

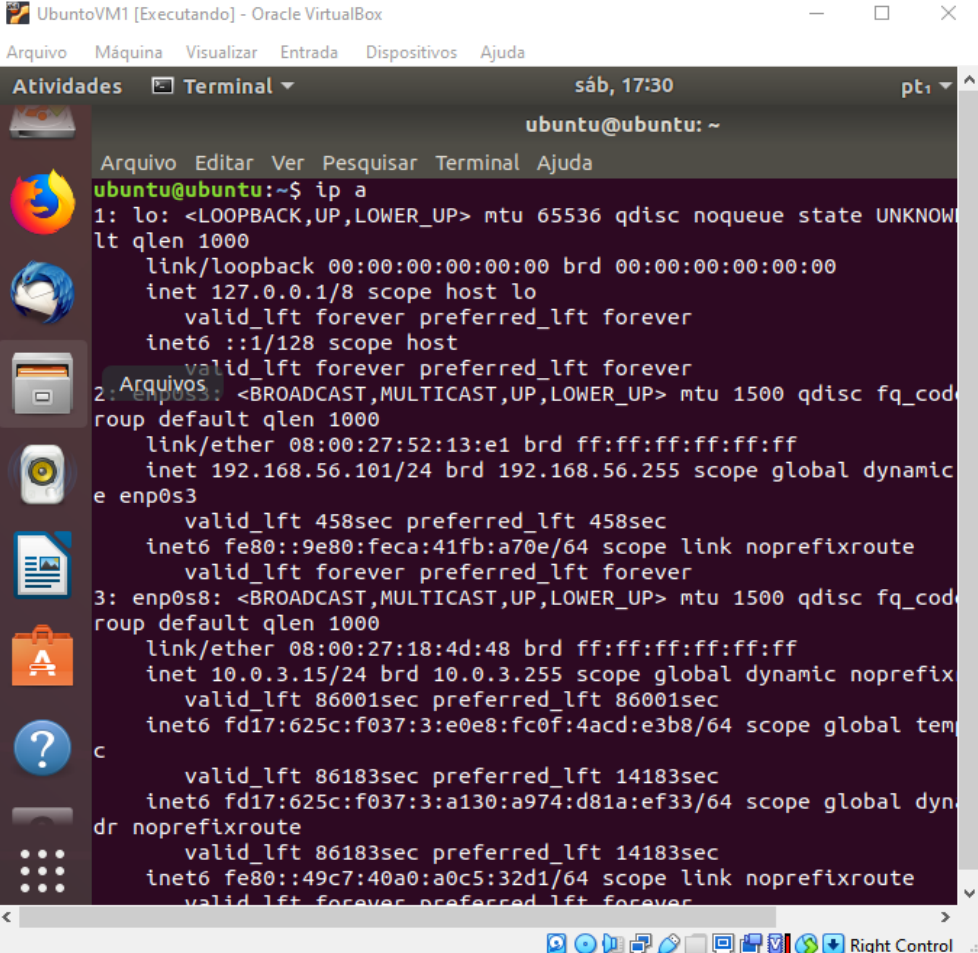
## OBJETIVO

Demonstrar como ocorre a inicialização de uma conexão TCP (Three-Way Handshake) entre duas máquinas reais usando netcat, com análise dos pacotes via tcpdump.

## AMBIENTE UTILIZADO

- 2 VMs Xubuntu no VirtualBox
- Netcat e tcpdump instalados
- Ambas em rede Host-Only (IP local visível com ip a)

## IPs das VMs



UbuntuVM1 [Executando] - Oracle VirtualBox

Arquivo Máquina Visualizar Entrada Dispositivos Ajuda

Atividades Terminal sábado, 17:30 pt1

ubuntu@ubuntu: ~

```
Arquivo Editar Ver Pesquisar Terminal Ajuda
ubuntu@ubuntu:~$ ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
        valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host
        valid_lft forever preferred_lft forever
2: enp0s3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel
    group default qlen 1000
    link/ether 08:00:27:52:13:e1 brd ff:ff:ff:ff:ff:ff
    inet 192.168.56.101/24 brd 192.168.56.255 scope global dynamic
        valid_lft 458sec preferred_lft 458sec
    inet6 fe80::9e80:feca:41fb:a70e/64 scope link noprefixroute
        valid_lft forever preferred_lft forever
3: enp0s8: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel
    group default qlen 1000
    link/ether 08:00:27:18:4d:48 brd ff:ff:ff:ff:ff:ff
    inet 10.0.3.15/24 brd 10.0.3.255 scope global dynamic noprefixroute
        valid_lft 86001sec preferred_lft 86001sec
    inet6 fd17:625c:f037:3:e0e8:fc0f:4acd:e3b8/64 scope global temporary
        valid_lft 86183sec preferred_lft 14183sec
    inet6 fd17:625c:f037:3:a130:a974:d81a:ef33/64 scope global dynamic
        valid_lft 86183sec preferred_lft 14183sec
    inet6 fe80::49c7:40a0:a0c5:32d1/64 scope link noprefixroute
        valid_lft forever preferred_lft forever
```

UbuntuVM2 [Executando] - Oracle VirtualBox

Arquivo Máquina Visualizar Entrada Dispositivos Ajuda

Atividades Terminal sábado, 17:32 pt1

ubuntu@ubuntu: ~

```
Arquivo Editar Ver Pesquisar Terminal Ajuda
ubuntu@ubuntu:~$ ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group defau
lt qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
        valid_lft forever preferred_lft forever
2: enp0s3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP g
roup default qlen 1000
    link/ether 08:00:27:b4:fb:99 brd ff:ff:ff:ff:ff:ff
    inet 192.168.56.102/24 brd 192.168.56.255 scope global dynamic noprefixrou
te enp0s3
        valid_lft 367sec preferred_lft 367sec
    inet6 fe80::f860:41a:907a:3583/64 scope link noprefixroute
        valid_lft forever preferred_lft forever
3: enp0s8: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP g
roup default qlen 1000
    link/ether 08:00:27:e3:98:da brd ff:ff:ff:ff:ff:ff
    inet 10.0.3.15/24 brd 10.0.3.255 scope global dynamic noprefixroute enp0s8
        valid_lft 85867sec preferred_lft 85867sec
    inet6 fd17:625c:f037:3:1808:e89d:3fae:43d4/64 scope global temporary dynami
c
        valid_lft 86337sec preferred_lft 14337sec
    inet6 fd17:625c:f037:3:302c:61c5:c337:fbaa/64 scope global dynamic mngtmpad
r noprefixroute
        valid_lft 86337sec preferred_lft 14337sec
    inet6 fe80::9c86:cc3c:7b9d:d516/64 scope link noprefixroute
        valid_lft forever preferred_lft forever
```

## O "servidor" TCP com netcat na VM1

UbuntuVM1 [Executando] - Oracle VirtualBox

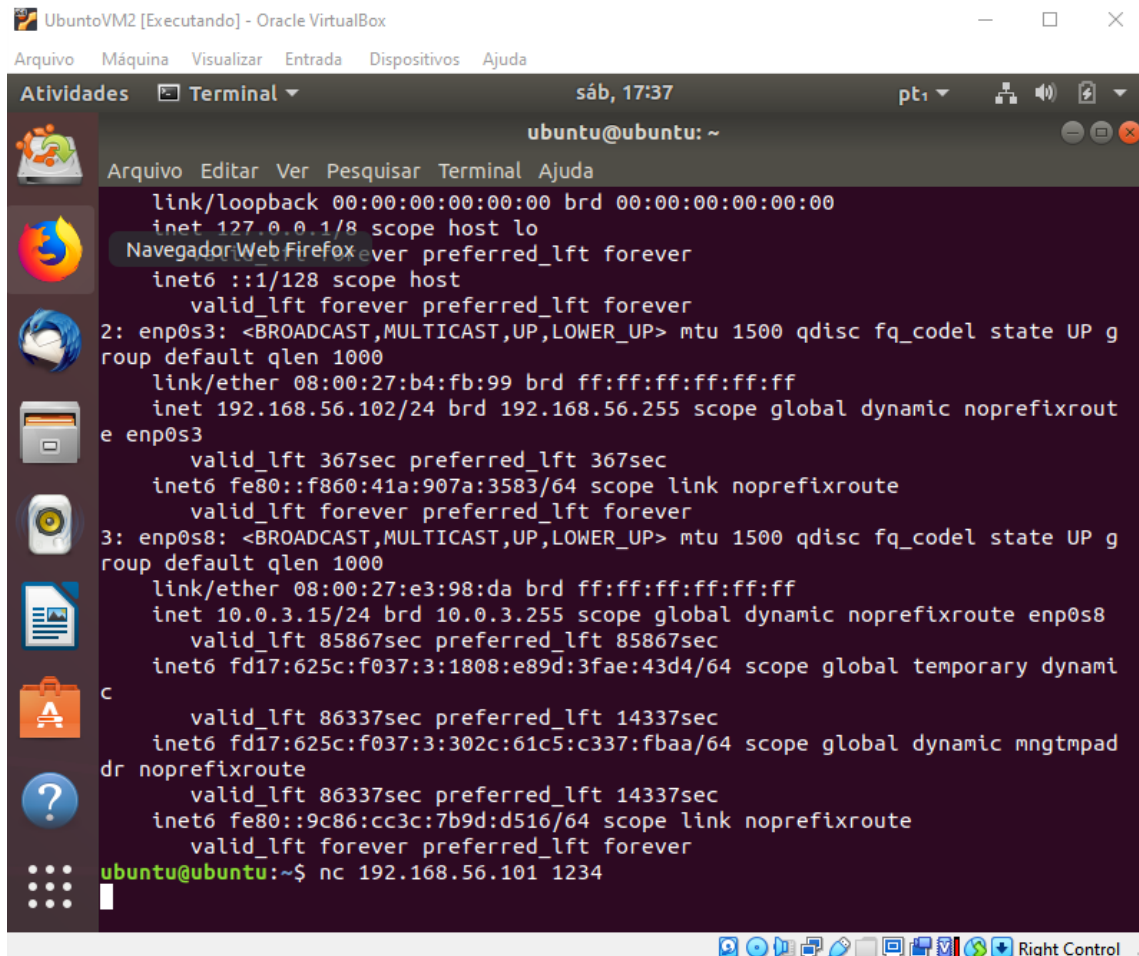
Arquivo Máquina Visualizar Entrada Dispositivos Ajuda

Atividades Terminal sábado, 17:35 pt1

ubuntu@ubuntu: ~

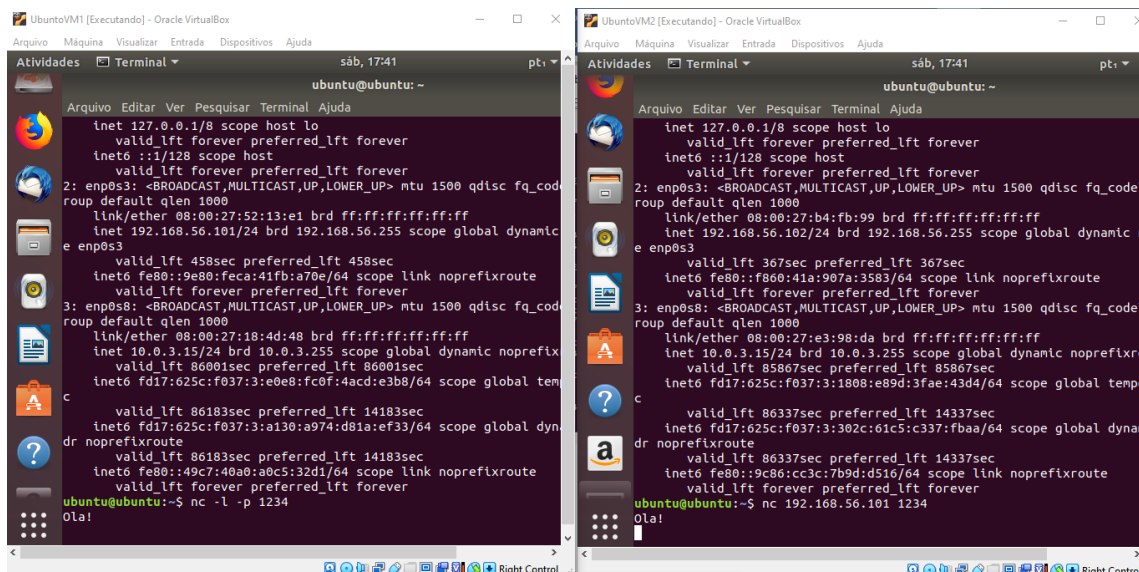
```
Arquivo Editar Ver Pesquisar Terminal Ajuda
link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
inet 127.0.0.1/8 scope host lo
    valid_lft forever preferred_lft forever
inet6 ::1/128 scope host
    valid_lft forever preferred_lft forever
2: enp0s3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP g
roup default qlen 1000
    link/ether 08:00:27:52:13:e1 brd ff:ff:ff:ff:ff:ff
    inet 192.168.56.101/24 brd 192.168.56.255 scope global dynamic noprefixrou
te enp0s3
        valid_lft 458sec preferred_lft 458sec
    inet6 fe80::9e80:feca:41fb:a70e/64 scope link noprefixroute
        valid_lft forever preferred_lft forever
3: enp0s8: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP g
roup default qlen 1000
    link/ether 08:00:27:18:4d:48 brd ff:ff:ff:ff:ff:ff
    inet 10.0.3.15/24 brd 10.0.3.255 scope global dynamic noprefixroute enp0s8
        valid_lft 86001sec preferred_lft 86001sec
    inet6 fd17:625c:f037:3:e0e8:fc0f:4acd:e3b8/64 scope global temporary dynami
c
        valid_lft 86183sec preferred_lft 14183sec
    inet6 fd17:625c:f037:3:a130:a974:d81a:ef33/64 scope global dynamic mngtmpadr
noprefixroute
        valid_lft 86183sec preferred_lft 14183sec
    inet6 fe80::49c7:40a0:a0c5:32d1/64 scope link noprefixroute
        valid_lft forever preferred_lft forever
ubuntu@ubuntu:~$ nc -l -p 1234
```

## VM2 (cliente) com netcat



```
ubuntu@ubuntu: ~  
Arquivo Editar Ver Pesquisar Terminal Ajuda  
link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00  
inet 127.0.0.1/8 scope host lo  
    valid_lft forever preferred_lft forever  
inet6 ::1/128 scope host  
    valid_lft forever preferred_lft forever  
2: enp0s3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP g  
roup default qlen 1000  
    link/ether 08:00:27:b4:fb:99 brd ff:ff:ff:ff:ff:ff  
    inet 192.168.56.102/24 brd 192.168.56.255 scope global dynamic noprefixrou  
t e enp0s3  
        valid_lft 367sec preferred_lft 367sec  
        inet6 fe80::f860:41a:907a:3583/64 scope link noprefixroute  
            valid_lft forever preferred_lft forever  
3: enp0s8: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP g  
roup default qlen 1000  
    link/ether 08:00:27:e3:98:da brd ff:ff:ff:ff:ff:ff  
    inet 10.0.3.15/24 brd 10.0.3.255 scope global dynamic noprefixroute enp0s8  
        valid_lft 85867sec preferred_lft 85867sec  
        inet6 fd17:625c:f037:3:1808:e89d:3fae:43d4/64 scope global temporary dynami  
c  
            valid_lft 86337sec preferred_lft 14337sec  
            inet6 fd17:625c:f037:3:302c:61c5:c337:fbaa/64 scope global dynamic mngt  
mpadr noprefixroute  
                valid_lft 86337sec preferred_lft 14337sec  
                inet6 fe80::9c86:cc3c:7b9d:d516/64 scope link noprefixroute  
                    valid_lft forever preferred_lft forever  
ubuntu@ubuntu:~$ nc 192.168.56.101 1234
```

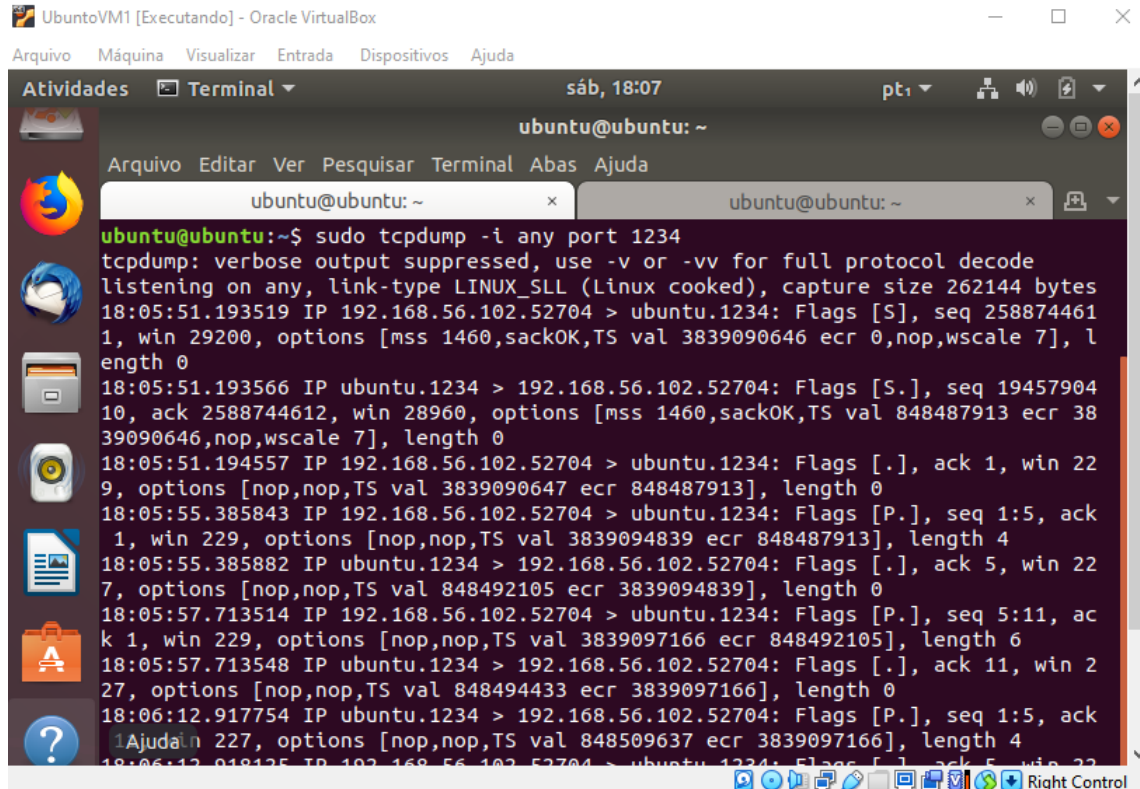
## Mensagem para testar



```
ubuntu@ubuntu: ~  
Arquivo Editar Ver Pesquisar Terminal Ajuda  
inet 127.0.0.1/8 scope host lo  
    valid_lft forever preferred_lft forever  
inet6 ::1/128 scope host  
    valid_lft forever preferred_lft forever  
2: enp0s3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel  
roup default qlen 1000  
    link/ether 08:00:27:18:4d:48 brd ff:ff:ff:ff:ff:ff  
    inet 192.168.56.101/24 brd 192.168.56.255 scope global dynamic  
n e enp0s3  
        valid_lft 458sec preferred_lft 458sec  
        inet6 fe80::9e80:feca:41fb:a70e/64 scope link noprefixroute  
            valid_lft forever preferred_lft forever  
3: enp0s8: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel  
roup default qlen 1000  
    link/ether 08:00:27:18:4d:48 brd ff:ff:ff:ff:ff:ff  
    inet 10.0.3.15/24 brd 10.0.3.255 scope global dynamic noprefix  
route  
        valid_lft 86001sec preferred_lft 86001sec  
        inet6 fd17:625c:f037:3:e0e8:fc0f:4acd:e3b8/64 scope global tempo  
rary dynami  
c  
            valid_lft 86183sec preferred_lft 14183sec  
            inet6 fd17:625c:f037:3:a130:a974:d81a:ef33/64 scope global dyna  
mic  
                valid_lft 86183sec preferred_lft 14183sec  
                inet6 fe80::49c7:40a0:a0c5:32d1/64 scope link noprefixroute  
                    valid_lft forever preferred_lft forever  
ubuntu@ubuntu:~$ nc -l -p 1234  
Ola!
```

```
ubuntu@ubuntu: ~  
Arquivo Editar Ver Pesquisar Terminal Ajuda  
inet 127.0.0.1/8 scope host lo  
    valid_lft forever preferred_lft forever  
inet6 ::1/128 scope host  
    valid_lft forever preferred_lft forever  
2: enp0s3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel  
roup default qlen 1000  
    link/ether 08:00:27:b4:fb:99 brd ff:ff:ff:ff:ff:ff  
    inet 192.168.56.102/24 brd 192.168.56.255 scope global dynamic  
n e enp0s3  
        valid_lft 367sec preferred_lft 367sec  
        inet6 fe80::f860:41a:907a:3583/64 scope link noprefixroute  
            valid_lft forever preferred_lft forever  
3: enp0s8: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel  
roup default qlen 1000  
    link/ether 08:00:27:e3:98:da brd ff:ff:ff:ff:ff:ff  
    inet 10.0.3.15/24 brd 10.0.3.255 scope global dynamic noprefixro  
ute  
        valid_lft 85867sec preferred_lft 85867sec  
        inet6 fd17:625c:f037:3:1808:e89d:3fae:43d4/64 scope global tempo  
rary dynami  
c  
            valid_lft 86337sec preferred_lft 14337sec  
            inet6 fd17:625c:f037:3:302c:61c5:c337:fbaa/64 scope global dyna  
mic  
                valid_lft 86337sec preferred_lft 14337sec  
                inet6 fe80::9c86:cc3c:7b9d:d516/64 scope link noprefixroute  
                    valid_lft forever preferred_lft forever  
ubuntu@ubuntu:~$ nc 192.168.56.101 1234  
Ola!
```

## Pacotes TCP com tcpdump



The screenshot shows a terminal window titled "UbuntuVM1 [Executando] - Oracle VirtualBox". The terminal output displays the results of a tcpdump command: `sudo tcpdump -i any port 1234`. The output shows a listening session on port 1234. It captures a SYN packet from IP 192.168.56.102 to ubuntu.1234, followed by a SYN-ACK response from ubuntu.1234, and then an ACK packet from the client. The terminal also shows the user's prompt `ubuntu@ubuntu: ~` and the command `sudo tcpdump -i any port 1234` being executed. The output of the command is as follows:

```
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on any, link-type LINUX_SLL (Linux cooked), capture size 262144 bytes
18:05:51.193519 IP 192.168.56.102.52704 > ubuntu.1234: Flags [S], seq 258874461
1, win 29200, options [mss 1460,sackOK,TS val 3839090646 ecr 0,nop,wscale 7], l
ength 0
18:05:51.193566 IP ubuntu.1234 > 192.168.56.102.52704: Flags [S.], seq 19457904
10, ack 2588744612, win 28960, options [mss 1460,sackOK,TS val 848487913 ecr 38
39090646,nop,wscale 7], length 0
18:05:51.194557 IP 192.168.56.102.52704 > ubuntu.1234: Flags [.], ack 1, win 22
9, options [nop,nop,TS val 3839090647 ecr 848487913], length 0
18:05:55.385843 IP 192.168.56.102.52704 > ubuntu.1234: Flags [P.], seq 1:5, ack
1, win 229, options [nop,nop,TS val 3839094839 ecr 848487913], length 4
18:05:55.385882 IP ubuntu.1234 > 192.168.56.102.52704: Flags [.], ack 5, win 22
7, options [nop,nop,TS val 848492105 ecr 3839094839], length 0
18:05:57.713514 IP 192.168.56.102.52704 > ubuntu.1234: Flags [P.], seq 5:11, ac
k 1, win 229, options [nop,nop,TS val 3839097166 ecr 848492105], length 6
18:05:57.713548 IP ubuntu.1234 > 192.168.56.102.52704: Flags [.], ack 11, win 2
27, options [nop,nop,TS val 848494433 ecr 3839097166], length 0
18:06:12.917754 IP ubuntu.1234 > 192.168.56.102.52704: Flags [P.], seq 1:5, ack
11, win 227, options [nop,nop,TS val 848509637 ecr 3839097166], length 4
18:06:12.918125 IP 192.168.56.102.52704 > ubuntu.1234: Flags [S.], seq 1:5, ack
11, win 227, options [nop,nop,TS val 3839097166 ecr 848494433], length 6
```

## Conclusão

A simulação comprovou o funcionamento do Three-Way Handshake, processo essencial para o estabelecimento de conexões TCP confiáveis. Com o netcat, foi possível iniciar uma sessão entre cliente e servidor manualmente, e através do tcpdump, visualizar os pacotes SYN, SYN-ACK e ACK trocados. Isso evidenciou a confiabilidade do protocolo TCP na criação de conexões estáveis antes do envio de dados. O exercício reforça o entendimento da camada 4 (Transporte) do modelo OSI.