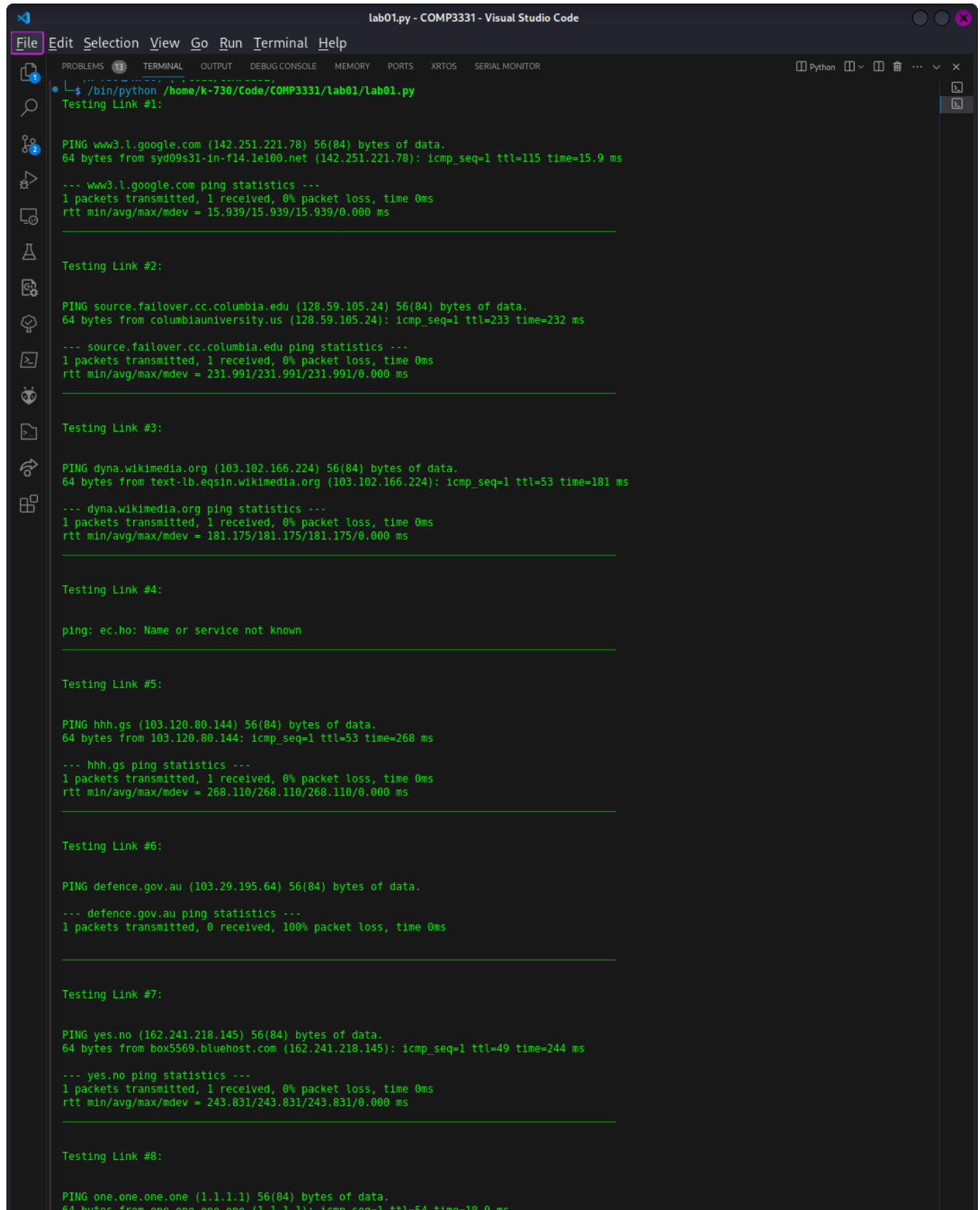


Lab01

Disclaimer: THIS WAS EXERCISE WAS COMPLETED WITH MY HOME INTERNET.

Exercise 2

Output for q2



```
lab01.py - COMP3331 - Visual Studio Code
File Edit Selection View Go Run Terminal Help
PROBLEMS 13 TERMINAL OUTPUT DEBUG CONSOLE MEMORY PORTS XRTOS SERIAL MONITOR
Python

$ /bin/python /home/k-730/Code/COMP3331/Lab01/lab01.py
Testing Link #1:

PING www3.l.google.com (142.251.221.78) 56(84) bytes of data.
64 bytes from syd09s31-in-f14.1e100.net (142.251.221.78): icmp_seq=1 ttl=115 time=15.9 ms

--- www3.l.google.com ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 15.939/15.939/15.939/0.000 ms

Testing Link #2:

PING source.failover.cc.columbia.edu (128.59.105.24) 56(84) bytes of data.
64 bytes from columbiauniversity.us (128.59.105.24): icmp_seq=1 ttl=233 time=232 ms

--- source.failover.cc.columbia.edu ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 231.991/231.991/231.991/0.000 ms

Testing Link #3:

PING dyna.wikimedia.org (103.102.166.224) 56(84) bytes of data.
64 bytes from text-lb.eqsin.wikimedia.org (103.102.166.224): icmp_seq=1 ttl=53 time=181 ms

--- dyna.wikimedia.org ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 181.175/181.175/181.175/0.000 ms

Testing Link #4:

ping: ec.ho: Name or service not known

Testing Link #5:

PING hhh.gs (103.120.80.144) 56(84) bytes of data.
64 bytes from 103.120.80.144: icmp_seq=1 ttl=53 time=268 ms

--- hhh.gs ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 268.110/268.110/268.110/0.000 ms

Testing Link #6:

PING defence.gov.au (103.29.195.64) 56(84) bytes of data.

--- defence.gov.au ping statistics ---
1 packets transmitted, 0 received, 100% packet loss, time 0ms

Testing Link #7:

PING yes.no (162.241.218.145) 56(84) bytes of data.
64 bytes from box5569.bluehost.com (162.241.218.145): icmp_seq=1 ttl=49 time=244 ms

--- yes.no ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 243.831/243.831/243.831/0.000 ms

Testing Link #8:

PING one.one.one.one (1.1.1.1) 56(84) bytes of data.
64 bytes from one.one.one.one (1.1.1.1): icmp_seq=1 ttl=54 time=18.9 ms
```

```

--- one.one.one.one ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 18.866/18.866/18.866/0.000 ms

Testing Link #9:

PING theguardian.com (151.101.193.111) 56(84) bytes of data.
64 bytes from 151.101.193.111 (151.101.193.111): icmp_seq=1 ttl=55 time=12.0 ms

--- theguardian.com ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 12.025/12.025/12.025/0.000 ms

Testing Link #10:

PING i*.ws (132.148.137.119) 56(84) bytes of data.
64 bytes from 132.148.137.119 (132.148.137.119): icmp_seq=1 ttl=45 time=262 ms

--- i*.ws ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 262.320/262.320/262.320/0.000 ms

```

URL	Reachable by ping	Reachable by Web
www.google.co.uk	Is reachable	Yes
www.columbia.edu	is reachable	Yes
www.wikipedia.org	is reachable	Yes
ec.ho	is NOT reachable. DNS non-e	NO
hhh.gs	is reachable.	Yes
defence.gov.au	NOT reachable by ping. Firewall blocks ICMP packet	Yes
yes.no	is reachable	Yes
one.one.one.one	is reachable	Yes
theguardian.com	is reachable	Yes
xn--i-7iq.ws	is reachable	Yes

Exercise 3

3.1)

```

(k-730@K730) ~/Code/COMP3331
$ /bin/python /home/k-730/Code/COMP3331/lab01/lab01.py
traceroute to us1.ch (195.176.55.64), 30 hops max, 60 byte packets
 1  192.168.0.1 (192.168.0.1)  5.631 ms  7.587 ms  7.688 ms
 2  gateway.nsw.superloop.au (122.199.32.1)  20.203 ms  25.686 ms  25.667 ms
 3  202.90.206.100 (202.90.206.100)  22.153 ms  23.230 ms  23.213 ms
 4  103.200.13.153 (103.200.13.153)  115.581 ms  115.565 ms  115.550 ms
 5  hundredridge0-0-1-2-132.bdr01-ipt-15plonee-sin.sg.superloop.net.co (202.177.40.22)  115.534 ms  115.518 ms  115.501 ms
 6  te0-1-0-18.br04.sin02.pccwbttn.net (63.217.25.225)  115.486 ms  104.842 ms  102.663 ms
 7  * Hu0-0-0-0.br05.sin02.pccwbttn.net (63.218.164.66)  107.154 ms *
 8  63-216-144-42.static.pccwglobal.net (63.216.144.42)  105.931 ms  113.424 ms  113.746 ms
 9  ae4.crl1-gva4.ip4.gtt.net (213.200.127.226)  264.239 ms  252.074 ms  63-216-144-42.static.pccwglobal.net (63.216.144.42)  107.016 ms
10  ip4.gtt.net (154.14.130.90)  250.011 ms  258.601 ms  ae4.crl1-gva4.ip4.gtt.net (213.200.127.226)  261.078 ms
11  sw1CE2-B1.switch.ch (130.59.36.69)  262.554 ms  262.514 ms  ip4.gtt.net (154.14.130.90)  200.704 ms
12  sw1LG2-400GE-0-0-0-0.switch.ch (130.59.38.70)  260.657 ms  261.028 ms  255.678 ms
13  sw1LG1-B1.switch.ch (130.59.36.77)  260.096 ms  sw1LG2-400GE-0-0-0-0.switch.ch (130.59.38.70)  261.239 ms  259.803 ms
14  lu-pop1-bkb02-100g-1-0-48.us1.ch (195.176.176.210)  256.760 ms  sw1LG1-B1.switch.ch (130.59.36.77)  267.512 ms  lu-pop1-bkb02-100g-1-0-48.us1.ch (195.176.176.210)  258.752 ms
15  ma-pop1-dcfw01.net.ti-edu.ch (195.176.176.34)  259.767 ms  259.727 ms  lu-pop1-bkb02-100g-1-0-48.us1.ch (195.176.176.210)  256.239 ms
16  * ma-pop1-dcfw01.net.ti-edu.ch (195.176.176.34)  263.656 ms  263.636 ms
17  selenio.ti-edu.ch (195.176.55.64)  263.618 ms  263.601 ms  263.583 ms

```

3.1.1)

There are 17 routers along the path to the [usi.ch](https://www.usi.ch) from my home internet.

For UNSW, last UNSW router is router #5 (172.17.17.102). However, hop #3 may be concealed or blocked by a firewall. And hop #4 may be a virtual router on the same physical router. Therefore, the number of **PHYSICAL UNSW ROUTERS** is 3.








```

 1  cserouter1-trusted.orchestra.cse.unsw.EDU.AU (129.94.208.251)  0.258 ms
0.156 ms  0.134 ms
 2  129.94.39.17 (129.94.39.17)  0.982 ms  1.020 ms  0.956 ms
 3  * * *
 4  172.17.17.9 (172.17.17.9)  1.190 ms 172.17.17.45 (172.17.17.45)  1.435
ms 172.17.17.9 (172.17.17.9)  1.153 ms
 5  172.17.17.102 (172.17.17.102)  4.096 ms  4.085 ms 172.17.17.110
(172.17.17.110)  4.089 ms
 6  138.44.5.0 (138.44.5.0)  16.233 ms  14.831 ms  14.752 ms
 7  et-1-1-0.pe1.rsby.nsw.aarnet.net.au (113.197.15.12)  1.764 ms  1.808 ms
1.783 ms
 8  xe-1-1-0.pe1.eskp.nsw.aarnet.net.au (113.197.15.199)  3.321 ms  3.197
ms 3.178 ms
 9  et-0-3-0.pe1.prka.sa.aarnet.net.au (113.197.15.42)  20.299 ms  20.213
ms 20.196 ms
10  et-0-3-0.pe1.knsg.wa.aarnet.net.au (113.197.15.45)  46.248 ms  46.174
ms 45.969 ms
11  et-1_0_5.bdr1.sing.sin.aarnet.net.au (113.197.15.231)  92.426 ms
92.614 ms  92.506 ms
12  138.44.226.7 (138.44.226.7)  256.352 ms  256.422 ms  256.315 ms
13  ae2.mx1.lon2.uk.geant.net (62.40.98.65)  272.069 ms  271.894 ms
271.786 ms
14  ae8.mx1.par.fr.geant.net (62.40.98.107)  263.617 ms  263.569 ms
263.309 ms
15  ae7.mx1.gen.ch.geant.net (62.40.98.238)  271.353 ms  271.193 ms
271.076 ms
16  swice1-100ge-0-3-0-1.switch.ch (62.40.124.22)  273.588 ms  274.746 ms
272.978 ms
17  swiLG2-400GE-0-0-0-0.switch.ch (130.59.38.70)  276.485 ms  276.605 ms
278.114 ms
18  swiLG1-B1.switch.ch (130.59.36.77)  275.449 ms  274.842 ms  274.952 ms
19  lu-pop1-bkb02-100g-1-0-48.usi.ch (195.176.176.210)  274.932 ms  275.084
ms 275.181 ms
20  ma-pop1-dcfw01.net.ti-edu.ch (195.176.176.34)  274.961 ms  274.938 ms
275.452 ms
21  selenio.ti-edu.ch (195.176.55.64)  276.089 ms  275.713 ms  276.151 ms

```

Warning: 172.17.17.102 is a private IP address.

Geolocation data from IP2Location (Product: DB6, 2024-2-1)

 IP ADDRESS: 129.94.8.4	 ISP: University of New South Wales
 COUNTRY: Australia 	 ORGANIZATION: Not available
 REGION: New South Wales	 LATITUDE: -33.8678
 CITY: Sydney	 LONGITUDE: 151.2070










```
% Information related to '138.44.5.0/24AS7575'

route:      138.44.5.0/24
origin:     AS7575
descr:      Australian Academic and Research Network
            Building 9
            Banks Street
mnt-by:      MAINT-AARNET-AP
last-modified: 2019-04-03T03:55:51Z
source:     APNIC
```

3.1.2)

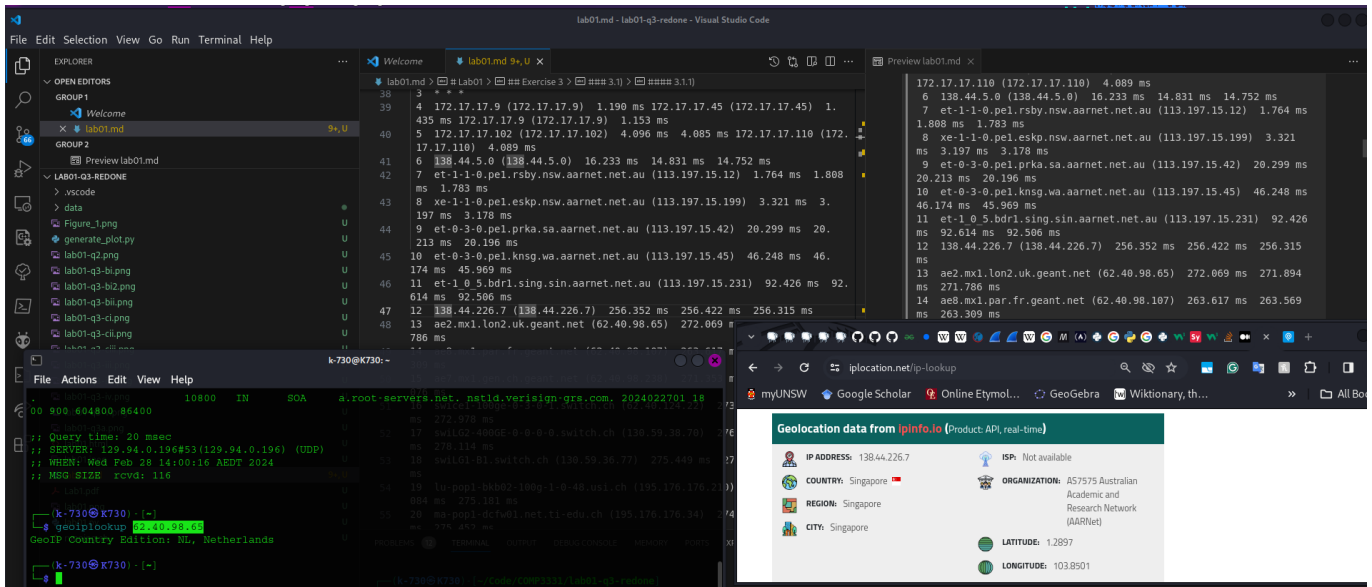
The first international router outside of Australia is Singapore as seen from the website IP geolocator ipinfo.co

Geolocation data from ipinfo.io (Product: API, real-time)

 IP ADDRESS: 113.197.15.231	 ISP: Not available
 COUNTRY: Singapore 	 ORGANIZATION: AS7575 Australian Academic and Research Network (AARNet)
 REGION: Singapore	
 CITY: Singapore	
	 LATITUDE: 1.2897
	 LONGITUDE: 103.8501

3.1.3)

The first EU router is number 13. Which is ae2.mx1.lon2.uk.geant.net (62.40.98.65) and is located in the Netherlands. Router #12 is located in Singapore and is not an EU router



3.2)

3.2.1)

Disclaimer, UNSW's physical wifi routers contain internal/NAT routing. This means router 5 can be excluded. This means the last common router they have in common is router #7 (138.44.5.0). The last routers that the paths have in common is router #3 with IP address: 202.90.206.100

Testing Link #1:

traceroute to jhu.edu (128.220.192.230), 30 hops max, 60 byte packets

```

1  * * *
2  irb-52686.kecd1-176q4-cbl-e1.gw.unsw.edu.au (172.17.30.178) 17.206 ms
17.416 ms 18.329 ms
3  ae4-2702.cfw1.gw.unsw.edu.au (172.17.31.52) 1.921 ms 2.217 ms 2.452
ms
4  irb-52710.kecd1-176q4-cbl-e1.gw.unsw.edu.au (172.17.31.114) 18.061 ms
17.969 ms 17.863 ms
5  ae2-1907.kecd2-lg11c1-pbr-c1.gw.unsw.edu.au (172.17.17.45) 3.321 ms
ae2-1905.kecd1-1q16c3-pbr-c1.gw.unsw.edu.au (172.17.17.9) 3.243 ms ae2-
1907.kecd2-lg11c1-pbr-c1.gw.unsw.edu.au (172.17.17.45) 3.166 ms
6  172.17.17.102 (172.17.17.102) 48.834 ms 172.17.17.110 (172.17.17.110)
47.723 ms 47.544 ms
7  138.44.5.0 (138.44.5.0) 2.627 ms 2.673 ms 3.010 ms
8  et-0-3-0.pe1.bkvl.nsw.aarnet.net.au (113.197.15.147) 2.939 ms 2.959
ms 3.005 ms
9  113.197.15.151 (113.197.15.151) 72.909 ms 72.813 ms 72.759 ms
10 138.44.228.5 (138.44.228.5) 186.950 ms 185.678 ms 187.922 ms
11 fourhundredge-0-0-0-2.4079.core2.salt.net.internet2.edu (163.253.1.115)
246.412 ms 246.261 ms 246.147 ms
12 fourhundredge-0-0-0-0.4079.core2.denv.net.internet2.edu (163.253.1.168)
245.623 ms 245.303 ms 244.698 ms
13 fourhundredge-0-0-0-0.4079.core2.kans.net.internet2.edu (163.253.1.251)
247.609 ms 246.140 ms 246.000 ms

```

```

14  fourhundredge-0-0-0-0.4079.core1.chic.net.internet2.edu (163.253.2.28)
245.743 ms  245.338 ms  244.965 ms
15  fourhundredge-0-0-0-0.4079.core1.eqch.net.internet2.edu (163.253.1.207)
245.659 ms  246.598 ms  246.548 ms
16  fourhundredge-0-0-0-0.4079.core1.clev.net.internet2.edu (163.253.1.210)
246.524 ms  246.503 ms  246.482 ms
17  fourhundredge-0-0-0-3.4079.core1.ashb.net.internet2.edu (163.253.1.122)
246.460 ms  245.806 ms  245.782 ms
18  et-0-1-8-1275.ashb-core.maxgigapop.net (206.196.177.2)  244.719 ms
244.698 ms  244.676 ms
19  206.196.178.141 (206.196.178.141)  243.681 ms  243.379 ms  273.334 ms
20  addr16212925332.testippl.jhmi.edu (162.129.253.32)  273.639 ms  273.566
ms  259.859 ms
21  162.129.255.245 (162.129.255.245)  259.689 ms  258.628 ms  258.507 ms
22  * * *
23  * * *
24  * * *
25  * * *
26  collaborate.johnshopkins.edu (128.220.192.230)  306.367 ms  306.399 ms
306.324 ms

```

Testing Link #2:

traceroute to usp.br (200.144.248.41), 30 hops max, 60 byte packets

```

1  * * *
2  irb-52686.kecd1-176q4-cbl-e1.gw.unsw.edu.au (172.17.30.178)  2.869 ms
2.839 ms  4.279 ms
3  ae4-2702.cfw1.gw.unsw.edu.au (172.17.31.52)  2.210 ms  1.798 ms  2.151
ms
4  irb-52710.kecd1-176q4-cbl-e1.gw.unsw.edu.au (172.17.31.114)  4.159 ms
4.875 ms  4.845 ms
5  ae2-1907.kecd2-lg11c1-pbr-c1.gw.unsw.edu.au (172.17.17.45)  4.074 ms
ae2-1905.kecd1-1q16c3-pbr-c1.gw.unsw.edu.au (172.17.17.9)  4.053 ms ae2-
1907.kecd2-lg11c1-pbr-c1.gw.unsw.edu.au (172.17.17.45)  4.033 ms
6  172.17.17.102 (172.17.17.102)  4.013 ms  3.056 ms  3.623 ms
7  138.44.5.0 (138.44.5.0)  12.681 ms  9.833 ms  11.341 ms
8  et-1-1-0.pe1.mcqp.nsw.aarnet.net.au (113.197.15.4)  4.929 ms  3.313 ms
4.869 ms
9  et-0_0_2.bdr1.guam.gum.aarnet.net.au (113.197.14.137)  74.478 ms
74.095 ms  74.074 ms
10  138.44.228.5 (138.44.228.5)  187.154 ms  187.574 ms  187.539 ms
11  fourhundredge-0-0-0-19.4079.core2.losa.net.internet2.edu (163.253.1.47)
235.656 ms  234.151 ms fourhundredge-0-0-0-
20.4079.core2.losa.net.internet2.edu (163.253.1.49)  233.563 ms
12  fourhundredge-0-0-0-0.4079.core2.elpa.net.internet2.edu (163.253.1.202)
232.533 ms  232.946 ms  233.306 ms
13  fourhundredge-0-0-0-23.4079.core1.elpa.net.internet2.edu (163.253.1.74)
231.852 ms fourhundredge-0-0-0-0.4079.core2.hous.net.internet2.edu
(163.253.1.247)  319.618 ms fourhundredge-0-0-0-
22.4079.core1.elpa.net.internet2.edu (163.253.1.72)  319.499 ms

```

```
14 fourhundredge-0-0-0-23.4079.core1.hous.net.internet2.edu (163.253.1.62)
319.082 ms fourhundredge-0-0-0-0.4079.core1.hous.net.internet2.edu
(163.253.2.39) 233.937 ms 233.786 ms
15 fourhundredge-0-0-0-0.4079.core1.houh.net.internet2.edu (163.253.2.24)
233.701 ms 233.631 ms 307.482 ms
16 fourhundredge-0-0-0-0.4079.core1.pens.net.internet2.edu (163.253.2.35)
307.355 ms 307.277 ms 307.203 ms
17 fourhundredge-0-0-0-0.4079.core1.jack.net.internet2.edu (163.253.1.0)
307.120 ms 307.024 ms 306.939 ms
18 64.57.28.62 (64.57.28.62) 306.893 ms 306.819 ms 307.174 ms
19 mia2-mia1.bkb.rnp.br (200.143.252.26) 307.049 ms 306.979 ms 306.905
ms
20 cce2-mia2-monet.bkb.rnp.br (170.79.213.46) 306.835 ms 306.753 ms
306.672 ms
21 sp2-cce2-tisparkle.bkb.rnp.br (170.79.213.3) 409.613 ms 409.469 ms
409.385 ms
22 as28571.saopaulo.sp.ix.br (187.16.220.3) 409.297 ms 409.210 ms
409.116 ms
23 e72361-sp2-r06-nx-swc.uspnet.usp.br (143.107.249.38) 409.035 ms
408.954 ms 408.940 ms
24 * * *
25 * * *
26 * * *
27 * * *
28 * * *
29 * * *
30 * * *
```

Testing Link #3:

```
traceroute to ed.ac.uk (129.215.235.216), 30 hops max, 60 byte packets
1 * * *
2 irb-52686.kecd1-176q4-cbl-e1.gw.unsw.edu.au (172.17.30.178) 1.936 ms
2.184 ms 2.085 ms
3 ae4-2702.cfw1.gw.unsw.edu.au (172.17.31.52) 2.966 ms 3.587 ms 2.761
ms
4 irb-52710.kecd1-176q4-cbl-e1.gw.unsw.edu.au (172.17.31.114) 4.761 ms
4.684 ms 3.232 ms
5 ae2-1905.kecd1-1q16c3-pbr-c1.gw.unsw.edu.au (172.17.17.9) 3.162 ms
ae2-1907.kecd2-lg11c1-pbr-c1.gw.unsw.edu.au (172.17.17.45) 3.093 ms 3.026
ms
6 172.17.17.102 (172.17.17.102) 40.299 ms 172.17.17.110 (172.17.17.110)
39.413 ms 39.467 ms
7 138.44.5.0 (138.44.5.0) 3.186 ms 2.491 ms 3.547 ms
8 et-1-1-0.pe1.mcqp.nsw.aarnet.net.au (113.197.15.4) 3.224 ms 4.056 ms
3.980 ms
9 et-0-3-0.pe1.eskp.nsw.aarnet.net.au (113.197.15.3) 4.281 ms 4.208 ms
4.210 ms
10 et-0-3-0.pe1.prka.sa.aarnet.net.au (113.197.15.42) 22.064 ms 21.856
ms 21.623 ms
```

```
11 et-0-3-0.pe1.knsg.wa.aarnet.net.au (113.197.15.45) 49.774 ms 49.540
ms 49.188 ms
12 et-2-1-2.bdr2.sing.sin.aarnet.net.au (113.197.15.247) 93.210 ms
93.848 ms 93.386 ms
13 ae1.bdr1.sing.sin.aarnet.net.au (113.197.15.234) 93.029 ms 93.723 ms
94.150 ms
14 138.44.226.7 (138.44.226.7) 256.971 ms 256.505 ms 256.781 ms
15 ae2.mx1.lon2.uk.geant.net (62.40.98.65) 258.175 ms 308.433 ms
308.312 ms
16 janet-bckp-gw.mx1.lon2.uk.geant.net (62.40.125.58) 310.399 ms 310.330
ms 310.261 ms
17 ae31.erdiss-sbr2.ja.net (146.97.33.22) 310.197 ms 310.133 ms 310.066
ms
18 ae29.manckh-sbr2.ja.net (146.97.33.42) 310.003 ms 309.935 ms 294.885
ms
19 ae31.glasss-sbr1.ja.net (146.97.33.54) 294.834 ms 294.803 ms 294.771
ms
20 ae29.edinat-rbr2.ja.net (146.97.38.38) 294.738 ms 268.917 ms 307.696
ms
21 ae25.edinkb-rbr2.ja.net (146.97.74.34) 308.127 ms 410.768 ms 410.609
ms
22 university-of-edinburgh.ja.net (146.97.156.78) 410.496 ms 410.399 ms
410.301 ms
23 remote.net.ed.ac.uk (192.41.103.209) 410.198 ms 410.090 ms 409.990
ms
24 * * *
25 * * *
26 * * *
27 * * *
28 * * *
29 * * *
30 * * *
```

Further information about this router reveals that

```
whois 138.44.5.0

#
# 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 1997-2024, 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](http://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

```
OrgAbuseRef:      https://rdap.arin.net/registry/entity/AWC12-ARIN
```

3.2.2)

Hop count and physical distance is weakly correlated. Since the hop count to Sao Paulo is the same to Edinburgh despite Sau Paulo being closer to Sydney.

Additionally, the difference in hopcount between New York and Sau paulo and Edin burgh is close (by 3).




Ultimately, hop count and physical distance must be weakly correlated as there must be other factors that contribute to varying hop count such as queuing or transmission delay, etc. (Scepticism is required here because the sample size is small)

#	Link	Hops	Location	Euclidean Distance from Sydney(km)
1	jhu.edu	26	New York	15,728
2	usp.br	23	Sao Paulo	14,235
3	ed.ac.uk	23	Edinburgh	17,006

3.3)

3.3.1)

My public ip address is 116.255.12.95 as follows:



NordVPN

Special VPN birthday deal

OPEN >

My IP Address is:

IPv4: ? 129.94.8.22

IPv6: ? Not detected

My IP Information:

ISP: University of New South Wales

City: Sydney

Region: New South Wales

Country: Australia

Your location may be exposed!

HIDE MY IP ADDRESS NOW

Show Complete IP Details

Click for more details about 129.94.8.22

Location not accurate?

Update My IP Location

Output from <https://www.net.princeton.edu/traceroute.html> to my IP address

Traceroute

```
tracing path from www.net.princeton.edu to 129.94.8.22 ...

traceroute to 129.94.8.22 (129.94.8.22), 30 hops max, 40 byte packets
 1 core-ns-router (128.112.128.2)  1.005 ms  0.826 ms  0.588 ms
 2 rtr-core-west-router.princeton.edu (128.112.12.229)  0.773 ms  0.651 ms  0.548 ms
 3 fw-border-hpcrc-router.princeton.edu (128.112.12.14)  1.063 ms  1.052 ms  0.923 ms
 4 rtr-border-hpcrc-router.princeton.edu (204.153.48.253)  1.322 ms  1.288 ms  4.491 ms
 5 172-96-130.unassigned.userdns.com (172.96.130.49)  6.015 ms  5.878 ms  4.641 ms
 6 172-96-130.unassigned.userdns.com (172.96.130.76)  6.303 ms  5.435 ms  172-96-130.unassigned.userdns.com (172.96.130.60)  6.055 ms
 7 bundle-ether1.102.core1.phil.net.internet2.edu (163.253.5.8)  6.311 ms  4.782 ms  6.013 ms
 8 fourhundredge-0-0-2.4079.core2.ashb.net.internet2.edu (163.253.1.136)  67.853 ms  67.961 ms  69.381 ms
 9 fourhundredge-0-0-17.4079.core1.ashb.net.internet2.edu (163.253.1.18)  69.425 ms  71.689 ms  70.381 ms
10 fourhundredge-0-0-1.4079.core1.clev.net.internet2.edu (163.253.1.123)  67.281 ms  67.323 ms  69.264 ms
11 fourhundredge-0-0-2.4079.core2.chic.net.internet2.edu (163.253.2.18)  67.534 ms  69.712 ms  69.264 ms
12 fourhundredge-0-0-22.4079.core1.chic.net.internet2.edu (163.253.1.96)  69.691 ms  69.761 ms  67.247 ms
13 fourhundredge-0-0-1.4079.core2.kans.net.internet2.edu (163.253.2.29)  69.126 ms  68.236 ms  69.108 ms
14 fourhundredge-0-0-1.4079.core2.denv.net.internet2.edu (163.253.1.250)  67.175 ms  67.840 ms  67.298 ms
15 fourhundredge-0-0-3.4079.core2.salt.net.internet2.edu (163.253.1.169)  68.390 ms  67.646 ms  67.133 ms
16 fourhundredge-0-0-8.4079.core1.losa.net.internet2.edu (163.253.1.114)  67.803 ms  69.064 ms  67.786 ms
17 et-1-1-2.897.bdr1.gum.gum.aarnet.net.au (138.44.228.4)  178.145 ms  178.490 ms  179.290 ms
18 et-5-1-0.pe1.brwy.nsw.aarnet.net.au (113.197.15.5)  248.937 ms et-3-1-0.pe1.brwy.nsw.aarnet.net.au (113.197.15.146)  248.302 ms et-5-1-0.pe1.brwy.nsw.aarnet.net.au (113.197.15.5)  248.205 ms
19 138.44.5.1 (138.44.5.1)  248.322 ms  249.103 ms  249.132 ms
20 * * *
21 * * *
22 * * *
23 * * *
24 * * *
25 * * *
26 * * *
27 * * *
28 * * *
29 * * *
30 * * *
```

Output from <https://www.as13030.net> to my IP address

```
traceroute to 129.94.8.22 (129.94.8.22), 30 hops max, 60 byte packets
 1 r2win7.core.init7.net (213.144.137.193) [AS13030]  1.147 ms  1.422 ms  1.813 ms
 2 r1win1.core.init7.net (5.180.134.125) [AS13030]  1.084 ms  1.268 ms  1.571 ms
```

```
3  r1win7.core.init7.net (5.180.134.122) [AS13030]  1.041 ms  1.331 ms
1.722 ms
4  r1win9.core.init7.net (5.180.135.25) [AS13030]  0.987 ms  1.165 ms
1.458 ms
5  r1zrh10.core.init7.net (5.180.135.56) [AS13030]  1.463 ms  1.817 ms
2.327 ms
6  r1glb3.core.init7.net (5.180.135.59) [AS13030]  1.222 ms  1.344 ms
1.517 ms
7  r2zrh5.core.init7.net (5.180.135.69) [AS13030]  1.401 ms  1.767 ms
1.502 ms
8  r2zrh2.core.init7.net (5.180.135.232) [AS13030]  5.543 ms  5.661 ms
6.131 ms
9  r1fra3.core.init7.net (5.180.135.173) [AS13030]  7.163 ms  7.393 ms
7.861 ms
10 xe-1-2-0.mpr1.fra4.de.above.net (80.81.194.26) [*]  7.128 ms  7.180 ms
7.173 ms
11 * ae12.cs1.fra6.de.eth.zayo.com (64.125.26.172) [*]  139.900 ms
139.953 ms
12 * * *
13 * * *
14 * * *
15 * * *
16 * * *
17 * * *
18 ae2.cs1.sea1.us.eth.zayo.com (64.125.29.26) [*]  139.880 ms  145.394 ms
145.382 ms
19 ae27.mpr1.sea1.us.zip.zayo.com (64.125.29.1) [*]  139.715 ms  139.706
ms  139.697 ms
20 64.125.193.130.i223.above.net (64.125.193.130) [*]  139.680 ms  139.668
ms  139.612 ms
21 et-10-0-5.170.pe1.brwy.nsw.aarnet.net.au (113.197.15.62) [AS7575]
279.492 ms  279.439 ms  279.421 ms
22 138.44.5.1 (138.44.5.1) [AS7575]  279.371 ms  279.389 ms  279.353 ms
23 * * *
24 * * *
25 * * *
26 * * *
27 * * *
28 * * *
29 * * *
30 * * *
```

IP address of the selected links:

Link	IP Address
https://www.net.princeton.edu	128.112.128.55
https://www.as13030.net	213.144.137.198

My output to www.net.princeton.edu

Testing Link #1 : 128.112.128.55

traceroute to 128.112.128.55 (128.112.128.55), 30 hops max, 60 byte packets

```
1  * * *
2  irb-52686.kecd1-176q4-cbl-e1.gw.unsw.edu.au (172.17.30.178)  7.437 ms
7.552 ms  8.587 ms
3  ae4-2702.cfw1.gw.unsw.edu.au (172.17.31.52)  3.059 ms  3.041 ms  2.300
ms
4  irb-52710.kecd1-176q4-cbl-e1.gw.unsw.edu.au (172.17.31.114)  8.515 ms
8.498 ms  8.481 ms
5  ae2-1907.kecd2-lg11c1-pbr-c1.gw.unsw.edu.au (172.17.17.45)  2.954 ms
2.938 ms ae2-1905.kecd1-1q16c3-pbr-c1.gw.unsw.edu.au (172.17.17.9)  2.921
ms
6  172.17.17.110 (172.17.17.110)  2.903 ms  2.802 ms 172.17.17.102
(172.17.17.102)  2.046 ms
7  138.44.5.0 (138.44.5.0)  6.510 ms  6.491 ms  6.472 ms
8  et-1-1-0.pe1.mcqp.nsw.aarnet.net.au (113.197.15.4)  3.163 ms  3.064 ms
3.681 ms
9  et-0_0_2.bdr1.guam.gum.aarnet.net.au (113.197.14.137)  72.765 ms
72.199 ms  73.247 ms
10 138.44.228.5 (138.44.228.5)  187.279 ms  187.145 ms  188.028 ms
11 fourhundredge-0-0-0-2.4079.core2.salt.net.internet2.edu (163.253.1.115)
249.426 ms  249.404 ms  249.388 ms
12 fourhundredge-0-0-0-22.4079.core1.salt.net.internet2.edu (163.253.1.30)
248.568 ms  248.320 ms fourhundredge-0-0-0-
0.4079.core2.denv.net.internet2.edu (163.253.1.168)  249.434 ms
13 fourhundredge-0-0-0-0.4079.core1.denv.net.internet2.edu (163.253.1.170)
247.155 ms  248.664 ms  248.270 ms
14 fourhundredge-0-0-0-0.4079.core1.kans.net.internet2.edu (163.253.1.243)
248.148 ms  307.285 ms  307.110 ms
15 fourhundredge-0-0-0-3.4079.core2.chic.net.internet2.edu (163.253.1.244)
306.827 ms  291.939 ms  291.867 ms
16 fourhundredge-0-0-0-3.4079.core2.eqch.net.internet2.edu (163.253.2.19)
291.827 ms  248.224 ms  249.951 ms
17 fourhundredge-0-0-0-0.4079.core2.clev.net.internet2.edu (163.253.2.16)
248.783 ms  248.701 ms  248.620 ms
18 fourhundredge-0-0-0-3.4079.core2.ashb.net.internet2.edu (163.253.1.138)
248.532 ms  248.008 ms  336.718 ms
19 fourhundredge-0-0-0-1.4079.core1.phil.net.internet2.edu (163.253.1.137)
336.570 ms  336.490 ms  336.418 ms
20 163.253.5.9 (163.253.5.9)  336.165 ms  336.096 ms  336.024 ms
21 172.96.130.54 (172.96.130.54)  336.039 ms  335.915 ms  291.235 ms
22 fw-border-87-router.princeton.edu (204.153.48.2)  291.173 ms  291.021
ms  291.026 ms
23 rtr-core-east-router.princeton.edu (128.112.12.9)  291.325 ms  291.258
ms  291.127 ms
24 core-ns-router.princeton.edu (128.112.12.226)  249.701 ms  249.618 ms
250.087 ms
25 www.net.princeton.edu (128.112.128.55)  249.445 ms  249.462 ms  249.412
ms
```

My output to www.as13030.net

Testing Link #2:

Testing Link #2 : 213.144.137.198

traceroute to 213.144.137.198 (213.144.137.198), 30 hops max, 60 byte packets

```
1  * * *
2  irb-52686.kecd1-176q4-cbl-e1.gw.unsw.edu.au (172.17.30.178)  1.805 ms
2.119 ms  3.955 ms
3  ae4-2702.cfw1.gw.unsw.edu.au (172.17.31.52)  2.323 ms  2.297 ms  2.274
ms
4  irb-52710.kecd1-176q4-cbl-e1.gw.unsw.edu.au (172.17.31.114)  3.853 ms
3.830 ms  3.800 ms
5  ae2-1907.kecd2-lg11c1-pbr-c1.gw.unsw.edu.au (172.17.17.45)  3.774 ms
ae2-1905.kecd1-1q16c3-pbr-c1.gw.unsw.edu.au (172.17.17.9)  3.751 ms ae2-
1907.kecd2-lg11c1-pbr-c1.gw.unsw.edu.au (172.17.17.45)  3.729 ms
6  172.17.17.110 (172.17.17.110)  3.708 ms  3.041 ms 172.17.17.102
(172.17.17.102)  2.700 ms
7  138.44.5.0 (138.44.5.0)  5.547 ms  6.153 ms  6.119 ms
8  et-0-3-0.pe1.bkvl.nsw.aarnet.net.au (113.197.15.147)  3.382 ms  3.705
ms  3.320 ms
9  xe-0-2-5.bdr1.b.sea.aarnet.net.au (202.158.194.121)  142.422 ms
142.398 ms  142.057 ms
10 xe-4-1-1.mpr1.sea1.us.above.net (64.125.193.129)  142.355 ms  142.334
ms  141.659 ms
11 ae27.cs1.sea1.us.eth.zayo.com (64.125.29.0)  263.948 ms  263.835 ms
264.203 ms
12  * * *
13  * * *
14  * * *
15 ae4.mpr1.lhr15.uk.zip.zayo.com (64.125.28.195)  431.304 ms  431.264 ms
431.224 ms
16 linux-1.init7.net (195.66.224.175)  431.906 ms  361.540 ms  361.420 ms
17 r2lon2.core.init7.net (5.180.135.248)  361.373 ms  306.227 ms  306.067
ms
18 r2fra3.core.init7.net (5.180.135.129)  306.916 ms  306.461 ms  306.282
ms
19 r1fra3.core.init7.net (80.81.192.67)  306.181 ms  306.089 ms  307.856
ms
20 r2zrh2.core.init7.net (5.180.135.172)  307.815 ms  306.998 ms  306.965
ms
21 r2zrh5.core.init7.net (5.180.135.233)  306.940 ms  306.921 ms  306.898
ms
22 r1glb3.core.init7.net (5.180.135.68)  306.983 ms  306.860 ms  306.787
ms
```

```
23  r1zrh10.core.init7.net (5.180.135.58)  306.719 ms  306.651 ms  306.584
ms
24  r1win9.core.init7.net (5.180.135.57)  306.513 ms  306.039 ms  305.917
ms
25  r1win7.core.init7.net (5.180.135.24)  306.261 ms  306.188 ms  306.121
ms
26  r1win1.core.init7.net (5.180.134.123)  306.051 ms  305.984 ms  307.638
ms
27  r2win7.core.init7.net (5.180.134.124)  307.510 ms  307.380 ms  307.304
ms
28  * * *
29  * * *
30  * * *
```

3.3.2)

The paths of the reverse and forward route are different.

Albeit, as seen above the reverse route goes through some similar routers with the forward route as with the case for which is Australia's national research and education network. However, for both routes there are many routers which are different because of the different IP addresses.

Something to note is the close proximity of the IP addresses for <https://init.7>, which may imply a server hosting many machines to achieve this.

3.3.3)

Standard routers appear if the IP address has not been translated. This is the case with <https://www.net.princeton.edu/traceroute.html> . However, it appears with the <https://init.7> and UNSW have used a translated IP (NAT Gateway) which may explain why the terminating IP addresses are different.

Exercise 4

Data

<http://cdu.edu.au>

Delay vs Time and Packet Number



Delay vs. Packet Size



Average and Min delay for packet size

Packet-Size	Avg	Min
-------------	-----	-----

Packet-Size	Avg	Min
50	71.14	61.694
250	67.106	61.878
500	68.239	62.84
750	67.265	63.326
1000	67.785	62.549
1250	67.948	62.787
1500	69.891	62.854

<http://usp.br>

Delay vs Time and Packet Number



Delay vs. Packet Size



Average and Min delay for packet size

Packet-Size	Avg	Min
50	392.834	334.572
250	404.478	332.872
500	397.889	335.137
750	389.037	333.947
1000	397.218	335.194
1250	397.085	335.352
1500	395.499	333.484

<http://ed.ac.uk>

Delay vs Time and Packet Number



Delay vs. Packet Size



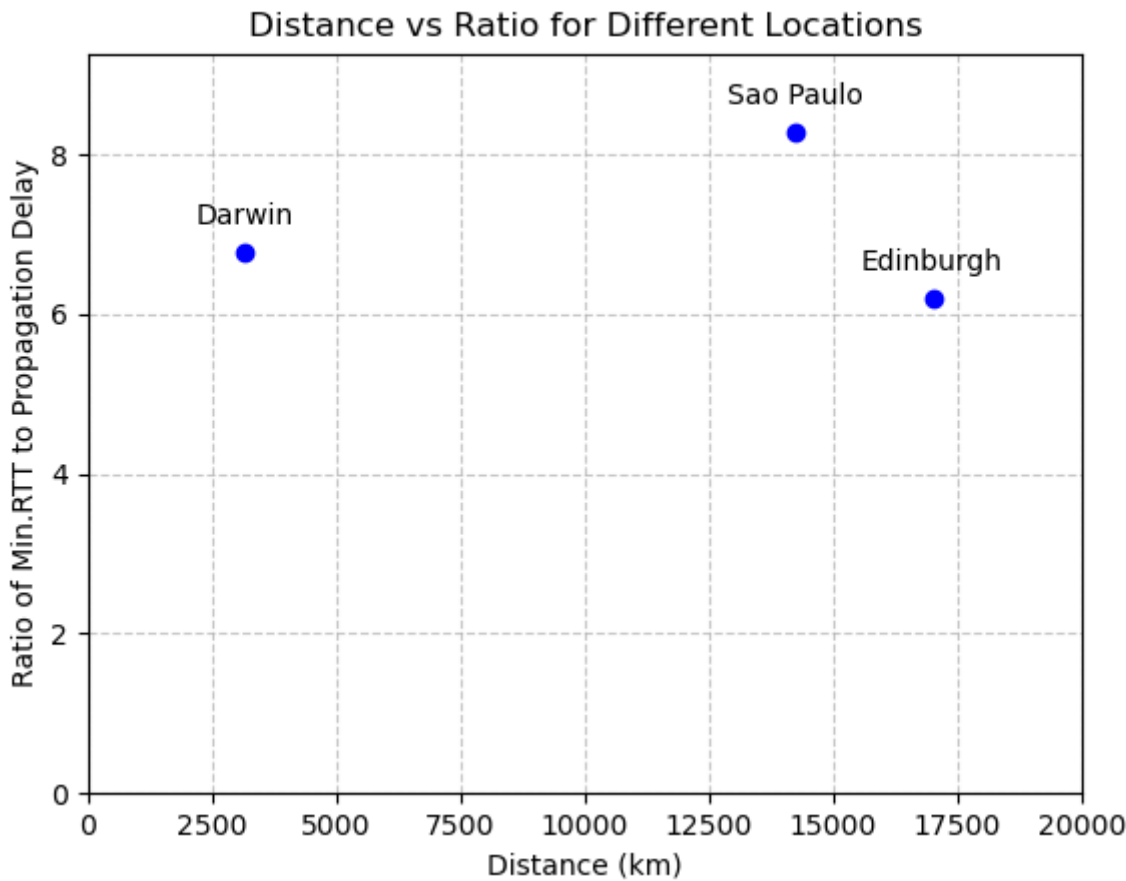
Average and Min delay for packet size

Packet-Size	Avg	Min
50	350.898	284.239
250	345.494	291.038
500	345.516	284.403
750	340.107	288.637
1000	339.109	286.988
1250	357.529	289.484
1500	339.793	284.49

4.1)

Link	Location	Euclidean Distance from Sydney(km)	Time to Destination(s)	Time to destination (ms)	Speed of light (m/s)	300000000
cdu.edu.au	Darwin	3,149	0.010496666667	10.496666667	Speed of light (km/s)	300000
usp.br	Sao Paulo	14,235	0.04745	47.45		
ed.ac.uk	Edinburgh	17,006	0.056686666667	56.686666667		

4.2)



4.3)

Possible reasons that the y-axis is greater than two are:

- 1. Transmission delay incurred along the route because each node(router) needs to manage other packets.
- 2. Propagation speed of a packet is not actually 3×10^8 m/s. It is more closer to 2×10^8 m/s because the speed of light (a packet) will travel slower in fibre optic (a different material)
- 3. Possible Processing and Queuing delay from individual routers as they will be managing other packets
- 4. ISP level routing may lead to paths that actually have higher delay

4.4)

Delay to the destination will vary over time. This is because the nodes/routers to the destination will have manage other packets and this means that factors such as processing, queueing and transmission time will also wildy vary. As such, each time a packet is sent to the destination it's RTT will vary.

4.5)

#	Delay type	Definition	Formula
1	Processing	time required to examine the packet headers and determine redirection	
2	Queueing	time spent by the packet waiting to be transmitted onto the link	
3	Transmission	time required to push the packet into the link	(L / R)

#	Delay type	Definition	Formula
4	Propogation	time spent by the packet travelling from the beginning to end node	(d / v)

Where:

R = Transmission rate of the link

L = The packet length in bits

d = The distance between two nodes (routers)

v = The speed of light in a physical medium

Transmission delay depends on the size of the packet L .

Processing delay can also depend on the packet size but to a smaller degree than transmission delay as it is in the order of microseconds[Computer Networking. Kurose page 64] and much smaller than a transmission delay.

The others do not.