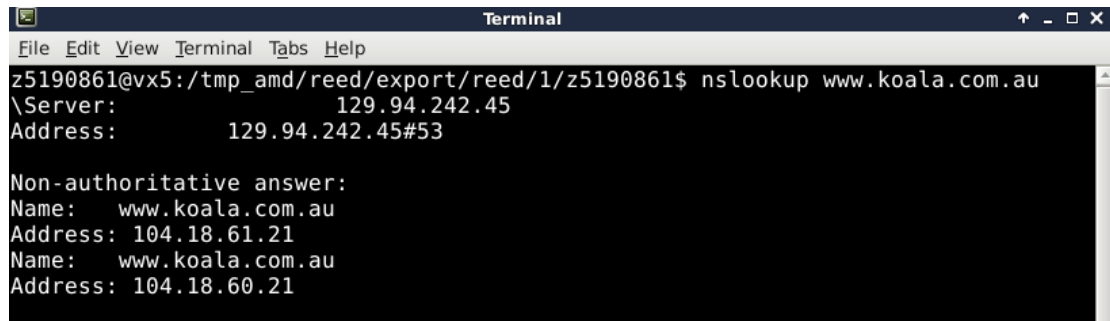


Lab1

Exercise 1

Question 1:

A terminal window titled "Terminal" with a menu bar (File, Edit, View, Terminal, Tabs, Help). The command prompt shows a user at a shell with the command `nslookup www.koala.com.au`. The output displays two authoritative server entries for `www.koala.com.au` with IP addresses `129.94.242.45` and `104.18.61.21`, followed by a "Non-authoritative answer" section showing the same two IP addresses.

```
z5190861@vx5:/tmp_amd/reed/export/reed/1/z5190861$ nslookup www.koala.com.au
Server:          129.94.242.45
Address:         129.94.242.45#53

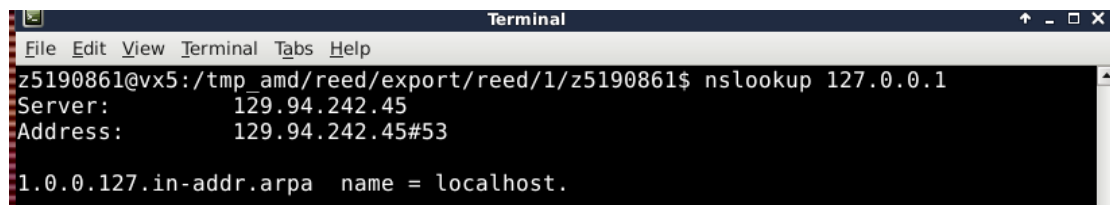
Non-authoritative answer:
Name:   www.koala.com.au
Address: 104.18.61.21
Name:   www.koala.com.au
Address: 104.18.60.21
```

What is the reason of having several IP addresses as an output?

Answer:

Because of the load balancing. The request is usually dispatched by the Load Balancer and processed by the specified server process. The processing task is dispatched to different processes to reduce the load of a single process, so as to achieve the purpose of expanding the capacity at the level of processing capacity. In addition, in the system that implements load balancing, multiple server processes provide the same service. If one process is not available, the task will be dispatched to other available processes by the load balancer to achieve the purpose of high availability. So one host usually has several IP addresses.

Question 2:

A terminal window titled "Terminal" with a menu bar (File, Edit, View, Terminal, Tabs, Help). The command prompt shows a user at a shell with the command `nslookup 127.0.0.1`. The output shows the authoritative server as `129.94.242.45` and the address as `129.94.242.45#53`. Below this, it shows the reverse lookup for `1.0.0.127.in-addr.arpa` resulting in `name = localhost.`

```
z5190861@vx5:/tmp_amd/reed/export/reed/1/z5190861$ nslookup 127.0.0.1
Server:          129.94.242.45
Address:         129.94.242.45#53

1.0.0.127.in-addr.arpa  name = localhost.
```

The name of it is localhost.

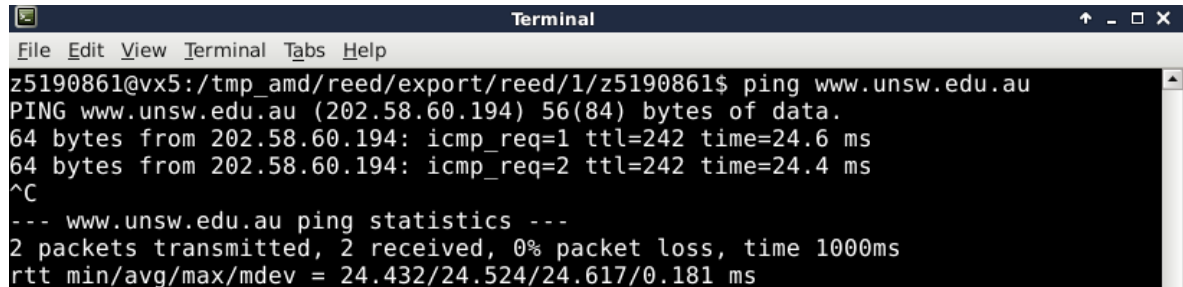
What is special about this IP address?

Answer:

Localhost is a domain name, a special DNS host name. And it represents to the computer you are on. It can send a packet to itself.

Exercise 2

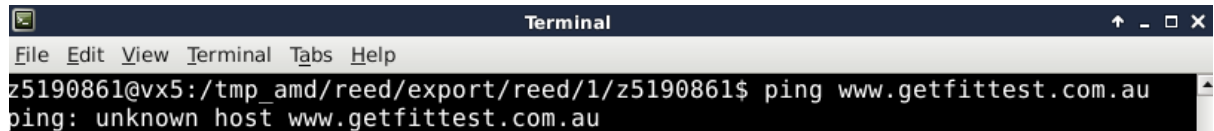
1: www.unsw.edu.au

A terminal window titled "Terminal" with a menu bar (File, Edit, View, Terminal, Tabs, Help). The command prompt shows the user is at z5190861@vx5. The command executed is "ping www.unsw.edu.au". The output shows two successful pings with 56(84) bytes of data, 64 bytes from 202.58.60.194, icmp_req=1 and 2, ttl=242, and times of 24.6 ms and 24.4 ms respectively. After pressing Ctrl-C, it shows ping statistics: 2 packets transmitted, 2 received, 0% packet loss, time 1000ms, and rtt min/avg/max/mdev = 24.432/24.524/24.617/0.181 ms.

```
z5190861@vx5:/tmp_amd/reed/export/reed/1/z5190861$ ping www.unsw.edu.au
PING www.unsw.edu.au (202.58.60.194) 56(84) bytes of data.
64 bytes from 202.58.60.194: icmp_req=1 ttl=242 time=24.6 ms
64 bytes from 202.58.60.194: icmp_req=2 ttl=242 time=24.4 ms
^C
--- www.unsw.edu.au ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1000ms
rtt min/avg/max/mdev = 24.432/24.524/24.617/0.181 ms
```

Both reachable

2: www.getfittest.com.au

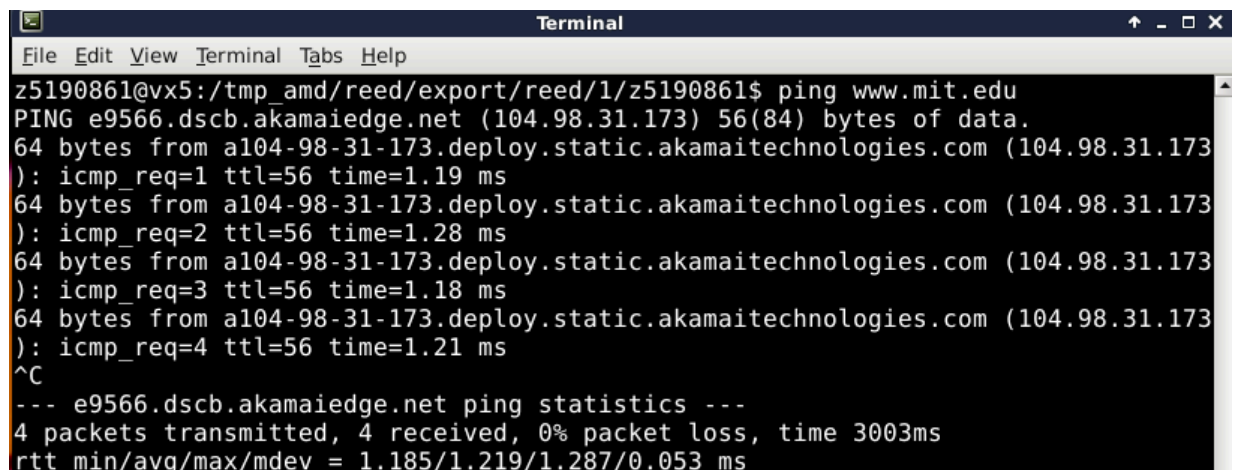
A terminal window titled "Terminal" with a menu bar (File, Edit, View, Terminal, Tabs, Help). The command prompt shows the user is at z5190861@vx5. The command executed is "ping www.getfittest.com.au". The output shows "ping: unknown host www.getfittest.com.au".

```
z5190861@vx5:/tmp_amd/reed/export/reed/1/z5190861$ ping www.getfittest.com.au
ping: unknown host www.getfittest.com.au
```

This address is unreachable both by the ping command and the Web browser.

Both the ping command and the Web browser are unreachable which means that this host is not exist.

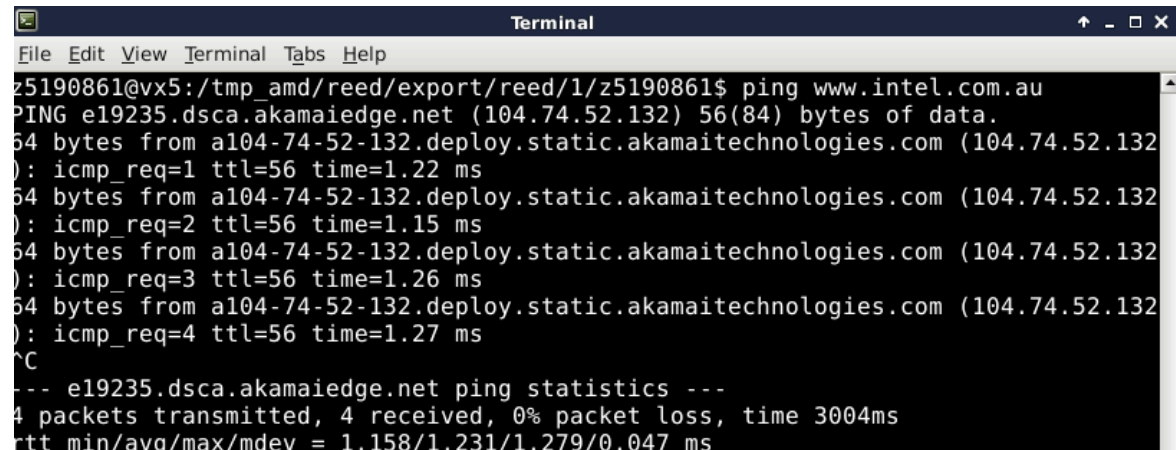
3: www.mit.edu

A terminal window titled "Terminal" with a menu bar (File, Edit, View, Terminal, Tabs, Help). The command prompt shows the user is at z5190861@vx5. The command executed is "ping www.mit.edu". The output shows four successful pings with 56(84) bytes of data, 64 bytes from a104-98-31-173.deploy.static.akamaitechnologies.com (104.98.31.173), icmp_req=1 to 4, ttl=56, and times of 1.19 ms, 1.28 ms, 1.18 ms, and 1.21 ms respectively. After pressing Ctrl-C, it shows ping statistics: 4 packets transmitted, 4 received, 0% packet loss, time 3003ms, and rtt min/avg/max/mdev = 1.185/1.219/1.287/0.053 ms.

```
z5190861@vx5:/tmp_amd/reed/export/reed/1/z5190861$ ping www.mit.edu
PING e9566.dscb.akamaiedge.net (104.98.31.173) 56(84) bytes of data.
64 bytes from a104-98-31-173.deploy.static.akamaitechnologies.com (104.98.31.173): icmp_req=1 ttl=56 time=1.19 ms
64 bytes from a104-98-31-173.deploy.static.akamaitechnologies.com (104.98.31.173): icmp_req=2 ttl=56 time=1.28 ms
64 bytes from a104-98-31-173.deploy.static.akamaitechnologies.com (104.98.31.173): icmp_req=3 ttl=56 time=1.18 ms
64 bytes from a104-98-31-173.deploy.static.akamaitechnologies.com (104.98.31.173): icmp_req=4 ttl=56 time=1.21 ms
^C
--- e9566.dscb.akamaiedge.net ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3003ms
rtt min/avg/max/mdev = 1.185/1.219/1.287/0.053 ms
```

Both reachable

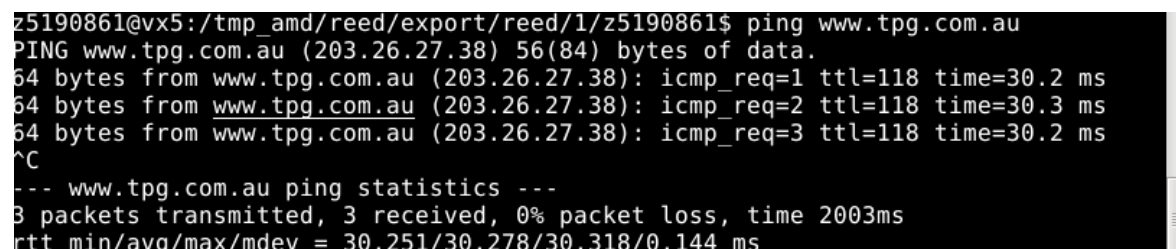
4: www.intel.com.au

A terminal window titled "Terminal" with a menu bar (File, Edit, View, Terminal, Tabs, Help). The prompt is "z5190861@vx5:/tmp_amd/reed/export/reed/1/z5190861\$". The command "ping www.intel.com.au" is executed. The output shows four successful ping requests to "e19235.dsca.akamaiedge.net (104.74.52.132)" with 56(84) bytes of data. Each request shows "64 bytes from a104-74-52-132.deploy.static.akamaitechnologies.com (104.74.52.132)" and "icmp_req=1" through "icmp_req=4" with times of 1.22 ms, 1.15 ms, 1.26 ms, and 1.27 ms respectively. A control character ^C is shown. The statistics section shows "4 packets transmitted, 4 received, 0% packet loss, time 3004ms" and "rtt min/avg/max/mdev = 1.158/1.231/1.279/0.047 ms".

```
z5190861@vx5:/tmp_amd/reed/export/reed/1/z5190861$ ping www.intel.com.au
PING e19235.dsca.akamaiedge.net (104.74.52.132) 56(84) bytes of data.
64 bytes from a104-74-52-132.deploy.static.akamaitechnologies.com (104.74.52.132): icmp_req=1 ttl=56 time=1.22 ms
64 bytes from a104-74-52-132.deploy.static.akamaitechnologies.com (104.74.52.132): icmp_req=2 ttl=56 time=1.15 ms
64 bytes from a104-74-52-132.deploy.static.akamaitechnologies.com (104.74.52.132): icmp_req=3 ttl=56 time=1.26 ms
64 bytes from a104-74-52-132.deploy.static.akamaitechnologies.com (104.74.52.132): icmp_req=4 ttl=56 time=1.27 ms
^C
--- e19235.dsca.akamaiedge.net ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3004ms
rtt min/avg/max/mdev = 1.158/1.231/1.279/0.047 ms
```

Both reachable

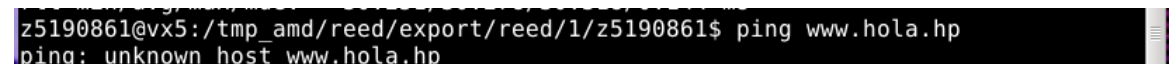
5: www.tpg.com.au

A terminal window showing the command "ping www.tpg.com.au". The output shows three successful ping requests to "www.tpg.com.au (203.26.27.38)" with 56(84) bytes of data. Each request shows "64 bytes from www.tpg.com.au (203.26.27.38): icmp_req=1" through "icmp_req=3" with times of 30.2 ms, 30.3 ms, and 30.2 ms respectively. A control character ^C is shown. The statistics section shows "3 packets transmitted, 3 received, 0% packet loss, time 2003ms" and "rtt min/avg/max/mdev = 30.251/30.278/30.318/0.144 ms".

```
z5190861@vx5:/tmp_amd/reed/export/reed/1/z5190861$ 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=30.2 ms
64 bytes from www.tpg.com.au (203.26.27.38): icmp_req=2 ttl=118 time=30.3 ms
64 bytes from www.tpg.com.au (203.26.27.38): icmp_req=3 ttl=118 time=30.2 ms
^C
--- www.tpg.com.au ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2003ms
rtt min/avg/max/mdev = 30.251/30.278/30.318/0.144 ms
```

Both reachable

6: www.hola.hp

A terminal window showing the command "ping www.hola.hp". The output is "ping: unknown host www.hola.hp".

```
z5190861@vx5:/tmp_amd/reed/export/reed/1/z5190861$ ping www.hola.hp
ping: unknown host www.hola.hp
```

This address is unreachable both by the ping command and the Web browser.

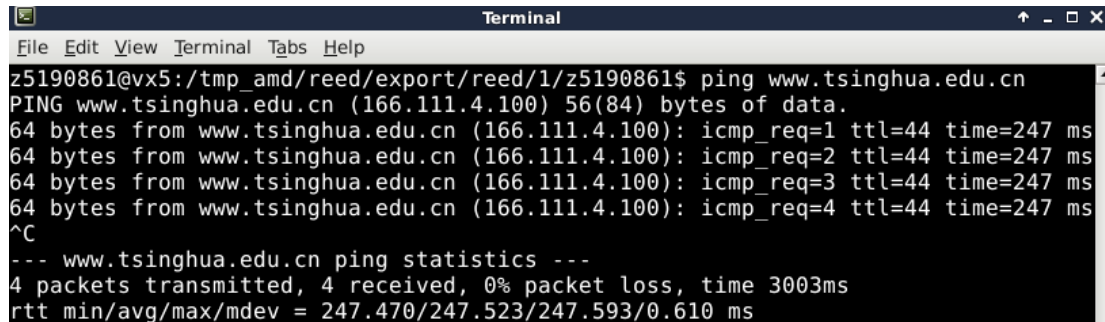
Both the ping command and the Web browser are unreachable which means that this host is not exist.

7: www.amazon.com

```
z5190861@vx5:/tmp_amd/reed/export/reed/1/z5190861$ ping www.amazon.com
PING d3ag4hukkh62yn.cloudfront.net (13.224.182.228) 56(84) bytes of data.
64 bytes from server-13-224-182-228.syd1.r.cloudfront.net (13.224.182.228): icmp
_req=1 ttl=244 time=1.25 ms
64 bytes from server-13-224-182-228.syd1.r.cloudfront.net (13.224.182.228): icmp
_req=2 ttl=244 time=1.22 ms
64 bytes from server-13-224-182-228.syd1.r.cloudfront.net (13.224.182.228): icmp
_req=3 ttl=244 time=1.23 ms
64 bytes from server-13-224-182-228.syd1.r.cloudfront.net (13.224.182.228): icmp
_req=4 ttl=244 time=1.21 ms
64 bytes from server-13-224-182-228.syd1.r.cloudfront.net (13.224.182.228): icmp
_req=5 ttl=244 time=1.26 ms
^C
--- d3ag4hukkh62yn.cloudfront.net ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4005ms
rtt min/avg/max/mdev = 1.216/1.240/1.262/0.042 ms
```

Both reachable

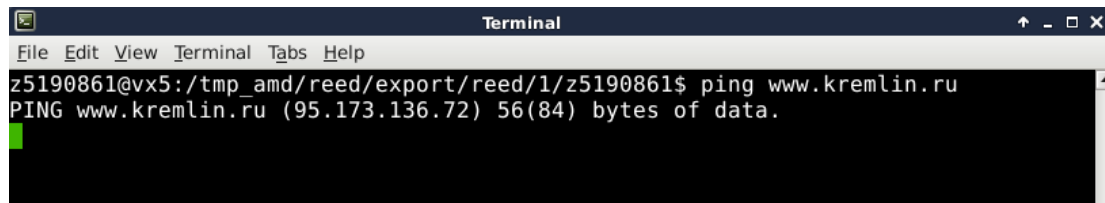
8: www.tsinghua.edu.cn

A terminal window titled "Terminal" with a menu bar (File, Edit, View, Terminal, Tabs, Help). The command executed is "ping www.tsinghua.edu.cn". The output shows four successful ping requests to 166.111.4.100, each with a TTL of 44 and a time of 247 ms. The statistics show 4 packets transmitted and received with 0% packet loss and a total time of 3003ms.

```
z5190861@vx5:/tmp_amd/reed/export/reed/1/z5190861$ ping www.tsinghua.edu.cn
PING www.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=44 time=247 ms
64 bytes from www.tsinghua.edu.cn (166.111.4.100): icmp_req=2 ttl=44 time=247 ms
64 bytes from www.tsinghua.edu.cn (166.111.4.100): icmp_req=3 ttl=44 time=247 ms
64 bytes from www.tsinghua.edu.cn (166.111.4.100): icmp_req=4 ttl=44 time=247 ms
^C
--- www.tsinghua.edu.cn ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3003ms
rtt min/avg/max/mdev = 247.470/247.523/247.593/0.610 ms
```

Both reachable

9: www.kremlin.ru

A terminal window titled "Terminal" with a menu bar (File, Edit, View, Terminal, Tabs, Help). The command executed is "ping www.kremlin.ru". The output shows the start of a ping request to 95.173.136.72, but the rest of the output is cut off by a green cursor.

```
z5190861@vx5:/tmp_amd/reed/export/reed/1/z5190861$ ping www.kremlin.ru
PING www.kremlin.ru (95.173.136.72) 56(84) bytes of data.
█
```

This address is unreachable by the ping command but is reachable from the Web browser.

The condition above means that ICMP response is closed. So using the ping command cannot get any response.

10: 8.8.8.8

```
Terminal
File Edit View Terminal Tabs Help
z5190861@vx5:/tmp_amd/reed/export/reed/1/z5190861$ 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=53 time=1.48 ms
64 bytes from 8.8.8.8: icmp_req=2 ttl=53 time=1.45 ms
64 bytes from 8.8.8.8: icmp_req=3 ttl=53 time=1.57 ms
64 bytes from 8.8.8.8: icmp_req=4 ttl=53 time=1.51 ms
^C
--- 8.8.8.8 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3004ms
rtt min/avg/max/mdev = 1.456/1.505/1.574/0.051 ms
z5190861@vx5:/tmp_amd/reed/export/reed/1/z5190861$
```

This address is reachable by the ping command but is not reachable from the Web browser.

Exercise 3

Question 1:

```
z5190861@vx5:/tmp_amd/reed/export/reed/1/z5190861$ 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) 0.128 ms 0.126 ms 0.115 ms
 2 129.94.39.17 (129.94.39.17) 0.859 ms 0.864 ms 0.872 ms
 3 libudnex1-vl-3154.gw.unsw.edu.au (149.171.253.34) 1.360 ms ombudnex1-vl-3154.gw.unsw.edu.au (149.171.253.35) 1.698 ms 1.421 ms
 4 libcr1-po-5.gw.unsw.edu.au (149.171.255.165) 1.186 ms ombcr1-po-5.gw.unsw.edu.au (149.171.255.197) 1.151 ms libcr1-po-5.gw.unsw.edu.au (149.171.255.165) 1.185 ms
 5 unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105) 1.588 ms unswbr1-te-1-9.gw.unsw.edu.au (149.171.255.101) 1.165 ms 1.176 ms
 6 138.44.5.0 (138.44.5.0) 1.842 ms 1.759 ms 1.759 ms
 7 et-1-3-0.pe1.sxt.bkvl.nsw.aarnet.net.au (113.197.15.149) 2.334 ms 2.105 ms 2.753 ms
 8 et-0-0-0.pe1.a.hnl.aarnet.net.au (113.197.15.99) 95.400 ms 95.445 ms 95.096 ms
 9 et-2-1-0.bdr1.a.sea.aarnet.net.au (113.197.15.201) 147.368 ms 147.377 ms 147.353 ms
10 abilene-1-lo-jmb-706.sttlwa.pacificwave.net (207.231.240.8) 147.108 ms 147.106 ms 146.915 ms
11 ae-1.4079.rts.w.minn.net.internet2.edu (162.252.70.173) 180.114 ms 180.039 ms 180.121 ms
12 ae-1.4079.rts.w.eqch.net.internet2.edu (162.252.70.106) 189.095 ms 190.223 ms 188.517 ms
13 ae-0.4079.rts.w3.eqch.net.internet2.edu (162.252.70.163) 188.319 ms 187.693 ms 189.084 ms
14 ae-1.4079.rts.w.clev.net.internet2.edu (162.252.70.130) 196.266 ms 196.487 ms 196.317 ms
15 buf-9208-I2-CLEV.nysernet.net (199.109.11.33) 200.718 ms 200.564 ms 200.517 ms
16 syr-9208-buf-9208.nysernet.net (199.109.7.193) 203.884 ms 204.187 ms 204.113 ms
17 nyc111-9204-syr-9208.nysernet.net (199.109.7.94) 212.916 ms 212.964 ms 212.849 ms
18 nyc-9208-nyc111-9204.nysernet.net (199.109.7.165) 212.934 ms 213.200 ms 213.123 ms
19 columbia.nyc-9208.nysernet.net (199.109.4.14) 213.064 ms 212.991 ms 213.018 ms
20 cc-core-1-x-nyser32-gw-1.net.columbia.edu (128.59.255.5) 213.203 ms 213.377 ms 213.122 ms
21 cc-conc-1-x-cc-core-1.net.columbia.edu (128.59.255.21) 213.473 ms 213.405 ms 213.372 ms
22 ci.columbia.edu (128.59.105.24) 213.327 ms 213.220 ms 213.186 ms
```

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

Answer: there are 21 routers.

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

Answer: 5 routers from the 1st to 5th.

Between which two routers do packets cross the Pacific Ocean?

Answer: the 7th and 8th. Because the time difference is biggest between the 7th and 8th.

Question 2:

1: www.ucla.edu

```
File Edit View Terminal Tabs Help
25190861@vx5:/tmp/and/reed/export/reed/1/z5190861$ 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) 0.085 ms 0.078 ms 0.065 ms
 2 129.94.39.17 (129.94.39.17) 0.831 ms 0.874 ms 0.817 ms
 3 ombudnex1-vl-3154.gw.unsw.edu.au (149.171.253.35) 1.374 ms libudnex1-vl-3154.gw.unsw.edu.au (149.171.253.34) 1.301 ms 18.783 ms
 4 libcr1-po-5.gw.unsw.edu.au (149.171.255.165) 1.081 ms libcr1-po-6.gw.unsw.edu.au (149.171.255.201) 1.120 ms 1.128 ms
 5 unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105) 1.210 ms 1.143 ms 1.200 ms
 6 138.44.5.0 (138.44.5.0) 1.375 ms 1.294 ms 1.241 ms
 7 et-1-3-0.pel.sxt.bkvl.nsw.aarnet.net.au (113.197.15.149) 2.185 ms 2.274 ms 2.268 ms
 8 et-0-0-0.pel.a.hnl.aarnet.net.au (113.197.15.99) 95.130 ms 94.931 ms 94.963 ms
 9 et-2-1-0.bdl1.a.sca.aarnet.net.au (113.197.15.201) 146.953 ms 146.850 ms 146.955 ms
10 cenichpr-1-is-jmb-778.snava.pacificwave.net (207.231.245.129) 164.459 ms 164.467 ms 163.521 ms
11 hpr-lax-hpr3--svl-hpr3-100ge.cenic.net (137.164.25.73) 160.594 ms 160.551 ms 160.026 ms
12 * * *
13 bdl1f1.anderson--cr001.anderson.ucla.net (169.232.4.6) 160.776 ms bdl1f1.anderson--cr00f2.csbl.ucla.net (169.232.4.4) 161.202 ms bdl1f1.anderson--cr001.anderson.ucla.net (169.232.4.6)
161.006 ms
14 cr00f2.csbl--rtr12f4.mathsci.ucla.net (169.232.8.183) 161.660 ms cr00f1.anderson--rtr11f4.mathsci.ucla.net (169.232.8.185) 161.236 ms cr00f2.csbl--rtr12f4.mathsci.ucla.net (169.232.8.1
83) 160.616 ms
15 * * *
16 * * *
17 * * *
18 * * *
19 * * *
20 * * *
21 * * *
22 * * *
23 * * *
24 * * *
25 * * *
26 * * *
27 * * *
28 * * *
29 * * *
30 * * *
```

2: www.u-tokyo.ac.jp

```
File Edit View Terminal Tabs Help
25190861@vx5:/tmp/and/reed/export/reed/1/z5190861$ traceroute www.u-tokyo.ac.jp
traceroute to www.u-tokyo.ac.jp (210.152.242.234), 30 hops max, 60 byte packets
 1 cserouter1-server.cse.unsw.EDU.AU (129.94.242.251) 0.074 ms 0.050 ms 0.061 ms
 2 129.94.39.17 (129.94.39.17) 0.927 ms 0.882 ms 0.841 ms
 3 libudnex1-vl-3154.gw.unsw.edu.au (149.171.253.34) 1.307 ms ombudnex1-vl-3154.gw.unsw.edu.au (149.171.253.35) 1.531 ms 1.544 ms
 4 libcr1-po-5.gw.unsw.edu.au (149.171.255.165) 1.029 ms libcr1-po-6.gw.unsw.edu.au (149.171.255.201) 1.073 ms ombcr1-po-5.gw.unsw.edu.au (149.171.255.197) 1.082 ms
 5 unswbr1-te-1-9.gw.unsw.edu.au (149.171.255.101) 19.854 ms unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105) 19.809 ms 19.824 ms
 6 138.44.5.0 (138.44.5.0) 22.782 ms 22.023 ms 22.905 ms
 7 et-0-3-0.pel.bkvl.nsw.aarnet.net.au (113.197.15.149) 1.688 ms 1.661 ms 1.691 ms
 8 ge-4-0-0.bb1.a.pao.aarnet.net.au (202.158.194.177) 155.023 ms 154.995 ms 154.950 ms
 9 paloalto0.iiij.net (198.32.176.24) 156.580 ms 156.755 ms 156.641 ms
10 osk0040bb00.IIJ.Net (58.138.88.185) 287.103 ms 287.337 ms 286.874 ms
11 osk004ip57.IIJ.Net (58.138.106.162) 278.020 ms 278.011 ms osk004ip57.IIJ.Net (58.138.106.166) 269.383 ms
12 210.130.135.130 (210.130.135.130) 278.111 ms 286.974 ms 278.039 ms
13 124.83.228.50 (124.83.228.50) 286.954 ms 278.293 ms 278.166 ms
14 124.83.252.178 (124.83.252.178) 292.217 ms 284.010 ms 292.923 ms
15 158.205.134.26 (158.205.134.26) 283.972 ms 284.074 ms 292.883 ms
16 * * *
17 * * *
18 * * *
19 * * *
20 * * *
21 * * *
22 * * *
23 * * *
24 * * *
25 * * *
26 * * *
27 * * *
28 * * *
29 * * *
30 * * *
```

3: www.lancaster.ac.uk

```
File Edit View Terminal Tabs Help
25190861@vx5:/tmp/and/reed/export/reed/1/z5190861$ 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)  0.094 ms  0.085 ms  0.074 ms
 2 129.94.39.17 (129.94.39.17)  0.834 ms  0.882 ms  0.838 ms
 3 ombudnxi-vl-3154.gw.unsw.edu.au (149.171.253.35)  1.379 ms  libudnxi-vl-3154.gw.unsw.edu.au (149.171.253.34)  1.467 ms  1.473 ms
 4 ombcr1-po-5.gw.unsw.edu.au (149.171.255.197)  1.086 ms  libcr1-po-5.gw.unsw.edu.au (149.171.255.165)  1.106 ms  libcr1-po-6.gw.unsw.edu.au (149.171.255.201)  1.129 ms
 5 unswbr1-te-1-9.gw.unsw.edu.au (149.171.255.101)  1.204 ms  1.223 ms  1.255 ms
 6 138.44.5.0 (138.44.5.0)  1.418 ms  1.281 ms  1.276 ms
 7 et-2-0-5.bdr1.sing.sin.aarnet.net.au (113.197.15.233)  92.656 ms  92.562 ms  92.513 ms
 8 138.44.226.7 (138.44.226.7)  259.926 ms  259.917 ms  259.922 ms
 9 janet-gw.mx1.lon.uk.geant.net (62.40.124.198)  276.443 ms  276.399 ms  276.432 ms
10 ae29.londpg-sbr2.ja.net (146.97.33.2)  268.454 ms  268.410 ms  268.447 ms
11 ae31.erdiss-sbr2.ja.net (146.97.33.22)  264.266 ms  265.310 ms  265.263 ms
12 ae29.manckh-sbr2.ja.net (146.97.33.42)  266.156 ms  266.329 ms  266.222 ms
13 ae24.lancu-rbr1.ja.net (146.97.38.58)  268.492 ms  268.613 ms  268.572 ms
14 lancaster-university.ja.net (194.81.46.2)  282.267 ms  282.006 ms  281.955 ms
15 is-border01.bfw01.rtr.lancs.ac.uk (148.88.253.202)  269.001 ms  268.922 ms  268.906 ms
16 bfw01.iss-servers.is-core01.rtr.lancs.ac.uk (148.88.258.98)  274.492 ms  273.986 ms  271.181 ms
17 * * *
18 www.lancs.ac.uk (148.88.65.80)  269.010 ms IX  268.971 ms IX  269.242 ms IX
```

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

Answer: the 7th router of these three hosts is different.

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

Answer: No

Distance: www.ucla.edu

Network Location Tool

approximate geophysical location

地图 卫星图像

locate a network

Remote Address

☒ MaxMind ☐ Hostip.info

network information

IP Address
164.67.228.152

Base Domain
ucla.edu

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

Distance: www.u-tokyo.ac.jp

Network Location Tool

approximate geophysical location



network information

IP Address
210.152.243.234

Base Domain
idcfcloud.com

Country
Japan

Region
Unknown

City
Unknown

Latitude
36

Longitude
138

Area Code
Unknown

Postal Code
Unknown

Distance from Last
(as the crow flies)
5558.0 miles

Source
MaxMind

locate a network

Remote Address

[Use Current IP](#)

Source ☒ MaxMind ☐ Hostip.info

Distance: www.lancaster.ac.uk

Network Location Tool

approximate geophysical location



network information

IP Address
148.88.65.80

Base Domain
ac.uk

Country
United Kingdom

Region
H2

City
Lancaster

Latitude
54.0667

Longitude
-2.8333

Area Code
Unknown

Postal Code
Unknown

Distance from Last
(as the crow flies)
5797.1 miles

Source
MaxMind

locate a network

Remote Address

[Use Current IP](#)

Source ☒ MaxMind ☐ Hostip.info

Distance: 1 > 3 > 2

But Amount of hops: 3 > 2 > 1

Question 3:

```
z5190861@vx5:/tmp_amd/reed/export/reed/1/z5190861$ nslookup www.speedtest.com
Server:      129.94.242.45
Address:     129.94.242.45#53

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

z5190861@vx5:/tmp_amd/reed/export/reed/1/z5190861$ 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
```

My IP address is 129.94.242.45

www.speedtest.com : IP address is 209.15.13.134

www.telstra.net: IP address is 203.50.5.178

From me to www.speedtest.com:

```
z5190861@vx5:/tmp_amd/reed/export/reed/1/z5190861$ 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)  0.078 ms  0.050 ms  0.053 ms
 2 129.94.39.17 (129.94.39.17)  0.803 ms  0.815 ms  0.836 ms
 3 libudnex1-vl-3154.gw.unsw.edu.au (149.171.253.34)  1.380 ms  1.380 ms  1.380 ms
 4 libcr1-po-6.gw.unsw.edu.au (149.171.255.201)  1.229 ms  1.180 ms  1.180 ms
 5 unswbr1-te-1-9.gw.unsw.edu.au (149.171.255.101)  41.588 ms  41.601 ms  41.597 ms
 6 138.44.5.0 (138.44.5.0)  1.293 ms  1.317 ms  1.316 ms
 7 et-0-3-0-pel.bkvl.nsw.aarnet.net.au (113.197.15.147)  1.780 ms  1.698 ms  1.764 ms
 8 xe-0-2-5-bdr1.b.sea.aarnet.net.au (202.158.194.121)  144.132 ms  144.888 ms  144.166 ms
 9 xe-0-0-23-2-a01.sttlwa01.us.bb.gin.ntt.net (198.104.202.61)  144.584 ms  144.613 ms  144.582 ms
10 ae-2-r04.sttlwa01.us.bb.gin.ntt.net (129.250.5.85)  144.545 ms  144.693 ms  144.704 ms
11 sea-b2-link.telstra.net (213.248.70.12)  144.394 ms  144.220 ms  144.192 ms
12 chi-b2-link.telstra.net (62.115.117.49)  200.338 ms  200.230 ms  200.238 ms
13 toro-b2-link.telstra.net (62.115.118.101)  198.293 ms  198.627 ms  198.486 ms
14 toro-b3-link.telstra.net (62.115.117.228)  196.447 ms  196.593 ms  196.435 ms
15 toro-b1-link.telstra.net (62.115.116.181)  209.818 ms  209.768 ms  209.686 ms
16 peer1-ic-309065-toro-b1.c.telstra.net (213.248.103.86)  209.811 ms  209.700 ms  209.603 ms
17 100ge.et-7-0-2-tor-20plops-dis-1.peer1.net (216.187.113.178)  201.693 ms  100ge.et-2-0-2-tor-20plops-dis-2.peer1.net (216.187.113.180)  200.855 ms  100ge.et-7-0-2-tor-20plops-dis-1.peer1.net (216.187.113.178)  201.164 ms
18 * * *
19 * * *
20 * * *
21 * * *
22 * * *
23 * * *
24 * * *
25 * * *
26 * * *
27 * * *
28 * * *
29 * * *
30 * * *
```

From www.speedtest.com to me:

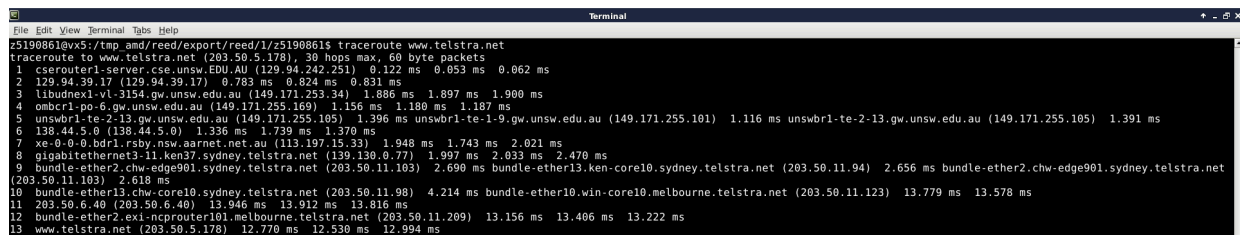
```

traceroute to 129.94.242.45 (129.94.242.45), 30 hops max, 60 byte packets
 1 ge2-8-r01.sin01.ne.com.sg (202.150.221.169)  0.189 ms  0.229 ms  0.253 ms
 2 10.15.62.210 (10.15.62.210)  0.263 ms  0.282 ms  0.299 ms
 3 aarnet.sgix.sg (103.16.102.67)  209.010 ms  209.026 ms  209.034 ms
 4 et-7-3-0.pel.nsw.brwy.aarnet.net.au (113.197.15.232)  208.149 ms  208.105 ms  208.156 ms
 5 138.44.5.1 (138.44.5.1)  209.329 ms  209.311 ms  209.374 ms
 6 libudnex1-te-1-5.gw.unsw.edu.au (149.171.255.102)  209.233 ms  209.204 ms  209.214 ms
 7 libudnex1-po-1.gw.unsw.edu.au (149.171.255.166)  209.491 ms  ombudnex1-po-1.gw.unsw.edu.au (149.171.255.202)  208.699 ms
 8 ufw1-ae-1-3154.gw.unsw.edu.au (149.171.253.36)  212.181 ms  212.200 ms  212.176 ms
 9 129.94.39.23 (129.94.39.23)  210.021 ms  210.006 ms  209.966 ms
10 * * *
11 * * *
12 * * *
13 * * *
14 * * *
15 * * *
16 * * *
17 * * *
18 * * *
19 * * *
20 * * *
21 * * *
22 * * *
23 * * *
24 * * *
25 * * *
26 * * *
27 * * *
28 * * *
29 * * *
30 * * *

```

Traceroute Completed.

From me to www.telstra.net:



```

25190861@vx5:/tmp amd/reed/export/reed/1/25190861$ 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)  0.122 ms  0.053 ms  0.062 ms
 2 129.94.39.17 (129.94.39.17)  0.783 ms  0.824 ms  0.831 ms
 3 libudnex1-vl-3154.gw.unsw.edu.au (149.171.253.34)  1.886 ms  1.897 ms  1.900 ms
 4 ombcr1-po-6.gw.unsw.edu.au (149.171.255.105)  1.156 ms  1.180 ms  1.187 ms
 5 unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105)  1.396 ms  unswbr1-te-1-9.gw.unsw.edu.au (149.171.255.101)  1.116 ms  unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105)  1.391 ms
 6 138.44.5.0 (138.44.5.0)  1.336 ms  1.739 ms  1.370 ms
 7 xe-0-0-0.bdr1.rsby.nsw.aarnet.net.au (113.197.15.33)  1.948 ms  1.743 ms  2.021 ms
 8 gigabitethernet3-11.ken37.sydney.telstra.net (139.130.0.77)  1.997 ms  2.033 ms  2.470 ms
 9 bundle-ether2.chw-edge901.sydney.telstra.net (203.50.11.103)  2.690 ms  bundle-ether13.ken-core10.sydney.telstra.net (203.50.11.94)  2.656 ms  bundle-ether2.chw-edge901.sydney.telstra.net (203.50.11.103)  2.618 ms
10 bundle-ether13.chw-core10.sydney.telstra.net (203.50.11.98)  4.214 ms  bundle-ether10.win-core10.melbourne.telstra.net (203.50.11.123)  13.779 ms  13.578 ms
11 203.50.6.40 (203.50.6.40)  13.946 ms  13.912 ms  13.816 ms
12 bundle-ether2.exi-ncrouter101.melbourne.telstra.net (203.50.11.209)  13.156 ms  13.406 ms  13.222 ms
13 www.telstra.net (203.50.5.178)  12.770 ms  12.530 ms  12.994 ms

```

From www.telstra.net to me:

```

 1 gigabitethernet3-3.exi2.melbourne.telstra.net (203.50.77.53)  68.309 ms  1.203 ms  5.116 ms
 2 bundle-ether3-100.win-core10.melbourne.telstra.net (203.50.80.129)  1.363 ms  1.728 ms  1.992 ms
 3 bundle-ether12.ken-core10.sydney.telstra.net (203.50.11.122)  12.733 ms  12.098 ms  12.863 ms
 4 bundle-ether1.ken-edge901.sydney.telstra.net (203.50.11.95)  12.107 ms  11.847 ms  11.986 ms
 5 aarnet6.lnk.telstra.net (139.130.0.78)  11.859 ms  11.600 ms  11.611 ms
 6 xe-5-2-2.pel.brwy.nsw.aarnet.net.au (113.197.15.32)  11.859 ms  11.850 ms  11.984 ms
 7 138.44.5.1 (138.44.5.1)  12.112 ms  11.977 ms  11.985 ms
 8 ombcr1-te-1-5.gw.unsw.edu.au (149.171.255.106)  11.984 ms  11.977 ms  11.983 ms
 9 ombudnex1-po-2.gw.unsw.edu.au (149.171.255.170)  12.237 ms  12.473 ms  12.611 ms
10 ufw1-ae-1-3154.gw.unsw.edu.au (149.171.253.36)  12.735 ms  12.722 ms  12.609 ms
11 129.94.39.23 (129.94.39.23)  12.861 ms  12.851 ms  12.861 ms

```

Does the reverse path go through the same routers as the forward path?

Answer: obviously no.

If you observe common routers between the forward and the reverse path, do you also observe the same IP addresses? Why or Why not?

Answer:

I observe common routers but don't observe the same IP addresses.

Reason: Load balancing, so there is no guarantee that there will be the same route when transporting to the target host and coming back.

Exercise 4:

Question 1:

1: www.uq.edu.au

The physical distance from Unsw to Brisbane is about 922km.

$$T = 922 \text{ km} / (3 * 10^8 \text{ m/s}) = 3.07 \text{ ms}$$

$$\text{Y-axis ratio: } 16.804 / 3.07 = 5.47$$

2: www.upm.edu.my

The physical distance from Unsw to Kuala Lumpur is about 6140km.

$$T = 6140 \text{ km} / (3 * 10^8 \text{ m/s}) = 20.47 \text{ ms}$$

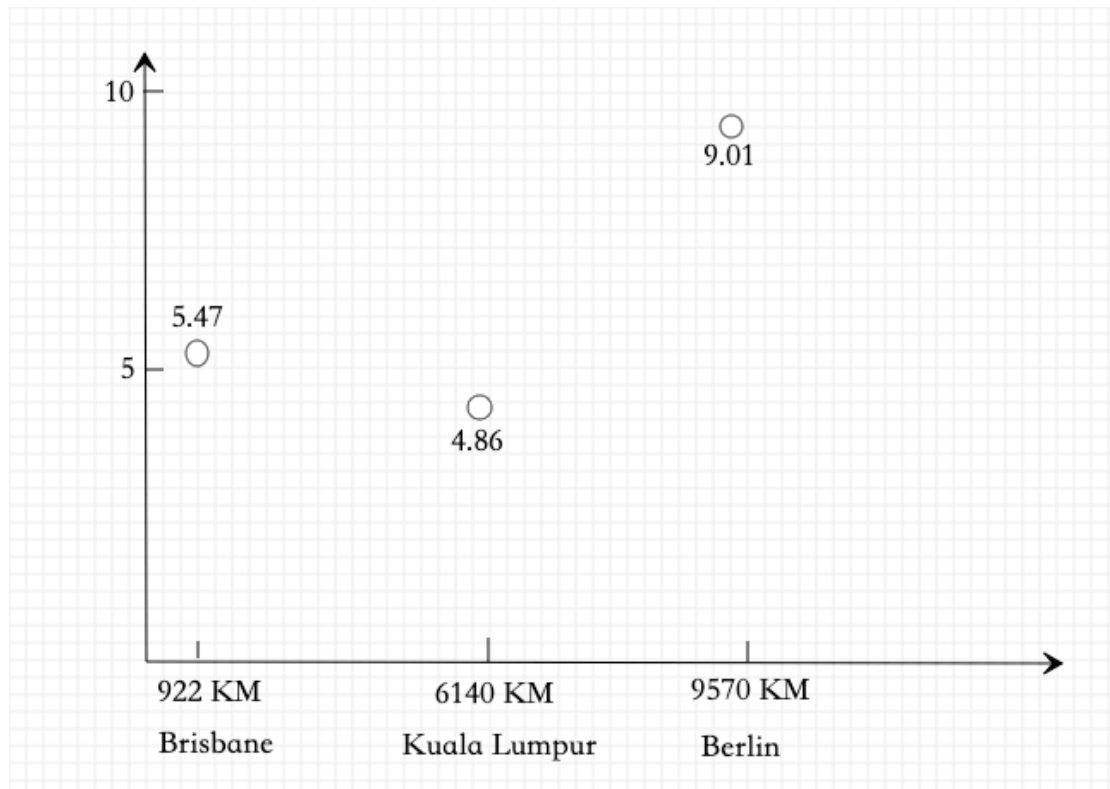
$$\text{Y-axis ratio: } 99.514 / 20.47 = 4.86$$

3: www.tu-berlin.de

The physical distance from Unsw to Berlin is about 9570km.

$$T = 9570 \text{ km} / (3 * 10^8 \text{ m/s}) = 31.9 \text{ ms}$$

$$\text{Y-axis ratio: } 287.498 / 31.9 = 9.01$$



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

Answer:

1: Use the speed of light (3×10^8)

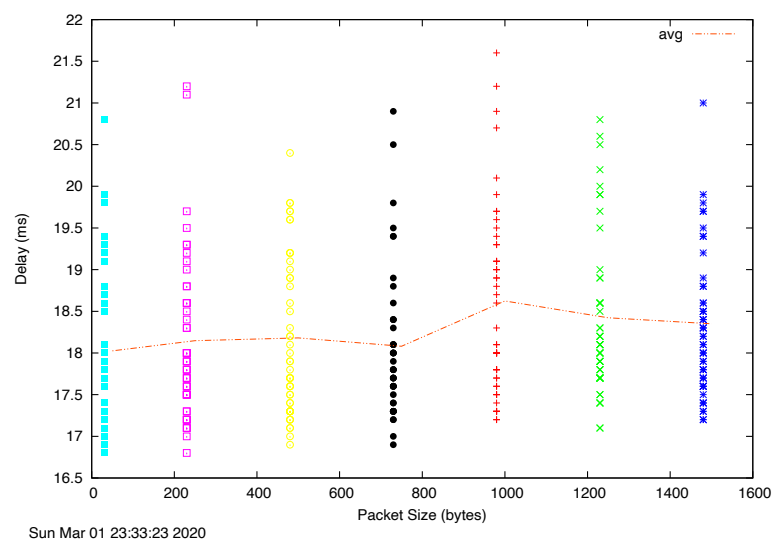
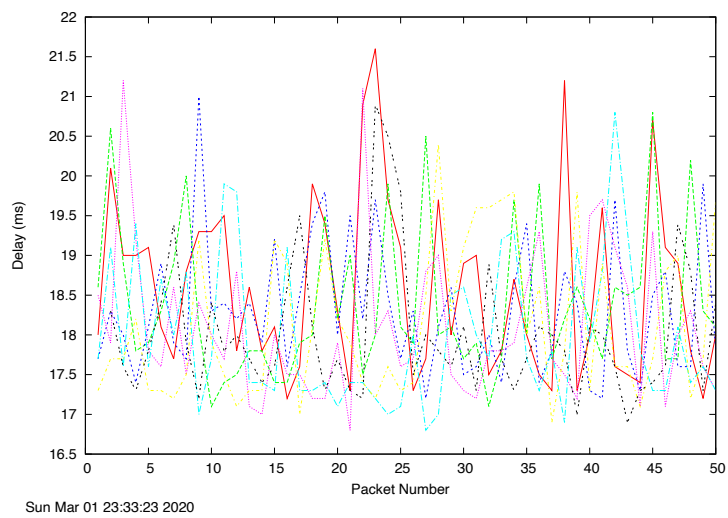
Usually, due to the influence of external factors, the speed of can not be equal to this.

2: the distance

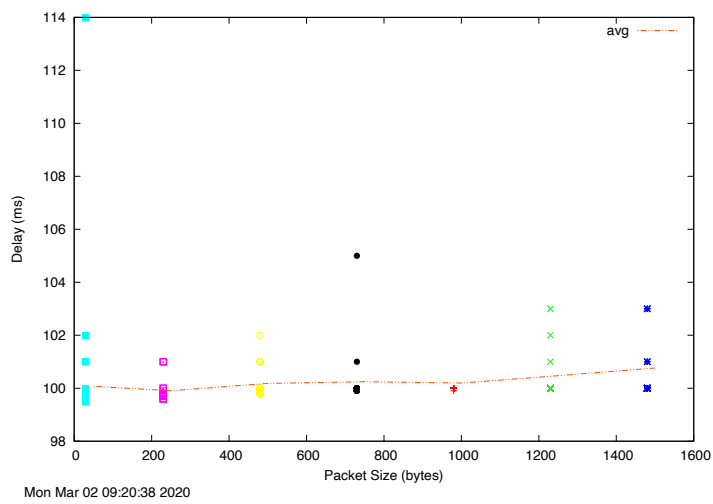
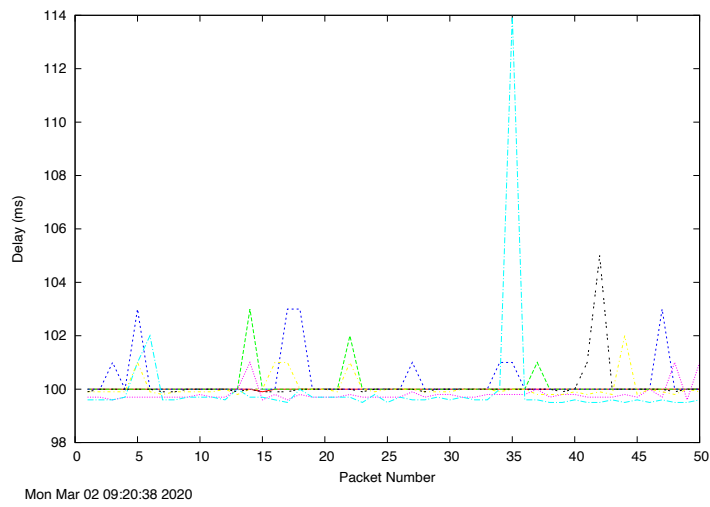
Usually, there is no ideal straight line distance between two places.

Question 2:

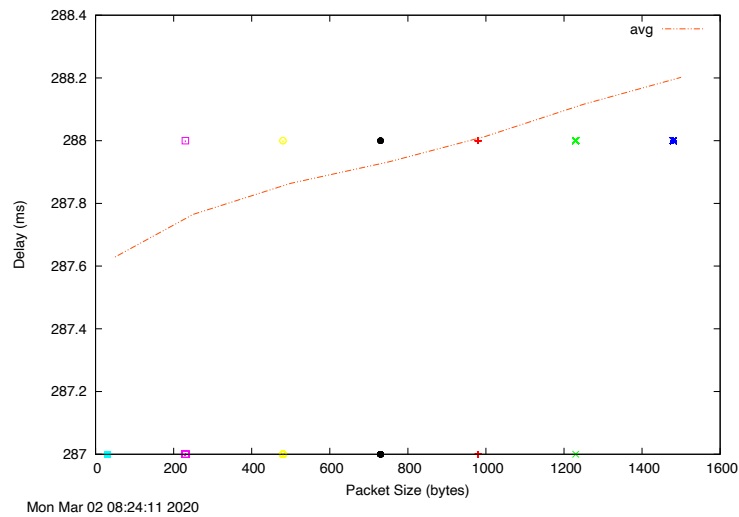
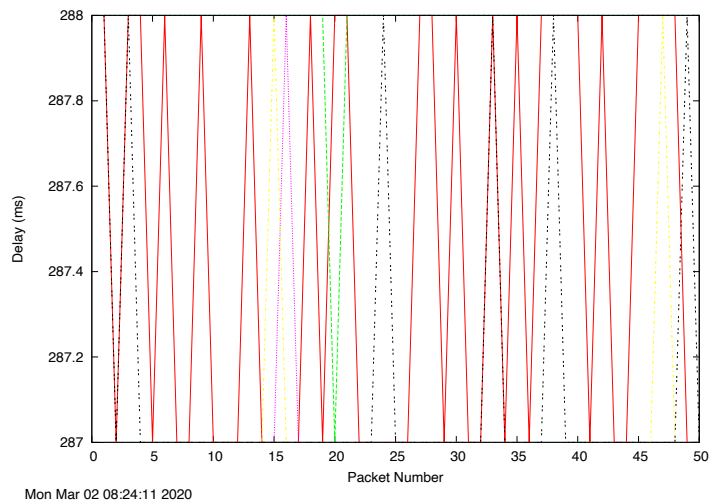
1: www.uq.edu.au



2: www.upm.edu.my



3: www.tu-berlin.de



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

Delay to the destinations varies over time.

Answer:

Question 3:

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

```
terminal
File Edit View Terminal Tabs Help
z5190861@vx2:/tmp_amd/reed/export/reed/1/z5190861/Downloads$ ping www.epfl.ch
PING www.epfl.ch.cdn.cloudflare.net (104.20.228.42) 56(84) bytes of data.
64 bytes from 104.20.228.42: icmp_req=1 ttl=56 time=1.53 ms
64 bytes from 104.20.228.42: icmp_req=2 ttl=56 time=3.80 ms
^C
--- www.epfl.ch.cdn.cloudflare.net ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1001ms
rtt min/avg/max/mdev = 1.534/2.667/3.800/1.133 ms
```

```
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
```

Answer: No, it is in US.

Question 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?

Answer:

The propagation delay does not depend on the packet size.

The transmission delay depends on the packet length.

The processing delay depends on the packet size.

The queuing delay does not depend on the packet size.