COMP9331 Lab Exercise 1

Student ID: z5145114

Student Name: Xiaodan Wang

Exercise 1

1.

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

Non-authoritative answer:
Name:   www.google.com
Address: 216.58.203.100
```

Google site's IP address: 216.58.203.100

Then I tried it again and found out:

```
wagner % 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
```

I think Google has many addresses which could be used to reply requests. In this way, server could reply requests efficiently. Otherwise, a large amount requests from all over the world will lead to a long waiting time.

2.

```
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.
```

The name of IP address 127.0.0.1 is localhost.

It is the IP address of local machine.

Exercise 2

1.www.cse.unsw.edu.au *reachable*

```
wagner % ping www.cse.unsw.edu.au
PING www.cse.unsw.edu.au (129.94.242.51) 56(84) bytes of data.
64 bytes from albeniz.orchestra.cse.unsw.EDU.AU (129.94.242.51): icmp_req=1 ttl=64 time=0.158 ms
64 bytes from albeniz.orchestra.cse.unsw.EDU.AU (129.94.242.51): icmp_req=2 ttl=64 time=0.179 ms
64 bytes from albeniz.orchestra.cse.unsw.EDU.AU (129.94.242.51): icmp_req=3 ttl=64 time=0.186 ms
64 bytes from albeniz.orchestra.cse.unsw.EDU.AU (129.94.242.51): icmp_req=4 ttl=64 time=0.173 ms
^C
--- www.cse.unsw.edu.au ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 2998ms
rtt min/avg/max/mdev = 0.158/0.174/0.186/0.010 ms
```

2.www.getfittest.com.au *unreachable*

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

3.www.mit.edu *reachable*

```
wagner % ping www.mit.edu
PING e9566.dscb.akamaiedge.net (104.74.27.200) 56(84) bytes of data.
64 bytes from a104-74-27-200.deploy.static.akamaitechnologies.com (104.74.27.200): icmp_req=1 ttl=56 time=1.15 ms
64 bytes from a104-74-27-200.deploy.static.akamaitechnologies.com (104.74.27.200): icmp_req=2 ttl=56 time=1.20 ms
64 bytes from a104-74-27-200.deploy.static.akamaitechnologies.com (104.74.27.200): icmp_req=3 ttl=56 time=1.23 ms
64 bytes from a104-74-27-200.deploy.static.akamaitechnologies.com (104.74.27.200): icmp_req=4 ttl=56 time=1.16 ms
64 bytes from a104-74-27-200.deploy.static.akamaitechnologies.com (104.74.27.200): icmp_req=5 ttl=56 time=1.19 ms
^C
--- e9566.dscb.akamaiedge.net ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4004ms
rtt min/avg/max/mdev = 1.153/1.191/1.231/0.027 ms
```

4.www.intel.com.au *reachable*

```
weill % ping www.intel.com.au
PING e117.b.akamaiedge.net (104.74.39.239) 56(84) bytes of data.
64 bytes from a104-74-39-239.deploy.static.akamaitechnologies.com (104.74.39.239): icmp_req=1 ttl=56 time=1.18 ms
64 bytes from a104-74-39-239.deploy.static.akamaitechnologies.com (104.74.39.239): icmp_req=2 ttl=56 time=1.16 ms
64 bytes from a104-74-39-239.deploy.static.akamaitechnologies.com (104.74.39.239): icmp_req=3 ttl=56 time=1.16 ms
^C
--- e117.b.akamaiedge.net ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2002ms
rtt min/avg/max/mdev = 1.160/1.171/1.184/0.009 ms
```

5.www.tpg.com.au *reachable*

```
weill % ping www.tpg.com.au
PING www.tpg.com.au (203.26.27.38) 56(84) bytes of data.
64 bytes from www.tpg.com.au (203.26.27.38): icmp_req=1 ttl=118 time=29.9 ms
64 bytes from www.tpg.com.au (203.26.27.38): icmp_req=2 ttl=118 time=29.7 ms
64 bytes from www.tpg.com.au (203.26.27.38): icmp_req=3 ttl=118 time=29.9 ms
^C
--- www.tpg.com.au ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2002ms
rtt min/avg/max/mdev = 29.757/29.888/29.957/0.092 ms
```

6.www.hola.hp *unreachable*

```
weill % ping www.hola.hp
ping: unknown host www.hola.hp
```

7.www.amazon.com *reachable*

```
weill % ping www.amazon.com
PING e15316.ci.akamaiedge.net (104.97.231.172) 56(84) bytes of data.
64 bytes from a104-97-231-172.deploy.static.akamaitechnologies.com (104.97.231.172): icmp_req=1 ttl=56 time=14.0 ms
64 bytes from a104-97-231-172.deploy.static.akamaitechnologies.com (104.97.231.172): icmp_req=2 ttl=56 time=14.0 ms
64 bytes from a104-97-231-172.deploy.static.akamaitechnologies.com (104.97.231.172): icmp_req=3 ttl=56 time=14.1 ms
64 bytes from a104-97-231-172.deploy.static.akamaitechnologies.com (104.97.231.172): icmp_req=4 ttl=56 time=14.0 ms
^C
--- e15316.ci.akamaiedge.net ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3003ms
rtt min/avg/max/mdev = 14.023/14.072/14.137/0.093 ms
```

8.www.tsinghua.edu.cn *reachable*

```
weill % ping www.tsinghua.edu.cn
PING www.d.tsinghua.edu.cn (166.111.4.100) 56(84) bytes of data.
64 bytes from www.tsinghua.edu.cn (166.111.4.100): icmp_req=1 ttl=233 time=310 ms
64 bytes from www.tsinghua.edu.cn (166.111.4.100): icmp_req=2 ttl=233 time=310 ms
64 bytes from www.tsinghua.edu.cn (166.111.4.100): icmp_req=3 ttl=233 time=310 ms
64 bytes from www.tsinghua.edu.cn (166.111.4.100): icmp_req=4 ttl=233 time=310 ms
^C
--- www.d.tsinghua.edu.cn ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3004ms
rtt min/avg/max/mdev = 310.569/310.657/310.739/0.400 ms
```

9.www.kremlin.ru *unreachable*

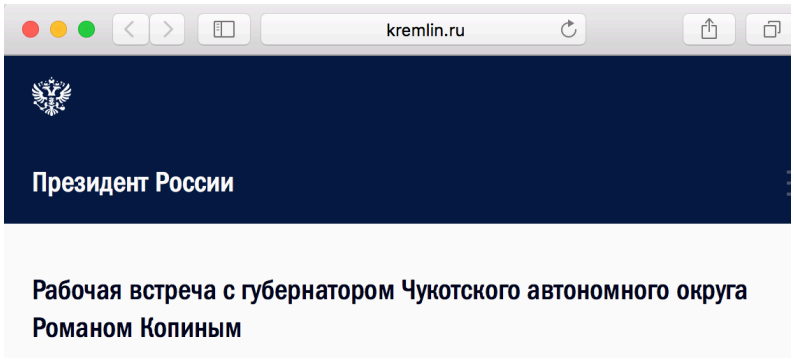
```
weill % ping www.kremlin.ru
PING www.kremlin.ru (95.173.136.72) 56(84) bytes of data.
^C
--- www.kremlin.ru ping statistics ---
2 packets transmitted, 0 received, 100% packet loss, time 1008ms
```

10.8.8.8.8 *reachable*

```
weill % ping 8.8.8.8
PING 8.8.8.8 (8.8.8.8) 56(84) bytes of data.
64 bytes from 8.8.8.8: icmp_req=1 ttl=120 time=1.19 ms
64 bytes from 8.8.8.8: icmp_req=2 ttl=120 time=1.24 ms
64 bytes from 8.8.8.8: icmp_req=3 ttl=120 time=1.13 ms
^C
--- 8.8.8.8 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2002ms
rtt min/avg/max/mdev = 1.137/1.195/1.249/0.045 ms
```

There are e hosts are unreachable: www.getfittest.com.au, www.kremlin.ru and www.hola.hp

www.getfittest.com.au and www.hola.hp are unreachable from the web browser.



However, I can reach www.kremlin.ru from the web browser.

I think the problem of www.getfittest.com.au and www.hola.hp is that the host server names are not exist.

As for www.kremlin.ru, the server exists. However, the address has been block out for some reason.

Exercise 3

1.

```
weill % 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)  0.121 ms  0.130 ms  0.111 ms
 2  129.94.39.17 (129.94.39.17)  1.088 ms  1.060 ms  1.000 ms
 3  ombudnex1-vl-3154.gw.unsw.edu.au (149.171.253.35)  1.586 ms libudnex1-vl-3154.gw.unsw.edu.au (149.
171.253.34)  2.208 ms  2.205 ms
 4  ombcr1-po-5.gw.unsw.edu.au (149.171.255.197)  1.185 ms libcr1-po-5.gw.unsw.edu.au (149.171.255.165
)  1.235 ms libcr1-po-6.gw.unsw.edu.au (149.171.255.201)  1.247 ms
 5  unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105)  1.301 ms  1.300 ms unswbr1-te-1-9.gw.unsw.edu.au
 (149.171.255.101)  1.312 ms
 6  138.44.5.0 (138.44.5.0)  5.001 ms  4.429 ms  4.413 ms
 7  et-1-3-0.pe1.sxt.bkvl.nsw.aarnet.net.au (113.197.15.149)  2.146 ms  1.961 ms  2.070 ms
 8  et-0-0-0.pe1.a.hnl.aarnet.net.au (113.197.15.99)  95.276 ms  95.179 ms  95.195 ms
 9  et-2-1-0.bdr1.a.sea.aarnet.net.au (113.197.15.201)  146.428 ms  146.433 ms  146.394 ms
10  abilene-1-lo-jmb-706.sttlwa.pacificwave.net (207.231.240.8)  146.472 ms  146.466 ms  146.496 ms
11  et-4-0-0.4079.rtsw.miss2.net.internet2.edu (162.252.70.0)  157.400 ms  157.369 ms  157.433 ms
12  et-4-0-0.4079.rtsw.minn.net.internet2.edu (162.252.70.58)  184.121 ms  180.333 ms  180.317 ms
13  et-1-1-2.4079.rtsw.eqch.net.internet2.edu (162.252.70.106)  188.287 ms  188.745 ms  188.661 ms
14  ae-1.4079.rtsw.clev.net.internet2.edu (162.252.70.130)  196.874 ms  211.478 ms  196.911 ms
15  buf-9208-I2-CLEV.nysernet.net (199.109.11.33)  201.167 ms  201.151 ms  201.172 ms
16  syr-9208-buf-9208.nysernet.net (199.109.7.193)  204.953 ms  207.640 ms  207.629 ms
17  nyc-9208-syr-9208.nysernet.net (199.109.7.162)  210.168 ms  210.315 ms  210.200 ms
18  columbia.nyc-9208.nysernet.net (199.109.4.14)  244.412 ms  236.091 ms  210.356 ms
19  cc-core-1-x-nyser32-gw-1.net.columbia.edu (128.59.255.5)  210.637 ms  210.716 ms  224.944 ms
20  cc-conc-1-x-cc-core-1.net.columbia.edu (128.59.255.210)  210.963 ms  210.859 ms  210.852 ms
21  neighbors.columbia.edu (128.59.105.24)  210.363 ms  210.328 ms  210.456 ms
```

There are 21 routers between my workstation and www.columbia.edu.

5 routers along the path are part of UNSW network.

From router7 to router9, the trip times increases dramatically, which is 2.146ms at router7 and reach 146.433 at router9. So I think router7 and router9 cross the Pacific Ocean.

2.

Comparing the traceroute of 3 destinations, it is easy to find out that they diverge at router6.

They hold same IP address at router6 which is 138.44.5.0, and became different in router7.

```
weill % 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)  0.137 ms  0.115 ms  0.094 ms
 2  129.94.39.17 (129.94.39.17)  1.084 ms  1.041 ms  1.100 ms
 3  libudnex1-vl-3154.gw.unsw.edu.au (149.171.253.34)  1.456 ms ombudnex1-vl-3154.gw.unsw.edu.au (149.1
71.253.35)  1.596 ms  1.593 ms
 4  libcr1-po-5.gw.unsw.edu.au (149.171.255.165)  1.148 ms ombcr1-po-6.gw.unsw.edu.au (149.171.255.169)
  1.210 ms  1.249 ms
 5  unswbr1-te-1-9.gw.unsw.edu.au (149.171.255.101)  1.259 ms unswbr1-te-2-13.gw.unsw.edu.au (149.171.2
55.105)  1.286 ms unswbr1-te-1-9.gw.unsw.edu.au (149.171.255.101)  1.300 ms
 6  138.44.5.0 (138.44.5.0)  1.352 ms  1.385 ms  1.325 ms
 7  et-1-3-0.pe1.sxt.bkvl.nsw.aarnet.net.au (113.197.15.149)  2.274 ms  2.287 ms  2.275 ms
 8  et-0-0-0.pe1.a.hnl.aarnet.net.au (113.197.15.99)  95.384 ms  95.426 ms  95.350 ms
 9  et-2-1-0.bdr1.a.sea.aarnet.net.au (113.197.15.201)  146.462 ms  146.462 ms  146.457 ms
10  cenichpr-1-is-jmb-778.snvaca.pacificwave.net (207.231.245.129)  162.997 ms  162.992 ms  162.990 ms
11  hpr-lax-hpr3--svl-hpr3-100ge.cenic.net (137.164.25.73)  170.913 ms  170.870 ms  170.888 ms
12  * * *
13  bd11f1.anderson--cr001.anderson.ucla.net (169.232.4.6)  171.201 ms bd11f1.anderson--cr00f2.csb1.ucl
a.net (169.232.4.4)  171.316 ms bd11f1.anderson--cr001.anderson.ucla.net (169.232.4.6)  171.267 ms
14  cr00f1.anderson--dr00f2.csb1.ucla.net (169.232.4.55)  171.265 ms  171.348 ms  171.301 ms
```

```
weill % 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)  0.193 ms  0.177 ms  0.155 ms
 2  129.94.39.17 (129.94.39.17)  1.064 ms  1.089 ms  0.978 ms
 3  libudnex1-vl-3154.gw.unsw.edu.au (149.171.253.34)  1.809 ms  1.803 ms ombudnex1-vl-3154.gw.unsw.edu
.au (149.171.253.35)  40.010 ms
 4  ombcr1-po-6.gw.unsw.edu.au (149.171.255.169)  10.008 ms ombcr1-po-5.gw.unsw.edu.au (149.171.255.197
)  10.000 ms libcr1-po-6.gw.unsw.edu.au (149.171.255.201)  1.201 ms
 5  unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105)  1.415 ms unswbr1-te-1-9.gw.unsw.edu.au (149.171.2
55.101)  1.330 ms unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105)  1.473 ms
 6  138.44.5.0 (138.44.5.0)  1.431 ms  1.438 ms  1.432 ms
 7  et-0-3-0.pe1.bkvl.nsw.aarnet.net.au (113.197.15.147)  1.827 ms  1.895 ms  1.894 ms
 8  ge-4_0_0.bb1.a.pao.aarnet.net.au (202.158.194.177)  156.114 ms  156.220 ms  156.166 ms
 9  paloalto0.iij.net (198.32.176.24)  157.970 ms  158.160 ms  158.185 ms
10  osk004bb01.IIJ.Net (58.138.88.189)  271.230 ms osk004bb00.IIJ.Net (58.138.88.185)  263.810 ms  263.
855 ms
11  osk004ix51.IIJ.Net (58.138.106.126)  263.738 ms  263.757 ms  263.467 ms
12  210.130.135.130 (210.130.135.130)  267.515 ms  263.637 ms  267.264 ms
13  124.83.228.78 (124.83.228.78)  271.088 ms  271.066 ms  267.441 ms
14  124.83.252.250 (124.83.252.250)  279.619 ms  277.674 ms  277.651 ms
15  158.205.134.26 (158.205.134.26)  270.026 ms  273.786 ms  273.807 ms
```

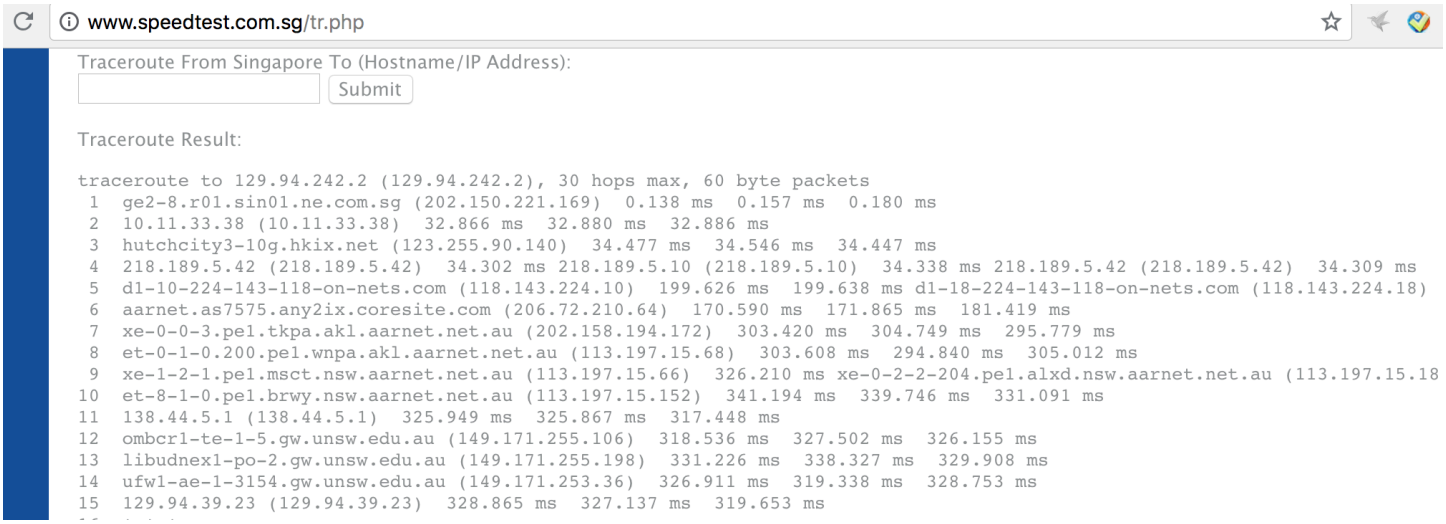
```
weill % traceroute www.lancaster.ac.uk
traceroute to www.lancaster.ac.uk (148.88.65.80), 30 hops max, 60 byte packets
 1  cserouter1-server.cse.unsw.EDU.AU (129.94.242.251)  0.161 ms  0.146 ms  0.124 ms
 2  129.94.39.17 (129.94.39.17)  1.092 ms  1.028 ms  1.052 ms
 3  libudnex1-vl-3154.gw.unsw.edu.au (149.171.253.34)  1.950 ms ombudnex1-vl-3154.gw.unsw.edu.au (149.1
71.253.35)  1.423 ms libudnex1-vl-3154.gw.unsw.edu.au (149.171.253.34)  1.920 ms
 4  ombcr1-po-5.gw.unsw.edu.au (149.171.255.197)  1.278 ms  1.273 ms libcr1-po-6.gw.unsw.edu.au (149.17
1.255.201)  1.198 ms
 5  unswbr1-te-1-9.gw.unsw.edu.au (149.171.255.101)  1.393 ms unswbr1-te-2-13.gw.unsw.edu.au (149.171.2
55.105)  1.312 ms unswbr1-te-1-9.gw.unsw.edu.au (149.171.255.101)  1.442 ms
 6  138.44.5.0 (138.44.5.0)  1.298 ms  1.384 ms  1.387 ms
 7  et-1-3-0.pe1.sxt.bkvl.nsw.aarnet.net.au (113.197.15.149)  2.319 ms  2.360 ms  2.175 ms
 8  et-0-0-0.pe1.a.hnl.aarnet.net.au (113.197.15.99)  95.176 ms  95.158 ms  95.224 ms
 9  et-2-1-0.bdr1.a.sea.aarnet.net.au (113.197.15.201)  146.510 ms  146.512 ms  146.438 ms
10  abilene-1-lo-jmb-706.sttlwa.pacificwave.net (207.231.240.8)  146.584 ms  146.653 ms  146.588 ms
11  et-4-0-0.4079.rtsw.miss2.net.internet2.edu (162.252.70.0)  157.359 ms  157.314 ms  157.337 ms
12  et-4-0-0.4079.rtsw.minn.net.internet2.edu (162.252.70.58)  180.604 ms  180.551 ms  180.534 ms
13  et-1-1-2.4079.rtsw.eqch.net.internet2.edu (162.252.70.106)  188.802 ms  188.686 ms  188.632 ms
14  ae-1.4079.rtsw.clev.net.internet2.edu (162.252.70.130)  197.344 ms  197.247 ms  197.151 ms
15  et-2-0-0.4079.rtsw.ashb.net.internet2.edu (162.252.70.54)  210.209 ms  210.160 ms  210.148 ms
16  ae-2.4079.rtsw.wash.net.internet2.edu (162.252.70.136)  205.026 ms  205.091 ms  205.005 ms
17  internet2.mx1.lon.uk.geant.net (62.40.124.44)  279.642 ms  279.892 ms  279.806 ms
18  janet-gw.mx1.lon.uk.geant.net (62.40.124.198)  279.973 ms  279.696 ms  279.820 ms
19  ae29.londpg-sbr2.ja.net (146.97.33.2)  280.234 ms  280.243 ms  280.291 ms
20  ae31.erdiss-sbr2.ja.net (146.97.33.22)  284.038 ms  283.822 ms  284.081 ms
21  ae29.manckh-sbr2.ja.net (146.97.33.42)  287.824 ms  287.778 ms  287.800 ms
22  ae24.lanclu-rbr1.ja.net (146.97.38.58)  293.502 ms  293.512 ms  293.473 ms
23  * * *
24  ismx-issrx.rtr.lancs.ac.uk (148.88.255.17)  302.921 ms  302.925 ms  295.481 ms
25  dc.iss.srv.rtrcloud.lancs.ac.uk (148.88.253.3)  327.536 ms  323.306 ms  315.953 ms
26  www.lancs.ac.uk (148.88.65.80)  290.058 ms !X  289.961 ms !X  290.148 ms !X
```

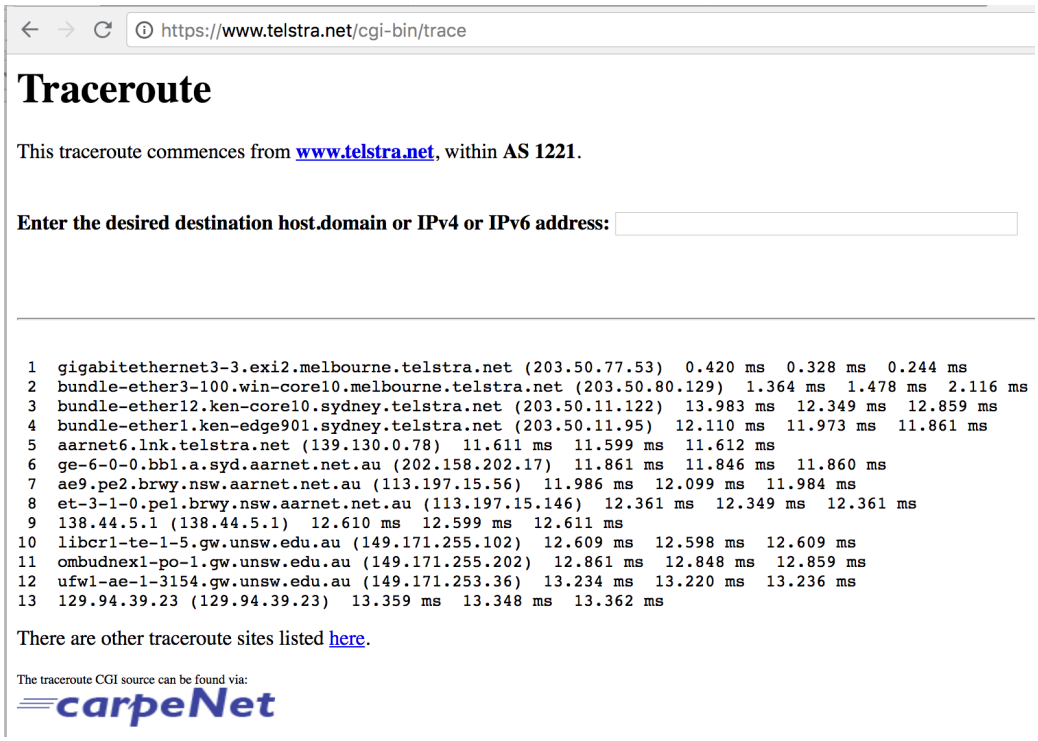
As the table below,

www.ucla.edu	164.67.228.152	12,056 km	14
www.u-tokyo.ac.jp	210.152.243.234	7,898 km	15
www.lancaster.ac.uk	148.88.65.80	16,998 km	26

It is easy to see the number of hops is not proportional the physical distance.

3.





https://www.telstra.net/cgi-bin/trace

Traceroute

This traceroute commences from **www.telstra.net**, within **AS 1221**.

Enter the desired destination host.domain or IPv4 or IPv6 address:

```
 1  gigabitethernet3-3.exi2.melbourne.telstra.net (203.50.77.53)  0.420 ms  0.328 ms  0.244 ms
 2  bundle-ether3-100.win-core10.melbourne.telstra.net (203.50.80.129)  1.364 ms  1.478 ms  2.116 ms
 3  bundle-ether12.ken-core10.sydney.telstra.net (203.50.11.122)  13.983 ms  12.349 ms  12.859 ms
 4  bundle-ether1.ken-edge901.sydney.telstra.net (203.50.11.95)  12.110 ms  11.973 ms  11.861 ms
 5  aarnet6.lnk.telstra.net (139.130.0.78)  11.611 ms  11.599 ms  11.612 ms
 6  ge-6-0-0.bb1.a.syd.aarnet.net.au (202.158.202.17)  11.861 ms  11.846 ms  11.860 ms
 7  ae9.pe2.brwy.nsw.aarnet.net.au (113.197.15.56)  11.986 ms  12.099 ms  11.984 ms
 8  et-3-1-0.pe1.brwy.nsw.aarnet.net.au (113.197.15.146)  12.361 ms  12.349 ms  12.361 ms
 9  138.44.5.1 (138.44.5.1)  12.610 ms  12.599 ms  12.611 ms
10  libcr1-te-1-5.gw.unsw.edu.au (149.171.255.102)  12.609 ms  12.598 ms  12.609 ms
11  ombudnex1-po-1.gw.unsw.edu.au (149.171.255.202)  12.861 ms  12.848 ms  12.859 ms
12  ufw1-ae-1-3154.gw.unsw.edu.au (149.171.253.36)  13.234 ms  13.220 ms  13.236 ms
13  129.94.39.23 (129.94.39.23)  13.359 ms  13.348 ms  13.362 ms
```

There are other traceroute sites listed here.

The traceroute CGI source can be found via:

carpeNet

```
[weill % 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)  0.147 ms  0.121 ms  0.118 ms
 2  129.94.39.17 (129.94.39.17)  1.098 ms  1.063 ms  1.052 ms
 3  ombudnex1-vl-3154.gw.unsw.edu.au (149.171.253.35)  1.496 ms  1.928 ms  1.910 ms
 4  libcr1-po-6.gw.unsw.edu.au (149.171.255.201)  1.300 ms ombcr1-po-6.gw.unsw.edu.au (149.171.255.169)
  1.226 ms libcr1-po-6.gw.unsw.edu.au (149.171.255.201)  1.262 ms
 5  unswbr1-te-1-9.gw.unsw.edu.au (149.171.255.101)  1.275 ms unswbr1-te-2-13.gw.unsw.edu.au (149.171.2
55.105)  1.277 ms  1.316 ms
 6  138.44.5.0 (138.44.5.0)  1.422 ms  1.591 ms  1.345 ms
 7  et-0-3-0.pe1.alxd.nsw.aarnet.net.au (113.197.15.153)  1.739 ms  1.861 ms  1.829 ms
 8  xe-0-2-1-204.pe1.wnpa.alxd.aarnet.net.au (113.197.15.183)  24.400 ms  24.306 ms  24.295 ms
 9  et-0-1-0.200.pe1.tkpa.akl.aarnet.net.au (113.197.15.69)  24.632 ms  24.602 ms  24.669 ms
10  xe-0-2-6.bdr1.a.lax.aarnet.net.au (202.158.194.173)  148.042 ms  148.007 ms  147.987 ms
11  peer1network.as13768.any2ix.coresite.com (206.72.210.79)  148.052 ms  148.043 ms  149.386 ms
12  * * *
13  * * *
14  10ge.xe-1-3-3.tor-fr709-cor-1.peer1.net (216.187.118.241)  219.192 ms * *
```

```
[weill % 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)  0.189 ms  0.175 ms  0.152 ms
 2  129.94.39.17 (129.94.39.17)  1.101 ms  1.052 ms  1.073 ms
 3  libudnex1-vl-3154.gw.unsw.edu.au (149.171.253.34)  2.030 ms  1.985 ms  1.470 ms
 4  ombcr1-po-6.gw.unsw.edu.au (149.171.255.169)  41.806 ms libcr1-po-6.gw.unsw.edu.au (149.171.255.201
)  1.223 ms  1.239 ms
 5  unswbr1-te-1-9.gw.unsw.edu.au (149.171.255.101)  166.075 ms unswbr1-te-2-13.gw.unsw.edu.au (149.171
.255.105)  166.011 ms unswbr1-te-1-9.gw.unsw.edu.au (149.171.255.101)  166.053 ms
 6  138.44.5.0 (138.44.5.0)  1.576 ms  1.448 ms  1.438 ms
 7  et-0-3-0.pe1.bkvl.nsw.aarnet.net.au (113.197.15.147)  1.724 ms  1.675 ms  1.717 ms
 8  ae9.bb1.a.syd.aarnet.net.au (113.197.15.57)  2.084 ms  2.005 ms  2.052 ms
 9  gigabitethernet1-1.pe1.b.syd.aarnet.net.au (202.158.202.18)  2.171 ms  2.101 ms  2.169 ms
10  gigabitethernet3-11.ken37.sydney.telstra.net (139.130.0.77)  2.835 ms  2.889 ms  2.873 ms
11  bundle-ether13.ken-core10.sydney.telstra.net (203.50.11.94)  3.313 ms  4.783 ms  4.319 ms
12  bundle-ether10.win-core10.melbourne.telstra.net (203.50.11.123)  14.351 ms  14.332 ms  14.303 ms
13  gigabitethernet5-0.exi-service2.melbourne.telstra.net (203.50.80.132)  14.194 ms  14.103 ms  14.023
 ms
```

The IP addresses of 2 servers are 209.15.13.134 and 203.50.5.178.

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

Even if the reverse path goes through the same routers as forward path, they do not share the same IP address. I think it may because that the reverse path and forward path are separate part and routers will give different IP address to different request.

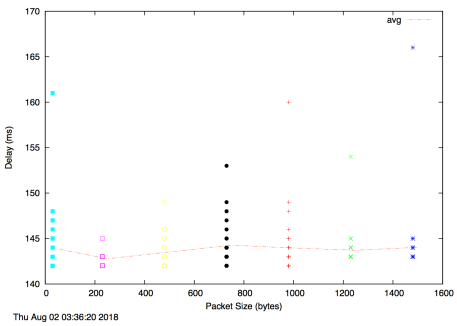
Exercise 4

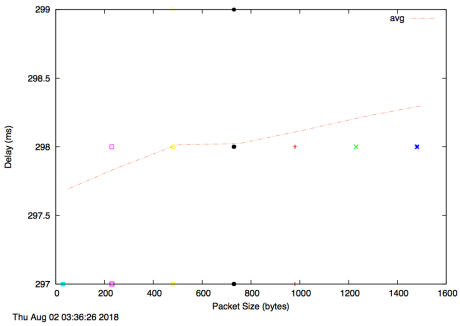
1.

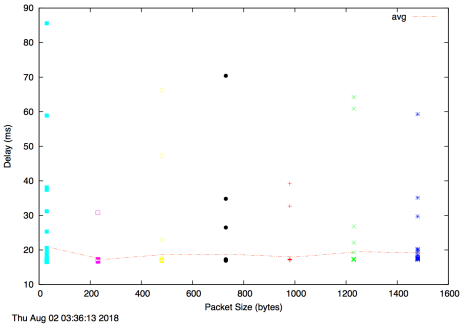
shortest possible time = distances / speed of light

websites	distances	shortest possible time T
www.uq.edu.au	734 km	2.45 ms
www.nus.edu.sg	6,313 km	21.04 ms
www.tu-berlin.de	16,100 km	53.67 ms

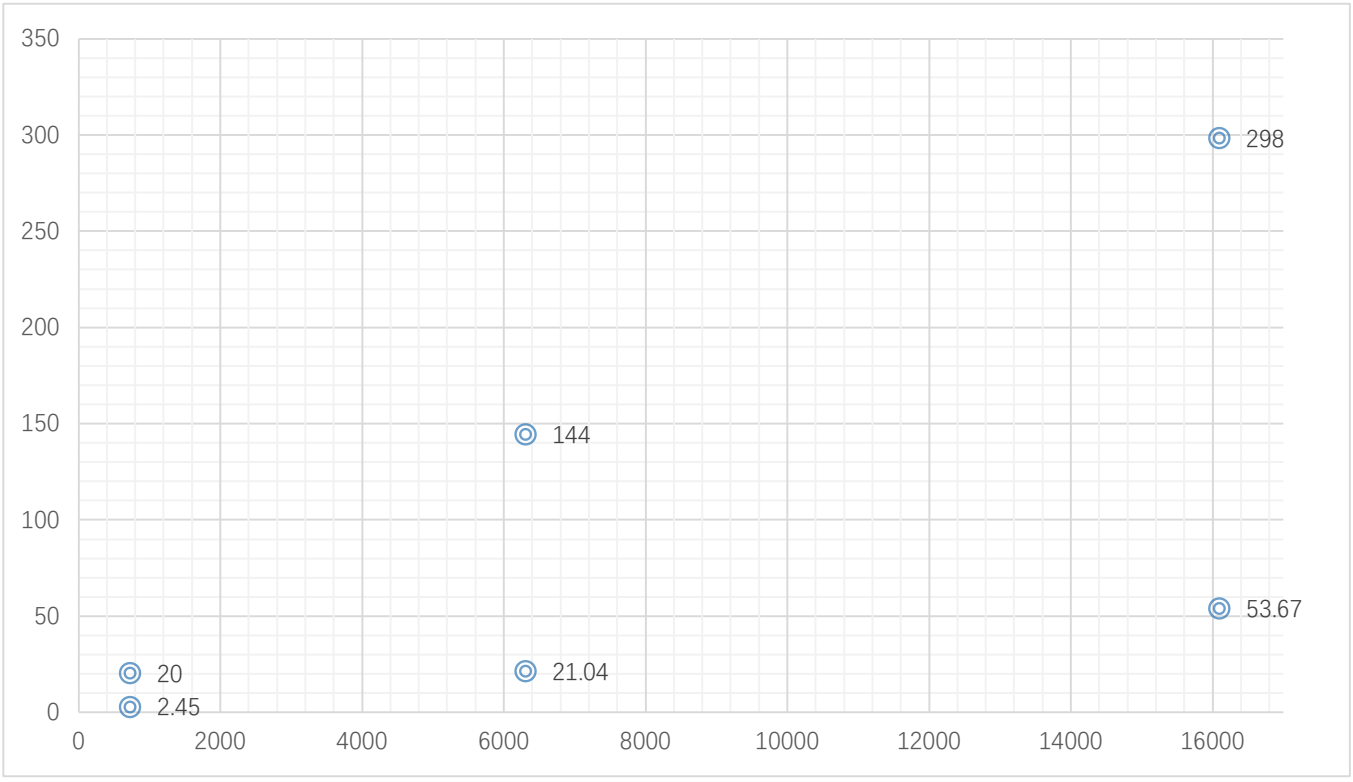
By runping.sh and plot.sh, we can get the ratio between the minimum delay.







websites	RRT	shortest possible time T
www.uq.edu.au	20 ms	2.45 ms
www.nus.edu.sg	144 ms	21.04 ms
www.tu-berlin.de	298 ms	53.67 ms

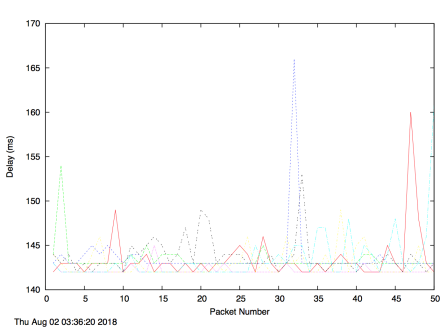


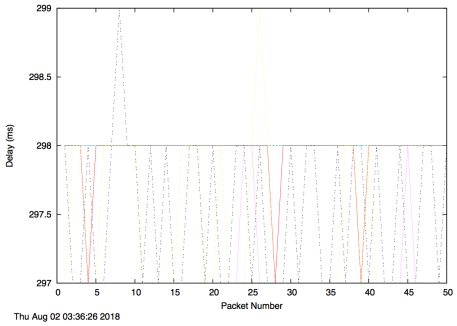
The reason why y-axis value greater than 2:

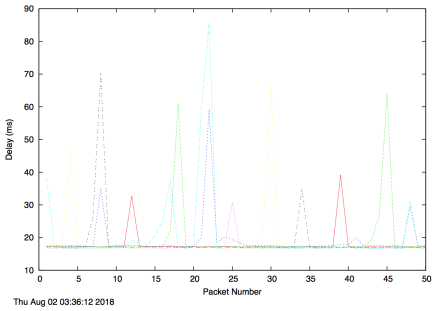
First, besides propagation delay, there also are processing delay, transmission delay and queueing delay.

Second, the packets do not move in light speed so it would take longer time.

2.







As shown above, the delay varies over time.

I think the reason is the delay could be influenced by many factor so it is not guaranteed the delay is constant. It depends on something such as queueing time.

3.

Propagation delay depends on link's physical length and propagation speed.

Transmission delay depends on packets length and link bandweith.

Processing delay is not related to packets size.

Queueing delay depends on congestion level of router.

In a conclusion, only transmission delay depends on packets size.