2025

Projeto Final, Fundamentos de Redes de Comunicação

CURSO TÉCNICO SUPERIOR PROFISSIONAL EM REDES E SISTEMAS INFORMÁTICOS

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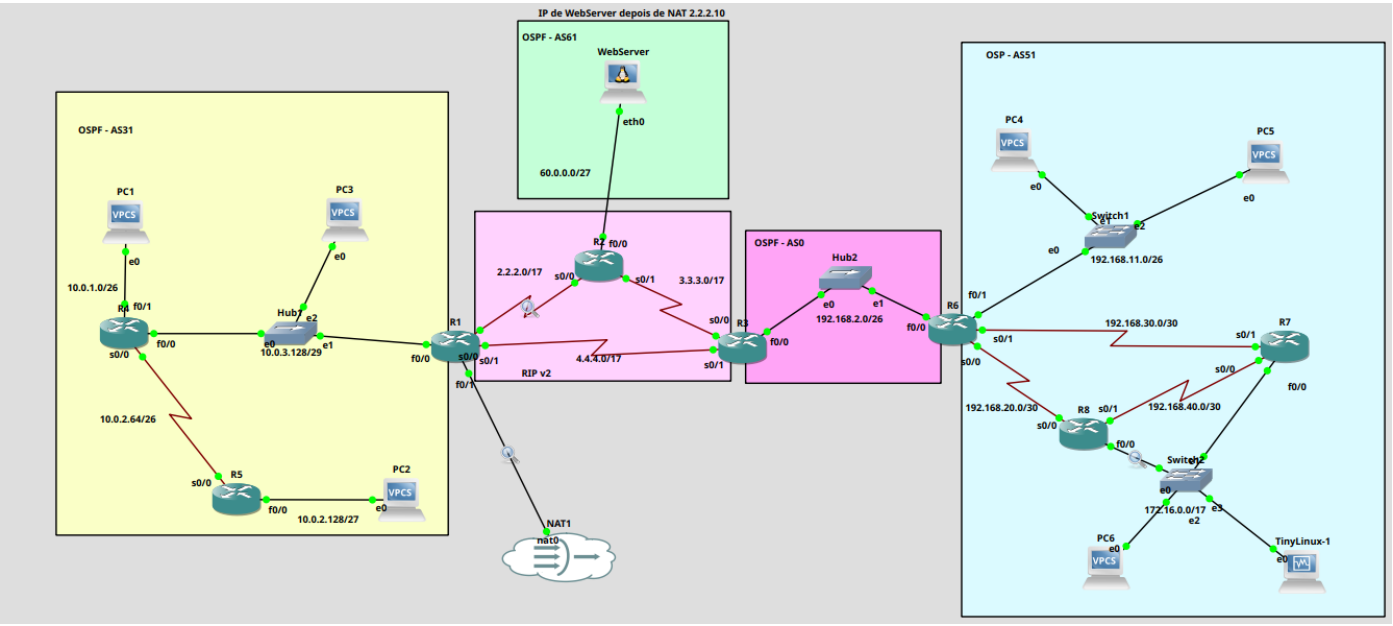
Link Google Drive com o projeto:

https://drive.google.com/file/d/1QNuci69K3woc42b269zMHExWZyJ2pXyB/view?usp=sharing

1. Execução do Trabalho

1.1) Topologia da Rede, com as áreas OSPF correspondentes ao nosso grupo (X = 3 - 2):



c) Configuração OSPF e RIP nos Routers envolvidos, de modo às redes OSPF divulgarem a informação da rede central, que possui protocolo RIP(v2); e, ao mesmo tempo, permitir que a parte configurada em RIP(v2) partilha e propaga a informação recebida pelo protocolo OSPF:

Router 1:

```
R1#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R1(config)#router ospf 1
R1(config-router)#redistribute rip subnets
R1(config-router)#
```

```
R1(config)#router rip
R1(config-router)#redistri
R1(config-router)#redistribute ospf 1 metric 1
R1(config-router)#end
```

Router 3:

```
R3#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R3(config)#router ospf 1
R3(config-router)#redistribute rip subnets
R3(config-router)#end
R3#write
*Mar  1 00:52:25.211: %SYS-5-CONFIG_I: Configured from console by cor
R3#write
```

```
R3#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R3(config)#router rip
R3(config-router)#redis
R3(config-router)#redistribute ospf 1 metric 1
R3(config-router)#end
R3#write
*Mar  1 01:02:34.543: %SYS-5-CONFIG_I: Configured from console by console
R3#write
```

d) Configuração do Router R2 para fazer NAT para o servidor interno:

De modo à rede ficar protegida, configurámos NAT estático da seguinte forma:

```
R2#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R2(config)#ip nat inside source static 60.0.0.1 2.2.2.10
R2(config)#router rip
R2(config-router)#version 2
R2(config-router)#network 2.2.2.10
```

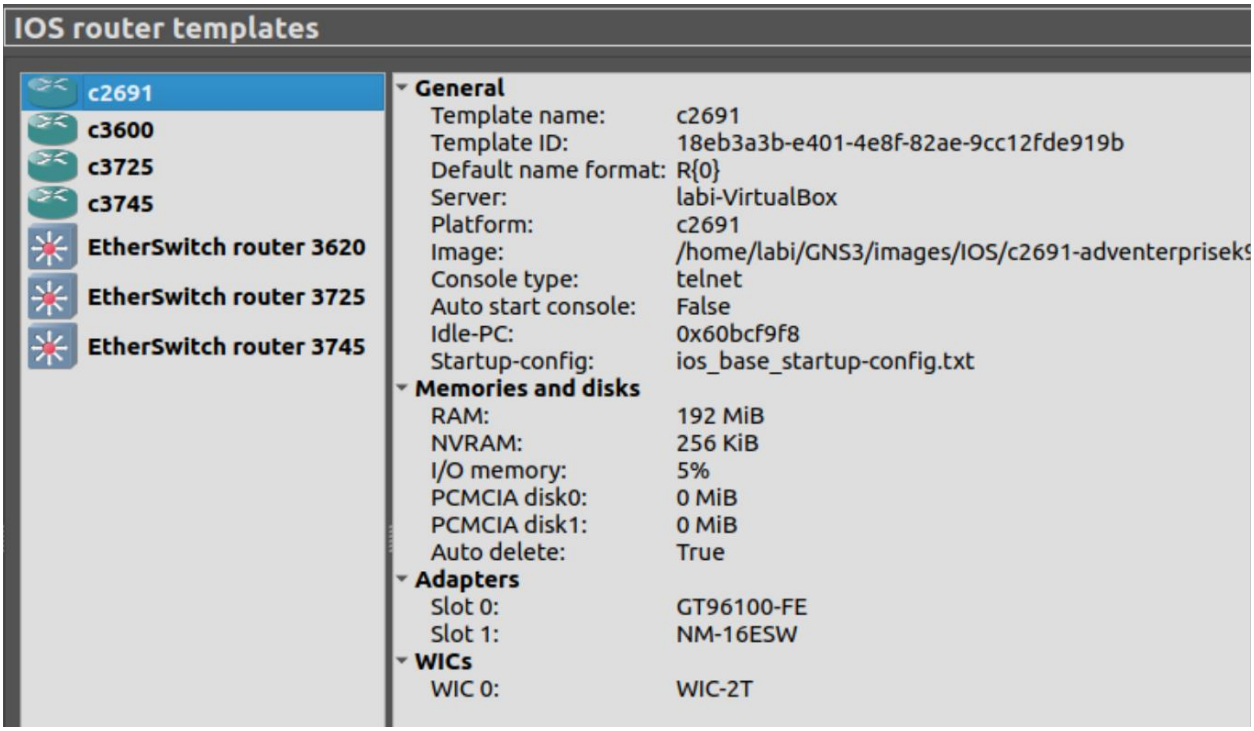
Para avisar os outros routers que R2 tem como IP Inside Global 2.2.2.10, usámos o RIPv2.

Não é possível fazer ping para 60.0.0.1, apesar de ser esse o IP real do WebServer. Mas, fazendo ping a 2.2.2.10, é possível chegar ao WebServer, ficando assim a rede protegida, através do NAT.

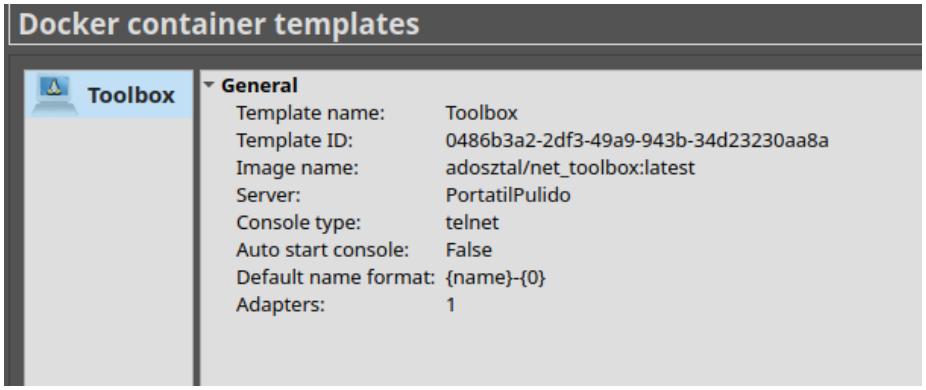
```
R2#show ip nat statistics
Total active translations: 1 (1 static, 0 dynamic; 0 extended)
Outside interfaces:
  Serial0/0, Serial0/1
Inside interfaces:
  FastEthernet0/0
Hits: 87  Misses: 0
CEF Translated packets: 87, CEF Punted packets: 0
Expired translations: 12
Dynamic mappings:
Appl doors: 0
Normal doors: 0
Queued Packets: 0
```

```
R2#show ip nat translations
Pro Inside global      Inside local       Outside local      Outside global
--- 2.2.2.10           60.0.0.1           ---                ---
```

e) No enunciado não referia o tipo de WIC 0 a usar, pelo que optámos por WIC-2T



f) GNS3 Toolbox appliance:



g)

Configurações NAT no Router 1 / Configuração da Cloud NAT:

```
R1#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R1(config)#ip ad
R1(config)#ip add
R1(config)#int f0/1
R1(config-if)#ip add
R1(config-if)#ip address dhcp
R1(config-if)#no shut
R1(config-if)#no shutdown
```

```
R1(config)#int f0/1
R1(config-if)#ip nat out
R1(config-if)#ip nat outside
R1(config-if)#
*Mar  1 00:05:33.531: %LINEPROTO-5-UPDOWN
o up
R1(config-if)#exit
R1(config)#int f0/0
R1(config-if)#ip nat inse
R1(config-if)#ip nat ins
R1(config-if)#ip nat inside
R1(config-if)#exit
R1(config)#int s0/0
R1(config-if)#ip nat inside
R1(config-if)#exit
R1(config)#int s0/1
R1(config-if)#ip nat inside
R1(config-if)#exit
```

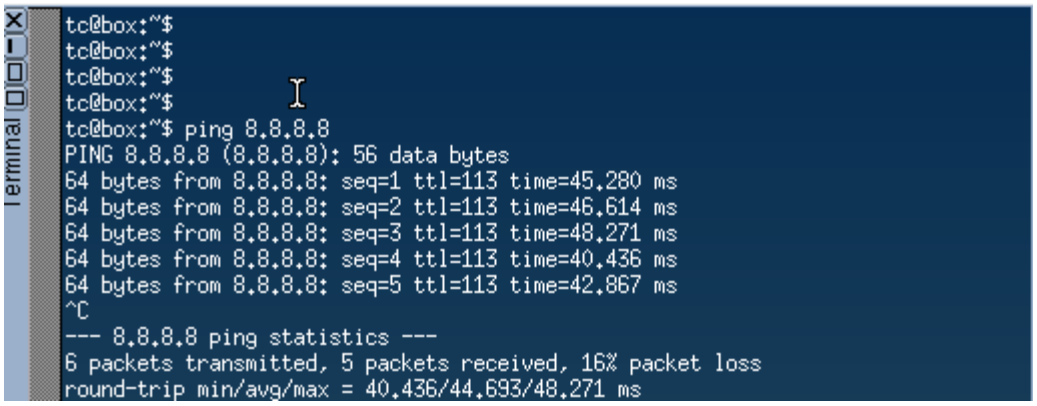
```
R1#show run | inc nat
 ip nat inside
 ip nat inside
 ip nat outside
 ip nat inside
ip nat inside source list 1 interface FastEthernet0/1 overload
```

O comando 'ip nat inside source list 1 interface FastEthernet0/1 overload' permite que os pacotes que vão para o exterior, tenham como IP de origem o IP da interface f0/1 do Router R1.

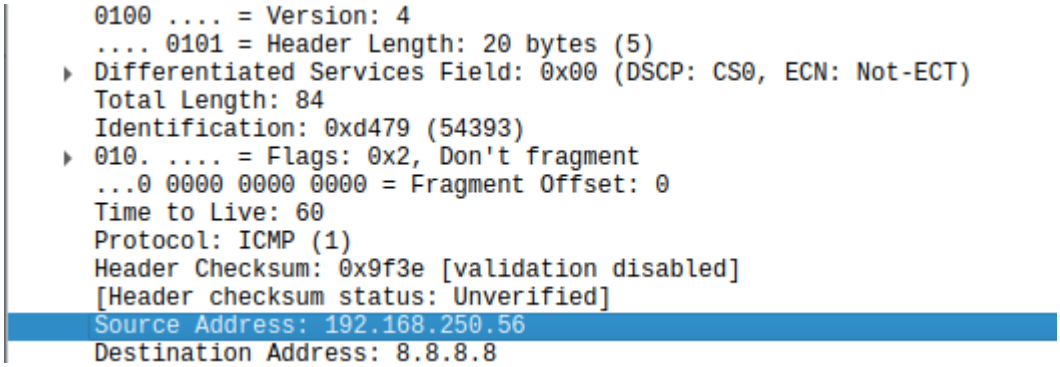
```
R1#show access-list
Standard IP access list 1
    10 permit 10.0.0.0, wildcard bits 0.255.255.255 (910 matches)
    20 permit 192.168.0.0, wildcard bits 0.0.255.255 (7 matches)
    30 permit 172.16.0.0, wildcard bits 0.0.255.255 (233 matches)
R1#
```

Encontrámos problemas ao usar 'permit any' na access list. Em vez disso, autorizámos as todas as nossas redes privadas, o que resolveu o esse problema.

Comprovativo de que o Router R1 faz NAT para a internet:



Comprovativo de que o IP é alterado ao sair da rede privada do Router R1:



2. Identificação das redes usadas e configuradas

Rede	ID Rede	Nº de hosts	Máscara	1º IP	Último IP	IP Broadcast
1	10.0.1.0	62	255.255.255.192	10.0.1.1	10.0.1.62	10.0.1.63
2	10.0.2.64	62	255.255.255.192	10.0.2.65	10.0.2.126	10.0.2.127
3	10.0.2.128	30	255.255.255.224	10.0.2.129	10.0.2.158	10.0.2.159
4	10.0.3.128	6	255.255.255.248	10.0.3.129	10.0.3.134	10.0.3.135
5	2.2.2.0	32766	255.255.128.0	2.2.2.1	2.2.127.254	2.2.127.255
6	3.3.3.0	32766	255.255.128.0	3.3.3.1	3.3.127.254	3.3.127.255
7	4.4.4.0	32766	255.255.128.0	4.4.4.1	4.4.127.254	4.4.127.255
8	60.0.0.0	30	255.255.255.224	60.0.0.1	60.0.0.30	60.0.0.31
9	192.168.2.0	62	255.255.255.192	192.168.2.1	192.168.2.62	192.168.2.63
10	192.168.11.0	62	255.255.255.192	192.168.11.1	192.168.11.62	192.168.11.63
11	192.168.20.0	2	255.255.255.252	192.168.20.1	192.168.20.2	192.168.20.3
12	192.168.30.0	2	255.255.255.252	192.168.30.1	192.168.30.2	192.168.30.3
13	192.168.40.0	2	255.255.255.252	192.168.40.1	192.168.40.2	192.168.40.3
14	172.16.0.0	32766	255.255.128.0	172.16.0.1	172.16.127.254	172.16.127.255

3. Identificação dos Equipamentos

Equipamento	Interface	IP	Máscara	Gateway	MAC adresses
Router 1	f0/0	10.0.3.134	255.255.255.248		C0:01:21:66:00:00
	f0/1	DHCP	DCHP		C0:01:21:66:00:01
	s0/0	2.2.127.254	255.255.128.0		
	s0/1	4.4.127.254	255.255.128.0		
Router 2	f0/0	60.0.0.30	255.255.255.224		C0:02:21:A4:00:00
	s0/0	2.2.2.1	255.255.128.0		
	s0/1	3.3.3.1	255.255.128.0		
Router 3	f0/0	192.168.2.62	255.255.255.192		C0:03:21:D3:00:00
	s0/0	3.3.3.2	255.255.128.0		
	s0/1	4.4.4.1	255.255.128.0		
Router 4	f0/0	10.0.3.129	255.255.255.248		C0:04:21:EF:00:00
	f0/1	10.0.1.62	255.255.255.192		C0:04:21:EF:00:01
	s0/0	10.0.2.126	255.255.255.192		
Router 5	f0/0	10.0.2.158	255.255.255.224		C0:05:22:11:00:00
	s0/0	10.0.2.65	255.255.255.192		
Router 6	f0/0	192.168.2.1	255.255.255.192		C0:06:22:D1:00:00
	f0/1	192.168.11.62	255.255.255.192		C0:06:22:D1:00:01
	s0/0	192.168.20.2	255.255.255.252		
	s0/1	192.168.30.2	255.255.255.252		
Router 7	f0/0	172.16.0.1	255.255.128.0		C0:07:1B:20:00:00
	s0/0	192.168.40.1	255.255.255.252		
	s0/1	192.168.30.1	255.255.255.252		
Router 8	f0/0	172.16.127.254	255.255.128.0		C0:08:1B:40:00:00
	s0/0	192.168.20.1	255.255.255.252		
	s0/1	192.168.40.2	255.255.255.252		
PC1	e0	10.0.1.1	255.255.255.192	10.0.1.62	00:50:79:66:68:00
PC2	e0	10.0.2.129	255.255.255.224	10.0.2.158	00:50:79:66:68:01
PC3	e0	10.0.3.130	255.255.255.248	10.0.3.134	00:50:79:66:68:02
PC4	e0	192.168.11.1	255.255.255.192	192.168.11.62	00:50:79:66:68:03
PC5	e0	168.192.11.2	255.255.255.192	192.168.11.62	00:50:79:66:68:04
PC6	e0	172.16.0.2	255.255.128.0	172.16.127.254	00:50:79:66:68:05
TinyLinux	e0	172.16.0.3	255.255.128.0	172.16.127.254	08:00:27:EF:C9:26
WebServer	e0	60.0.0.1	255.255.255.224	60.0.0.30	02:42:A0:E5:61:00

Configuração dos equipamentos, com mais detalhe:

- ### Configuração Routers

Router 1:

```
R1#show ip int br
Interface                  IP-Address      OK? Method Status                Protocol
FastEthernet0/0            10.0.3.134      YES manual up                    up
Serial0/0                  2.2.127.254     YES manual up                    down
FastEthernet0/1            unassigned      YES unset  administratively down down
Serial0/1                  4.4.127.254     YES manual up                    down
FastEthernet1/0            unassigned      YES unset  up                    down
FastEthernet1/1            unassigned      YES unset  up                    down
FastEthernet1/2            unassigned      YES unset  up                    down
FastEthernet1/3            unassigned      YES unset  up                    down
FastEthernet1/4            unassigned      YES unset  up                    down
FastEthernet1/5            unassigned      YES unset  up                    down
FastEthernet1/6            unassigned      YES unset  up                    down
```

R1 — Konsole

New Tab Split View

```
interface Vlan1
 no ip address
!
router ospf 1
 log-adjacency-changes
 network 10.0.3.128 0.0.0.7 area 31
!
router rip
 version 2
 network 2.0.0.0
 network 4.0.0.0
 network 10.0.0.0
 no auto-summary
```

```
R1#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R1(config)#ip route 0.0.0.0 0.0.0.0 f0/1
R1(config)#end
```

Router 2:

```
R2#show ip int br
Interface                  IP-Address      OK? Method Status                Protocol
FastEthernet0/0            60.0.0.30       YES manual up                    up
Serial0/0                  2.2.2.1         YES manual up                    up
FastEthernet0/1            unassigned      YES unset  administratively down down
Serial0/1                  3.3.3.1         YES manual up                    down
FastEthernet1/0            unassigned      YES unset  up                    down
FastEthernet1/1            unassigned      YES unset  up                    down
FastEthernet1/2            unassigned      YES unset  up                    down
FastEthernet1/3            unassigned      YES unset  up                    down
FastEthernet1/4            unassigned      YES unset  up                    down
FastEthernet1/5            unassigned      YES unset  up                    down
FastEthernet1/6            unassigned      YES unset  up                    down
```

R2 — Konsole

New Tab Split View

```
 no ip address
!
router ospf 1
 log-adjacency-changes
 network 60.0.0.0 0.0.0.31 area 61
!
router rip
 version 2
 network 2.0.0.0
 network 3.0.0.0
 network 60.0.0.0
 no auto-summary
!
```

Size: 91 x 15

```
R2#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R2(config)#ip route 0.0.0.0 0.0.0.0 2.2.127.254
R2(config)#end
```

Router 3:

```
R3#show ip int br
Interface                  IP-Address      OK? Method Status                Protocol
FastEthernet0/0            192.168.2.62    YES manual up                    up
Serial0/0                  3.3.3.2         YES NVRAM  up                    up
FastEthernet0/1            unassigned      YES NVRAM  administratively down down
Serial0/1                  4.4.4.1         YES NVRAM  up                    up
```

```
!
router ospf 1
 log-adjacency-changes
 network 192.168.2.0 0.0.0.63 area 0
!
router rip
 version 2
 network 3.0.0.0
 network 4.0.0.0
 network 192.168.2.0
 no auto-summary
!
```

```
R3(config)#ip route 0.0.0.0 0.0.0.0 4.4.127.254
R3(config)#end
R3#write
```

Router 4:

```
R4#
*Mar  1 00:32:42.175: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0, changed state to up
R4#show ip int br
Interface                  IP-Address      OK? Method Status                Protocol
FastEthernet0/0            10.0.3.129      YES manual up                    up
Serial0/0                  10.0.2.126      YES manual up                    up
FastEthernet0/1            10.0.1.62       YES manual up                    up
Serial0/1                  unassigned      YES unset  administratively down down
FastEthernet1/0            unassigned      YES unset  up                    down
FastEthernet1/1            unassigned      YES unset  up                    down
FastEthernet1/2            unassigned      YES unset  up                    down
FastEthernet1/3            unassigned      YES unset  up                    down
FastEthernet1/4            unassigned      YES unset  up                    down
FastEthernet1/5            unassigned      YES unset  up                    down
FastEthernet1/6            unassigned      YES unset  up                    down
```

```
R4(config)#router ospf 1
R4(config-router)#network 10.0.2.64 0.0.0.63 area 31
R4(config-router)#network 10.0.2.64 0.0.0.63 area 31
*Mar  1 00:06:10.063: %OSPF-5-ADJCHG: Process 1, Nbr 10.0.2.
e
R4(config-router)#network 10.0.3.128 0.0.0.7 area 31
R4(config-router)#network 10.0.1.0 0.0.0.63 area 31
R4(config-router)#end
```

```
R4#conf t
Enter configuration commands, one per line.  End with CNTL/Z
R4(config)#ip route 0.0.0.0 0.0.0.0 10.0.3.134
R4(config)#
```

Router 5:

```
R5#show ip int br
Interface                  IP-Address      OK? Method Status                Protocol
FastEthernet0/0            10.0.2.158      YES manual up                    up
Serial0/0                  10.0.2.65       YES manual up                    up
FastEthernet0/1            unassigned      YES unset  administratively down down
Serial0/1                  unassigned      YES unset  administratively down down
FastEthernet1/0            unassigned      YES unset  up                    down
FastEthernet1/1            unassigned      YES unset  up                    down
```

```
Enter configuration commands, one per line.  End with CNTL/Z.
R5(config)#router ospf 1
R5(config-router)#network 10.0.2.128 0.0.0.31 area 31
R5(config-router)#network 10.0.2.64 0.0.0.63 area 31
```

```
R5(config)#ip route 0.0.0.0 0.0.0.0 10.0.2.126
R5(config)#end
```

Router 6:

```
R6#show ip int br
Interface                  IP-Address      OK? Method Status                Protocol
FastEthernet0/0            192.168.2.1     YES manual up                    up
Serial0/0                  192.168.20.2    YES manual up                    up
FastEthernet0/1            192.168.11.62   YES manual up                    up
Serial0/1                  192.168.30.2    YES manual up                    up
FastEthernet1/0            unassigned      YES unset  up                    down
FastEthernet1/1            unassigned      YES unset  up                    down
FastEthernet1/2            unassigned      YES unset  up                    down
```

```
R6#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R6(config)#router ospf 1
R6(config-router)#network 192.168.20.0 0.0.0.3 area 51
R6(config-router)#network 192.168.20.0 0.0.0.3 area 51
*Mar  1 00:13:27.215: %OSPF-5-ADJCHG: Process 1, Nbr 192.168.40.2 on Serial0/0 from LOADING t
o FULL, Loading Done
R6(config-router)#network 192.168.30.0 0.0.0.3 area 51
R6(config-router)#
*Mar  1 00:13:37.595: %OSPF-5-ADJCHG: Process 1, Nbr 192.168.40.1 on Serial0/1 from LOADING t
o FULL, Loading Done
R6(config-router)#network 192.168.11.0 0.0.0.63 area 51
R6(config-router)#network 192.168.2.0 0.0.0.63 area 0
R6(config-router)#
```

```
R6#conf
Configuring from terminal, memory, or network [terminal]?
Enter configuration commands, one per line.  End with CNTL/Z.
R6(config)#ip route 0.0.0.0 0.0.0.0 192.168.2.62
R6(config)#
```

Router 7

```
R7#show ip int br
Interface                  IP-Address      OK? Method Status                Protocol
FastEthernet0/0            172.16.0.1      YES manual up                    up
Serial0/0                  192.168.40.1    YES manual up                    up
FastEthernet0/1            unassigned      YES unset  administratively down down
Serial0/1                  192.168.30.1    YES manual up                    up
FastEthernet1/0            unassigned      YES unset  up                    down
FastEthernet1/1            unassigned      YES unset  up                    down
```

```
R7#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R7(config)#router ospf 1
R7(config-router)#network 172.16.0.0 0.0.127.255 area 51
R7(config-router)#network 192.168.40.0 0.0.0.3 area 51
R7(config-router)#network 192.168.30.0 0.0.0.3 area 51
R7(config-router)#
```

```
Enter configuration commands, one per line.  End with CNTL/Z.
R7(config)#ip route 0.0.0.0 0.0.0.0 192.168.30.2
R7(config)#
```

Router 8

```
R8#show ip int br
Interface                  IP-Address      OK? Method Status                Protocol
FastEthernet0/0            172.16.127.254  YES manual up                    up
Serial0/0                  192.168.20.1    YES manual up                    up
FastEthernet0/1            unassigned      YES unset  administratively down down
Serial0/1                  192.168.40.2    YES manual up                    up
FastEthernet1/0            unassigned      YES unset  up                    down
FastEthernet1/1            unassigned      YES unset  up                    down
```

```
R8#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R8(config)#router ospf 1
R8(config-router)#network 172.16.0.0 0.0.127.255 area 51
R8(config-router)#
*Mar  1 00:11:47.779: %OSPF-5-ADJCHG: Process 1, Nbr 192.168.40.1 on FastEthe
DING to FULL, Loading Done
R8(config-router)#network 192.168.40.0 0.0.0.3  area 51
R8(config-router)#network 192.168.40.0 0.0.0.3  area 51
*Mar  1 00:12:11.011: %OSPF-5-ADJCHG: Process 1, Nbr 192.168.40.1 on Serial0/
o FULL, Loading Done
R8(config-router)#network 192.168.20.0 0.0.0.3  area 51
R8(config-router)#
```

```
R8#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R8(config)#ip route 0.0.0.0 0.0.0.0 192.168.20.2
R8(config)#
```

- Configuração VPCs:

PC 1:

```
PC1> show ip

NAME        : PC1[1]
IP/MASK     : 10.0.1.1/26
GATEWAY     : 10.0.1.62
DNS         :
MAC         : 00:50:79:66:68:00
LPORT       : 10096
RHOST:PORT  : 127.0.0.1:10097
MTU         : 1500

PC1> save
Saving startup configuration to startup.vpc
.  done
```

PC 2:

```
PC2> show ip

NAME        : PC2[1]
IP/MASK     : 10.0.2.129/27
GATEWAY     : 10.0.2.158
DNS         :
MAC         : 00:50:79:66:68:01
LPORT       : 10098
RHOST:PORT  : 127.0.0.1:10099
MTU         : 1500
```

PC 3:

```
PC3> show ip

NAME        : PC3[1]
IP/MASK     : 10.0.3.130/29
GATEWAY     : 10.0.3.134
DNS         :
MAC         : 00:50:79:66:68:02
LPORT       : 10100
RHOST:PORT  : 127.0.0.1:10101
MTU         : 1500
```

PC 4:

```
PC4> show ip

NAME        : PC4[1]
IP/MASK     : 192.168.11.1/26
GATEWAY     : 192.168.11.62
DNS         :
MAC         : 00:50:79:66:68:03
LPORT       : 10102
RHOST:PORT  : 127.0.0.1:10103
MTU         : 1500
```

PC 5:

```
PC5> show ip

NAME        : PC5[1]
IP/MASK     : 192.168.11.2/26
GATEWAY     : 192.168.11.62
DNS         :
MAC         : 00:50:79:66:68:04
LPORT       : 10104
RHOST:PORT  : 127.0.0.1:10105
MTU         : 1500
```

PC 6:

```
PC6> show ip

NAME        : PC6[1]
IP/MASK     : 172.16.0.2/17
GATEWAY     : 172.16.127.254
DNS         :
MAC         : 00:50:79:66:68:05
LPORT       : 10106
RHOST:PORT  : 127.0.0.1:10107
MTU         : 1500
```

- Configuração WebServer

```
auto eth0
iface eth0 inet static
        address 60.0.0.1
        netmask 255.255.255.224
        gateway 60.0.0.30
```

Toolbox-1 — Konsole

New Tab Split View

```
 GNU nano 4.8                                  /etc/network/interfac
#
# This is a sample network config, please uncomment lines to confi
#

# Uncomment this line to load custom interface files
# source /etc/network/interfaces.d/*

auto eth0
iface eth0 inet static
        address 60.0.0.1
        netmask 255.255.255.224
        gateway 60.0.0.30
```

```
root@Toolbox-1:~# nano /root/set-static-ip.sh
root@Toolbox-1:~# /root/set-static-ip.sh
root@Toolbox-1:~# ip a
```

Toolbox-1 — Konsole

New Tab Split View Copy Paste Find

```
      valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host
      valid_lft forever preferred_lft forever
7: eth0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UNKNOWN group default qlen 1000
    link/ether 02:42:a0:e5:61:00 brd ff:ff:ff:ff:ff:ff
    inet 60.0.0.1/27 scope global eth0
      valid_lft forever preferred_lft forever
```

4. Evidência de conectividade entre o PC1 e o PC8 (ping), e caminho que os pacotes utilizam entre os dois PCs (fazendo traceroute num dos PCs, usando o comando ‘trace’):

```
PC1> ping 172.16.0.3

172.16.0.3 icmp_seq=1 timeout
84 bytes from 172.16.0.3 icmp_seq=2 ttl=59 time=36.961 ms
84 bytes from 172.16.0.3 icmp_seq=3 ttl=59 time=34.591 ms
84 bytes from 172.16.0.3 icmp_seq=4 ttl=59 time=22.811 ms
84 bytes from 172.16.0.3 icmp_seq=5 ttl=59 time=23.665 ms

PC1> trace 172.16.0.3
trace to 172.16.0.3, 8 hops max, press Ctrl+C to stop
 1   10.0.1.62   8.798 ms  9.350 ms  9.931 ms
 2   10.0.3.134   19.508 ms  19.495 ms  19.499 ms
 3   4.4.4.1   28.243 ms  29.749 ms  19.212 ms
 4   192.168.2.1   29.281 ms  29.785 ms  29.334 ms
 5   192.168.30.1   29.879 ms  29.428 ms  29.917 ms
 6   *172.16.0.3   29.877 ms (ICMP type:3, code:3, Destination port unreachable)
```

5. Evidência de conectividade entre o PC6 e o Servidor Web (ping num dos equipamentos), e caminho que os pacotes utilizam entre os dois (fazendo traceroute num dos equipamentos):

Desligando a ligação R6 e R7, como pedido:

```
R7#sh ip int br
Interface                  IP-Address      OK? Method Status                Protocol
FastEthernet0/0            172.16.0.1      YES NVRAM  up                    up
Serial0/0                  192.168.40.1    YES NVRAM  up                    up
FastEthernet0/1            unassigned      YES NVRAM  administratively down down
Serial0/1                  192.168.30.1    YES NVRAM  administratively down down
```

```
PC6> trace 2.2.2.10
trace to 2.2.2.10, 8 hops max, press Ctrl+C to stop
 1   172.16.127.254   9.759 ms  9.297 ms  10.033 ms
 2   192.168.20.2   9.686 ms  9.351 ms  8.983 ms
 3   192.168.2.62   19.515 ms  19.844 ms  19.180 ms
 4   4.4.127.254   19.534 ms  19.550 ms  19.512 ms
 5   *2.2.2.1   19.476 ms (ICMP type:3, code:3, Destination port unreachable)
```

Fazendo esta desconexão, o caminho não se altera, uma vez que a Default Gateway do PC6 e a interface FastEthernet 0/0 do Router R8.

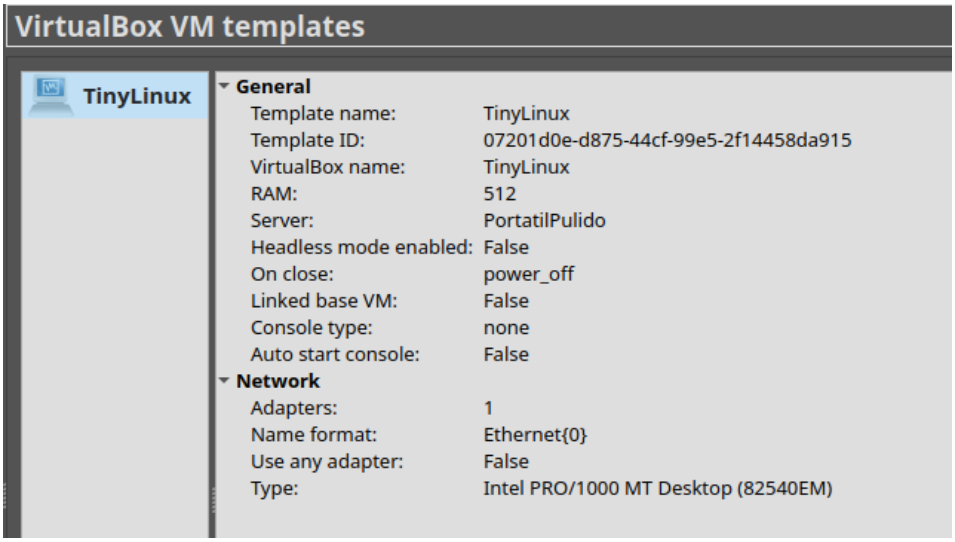
Fizemos a desconexão entre a interface do Router R8 que estava diretamente conectada ao Router R6, de modo a verificar uma alteração de rota, que não conseguimos verificar anteriormente:

```
R8#
R8#sh ip int br
Interface                  IP-Address      OK? Method Status                Protocol
FastEthernet0/0            172.16.127.254  YES NVRAM  up                    up
Serial0/0                  192.168.20.1    YES NVRAM  administratively down down
FastEthernet0/1            unassigned      YES NVRAM  administratively down down
Serial0/1                  192.168.40.2    YES NVRAM  up                    up
```

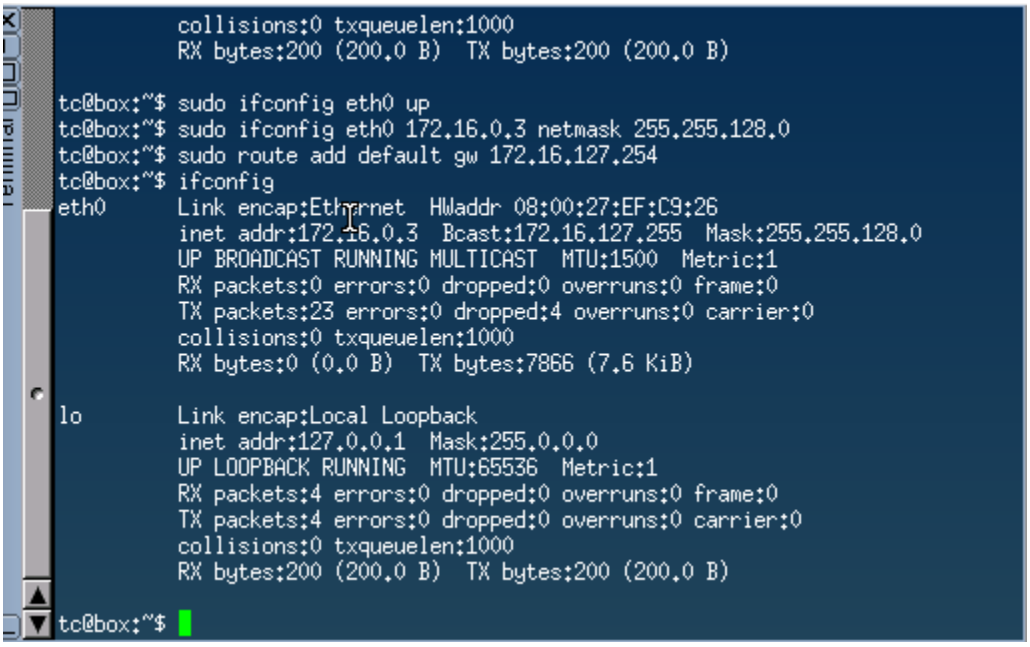
```
PC6> ping 2.2.2.10

2.2.2.10 icmp_seq=1 timeout
2.2.2.10 icmp_seq=2 timeout
84 bytes from 2.2.2.10 icmp_seq=3 ttl=60 time=17.339 ms
84 bytes from 2.2.2.10 icmp_seq=4 ttl=60 time=33.338 ms
84 bytes from 2.2.2.10 icmp_seq=5 ttl=60 time=33.434 ms

PC6> trace 2.2.2.10
trace to 2.2.2.10, 8 hops max, press Ctrl+C to stop
 1     *172.16.127.254   8.493 ms  9.093 ms
 2   172.16.0.1   13.897 ms  9.118 ms  9.683 ms
 3   192.168.30.2   9.153 ms  19.786 ms  9.745 ms
 4   192.168.2.62   29.329 ms  19.776 ms  19.909 ms
 5   4.4.127.254   30.026 ms  29.545 ms  30.124 ms
 6   *2.2.2.1   29.616 ms (ICMP type:3, code:3, Destination port unreachable)
```

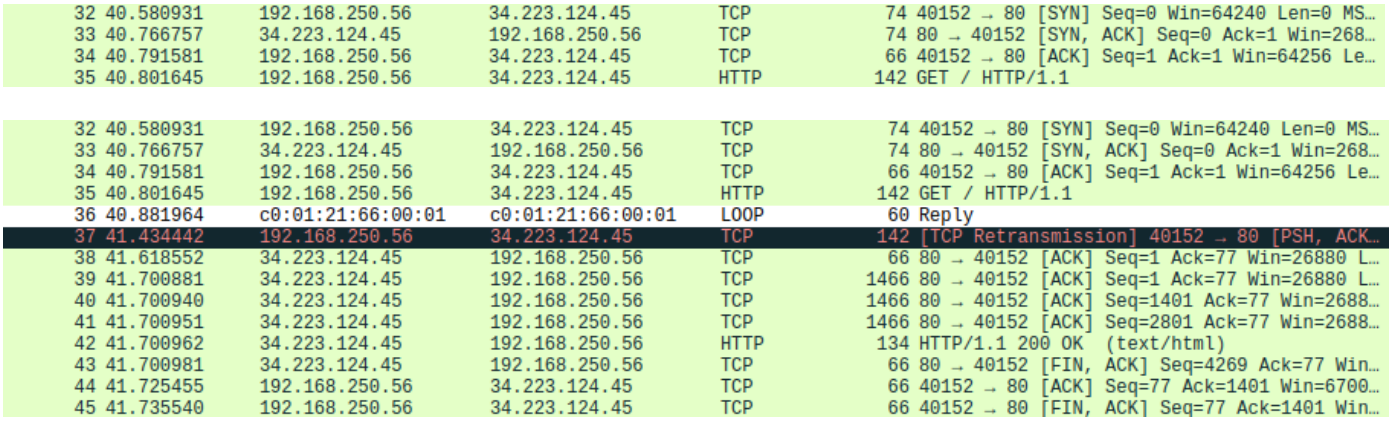
Alteração do caminho utilizado entre os pacotes verificada.

6. Utilização de um TinyCore Linux



- Configuração TinyLinux





Início da ligação TCP/estabelecimento da sessão TCP: pacote 32 até 34.

Porto de origem: 40152

Porto de destino: 80 (well-known HTTP port)

- **A diferença entre esta pergunta e a 5 consiste em que, na pergunta 5, o ping (ICMP Request and Reply) fica-se apenas pela camada de IP (Network), enquanto que o wget permite o estabelecimento de uma sessão TCP, que fica na camada de**

Transporte. Além disto, na pergunta 5, o ping foi feito para o "WebServer", e aqui para a pergunta 6, utilizámos um IP de um site real do exterior, de forma a conseguir uma sessão HTTP sobre TCP.