**COMP3331 Lab101 by Katrina**

**Exercise 1**

**1.**

Google's IP address: 216.58.203.110  
Reason having serveral IP addresses is becuase there are multiple records for a single host.

**2.**

name = localhost. This IP address is the local computer's IP address.

**Exercise 2**

* www.cse.unsw.edu.au Yes
* www.getfittest.com.au No
* www.mit.edu Yes
* www.intel.com.au Yes
* www.tpg.com.au Yes
* www.hola.hp No
* www.amazon.com Yes
* www.tsinghua.edu.cn Yes
* www.kremlin.ru No
* 8.8.8.8 Yes

www.getfittest.com.au and www.hola.hp are not valid hosts and are not reachable from Web browser. www.kremlin.ru can be transmitted packets using ping, but 0 packets received; however, it can be reachable by Web browser. Government website has firewall that blocks ping request for security reason.

**Exercise 3**

**1.**

There are 22 routers.  
There are 4 routers are part of the UNSW network (1, 3, 4, 5).  
Crossing the Pacific Ocean is between route 7 (113.197.15.149) and route 8 (113.197.15.99) because the time is significantly different.

Traceroot result:

wagner % 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) 0.118 ms 0.141 ms 0.126 ms

2 129.94.39.17 (129.94.39.17) 1.152 ms 1.118 ms 1.095 ms

3 libudnex1-vl-3154.gw.unsw.edu.au (149.171.253.34) 3.564 ms ombudnex1-vl-3154.gw.unsw.edu.au (149.171.253.35) 1.937 ms 1.830 ms

4 libcr1-po-5.gw.unsw.edu.au (149.171.255.165) 1.296 ms ombcr1-po-5.gw.unsw.edu.au (149.171.255.197) 1.278 ms 1.278 ms

5 unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105) 1.294 ms unswbr1-te-1-9.gw.unsw.edu.au (149.171.255.101) 1.356 ms unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105) 1.305 ms

6 138.44.5.0 (138.44.5.0) 1.650 ms 1.414 ms 1.436 ms

7 et-1-3-0.pe1.sxt.bkvl.nsw.aarnet.net.au (113.197.15.149) 4.159 ms 2.469 ms 2.367 ms

8 et-0-0-0.pe1.a.hnl.aarnet.net.au (113.197.15.99) 95.732 ms 95.360 ms 95.285 ms

9 et-2-1-0.bdr1.a.sea.aarnet.net.au (113.197.15.201) 146.750 ms 146.805 ms 146.777 ms

10 abilene-1-lo-jmb-706.sttlwa.pacificwave.net (207.231.240.8) 146.760 ms 146.875 ms 146.848 ms

11 et-4-0-0.4079.rtsw.miss2.net.internet2.edu (162.252.70.0) 157.711 ms 157.702 ms 157.817 ms

12 et-4-0-0.4079.rtsw.minn.net.internet2.edu (162.252.70.58) 180.692 ms 180.763 ms 180.829 ms

13 et-1-1-5.4079.rtsw.eqch.net.internet2.edu (162.252.70.106) 229.391 ms 188.866 ms 202.591 ms

14 162.252.70.163 (162.252.70.163) 192.517 ms 188.783 ms 188.774 ms

15 ae-1.4079.rtsw.clev.net.internet2.edu (162.252.70.130) 197.227 ms 197.198 ms 197.159 ms

16 buf-9208-I2-CLEV.nysernet.net (199.109.11.33) 201.526 ms 201.539 ms 201.530 ms

17 syr-9208-buf-9208.nysernet.net (199.109.7.193) 204.785 ms 204.861 ms 204.755 ms

18 nyc-9208-syr-9208.nysernet.net (199.109.7.162) 210.386 ms 210.447 ms 210.432 ms

19 columbia.nyc-9208.nysernet.net (199.109.4.14) 210.521 ms 210.428 ms 210.411 ms

20 cc-core-1-x-nyser32-gw-1.net.columbia.edu (128.59.255.5) 210.590 ms 210.710 ms 210.855 ms

21 cc-conc-1-x-cc-core-1.net.columbia.edu (128.59.255.210) 211.640 ms 211.276 ms 211.191 ms

22 www.neurotheory.columbia.edu (128.59.105.24) 211.014 ms 210.986 ms 211.015 ms

Ping result:

wagner % ping 113.197.15.99

PING 113.197.15.99 (113.197.15.99) 56(84) bytes of data.

64 bytes from 113.197.15.99: icmp\_req=1 ttl=57 time=94.8 ms

64 bytes from 113.197.15.99: icmp\_req=2 ttl=57 time=94.9 ms

64 bytes from 113.197.15.99: icmp\_req=3 ttl=57 time=94.9 ms

64 bytes from 113.197.15.99: icmp\_req=4 ttl=57 time=95.0 ms

64 bytes from 113.197.15.99: icmp\_req=5 ttl=57 time=94.9 ms

64 bytes from 113.197.15.99: icmp\_req=6 ttl=57 time=95.0 ms

64 bytes from 113.197.15.99: icmp\_req=7 ttl=57 time=95.0 ms

64 bytes from 113.197.15.99: icmp\_req=8 ttl=57 time=95.1 ms

64 bytes from 113.197.15.99: icmp\_req=9 ttl=57 time=94.9 ms

64 bytes from 113.197.15.99: icmp\_req=10 ttl=57 time=94.9 ms

^C

--- 113.197.15.99 ping statistics ---

10 packets transmitted, 10 received, 0% packet loss, time 9012ms

rtt min/avg/max/mdev = 94.889/94.976/95.136/0.419 ms

wagner % ping 113.197.15.149

PING 113.197.15.149 (113.197.15.149) 56(84) bytes of data.

64 bytes from 113.197.15.149: icmp\_req=1 ttl=58 time=2.03 ms

64 bytes from 113.197.15.149: icmp\_req=2 ttl=58 time=1.93 ms

64 bytes from 113.197.15.149: icmp\_req=3 ttl=58 time=1.89 ms

64 bytes from 113.197.15.149: icmp\_req=4 ttl=58 time=1.93 ms

64 bytes from 113.197.15.149: icmp\_req=5 ttl=58 time=1.84 ms

64 bytes from 113.197.15.149: icmp\_req=6 ttl=58 time=1.80 ms

64 bytes from 113.197.15.149: icmp\_req=7 ttl=58 time=2.17 ms

64 bytes from 113.197.15.149: icmp\_req=8 ttl=58 time=1.82 ms

64 bytes from 113.197.15.149: icmp\_req=9 ttl=58 time=2.04 ms

64 bytes from 113.197.15.149: icmp\_req=10 ttl=58 time=2.18 ms

^C

--- 113.197.15.149 ping statistics ---

10 packets transmitted, 10 received, 0% packet loss, time 9014ms

rtt min/avg/max/mdev = 1.809/1.967/2.182/0.139 ms

**2.**

These three paths diverge at 138.44.5.0. The organizaion of this router is Asia Pacific Network Information Centre (APNIC), and the router locates in Qeensland, which makes sense that those three paths diverge here. No, the number of hops on each path is not neccessary to be propotional to the physical distance since the number of routers on land is much more than the routers across oceans.

wagner % 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 1997-2019, 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

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

#

# 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 1997-2019, American Registry for Internet Numbers, Ltd.

#

Found a referral to whois.apnic.net.

% [whois.apnic.net]

% Whois data copyright terms http://www.apnic.net/db/dbcopyright.html

% Information related to '138.44.0.0 - 138.44.255.255'

% Abuse contact for '138.44.0.0 - 138.44.255.255' is 'abuse@aarnet.edu.au'

inetnum: 138.44.0.0 - 138.44.255.255

netname: AARNET

descr: Australian Academic and Research Network

descr: Building 9

descr: Banks Street

country: AU

org: ORG-AAAR1-AP

admin-c: SM6-AP

tech-c: ANOC-AP

notify: irrcontact@aarnet.edu.au

mnt-by: APNIC-HM

mnt-lower: MAINT-AARNET-AP

mnt-routes: MAINT-AARNET-AP

mnt-irt: IRT-AARNET-AU

status: ALLOCATED PORTABLE

remarks: -+-+-+-+-+-+-+-+-+-+-+-++-+-+-+-+-+-+-+-+-+-+-+-+-+-+

remarks: This object can only be updated by APNIC hostmasters.

remarks: To update this object, please contact APNIC

remarks: hostmasters and include your organisation's account

remarks: name in the subject line.

remarks: -+-+-+-+-+-+-+-+-+-+-+-++-+-+-+-+-+-+-+-+-+-+-+-+-+-+

last-modified: 2017-10-09T13:02:43Z

source: APNIC

irt: IRT-AARNET-AU

address: AARNet Pty Ltd

address: 26 Dick Perry Avenue

address: Kensington, Western Australia

address: Australia

e-mail: abuse@aarnet.edu.au

abuse-mailbox: abuse@aarnet.edu.au

admin-c: SM6-AP

tech-c: ANOC-AP

auth: # Filtered

mnt-by: MAINT-AARNET-AP

last-modified: 2010-11-08T08:02:43Z

source: APNIC

organisation: ORG-AAAR1-AP

org-name: Australian Academic and Research Network

country: AU

address: Building 9

address: Banks Street

phone: +61-2-6222-3530

fax-no: +61-2-6222-3535

e-mail: irrcontact@aarnet.edu.au

mnt-ref: APNIC-HM

mnt-by: APNIC-HM

last-modified: 2017-10-09T12:56:36Z

source: APNIC

role: AARNet Network Operations Centre

remarks:

address: AARNet Pty Ltd

address: GPO Box 1559

address: Canberra

address: ACT 2601

country: AU

phone: +61 1300 275 662

phone: +61 2 6222 3555

remarks:

e-mail: noc@aarnet.edu.au

remarks:

remarks: Send abuse reports to abuse@aarnet.edu.au

remarks: Please include timestamps and offset to UTC in logs

remarks: Peering requests to peering@aarnet.edu.au

remarks:

admin-c: SM6-AP

tech-c: BM-AP

nic-hdl: ANOC-AP

mnt-by: MAINT-AARNET-AP

last-modified: 2010-06-30T13:16:48Z

source: APNIC

person: Steve Maddocks

remarks: Director Operations

address: AARNet Pty Ltd

address: 26 Dick Perry Avenue

address: Kensington

address: Perth

address: WA 6151

country: AU

phone: +61-8-9289-2210

fax-no: +61-2-6222-7509

e-mail: steve.maddocks@aarnet.edu.au

nic-hdl: SM6-AP

mnt-by: MAINT-AARNET-AP

last-modified: 2011-02-01T08:37:06Z

source: APNIC

% This query was served by the APNIC Whois Service version 1.88.15-46 (WHOIS-NODE1)

Running traceroute to www.ucla.edu, www.u-tokyo.ac.jp, www.lancaster.ac.uk.

z5211336@drum00:~$ 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) 0.141 ms 0.105 ms 0.114 ms

2 129.94.39.17 (129.94.39.17) 1.092 ms 1.086 ms 1.053 ms

3 libudnex1-vl-3154.gw.unsw.edu.au (149.171.253.34) 1.578 ms ombudnex1-vl-3154.gw.unsw.edu.au (149.171.253.35) 1.681 ms 1.493 ms

4 ombcr1-po-6.gw.unsw.edu.au (149.171.255.169) 1.347 ms libcr1-po-6.gw.unsw.edu.au (149.171.255.201) 1.418 ms 1.409 ms

5 unswbr1-te-1-9.gw.unsw.edu.au (149.171.255.101) 1.412 ms unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105) 1.515 ms 1.469 ms

6 138.44.5.0 (138.44.5.0) 1.594 ms 1.452 ms 1.536 ms

7 et-1-3-0.pe1.sxt.bkvl.nsw.aarnet.net.au (113.197.15.149) 2.381 ms 2.360 ms 2.371 ms

8 et-0-0-0.pe1.a.hnl.aarnet.net.au (113.197.15.99) 95.444 ms 95.289 ms 95.286 ms

9 et-2-1-0.bdr1.a.sea.aarnet.net.au (113.197.15.201) 146.681 ms 146.753 ms 146.715 ms

10 cenichpr-1-is-jmb-778.snvaca.pacificwave.net (207.231.245.129) 163.484 ms 163.421 ms 163.433 ms

11 hpr-lax-hpr3--svl-hpr3-100ge.cenic.net (137.164.25.73) 171.203 ms 171.205 ms 170.956 ms

12 \* \* \*

13 bd11f1.anderson--cr00f2.csb1.ucla.net (169.232.4.4) 173.630 ms 171.594 ms bd11f1.anderson--cr001.anderson.ucla.net (169.232.4.6) 171.579 ms

14 cr00f2.csb1--dr00f2.csb1.ucla.net (169.232.4.53) 171.622 ms cr00f1.anderson--dr00f2.csb1.ucla.net (169.232.4.55) 171.657 ms 171.561 ms

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z5211336@drum00:~$ 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-trusted.cse.unsw.EDU.AU (129.94.208.251) 0.139 ms 0.137 ms 0.112 ms

2 129.94.39.17 (129.94.39.17) 1.070 ms 1.053 ms 1.032 ms

3 libudnex1-vl-3154.gw.unsw.edu.au (149.171.253.34) 1.609 ms ombudnex1-vl-3154.gw.unsw.edu.au (149.171.253.35) 1.526 ms 1.678 ms

4 libcr1-po-5.gw.unsw.edu.au (149.171.255.165) 1.159 ms ombcr1-po-5.gw.unsw.edu.au (149.171.255.197) 1.318 ms 1.228 ms

5 unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105) 1.381 ms 1.369 ms 1.335 ms

6 138.44.5.0 (138.44.5.0) 1.432 ms 1.453 ms 1.465 ms

7 et-0-3-0.pe1.bkvl.nsw.aarnet.net.au (113.197.15.147) 1.947 ms 1.980 ms 1.997 ms

8 ge-4\_0\_0.bb1.a.pao.aarnet.net.au (202.158.194.177) 156.231 ms 156.382 ms 156.331 ms

9 paloalto0.iij.net (198.32.176.24) 158.168 ms 158.184 ms 158.270 ms

10 osk004bb00.IIJ.Net (58.138.88.185) 289.198 ms 289.223 ms 289.222 ms

11 osk004ix51.IIJ.Net (58.138.106.126) 279.974 ms 279.918 ms 279.789 ms

12 210.130.135.130 (210.130.135.130) 280.030 ms 280.046 ms 280.045 ms

13 124.83.228.58 (124.83.228.58) 288.997 ms 289.022 ms 280.143 ms

14 124.83.252.178 (124.83.252.178) 285.947 ms 277.103 ms 285.917 ms

15 158.205.134.26 (158.205.134.26) 285.619 ms 285.827 ms 285.746 ms

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z5211336@drum00:~$ traceroute www.lancaster.ac.uk

traceroute to www.lancaster.ac.uk (148.88.65.80), 30 hops max, 60 byte packets

1 cserouter1-trusted.cse.unsw.EDU.AU (129.94.208.251) 0.217 ms 0.178 ms 0.150 ms

2 129.94.39.17 (129.94.39.17) 1.106 ms 1.055 ms 1.090 ms

3 ombudnex1-vl-3154.gw.unsw.edu.au (149.171.253.35) 1.742 ms 1.710 ms libudnex1-vl-3154.gw.unsw.edu.au (149.171.253.34) 1.403 ms

4 ombcr1-po-6.gw.unsw.edu.au (149.171.255.169) 1.259 ms libcr1-po-5.gw.unsw.edu.au (149.171.255.165) 1.296 ms 1.217 ms

5 unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105) 1.303 ms unswbr1-te-1-9.gw.unsw.edu.au (149.171.255.101) 1.328 ms 1.357 ms

6 138.44.5.0 (138.44.5.0) 1.442 ms 1.467 ms 1.414 ms

7 et-1-3-0.pe1.sxt.bkvl.nsw.aarnet.net.au (113.197.15.149) 2.424 ms 2.235 ms 2.252 ms

8 et-0-0-0.pe1.a.hnl.aarnet.net.au (113.197.15.99) 102.347 ms 102.260 ms 102.224 ms

9 et-2-1-0.bdr1.a.sea.aarnet.net.au (113.197.15.201) 146.741 ms 147.279 ms 146.651 ms

10 abilene-1-lo-jmb-706.sttlwa.pacificwave.net (207.231.240.8) 147.195 ms 147.167 ms 146.768 ms

11 et-4-0-0.4079.rtsw.miss2.net.internet2.edu (162.252.70.0) 157.767 ms 157.784 ms 157.541 ms

12 et-4-0-0.4079.rtsw.minn.net.internet2.edu (162.252.70.58) 180.850 ms 180.845 ms 180.771 ms

13 et-1-1-5.4079.rtsw.eqch.net.internet2.edu (162.252.70.106) 188.502 ms 188.784 ms 188.770 ms

14 162.252.70.163 (162.252.70.163) 213.152 ms 188.920 ms 188.893 ms

15 ae-1.4079.rtsw.clev.net.internet2.edu (162.252.70.130) 198.006 ms 197.980 ms 197.515 ms

16 et-2-0-0.4079.rtsw.ashb.net.internet2.edu (162.252.70.54) 204.977 ms 205.403 ms 205.310 ms

17 ae-2.4079.rtsw.wash.net.internet2.edu (162.252.70.136) 205.461 ms 205.557 ms 205.680 ms

18 internet2-gw.mx1.lon.uk.geant.net (62.40.124.44) 280.438 ms 280.425 ms 280.670 ms

19 janet-gw.mx1.lon.uk.geant.net (62.40.124.198) 280.919 ms 280.795 ms 280.698 ms

20 ae29.londpg-sbr2.ja.net (146.97.33.2) 281.449 ms 281.037 ms 281.068 ms

21 ae31.erdiss-sbr2.ja.net (146.97.33.22) 284.913 ms 285.137 ms 284.906 ms

22 ae29.manckh-sbr2.ja.net (146.97.33.42) 286.665 ms 286.715 ms 286.641 ms

23 ae24.lanclu-rbr1.ja.net (146.97.38.58) 289.066 ms 289.204 ms 289.061 ms

24 lancaster-university.ja.net (194.81.46.2) 307.719 ms 307.120 ms 300.330 ms

25 isbfw01-isborder01.rtr.lancs.ac.uk (148.88.253.198) 289.303 ms 289.469 ms \*

26 ismx-issrx.rtr.lancs.ac.uk (148.88.255.17) 293.785 ms 290.758 ms 291.006 ms

27 dc.iss.srv.rtrcloud.lancs.ac.uk (148.88.253.3) 312.759 ms 310.652 ms 310.524 ms

28 www.lancs.ac.uk (148.88.65.80) 290.909 ms !X 290.703 ms !X 290.946 ms !X

**3.**

www.speeedtest.com.sg has IP address 202.150.221.170, www.telstra.net has IP address 203.50.5.178.

No, the reverse path doesn't go through the same route. It might because the routes go through the same ISP, but it's not neccessary to go through the same router. Hence, the IP addresses for forward and reverse routes are similar but not the same.

traceroute to speedtest:

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) 0.233 ms 0.193 ms 0.169 ms

2 129.94.39.17 (129.94.39.17) 1.218 ms 1.127 ms 1.173 ms

3 ombudnex1-vl-3154.gw.unsw.edu.au (149.171.253.35) 1.798 ms libudnex1-vl-3154.gw.unsw.edu.au (149.171.253.34) 1.570 ms ombudnex1-vl-3154.gw.unsw.edu.au (149.171.253.35) 1.752 ms

4 libcr1-po-5.gw.unsw.edu.au (149.171.255.165) 1.337 ms libcr1-po-6.gw.unsw.edu.au (149.171.255.201) 1.237 ms 1.340 ms

5 unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105) 1.417 ms unswbr1-te-1-9.gw.unsw.edu.au (149.171.255.101) 1.401 ms 1.474 ms

6 138.44.5.0 (138.44.5.0) 1.641 ms 1.581 ms 1.530 ms

7 et-0-3-0.pe1.alxd.nsw.aarnet.net.au (113.197.15.153) 1.829 ms 1.928 ms 1.905 ms

8 xe-0-0-3.pe1.wnpa.akl.aarnet.net.au (113.197.15.67) 24.588 ms 24.634 ms xe-0-2-1-204.pe1.wnpa.alxd.aarnet.net.au (113.197.15.183) 24.617 ms

9 et-0-1-0.200.pe1.tkpa.akl.aarnet.net.au (113.197.15.69) 24.761 ms 24.805 ms 24.772 ms

10 xe-0-2-6.bdr1.a.lax.aarnet.net.au (202.158.194.173) 148.387 ms 148.386 ms 148.360 ms

11 singtel.as7473.any2ix.coresite.com (206.72.210.63) 170.484 ms 170.499 ms 170.466 ms

12 203.208.178.185 (203.208.178.185) 332.284 ms 203.208.172.173 (203.208.172.173) 148.423 ms 148.369 ms

13 203.208.153.121 (203.208.153.121) 310.093 ms 203.208.173.73 (203.208.173.73) 337.156 ms 203.208.177.110 (203.208.177.110) 237.028 ms

14 203.208.182.45 (203.208.182.45) 308.363 ms 308.109 ms 310.329 ms

15 203.208.177.110 (203.208.177.110) 224.735 ms 202-150-221-170.rev.ne.com.sg (202.150.221.170) 224.978 ms 203.208.177.110 (203.208.177.110) 240.213 ms

traceroute from speedtest:

traceroute to 129.94.209.30 (129.94.209.30), 30 hops max, 60 byte packets

1 ge2-8.r01.sin01.ne.com.sg (202.150.221.169) 0.195 ms 0.212 ms 0.222 ms

2 10.11.33.30 (10.11.33.30) 0.264 ms 0.274 ms 0.282 ms

3 10.11.33.74 (10.11.33.74) 0.745 ms 0.757 ms 0.762 ms

4 aarnet.sgix.sg (103.16.102.67) 225.569 ms 225.639 ms 225.653 ms

5 xe-3-0-3.pe1.brwy.nsw.aarnet.net.au (113.197.15.206) 232.832 ms 232.847 ms 232.912 ms

6 138.44.5.1 (138.44.5.1) 225.837 ms 225.935 ms 226.023 ms

7 libcr1-te-1-5.gw.unsw.edu.au (149.171.255.102) 225.983 ms 226.061 ms 226.082 ms

8 ombudnex1-po-1.gw.unsw.edu.au (149.171.255.202) 236.181 ms libudnex1-po-1.gw.unsw.edu.au (149.171.255.166) 224.035 ms ombudnex1-po-1.gw.unsw.edu.au (149.171.255.202) 236.084 ms

9 ufw1-ae-1-3154.gw.unsw.edu.au (149.171.253.36) 236.452 ms 236.447 ms 236.421 ms

10 129.94.39.23 (129.94.39.23) 224.832 ms 224.691 ms 224.786 ms

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traceroute to telstra:

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) 0.119 ms 0.101 ms 0.161 ms

2 129.94.39.17 (129.94.39.17) 1.003 ms 1.110 ms 0.969 ms

3 ombudnex1-vl-3154.gw.unsw.edu.au (149.171.253.35) 1.775 ms libudnex1-vl-3154.gw.unsw.edu.au (149.171.253.34) 1.973 ms 2.022 ms

4 ombcr1-po-6.gw.unsw.edu.au (149.171.255.169) 1.364 ms 1.342 ms 1.355 ms

5 unswbr1-te-1-9.gw.unsw.edu.au (149.171.255.101) 1.303 ms unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105) 1.301 ms unswbr1-te-1-9.gw.unsw.edu.au (149.171.255.101) 1.281 ms

6 138.44.5.0 (138.44.5.0) 1.457 ms 1.421 ms 1.402 ms

7 et-0-3-0.pe1.alxd.nsw.aarnet.net.au (113.197.15.153) 4.912 ms 3.634 ms 3.612 ms

8 ae9.bb1.b.syd.aarnet.net.au (113.197.15.65) 2.028 ms 1.984 ms 1.988 ms

9 gigabitethernet1-1.pe1.b.syd.aarnet.net.au (202.158.202.18) 1.973 ms 2.035 ms 1.954 ms

10 gigabitethernet3-11.ken37.sydney.telstra.net (139.130.0.77) 2.594 ms 2.696 ms 2.782 ms

11 bundle-ether2.chw-edge901.sydney.telstra.net (203.50.11.103) 2.898 ms bundle-ether13.ken-core10.sydney.telstra.net (203.50.11.94) 3.506 ms 3.977 ms

12 bundle-ether13.chw-core10.sydney.telstra.net (203.50.11.98) 3.446 ms bundle-ether10.win-core10.melbourne.telstra.net (203.50.11.123) 15.277 ms bundle-ether13.chw-core10.sydney.telstra.net (203.50.11.98) 2.812 ms

13 bundle-ether8.exi-core10.melbourne.telstra.net (203.50.11.125) 17.291 ms 17.245 ms 203.50.6.40 (203.50.6.40) 16.293 ms

14 bundle-ether2.exi-ncprouter101.melbourne.telstra.net (203.50.11.209) 14.485 ms 14.578 ms 13.830 ms

15 www.telstra.net (203.50.5.178) 14.239 ms 15.108 ms 15.101 ms

traceroute from telstra:

1 gigabitethernet3-3.exi2.melbourne.telstra.net (203.50.77.53) 0.271 ms 0.216 ms 0.243 ms

2 bundle-ether3-100.win-core10.melbourne.telstra.net (203.50.80.129) 2.866 ms 1.486 ms 2.118 ms

3 bundle-ether12.ken-core10.sydney.telstra.net (203.50.11.122) 13.112 ms 11.980 ms 12.861 ms

4 bundle-ether1.ken-edge901.sydney.telstra.net (203.50.11.95) 11.862 ms 11.856 ms 11.986 ms

5 aarnet6.lnk.telstra.net (139.130.0.78) 11.612 ms 11.606 ms 11.612 ms

6 ge-6-0-0.bb1.a.syd.aarnet.net.au (202.158.202.17) 11.863 ms 12.105 ms 11.736 ms

7 ae9.pe2.brwy.nsw.aarnet.net.au (113.197.15.56) 12.861 ms 12.107 ms 11.986 ms

8 et-3-1-0.pe1.brwy.nsw.aarnet.net.au (113.197.15.146) 12.113 ms 12.106 ms 12.111 ms

9 138.44.5.1 (138.44.5.1) 12.362 ms 12.356 ms 12.237 ms

10 libcr1-te-1-5.gw.unsw.edu.au (149.171.255.102) 12.362 ms 12.356 ms 12.362 ms

11 libudnex1-po-1.gw.unsw.edu.au (149.171.255.166) 12.612 ms

12 ufw1-ae-1-3154.gw.unsw.edu.au (149.171.253.36) 13.106 ms 13.105 ms 13.005 ms

13 129.94.39.23 (129.94.39.23) 13.208 ms 13.226 ms 13.236 ms

**Exercise 4:**

\*Note: all ping result and graphs are in result folder.

**1.**

Physical distance from UNSW:

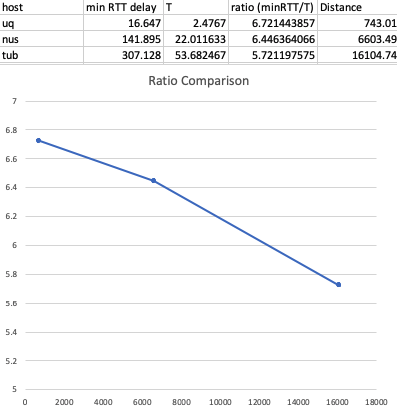
* to UQ: 743.01 km (456.09 mi)
* to NUS: 6603.49 km (4103.22 mi)
* to TUB: 16104.74 km (1007.02 mi)

Shortest possible time T from UNSW:

* to UQ: 2.4767 ms
* to NUS: 22.011633 ms
* to TUB: 53.682467 ms

Possible reasons for greater than 2:

1. We assume that the packet moves at the speed of light, but in reality, the propagation speed is impossible to reach the speed of light. Hence, the delay will be greater.
2. Only propagation delay is counting for T, but actually there are also processing delay, queueing delay and transmission delay, so the mininum delay is greater than assumption.
3. The shortest distance measured using google map is straight-line distance, but in reality, the path that packets go through is not straight line, which means it takes longer for propagation, hence the delay is greater.



TUB

NUS

UQ

**2.**

The delay varies over time, because except for propagation delay, there are also: processing delay and transmission delay, which depends on the specific router; and queueing delay, which depends on the load of the router. Hence, the total delay varies over time.

**3.**

The one mainly depends on packet size is transmission delay as it is calculated from packet size / bandwidth. Queueing delay mainly depends on the load but it is revalent to packet size because is is calculated from packets size \* packets arrival rate / bandwidth.

Processing delay and propagation delay don't depend on packet size since processing delay depends on content complexity (as it has to scan and check error) and propagation delay depends on physical distance.