Exercise1：

1、

the IP address of www.koala.com.au is **104.18.61.21** and **104.18.60.21**
The reason why a website has many IP addresses is that there may many servers contain the the same website in different regions, even one server down, the website can be browsed from another server.

2、

127.0.0.1 is localhost
The special about this address is 127.x.x.x is loopback address, which is mainly used for network software testing and local inter-process communication.

```
z5224151@vx3:/tmp_amd/kamen/export/kamen/4/z5224151/Desktop$ nslookup 127.0.0.1
Server:         129.94.242.45
Address:        129.94.242.45#53

1.0.0.127.in-addr.arpa  name = localhost.
```

Exercise2:

www.getfittest.com.au and
www.hola.hp and
www.kremlin.ru are not reachable by using ping.

```
z5224151@vx3:/tmp_amd/kamen/export/kamen/4/z5224151/Desktop$ ping www.getfittest.com.au
ping: unknown host www.getfittest.com.au
z5224151@vx3:/tmp_amd/kamen/export/kamen/4/z5224151/Desktop$
```

```
z5224151@vx3:/tmp_amd/kamen/export/kamen/4/z5224151/Desktop$ ping www.hola.hp
ping: unknown host www.hola.hp
```

```
z5224151@vx3:/tmp_amd/kamen/export/kamen/4/z5224151/Desktop$ ping www.kremlin.ru
PING www.kremlin.ru (95.173.136.70) 56(84) bytes of data.
```

The other websites are all reachable.

```
z5224151@vx3:/tmp_amd/kamen/export/kamen/4/z5224151/Desktop$ ping www.unsw.edu.au
PING www.unsw.edu.au (202.58.60.194) 56(84) bytes of data.
64 bytes from 202.58.60.194: icmp_req=1 ttl=243 time=24.6 ms
64 bytes from 202.58.60.194: icmp_req=2 ttl=243 time=24.5 ms
```

```
z5224151@vx3:/tmp_amd/kamen/export/kamen/4/z5224151/Desktop$ ping www.mit.edu
PING e9566.dscb.akamaiedge.net (104.98.31.173) 56(84) bytes of data.
64 bytes from a104-98-31-173.deploy.static.akamaitechnologies.com (104.98.31.173): icmp_req=1 ttl=56 time=1.28 ms
64 bytes from a104-98-31-173.deploy.static.akamaitechnologies.com (104.98.31.173): icmp_req=2 ttl=56 time=1.23 ms
```

```
z5224151@vx3:/tmp_amd/kamen/export/kamen/4/z5224151/Desktop$ ping www.intel.com.au
PING e19235.dsca.akamaiedge.net (104.74.52.132) 56(84) bytes of data.
64 bytes from a104-74-52-132.deploy.static.akamaitechnologies.com (104.74.52.132): icmp_req=1 ttl=56 time=1.37 ms
64 bytes from a104-74-52-132.deploy.static.akamaitechnologies.com (104.74.52.132): icmp_req=2 ttl=56 time=1.32 ms
```

```
z5224151@vx3:/tmp_amd/kamen/export/kamen/4/z5224151/Desktop$ ping www.tpg.com.au
PING www.tpg.com.au (203.26.27.38) 56(84) bytes of data.
64 bytes from www.tpg.com.au (203.26.27.38): icmp_req=1 ttl=118 time=30.0 ms
64 bytes from www.tpg.com.au (203.26.27.38): icmp_req=2 ttl=118 time=29.9 ms
```

```
z5224151@vx3:/tmp_amd/kamen/export/kamen/4/z5224151/Desktop$ ping www.amazon.com
PING d3ag4hukkh62yn.cloudfront.net (13.35.141.74) 56(84) bytes of data.
64 bytes from server-13-35-141-74.syd1.r.cloudfront.net (13.35.141.74): icmp_req=1 ttl=244 time=1.32 ms
64 bytes from server-13-35-141-74.syd1.r.cloudfront.net (13.35.141.74): icmp_req=2 ttl=244 time=1.10 ms
```

```
z5224151@vx3:/tmp_amd/kamen/export/kamen/4/z5224151/Desktop$ ping www.tsinghua.edu.cn
PING www.tsinghua.edu.cn (166.111.4.100) 56(84) bytes of data.
64 bytes from www.tsinghua.edu.cn (166.111.4.100): icmp_req=1 ttl=44 time=248 ms
64 bytes from www.tsinghua.edu.cn (166.111.4.100): icmp_req=2 ttl=44 time=248 ms
```

```
z5224151@vx3:/tmp_amd/kamen/export/kamen/4/z5224151/Desktop$ ping 8.8.8.8
PING 8.8.8.8 (8.8.8.8) 56(84) bytes of data.
64 bytes from 8.8.8.8: icmp_req=1 ttl=53 time=1.75 ms
64 bytes from 8.8.8.8: icmp_req=2 ttl=53 time=1.53 ms
```

The reason why www.getfittest.com.au and www.hola.hp cannot be reachable using ping is that the domain name may be wrong or the domain are expired, thus these two websites cannot be browsed from web browser.

The reason why www.kremlin.ru cannot be reachable by ping is because this site disabled ICMP responses or enabled ICMP filtering to protect the server and host, therefore the website can still be browsed by web browser.

Exercise3:

1、

```
z5224151@vx3:/tmp_amd/kamen/export/kamen/4/z5224151/Desktop$ 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)  0.082 ms  0.072 ms  0.057 ms
 2  129.94.39.17 (129.94.39.17)  0.881 ms  0.879 ms  0.862 ms
 3  libudnex1-vl-3154.gw.unsw.edu.au (149.171.253.34)  1.295 ms ombudnex1-vl-3154.gw.unsw.edu.au (149.171.253.35)  1.292 ms  1.3
57 ms
 4  ombcr1-po-6.gw.unsw.edu.au (149.171.255.169)  1.224 ms  1.218 ms ombcr1-po-5.gw.unsw.edu.au (149.171.255.197)  1.213 ms
 5  unswbr1-te-1-9.gw.unsw.edu.au (149.171.255.101)  1.236 ms unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105)  1.191 ms  1.236
ms
 6  138.44.5.0 (138.44.5.0)  1.387 ms  1.906 ms  1.895 ms
 7  et-1-3-0.pe1.sxt.bkvl.nsw.aarnet.net.au (113.197.15.149)  2.283 ms  2.143 ms  2.139 ms
 8  et-0-0-0.pe1.a.hnl.aarnet.net.au (113.197.15.99)  95.099 ms  95.111 ms  95.091 ms
 9  et-2-1-0.bdr1.a.sea.aarnet.net.au (113.197.15.201)  146.965 ms  146.968 ms  146.955 ms
10  abilene-1-lo-jmb-706.sttlwa.pacificwave.net (207.231.240.8)  147.025 ms  146.977 ms  146.986 ms
11  ae-1.4079.rtsw.minn.net.internet2.edu (162.252.70.173)  179.774 ms  179.772 ms  179.541 ms
12  ae-1.4079.rtsw.eqch.net.internet2.edu (162.252.70.106)  192.818 ms  192.325 ms  192.995 ms
13  ae-0.4079.rtsw3.eqch.net.internet2.edu (162.252.70.163)  187.796 ms  187.640 ms  187.605 ms
14  ae-1.4079.rtsw.clev.net.internet2.edu (162.252.70.130)  196.148 ms  196.196 ms  196.129 ms
15  buf-9208-I2-CLEV.nysernet.net (199.109.11.33)  200.795 ms  200.706 ms  200.644 ms
16  syr-9208-buf-9208.nysernet.net (199.109.7.193)  203.661 ms  203.957 ms  203.893 ms
17  nyc111-9204-syr-9208.nysernet.net (199.109.7.94)  212.894 ms  213.012 ms  212.875 ms
18  nyc-9208-nyc111-9204.nysernet.net (199.109.7.165)  213.293 ms  213.274 ms  215.166 ms
19  columbia.nyc-9208.nysernet.net (199.109.4.14)  212.926 ms  212.932 ms  212.944 ms
20  cc-core-1-x-nyser32-gw-1.net.columbia.edu (128.59.255.5)  213.245 ms  213.249 ms  213.343 ms
21  cc-conc-1-x-cc-core-1.net.columbia.edu (128.59.255.21)  213.282 ms  213.400 ms  213.262 ms
22  exeas.org (128.59.105.24)  213.146 ms  213.073 ms  213.203 ms
z5224151@vx3:/tmp_amd/kamen/export/kamen/4/z5224151/Desktop$
```

There are 22 routes between my workstation and www.columbia.edu

By using whois command, there are 5 routes are part of UNSW network

```
 1  cserouter1-server.cse.unsw.EDU.AU (129.94.242.251)  0.082 ms  0.072 ms  0.057 ms
 2  129.94.39.17 (129.94.39.17)  0.881 ms  0.879 ms  0.862 ms
 3  libudnex1-vl-3154.gw.unsw.edu.au (149.171.253.34)  1.295 ms ombudnex1-vl-3154.gw.unsw.edu.au (149.171.253.35)  1.292 ms  1.3
57 ms
 4  ombcr1-po-6.gw.unsw.edu.au (149.171.255.169)  1.224 ms  1.218 ms ombcr1-po-5.gw.unsw.edu.au (149.171.255.197)  1.213 ms
 5  unswbr1-te-1-9.gw.unsw.edu.au (149.171.255.101)  1.236 ms unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105)  1.191 ms  1.236
ms
```

```
% Information related to '149.171.0.0 - 149.171.255.255'

% Abuse contact for '149.171.0.0 - 149.171.255.255' is 'hostmaster@unsw.edu.au'

inetnum:        149.171.0.0 - 149.171.255.255
netname:        UNSWNET
country:        AU
org:            ORG-UONS1-AP
descr:          University of New South Wales
```

```
% Abuse contact for '129.94.0.0 - 129.94.255.255' is 'hostmaster@unsw.edu.au'

inetnum:        129.94.0.0 - 129.94.255.255
netname:        UNSW
country:        AU
org:            ORG-UONS1-AP
descr:          University of New South Wales
```

The ping between seventh routes and the eighth routes are increasing sharply, thus packets may cross the Pacific Ocean.

```
 7  et-1-3-0.pe1.sxt.bkvl.nsw.aarnet.net.au (113.197.15.149)  2.283 ms  2.143 ms  2.139 ms
 8  et-0-0-0.pe1.a.hnl.aarnet.net.au (113.197.15.99)  95.099 ms  95.111 ms  95.091 ms
```

2、

```
 5  unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105)  1.606 ms  1.606 ms  1.603 ms
 6  138.44.5.0 (138.44.5.0)  1.293 ms  1.310 ms  1.296 ms
 7  et-1-3-0.pe1.sxt.bkvl.nsw.aarnet.net.au (113.197.15.149)  2.174 ms  2.298 ms  2.281 ms
```

```
 5  unswbr1-te-1-9.gw.unsw.edu.au (149.171.255.101)  1.134 ms unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105)  1.127 ms  1.135
ms
 6  138.44.5.0 (138.44.5.0)  1.359 ms  1.361 ms  1.350 ms
 7  et-0-3-0.pe1.bkvl.nsw.aarnet.net.au (113.197.15.147)  1.687 ms  1.720 ms  1.746 ms
 8  ge-4_0_0.bb1.a.pao.aarnet.net.au (202.158.194.177)  154.935 ms  154.949 ms  154.947 ms
```

```
 5  unswbr1-te-1-9.gw.unsw.edu.au (149.171.255.101)  1.290 ms  1.321 ms unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105)  1.276
ms
 6  138.44.5.0 (138.44.5.0)  1.327 ms  1.335 ms  1.320 ms
 7  et-2-0-5.bdr1.sing.sin.aarnet.net.au (113.197.15.233)  92.578 ms  92.574 ms  92.554 ms
```

At route 138.44.5.0 the paths divide to three different routes.

The detail of this IP address as below:

```
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
```

www.ucla.edu

```
z5224151@vx3:/tmp_amd/kamen/export/kamen/4/z5224151/Desktop$ 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)  0.150 ms  0.124 ms  0.107 ms
 2  129.94.39.17 (129.94.39.17)  0.819 ms  0.813 ms  0.797 ms
 3  libudnex1-vl-3154.gw.unsw.edu.au (149.171.253.34)  1.363 ms ombudnex1-vl-3154.gw.unsw.edu.au (149.171.253.35)  58.540 ms  58
.919 ms
 4  ombcr1-po-6.gw.unsw.edu.au (149.171.255.169)  1.121 ms  1.143 ms ombcr1-po-5.gw.unsw.edu.au (149.171.255.197)  1.091 ms
 5  unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105)  1.606 ms  1.606 ms  1.603 ms
 6  138.44.5.0 (138.44.5.0)  1.293 ms  1.310 ms  1.296 ms
 7  et-1-3-0.pe1.sxt.bkvl.nsw.aarnet.net.au (113.197.15.149)  2.174 ms  2.298 ms  2.281 ms
 8  et-0-0-0.pe1.a.hnl.aarnet.net.au (113.197.15.99)  95.065 ms  95.002 ms  94.995 ms
 9  et-2-1-0.bdr1.a.sea.aarnet.net.au (113.197.15.201)  146.946 ms  146.945 ms  146.931 ms
10  cenichpr-1-is-jmb-778.snvaca.pacificwave.net (207.231.245.129)  163.482 ms  164.037 ms  163.457 ms
11  hpr-lax-hpr3--svl-hpr3-100ge.cenic.net (137.164.25.73)  160.582 ms  160.014 ms  160.027 ms
12  * * *
13  bd11f1.anderson--cr00f2.csb1.ucla.net (169.232.4.4)  162.297 ms  160.408 ms  161.171 ms
14  cr00f1.anderson--rtr12f4.mathsci.ucla.net (169.232.8.187)  161.163 ms cr00f2.csb1--rtr12f4.mathsci.ucla.net (169.232.8.183)
 160.689 ms cr00f1.anderson--rtr12f4.mathsci.ucla.net (169.232.8.187)  161.097 ms
15  * * *
16  * * *
17  * * *
18  * * *
19  * * *
20  * * *
21  * * *
22  * * *
23  * * *
24  * * *
25  * * *
26  * * *
27  * * *
28  * * *
29  * * *
30  * * *
```

Distance: **7209.7 miles, with 15 hops**

www.u-tokyo.ac.jp

```
z5224151@vx3:/tmp_amd/kamen/export/kamen/4/z5224151/Desktop$ 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)  0.101 ms  0.082 ms  0.065 ms
 2  129.94.39.17 (129.94.39.17)  0.866 ms  0.859 ms  0.855 ms
 3  ombudnex1-vl-3154.gw.unsw.edu.au (149.171.253.35)  2.288 ms  2.290 ms libudnex1-vl-3154.gw.unsw.edu.au (149.171.253.34)  7.7
85 ms
 4  libcr1-po-6.gw.unsw.edu.au (149.171.255.201)  1.127 ms ombcr1-po-6.gw.unsw.edu.au (149.171.255.169)  1.101 ms libcr1-po-6.gw
.unsw.edu.au (149.171.255.201)  1.117 ms
 5  unswbr1-te-1-9.gw.unsw.edu.au (149.171.255.101)  1.134 ms unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105)  1.127 ms  1.135
ms
 6  138.44.5.0 (138.44.5.0)  1.359 ms  1.361 ms  1.350 ms
 7  et-0-3-0.pe1.bkvl.nsw.aarnet.net.au (113.197.15.147)  1.687 ms  1.720 ms  1.746 ms
 8  ge-4_0_0.bb1.a.pao.aarnet.net.au (202.158.194.177)  154.935 ms  154.949 ms  154.947 ms
 9  paloalto0.iij.net (198.32.176.24)  156.303 ms  156.348 ms  156.401 ms
10  osk004bb01.IIJ.Net (58.138.88.189)  269.489 ms  269.488 ms osk004bb00.IIJ.Net (58.138.88.185)  287.077 ms
11  osk004ip57.IIJ.Net (58.138.106.166)  269.356 ms  269.307 ms osk004ip57.IIJ.Net (58.138.106.162)  278.098 ms
12  210.130.135.130 (210.130.135.130)  286.956 ms  282.606 ms  282.588 ms
13  124.83.228.58 (124.83.228.58)  278.132 ms  269.302 ms  269.269 ms
14  124.83.252.178 (124.83.252.178)  284.068 ms  292.916 ms  292.884 ms
15  158.205.134.26 (158.205.134.26)  284.019 ms  275.348 ms  284.187 ms
16  * * *
17  * * *
18  * * *
```

Distance: **4335.6 miles, with 16 hops**

www.lancaster.ac.uk

```
z5224151@vx3:/tmp_amd/kamen/export/kamen/4/z5224151/Desktop$ 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)  0.147 ms  0.128 ms  0.111 ms
 2  129.94.39.17 (129.94.39.17)  0.946 ms  0.888 ms  0.882 ms
 3  libudnex1-vl-3154.gw.unsw.edu.au (149.171.253.34)  1.622 ms  1.614 ms ombudnex1-vl-3154.gw.unsw.edu.au (149.171.253.35)  1.3
55 ms
 4  libcr1-po-5.gw.unsw.edu.au (149.171.255.165)  1.146 ms libcr1-po-6.gw.unsw.edu.au (149.171.255.201)  1.082 ms libcr1-po-5.gw
.unsw.edu.au (149.171.255.165)  1.116 ms
 5  unswbr1-te-1-9.gw.unsw.edu.au (149.171.255.101)  1.290 ms  1.321 ms unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105)  1.276
ms
 6  138.44.5.0 (138.44.5.0)  1.327 ms  1.335 ms  1.320 ms
 7  et-2-0-5.bdr1.sing.sin.aarnet.net.au (113.197.15.233)  92.578 ms  92.574 ms  92.554 ms
 8  138.44.226.7 (138.44.226.7)  260.069 ms  259.964 ms  259.951 ms
 9  janet-gw.mx1.lon.uk.geant.net (62.40.124.198)  260.050 ms  260.049 ms  259.975 ms
10  ae29.londpg-sbr2.ja.net (146.97.33.2)  260.526 ms  260.537 ms  260.500 ms
11  ae31.erdiss-sbr2.ja.net (146.97.33.22)  264.342 ms  264.327 ms  264.228 ms
12  ae29.manckh-sbr2.ja.net (146.97.33.42)  266.265 ms  266.389 ms  266.278 ms
13  ae24.lanclu-rbr1.ja.net (146.97.38.58)  268.525 ms  268.537 ms  268.457 ms
14  lancaster-university.ja.net (194.81.46.2)  407.044 ms  407.008 ms  406.881 ms
15  is-border01.bfw01.rtr.lancs.ac.uk (148.88.253.202)  268.879 ms  268.893 ms  268.891 ms
16  bfw01.iss-servers.is-core01.rtr.lancs.ac.uk (148.88.250.98)  275.254 ms  271.680 ms  272.091 ms
17  * * *
18  www.lancs.ac.uk (148.88.65.80)  269.140 ms !X  269.051 ms !X  269.304 ms !X
```

Distance: **10063.9 miles, with 18hops**

In conclusion, we can find the hops on each path doesn't proportional the physical distance.

3、

(i) http://www.speedtest.com.sg/tr.php

From The Singapore Broadband Speed Test service to my machine.

Traceroute Result:

```
traceroute to 129.94.242.45 (129.94.242.45), 30 hops max, 60 byte packets
 1  ge2-8.r01.sin01.ne.com.sg (202.150.221.169)  0.173 ms  0.215 ms  0.231 ms
 2  10.15.62.210 (10.15.62.210)  0.240 ms  0.254 ms  0.261 ms
 3  aarnet.sgix.sg (103.16.102.67)  199.670 ms  199.706 ms  199.713 ms
 4  et-7-3-0.pe1.nsw.brwy.aarnet.net.au (113.197.15.232)  208.216 ms  208.086 ms  208.217 ms
 5  138.44.5.1 (138.44.5.1)  209.270 ms  209.217 ms  209.325 ms
 6  libcr1-te-1-5.gw.unsw.edu.au (149.171.255.102)  209.242 ms  209.205 ms  209.221 ms
 7  ombudnex1-po-1.gw.unsw.edu.au (149.171.255.202)  212.199 ms  212.121 ms libudnex1-po-1.gw.unsw.edu.au (149.171.255.166)  208.624 ms
 8  ufw1-ae-1-3154.gw.unsw.edu.au (149.171.253.36)  200.471 ms  200.405 ms  200.451 ms
 9  129.94.39.23 (129.94.39.23)  210.096 ms  210.014 ms  210.056 ms
10  * * *
11  * * *
12  * * *
```

From my machine to The Singapore Broadband Speed Test service.

```
z5224151@vx3:/tmp_amd/kamen/export/kamen/4/z5224151/Desktop$ traceroute www.speedtest.com.sg
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)  0.104 ms  0.078 ms  0.058 ms
 2  129.94.39.17 (129.94.39.17)  0.942 ms  0.890 ms  0.894 ms
 3  libudnex1-vl-3154.gw.unsw.edu.au (149.171.253.34)  1.299 ms ombudnex1-vl-3154.gw.unsw.edu.au (149.171.253.35)  1.337 ms libu
dnex1-vl-3154.gw.unsw.edu.au (149.171.253.34)  1.351 ms
 4  ombcr1-po-5.gw.unsw.edu.au (149.171.255.197)  1.119 ms  1.121 ms ombcr1-po-6.gw.unsw.edu.au (149.171.255.169)  1.150 ms
 5  unswbr1-te-2-13.gw.unsw.edu.au (149.171.255.105)  1.162 ms  1.157 ms unswbr1-te-1-9.gw.unsw.edu.au (149.171.255.101)  1.170
ms
 6  138.44.5.0 (138.44.5.0)  41.031 ms  40.366 ms  40.303 ms
 7  et-0-3-0.pe1.alxd.nsw.aarnet.net.au (113.197.15.153)  1.606 ms  1.699 ms  1.682 ms
 8  xe-0-2-7.bdr1.a.lax.aarnet.net.au (202.158.194.173)  147.613 ms  147.552 ms  147.546 ms
 9  singtel.as7473.any2ix.coresite.com (206.72.210.63)  147.902 ms  147.900 ms  147.695 ms
10  203.208.171.117 (203.208.171.117)  147.896 ms  147.893 ms 203.208.172.133 (203.208.172.133)  334.221 ms
11  203.208.177.110 (203.208.177.110)  332.945 ms 203.208.172.145 (203.208.172.145)  244.721 ms  244.623 ms
12  * 203.208.158.17 (203.208.158.17)  332.383 ms  332.402 ms
13  202-150-221-170.rev.ne.com.sg (202.150.221.170)  213.028 ms 203.208.177.110 (203.208.177.110)  334.986 ms 202-150-221-170.re
v.ne.com.sg (202.150.221.170)  200.429 ms
```

From https://www.telstra.net/cgi-bin/trace service to my machine.

```
 1  gigabitethernet3-3.exi2.melbourne.telstra.net (203.50.77.53)  0.318 ms  0.205 ms  0.367 ms
 2  bundle-ether3-100.win-core10.melbourne.telstra.net (203.50.80.129)  1.239 ms  1.602 ms  2.115 ms
 3  bundle-ether12.ken-core10.sydney.telstra.net (203.50.11.122)  13.985 ms  12.097 ms  12.611 ms
 4  bundle-ether1.ken-edge901.sydney.telstra.net (203.50.11.95)  12.863 ms  11.847 ms  11.861 ms
 5  aarnet6.lnk.telstra.net (139.130.0.78)  11.608 ms  11.601 ms  11.609 ms
 6  xe-5-2-2.pe1.brwy.nsw.aarnet.net.au (113.197.15.32)  12.486 ms  11.847 ms  11.738 ms
 7  138.44.5.1 (138.44.5.1)  12.111 ms  11.977 ms  11.985 ms
 8  ombcr1-te-1-5.gw.unsw.edu.au (149.171.255.106)  11.984 ms  11.972 ms  11.988 ms
 9  ombudnex1-po-2.gw.unsw.edu.au (149.171.255.170)  13.731 ms  12.474 ms  17.106 ms
10  ufw1-ae-1-3154.gw.unsw.edu.au (149.171.253.36)  12.735 ms  12.723 ms  12.612 ms
11  129.94.39.23 (129.94.39.23)  12.858 ms  12.850 ms  12.860 ms
```

From my machine to https://www.telstra.net/cgi-bin/trace service.

```
z5224151@vx3:/tmp_amd/kamen/export/kamen/4/z5224151/Desktop$ traceroute www.telstra.net
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)  0.113 ms  0.093 ms  0.075 ms
 2  129.94.39.17 (129.94.39.17)  0.824 ms  0.832 ms  0.834 ms
 3  libudnex1-vl-3154.gw.unsw.edu.au (149.171.253.34)  1.379 ms  1.516 ms ombudnex1-vl-3154.gw.unsw.edu.au (149.171.253.35)  1.4
44 ms
 4  libcr1-po-5.gw.unsw.edu.au (149.171.255.165)  1.071 ms ombcr1-po-6.gw.unsw.edu.au (149.171.255.169)  1.081 ms  1.087 ms
 5  unswbr1-te-1-9.gw.unsw.edu.au (149.171.255.101)  1.091 ms  1.112 ms  1.121 ms
 6  138.44.5.0 (138.44.5.0)  44.790 ms  44.114 ms  44.089 ms
 7  xe-0-0-0.bdr1.rsby.nsw.aarnet.net.au (113.197.15.33)  1.525 ms  1.468 ms  1.454 ms
 8  gigabitethernet3-11.ken37.sydney.telstra.net (139.130.0.77)  2.376 ms  3.875 ms  2.253 ms
 9  bundle-ether13.ken-core10.sydney.telstra.net (203.50.11.94)  4.058 ms bundle-ether2.chw-edge901.sydney.telstra.net (203.50.1
1.103)  2.173 ms  2.285 ms
10  bundle-ether10.win-core10.melbourne.telstra.net (203.50.11.123)  14.882 ms  14.822 ms  14.822 ms
11  203.50.6.40 (203.50.6.40)  13.510 ms  15.157 ms  14.577 ms
12  bundle-ether2.exi-ncprouter101.melbourne.telstra.net (203.50.11.209)  13.488 ms  13.207 ms  13.198 ms
13  www.telstra.net (203.50.5.178)  12.507 ms  12.451 ms  12.428 ms
```

The IP address of http://www.speedtest.com.sg/tr.php is 202.150.221.170

```
z5224151@vx7:/tmp_amd/kamen/export/kamen/4/z5224151/Desktop$ nslookup www.speedtest.com.sg
Server:         129.94.242.45
Address:        129.94.242.45#53

Non-authoritative answer:
Name:   www.speedtest.com.sg
Address: 202.150.221.170
```

The IP address of https://www.telstra.net/cgi-bin/trace is 203.50.5.178

```
z5224151@vx7:/tmp_amd/kamen/export/kamen/4/z5224151/Desktop$ nslookup www.telstra.net
Server:         129.94.242.45
Address:        129.94.242.45#53

Non-authoritative answer:
Name:   www.telstra.net
Address: 203.50.5.178
```

The reverse path may go through the same routes, but they go through the different IP address, the main reason is loading balance, the route may distribute different IP address at different time to achieve the best transmission effect.

Exercise4:

1、

the reason why y-axis values are greater than 2 is that
(1) the physical distance we get from Google Maps is the same as the sum of distance of each routes, which means the actual distance is much longer than the physical distance, and therefore the delay will get increased.
(2) the actual speed of data transmission is the same as the speed of light, due to the congestion of server or any other reasons, the speed of transmission will get slower, which will also cause the RTT increasing.

The distance from UNSW to UQ server is **1131.5km**

T1 = 1131500 / $3*10^8$ =0.00377s = 3.77ms

```
PING www.uq.edu.au (130.102.184.3) 22(50) bytes of data.
30 bytes from professional-services.uq.edu.au (130.102.184.3): icmp_req=1 ttl=240 time=16.6 ms
30 bytes from professional-services.uq.edu.au (130.102.184.3): icmp_req=2 ttl=240 time=16.6 ms
30 bytes from professional-services.uq.edu.au (130.102.184.3): icmp_req=3 ttl=240 time=16.6 ms
30 bytes from professional-services.uq.edu.au (130.102.184.3): icmp_req=4 ttl=240 time=16.6 ms
30 bytes from professional-services.uq.edu.au (130.102.184.3): icmp_req=5 ttl=240 time=16.6 ms
```

RTT = 16.6 ms

RTT / T1 = 4.4 > 2

The distance from UNSW to DLSU server is **6286.6km**

T2 = 6286600 / $3*10^8$ =0.02095s = 20.95ms

```
PING www.dlsu.edu.ph (103.231.241.180) 22(50) bytes of data.
30 bytes from 103.231.241.180: icmp_req=1 ttl=114 time=344 ms
30 bytes from 103.231.241.180: icmp_req=2 ttl=114 time=343 ms
30 bytes from 103.231.241.180: icmp_req=3 ttl=114 time=341 ms
30 bytes from 103.231.241.180: icmp_req=4 ttl=114 time=341 ms
```

RTT = 341 ms

RTT/ T2 = 16.2 > 2

The distance from UNSW to TU-berlin server is **16105.3km**

T3 = 16105300 / $3*10^8$ =0.05368s = 53.68ms

```
PING www.tu-berlin.de (130.149.7.201) 22(50) bytes of data.
30 bytes from tu-berlin.de (130.149.7.201): icmp_req=1 ttl=240 time=287 ms
30 bytes from tu-berlin.de (130.149.7.201): icmp_req=2 ttl=240 time=287 ms
30 bytes from tu-berlin.de (130.149.7.201): icmp_req=3 ttl=240 time=287 ms
30 bytes from tu-berlin.de (130.149.7.201): icmp_req=4 ttl=240 time=287 ms
```

RTT = 287 ms

RTT / T3 = 5.34 > 2

2、

The delay to destination vary over time, the reasons may be the congestion of server network, for example, at rush hours, the server we want to connect is overloaded or the bandwidth is not enough, therefore the delay will significantly increase compare to other time in a day.

3、

By using whois command, we can find that the server of website www.epfl.ch is in U.S., not in

Switzerland.

```
z5224151@vx2:/tmp_amd/kamen/export/kamen/4/z5224151/Desktop/9331$ nslookup www.epfl.ch
Server:         129.94.242.2
Address:        129.94.242.2#53

Non-authoritative answer:
www.epfl.ch     canonical name = www.epfl.ch.cdn.cloudflare.net.
Name:   www.epfl.ch.cdn.cloudflare.net
Address: 104.20.228.42
Name:   www.epfl.ch.cdn.cloudflare.net
Address: 104.20.229.42


NetRange:       104.16.0.0 - 104.31.255.255
CIDR:           104.16.0.0/12
NetName:        CLOUDFLARENET
NetHandle:      NET-104-16-0-0-1
Parent:         NET104 (NET-104-0-0-0-0)
NetType:        Direct Assignment
OriginAS:       AS13335
Organization:   Cloudflare, Inc. (CLOUD14)
RegDate:        2014-03-28
Updated:        2017-02-17
Comment:        All Cloudflare abuse reporting can be done via https://www.cloudflare.com/abuse
Ref:            https://rdap.arin.net/registry/ip/104.16.0.0


OrgName:        Cloudflare, Inc.
OrgId:          CLOUD14
Address:        101 Townsend Street
City:           San Francisco
StateProv:      CA
PostalCode:     94107
Country:        US
RegDate:        2010-07-09
Updated:        2019-09-25
Ref:            https://rdap.arin.net/registry/entity/CLOUD14
```

4、

Transmission delay depends on packet size, d_{trans} = L/R, the longer of the packet, the more delay may cause.

Processing delay also rely on the packet size, during processing of a packet, routers need time to check bit-level errors and determining where the next destination.

The other two delays: propagation delay and queuing delay have nothing to do with packet size.

The propagation delay depends on length of physical link and propagation speed in medium.

The queuing delay depends on congestion of router.