

CS536 Homework1(Spring 23)

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1 Answer to Q1

(b) The number of hops and average round trip delays to each destination are summarized below.

Destination	Number of Hops	Average Round Trip Delay
www.cs.purdue.edu	7	3.104
www.google.com	16	49.2775
www.ntu.edu.sg	15	29.567

Table 1: Number of Hops and Average Round Trip Delay to Destination

(c) The hops in common after comparing all the hops to all the destinations are listed below.

Hop Name	IP Address
lamb-20-c7710-03-vlan1329.tcom.purdue.edu	10.186.176.10
tel-210-c7710-03-vlan3301.tcom.purdue.edu	172.28.163.66
lamb-20-c7710-03-vlan3014.tcom.purdue.edu	172.28.160.195

Table 2: Common Hops to the Destinations

Explanation: The traceroute was run from the **ARMS** building **B061** classroom. To reach each destination (www.cs.purdue.edu, www.google.com, and www.ntu.edu.sg) a packet has to leave the ARMS building and follow its path to destination. In the path to the three destinations, the listed three hops are common because the starting point and initial route is the same because its the the local gateway for our subnet. After that the paths diverges and we do not find any more hops in common.

(d) In the traceroute experiment to www.ntu.edu.sg, the largest delay on one hop occurs at the **lo-0.1.rtr.star.indiana.gigapop.net (149.165.255.9)** hop. In line 8 of the traceroute it takes **86.185** ms and in line 9 it takes **86.151** ms. This is because it can be visited in two different routes to the destination. The average delay is $(86.185 + 86.151)/2 = \mathbf{86.168}$ ms.

2 Answer to Q2

(b) For this task, the google.pcap packet trace was picked and Wireshark was used to locate the records to each traceroute's response by filtering the ICMP packets. These records are shown in Figure 1.

(c) **172.28.160.195** was the intermediate router selected with three delay values and all the packets to/from this router were located by the filter "**ip.src == 172.28.160.195**" in Wireshark. These records are shown in Figure 2.

No.	Time	Source	Destination	Protocol	Info	Length
84.3.933287	172.28.176.10	10.186.188.100	ICMP	Time-to-live exceeded (Time to live exceeded in transit)	70	
85.3.9345617	10.186.176.10	10.186.188.100	ICMP	Time-to-live exceeded (Time to live exceeded in transit)	70	
86.3.9345635	10.186.176.10	10.186.188.100	ICMP	Time-to-live exceeded (Time to live exceeded in transit)	70	
88.3.9352060	172.28.163.67	10.186.188.100	ICMP	Time-to-live exceeded (Time to live exceeded in transit)	70	
89.3.9352073	172.28.160.195	10.186.188.100	ICMP	Time-to-live exceeded (Time to live exceeded in transit)	70	
90.3.9352074	172.28.249.24	10.186.188.100	ICMP	Time-to-live exceeded (Time to live exceeded in transit)	70	
91.3.9360185	172.28.160.195	10.186.188.100	ICMP	Time-to-live exceeded (Time to live exceeded in transit)	70	
92.3.9360187	172.28.249.18	10.186.188.100	ICMP	Time-to-live exceeded (Time to live exceeded in transit)	70	
93.3.9360188	192.168.18.4	10.186.188.100	ICMP	Time-to-live exceeded (Time to live exceeded in transit)	186	
94.3.9360189	172.28.160.195	10.186.188.100	ICMP	Time-to-live exceeded (Time to live exceeded in transit)	70	
95.3.9360190	172.28.249.90	10.186.188.100	ICMP	Time-to-live exceeded (Time to live exceeded in transit)	70	
96.3.9360192	172.28.249.18	10.186.188.100	ICMP	Time-to-live exceeded (Time to live exceeded in transit)	70	
97.3.9360193	192.168.18.6	10.186.188.100	ICMP	Time-to-live exceeded (Time to live exceeded in transit)	70	
98.3.9360194	192.168.18.8	10.186.188.100	ICMP	Time-to-live exceeded (Time to live exceeded in transit)	186	
100.3.9378446	172.28.163.66	10.186.188.100	ICMP	Time-to-live exceeded (Time to live exceeded in transit)	70	
101.3.9386277	172.28.163.66	10.186.188.100	ICMP	Time-to-live exceeded (Time to live exceeded in transit)	70	
104.3.9420461	172.28.249.1	10.186.188.100	ICMP	Time-to-live exceeded (Time to live exceeded in transit)	70	
140.4.0137321	172.28.249.1	10.186.188.100	ICMP	Time-to-live exceeded (Time to live exceeded in transit)	70	
140.4.0141296	172.28.249.90	10.186.188.100	ICMP	Time-to-live exceeded (Time to live exceeded in transit)	70	
147.4.0145583	172.28.249.88	10.186.188.100	ICMP	Time-to-live exceeded (Time to live exceeded in transit)	70	
154.4.0260384	72.14.218.180	10.186.188.100	ICMP	Time-to-live exceeded (Time to live exceeded in transit)	102	
158.4.0305646	192.5.40.187	10.186.188.100	ICMP	Time-to-live exceeded (Time to live exceeded in transit)	70	
159.4.0305649	192.5.40.187	10.186.188.100	ICMP	Time-to-live exceeded (Time to live exceeded in transit)	70	
160.4.0305651	192.5.40.187	10.186.188.100	ICMP	Time-to-live exceeded (Time to live exceeded in transit)	70	
161.4.0305652	192.5.40.187	10.186.188.100	ICMP	Time-to-live exceeded (Time to live exceeded in transit)	70	
162.4.0305656	149.189.9.133	10.186.188.100	ICMP	Time-to-live exceeded (Time to live exceeded in transit)	70	
164.4.0323761	149.189.9.133	10.186.188.100	ICMP	Time-to-live exceeded (Time to live exceeded in transit)	70	
165.4.0323780	149.189.9.133	10.186.188.100	ICMP	Time-to-live exceeded (Time to live exceeded in transit)	70	
166.4.0323782	72.14.218.180	10.186.188.100	ICMP	Time-to-live exceeded (Time to live exceeded in transit)	182	
167.4.0323783	149.189.9.133	10.186.188.100	ICMP	Time-to-live exceeded (Time to live exceeded in transit)	70	
168.4.0328210	72.14.218.180	10.186.188.100	ICMP	Time-to-live exceeded (Time to live exceeded in transit)	70	
170.4.0361601	149.189.9.133	10.186.188.100	ICMP	Time-to-live exceeded (Time to live exceeded in transit)	70	
181.4.0394545	149.165.183.86	10.186.188.100	ICMP	Time-to-live exceeded (Time to live exceeded in transit)	70	
182.4.0394548	149.165.255.9	10.186.188.100	ICMP	Time-to-live exceeded (Time to live exceeded in transit)	70	
183.4.0406243	149.165.255.9	10.186.188.100	ICMP	Time-to-live exceeded (Time to live exceeded in transit)	70	
189.4.0521083	142.251.60.209	10.186.188.100	ICMP	Time-to-live exceeded (Time to live exceeded in transit)	102	
192.4.0547051	108.170.243.225	10.186.188.100	ICMP	Time-to-live exceeded (Time to live exceeded in transit)	110	
195.4.0605106	108.170.243.175	10.186.188.100	ICMP	Time-to-live exceeded (Time to live exceeded in transit)	70	
196.4.0605190	108.170.243.105	10.186.188.100	ICMP	Time-to-live exceeded (Time to live exceeded in transit)	110	
197.4.0605205	142.251.60.18	10.186.188.100	ICMP	Time-to-live exceeded (Time to live exceeded in transit)	192	
198.4.0605206	108.170.243.197	10.186.188.100	ICMP	Time-to-live exceeded (Time to live exceeded in transit)	110	
199.4.0605207	108.170.243.105	10.186.188.100	ICMP	Time-to-live exceeded (Time to live exceeded in transit)	110	
208.4.0871173	142.250.198.132	10.186.188.100	ICMP	Destination unreachable (Port unreachable)	70	
201.4.0871176	142.251.233.222	10.186.188.100	ICMP	Time-to-live exceeded (Time to live exceeded in transit)	70	
282.4.0907038	142.250.198.132	10.186.188.100	ICMP	Destination unreachable (Port unreachable)	70	
289.4.1631252	142.250.198.132	10.186.188.100	ICMP	Destination unreachable (Port unreachable)	70	

Frame 84: 70 bytes on wire (560 bits), 70 bytes captured (560 bits) on interface wlp3s0, id 0

0000 5c 0f 7d a9 da 00 de fb 79 64 c1 08 00 45 00 \g.....yd...E

Internet Control Message Protocol: Protocol Packets: 283 - Displayed: 46 (16.3%) Profile: Default

Figure 1: Each traceroute's response in Google.pcap

google.pcapng

FileEditViewGoCaptureAnalyzeStatisticsTelephonyWirelessToolsHelp

ip.src == 172.28.160.195

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Figure 2: Packets to/from intermediate router 172.28.160.195

3 Bonus

I picked **172.28.160.195** (lamb-20-c7710-03-vlan3014.tcom.purdue.edu) as intermediate router and used Wireshark to capture packet traces while running ping.

Protocols Used: Protocol used for ping is **ICMP**.