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CSE310

Programming Assignment 3

04-20-2022

Grace hours used: 1 Hour: PA1 and 27 hours: PA2 and 21 hours: PA3 = 49 hours used)

(No need to use the remaining 11 grace hours)

## Part A.

**Test your client by sending packets to localhost, that is, 127.0.0.1**

Pinging Local Host (127.0.0.1)

```
Pinging 127.0.0.1 using Python:
36 bytes from 127.0.0.1; time=0.0ms
36 bytes from 127.0.0.1; time=0.5016326904296875ms
36 bytes from 127.0.0.1; time=1.3000965118408203ms
36 bytes from 127.0.0.1; time=1.0135173797607422ms
36 bytes from 127.0.0.1; time=0.9999275207519531ms
--- 127.0.0.1 ping statistics ---
round-trip min/avg/max 0.0/0.7630348205566406/1.3000965118408203 ms
```

**Test your client by sending packets to stonybrook.edu or cs.stonybrook.edu.**

Pinging cs.stonybrook.edu (23.185.0.2)

```
Pinging 23.185.0.2 using Python:
36 bytes from 23.185.0.2; time=10.841131210327148ms
36 bytes from 23.185.0.2; time=4.516839981079102ms
36 bytes from 23.185.0.2; time=0.0ms
36 bytes from 23.185.0.2; time=6.039619445800781ms
36 bytes from 23.185.0.2; time=5.141258239746094ms
--- 23.185.0.2 ping statistics ---
round-trip min/avg/max 0.0/5.307769775390625/10.841131210327148 ms
```

**Select and ping 4 root servers outside the U.S.**

Pinging Sweden (192.36.148.17)

```
Pinging 192.36.148.17 using Python:
36 bytes from 192.36.148.17; time=150.0232219696045ms
36 bytes from 192.36.148.17; time=139.9862766265869ms
36 bytes from 192.36.148.17; time=47.58191108703613ms
36 bytes from 192.36.148.17; time=16.779422760009766ms
36 bytes from 192.36.148.17; time=26.96084976196289ms
--- 192.36.148.17 ping statistics ---
round-trip min/avg/max 16.779422760009766/76.26633644104004/150.0232219696045 ms
```

Pinging the Netherlands (193.0.14.129)

```
Pinging 193.0.14.129 using Python:
36 bytes from 193.0.14.129; time=100.44288635253906ms
36 bytes from 193.0.14.129; time=96.50444984436035ms
36 bytes from 193.0.14.129; time=97.03469276428223ms
36 bytes from 193.0.14.129; time=93.77288818359375ms
36 bytes from 193.0.14.129; time=87.127685546875ms
--- 193.0.14.129 ping statistics ---
round-trip min/avg/max 87.127685546875/94.97652053833008/100.44288635253906 ms
```

Pinging Japan (202.12.27.33)

```
Pinging 202.12.27.33 using Python:
36 bytes from 202.12.27.33; time=81.25782012939453ms
36 bytes from 202.12.27.33; time=80.30152320861816ms
36 bytes from 202.12.27.33; time=80.06167411804199ms
36 bytes from 202.12.27.33; time=78.38964462280273ms
36 bytes from 202.12.27.33; time=78.22751998901367ms
--- 202.12.27.33 ping statistics ---
round-trip min/avg/max 78.22751998901367/79.64763641357422/81.25782012939453 ms
```

Pinging Los Angeles, California (199.7.83.42)

```
Pinging 199.7.83.42 using Python:
36 bytes from 199.7.83.42; time=64.41450119018555ms
36 bytes from 199.7.83.42; time=64.23449516296387ms
36 bytes from 199.7.83.42; time=62.58201599121094ms
36 bytes from 199.7.83.42; time=62.54744529724121ms
36 bytes from 199.7.83.42; time=62.471866607666016ms
--- 199.7.83.42 ping statistics ---
round-trip min/avg/max 62.471866607666016/63.250064849853516/64.41450119018555 ms
```

**Explain the differences in minimum round trip time to each of these servers in parts A, B, and C:**

Beginning with the local host ping, I received the shortest time feedback from 127.0.0.1 because it is ping the local address, and it's a loopback. As a result, the average RTT of 0.763ms is a reasonable time because it never went to the network and also the quickest out of all of the other pings.

Next, as I pinged cs.stonybrook.edu, I received the average RTT of 5.307ms. The time it took to receive feedback is slightly longer than the localhost as it traveled through the Stony Brook network, however, it is still relatively quick as I pinged this on the Stony Brook campus with the Stony Brook wifi network connection.

Next, when it comes to pinging the root servers of foreign locations, the average RTT increased significantly, with Sweden averaging 76.266ms, the Netherlands averaging 94.976ms, and Japan averaging 79.647ms.

According to Piazza's post @178, there are only 3 root servers outside of the US we can find, so the last root server I decided to use is in Los Angeles, California, since it is a faraway state, it should be a reasonable location to ping. For Los Angeles, the average RTT is 63.250, which is lower than the international pings but higher than the local hosts and cs.stonybrook.edu.

In conclusion, the international pings have much higher RTT compared to the localhost and cs.stonybrook.edu because the roots that are outside of the US or Stony Brook are geographically further from my current location which is Stony Brook and as a result, it requires many more hops and ultimately more RTTs.

## Part B.

### (i). One ARP packet exchange

arp						
No.	Time	Source	Destination	Protocol	Length	Info
18	0.199077	IntelCor_9e:10:74	Broadcast	ARP	42	Who has 172.20.10.1? Tell 172.20.10.4
20	0.205247	ba:5d:0a:8a:1a:64	IntelCor_9e:10:...	ARP	42	172.20.10.1 is at ba:5d:0a:8a:1a:64

#### ARP Request Details:

```
~ Address Resolution Protocol (request)
  Hardware type: Ethernet (1)
  Protocol type: IPv4 (0x0800)
  Hardware size: 6
  Protocol size: 4
  Opcode: request (1)
  Sender MAC address: IntelCor_9e:10:74 (cc:f9:e4:9e:10:74)
  Sender IP address: 172.20.10.4
  Target MAC address: 00:00:00_00:00:00 (00:00:00:00:00:00)
  Target IP address: 172.20.10.1
```

#### ARP Reply Details:

```
~ Address Resolution Protocol (reply)
  Hardware type: Ethernet (1)
  Protocol type: IPv4 (0x0800)
  Hardware size: 6
  Protocol size: 4
  Opcode: reply (2)
  Sender MAC address: ba:5d:0a:8a:1a:64 (ba:5d:0a:8a:1a:64)
  Sender IP address: 172.20.10.1
  Target MAC address: IntelCor_9e:10:74 (cc:f9:e4:9e:10:74)
  Target IP address: 172.20.10.4
```

(ii) Based on the ARP messages, tell us the IP address and MAC address of your router.  
Explain how you determined this.

**Router IP address: 172.20.10.1 and MAC address: ba:5d:0a:8a:1a:64**

Because the reply originated from the router and my computer sends out broadcast messages to routers to find out who has the router's ip address so that the sender IP and MAC address from the ARP reply packet will be my routers IP address and MAC address and shown in the image above.

While my own computer's IP address is 172.20.10.4 and my MAC address is cc:f9:e4:9e:10:74, and can be confirmed by doing ipconfig, the command prompt also shows the correct and corresponding addresses.

## Part B outputs:

```
Enter the pcap file: assignment3_my_arp.pcap

This pcap file contains 7 ARP packets and 2 ARP Request packets and 2 ARP Reply packets and 3 ARP Probe packets.

Below is One ARP Exchange:

Hardware Type: Ethernet
Protocol Type: IPv4
Hardware size: 6
Protocal Size: 4
Opcode: 1 REQUEST
Sender MAC address: cc:f9:e4:9e:10:74
Sender IP: 172.20.10.4
Target MAC address: 00:00:00:00:00:00
Target IP: 172.20.10.1

Hardware Type: Ethernet
Protocol Type: IPv4
Hardware size: 6
Protocal Size: 4
Opcode: 2 REPLY
Sender MAC address: ba:5d:0a:8a:1a:64
Sender IP: 172.20.10.1
Target MAC address: cc:f9:e4:9e:10:74
Target IP: 172.20.10.4
PS C:\Users\jacky\Desktop\SBU\SPRING 2022 Classes\CSE310\Chow-Jacky-assignment3\root> 
```