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1/31/25

Florida State University

CIS 4360

CIS 4360 – Lab 1

Task Set 1.1:

The first task was to test a very simple sniffing script to make sure we were able to see the packets traversing the network as seen here:

3.1 Task 1.1: Sniffing Packets

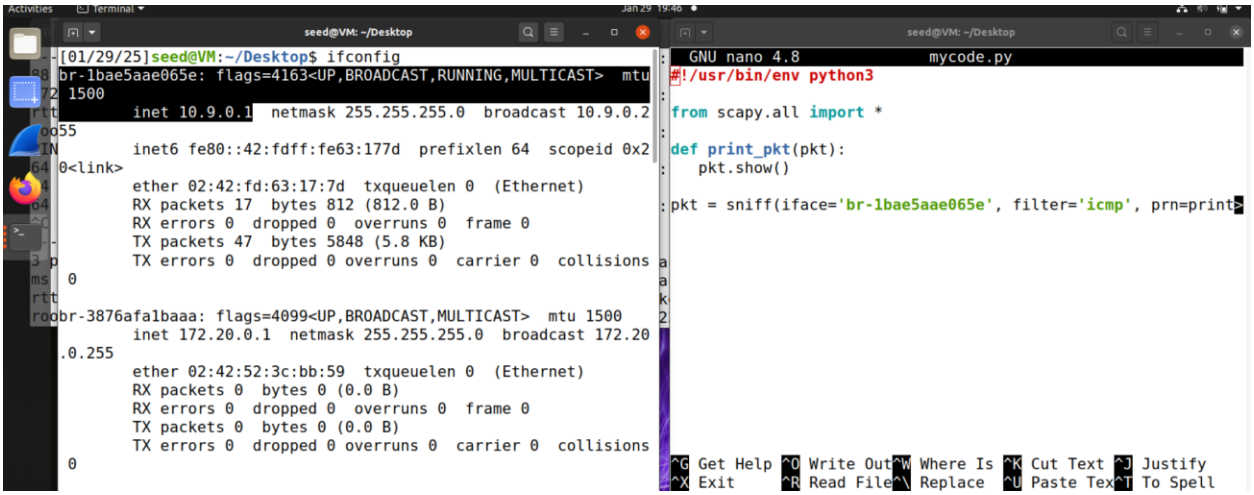
Wireshark is the most popular sniffing tool, and it is easy to use. We will use it throughout the entire lab. However, it is difficult to use Wireshark as a building block to construct other tools. We will use Scapy for that purpose. The objective of this task is to learn how to use Scapy to do packet sniffing in Python programs. A sample code is provided in the following:

```
#!/usr/bin/env python3
from scapy.all import *

def print_pkt(pkt):
  pkt.show()

pkt = sniff(iface='br-c93733e9f913', filter='icmp', prn=print_pkt)
```

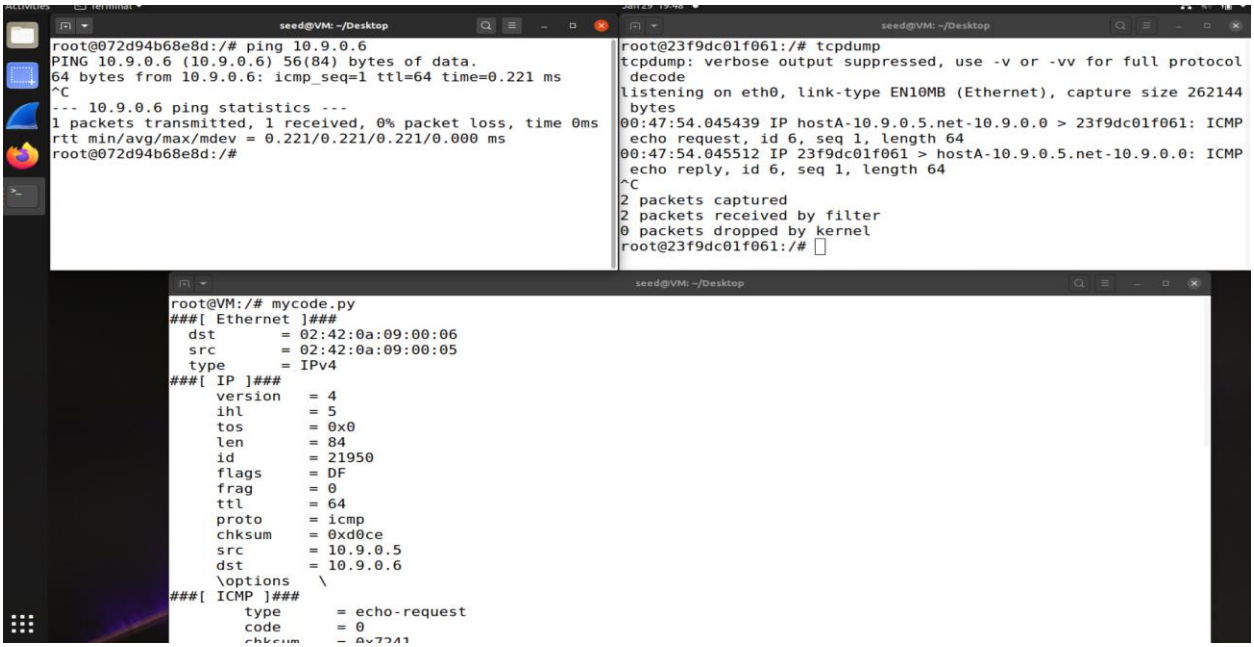
The code above will sniff the packets on the `br-c93733e9f913` interface. Please read the instruction in the lab setup section regarding how to get the interface name. If we want to sniff on multiple interfaces, we can put all the interfaces in a list, and assign it to `iface`. See the following example:

```
iface=['br-c93733e9f913', 'enp0s3']
```

To accomplish this, I ran “ipconfig” to show the interface name and IPs. The setup page (not shown here) tells us to find the network with IP 10.9.0.1 as highlighted in the left terminal. The right terminal contains our script using Scapy to sniff the ping packets:



Next, I ran a ping from Host A (10.9.0.5) to Host B (10.9.0.6), while using tcpdump on Host B to see the incoming ping. On the left is Host A running ping, on the right is Host B running tcpdump, and on the bottom is our attacker (seed-attacker) running the Scapy script to sniff the packets.



The rest of the sniffed packet is shown here:

```
###[ ICMP ]###
        type      = echo-request
        code      = 0
        chksum    = 0x7241
        id        = 0x6
        seq       = 0x1
###[ Raw ]###
           load      = ':\xcc\x9ag\x00\x00\x00\x00\xf1\xb0\x00\x00\x00\x00\x00\x00\x10\x11\x12\x13\x14\x15\x16\x17\x18\x19\x1a\x1
b\x1c\x1d\x1e\x1f !"#$%&\'()*+,-./01234567'

###[ Ethernet ]###
  dst       = 02:42:0a:09:00:05
  src       = 02:42:0a:09:00:06
  type      = IPv4
###[ IP ]###
     version   = 4
     ihl       = 5
     tos       = 0x0
     len       = 84
     id        = 41336
     flags     =
     frag      = 0
     ttl       = 64
     proto     = icmp
     chksum    = 0xc514
     src       = 10.9.0.6
     dst       = 10.9.0.5
     \options   \
###[ ICMP ]###
        type      = echo-reply
        code      = 0
        chksum    = 0x7a41
        id        = 0x6
        seq       = 0x1
###[ Raw ]###
           load      = ':\xcc\x9ag\x00\x00\x00\x00\xf1\xb0\x00\x00\x00\x00\x00\x00\x10\x11\x12\x13\x14\x15\x16\x17\x18\x19\x1a\x1
b\x1c\x1d\x1e\x1f !"#$%&\'()*+,-./01234567'

root@VM:/#
```

Task 1.1A

For this task, we need to switch our user to “seed” and re-run the sniffing program using reduced permissions. In the picture you can see I switched to the “seed” user and checked the file permissions to ensure that the “seed” user is able to execute the file. Despite this, I am still unable to run the sniffing program. The reason for this is because (I think) only root has permission to create raw sockets. (Changed terminal to dark because white hurt my eyes)

```
root@VM:/# su seed
seed@VM:/$ ls -l mycode.py
-rwxr-xr-x 1 root root 152 Jan 30 00:37 mycode.py
seed@VM:/$ mycode.py
Traceback (most recent call last):
  File "./mycode.py", line 8, in <module>
    pkt = sniff(iface='br-1bae5aae065e', filter='icmp', prn=print_pkt)
  File "/usr/local/lib/python3.8/dist-packages/scapy/sendrecv.py", line 1036, in
 sniff
    sniffer._run(*args, **kwargs)
  File "/usr/local/lib/python3.8/dist-packages/scapy/sendrecv.py", line 906, in
_run
    sniff_sockets[L2socket(type=ETH_P_ALL, iface=iface,
  File "/usr/local/lib/python3.8/dist-packages/scapy/arch/linux.py", line 398, i
n __init__
    self.ins = socket.socket(socket.AF_PACKET, socket.SOCK_RAW, socket.htons(typ
e))  # noqa: E501
  File "/usr/lib/python3.8/socket.py", line 231, in __init__
    _socket.socket.__init__(self, family, type, proto, fileno)
PermissionError: [Errno 1] Operation not permitted
seed@VM:/$
```

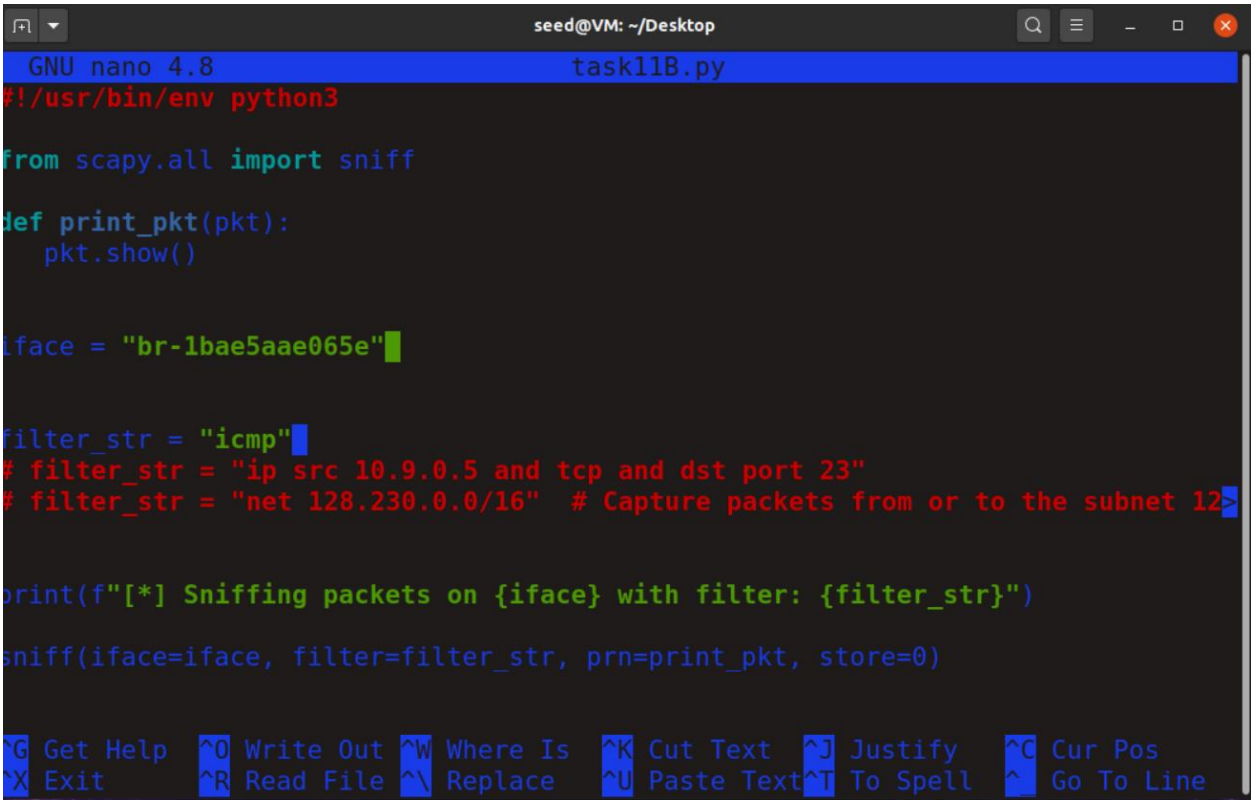
Task 1.1B

In this task we have 3 different objectives.

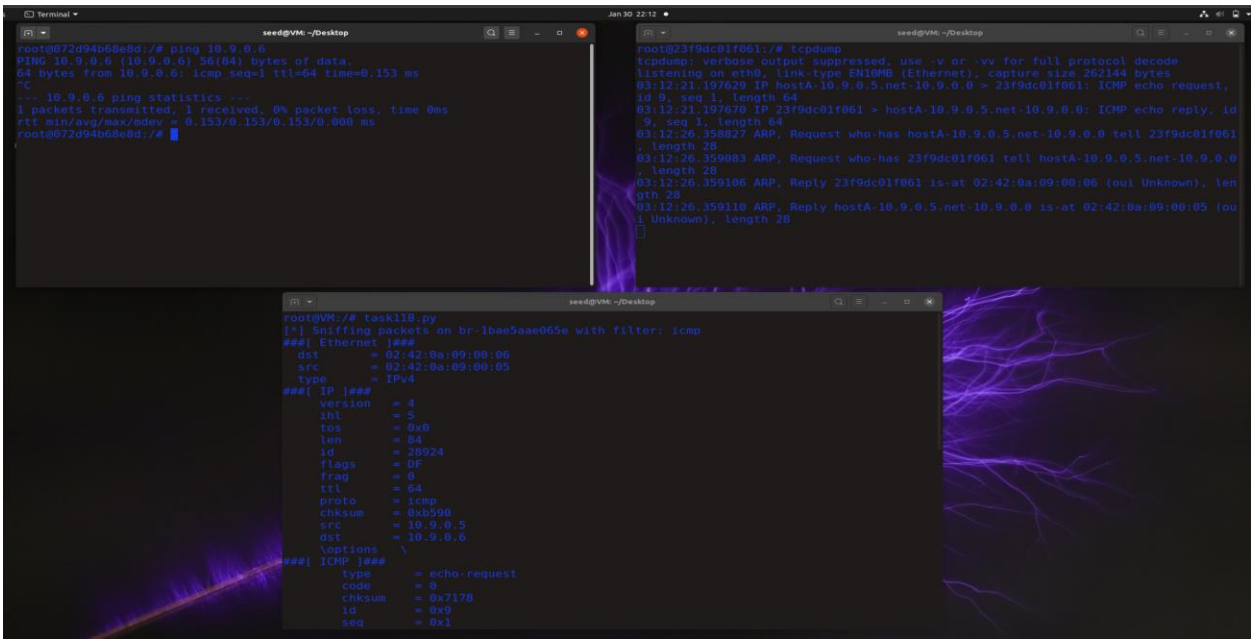
- Capture a packet only via ICMP

- Capture any TCP packet that comes from a particular IP (in our case, HostA-10.9.0.5 and with a destination port number 23
- Capture packets coming from or going to a particular subnet, 128.230.0.0/16

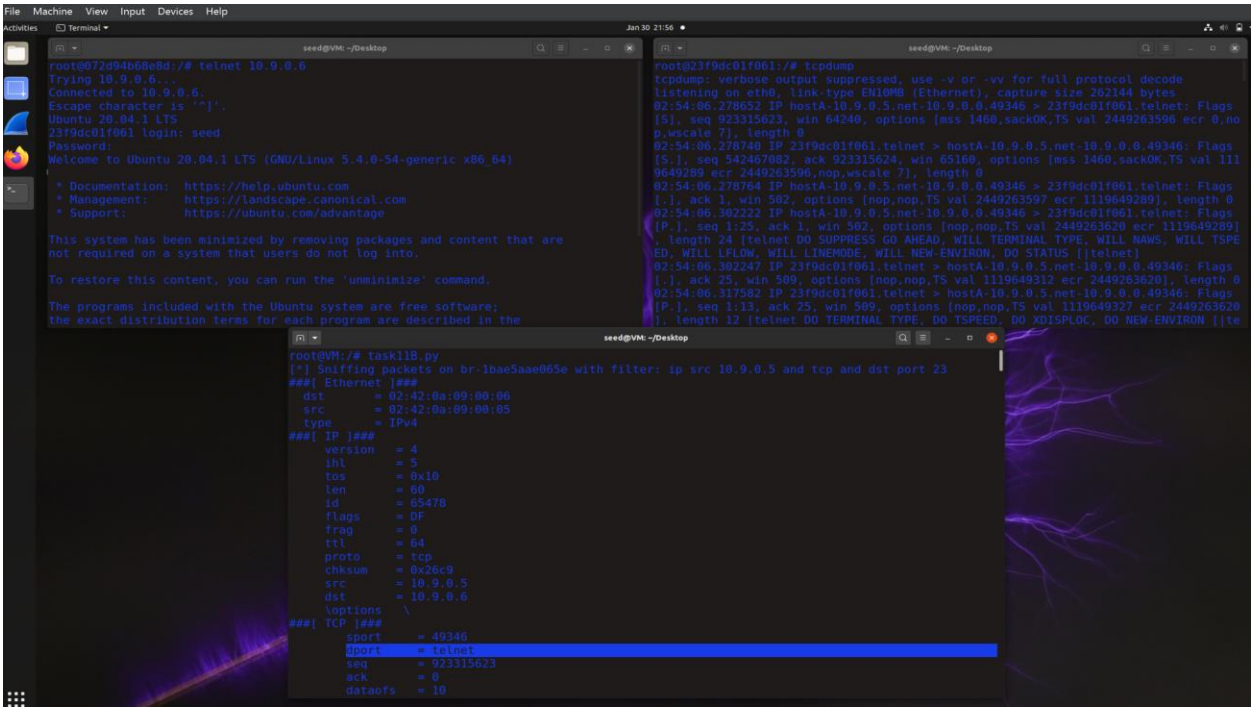
Here is the code used for the 3 tasks listed above:



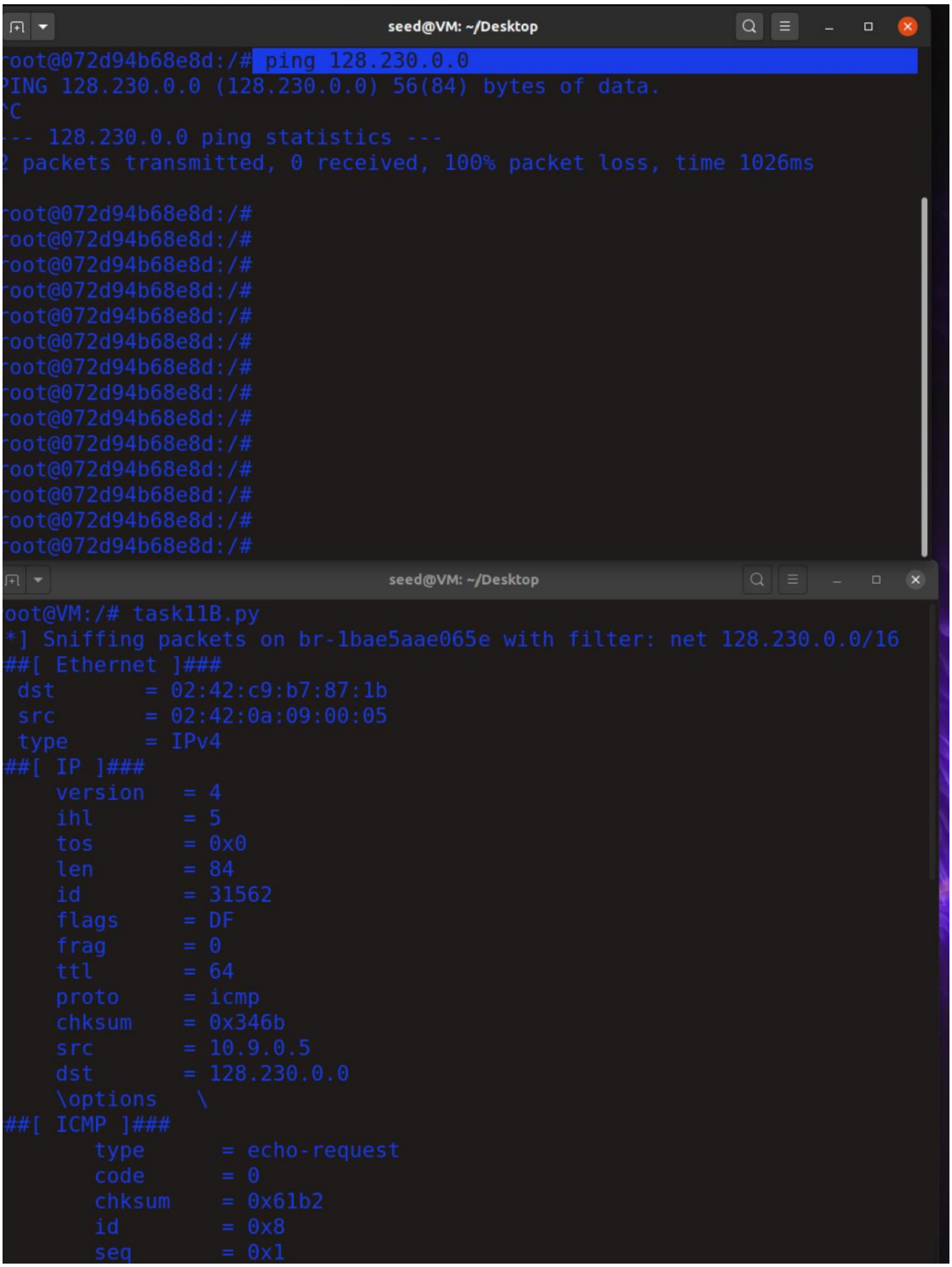
Here is the ICMP captured code. The bottom terminal is running the sniffer, the top left terminal is running ping, and the top right terminal is running tcpdump:



Here is the TCP port 23 captured code. The bottom terminal is running the sniffer, the top left terminal is running telnet which connet via port 23, and the top right terminal is running tcpdump:



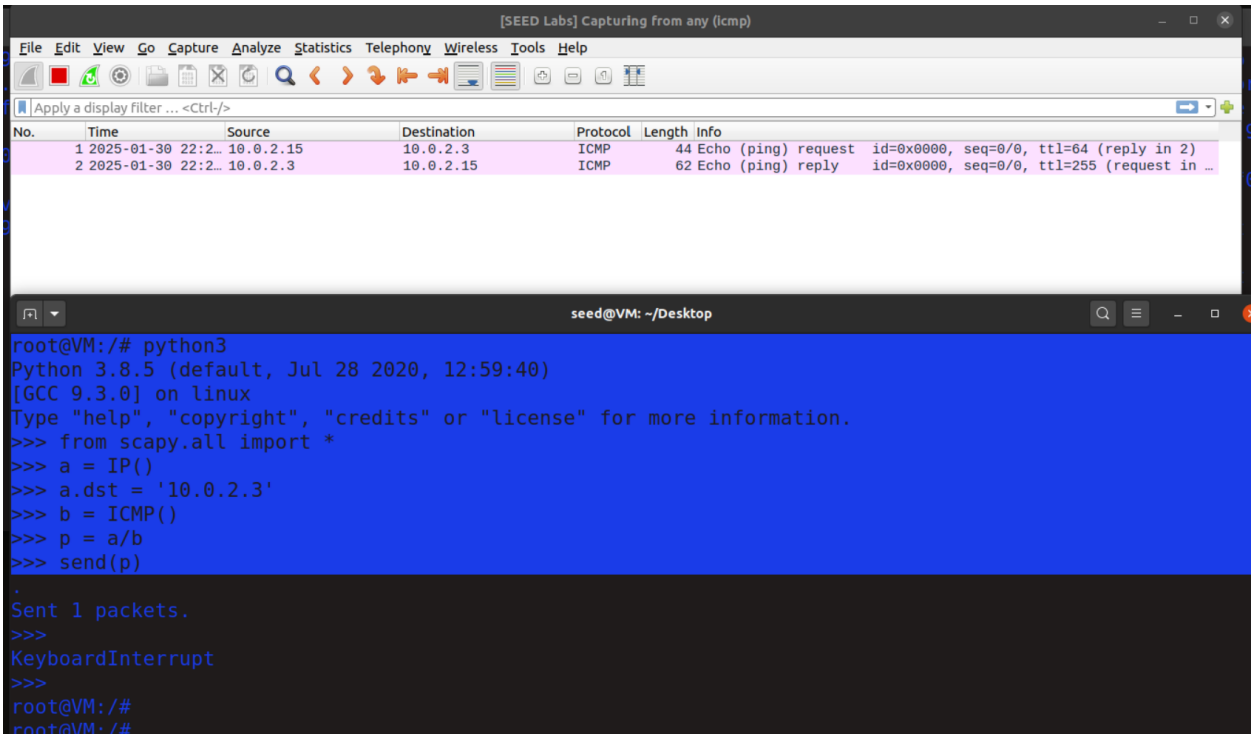
Here is the subnet captured code. The bottom terminal is running the sniffer, and the top terminal is running ping to the subnet in question, 128.230.0.0.



Task 1.2

Task 1.2 asks us to do the following: spoof an ICMP echo request packet with an arbitrary source IP address. Here I used the interactive python command, “python3” to run the code 1 line at a

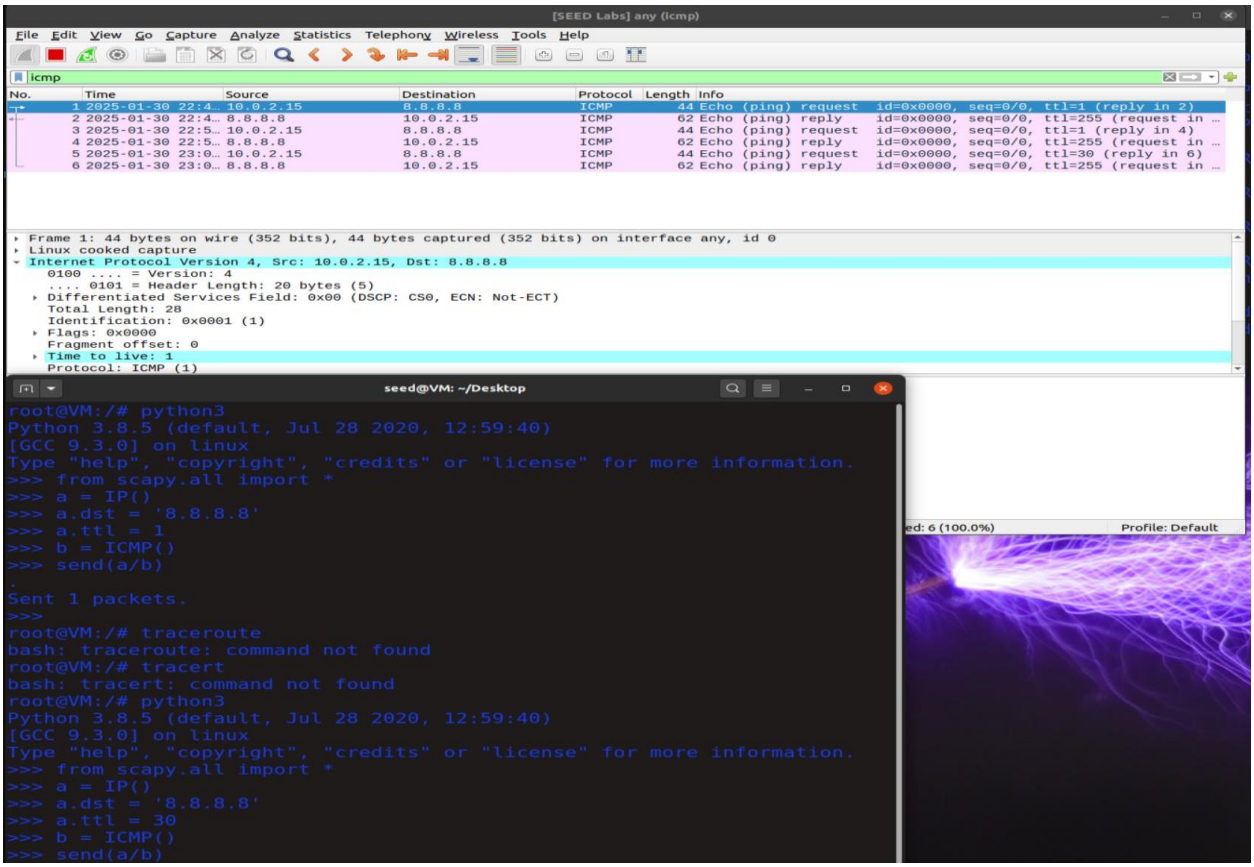
time, and using Wireshark on the host VM, I was able to capture the packet that had the spoofed IP address. I chose 10.0.2.3 as the random IP address, as you can see on the bottom terminal, and on the top, Wireshark has captured the spoofed ICMP packet and its reply.

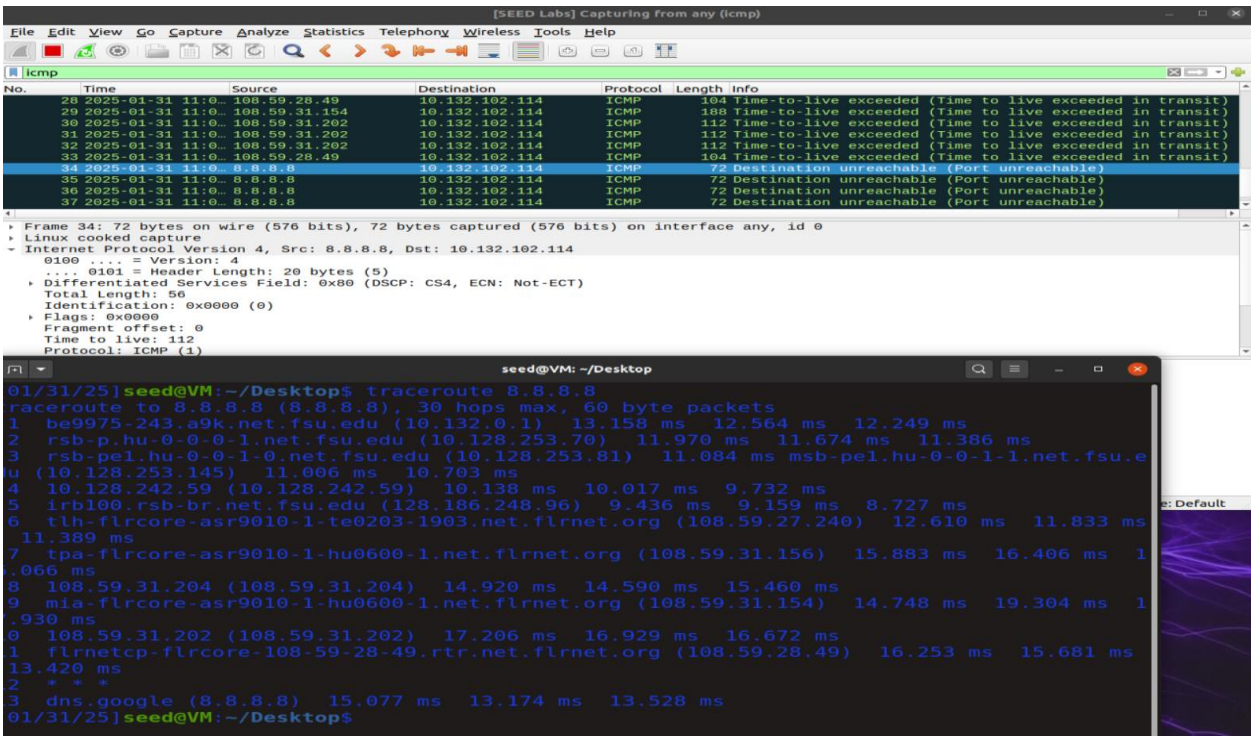


Task 1.3

Task 1.3 asks us to implement traceroute to see how packet switching occurs. Specifically: “The objective of this task is to use Scapy to estimate the distance, in terms of number of routers, between your VM and a selected destination”. Unfortunately, I fell into the common problem of only being able to see the send and reply, and not being able to see the routers along the way. However, I ran the interactive python script twice, once with a TTL of 1, and once with a TTL of 30, which are both listed in the top Wireshark program (+1 send a receive test). I was able to perform a proper traceroute by switching my network settings from NAT to Bridged, which allowed me to run traceroute correctly.

The first picture below shows the script with only the first and last hop, the second picture is the full traceroute with all subsequent routers.

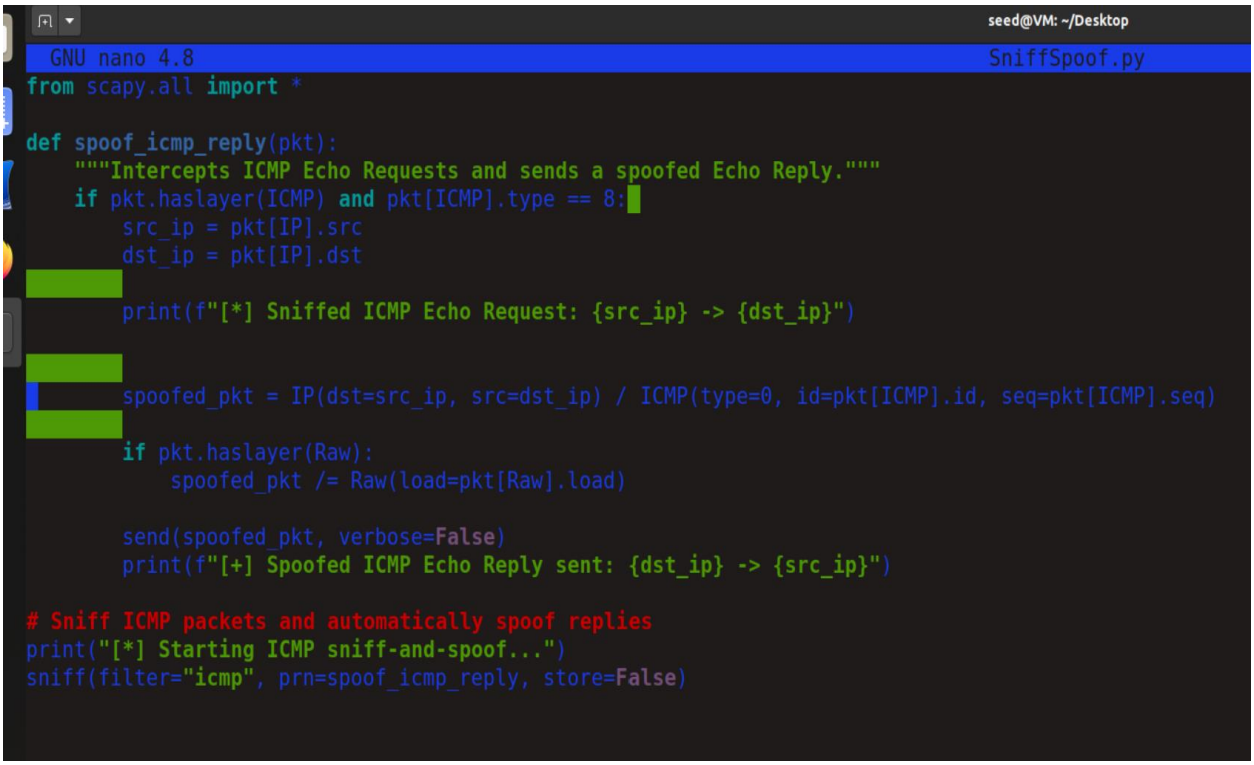

[SEED Labs] any (icmp)
File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help
icmp
No. Time Source Destination Protocol Length Info
1 2025-01-30 22:4… 10.0.2.15 8.8.8.8 ICMP 44 Echo (ping) request id=0x0000, seq=0/0, ttl=1 (reply in 2)
2 2025-01-30 22:4… 8.8.8.8 10.0.2.15 ICMP 62 Echo (ping) reply id=0x0000, seq=0/0, ttl=255 (request in …
3 2025-01-30 22:5… 10.0.2.15 8.8.8.8 ICMP 44 Echo (ping) request id=0x0000, seq=0/0, ttl=1 (reply in 4)
4 2025-01-30 22:5… 8.8.8.8 10.0.2.15 ICMP 62 Echo (ping) reply id=0x0000, seq=0/0, ttl=255 (request in …
5 2025-01-30 23:0… 10.0.2.15 8.8.8.8 ICMP 44 Echo (ping) request id=0x0000, seq=0/0, ttl=30 (reply in 6)
6 2025-01-30 23:0… 8.8.8.8 10.0.2.15 ICMP 62 Echo (ping) reply id=0x0000, seq=0/0, ttl=255 (request in …
Frame 1: 44 bytes on wire (352 bits), 44 bytes captured (352 bits) on interface any, id 0
Linux cooked capture
Internet Protocol Version 4, Src: 10.0.2.15, Dst: 8.8.8.8
0100 .... = Version: 4
.... 0101 = Header Length: 20 bytes (5)
Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
Total Length: 28
Identification: 0x0001 (1)
Flags: 0x0000
Fragment offset: 0
Time to live: 1
Protocol: ICMP (1)
seed@VM: ~/Desktop
root@VM:/# python3
Python 3.8.5 (default, Jul 28 2020, 12:59:40)
[GCC 9.3.0] on linux
Type "help", "copyright", "credits" or "license" for more information.
>>> from scapy.all import *
>>> a = IP()
>>> a.dst = '8.8.8.8'
>>> a.ttl = 1
>>> b = ICMP()
>>> send(a/b)
.
Sent 1 packets.
>>>
root@VM:/# traceroute
bash: traceroute: command not found
root@VM:/# tracert
bash: tracert: command not found
root@VM:/# python3
Python 3.8.5 (default, Jul 28 2020, 12:59:40)
[GCC 9.3.0] on linux
Type "help", "copyright", "credits" or "license" for more information.
>>> from scapy.all import *
>>> a = IP()
>>> a.dst = '8.8.8.8'
>>> a.ttl = 30
>>> b = ICMP()
>>> send(a/b)
ed: 6 (100.0%)
Profile: Default


[SEED Labs] Capturing from any (icmp)
File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help
icmp
No. Time Source Destination Protocol Length Info
28 2025-01-31 11:0… 108.59.28.49 10.132.102.114 ICMP 104 Time-to-live exceeded (Time to live exceeded in transit)
29 2025-01-31 11:0… 108.59.31.154 10.132.102.114 ICMP 188 Time-to-live exceeded (Time to live exceeded in transit)
30 2025-01-31 11:0… 108.59.31.202 10.132.102.114 ICMP 112 Time-to-live exceeded (Time to live exceeded in transit)
31 2025-01-31 11:0… 108.59.31.202 10.132.102.114 ICMP 112 Time-to-live exceeded (Time to live exceeded in transit)
32 2025-01-31 11:0… 108.59.31.202 10.132.102.114 ICMP 112 Time-to-live exceeded (Time to live exceeded in transit)
33 2025-01-31 11:0… 108.59.28.49 10.132.102.114 ICMP 104 Time-to-live exceeded (Time to live exceeded in transit)
34 2025-01-31 11:0… 8.8.8.8 10.132.102.114 ICMP 72 Destination unreachable (Port unreachable)
35 2025-01-31 11:0… 8.8.8.8 10.132.102.114 ICMP 72 Destination unreachable (Port unreachable)
36 2025-01-31 11:0… 8.8.8.8 10.132.102.114 ICMP 72 Destination unreachable (Port unreachable)
37 2025-01-31 11:0… 8.8.8.8 10.132.102.114 ICMP 72 Destination unreachable (Port unreachable)
Frame 34: 72 bytes on wire (576 bits), 72 bytes captured (576 bits) on interface any, id 0
Linux cooked capture
Internet Protocol Version 4, Src: 8.8.8.8, Dst: 10.132.102.114
0100 .... = Version: 4
.... 0101 = Header Length: 20 bytes (5)
Differentiated Services Field: 0x80 (DSCP: CS4, ECN: Not-ECT)
Total Length: 56
Identification: 0x0000 (0)
Flags: 0x0000
Fragment offset: 0
Time to live: 112
Protocol: ICMP (1)
seed@VM: ~/Desktop
01/31/25]seed@VM:~/Desktop$ traceroute 8.8.8.8
raceroute to 8.8.8.8 (8.8.8.8), 30 hops max, 60 byte packets
1 be9975-243.a9k.net.fsu.edu (10.132.0.1) 13.158 ms 12.564 ms 12.249 ms
2 rsb-p.hu-0-0-0-1.net.fsu.edu (10.128.253.70) 11.970 ms 11.674 ms 11.386 ms
3 rsb-pe1.hu-0-0-1-0.net.fsu.edu (10.128.253.81) 11.084 ms msb-pe1.hu-0-0-1-1.net.fsu.e
u (10.128.253.145) 11.006 ms 10.703 ms
4 10.128.242.59 (10.128.242.59) 10.138 ms 10.017 ms 9.732 ms
5 irb100.rsb-br.net.fsu.edu (128.186.248.96) 9.436 ms 9.159 ms 8.727 ms
6 tlh-flrcore-asr9010-1-te0203-1903.net.flrnet.org (108.59.27.240) 12.610 ms 11.833 ms
11.389 ms
7 tpa-flrcore-asr9010-1-hu0600-1.net.flrnet.org (108.59.31.156) 15.883 ms 16.406 ms 1
.066 ms
8 108.59.31.204 (108.59.31.204) 14.920 ms 14.590 ms 15.460 ms
9 mia-flrcore-asr9010-1-hu0600-1.net.flrnet.org (108.59.31.154) 14.748 ms 19.304 ms 1
.930 ms
0 108.59.31.202 (108.59.31.202) 17.206 ms 16.929 ms 16.672 ms
1 flrnetcp-flrcore-108-59-28-49.rtr.net.flrnet.org (108.59.28.49) 16.253 ms 15.681 ms
13.420 ms
2 * * *
3 dns.google (8.8.8.8) 15.077 ms 13.174 ms 13.528 ms
01/31/25]seed@VM:~/Desktop$
e: Default

Task 1.4

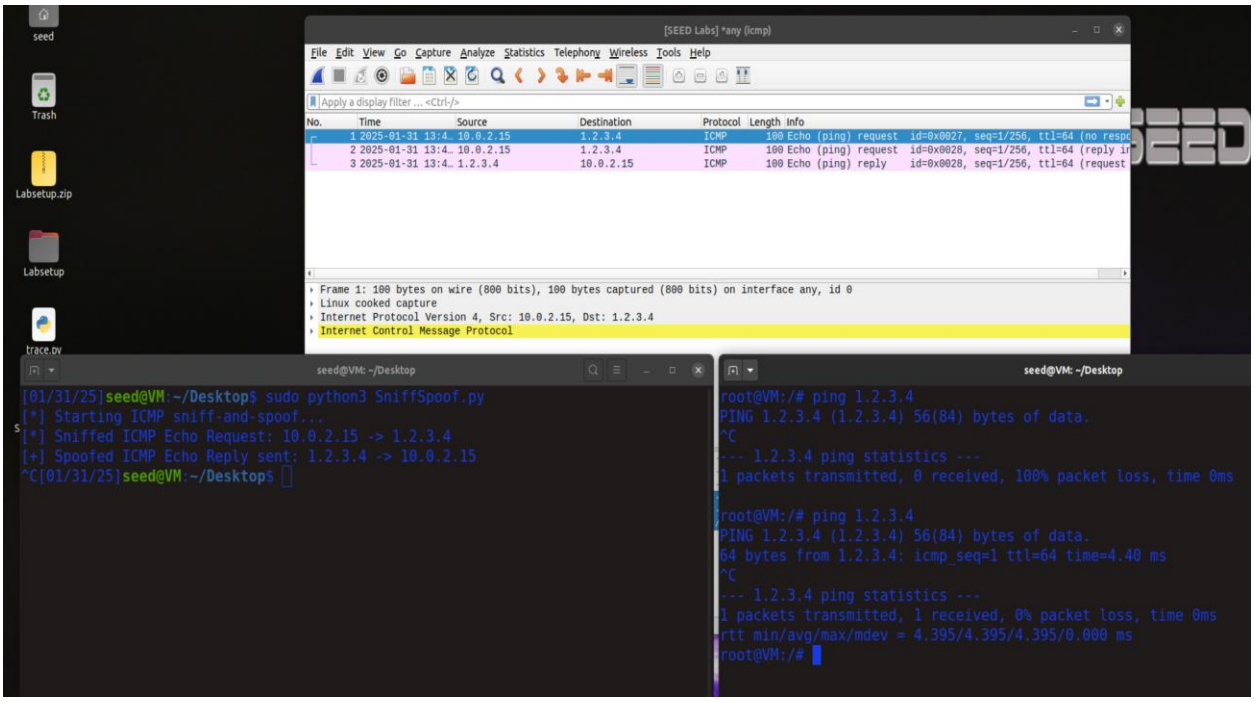
This task asks us to send a ping 3 separate IP addresses from our host VM. 1 non-existing host on the internet, 1 non-existing host on the LAN, and one real host on the internet. We will then run a script to sniff the sent packet's destination addresses, and send a reply from our attacker with a spoofed source address, matching the destination address of the host's sent packet.

Here is the code used to intercept and spoof the reply packet. Notice how "src_ip" is used as the destination Ip and vice-versa in line 12 (spoofed_pkt = ...)



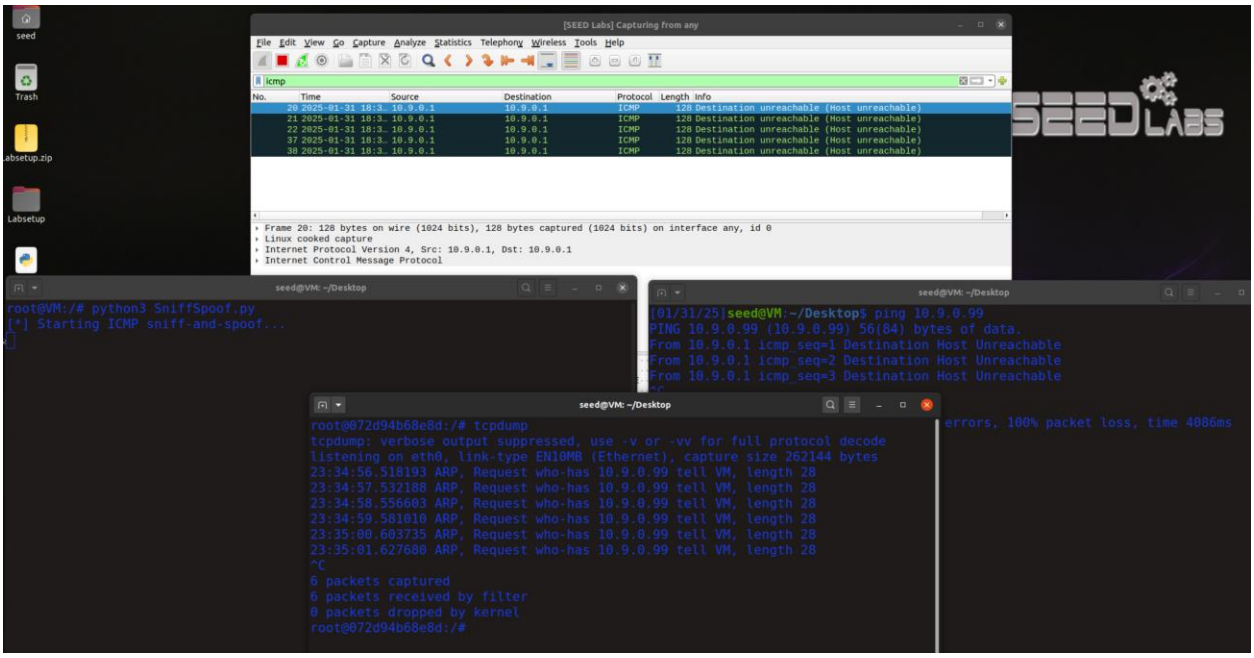
Below you can see the script in action. Notice the terminal on the right sends a ping to the non-existent 1.2.3.4 without the script running and gets no reply, seen as "1 packet transmitted, 0 received". This is also reflected in Wireshark as the top data point, with source IP 10.0.2.15 sending an ICMP packet to 1.2.3.4 with no reply.

The second ping is with the Sniff and Spoof script running, which intercepts the packet and sends a spoofed reply. Notice this time the right terminal says, “1 packet transmitted, 1 received”, which is again reflected on Wireshark as the bottom 2 data points.

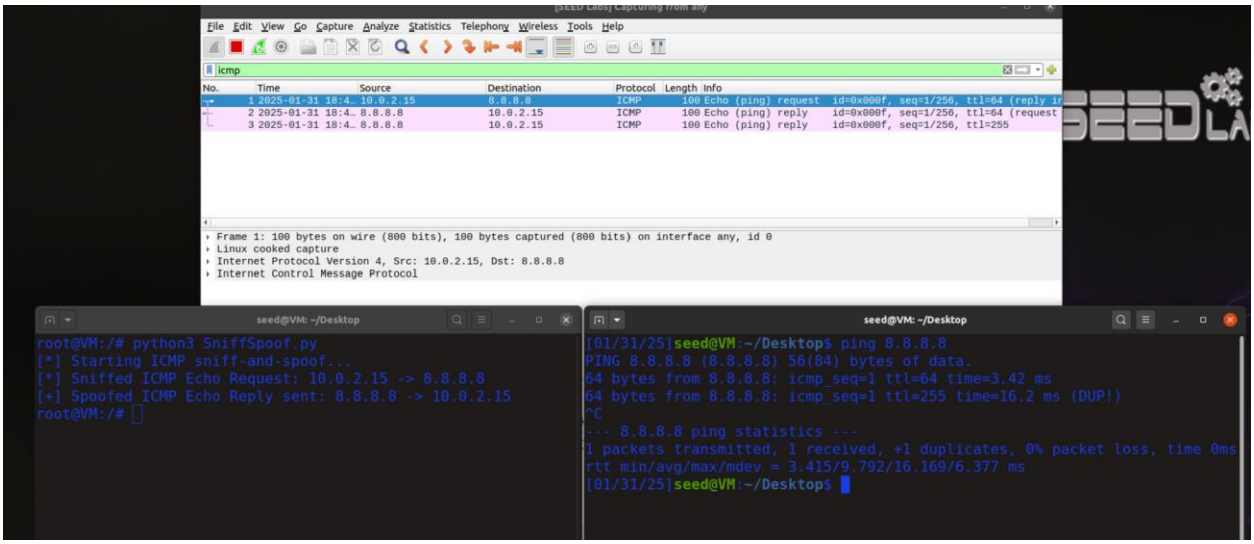


The same methodology will be repeated below with non-existing host 10.9.0.99 on the LAN, and existing host 8.8.8.8 on the internet.

When I ping 10.9.0.99 I get an ARP resolution error. ARP is used to translate IP addresses into MAC addresses, allowing a private IP address to correlate to a physical address. Because the IP doesn't exist, we get an ARP resolution error because it can't find the matching MAC address. The left terminal is running our Sniff/Spoof script, the bottom terminal is running tcpdump, and the right terminal is running ping to the unreachable host.



Lastly, we run the script against a real host on the internet, 8.8.8.8. You can see in Wireshark at the top that we get 1 request but 2 replies. One reply from google, and one from our spoofed packet script.



END REPORT