ms  196.917 ms  196.884 ms
15 buf-9208-I2-CLEV.nysernet.net (199.109.11.33)  201.355 ms  201.341 ms  201.294 ms
16 syr-9208-buf-9208.nysernet.net (199.109.7.193)  205.240 ms  205.034 ms  205.554 ms
17 nyc-9208-syr-9208.nysernet.net (199.109.7.162)  210.307 ms  210.427 ms  210.398 ms
18 columbia.nyc-9208.nysernet.net (199.109.4.14)  210.267 ms  210.344 ms  210.333 ms
19 cc-core-1-x-nyser32-gw-1.net.columbia.edu (128.59.255.5)  210.599 ms  210.735 ms  211.255 ms
20 cc-conc-1-x-cc-core-1.net.columbia.edu (128.59.255.210)  210.948 ms  210.907 ms  210.894 ms
21 admissions.columbia.edu (128.59.105.24)  210.705 ms  210.810 ms  210.620 ms
z5166834@weber:~$
```

I did this on my own laptop using ssh, because I do not know how to take a screenshot on CSE machine, the results may be slightly different.

As it is shown above, there are 21 routers between my workstation and [www.columbia.edu](http://www.columbia.edu).

As we can see there are 5 routers contain the string 'unsw' and the sixth 138.44.5.0 belongs to Australian Academic and Research Network. So there are 5 routers are part of UNSW network.

The RRTs from my station to the 7<sup>th</sup> router are around 2ms, whereas the RRTs from my station to the 8<sup>th</sup> router are about 95ms, there is huge difference in these RRTs. Thus, packets between these two routers cross the Pacific Ocean. It takes more time for traceroute responses to get to my workstation when the packets cross the Pacific Ocean.

## Q2.

### Traceroute result from my machine to www.ucla.edu

```
z5166834@weber:~$ 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) 0.183 ms 0.178 ms 0.169 ms
 2 129.94.39.17 (129.94.39.17) 1.082 ms 1.120 ms 1.074 ms
 3 libudnexpl-vl-3154.gw.unsw.edu.au (149.171.253.34) 1.840 ms 1.821 ms ombudnexpl-vl-3154.gw.unsw.edu.au (149.171.253.35) 1.625 ms
 4 ombcrl-po-6.gw.unsw.edu.au (149.171.255.169) 1.356 ms ombcrl-po-5.gw.unsw.edu.au (149.171.255.197) 1.390 ms 1.351 ms
 5 unswbr1-te-1-9.gw.unsw.edu.au (149.171.255.101) 1.405 ms unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105) 1.550 ms 1.434 ms
 6 138.44.5.0 (138.44.5.0) 1.620 ms 1.472 ms 1.564 ms
 7 et-1-3-0.pel.sxt.bkvl.nsw.aarnet.net.au (113.197.15.149) 2.294 ms 2.171 ms 2.175 ms
 8 et-0-0-0.pel.a.hnl.aarnet.net.au (113.197.15.99) 95.316 ms 95.097 ms 95.109 ms
 9 et-2-1-0.bdr1.a.sea.aarnet.net.au (113.197.15.201) 149.247 ms 149.225 ms 149.192 ms
10 cenichpr-1-is-jmb-778.snvac.pacificwave.net (207.231.245.129) 163.023 ms 162.991 ms 162.964 ms
11 hpr-lax-hpr3--sv1-hpr3-100ge.cenic.net (137.164.25.73) 170.757 ms 170.739 ms 170.660 ms
12 * * *
13 bdlifl.anderson--cr001.anderson.ucla.net (169.232.4.6) 171.148 ms bdlifl.anderson--cr00f2.csbl.ucla.net (169.232.4.4) 171.721 ms 171.686 ms
14 cr00f2.csbl--dr00f2.csbl.ucla.net (169.232.4.53) 171.445 ms cr00f1.anderson--dr00f2.csbl.ucla.net (169.232.4.55) 171.308 ms 171.305 ms
15 * * *
16 * * *
17 * * *
18 * * *
19 * * *
20 * * *
21 * * *
22 * * *
23 * * *
24 * * *
25 * * *
26 * * *
27 * * *
28 * * *
29 * * *
30 * * *
```

### Traceroute result from my machine to www.u-tokyo.ac.jp

```
z5166834@weber:~$ 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) 0.146 ms 0.125 ms 0.109 ms
 2 129.94.39.17 (129.94.39.17) 1.106 ms 1.111 ms 1.097 ms
 3 ombudnexpl-vl-3154.gw.unsw.edu.au (149.171.253.35) 2.062 ms 1.951 ms 2.058 ms
 4 ombcrl-po-6.gw.unsw.edu.au (149.171.255.169) 1.336 ms ombcrl-po-5.gw.unsw.edu.au (149.171.255.197) 1.358 ms ombcrl-po-6.gw.unsw.edu.au (149.171.255.169) 1.332 ms
 5 unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105) 1.452 ms unswbr1-te-1-9.gw.unsw.edu.au (149.171.255.101) 1.503 ms 1.499 ms
 6 138.44.5.0 (138.44.5.0) 1.736 ms 1.641 ms 1.627 ms
 7 et-0-3-0.pel.bkvl.nsw.aarnet.net.au (113.197.15.147) 1.907 ms 1.984 ms 2.002 ms
 8 ge-4_0_0.bbl.a.pao.aarnet.net.au (202.158.194.177) 156.278 ms 156.247 ms 156.196 ms
 9 palcal500.iij.net (198.32.176.24) 158.032 ms 158.106 ms 158.162 ms
10 osk004hb00.iij.net (58.138.88.185) 288.884 ms osk004hb01.iij.net (58.138.88.189) 271.233 ms 271.326 ms
11 osk004xsl.iij.net (58.138.106.130) 270.894 ms 270.905 ms 270.938 ms
12 210.130.135.130 (210.130.135.130) 279.882 ms 279.808 ms 271.356 ms
13 124.83.228.78 (124.83.228.78) 279.714 ms 279.775 ms 288.606 ms
14 124.83.252.250 (124.83.252.250) 277.507 ms 286.304 ms 277.490 ms
15 158.205.134.26 (158.205.134.26) 277.500 ms 286.323 ms 290.701 ms
16 * * *
17 * * *
18 * * *
19 * * *
20 * * *
21 * * *
22 * * *
23 * * *
24 * * *
25 * * *
26 * * *
27 * * *
28 * * *
29 * * *
30 * * *
```

### Traceroute result from my machine to www.lancaster.ac.uk

```
z5166834@weber:~$ 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) 0.146 ms 0.132 ms 0.121 ms
 2 129.94.39.17 (129.94.39.17) 1.043 ms 1.065 ms 1.036 ms
 3 ombudnexpl-vl-3154.gw.unsw.edu.au (149.171.253.35) 1.491 ms 2.128 ms 2.094 ms
 4 libcrl-po-6.gw.unsw.edu.au (149.171.255.201) 1.391 ms 1.348 ms 1.385 ms
 5 unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105) 1.437 ms unswbr1-te-1-9.gw.unsw.edu.au (149.171.255.101) 1.392 ms 1.439 ms
 6 138.44.5.0 (138.44.5.0) 1.532 ms 1.472 ms 1.479 ms
 7 et-1-3-0.pel.sxt.bkvl.nsw.aarnet.net.au (113.197.15.149) 2.244 ms 2.358 ms 2.316 ms
 8 et-0-0-0.pel.a.hnl.aarnet.net.au (113.197.15.99) 95.277 ms 95.321 ms 95.345 ms
 9 et-2-1-0.bdr1.a.sea.aarnet.net.au (113.197.15.201) 146.504 ms 146.509 ms 146.497 ms
10 abilene-1-lo-jmb-706.sttlwa.pacificwave.net (207.231.240.8) 146.673 ms 146.846 ms 146.650 ms
11 et-4-0-0.4079.rtsw.miss2.net.internet2.edu (162.252.70.0) 157.376 ms 157.423 ms 157.210 ms
12 et-4-0-0.4079.rtsw.minn.net.internet2.edu (162.252.70.58) 180.831 ms 180.919 ms 180.772 ms
13 et-1-1-2.4079.rtsw.eqch.net.internet2.edu (162.252.70.106) 189.937 ms 188.547 ms 188.447 ms
14 ae-1.4079.rtsw.clev.net.internet2.edu (162.252.70.130) 197.644 ms 197.262 ms 197.199 ms
15 et-2-0-0.4079.rtsw.ashb.net.internet2.edu (162.252.70.54) 204.788 ms 204.817 ms 204.679 ms
16 ae-2.4079.rtsw.wash.net.internet2.edu (162.252.70.136) 205.195 ms 212.064 ms 205.423 ms
17 internet2.mx1.lon.uk.geant.net (62.40.124.44) 279.576 ms 279.547 ms 279.578 ms
18 janet-gw.mx1.lon.uk.geant.net (62.40.124.198) 279.625 ms 279.890 ms 279.701 ms
19 ae29.londpg-sbr2.ja.net (146.97.33.2) 280.021 ms 280.109 ms 284.891 ms
20 ae31.erdisg-sbr2.ja.net (146.97.33.22) 283.909 ms 284.070 ms 284.043 ms
21 ae29.manckh-sbr2.ja.net (146.97.33.42) 285.766 ms 285.737 ms 285.828 ms
22 ae24.lancu-rbx1.ja.net (146.97.38.58) 288.103 ms 288.147 ms 288.057 ms
23 lancaster-university.ja.net (194.81.46.2) 288.514 ms * *
24 ismx-issrx.rtr.lancs.ac.uk (148.88.255.17) 290.225 ms 289.997 ms 289.835 ms
25 dc.iss.srv.rtrcloud.lancs.ac.uk (148.88.253.3) 302.973 ms 302.040 ms 295.209 ms
26 www.lancs.ac.uk (148.88.65.80) 289.875 ms !X 289.940 ms !X 289.857 ms !X
z5166834@weber:~$
```

These paths diverge from the 7<sup>th</sup> router, the 6<sup>th</sup> router along these paths is the same,

which is 138.44.5.0.

The following is detailed information of the 6<sup>th</sup> router(138.44.5.0).

```
z5166834@login.cse.unsw.edu.au
weber % whois 138.44.5.0

#
# ARIN WHOIS data and services are subject to the Terms of Use
# available at: https://www.arin.net/whois_tou.html
#
# If you see inaccuracies in the results, please report at
# https://www.arin.net/resources/whois_reporting/index.html
#
# Copyright 1997-2018, American Registry for Internet Numbers, Ltd.
#

NetRange:      138.44.0.0 - 138.44.255.255
CIDR:          138.44.0.0/16
NetName:       APNIC-ERX-138-44-0-0
NetHandle:     NET-138-44-0-0-1
Parent:        NET138 (NET-138-0-0-0-0)
NetType:       Early Registrations, Transferred to APNIC
OriginAS:
Organization:  Asia Pacific Network Information Centre (APNIC)
RegDate:       2003-12-11
Updated:       2009-10-08
Comment:       This IP address range is not registered in the ARIN database.
Comment:       This range was transferred to the APNIC Whois Database as
Comment:       part of the ERX (Early Registration Transfer) project.
Comment:       For details, refer to the APNIC Whois Database via
Comment:       WHOIS.APNIC.NET or http://wq.apnic.net/apnic-bin/whois.pl
Comment:
Comment:       ** IMPORTANT NOTE: APNIC is the Regional Internet Registry
Comment:       for the Asia Pacific region. APNIC does not operate networks
Comment:       using this IP address range and is not able to investigate
Comment:       spam or abuse reports relating to these addresses. For more
Comment:       help, refer to http://www.apnic.net/apnic-info/whois_search2/abuse-and-spamming
Ref:           https://rdap.arin.net/registry/ip/138.44.0.0

ResourceLink:  http://wq.apnic.net/whois-search/static/search.html
ResourceLink:  whois.apnic.net

OrgName:       Asia Pacific Network Information Centre
OrgId:         APNIC
Address:       PO Box 3646
City:          South Brisbane
StateProv:     QLD
PostalCode:    4101
Country:       AU
RegDate:
Updated:       2012-01-24
Ref:           https://rdap.arin.net/registry/entity/APNIC

ReferralServer: whois://whois.apnic.net
ResourceLink:  http://wq.apnic.net/whois-search/static/search.html

OrgTechHandle: AWC12-ARIN
OrgTechName:   APNIC Whois Contact
OrgTechPhone:  +61 7 3858 3188
OrgTechEmail:  search-apnic-not-arin@apnic.net
OrgTechRef:    https://rdap.arin.net/registry/entity/AWC12-ARIN

OrgAbuseHandle: AWC12-ARIN
OrgAbuseName:  APNIC Whois Contact
```

```
z5166834@login.cse.unsw.edu.au
OrgTechName: APNIC Whois Contact
OrgTechPhone: +61 7 3858 3188
OrgTechEmail: search-apnic-not-arin@apnic.net
OrgTechRef: https://rdap.arin.net/registry/entity/AWC12-ARIN

OrgAbuseHandle: AWC12-ARIN
OrgAbuseName: APNIC Whois Contact
OrgAbusePhone: +61 7 3858 3188
OrgAbuseEmail: search-apnic-not-arin@apnic.net
OrgAbuseRef: https://rdap.arin.net/registry/entity/AWC12-ARIN

#
# ARIN WHOIS data and services are subject to the Terms of Use
# available at: https://www.arin.net/whois_tou.html
#
# If you see inaccuracies in the results, please report at
# https://www.arin.net/resources/whois_reporting/index.html
#
# Copyright 1997-2018, American Registry for Internet Numbers, Ltd.
#

Found a referral to whois.apnic.net.

% [whois.apnic.net]
% Whois data copyright terms http://www.apnic.net/db/dbcopyright.html

% Information related to '138.44.0.0 - 138.44.255.255'

% Abuse contact for '138.44.0.0 - 138.44.255.255' is 'abuse@aarnet.edu.au'

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-AAARI-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
mnt-irt: IRT-AARNET-AU
status: ALLOCATED PORTABLE
remarks:
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
```

z5166834@login.cse.unsw.edu.au

```
e-mail: abuse@aarnet.edu.au
abuse-mailbox: abuse@aarnet.edu.au
admin-c: SM6-AP
tech-c: ANOC-AP
auth: # Filtered
mnt-by: MAINT-AARNET-AP
last-modified: 2010-11-08T08:02:43Z
source: APNIC

organisation: ORG-AAAR1-AP
org-name: Australian Academic and Research Network
country: AU
address: Building 9
address: Banks Street
phone: +61-2-6222-3530
fax-no: +61-2-6222-3535
e-mail: irrcontact@aarnet.edu.au
mnt-ref: APNIC-HM
mnt-by: APNIC-HM
last-modified: 2017-10-09T12:56:36Z
source: APNIC

role: AARNet Network Operations Centre
remarks:
address: AARNet Pty Ltd
address: GPO Box 1559
address: Canberra
address: ACT 2601
country: AU
phone: +61 1300 275 662
phone: +61 2 6222 3555
remarks:
e-mail: noc@aarnet.edu.au
remarks:
remarks: Send abuse reports to abuse@aarnet.edu.au
remarks: Please include timestamps and offset to UTC in logs
remarks: Peering requests to peering@aarnet.edu.au
remarks:
admin-c: SM6-AP
tech-c: BM-AP
nic-hdl: ANOC-AP
mnt-by: MAINT-AARNET-AP
last-modified: 2010-06-30T13:16:48Z
source: APNIC

person: Steve Maddocks
remarks: Director Operations
address: AARNet Pty Ltd
address: 26 Dick Perry Avenue
address: Kensington
address: Perth
address: WA 6151
country: AU
phone: +61-8-9289-2210
fax-no: +61-2-6222-7509
e-mail: steve.maddocks@aarnet.edu.au
nic-hdl: SM6-AP
mnt-by: MAINT-AARNET-AP
last-modified: 2011-02-01T08:37:06Z
source: APNIC
```

% This query was served by the APNIC Whois Service version 1.88.15-46 (WHOIS-NODE2)



It looks like the numbers of hops on each path is not proportional to the physical distance.

[www.ucla.edu](http://www.ucla.edu) the physical distance is about 7499 miles, and it is 14 hops away.

[www.u-tokyo.ac.jp](http://www.u-tokyo.ac.jp) the physical distance is about 5558 miles, and it is 15 hops away.

[www.lancaster.ac.uk](http://www.lancaster.ac.uk) the physical distance is about 10569 miles, and it is 26 hops away.

Q3.

1) <http://www.speedtest.com.sg/tr.php>

IP address:209.15.13.134

```
z5166834@weber:~$ nslookup www.speedtest.com
Server:                129.94.242.2
Address:                129.94.242.2#53

Non-authoritative answer:
Name:   www.speedtest.com
Address: 209.15.13.134
```

#### Traceroute Result:

```
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)  0.188 ms  0.228 ms  0.246 ms
 2  10.11.33.38 (10.11.33.38)  32.911 ms  32.929 ms  32.943 ms
 3  hutchcity3-10g.hkix.net (123.255.90.140)  36.862 ms  36.790 ms  36.875 ms
 4  218.189.5.42 (218.189.5.42)  34.345 ms  dl-42-238-143-118-on-nets.com (118.143.238.42)  34.410 ms  34.384 ms
 5  dl-10-224-143-118-on-nets.com (118.143.224.10)  199.628 ms  dl-2-224-143-118-on-nets.com (118.143.224.2)  183.056 ms  dl-26-224-143-118-on-nets.com
 6  aarnet.as7575.any2ix.coresite.com (206.72.210.64)  179.432 ms  171.828 ms  179.557 ms
 7  xe-0-0-3.pel.tkpa.akl.aarnet.net.au (202.158.194.172)  295.808 ms  294.569 ms  303.405 ms
 8  et-0-1-0.200.pel.wmpa.akl.aarnet.net.au (113.197.15.68)  294.869 ms  296.071 ms  305.080 ms
 9  xe-0-2-2-204.pel.alxd.nsw.aarnet.net.au (113.197.15.182)  325.618 ms  325.719 ms  332.973 ms
10  et-8-1-0.pel.brwy.nsw.aarnet.net.au (113.197.15.152)  339.822 ms  332.352 ms  339.470 ms
11  138.44.5.1 (138.44.5.1)  325.942 ms  326.048 ms  325.952 ms
12  ombcrl-te-1-5.gw.unsw.edu.au (149.171.255.106)  317.388 ms  325.822 ms  318.600 ms
13  libudnexl-po-2.gw.unsw.edu.au (149.171.255.198)  331.057 ms  338.434 ms  330.122 ms
14  ufvl-ae-1-3154.gw.unsw.edu.au (149.171.253.36)  326.706 ms  326.871 ms  326.599 ms
15  129.94.39.23 (129.94.39.23)  326.818 ms  326.834 ms  326.856 ms
16  * * *
17  * * *
18  * * *
19  * * *
20  * * *
21  * * *
22  * * *
23  * * *
24  * * *
25  * * *
26  * * *
27  * * *
28  * * *
29  * * *
30  * * *
```

Traceroute Completed.

```
z5166834@login.cse.unsw.edu.au
weber ~$ traceroute www.speedtest.com
traceroute to www.speedtest.com (209.15.13.134), 30 hops max, 60 byte packets
 1  cserouter1-server.cse.unsw.EDU.AU (129.94.242.251)  0.145 ms  0.132 ms  0.124 ms
 2  129.94.39.17 (129.94.39.17)  1.047 ms  1.005 ms  1.082 ms
 3  ombudnexl-v1-3154.gw.unsw.edu.au (149.171.253.35)  1.871 ms  libudnexl-v1-3154.gw.unsw.edu.au (149.171.253.34)  1.730 ms  ombudnexl-v1-3154.gw.unsw.edu.au (149.171.253.35)  1.853 ms
 4  ombcrl-po-6.gw.unsw.edu.au (149.171.255.169)  1.226 ms  libcrl-po-5.gw.unsw.edu.au (149.171.255.165)  1.270 ms  ombcrl-po-5.gw.unsw.edu.au (149.171.255.197)  1.243 ms
 5  unswbrl-te-2-13.gw.unsw.edu.au (149.171.255.105)  1.565 ms  1.490 ms  unswbrl-te-1-9.gw.unsw.edu.au (149.171.255.101)  1.731 ms
 6  138.44.5.0 (138.44.5.0)  1.552 ms  1.471 ms  1.449 ms
 7  et-0-3-0.pel.alxd.nsw.aarnet.net.au (113.197.15.153)  1.902 ms  1.776 ms  1.740 ms
 8  xe-0-2-1-204.pel.wmpa.akl.aarnet.net.au (113.197.15.183)  24.366 ms  24.381 ms  24.373 ms
 9  et-0-1-0.200.pel.tkpa.akl.aarnet.net.au (113.197.15.69)  24.797 ms  24.749 ms  24.833 ms
10  xe-0-2-6.bdr1.a.lax.aarnet.net.au (202.158.194.173)  148.210 ms  148.187 ms  148.146 ms
11  peer1network.as13768.any2ix.coresite.com (206.72.210.79)  148.244 ms  149.402 ms  148.126 ms
weber ~$ traceroute www.speedtest.com
traceroute to www.speedtest.com (209.15.13.134), 30 hops max, 60 byte packets
 1  cserouter1-server.cse.unsw.EDU.AU (129.94.242.251)  0.176 ms  0.158 ms  0.144 ms
 2  129.94.39.17 (129.94.39.17)  1.043 ms  1.058 ms  1.006 ms
 3  ombudnexl-v1-3154.gw.unsw.edu.au (149.171.253.35)  1.787 ms  1.791 ms  libudnexl-v1-3154.gw.unsw.edu.au (149.171.253.34)  1.557 ms
 4  ombcrl-po-5.gw.unsw.edu.au (149.171.255.197)  1.265 ms  libcrl-po-6.gw.unsw.edu.au (149.171.255.201)  1.338 ms  libcrl-po-5.gw.unsw.edu.au (149.171.255.165)  1.359 ms
 5  unswbrl-te-2-13.gw.unsw.edu.au (149.171.255.105)  1.441 ms  unswbrl-te-1-9.gw.unsw.edu.au (149.171.255.101)  1.399 ms  1.484 ms
 6  138.44.5.0 (138.44.5.0)  1.577 ms  1.495 ms  1.474 ms
 7  et-0-3-0.pel.alxd.nsw.aarnet.net.au (113.197.15.153)  1.841 ms  1.859 ms  1.842 ms
 8  xe-0-0-3.pel.wmpa.akl.aarnet.net.au (113.197.15.67)  24.723 ms  xe-0-2-1-204.pel.wmpa.akl.aarnet.net.au (113.197.15.183)  24.561 ms  24.487 ms
 9  et-0-1-0.200.pel.tkpa.akl.aarnet.net.au (113.197.15.69)  24.553 ms  24.554 ms  24.651 ms
10  xe-0-2-6.bdr1.a.lax.aarnet.net.au (202.158.194.173)  147.978 ms  148.004 ms  148.005 ms
11  peer1network.as13768.any2ix.coresite.com (206.72.210.79)  148.102 ms  148.042 ms  148.180 ms
12  * * *
13  * * *
14  * * 10ge.xe-1-3-3.tor-fr709-cor-1.peer1.net (216.187.118.241)  226.477 ms
15  * * 10ge.xe-4-1-0.tor-20plops-dis-2.peer1.net (216.187.118.245)  223.131 ms
16  * * *
17  * * *
18  * * *
19  * * *
20  * * *
21  * * *
22  * * *
23  * * *
24  * * *
25  * * *
26  * * *
27  * * *
28  * * *
29  * * *
30  * * *
weber ~$
```



2) <https://www.telstra.net/cgi-bin/trace>

IP address:203.50.5.178

```
z5166834@weber:~$ nslookup www.telstra.net
Server:      129.94.242.2
Address:     129.94.242.2#53
```

```
Non-authoritative answer:
Name:   www.telstra.net
Address: 203.50.5.178
```

```
1  gigabitethernet3-3.exi2.melbourne.telstra.net (203.50.77.53)  0.289 ms  0.221 ms  0.244 ms
2  bundle-ether3-100.win-core10.melbourne.telstra.net (203.50.80.129)  1.121 ms  1.613 ms  2.242 ms
3  bundle-ether12.ken-core10.sydney.telstra.net (203.50.11.122)  12.114 ms  11.981 ms  12.989 ms
4  bundle-ether1.ken-edge901.sydney.telstra.net (203.50.11.95)  12.113 ms  11.982 ms  11.987 ms
5  aarnet6.lnk.telstra.net (139.130.0.78)  11.613 ms  11.607 ms  11.613 ms
6  ge-6-0-0.bb1.a.syd.aarnet.net.au (202.158.202.17)  11.737 ms  11.857 ms  11.738 ms
7  ae9.pe2.brwy.nsw.aarnet.net.au (113.197.15.56)  11.989 ms  12.106 ms  11.989 ms
8  et-3-1-0.pe1.brwy.nsw.aarnet.net.au (113.197.15.146)  12.362 ms  12.356 ms  12.361 ms
9  138.44.5.1 (138.44.5.1)  12.613 ms  12.608 ms  12.614 ms
10 liber1-te-1-5.gw.unsw.edu.au (149.171.255.102)  12.613 ms  12.606 ms  12.612 ms
11 ombudnex1-po-1.gw.unsw.edu.au (149.171.255.202)  13.135 ms
12 ufw1-ae-1-3154.gw.unsw.edu.au (149.171.253.36)  13.236 ms  13.231 ms  13.238 ms
13 129.94.39.23 (129.94.39.23)  13.360 ms  13.356 ms  13.363 ms
```

There are other traceroute sites listed [here](#).

The traceroute CGI source can be found via:



```
weber % traceroute www.telstra.net
traceroute to www.telstra.net (203.50.5.178), 30 hops max, 60 byte packets
 1 cse01rtr1-server.cse.unsw.EDU.AU (129.94.242.251)  0.179 ms  0.174 ms  0.158 ms
 2 129.94.39.17 (129.94.39.17)  1.078 ms  1.081 ms  1.131 ms
 3 libudnex1-v1-3154.gw.unsw.edu.au (149.171.253.36)  1.718 ms  1.564 ms  1.706 ms
 4 cse01rtr1-po-5.gw.unsw.edu.au (149.171.255.197)  1.235 ms  1.394 ms  1.459 ms
 5 unswbr1-te-1-9.gw.unsw.edu.au (149.171.255.101)  1.554 ms  1.495 ms  1.494 ms
 6 138.44.5.0 (138.44.5.0)  1.662 ms  1.586 ms  1.561 ms
 7 et-0-3-0.pe1.brwy.nsw.aarnet.net.au (113.197.15.147)  1.824 ms  1.820 ms  1.818 ms
 8 ae9.bb1.a.syd.aarnet.net.au (113.197.15.57)  2.203 ms  2.141 ms  2.195 ms
 9 gigabitethernet1-1.pe1.b.syd.aarnet.net.au (202.158.202.18)  2.435 ms  2.407 ms  2.276 ms
10 gigabitethernet3-11.ken37.sydney.telstra.net (139.130.0.77)  4.182 ms  4.188 ms  4.235 ms
11 bundle-ether13.ken-core10.sydney.telstra.net (203.50.11.94)  3.859 ms  3.875 ms  4.544 ms
12 bundle-ether10.win-core10.melbourne.telstra.net (203.50.11.123)  14.896 ms  14.899 ms  14.868 ms
13 gigabitethernet3-0.exi-service2.melbourne.telstra.net (203.50.50.132)  15.029 ms  13.715 ms  13.765 ms
14 * * *
15 * * *
16 * * *
17 * * *
18 * * *
19 * * *
20 * * *
21 * * *
22 * * *
23 * * *
24 * * *
25 * * *
26 * * *
27 * * *
28 * * *
29 * * *
30 * * *
weber %
```

The reverse paths do not go through the same routers as the forward paths, although I did find some common routers that have the same host names but have different IP addresses, I think this is may be the result of the packets are transported through the optimal routers and the IP address can actually change between a fixed range.

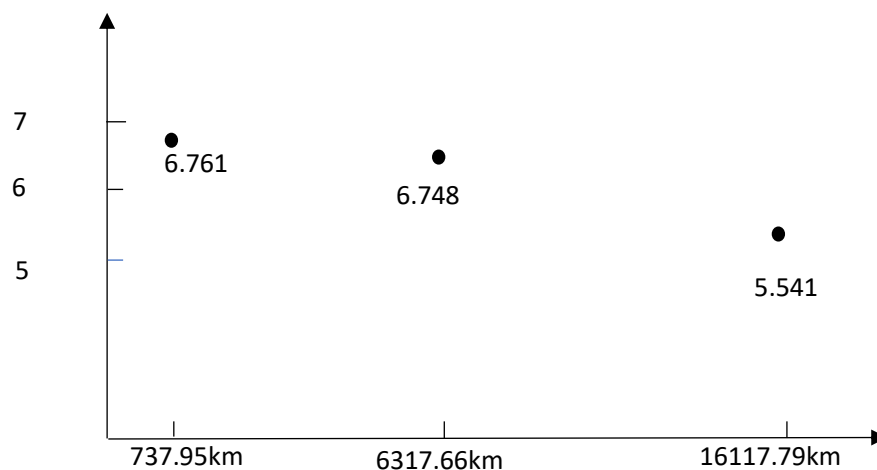
#### Exercise 4:

Q1.

The approximate physical distance between UNSW and Brisbane is about 737.95km. The shortest possible time  $T = 737.95 / 3 \times 10^8 = 2.460\text{ms}$ . The value of y-axis is  $16.632 / 2.460 = 6.761$

The approximate physical distance between UNSW and Singapore is about 6317.66km. The shortest possible time  $T = 6317.66 / 3 \times 10^8 = 21.059\text{ms}$ . The value of y-axis is  $142.111 / 21.059 = 6.748$

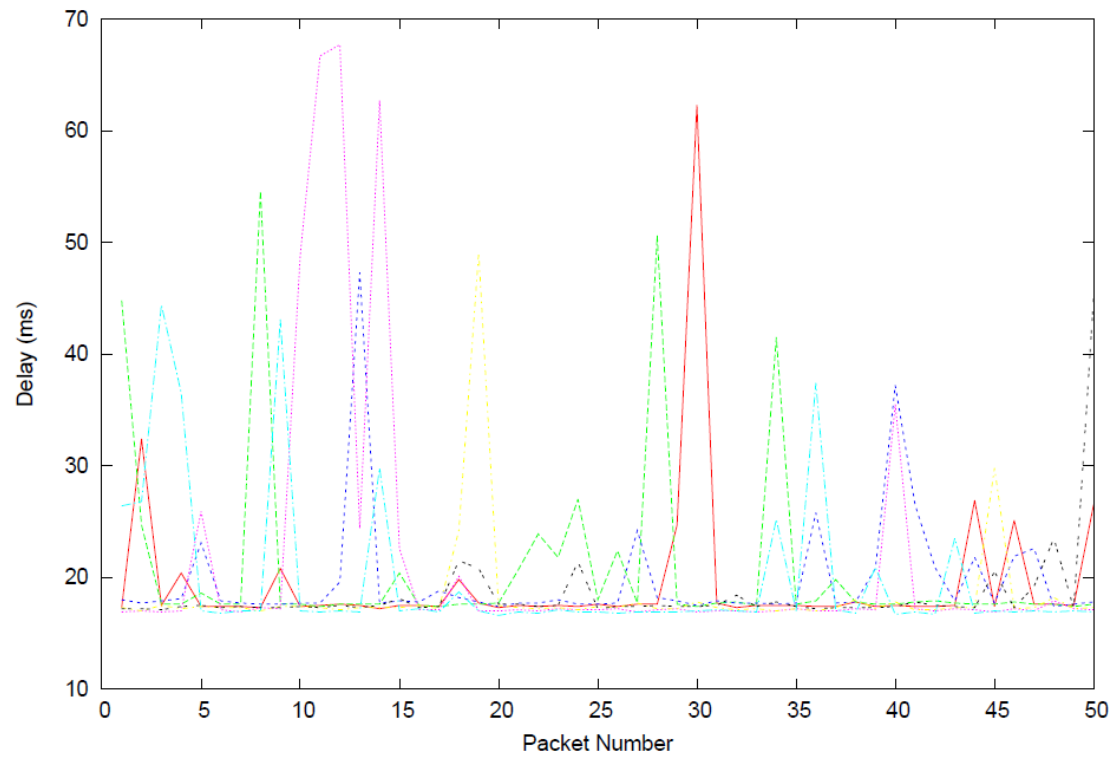
The approximate physical distance between UNSW and Berlin is about 16117.79km. The shortest possible time  $T = 16117.79 / 3 \times 10^8 = 53.726\text{ms}$ . The value of y-axis is  $297.680 / 53.726 = 5.541$ .



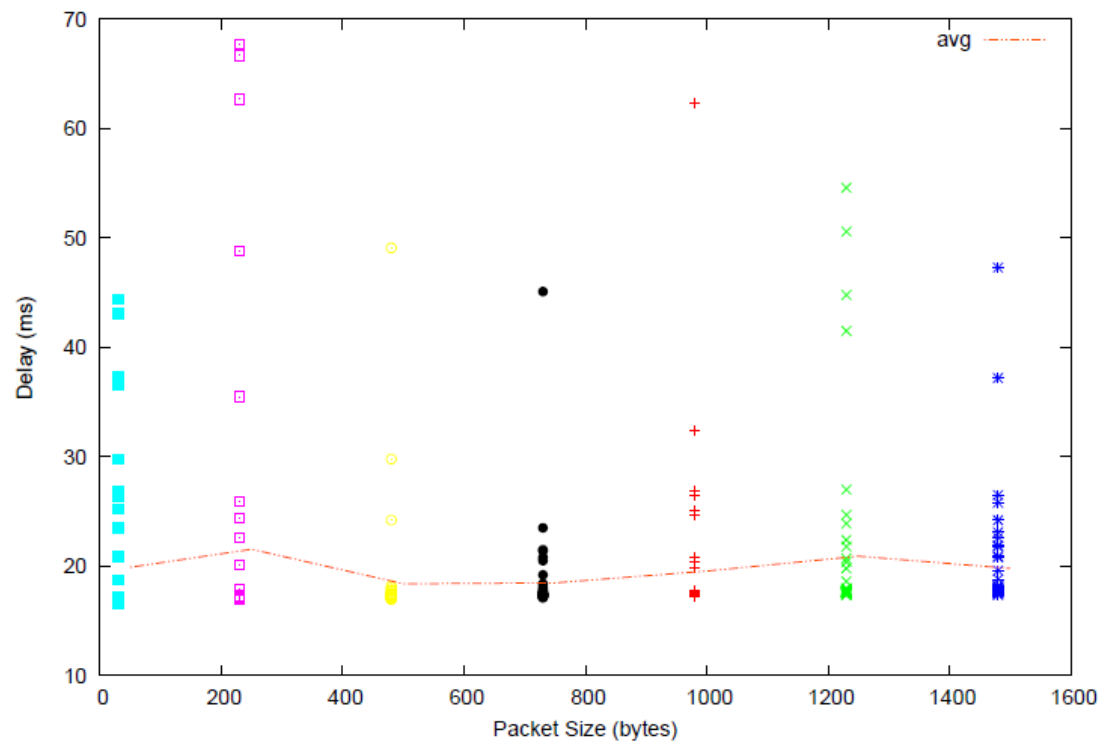
As to the y-axis values are greater than 2, I think it may be due to that there is congestion along the network and there are many routers along the path from my workstation to these three destinations.

Q2

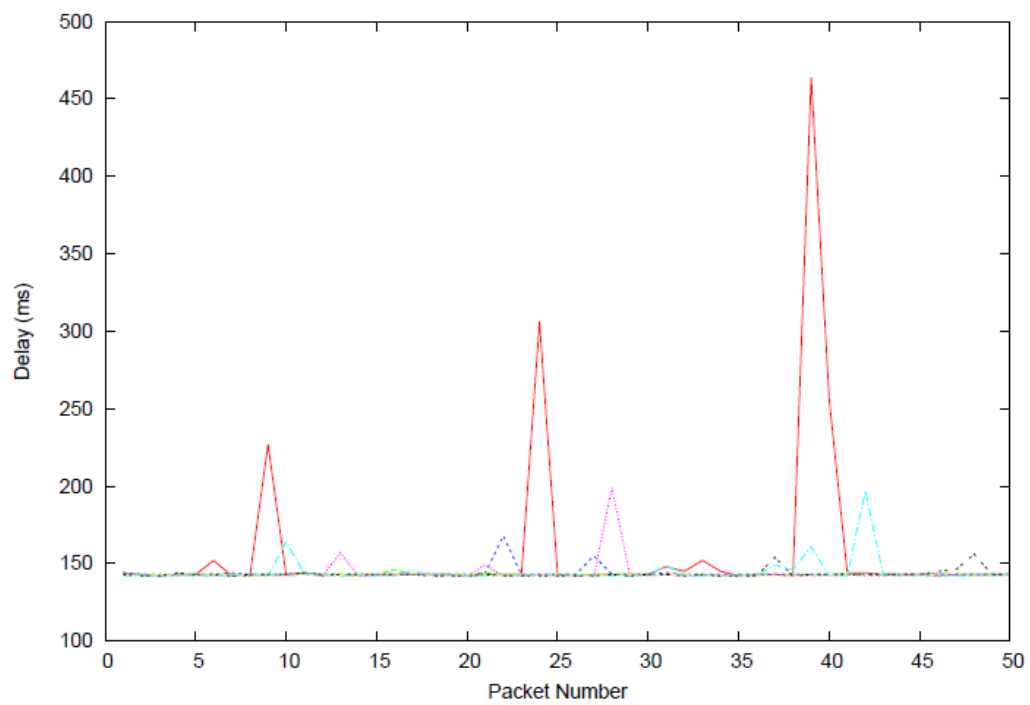
[www.uq.edu.au](http://www.uq.edu.au)



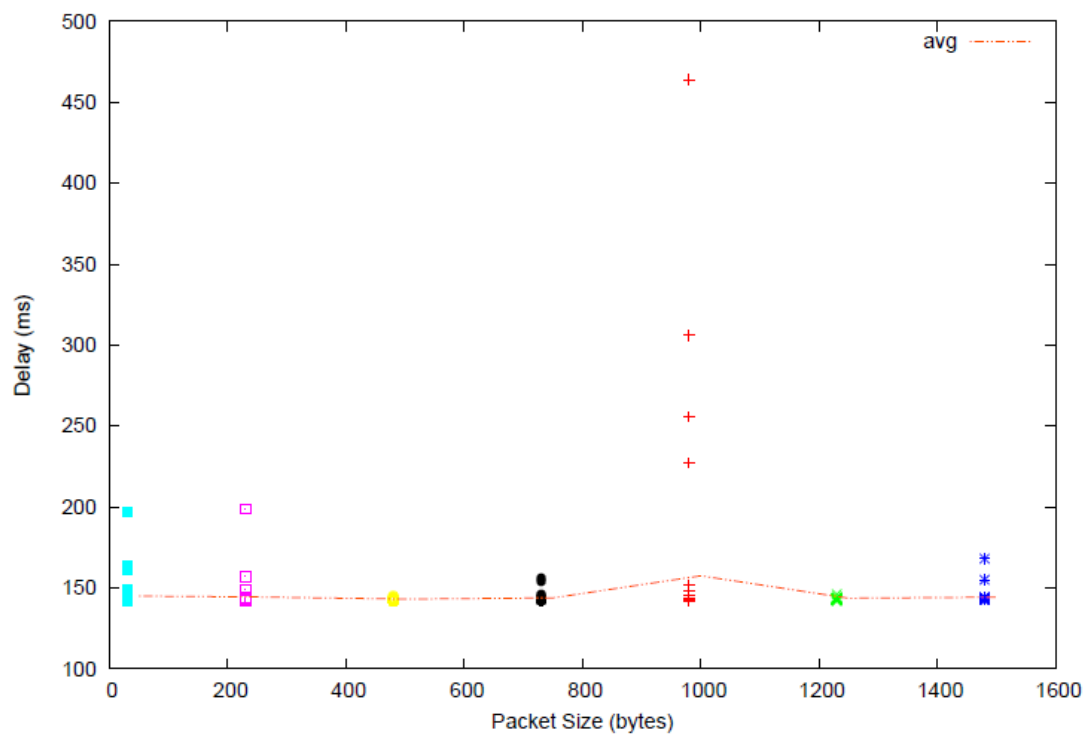
Wed Aug 01 08:45:46 2018



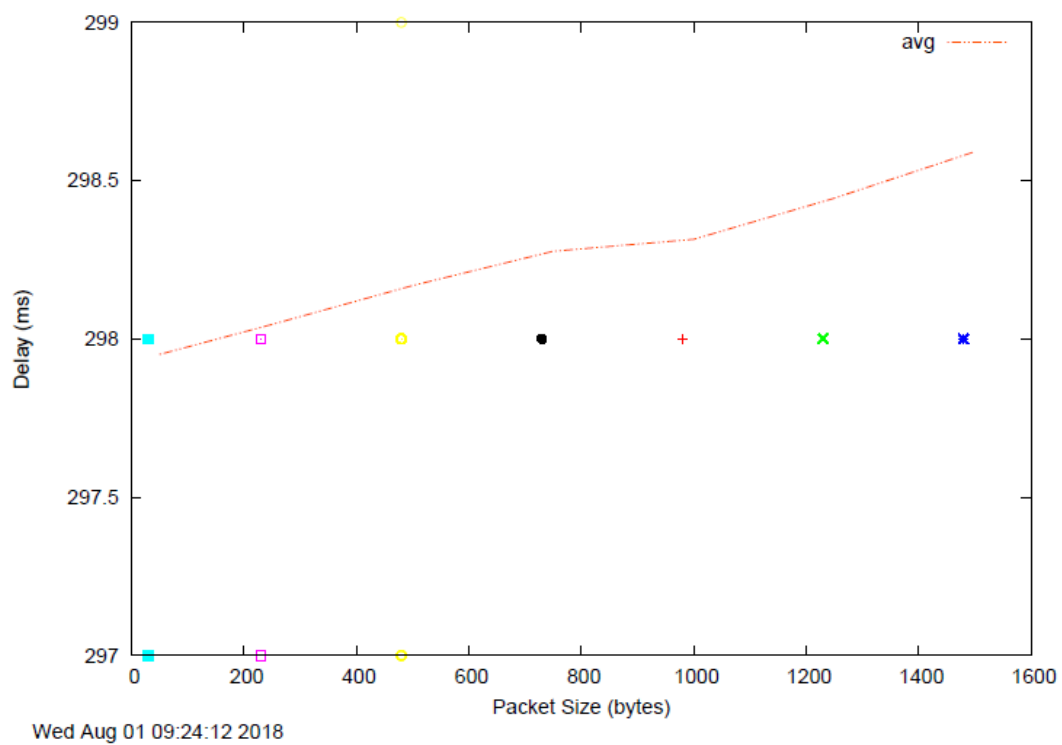
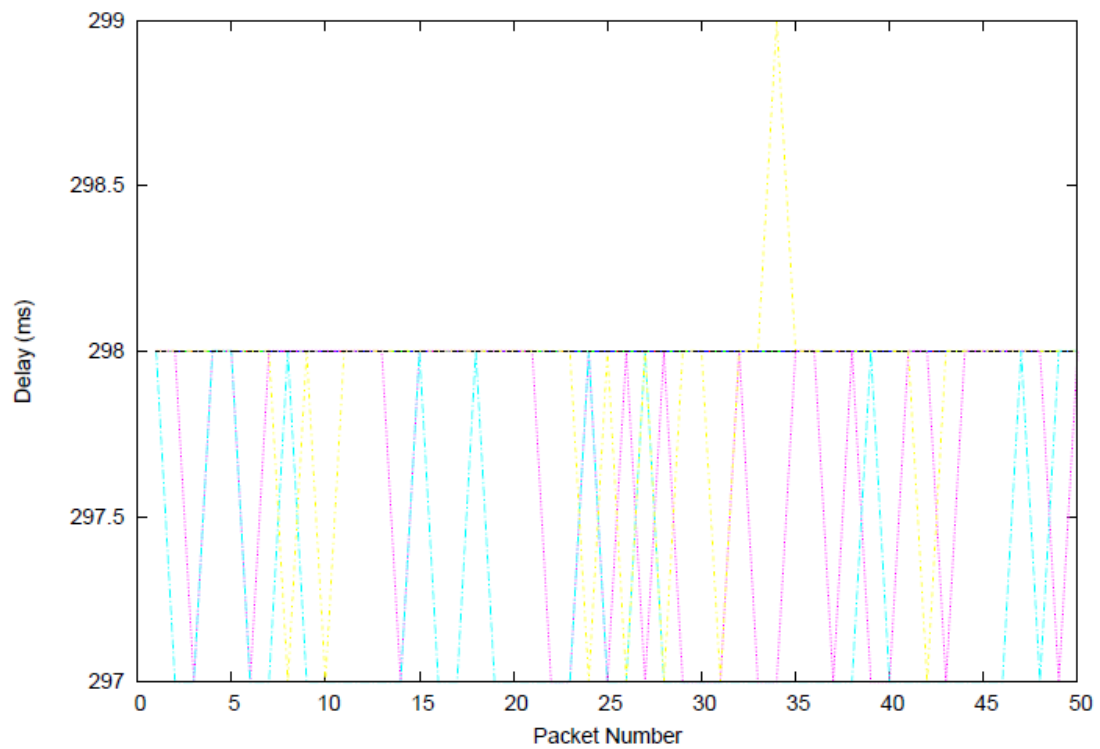
Wed Aug 01 08:45:46 2018



Wed Aug 01 09:12:18 2018



Wed Aug 01 09:12:19 2018



As it is shown in the graphs above, the delay to the destination randomly varies over

time. The variability of the processing and queuing delay may be one reason for this. The quality of the connection will actually influence the variability.

Q3.

The propagation delay does not depend on the packet size, it is affected by the link and it generally remains unchanged if the material of the link stays unchanged.

The queuing delay only depends on the congestion of the network. If the amount of the traffic is huge, then packets have to wait until all the packets in the queue have been processed.

The transmission delay depends on the packet size and is proportional to it.

The processing delay depends on the packet size but to a much smaller degree than the transmission delay.