

Comunicación de Datos II

Trabajo Práctico Especial



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Consideraciones generales del TPE

- La topología a utilizar debe ser igual a la definida en la figura
- La configuración de direcciones y rutas en los distintos equipos debe especificarse en el servicio "user defined" de cada equipo.
- Para el correcto funcionamiento de la red, se debe deshabilitar todos los servicios de Quagga en los routers.
- Para configurar los equipos, se debe utilizar los comandos del paquete ip route 2 vistos en las teóricas.
- Se debe entregar un informe con la resolución de los distintos ítems. En dicho informe se debe colocar cada uno de los comandos colocados en los "user defined" de cada equipo, como también el resto de comandos ejecutados para la resolución de cada uno de los ejercicios.
- Se debe entregar dos archivos .imn. El primero con la topología y todas las configuraciones realizadas sobre los equipos sin la utilización del RADVD, y otro con la configuración de RADVD.

Características de la red a definir

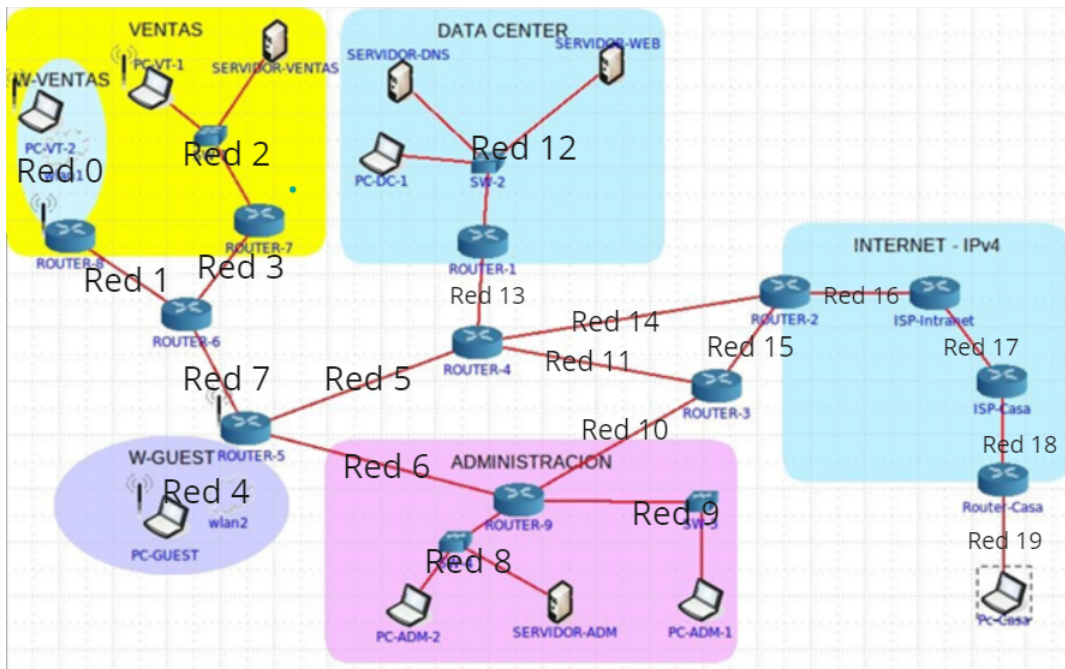
- Todos los equipos (incluye hosts y routers) deben poder comunicarse entre sí dentro de la intranet
- VENTAS debe poder comunicarse con otros equipos en la Internet
- El SERVIDOR-WEB debe poder ser accedido por cualquier equipo de la Internet, en la dirección (global) provista por el DNS (servidorweb.abc.com).
- El SERVIDOR-DNS debe tener una dirección global que permita que sea accedido desde afuera de la intranet.
- Desde la red inalámbrica de W-GUEST no debe ser posible acceder a equipos internos de la intranet, excepto al SERVIDOR-DNS y al SERVIDOR-WEB, pero por sus direcciones globales.
- Los paquetes que se procesen en el ROUTER-5 originados en W-GUEST deben pasar por el ROUTER-9, mientras que el resto del tráfico procesado en el ROUTER-5 se debe direccionar al ROUTER-4.
- Los paquetes TCP con destino fuera de la intranet deben pasar por el Router 3, mientras que el resto del tráfico dirigido fuera de la intranet no deben pasar por dicho equipo.
- Se debe poder acceder a cualquiera de los routers desde fuera de la intranet.
- Todas las interfaces de INTERNET sólo tienen direcciones IPv4. El resto de las interfaces sólo tienen direcciones IPv6.

Resolución de Ejercicios:

Ejercicio 1.

Suponiendo que nuestro proveedor nos asigna 2001:1200:0:21f0::/60

a. Identifique las redes que componen la intranet, nombrándolas como Red 1, Red 2, etc.



Redes de la intranet identificadas:

- Red 0: red w-ventas
- Red 1: red entre Router 8 y 6
- Red 2: red de ventas
- Red 3: red entre Router 7 y 6
- Red 4: red w-guest
- Red 5: red entre Router 4 y 5
- Red 6: red entre Router 5 y 9
- Red 7: red entre Router 6 y 5
- Red 8: red de Administración con PC-ADM-2 y Servidor-ADM
- Red 9: red de Administración con PC-ADM-1
- Red 10: red entre router 9 y 3
- Red 11: red entre router 4 y 3
- Red 12: red del Data Center
- Red 13: red entre Router 1 y 4
- Red 14: red entre router 4 y 2
- Red 15: red entre router 3 y 2
- Red 16: red entre Router 2 y el ISP-Intranet
- Red 17: red entre ISP-Intranet y el ISP-Casa
- Red 18: red entre el ISP-Casa y el Router-Casa
- Red 19: red del Router-Casa con la PC-Casa

b. Proponga una asignación de direcciones globales para la intranet. Indicarlas en una tabla que contenga los campos NOMBRE RED – DIRECCIÓN/PREFIJO.

Nombre de Red	Dirección/Prefijo
Red 0	2001:1200:0:21f1::/64
Red 1	2001:1200:0:21f0::/127
Red 2	2001:1200:0:21f2::/64
Red 3	2001:1200:0:21f0::2/127
Red 4	2001:1200:0:21f3::/64
Red 5	2001:1200:0:21f0::6/127
Red 6	2001:1200:0:21f0::8/127
Red 7	2001:1200:0:21f0::4/127
Red 8	2001:1200:0:21f4::/64
Red 9	2001:1200:0:21f5::/64
Red 10	2001:1200:0:21f0::12/127
Red 11	2001:1200:0:21f0::e/127
Red 12	2001:1200:0:21f6::/64
Red 13	2001:1200:0:21f0::a/127
Red 14	2001:1200:0:21f0::c/127
Red 15	2001:1200:0:21f0::10/127
Red 16	(IPv4 - próximamente definidas)
Red 17	(IPv4 - próximamente definidas)
Red 18	(IPv4 - próximamente definidas)
Red 19	2001:1234::/60

C. Indique en una tabla, las direcciones globales que tendrán los equipos que pueden comunicarse con otros en la Internet.

Nombre equipo	Dirección
PC-VT-1	2001:1200:0:21f2::2/64
Servidor-Ventas	2001:1200:0:21f2::3/64
Router-7 eth0	2001:1200:0:21f0::3/127
Router-7 eth1	2001:1200:0:21f2::1/64
PC-VT-2	2001:1200:0:21f1::1/64
Router-8 eth1	2001:1200:0:21f1::2/64
Router-8 eth0	2001:1200:0:21f0::/127
Router-6 eth0	2001:1200:0:21f0::4/127
Router-6 eth1	2001:1200:0:21f0::1/127
Router-6 eth2	2001:1200:0:21f0::2/127
Router-5 eth3	2001:1200:0:21f0::8/127
Router-5 eth1	2001:1200:0:21f0::5/127
Router-5 eth2	2001:1200:0:21f0::6/127
Servidor Web	2001:1200:0:21f6::4/64
Servidor DNS	2001:1200:0:21f6::3/64
Router-1 eth0	2001:1200:0:21f0::b/127
Router-1 eth1	2001:1200:0:21f6::1/64
Router-4 eth0	2001:1200:0:21f0::7/127
Router-4 eth1	2001:1200:0:21f0::f/127
Router-4 eth2	2001:1200:0:21f0::c/127
Router-4 eth3	2001:1200:0:21f0::a/127
Router-2 eth0	2001:1200:0:21f0::d/127
Router-2 eth1	2001:1200:0:21f0::10/127
Router-2 eth2	192.168.0.2/16
Router-3 eth0	2001:1200:0:21f0::13/127

Router-3 eth1	2001:1200:0:21f0::e/127
Router-3 eth2	2001:1200:0:21f0::11/127
Router-9 eth1	2001:1200:0:21f0::9/127
Router-9 eth3	2001:1200:0:21f0::12/127
ISP-Intranet eth0	192.168.0.1/16
ISP-Intranet eth1	192.169.0.2/16
ISP-Casa eth0	192.169.0.1/16
ISP-Casa eth1	192.170.0.2/16
Router-Casa eth0	192.170.0.1/16
Router-Casa eth1	2001:1200:0:21f7::1/64
Pc-Casa	2001:1200:0:21f7::2/64

Ejercicio 2.

Teniendo en cuenta facilidad para la administración, proponga una asignación de direcciones de alcance en el site.

Direcciones	ULA
Administración	
PC-ADM-2	fd00:0:0:1::1/64
SERVIDOR-ADM	fd00:0:0:1::2/64
ROUTER 9 ETH0	fd00:0:0:1::3/64
PC-ADM-1	fd00:0:0:2::1/64
ROUTER 9 ETH2	fd00:0:0:2::2/64
VENTAS	
PC-VT-1	fd00:0:0:3::1/64
SERVIDOR-VENTAS	fd00:0:0:3::2/64
ROUTER 7 ETH 1	fd00:0:0:3::3/64
PC-VT-2	fd00:0:0:4::1/64
ROUTER 8 ETH1	fd00:0:0:4::2/64

W-GUEST	
PC-GUEST	fd00:0:0:5::1/64
ROUTER-5 ETH 0	fd00:0:0:5::2/64
DATA-CENTER	
PC-DC-1	fd00:0:0:6::1/64
SERVIDOR-WEB	fd00:0:0:6::2/64
SERVIDOR-DNS	fd00:0:0:6::3/64
ROUTER-1 ETH 1	fd00:0:0:6::4/64
ROUTERS	
ROUTER 9 ETH1	fd00:0:0:7::1/64
ROUTER 5 ETH3	fd00:0:0:7::2/64
ROUTER 9 ETH3	fd00:0:0:8::1/64
ROUTER 3 ETH0	fd00:0:0:8::2/64
ROUTER 5 ETH2	fd00:0:0:9::1/64
ROUTER 4 ETH0	fd00:0:0:9::2/64
ROUTER 5 ETH1	fd00:0:0:a::1/64
ROUTER 6 ETH0	fd00:0:0:a::2/64
ROUTER 6 ETH1	fd00:0:0:b::1/64
ROUTER 8 ETH0	fd00:0:0:b::2/64
ROUTER 6 ETH2	fd00:0:0:c::1/64
ROUTER 7 ETH0	fd00:0:0:c::2/64
ROUTER 4 ETH3	fd00:0:0:d::1/64
ROUTER 1 ETH0	fd00:0:0:d::2/64
ROUTER 4 ETH2	fd00:0:0:e::1/64
ROUTER 2 ETH0	fd00:0:0:e::2/64
ROUTER 4 ETH1	fd00:0:0:f::1/64
ROUTER 3 ETH1	fd00:0:0:f::2/64
ROUTER 3 ETH2	fd00:0:0:10::1/64

ROUTER 2 ETH1	fd00:0:0:10::2/64
---------------	-------------------

Ejercicio 3.

Configure manualmente las direcciones de los equipos

PC-VT-2:

ip -6 addr add fd00:0:0:4::1/64 dev eth0

Router-8:

ip -6 addr add fd00:0:0:4::2/64 dev eth1

ip -6 addr add fd00:0:0:b::2/64 dev eth0

Router-6:

ip -6 addr add fd00:0:0:a::2/64 dev eth0

ip -6 addr add fd00:0:0:b::1/64 dev eth1

ip -6 addr add fd00:0:0:c::1/64 dev eth2

Router-7:

ip -6 addr add fd00:0:0:3::3/64 dev eth1

ip -6 addr add fd00:0:0:c::2/64 dev eth0

PC-VT-1:

ip -6 addr add fd00:0:0:3::1/64 dev eth0

Servidor-Ventas:

ip -6 addr add fd00:0:0:3::2/64 dev eth0

Router-5:

ip -6 addr add fd00:0:0:5::2/64 dev eth0

ip -6 addr add fd00:0:0:a::1/64 dev eth1

ip -6 addr add fd00:0:0:9::1/64 dev eth2

ip -6 addr add fd00:0:0:7::2/64 dev eth3

PC-Guest:

ip -6 addr add fd00:0:0:5::1/64 dev eth0

Router-9:

ip -6 addr add fd00:0:0:1::3/64 dev eth0

ip -6 addr add fd00:0:0:7::1/64 dev eth1

ip -6 addr add fd00:0:0:2::2/64 dev eth2

ip -6 addr add fd00:0:0:8::1/64 dev eth3

PC-Adm-2:

```
ip -6 addr add fd00:0:0:1::1/64 dev eth0
```

Servidor Adm:

```
ip -6 addr add fd00:0:0:1::2/64 dev eth0
```

PC-ADM-1:

```
ip -6 addr add fd00:0:0:2::1/64 dev eth0
```

Router-3:

```
ip -6 addr add fd00:0:0:8::2/64 dev eth0
```

```
ip -6 addr add fd00:0:0:f::2/64 dev eth1
```

```
ip -6 addr add fd00:0:0:10::1/64 dev eth2
```

Router-4:

```
ip -6 addr add fd00:0:0:9::2/64 dev eth0
```

```
ip -6 addr add fd00:0:0:f::1/64 dev eth1
```

```
ip -6 addr add fd00:0:0:e::1/64 dev eth2
```

```
ip -6 addr add fd00:0:0:d::1/64 dev eth3
```

Router-1:

```
ip -6 addr add fd00:0:0:6::4/64 dev eth1
```

```
ip -6 addr add fd00:0:0:d::2/64 dev eth0
```

PC-DC-1:

```
ip -6 addr add fd00:0:0:6::1/64 dev eth0
```

Servidor DNS:

```
ip -6 addr add fd00:0:0:6::3/64 dev eth0
```

Servidor web:

```
ip -6 addr add fd00:0:0:6::2/64 dev eth0
```

Router 2:

```
ip -6 addr add fd00:0:0:e::2/64 dev eth0
```

```
ip -6 addr add fd00:0:0:10::2/64 dev eth1
```

Ejercicio 4.

Configure manualmente las rutas que permitan comunicarse a los equipos entre sí y con la PC-Casa

Router-1:

```
ip -6 route add default via 2001:1200:0:21f0::a dev eth0
```

Router-2:

```
ip -6 route add 2001:1200:0:21f0::8/127 via 2001:1200:0:21f0::11 dev eth1
ip -6 route add 2001:1200:0:21f0::e/127 via 2001:1200:0:21f0::11 dev eth1
ip -6 route add 2001:1200:0:21f0::10/127 via 2001:1200:0:21f0::11 dev eth1
ip -6 route add 2001:1200:0:21f0::12/127 via 2001:1200:0:21f0::11 dev eth1
ip -6 route add fd00:0:0:1::/64 via 2001:1200:0:21f0::11 dev eth1
ip -6 route add fd00:0:0:2::/64 via 2001:1200:0:21f0::11 dev eth1
ip -6 route add fd00:0:0:7::/64 via 2001:1200:0:21f0::11 dev eth1
ip -6 route add fd00:0:0:f::/64 via 2001:1200:0:21f0::11 dev eth1
ip -6 route add fd00:0:0:10::/64 via 2001:1200:0:21f0::11 dev eth1
ip -6 route add fd00:0:0:8::/64 via 2001:1200:0:21f0::11 dev eth1
ip route add 2001:1200::0:21f6::/64 via 2001:1200:0:21f0::c dev eth0
ip route add 2001:1200::0:21f6::/64 via 2001:1200:0:21f0::c dev eth0
ip route add 2001:1200::0:21f0::/124 via 2001:1200:0:21f0::c dev eth0
ip -6 route add 2001:1200:0:21f0::a/127 via 2001:1200:0:21f0::c dev eth0
ip -6 route add 2001:1200:0:21f0::c/127 via 2001:1200:0:21f0::c dev eth0
ip -6 route add fd00:0:0:3::/64 via 2001:1200:0:21f0::c dev eth0
ip -6 route add fd00:0:0:4::/64 via 2001:1200:0:21f0::c dev eth0
ip -6 route add fd00:0:0:5::/64 via 2001:1200:0:21f0::c dev eth0
ip -6 route add fd00:0:0:6::/64 via 2001:1200:0:21f0::c dev eth0
ip -6 route add fd00:0:0:b::/64 via 2001:1200:0:21f0::c dev eth0
ip -6 route add fd00:0:0:c::/64 via 2001:1200:0:21f0::c dev eth0
ip -6 route add fd00:0:0:a::/64 via 2001:1200:0:21f0::c dev eth0
ip -6 route add fd00:0:0:9::/64 via 2001:1200:0:21f0::c dev eth0
ip -6 route add fd00:0:0:d::/64 via 2001:1200:0:21f0::c dev eth0
ip -6 route add 2001:1200:0:21f1::/62 via 2001:1200:0:21f0::c dev eth0
ip -6 route add 2001:1200:0:21f4::/64 via 2001:1200:0:21f0::c dev eth0
ip -6 route add 2001:1200:0:21f5::/64 via 2001:1200:0:21f0::c dev eth0
ip -6 route add 2001:1200:0:21f6::/64 via 2001:1200:0:21f0::c dev eth0
ip -6 rule add from fd00::/8 prohibit
ip route add default via 192.168.0.1 dev eth2
```

Router-3:

```
ip -6 route add 2001:1200:0:21f6::/64 via 2001:1200:0:21f0::f dev eth1
ip -6 route add 2001:1200:0:21f0::a/127 via 2001:1200:0:21f0::f dev eth1
ip -6 route add 2001:1200:0:21f0::c/127 via 2001:1200:0:21f0::f dev eth1
ip -6 route add 2001:1200:0:21f0::e/127 via 2001:1200:0:21f0::f dev eth1
ip -6 route add 2001:1200:0:21f0::6/127 via 2001:1200:0:21f0::f dev eth1
ip -6 route add 2001:1200:0:21f0::12/127 via 2001:1200:0:21f0::12 dev eth0
ip -6 route add 2001:1200:0:21f0::/127 via 2001:1200:0:21f0::12 dev eth0
ip -6 route add 2001:1200:0:21f0::2/127 via 2001:1200:0:21f0::12 dev eth0
ip -6 route add 2001:1200:0:21f0::4/127 via 2001:1200:0:21f0::12 dev eth0
ip -6 route add 2001:1200:0:21f0::8/127 via 2001:1200:0:21f0::12 dev eth0
ip -6 route add 2001:1200:0:21f1::/64 via 2001:1200:0:21f0::12 dev eth0
ip -6 route add 2001:1200:0:21f2::/64 via 2001:1200:0:21f0::12 dev eth0
```

```

ip -6 route add 2001:1200:0:21f3::/64 via 2001:1200:0:21f0::12 dev eth0
ip -6 route add 2001:1200:0:21f4::/64 via 2001:1200:0:21f0::12 dev eth0
ip -6 route add 2001:1200:0:21f5::/64 via 2001:1200:0:21f0::12 dev eth0
ip -6 route add fd00:0:0:6::/64 via 2001:1200:0:21f0::f dev eth1
ip -6 route add fd00:0:0:d::/64 via 2001:1200:0:21f0::f dev eth1
ip -6 route add fd00:0:0:e::/64 via 2001:1200:0:21f0::f dev eth1
ip -6 route add fd00:0:0:f::/64 via 2001:1200:0:21f0::f dev eth1
ip -6 route add fd00:0:0:9::2/64 via 2001:1200:0:21f0::f dev eth1
ip -6 route add fd00:0:0:8::2/64 via 2001:1200:0:21f0::12 dev eth0
ip -6 route add fd00:0:0:b::2/64 via 2001:1200:0:21f0::12 dev eth0
ip -6 route add fd00:0:0:c::2/64 via 2001:1200:0:21f0::12 dev eth0
ip -6 route add fd00:0:0:a::2/64 via 2001:1200:0:21f0::12 dev eth0
ip -6 route add fd00:0:0:7::/64 via 2001:1200:0:21f0::12 dev eth0
ip -6 route add fd00:0:0:4::/64 via 2001:1200:0:21f0::12 dev eth0
ip -6 route add fd00:0:0:3::/64 via 2001:1200:0:21f0::12 dev eth0
ip -6 route add fd00:0:0:5::/64 via 2001:1200:0:21f0::12 dev eth0
ip -6 route add fd00:0:0:1::/64 via 2001:1200:0:21f0::12 dev eth0
ip -6 route add fd00:0:0:2::/64 via 2001:1200:0:21f0::12 dev eth0
ip -6 route add default via 2001:1200:0:21f0::10 dev eth2

```

Router-4:

```

ip -6 route add fd00:0:0:6::/64 via 2001:1200:0:21f0::b dev eth3
ip -6 route add fd00:0:0:d::/64 via 2001:1200:0:21f0::b dev eth3
ip -6 route add fd00:0:0:f::/64 via 2001:1200:0:21f0::e dev eth1
ip -6 route add fd00:0:0:8::/64 via 2001:1200:0:21f0::e dev eth1
ip -6 route add fd00:0:0:10::/64 via 2001:1200:0:21f0::e dev eth1
ip -6 route add fd00:0:0:2::/64 via 2001:1200:0:21f0::e dev eth1
ip -6 route add fd00:0:0:1::/64 via 2001:1200:0:21f0::e dev eth1
ip -6 route add fd00:0:0:7::/64 via 2001:1200:0:21f0::e dev eth1
ip -6 route add fd00:0:0:b::/64 via 2001:1200:0:21f0::e dev eth1
ip -6 route add fd00:0:0:c::/64 via 2001:1200:0:21f0::e dev eth1
ip -6 route add fd00:0:0:a::/64 via 2001:1200:0:21f0::e dev eth1
ip -6 route add fd00:0:0:4::/64 via 2001:1200:0:21f0::e dev eth1
ip -6 route add fd00:0:0:3::/64 via 2001:1200:0:21f0::e dev eth1
ip -6 route add fd00:0:0:5::/64 via 2001:1200:0:21f0::e dev eth1
ip -6 route add fd00:0:0:9::/64 via 2001:1200:0:21f0::6 dev eth0
ip6tables -A PREROUTING -t mangle -p tcp -j MARK --set-mark 10
ip -6 rule add priority 150 to 2000::/3 fwmark 10 table 150
ip -6 route add default via 2001:1200:0:21f0::e dev eth1 table 150
ip -6 rule add to 2001:1200:0:21f0::/60 table 100 priority 100
ip -6 route add 2001:1200:0:21f1::/64 via 2001:1200:0:21f0::e dev eth1 table 100
ip -6 route add 2001:1200:0:21f2::/64 via 2001:1200:0:21f0::e dev eth1 table 100
ip -6 route add 2001:1200:0:21f3::/64 via 2001:1200:0:21f0::e dev eth1 table 100
ip -6 route add 2001:1200:0:21f4::/64 via 2001:1200:0:21f0::e dev eth1 table 100

```

```
ip -6 route add 2001:1200:0:21f5::/64 via 2001:1200:0:21f0::e dev eth1 table 100
ip -6 route add 2001:1200:0:21f6::/64 via 2001:1200:0:21f0::b dev eth3 table 100
ip -6 route add 2001:1200:0:21f0::/127 via 2001:1200:0:21f0::e dev eth1 table 100
ip -6 route add 2001:1200:0:21f0::2/127 via 2001:1200:0:21f0::e dev eth1 table 100
ip -6 route add 2001:1200:0:21f0::4/127 via 2001:1200:0:21f0::e dev eth1 table 100
ip -6 route add 2001:1200:0:21f0::6/127 via 2001:1200:0:21f0::6 dev eth0 table 100
ip -6 route add 2001:1200:0:21f0::8/127 via 2001:1200:0:21f0::e dev eth1 table 100
ip -6 route add 2001:1200:0:21f0::10/127 via 2001:1200:0:21f0::e dev eth1 table 100
ip -6 route add 2001:1200:0:21f0::12/127 via 2001:1200:0:21f0::e dev eth1 table 100
ip -6 route add 2001:1200:0:21f0::a/127 via 2001:1200:0:21f0::b dev eth3 table 100
ip -6 route add 2001:1200:0:21f0::e/127 via 2001:1200:0:21f0::e dev eth1 table 100
ip -6 route add default via 2001:1200:0:21f0::d dev eth2
```

Router-5:

```
ip -6 route add fd00:0:0:3::/64 via 2001:1200:0:21f0::4 dev eth1
ip -6 route add fd00:0:0:4::/64 via 2001:1200:0:21f0::4 dev eth1
ip -6 route add fd00:0:0:b::/64 via 2001:1200:0:21f0::4 dev eth1
ip -6 route add fd00:0:0:c::/64 via 2001:1200:0:21f0::4 dev eth1
ip -6 route add 2001:1200:0:21f0::4/127 via 2001:1200:0:21f0::4 dev eth1
ip -6 route add 2001:1200:0:21f0::/126 via 2001:1200:0:21f0::4 dev eth1
ip -6 route add 2001:1200:0:21f1::/64 via 2001:1200:0:21f0::4 dev eth1
ip -6 route add 2001:1200:0:21f2::/64 via 2001:1200:0:21f0::4 dev eth1
ip -6 rule add priority 100 from fd00:0:0:5::/64 table 100
ip -6 route add 2001:1200:0:21f6::3 via 2001:1200:0:21f0::9 dev eth3 table 100
ip -6 route add 2001:1200:0:21f6::4 via 2001:1200:0:21f0::9 dev eth3 table 100
ip -6 rule add priority 150 from fd00:0:0:5::/64 prohibit
ip -6 route add default via 2001:1200:0:21f0::7 dev eth2
```

Router-6:

```
ip -6 route add 2001:1200:0:21f0::/127 via 2001:1200:0:21f0:: dev eth1
ip -6 route add 2001:1200:0:21f1::/64 via 2001:1200:0:21f0:: dev eth1
ip -6 route add 2001:1200:0:21f0::2/127 via 2001:1200:0:21f0::3 dev eth2
ip -6 route add 2001:1200:0:21f2::/64 via 2001:1200:0:21f0::3 dev eth2
ip -6 route add fd00:0:0:b::/64 via 2001:1200:0:21f0:: dev eth1
ip -6 route add fd00:0:0:4::/64 via 2001:1200:0:21f0:: dev eth1
ip -6 route add fd00:0:0:c::/64 via 2001:1200:0:21f0::3 dev eth2
ip -6 route add fd00:0:0:3::/64 via 2001:1200:0:21f0::3 dev eth2
ip -6 route add default via 2001:1200:0:21f0::5 dev eth0
```

Router-7:

```
ip -6 route add default via 2001:1200:0:21f0::2 dev eth0
```

Router-8:

```
ip -6 route add default via 2001:1200:0:21f0::1 dev eth0
```

Router-9:

```

ip -6 route add fd00:0:0:7::/64 via 2001:1200:0:21f0::8/127 dev eth1
ip -6 route add fd00:0:0:9::/64 via 2001:1200:0:21f0::8/127 dev eth1
ip -6 route add fd00:0:0:a::/64 via 2001:1200:0:21f0::8/127 dev eth1
ip -6 route add fd00:0:0:c::/64 via 2001:1200:0:21f0::8/127 dev eth1
ip -6 route add fd00:0:0:b::/64 via 2001:1200:0:21f0::8/127 dev eth1
ip -6 route add fd00:0:0:3::/64 via 2001:1200:0:21f0::8/127 dev eth1
ip -6 route add fd00:0:0:4::/64 via 2001:1200:0:21f0::8/127 dev eth1
ip -6 route add fd00:0:0:5::/64 via 2001:1200:0:21f0::8/127 dev eth1
ip6tables -A PREROUTING -t mangle -p tcp -j MARK --set-mark 10
ip -6 rule add priority 150 to 2000::/3 fwmark 10 table 150
ip -6 route add default via 2001:1200:0:21f0::13 dev eth3 table 150
ip -6 rule add to 2001:1200:0:21f0::/60 table 100 priority 100
ip -6 route add 2001:1200:0:21f1::/64 via 2001:1200:0:21f0::8 dev eth1 table 100
ip -6 route add 2001:1200:0:21f2::/64 via 2001:1200:0:21f0::8 dev eth1 table 100
ip -6 route add 2001:1200:0:21f3::/64 via 2001:1200:0:21f0::8 dev eth1 table 100
ip -6 route add 2001:1200:0:21f0::/126 via 2001:1200:0:21f0::8 dev eth1 table 100
ip -6 route add 2001:1200:0:21f0::4/127 via 2001:1200:0:21f0::8 dev eth1 table 100
ip -6 route add 2001:1200:0:21f0::8/127 via 2001:1200:0:21f0::8 dev eth1 table 100
ip -6 route add default via 2001:1200:0:21f0::13 dev eth3 table 100
ip -6 route add default via 2001:1200:0:21f0::8 dev eth1

```

Ejercicio 5.

Configure el Router-2 y Router-Casa para establecer un túnel tipo sit (transporte de datagramas IPv6 sobre IPv4) entre la red de la empresa y la red hogareña.

Router-2:

```

ip route add default via 192.168.0.1 dev eth2
ip tunnel add site1 mode sit local 192.168.0.1 remote 192.170.0.1
ip link set site1 up
ip -6 route add default dev site1

```

Router-Casa:

```

ip route add default via 192.170.0.2 dev eth0
ip tunnel add site1 mode sit local 192.170.0.1 remote 192.168.0.2
ip link set site1 up
ip -6 route add default dev site1

```

ISP-INTRANET:

```

ip route add default via 192.169.0.1 dev eth1

```

ISP-CASA:

```

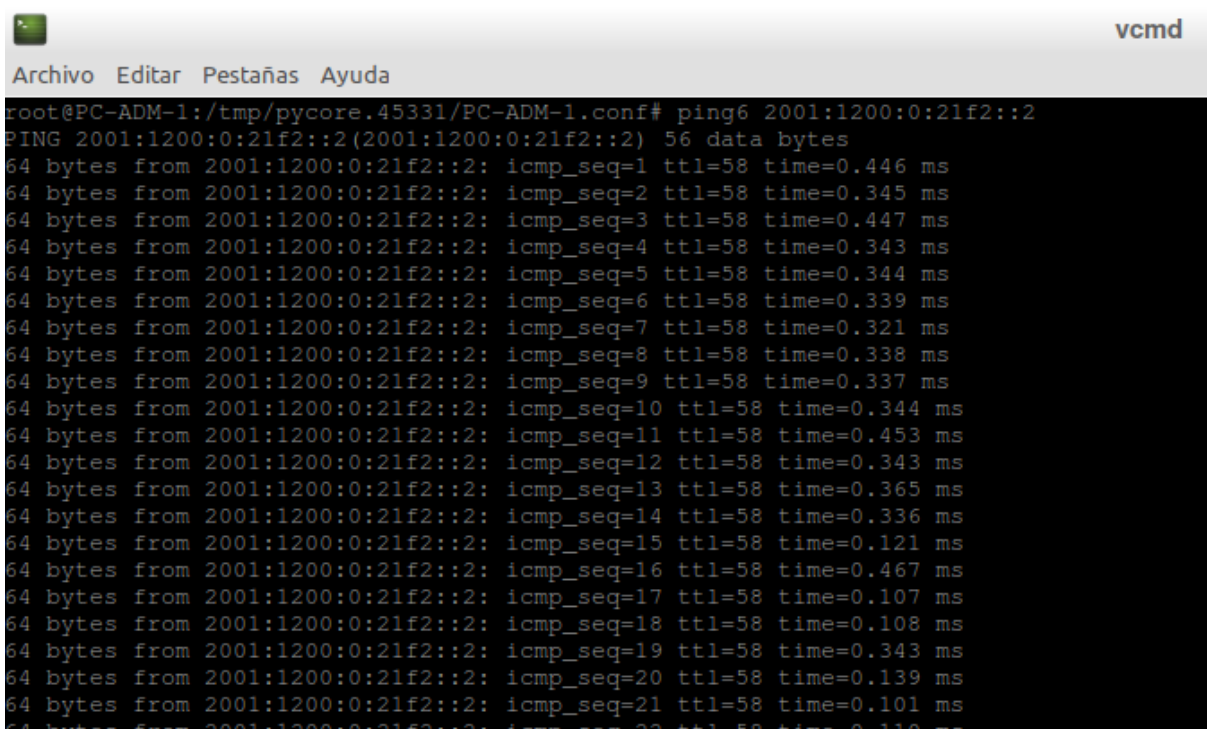
ip route add default via 192.169.0.2 dev eth0

```

Ejercicio 6.

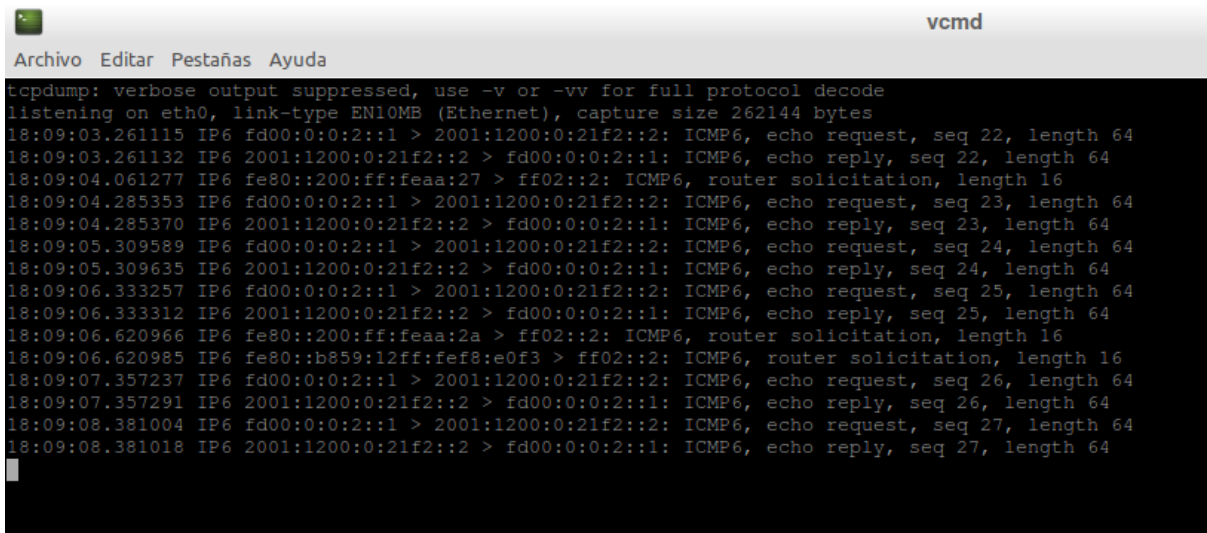
Arranque la emulación y compruebe la conectividad resultante en la intranet utilizando el comando ping6. Probar la conectividad entre PC-ADM-1 y PC-VT-1, entre PC-ADM-1 y SERVIDOR-WEB, y entre el PC-GUEST y SERVIDOR-DNS. Tenga en cuenta la utilización del TCPDump provisto por el emulador para verificar el tráfico en cada interfaz

Conectividad entre PC-ADM-1 y PC-VT-1:

A screenshot of a terminal window titled 'vcmd'. The terminal shows a command prompt 'root@PC-ADM-1:/tmp/pycore.45331/PC-ADM-1.conf#' followed by the command 'ping6 2001:1200:0:21f2::2'. The output shows a successful ping with 21 data bytes and a TTL of 58. The response times for each of the 21 packets are listed, ranging from 0.101 ms to 0.453 ms.

```
root@PC-ADM-1:/tmp/pycore.45331/PC-ADM-1.conf# ping6 2001:1200:0:21f2::2
PING 2001:1200:0:21f2::2(2001:1200:0:21f2::2) 56 data bytes
64 bytes from 2001:1200:0:21f2::2: icmp_seq=1 ttl=58 time=0.446 ms
64 bytes from 2001:1200:0:21f2::2: icmp_seq=2 ttl=58 time=0.345 ms
64 bytes from 2001:1200:0:21f2::2: icmp_seq=3 ttl=58 time=0.447 ms
64 bytes from 2001:1200:0:21f2::2: icmp_seq=4 ttl=58 time=0.343 ms
64 bytes from 2001:1200:0:21f2::2: icmp_seq=5 ttl=58 time=0.344 ms
64 bytes from 2001:1200:0:21f2::2: icmp_seq=6 ttl=58 time=0.339 ms
64 bytes from 2001:1200:0:21f2::2: icmp_seq=7 ttl=58 time=0.321 ms
64 bytes from 2001:1200:0:21f2::2: icmp_seq=8 ttl=58 time=0.338 ms
64 bytes from 2001:1200:0:21f2::2: icmp_seq=9 ttl=58 time=0.337 ms
64 bytes from 2001:1200:0:21f2::2: icmp_seq=10 ttl=58 time=0.344 ms
64 bytes from 2001:1200:0:21f2::2: icmp_seq=11 ttl=58 time=0.453 ms
64 bytes from 2001:1200:0:21f2::2: icmp_seq=12 ttl=58 time=0.343 ms
64 bytes from 2001:1200:0:21f2::2: icmp_seq=13 ttl=58 time=0.365 ms
64 bytes from 2001:1200:0:21f2::2: icmp_seq=14 ttl=58 time=0.336 ms
64 bytes from 2001:1200:0:21f2::2: icmp_seq=15 ttl=58 time=0.121 ms
64 bytes from 2001:1200:0:21f2::2: icmp_seq=16 ttl=58 time=0.467 ms
64 bytes from 2001:1200:0:21f2::2: icmp_seq=17 ttl=58 time=0.107 ms
64 bytes from 2001:1200:0:21f2::2: icmp_seq=18 ttl=58 time=0.108 ms
64 bytes from 2001:1200:0:21f2::2: icmp_seq=19 ttl=58 time=0.343 ms
64 bytes from 2001:1200:0:21f2::2: icmp_seq=20 ttl=58 time=0.139 ms
64 bytes from 2001:1200:0:21f2::2: icmp_seq=21 ttl=58 time=0.101 ms
64 bytes from 2001:1200:0:21f2::2: icmp_seq=22 ttl=58 time=0.110 ms
```

Captura Comando Ping6



```

vcmd
Archivo  Editar  Pestañas  Ayuda
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on eth0, link-type EN10MB (Ethernet), capture size 262144 bytes
18:09:03.261115 IP6 fd00:0:0:2::1 > 2001:1200:0:21f2::2: ICMP6, echo request, seq 22, length 64
18:09:03.261132 IP6 2001:1200:0:21f2::2 > fd00:0:0:2::1: ICMP6, echo reply, seq 22, length 64
18:09:04.061277 IP6 fe80::200:ff:feaa:27 > ff02::2: ICMP6, router solicitation, length 16
18:09:04.285353 IP6 fd00:0:0:2::1 > 2001:1200:0:21f2::2: ICMP6, echo request, seq 23, length 64
18:09:04.285370 IP6 2001:1200:0:21f2::2 > fd00:0:0:2::1: ICMP6, echo reply, seq 23, length 64
18:09:05.309589 IP6 fd00:0:0:2::1 > 2001:1200:0:21f2::2: ICMP6, echo request, seq 24, length 64
18:09:05.309635 IP6 2001:1200:0:21f2::2 > fd00:0:0:2::1: ICMP6, echo reply, seq 24, length 64
18:09:06.333257 IP6 fd00:0:0:2::1 > 2001:1200:0:21f2::2: ICMP6, echo request, seq 25, length 64
18:09:06.333312 IP6 2001:1200:0:21f2::2 > fd00:0:0:2::1: ICMP6, echo reply, seq 25, length 64
18:09:06.620966 IP6 fe80::200:ff:feaa:2a > ff02::2: ICMP6, router solicitation, length 16
18:09:06.620985 IP6 fe80::b859:12ff:ef8:e0f3 > ff02::2: ICMP6, router solicitation, length 16
18:09:07.357237 IP6 fd00:0:0:2::1 > 2001:1200:0:21f2::2: ICMP6, echo request, seq 26, length 64
18:09:07.357291 IP6 2001:1200:0:21f2::2 > fd00:0:0:2::1: ICMP6, echo reply, seq 26, length 64
18:09:08.381004 IP6 fd00:0:0:2::1 > 2001:1200:0:21f2::2: ICMP6, echo request, seq 27, length 64
18:09:08.381018 IP6 2001:1200:0:21f2::2 > fd00:0:0:2::1: ICMP6, echo reply, seq 27, length 64

```

Captura TCPDump eth0 PC-VT-1

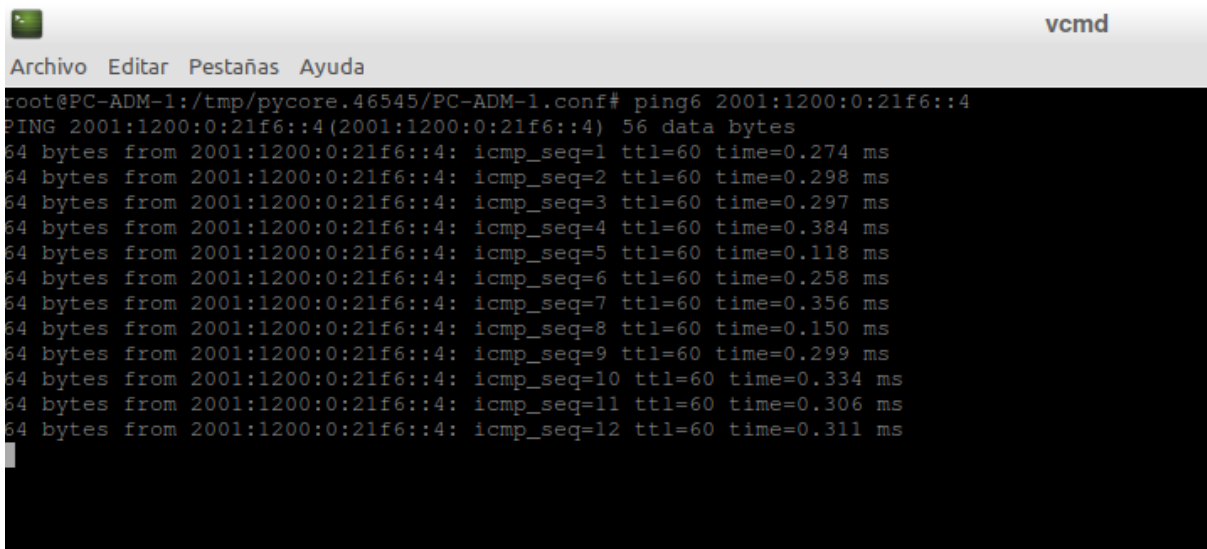
```

tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on eth0, link-type EN10MB (Ethernet), capture size 262144 bytes
12:16:46.610931 IP6 fd00:0:0:2::1 > 2001:1200:0:21f2::2: ICMP6, echo request, seq 21, length 64
12:16:46.611175 IP6 2001:1200:0:21f2::2 > fd00:0:0:2::1: ICMP6, echo reply, seq 21, length 64
12:16:47.634731 IP6 fd00:0:0:2::1 > 2001:1200:0:21f2::2: ICMP6, echo request, seq 22, length 64
12:16:47.634959 IP6 2001:1200:0:21f2::2 > fd00:0:0:2::1: ICMP6, echo reply, seq 22, length 64
12:16:48.659235 IP6 fd00:0:0:2::1 > 2001:1200:0:21f2::2: ICMP6, echo request, seq 23, length 64
12:16:48.659470 IP6 2001:1200:0:21f2::2 > fd00:0:0:2::1: ICMP6, echo reply, seq 23, length 64
12:16:49.682709 IP6 fd00:0:0:2::1 > 2001:1200:0:21f2::2: ICMP6, echo request, seq 24, length 64
12:16:49.683021 IP6 2001:1200:0:21f2::2 > fd00:0:0:2::1: ICMP6, echo reply, seq 24, length 64
12:16:50.712606 IP6 fd00:0:0:2::1 > 2001:1200:0:21f2::2: ICMP6, echo request, seq 25, length 64
12:16:50.712842 IP6 2001:1200:0:21f2::2 > fd00:0:0:2::1: ICMP6, echo reply, seq 25, length 64
12:16:51.730673 IP6 fd00:0:0:2::1 > 2001:1200:0:21f2::2: ICMP6, echo request, seq 26, length 64
12:16:51.730905 IP6 2001:1200:0:21f2::2 > fd00:0:0:2::1: ICMP6, echo reply, seq 26, length 64
12:16:52.765377 IP6 fd00:0:0:2::1 > 2001:1200:0:21f2::2: ICMP6, echo request, seq 27, length 64
12:16:52.765609 IP6 2001:1200:0:21f2::2 > fd00:0:0:2::1: ICMP6, echo reply, seq 27, length 64
12:16:53.782281 IP6 fd00:0:0:2::1 > 2001:1200:0:21f2::2: ICMP6, echo request, seq 28, length 64

```

Captura TCPDump eth0 PC-ADM-1

Conectividad entre PC-ADM-1 y SERVIDOR-WEB

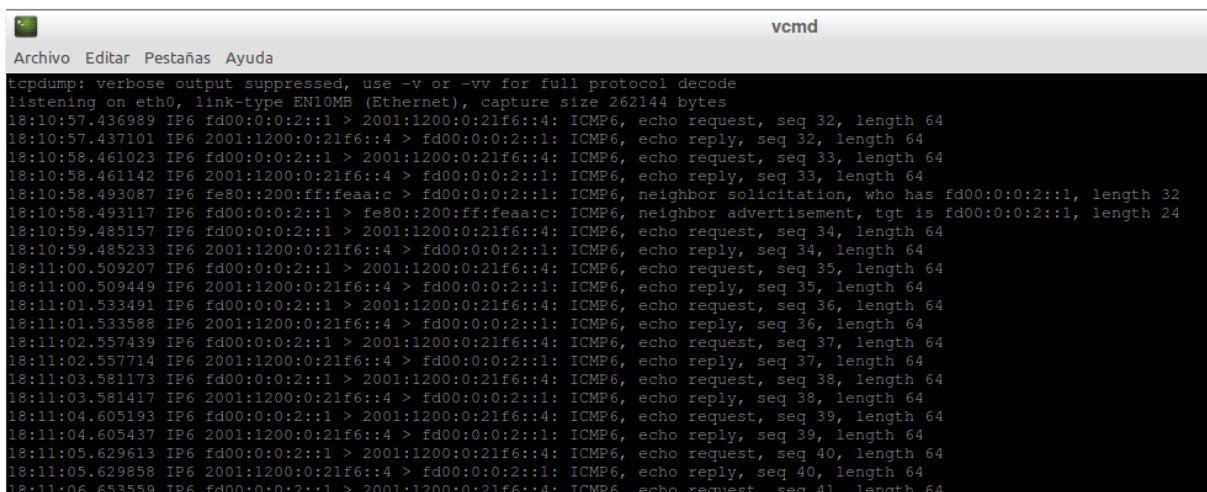


```

vcmd
Archivo  Editar  Pestañas  Ayuda
root@PC-ADM-1:/tmp/pycore.46545/PC-ADM-1.conf# ping6 2001:1200:0:21f6::4
PING 2001:1200:0:21f6::4 (2001:1200:0:21f6::4) 56 data bytes
64 bytes from 2001:1200:0:21f6::4: icmp_seq=1 ttl=60 time=0.274 ms
64 bytes from 2001:1200:0:21f6::4: icmp_seq=2 ttl=60 time=0.298 ms
64 bytes from 2001:1200:0:21f6::4: icmp_seq=3 ttl=60 time=0.297 ms
64 bytes from 2001:1200:0:21f6::4: icmp_seq=4 ttl=60 time=0.384 ms
64 bytes from 2001:1200:0:21f6::4: icmp_seq=5 ttl=60 time=0.118 ms
64 bytes from 2001:1200:0:21f6::4: icmp_seq=6 ttl=60 time=0.258 ms
64 bytes from 2001:1200:0:21f6::4: icmp_seq=7 ttl=60 time=0.356 ms
64 bytes from 2001:1200:0:21f6::4: icmp_seq=8 ttl=60 time=0.150 ms
64 bytes from 2001:1200:0:21f6::4: icmp_seq=9 ttl=60 time=0.299 ms
64 bytes from 2001:1200:0:21f6::4: icmp_seq=10 ttl=60 time=0.334 ms
64 bytes from 2001:1200:0:21f6::4: icmp_seq=11 ttl=60 time=0.306 ms
64 bytes from 2001:1200:0:21f6::4: icmp_seq=12 ttl=60 time=0.311 ms

```

Captura comando Ping6

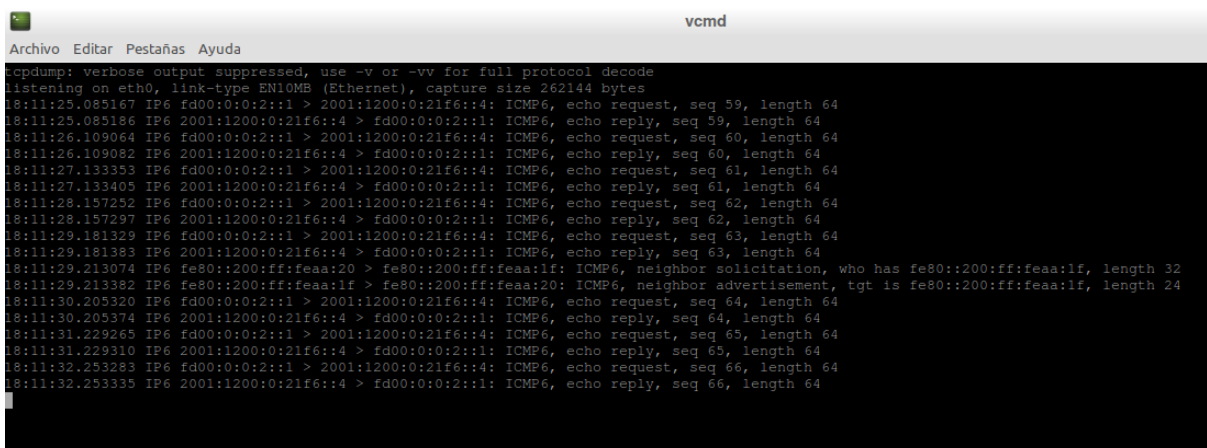


```

vcmd
Archivo  Editar  Pestañas  Ayuda
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on eth0, link-type EN10MB (Ethernet), capture size 262144 bytes
18:10:57.436989 IP6 fd00:0:0:2::1 > 2001:1200:0:21f6::4: ICMP6, echo request, seq 32, length 64
18:10:57.437101 IP6 2001:1200:0:21f6::4 > fd00:0:0:2::1: ICMP6, echo reply, seq 32, length 64
18:10:58.461023 IP6 fd00:0:0:2::1 > 2001:1200:0:21f6::4: ICMP6, echo request, seq 33, length 64
18:10:58.461142 IP6 2001:1200:0:21f6::4 > fd00:0:0:2::1: ICMP6, echo reply, seq 33, length 64
18:10:58.493087 IP6 fe80::200:fff:feaa:c > fd00:0:0:2::1: ICMP6, neighbor solicitation, who has fd00:0:0:2::1, length 32
18:10:58.493117 IP6 fd00:0:0:2::1 > fe80::200:fff:feaa:c: ICMP6, neighbor advertisement, tgt is fd00:0:0:2::1, length 24
18:10:59.485157 IP6 fd00:0:0:2::1 > 2001:1200:0:21f6::4: ICMP6, echo request, seq 34, length 64
18:10:59.485233 IP6 2001:1200:0:21f6::4 > fd00:0:0:2::1: ICMP6, echo reply, seq 34, length 64
18:11:00.509207 IP6 fd00:0:0:2::1 > 2001:1200:0:21f6::4: ICMP6, echo request, seq 35, length 64
18:11:00.509449 IP6 2001:1200:0:21f6::4 > fd00:0:0:2::1: ICMP6, echo reply, seq 35, length 64
18:11:01.533491 IP6 fd00:0:0:2::1 > 2001:1200:0:21f6::4: ICMP6, echo request, seq 36, length 64
18:11:01.533588 IP6 2001:1200:0:21f6::4 > fd00:0:0:2::1: ICMP6, echo reply, seq 36, length 64
18:11:02.557439 IP6 fd00:0:0:2::1 > 2001:1200:0:21f6::4: ICMP6, echo request, seq 37, length 64
18:11:02.557714 IP6 2001:1200:0:21f6::4 > fd00:0:0:2::1: ICMP6, echo reply, seq 37, length 64
18:11:03.581173 IP6 fd00:0:0:2::1 > 2001:1200:0:21f6::4: ICMP6, echo request, seq 38, length 64
18:11:03.581417 IP6 2001:1200:0:21f6::4 > fd00:0:0:2::1: ICMP6, echo reply, seq 38, length 64
18:11:04.605193 IP6 fd00:0:0:2::1 > 2001:1200:0:21f6::4: ICMP6, echo request, seq 39, length 64
18:11:04.605437 IP6 2001:1200:0:21f6::4 > fd00:0:0:2::1: ICMP6, echo reply, seq 39, length 64
18:11:05.629613 IP6 fd00:0:0:2::1 > 2001:1200:0:21f6::4: ICMP6, echo request, seq 40, length 64
18:11:05.629858 IP6 2001:1200:0:21f6::4 > fd00:0:0:2::1: ICMP6, echo reply, seq 40, length 64
18:11:06.653559 IP6 fd00:0:0:2::1 > 2001:1200:0:21f6::4: ICMP6, echo request, seq 41, length 64

```

TCPDump PC-ADM-1



```

vcmd
Archivo  Editar  Pestañas  Ayuda
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on eth0, link-type EN10MB (Ethernet), capture size 262144 bytes
18:11:25.085167 IP6 fd00:0:0:2::1 > 2001:1200:0:21f6::4: ICMP6, echo request, seq 59, length 64
18:11:25.085186 IP6 2001:1200:0:21f6::4 > fd00:0:0:2::1: ICMP6, echo reply, seq 59, length 64
18:11:26.109064 IP6 fd00:0:0:2::1 > 2001:1200:0:21f6::4: ICMP6, echo request, seq 60, length 64
18:11:26.109082 IP6 2001:1200:0:21f6::4 > fd00:0:0:2::1: ICMP6, echo reply, seq 60, length 64
18:11:27.133353 IP6 fd00:0:0:2::1 > 2001:1200:0:21f6::4: ICMP6, echo request, seq 61, length 64
18:11:27.133405 IP6 2001:1200:0:21f6::4 > fd00:0:0:2::1: ICMP6, echo reply, seq 61, length 64
18:11:28.157252 IP6 fd00:0:0:2::1 > 2001:1200:0:21f6::4: ICMP6, echo request, seq 62, length 64
18:11:28.157297 IP6 2001:1200:0:21f6::4 > fd00:0:0:2::1: ICMP6, echo reply, seq 62, length 64
18:11:29.181329 IP6 fd00:0:0:2::1 > 2001:1200:0:21f6::4: ICMP6, echo request, seq 63, length 64
18:11:29.181383 IP6 2001:1200:0:21f6::4 > fd00:0:0:2::1: ICMP6, echo reply, seq 63, length 64
18:11:29.213074 IP6 fe80::200:fff:feaa:20 > fe80::200:fff:feaa:1f: ICMP6, neighbor solicitation, who has fe80::200:fff:feaa:1f, length 32
18:11:29.213382 IP6 fe80::200:fff:feaa:1f > fe80::200:fff:feaa:20: ICMP6, neighbor advertisement, tgt is fe80::200:fff:feaa:1f, length 24
18:11:30.205320 IP6 fd00:0:0:2::1 > 2001:1200:0:21f6::4: ICMP6, echo request, seq 64, length 64
18:11:30.205374 IP6 2001:1200:0:21f6::4 > fd00:0:0:2::1: ICMP6, echo reply, seq 64, length 64
18:11:31.229265 IP6 fd00:0:0:2::1 > 2001:1200:0:21f6::4: ICMP6, echo request, seq 65, length 64
18:11:31.229310 IP6 2001:1200:0:21f6::4 > fd00:0:0:2::1: ICMP6, echo reply, seq 65, length 64
18:11:32.253283 IP6 fd00:0:0:2::1 > 2001:1200:0:21f6::4: ICMP6, echo request, seq 66, length 64
18:11:32.253335 IP6 2001:1200:0:21f6::4 > fd00:0:0:2::1: ICMP6, echo reply, seq 66, length 64

```

TCPDump Servidor Web

Conectividad PC-GUEST y SERVIDOR-DNS:

```

root@PC-GUEST:/tmp/pycore.43585/PC-GUEST.conf# ping6 2001:1200:0:21f6::3
PING 2001:1200:0:21f6::3(2001:1200:0:21f6::3) 56 data bytes
64 bytes from 2001:1200:0:21f6::3: icmp_seq=1 ttl=59 time=87.2 ms
64 bytes from 2001:1200:0:21f6::3: icmp_seq=2 ttl=59 time=41.1 ms
64 bytes from 2001:1200:0:21f6::3: icmp_seq=3 ttl=59 time=42.7 ms
64 bytes from 2001:1200:0:21f6::3: icmp_seq=4 ttl=59 time=45.8 ms
64 bytes from 2001:1200:0:21f6::3: icmp_seq=5 ttl=59 time=42.2 ms
64 bytes from 2001:1200:0:21f6::3: icmp_seq=6 ttl=59 time=45.6 ms
64 bytes from 2001:1200:0:21f6::3: icmp_seq=7 ttl=59 time=55.8 ms
64 bytes from 2001:1200:0:21f6::3: icmp_seq=8 ttl=59 time=50.2 ms
64 bytes from 2001:1200:0:21f6::3: icmp_seq=9 ttl=59 time=48.1 ms

```

Captura comando Ping6

```

tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on eth0, link-type EN10MB (Ethernet), capture size 262144 bytes
12:23:50.888919 IP6 fd00:0:0:5::1 > 2001:1200:0:21f6::3: ICMP6, echo request, seq 109, length 64
12:23:50.933065 IP6 2001:1200:0:21f6::3 > fd00:0:0:5::1: ICMP6, echo reply, seq 109, length 64
12:23:51.890367 IP6 fd00:0:0:5::1 > 2001:1200:0:21f6::3: ICMP6, echo request, seq 110, length 64
12:23:51.932238 IP6 2001:1200:0:21f6::3 > fd00:0:0:5::1: ICMP6, echo reply, seq 110, length 64
12:23:52.892794 IP6 fd00:0:0:5::1 > 2001:1200:0:21f6::3: ICMP6, echo request, seq 111, length 64
12:23:52.933523 IP6 2001:1200:0:21f6::3 > fd00:0:0:5::1: ICMP6, echo reply, seq 111, length 64
12:23:53.894419 IP6 fd00:0:0:5::1 > 2001:1200:0:21f6::3: ICMP6, echo request, seq 112, length 64
12:23:53.935076 IP6 2001:1200:0:21f6::3 > fd00:0:0:5::1: ICMP6, echo reply, seq 112, length 64
12:23:54.896607 IP6 fd00:0:0:5::1 > 2001:1200:0:21f6::3: ICMP6, echo request, seq 113, length 64

```

TCPDump PC-GUEST

```

tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on eth0, link-type EN10MB (Ethernet), capture size 262144 bytes
12:25:39.171090 IP6 fd00:0:0:5::1 > 2001:1200:0:21f6::3: ICMP6, echo request, seq 217, length 64
12:25:39.171155 IP6 2001:1200:0:21f6::3 > fd00:0:0:5::1: ICMP6, echo reply, seq 217, length 64
12:25:40.172355 IP6 fd00:0:0:5::1 > 2001:1200:0:21f6::3: ICMP6, echo request, seq 218, length 64
12:25:40.172393 IP6 2001:1200:0:21f6::3 > fd00:0:0:5::1: ICMP6, echo reply, seq 218, length 64
12:25:41.174657 IP6 fd00:0:0:5::1 > 2001:1200:0:21f6::3: ICMP6, echo request, seq 219, length 64
12:25:41.174729 IP6 2001:1200:0:21f6::3 > fd00:0:0:5::1: ICMP6, echo reply, seq 219, length 64
12:25:42.173726 IP6 fd00:0:0:5::1 > 2001:1200:0:21f6::3: ICMP6, echo request, seq 220, length 64
12:25:42.173804 IP6 2001:1200:0:21f6::3 > fd00:0:0:5::1: ICMP6, echo reply, seq 220, length 64
12:25:43.175998 IP6 fd00:0:0:5::1 > 2001:1200:0:21f6::3: ICMP6, echo request, seq 221, length 64
12:25:43.176033 IP6 2001:1200:0:21f6::3 > fd00:0:0:5::1: ICMP6, echo reply, seq 221, length 64

```

TCPDump Servidor DNS

Ejercicio 7.

Describe las direcciones de las interfaces.

Conectividad entre PC-ADM-1 y PC-VT-1:

La interfaz eth0 de PC-ADM-1 tiene la dirección ULA fd00::0:0:2::1/64 pertenece a la red fd00::0:0:2::/64.

La interfaz eth0 de PC-VT-1 tiene la dirección global 2001:1200:0:21f2::2/64 pertenece a la red 2001:1200:0:21f2::/64.

Conectividad entre PC-ADM-1 y SERVIDOR-WEB

La interfaz eth0 de PC-ADM-1 tiene la dirección ULA fd00:0:0:2::1/64 pertenece a la red fd00:0:0:2::/64

La interfaz eth0 del Servidor-Web tiene la dirección global 2001:1200:0:21f6::4/64 pertenece a la red 2001:1200:0:21f6::/64

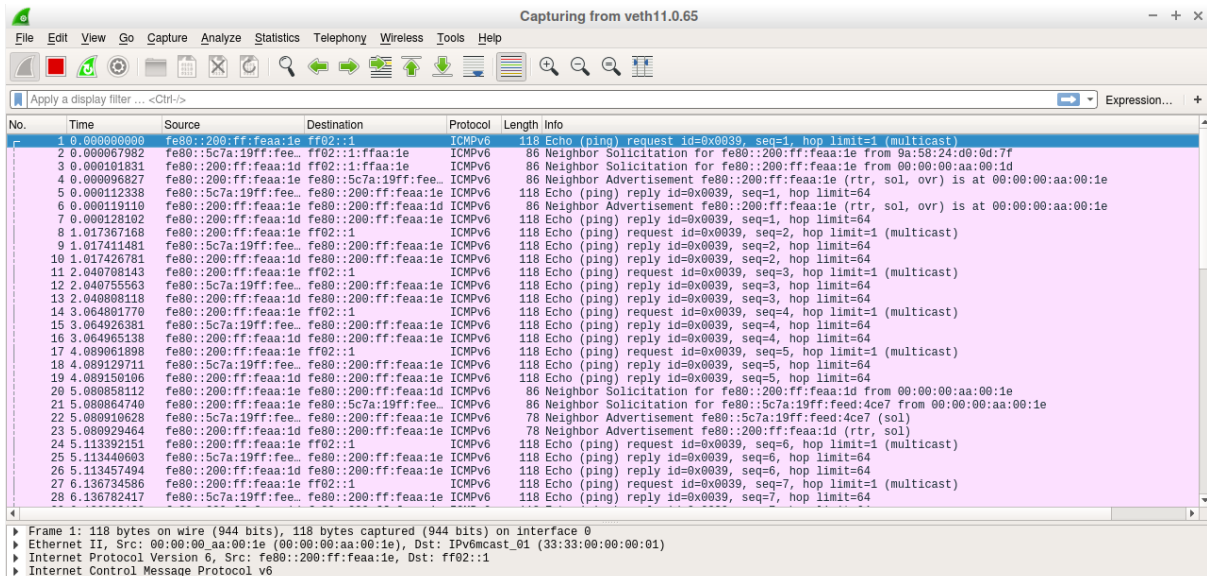
Conectividad PC-GUEST y SERVIDOR-DNS:

La interfaz eth0 de PC-Guest tiene la dirección ULA fd00:0:0:5::1/64 pertenece a la red fd00:0:0:5::/64

La interfaz eth0 de Servidor-Dns tiene la dirección global 2001:1200:0:21f6::3/64 pertenece a la red 2001:1200:0:21f6::/64

Ejercicio 8.

Desde Router-1, ejecute: “ping6 ff02::1%eth0”. Analice los paquetes utilizando Wireshark.



Captura de Router-1 eth1 - Wireshark

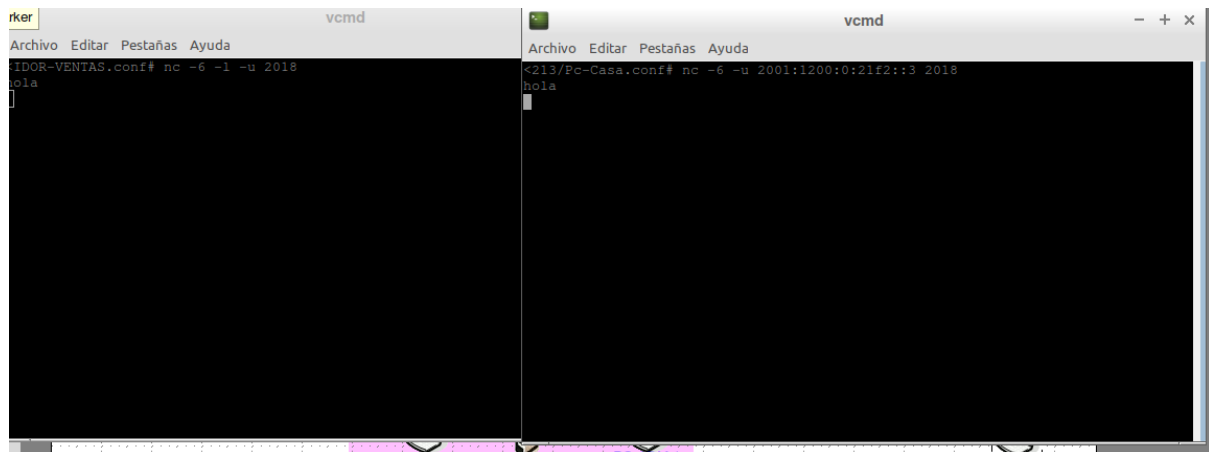
Mediante “ping6 ff02::1%eth0”, lo que se hace es enviar un multicast a todos los equipos de la red local. Como en el caso de nuestro caso, el Router-1, su interfaz eth0 se conecta con únicamente otro router (Router-4) lo que sucede es que se enviará un multicast a este Router-4 únicamente.

En caso que se utilizara el comando “ping6 ff02::1%eth1” el multicast sería enviado a toda la red del Data Center.

Lo que se analiza en la captura adjunta es como el inciso lo indica el comando “ping6 ff02::1%eth0” en el Router-1. Como primera instancia podemos ver cómo el Router-1 envía un ping request hacia todos los equipos de la red local, en este caso únicamente será hacia Router-4. Luego podemos ver como se reciben los “ping reply” por parte de los equipos de la red local.

Ejercicio 9.

Realice comunicaciones usando netcat usando UDP a nivel site entre el SERVIDOR-VENTAS y Pc-Casa. Adjunte capturas de Wireshark de la comunicación realizada, y explique cada uno de los niveles. Tenga en cuenta los comandos `nc -6 -l -u {puerto}` para el servidor y `nc -6 -u {dirección} {puerto}`.



A la izquierda se puede observar la consola del Servidor-Ventas y a la derecha, por otra parte, se observa la consola de la PC-Casa (fuera de la intranet).

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000000	2001:1234::2	2001:1200:0:21f2::3	UDP	67	40187 → 2018 Len=5
2	5.085710020	fe80::200:ff:feaa:26	2001:1200:0:21f2::3	ICMPv6	86	Neighbor Solicitat:
3	5.085728357	2001:1200:0:21f2::3	fe80::200:ff:feaa:26	ICMPv6	78	Neighbor Advertiser
4	6.996414951	2001:1234::2	2001:1200:0:21f2::3	UDP	68	40187 → 2018 Len=6

<p>Frame 1: 67 bytes on wire (536 bits), 67 bytes captured (536 bits) on interface 0</p> <p>Ethernet II, Src: 00:00:00_aa:00:26 (00:00:00:aa:00:26), Dst: 00:00:00_aa:00:27 (00:00:00:aa:00:27)</p> <ul style="list-style-type: none"> Destination: 00:00:00_aa:00:27 (00:00:00:aa:00:27) Source: 00:00:00_aa:00:26 (00:00:00:aa:00:26) Type: IPv6 (0x86dd) <p>Internet Protocol Version 6, Src: 2001:1234::2, Dst: 2001:1200:0:21f2::3</p> <ul style="list-style-type: none"> 0110 = Version: 6 0000 0000 = Traffic Class: 0x00 (DSCP: CS0, ECN: Not-ECT) 0000 1010 0110 0000 0010 = Flow Label: 0x0a602 Payload Length: 13 Next Header: UDP (17) Hop Limit: 56 Source: 2001:1234::2 Destination: 2001:1200:0:21f2::3 <p>User Datagram Protocol, Src Port: 40187, Dst Port: 2018</p> <ul style="list-style-type: none"> Source Port: 40187 Destination Port: 2018 Length: 13 Checksum: 0xf5f8 [unverified] [Checksum Status: Unverified] [Stream index: 0] <p>Data (5 bytes)</p> <ul style="list-style-type: none"> Data: 686f6c610a [Length: 5]

En NetCat, cuando un mensaje es enviado se utiliza el protocolo UDP por lo que siempre que la PC-Casa envíe un mensaje, el servidor recibirá un paquete UDP.

Éste paquete pasa por distintos niveles:

Nivel Ethernet: se tiene en primer lugar las direcciones MAC de origen(Source) y

destino(destination)

Nivel IP: se poseen las direcciones IPv6 de origen(Src) y destino(Dst) e información sobre el paquete como por ejemplo el siguiente header ipv6 (next header que indica, en el caso de ser un mensaje el protocolo utilizado que será UDP) y hop limit.

User Datagram Protocol (Nivel de Transporte): contiene información de los puertos de origen y destino, además de la longitud del header UDP y checksum.

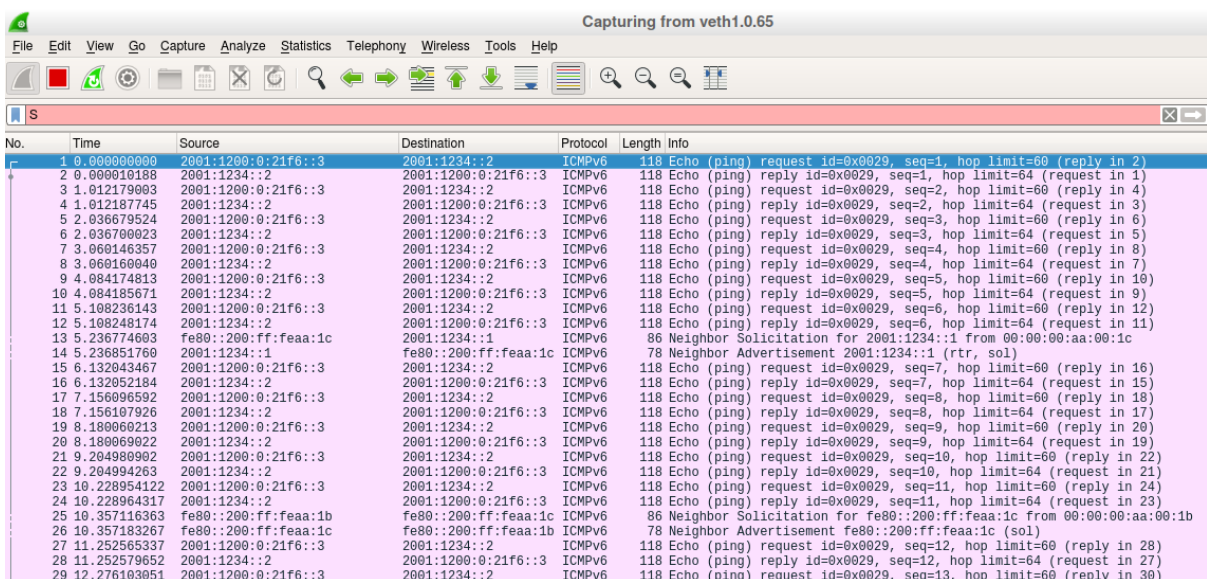
Data: contiene los datos que se envían dentro del datagram.

Ejercicio 10.

Compruebe la conectividad utilizando ping6 y traceroute6 entre equipos internos de la intranet y las direcciones externas. Probar la conectividad entre PC-Casa y SERVIDOR-DNS y PC-VT-1 y PC-Casa. En cada caso, utilizar Wireshark para verificar la encapsulación de IPv6 en IPv4 (tunel en los equipos de la Internet)

Conectividad entre PC-Casa y Servidor-DNS:

- Ping6:



No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000000	2001:1200:0:21f6::3	2001:1234::2	ICMPv6	118	Echo (ping) request id=0x0029, seq=1, hop limit=60 (reply in 2)
2	0.000010188	2001:1234::2	2001:1200:0:21f6::3	ICMPv6	118	Echo (ping) reply id=0x0029, seq=1, hop limit=64 (request in 1)
3	1.012179003	2001:1200:0:21f6::3	2001:1234::2	ICMPv6	118	Echo (ping) request id=0x0029, seq=2, hop limit=60 (reply in 4)
4	1.012187745	2001:1234::2	2001:1200:0:21f6::3	ICMPv6	118	Echo (ping) reply id=0x0029, seq=2, hop limit=64 (request in 3)
5	2.036679524	2001:1200:0:21f6::3	2001:1234::2	ICMPv6	118	Echo (ping) request id=0x0029, seq=3, hop limit=60 (reply in 6)
6	2.036700023	2001:1234::2	2001:1200:0:21f6::3	ICMPv6	118	Echo (ping) reply id=0x0029, seq=3, hop limit=64 (request in 5)
7	3.060146357	2001:1200:0:21f6::3	2001:1234::2	ICMPv6	118	Echo (ping) request id=0x0029, seq=4, hop limit=60 (reply in 8)
8	3.060160040	2001:1234::2	2001:1200:0:21f6::3	ICMPv6	118	Echo (ping) reply id=0x0029, seq=4, hop limit=64 (request in 7)
9	4.084174813	2001:1200:0:21f6::3	2001:1234::2	ICMPv6	118	Echo (ping) request id=0x0029, seq=5, hop limit=60 (reply in 10)
10	4.084185671	2001:1234::2	2001:1200:0:21f6::3	ICMPv6	118	Echo (ping) reply id=0x0029, seq=5, hop limit=64 (request in 9)
11	5.108236143	2001:1200:0:21f6::3	2001:1234::2	ICMPv6	118	Echo (ping) request id=0x0029, seq=6, hop limit=60 (reply in 12)
12	5.108248174	2001:1234::2	2001:1200:0:21f6::3	ICMPv6	118	Echo (ping) reply id=0x0029, seq=6, hop limit=64 (request in 11)
13	5.236774603	fe80::200:ff:feaa:1c	2001:1234::1	ICMPv6	86	Neighbor Solicitation for 2001:1234::1 from 00:00:00:aa:00:1c
14	5.236851760	2001:1234::1	fe80::200:ff:feaa:1c	ICMPv6	78	Neighbor Advertisement 2001:1234::1 (rtr, sol)
15	6.132943467	2001:1200:0:21f6::3	2001:1234::2	ICMPv6	118	Echo (ping) request id=0x0029, seq=7, hop limit=60 (reply in 16)
16	6.132952184	2001:1234::2	2001:1200:0:21f6::3	ICMPv6	118	Echo (ping) reply id=0x0029, seq=7, hop limit=64 (request in 15)
17	7.156096592	2001:1200:0:21f6::3	2001:1234::2	ICMPv6	118	Echo (ping) request id=0x0029, seq=8, hop limit=60 (reply in 18)
18	7.156107926	2001:1234::2	2001:1200:0:21f6::3	ICMPv6	118	Echo (ping) reply id=0x0029, seq=8, hop limit=64 (request in 17)
19	8.180060213	2001:1200:0:21f6::3	2001:1234::2	ICMPv6	118	Echo (ping) request id=0x0029, seq=9, hop limit=60 (reply in 20)
20	8.180069022	2001:1234::2	2001:1200:0:21f6::3	ICMPv6	118	Echo (ping) reply id=0x0029, seq=9, hop limit=64 (request in 19)
21	9.204980902	2001:1200:0:21f6::3	2001:1234::2	ICMPv6	118	Echo (ping) request id=0x0029, seq=10, hop limit=60 (reply in 22)
22	9.204994263	2001:1234::2	2001:1200:0:21f6::3	ICMPv6	118	Echo (ping) reply id=0x0029, seq=10, hop limit=64 (request in 21)
23	10.228954122	2001:1200:0:21f6::3	2001:1234::2	ICMPv6	118	Echo (ping) request id=0x0029, seq=11, hop limit=60 (reply in 24)
24	10.228964317	2001:1234::2	2001:1200:0:21f6::3	ICMPv6	118	Echo (ping) reply id=0x0029, seq=11, hop limit=64 (request in 23)
25	10.357116363	fe80::200:ff:feaa:1b	fe80::200:ff:feaa:1c	ICMPv6	86	Neighbor Solicitation for fe80::200:ff:feaa:1c from 00:00:00:aa:00:1b
26	10.357183267	fe80::200:ff:feaa:1c	fe80::200:ff:feaa:1b	ICMPv6	78	Neighbor Advertisement fe80::200:ff:feaa:1c (sol)
27	11.252565337	2001:1200:0:21f6::3	2001:1234::2	ICMPv6	118	Echo (ping) request id=0x0029, seq=12, hop limit=60 (reply in 28)
28	11.252579652	2001:1234::2	2001:1200:0:21f6::3	ICMPv6	118	Echo (ping) reply id=0x0029, seq=12, hop limit=64 (request in 27)
29	12.276103051	2001:1200:0:21f6::3	2001:1234::2	ICMPv6	118	Echo (ping) request id=0x0029, seq=13, hop limit=60 (reply in 30)

Wireshark PC-Casa

Capturing from veth13.0.65

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Apply a display filter ... <Ctrl-F>

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000000	2001:1200:0:21f6::3	2001:1234::2	ICMPv6	118	Echo (ping) request id=0x0029, seq=1, hop limit=64 (reply in 2)
2	0.000161492	2001:1234::2	2001:1200:0:21f6::3	ICMPv6	118	Echo (ping) reply id=0x0029, seq=1, hop limit=60 (request in 1)
3	1.012229673	2001:1200:0:21f6::3	2001:1234::2	ICMPv6	118	Echo (ping) request id=0x0029, seq=2, hop limit=64 (reply in 4)
4	1.012325831	2001:1234::2	2001:1200:0:21f6::3	ICMPv6	118	Echo (ping) reply id=0x0029, seq=2, hop limit=60 (request in 3)
5	2.036697568	2001:1200:0:21f6::3	2001:1234::2	ICMPv6	118	Echo (ping) request id=0x0029, seq=3, hop limit=64 (reply in 6)
6	2.036868212	2001:1234::2	2001:1200:0:21f6::3	ICMPv6	118	Echo (ping) reply id=0x0029, seq=3, hop limit=60 (request in 5)
7	3.060159000	2001:1200:0:21f6::3	2001:1234::2	ICMPv6	118	Echo (ping) request id=0x0029, seq=4, hop limit=64 (reply in 8)
8	3.060306775	2001:1234::2	2001:1200:0:21f6::3	ICMPv6	118	Echo (ping) reply id=0x0029, seq=4, hop limit=60 (request in 7)
9	4.084217023	2001:1200:0:21f6::3	2001:1234::2	ICMPv6	118	Echo (ping) request id=0x0029, seq=5, hop limit=64 (reply in 10)
10	4.084329395	2001:1234::2	2001:1200:0:21f6::3	ICMPv6	118	Echo (ping) reply id=0x0029, seq=5, hop limit=60 (request in 9)
11	5.108249442	2001:1200:0:21f6::3	2001:1234::2	ICMPv6	118	Echo (ping) request id=0x0029, seq=6, hop limit=64 (reply in 12)
12	5.108394230	2001:1234::2	2001:1200:0:21f6::3	ICMPv6	118	Echo (ping) reply id=0x0029, seq=6, hop limit=60 (request in 11)
13	5.236905065	fe80::200:ff:feaa:1f	2001:1200:0:21f6::3	ICMPv6	86	Neighbor Solicitation for 2001:1200:0:21f6::3 from 00:00:00:aa:00:1f
14	5.236933170	2001:1200:0:21f6::3	fe80::200:ff:feaa:1f	ICMPv6	78	Neighbor Advertisement 2001:1200:0:21f6::3 (sol)
15	6.004440894	fe80::200:ff:feaa:21	ff02::2	ICMPv6	70	Router Solicitation from 00:00:00:aa:00:21
16	6.132093867	2001:1200:0:21f6::3	2001:1234::2	ICMPv6	118	Echo (ping) request id=0x0029, seq=7, hop limit=64 (reply in 17)
17	6.132189839	2001:1234::2	2001:1200:0:21f6::3	ICMPv6	118	Echo (ping) reply id=0x0029, seq=7, hop limit=60 (request in 16)
18	7.156134760	2001:1200:0:21f6::3	2001:1234::2	ICMPv6	118	Echo (ping) request id=0x0029, seq=8, hop limit=64 (reply in 19)
19	7.156256888	2001:1234::2	2001:1200:0:21f6::3	ICMPv6	118	Echo (ping) reply id=0x0029, seq=8, hop limit=60 (request in 18)
20	8.180109957	2001:1200:0:21f6::3	2001:1234::2	ICMPv6	118	Echo (ping) request id=0x0029, seq=9, hop limit=64 (reply in 21)
21	8.180206749	2001:1234::2	2001:1200:0:21f6::3	ICMPv6	118	Echo (ping) reply id=0x0029, seq=9, hop limit=60 (request in 20)
22	9.205004554	2001:1200:0:21f6::3	2001:1234::2	ICMPv6	118	Echo (ping) request id=0x0029, seq=10, hop limit=64 (reply in 23)
23	9.205143356	2001:1234::2	2001:1200:0:21f6::3	ICMPv6	118	Echo (ping) reply id=0x0029, seq=10, hop limit=60 (request in 22)
24	10.228990190	2001:1200:0:21f6::3	2001:1234::2	ICMPv6	118	Echo (ping) request id=0x0029, seq=11, hop limit=64 (reply in 25)
25	10.229104436	2001:1234::2	2001:1200:0:21f6::3	ICMPv6	118	Echo (ping) reply id=0x0029, seq=11, hop limit=60 (request in 24)
26	10.357194513	fe80::200:ff:feaa:21	fe80::200:ff:feaa:1f	ICMPv6	86	Neighbor Solicitation for fe80::200:ff:feaa:1f from 00:00:00:aa:00:21
27	10.357352807	fe80::200:ff:feaa:1f	fe80::200:ff:feaa:21	ICMPv6	78	Neighbor Advertisement fe80::200:ff:feaa:1f (rtr, sol)
28	11.252572013	2001:1200:0:21f6::3	2001:1234::2	ICMPv6	118	Echo (ping) request id=0x0029, seq=12, hop limit=64 (reply in 29)
29	11.252733208	2001:1234::2	2001:1200:0:21f6::3	ICMPv6	118	Echo (ping) reply id=0x0029, seq=12, hop limit=60 (request in 28)
30	12.276149007	2001:1200:0:21f6::3	2001:1234::2	ICMPv6	118	Echo (ping) request id=0x0029, seq=13, hop limit=64 (reply in 31)
31	12.276254407	2001:1234::2	2001:1200:0:21f6::3	ICMPv6	118	Echo (ping) reply id=0x0029, seq=13, hop limit=60 (request in 30)

Servidor-DNS

Capturing from veth5.0.65

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Apply a display filter ... <Ctrl-F>

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000000	2001:1200:0:21f6::3	2001:1234::2	ICMPv6	118	Echo (ping) request id=0x0027, seq=72, hop limit=62 (reply in 2)
2	0.000061280	2001:1234::2	2001:1200:0:21f6::3	ICMPv6	118	Echo (ping) reply id=0x0027, seq=72, hop limit=62 (request in 1)
3	1.023961298	2001:1200:0:21f6::3	2001:1234::2	ICMPv6	118	Echo (ping) request id=0x0027, seq=73, hop limit=62 (reply in 4)
4	1.024025626	2001:1234::2	2001:1200:0:21f6::3	ICMPv6	118	Echo (ping) reply id=0x0027, seq=73, hop limit=62 (request in 3)
5	2.048719154	2001:1200:0:21f6::3	2001:1234::2	ICMPv6	118	Echo (ping) request id=0x0027, seq=74, hop limit=62 (reply in 6)
6	2.048778605	2001:1234::2	2001:1200:0:21f6::3	ICMPv6	118	Echo (ping) reply id=0x0027, seq=74, hop limit=62 (request in 5)
7	3.072825596	2001:1200:0:21f6::3	2001:1234::2	ICMPv6	118	Echo (ping) request id=0x0027, seq=75, hop limit=62 (reply in 8)
8	3.072896109	2001:1234::2	2001:1200:0:21f6::3	ICMPv6	118	Echo (ping) reply id=0x0027, seq=75, hop limit=62 (request in 7)
9	3.103018832	fe80::200:ff:feaa:12	fe80::200:ff:feaa:11	ICMPv6	86	Neighbor Solicitation for fe80::200:ff:feaa:11 from 00:00:00:aa:00:12
10	3.103050882	fe80::200:ff:feaa:11	fe80::200:ff:feaa:12	ICMPv6	78	Neighbor Advertisement fe80::200:ff:feaa:11 (rtr, sol)
11	4.096018389	2001:1234::2	2001:1200:0:21f6::3	ICMPv6	118	Echo (ping) request id=0x0027, seq=76, hop limit=62 (reply in 12)
12	4.096102743	2001:1234::2	2001:1200:0:21f6::3	ICMPv6	118	Echo (ping) reply id=0x0027, seq=76, hop limit=62 (request in 11)
13	5.120288073	2001:1200:0:21f6::3	2001:1234::2	ICMPv6	118	Echo (ping) request id=0x0027, seq=77, hop limit=62 (reply in 14)
14	5.120349368	2001:1234::2	2001:1200:0:21f6::3	ICMPv6	118	Echo (ping) reply id=0x0027, seq=77, hop limit=62 (request in 13)
15	6.144042620	2001:1200:0:21f6::3	2001:1234::2	ICMPv6	118	Echo (ping) request id=0x0027, seq=78, hop limit=62 (reply in 16)
16	6.144101935	2001:1234::2	2001:1200:0:21f6::3	ICMPv6	118	Echo (ping) reply id=0x0027, seq=78, hop limit=62 (request in 15)
17	7.168121592	2001:1200:0:21f6::3	2001:1234::2	ICMPv6	118	Echo (ping) request id=0x0027, seq=79, hop limit=62 (reply in 18)
18	7.168258183	2001:1234::2	2001:1200:0:21f6::3	ICMPv6	118	Echo (ping) reply id=0x0027, seq=79, hop limit=62 (request in 17)
19	8.192178925	2001:1200:0:21f6::3	2001:1234::2	ICMPv6	118	Echo (ping) request id=0x0027, seq=80, hop limit=62 (reply in 20)
20	8.192341367	2001:1234::2	2001:1200:0:21f6::3	ICMPv6	118	Echo (ping) reply id=0x0027, seq=80, hop limit=62 (request in 19)

Router-2 eth0 (ipv6)

Capturing from veth5.0.65

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

Start capturing packets Ctrl-F

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000000	2001:1200:0:21f6::3	2001:1234::2	ICMPv6	138	Echo (ping) request id=0x0027, seq=45, hop limit=61 (reply in 2)
2	0.000044836	2001:1234::2	2001:1200:0:21f6::3	ICMPv6	138	Echo (ping) reply id=0x0027, seq=45, hop limit=63 (request in 1)
3	1.023976220	2001:1200:0:21f6::3	2001:1234::2	ICMPv6	138	Echo (ping) request id=0x0027, seq=46, hop limit=61 (reply in 4)
4	1.024016328	2001:1234::2	2001:1200:0:21f6::3	ICMPv6	138	Echo (ping) reply id=0x0027, seq=46, hop limit=63 (request in 3)
5	2.047837079	2001:1200:0:21f6::3	2001:1234::2	ICMPv6	138	Echo (ping) request id=0x0027, seq=47, hop limit=61 (reply in 6)
6	2.047885991	2001:1234::2	2001:1200:0:21f6::3	ICMPv6	138	Echo (ping) reply id=0x0027, seq=47, hop limit=63 (request in 5)
7	2.079995893	00:00:00:aa:00:16	00:00:00:aa:00:15	ARP	42	Who has 192.168.0.2? Tell 192.168.0.1
8	2.080005223	00:00:00:aa:00:15	00:00:00:aa:00:16	ARP	42	192.168.0.2 is at 00:00:00:aa:00:15
9	3.072010349	2001:1200:0:21f6::3	2001:1234::2	ICMPv6	138	Echo (ping) request id=0x0027, seq=48, hop limit=61 (reply in 10)
10	3.072060389	2001:1234::2	2001:1200:0:21f6::3	ICMPv6	138	Echo (ping) reply id=0x0027, seq=48, hop limit=63 (request in 9)
11	4.096269705	2001:1200:0:21f6::3	2001:1234::2	ICMPv6	138	Echo (ping) request id=0x0027, seq=49, hop limit=61 (reply in 12)
12	4.096342396	2001:1234::2	2001:1200:0:21f6::3	ICMPv6	138	Echo (ping) reply id=0x0027, seq=49, hop limit=63 (request in 11)
13	5.120997901	2001:1200:0:21f6::3	2001:1234::2	ICMPv6	138	Echo (ping) request id=0x0027, seq=50, hop limit=61 (reply in 14)
14	5.121042131	2001:1234::2	2001:1200:0:21f6::3	ICMPv6	138	Echo (ping) reply id=0x0027, seq=50, hop limit=63 (request in 13)
15	6.143897147	2001:1200:0:21f6::3	2001:1234::2	ICMPv6	138	Echo (ping) request id=0x0027, seq=51, hop limit=61 (reply in 16)
16	6.143970772	2001:1234::2	2001:1200:0:21f6::3	ICMPv6	138	Echo (ping) reply id=0x0027, seq=51, hop limit=63 (request in 15)
17	7.167777767	2001:1200:0:21f6::3	2001:1234::2	ICMPv6	138	Echo (ping) request id=0x0027, seq=52, hop limit=61 (reply in 18)
18	7.167821481	2001:1234::2	2001:1200:0:21f6::3	ICMPv6	138	Echo (ping) reply id=0x0027, seq=52, hop limit=63 (request in 17)
19	8.192426745	2001:1200:0:21f6::3	2001:1234::2	ICMPv6	138	Echo (ping) request id=0x0027, seq=53, hop limit=61 (reply in 20)
20	8.192564904	2001:1234::2	2001:1200:0:21f6::3	ICMPv6	138	Echo (ping) reply id=0x0027, seq=53, hop limit=63 (request in 19)
21	9.215938465	2001:1200:0:21f6::3	2001:1234::2	ICMPv6	138	Echo (ping) request id=0x0027, seq=54, hop limit=61 (reply in 22)
22	9.216002982	2001:1234::2	2001:1200:0:21f6::3	ICMPv6	138	Echo (ping) reply id=0x0027, seq=54, hop limit=63 (request in 21)
23	10.240525030	2001:1200:0:21f6::3	2001:1234::2	ICMPv6	138	Echo (ping) request id=0x0027, seq=55, hop limit=61 (reply in 24)
24	10.240586481	2001:1234::2	2001:1200:0:21f6::3	ICMPv6	138	Echo (ping) reply id=0x0027, seq=55, hop limit=63 (request in 23)
25	11.264475718	2001:1200:0:21f6::3	2001:1234::2	ICMPv6	138	Echo (ping) request id=0x0027, seq=56, hop limit=61 (reply in 26)
26	11.264518805	2001:1234::2	2001:1200:0:21f6::3	ICMPv6	138	Echo (ping) reply id=0x0027, seq=56, hop limit=63 (request in 25)
27	12.288271475	2001:1200:0:21f6::3	2001:1234::2	ICMPv6	138	Echo (ping) request id=0x0027, seq=57, hop limit=61 (reply in 28)
28	12.288316288	2001:1234::2	2001:1200:0:21f6::3	ICMPv6	138	Echo (ping) reply id=0x0027, seq=57, hop limit=63 (request in 27)

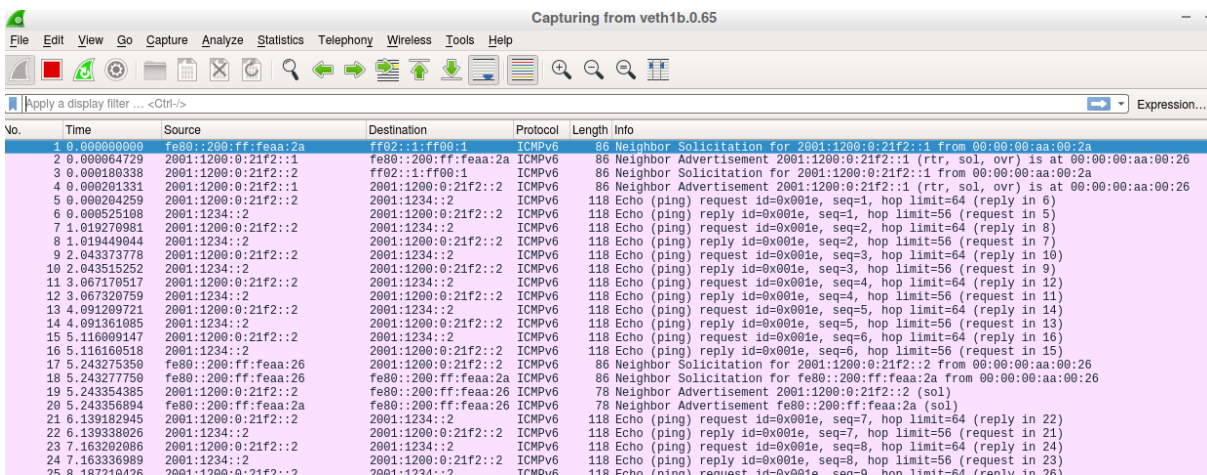
Router-2 eth2 (ipv4)

Por el lado de las capturas de Wireshark de PC-Casa y Servidor-DNS podemos ver que el ping es efectivo en términos de ipv6.

Mientras que por el lado de las capturas de Wireshark de Router-2 eth0 (ipv6) nos muestra que los paquetes son efectivamente tratados como ipv6. Pero en las capturas Router-2 eth2 (ipv4) podemos ver que los paquetes son tratados como ipv4, además de aparecer el protocolo ARP.

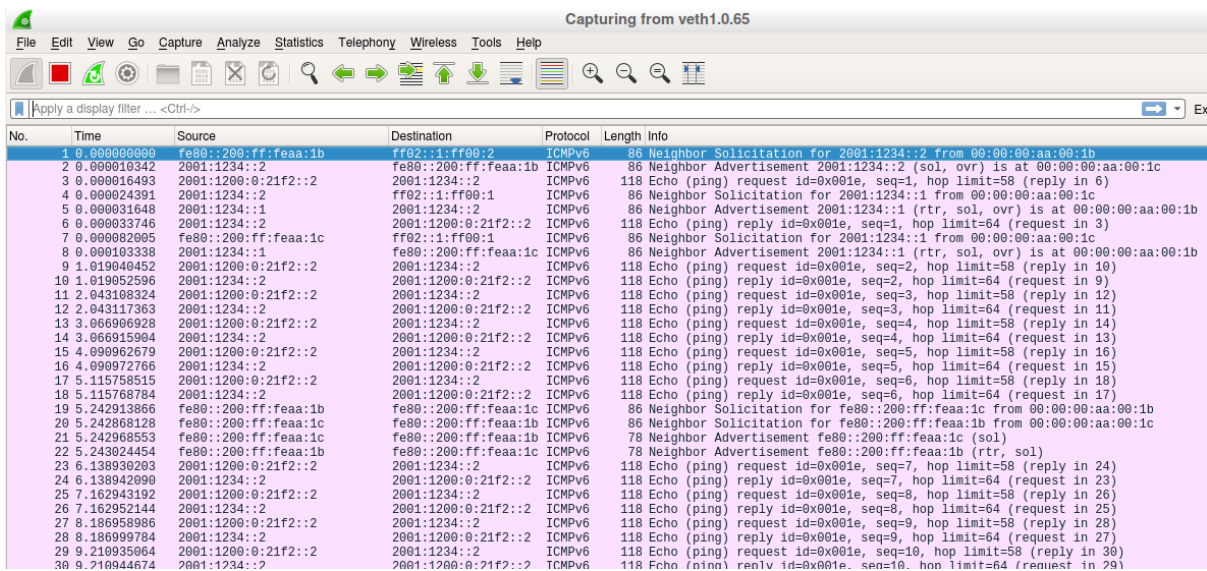
Conectividad entre PC-VT-1 y PC-Casa:

- Ping6:



No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000000	fe80::200:ff:feaa:2a	ff02::1:ff00:1	ICMPv6	86	Neighbor Solicitation for 2001:1200:0:21f2::1 from 00:00:00:aa:00:2a
2	0.000064729	2001:1200:0:21f2::1	fe80::200:ff:feaa:2a	ICMPv6	86	Neighbor Advertisement 2001:1200:0:21f2::1 (rtr, sol, ovr) is at 00:00:00:aa:00:2a
3	0.000180338	2001:1200:0:21f2::2	ff02::1:ff00:1	ICMPv6	86	Neighbor Solicitation for 2001:1200:0:21f2::1 from 00:00:00:aa:00:2a
4	0.000201331	2001:1200:0:21f2::1	2001:1200:0:21f2::2	ICMPv6	86	Neighbor Advertisement 2001:1200:0:21f2::1 (rtr, sol, ovr) is at 00:00:00:aa:00:2a
5	0.000204259	2001:1200:0:21f2::2	2001:1234::2	ICMPv6	118	Echo (ping) request id=0x001e, seq=1, hop limit=64 (reply in 6)
6	0.000525198	2001:1234::2	2001:1200:0:21f2::2	ICMPv6	118	Echo (ping) reply id=0x001e, seq=1, hop limit=64 (request in 5)
7	1.019270981	2001:1200:0:21f2::2	2001:1234::2	ICMPv6	118	Echo (ping) request id=0x001e, seq=2, hop limit=64 (reply in 8)
8	1.019449044	2001:1234::2	2001:1200:0:21f2::2	ICMPv6	118	Echo (ping) reply id=0x001e, seq=2, hop limit=56 (request in 7)
9	2.043373778	2001:1200:0:21f2::2	2001:1234::2	ICMPv6	118	Echo (ping) request id=0x001e, seq=3, hop limit=64 (reply in 10)
10	2.043515252	2001:1234::2	2001:1200:0:21f2::2	ICMPv6	118	Echo (ping) reply id=0x001e, seq=3, hop limit=56 (request in 9)
11	3.067170517	2001:1200:0:21f2::2	2001:1234::2	ICMPv6	118	Echo (ping) request id=0x001e, seq=4, hop limit=64 (reply in 12)
12	3.067320759	2001:1234::2	2001:1200:0:21f2::2	ICMPv6	118	Echo (ping) reply id=0x001e, seq=4, hop limit=56 (request in 11)
13	4.091209721	2001:1200:0:21f2::2	2001:1234::2	ICMPv6	118	Echo (ping) request id=0x001e, seq=5, hop limit=64 (reply in 14)
14	4.091361085	2001:1234::2	2001:1200:0:21f2::2	ICMPv6	118	Echo (ping) reply id=0x001e, seq=5, hop limit=56 (request in 13)
15	5.116090147	2001:1200:0:21f2::2	2001:1234::2	ICMPv6	118	Echo (ping) request id=0x001e, seq=6, hop limit=64 (reply in 16)
16	5.116160518	2001:1234::2	2001:1200:0:21f2::2	ICMPv6	118	Echo (ping) reply id=0x001e, seq=6, hop limit=56 (request in 15)
17	5.243275350	fe80::200:ff:feaa:2a	2001:1200:0:21f2::2	ICMPv6	86	Neighbor Solicitation for 2001:1200:0:21f2::2 from 00:00:00:aa:00:2a
18	5.243277750	fe80::200:ff:feaa:2a	fe80::200:ff:feaa:2a	ICMPv6	86	Neighbor Solicitation for fe80::200:ff:feaa:2a from 00:00:00:aa:00:2a
19	5.243354385	2001:1200:0:21f2::2	fe80::200:ff:feaa:2a	ICMPv6	78	Neighbor Advertisement 2001:1200:0:21f2::2 (sol)
20	5.243356894	fe80::200:ff:feaa:2a	fe80::200:ff:feaa:2a	ICMPv6	78	Neighbor Advertisement fe80::200:ff:feaa:2a (sol)
21	6.109182045	2001:1200:0:21f2::2	2001:1234::2	ICMPv6	118	Echo (ping) request id=0x001e, seq=7, hop limit=64 (reply in 22)
22	6.109338026	2001:1234::2	2001:1200:0:21f2::2	ICMPv6	118	Echo (ping) reply id=0x001e, seq=7, hop limit=56 (request in 21)
23	7.163202086	2001:1200:0:21f2::2	2001:1234::2	ICMPv6	118	Echo (ping) request id=0x001e, seq=8, hop limit=64 (reply in 24)
24	7.163336989	2001:1234::2	2001:1200:0:21f2::2	ICMPv6	118	Echo (ping) reply id=0x001e, seq=8, hop limit=56 (request in 23)
25	8.187210426	2001:1200:0:21f2::2	2001:1234::2	ICMPv6	118	Echo (ping) request id=0x001e, seq=9, hop limit=64 (reply in 26)

Wireshark PC-VT-1



No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000000	fe80::200:ff:feaa:1b	ff02::1:ff00:2	ICMPv6	86	Neighbor Solicitation for 2001:1234::2 from 00:00:00:aa:00:1b
2	0.000010342	2001:1234::2	fe80::200:ff:feaa:1b	ICMPv6	86	Neighbor Advertisement 2001:1234::2 (sol, ovr) is at 00:00:00:aa:00:1b
3	0.000016493	2001:1200:0:21f2::2	2001:1234::2	ICMPv6	118	Echo (ping) request id=0x001e, seq=1, hop limit=58 (reply in 6)
4	0.000024391	2001:1234::2	ff02::1:ff00:1	ICMPv6	86	Neighbor Solicitation for 2001:1234::1 from 00:00:00:aa:00:1c
5	0.000031648	2001:1234::1	2001:1234::2	ICMPv6	86	Neighbor Advertisement 2001:1234::1 (rtr, sol, ovr) is at 00:00:00:aa:00:1b
6	0.000033746	2001:1234::2	2001:1200:0:21f2::2	ICMPv6	118	Echo (ping) request id=0x001e, seq=1, hop limit=64 (request in 3)
7	0.000082005	fe80::200:ff:feaa:1c	ff02::1:ff00:1	ICMPv6	86	Neighbor Solicitation for 2001:1234::1 from 00:00:00:aa:00:1c
8	0.000103338	2001:1234::1	fe80::200:ff:feaa:1c	ICMPv6	86	Neighbor Advertisement 2001:1234::1 (rtr, sol, ovr) is at 00:00:00:aa:00:1b
9	1.019040452	2001:1200:0:21f2::2	2001:1234::2	ICMPv6	118	Echo (ping) request id=0x001e, seq=2, hop limit=58 (reply in 10)
10	1.019052596	2001:1234::2	2001:1200:0:21f2::2	ICMPv6	118	Echo (ping) reply id=0x001e, seq=2, hop limit=64 (request in 9)
11	2.043108342	2001:1200:0:21f2::2	2001:1234::2	ICMPv6	118	Echo (ping) request id=0x001e, seq=3, hop limit=58 (reply in 12)
12	2.043117363	2001:1234::2	2001:1200:0:21f2::2	ICMPv6	118	Echo (ping) reply id=0x001e, seq=3, hop limit=64 (request in 11)
13	3.066906928	2001:1200:0:21f2::2	2001:1234::2	ICMPv6	118	Echo (ping) request id=0x001e, seq=4, hop limit=58 (reply in 14)
14	3.066915904	2001:1234::2	2001:1200:0:21f2::2	ICMPv6	118	Echo (ping) reply id=0x001e, seq=4, hop limit=64 (request in 13)
15	4.090962679	2001:1200:0:21f2::2	2001:1234::2	ICMPv6	118	Echo (ping) request id=0x001e, seq=5, hop limit=58 (reply in 16)
16	4.090972766	2001:1234::2	2001:1200:0:21f2::2	ICMPv6	118	Echo (ping) reply id=0x001e, seq=5, hop limit=64 (request in 15)
17	5.115758515	2001:1200:0:21f2::2	2001:1234::2	ICMPv6	118	Echo (ping) request id=0x001e, seq=6, hop limit=58 (reply in 18)
18	5.115768784	2001:1234::2	2001:1200:0:21f2::2	ICMPv6	118	Echo (ping) reply id=0x001e, seq=6, hop limit=64 (request in 17)
19	5.242913866	fe80::200:ff:feaa:1b	fe80::200:ff:feaa:1c	ICMPv6	86	Neighbor Solicitation for fe80::200:ff:feaa:1c from 00:00:00:aa:00:1b
20	5.242868128	fe80::200:ff:feaa:1c	fe80::200:ff:feaa:1b	ICMPv6	86	Neighbor Solicitation for fe80::200:ff:feaa:1b from 00:00:00:aa:00:1c
21	5.242968553	fe80::200:ff:feaa:1c	fe80::200:ff:feaa:1b	ICMPv6	78	Neighbor Advertisement fe80::200:ff:feaa:1c (sol)
22	5.243024454	fe80::200:ff:feaa:1b	fe80::200:ff:feaa:1c	ICMPv6	78	Neighbor Advertisement fe80::200:ff:feaa:1b (sol)
23	6.138930203	2001:1200:0:21f2::2	2001:1234::2	ICMPv6	118	Echo (ping) request id=0x001e, seq=7, hop limit=58 (reply in 24)
24	6.138940990	2001:1234::2	2001:1200:0:21f2::2	ICMPv6	118	Echo (ping) reply id=0x001e, seq=7, hop limit=64 (request in 23)
25	7.162943192	2001:1200:0:21f2::2	2001:1234::2	ICMPv6	118	Echo (ping) request id=0x001e, seq=8, hop limit=58 (reply in 26)
26	7.162952144	2001:1234::2	2001:1200:0:21f2::2	ICMPv6	118	Echo (ping) reply id=0x001e, seq=8, hop limit=64 (request in 25)
27	8.186956086	2001:1200:0:21f2::2	2001:1234::2	ICMPv6	118	Echo (ping) request id=0x001e, seq=9, hop limit=58 (reply in 28)
28	8.186999784	2001:1234::2	2001:1200:0:21f2::2	ICMPv6	118	Echo (ping) reply id=0x001e, seq=9, hop limit=64 (request in 27)
29	9.210935064	2001:1200:0:21f2::2	2001:1234::2	ICMPv6	118	Echo (ping) request id=0x001e, seq=10, hop limit=58 (reply in 30)
30	9.210944674	2001:1234::2	2001:1200:0:21f2::2	ICMPv6	118	Echo (ping) reply id=0x001e, seq=10, hop limit=64 (request in 29)

Wireshark PC-Casa

1	0.000000000	2001:1200:0:21f2::2	2001:1234::2	ICMPv6	138	Echo (ping) request id=0x001f, seq=7, hop limit=60 (reply in 2)
2	0.000058265	2001:1234::2	2001:1200:0:21f2::2	ICMPv6	118	Echo (ping) reply id=0x001f, seq=7, hop limit=62 (request in 1)
3	1.024269474	2001:1200:0:21f2::2	2001:1234::2	ICMPv6	118	Echo (ping) request id=0x001f, seq=8, hop limit=60 (reply in 4)
4	1.024349786	2001:1234::2	2001:1200:0:21f2::2	ICMPv6	118	Echo (ping) reply id=0x001f, seq=8, hop limit=62 (request in 3)
5	2.048843322	2001:1200:0:21f2::2	2001:1234::2	ICMPv6	118	Echo (ping) request id=0x001f, seq=9, hop limit=60 (reply in 6)
6	2.048900563	2001:1234::2	2001:1200:0:21f2::2	ICMPv6	118	Echo (ping) reply id=0x001f, seq=9, hop limit=62 (request in 5)
7	3.071930588	2001:1200:0:21f2::2	2001:1234::2	ICMPv6	118	Echo (ping) request id=0x001f, seq=10, hop limit=60 (reply in 8)
8	3.071997710	2001:1234::2	2001:1200:0:21f2::2	ICMPv6	118	Echo (ping) reply id=0x001f, seq=10, hop limit=62 (request in 7)
9	4.096301382	2001:1200:0:21f2::2	2001:1234::2	ICMPv6	118	Echo (ping) request id=0x001f, seq=11, hop limit=60 (reply in 10)
10	4.096358727	2001:1234::2	2001:1200:0:21f2::2	ICMPv6	118	Echo (ping) reply id=0x001f, seq=11, hop limit=62 (request in 9)
11	5.120103493	2001:1200:0:21f2::2	2001:1234::2	ICMPv6	118	Echo (ping) request id=0x001f, seq=12, hop limit=60 (reply in 12)
12	5.120161066	2001:1234::2	2001:1200:0:21f2::2	ICMPv6	118	Echo (ping) reply id=0x001f, seq=12, hop limit=62 (request in 11)
13	6.144584999	2001:1200:0:21f2::2	2001:1234::2	ICMPv6	118	Echo (ping) request id=0x001f, seq=13, hop limit=60 (reply in 14)
14	6.144645913	2001:1234::2	2001:1200:0:21f2::2	ICMPv6	118	Echo (ping) reply id=0x001f, seq=13, hop limit=62 (request in 13)
15	7.168571712	2001:1200:0:21f2::2	2001:1234::2	ICMPv6	118	Echo (ping) request id=0x001f, seq=14, hop limit=60 (reply in 16)
16	7.168641059	2001:1234::2	2001:1200:0:21f2::2	ICMPv6	118	Echo (ping) reply id=0x001f, seq=14, hop limit=62 (request in 15)
17	8.191912261	2001:1200:0:21f2::2	2001:1234::2	ICMPv6	118	Echo (ping) request id=0x001f, seq=15, hop limit=60 (reply in 18)
18	8.191976350	2001:1234::2	2001:1200:0:21f2::2	ICMPv6	118	Echo (ping) reply id=0x001f, seq=15, hop limit=62 (request in 17)
19	9.216218041	2001:1200:0:21f2::2	2001:1234::2	ICMPv6	118	Echo (ping) request id=0x001f, seq=16, hop limit=60 (reply in 20)
20	9.216280470	2001:1234::2	2001:1200:0:21f2::2	ICMPv6	118	Echo (ping) reply id=0x001f, seq=16, hop limit=62 (request in 19)
21	10.241001561	2001:1200:0:21f2::2	2001:1234::2	ICMPv6	118	Echo (ping) request id=0x001f, seq=17, hop limit=60 (reply in 22)
22	10.241077000	2001:1234::2	2001:1200:0:21f2::2	ICMPv6	118	Echo (ping) reply id=0x001f, seq=17, hop limit=62 (request in 21)

Router-2 eth0 (ipv6)

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000000	2001:1200:0:21f2::2	2001:1234::2	ICMPv6	138	Echo (ping) request id=0x001e, seq=1, hop limit=59 (reply in 2)
2	0.000069393	2001:1234::2	2001:1200:0:21f2::2	ICMPv6	138	Echo (ping) reply id=0x001e, seq=1, hop limit=63 (request in 1)
3	1.013328592	2001:1200:0:21f2::2	2001:1234::2	ICMPv6	138	Echo (ping) request id=0x001e, seq=2, hop limit=59 (reply in 4)
4	1.013379995	2001:1234::2	2001:1200:0:21f2::2	ICMPv6	138	Echo (ping) reply id=0x001e, seq=2, hop limit=63 (request in 3)
5	2.037691392	2001:1200:0:21f2::2	2001:1234::2	ICMPv6	138	Echo (ping) request id=0x001e, seq=3, hop limit=59 (reply in 6)
6	2.037745193	2001:1234::2	2001:1200:0:21f2::2	ICMPv6	138	Echo (ping) reply id=0x001e, seq=3, hop limit=63 (request in 5)
7	3.061946112	2001:1200:0:21f2::2	2001:1234::2	ICMPv6	138	Echo (ping) request id=0x001e, seq=4, hop limit=59 (reply in 8)
8	3.061991283	2001:1234::2	2001:1200:0:21f2::2	ICMPv6	138	Echo (ping) reply id=0x001e, seq=4, hop limit=63 (request in 7)
9	4.085629621	2001:1200:0:21f2::2	2001:1234::2	ICMPv6	138	Echo (ping) request id=0x001e, seq=5, hop limit=59 (reply in 10)
10	4.085677874	2001:1234::2	2001:1200:0:21f2::2	ICMPv6	138	Echo (ping) reply id=0x001e, seq=5, hop limit=63 (request in 9)
11	5.077317482	00:00:00:aa:00:16	00:00:00:aa:00:15	ARP	42	Who has 192.168.0.2? Tell 192.168.0.1
12	5.077378007	00:00:00:aa:00:15	00:00:00:aa:00:16	ARP	42	192.168.0.2 is at 00:00:00:aa:00:15
13	5.109162603	2001:1200:0:21f2::2	2001:1234::2	ICMPv6	138	Echo (ping) request id=0x001e, seq=6, hop limit=59 (reply in 14)
14	5.109206750	2001:1234::2	2001:1200:0:21f2::2	ICMPv6	138	Echo (ping) reply id=0x001e, seq=6, hop limit=63 (request in 13)
15	6.133483528	2001:1200:0:21f2::2	2001:1234::2	ICMPv6	138	Echo (ping) request id=0x001e, seq=7, hop limit=59 (reply in 16)
16	6.133542963	2001:1234::2	2001:1200:0:21f2::2	ICMPv6	138	Echo (ping) reply id=0x001e, seq=7, hop limit=63 (request in 15)
17	7.157176859	2001:1200:0:21f2::2	2001:1234::2	ICMPv6	138	Echo (ping) request id=0x001e, seq=8, hop limit=59 (reply in 18)
18	7.157218883	2001:1234::2	2001:1200:0:21f2::2	ICMPv6	138	Echo (ping) reply id=0x001e, seq=8, hop limit=63 (request in 17)
19	8.181627926	2001:1200:0:21f2::2	2001:1234::2	ICMPv6	138	Echo (ping) request id=0x001e, seq=9, hop limit=59 (reply in 20)
20	8.181704860	2001:1234::2	2001:1200:0:21f2::2	ICMPv6	138	Echo (ping) reply id=0x001e, seq=9, hop limit=63 (request in 19)
21	9.205216243	2001:1200:0:21f2::2	2001:1234::2	ICMPv6	138	Echo (ping) request id=0x001e, seq=10, hop limit=59 (reply in 22)
22	9.205279433	2001:1234::2	2001:1200:0:21f2::2	ICMPv6	138	Echo (ping) reply id=0x001e, seq=10, hop limit=63 (request in 21)

Router-2 eth2 (ipv4)

La descripción de los paquetes es igual a la descripción de conectividad entre PC-Casa y Servidor-DNS.

Ejercicio 11.

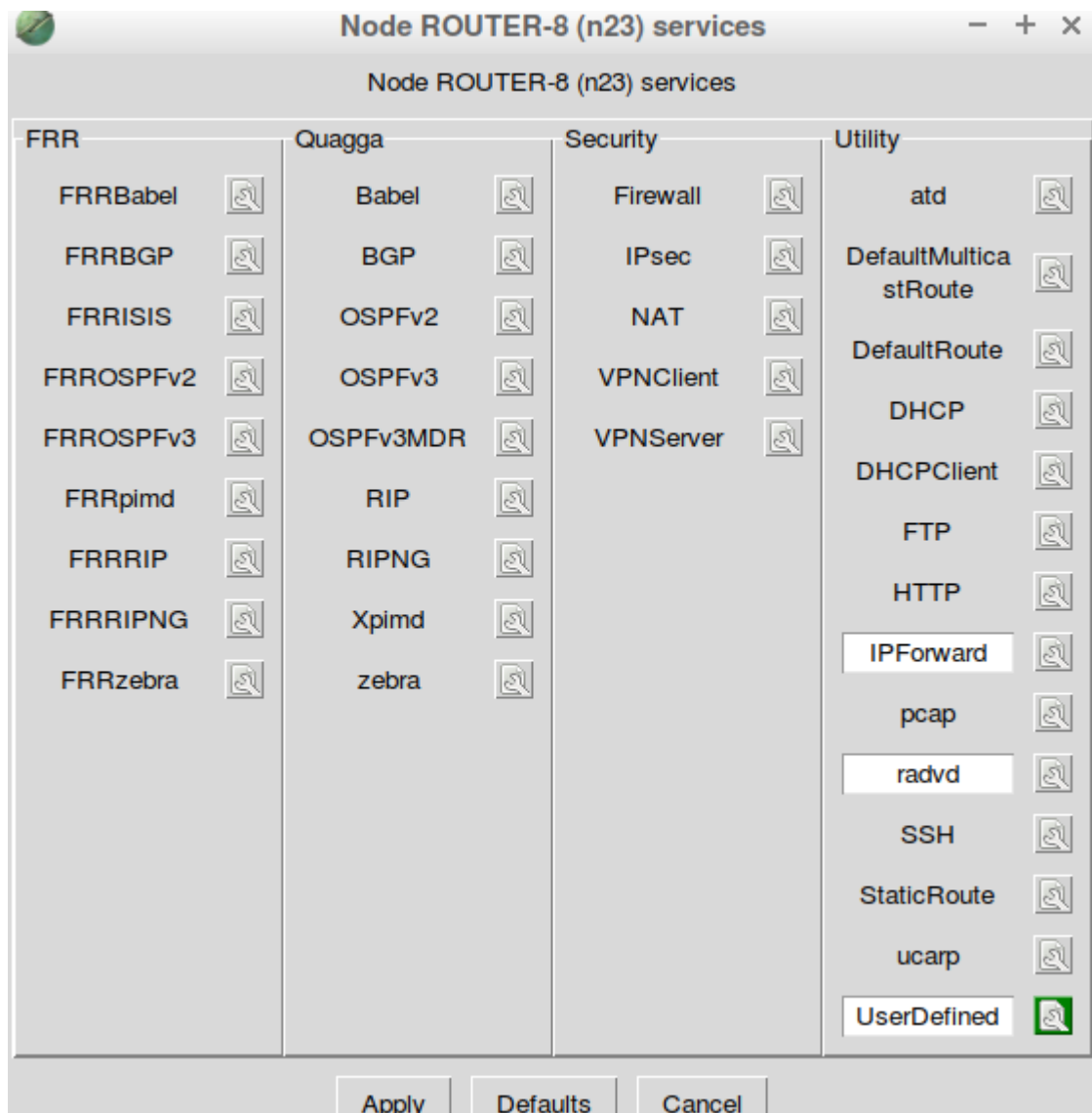
Configure los routers para que anuncien prefijos y de esta manera evitar configurar manualmente los equipos (RADVD). Tenga en cuenta las direcciones de los equipos que deben tener direcciones fijas. (implementar en un archivo .imn separado al resto).

Para evitar la configuración manual de los host en las redes, existe el servicio de RADVD. El procedimiento para activarlo es el siguiente:

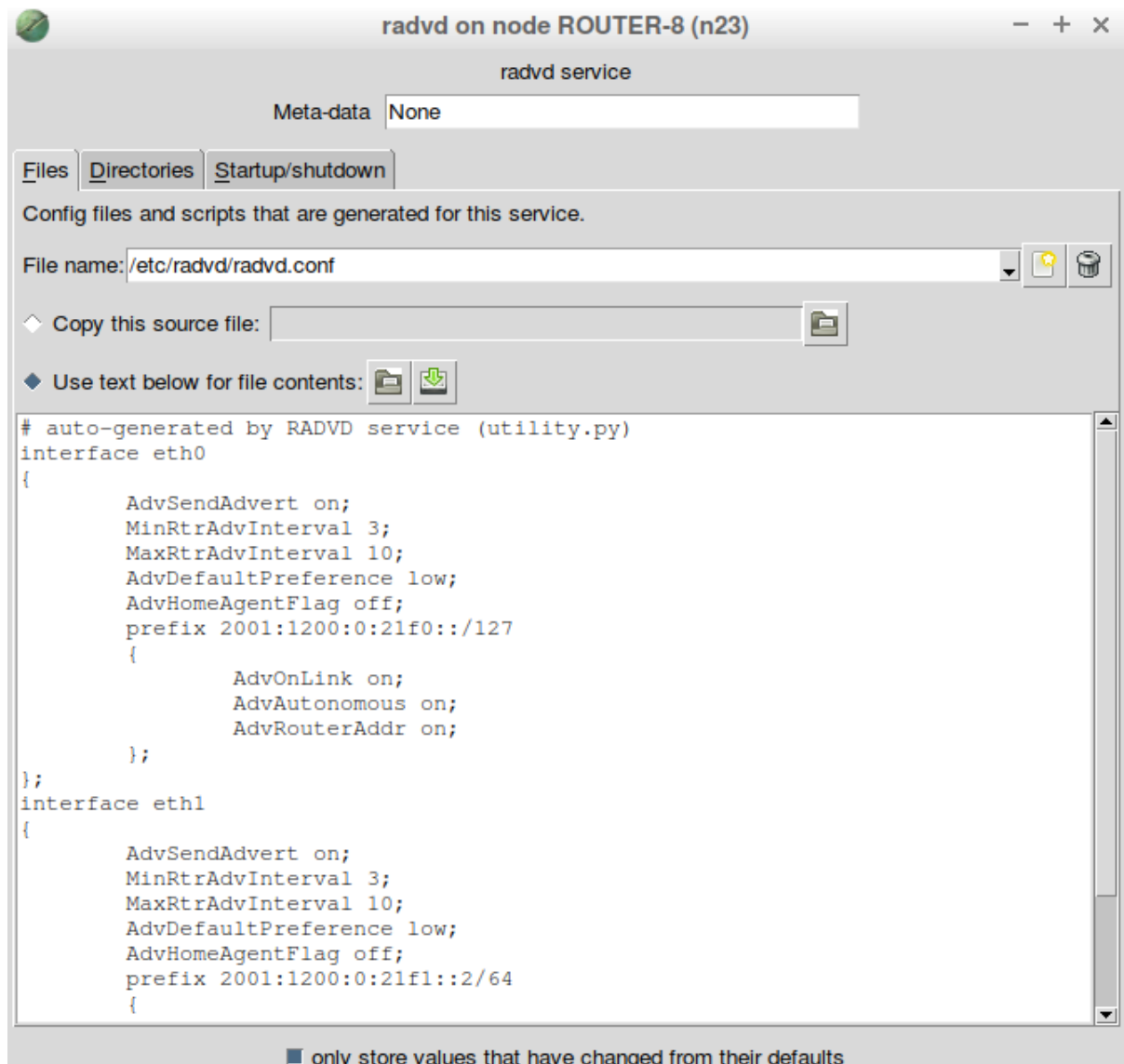
En primer lugar este servicio debe ser instalado (sudo apt install radvd), luego se deben borrar las direcciones que tienen los hosts de las diversas redes a aplicarlo. Después a cada router administrador de la red se le activa en la pestaña de servicios la opción “radvd”. Si entramos en esa opción se mostrará cómo radvd asigna las ips por interfaz.

Para comprobarlo basta con iniciar la simulación, y dentro de un equipo host de la red a la que se aplicó RADVD se le pone el comando “ip -6 addr show” para ver su ip asignada.

Se adjuntó un .imn con la implementación.



Captura de muestra de servicios de Router-8 con RADVD activado.



Captura del código generado por RADVD.

