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Programming Assignment 3: ICMP Ping and ARP Packet Capture and Analysis

CSE 310, Spring 2022

Instructor: Aruna Balasubramanian

Due date: April 19 2022, 9.00pm

Part A: ICMP Ping Tool

- A. Test your client by sending packets to localhost, 127.0.0.1:

```
(base) nicoleniemiec@Nicoles-MBP niemiec-nicole-assignment3 % python3 sample_pinger.py 127.0.0.1
Pinging 127.0.0.1 using Python:
8 bytes from 127.0.0.1; time = 0.05507469177246094 ms
8 bytes from 127.0.0.1; time = 0.080108642578125 ms
8 bytes from 127.0.0.1; time = 0.10013580322265625 ms
8 bytes from 127.0.0.1; time = 0.014781951904296875 ms
8 bytes from 127.0.0.1; time = 0.09179115295410156 ms
8 bytes from 127.0.0.1; time = 0.08320808410644531 ms
8 bytes from 127.0.0.1; time = 0.11229515075683594 ms
8 bytes from 127.0.0.1; time = 0.07104873657226562 ms
8 bytes from 127.0.0.1; time = 0.0901222290039062 ms
8 bytes from 127.0.0.1; time = 0.07581710815429688 ms
^C- - - Ping statistics for 127.0.0.1:
    Packets: Sent = 10, Received = 10, Lost = 0 (0% loss),
Approximate statistics in milli-seconds:
    Minimum round-trip = 0ms, Maximum round-trip = 0ms, Average round-trip = 0ms
```

- B. Test your client by sending packets to stonybrook.edu or cs.stonybrook.edu:

- a. cs.stonybrook.edu

```
(base) nicoleniemiec@Nicoles-MBP pinger % python3 sample_pinger.py cs.stonybrook.edu
Pinging 23.185.0.2 using Python:
8 bytes from 23.185.0.2; time = 10 ms
8 bytes from 23.185.0.2; time = 13 ms
8 bytes from 23.185.0.2; time = 20 ms
8 bytes from 23.185.0.2; time = 13 ms
8 bytes from 23.185.0.2; time = 11 ms
8 bytes from 23.185.0.2; time = 16 ms
8 bytes from 23.185.0.2; time = 8 ms
8 bytes from 23.185.0.2; time = 14 ms
8 bytes from 23.185.0.2; time = 7 ms
^C- - - Ping statistics for cs.stonybrook.edu:
    Packets: Sent = 9, Received = 9, Lost = 0 (0% loss),
Approximate statistics in milli-seconds:
    Minimum round-trip = 7ms, Maximum round-trip = 20ms, Average round-trip = 12ms
```

- b. stonybrook.edu

```
(base) nicoleniemiec@Nicoles-MBP pinger % python3 sample_pinger.py stonybrook.edu
Pinging 129.49.2.176 using Python:
Request timed out.
Request timed out.
Request timed out.
Request timed out.
Request timed out.
Request timed out.
Request timed out.
^C- - - Ping statistics for stonybrook.edu:
    Packets: Sent = 8, Received = 0, Lost = 8 (100% loss),
```

C. Select and ping 4 root servers (3 outside the US and one in the US):

a. 192.36.148.17, Sweden

```
(base) nicoleniemiec@Nicoles-MBP niemiec-nicole-assignment3 % python3 sample_pinger.py 192.36.148.17
Pinging 192.36.148.17 using Python:
8 bytes from 192.36.148.17: time = 172 ms
8 bytes from 192.36.148.17: time = 170 ms
8 bytes from 192.36.148.17: time = 167 ms
8 bytes from 192.36.148.17: time = 165 ms
8 bytes from 192.36.148.17: time = 169 ms
8 bytes from 192.36.148.17: time = 167 ms
8 bytes from 192.36.148.17: time = 164 ms
8 bytes from 192.36.148.17: time = 166 ms
8 bytes from 192.36.148.17: time = 164 ms
8 bytes from 192.36.148.17: time = 171 ms
8 bytes from 192.36.148.17: time = 164 ms
8 bytes from 192.36.148.17: time = 172 ms
8 bytes from 192.36.148.17: time = 164 ms
^C- - - Ping statistics for 192.36.148.17:
    Packets: Sent = 13, Received = 13, Lost = 0 (0% loss),
Approximate statistics in milli-seconds:
    Minimum round-trip = 164ms, Maximum round-trip = 172ms, Average round-trip = 167ms
```

b. 193.0.14.129, Netherlands

```
(base) nicoleniemiec@Nicoles-MBP niemiec-nicole-assignment3 % python3 sample_pinger.py 193.0.14.129
Pinging 193.0.14.129 using Python:
8 bytes from 193.0.14.129: time = 38 ms
8 bytes from 193.0.14.129: time = 43 ms
8 bytes from 193.0.14.129: time = 41 ms
8 bytes from 193.0.14.129: time = 43 ms
8 bytes from 193.0.14.129: time = 35 ms
8 bytes from 193.0.14.129: time = 41 ms
8 bytes from 193.0.14.129: time = 35 ms
8 bytes from 193.0.14.129: time = 36 ms
8 bytes from 193.0.14.129: time = 34 ms
8 bytes from 193.0.14.129: time = 35 ms
8 bytes from 193.0.14.129: time = 35 ms
^C- - - Ping statistics for 193.0.14.129:
    Packets: Sent = 11, Received = 11, Lost = 0 (0% loss),
Approximate statistics in milli-seconds:
    Minimum round-trip = 34ms, Maximum round-trip = 43ms, Average round-trip = 38ms
```

c. 202.12.27.33, Japan

```
(base) nicoleniemiec@Nicoles-MBP niemiec-nicole-assignment3 % python3 sample_pinger.py 202.12.27.33
Pinging 202.12.27.33 using Python:
8 bytes from 202.12.27.33; time = 189 ms
8 bytes from 202.12.27.33; time = 167 ms
8 bytes from 202.12.27.33; time = 173 ms
8 bytes from 202.12.27.33; time = 174 ms
8 bytes from 202.12.27.33; time = 174 ms
8 bytes from 202.12.27.33; time = 168 ms
8 bytes from 202.12.27.33; time = 214 ms
8 bytes from 202.12.27.33; time = 173 ms
8 bytes from 202.12.27.33; time = 166 ms
8 bytes from 202.12.27.33; time = 174 ms
8 bytes from 202.12.27.33; time = 176 ms
^C- - - Ping statistics for 202.12.27.33:
        Packets: Sent = 11, Received = 11, Lost = 0 (0% loss),
Approximate statistics in milli-seconds:
        Minimum round-trip = 166ms, Maximum round-trip = 214ms, Average round-trip = 177ms
```

d. 192.5.5.241, Newmarket, New Hampshire

```
(base) nicoleniemiec@Nicoles-MBP niemiec-nicole-assignment3 % python3 sample_pinger.py 192.5.5.241
Pinging 192.5.5.241 using Python:
8 bytes from 192.5.5.241; time = 8 ms
8 bytes from 192.5.5.241; time = 7 ms
8 bytes from 192.5.5.241; time = 15 ms
8 bytes from 192.5.5.241; time = 15 ms
8 bytes from 192.5.5.241; time = 17 ms
8 bytes from 192.5.5.241; time = 14 ms
8 bytes from 192.5.5.241; time = 8 ms
8 bytes from 192.5.5.241; time = 16 ms
8 bytes from 192.5.5.241; time = 9 ms
^C- - - Ping statistics for 192.5.5.241:
        Packets: Sent = 9, Received = 9, Lost = 0 (0% loss),
Approximate statistics in milli-seconds:
        Minimum round-trip = 7ms, Maximum round-trip = 17ms, Average round-trip = 12ms
```

- D. Explain the differences in minimum round-trip time to each of these servers in parts A, B, and C:
- In Part A, we are pinging the localhost, or essentially looping back to our computer using the same server. This essentially takes no time since it is internal within our computers, hence why we have a minimum, average, and maximum round-trip time of 0ms.
 - In Part B, we ping both *cs.stonybrook.edu* and *stonybrook.edu*. In the case of *cs.stonybrook.edu*, we get a minimum round-trip time of 7ms. At the time of this assignment, I'm located on the south shore of Long Island which is close enough to Stony Brook to get a quick response. When we ping *stonybrook.edu*, we get an error: "Request timed out." This could mean that there is a firewall blocking our connection and that the destination host of *stonybrook.edu* was unreachable. It's interesting how *cs.stonybrook.edu* wouldn't have the same firewall, if this is the case.
 - Like mentioned in (b), I'm located on the south shore of Long Island, and we can conclude that geographic distance between servers has an effect on average round trip time. In part C, the highest minimum round-trip time is from the server located in Japan (166ms), then Sweden (164ms), and then the Netherlands (34ms). The quickest minimum round-trip time is from the server located in New Hampshire (7ms), which is the closest server to us out of the four.

Part B: ARP Packet Capture and Analysis

- (i) One ARP packet exchanged as captured in Wireshark and located in “assignment4_my_arp.pcap.”

No.	Time	Source	Destination	Protocol	Length	Info
121	2.456957	Verizon_37:fe:c9	Apple_07:56:7a	ARP	60	Who has 192.168.1.193? Tell 192.168.1.1
122	2.457034	Apple_07:56:7a	Verizon_37:fe:c9	ARP	42	192.168.1.193 is at f0:18:98:07:56:7a

```
(base) nicoleniemiec@Nicoles-MBP analysis_pcap_arp % python3 analysis_pcap_arp.py assignment4_my_arp.pcap
ARP request-response exchange information:

-----ARP REQUEST:
Header info:
Hardware Type: 1
Protocol Type: 0x0800
Hardware Size: 6
Protocol Size: 4
Opcode: request (1)
Sender MAC Address: 48:5d:36:37:fe:c9
Sender IP Address: 192.168.1.1
Target MAC Address: f0:18:98:07:56:7a
Target IP Address: 192.168.1.193

-----ARP RESPONSE:
Header info:
Hardware Type: 1
Protocol Type: 0x0800
Hardware Size: 6
Protocol Size: 4
Opcode: response (2)
Sender MAC Address: f0:18:98:07:56:7a
Sender IP Address: 192.168.1.193
Target MAC Address: 48:5d:36:37:fe:c9
Target IP Address: 192.168.1.193
```

- (ii) Based on the ARP messages, we are able to tell that my IP address and MAC address of my router is as follows: the IP address of my router is 192.168.1.1, my IPv4 address is 192.168.1.193, and my MAC address is f0:18:98:07:56:7a. We are able to determine this by isolating bits in the ARP header of both the response and request packets.

```
(base) nicoleniemiec@Nicoles-MBP analysis_pcap_arp % python3 analysis_pcap_arp.py assignment4_my_arp.pcap
ARP request-response exchange information:

-----ARP REQUEST:
Header info:
Hardware Type: 1
Protocol Type: 0x0800
Hardware Size: 6
Protocol Size: 4
Opcode: request (1)
Sender MAC Address: 48:5d:36:37:fe:c9
Sender IP Address: 192.168.1.1
Target MAC Address: f0:18:98:07:56:7a
Target IP Address: 192.168.1.193

-----ARP RESPONSE:
Header info:
Hardware Type: 1
Protocol Type: 0x0800
Hardware Size: 6
Protocol Size: 4
Opcode: response (2)
Sender MAC Address: f0:18:98:07:56:7a
Sender IP Address: 192.168.1.193
Target MAC Address: 48:5d:36:37:fe:c9
Target IP Address: 192.168.1.193
```