Lab1

Exercise 1: nslookup

1.1

```
$ 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: 104.18.61.21
Name:    www.koala.com.au
Address: 172.67.219.46
Name:    www.koala.com.au
Address: 104.18.60.21
```

The IP address is :

- `172.67.219.46`
- `104.18.60.21`
- `104.18.61.21`

In my opinion, several IP addresses can help server or website to reduce load. For example, in an instant, there are a large number visits in this website and several IP addresses could help or reduce the load than using one IP address.

1.2

```
$ 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.
```

The name of the IP address `127.0.0.1` is `localhost'.

`127.0.0.1` is a local IP address and it is used for loopback.Each machine or computer has this special address and can only visit this address by itself, in other words, the other machine cannot visit this address.

It always uses for testing purpose. For example, try to `ping 127.0.0.1` can test if you set network properly by checking if the network can send or receive packets.

Exercise 2: Use ping to test host reachability

Website	ping if reachable	Reason	Reachable from Web browser
www.unsw.edu.au	Reachable		Reachable
www.getfittest.com.au	Unreachable	Unknown host. Maybe it is not a exist website, cannot visit	Unreachable
www.mit.edu	Reachable		Reachable
www.intel.com.au	Reachable		Reachable
www.tgp.com.au	Reachable		Reachable
www.telstra.com.au	Reachable		Reachable
www.hola.hp	Unreachable	Unknown host, may be this website do not exist	Unreachable
www.amazon.com	Reachable		Reachable
www.tsinghua.edu.cn	Reachable		Reachable
www.kremlin.ru	Unreachable	Request time out	Reachable
8.8.8.8	Reachable		Unreachable

Exercise 3: Use traceroute to understand network topology

3.1

```
$ 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)  0.154 ms  0.161 ms  0.126 ms
 2  129.94.39.17 (129.94.39.17)  0.951 ms  0.938 ms  0.974 ms
 3  ombudnex1-vl-3154.gw.unsw.edu.au (149.171.253.35)  1.730 ms  1.702 ms  1.611 ms
 4  libcr1-po-5.gw.unsw.edu.au (149.171.255.165)  1.316 ms libcr1-po-6.gw.unsw.edu.au (149.171.255.201)  1.312 ms libcr1-po
-5.gw.unsw.edu.au (149.171.255.165)  1.323 ms
 5  unswbr1-te-1-9.gw.unsw.edu.au (149.171.255.101)  1.181 ms  1.166 ms unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105)  1
.174 ms
 6  138.44.5.0 (138.44.5.0)  1.357 ms  1.331 ms  1.382 ms
 7  et-1-3-0.pe1.sxt.bkvl.nsw.aarnet.net.au (113.197.15.149)  2.217 ms  2.082 ms  2.152 ms
 8  et-0-0-0.pe1.a.hnl.aarnet.net.au (113.197.15.99)  95.297 ms  95.265 ms  95.478 ms
 9  et-2-1-0.bdr1.a.sea.aarnet.net.au (113.197.15.201)  146.592 ms  146.585 ms  146.520 ms
10  abilene-1-lo-jmb-706.sttlwa.pacificwave.net (207.231.240.8)  146.767 ms  146.734 ms  146.740 ms
11  ae-1.4079.rtsw.minn.net.internet2.edu (162.252.70.173)  179.346 ms  179.392 ms  179.405 ms
12  ae-1.4079.rtsw.eqch.net.internet2.edu (162.252.70.106)  187.235 ms  187.239 ms  187.233 ms
13  ae-0.4079.rtsw3.eqch.net.internet2.edu (162.252.70.163)  187.153 ms  187.200 ms  187.397 ms
14  ae-1.4079.rtsw.clev.net.internet2.edu (162.252.70.130)  193.147 ms  193.263 ms  193.258 ms
15  buf-9208-I2-CLEV.nysernet.net (199.109.11.33)  196.907 ms  196.537 ms  196.516 ms
16  syr-9208-buf-9208.nysernet.net (199.109.7.193)  199.572 ms  199.865 ms  199.718 ms
17  nyc111-9204-syr-9208.nysernet.net (199.109.7.94)  208.821 ms  208.930 ms  208.841 ms
18  nyc-9208-nyc111-9204.nysernet.net (199.109.7.165)  209.077 ms  209.054 ms  209.174 ms
19  columbia.nyc-9208.nysernet.net (199.109.4.14)  208.931 ms  208.905 ms  209.005 ms
20  cc-core-1-x-nyser32-gw-1.net.columbia.edu (128.59.255.5)  209.334 ms  209.309 ms  209.448 ms
21  cc-conc-1-x-cc-core-1.net.columbia.edu (128.59.255.21)  209.317 ms  209.452 ms  209.375 ms
22  gutenberg-e.org (128.59.105.24)  209.096 ms  209.122 ms  209.162 ms
```

How many routers are there between your workstation and www.columbia.edu ?

22

How many routers along the path are part of the UNSW network?

4 (1, 3, 4, 5)

Between which two routers do packets cross the Pacific Ocean?

Between 9 and 10

3.2

i) www.ucla.edu

```
$ 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)  0.194 ms  0.144 ms  0.133 ms
 2  129.94.39.17 (129.94.39.17)  1.007 ms  0.969 ms  1.111 ms
 3  libudnex1-vl-3154.gw.unsw.edu.au (149.171.253.34)  1.720 ms  1.648 ms  1.913 ms
 4  libcr1-po-5.gw.unsw.edu.au (149.171.255.165)  1.258 ms ombcr1-po-5.gw.unsw.edu.au (149.171.255.197)  1.219 ms libcr1-po
-5.gw.unsw.edu.au (149.171.255.165)  1.298 ms
 5  unswbr1-te-1-9.gw.unsw.edu.au (149.171.255.101)  1.186 ms  1.193 ms unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105)  1
.366 ms
 6  138.44.5.0 (138.44.5.0)  1.557 ms  2.115 ms  2.000 ms
 7  et-1-3-0.pe1.sxt.bkvl.nsw.aarnet.net.au (113.197.15.149)  1.945 ms  2.118 ms  2.075 ms
 8  et-0-0-0.pe1.a.hnl.aarnet.net.au (113.197.15.99)  95.369 ms  95.231 ms  95.263 ms
 9  et-2-1-0.bdr1.a.sea.aarnet.net.au (113.197.15.201)  146.976 ms  146.936 ms  146.892 ms
10  cenichpr-1-is-jmb-778.snvaca.pacificwave.net (207.231.245.129)  164.573 ms  164.574 ms  163.989 ms
11  svl-agg10-hpr--svl-hpr3--100g.cenic.net (137.164.25.106)  164.059 ms  164.018 ms  164.964 ms
12  hpr-lax-agg10--svl-agg10-100ge.cenic.net (137.164.25.73)  160.121 ms  160.752 ms  160.059 ms
13  * * *
14  bd11f1.anderson--cr001.anderson.ucla.net (169.232.4.6)  160.309 ms bd11f1.anderson--cr00f2.csb1.ucla.net (169.232.4.4)
 160.402 ms  160.328 ms
15  cr00f1.anderson--rtr11f4.mathsci.ucla.net (169.232.8.185)  161.288 ms  161.241 ms  161.253 ms
16  * * *
17  * * *
18  * * *
19  * * *
20  * * *
21  * * *
22  * * *
23  * * *
24  * * *
25  * * *
26  * * *
27  * * *
28  * * *
29  * * *
30  * * *
```

ii) www.u-tokyo.ac.jp

```
$ 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)  0.132 ms  0.143 ms  0.107 ms
 2  129.94.39.17 (129.94.39.17)  0.889 ms  0.827 ms  0.818 ms
 3  ombudnex1-vl-3154.gw.unsw.edu.au (149.171.253.35)  1.713 ms  1.683 ms libudnex1-vl-3154.gw.unsw.edu.au (149.171.253.34)
    1.188 ms
 4  ombcr1-po-5.gw.unsw.edu.au (149.171.255.197)  1.073 ms libcr1-po-5.gw.unsw.edu.au (149.171.255.165)  1.130 ms libcr1-po
-6.gw.unsw.edu.au (149.171.255.201)  1.124 ms
 5  unswbr1-te-1-9.gw.unsw.edu.au (149.171.255.101)  1.153 ms unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105)  1.126 ms un
swbr1-te-1-9.gw.unsw.edu.au (149.171.255.101)  1.154 ms
 6  138.44.5.0 (138.44.5.0)  1.338 ms  1.379 ms  1.320 ms
 7  et-0-3-0.pe1.bkvl.nsw.aarnet.net.au (113.197.15.147)  1.733 ms  1.813 ms  1.780 ms
 8  ge-4_0_0.bb1.a.pao.aarnet.net.au (202.158.194.177)  155.149 ms  155.116 ms  155.074 ms
 9  paloalto0.iij.net (198.32.176.24)  156.508 ms  156.525 ms  156.537 ms
10  osk004bb00.IIJ.Net (58.138.88.185)  287.548 ms osk004bb01.IIJ.Net (58.138.88.189)  269.390 ms osk004bb00.IIJ.Net (58.13
8.88.185)  287.455 ms
11  osk004ip57.IIJ.Net (58.138.106.166)  278.281 ms osk004ip57.IIJ.Net (58.138.106.162)  286.965 ms osk004ip57.IIJ.Net (58.
138.106.166)  278.223 ms
12  210.130.135.130 (210.130.135.130)  287.319 ms  287.243 ms  287.247 ms
13  124.83.228.58 (124.83.228.58)  278.422 ms  269.361 ms  278.150 ms
14  124.83.252.178 (124.83.252.178)  284.173 ms  275.082 ms  275.084 ms
15  158.205.134.26 (158.205.134.26)  292.943 ms  293.106 ms  284.104 ms
16  * * *
17  * * *
18  * * *
19  * * *
20  * * *
21  * * *
22  * * *
23  * * *
24  * * *
25  * * *
26  * * *
27  * * *
28  * * *
29  * * *
30  * * *
```

iii) www.lancaster.ac.uk

```
$ 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)  0.183 ms  0.161 ms  0.136 ms
 2  129.94.39.17 (129.94.39.17)  0.934 ms  0.930 ms  0.941 ms
 3  libudnex1-vl-3154.gw.unsw.edu.au (149.171.253.34)  3.183 ms  3.106 ms  3.117 ms
 4  libcr1-po-5.gw.unsw.edu.au (149.171.255.165)  1.168 ms ombcr1-po-6.gw.unsw.edu.au (149.171.255.169)  1.182 ms ombcr1-po
-5.gw.unsw.edu.au (149.171.255.197)  1.163 ms
 5  unswbr1-te-1-9.gw.unsw.edu.au (149.171.255.101)  22.872 ms  22.845 ms unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105)
22.855 ms
 6  138.44.5.0 (138.44.5.0)  9.669 ms  8.269 ms  8.243 ms
 7  et-2-0-5.bdr1.sing.sin.aarnet.net.au (113.197.15.233)  123.265 ms  122.286 ms  122.249 ms
 8  138.44.226.7 (138.44.226.7)  263.885 ms  263.867 ms  263.814 ms
 9  janet-gw.mx1.lon.uk.geant.net (62.40.124.198)  263.894 ms  263.804 ms  263.718 ms
10  ae29.londpg-sbr2.ja.net (146.97.33.2)  264.241 ms  264.328 ms  264.260 ms
11  ae31.erdiss-sbr2.ja.net (146.97.33.22)  268.499 ms  272.232 ms  272.184 ms
12  ae29.manckh-sbr2.ja.net (146.97.33.42)  269.923 ms  270.013 ms  269.976 ms
13  ae25.manckh-ban1.ja.net (146.97.35.50)  269.951 ms  270.583 ms  270.543 ms
14  lancaster-uni.ja.net (146.97.40.178)  286.781 ms  284.964 ms  284.905 ms
15  * * *
16  * * *
17  * * *
18  * * *
19  * * *
20  * * *
21  * * *
22  * * *
23  * * *
24  * * *
25  * * *
26  * * *
27  * * *
28  * * *
29  * * *
30  * * *
```

At which router do the paths from your machine to these three destinations diverge?

`138.44.5.0`, diverge after this router to three different destinations

Find out further details about this router.

running `whois 138.44.5.0`

```
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
OrgAbusePhone:  +61 7 3858 3188
OrgAbuseEmail:  search-apnic-not-arin@apnic.net


% 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-AAAR1-AP
admin-c:          SM6-AP
tech-c:           ANOC-AP
abuse-c:          AA1638-AP
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:          -+-+-+-+-+-+-+-+-+-+-+-+-+-++-+-+-+-+-+-+-+-+-+-+-+-+-+
notify:           irrcontact@aarnet.edu.au
mnt-by:           APNIC-HM
mnt-lower:        MAINT-AARNET-AP
mnt-routes:       MAINT-AARNET-AP
mnt-irt:          IRT-AARNET-AU
last-modified:    2020-06-22T05:22:11Z
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
```

```
abuse-mailbox:    abuse@aarnet.edu.au
admin-c:          SM6-AP
tech-c:           ANOC-AP
auth:             # Filtered
remarks:          abuse@aarnet.edu.au was validated on 2020-06-22
mnt-by:           MAINT-AARNET-AP
last-modified:    2020-06-22T05:21:20Z
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
```

We can get this router belongs to APNIC and more details in the screenshot above

Is the number of hops on each path proportional the physical distance?

Network Location Tool

approximate geophysical location

locate a network

Remote Address [169.232.8.185] [Locate]
☞ Use Current IP

Source ● MaxMind ○ Hostip.info

network information

IP Address
169.232.8.185

Base Domain
ucla.net

Country
United States 🇺🇸

Region
CA

City
Los Angeles

Latitude
33.7866

Longitude
-118.2987

Area Code
310

Postal Code
90095

Distance from Last
(as the crow flies)
7499.0 miles

Source
MaxMind

about

Network Location Tool

approximate geophysical location

locate a network

Remote Address [158.205.134.26] [Locate]
☞ Use Current IP

Source ● MaxMind ○ Hostip.info

network information

IP Address
158.205.134.26

Base Domain
158.205.134.26

Country
Japan 🇯🇵

Region
Unknown

City
Unknown

Latitude
36

Longitude
138

Area Code
Unknown

Postal Code
Unknown

Distance from Last
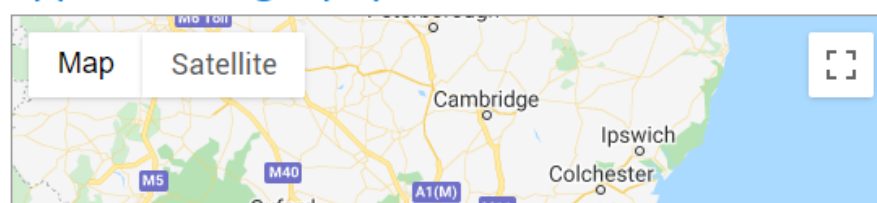(as the crow flies)
4908.7 miles

Source
MaxMind

Network Location Tool

approximate geophysical location

network information

IP Address
146.97.40.178

Base Domain
ja.net

Country
United Kingdom 🇬🇧

Region

locate a network

Remote Address `146.97.40.178` [Locate]

☞ Use Current IP

Source ⦿ MaxMind ○ Hostip.info

Uni	Num of hops	physical distance
UCLA	15	7499.0 miles
u-tokyo	15	4908.7 miles
lancaster	14	10572.2 miles

Thus, it seems that the number of hops is not proportional the physical distance.

3.3

```
$ ip addr
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group defaul
t qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
       valid_lft forever preferred_lft forever
2: eth4: <BROADCAST,MULTICAST> mtu 1500 qdisc noop state DOWN group default qlen
 1000
    link/ether 4c:d9:8f:97:f2:5a brd ff:ff:ff:ff:ff:ff
3: eth1: <BROADCAST,MULTICAST> mtu 1500 qdisc noop state DOWN group default qlen
 1000
    link/ether 4c:d9:8f:97:f2:5b brd ff:ff:ff:ff:ff:ff
4: eth2: <BROADCAST,MULTICAST> mtu 1500 qdisc noop state DOWN group default qlen
 1000
    link/ether 34:80:0d:1f:f7:d0 brd ff:ff:ff:ff:ff:ff
5: eth0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc mq state UP group defa
ult qlen 1000
    link/ether 34:80:0d:1f:f7:d1 brd ff:ff:ff:ff:ff:ff
6: eth0.385@eth0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc noqueue state
 UP group default qlen 1000
    link/ether 34:80:0d:1f:f7:d1 brd ff:ff:ff:ff:ff:ff
    inet 129.94.242.118/24 brd 129.94.242.255 scope global eth0.385
       valid_lft forever preferred_lft forever
```

`129.94.242.118` is my machine's IP address

test1

traceroute from http://www.speedtest.com.sg to my machine

Traceroute Result:

```
traceroute to 129.94.242.118 (129.94.242.118), 30 hops max, 60 byte packets
 1  ge2-8.r01.sin01.ne.com.sg (202.150.221.169)  0.125 ms  0.136 ms  0.162 ms
 2  10.11.34.146 (10.11.34.146)  0.411 ms  0.476 ms  0.514 ms
 3  aarnet.sgix.sg (103.16.102.67)  209.237 ms  209.190 ms  209.322 ms
 4  et-7-3-0.pe1.nsw.brwy.aarnet.net.au (113.197.15.232)  225.526 ms  225.453 ms  225.481 ms
 5  138.44.5.1 (138.44.5.1)  206.863 ms  206.831 ms  206.964 ms
 6  libcr1-te-1-5.gw.unsw.edu.au (149.171.255.102)  206.780 ms  206.769 ms  206.754 ms
 7  libudnex1-po-1.gw.unsw.edu.au (149.171.255.166)  215.501 ms ombudnex1-po-1.gw.unsw.edu.au (149.171.255.202)  209.630 ms libudnex1-po
 8  ufw1-ae-1-3154.gw.unsw.edu.au (149.171.253.36)  212.275 ms  212.332 ms  212.329 ms
 9  129.94.39.23 (129.94.39.23)  214.545 ms  214.456 ms  214.577 ms
10  * * *
11  * * *
12  * * *
13  * * *
14  * * *
15  * * *
16  * * *
17  * * *
18  * * *
19  * * *
20  * * *
21  * * *
22  * * *
23  * * *
24  * * *
25  * * *
26  * * *
27  * * *
28  * * *
29  * * *
30  * * *
```

Traceroute Completed.

traceroute from my meachine to www.speedtest.com.sg

```
$ 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)  0.137 ms  0.127 ms  0.112 ms
 2  129.94.39.17 (129.94.39.17)  0.926 ms  0.932 ms  0.960 ms
 3  libudnex1-vl-3154.gw.unsw.edu.au (149.171.253.34)  1.824 ms ombudnex1-vl-3154.gw.unsw.edu.au (149.171.253
.35)  1.423 ms libudnex1-vl-3154.gw.unsw.edu.au (149.171.253.34)  1.812 ms
 4  ombcr1-po-6.gw.unsw.edu.au (149.171.255.169)  1.293 ms libcr1-po-5.gw.unsw.edu.au (149.171.255.165)  1.17
8 ms ombcr1-po-6.gw.unsw.edu.au (149.171.255.169)  1.340 ms
 5  unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105)  1.196 ms  1.254 ms  1.264 ms
 6  138.44.5.0 (138.44.5.0)  8.322 ms  7.559 ms  7.539 ms
 7  et-0-3-0.pe1.alxd.nsw.aarnet.net.au (113.197.15.153)  1.592 ms  1.910 ms  1.916 ms
 8  xe-0-2-7.bdr1.a.lax.aarnet.net.au (202.158.194.173)  147.763 ms  147.719 ms  147.696 ms
 9  singtel.as7473.any2ix.coresite.com (206.72.210.63)  147.636 ms  147.664 ms  147.672 ms
10  203.208.171.117 (203.208.171.117)  147.977 ms  147.992 ms 203.208.172.133 (203.208.172.133)  328.540 ms
11  203.208.177.110 (203.208.177.110)  321.759 ms 203.208.172.145 (203.208.172.145)  304.751 ms  304.665 ms
12  203.208.182.253 (203.208.182.253)  321.438 ms  334.982 ms 203.208.158.17 (203.208.158.17)  329.524 ms
13  203.208.177.110 (203.208.177.110)  323.593 ms 202-150-221-170.rev.ne.com.sg (202.150.221.170)  212.584 ms
   213.173 ms
```

test2

traceroute from http://www.telstra.net/ to my machine

```
 1  gigabitethernet3-3.exi2.melbourne.telstra.net (203.50.77.53)  0.327 ms  0.328 ms  0.242 ms
 2  bundle-ether3-100.win-core10.melbourne.telstra.net (203.50.80.129)  2.238 ms  1.603 ms  2.115 ms
 3  bundle-ether12.ken-core10.sydney.telstra.net (203.50.11.122)  12.486 ms  12.598 ms  12.736 ms
 4  bundle-ether1.ken-edge903.sydney.telstra.net (203.50.11.173)  12.483 ms  12.223 ms  12.110 ms
 5  aar3533567.lnk.telstra.net (139.130.0.78)  11.737 ms  11.599 ms  11.612 ms
 6  et-7-1-0.pe1.brwy.nsw.aarnet.net.au (113.197.15.13)  11.859 ms  11.971 ms  11.862 ms
 7  138.44.5.1 (138.44.5.1)  12.108 ms  12.098 ms  11.986 ms
 8  ombcr1-te-1-5.gw.unsw.edu.au (149.171.255.106)  12.234 ms  12.098 ms  12.109 ms
 9  libudnex1-po-2.gw.unsw.edu.au (149.171.255.198)  12.488 ms  12.596 ms  12.734 ms
10  ufw1-ae-1-3154.gw.unsw.edu.au (149.171.253.36)  12.734 ms  12.724 ms  12.735 ms
11  129.94.39.23 (129.94.39.23)  12.985 ms  12.975 ms  12.984 ms
```

traceroute from my machine to www.telstra.net

```
$ 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)  0.110 ms  0.104 ms  0.098 ms
 2  129.94.39.17 (129.94.39.17)  0.851 ms  0.817 ms  0.858 ms
 3  libudnex1-vl-3154.gw.unsw.edu.au (149.171.253.34)  1.879 ms  1.892 ms  1.909 ms
 4  ombcr1-po-6.gw.unsw.edu.au (149.171.255.169)  3.476 ms libcr1-po-5.gw.unsw.edu.au (149.171.255.165)  1.131 ms ombcr1
-po-5.gw.unsw.edu.au (149.171.255.197)  3.483 ms
 5  unswbr1-te-1-9.gw.unsw.edu.au (149.171.255.101)  1.363 ms unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105)  1.387 ms
  1.323 ms
 6  138.44.5.0 (138.44.5.0)  1.481 ms  1.241 ms  1.255 ms
 7  et-1-1-0.pe1.rsby.nsw.aarnet.net.au (113.197.15.12)  2.038 ms  1.713 ms  1.548 ms
 8  xe-0-0-3.bdr1.rsby.nsw.aarnet.net.au (113.197.15.31)  1.685 ms  1.674 ms  1.636 ms
 9  HundredGigE0-1-0-4.ken-edge903.sydney.telstra.net (139.130.0.77)  2.224 ms  2.363 ms  2.444 ms
10  bundle-ether17.ken-core10.sydney.telstra.net (203.50.11.172)  4.245 ms  4.216 ms bundle-ether2.chw-edge903.sydney.te
lstra.net (203.50.11.175)  2.750 ms
11  bundle-ether17.chw-core10.sydney.telstra.net (203.50.11.176)  4.300 ms  3.980 ms  3.997 ms
12  203.50.6.40 (203.50.6.40)  15.272 ms bundle-ether8.exi-core10.melbourne.telstra.net (203.50.11.125)  15.241 ms 203.5
0.6.40 (203.50.6.40)  15.256 ms
13  bundle-ether2.exi-ncprouter101.melbourne.telstra.net (203.50.11.209)  15.102 ms  14.877 ms  14.845 ms
14  www.telstra.net (203.50.5.178)  13.649 ms  13.688 ms  13.821 ms
```

What are the IP addresses of the two servers that you have chosen

Using `traceroute` and this command will directly show the IP addresses which we will visit. Then using `nslookup` to make sure that is right IP address.

For example:

```
$ nslookup www.telstra.net
Server:         129.94.242.45
Address:        129.94.242.45#53

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

$ nslookup www.speedtest.com.sg
Server:         129.94.242.45
Address:        129.94.242.45#53

Non-authoritative answer:
Name:   www.speedtest.com.sg
Address: 202.150.221.170
```

Therefore, I choose `203.50.5.178` and `202.150.221.170`

My machine IP address is `129.94.242.118` which i mentioned before.

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?

- From the screenshot, we can get the reverse path do not go through the same routers as the forward path.
- Do not see the same routers between the forward and reverse path.
- Same, do not see the same IP address.

In my opinion, different routers have different forwarding table, if the first routers is not the same, the switch routers will jump to different routers.

Exercise 4

4.1

```
$ ./runping.sh www.uq.edu.au

ping -s 22 -c 50 -i 1 www.uq.edu.au > www.uq.edu.au-p50
ping -s 222 -c 50 -i 1 www.uq.edu.au > www.uq.edu.au-p250
ping -s 472 -c 50 -i 1 www.uq.edu.au > www.uq.edu.au-p500
ping -s 722 -c 50 -i 1 www.uq.edu.au > www.uq.edu.au-p750
ping -s 972 -c 50 -i 1 www.uq.edu.au > www.uq.edu.au-p1000
ping -s 1222 -c 50 -i 1 www.uq.edu.au > www.uq.edu.au-p1250
ping -s 1472 -c 50 -i 1 www.uq.edu.au > www.uq.edu.au-p1500


# z5183982 @ wagner in /tmp_amd/kamen/export/kamen/4/z5183982/cs3331
$ ./runping.sh www.upm.edu.my

ping -s 22 -c 50 -i 1 www.upm.edu.my > www.upm.edu.my-p50
ping -s 222 -c 50 -i 1 www.upm.edu.my > www.upm.edu.my-p250
ping -s 472 -c 50 -i 1 www.upm.edu.my > www.upm.edu.my-p500
ping -s 722 -c 50 -i 1 www.upm.edu.my > www.upm.edu.my-p750
ping -s 972 -c 50 -i 1 www.upm.edu.my > www.upm.edu.my-p1000
ping -s 1222 -c 50 -i 1 www.upm.edu.my > www.upm.edu.my-p1250
ping -s 1472 -c 50 -i 1 www.upm.edu.my > www.upm.edu.my-p1500


# z5183982 @ wagner in /tmp_amd/kamen/export/kamen/4/z5183982/cs3331
$ ./runping.sh www.tu-berlin.de

ping -s 22 -c 50 -i 1 www.tu-berlin.de > www.tu-berlin.de-p50
ping -s 222 -c 50 -i 1 www.tu-berlin.de > www.tu-berlin.de-p250
ping -s 472 -c 50 -i 1 www.tu-berlin.de > www.tu-berlin.de-p500
ping -s 722 -c 50 -i 1 www.tu-berlin.de > www.tu-berlin.de-p750
ping -s 972 -c 50 -i 1 www.tu-berlin.de > www.tu-berlin.de-p1000
ping -s 1222 -c 50 -i 1 www.tu-berlin.de > www.tu-berlin.de-p1250
ping -s 1472 -c 50 -i 1 www.tu-berlin.de > www.tu-berlin.de-p1500
```
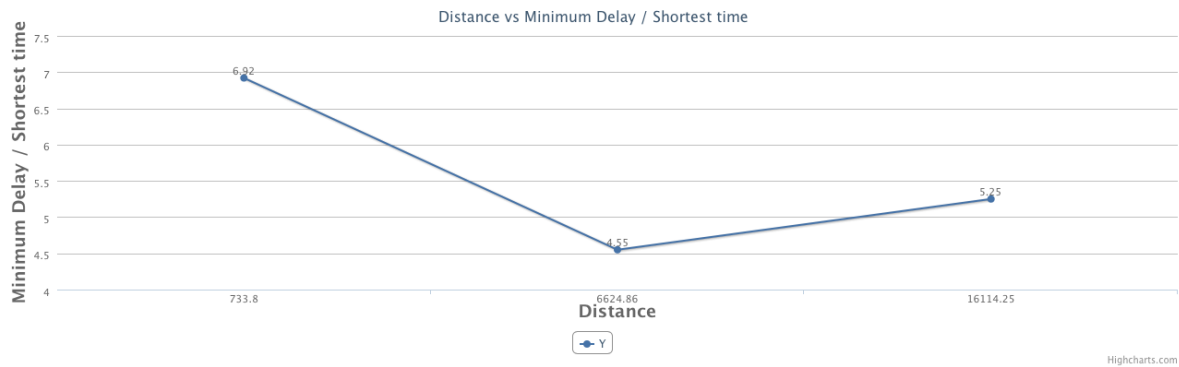
Host	Distance	Min Delay	Shortest Time	Ratio = Minium Delay / Shortest time
www.uq.edu.au	733.8 km	16.935	2.446 ms	6.92
www.upm.edu.my	4116.5 miles = 6624.86 km	100.657	22.08 ms	4.55
www.tu-berlin.de	10013.1 miles = 16114.52 km	281.883	53.72 ms	5.25

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

The y-axis = Minimum Delay / Shortest Time

Delay is the time including send time and receive time.
Ideally, Minimum Delay is twice as Shortest time. But in reality, the y-axis values is always greater than 2

- the first reason, the distance between two routers is not the shortest distance which search in google. In practice, it must be longer than it.
- Then, the different area has different transmission medium or different materials. It will result in different speed
- There are other delay, like transmission delay, queueing delay and processing delay.

4.2

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

The delay to the destinations varies over time. There are different delay when machine send or receive packets and each time may be different, for example, if traffic happens the delay will be larger.

4.3

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

```
$ ping www.epfl.ch
PING www.epfl.ch.cdn.cloudflare.net (172.67.2.106) 56(84) bytes of data.
64 bytes from 172.67.2.106: icmp_seq=1 ttl=56 time=1.54 ms
```

```
$ whois 172.67.2.106

#
# ARIN WHOIS data and services are subject to the Terms of Use
# available at: https://www.arin.net/resources/registry/whois/tou/
#
# If you see inaccuracies in the results, please report at
# https://www.arin.net/resources/registry/whois/inaccuracy_reporting/
#
# Copyright 1997-2020, American Registry for Internet Numbers, Ltd.
#


NetRange:       172.64.0.0 - 172.71.255.255
CIDR:           172.64.0.0/13
NetName:        CLOUDFLARENET
NetHandle:      NET-172-64-0-0-1
Parent:         NET172 (NET-172-0-0-0-0)
NetType:        Direct Assignment
OriginAS:       AS13335
Organization:   Cloudflare, Inc. (CLOUD14)
RegDate:        2015-02-25
Updated:        2017-02-17
Comment:        All Cloudflare abuse reporting can be done via https://www.cloudflare.com/abuse
Ref:            https://rdap.arin.net/registry/ip/172.64.0.0



OrgName:        Cloudflare, Inc.
OrgId:          CLOUD14
Address:        101 Townsend Street
City:           San Francisco
StateProv:      CA
PostalCode:     94107
Country:        US
RegDate:        2010-07-09
Updated:        2019-09-25
Ref:            https://rdap.arin.net/registry/entity/CLOUD14


OrgNOCHandle: NOC11962-ARIN
OrgNOCName:   NOC
OrgNOCPhone:  +1-650-319-8930
OrgNOCEmail:  noc@cloudflare.com
OrgNOCRef:    https://rdap.arin.net/registry/entity/NOC11962-ARIN

OrgTechHandle: ADMIN2521-ARIN
OrgTechName:   Admin
OrgTechPhone:  +1-650-319-8930
OrgTechEmail:  rir@cloudflare.com
OrgTechRef:    https://rdap.arin.net/registry/entity/ADMIN2521-ARIN

OrgAbuseHandle: ABUSE2916-ARIN
```

It is not in Switzerland.

This IP belongs to Cloudflare, the country is US.

4.4

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?

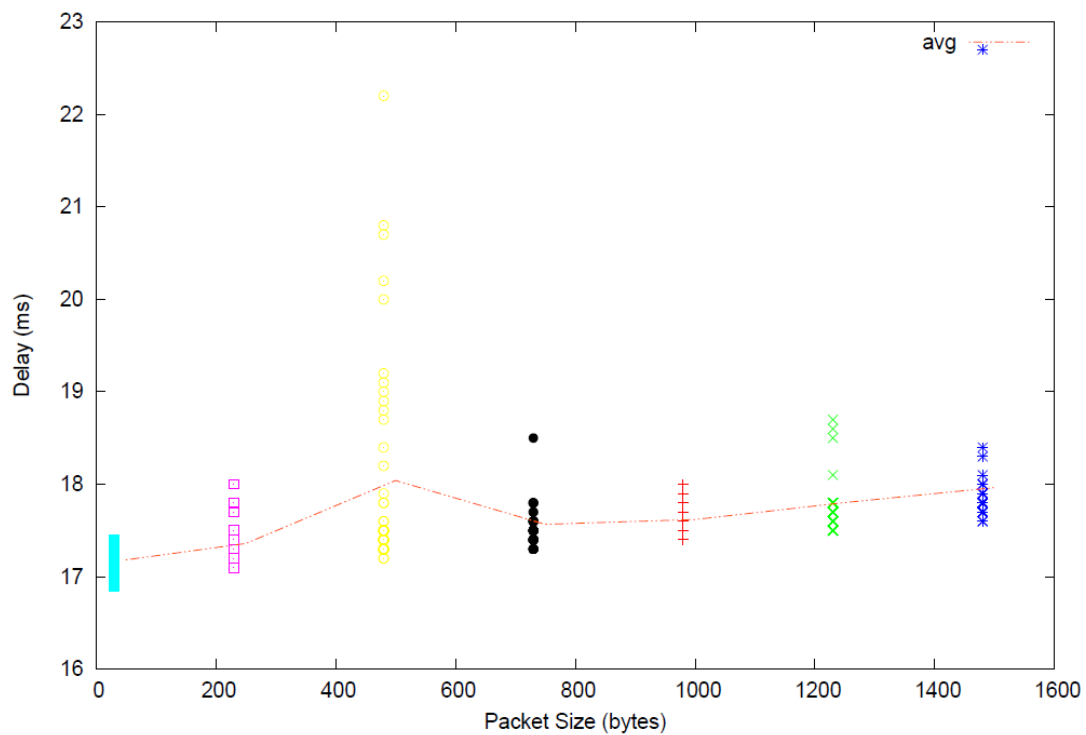| propagation delay	transmission delay	processing delay	queueing delay
Do not depends on	Depend on	Depend on	Do not depend on

- Propagation delay cause by distance between two routers and the material of the wired.
- Queueing delay is up to how many packets.

Materials in Exercise 4

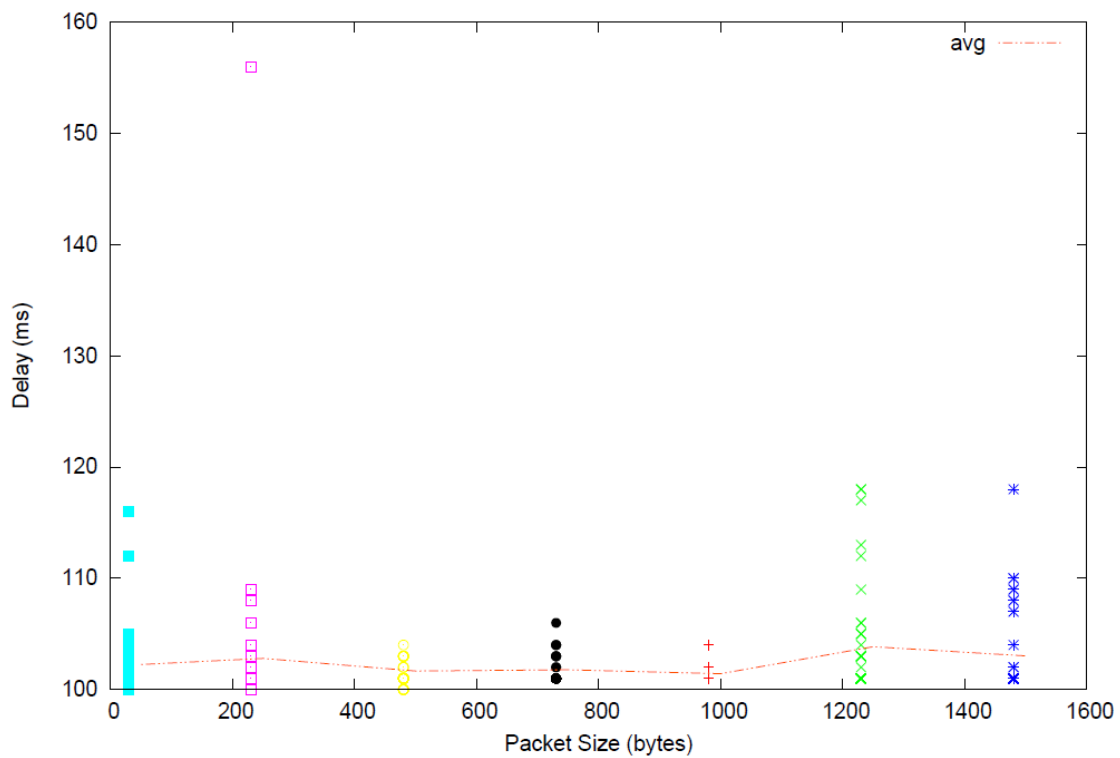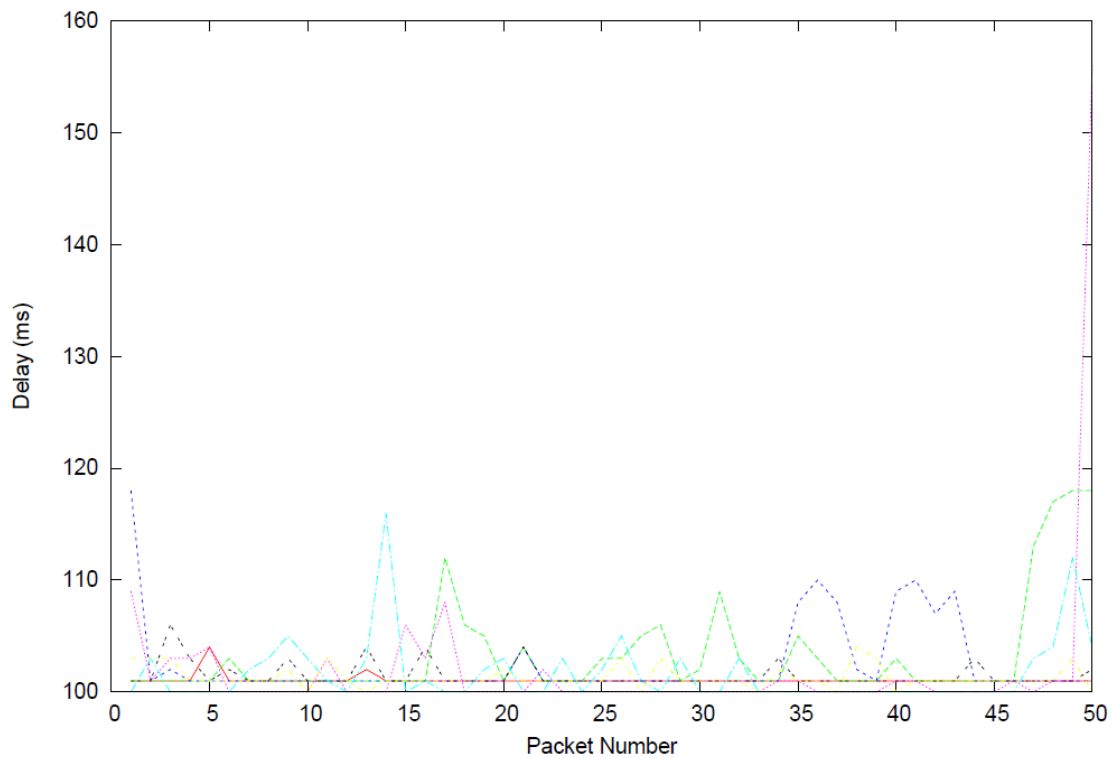www.uq.edu.au
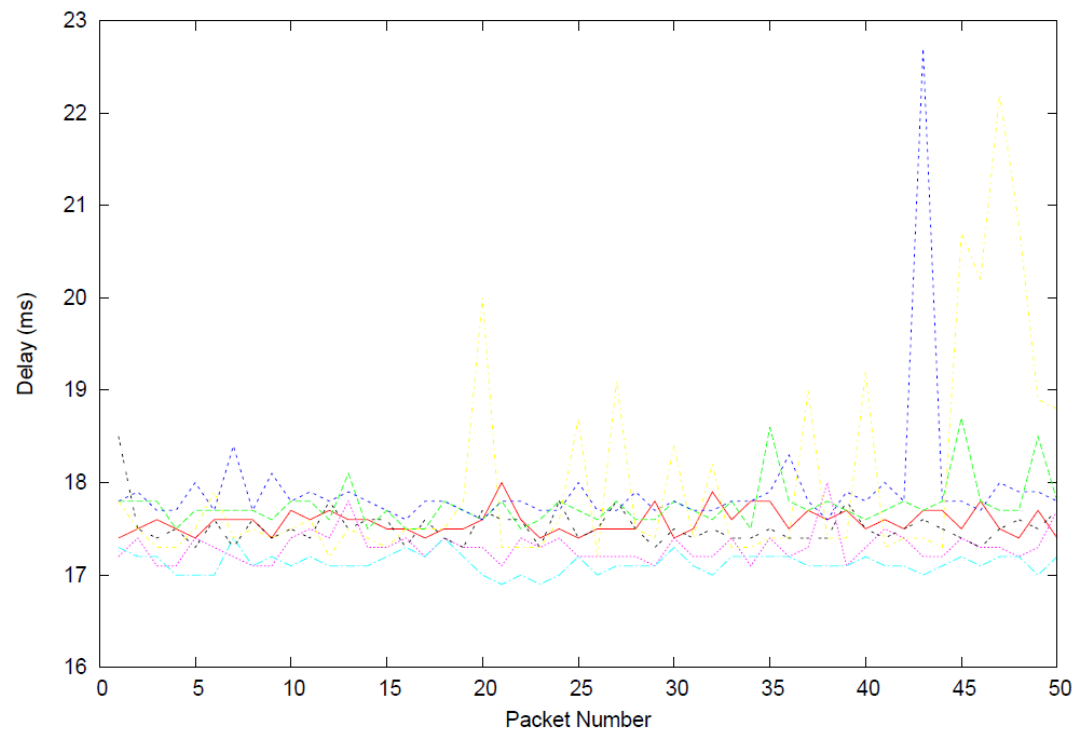
Fri Sep 25 15:44:11 2020

Fri Sep 25 15:44:11 2020

Week2 > lab1 > Exercise4 > 📄 www.uq.edu.au_avg.txt

```
1    50 17.183 16.935
2    250 17.359 17.130
3    500 18.041 17.225
4    750 17.567 17.335
5    1000 17.619 17.404
6    1250 17.803 17.536
7    1500 17.965 17.668
8
```
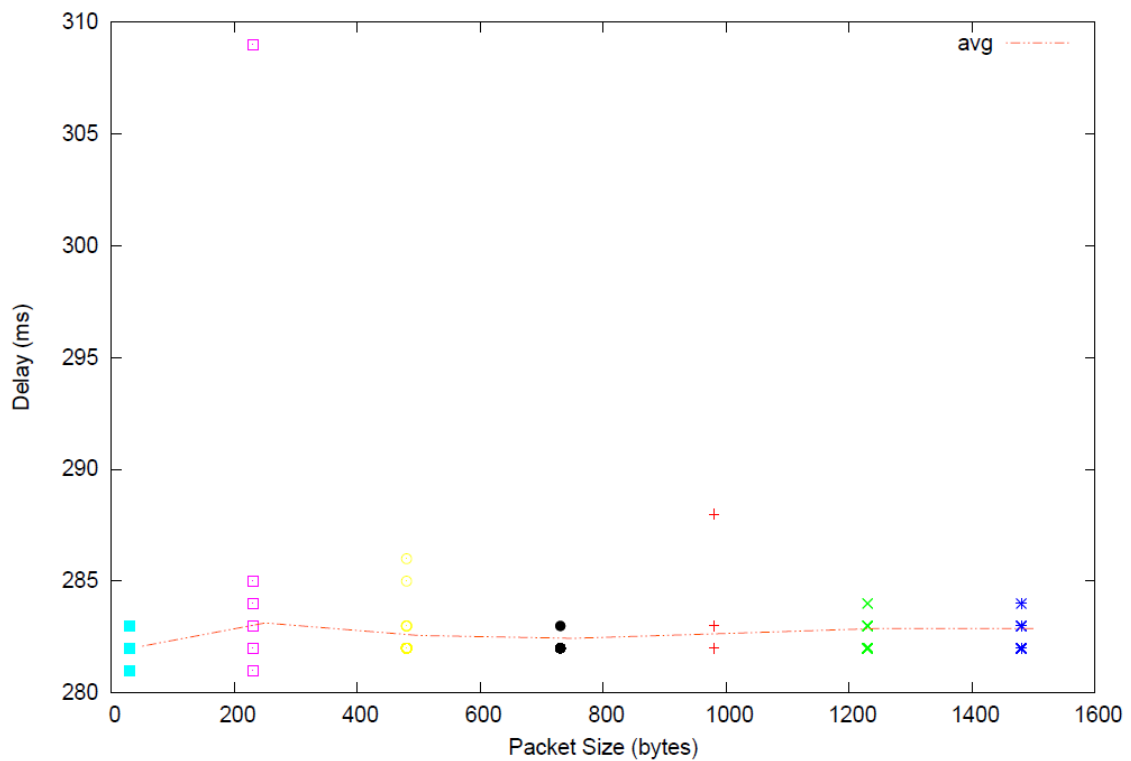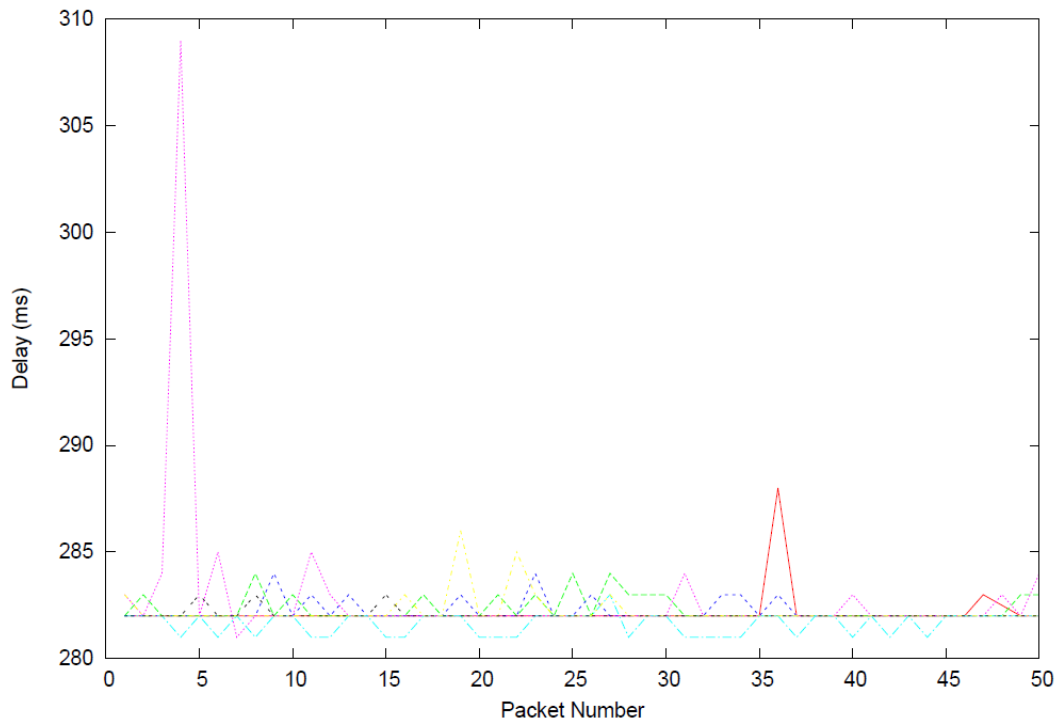
Fri Sep 25 15:44:22 2020

Fri Sep 25 15:44:22 2020

Week2 > lab1 > Exercise4 > 📄 www.upm.edu.my_avg.txt

```
1    50 102.254 100.657
2    250 102.804 100.808
3    500 101.668 100.952
4    750 101.774 101.098
5    1000 101.433 101.162
6    1250 103.858 101.342
7    1500 103.028 101.462
8
```

www.tu-berlin.de

Fri Sep 25 15:44:36 2020

Fri Sep 25 15:44:36 2020

```
1    50 282.092 281.883
2    250 283.134 281.989
3    500 282.570 282.151
4    750 282.445 282.240
5    1000 282.662 282.364
6    1250 282.886 282.414
7    1500 282.878 282.573
8
```