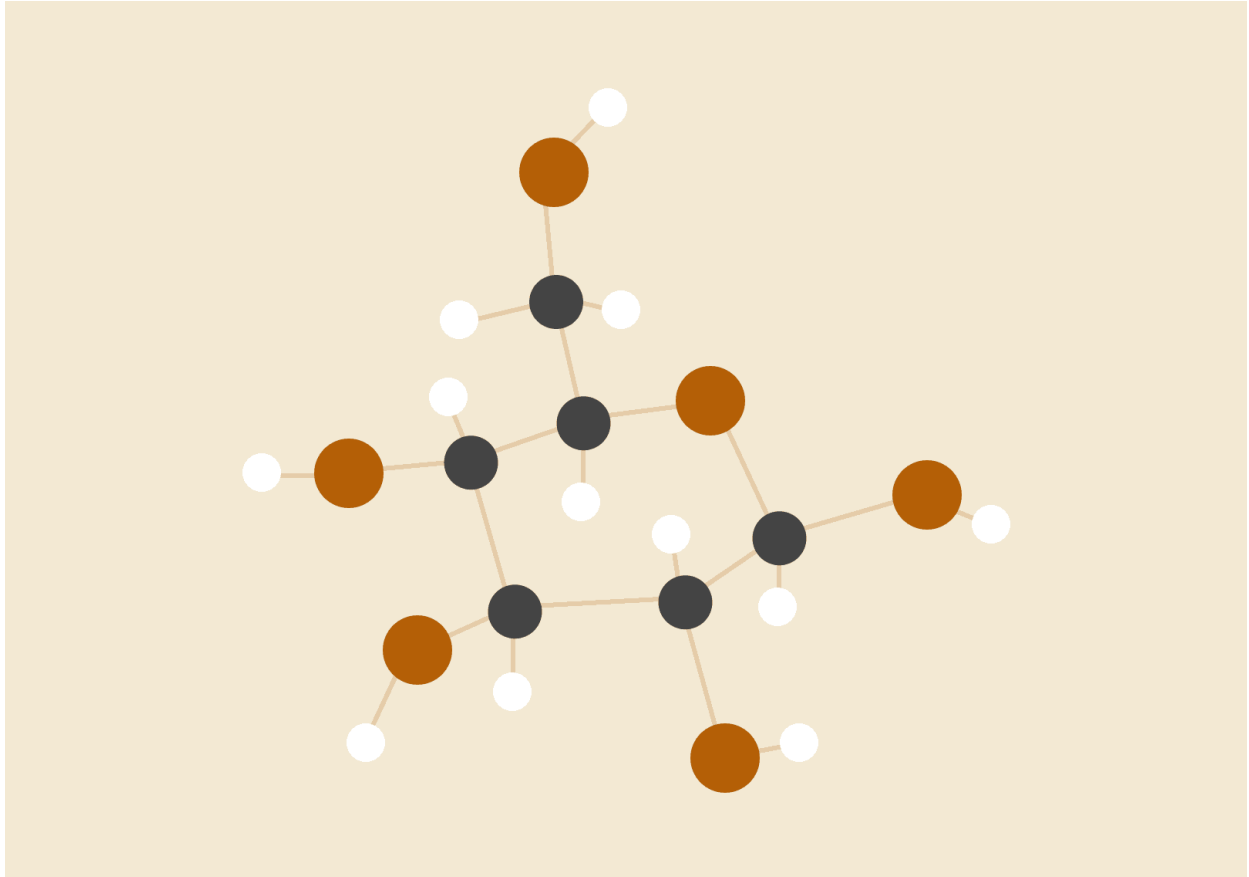


Computer Networks Lab 10



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1. Packet Sniffer sniffing sent and received packets:

Program Name: Q1.c

Compilation: gcc Q1.c -o Q1

Invocation: sudo ./Q1

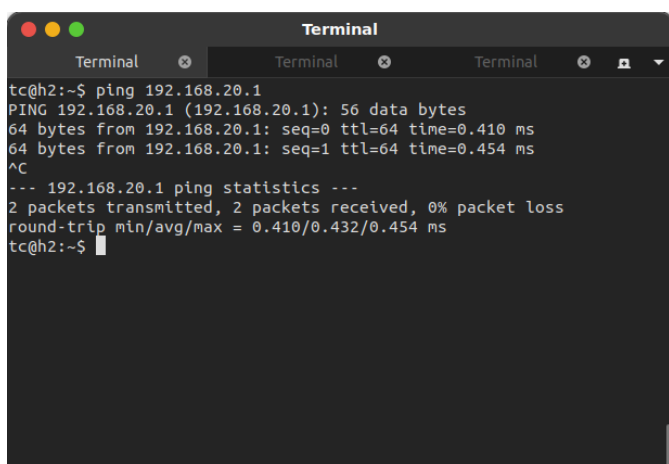
Algorithm Outline:

Initialization:

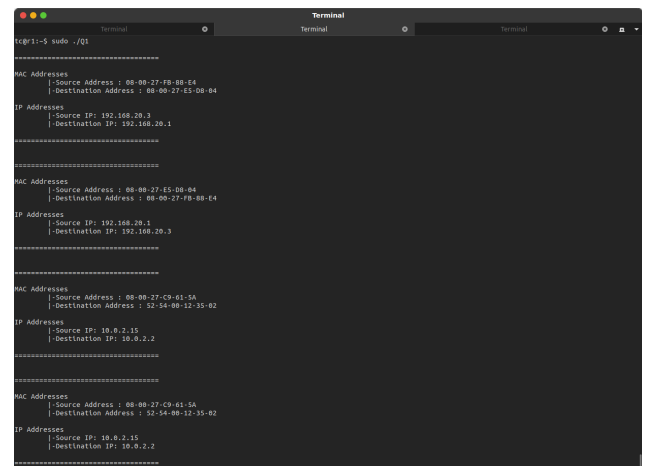
1. Initialize sockets, buffer and sockaddr_ll structure.

Algorithm:

1. Creating raw sockets with ETH_P_ALL protocol which listens to all activity on the network card.
2. Loop
 - a. Receive from all the interfaces
 - b. Process the received packets to extract the ethernet header and IP header.
 - c. From the ethernet header extract source and destination MAC addresses.
 - d. From the IP header extract source and destination IP addresses.



```
tc@h2:~$ ping 192.168.20.1
PING 192.168.20.1 (192.168.20.1): 56 data bytes
64 bytes from 192.168.20.1: seq=0 ttl=64 time=0.410 ms
64 bytes from 192.168.20.1: seq=1 ttl=64 time=0.454 ms
^C
--- 192.168.20.1 ping statistics ---
2 packets transmitted, 2 packets received, 0% packet loss
round-trip min/avg/max = 0.410/0.432/0.454 ms
tc@h2:~$
```



```
tc@h2:~$ sudo ./Q1

-----
MAC Addresses
|-Source Address : 08-00-27-F8-B8-E4
|-Destination Address : 08-00-27-E5-08-04
IP Addresses
|-Source IP: 192.168.20.3
|-Destination IP: 192.168.20.1
-----

-----
MAC Addresses
|-Source Address : 08-00-27-E5-08-04
|-Destination Address : 08-00-27-F8-B8-E4
IP Addresses
|-Source IP: 192.168.20.1
|-Destination IP: 192.168.20.3
-----

-----
MAC Addresses
|-Source Address : 08-00-27-C9-61-5A
|-Destination Address : 32-54-00-12-35-02
IP Addresses
|-Source IP: 10.0.2.15
|-Destination IP: 10.0.2.2
-----

-----
MAC Addresses
|-Source Address : 08-00-27-C9-61-5A
|-Destination Address : 32-54-00-12-35-02
IP Addresses
|-Source IP: 10.0.2.15
|-Destination IP: 10.0.2.2
-----
```

i) Pinging r1 from h2

```
Terminal
tc@r2:~$ ping 192.168.30.1
PING 192.168.30.1 (192.168.30.1): 56 data bytes
64 bytes from 192.168.30.1: seq=0 ttl=64 time=0.596 ms
64 bytes from 192.168.30.1: seq=1 ttl=64 time=0.568 ms
^C
--- 192.168.30.1 ping statistics ---
2 packets transmitted, 2 packets received, 0% packet loss
round-trip min/avg/max = 0.568/0.582/0.596 ms
tc@r2:~$
```

```
Terminal
tc@r1:~$ sudo ./Q1
=====
MAC Addresses
|-Source Address : 08-00-27-00-1F-5D
|-Destination Address : 08-00-27-00-7C-C0
IP Addresses
|-Source IP: 192.168.30.2
|-Destination IP: 192.168.30.1
=====
MAC Addresses
|-Source Address : 08-00-27-00-7C-C0
|-Destination Address : 08-00-27-00-1F-5D
IP Addresses
|-Source IP: 192.168.30.1
|-Destination IP: 192.168.30.2
=====
MAC Addresses
|-Source Address : 08-00-27-C9-01-5A
|-Destination Address : 32-54-00-12-35-02
IP Addresses
|-Source IP: 10.0.2.15
|-Destination IP: 10.0.2.2
=====
MAC Addresses
|-Source Address : 32-54-00-12-35-02
|-Destination Address : 08-00-27-C9-01-5A
IP Addresses
|-Source IP: 10.0.2.2
|-Destination IP: 10.0.2.15
=====
```

ii) Pinging r1 from r2

```
Terminal
tc@h1:~$ ping 192.168.20.1
PING 192.168.20.1 (192.168.20.1): 56 data bytes
64 bytes from 192.168.20.1: seq=0 ttl=64 time=0.737 ms
64 bytes from 192.168.20.1: seq=1 ttl=64 time=0.592 ms
64 bytes from 192.168.20.1: seq=2 ttl=64 time=0.604 ms
^C
--- 192.168.20.1 ping statistics ---
3 packets transmitted, 3 packets received, 0% packet loss
round-trip min/avg/max = 0.592/0.644/0.737 ms
tc@h1:~$
```

```
Terminal
tc@r1:~$ sudo ./Q1
=====
MAC Addresses
|-Source Address : 08-00-27-03-A5-05
|-Destination Address : FF-FF-FF-FF-FF-FF
IP Addresses
|-Source IP: 165.233.192.168
|-Destination IP: 20.2.0.6
=====
MAC Addresses
|-Source Address : 08-00-27-E5-08-04
|-Destination Address : 08-00-27-03-A5-05
IP Addresses
|-Source IP: 216.4.192.108
|-Destination IP: 20.2.0.6
=====
MAC Addresses
|-Source Address : 08-00-27-03-A5-05
|-Destination Address : 08-00-27-E5-08-04
IP Addresses
|-Source IP: 192.168.20.2
|-Destination IP: 192.168.20.1
=====
MAC Addresses
|-Source Address : 08-00-27-E5-08-04
|-Destination Address : 08-00-27-03-A5-05
IP Addresses
|-Source IP: 192.168.20.1
|-Destination IP: 192.168.20.2
=====
```

iii) Pinging r1 from h1

2. Packet Sniffer sniffing received packets on eth1:

Program Name: Q2.c

Compilation: gcc Q2.c -o Q2

Invocation: sudo ./Q2

Algorithm Outline:

Initialization:

1. Initialize sockets, buffer and sockaddr_ll structure.

Algorithm:

2. Creating raw sockets with ETH_P_IP protocol which listens to only IP packets on the network card.
3. Loop
 - a. Receive from all the interfaces
 - b. Filter only received packets using packet type field in sockaddr_ll structure.
 - c. Process the received packets to extract the ethernet header and IP header.
 - d. From the ethernet header extract source and destination MAC addresses.
 - e. From the IP header extract source and destination IP addresses.

```
Terminal
Terminal x Terminal x Terminal x Terminal x [ ] v
tc@h2:~$ ping 192.168.20.1
PING 192.168.20.1 (192.168.20.1): 56 data bytes
64 bytes from 192.168.20.1: seq=0 ttl=64 time=0.536 ms
64 bytes from 192.168.20.1: seq=1 ttl=64 time=0.451 ms
^C
--- 192.168.20.1 ping statistics ---
2 packets transmitted, 2 packets received, 0% packet loss
round-trip min/avg/max = 0.451/0.493/0.536 ms
tc@h2:~$
```

```
Terminal
Terminal x Terminal x Terminal x Terminal x [ ] v
tc@r1:~$ sudo ./Q2

=====
MAC Addresses
|-Source Address : 08-00-27-FB-88-E4
|-Destination Address : 08-00-27-E5-D8-04

IP Addresses
|-Source IP: 192.168.20.3
|-Destination IP: 192.168.20.1

=====

MAC Addresses
|-Source Address : 08-00-27-FB-88-E4
|-Destination Address : 08-00-27-E5-D8-04

IP Addresses
|-Source IP: 192.168.20.3
|-Destination IP: 192.168.20.1

=====
```

i) Pinging r1 from h2

```
Terminal
Terminal x Terminal x Terminal x Terminal x [ ] v
tc@r2:~$ ping 192.168.30.1
PING 192.168.30.1 (192.168.30.1): 56 data bytes
64 bytes from 192.168.30.1: seq=0 ttl=64 time=0.459 ms
64 bytes from 192.168.30.1: seq=1 ttl=64 time=0.527 ms
64 bytes from 192.168.30.1: seq=2 ttl=64 time=0.457 ms
^C
--- 192.168.30.1 ping statistics ---
3 packets transmitted, 3 packets received, 0% packet loss
round-trip min/avg/max = 0.457/0.481/0.527 ms
tc@r2:~$
```

```
Terminal
Terminal x Terminal x Terminal x Terminal x [ ] v
tc@r1:~$ sudo ./Q2
```

ii) Pinging r1 from r2 produces no response on r1 since r1 is listening on eth1 not eth2

```
Terminal
Terminal x Terminal x Terminal x Terminal x [ ] v
tc@h1:~$ ping 192.168.20.1
PING 192.168.20.1 (192.168.20.1): 56 data bytes
64 bytes from 192.168.20.1: seq=0 ttl=64 time=0.361 ms
64 bytes from 192.168.20.1: seq=1 ttl=64 time=0.593 ms
^C
--- 192.168.20.1 ping statistics ---
2 packets transmitted, 2 packets received, 0% packet loss
round-trip min/avg/max = 0.361/0.477/0.593 ms
tc@h1:~$
```

```
Terminal
Terminal x Terminal x Terminal x Terminal x [ ] v
tc@r1:~$ sudo ./Q2

=====
MAC Addresses
|-Source Address : 08-00-27-63-A5-D5
|-Destination Address : 08-00-27-E5-D8-04

IP Addresses
|-Source IP: 192.168.20.2
|-Destination IP: 192.168.20.1

=====

MAC Addresses
|-Source Address : 08-00-27-63-A5-D5
|-Destination Address : 08-00-27-E5-D8-04

IP Addresses
|-Source IP: 192.168.20.2
|-Destination IP: 192.168.20.1

=====
```

iii) Pinging r1 from h1

3. Rudimentary Router:

Program Name: Q2.c

Compilation: gcc Q2.c -o Q2

Invocation: sudo ./Q2

Algorithm Outline:

Initialization:

1. Initialize sockets, buffer and sockaddr_ll structure.

Algorithm:

2. Creating 4 raw sockets with ETH_P_IP protocol which listens to only IP packets on the network card. Two of the sockets are used for receiving packets and are created by using the following arguments `socket(AF_PACKET, SOCK_RAW, htons(ETH_P_IP))`. The other two sockets are used for sending and are created by using the following arguments `socket(AF_INET, SOCK_RAW, IPPROTO_RAW)`. Here `IPPROTO_RAW` protocol signifies that the data passed into the socket should be an IP packet with an IP header and transport layer header.
3. Loop
 - a. Select on the receiving sockets
 - i. If eth1 is ready on select
 1. Receive from interface eth1
 2. Filter only received packets using packet type field in `sockaddr_ll` structure.
 3. Process the received packets to extract the ethernet header and IP header.
 4. From the ethernet header extract source and destination MAC addresses.
 5. From the IP header extract source and destination IP addresses.
 6. Filter the packets with destination ip as different from that of ip address of interface eth1

- a. Send the packet to the appropriate destination IP by filling the sockaddr_in structure and passing it to the sendto() function.

```
Terminal
tc@h1:~$ ping 192.168.30.2
PING 192.168.30.2 (192.168.30.2): 56 data bytes
64 bytes from 192.168.30.2: seq=0 ttl=64 time=3.634 ms
64 bytes from 192.168.30.2: seq=1 ttl=64 time=1.422 ms
^C
--- 192.168.30.2 ping statistics ---
2 packets transmitted, 2 packets received, 0% packet loss
round-trip min/avg/max = 1.422/2.528/3.634 ms
tc@h1:~$
```

```
Terminal
tc@r1:~$ sudo ./q3
=====
MAC Addresses
|-Source Address : 08-00-27-63-A5-D5
|-Destination Address : 08-00-27-E5-08-04
IP Addresses
|-Source IP: 192.168.20.2
|-Destination IP: 192.168.30.2
=====
MAC Addresses
|-Source Address : 08-00-27-A6-EF-5D
|-Destination Address : 08-00-27-00-7C-CD
IP Addresses
|-Source IP: 192.168.30.2
|-Destination IP: 192.168.20.2
=====
MAC Addresses
|-Source Address : 08-00-27-63-A5-D5
|-Destination Address : 08-00-27-E5-08-04
IP Addresses
|-Source IP: 192.168.30.2
|-Destination IP: 192.168.30.2
=====
MAC Addresses
|-Source Address : 08-00-27-A6-EF-5D
|-Destination Address : 08-00-27-00-7C-CD
IP Addresses
|-Source IP: 192.168.30.2
|-Destination IP: 192.168.20.2
=====
```

i) Pinging r2 from h1

```
Terminal
tc@r2:~$ ping 192.168.20.2
PING 192.168.20.2 (192.168.20.2): 56 data bytes
64 bytes from 192.168.20.2: seq=0 ttl=64 time=1.068 ms
64 bytes from 192.168.20.2: seq=1 ttl=64 time=1.244 ms
^C
--- 192.168.20.2 ping statistics ---
2 packets transmitted, 2 packets received, 0% packet loss
round-trip min/avg/max = 1.068/1.156/1.244 ms
tc@r2:~$
```

```
Terminal
tc@r1:~$ sudo ./q3
=====
MAC Addresses
|-Source Address : 08-00-27-A6-EF-5D
|-Destination Address : 08-00-27-00-7C-CD
IP Addresses
|-Source IP: 192.168.30.2
|-Destination IP: 192.168.20.2
=====
MAC Addresses
|-Source Address : 08-00-27-63-A5-D5
|-Destination Address : 08-00-27-E5-08-04
IP Addresses
|-Source IP: 192.168.30.2
|-Destination IP: 192.168.30.2
=====
MAC Addresses
|-Source Address : 08-00-27-A6-EF-5D
|-Destination Address : 08-00-27-00-7C-CD
IP Addresses
|-Source IP: 192.168.30.2
|-Destination IP: 192.168.20.2
=====
MAC Addresses
|-Source Address : 08-00-27-63-A5-D5
|-Destination Address : 08-00-27-E5-08-04
IP Addresses
|-Source IP: 192.168.30.2
|-Destination IP: 192.168.30.2
=====
```

ii) Pinging h1 from r2

```
Terminal
Terminal
Terminal
Terminal
tc@r2:~$ ping 192.168.20.3
PING 192.168.20.3 (192.168.20.3): 56 data bytes
64 bytes from 192.168.20.3: seq=0 ttl=64 time=1.064 ms
64 bytes from 192.168.20.3: seq=1 ttl=64 time=1.114 ms
^C
--- 192.168.20.3 ping statistics ---
2 packets transmitted, 2 packets received, 0% packet loss
round-trip min/avg/max = 1.064/1.089/1.114 ms
tc@r2:~$
```

```
Terminal
tc@r1:~$ sudo ./Q3
=====
MAC Addresses
|-Source Address : 08-00-27-A6-EF-5D
|-Destination Address : 08-00-27-08-7C-CD
IP Addresses
|-Source IP: 192.168.30.2
|-Destination IP: 192.168.20.3
=====
MAC Addresses
|-Source Address : 08-00-27-FB-88-E4
|-Destination Address : 08-00-27-E3-08-04
IP Addresses
|-Source IP: 192.168.20.3
|-Destination IP: 192.168.30.2
=====
MAC Addresses
|-Source Address : 08-00-27-A6-EF-5D
|-Destination Address : 08-00-27-08-7C-CD
IP Addresses
|-Source IP: 192.168.30.2
|-Destination IP: 192.168.20.3
=====
MAC Addresses
|-Source Address : 08-00-27-FB-88-E4
|-Destination Address : 08-00-27-E3-08-04
IP Addresses
|-Source IP: 192.168.20.3
|-Destination IP: 192.168.30.2
=====
```

iii) Pinging h2 from r2

```
Terminal
Terminal
Terminal
Terminal
tc@h2:~$ ping 192.168.30.2
PING 192.168.30.2 (192.168.30.2): 56 data bytes
64 bytes from 192.168.30.2: seq=0 ttl=64 time=0.944 ms
64 bytes from 192.168.30.2: seq=1 ttl=64 time=1.222 ms
^C
--- 192.168.30.2 ping statistics ---
2 packets transmitted, 2 packets received, 0% packet loss
round-trip min/avg/max = 0.944/1.083/1.222 ms
tc@h2:~$
```

```
Terminal
tc@r1:~$ sudo ./Q3
=====
MAC Addresses
|-Source Address : 08-00-27-FB-88-E4
|-Destination Address : 08-00-27-E3-08-04
IP Addresses
|-Source IP: 192.168.20.3
|-Destination IP: 192.168.30.2
=====
MAC Addresses
|-Source Address : 08-00-27-A6-EF-5D
|-Destination Address : 08-00-27-08-7C-CD
IP Addresses
|-Source IP: 192.168.30.2
|-Destination IP: 192.168.20.3
=====
MAC Addresses
|-Source Address : 08-00-27-FB-88-E4
|-Destination Address : 08-00-27-E3-08-04
IP Addresses
|-Source IP: 192.168.20.3
|-Destination IP: 192.168.30.2
=====
MAC Addresses
|-Source Address : 08-00-27-A6-EF-5D
|-Destination Address : 08-00-27-08-7C-CD
IP Addresses
|-Source IP: 192.168.30.2
|-Destination IP: 192.168.20.3
=====
```

iv) Pinging r2 from h2

Note:

1. In Q3 r1 is only printing the received packets.
2. In Q2 r1 is only printing the received packets as mentioned in the question.