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50.005 Lab #5

Q1: For each host, record the percentage of packets sent that resulted in a successful response. Record also the minimum, average, and maximum round trip times for the packets that resulted in a response.

Website	Successful Percentage (%)	Min RTT (ms)	Average RTT (ms)	Max RTT (ms)
www.csail.mit.edu	100	5.557	7.336	10.452
www.berkeley.edu	100	213.461	270.683	321.709
www.usyd.edu.au	100	227.929	299.743	417.758
www.kyoto-u.ac.jp	100	81.805	99.320	126.517

Q2: Describe & explain the differences in the minimum round trip to each of these hosts

The trend of increasing RTT goes from MIT to Kyoto-u to Berkeley and to USYD. Theoretically, the further the destination is from SUTD, the longer the propagation time. Kyoto (Japan) is much nearer to us than Berkeley and USYD and thus has a much faster RTT. One anomaly is the RTT to MIT which is expected to be longer than Kyoto-u but ends up being way faster than the rest.

Q3: Repeat the exercise using packet sizes of 56, 512 and 1024 bytes. Record the minimum, average, and maximum round trip times for each of the packet sizes. Why are the minimum round-trip times to the same hosts different when using 56, 512, and 1024–byte packets?

Website	Data Byte Packet	Successful Percentage (%)	Min RTT (ms)	Average RTT (ms)	Max RTT (ms)
www.csail.mit.edu	56	100	6.124	7.982	11.532
	512	100	6.547	11.132	22.377
	1024	100	6.721	15.092	28.198
www.berkeley.edu	56	100	214.289	271.997	323.871
	512	100	211.415	278.058	331.812
	1024	100	215.219	277.638	412.297
www.usyd.edu.au	56	100	265.326	346.817	416.200
	512	100	287.325	383.164	480.410
	1024	100	289.120	385.182	492.176
www.kyoto-u.ac.jp	56	100	81.010	92.076	100.242
	512	100	83.075	95.934	120.209
	1024	100	94.953	97.219	126.288

From the table above, we can see that the minimum RTT to the same hosts are different when using packets of different sizes. The general trend is that larger packets have a longer RTT. This is likely to be due to longer transmission delay.

Q4: Record the percentage of the packets sent that resulted in a successful response. What are some possible reasons why you may not have received a response? (Be sure to check the host in a web browser.)

0% of the packets sent resulted in a successful response (100% packet loss).
Some possible reasons include:

- Security: The University of the Witwatersrand may have disabled ping responses for security reasons. (EG. to prevent people from sending very large packets to hosts and crash the system.)
- Congestion: The packets may be dropped due to a temporary congestion
- Misconfiguration: The network may be misconfigured

Q5: Explain how `traceroute` discovers a path to a remote host. (*Hint:* The `traceroute` manual will be helpful for answering this question.)

The traceroute command tracks the route an IP packet would follow to some internet host by launching probe packets with a small time to live (TTL) then listening for an ICMP "time exceeded" reply from a gateway. The probes are started with a TTL of one and increases by one until we get an ICMP "port unreachable" (or TCP reset), which means we got to the "host", or hit a max (which defaults to 30 hops).

Q6: Record the output of `traceroute` when run in both directions above.

New York:

Step	Time	Time	Time	Host name	IP address
1	1	<1	<1	72-9-99-137-cust-gw.reverse.ezzi.net	72.9.99.137
2	1	2	3	ads-psc-cr01.ezzi.net	96.45.77.1
3	1	<1	<1	ads-psc-ir01-v261.ezzi.net	72.9.111.109
4	2	1	1	ads-85t-ir01-vl2598-te6-4.ezzi.net	72.9.111.177
5	1	2	1	nyk-b5-link.telia.net	213.248.104.110
6	234	233	233	nyk-bb4-link.telia.net	80.91.254.15
7	68	68	69	sjo-b21-link.telia.net	62.115.119.229
8	233	233	233	snge-b1-link.telia.net	62.115.114.41
9	234	233	233	snge-b2-link.telia.net	62.115.135.175
10	234	234	234	starhub-ic-338377-snge-b2.c.telia.net	62.115.147.113
11	234	234	234		203.117.36.41
12	235	235	234		203.117.36.101
13	235	236	235		203.117.35.218
14	233	233	233		183.90.44.206
15	235	235	235		183.90.44.150
16	-	-	-		

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Amsterdam:

Step	Time	Time	Time	Host name	IP address
1	1	<1	<1		213.214.121.210
2	1	1	<1		213.214.116.98
3	1	1	1		213.214.116.2
4	1	1	1	amsix-200gbps.core1.ams1.he.net	80.249.209.150
5	14	10	10	100ge9-2.core1.par2.he.net	184.105.81.109
6	22	29	20	100ge6-1.core1.mrs1.he.net	184.105.222.22
7	158	158	158	100ge10-1.core1.sin1.he.net	184.105.65.13
8	184	184	191	starhub-internet-exchange-as-ap-as38861.e0-49.switch2.sin2.he.net	74.82.46.114
9	184	184	184		203.117.36.37
10	184	185	184		203.117.34.82
11	185	185	185		203.117.35.222
12	184	184	184		183.90.44.198
13	184	184	186		183.90.44.146
14	-	-	-		

Tokyo:

Step	Time	Time	Time	Host name	IP address
1	<1	<1	<1	hosted-by.i3d.net	31.204.145.129
2	<1	<1	<1	6939.tyo.equinix.com	203.190.230.40
3	53	53	53	100ge10-2.core1.hkg1.he.net	184.105.64.129
4	84	83	84	starhub-internet-exchange-as-ap-as38861.10gigabitethernet7-20.core1.hkg1.he.net	74.82.46.82
5	87	87	87		203.116.188.77
6	84	84	84		203.117.36.101
7	85	85	85		203.117.35.218
8	83	84	83		183.90.44.206
9	84	84	84		183.90.44.150
10	-	-	-		
11	-	-	-		
12	-	-	-		
13	-	-	-		
14	-	-	-		

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New York:

```
michellegoherhui@Michelles-MBP ~ $ traceroute 96.45.77.1
traceroute to 96.45.77.1 (96.45.77.1), 64 hops max, 52 byte packets
 1  linksys09678 (192.168.1.1)  2.683 ms  1.152 ms  0.974 ms
 2  182.55.228.3 (182.55.228.3)  3.968 ms  3.314 ms  4.303 ms
 3  183.90.44.145 (183.90.44.145)  4.416 ms  4.038 ms
    183.90.44.149 (183.90.44.149)  4.072 ms
 4  183.90.44.205 (183.90.44.205)  4.059 ms
    183.90.44.197 (183.90.44.197)  5.332 ms
    183.90.44.205 (183.90.44.205)  4.600 ms
 5  203.117.35.221 (203.117.35.221)  5.156 ms
    203.117.35.105 (203.117.35.105)  4.230 ms
    203.117.35.221 (203.117.35.221)  4.476 ms
 6  203.117.36.6 (203.117.36.6)  3.578 ms  4.283 ms
    203.117.34.81 (203.117.34.81)  4.581 ms
 7  203.116.188.34 (203.116.188.34)  4.554 ms
    203.117.36.38 (203.117.36.38)  4.553 ms
    203.116.188.38 (203.116.188.38)  4.075 ms
 8  snge-b2-link.telia.net (62.115.147.112)  9.528 ms  6.453 ms
    snge-b1-link.telia.net (62.115.11.217)  40.022 ms
 9  sjo-b21-link.telia.net (62.115.114.40)  166.697 ms  166.486 ms  166.788 ms
10  sjo-b21-link.telia.net (62.115.114.40)  171.700 ms  166.015 ms  167.009 ms
11  nyk-bb4-link.telia.net (62.115.119.228)  236.794 ms
    nyk-b5-link.telia.net (80.91.254.14)  236.575 ms
    nyk-b5-link.telia.net (62.115.115.1)  237.083 ms
12  coretech-ic-322321-nyk-b5.c.telia.net (213.248.104.111)  236.776 ms  236.568 ms
    nyk-b5-link.telia.net (62.115.115.1)  239.382 ms
13  coretech-ic-322321-nyk-b5.c.telia.net (213.248.104.111)  237.040 ms  236.647 ms  237.359 ms
14  ads-psc-cr01.ezzi.net (72.9.111.110)  238.219 ms  239.442 ms *
```

Amsterdam:

```
michellegoherhui@Michelles-MBP ~ $ traceroute 213.214.116.98
traceroute to 213.214.116.98 (213.214.116.98), 64 hops max, 52 byte packets
 1  linksys09678 (192.168.1.1)  1.540 ms  1.480 ms  1.383 ms
 2  182.55.228.3 (182.55.228.3)  4.179 ms  4.368 ms  4.566 ms
 3  183.90.44.145 (183.90.44.145)  6.897 ms
    183.90.44.149 (183.90.44.149)  3.839 ms
    183.90.44.145 (183.90.44.145)  4.181 ms
 4  183.90.44.197 (183.90.44.197)  4.621 ms
    183.90.44.205 (183.90.44.205)  11.489 ms
    183.90.44.197 (183.90.44.197)  4.394 ms
 5  203.117.35.221 (203.117.35.221)  4.198 ms
    203.117.35.193 (203.117.35.193)  4.187 ms
    203.117.35.221 (203.117.35.221)  4.431 ms
 6  203.117.34.85 (203.117.34.85)  4.317 ms
    203.117.34.81 (203.117.34.81)  3.962 ms
    203.117.36.6 (203.117.36.6)  4.185 ms
 7  203.116.188.38 (203.116.188.38)  4.395 ms
    203.117.36.42 (203.117.36.42)  7.735 ms
    203.116.188.34 (203.116.188.34)  4.600 ms
 8  an-uts-int12.starhub.net.sg (203.118.15.97)  4.402 ms  8.283 ms  4.467 ms
 9  203.118.15.133 (203.118.15.133)  4.700 ms
    203.118.15.10 (203.118.15.10)  4.961 ms
    203.118.15.133 (203.118.15.133)  4.793 ms
10  203.117.35.78 (203.117.35.78)  4.902 ms
    203.116.189.178 (203.116.189.178)  3.943 ms  5.333 ms
11  203.118.6.33 (203.118.6.33)  4.559 ms  4.329 ms
    203.118.6.29 (203.118.6.29)  4.318 ms
12  anutli13.starhub.net.sg (203.118.12.46)  5.397 ms
    anutli13.starhub.net.sg (203.118.12.42)  5.686 ms  8.116 ms
13  ip4.glo.combell.com (80.249.210.149)  186.851 ms  187.388 ms  187.590 ms
14  213.214.116.52 (213.214.116.52)  187.640 ms  186.965 ms  186.588 ms
15  213.214.116.98 (213.214.116.98)  187.927 ms  187.346 ms  186.935 ms
```

Tokyo:

```
michellegoherhui@Michelles-MBP ~ $ traceroute 203.190.230.40
traceroute to 203.190.230.40 (203.190.230.40), 64 hops max, 52 byte packets
 1  linksys09678 (192.168.1.1)  1.272 ms  1.031 ms  10.933 ms
 2  182.55.228.3 (182.55.228.3)  14.462 ms  4.059 ms  4.783 ms
 3  183.90.44.145 (183.90.44.145)  4.354 ms  4.168 ms
    183.90.44.149 (183.90.44.149)  3.939 ms
 4  183.90.44.205 (183.90.44.205)  4.758 ms  3.733 ms  4.217 ms
 5  203.117.35.105 (203.117.35.105)  3.983 ms
    203.117.35.193 (203.117.35.193)  3.790 ms
    203.117.35.217 (203.117.35.217)  4.432 ms
 6  203.117.36.6 (203.117.36.6)  4.022 ms
    203.117.34.85 (203.117.34.85)  4.130 ms  6.728 ms
 7  dsts03.starhub.net.sg (203.118.12.66)  150.339 ms
    ds-ts-04.starhub.net.sg (203.118.12.62)  196.071 ms  168.049 ms
 8  203.118.15.206 (203.118.15.206)  4.584 ms
    203.118.15.214 (203.118.15.214)  3.958 ms
    203.118.15.206 (203.118.15.206)  4.829 ms
 9  * * *
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```

Q7: Describe anything unusual you might observe about the output. Are the same routers traversed in both directions? If no, why might this be the case?

The routers traversed in both directions are not the same. This might be due to routing being a two-way process; the best path from a client to the site might not be the best path from the site to the client. Routers are likely to choose the least cost link to forward the packets and the costs may not be the same in both directions. Hence, there exists an asymmetry which is likely to have led to the different routers traversed in both directions.