Lab Task Set 1: Using Scapy to Sniff and Spoof Packets

Task 1.1: Sniffing Packets

Task 1.1A.

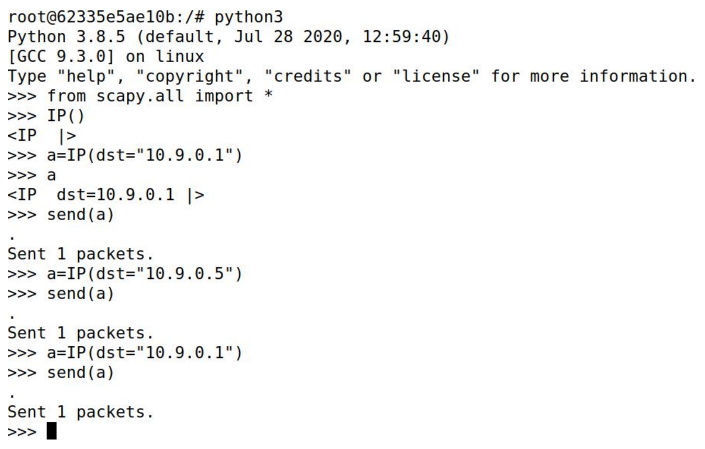
实验目标：一方发送报文，另一方进行 sniffer 抓取嗅探。

Code:

```python
from scapy.all import *
def print_pkt(pkt):
    pkt.show()
pkt = sniff(iface='br-a662275d44ba', filter='icmp', prn=print_pkt)
```

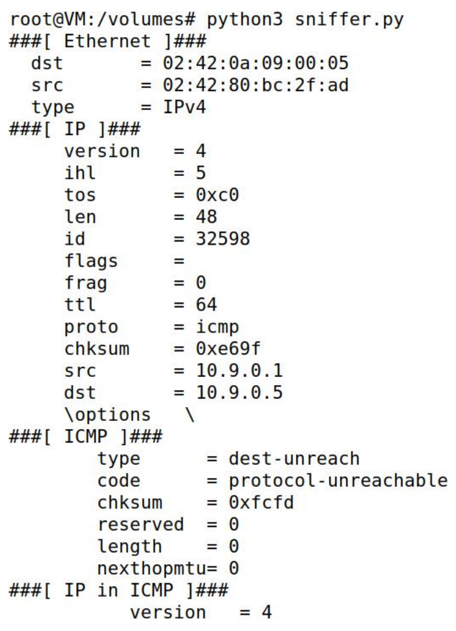
Result:

User 端发送报文，进行如下操作：



```
root@62335e5ae10b:/# python3
Python 3.8.5 (default, Jul 28 2020, 12:59:40)
[GCC 9.3.0] on linux
Type "help", "copyright", "credits" or "license" for more information.
>>> from scapy.all import *
>>> IP()
<IP  |>
>>> a=IP(dst="10.9.0.1")
>>> a
<IP  dst=10.9.0.1 |>
>>> send(a)
.
Sent 1 packets.
>>> a=IP(dst="10.9.0.5")
>>> send(a)
.
Sent 1 packets.
>>> a=IP(dst="10.9.0.1")
>>> send(a)
.
Sent 1 packets.
>>> 
```

Attacker 段进行 sniffer，结果如下：



```
root@VM:/volumes# python3 sniffer.py
###[ Ethernet ]###
  dst       = 02:42:0a:09:00:05
  src       = 02:42:80:bc:2f:ad
  type      = IPv4
###[ IP ]###
     version   = 4
     ihl       = 5
     tos       = 0xc0
     len       = 48
     id        = 32598
     flags     =
     frag      = 0
     ttl       = 64
     proto     = icmp
     chksum    = 0xe69f
     src       = 10.9.0.1
     dst       = 10.9.0.5
     \options   \
###[ ICMP ]###
        type      = dest-unreach
        code      = protocol-unreachable
        chksum    = 0xfcfd
        reserved  = 0
        length    = 0
        nexthopmtu= 0
###[ IP in ICMP ]###
           version   = 4
```

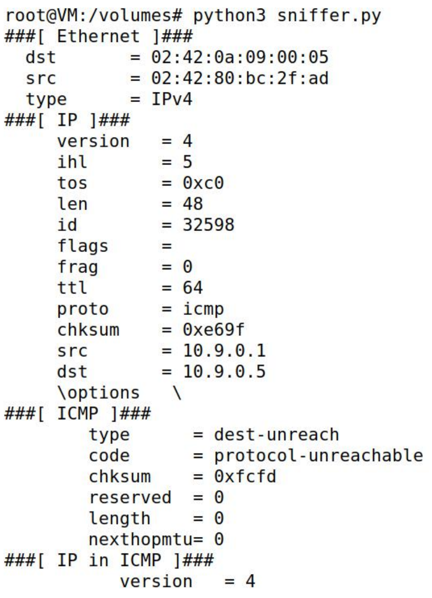
Task 1.1B.

实验目标：筛选报文

筛选 ICMP 报文：

Code：

```
pkt = sniff(iface='br-a662275d44ba', filter='icmp', prn=print_pkt)
```

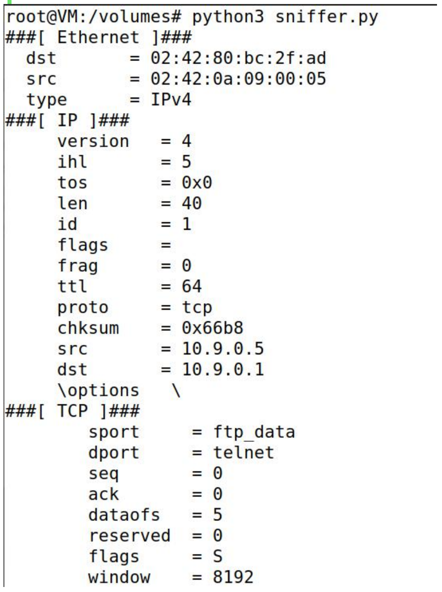


```
root@VM:/volumes# python3 sniffer.py
###[ Ethernet ]###
  dst       = 02:42:0a:09:00:05
  src       = 02:42:80:bc:2f:ad
  type      = IPv4
###[ IP ]###
     version   = 4
     ihl       = 5
     tos       = 0xc0
     len       = 48
     id        = 32598
     flags     =
     frag      = 0
     ttl       = 64
     proto     = icmp
     chksum    = 0xe69f
     src       = 10.9.0.1
     dst       = 10.9.0.5
     \options   \
###[ ICMP ]###
        type      = dest-unreach
        code      = protocol-unreachable
        chksum    = 0xfcfd
        reserved  = 0
        length    = 0
        nexthopmtu= 0
###[ IP in ICMP ]###
           version   = 4
```

筛选 TCP，宿端口为 23 和源 IP 为 10.9.0.5 的报文

Code：

```
pkt = sniff(iface='br-a662275d44ba', filter='tcp and dst port 23 and src net 10.9.0.5', prn=print_
pkt)
```

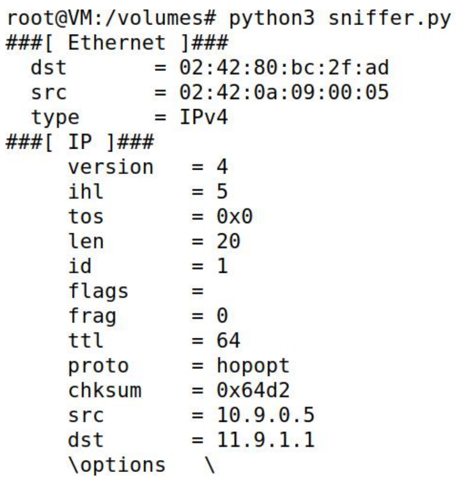


```
root@VM:/volumes# python3 sniffer.py
###[ Ethernet ]###
  dst       = 02:42:80:bc:2f:ad
  src       = 02:42:0a:09:00:05
  type      = IPv4
###[ IP ]###
     version   = 4
     ihl       = 5
     tos       = 0x0
     len       = 40
     id        = 1
     flags     =
     frag      = 0
     ttl       = 64
     proto     = tcp
     chksum    = 0x66b8
     src       = 10.9.0.5
     dst       = 10.9.0.1
     \options   \
###[ TCP ]###
        sport     = ftp_data
        dport     = telnet
        seq       = 0
        ack       = 0
        dataofs   = 5
        reserved  = 0
        flags     = S
        window    = 8192
```

筛选 11.9.1.0/24 的网段报文

Code:

```
pkt = sniff(iface='br-a662275d44ba', filter='net 11.9.1.0 mask 255.255.255.0', prn=print_pkt)
```

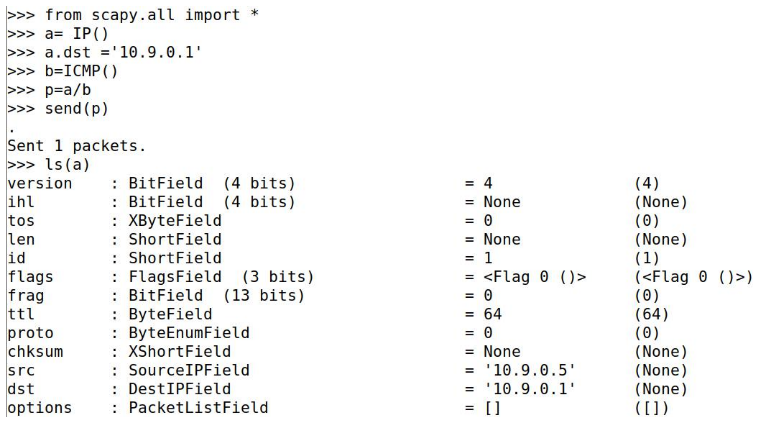


```
root@VM:/volumes# python3 sniffer.py
###[ Ethernet ]###
  dst       = 02:42:80:bc:2f:ad
  src       = 02:42:0a:09:00:05
  type      = IPv4
###[ IP ]###
     version   = 4
     ihl       = 5
     tos       = 0x0
     len       = 20
     id        = 1
     flags     =
     frag      = 0
     ttl       = 64
     proto     = hopopt
     chksum    = 0x64d2
     src       = 10.9.0.5
     dst       = 11.9.1.1
     \options   \
```

Task 1.2: Spoofing ICMP Packets

实验目的：构造 ICMP 报文

实验过程即结果如下：



```
>>> from scapy.all import *
>>> a= IP()
>>> a.dst ='10.9.0.1'
>>> b=ICMP()
>>> p=a/b
>>> send(p)
.
Sent 1 packets.
>>> ls(a)
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                       = 0             (0)
chksum     : XShortField                         = None          (None)
src        : SourceIPField                       = '10.9.0.5'    (None)
dst        : DestIPField                         = '10.9.0.1'    (None)
options    : PacketListField                     = []            ([])
```

Task 1.3: Traceroute

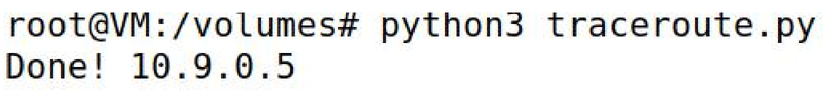
实验目的：路由追踪

Code：

```
from scapy.all import *
hostname = "172.17.0.1"
for i in range(1, 28):
    pkt = IP(dst=hostname, ttl=i) / UDP(dport=33434)
    # Send the packet and get a reply
    reply = sr1(pkt,verbose=0)
    if reply is None:
        # No reply =(
        break
```

```python
    elif reply.type == 3:
        # We've reached our destination
        print ("Done!", reply.src)
        break
    else:
        # We're in the middle somewhere
        print ("%d hops away: " % i , reply.src)
```

实验结果：如下



```
root@VM:/volumes# python3 traceroute.py
Done! 10.9.0.5
```

Task 1.4: Sniffing and-then Spoofing

Code：

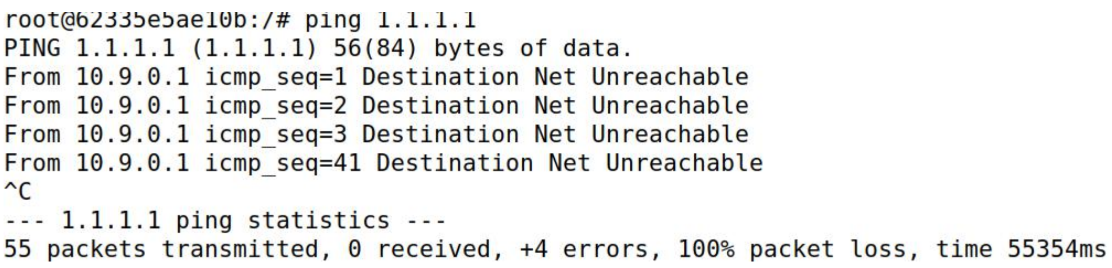
```python
from scapy.all import *
def sniffandspoof(pkt):
    if ICMP in pkt and pkt[ICMP].type==8:
        print("Original Packet.........")
        print("Source IP:",pkt[IP].src)
        print("Destination IP:",pkt[IP].dst)

        ip=IP(src=pkt[IP].dst,dst=pkt[IP].src,ihl=pkt[IP].ihl)
        icmp=ICMP(type=0,id=pkt[ICMP].id,seq=pkt[ICMP].seq)
        data=pkt[Raw].load
        newpkt=ip/icmp/data
        print("Spoofed Packet.........")
        print("Source IP:",newpkt[IP].src)
        print("Destination IP:",newpkt[IP].dst)
        send(newpkt,verbose=0)


pkt = sniff(iface='br-a662275d44ba', filter='icmp and src host 10.9.0.5', prn=sniffandspoof)
```

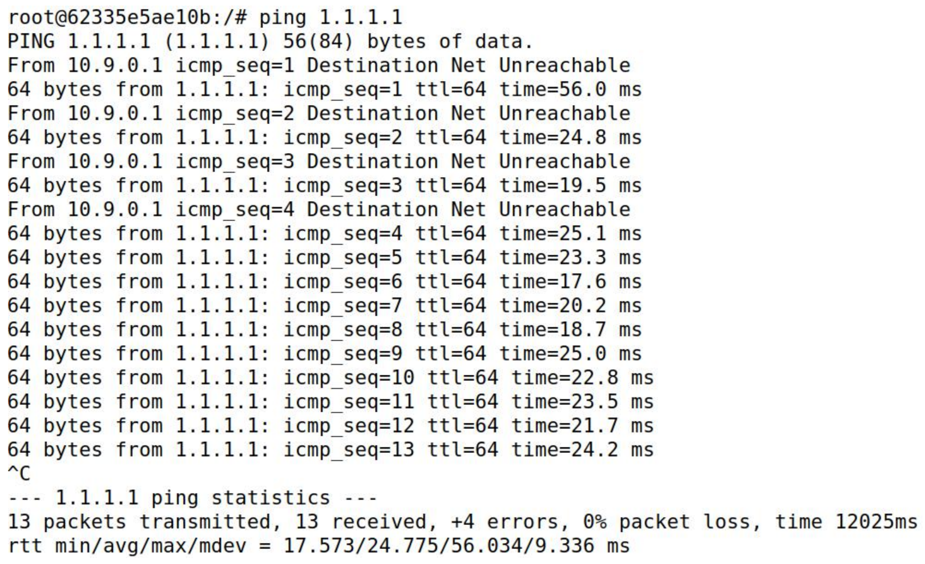
实验结果如下：

初次在 User 端 ping 不存在的 IP 地址 1.1.1.1，显示无法 ping 通：



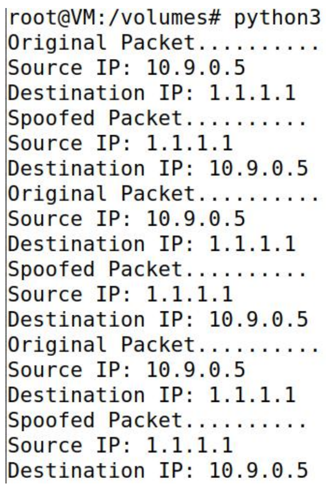
```
root@62335e5ae10b:/# ping 1.1.1.1
PING 1.1.1.1 (1.1.1.1) 56(84) bytes of data.
From 10.9.0.1 icmp_seq=1 Destination Net Unreachable
From 10.9.0.1 icmp_seq=2 Destination Net Unreachable
From 10.9.0.1 icmp_seq=3 Destination Net Unreachable
From 10.9.0.1 icmp_seq=41 Destination Net Unreachable
^C
--- 1.1.1.1 ping statistics ---
55 packets transmitted, 0 received, +4 errors, 100% packet loss, time 55354ms
```

在 Attacker 端运行上述代码后，构造欺骗 ICMP 报文后，在 User 端 ping1.1.1.1 结果如下：



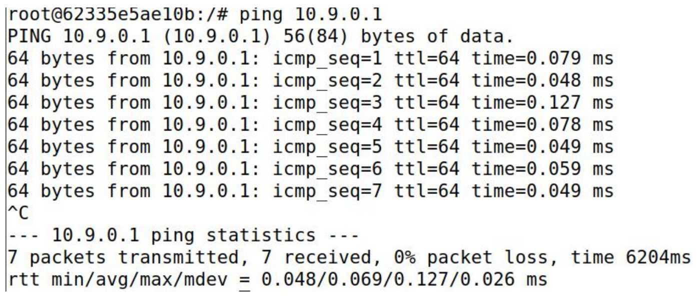
```
root@62335e5ae10b:/# ping 1.1.1.1
PING 1.1.1.1 (1.1.1.1) 56(84) bytes of data.
From 10.9.0.1 icmp_seq=1 Destination Net Unreachable
64 bytes from 1.1.1.1: icmp_seq=1 ttl=64 time=56.0 ms
From 10.9.0.1 icmp_seq=2 Destination Net Unreachable
64 bytes from 1.1.1.1: icmp_seq=2 ttl=64 time=24.8 ms
From 10.9.0.1 icmp_seq=3 Destination Net Unreachable
64 bytes from 1.1.1.1: icmp_seq=3 ttl=64 time=19.5 ms
From 10.9.0.1 icmp_seq=4 Destination Net Unreachable
64 bytes from 1.1.1.1: icmp_seq=4 ttl=64 time=25.1 ms
64 bytes from 1.1.1.1: icmp_seq=5 ttl=64 time=23.3 ms
64 bytes from 1.1.1.1: icmp_seq=6 ttl=64 time=17.6 ms
64 bytes from 1.1.1.1: icmp_seq=7 ttl=64 time=20.2 ms
64 bytes from 1.1.1.1: icmp_seq=8 ttl=64 time=18.7 ms
64 bytes from 1.1.1.1: icmp_seq=9 ttl=64 time=25.0 ms
64 bytes from 1.1.1.1: icmp_seq=10 ttl=64 time=22.8 ms
64 bytes from 1.1.1.1: icmp_seq=11 ttl=64 time=23.5 ms
64 bytes from 1.1.1.1: icmp_seq=12 ttl=64 time=21.7 ms
64 bytes from 1.1.1.1: icmp_seq=13 ttl=64 time=24.2 ms
^C
--- 1.1.1.1 ping statistics ---
13 packets transmitted, 13 received, +4 errors, 0% packet loss, time 12025ms
rtt min/avg/max/mdev = 17.573/24.775/56.034/9.336 ms
```

如下是 sniff and spoof 程序实时输出结果：



```
root@VM:/volumes# python3 ss.py
Original Packet..........
Source IP: 10.9.0.5
Destination IP: 1.1.1.1
Spoofed Packet..........
Source IP: 1.1.1.1
Destination IP: 10.9.0.5
Original Packet..........
Source IP: 10.9.0.5
Destination IP: 1.1.1.1
Spoofed Packet..........
Source IP: 1.1.1.1
Destination IP: 10.9.0.5
Original Packet..........
Source IP: 10.9.0.5
Destination IP: 1.1.1.1
Spoofed Packet..........
Source IP: 1.1.1.1
Destination IP: 10.9.0.5
```

此外对于正常存在的 ip 地址 10.9.0.1，仍然能够 ping 通：



```
root@62335e5ae10b:/# ping 10.9.0.1
PING 10.9.0.1 (10.9.0.1) 56(84) bytes of data.
64 bytes from 10.9.0.1: icmp_seq=1 ttl=64 time=0.079 ms
64 bytes from 10.9.0.1: icmp_seq=2 ttl=64 time=0.048 ms
64 bytes from 10.9.0.1: icmp_seq=3 ttl=64 time=0.127 ms
64 bytes from 10.9.0.1: icmp_seq=4 ttl=64 time=0.078 ms
64 bytes from 10.9.0.1: icmp_seq=5 ttl=64 time=0.049 ms
64 bytes from 10.9.0.1: icmp_seq=6 ttl=64 time=0.059 ms
64 bytes from 10.9.0.1: icmp_seq=7 ttl=64 time=0.049 ms
^C
--- 10.9.0.1 ping statistics ---
7 packets transmitted, 7 received, 0% packet loss, time 6204ms
rtt min/avg/max/mdev = 0.048/0.069/0.127/0.026 ms
```