Trabajo práctico especial

Comunicación de datos II

Grupo 58

Integrantes del grupo

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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 items. 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[1] (servidorweb.abc.com).
- El SERVIDOR-DNS debe tener una dirección global que permita que sea accedido desde afuera da 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.

[1] El DNS es a fines del enunciado, elija una dirección global para dicho servidor

- 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 afuera de la intranet.
- Todas las interfaces de INTERNET sólo tienen tienen direcciones IPv4. El resto de las interfaces sólo tienen direcciones IPv6.

Topología y configuración

A continuación se muestra la configuración del servicio “user defined” de las distintas máquinas que pertenecen a la topología dada. Para esto se utilizaron los comandos ip route 2

Routers:

- Router-5:
  - 'ip -6 addr add 2001:1200:0:21f0::6/127 dev eth0'
  - 'ip -6 addr add 2001:1200:0:21f0::5/127 dev eth1'
  - 'ip -6 addr add 2001:1200:0:21f0::a/127 dev eth2'
  - 'ip -6 addr add 2001:1200:0:21f4::/64 dev eth3'
  - 'ip -6 route add 2001:1200:0:21f2::/64 via 2001:1200:0:21f0::4 dev eth1'
  - 'ip -6 route add 2001:1200:0:21f3::/64 via 2001:1200:0:21f0::4 dev eth1'
  - 'ip -6 route add default via 2001:1200:0:21f0::7 dev eth0'
  - 'ip -6 rule add from 2001:1200:0:21f4::/64 table 10'
  - 'ip -6 route add default via 2001:1200:0:21f0::b dev eth2 table 10'
  - 'ip -6 route add prohibit 2001:1200:0:21f3::/64 table 10'
  - 'ip -6 route add prohibit 2001:1200:0:21f2::/64 table 10'
  - 'ip -6 route add 2001:1200:0:21f0::/128 via 2001:1200:0:21f0::4 dev eth1'
  - 'ip -6 route add 2001:1200:0:21f0::1/128 via 2001:1200:0:21f0::4 dev eth1'
  - 'ip -6 route add 2001:1200:0:21f0::2/128 via 2001:1200:0:21f0::4 dev eth1'
  - 'ip -6 route add 2001:1200:0:21f0::3/128 via 2001:1200:0:21f0::4 dev eth1'
  - 'ip -6 route add fd00:0:0:21f2::/64 via 2001:1200:0:21f0::4 dev eth1'

    - 'ip -6 route add fd00:0:0:21f3::/64 via 2001:1200:0:21f0::4 dev eth1'
- Router-3:
    - 'ip -6 addr add 2001:1200:0:21f0::d/127 dev eth0'
    - 'ip -6 addr add 2001:1200:0:21f0::f/127 dev eth1'
    - 'ip -6 addr add 2001:1200:0:21f0::13/127 dev eth2'
    - 'ip -6 route add default via 2001:1200:0:21f0::c dev eth0'
    - 'ip -6 rule add from 2001:1200:0:21f4::/64 table 10'
    - 'ip -6 route add default via 2001:1200:0:21f0::12 dev eth2 table 10'
    - 'ip -6 route add default via 2001:1200:0:21f0::12 dev eth2 table 15'
    - 'ip6tables -A PREROUTING -t mangle -p tcp -j MARK --set-mark 10'
    - 'ip -6 rule add to 2001:2::/64 fwmark 10 table 15 priority 6'
- Router-4:
    - 'ip -6 addr add 2001:1200:0:21f0::e/127 dev eth0'
    - 'ip -6 addr add 2001:1200:0:21f0::7/127 dev eth1'
    - 'ip -6 addr add 2001:1200:0:21f0::8/127 dev eth2'
    - 'ip -6 addr add 2001:1200:0:21f0::10/127 dev eth3'
    - 'ip -6 route add 2001:1200:0:21f1::/64 via 2001:1200:0:21f0::9 dev eth2'
    - 'ip -6 route add default via 2001:1200:0:21f0::11 dev eth3'
    - 'ip -6 route add default via 2001:1200:0:21f0::f dev eth30 table 15'
    - 'ip6tables -A PREROUTING -t mangle -p tcp -j MARK --set-mark 10'
    - 'ip -6 rule add to 2001:2::/64 fwmark 10 table 15 priority 6'
    - 'ip -6 route add fd00:0:0:21f1::/64 via 2001:1200:0:21f0::9 dev eth2'
- Router-1:
    - 'ip -6 addr add 2001:1200:0:21f1::/64 dev eth1'
    - 'ip -6 addr add fd00:0:0:21f1::/64 dev eth1'
    - 'ip -6 route add default via 2001:1200:0:21f0::8 dev eth0'
    - 'ip -6 rule add from 2001:1200:0:21f4::/64 table 10'
    - 'ip -6 route add prohibit 2001:1200:0:21f1::3/128 table 10'
    - 'ip -6 rule add from 2001:1200:0:21f1::3/128 to 2001:1200:0:21f4::/64 table 20'
    - 'ip -6 route add prohibit 2001:1200:0:21f4::/64 table 20'
- Router-6:
    - 'ip -6 addr add 2001:1200:0:21f0::1/127 dev eth2'
    - 'ip -6 addr add 2001:1200:0:21f0::3/127 dev eth1'
    - 'ip -6 addr add 2001:1200:0:21f0::4/127 dev eth0'
    - 'ip -6 route add default via 2001:1200:0:21f0::5 dev eth0'
    - 'ip -6 route add 2001:1200:0:21f2::/64 via 2001:1200:0:21f0::2 dev eth1'
    - 'ip -6 route add 2001:1200:0:21f3::/64 via 2001:1200:0:21f0:: dev eth2'
    - 'ip -6 route add fd00:0:0:21f2::/64 via 2001:1200:0:21f0::2 dev eth1'
    - 'ip -6 route add fd00:0:0:21f3::/64 via 2001:1200:0:21f0:: dev eth2'
- Router-7:
    - 'ip -6 addr add 2001:1200:0:21f2::/64 dev eth1'
    - 'ip -6 addr add fd00:0:0:21f2::/64 dev eth1'
    - 'ip -6 route add default via 2001:1200:0:21f0::3 dev eth0'
    - 'ip -6 addr add 2001:1200:0:21f0::2/127 dev eth0'
    - 'ip -6 rule add from 2001:1200:0:21f4::/64 table 10'
    - 'ip -6 route add default via 2001:1200:0:21f0::3 dev eth0 table 10'
    - 'ip -6 route add prohibit 2001:1200:0:21f2::/64 table 10'

    - 'ip -6 rule add from 2001:1200:0:21f2::/64 to 2001:1200:0:21f4::/64 table 20'
    - 'ip -6 route add prohibit 2001:1200:0:21f4::/64 table 20'
- Router-8:
    - 'ip -6 addr add 2001:1200:0:21f3::/64 dev eth1'
    - 'ip -6 route add default via 2001:1200:0:21f0::1 dev eth0'
    - 'ip -6 addr add 2001:1200:0:21f0::/127 dev eth0'
    - 'ip -6 rule add from 2001:1200:0:21f4::/64 table 10'
    - 'ip -6 route add default via 2001:1200:0:21f0::1 dev eth0 table 10'
    - 'ip -6 route add prohibit 2001:1200:0:21f3::/64 table 10'
    - 'ip -6 rule add from 2001:1200:0:21f3::/64 to 2001:1200:0:21f4::/64 table 20'
    - 'ip -6 route add prohibit 2001:1200:0:21f4::/64 table 20'
    - 'ip -6 addr add fd00:0:0:21f3::/64 dev eth1'
- Router-9:
    - 'ip -6 addr add 2001:1200:0:21f0::c/127 dev eth0'
    - 'ip -6 addr add 2001:1200:0:21f0::b/127 dev eth1'
    - 'ip -6 addr add 2001:1200:0:21f6::/64 dev eth3'
    - 'ip -6 addr add 2001:1200:0:21f7::/64 dev eth2'
    - 'ip -6 route add default via 2001:1200:0:21f0::d dev eth0 table 10'
    - 'ip -6 route add default via 2001:1200:0:21f0::a dev eth1'
    - 'ip -6 route add prohibit 2001:1200:0:21f6::/64 table 10'
    - 'ip -6 route add prohibit 2001:1200:0:21f7::/64 table 10'
    - 'ip -6 rule add from 2001:1200:0:21f4::/64 table 10'
    - 'ip -6 rule add from 2001:1200:0:21f6::/64 to 2001:1200:0:21f4::/64 table 20'
    - 'ip -6 rule add from 2001:1200:0:21f7::/64 to 2001:1200:0:21f4::/64 table 20'
    - 'ip -6 route add prohibit 2001:1200:0:21f4::/64 table 20'
    - 'ip -6 addr add fd00:0:0:21f6::/64 dev eth3'
    - 'ip -6 addr add fd00:0:0:21f7::/64 dev eth2'
- Router-2:
    - 'ip addr add 10.0.9.1/24 dev eth2'
    - 'ip route add default via 10.0.9.2 dev eth2'
    - 'ip -6 addr add 2001:1200:0:21f0::11/127 dev eth0'
    - 'ip -6 addr add 2001:1200:0:21f0::12/127 dev eth1'
    - 'ip tunnel add tunnel0 mode sit remote 10.0.11.2 local 10.0.9.1'
    - 'ip addr add 2001:1200:0:21f0::11/127 dev tunnel0'
    - 'ip link set tunnel0 up'
    - 'ip -6 route add 2001:1::/64 dev tunnel0'
    - 'ip -6 route add 2001:2::/64 dev tunnel0'
    - 'ip -6 route add default via 2001:1200:0:21f0::13 dev eth1'
    - 'ip -6 rule add from 2001:1200:0:21f4::/64 table 10'
    - 'ip -6 route add default via 2001:1200:0:21f0::10 dev eth0 table 10'
    - 'ip -6 route add 2001:2::/64 dev tunnel0 table 10'
- R-Intermedio:
    - 'ip -6 addr add 2001:1::2/64 dev eth0'
    - 'ip -6 addr add 2001:2::1/64 dev eth1'
    - 'ip -6 route add default via 2001:1::1 dev eth0'
    - 'ip -6 route add prohibit 2001:2::20/128 table 10'
    - 'ip -6 rule add from 2001:1200:0:21f4::1/128 table 10'

    - 'ip -6 rule add from 2001:2::/64 to 2001:1200:0:21f4::/64 table 20'
    - 'ip -6 route add prohibit 2001:1200:0:21f4::/64 table 20'

Ventas:

- PC-VT-2:
    - 'ip -6 addr add 2001:1200:0:21f3::1/64 dev eth0'
    - 'ip -6 addr add fd00:0:0:21f3::1/64 dev eth0'
- SERVIDOR-VENTAS:
    - 'ip -6 addr add fd00:0:0:21f2::1/64 dev eth0'
    - 'ip -6 addr add 2001:1200:0:21f2::1/64 dev eth0'
- PC-VT-1:
    - 'ip -6 addr add fd00:0:0:21f2::2/64 dev eth0'
    - 'ip -6 addr add 2001:1200:0:21f2::2/64 dev eth0'

Data Center:

- PC-DC-1:
    - 'ip -6 addr add fd00:0:0:21f1::3/64 dev eth0'
    - 'ip -6 addr add 2001:1200:0:21f1::3/64 dev eth0'
- SERVIDOR-DNS:
    - 'ip -6 addr add 2001:1200:0:21f1::2/64 dev eth0'
    - 'ip -6 addr add fd00:0:0:21f1::2/64 dev eth0'
- SERVIDOR-WEB:
    - 'ip -6 addr add fd00:0:0:21f1::1/64 dev eth0'
    - 'ip -6 addr add 2001:1200:0:21f1::1/64 dev eth0'

Administración:

- PC-ADM:
    - 'ip -6 addr add fd00:0:0:21f6::1/64 dev eth0'
    - 'ip -6 addr add 2001:1200:0:21f6::1/64 dev eth0'
- PC-ADM-2:
    - 'ip -6 addr add fd00:0:0:21f7::1/64 dev eth0'
    - 'ip -6 addr add 2001:1200:0:21f7::1/64 dev eth0'
- SERVIDOR-ADM:
    - 'ip -6 addr add fd00:0:0:21f7::2/64 dev eth0'
    - 'ip -6 addr add 2001:1200:0:21f7::2/64 dev eth0'

W-Guest:

- PC-GUEST:

    - 'ip -6 addr add 2001:1200:0:21f4::1/64 dev eth0'
    - 'ip -6 addr add fd00:0:0:21f4::1/64 dev eth0'

Otros:

- ISP-intranet:
    - 'ip addr add 10.0.9.2/24 dev eth0'
    - 'ip addr add 10.0.10.1/24 dev eth1'
    - 'ip route add 10.0.9.0 via 10.0.9.1 dev eth0'
    - 'ip route add default via 10.0.10.2 dev eth1'
- ISP-Casa:
    - 'ip addr add 10.0.10.2/24 dev eth0'
    - 'ip addr add 10.0.11.1/24 dev eth1'
    - 'ip route add default via 10.0.10.1 dev eth0'
    - 'ip route add 10.0.11.0 via 10.0.11.2 dev eth1'
- Router-Casa:
    - 'ip addr add 10.0.11.2/24 dev eth0'
    - 'ip route add default via 10.0.11.1 dev eth0'
    - 'ip -6 addr add fd00:1::1/64 dev eth1'
    - 'ip -6 addr add 2001:1::1/64 dev eth1'
    - 'ip tunnel add tunnel0 mode sit remote 10.0.9.1 local 10.0.11.2'
    - 'ip addr add 2001:1::1/64 dev tunnel0'
    - 'ip link set tunnel0 up'
    - 'ip -6 route add default dev tunnel0'
    - 'ip -6 route add 2001:2::/64 via 2001:1::2 dev eth1'
- Pc-casa:
    - 'ip -6 addr add 2001:2::20/64 dev eth0'

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.

    Res: Las redes que componen la intranet son las siguientes:

    Ventas:

    - Red 1: SW-1
    - Red 2: W-VENTAS (wlan1)

    Data Center:

    - Red 3: SW-2

Administración:

- Red 4: SW-3
- Red 5: SW-4

W-Guest:

- Red 6: wlan2

Redes centrales:

- Red 7: Router-7 / Router-6
- Red 8: Router-8 / Router-6
- Red 9: Router-6 / Router-5
- Red 10: Router-1 / Router-4
- Red 11: Router-4 / Router-5
- Red 12: Router-2 / Router-4
- Red 13: Router-2 / Router-3
- Red 14: Router-4 / Router-3
- Red 15: Router-3 / Router-9
- Red 16: Router-9 / Router-5

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

Res: Según el rango asignados por el proveedor, tenemos las siguientes direcciones disponibles:

2001:1200:0:21f**0:0000:0000:0000:0000** hasta 2001:1200:0:21f**f:ffff:ffff:ffff:ffff**

*Se indica con **negrita** las redes compuestas*

Nombre de red	**Dirección/Prefijo**
Red 1 (SW-1)	2001:2100:0:21f2::/64
Red 2 (W-VENTAS)	2001:1200:0:21f3::/64
Red 3 (SW-2)	2001:1200:0:21f1::/64
Red 4 (SW-3)	2001:1200:0:21f6::/64
Red 5 (SW-4)	2001:1200:0:21f7::/64

Nombre de red	**Dirección/Prefijo**
Red 6 (W-GUEST)	2001:1200:0:21f4::/64
VENTAS	2001:1200:0:21f2::/63
ADMINISTRACIÓN	2001:1200:0:21f6::/63
Routers	2001:1200:0:21f0::/123

Adicionalmente, la red entre cada par de routers se lista a continuación:

Nombre de red	**Dirección/Prefijo**
Red 7 (R7-R6)	2001:1200:0:21f0::2/127
Red 8 (R8-R6)	2001:1200:0:21f0::/127
Red 9 (R6-R5)	2001:1200:0:21f0::4/127
Red 10 (R1-R4)	2001:1200:0:21f0::8/127
Red 11 (R4-R5)	2001:1200:0:21f0::6/127
Red 12 (R2-R4)	2001:1200:0:21f0::10/127
Red 13 (R2-R3)	2001:1200:0:21f0::12/127
Red 14 (R4-R3)	2001:1200:0:21f0::e/127
Red 15 (R3-R9)	2001:1200:0:21f0::c/127
Red 16 (R5-R9)	2001:1200:0:21f0::a/127

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

Red	**Equipo**	**IP**
Red 1 (SW-1 VENTAS)	SERVIDOR-VENTAS	2001:1200:0:21f2::1

Red 1 (SW-1 VENTAS)	PC-VT-1	2001:1200:0:21f2::2
Red 2 (W-VENTAS)	PC-VT-2	2001:1200:0:21f3::1
Red 3 (DATACENTER)	SERVIDOR-DNS	2001:1200:0:21f1::2
Red 3 (DATACENTER)	SERVIDOR-WEB	2001:1200:0:21f1::1
Red 3 (DATACENTER)	PC-DC-1	2001:1200:0:21f1::3
Red 4 (SW-3)	PC-ADM	2001:1200:0:21f6::1
Red 5 (SW-4)	PC-ADM-2	2001:1200:0:21f7::1
Red 5 (SW-4)	SERVIDOR-ADM	2001:1200:0:21f7::1/
Red 6 (W-GUEST)	PC-GUEST	2001:1200:0:21f4::1
Red PC Casa	PC-CASA	2001:2::20

* *No se tuvieron en cuenta las IPs usadas en redes punto a punto*

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

Nota: En todos los casos la puerta de enlace predeterminada es el dispositivo ::0

*Se indica con **negrita** las redes compuestas*

Nombre de red	**ULA/Prefijo**
Red 1 (SW-1)	fd00:0:0:21f2::/64
Red 2 (W-VENTAS)	fd00:0:0:21f3::/64
Red 3 (SW-2)	fd00:0:0:21f1::/64
Red 4 (SW-3)	fd00:0:0:21f6::/64
Red 5 (SW-4)	fd00:0:0:21f7::/64
Red 6 (W-GUEST)	fd00:0:0:21f4::/64
VENTAS	fd00:0:0:21f2::/63

Nombre de red	ULA/Prefijo
ADMINISTRACIÓN	fd00:0:0:21f6::/63

Red	Equipo	ULA
Red 1 (SW-1 VENTAS)	SERVIDOR-VENTAS	fd00:0:0:21f2::1
Red 1 (SW-1 VENTAS)	PC-VT-1	fd00:0:0:21f2::2
Red 2 (W-VENTAS)	PC-VT-2	fd00:0:0:21f3::1
Red 3 (DATACENTER)	SERVIDOR-DNS	fd00:0:0:21f1::2
Red 3 (DATACENTER)	SERVIDOR-WEB	fd00:0:0:21f1::1
Red 3 (DATACENTER)	PC-DC-1	fd00:0:0:21f1::3
Red 4 (SW-3)	PC-ADM	fd00:0:0:21f6::1
Red 5 (SW-4)	PC-ADM-2	fd00:0:0:21f7::1
Red 5 (SW-4)	SERVIDOR-ADM	fd00:0:0:21f7::2
Red 6 (W-GUEST)	PC-GUEST	fd00:0:0:21f4::1

3. Configure manualmente las direcciones de los equipos

Routers:

- Router-5:
  - 'ip -6 addr add 2001:1200:0:21f0::6/127 dev eth0'
  - 'ip -6 addr add 2001:1200:0:21f0::5/127 dev eth1'
  - 'ip -6 addr add 2001:1200:0:21f0::a/127 dev eth2'
  - 'ip -6 addr add 2001:1200:0:21f4::/64 dev eth3'
  - ‘ip -6 addr add fd00:0:0:21f4::/64 dev eth3’
- Router-3:
  - 'ip -6 addr add 2001:1200:0:21f0::d/127 dev eth0'
  - 'ip -6 addr add 2001:1200:0:21f0::f/127 dev eth1'
  - 'ip -6 addr add 2001:1200:0:21f0::13/127 dev eth2'
- Router-4:

    - 'ip -6 addr add 2001:1200:0:21f0::e/127 dev eth0'
    - 'ip -6 addr add 2001:1200:0:21f0::7/127 dev eth1'
    - 'ip -6 addr add 2001:1200:0:21f0::8/127 dev eth2'
    - 'ip -6 addr add 2001:1200:0:21f0::10/127 dev eth3'
- Router-1:
    - 'ip -6 addr add 2001:1200:0:21f1::/64 dev eth1'
    - 'ip -6 addr add fd00:0:0:21f1::/64 dev eth1'
- Router-6:
    - 'ip -6 addr add 2001:1200:0:21f0::1/127 dev eth2'
    - 'ip -6 addr add 2001:1200:0:21f0::3/127 dev eth1'
    - 'ip -6 addr add 2001:1200:0:21f0::4/127 dev eth0'
- Router-7:
    - 'ip -6 addr add 2001:1200:0:21f2::/64 dev eth1'
    - 'ip -6 addr add fd00:0:0:21f2::/64 dev eth1'
    - 'ip -6 addr add 2001:1200:0:21f0::2/127 dev eth0'
- Router-8:
    - 'ip -6 addr add 2001:1200:0:21f3::/64 dev eth1'
    - 'ip -6 addr add 2001:1200:0:21f0::/127 dev eth0'
    - 'ip -6 addr add fd00:0:0:21f3::/64 dev eth1'
- Router-9:
    - 'ip -6 addr add 2001:1200:0:21f0::c/127 dev eth0'
    - 'ip -6 addr add 2001:1200:0:21f0::b/127 dev eth1'
    - 'ip -6 addr add 2001:1200:0:21f6::/64 dev eth3'
    - 'ip -6 addr add 2001:1200:0:21f7::/64 dev eth2'
    - 'ip -6 addr add fd00:0:0:21f6::/64 dev eth3'
    - 'ip -6 addr add fd00:0:0:21f7::/64 dev eth2'
- Router-2:
    - 'ip addr add 10.0.9.1/24 dev eth2'
    - 'ip -6 addr add 2001:1200:0:21f0::11/127 dev eth0'
    - 'ip -6 addr add 2001:1200:0:21f0::12/127 dev eth1'
- R-Intermedio:
    - 'ip -6 addr add 2001:1::2/64 dev eth0'
    - 'ip -6 addr add 2001:2::1/64 dev eth1'

Ventas:

- PC-VT-2:
    - 'ip -6 addr add 2001:1200:0:21f3::1/64 dev eth0'
    - 'ip -6 addr add fd00:0:0:21f3::1/64 dev eth0'
- SERVIDOR-VENTAS:
    - 'ip -6 addr add fd00:0:0:21f2::1/64 dev eth0'
    - 'ip -6 addr add 2001:1200:0:21f2::1/64 dev eth0'
- PC-VT-1:
    - 'ip -6 addr add fd00:0:0:21f2::2/64 dev eth0'
    - 'ip -6 addr add 2001:1200:0:21f2::2/64 dev eth0'

Data Center:

- PC-DC-1:
    - 'ip -6 addr add fd00:0:0:21f1::3/64 dev eth0'
    - 'ip -6 addr add 2001:1200:0:21f1::3/64 dev eth0'
- SERVIDOR-DNS:
    - 'ip -6 addr add 2001:1200:0:21f1::2/64 dev eth0'
    - 'ip -6 addr add fd00:0:0:21f1::2/64 dev eth0'
- SERVIDOR-WEB:
    - 'ip -6 addr add fd00:0:0:21f1::1/64 dev eth0'
    - 'ip -6 addr add 2001:1200:0:21f1::1/64 dev eth0'

Administración:

- PC-ADM:
    - 'ip -6 addr add fd00:0:0:21f6::1/64 dev eth0'
    - 'ip -6 addr add 2001:1200:0:21f6::1/64 dev eth0'
- PC-ADM-2:
    - 'ip -6 addr add fd00:0:0:21f7::1/64 dev eth0'
    - 'ip -6 addr add 2001:1200:0:21f7::1/64 dev eth0'
- SERVIDOR-ADM:
    - 'ip -6 addr add fd00:0:0:21f7::2/64 dev eth0'
    - 'ip -6 addr add 2001:1200:0:21f7::2/64 dev eth0'

W-Guest:

- PC-GUEST:
    - 'ip -6 addr add 2001:1200:0:21f4::1/64 dev eth0'
    - 'ip -6 addr add fd00:0:0:21f4::1/64 dev eth0'

Otros:

- ISP-intranet:
    - 'ip addr add 10.0.9.2/24 dev eth0'
    - 'ip addr add 10.0.10.1/24 dev eth1'
- ISP-Casa:
    - 'ip addr add 10.0.10.2/24 dev eth0'
    - 'ip addr add 10.0.11.1/24 dev eth1'
- Router-Casa:
    - 'ip addr add 10.0.11.2/24 dev eth0'
    - 'ip -6 addr add fd00:1::1/64 dev eth1'
    - 'ip -6 addr add 2001:1::1/64 dev eth1'
    - 'ip addr add 2001:1::1/64 dev tunnel0'
- Pc-casa:
    - 'ip -6 addr add 2001:2::20/64 dev eth0'

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

Routers:

- Router-5:
  - 'ip -6 route add 2001:1200:0:21f2::/64 via 2001:1200:0:21f0::4 dev eth1'
  - 'ip -6 route add 2001:1200:0:21f3::/64 via 2001:1200:0:21f0::4 dev eth1'
  - 'ip -6 route add default via 2001:1200:0:21f0::7 dev eth0'
  - 'ip -6 rule add from 2001:1200:0:21f4::/64 table 10'
  - 'ip -6 route add default via 2001:1200:0:21f0::b dev eth2 table 10'
  - 'ip -6 route add prohibit 2001:1200:0:21f3::/64 table 10'
  - 'ip -6 route add prohibit 2001:1200:0:21f2::/64 table 10'
  - 'ip -6 route add 2001:1200:0:21f0::/128 via 2001:1200:0:21f0::4 dev eth1'
  - 'ip -6 route add 2001:1200:0:21f0::1/128 via 2001:1200:0:21f0::4 dev eth1'
  - 'ip -6 route add 2001:1200:0:21f0::2/128 via 2001:1200:0:21f0::4 dev eth1'
  - 'ip -6 route add 2001:1200:0:21f0::3/128 via 2001:1200:0:21f0::4 dev eth1'
  - 'ip -6 route add fd00:0:0:21f2::/64 via 2001:1200:0:21f0::4 dev eth1'
  - 'ip -6 route add fd00:0:0:21f3::/64 via 2001:1200:0:21f0::4 dev eth1'
- Router-3:
  - 'ip -6 route add default via 2001:1200:0:21f0::c dev eth0'
  - 'ip -6 rule add from 2001:1200:0:21f4::/64 table 10'
  - 'ip -6 route add default via 2001:1200:0:21f0::12 dev eth2 table 10'
  - 'ip -6 route add default via 2001:1200:0:21f0::12 dev eth2 table 15'
  - 'ip6tables -A PREROUTING -t mangle -p tcp -j MARK --set-mark 10'
  - 'ip -6 rule add to 2001:2::/64 fwmark 10 table 15 priority 6'
- Router-4:
  - 'ip -6 route add 2001:1200:0:21f1::/64 via 2001:1200:0:21f0::9 dev eth2'
  - 'ip -6 route add default via 2001:1200:0:21f0::11 dev eth3'
  - 'ip -6 route add default via 2001:1200:0:21f0::f dev eth30 table 15'
  - 'ip6tables -A PREROUTING -t mangle -p tcp -j MARK --set-mark 10'
  - 'ip -6 rule add to 2001:2::/64 fwmark 10 table 15 priority 6'
  - 'ip -6 route add fd00:0:0:21f1::/64 via 2001:1200:0:21f0::9 dev eth2'
- Router-1:
  - 'ip -6 route add default via 2001:1200:0:21f0::8 dev eth0'
  - 'ip -6 rule add from 2001:1200:0:21f4::/64 table 10'
  - 'ip -6 route add prohibit 2001:1200:0:21f1::3/128 table 10'
  - 'ip -6 rule add from 2001:1200:0:21f1::3/128 to 2001:1200:0:21f4::/64 table 20'
  - 'ip -6 route add prohibit 2001:1200:0:21f4::/64 table 20'
- Router-6:
  - 'ip -6 route add default via 2001:1200:0:21f0::5 dev eth0'
  - 'ip -6 route add 2001:1200:0:21f2::/64 via 2001:1200:0:21f0::2 dev eth1'
  - 'ip -6 route add 2001:1200:0:21f3::/64 via 2001:1200:0:21f0:: dev eth2'
  - 'ip -6 route add fd00:0:0:21f2::/64 via 2001:1200:0:21f0::2 dev eth1'

    - 'ip -6 route add fd00:0:0:21f3::/64 via 2001:1200:0:21f0:: dev eth2'
- Router-7:
    - 'ip -6 route add default via 2001:1200:0:21f0::3 dev eth0'
    - 'ip -6 rule add from 2001:1200:0:21f4::/64 table 10'
    - 'ip -6 route add default via 2001:1200:0:21f0::3 dev eth0 table 10'
    - 'ip -6 route add prohibit 2001:1200:0:21f2::/64 table 10'
    - 'ip -6 rule add from 2001:1200:0:21f2::/64 to 2001:1200:0:21f4::/64 table 20'
    - 'ip -6 route add prohibit 2001:1200:0:21f4::/64 table 20'
- Router-8:
    - 'ip -6 route add default via 2001:1200:0:21f0::1 dev eth0'
    - 'ip -6 rule add from 2001:1200:0:21f4::/64 table 10'
    - 'ip -6 route add default via 2001:1200:0:21f0::1 dev eth0 table 10'
    - 'ip -6 route add prohibit 2001:1200:0:21f3::/64 table 10'
    - 'ip -6 rule add from 2001:1200:0:21f3::/64 to 2001:1200:0:21f4::/64 table 20'
    - 'ip -6 route add prohibit 2001:1200:0:21f4::/64 table 20'
    - 'ip -6 addr add fd00:0:0:21f3::/64 dev eth1'
- Router-9:
    - 'ip -6 route add default via 2001:1200:0:21f0::d dev eth0 table 10'
    - 'ip -6 route add default via 2001:1200:0:21f0::a dev eth1'
    - 'ip -6 route add prohibit 2001:1200:0:21f6::/64 table 10'
    - 'ip -6 route add prohibit 2001:1200:0:21f7::/64 table 10'
    - 'ip -6 rule add from 2001:1200:0:21f4::/64 table 10'
    - 'ip -6 rule add from 2001:1200:0:21f6::/64 to 2001:1200:0:21f4::/64 table 20'
    - 'ip -6 rule add from 2001:1200:0:21f7::/64 to 2001:1200:0:21f4::/64 table 20'
    - 'ip -6 route add prohibit 2001:1200:0:21f4::/64 table 20'
- Router-2:
    - 'ip route add default via 10.0.9.2 dev eth2'
    - 'ip tunnel add tunnel0 mode sit remote 10.0.11.2 local 10.0.9.1'
    - 'ip link set tunnel0 up'
    - 'ip -6 route add 2001:1::/64 dev tunnel0'
    - 'ip -6 route add 2001:2::/64 dev tunnel0'
    - 'ip -6 route add default via 2001:1200:0:21f0::13 dev eth1'
    - 'ip -6 rule add from 2001:1200:0:21f4::/64 table 10'
    - 'ip -6 route add default via 2001:1200:0:21f0::10 dev eth0 table 10'
    - 'ip -6 route add 2001:2::/64 dev tunnel0 table 10'
- R-Intermedio:
    - 'ip -6 route add default via 2001:1::1 dev eth0'
    - 'ip -6 route add prohibit 2001:2::20/128 table 10'
    - 'ip -6 rule add from 2001:1200:0:21f4::1/128 table 10'
    - 'ip -6 rule add from 2001:2::/64 to 2001:1200:0:21f4::/64 table 20'
    - 'ip -6 route add prohibit 2001:1200:0:21f4::/64 table 20'

Otros:

- ISP-intranet:
    - 'ip route add 10.0.9.0 via 10.0.9.1 dev eth0'
    - 'ip route add default via 10.0.10.2 dev eth1'
- ISP-Casa:

    - 'ip route add default via 10.0.10.1 dev eth0'
    - 'ip route add 10.0.11.0 via 10.0.11.2 dev eth1'
- Router-Casa:
    - 'ip route add default via 10.0.11.1 dev eth0'
    - 'ip tunnel add tunnel0 mode sit remote 10.0.9.1 local 10.0.11.2'
    - 'ip link set tunnel0 up'
    - 'ip -6 route add default dev tunnel0'
    - 'ip -6 route add 2001:2::/64 via 2001:1::2 dev eth1'

5. Configure el Router2 y Router-Casa para establecer un tunel tipo sit (transporte de datagramas IPv6 sobre IPv4) entre la red de la empresa y la red hogareña.

- Router-2:
    - ip tunnel add tunnel0 mode sit remote 10.0.11.2 local 10.0.9.1
    - ip addr add 2001:1200:0:21f0::11/127 dev tunnel0
    - ip link set tunnel0 up
- Router-Casa:
    - ip tunnel add tunnel0 mode sit remote 10.0.9.1 local 10.0.11.2
    - ip addr add 2001:1::1/64 dev tunnel0
    - ip link set tunnel0 up

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.

- PC-ADM-1 → PC-VT-1:

```
root@PC-ADM:/tmp/pycore.37667/PC-ADM.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=57 time=0.396 ms
64 bytes from 2001:1200:0:21f2::2: icmp_seq=2 ttl=57 time=0.196 ms
64 bytes from 2001:1200:0:21f2::2: icmp_seq=3 ttl=57 time=0.106 ms
64 bytes from 2001:1200:0:21f2::2: icmp_seq=4 ttl=57 time=0.108 ms
^C
--- 2001:1200:0:21f2::2 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3078ms
rtt min/avg/max/mdev = 0.106/0.201/0.396/0.118 ms
root@PC-ADM:/tmp/pycore.37667/PC-ADM.conf#
```

```
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on eth0, link-type EN10MB (Ethernet), capture size 262144 bytes
20:54:34.252594 IP6 fe80::1469:8ff:fe6a:ecf0 > ff02::2: ICMP6, router solicitati
on, length 16
20:54:36.812992 IP6 fe80::200:ff:feaa:23 > ff02::2: ICMP6, router solicitation,
length 16
20:54:36.813181 IP6 fe80::200:ff:feaa:22 > ff02::2: ICMP6, router solicitation,
length 16
20:54:59.341140 IP6 fe80::e6:91ff:feef:69c3 > ff02::2: ICMP6, router solicitatio
n, length 16
20:55:05.484660 IP6 fe80::1469:8ff:fe6a:ecf0 > ff02::2: ICMP6, router solicitati
on, length 16
20:55:09.580923 IP6 fe80::200:ff:feaa:22 > ff02::2: ICMP6, router solicitation,
length 16
20:55:11.629183 IP6 fe80::200:ff:feaa:23 > ff02::2: ICMP6, router solicitation,
length 16
20:55:34.598252 IP6 fe80::200:ff:feaa:21 > ff02::1:ff00:2: ICMP6, neighbor solic
itation, who has 2001:1200:0:21f2::2, length 32
20:55:34.598286 IP6 2001:1200:0:21f2::2 > fe80::200:ff:feaa:21: ICMP6, neighbor
advertisement, tgt is 2001:1200:0:21f2::2, length 32
20:55:34.598297 IP6 2001:1200:0:21f6::1 > 2001:1200:0:21f2::2: ICMP6, echo reque
st, seq 1, length 64
20:55:34.598309 IP6 2001:1200:0:21f2::2 > ff02::1:ff00:0: ICMP6, neighbor solici
tation, who has 2001:1200:0:21f2::, length 32
```

PC-ADM-1 → SERVIDOR-WEB:

```
root@PC-ADM:/tmp/pycore.37667/PC-ADM.conf# ping 2001:1200:0:21f1::1
PING 2001:1200:0:21f1::1(2001:1200:0:21f1::1) 56 data bytes
64 bytes from 2001:1200:0:21f1::1: icmp_seq=1 ttl=59 time=0.281 ms
64 bytes from 2001:1200:0:21f1::1: icmp_seq=2 ttl=59 time=0.103 ms
64 bytes from 2001:1200:0:21f1::1: icmp_seq=3 ttl=59 time=0.114 ms
^C
--- 2001:1200:0:21f1::1 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2033ms
rtt min/avg/max/mdev = 0.103/0.166/0.281/0.081 ms
root@PC-ADM:/tmp/pycore.37667/PC-ADM.conf#
```

```
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on eth0, link-type EN10MB (Ethernet), capture size 262144 bytes
21:03:02.668482 IP6 fe80::200:ff:feaa:26 > ff02::2: ICMP6, router solicitation,
length 16
21:03:06.267427 IP6 fe80::200:ff:feaa:24 > ff02::1:ff00:1: ICMP6, neighbor solic
itation, who has 2001:1200:0:21f1::1, length 32
21:03:06.267442 IP6 2001:1200:0:21f1::1 > fe80::200:ff:feaa:24: ICMP6, neighbor
advertisement, tgt is 2001:1200:0:21f1::1, length 32
21:03:06.267451 IP6 2001:1200:0:21f6::1 > 2001:1200:0:21f1::1: ICMP6, echo reque
st, seq 1, length 64
21:03:06.267458 IP6 2001:1200:0:21f1::1 > ff02::1:ff00:0: ICMP6, neighbor solici
tation, who has 2001:1200:0:21f1::, length 32
21:03:06.267465 IP6 2001:1200:0:21f1:: > 2001:1200:0:21f1::1: ICMP6, neighbor ad
vertisement, tgt is 2001:1200:0:21f1::, length 32
21:03:06.267466 IP6 2001:1200:0:21f1::1 > 2001:1200:0:21f6::1: ICMP6, echo reply
, seq 1, length 64
21:03:06.267634 IP6 fe80::200:ff:feaa:27 > ff02::1:ff00:0: ICMP6, neighbor solic
itation, who has 2001:1200:0:21f1::, length 32
21:03:06.267647 IP6 2001:1200:0:21f1:: > fe80::200:ff:feaa:27: ICMP6, neighbor a
dvertisement, tgt is 2001:1200:0:21f1::, length 32
```

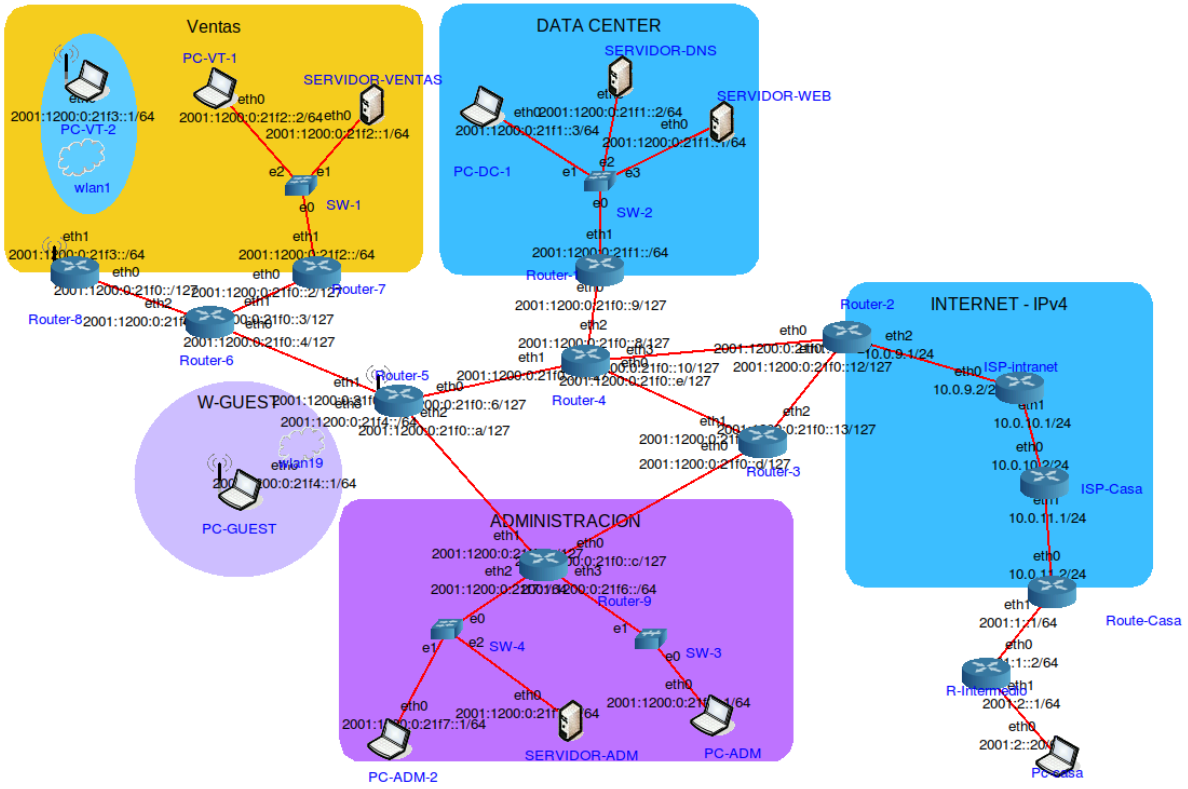
PC-GUEST → SERVIDOR-DNS:

```
root@PC-GUEST:/tmp/pycore.37667/PC-GUEST.conf# ping 2001:1200:0:21f1::2
PING 2001:1200:0:21f1::2(2001:1200:0:21f1::2) 56 data bytes
64 bytes from 2001:1200:0:21f1::2: icmp_seq=1 ttl=58 time=82.0 ms
64 bytes from 2001:1200:0:21f1::2: icmp_seq=2 ttl=58 time=40.5 ms
^C
--- 2001:1200:0:21f1::2 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1001ms
rtt min/avg/max/mdev = 40.533/61.266/82.000/20.734 ms
root@PC-GUEST:/tmp/pycore.37667/PC-GUEST.conf#
```

```
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on eth0, link-type EN10MB (Ethernet), capture size 262144 bytes
21:04:11.383376 IP6 fe80::200:ff:feaa:24 > ff02::1:ff00:2: ICMP6, neighbor solic
itation, who has 2001:1200:0:21f1::2, length 32
21:04:11.383411 IP6 2001:1200:0:21f1::2 > fe80::200:ff:feaa:24: ICMP6, neighbor
advertisement, tgt is 2001:1200:0:21f1::2, length 32
21:04:11.383418 IP6 2001:1200:0:21f4::1 > 2001:1200:0:21f1::2: ICMP6, echo reque
st, seq 1, length 64
21:04:11.383428 IP6 2001:1200:0:21f1::2 > ff02::1:ff00:0: ICMP6, neighbor solici
tation, who has 2001:1200:0:21f1::, length 32
21:04:11.383436 IP6 2001:1200:0:21f1:: > 2001:1200:0:21f1::2: ICMP6, neighbor ad
vertisement, tgt is 2001:1200:0:21f1::, length 32
21:04:11.383438 IP6 2001:1200:0:21f1::2 > 2001:1200:0:21f4::1: ICMP6, echo reply
, seq 1, length 64
21:04:11.383996 IP6 fe80::200:ff:feaa:26 > ff02::1:ff00:0: ICMP6, neighbor solic
itation, who has 2001:1200:0:21f1::, length 32
21:04:11.384027 IP6 2001:1200:0:21f1:: > fe80::200:ff:feaa:26: ICMP6, neighbor a
dvertisement, tgt is 2001:1200:0:21f1::, length 32
21:04:12.343312 IP6 2001:1200:0:21f4::1 > 2001:1200:0:21f1::2: ICMP6, echo reque
st, seq 2, length 64
21:04:12.343388 IP6 2001:1200:0:21f1::2 > 2001:1200:0:21f4::1: ICMP6, echo reply
```

7. Describa las direcciones de las interfaces.

A continuación se muestran las direcciones globales ipv6 asignadas a cada interfaz.



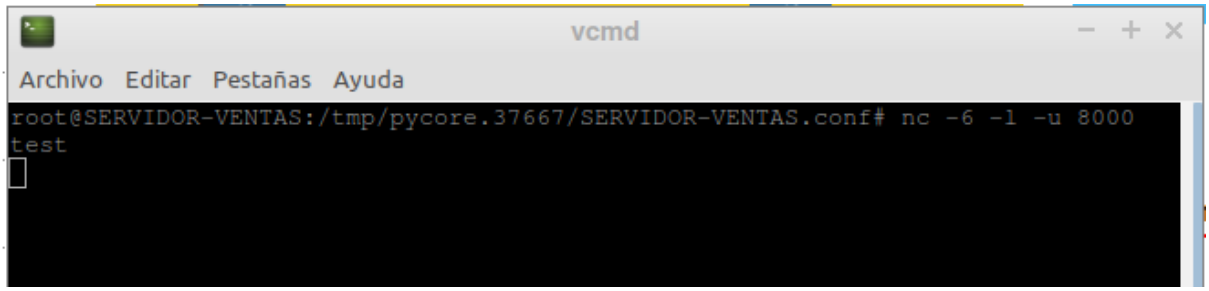
Las direcciones ULA asignadas son un mapeo de la global, por ejemplo, la global “2001:1200:0:21f0::3” se transforma en la ULA “fd00:0:0:21f0::3” y se asignan a la misma interfaz que la global.

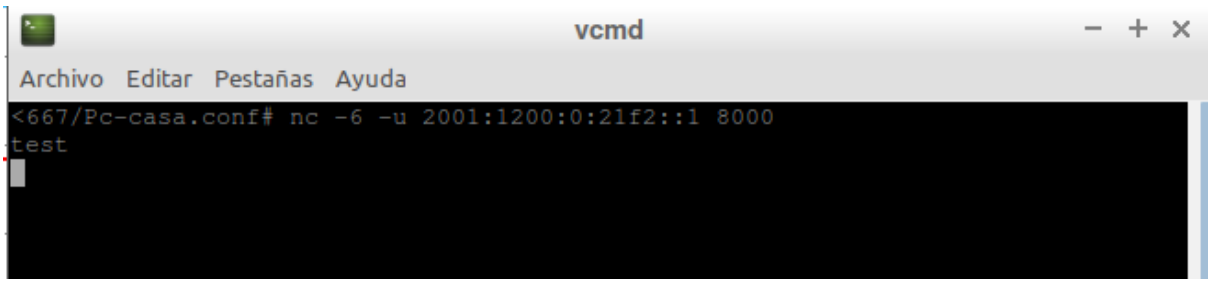
8. Desde Router-1, ejecute: “ping6 ff02::1%eth0”. Analice los paquetes utilizando Wireshark.

Source	Destination	Protocol	Length	Info
fe80::200:ff:feaa:d	ff02::1	ICMPv6	118	Echo (ping) request id=0x0039, seq=1, hop limit=1 (multicast)
fe80::d448:8fff:fed…	ff02::1:ffaa:d	ICMPv6	86	Neighbor Solicitation for fe80::200:ff:feaa:d from 46:e5:60:79:6c:8e
fe80::200:ff:feaa:c	fe80::200:ff:feaa:d	ICMPv6	118	Echo (ping) reply id=0x0039, seq=1, hop limit=64
fe80::200:ff:feaa:d	fe80::d448:8fff:fed…	ICMPv6	86	Neighbor Advertisement fe80::200:ff:feaa:d (rtr, sol, ovr) is at 00:00:00:aa:00:0d
fe80::d448:8fff:fed…	fe80::200:ff:feaa:d	ICMPv6	118	Echo (ping) reply id=0x0039, seq=1, hop limit=64
fe80::200:ff:feaa:d	ff02::1	ICMPv6	118	Echo (ping) request id=0x0039, seq=2, hop limit=1 (multicast)
fe80::d448:8fff:fed…	fe80::200:ff:feaa:d	ICMPv6	118	Echo (ping) reply id=0x0039, seq=2, hop limit=64
fe80::200:ff:feaa:c	fe80::200:ff:feaa:d	ICMPv6	118	Echo (ping) reply id=0x0039, seq=2, hop limit=64
fe80::200:ff:feaa:d	ff02::1	ICMPv6	118	Echo (ping) request id=0x0039, seq=3, hop limit=1 (multicast)
fe80::d448:8fff:fed…	fe80::200:ff:feaa:d	ICMPv6	118	Echo (ping) reply id=0x0039, seq=3, hop limit=64
fe80::200:ff:feaa:c	fe80::200:ff:feaa:d	ICMPv6	118	Echo (ping) reply id=0x0039, seq=3, hop limit=64

Al hacer el ping, todos los dispositivos alcanzados mediante eth0 del Router-1, responden con un ping reply. En este caso, solo responde el Router-4 ya que es el único dispositivo conectado a nivel link a través de esa interfaz.

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}





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)

- PC-CASA → SERVIDOR-DNS:

```
vcmd
Archivo  Editar  Pestañas  Ayuda
root@Pc-casa:/tmp/pycore.36953/Pc-casa.conf# ping6 2001:1200:0:21f1::2
PING 2001:1200:0:21f1::2(2001:1200:0:21f1::2) 56 data bytes
64 bytes from 2001:1200:0:21f1::2: icmp_seq=1 ttl=59 time=0.733 ms
64 bytes from 2001:1200:0:21f1::2: icmp_seq=2 ttl=59 time=0.324 ms
64 bytes from 2001:1200:0:21f1::2: icmp_seq=3 ttl=59 time=0.300 ms
64 bytes from 2001:1200:0:21f1::2: icmp_seq=4 ttl=59 time=0.363 ms
^C
--- 2001:1200:0:21f1::2 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3043ms
rtt min/avg/max/mdev = 0.300/0.430/0.733/0.176 ms
root@Pc-casa:/tmp/pycore.36953/Pc-casa.conf#
```

```
vcmd
Archivo  Editar  Pestañas  Ayuda
root@Pc-casa:/tmp/pycore.36953/Pc-casa.conf# traceroute6 2001:1200:0:21f1::2
traceroute to 2001:1200:0:21f1::2 (2001:1200:0:21f1::2) from 2001:2::20, 30 hops
 max, 24 byte packets
 1  2001:2::1 (2001:2::1)  0,083 ms  0,029 ms  0,013 ms
 2  2001:1::1 (2001:1::1)  0,038 ms  0,02 ms  0,014 ms
 3  * * *
 4  * * *
 5  2001:1200:0:21f0::b (2001:1200:0:21f0::b)  0,426 ms  0,088 ms  0,037 ms
 6  2001:1200:0:21f0::6 (2001:1200:0:21f0::6)  0,045 ms  0,038 ms  0,031 ms
 7  2001:1200:0:21f0::10 (2001:1200:0:21f0::10)  0,044 ms  0,039 ms  0,031 ms
 8  2001:1200:0:21f0::9 (2001:1200:0:21f0::9)  0,058 ms  0,042 ms  0,034 ms
 9  2001:1200:0:21f1::2 (2001:1200:0:21f1::2)  0,082 ms  0,058 ms  0,038 ms
root@Pc-casa:/tmp/pycore.36953/Pc-casa.conf#
```

Wireshark en eth1 del Router “ISP-intranet”

Apply a display filter … <Ctrl-/> Expression…

Source	Destination	Protocol	Length	Info
2001:2::20	2001:1200:0:21f1::2	ICMPv6	138	Echo (ping) request id=0x003d, seq=1, hop limit=62 (reply in 2)
2001:1200:0:21f1::2	2001:2::20	ICMPv6	138	Echo (ping) reply id=0x003d, seq=1, hop limit=61 (request in 1)
2001:2::20	2001:1200:0:21f1::2	ICMPv6	138	Echo (ping) request id=0x003d, seq=2, hop limit=62 (reply in 4)
2001:1200:0:21f1::2	2001:2::20	ICMPv6	138	Echo (ping) reply id=0x003d, seq=2, hop limit=61 (request in 3)
2001:2::20	2001:1200:0:21f1::2	ICMPv6	138	Echo (ping) request id=0x003d, seq=3, hop limit=62 (reply in 6)
2001:1200:0:21f1::2	2001:2::20	ICMPv6	138	Echo (ping) reply id=0x003d, seq=3, hop limit=61 (request in 5)
00:00:00_aa:00:14	00:00:00_aa:00:15	ARP	42	Who has 10.0.10.2? Tell 10.0.10.1
00:00:00_aa:00:15	00:00:00_aa:00:14	ARP	42	10.0.10.2 is at 00:00:00:aa:00:15

```
▸ Frame 1: 138 bytes on wire (1104 bits), 138 bytes captured (1104 bits) on interface 0
▸ Ethernet II, Src: 00:00:00_aa:00:15 (00:00:00:aa:00:15), Dst: 00:00:00_aa:00:14 (00:00:00:aa:00:14)
▸ Internet Protocol Version 4, Src: 10.0.11.2, Dst: 10.0.9.1
▸ Internet Protocol Version 6, Src: 2001:2::20, Dst: 2001:1200:0:21f1::2
▸ Internet Control Message Protocol v6
```

```
0000  00 00 00 aa 00 14 00 00  00 aa 00 15 08 00 45 00   ·····E·
0010  00 7c 61 8a 40 00 3d 29  b3 cc 0a 00 0b 02 0a 00   ·|a·@·=) ·····
0020  09 01 60 0a 53 cf 00 40  3a 3e 20 01 00 02 00 00   ··`·S··@ :> ····
0030  00 00 00 00 00 00 00 00  00 20 20 01 12 00 00 00   ····· ·  ····
0040  21 f1 00 00 00 00 00 00  00 02 80 00 9a b1 00 3d   !····· ·····=
0050  00 01 8b af 71 66 00 00  00 00 a8 95 0c 00 00 00   ····qf·· ····
0060  00 00 10 11 12 13 14 15  16 17 18 19 1a 1b 1c 1d   ····· ····
0070  1e 1f 20 21 22 23 24 25  26 27 28 29 2a 2b 2c 2d   ·· !"#$% &'()*+,-
0080  2e 2f 30 31 32 33 34 35  36 37                     ./012345 67
```

- PC-VT-1 → PC-Casa:

```
vcmd
Archivo  Editar  Pestañas  Ayuda
root@PC-VT-1:/tmp/pycore.36953/PC-VT-1.conf# ping6 2001:2::20
PING 2001:2::20(2001:2::20) 56 data bytes
64 bytes from 2001:2::20: icmp_seq=1 ttl=56 time=0.544 ms
64 bytes from 2001:2::20: icmp_seq=2 ttl=56 time=0.475 ms
64 bytes from 2001:2::20: icmp_seq=3 ttl=56 time=0.409 ms
^C
--- 2001:2::20 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2028ms
rtt min/avg/max/mdev = 0.409/0.476/0.544/0.055 ms
root@PC-VT-1:/tmp/pycore.36953/PC-VT-1.conf#
```

```
vcmd
Archivo  Editar  Pestañas  Ayuda
root@PC-VT-1:/tmp/pycore.36953/PC-VT-1.conf# traceroute6 2001:2::20
traceroute to 2001:2::20 (2001:2::20) from 2001:1200:0:21f2::2, 30 hops max, 24
byte packets
 1  2001:1200:0:21f2:: (2001:1200:0:21f2::)  0,119 ms  0,025 ms  0,01 ms
 2  2001:1200:0:21f0::3 (2001:1200:0:21f0::3)  0,038 ms  0,017 ms  0,012 ms
 3  2001:1200:0:21f0::5 (2001:1200:0:21f0::5)  0,044 ms  0,021 ms  0,015 ms
 4  2001:1200:0:21f0::10 (2001:1200:0:21f0::10)  0,083 ms  0,031 ms  0,025 ms
 5  2001:1200:0:21f0::12 (2001:1200:0:21f0::12)  0,07 ms  0,036 ms  0,023 ms
 6  * * *
 7  * * *
 8  2001:2::20 (2001:2::20)  0,389 ms  0,054 ms  0,04 ms
root@PC-VT-1:/tmp/pycore.36953/PC-VT-1.conf#
```

Wireshark en eth1 del Router “ISP-intranet”

Apply a display filter … <Ctrl-/> Expression… +

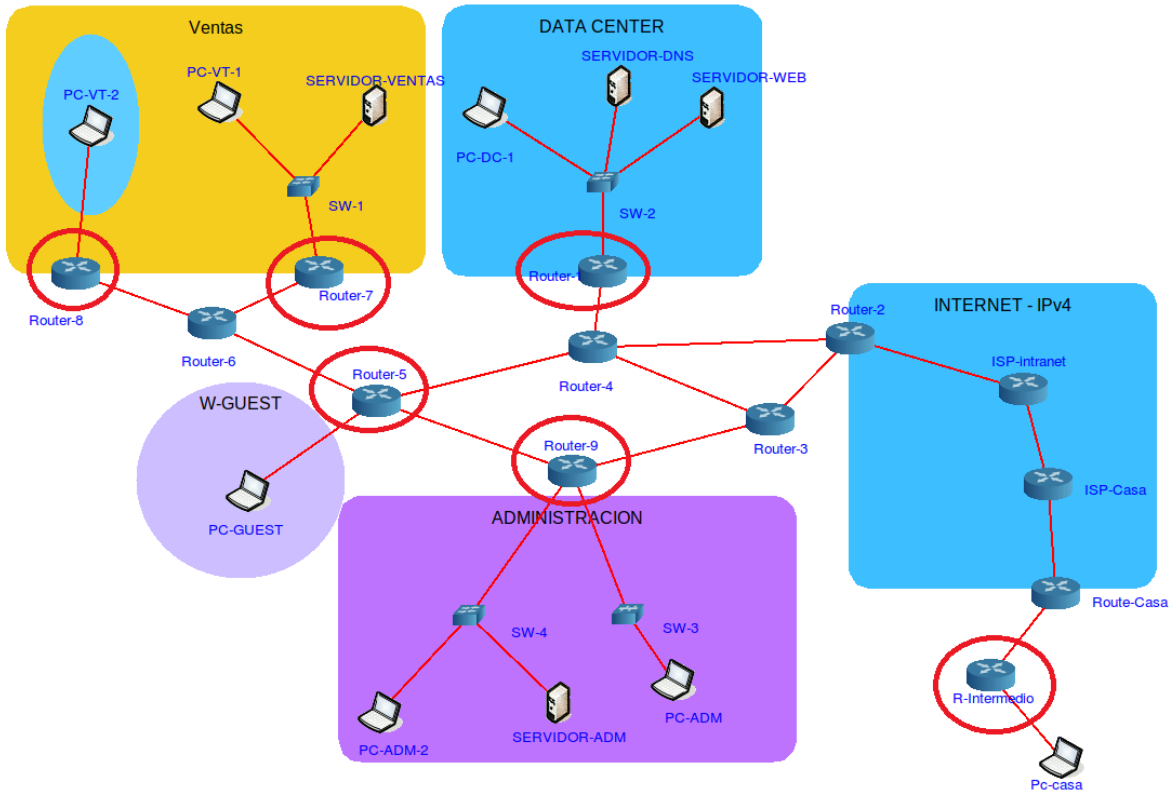
Source	Destination	Protocol	Length	Info
2001:1200:0:21f2::2	2001:2::20	ICMPv6	138	Echo (ping) request id=0x002a, seq=1, hop limit=59 (reply in 2)
2001:2::20	2001:1200:0:21f2::2	ICMPv6	138	Echo (ping) reply id=0x002a, seq=1, hop limit=62 (request in 1)
2001:1200:0:21f2::2	2001:2::20	ICMPv6	138	Echo (ping) request id=0x002a, seq=2, hop limit=59 (reply in 4)
2001:2::20	2001:1200:0:21f2::2	ICMPv6	138	Echo (ping) reply id=0x002a, seq=2, hop limit=62 (request in 3)
2001:1200:0:21f2::2	2001:2::20	ICMPv6	138	Echo (ping) request id=0x002a, seq=3, hop limit=59 (reply in 6)
2001:2::20	2001:1200:0:21f2::2	ICMPv6	138	Echo (ping) reply id=0x002a, seq=3, hop limit=62 (request in 5)
00:00:00_aa:00:15	00:00:00_aa:00:14	ARP	42	Who has 10.0.10.1? Tell 10.0.10.2
00:00:00_aa:00:14	00:00:00_aa:00:15	ARP	42	10.0.10.1 is at 00:00:00:aa:00:14

```
▸ Frame 5: 138 bytes on wire (1104 bits), 138 bytes captured (1104 bits) on interface 0
▸ Ethernet II, Src: 00:00:00_aa:00:14 (00:00:00:aa:00:14), Dst: 00:00:00_aa:00:15 (00:00:00:aa:00:15)
▸ Internet Protocol Version 4, Src: 10.0.9.1, Dst: 10.0.11.2
▸ Internet Protocol Version 6, Src: 2001:1200:0:21f2::2, Dst: 2001:2::20
▸ Internet Control Message Protocol v6
```

```
0000  00 00 00 aa 00 15 00 00  00 aa 00 14 08 00 45 00   ······ ····· ····E·
0010  00 7c 89 af 40 00 3a 29  8e a7 0a 00 09 01 0a 00   ·|··@·:) ····· ····
0020  0b 02 60 09 5a 52 00 40  3a 3b 20 01 12 00 00 00   ··`·ZR·@ :; ····· ····
0030  21 f2 00 00 00 00 00 00  00 02 20 01 00 02 00 00   !····· ·· ·····
0040  00 00 00 00 00 00 00 00  00 20 80 00 22 1a 00 2a   ····· · ··"··*
0050  00 03 a7 ae 71 66 00 00  00 00 09 3e 08 00 00 00   ····qf·· ···>····
0060  00 00 10 11 12 13 14 15  16 17 18 19 1a 1b 1c 1d   ····· ····· ····
0070  1e 1f 20 21 22 23 24 25  26 27 28 29 2a 2b 2c 2d   ·· !"#$% &'()*+,-
0080  2e 2f 30 31 32 33 34 35  36 37                     ./012345 67
```

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 implementar RADVD sobre la red, activamos tal configuración en los routers marcados a continuación:



Configuraciones realizadas

Router-7:

```
interface eth1 {
    AdvSendAdvert on;
    MinRtrAdvInterval 3;
    MaxRtrAdvInterval 10;
    AdvDefaultPreference low;
    AdvHomeAgentFlag off;
    prefix 2001:1200:0:21f2::/64 {
    AdvOnLink on;
    AdvAutonomous on;
```

```
    AdvRouterAddr on;
    };
    prefix fd00:0:0:21f2::/64 {
       AdvOnLink on;
       AdvAutonomous on;
       AdvRouterAddr on;
    };
};
```

Router-8:

```
interface eth1 {
    AdvSendAdvert on;
    MinRtrAdvInterval 3;
    MaxRtrAdvInterval 10;
    AdvDefaultPreference low;
    AdvHomeAgentFlag off;
    prefix 2001:1200:0:21f3::/64 {
    AdvOnLink on;
    AdvAutonomous on;
    AdvRouterAddr on;
    };
    prefix fd00:0:0:21f3::/64 {
       AdvOnLink on;
       AdvAutonomous on;
       AdvRouterAddr on;
    };
};
```

Router-1:

```
interface eth1 {
    AdvSendAdvert on;
    MinRtrAdvInterval 3;
    MaxRtrAdvInterval 10;
    AdvDefaultPreference low;
    AdvHomeAgentFlag off;
    prefix 2001:1200:0:21f1::/64 {
    AdvOnLink on;
    AdvAutonomous on;
    AdvRouterAddr on;
    };
    prefix fd00:0:0:21f1::/64 {
       AdvOnLink on;
       AdvAutonomous on;
       AdvRouterAddr on;
```

```
    };
};
```

Router-5:

```
interface eth3 {
    AdvSendAdvert on;
    MinRtrAdvInterval 3;
    MaxRtrAdvInterval 10;
    AdvDefaultPreference low;
    AdvHomeAgentFlag off;
    prefix 2001:1200:0:21f4::/64 {
    AdvOnLink on;
    AdvAutonomous on;
    AdvRouterAddr on;
    };
    prefix fd00:0:0:21f4::/64 {
       AdvOnLink on;
       AdvAutonomous on;
       AdvRouterAddr on;
    };
};
```

Router-9:

```
interface eth2 {
    AdvSendAdvert on;
    MinRtrAdvInterval 3;
    MaxRtrAdvInterval 10;
    AdvDefaultPreference low;
    AdvHomeAgentFlag off;
    prefix 2001:1200:0:21f7::/64 {
    AdvOnLink on;
    AdvAutonomous on;
    AdvRouterAddr on;
    };
    prefix fd00:0:0:21f7::/64 {
       AdvOnLink on;
       AdvAutonomous on;
       AdvRouterAddr on;
    };
};
interface eth3 {
    AdvSendAdvert on;
    MinRtrAdvInterval 3;
    MaxRtrAdvInterval 10;
```

```
    AdvDefaultPreference low;
    AdvHomeAgentFlag off;
    prefix 2001:1200:0:21f6::/64 {
    AdvOnLink on;
    AdvAutonomous on;
    AdvRouterAddr on;
    };
    prefix fd00:0:0:21f6::/64 {
       AdvOnLink on;
       AdvAutonomous on;
       AdvRouterAddr on;
    };
};
```

Router-Intermedio:

```
interface eth1 {
    AdvSendAdvert on;
    MinRtrAdvInterval 3;
    MaxRtrAdvInterval 10;
    AdvDefaultPreference low;
    AdvHomeAgentFlag off;
    prefix 2001:2::/64 {
    AdvOnLink on;
    AdvAutonomous on;
    AdvRouterAddr on;
    };
    prefix fd00:0:0:2::/64 {
       AdvOnLink on;
       AdvAutonomous on;
       AdvRouterAddr on;
    };
};
```

De esta manera, las ip’s globales y de tipo site se asignan automáticamente cuando se inicia el programa.