COMP3331 Lab1

Exercise 1:

- www.cse.unsw.edu.au
0% packet loss, average time was 0.424ms per packet

- www.cancercouncil.org.au
100% packet loss. The address was unreachable from the web browser

- compnet.epfl.ch
0% packet loss, average time was 294.993ms per packet

- www.intel.com.au
0% packet loss, average time was 1.201ms per packet

- www.telstra.com.au
0% packet loss, average time was 14.391 per packet

- www.hola.hp
host was unknown. Address was unreachable from the web browser as it doesn't exist

- www.amazon.com
0% packet loss, average time was 1.084ms per packet

- www.wikileaks.org
0% packet loss, average time 311.382ms per packet

- www.tsinghua.edu.cn
host was unknown, Address was unreachable from the web browser

- www.kremlin.ru
100% packet loss. Address was accessible on the web browser. I'm not sure why this is the case.

- 8.8.8.8
0% packet loss, average time was 1.246ms per packet

Exercise 2:

1. www.nyu.edu

z5115237@tabla20:~/comp3331/lab02$ traceroute www.nyu.edu
traceroute to www.nyu.edu (216.165.47.12), 30 hops max, 60 byte packets
1 cserouter1-trusted.cse.unsw.EDU.AU (129.94.208.251) 0.150 ms 0.135 ms 0.122 ms
2 129.94.39.17 (129.94.39.17) 25.010 ms 25.066 ms 24.997 ms
3 libudnex1-vl-3154.gw.unsw.edu.au (149.171.253.34) 39.307 ms 39.240 ms 39.219 ms
4 ombcr1-po-5.gw.unsw.edu.au (149.171.255.197) 38.652 ms libcr1-po-5.gw.unsw.edu.au (149.171.255.165) 38.607 ms ombcr1-po-5.gw.unsw.edu.au (149.171.255.197) 38.628 ms
5 unswbr1-te-1-9.gw.unsw.edu.au (149.171.255.101) 38.616 ms 38.664 ms unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105) 38.654 ms
6 138.44.5.0 (138.44.5.0) 38.748 ms 38.216 ms 38.157 ms
7 et-1-3-0.pe1.sxt.bkvl.nsw.aarnet.net.au (113.197.15.149) 39.131 ms 30.607 ms 30.553 ms
8 et-0-0-0.pe1.a.hnl.aarnet.net.au (113.197.15.99) 124.922 ms 124.543 ms 124.482 ms
9 et-2-1-0.bdr1.a.sea.aarnet.net.au (113.197.15.201) 186.049 ms 186.061 ms 186.026 ms
10 abilene-1-lo-jmb-706.sttlwa.pacificwave.net (207.231.240.8) 186.008 ms 185.984 ms 185.649 ms
11 et-4-0-0.4079.sdn-sw.miss2.net.internet2.edu (162.252.70.0) 193.300 ms 193.282 ms 193.269 ms
12 et-4-0-0.4079.sdn-sw.minn.net.internet2.edu (162.252.70.58) 219.572 ms 219.407 ms 219.403 ms
13 et-7-0-0.4079.sdn-sw.eqch.net.internet2.edu (162.252.70.106) 225.941 ms 217.344 ms 221.380 ms
14 et-4-1-0.4079.rtsw.clev.net.internet2.edu (162.252.70.112) 233.178 ms 231.356 ms 231.350 ms
15 buf-9208-I2-CLEV.nysernet.net (199.109.11.33) 235.061 ms 235.072 ms 235.051 ms
16 syr-9208-buf-9208.nysernet.net (199.109.7.193) 235.473 ms 236.913 ms 236.866 ms
17 nyc-9208-syr-9208.nysernet.net (199.109.7.162) 241.519 ms 253.787 ms 253.741 ms
18 199.109.5.6 (199.109.5.6) 254.220 ms 256.245 ms 247.635 ms
19 DMZGWB-PTP-EXTGWA.NET.NYU.EDU (128.122.254.67) 256.562 ms 256.302 ms 244.864 ms
20 NYUGWA-PTP-DMZGWB-NGFW.NET.NYU.EDU (128.122.254.110) 244.523 ms 243.488 ms 243.609 ms
21 NYUFW-OUTSIDE-NGFW.NET.NYU.EDU (128.122.254.116) 244.399 ms 244.813 ms 248.383 ms
22 * * *
23 WSQDCGWA-VL901.NET.NYU.EDU (128.122.1.6) 245.990 ms 242.876 ms 242.890 ms
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- There are 23 routers between my workstation and www.nyu.edu.au.
- There are 6 routers along the UNSW network.
- The packets cross the pacific ocean between 9 and 10. At hop 9 the router location is still in Australia, however at hop 10, the router location is in the US.

2. i. www.ucla.edu

z5115237@tabla20:~/comp3331/lab02$ traceroute www.ucla.edu
traceroute to www.ucla.edu (164.67.228.152), 30 hops max, 60 byte packets
 1 cserouter1-trusted.cse.unsw.EDU.AU (129.94.208.251) 0.142 ms 0.130 ms 0.120 ms
 2 129.94.39.17 (129.94.39.17) 1.159 ms 1.390 ms 1.386 ms
 3 ombudnex1-vl-3154.gw.unsw.edu.au (149.171.253.35) 1.499 ms libudnex1-vl-3154.gw.unsw.edu.au (149.171.253.34) 1.566 ms 1.905 ms
 4 ombcr1-po-6.gw.unsw.edu.au (149.171.255.169) 1.340 ms libcr1-po-6.gw.unsw.edu.au (149.171.255.201) 1.321 ms libcr1-po-5.gw.unsw.edu.au (149.171.255.165) 1.309 ms
 5 unswbr1-te-1-9.gw.unsw.edu.au (149.171.255.101) 1.343 ms 1.331 ms unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105) 1.370 ms
 6 138.44.5.0 (138.44.5.0) 1.552 ms 1.465 ms 1.502 ms
 7 et-1-3-0.pe1.sxt.bkvl.nsw.aarnet.net.au (113.197.15.149) 2.381 ms 2.202 ms 2.216 ms
 8 et-0-0-0.pe1.a.hnl.aarnet.net.au (113.197.15.99) 95.170 ms 95.188 ms 95.165 ms
 9 et-2-1-0.bdr1.a.sea.aarnet.net.au (113.197.15.201) 146.398 ms 146.364 ms 146.377 ms
10 cenichpr-1-is-jmb-778.snvaca.pacificwave.net (207.231.245.129) 163.077 ms 163.201 ms 163.066 ms
11 hpr-lax-hpr3--svl-hpr3-100ge.cenic.net (137.164.25.73) 171.072 ms 170.981 ms 171.048 ms
12 * * *
13 bd11f1.anderson--cr001.anderson.ucla.net (169.232.4.6) 171.245 ms 171.449 ms 171.417 ms
14 cr00f1.anderson--dr00f2.csb1.ucla.net (169.232.4.55) 171.385 ms cr00f2.csb1--dr00f2.csb1.ucla.net (169.232.4.53) 171.410 ms cr00f1.anderson--dr00f2.csb1.ucla.net (169.232.4.55) 171.398 ms
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ii. www.u-tokyo.ac.jp

traceroute to www.u-tokyo.ac.jp (210.152.135.178), 30 hops max, 60 byte packets
 1 cserouter1-trusted.cse.unsw.EDU.AU (129.94.208.251) 0.103 ms 0.089 ms 0.074 ms
 2 129.94.39.17 (129.94.39.17) 1.080 ms 1.052 ms 1.046 ms
 3 ombudnex1-vl-3154.gw.unsw.edu.au (149.171.253.35) 1.676 ms 1.670 ms libudnex1-vl-3154.gw.unsw.edu.au (149.171.253.34) 1.491 ms
 4 libcr1-po-6.gw.unsw.edu.au (149.171.255.201) 1.266 ms ombcr1-po-6.gw.unsw.edu.au (149.171.255.169) 1.243 ms ombcr1-po-5.gw.unsw.edu.au (149.171.255.197) 1.253 ms
 5 unswbr1-te-1-9.gw.unsw.edu.au (149.171.255.101) 1.401 ms unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105) 1.327 ms unswbr1-te-1-9.gw.unsw.edu.au (149.171.255.101) 1.306 ms
 6 138.44.5.0 (138.44.5.0) 1.507 ms 1.428 ms 1.406 ms
 7 et-0-3-0.pe1.bkvl.nsw.aarnet.net.au (113.197.15.147) 1.860 ms 2.021 ms 1.920 ms
 8 ge-4_0_0.bb1.a.pao.aarnet.net.au (202.158.194.177) 156.661 ms 156.672 ms 156.657 ms
 9 paloalto0.iij.net (198.32.176.24) 158.372 ms 158.391 ms 158.359 ms
10 osk004bb00.IIJ.Net (58.138.88.185) 290.884 ms osk004bb01.IIJ.Net (58.138.88.189) 271.899 ms 271.904 ms
11 osk004ix51.IIJ.Net (58.138.106.126) 290.611 ms osk004ix51.IIJ.Net (58.138.106.130) 280.937 ms osk004ix51.IIJ.Net (58.138.106.126) 290.669 ms
12 210.130.135.130 (210.130.135.130) 281.105 ms 281.093 ms 281.045 ms
13 124.83.228.93 (124.83.228.93) 290.589 ms 290.909 ms 281.230 ms
14 124.83.228.74 (124.83.228.74) 271.571 ms 271.479 ms 271.466 ms
15 124.83.252.242 (124.83.252.242) 279.235 ms 279.262 ms 288.728 ms
16 158.205.134.22 (158.205.134.22) 288.681 ms 288.604 ms 288.636 ms
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iii. www.lancaster.ac.uk

z5115237@tabla20:~/comp3331/lab02$ traceroute www.lancaster.ac.uk
traceroute to www.lancaster.ac.uk (148.88.2.80), 30 hops max, 60 byte packets

1 cserouter1-trusted.cse.unsw.EDU.AU (129.94.208.251) 0.182 ms 0.159 ms 0.146 ms
2 129.94.39.17 (129.94.39.17) 1.169 ms 1.148 ms 1.112 ms
3 libudnex1-vl-3154.gw.unsw.edu.au (149.171.253.34) 1.798 ms 1.790 ms ombudnex1-vl-3154.gw.unsw.edu.au (149.171.253.35) 1.600 ms
4 libcr1-po-5.gw.unsw.edu.au (149.171.255.165) 1.414 ms libcr1-po-6.gw.unsw.edu.au (149.171.255.201) 1.391 ms libcr1-po-5.gw.unsw.edu.au (149.171.255.165) 1.309 ms
5 unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105) 1.312 ms 1.352 ms 1.333 ms
6 138.44.5.0 (138.44.5.0) 1.478 ms 1.459 ms 1.444 ms
7 et-1-3-0.pe1.sxt.bkvl.nsw.aarnet.net.au (113.197.15.149) 2.382 ms 2.274 ms 2.264 ms
8 et-0-0-0.pe1.a.hnl.aarnet.net.au (113.197.15.99) 95.096 ms 94.958 ms 94.977 ms
9 et-2-1-0.bdr1.a.sea.aarnet.net.au (113.197.15.201) 146.351 ms 146.305 ms 146.313 ms
10 abilene-1-lo-jmb-706.sttlwa.pacificwave.net (207.231.240.8) 146.489 ms 146.407 ms 146.430 ms
11 et-4-0-0.4079.sdn-sw.miss2.net.internet2.edu (162.252.70.0) 157.327 ms 157.203 ms 157.112 ms
12 et-4-0-0.4079.sdn-sw.minn.net.internet2.edu (162.252.70.58) 180.300 ms 180.081 ms 180.205 ms
13 et-7-0-0.4079.sdn-sw.eqch.net.internet2.edu (162.252.70.106) 188.033 ms 188.079 ms 188.024 ms
14 et-4-1-0.4079.rtsw.clev.net.internet2.edu (162.252.70.112) 197.065 ms 197.038 ms 196.990 ms
15 et-2-0-0.4079.sdn-sw.ashb.net.internet2.edu (162.252.70.54) 204.819 ms 204.750 ms 204.685 ms
16 et-4-1-0.4079.rtsw.wash.net.internet2.edu (162.252.70.65) 204.836 ms 204.951 ms 204.805 ms
17 internet2-gw.mx1.lon.uk.geant.net (62.40.124.44) 279.605 ms 279.548 ms 279.589 ms
18 janet-gw.mx1.lon.uk.geant.net (62.40.124.198) 279.679 ms 279.598 ms 279.695 ms
19 ae29.londpg-sbr2.ja.net (146.97.33.2) 280.098 ms 280.163 ms 280.083 ms
20 ae31.erdiss-sbr2.ja.net (146.97.33.22) 283.908 ms 283.970 ms 283.942 ms
21 ae29.manckh-sbr1.ja4908.7 miles.net (146.97.33.42) 285.707 ms 285.656 ms 285.696 ms
22 cnl.manckh-sbr1.ja.net (146.97.41.54) 288.010 ms 288.126 ms 288.009 ms
23 * * *
24 ismx-issrx.rtr.lancs.ac.uk (148.88.255.17) 289.866 ms 289.868 ms 289.766 ms
25 dc.iss.srv.rtrcloud.lancs.ac.uk (148.88.253.3) 301.500 ms 301.276 ms 304.476 ms
26 www-ha.lancs.ac.uk (148.88.2.80) 289.552 ms !X 289.539 ms !X 289.412 ms !X

All three paths divert at 138.44.5.0 which is a router in Perth. This is evident on hop 6 for all 3 websites. All three paths go to the US first however they use different routers.

Lancaster 17,000 km with 26 hops
Tokyo 8,000 km with 16 hops
UCLA 12,000 km with 14 hops

The amount of hops isn't proportional to the distance as UCLA is further than Tokyo, however requires less hops to reach the destination

3.

www.speedtest.com.sg/tr.php

server to machine

traceroute to 129.94.209.20 (129.94.209.20), 30 hops max, 60 byte packets
1 ge2-8.r01.sin01.ne.com.sg (202.150.221.169) 0.241 ms 0.262 ms 0.270 ms
2 10.12.0.101 (10.12.0.101) 38.347 ms 38.378 ms 38.382 ms
3 hutchcity3-10g.hkix.net (123.255.90.140) 39.818 ms 39.845 ms 39.857 ms
4 218.189.5.10 (218.189.5.10) 39.673 ms 218.189.5.42 (218.189.5.42) 39.677 ms d1-42-238-143-118-on-nets.com (118.143.238.42) 39.649 ms
5 d1-10-224-143-118-on-nets.com (118.143.224.10) 203.380 ms 203.391 ms 203.318 ms
6 aarnet.as7575.any2ix.coresite.com (206.72.210.64) 182.149 ms 182.118 ms 180.654 ms
7 xe-0-0-3.pe1.tkpa.akl.aarnet.net.au (202.158.194.172) 314.106 ms 317.990 ms 310.336 ms
8 et-0-1-0.200.pe1.wnpa.akl.aarnet.net.au (113.197.15.68) 298.655 ms 298.672 ms 306.295 ms
9 xe-0-2-2-204.pe1.alxd.nsw.aarnet.net.au (113.197.15.182) 334.125 ms 337.489 ms xe-1-2-1.pe1.msct.nsw.aarnet.net.au (113.197.15.66) 321.245 ms
10 et-8-1-0.pe1.brwy.nsw.aarnet.net.au (113.197.15.152) 330.289 ms 334.115 ms 330.361 ms
11 138.44.5.1 (138.44.5.1) 329.323 ms 320.223 ms 325.153 ms
12 ombcr1-te-1-5.gw.unsw.edu.au (149.171.255.106) 343.962 ms 343.189 ms 342.783 ms
13 ombudnex1-po-2.gw.unsw.edu.au (149.171.255.170) 340.879 ms 344.391 ms 340.802 ms
14 ufw1-ae-1-3154.gw.unsw.edu.au (149.171.253.36) 344.791 ms 344.862 ms 343.372 ms
15 129.94.39.23 (129.94.39.23) 340.028 ms 343.696 ms 340.101 ms
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machine to server

traceroute to www.speedtest.com.sg (202.150.221.170), 30 hops max, 60 byte packets

1 cserouter1-trusted.cse.unsw.EDU.AU (129.94.208.251) 0.145 ms 0.128 ms 0.113 ms
2 129.94.39.17 (129.94.39.17) 1.088 ms 1.076 ms 1.036 ms
3 libudnex1-vl-3154.gw.unsw.edu.au (149.171.253.34) 1.714 ms ombudnex1-vl-3154.gw.unsw.edu.au (149.171.253.35) 1.570 ms libudnex1-vl-3154.gw.unsw.edu.au (149.171.253.34) 1.786 ms
4 libcr1-po-6.gw.unsw.edu.au (149.171.255.201) 1.296 ms ombcr1-po-6.gw.unsw.edu.au (149.171.255.169) 1.333 ms ombcr1-po-5.gw.unsw.edu.au (149.171.255.197) 1.326 ms
5 unswbr1-te-1-9.gw.unsw.edu.au (149.171.255.101) 1.375 ms 1.362 ms unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105) 1.395 ms
6 138.44.5.0 (138.44.5.0) 1.530 ms 1.463 ms 1.448 ms
7 et-0-3-0.pe1.alxd.nsw.aarnet.net.au (113.197.15.153) 1.815 ms 1.921 ms 1.896 ms
8 xe-0-0-3.pe1.wnpa.akl.aarnet.net.au (113.197.15.67) 24.321 ms 24.342 ms 24.331 ms
9 et-0-1-0.200.pe1.tkpa.akl.aarnet.net.au (113.197.15.69) 24.741 ms 24.720 ms 24.687 ms
10 xe-0-2-6.bdr1.a.lax.aarnet.net.au (202.158.194.173) 148.174 ms 148.134 ms 148.155 ms
11 singtel.as7473.any2ix.coresite.com (206.72.210.63) 314.535 ms 314.515 ms 314.475 ms
12 203.208.171.117 (203.208.171.117) 306.195 ms 306.208 ms 306.176 ms
13 203.208.178.185 (203.208.178.185) 331.899 ms 203.208.182.77 (203.208.182.77) 328.706 ms 328.576 ms
14 203.208.171.198 (203.208.171.198) 338.841 ms 202-150-221-170.rev.ne.com.sg (202.150.221.170) 331.571 ms 203.208.171.198 (203.208.171.198) 325.556 ms

www.telstra.net/cgi-bin/trace

server to machine

traceroute to 129.94.209.20 (129.94.209.20)
1 gigabitethernet3-3.exi2.melbourne.telstra.net (203.50.77.53) 0.233 ms 0.224 ms 0.244 ms
2 bundle-ether3-100.win-core10.melbourne.telstra.net (203.50.80.129) 2.868 ms 1.362 ms 2.243 ms
3 bundle-ether12.ken-core10.sydney.telstra.net (203.50.11.122) 13.989 ms 12.605 ms 12.613 ms
4 bundle-ether1.ken-edge901.sydney.telstra.net (203.50.11.95) 11.864 ms 11.857 ms 11.863 ms
5 aarnet6.lnk.telstra.net (139.130.0.78) 11.613 ms 11.607 ms 11.614 ms
6 ge-6-0-0.bb1.a.syd.aarnet.net.au (202.158.202.17) 11.864 ms 11.732 ms 11.738 ms
7 ae9.pe2.brwy.nsw.aarnet.net.au (113.197.15.56) 11.987 ms 11.982 ms 11.988 ms
8 et-3-1-0.pe1.brwy.nsw.aarnet.net.au (113.197.15.146) 12.362 ms 12.107 ms 12.114 ms
9 138.44.5.1 (138.44.5.1) 12.363 ms 12.315 ms 12.235 ms
10 ombcr1-te-1-5.gw.unsw.edu.au (149.171.255.106) 12.362 ms 12.353 ms 12.364 ms
11 ombudnex1-po-2.gw.unsw.edu.au (149.171.255.170) 13.362 ms 12.732 ms 33.850 ms
12 ufw1-ae-1-3154.gw.unsw.edu.au (149.171.253.36) 12.861 ms 12.855 ms 12.863 ms
13 129.94.39.23 (129.94.39.23) 12.987 ms 12.982 ms 12.987 ms

machine to server

traceroute to www.telstra.net (203.50.5.178), 30 hops max, 60 byte packets
 1 cserouter1-trusted.cse.unsw.EDU.AU (129.94.208.251) 0.148 ms 0.126 ms 0.114 ms
 2 129.94.39.17 (129.94.39.17) 1.109 ms 1.100 ms 1.069 ms
 3 ombudnex1-vl-3154.gw.unsw.edu.au (149.171.253.35) 1.784 ms 1.762 ms libudnex1-vl-3154.gw.unsw.edu.au (149.171.253.34) 1.813 ms
 4 libcr1-po-6.gw.unsw.edu.au (149.171.255.201) 1.257 ms ombcr1-po-5.gw.unsw.edu.au (149.171.255.197) 1.254 ms ombcr1-po-6.gw.unsw.edu.au (149.171.255.169) 1.287 ms
 5 unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105) 1.339 ms 1.330 ms unswbr1-te-1-9.gw.unsw.edu.au (149.171.255.101) 1.357 ms
 6 138.44.5.0 (138.44.5.0) 1.452 ms 1.465 ms 1.448 ms
 7 et-0-3-0.pe1.alxd.nsw.aarnet.net.au (113.197.15.153) 1.552 ms 1.692 ms 1.569 ms
 8 ae9.bb1.b.syd.aarnet.net.au (113.197.15.65) 1.908 ms 2.085 ms 2.037 ms
 9 gigabitethernet1-1.pe1.b.syd.aarnet.net.au (202.158.202.18) 2.032 ms 2.083 ms 1.998 ms
10 gigabitethernet3-11.ken37.sydney.telstra.net (139.130.0.77) 2.832 ms 2.546 ms 2.811 ms
11 bundle-ether13.ken-core10.sydney.telstra.net (203.50.11.94) 3.740 ms 3.731 ms 2.717 ms
12 bundle-ether12.win-core10.melbourne.telstra.net (203.50.11.123) 15.745 ms 15.724 ms 15.697 ms
13 gigabitethernet5-0.exi-service2.melbourne.telstra.net (203.50.80.132) 13.499 ms 13.590 ms 13.606 ms
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The reverse paths does not go through the same exact routers as there are many possible paths between two endpoints in a network, however the router IP adresses are somewhat similar

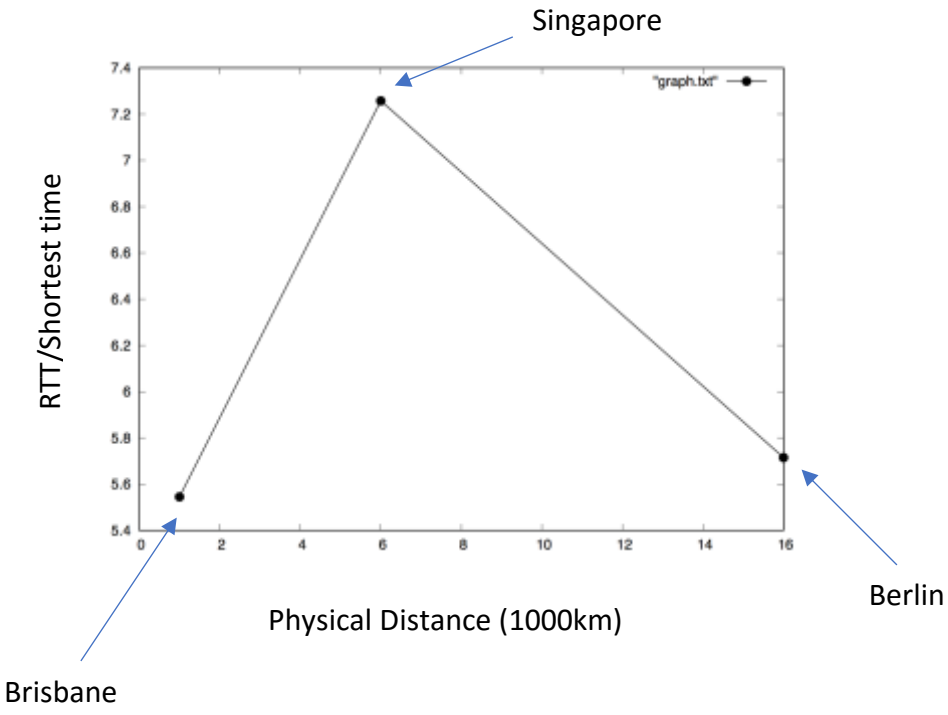
Exercise 3

1.
www.nus.edu.sg
Distance: 6,000km
Shortest possible time: 20ms
Min delay (50 bytes): 145.15ms
Ratio: 7.2575

www.uq.edu.au
Distance: 1,000km
Shortest possible time: 3ms
Min delay (50 bytes): 16.634ms
Ratio: 5.5446

www.tu-berlin.de
Distance: 16,000km
Shortest possible time: 53ms
Min delay (50 bytes): 302.863ms
Ratio: 5.714396226

Two reasons why the ratio between the RTT and the shortest possible time to reach the city is greater than two:
- Transmission delay which depends on the size of the packets and the bandwidth. A packet of greater size and a host with limited bandwidth can suffer from a longer delay
- Queueing delay which depends on the congestion at the router. If there is high traffic in the network the packet will take longer to process and therefore a longer delay will occur.



2.
The delay to the destinations are not constant over time as from the graphs there are varying times of delay for each packet size.

For the Singapore website, the average delay was constant as size increased until 1000 bytes where it increased until approx. 1200 bytes where it peaked. Packets greater than 1200 bytes experienced shorter delays on average than packets of 1200 bytes.

For the Brisbane website, the average delay was constant as size increased for all sizes of packets

For the Berlin website, the average delay was constant as increased from approx. 200 byte packets. Packets less than 200 bytes experienced greater delays. Strangely packets with sizes close to 0 experienced the greatest average delay.

3.
Transmission delay depends on the size of the packets as it is calculated by L/R, where L is the size of the packet and R is the link bandwidth. Other delays such as propagation delay, processing delay and queuing delay do not depend on packet size.