

T3 Redes - Roteamento

É necessário informar que a matricula utilizada para gerar as máscaras do ipv4 e ipv6, foi a matricula da aluna Joana Venturin Loureiro: 2019109666.

Para executar, basta chamar o script desejado. Por exemplo, para rodar a primeira topologia, bastar executar:

```
./script-rip.sh
```

Dessa forma, todos os roteadores serão "levantados" e também conexões/janelas do Telnet para cada roteador serão abertas.

**Obs: pode ser necessário ajustar o tempo de sleep (sleep 5) entre os comandos para iniciar os roteadores e o comando para abrir os terminais telnet devido ao tempo necessário para "subir" os roteadores ser diferente em cada computador...*

Para realizar alguns testes, basta entrar no telnet correspondente e rodar os seguintes comandos:

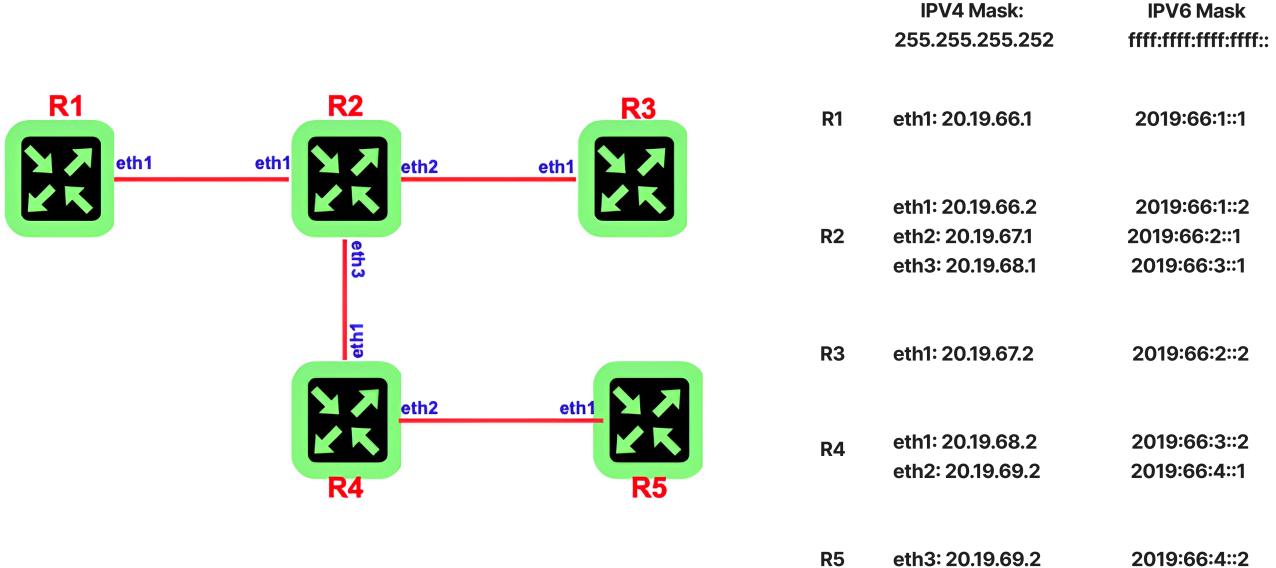
```
ping <ip> vrf v1  
traceroute <ip> vrf v1
```

Para desativar alguma interface, entrar no menu de configuração, depois no menu da interface desejada e por fim o comando shutdown. Por exemplo:

```
conf t  
int eth1  
shutdown
```

Topologia 1

Rede da topologia 1



Na topologia 1, temos uma rede com 5 elementos, implementada com roteamento estático.

Mostrando a tabela de rotas para ipv4 e ipv6:

show ipv4 route v1

```

line ready
R1_Joanelly#show ipv4 route v1
typ prefix metric iface hop time
S 0.0.0.0/0 1/0 ethernet1 20.19.66.2 00:00:42
C 20.19.66.0/30 0/0 ethernet1 null 00:00:42
LOC 20.19.66.1/32 0/1 ethernet1 null 00:00:42
R1_Joanelly#
R4_Joanelly#show ipv4 route v1
typ prefix metric iface hop time
S 20.19.66.0/30 1/0 ethernet1 20.19.68.1 00:01:06
S 20.19.67.0/30 1/0 ethernet1 20.19.68.1 00:01:06
C 20.19.68.0/30 0/0 ethernet1 null 00:01:06
LOC 20.19.68.2/32 0/1 ethernet1 null 00:01:06
-[more]-
R2_Joanelly#show ipv4 route v1
typ prefix metric iface hop time
C 20.19.66.0/30 0/0 ethernet1 null 00:01:11
LOC 20.19.66.2/32 0/1 ethernet1 null 00:01:11
C 20.19.67.0/30 0/0 ethernet2 null 00:01:11
LOC 20.19.67.1/32 0/1 ethernet2 null 00:01:11
C 20.19.68.0/30 0/0 ethernet3 null 00:01:11
-[more]-
R5_Joanelly#show ipv4 route v1
typ prefix metric iface hop time
S 0.0.0.0/0 1/0 ethernet1 20.19.69.1 00:00:57
C 20.19.69.0/30 0/0 ethernet1 null 00:00:57
LOC 20.19.69.2/32 0/1 ethernet1 null 00:00:57
R5_Joanelly#
R3_Joanelly#show ipv4 route v1
typ prefix metric iface hop time
S 0.0.0.0/0 1/0 ethernet1 20.19.67.1 00:01:02
C 20.19.67.0/30 0/0 ethernet1 null 00:01:02
LOC 20.19.67.2/32 0/1 ethernet1 null 00:01:02
R3_Joanelly#

```

show ipv6 route v1

```

line ready
R1_Joanelly#show ipv6 route v1
typ prefix metric iface hop time
S ::/0 1/0 ethernet1 2019:66:1::2 00:02:38
C 2019:66:1::/64 0/0 ethernet1 null 00:02:38
LOC 2019:66:1::1/128 0/1 ethernet1 null 00:02:38
R1_Joanelly#
R4_Joanelly#show ipv6 route v1
typ prefix metric iface hop time
S 2019:66:1::/64 1/0 ethernet1 2019:66:3::1 00:02:25
S 2019:66:2::/64 1/0 ethernet1 2019:66:3::1 00:02:25
C 2019:66:3::/64 0/0 ethernet1 null 00:02:25
LOC 2019:66:3::2/128 0/1 ethernet1 null 00:02:25
-[more]-
R2_Joanelly#show ipv6 route v1
typ prefix metric iface hop time
C 2019:66:1::/64 0/0 ethernet1 null 00:02:09
LOC 2019:66:1::2/128 0/1 ethernet1 null 00:02:09
C 2019:66:2::/64 0/0 ethernet2 null 00:02:09
LOC 2019:66:2::1/128 0/1 ethernet2 null 00:02:09
C 2019:66:3::/64 0/0 ethernet3 null 00:02:09
-[more]-
R5_Joanelly#show ipv6 route v1
typ prefix metric iface hop time
S ::/0 1/0 ethernet1 2019:66:4::1 00:02:34
C 2019:66:4::/64 0/0 ethernet1 null 00:02:34
LOC 2019:66:4::2/128 0/1 ethernet1 null 00:02:34
R5_Joanelly#
R3_Joanelly#show ipv6 route v1
typ prefix metric iface hop time
S ::/0 1/0 ethernet1 2019:66:2::1 00:02:30
C 2019:66:2::/64 0/0 ethernet1 null 00:02:30
LOC 2019:66:2::2/128 0/1 ethernet1 null 00:02:30
R3_Joanelly#

```

Teste de ping e traceroute no roteador R1 para o roteador R5 usando ipv4:

```
ping 20.19.69.2 vrf v1
traceroute 20.19.69.2 vrf v1
```

```
line ready
R1_Joanelly#ping 20.19.69.2 vrf v1
pinging 20.19.69.2, src=null, vrf=v1, cnt=5, len=64, df=false, tim=1000, gap=0, ttl=255, tos=0
, sgt=0, flow=0, fill=0, alrt=-1, sweep=false, multi=false
...!!
result=40.0%, recv/sent/lost/err=2/5/3/0, took 3029, min/avg/max/dev rtt=1/1.5/2/0.2, ttl 253/
253/253/0.0, tos 0/0.0/0/0.0
R1_Joanelly#traceroute 20.19.69.2 vrf v1
tracing 20.19.69.2, src=null, vrf=v1, prt=0/33440, tim=1000, tos=0, flow=0, len=64
via 0.0.0.0/0 1/0 ethernet1 20.19.66.2 00:00:48
1 20.19.66.2 time=18
2 20.19.68.2 time=2
3 20.19.69.2 time=3
R1_Joanelly#
```

Teste de ping e traceroute no roteador R1 para o roteador R5 usando ipv6:

```
ping 2019:66:4::2 vrf v1
traceroute 2019:66:4::2 vrf v1
```

```
R1_Joanelly#ping 2019:66:4::2 vrf v1
pinging 2019:66:4::2, src=null, vrf=v1, cnt=5, len=64, df=false, tim=1000, gap=0, ttl=255, tos
=0, sgt=0, flow=0, fill=0, alrt=-1, sweep=false, multi=false
.!!!!
result=80.0%, recv/sent/lost/err=4/5/1/0, took 1008, min/avg/max/dev rtt=1/1.5/2/0.2, ttl 253/
253/253/0.0, tos 0/0.0/0/0.0
R1_Joanelly#traceroute 2019:66:4::2 vrf v1
tracing 2019:66:4::2, src=null, vrf=v1, prt=0/33440, tim=1000, tos=0, flow=0, len=64
via ::/0 1/0 ethernet1 2019:66:1::2 00:01:52
1 2019:66:1::2 time=1
2 2019:66:3::2 time=1
3 2019:66:4::2 time=1
R1_Joanelly#
```

Podemos reparar que o caminho realizado entre os roteadores para a comunicação é: R1 para R2 para R4 e finalmente chegando ao R5.

Desligando a interface eth1 do R2, para que, como demonstrado no desenho, o R1 não tenha conexão alguma com o R5:

```
conf t
int eth1
shutdown
```

Novamente realizamos os testes de ping e traceroute no roteador R1 para o roteador R5 usando ipv4 e ipv6:

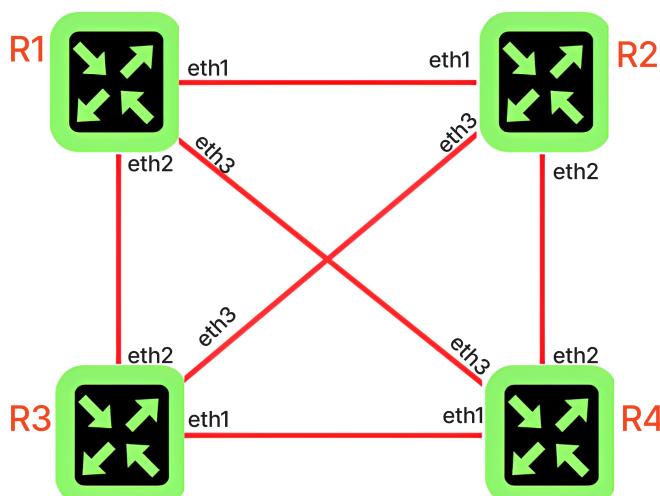
```
root@R1_Joanelly:~#ping 20.19.69.2 vrf v1
pinging 20.19.69.2, src=null, vrf=v1, cnt=5, len=64, df=false, tim=1000, gap=0, ttl=255, tos=0
, sgt=0, flow=0, fill=0, alrt=-1, sweep=false, multi=false
.....
result=0.0%, recv/sent/lost/err=0/5/5/0, took 5001, min/avg/max/dev rtt=10000/0.0/0/0.0, ttl 2
56/0.0/0/0.0, tos 256/0.0/0/0.0
root@R1_Joanelly:~#traceroute 20.19.69.2 vrf v1
tracing 20.19.69.2, src=null, vrf=v1, prt=0/33440, tim=1000, tos=0, flow=0, len=64
via 0.0.0.0/0 1/0 ethernet1 20.19.66.2 00:04:27
1 null time=1000
2 null time=1000
3 null time=1000
4 null time=1000
```

```
root@R1_Joanelly:~#ping 2019:66:4::2 vrf v1
pinging 2019:66:4::2, src=null, vrf=v1, cnt=5, len=64, df=false, tim=1000, gap=0, ttl=255, tos
=0, sgt=0, flow=0, fill=0, alrt=-1, sweep=false, multi=false
.....
result=0.0%, recv/sent/lost/err=0/5/5/0, took 5003, min/avg/max/dev rtt=10000/0.0/0/0.0, ttl 2
56/0.0/0/0.0, tos 256/0.0/0/0.0
root@R1_Joanelly:~#traceroute 2019:66:4::2 vrf v1
tracing 2019:66:4::2, src=null, vrf=v1, prt=0/33440, tim=1000, tos=0, flow=0, len=64
via ::/0 1/0 ethernet1 2019:66:1::2 00:05:03
1 null time=1000
2 null time=1000
3 null time=1000
4 null time=1000
5 null time=1000
```

Concluimos que os pacotes não chegam até R2, porém se a interface eth1 for ligada novamente, a rede volta a funcionar sem problemas.

Rede da topologia 2

Na topologia 2, temos uma rede Full-mesh implementada com o algoritmo de roteamento RIP (mais precisamente RIP2).



	IPV4 Mask: 255.255.255.252	IPV6 Mask ffff:ffff:ffff:ffff::
R1	eth1: 66.19.1.1 eth2: 66.19.2.1 eth3: 66.19.3.1	2019:66:1::1 2019:66:2::1 2019:66:3::1
R2	eth1: 66.19.1.2 eth2: 66.19.5.1 eth3: 66.19.6.1	2019:66:1::2 2019:66:5::1 2019:66:6::1
R3	eth1: 66.19.4.1 eth2: 66.19.2.2 eth3: 66.19.6.2	2019:66:4::1 2019:66:2::2 2019:66:6::2
R4	eth1: 66.19.4.2 eth2: 66.19.5.2 eth3: 66.19.3.2	2019:66:4::2 2019:66:5::2 2019:66:3::2

Mostrando a tabela de rotas para ipv4 e ipv6:

```
show ipv4 route v1
```

```
Trying 127.0.0.1...
Connected to localhost.
Escape character is '^]'.
welcome
line ready
R1_Joanelly#show ipv4 route v1
typ prefix metric iface hop time
C 20.19.66.0/30 0/0 ethernet1 null 00:00:22
LOC 20.19.66.1/32 0/1 ethernet1 null 00:00:22
C 20.19.67.0/30 0/0 ethernet2 null 00:00:22
LOC 20.19.67.1/32 0/1 ethernet2 null 00:00:22
C 20.19.68.0/30 0/0 ethernet3 null 00:00:22
LOC 20.19.68.1/32 0/1 ethernet3 null 00:00:22
R1_Joanelly#
```

```
Trying 127.0.0.1...
Connected to localhost.
Escape character is '^]'.
welcome
line ready
R4_Joanelly#show ipv4 route v1
typ prefix metric iface hop time
C 20.19.68.0/30 0/0 ethernet3 null 00:00:09
LOC 20.19.68.2/32 0/1 ethernet3 null 00:00:09
C 20.19.69.0/30 0/0 ethernet1 null 00:00:09
LOC 20.19.69.2/32 0/1 ethernet1 null 00:00:09
C 20.19.70.0/30 0/0 ethernet2 null 00:00:09
LOC 20.19.70.2/32 0/1 ethernet2 null 00:00:09
R4_Joanelly#
```

```
Trying 127.0.0.1...
Connected to localhost.
Escape character is '^]'.
welcome
line ready
R3_Joanelly#show ipv4 route v1
typ prefix metric iface hop time
C 20.19.67.0/30 0/0 ethernet2 null 00:00:18
LOC 20.19.67.2/32 0/1 ethernet2 null 00:00:18
C 20.19.69.0/30 0/0 ethernet1 null 00:00:18
LOC 20.19.69.1/32 0/1 ethernet1 null 00:00:18
C 20.19.71.0/30 0/0 ethernet3 null 00:00:18
LOC 20.19.71.2/32 0/1 ethernet3 null 00:00:18
R3_Joanelly#
```

```
Trying 127.0.0.1...
Connected to localhost.
Escape character is '^]'.
welcome
line ready
R2_Joanelly#show ipv4 route v1
typ prefix metric iface hop time
C 20.19.66.0/30 0/0 ethernet1 null 00:00:14
LOC 20.19.66.2/32 0/1 ethernet1 null 00:00:14
C 20.19.70.0/30 0/0 ethernet2 null 00:00:14
LOC 20.19.70.1/32 0/1 ethernet2 null 00:00:14
C 20.19.71.0/30 0/0 ethernet3 null 00:00:14
LOC 20.19.71.1/32 0/1 ethernet3 null 00:00:14
R2_Joanelly#
```

```
show ipv6 route v1
```

```
Trying 127.0.0.1...
Connected to localhost.
Escape character is '^]'.
welcome
line ready
R1_Joanelly#show ipv6 route v1
typ prefix metric iface hop time
C 2019:66:1::/64 0/0 ethernet1 null 00:00:15
LOC 2019:66:1::1/128 0/1 ethernet1 null 00:00:15
C 2019:66:2::/64 0/0 ethernet2 null 00:00:15
LOC 2019:66:2::1/128 0/1 ethernet2 null 00:00:15
C 2019:66:3::/64 0/0 ethernet3 null 00:00:15
LOC 2019:66:3::1/128 0/1 ethernet3 null 00:00:15
```

R1_Joanelly#

```
Trying 127.0.0.1...
Connected to localhost.
Escape character is '^]'.
welcome
line ready
R3_Joanelly#show ipv6 route v1
typ prefix metric iface hop time
C 2019:66:2::/64 0/0 ethernet2 null 00:00:12
LOC 2019:66:2::2/128 0/1 ethernet2 null 00:00:12
C 2019:66:4::/64 0/0 ethernet1 null 00:00:12
LOC 2019:66:4::1/128 0/1 ethernet1 null 00:00:12
C 2019:66:6::/64 0/0 ethernet3 null 00:00:12
LOC 2019:66:6::2/128 0/1 ethernet3 null 00:00:12
```

R3_Joanelly#

```
Trying 127.0.0.1...
Connected to localhost.
Escape character is '^]'.
welcome
line ready
R4_Joanelly#show ipv6 route v1
typ prefix metric iface hop time
C 2019:66:3::/64 0/0 ethernet3 null 00:00:05
LOC 2019:66:3::2/128 0/1 ethernet3 null 00:00:05
C 2019:66:4::/64 0/0 ethernet1 null 00:00:05
LOC 2019:66:4::2/128 0/1 ethernet1 null 00:00:05
C 2019:66:5::/64 0/0 ethernet2 null 00:00:05
LOC 2019:66:5::2/128 0/1 ethernet2 null 00:00:05
```

R4_Joanelly#

```
Trying 127.0.0.1...
Connected to localhost.
Escape character is '^]'.
welcome
line ready
R2_Joanelly#show ipv6 route v1
typ prefix metric iface hop time
C 2019:66:1::/64 0/0 ethernet1 null 00:00:10
LOC 2019:66:1::2/128 0/1 ethernet1 null 00:00:10
C 2019:66:5::/64 0/0 ethernet2 null 00:00:09
LOC 2019:66:5::1/128 0/1 ethernet2 null 00:00:09
C 2019:66:6::/64 0/0 ethernet3 null 00:00:09
LOC 2019:66:6::1/128 0/1 ethernet3 null 00:00:09
```

R2_Joanelly#

Depois de 30 segundos, a tabela de rotas foi atualizada tanto para ipv4 e ipv6 (RIP em funcionamento):

show ipv4 route v1

```
R1_Joanelly#show ipv4 route v1
typ prefix metric iface hop time
C 20.19.66.0/30 0/0 ethernet1 null 00:04:47
LOC 20.19.66.1/32 0/1 ethernet1 null 00:04:47
C 20.19.67.0/30 0/0 ethernet2 null 00:04:47
LOC 20.19.67.1/32 0/1 ethernet2 null 00:04:47
C 20.19.68.0/30 0/0 ethernet3 null 00:04:47
LOC 20.19.68.1/32 0/1 ethernet3 null 00:04:47
R 20.19.69.0/30 120/1 ethernet2 20.19.67.2 00:04:17
R 20.19.70.0/30 120/1 ethernet3 20.19.68.2 00:04:17
R 20.19.71.0/30 120/1 ethernet1 20.19.66.2 00:04:17
```

R1_Joanelly#

```
R 2019:66:5::/64 120/1 ethernet1 2019:66:4::2 00:01:50
C 2019:66:6::/64 0/0 ethernet3 null 00:02:20
LOC 2019:66:6::2/128 0/1 ethernet3 null 00:02:20
```

```
R3_Joanelly#show ipv4 route v1
typ prefix metric iface hop time
R 20.19.66.0/30 120/1 ethernet3 20.19.71.1 00:04:26
C 20.19.67.0/30 0/0 ethernet2 null 00:04:56
LOC 20.19.67.2/32 0/1 ethernet2 null 00:04:56
R 20.19.68.0/30 120/1 ethernet2 20.19.67.1 00:04:26
C 20.19.69.0/30 0/0 ethernet1 null 00:04:57
LOC 20.19.69.1/32 0/1 ethernet1 null 00:04:57
R 20.19.70.0/30 120/1 ethernet3 20.19.71.1 00:04:26
C 20.19.71.0/30 0/0 ethernet3 null 00:04:56
LOC 20.19.71.2/32 0/1 ethernet3 null 00:04:56
```

R3_Joanelly#

```
R4_Joanelly#show ipv4 route v1
typ prefix metric iface hop time
R 20.19.66.0/30 120/1 ethernet3 20.19.68.1 00:04:21
R 20.19.67.0/30 120/1 ethernet1 20.19.69.1 00:04:21
C 20.19.68.0/30 0/0 ethernet3 null 00:04:51
LOC 20.19.68.2/32 0/1 ethernet3 null 00:04:51
C 20.19.69.0/30 0/0 ethernet1 null 00:04:51
LOC 20.19.69.2/32 0/1 ethernet1 null 00:04:51
C 20.19.70.0/30 0/0 ethernet2 null 00:04:51
LOC 20.19.70.2/32 0/1 ethernet2 null 00:04:51
R 20.19.71.0/30 120/1 ethernet1 20.19.69.1 00:04:21
```

R4_Joanelly#

```
LOC 2019:66:5::1/128 0/1 ethernet2 null 00:02:28
C 2019:66:6::/64 0/0 ethernet3 null 00:02:28
LOC 2019:66:6::1/128 0/1 ethernet3 null 00:02:28
```

```
R2_Joanelly#show ipv4 route v1
typ prefix metric iface hop time
C 20.19.66.0/30 0/0 ethernet1 null 00:04:54
LOC 20.19.66.2/32 0/1 ethernet1 null 00:04:54
R 20.19.67.0/30 120/1 ethernet1 20.19.66.1 00:04:24
R 20.19.68.0/30 120/1 ethernet2 20.19.70.2 00:04:24
R 20.19.69.0/30 120/1 ethernet2 20.19.70.2 00:04:24
C 20.19.70.0/30 0/0 ethernet2 null 00:04:54
LOC 20.19.70.1/32 0/1 ethernet2 null 00:04:54
C 20.19.71.0/30 0/0 ethernet3 null 00:04:54
LOC 20.19.71.1/32 0/1 ethernet3 null 00:04:54
```

R2_Joanelly#

show ipv6 route v1

```
R1_Joanelly#show ipv6 route v1
typ prefix metric iface hop time
C 2019:66:1::/64 0/0 ethernet1 null 00:05:22
LOC 2019:66:1::1/128 0/1 ethernet1 null 00:05:22
C 2019:66:2::/64 0/0 ethernet2 null 00:05:22
LOC 2019:66:2::1/128 0/1 ethernet2 null 00:05:22
C 2019:66:3::/64 0/0 ethernet3 null 00:05:22
LOC 2019:66:3::1/128 0/1 ethernet3 null 00:05:22
R 2019:66:4::/64 120/1 ethernet3 2019:66:3::2 00:04:52
R 2019:66:5::/64 120/1 ethernet1 2019:66:1::2 00:04:52
R 2019:66:6::/64 120/1 ethernet2 2019:66:2::2 00:04:52
```

R1_Joanelly#

```
LOC 20.19.70.0/30 120/1 ethernet3 20.19.71.1 00:04:26
C 20.19.71.0/30 0/0 ethernet3 null 00:04:56
LOC 20.19.71.2/32 0/1 ethernet3 null 00:04:56
```

```
R4_Joanelly#show ipv6 route v1
typ prefix metric iface hop time
R 2019:66:1::/64 120/1 ethernet2 2019:66:5::1 00:04:50
R 2019:66:2::/64 120/1 ethernet3 2019:66:3::1 00:04:50
C 2019:66:3::/64 0/0 ethernet3 null 00:05:20
LOC 2019:66:3::2/128 0/1 ethernet3 null 00:05:20
C 2019:66:4::/64 0/0 ethernet1 null 00:05:20
LOC 2019:66:4::2/128 0/1 ethernet1 null 00:05:20
C 2019:66:5::/64 0/0 ethernet2 null 00:05:20
LOC 2019:66:5::2/128 0/1 ethernet2 null 00:05:20
R 2019:66:6::/64 120/1 ethernet2 2019:66:5::1 00:04:50
```

R4_Joanelly#

```
LOC 20.19.70.1/32 0/1 ethernet2 null 00:04:54
C 20.19.71.0/30 0/0 ethernet3 null 00:04:54
LOC 20.19.71.1/32 0/1 ethernet3 null 00:04:54
```

```
R2_Joanelly#show ipv6 route v1
typ prefix metric iface hop time
C 2019:66:1::/64 0/0 ethernet1 null 00:05:17
LOC 2019:66:1::2/128 0/1 ethernet1 null 00:05:17
R 2019:66:2::/64 120/1 ethernet3 2019:66:6::2 00:04:47
R 2019:66:3::/64 120/1 ethernet1 2019:66:1::1 00:04:47
R 2019:66:4::/64 120/1 ethernet3 2019:66:6::2 00:04:47
C 2019:66:5::/64 0/0 ethernet2 null 00:05:17
LOC 2019:66:5::2/128 0/1 ethernet2 null 00:05:17
C 2019:66:6::/64 0/0 ethernet3 null 00:05:17
LOC 2019:66:6::1/128 0/1 ethernet3 null 00:05:17
```

R2_Joanelly#

Podemos ver no terminal do roteador o aviso de que chega um "datagram" que os vizinhos estão "up" (exemplo do R1):

```
tmux a -t rare
```

```
R1_Joanelly#          R1_Joanelly#info ipIfc6nei.gotIcmpPack:ipI
fc6nei.java:213 linklocal address conflict at ethernet1
info ipIfc6nei.gotIcmpPack:ipIfc6nei.java:213 linklocal address conflict at ether
net1
warning rtrRip4.datagramAccept:rtrRip4.java:243 neighbor 20.19.66.2 up
warning rtrRip6.datagramAccept:rtrRip6.java:238 neighbor 2019:66:1::2 up
warning rtrRip4.datagramAccept:rtrRip4.java:243 neighbor 20.19.67.2 up
warning rtrRip6.datagramAccept:rtrRip6.java:238 neighbor 2019:66:2::2 up
warning rtrRip4.datagramAccept:rtrRip4.java:243 neighbor 20.19.68.2 up
warning rtrRip6.datagramAccept:rtrRip6.java:238 neighbor 2019:66:3::2 up
info ipIfc6nei.gotIcmpPack:ipIfc6nei.java:213 linklocal address conflict at ether
net1
info ipIfc6nei.gotIcmpPack:ipIfc6nei.java:213 linklocal address conflict at ether
net1
```

Teste de ping e traceroute no roteador R1 para o roteador R4 usando ipv4:

```
ping 20.19.69.2 vrf v1
traceroute 20.19.69.2 vrf v1
```

```
I 2019:66:3::2 time=2
R1_Joanelly#ping 20.19.70.2 vrf v1
pinging 20.19.70.2, src=null, vrf=v1, cnt=5, len=64, df=false, tim=1000, gap=0, ttl=255, tos=0, sgt=0, flow=0,
fill=0, alrt=-1, sweep=false, multi=false
!!!!!
result=100.0%, recv/sent/lost/err=5/5/0/0, took 3, min/avg/max/dev rtt=0/0.6/1/0.2, ttl 255/255/255/0.0, tos 0/
0.0/0.0
R1_Joanelly#traceroute 2019:66:5::2 vrf v1
tracing 2019:66:5::2, src=null, vrf=v1, prt=0/33440, tim=1000, tos=0, flow=0, len=64
via 2019:66:5::/64 120/1 ethernet1 2019:66:1::2 00:09:16
1 2019:66:1::2 time=2
2 2019:66:5::2 time=2
R1_Joanelly#
```

Teste de ping e traceroute no roteador R1 para o roteador R4 usando ipv6:

```
ping 2019:66:4::2 vrf v1
traceroute 2019:66:4::2 vrf v1
```

```
o 2019:66:4::2
R1_Joanelly#ping 2019:66:4::2 vrf v1
pinging 2019:66:4::2, src=null, vrf=v1, cnt=5, len=64, df=false, tim=1000, gap=0, ttl=255, tos=0, sgt=
0, flow=0, fill=0, alrt=-1, sweep=false, multi=false
!!!!!
result=100.0%, recv/sent/lost/err=5/5/0/0, took 12, min/avg/max/dev rtt=1/1.6/2/0.2, ttl 255/255/255/0
.0, tos 0/0.0/0/0.0
R1_Joanelly#traceroute 2019:66:4::2 vrf v1
tracing 2019:66:4::2, src=null, vrf=v1, prt=0/33440, tim=1000, tos=0, flow=0, len=64
via 2019:66:4::/64 120/1 ethernet3 2019:66:3::2 00:01:09
1 2019:66:4::2 time=2
R1_Joanelly#
```

Como podemos visualizar nas imagens acima, utilizando o ipv4 o caminho seguido pacote é R1 para R3 que chega a R4. Já no ipv6, é realizada a passagem do pacote diretamente entre o R1 para o R4, sem passar pelo R3 (pode-se questionar se foi escolhido o caminho mais rápido na rede).

Desligando a interface eth2 do R3:

```
conf t  
int eth2  
shutdown
```

Podemos observar que em R3 houve um aviso no terminal, mostrando que os vizinhos (58.16.3.1 e 2016:58:3::1) "caíram" ("down"):

```
R3_Joanelly#                                     R3_Joanelly#warning rtrRip4.datagramAccept:rtrRip4.  
java:243 neighbor 20.19.69.2 up  
warning rtrRip6.datagramAccept:rtrRip6.java:238 neighbor 2019:66:4::2 up  
warning rtrRip4.datagramAccept:rtrRip4.java:243 neighbor 20.19.67.1 up  
warning rtrRip6.datagramAccept:rtrRip6.java:238 neighbor 2019:66:2::1 up  
warning rtrRip4.datagramAccept:rtrRip4.java:243 neighbor 20.19.71.1 up  
warning rtrRip6.datagramAccept:rtrRip6.java:238 neighbor 2019:66:6::1 up  
warning userLineHandler.doExec:userLine.java:875 <nobody> configuring from local:telnet <l  
oop> 23 -> 127.0.0.1 37626  
error rtrRip4.datagramClosed:rtrRip4.java:275 neighbor 20.19.67.1 down  
error rtrRip6.datagramClosed:rtrRip6.java:270 neighbor 2019:66:2::1 down
```

Refazendo os pings ipv4 e ipv6:

```

via 2019:66:4::/64 120/1 ethernet3 2019:66:3::2 00:00:48
1 2019:66:4::2 time=2
R1_Joanelly#ping 20.19.69.2 vrf v1
pinging 20.19.69.2, src=null, vrf=v1, cnt=5, len=64, df=false, tim=1000, gap=0, ttl=255, tos=0, sgt=0, flow=0,
fill=0, alrt=-1, sweep=false, multi=false
.....
result=0.0%, recv/sent/lost/err=0/5/5/0, took 5002, min/avg/max/dev rtt=10000/0.0/0/0.0, ttl 256/0.0/0/0.0, to
s 256/0.0/0/0.0
R1_Joanelly#traceroute 20.19.69.2 vrf v1
tracing 20.19.69.2, src=null, vrf=v1, prt=0/33440, tim=1000, tos=0, flow=0, len=64
via 20.19.69.0/30 120/1 ethernet2 20.19.67.2 00:05:10
1 null time=1000
2 null time=1000
3 null time=1000
4 null time=1000
5 null time=1000
6 null time=1000
7 null time=1000
8 null time=1000
9 null time=1000
10 null time=1000
11 null time=1000
[]

telnet localhost 26003
joana@jvl-Inspiron-7580:~/Documents/t3-redes-topologia$ telnet localhost 26003
Trying 127.0.0.1...
Connected to localhost.
Escape character is '^>'.
welcome
line ready
R3_Joanelly#conf t
R3_Joanelly(cfg)#int eth2
R3_Joanelly(cfg-if)#shutdown
R3_Joanelly(cfg-if)#

R1_Joanelly#ping 2019:66:4::2 vrf v1
pinging 2019:66:4::2, src=null, vrf=v1, cnt=5, len=64, df=false, tim=1000, gap=0, ttl=255, tos=0, sgt=0, flow=0
, fill=0, alrt=-1, sweep=false, multi=false
!!!!!
result=100.0%, recv/sent/lost/err=5/5/0/0, took 2, min/avg/max/dev rtt=0/0.4/1/0.2, ttl 255/255/255/0.0, tos 0/
0.0/0/0.0
R1_Joanelly#traceroute 2019:66:4::2 vrf v1
tracing 2019:66:4::2, src=null, vrf=v1, prt=0/33440, tim=1000, tos=0, flow=0, len=64
via 2019:66:4::/64 120/1 ethernet3 2019:66:3::2 00:10:24
1 2019:66:4::2 time=1
R1_Joanelly#

```

Ao fazer o traceroute ipv4, é possível visualizar que os pacotes não chegam mais ao R4. Já no traceroute ipv6, como ele não realiza o caminho passando pelo R3, os pacotes são transmitidos normalmente.

Após aproximadamente 2 minutos, utilizando ipv4, uma nova rota é criada para ser possível realizar a passagem do pacote entre o R1 e R4, como é possível observar na imagem a seguir. Lembrando que não é criada uma nova rota para o ipv6 já que o mesmo não utilizou o eth2 do R3 para realizar o caminho do R1 para o R4.

```

10 null time=1000
11 null time=1000
12 null time=1000
13 null time=1000
14 null time=1000
15 null time=1000
16 null time=1000
17 null time=1000
R1_Joanelly#traceroute 20.19.69.2 vrf v1
tracing 20.19.69.2, src=null, vrf=v1, prt=0/33440, tim=1000, tos=0, flow=0, len=64
via 20.19.69.0/30 120/1 ethernet3 20.19.68.2 00:00:35
1 20.19.69.2 time=8
R1_Joanelly#■

```

Observando as tabelas após:

```
R1_Joanelly#show ipv4 route v1
typ prefix metric iface hop time
C 20.19.66.0/30 0/0 ethernet1 null 00:04:10
LOC 20.19.66.1/32 0/1 ethernet1 null 00:04:10
C 20.19.67.0/30 0/0 ethernet2 null 00:04:10
LOC 20.19.67.1/32 0/1 ethernet2 null 00:04:10
C 20.19.68.0/30 0/0 ethernet3 null 00:04:10
LOC 20.19.68.1/32 0/1 ethernet3 null 00:04:10
R 20.19.69.0/30 120/1 ethernet3 20.19.68.2 00:01:10
R 20.19.70.0/30 120/1 ethernet3 20.19.68.2 00:03:40
R 20.19.71.0/30 120/1 ethernet1 20.19.66.2 00:03:40
```

```
R1_Joanelly#■
```

```
R3_Joanelly(cfg)#int eth2
R3_Joanelly(cfg-if)#shutdown
R3_Joanelly(cfg-if)#show ipv4 route v1
typ prefix metric iface hop time
R 20.19.66.0/30 120/1 ethernet3 20.19.71.1 00:03:49
R 20.19.67.0/30 120/2 ethernet1 20.19.69.2 00:02:49
R 20.19.68.0/30 120/1 ethernet1 20.19.69.2 00:03:49
C 20.19.69.0/30 0/0 ethernet1 null 00:04:19
LOC 20.19.69.1/32 0/1 ethernet1 null 00:04:19
R 20.19.70.0/30 120/1 ethernet3 20.19.71.1 00:03:49
C 20.19.71.0/30 0/0 ethernet3 null 00:04:19
LOC 20.19.71.2/32 0/1 ethernet3 null 00:04:19
```

```
R3_Joanelly(cfg-if)#■
```

```
R4_Joanelly#show ipv4 route v1
typ prefix metric iface hop time
R 20.19.66.0/30 120/1 ethernet3 20.19.68.1 00:03:44
R 20.19.67.0/30 120/1 ethernet3 20.19.68.1 00:03:44
C 20.19.68.0/30 0/0 ethernet3 null 00:04:14
LOC 20.19.68.2/32 0/1 ethernet3 null 00:04:14
C 20.19.69.0/30 0/0 ethernet1 null 00:04:14
LOC 20.19.69.2/32 0/1 ethernet1 null 00:04:14
C 20.19.70.0/30 0/0 ethernet2 null 00:04:14
LOC 20.19.70.2/32 0/1 ethernet2 null 00:04:14
R 20.19.71.0/30 120/1 ethernet1 20.19.69.1 00:03:44
```

```
R4_Joanelly#■
```

```
line ready
R2_Joanelly#show ipv4 route v1
typ prefix metric iface hop time
C 20.19.66.0/30 0/0 ethernet1 null 00:04:16
LOC 20.19.66.2/32 0/1 ethernet1 null 20.19.66.1 00:03:46
R 20.19.67.0/30 120/1 ethernet1 20.19.70.2 00:03:46
R 20.19.68.0/30 120/1 ethernet2 20.19.70.2 00:03:46
R 20.19.69.0/30 120/1 ethernet2 20.19.70.2 00:03:46
C 20.19.70.0/30 0/0 ethernet2 null 00:04:16
LOC 20.19.70.1/32 0/1 ethernet2 null 00:04:16
C 20.19.71.0/30 0/0 ethernet3 null 00:04:16
LOC 20.19.71.1/32 0/1 ethernet3 null 00:04:16
```

```
R2_Joanelly#■
```

```
R1_Joanelly#show ipv6 route v1
typ prefix metric iface hop time
C 2019:66:1::/64 0/0 ethernet1 null 00:07:56
LOC 2019:66:1::1/128 0/1 ethernet1 null 00:07:56
C 2019:66:2::/64 0/0 ethernet2 null 00:07:56
LOC 2019:66:2::1/128 0/1 ethernet2 null 00:07:56
C 2019:66:3::/64 0/0 ethernet3 null 00:07:56
LOC 2019:66:3::1/128 0/1 ethernet3 null 00:07:56
R 2019:66:4::/64 120/1 ethernet3 2019:66:3::2 00:07:26
R 2019:66:5::/64 120/1 ethernet1 2019:66:1::2 00:07:26
R 2019:66:6::/64 120/1 ethernet1 2019:66:1::2 00:01:26
```

```
R1_Joanelly#■
```

```
LOC 20.19.69.1/32 0/1 ethernet1 null 00:03:53
R 20.19.70.0/30 120/1 ethernet3 20.19.71.1 00:03:23
C 20.19.71.0/30 0/0 ethernet3 null 00:03:53
LOC 20.19.71.2/32 0/1 ethernet3 null 00:03:53
```

```
R3_Joanelly(cfg-if)#show ipv6 route v1
typ prefix metric iface hop time
R 2019:66:1::/64 120/1 ethernet3 2019:66:6::1 00:04:28
R 2019:66:2::/64 120/2 ethernet3 2019:66:6::1 00:03:28
R 2019:66:3::/64 120/1 ethernet1 2019:66:4::2 00:07:28
C 2019:66:4::/64 0/0 ethernet1 null 00:07:58
LOC 2019:66:4::1/128 0/1 ethernet1 null 00:07:58
R 2019:66:5::/64 120/1 ethernet1 2019:66:4::2 00:07:28
C 2019:66:6::/64 0/0 ethernet3 null 00:07:58
LOC 2019:66:6::1/128 0/1 ethernet3 null 00:07:58
```

```
R3_Joanelly(cfg-if)#■
```

```
R4_Joanelly#show ipv6 route v1
typ prefix metric iface hop time
R 2019:66:1::/64 120/1 ethernet2 2019:66:5::1 00:07:22
R 2019:66:2::/64 120/1 ethernet3 2019:66:3::1 00:07:22
C 2019:66:3::/64 0/0 ethernet3 null 00:07:52
LOC 2019:66:3::2/128 0/1 ethernet3 null 00:07:52
C 2019:66:4::/64 0/0 ethernet1 null 00:07:52
LOC 2019:66:4::2/128 0/1 ethernet1 null 00:07:52
C 2019:66:5::/64 0/0 ethernet2 null 00:07:52
LOC 2019:66:5::2/128 0/1 ethernet2 null 00:07:52
R 2019:66:6::/64 120/1 ethernet2 2019:66:5::1 00:07:22
```

```
R4_Joanelly#■
```

```
LOC 20.19.70.1/32 0/1 ethernet2 null 00:03:57
C 20.19.71.0/30 0/0 ethernet3 null 00:03:57
LOC 20.19.71.1/32 0/1 ethernet3 null 00:03:57
```

```
R2_Joanelly#show ipv6 route v1
typ prefix metric iface hop time
C 2019:66:1::/64 0/0 ethernet1 null 00:08:03
LOC 2019:66:1::2/128 0/1 ethernet1 null 00:08:03
R 2019:66:2::/64 120/1 ethernet1 2019:66:1::1 00:04:03
R 2019:66:3::/64 120/1 ethernet1 2019:66:1::1 00:07:33
R 2019:66:4::/64 120/1 ethernet3 2019:66:6::2 00:07:32
C 2019:66:5::/64 0/0 ethernet2 null 00:08:03
LOC 2019:66:5::1/128 0/1 ethernet2 null 00:08:03
C 2019:66:6::/64 0/0 ethernet3 null 00:08:02
LOC 2019:66:6::1/128 0/1 ethernet3 null 00:08:02
```