

# Firewall

## Lab Report 5

Information Systems Security course (01TYM, 02KRQ)

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### Packet filter

- Which authorisation policy is configured by default on your machine (on each of the three chains)?

```
# iptables -L -v -n
Chain INPUT (policy ACCEPT 0 packets, 0 bytes)
 pkts bytes target    prot opt in     out     source                   destination

Chain FORWARD (policy ACCEPT 0 packets, 0 bytes)
 pkts bytes target    prot opt in     out     source                   destination

Chain OUTPUT (policy ACCEPT 0 packets, 0 bytes)
 pkts bytes target    prot opt in     out     source                   destination
```

Which chain (out from INPUT, FORWARD, and OUTPUT) do you have to modify to protect your machine from connections originating from the external users?

- INPUT and FORWARD in order to have protection from external users

```

(root@geo)-[/home/george]
# iptables -P INPUT DROP

(root@geo)-[/home/george]
# iptables -L -v -n
Chain INPUT (policy DROP 0 packets, 0 bytes)
 pkts bytes target    prot opt in     out     source         destination

Chain FORWARD (policy ACCEPT 0 packets, 0 bytes)
 pkts bytes target    prot opt in     out     source         destination

Chain OUTPUT (policy ACCEPT 300 packets, 55360 bytes)
 pkts bytes target    prot opt in     out     source         destination

```

- Write down the iptables command to modify the authorisation policy of Alice's host, so that to reject any traffic (hint: you need to modify the default policy for the INPUT chain from ACCEPT to DROP):
- Does Bob receive any responses (to the ping) from Alice's host?
  - No, he doesn't

```

(elion-man@Elion-Man-on-Kali)-[~]
$ ping 172.22.17.139
PING 172.22.17.139 (172.22.17.139) 56(84) bytes of data.
^C
— 172.22.17.139 ping statistics —
31 packets transmitted, 0 received, 100% packet loss, time 30701ms

```

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an Bob connect to Alice's host via SSH and HTTP (with the browser)?

- No, he doesn't. In both cases, Bob doesn't receive any response from Alice because Alice's firewall has the INPUT chain set to DROP, so it discards all requests from the external source.
- Check with nmap (running the above indicated nmap command on Bob's host) the status of the ports 22 and 80 on Alice's host. What is their status now?

```

# nmap -sT -Pn -n -p 80,22 -v 172.22.17.139
Starting Nmap 7.94 ( https://nmap.org ) at 2023-12-05 12:24 CET
Initiating Connect Scan at 12:24
Scanning 172.22.17.139 [2 ports]
Completed Connect Scan at 12:24, 3.00s elapsed (2 total ports)
Nmap scan report for 172.22.17.139
Host is up.

PORT      STATE      SERVICE
22/tcp    filtered  ssh
80/tcp    filtered  http

Read data files from: /usr/bin/../../share/nmap
Nmap done: 1 IP address (1 host up) scanned in 3.04 seconds

```

- Write down the iptables command to add a rule to the authorisation policy on Alice's host (for the input traffic), so that to enable all ICMP traffic (for simplicity, we provide you some of the parameters of the command)
  - iptables -A INPUT -p icmp -j ACCEPT

```

(root@geo)-[/var/www/html]
# iptables -L -v -n
Chain INPUT (policy DROP 0 packets, 0 bytes)
 pkts bytes target    prot opt in     out     source           destination
    6   504 ACCEPT     1    --  *      *       172.22.16.108    0.0.0.0/0

Chain FORWARD (policy ACCEPT 0 packets, 0 bytes)
 pkts bytes target    prot opt in     out     source           destination

Chain OUTPUT (policy ACCEPT 1292 packets, 547K bytes)
 pkts bytes target    prot opt in     out     source           destination

```

- Does Bob receive this time any response from Alice's host in response to the ping command?
  - Yes, now he does because Alice allows all the icmp packets in input.

```
(elion-man@Elion-Man-on-Kali)-[~]
$ ping 172.22.17.139
PING 172.22.17.139 (172.22.17.139) 56(84) bytes of data.
64 bytes from 172.22.17.139: icmp_seq=1 ttl=64 time=7.40 ms
64 bytes from 172.22.17.139: icmp_seq=2 ttl=64 time=7.32 ms
64 bytes from 172.22.17.139: icmp_seq=3 ttl=64 time=5.06 ms
64 bytes from 172.22.17.139: icmp_seq=4 ttl=64 time=4.27 ms
64 bytes from 172.22.17.139: icmp_seq=5 ttl=64 time=17.3 ms
64 bytes from 172.22.17.139: icmp_seq=6 ttl=64 time=19.5 ms
64 bytes from 172.22.17.139: icmp_seq=7 ttl=64 time=30.6 ms
64 bytes from 172.22.17.139: icmp_seq=8 ttl=64 time=7.02 ms
^C
— 172.22.17.139 ping statistics —
8 packets transmitted, 8 received, 0% packet loss, time 7013ms
rtt min/avg/max/mdev = 4.271/12.311/30.586/8.699 ms
```

- Next,

on Alice's host, write down the iptables command to allow the TCP input traffic towards the port 80 (on Alice):

- iptables -A INPUT -p tcp --dport 80 -j ACCEPT
- Check out the configuration of IPtables on Alice's host. Which chain has been modified?
  - The chain modified is the INPUT chain as specified in the command

```
(root@geo)-[/var/www/html]
# ./script_firewall.sh
Chain INPUT (policy DROP 0 packets, 0 bytes)
  pkts bytes target    prot opt in     out     source    destination
    0     0 ACCEPT    1    --  *      *       0.0.0.0/0  0.0.0.0/0
    0     0 ACCEPT    6    --  *      *       0.0.0.0/0  0.0.0.0/0                                     tcp dpt:80

Chain FORWARD (policy ACCEPT 0 packets, 0 bytes)
  pkts bytes target    prot opt in     out     source    destination

Chain OUTPUT (policy ACCEPT 1544 packets, 609K bytes)
  pkts bytes target    prot opt in     out     source    destination
```

- Does Chuck receive any response (to the ping) from the Alice's host? Why?
  - Yes, Chuck receives ping responses from Alice because she doesn't drop the icmp requests (source is set to anyone)

```
(kali㉿kali)-[~]
└─$ nmap -sT -Pn -n -p 80,22 -v 172.22.17.186
Starting Nmap 7.94 ( https://nmap.org ) at 2023-12-05 15:35 UTC
Initiating Connect Scan at 15:35
Scanning 172.22.17.186 [2 ports]
Discovered open port 80/tcp on 172.22.17.186
Completed Connect Scan at 15:35, 1.61s elapsed (2 total ports)
Nmap scan report for 172.22.17.186
Host is up (0.061s latency).

PORT      STATE      SERVICE
22/tcp    filtered  ssh
80/tcp    open      http

Read data files from: /usr/bin/../../share/nmap
Nmap done: 1 IP address (1 host up) scanned in 1.66 seconds
```

- How can nmap distinguish between filtered ports and closed ports? Verify by analysing the traffic exchanged between the two machines (e.g. with wireshark).
  - Nmap distinguishes between these two states based on whether it receives a response to its probe. In the case of a closed port, it receives a TCP RST packet in response, whereas for a filtered port, it doesn't receive any packet.
- What is the status of the port 80 (as listed by the above nmap command)?
  - The status of the port 80 is set to filtered.

```
└─$ nmap -sT -Pn -n -p 80 -v 172.22.17.170
Starting Nmap 7.94SVN ( https://nmap.org ) at 2023-12-12 09:41 CET
Initiating Connect Scan at 09:41
Scanning 172.22.17.170 [1 port]
Completed Connect Scan at 09:41, 2.00s elapsed (1 total ports)
Nmap scan report for 172.22.17.170
Host is up.

PORT      STATE      SERVICE
80/tcp    filtered  http

Read data files from: /usr/bin/../../share/nmap
Nmap done: 1 IP address (1 host up) scanned in 2.04 seconds
```

- What is now the status of the port 80 on Bob (as listed by the above nmap command on Alice's host)?
  - The status of the port 80 is still set to filtered.

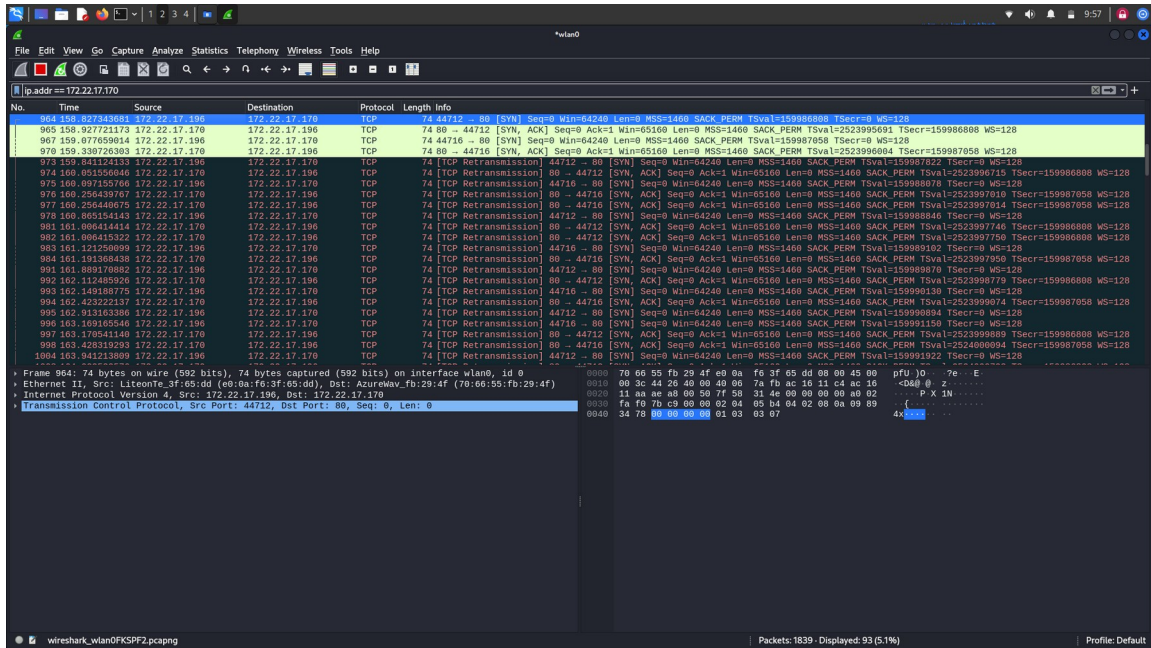
```
$ nmap -sT -Pn -n -p 80 -v 172.22.17.170
Starting Nmap 7.94SVN ( https://nmap.org ) at 2023-12-12 09:42 CET
Initiating Connect Scan at 09:42
Scanning 172.22.17.170 [1 port]
Completed Connect Scan at 09:42, 2.00s elapsed (1 total ports)
Nmap scan report for 172.22.17.170
Host is up.

PORT      STATE      SERVICE
80/tcp    filtered  http

Read data files from: /usr/bin/../../share/nmap
Nmap done: 1 IP address (1 host up) scanned in 2.04 seconds
```

- Can Alice browse web content on Bob's host? Verify by analysing the traffic among the two machines (with Wireshark). After analyzing the traffic with Wireshark, describe what is happening with the SYN, SYN ACK, and ACK messages exchanged between Alice and Bob when Alice tries to browse web content on Bob's host.
  - Alice is unable to browse the web content on Bob's host because she sends a SYN packet to Bob, and Bob responds with a SYN-ACK packet. However, Alice drops the response because the policies specify allowing packets from the destination port equal to 80, whereas it is not allowed to accept packets with the source port equal to 80. Consequently, Alice retransmits the SYN packet because, from her perspective, she doesn't receive the response (SYN-ACK). When the timeout expires, she retries to send the SYN packet.





- Before passing to the execution of the next exercise, restore on Alice's host the authorisation policy of type "ACCEPT ALL".  
Hint: You need to delete all the current rules and specify afterwards the rules for the input chain.
  - `sudo iptables -F INPUT`
  - `sudo iptables -P INPUT ACCEPT`

```
(elion-man@Elion-Man-on-Kali)-[~/Desktop/LAB_IIS/LAB_5]
$ sudo iptables -L -v -n

Chain INPUT (policy ACCEPT 996 packets, 619K bytes)
 pkts bytes target    prot opt in     out     source            destination

Chain FORWARD (policy ACCEPT 0 packets, 0 bytes)
 pkts bytes target    prot opt in     out     source            destination

Chain OUTPUT (policy ACCEPT 0 packets, 0 bytes)
 pkts bytes target    prot opt in     out     source            destination
```

## **Packet filter stateless**

- Can Alice browse the web server of Bob?
  - No, with this settings in the Frank's iptables, she cannot browse the web server of Bob.
- On which chain operate the above commands (on Frank)?
  - Frank is operating on the FORWARD chain.
- At this point, can Alice connect to the web server running on Bob's host?
  - Now, Yes she can.
- Which is the purpose of the last rule?
  - The purpose of the last rule is to allow the forwarding of the tcp segments when the source is Alice and the destination port is equal to 80, and same thing when the destination is Alice with source port equal to 80.
- Can Alice connect to the web server running on another machine (let's say Deborah), after you have configured Deborah to make her traffic pass through Frank's host? Why?
  - Yes, she can. Because, with this rule enables all the tcp traffic for Alice through Frank (it's not specified Bob, Deborah or someone else) allowing her to browse http contents because it operates over tcp with source/destination port equal to 80.
- Start the Apache web server on Alice (if not already started). Can Bob connect with his browser to the web server running on Alice's host?
  - No, he cannot. Because, as said in the previous question, Frank enables the traffic for Alice but not for Bob.
- Can Bob download the web page from Alice's host?
  - No, he cannot (the same reason explained in the previous questions).



- Can Alice and Bob connect to the corresponding SSH servers of the counterparts, that is can Alice connect to SSH server of Bob and viceversa? (hint: think what happens if Bob uses the port 80 as source port)
  - No, she cannot, because ssh operates with source/destination port equal to 22, so it will be dropped by Frank as specified in the rules chain (default-deny).
- Write down (and execute) the iptables command which modifies the policy on Frank's host, so that to enable only the web connections from Alice towards any external user (any IP address):
  - `iptables -I FORWARD 2 -p tcp -d IP Alice --sport 80 --syn -j DROP`

```

# iptables -L -v -n
Chain INPUT (policy ACCEPT 0 packets, 0 bytes)
pkts bytes target      prot opt in      out     source            destination
Chain FORWARD (policy DROP 0 packets, 0 bytes)
pkts bytes target      prot opt in      out     source            destination
 6   264 DROP        6    -- *      *       0.0.0.0/0         172.20.10.13      tcp spt:80 flags:0x17/0x02
 9   540 ACCEPT     6    -- *      *       172.20.10.13      0.0.0.0/0         tcp dpt:80
 7   280 ACCEPT     6    -- *      *       0.0.0.0/0         172.20.10.13      tcp spt:80
Chain OUTPUT (policy ACCEPT 0 packets, 0 bytes)
pkts bytes target      prot opt in      out     source            destination

```

- Have you been successful in running the commands above?
  - No, I haven't.