COMP9331 WANZE LIU Z5137189

Exercise 1: nslookup

1.Name: 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

Different servers can be access through different IP addresses. some website like google, there are a lot of DNS requests daily ,therefore, using more servers makes website load balancing.

2.name = localhost.

The IP address 127.0.0.1 is a special-purpose IPv4 address
called localhost or loopback address. All computers use this address as their own but it doesn't let them communicate with other devices like a real IP address does.

Exercise 2: Use ping to test host reachability

- www.cse.unsw.edu.au yes
- www.getfittest.com.au no
- the remote host or network may be down, or the domain name does not exist.
- www.mit.edu yes
- www.intel.com.au yes
- www.tpg.com.au yes
- www.hola.hp no
- the remote host or network may be down, or the domain name does not exist.
- www.amazon.com yes
- www.tsinghua.edu.cn yes
- www.kremlin.ru no
- when I ping it, it shown time out ,but I can open it by using web browser, some reasons that cause this problem maybe is that the remote host is not in the same network segment as the user, and the host cannot be found though the route ,and another reason is that the IP address was blocked by some security reason.
- 8.8.8.8 yes

```
ping: cannot resolve www.getfittest.com.au: Unknown host
ping: cannot resolve www.hola.hp: Unknown host
us579:Desktop us579$ ping www.kremlin.ru
PING www.kremlin.ru (95.173.136.70): 56 data bytes
Request timeout for icmp_seq 0
Request timeout for icmp_seq 1
Request timeout for icmp_seq 2
Request timeout for icmp_seq 3
Request timeout for icmp_seq 4
```

Exercise 3: Use traceroute to understand network topology

```
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)  0.166 ms  0.156 ms  0.146 ms
 2  129.94.39.17 (129.94.39.17)  1.102 ms  1.064 ms  1.097 ms
 3  ombudnex1-vl-3154.gw.unsw.edu.au (149.171.253.35)  2.009 ms libudnex1-vl-3154.gw.unsw.edu.au (149.171.253.34)  143.340 ms ombudnex1-vl-3154.gw.unsw.edu.au (149.171.253.35)  2.00
 4  libcr1-po-5.gw.unsw.edu.au (149.171.255.165)  1.395 ms libcr1-po-6.gw.unsw.edu.au (149.171.255.201)  1.410 ms libcr1-po-5.gw.unsw.edu.au (149.171.255.165)  1.453 ms
 5  unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105)  1.408 ms  1.461 ms  1.496 ms
 6  138.44.5.0 (138.44.5.0)  1.732 ms  1.670 ms  1.696 ms
 7  et-1-3-0.pe1.sxt.bkvl.nsw.aarnet.net.au (113.197.15.149)  3.623 ms  3.320 ms  2.823 ms
 8  et-0-0-0.pe1.a.hnl.aarnet.net.au (113.197.15.99)  95.288 ms  95.188 ms  95.366 ms
 9  et-2-1-0.bdr1.a.sea.aarnet.net.au (113.197.15.201)  146.459 ms  146.551 ms  146.464 ms
10  abilene-1-lo-jmb-706.sttlwa.pacificwave.net (207.231.240.8)  146.669 ms  146.556 ms  146.470 ms
11  et-4-0-0.4079.rtsw.miss2.net.internet2.edu (162.252.70.0)  157.247 ms  157.117 ms  157.187 ms
12  et-4-0-0.4079.rtsw.minn.net.internet2.edu (162.252.70.58)  180.329 ms  180.391 ms  180.341 ms
13  et-1-1-2.4079.rtsw.eqch.net.internet2.edu (162.252.70.106)  188.365 ms  188.349 ms  188.451 ms
14  ae-1.4079.rtsw.clev.net.internet2.edu (162.252.70.130)  197.016 ms  197.087 ms  197.142 ms
15  buf-9208-I2-CLEV.nysernet.net (199.109.11.33)  201.674 ms  201.575 ms  201.529 ms
16  syr-9208-buf-9208.nysernet.net (199.109.7.193)  205.123 ms  205.092 ms  205.060 ms
17  nyc-9208-syr-9208.nysernet.net (199.109.7.162)  210.243 ms  210.383 ms  210.296 ms
18  columbia.nyc-9208.nysernet.net (199.109.4.14)  210.271 ms  210.509 ms  210.278 ms
19  cc-core-1-x-nyser32-gw-1.net.columbia.edu (128.59.255.5)  211.365 ms  210.698 ms  210.693 ms
20  cc-conc-1-x-cc-core-1.net.columbia.edu (128.59.255.210)  210.879 ms  211.136 ms  211.168 ms
21  dkv.columbia.edu (128.59.105.24)  210.638 ms  210.681 ms  210.771 ms
```

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

There are 5 routers belong to UNSW network(the first five).

I noticed that the response time of router 7 and router 8 has increased dramatically, which means the distance could be very long between this two routers, so we can know that they cross the Pacific Ocean .

2.

```
-bash-4.1$ 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)  0.173 ms  0.153 ms  0.141 ms
 2  129.94.39.17 (129.94.39.17)  1.002 ms  1.122 ms  1.036 ms
 3  libudnex1-vl-3154.gw.unsw.edu.au (149.171.253.34)  1.568 ms ombudnex1-vl-3154.gw.unsw.edu.au (149.171.253.35)  1.838 ms  1.758 ms
 4  libcr1-po-5.gw.unsw.edu.au (149.171.255.165)  1.335 ms libcr1-po-6.gw.unsw.edu.au (149.171.255.201)  1.257 ms ombcr1-po-6.gw.unsw.edu.au (149.171.255.169)  1.280 ms
 5  unswbr1-te-1-9.gw.unsw.edu.au (149.171.255.101)  163.668 ms unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105)  163.752 ms unswbr1-te-1-9.gw.unsw.edu.au (149.171.255.101)  163.704 ms
 6  138.44.5.0 (138.44.5.0)  1.410 ms  1.380 ms  1.373 ms
 7  et-1-3-0.pe1.sxt.bkvl.nsw.aarnet.net.au (113.197.15.149)  2.245 ms  2.403 ms  2.394 ms
 8  et-0-0-0.pe1.a.hnl.aarnet.net.au (113.197.15.99)  95.304 ms  95.341 ms  95.276 ms
 9  et-2-1-0.bdr1.a.sea.aarnet.net.au (113.197.15.201)  146.324 ms  146.375 ms  146.399 ms
10  cenichpr-1-is-jmb-778.snvaca.pacificwave.net (207.231.245.129)  162.899 ms  163.043 ms  162.920 ms
11  hpr-lax-hpr3--svl-hpr3-100ge.cenic.net (137.164.25.73)  170.781 ms  170.763 ms  170.732 ms
12  * * *
13  bd11f1.anderson--cr00f2.csb1.ucla.net (169.232.4.4)  171.332 ms bd11f1.anderson--cr001.anderson.ucla.net (169.232.4.6)  171.278 ms bd11f1.anderson--cr00f2.csb1.ucla.net (169.232.4.4)  171.266 ms
14  cr00f2.csb1--dr00f2.csb1.ucla.net (169.232.4.53)  171.203 ms  171.333 ms cr00f1.anderson--dr00f2.csb1.ucla.net (169.232.4.55)  171.230 ms
15  * * *
16  * * *
17  * * *
18  * * *
19  * * *
20  * * *
21  * * *
22  * * *
23  * * *
24  * * *
25  * * *
26  * * *
27  * * *
28  * * *
29  * * *
30  * * *
```

```
~bash-4.1$ 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)  0.111 ms  0.095 ms  0.086 ms
 2  129.94.39.17 (129.94.39.17)  1.014 ms  1.042 ms  1.010 ms
 3  ombudnex1-vl-3154.gw.unsw.edu.au (149.171.253.35)  1.467 ms  1.613 ms libudnex1-vl-3154.gw.unsw.edu.au (149.171.253.34)  1.671 ms
 4  libcr1-po-6.gw.unsw.edu.au (149.171.255.201)  1.246 ms libcr1-po-5.gw.unsw.edu.au (149.171.255.165)  1.258 ms ombcr1-po-6.gw.unsw.edu.au (149.171.255.169)  1.241 ms
 5  unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105)  1.258 ms  1.331 ms unswbr1-te-1-9.gw.unsw.edu.au (149.171.255.101)  1.248 ms
 6  138.44.5.0 (138.44.5.0)  1.499 ms  1.410 ms  1.351 ms
 7  et-0-3-0.pe1.bkvl.nsw.aarnet.net.au (113.197.15.147)  1.891 ms  1.912 ms  1.938 ms
 8  ge-4_0_0.bb1.a.pao.aarnet.net.au (202.158.194.177)  156.238 ms  156.186 ms  156.205 ms
 9  paloalto0.iij.net (198.32.176.24)  158.233 ms  158.232 ms  158.027 ms
10  osk004bb01.IIJ.Net (58.138.88.189)  271.193 ms osk004bb00.IIJ.Net (58.138.88.185)  288.804 ms  288.837 ms
11  osk004ix51.IIJ.Net (58.138.106.130)  279.688 ms osk004ix51.IIJ.Net (58.138.106.126)  288.659 ms osk004ix51.IIJ.Net (58.138.106.130)  279.583 ms
12  210.130.135.130 (210.130.135.130)  280.157 ms  280.137 ms  288.648 ms
13  124.83.228.78 (124.83.228.78)  280.455 ms  271.076 ms  270.922 ms
14  124.83.252.250 (124.83.252.250)  295.155 ms  286.415 ms  295.075 ms
15  158.205.134.26 (158.205.134.26)  277.503 ms  286.307 ms  277.534 ms
16  * * *
17  * * *
18  * * *
19  * * *
20  * * *
21  * * *
22  * * *
23  * * *
24  * * *
25  * * *
26  * * *
27  * * *
28  * * *
29  * * *
30  * * *
~bash-4.1$ 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)  0.095 ms  0.103 ms  0.091 ms
 2  129.94.39.17 (129.94.39.17)  1.014 ms  1.030 ms  0.980 ms
 3  ombudnex1-vl-3154.gw.unsw.edu.au (149.171.253.35)  1.825 ms  1.741 ms  1.740 ms
 4  ombcr1-po-5.gw.unsw.edu.au (149.171.255.197)  1.252 ms ombcr1-po-6.gw.unsw.edu.au (149.171.255.169)  1.291 ms ombcr1-po-5.gw.unsw.edu.au (149.171.255.197)  1.315 ms
 5  unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105)  1.265 ms unswbr1-te-1-9.gw.unsw.edu.au (149.171.255.101)  1.289 ms  1.307 ms
 6  138.44.5.0 (138.44.5.0)  1.374 ms  1.367 ms  1.386 ms
 7  et-1-3-0.pe1.sxt.bkvl.nsw.aarnet.net.au (113.197.15.149)  5.388 ms  4.515 ms  4.474 ms
 8  et-0-0-0.pe1.a.hnl.aarnet.net.au (113.197.15.99)  95.234 ms  95.246 ms  95.280 ms
 9  et-2-1-0.bdr1.a.sea.aarnet.net.au (113.197.15.201)  146.452 ms  146.445 ms  146.425 ms
10  abilene-1-lo-jmb-706.sttlwa.pacificwave.net (207.231.240.8)  146.497 ms  146.475 ms  146.469 ms
11  et-4-0-0.4079.rtsw.miss2.net.internet2.edu (162.252.70.0)  157.163 ms  157.221 ms  157.199 ms
12  et-4-0-0.4079.rtsw.minn.net.internet2.edu (162.252.70.58)  180.375 ms  180.485 ms  180.397 ms
13  et-1-1-2.4079.rtsw.eqch.net.internet2.edu (162.252.70.106)  188.401 ms  188.381 ms  188.356 ms
14  ae-1.4079.rtsw.clev.net.internet2.edu (162.252.70.130)  197.555 ms  197.195 ms  197.222 ms
15  et-2-0-0.4079.rtsw.ashb.net.internet2.edu (162.252.70.54)  204.816 ms  204.613 ms  204.719 ms
16  ae-2.4079.rtsw.wash.net.internet2.edu (162.252.70.136)  204.945 ms  204.910 ms  205.189 ms
17  internet2.mx1.lon.uk.geant.net (62.40.124.44)  279.562 ms  279.576 ms  279.514 ms
18  janet-gw.mx1.lon.uk.geant.net (62.40.124.198)  279.645 ms  279.654 ms  279.978 ms
19  ae29.londpg-sbr2.ja.net (146.97.33.2)  280.051 ms  280.138 ms  280.029 ms
20  ae31.erdiss-sbr2.ja.net (146.97.33.22)  283.989 ms  284.055 ms  283.834 ms
21  ae29.manckh-sbr2.ja.net (146.97.33.42)  285.906 ms  285.826 ms  285.877 ms
22  ae24.lanclu-rbr1.ja.net (146.97.38.58)  288.143 ms  288.093 ms  288.112 ms
23  * * *
24  ismx-issrx.rtr.lancs.ac.uk (148.88.255.17)  289.853 ms  289.899 ms  289.934 ms
25  dc.iss.srv.rtrcloud.lancs.ac.uk (148.88.253.3)  300.476 ms  296.296 ms  303.060 ms
26  www.lancs.ac.uk (148.88.65.80)  289.875 ms !X  289.809 ms !X  289.488 ms !X
```

So the path diverge at no.6 router which IP address is 138.44.5.0

According to geographical location tool, we can obtain the information below

14 routers----7499.0 miles

15 routers----4908.7 miles

26 routers----10569.8 miles

So as we can see ,we can conclude that the number of hops is not proportional to the physical distance.

3. From my machine to speedtest

```
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)  0.183 ms  0.170 ms  0.160 ms
 2  129.94.39.17 (129.94.39.17)  1.132 ms  1.097 ms  1.145 ms
 3  libudnex1-vl-3154.gw.unsw.edu.au (149.171.253.34)  2.224 ms  2.321 ms  2.241 ms
 4  ombcr1-po-6.gw.unsw.edu.au (149.171.255.169)  1.369 ms libcr1-po-5.gw.unsw.edu.au (149.171.255.165)  1.327 ms ombcr1-po-
 5  unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105)  1.452 ms  1.516 ms  1.457 ms
 6  138.44.5.0 (138.44.5.0)  1.602 ms  1.554 ms  1.561 ms
 7  et-0-3-0.pe1.alxd.nsw.aarnet.net.au (113.197.15.153)  1.939 ms  1.767 ms  1.733 ms
 8  xe-0-0-3.pe1.wnpa.akl.aarnet.net.au (113.197.15.67)  24.368 ms  24.233 ms  24.270 ms
 9  et-0-1-0.200.pe1.tkpa.akl.aarnet.net.au (113.197.15.69)  24.673 ms  24.599 ms  24.729 ms
10  xe-0-2-6.bdr1.a.lax.aarnet.net.au (202.158.194.173)  148.035 ms  148.069 ms  148.014 ms
11  singtel.as7473.any2ix.coresite.com (206.72.210.63)  314.404 ms  314.283 ms  314.245 ms
12  203.208.172.173 (203.208.172.173)  310.797 ms  314.837 ms  314.921 ms
13  203.208.177.110 (203.208.177.110)  330.277 ms 203.208.182.125 (203.208.182.125)  334.944 ms 203.208.151.233 (203.208.151
14  203.208.182.45 (203.208.182.45)  327.420 ms 202-150-221-170.rev.ne.com.sg (202.150.221.170)  326.832 ms 203.208.182.45 (
```

From speedtest To my machine

```
traceroute to 129.94.242.53 (129.94.242.53), 30 hops max, 60 byte packets
 1  ge2-8.r01.sin01.ne.com.sg (202.150.221.169)  0.172 ms  0.226 ms  0.245 ms
 2  10.11.33.38 (10.11.33.38)  32.878 ms  32.910 ms  32.932 ms
 3  hutchcity3-10g.hkix.net (123.255.90.140)  34.452 ms  34.468 ms  34.551 ms
 4  218.189.5.42 (218.189.5.42)  34.395 ms  34.368 ms d1-42-238-143-118-on-nets.com (118.143.23
 5  d1-6-224-143-118-on-nets.com (118.143.224.6)  180.718 ms  180.736 ms d1-2-224-143-118-on-ne
 6  aarnet.as7575.any2ix.coresite.com (206.72.210.64)  172.461 ms  171.197 ms  180.438 ms
 7  xe-0-0-3.pe1.tkpa.akl.aarnet.net.au (202.158.194.172)  304.766 ms  303.523 ms  303.440 ms
 8  et-0-1-0.200.pe1.wnpa.akl.aarnet.net.au (113.197.15.68)  303.668 ms  298.869 ms  296.056 ms
 9  xe-1-2-1.pe1.msct.nsw.aarnet.net.au (113.197.15.66)  318.700 ms  330.483 ms xe-0-2-2-204.pe
10  et-8-1-0.pe1.brwy.nsw.aarnet.net.au (113.197.15.152)  339.651 ms  333.510 ms  339.484 ms
11  138.44.5.1 (138.44.5.1)  326.321 ms  317.781 ms  319.461 ms
12  libcr1-te-1-5.gw.unsw.edu.au (149.171.255.102)  317.552 ms  325.989 ms  325.996 ms
13  libudnex1-po-1.gw.unsw.edu.au (149.171.255.166)  339.328 ms ombudnex1-po-1.gw.unsw.edu.au (
14  ufw1-ae-1-3154.gw.unsw.edu.au (149.171.253.36)  328.464 ms  326.502 ms  318.129 ms
15  129.94.39.23 (129.94.39.23)  318.462 ms  319.661 ms  327.214 ms
```

From my machine to telstra

```
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)  0.160 ms  0.145 ms  0.129 ms
 2  129.94.39.17 (129.94.39.17)  1.119 ms  1.092 ms  1.113 ms
 3  ombudnex1-vl-3154.gw.unsw.edu.au (149.171.253.35)  1.953 ms libudnex1-vl-3154.gw.unsw.edu.au (149.171.253.34)  1.9
 4  ombcr1-po-6.gw.unsw.edu.au (149.171.255.169)  1.295 ms ombcr1-po-5.gw.unsw.edu.au (149.171.255.197)  1.328 ms  1.3
 5  unswbr1-te-1-9.gw.unsw.edu.au (149.171.255.101)  1.367 ms unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105)  1.406
 6  138.44.5.0 (138.44.5.0)  1.771 ms  1.670 ms  1.690 ms
 7  et-0-3-0.pe1.bkvl.nsw.aarnet.net.au (113.197.15.147)  1.782 ms  1.630 ms  1.641 ms
 8  ae9.bb1.a.syd.aarnet.net.au (113.197.15.57)  2.062 ms  2.091 ms  1.959 ms
 9  gigabitethernet1-1.pe1.b.syd.aarnet.net.au (202.158.202.18)  2.293 ms  2.267 ms  2.322 ms
10  gigabitethernet3-11.ken37.sydney.telstra.net (139.130.0.77)  2.867 ms  2.861 ms  2.912 ms
11  bundle-ether13.ken-core10.sydney.telstra.net (203.50.11.94)  4.163 ms  3.512 ms  4.584 ms
12  bundle-ether10.win-core10.melbourne.telstra.net (203.50.11.123)  14.834 ms  14.707 ms  14.696 ms
13  gigabitethernet5-0.exi-service2.melbourne.telstra.net (203.50.80.132)  13.853 ms  13.723 ms  13.909 ms
```

```
 1  gigabitethernet3-3.exi2.melbourne.telstra.net (203.50.77.53)  0.377 ms  0.205 ms  0.241 ms
 2  bundle-ether3-100.win-core10.melbourne.telstra.net (203.50.80.129)  8.237 ms  2.227 ms  2.241
 3  bundle-ether12.ken-core10.sydney.telstra.net (203.50.11.122)  12.613 ms  12.348 ms  12.861 ms
 4  bundle-ether1.ken-edge901.sydney.telstra.net (203.50.11.95)  11.861 ms  11.973 ms  11.986 ms
 5  aarnet6.lnk.telstra.net (139.130.0.78)  11.612 ms  11.598 ms  11.611 ms
 6  ge-6-0-0.bb1.a.syd.aarnet.net.au (202.158.202.17)  11.736 ms  11.725 ms  11.734 ms
 7  ae9.pe2.brwy.nsw.aarnet.net.au (113.197.15.56)  31.474 ms  12.098 ms  11.986 ms
 8  et-3-1-0.pe1.brwy.nsw.aarnet.net.au (113.197.15.146)  12.360 ms  12.347 ms  12.362 ms
 9  138.44.5.1 (138.44.5.1)  12.611 ms  12.599 ms  12.611 ms
10  libcr1-te-1-5.gw.unsw.edu.au (149.171.255.102)  12.611 ms  12.598 ms  12.610 ms
11  libudnex1-po-1.gw.unsw.edu.au (149.171.255.166)  12.860 ms  12.848 ms  12.860 ms
12  ufw1-ae-1-3154.gw.unsw.edu.au (149.171.253.36)  13.235 ms  13.098 ms  13.109 ms
13  129.94.39.23 (129.94.39.23)  13.361 ms  13.351 ms  13.359 ms
```

From telstra To my machine

The IP that i chosen are : www.speedtest.com.sg and www.telstra.net

As we can see, The reverse path is different form the forward path. So the answer is No ,because it is random to choose paths. they do not use the same path. Eventhough they use the same router ,the IP address is different.

Exercise 4: Use ping to gain insights into network performance

Compute the shortest possible time T using speed of light as propagation speed:

Approximate physical distance from UNSW to Brisbane:

T = 745km/speed of light = 2.48 ms

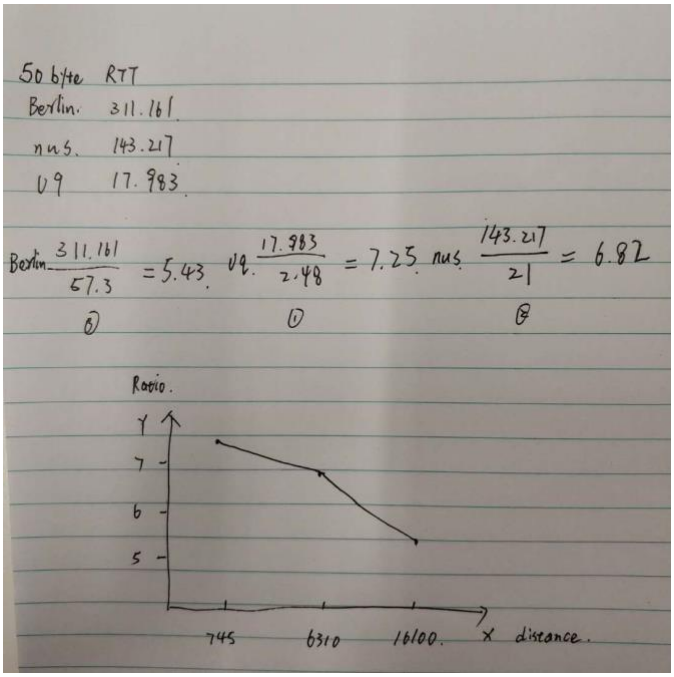
COMP9331 WANZE LIU Z5137189

Approximate physical distance from UNSW to Singapore

T = 6310km/speed of light = 21 ms

Approximate physical distance from UNSW to Berlin

16100km/speed of light = 53.7 ms



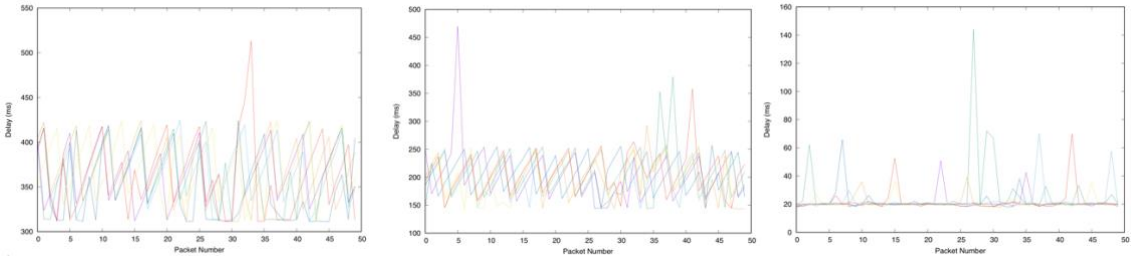
Can you think of at least two reasons why the y-axis values that you plot are greater than 2?

three kinds of delay. Processing delay, queue delay, transmission delay.

Packets don’t travel at speed of light through any physical medium**.**

Packets travel along cables and go through multiple hops rather than travel directly .

Q2: Is the delay to the destinations constant or does it vary over time? Explain why.



The delay varies over the time. Because it related to the current network condition. If the traffic is busy, the queue delay would be longer.

Q3: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?

Only Transmission delay depend on the packet size. its definition is the rate of which bits are pushed out of the queue.
Propagation Delay is the amount of time it takes for the head of the signal to travel from the sender to the receiver. It can be computed as the ratio between the link length and the propagation speed over the specific medium.it depends on the distance and specific medium.
Processing Delay can be generated on many places ,like checking the head of packet and determining the direction of packets' transmission. and its influence is very tiny.
Queuing delay is the time a job waits in a queue until it can be executed. it depends on the congestion of network.