COMP3331 lab01
Haibo Wang(z5135009)

EX1:

1. The IP address of google is: 216.58.203.110.
   Reason for having several IP address: It can be for load balancing or redundancy.Or to serve web pages based on the user location.
2. Name of 127.0.0.1 is localhost. It can be dedicated to local network devices and use for inter-device communication.

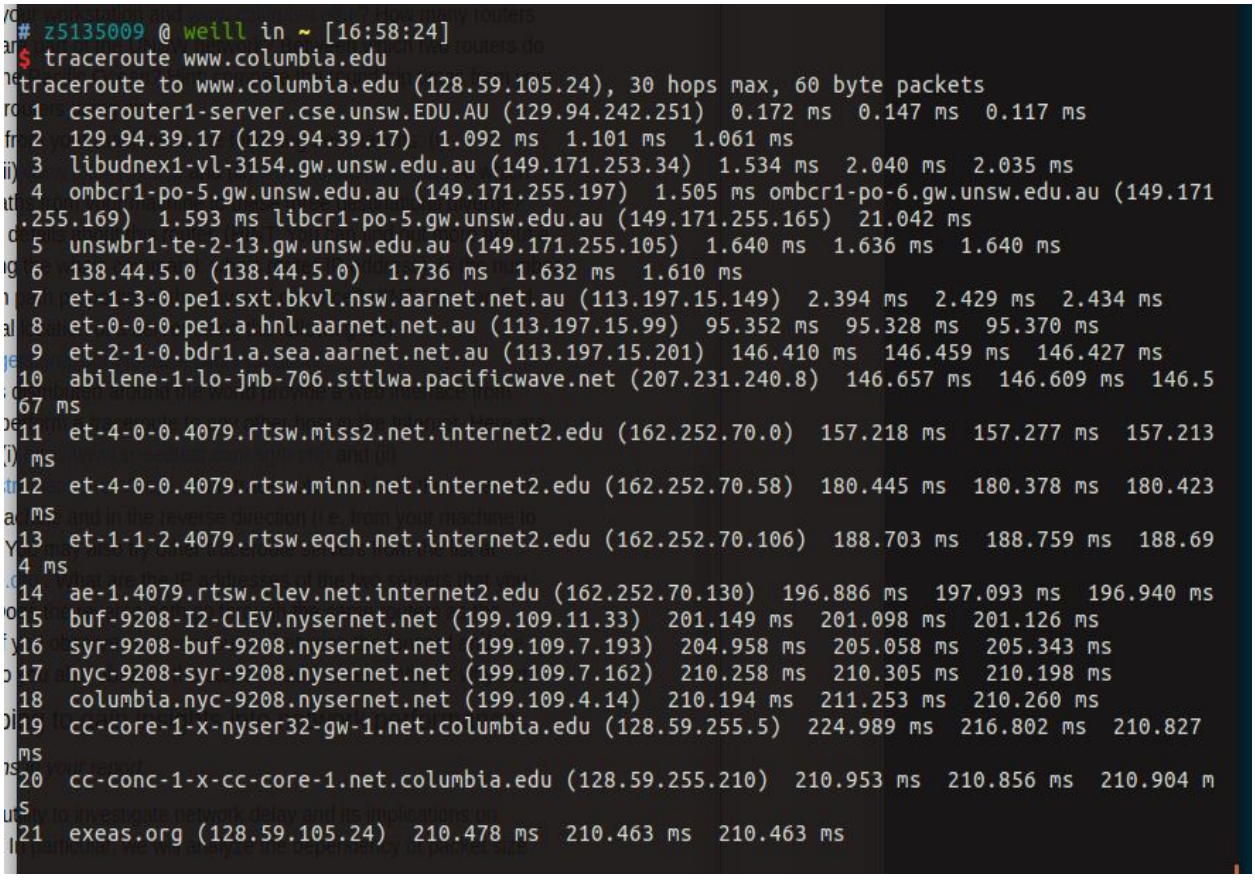
EX2:

- Probably some websites disable ping response for security reasons(ie.www.kremlin.ru).
- Destination host not reachable: either the local system has no route to the desired destination, or a remote router reports that it has no route to the destination.

EX3:

1. **22** routers between workstation and www.columbia.edu. **First 5** routers along the path are part of the UNSW network. **7th**(located in AU), **8th**(located in Honolulu) and **9th**(located in Seattle) routers do packets cross the Pacific Ocean

Traceroute www.columbia.edu



2. At the **6th**(138.44.5.0) router, the paths to these three destinations diverge. This router located in South Brisbane, belongs to a organization named Asia Pacific Network Information Centre (APNIC), net range between 138.44.0.0 to 138.44.255.255, ISP is Australian Academic and Research Network. YES, it's proportional the physical distance.

Traceroute www.ucla.edu

```
# z5135009 @ weill in ~ [16:32:56]
$ 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)  0.181 ms  0.160 ms  0.140 ms
 2  129.94.39.17 (129.94.39.17)  1.011 ms  1.026 ms  1.151 ms
 3  libudnex1-vl-3154.gw.unsw.edu.au (149.171.253.34)  2.000 ms ombudnex1-vl-3154.gw.unsw.edu.
au (149.171.253.35)  1.730 ms libudnex1-vl-3154.gw.unsw.edu.au (149.171.253.34)  1.961 ms
 4  ombcr1-po-5.gw.unsw.edu.au (149.171.255.197)  1.280 ms  1.266 ms ombcr1-po-6.gw.unsw.edu.a
u (149.171.255.169)  1.318 ms
 5  unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105)  1.304 ms unswbr1-te-1-9.gw.unsw.edu.au (
149.171.255.101)  1.353 ms unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105)  1.340 ms
 6  138.44.5.0 (138.44.5.0)  1.490 ms  1.416 ms  1.412 ms
 7  et-1-3-0.pe1.sxt.bkvl.nsw.aarnet.net.au (113.197.15.149)  2.272 ms  2.385 ms  2.288 ms
 8  et-0-0-0.pe1.a.hnl.aarnet.net.au (113.197.15.99)  95.356 ms  95.432 ms  95.317 ms
 9  et-2-1-0.bdr1.a.sea.aarnet.net.au (113.197.15.201)  146.481 ms  146.449 ms  146.444 ms
10  cenichpr-1-is-jmb-778.snvaca.pacificwave.net (207.231.245.129)  163.418 ms  162.918 ms  16
2.935 ms
11  hpr-lax-hpr3--svl-hpr3-100ge.cenic.net (137.164.25.73)  170.792 ms  170.854 ms  170.732 ms
12  * * *
13  bd11f1.anderson--cr00f2.csb1.ucla.net (169.232.4.4)  171.239 ms  171.340 ms bd11f1.anderso
n--cr001.anderson.ucla.net (169.232.4.6)  171.304 ms
14  cr00f2.csb1--dr00f2.csb1.ucla.net (169.232.4.53)  171.195 ms  171.289 ms  171.275 ms
15  * * *
16  * * *
17  * * *
```

Traceroute www.u-tokyo.ac.jp

```
# z5135009 @ weill in ~ [16:56:53] C:130
$ 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)  0.151 ms  0.138 ms  0.112 ms
 2  129.94.39.17 (129.94.39.17)  1.004 ms  1.059 ms  1.024 ms
 3  libudnex1-vl-3154.gw.unsw.edu.au (149.171.253.34)  1.974 ms  1.897 ms  1.867 ms
 4  libcr1-po-6.gw.unsw.edu.au (149.171.255.201)  1.205 ms  1.240 ms ombcr1-po-6.gw.unsw.edu.a
u (149.171.255.169)  1.181 ms
 5  unswbr1-te-1-9.gw.unsw.edu.au (149.171.255.101)  1.280 ms  1.275 ms unswbr1-te-2-13.gw.uns
w.edu.au (149.171.255.105)  1.384 ms
 6  138.44.5.0 (138.44.5.0)  1.459 ms  1.417 ms  1.409 ms
 7  et-0-3-0.pe1.bkvl.nsw.aarnet.net.au (113.197.15.147)  3.573 ms  2.977 ms  2.973 ms
 8  ge-4_0_0.bb1.a.pao.aarnet.net.au (202.158.194.177)  156.194 ms  156.148 ms  156.246 ms
 9  paloalto0.iij.net (198.32.176.24)  158.074 ms  158.073 ms  158.150 ms
10  osk004bb00.IIJ.Net (58.138.88.185)  288.790 ms osk004bb01.IIJ.Net (58.138.88.189)  271.305
 ms  271.293 ms
11  osk004ix51.IIJ.Net (58.138.106.130)  279.640 ms  279.632 ms  279.632 ms
12  210.130.135.130 (210.130.135.130)  279.930 ms  279.853 ms  288.558 ms
13  124.83.228.78 (124.83.228.78)  279.731 ms  279.875 ms  271.059 ms
14  124.83.252.250 (124.83.252.250)  286.320 ms  295.122 ms  295.076 ms
15  158.205.134.26 (158.205.134.26)  295.021 ms  295.120 ms  286.255 ms
16  * * *
17  * * *
```

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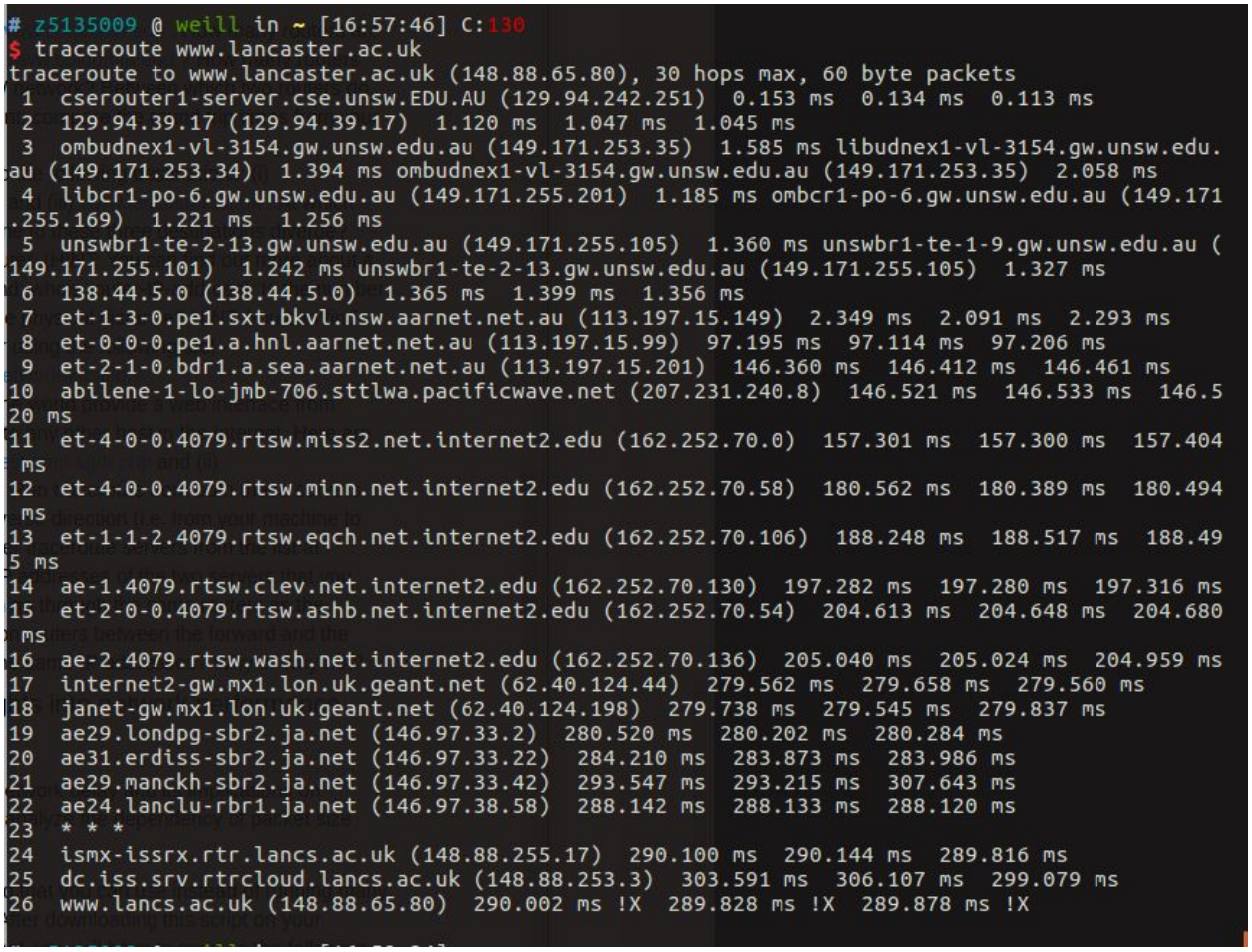
Traceroute www.lancaster.ac.uk



```
# z5135009 @ weill in ~ [16:57:46] C:130
$ 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)  0.153 ms  0.134 ms  0.113 ms
 2  129.94.39.17 (129.94.39.17)  1.120 ms  1.047 ms  1.045 ms
 3  ombudnex1-vl-3154.gw.unsw.edu.au (149.171.253.35)  1.585 ms libudnex1-vl-3154.gw.unsw.edu.
au (149.171.253.34)  1.394 ms ombudnex1-vl-3154.gw.unsw.edu.au (149.171.253.35)  2.058 ms
 4  libcr1-po-6.gw.unsw.edu.au (149.171.255.201)  1.185 ms ombcr1-po-6.gw.unsw.edu.au (149.171
.255.169)  1.221 ms  1.256 ms
 5  unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105)  1.360 ms unswbr1-te-1-9.gw.unsw.edu.au (
149.171.255.101)  1.242 ms unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105)  1.327 ms
 6  138.44.5.0 (138.44.5.0)  1.365 ms  1.399 ms  1.356 ms
 7  et-1-3-0.pe1.sxt.bkvl.nsw.aarnet.net.au (113.197.15.149)  2.349 ms  2.091 ms  2.293 ms
 8  et-0-0-0.pe1.a.hnl.aarnet.net.au (113.197.15.99)  97.195 ms  97.114 ms  97.206 ms
 9  et-2-1-0.bdr1.a.sea.aarnet.net.au (113.197.15.201)  146.360 ms  146.412 ms  146.461 ms
10  abilene-1-lo-jmb-706.sttlwa.pacificwave.net (207.231.240.8)  146.521 ms  146.533 ms  146.5
20 ms
11  et-4-0-0.4079.rtsw.miss2.net.internet2.edu (162.252.70.0)  157.301 ms  157.300 ms  157.404
 ms
12  et-4-0-0.4079.rtsw.minn.net.internet2.edu (162.252.70.58)  180.562 ms  180.389 ms  180.494
 ms
13  et-1-1-2.4079.rtsw.eqch.net.internet2.edu (162.252.70.106)  188.248 ms  188.517 ms  188.49
5 ms
14  ae-1.4079.rtsw.clev.net.internet2.edu (162.252.70.130)  197.282 ms  197.280 ms  197.316 ms
15  et-2-0-0.4079.rtsw.ashb.net.internet2.edu (162.252.70.54)  204.613 ms  204.648 ms  204.680
 ms
16  ae-2.4079.rtsw.wash.net.internet2.edu (162.252.70.136)  205.040 ms  205.024 ms  204.959 ms
17  internet2-gw.mx1.lon.uk.geant.net (62.40.124.44)  279.562 ms  279.658 ms  279.560 ms
18  janet-gw.mx1.lon.uk.geant.net (62.40.124.198)  279.738 ms  279.545 ms  279.837 ms
19  ae29.londpg-sbr2.ja.net (146.97.33.2)  280.520 ms  280.202 ms  280.284 ms
20  ae31.erdiss-sbr2.ja.net (146.97.33.22)  284.210 ms  283.873 ms  283.986 ms
21  ae29.manckh-sbr2.ja.net (146.97.33.42)  293.547 ms  293.215 ms  307.643 ms
22  ae24.lanclu-rbr1.ja.net (146.97.38.58)  288.142 ms  288.133 ms  288.120 ms
23  * * *
24  ismx-issrx.rtr.lancs.ac.uk (148.88.255.17)  290.100 ms  290.144 ms  289.816 ms
25  dc.iss.srv.rtrcloud.lancs.ac.uk (148.88.253.3)  303.591 ms  306.107 ms  299.079 ms
26  www.lancs.ac.uk (148.88.65.80)  290.002 ms !X  289.828 ms !X  289.878 ms !X
```

Whois 138.44.5.0

```
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
```

```
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
```

3. IP1: 202.150.221.170
   IP2: 203.50.5.178
   No, the reverse path go through different routers from the forward path, however we can observe some common routers,they have different IP address. In my opinion, the common routers belong to the same net range, for a high speed during transmission or avoid overloading, ISP could choose different router(in their net range) to forward packet.

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Telstra to weill@cse.unsw.edu.au

```
 1  gigabitethernet3-3.exi2.melbourne.telstra.net (203.50.77.53)  0.245 ms  0.222 ms  0.245 ms
 2  bundle-ether3-100.win-core10.melbourne.telstra.net (203.50.80.129)  2.867 ms  1.612 ms  2.119 ms
 3  bundle-ether12.ken-core10.sydney.telstra.net (203.50.11.122)  13.738 ms  12.482 ms  12.739 ms
 4  bundle-ether1.ken-edge901.sydney.telstra.net (203.50.11.95)  11.864 ms  11.858 ms  11.863 ms
 5  aarnet6.lnk.telstra.net (139.130.0.78)  11.614 ms  11.607 ms  11.614 ms
 6  ge-6-0-0.bb1.a.syd.aarnet.net.au (202.158.202.17)  11.738 ms  11.733 ms  11.736 ms
 7  ae9.pe2.brwy.nsw.aarnet.net.au (113.197.15.56)  11.989 ms  11.982 ms  11.987 ms
 8  et-3-1-0.pe1.brwy.nsw.aarnet.net.au (113.197.15.146)  12.362 ms  12.356 ms  12.364 ms
 9  138.44.5.1 (138.44.5.1)  12.614 ms  12.607 ms  12.488 ms
10  libcr1-te-1-5.gw.unsw.edu.au (149.171.255.102)  259.345 ms  12.605 ms  12.613 ms
11  ombudnex1-po-1.gw.unsw.edu.au (149.171.255.202)  13.239 ms  13.231 ms  13.488 ms
12  ufw1-ae-1-3154.gw.unsw.edu.au (149.171.253.36)  13.238 ms  13.230 ms  13.113 ms
13  129.94.39.23 (129.94.39.23)  13.363 ms  13.358 ms  13.363 ms
```

There are other traceroute sites listed here.

Cse to telstra

```
$ traceroute -m  100 www.telstra.net
traceroute to www.telstra.net (203.50.5.178), 100 hops max, 60 byte packets
 1  cserouter1-server.cse.unsw.EDU.AU (129.94.242.251)  0.173 ms  0.157 ms  0.13
2 ms
 2  129.94.39.17 (129.94.39.17)  1.096 ms  1.008 ms  1.057 ms
 3  ombudnex1-vl-3154.gw.unsw.edu.au (149.171.253.35)  2.041 ms libudnex1-vl-315
4.gw.unsw.edu.au (149.171.253.34)  1.453 ms ombudnex1-vl-3154.gw.unsw.edu.au (14
9.171.253.35)  1.995 ms
 4  ombcr1-po-6.gw.unsw.edu.au (149.171.255.169)  1.193 ms libcr1-po-5.gw.unsw.e
du.au (149.171.255.165)  1.261 ms libcr1-po-6.gw.unsw.edu.au (149.171.255.201)
1.376 ms
 5  unswbr1-te-1-9.gw.unsw.edu.au (149.171.255.101)  1.285 ms unswbr1-te-2-13.gw
.unsw.edu.au (149.171.255.105)  1.237 ms unswbr1-te-1-9.gw.unsw.edu.au (149.171.
255.101)  1.297 ms
 6  138.44.5.0 (138.44.5.0)  1.329 ms  1.650 ms  1.610 ms
 7  et-0-3-0.pe1.bkvl.nsw.aarnet.net.au (113.197.15.147)  1.780 ms  1.669 ms  1.
866 ms
 8  ae9.bb1.a.syd.aarnet.net.au (113.197.15.57)  2.217 ms  2.123 ms  2.174 ms
 9  gigabitethernet1-1.pe1.b.syd.aarnet.net.au (202.158.202.18)  2.452 ms  2.371
 ms  2.463 ms
10  gigabitethernet3-11.ken37.sydney.telstra.net (139.130.0.77)  3.145 ms  2.822
 ms  3.027 ms
11  bundle-ether13.ken-core10.sydney.telstra.net (203.50.11.94)  3.748 ms  4.107
 ms  3.854 ms
12  bundle-ether10.win-core10.melbourne.telstra.net (203.50.11.123)  15.261 ms
15.279 ms  15.088 ms
13  gigabitethernet5-0.exi-service2.melbourne.telstra.net (203.50.80.132)  13.86
3 ms  13.904 ms  14.055 ms
14  * * *
15  * * *
16  * * *
```

Speedtest to cse

```
traceroute to weill.cse.unsw.edu.au (129.94.242.49), 30 hops max, 60 byte packets
 1  ge2-8.r01.sin01.ne.com.sg (202.150.221.169)  0.141 ms  0.208 ms  0.226 ms
 2  10.11.33.38 (10.11.33.38)  32.899 ms  32.914 ms  32.919 ms
 3  hutchcity3-10g.hkix.net (123.255.90.140)  34.489 ms  34.467 ms  34.572 ms
 4  218.189.5.42 (218.189.5.42)  34.622 ms d1-42-238-143-118-on-nets.com (118.143.238.42)  34.668 ms
 5  d1-6-224-143-118-on-nets.com (118.143.224.6)  180.811 ms  180.827 ms d1-10-224-143-118-on-nets.c
 6  aarnet.as7575.any2ix.coresite.com (206.72.210.64)  179.060 ms  171.819 ms  170.589 ms
 7  xe-0-0-3.pe1.tkpa.akl.aarnet.net.au (202.158.194.172)  305.312 ms  305.301 ms  295.795 ms
 8  et-0-1-0.200.pe1.wnpa.akl.aarnet.net.au (113.197.15.68)  297.947 ms  303.635 ms  303.263 ms
 9  xe-1-2-1.pe1.msct.nsw.aarnet.net.au (113.197.15.66)  325.953 ms xe-0-2-2-204.pe1.alxd.nsw.aarnet
10  et-8-1-0.pe1.brwy.nsw.aarnet.net.au (113.197.15.152)  330.964 ms  331.001 ms  339.873 ms
11  138.44.5.1 (138.44.5.1)  317.582 ms  318.773 ms  325.966 ms
12  ombcr1-te-1-5.gw.unsw.edu.au (149.171.255.106)  325.835 ms  325.775 ms  325.775 ms
13  ombudnex1-po-2.gw.unsw.edu.au (149.171.255.170)  329.978 ms  328.342 ms  328.659 ms
14  ufw1-ae-1-3154.gw.unsw.edu.au (149.171.253.36)  326.909 ms  327.000 ms  327.013 ms
15  129.94.39.23 (129.94.39.23)  328.435 ms  327.216 ms  319.579 ms
16  * * *
17  * * *
18  * * *
19  * * *
20  * * *
21  * * *
22  * * *
23  * * *
24  * * *
25  * * *
26  * * *
27  * * *
28  * * *
```

Cse to speedtest

```
# z5135009 @ weill in ~ [16:11:43]
$ traceroute www.speedtest.com.sg
traceroute to www.speedtest.com.sg (202.150.221.170), 30 hops max, 60 byte packe
ts
 1  cserouter1-server.cse.unsw.EDU.AU (129.94.242.251)  0.144 ms  0.122 ms  0.09
9 ms
 2  129.94.39.17 (129.94.39.17)  1.079 ms  1.057 ms  0.989 ms
 3  libudnex1-vl-3154.gw.unsw.edu.au (149.171.253.34)  1.707 ms ombudnex1-vl-315
4.gw.unsw.edu.au (149.171.253.35)  1.948 ms  1.934 ms
 4  libcr1-po-6.gw.unsw.edu.au (149.171.255.201)  1.214 ms ombcr1-po-6.gw.unsw.e
du.au (149.171.255.169)  1.206 ms libcr1-po-5.gw.unsw.edu.au (149.171.255.165)
1.206 ms
 5  unswbr1-te-1-9.gw.unsw.edu.au (149.171.255.101)  1.256 ms  1.290 ms unswbr1-
te-2-13.gw.unsw.edu.au (149.171.255.105)  1.306 ms
 6  138.44.5.0 (138.44.5.0)  1.416 ms  1.475 ms  1.454 ms
 7  et-0-3-0.pe1.alxd.nsw.aarnet.net.au (113.197.15.153)  1.743 ms  1.731 ms  1.
754 ms
 8  xe-0-2-1-204.pe1.wnpa.alxd.aarnet.net.au (113.197.15.183)  24.243 ms  24.190
 ms xe-0-0-3.pe1.wnpa.akl.aarnet.net.au (113.197.15.67)  24.232 ms
 9  et-0-1-0.200.pe1.tkpa.akl.aarnet.net.au (113.197.15.69)  26.604 ms  26.624 m
s  26.656 ms
10  xe-0-2-6.bdr1.a.lax.aarnet.net.au (202.158.194.173)  148.042 ms  148.028 ms
 148.010 ms
11  singtel.as7473.any2ix.coresite.com (206.72.210.63)  303.211 ms  303.202 ms
304.181 ms
12  203.208.172.173 (203.208.172.173)  305.920 ms 203.208.151.181 (203.208.151.1
81)  321.220 ms 203.208.172.173 (203.208.172.173)  308.073 ms
13  203.208.153.121 (203.208.153.121)  346.076 ms 203.208.177.110 (203.208.177.1
10)  340.719 ms 203.208.151.233 (203.208.151.233)  317.004 ms
14  203.208.182.45 (203.208.182.45)  342.699 ms  342.689 ms 202-150-221-170.rev.
ne.com.sg (202.150.221.170)  328.726 ms
```

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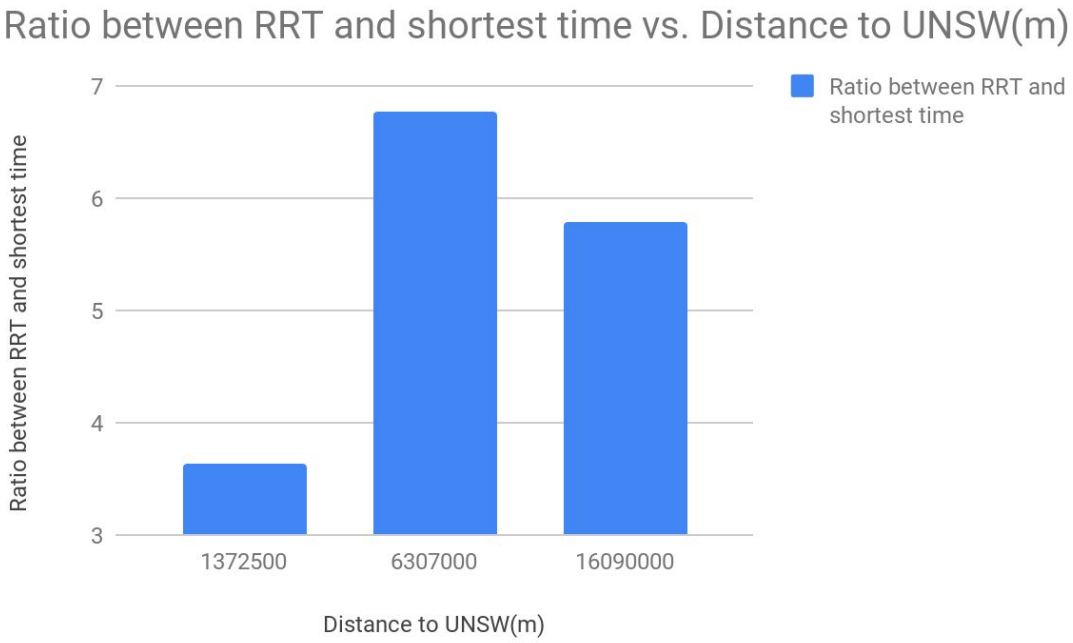
EX4:

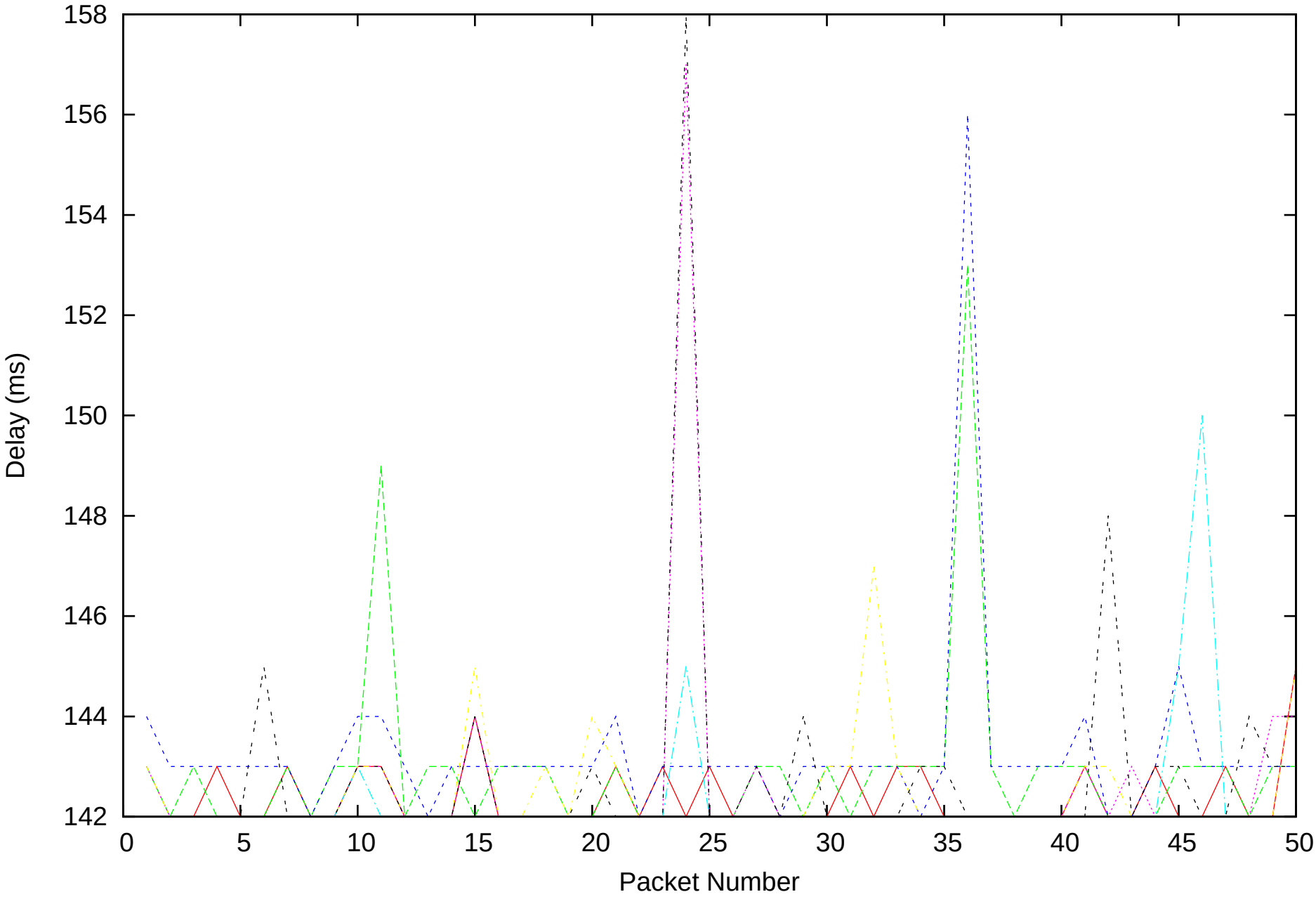
1. Adelaide: 1,372500/300000000 = 4.575ms
   Singapore: 6307000/300000000 = 21.02333333ms
   Berlin: 16090000/300000000 = 53.63333ms

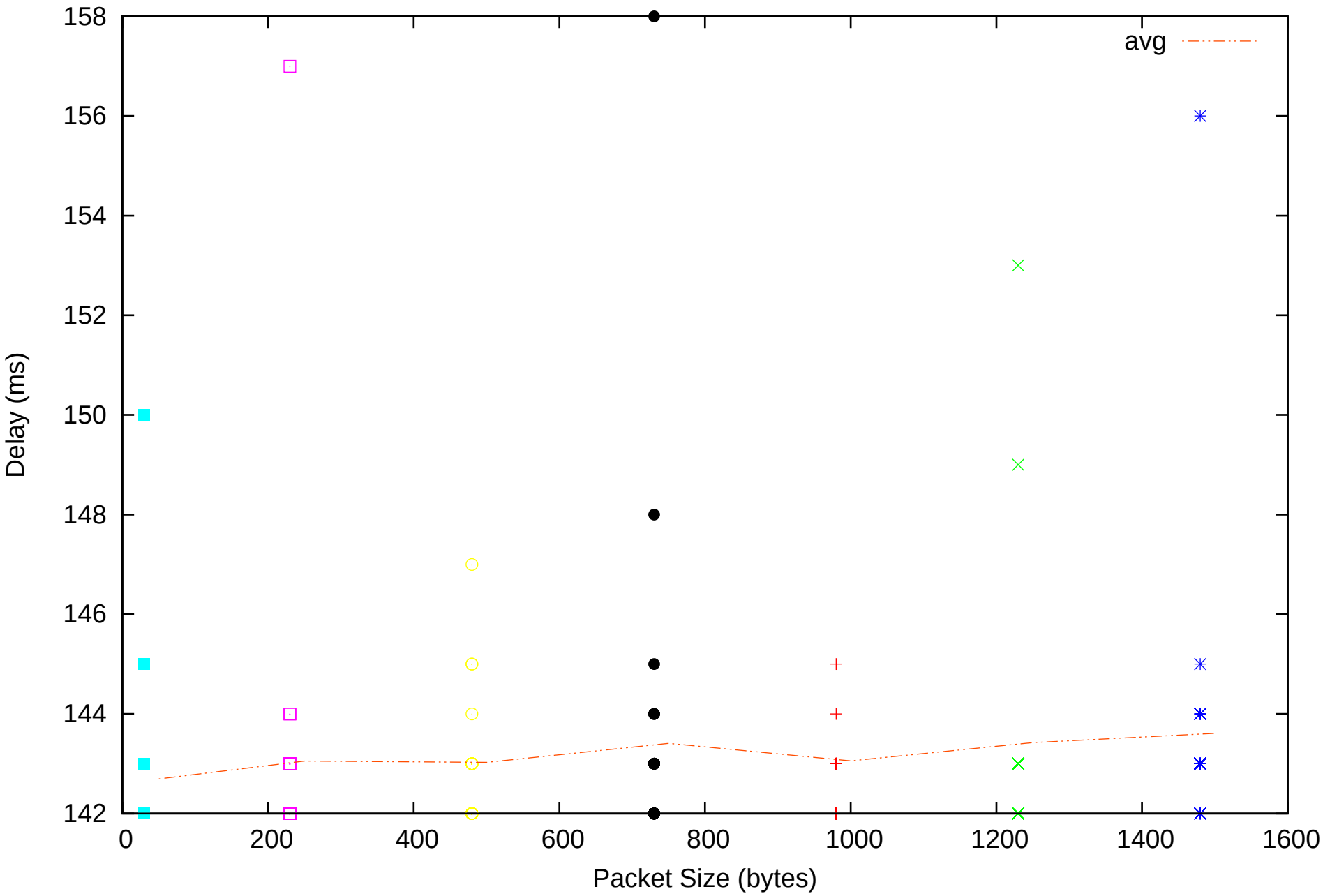


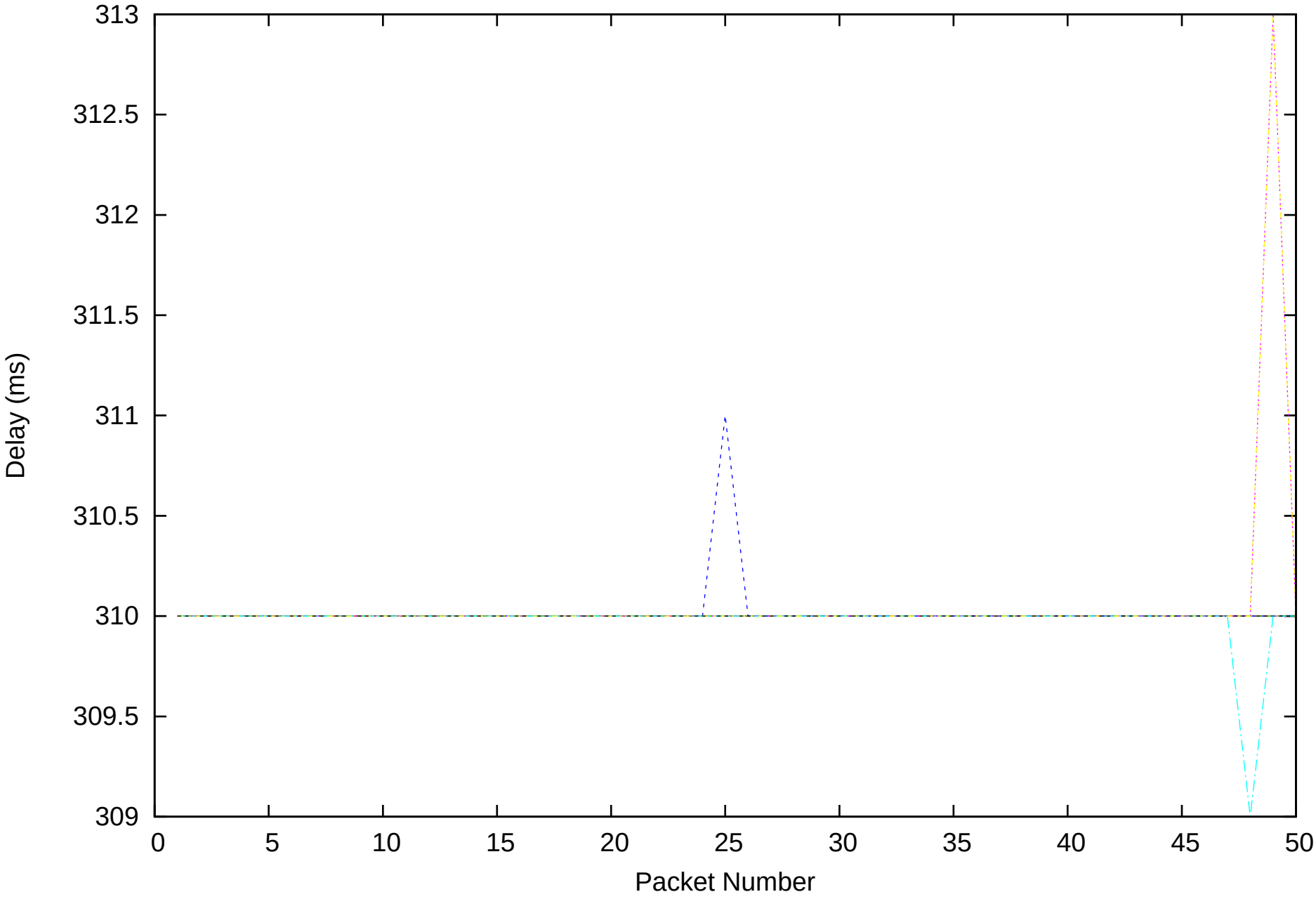
Because of transmission delay, processing delay and queuing delay. Firstly, routers need time to examine the packet's header and determine where to direct the packet and also need to check for bit-level errors in the packet that occured in transmitting. Secondly, packet may wait to be transmitted onto the link. Thirdly, assuming that packet are transmitted in a first-come-first-served manner, as is common in packet-switched networks, our packet can be transmitted only after all the packets that have arrived before it have been transmitted, it will also take some time.

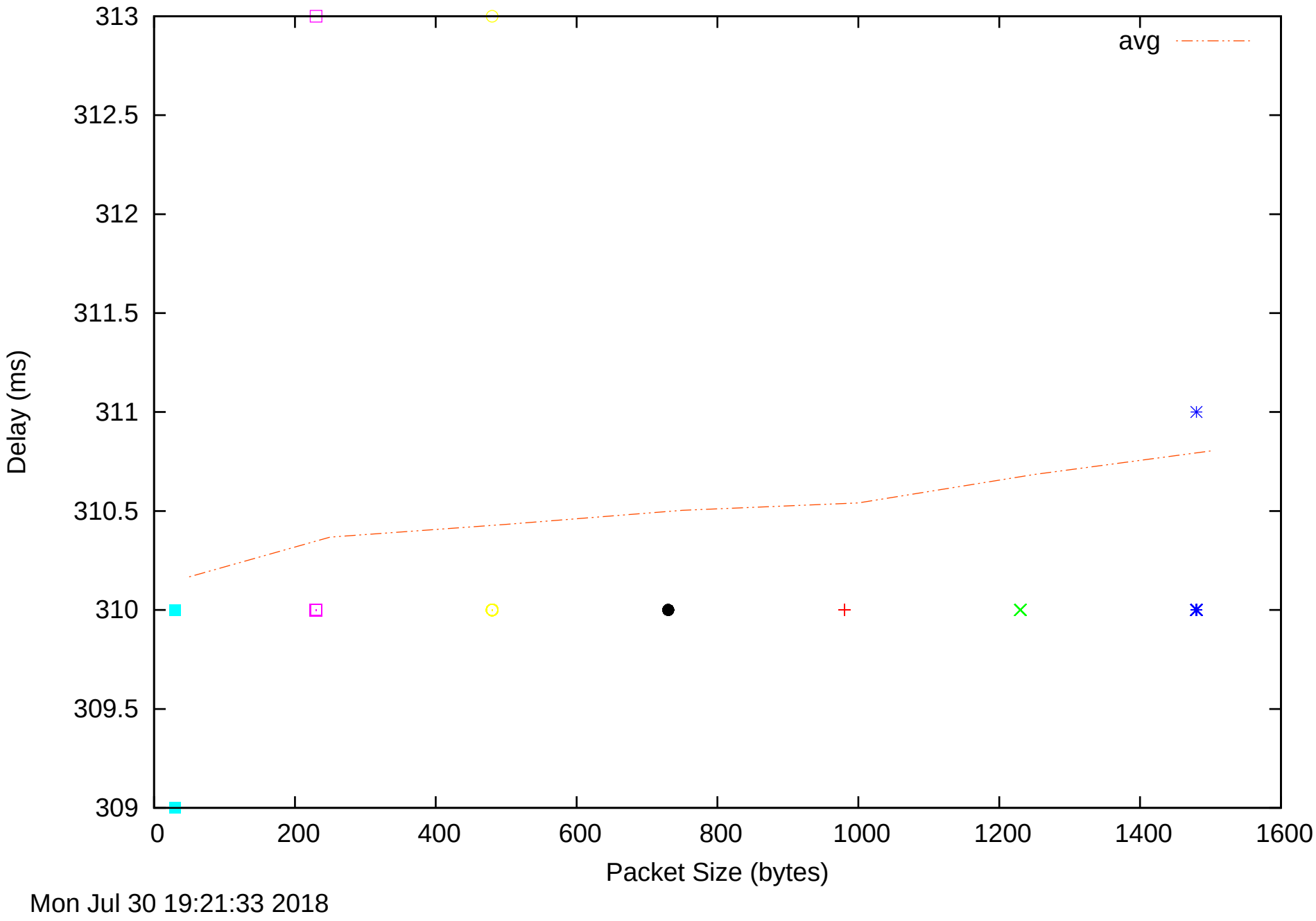
2. It vary over time. For example, when you send different package, it may have different route to reach the destination,then it will cause different propagation delay. Secondly, due to queue delay, if the traffic is heavy and many other packets are also waiting to be transmitted, queue may be full and the queuing delay will be long, so it will have different delay time compared with empty queue.

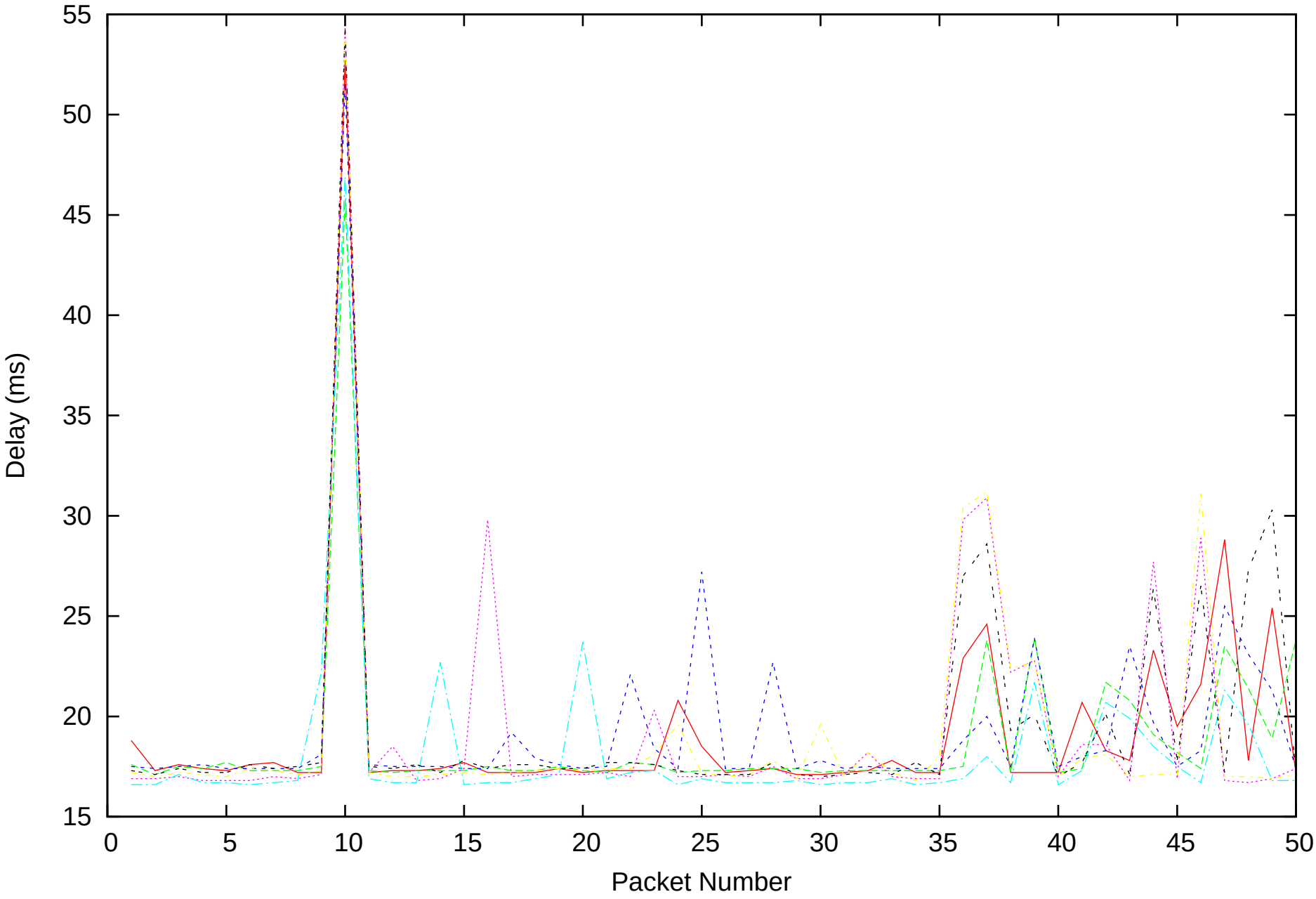
3. Transmission delay depend on packet size, others are not.

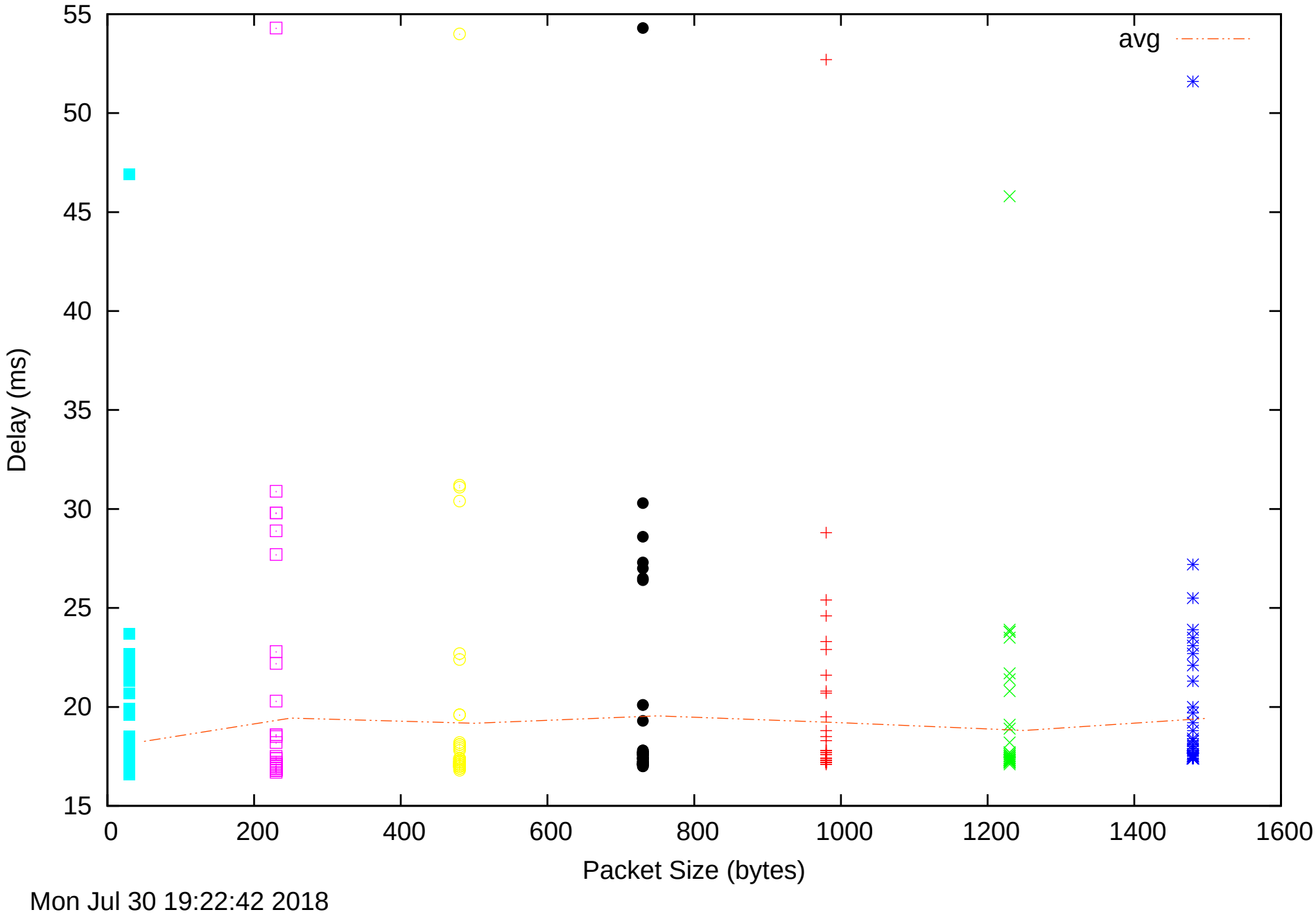

158
156
154
152
150
148
146
144
142
Delay (ms)
0
5
10
15
20
25
30
35
40
45
50
Packet Number
Mon Jul 30 19:22:34 2018


158
156
154
152
150
148
146
144
142
Delay (ms)
0
200
400
600
800
1000
1200
1400
1600
Packet Size (bytes)
avg
Mon Jul 30 19:22:34 2018


313
312.5
312
311.5
311
310.5
310
309.5
309
Delay (ms)
0
5
10
15
20
25
30
35
40
45
50
Packet Number
Mon Jul 30 19:21:33 2018


313
312.5
312
311.5
311
310.5
310
309.5
309
Delay (ms)
0
200
400
600
800
1000
1200
1400
1600
Packet Size (bytes)
avg
Mon Jul 30 19:21:33 2018


55
50
45
40
35
30
25
20
15
Delay (ms)
0
5
10
15
20
25
30
35
40
45
50
Packet Number
Mon Jul 30 19:22:42 2018


avg
Delay (ms)
Packet Size (bytes)
55
50
45
40
35
30
25
20
15
0
200
400
600
800
1000
1200
1400
1600
Mon Jul 30 19:22:42 2018