

COMP90007 Internet Technologies Lab – Network Analysis

Week 4

Slides

<https://github.com/SiaHuo/COMP90007Workshops>

If there is any error in slides, please point it out.
Please refer to solution on LMS for standard answers

Go to LMS – Assignment - Network Analysis Assignment

-  [Network Analysis Assignment Sem 2 2018.pdf](#)  (115.162 KB)
-  [NeCTAR Tutorial.pdf](#)  (4.244 MB)
-  [Unix Server Access\(1\).pdf](#)  (675.146 KB)
-  [Commonly Asked Questions.pdf](#)  (316.812 KB)

It is recommended that you perform these tasks in a consistent networking environment to reduce the variance in your results

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Experiment 1 -- Measuring the hop count

traceroute/tracert(packet)

Represent the hop number from the source to the target

Mac User: Open Terminal

traceroute –nw 1 cis.unimelb.edu.au

Windows User: Open Command Prompt

tracert cis.unimelb.edu.au

Computer network diagnostic tool for displaying the route and measuring transit delays of packets across an Internet Protocol (IP)

Mac User: Open Terminal

traceroute -nw 1 cis.unimelb.edu.au

traceoute -P icmp cis.unimelb.edu.au

Windows User: Open Command Prompt

tracert cis.unimelb.edu.au

Hop #	RTT 1	RTT 2	RTT 3	Name/IP Address
1	<1 ms	<1 ms	<1 ms	10.98.228.1
2	*	*	*	Request timed out.
3	*	*	*	Request timed out.
4	<1 ms	<1 ms	<1 ms	172.18.68.1
5	<1 ms	<1 ms	<1 ms	172.18.68.3
6	1 ms	1 ms	1 ms	br-200_po21.unimelb.net.au [172.18.66.217]
7	1 ms	1 ms	1 ms	br-266-te-2-3-v89.unimelb.net.au [172.18.66.234]
8	1 ms	1 ms	1 ms	172.18.66.253
9	1 ms	1 ms	1 ms	172.19.1.181
10	1 ms	1 ms	1 ms	172.18.66.137
11	1 ms	1 ms	1 ms	pe1-266-vss-vpn-research-v3755.unimelb.net.au [172.18.86.73]
12	5 ms	3 ms	1 ms	ce1-266-1-res-vpn-research-v3755.unimelb.net.au [172.18.86.76]
13	1 ms	1 ms	1 ms	4000v-eng-web-departments-l.eng.unimelb.edu.au [128.250.106.72]
Trace complete.				
C:\Users\huor>				

**** time out hops still count

Mac User: Open Terminal

traceroute -nw 1 cis.unimelb.edu.au

traceoute -P icmp cis.unimelb.edu.au

Windows User: Open Command Prompt

tracert cis.unimelb.edu.au

Hop #	RTT 1	RTT 2	RTT 3	Name/IP Address
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4	<1 ms	<1 ms	<1 ms	172.18.68.1
5	<1 ms	<1 ms	<1 ms	172.18.68.3
6	1 ms	1 ms	1 ms	br-200_po21.unimelb.net.au [172.18.66.217]
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13	1 ms	1 ms	1 ms	4000v-eng-web-departments-l.eng.unimelb.edu.au [128.250.106.72]
Trace complete.				
C:\Users\huor>				
*** time out hops stat count				

Parameters

Mac User: **man traceroute**

Windows User: **tracert /?**

```
C:\Users\huor>tracert /?

Usage: tracert [-d] [-h maximum_hops] [-j host-list] [-w timeout]
                [-R] [-S srcaddr] [-4] [-6] target_name

Options:
  -d                      Do not resolve addresses to hostnames.
  -h maximum_hops          Maximum number of hops to search for target.
  -j host-list             Loose source route along host-list (IPv4-only).
  -w timeout               Wait timeout milliseconds for each reply.
  -R                      Trace round-trip path (IPv6-only).
  -S srcaddr               Source address to use (IPv6-only).
  -4                      Force using IPv4.
  -6                      Force using IPv6.
```

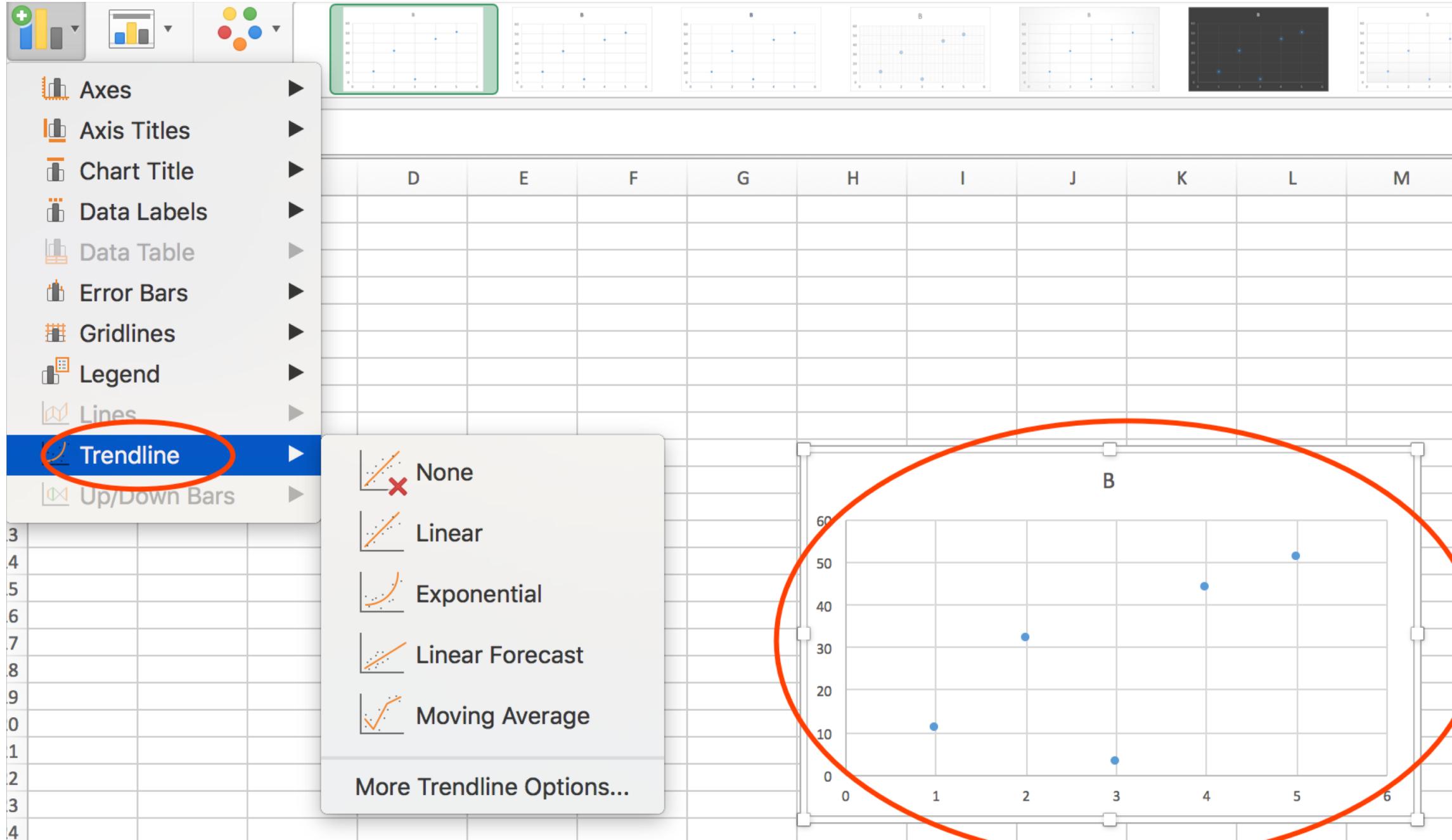
Task 1

Plot the hop count versus the approximate geographical distance from Melbourne. Do you observe a correlation? Why? Why not?

For finding out the physical geographical distance you may use any tool or application available online, for example, you may use a combination of: <https://db-ip.com> and <https://www.freemaptools.com/how-far-is-it-between.htm> or <https://www.site24x7.com/find-website-location.html> and <https://www.distancecalculator.net/> or anything of your choice. However, do make sure to document it and provide the appropriate reference to that application/ tool/ software used.

Table 1: List of public iperf hosts

Host	Location
iperf.he.net	USA
bouygues.testdebit.info	France
iperf.comneonext.de	Germany
ikoula.testdebit.info	France
st2.nn.ertelecom.ru	Russia
iperf.biznetnetworks.com	Indonesia
iperf.scottlinux.com	USA
speedtest.serverius.net	Netherlands



Experiment 2 Measuring delay and jitter

ping

Windows User: **ping cis.unimelb.edu.au**

Mac User: **ping -c 5 cis.unimelb.edu.au**

Windows User: **ping cis.unimelb.edu.au**

Mac User: **ping -c 5 cis.unimelb.edu.au**

```
C:\Users\huor>ping cis.unimelb.edu.au

Pinging cis.unimelb.edu.au [128.250.106.72] with 32 bytes of data:
Reply from 128.250.106.72: bytes=32 time=1ms TTL=52

Ping statistics for 128.250.106.72:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 1ms, Maximum = 1ms, Average = 1ms
```

Round-trip time (RTT): is the length of time it takes for a single to be sent plus the length of time it takes for an acknowledgement of that signal to be received.

Jitter

How to calculate jitter?

The standard deviation of the round-trip delay time will be taken as the value for jitter for this project

The standard deviation measures the variation in a set of data. It is defined as the square root of the variance and **is expressed as follows :**

$$\sigma = \sqrt{\frac{1}{N-1} \sum_{i=1}^N (x_i - \bar{x})^2}$$

where \bar{x} is the mean of the set of data.

Task 2

Run the ping command 3 times of each host, and find the average round-trip delay and jitter by calculating the standard deviation, for each host in Table1

$$\sigma = \sqrt{\frac{1}{N-1} \sum_{i=1}^N (x_i - \bar{x})^2}$$

Table 1: List of public iperf hosts

Host	Location
iperf.he.net	USA
bouygues.testdebit.info	France
iperf.comneonext.de	Germany
ikoula.testdebit.info	France
st2.nn.ertelecom.ru	Russia
iperf.biznetnetworks.com	Indonesia
iperf.scottlinux.com	USA
speedtest.serverius.net	Netherlands

For each of the above hosts, plot the average round-trip delay versus the approximate physical geographical distance to the server. Do the same with the jitter (i.e. jitter vs geo distance).

Experiment 3 Bandwidth

iperf

- Download to your own laptop
- Use university servers: digitalis, digitalis2

Server mode –s / Client mode –c

- Server mode: iperf3 –s
- Client mode: **iperf3 -c iperf.eenet.ee**

An iperf instance running in client mode will connect to the server, and packets will be exchanged and timed between the two hosts to calculate the bandwidth

iperf3 -c bouygues.iperf.fr

```
-bash-4.2$ iperf3 -c bouygues.iperf.fr
Connecting to host bouygues.iperf.fr, port 5201
[ 4] local 128.250.106.77 port 40588 connected to 89.84.1.222 port 5201
[ ID] Interval          Transfer     Bandwidth      Retr  Cwnd
[ 4]  0.00-1.00  sec   393 KBytes   3.22 Mbits/sec    0   56.6 KBytes
[ 4]  1.00-2.00  sec   2.12 MBytes  17.8 Mbits/sec    0   451 KBytes
[ 4]  2.00-3.00  sec   3.62 MBytes  30.4 Mbits/sec    0   3.51 MBytes
[ 4]  3.00-4.00  sec   8.75 MBytes  73.4 Mbits/sec    0   6.00 MBytes
[ 4]  4.00-5.00  sec  12.5 MBytes  105 Mbits/sec    0   6.00 MBytes
[ 4]  5.00-6.00  sec   8.75 MBytes  73.4 Mbits/sec    0   6.00 MBytes
[ 4]  6.00-7.00  sec   8.75 MBytes  73.4 Mbits/sec    0   6.00 MBytes
[ 4]  7.00-8.00  sec   8.75 MBytes  73.4 Mbits/sec    0   6.00 MBytes
[ 4]  8.00-9.00  sec   8.75 MBytes  73.4 Mbits/sec    0   6.00 MBytes
[ 4]  9.00-10.00  sec  11.2 MBytes  94.4 Mbits/sec   0   6.00 MBytes
-
[ ID] Interval         Transfer     Bandwidth      Retr
[ 4]  0.00-10.00  sec  73.6 MBytes  61.8 Mbits/sec   0             sender
[ 4]  0.00-10.00  sec  73.4 MBytes  61.5 Mbits/sec           receiver
```

- digitalis.eng.unimelb.edu.au (Runs iperf2; **Update:** Might have iperf3 as well now)
- digitalis2.eng.unimelb.edu.au (Runs iperf3; **Update:** Might have iperf2 as well now)

How to access to unimelb server: **deigitalis**, **digitalis2** (refer to the document on LMS)

- Mac user: **ssh username@digitalis2.eng.unimelb.edu.au**

```
my_new_host_name:~ Sia$ ssh huor@digitalis2.eng.unimelb.edu.au
The authenticity of host 'digitalis2.eng.unimelb.edu.au (128.250.106.77)' can't be established.
ECDSA key fingerprint is SHA256:M/geNfTEgVRt0rMYd0fA0hIb+TdHleSjyPFNpapXWTU.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added 'digitalis2.eng.unimelb.edu.au,128.250.106.77' (ECDSA) to the list of known hosts.
huor@digitalis2.eng.unimelb.edu.au's password:
```

- Windows user: **PuTTy**

Download a software called PuTTY, <http://www.putty.org/>



4000v-cis-digitalis-l.eng.unimelb.edu.au - PuTTY

Using username "rahuls2".

rahuls2@digitalis.eng.unimelb.edu.au's password:

After pressing enter, if your credentials are correct you will be shown a bash shell prompt.



4000v-cis-digitalis-l.eng.unimelb.edu.au - PuTTY

- □ ×

Using username "rahuls2".

rahuls2@digitalis.eng.unimelb.edu.au's password:

Last login: Fri Jul 21 21:18:44 2017 from e-nat-unimelb-128-250-0-195.uniaccess.unimelb.edu.au

-bash-4.1\$

VPN

The University Unix servers are pre-configured with Traceroute, Ping, and iperf (2 and 3) so you do not need to install anything yourself. You can logon to these servers (using SSH) and use these utility tools directly as long as you are connected to the University Network. If you wish to access these servers from your home then you need to use a VPN (CISCO VPN) in order to tunnel into the University network and SSH into these servers. You can download the VPN from here:

<http://studentit.unimelb.edu.au/findconnect/vpn>

Tips :

server

2. The server listed in the spec sheet is down, what do I do now ?

Ans. The servers presented in the spec sheet are public servers – not managed by the University of Melbourne. These are liable to go down at any given time, hence it is recommended you try and get your tests in as soon as possible for your sake. If you are still unable to connect to the servers then you might want to look at alternate servers available on the internet (any public iperf server will do). For ex - <https://iperf.fr/iperf-servers.php>.

You might also want to look at whether the server is responding to iperf2 if not to iperf3 just to be sure as some servers respond to only one of these.

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iperf.scottlinux.com	USA
speedtest.serverius.net	Netherlands

Tips :

Appendix

Important Note: When you run these commands, take a screenshot of the results obtained and place it in the appendix of the document. Reports failing to do so will be penalized. All plots however, should be placed in the main body of your report where you will explain the observations being derived.

Tips :

Consistency

You should test all 8 servers either on ur own laptop, or digitalis, or VM.
Do not mix.

It is recommended that you perform these tasks in a consistent networking environment to reduce the variance in your results

Tips :

Order

traceroute --- hop number
ping --- delay and jitter
iperf --- bandwidth

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