

DIPLOMADO DE PROFUNDIZACION CISCO
PRUEBA DE HABILIDADES PRÁCTICAS CCNP

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UNIVERSIDAD NACIONAL ABIERTA Y A DISTANCIA - UNAD ESCUELA DE
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INGENIERO DE TELECOMUNICACIONES

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2022

NOTA DE ACEPTACIÓN

Firma del Presidente del Jurado

Firma del Jurado

Firma del Jurado

Bogotá, 27 de noviembre de 2022

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Quiero dar las gracias a mi familia por alentarme siempre a continuar en este largo proceso de preparación académica, por enseñarme a creer en mí y en mis fortalezas, especialmente a mi madre y a mi pareja por sus palabras de aliento y motivación, a la universidad por abrir estos espacios del conocimiento que nos permite fortalecernos aún más en nuestra formación profesional y finalmente a la red de docentes y tutores, quienes estuvieron presentes para brindar su apoyo y colaboración.

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GLOSARIO

ASN: Autonomous System Number, es un grupo de redes de direcciones IP que es gestionado por los operadores con políticas de ruteo (Lacnic, s.f.)

BGP: Es un protocolo escalable de dynamic routing usado en la Internet por grupos de enrutadores para compartir información de enrutamiento. BGP usa parámetros de ruta o atributos para definir políticas de enrutamiento y crear un entorno de enrutamiento estable (Fireware Help, s.f.)

DHCP: El Protocolo de configuración dinámica de host (DHCP) es un protocolo cliente/servidor que proporciona automáticamente un host de Protocolo de Internet (IP) con su dirección IP y otra información de configuración relacionada, como la máscara de subred y la puerta de enlace predeterminada (Microsfot, 2022)

HSRP: (Hot Standby Router Protocol) es un protocolo de Cisco y uno de los FHRP (First Hop Redundancy Protocol) que se encarga de proveer redundancia en la red (Capa 3), es normalmente usado en los gateway, justo antes de la WAN, o incluso en la WAN del lado del proveedor hacia nuestro router(s) (Estudiaredes, 2022)

LACP: La agregación virtual de enlaces, también llamada trunking, es una característica de nivel 2, que une puertos físicos de la red en un único enlace de datos de gran ancho de banda; de este modo se aumenta la capacidad de ancho de banda y se crean enlaces redundantes y de alta disponibilidad (D-Link, 2020)

OSPF: Open Shortest Path First (OSPF) es un protocolo de direccionamiento de tipo enlace-estado, desarrollado para las redes IP y basado en el algoritmo de primera vía más corta (SPF). OSPF es un protocolo de pasarela interior (IGP) (IBM, 2021)

RSTP: RSTP es el protocolo que previene loops en una red de switches. Éste suplanta a su antecesor; el protocolo STP. RSTP trae consigo varias mejoras respecto a STP, principalmente en lo que tiene que ver a los tiempos de convergencia (ccnadesdecero, 2022)

VLAN: también conocidas como redes de área local virtuales, es una tecnología de redes que nos permite crear redes lógicas independientes dentro de la misma red física (Redeszone, 2022)

RESUMEN

Por medio del desarrollo del presente trabajo se demostrarán todos los conocimientos adquiridos a lo largo del diplomado de profundización como opción de grado para la ingeniería en telecomunicaciones y electrónica, aplicando las habilidades prácticas en CCNP bajo cierto escenario planteado, dejando en evidencia las configuraciones requeridas para poder conectar las redes preestablecidas, implementando métodos de seguridad y protocolos de conexión que actualmente se utilizan de manera estándar. Todo el proceso de implementación y configuración se realizara mediante el software GNS3, el cual permite realizar simulaciones de red con todas sus funciones y características, haciendo posible configurar plataformas de conmutación basadas en switches, mediante el uso de protocolos como STP y la configuración de VLANs, también permite usar comandos IOS para la configuración avanzada en routers (con direccionamiento IPv4 e IPv6) para protocolos de enrutamiento como: OSPF, EIGRP y BGP, en entornos de direccionamiento sin clase, con el fin diseñar e implementar soluciones de red escalables, mediante el uso de los principios de enrutamiento y conmutación de paquetes en ambientes LAN y WAN.

Palabras clave: CISCO, CCNP, Conmutación, Enrutamiento, Redes, Electrónica.

ABSTRACT

Through the development of this work, all the knowledge acquired throughout the deepening diploma course will be demonstrated as a degree option for telecommunications and electronics engineering, applying the practical skills in CCNP under a certain scenario, revealing the configurations required for being able to connect pre-established networks, implementing security methods and connection protocols that are currently used as standard. The entire implementation and configuration process will be carried out using the GNS3 software, which allows network simulations to be carried out with all its functions and characteristics, making it possible to configure switching platforms based on switches, through the use of protocols such as STP and the configuration of VLANs. , also allows the use of IOS commands for advanced configuration in routers (with IPv4 and IPv6 addressing) for routing protocols such as: OSPF, EIGRP and BGP, in classless addressing environments, in order to design and implement scalable network solutions, through the use of routing and packet switching principles in LAN and WAN environments.

Keywords: CCNP, Switching, Routing, Networking, Electronics.

INTRODUCCIÓN

Debido al crecimiento del uso sistematizado de las comunicaciones y la información que se presenta tanto en organizaciones como consumidor en general, se ha hecho necesario implementar tecnologías que puedan gestionar y procesar toda esta información. Por lo que se implementan redes de todas las clases, dependiendo de las necesidades particulares de cada uno de los usuarios.

Lo cual exige que las personas estén capacitadas para diseñar, implementar, configurar y gestionar estos sistemas de información, para los cuales la Universidad Nacional Abierta y a Distancia, a través de este diplomado de profundización CISCO CCNP, permite la obtención de dichas habilidades y competencias mediante el uso de herramientas de simulación, protocolos de administración de redes para la solución de problemas, evaluación de desempeños de routers y switches, entre otras cosas.

Por ende, se desarrolló un proyecto aplicado que consiste en un diseño de red específico, sobre el cual se irá realizando su configuración paso a paso con su respectiva evidencia de la configuración de cada uno de los dispositivos, de los comandos utilizados para la implementación de protocolos y uso del software GNS3. Dando cumplimiento a cada uno de los puntos solicitados a lo largo de su desarrollo.

DESARROLLO

Escenario

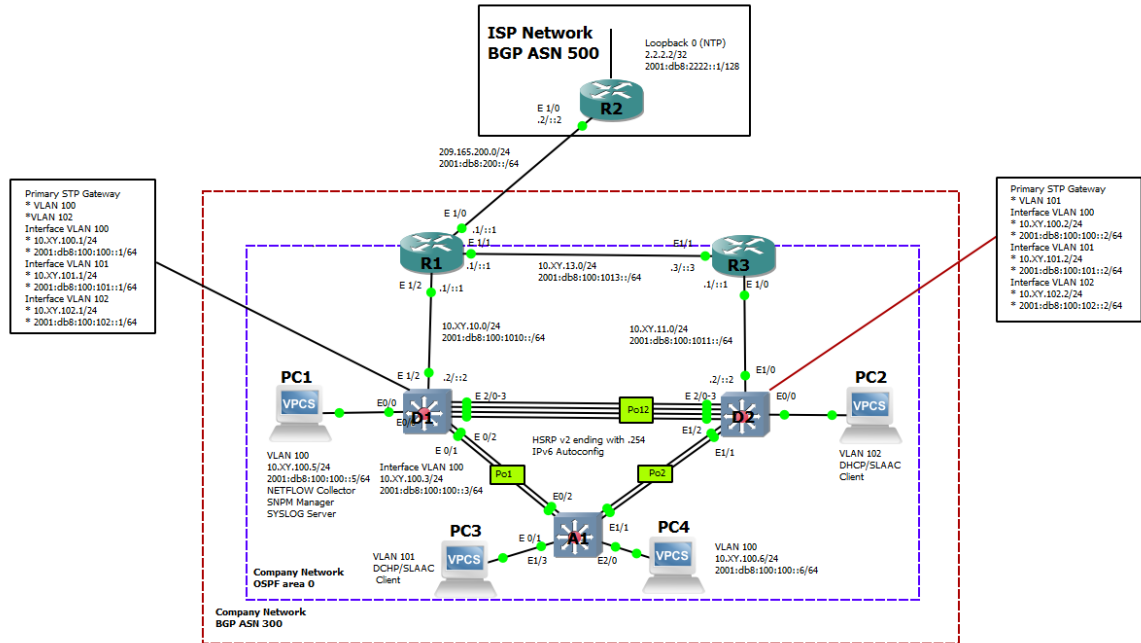


Figura 1. Montaje del escenario propuesto.

Tabla 1. Direccionamiento ip

Device	Interface	IPv4 Address	IPv6 Address	IPv6 Link-Local
R1	E1/0	209.165.200.225/27	2001:db8:200::1/64	fe80::1:1
R1	E1/2	10.57.10.1/24	2001:db8:100:1010::1/64	fe80::1:2
R1	E1/1	10.57.13.1/24	2001:db8:100:1013::1/64	fe80::1:3
R2	E1/0	209.165.200.226/27	2001:db8:200::2/64	fe80::2:1
R2	Loopback0	2.2.2.2/32	2001:db8:2222::1/128	fe80::2:3
R3	E1/0	10.57.11.1/24	2001:db8:100:1011::1/64	fe80::3:2
R3	E1/1	10.57.13.3/24	2001:db8:100:1013::3/64	fe80::3:3
D1	E1/2	10.57.10.2/24	2001:db8:100:1010::2/64	fe80::d1:1
D1	VLAN 100	10.57.100.1/24	2001:db8:100:100::1/64	fe80::d1:2
D1	VLAN 101	10.57.101.1/24	2001:db8:100:101::1/64	fe80::d1:3
D1	VLAN 102	10.57.102.1/24	2001:db8:100:102::1/64	fe80::d1:4
D2	E1/0	10.57.11.2/24	2001:db8:100:1011::2/64	fe80::d2:1
D2	VLAN 100	10.57.100.2/24	2001:db8:100:100::2/64	fe80::d2:2
D2	VLAN 101	10.57.101.2/24	2001:db8:100:101::2/64	fe80::d2:3
D2	VLAN 102	10.57.102.2/24	2001:db8:100:102::2/64	fe80::d2:4
A1	VLAN 100	10.57.100.3/23	2001:db8:100:100::3/64	fe80::a1:1
PC1	NIC	10.57.100.5/24	2001:db8:100:100::5/64	EUI-64
PC2	NIC	DHCP	SLAAC	EUI-64
PC3	NIC	DHCP	SLAAC	EUI-64
PC4	NIC	10.57.100.6/24	2001:db8:100:100::6/64	EUI-64

Tabla 1 - Tabla de direccionamiento

Objetivos

Parte 1: Construir la red y configurar los ajustes básicos de cada dispositivo y el direccionamiento de las interfaces

Parte 2: Configurar la capa 2 de la red y el soporte de Host

Escenario

En esta prueba de habilidades, debe completar la configuración de la red para que haya una accesibilidad completa de un extremo a otro, para que los hosts tengan un soporte confiable de la puerta de enlace predeterminada (default Gateway) y para que los protocolos configurados estén operativos dentro de la parte

correspondiente a la "Red de la Compañía" en la topología. Tenga presente verificar que las configuraciones cumplan con las especificaciones proporcionadas y que los dispositivos funcionen como se requiere.

Nota: Los routers usados son Cisco 4221 con CISCO IOS XE versión 16.9.4 (imagen universalk9). Los switches usados son Cisco Catalyst 3650 con Cisco IOS XE versión 16.9.4 (imagen universalk9) y Cisco Catalyst 2960 con Cisco IOS versión 15.2(2) (imagen lanbasek9). Se pueden usar otras versiones de switches, routers y Cisco IOS. Dependiendo del modelo y la versión de Cisco IOS, los comandos disponibles y el resultado producido pueden variar de lo que se muestra en las prácticas de laboratorio.

Nota: Asegúrese de que los conmutadores se hayan borrado y no tengan configuraciones de inicio. Si no está seguro, póngase en contacto con su instructor.

Recursos necesarios

- 3 Routers (Cisco 7200).
- 3 Switches (Cisco IOU L2).
- 4 PC (Utilice las VPCS del GNS3)
- Después de la configuración de los dispositivos en GNS3, las ranuras de los adaptadores de red del SW deben configurarse de la siguiente manera:

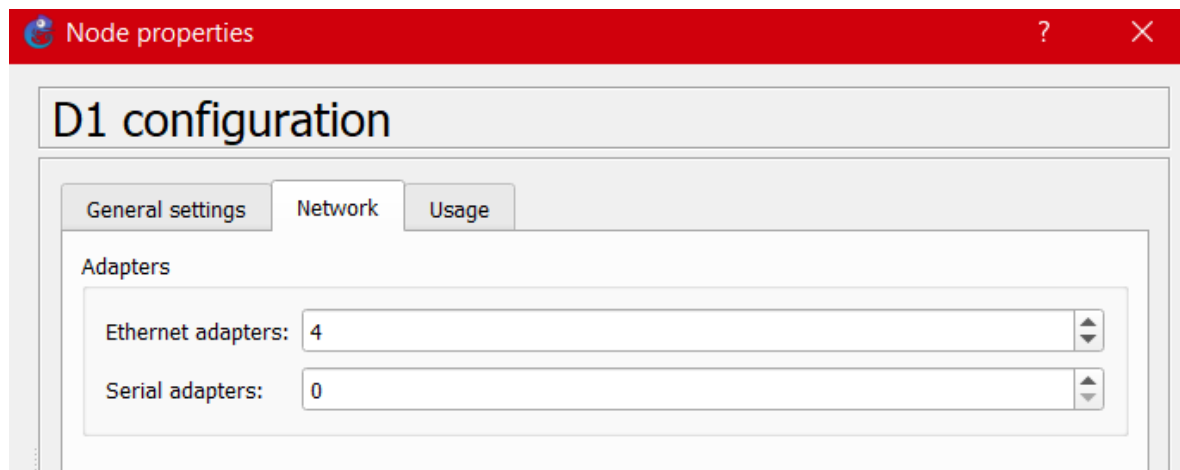


Figura 2. Configuración adaptador Ethernet SW.

Y de los Routers así:

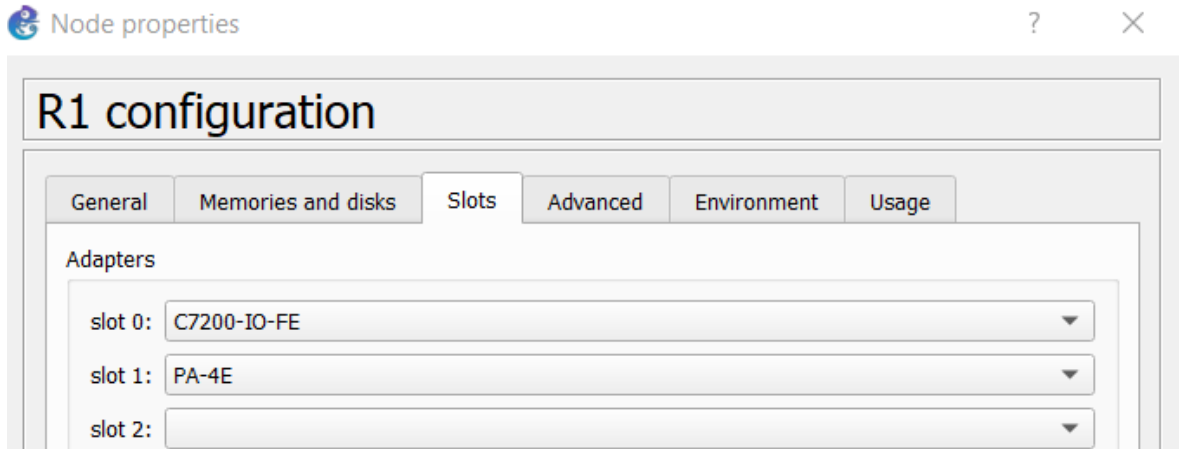


Figura 3. Configuración adaptador Ethernet RTS.

Parte 1: construir la red y configurar los parámetros básicos de los dispositivos y el direccionamiento de las interfaces

En la Parte 1, configurará la topología de red y configurará los ajustes básicos y el direccionamiento de la interfaz

Paso 1: Cablear la red como se muestra en la topología.

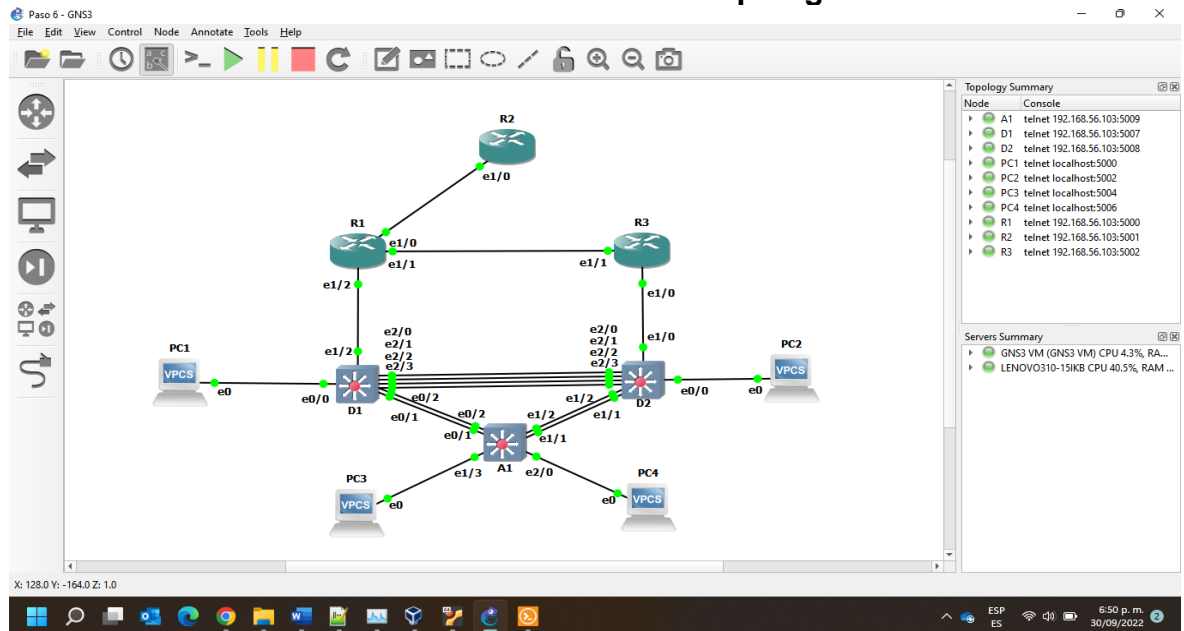


Figura 4. Topología y cableado.

Paso 2: Configurar los parámetros básicos para cada dispositivo

- a. Conecte la consola a cada dispositivo, entre en el modo de configuración global y aplique la configuración básica. Las configuraciones de inicio para cada dispositivo se proporcionan a continuación.

Router 1:

```
hostname R1
ipv6 unicast-routing
no ip domain lookup
banner motd # R1, ENCOR Skills Assessment#
line con 0
  exec-timeout 0 0
  logging synchronous
  exit
interface e1/0
  ip address 209.165.200.225 255.255.255.224
  ipv6 address fe80::1:1 link-local
  ipv6 address 2001:db8:200::1/64
  no shutdown
  exit
interface e1/2
  ip address 10.57.10.1 255.255.255.0
  ipv6 address fe80::1:2 link-local
  ipv6 address 2001:db8:100:1010::1/64
  no shutdown
  exit
interface e1/1
  ip address 10.57.13.1 255.255.255.0
  ipv6 address fe80::1:3 link-local
  ipv6 address 2001:db8:100:1013::1/64
  no shutdown
  exit
```

Router 2

```
hostname R2
ipv6 unicast-routing
no ip domain lookup
banner motd # R2, ENCOR Skills Assessment#
```

```
line con 0
  exec-timeout 0 0
  logging synchronous
  exit
interface e1/0
  ip address 209.165.200.226 255.255.255.224
  ipv6 address fe80::2:1 link-local
  ipv6 address 2001:db8:200::2/64
  no shutdown
  exit
interface Loopback 0
  ip address 2.2.2.2 255.255.255.255
  ipv6 address fe80::2:3 link-local
  ipv6 address 2001:db8:2222::1/128
  no shutdown
  exit
```

Router 3

```
hostname R3
ipv6 unicast-routing
no ip domain lookup
banner motd # R3, ENCOR Skills Assessment#
line con 0
  exec-timeout 0 0
  logging synchronous
  exit
interface e1/0
  ip address 10.57.11.1 255.255.255.0
  ipv6 address fe80::3:2 link-local
  ipv6 address 2001:db8:100:1011::1/64
  no shutdown
  exit
interface e1/1
  ip address 10.57.13.3 255.255.255.0
  ipv6 address fe80::3:3 link-local
  ipv6 address 2001:db8:100:1010::2/64
  no shutdown
  exit
```

Switch D1

```
hostname D1
ip routing
ipv6 unicast-routing
no ip domain lookup
banner motd # D1, ENCOR Skills Assessment#
line con 0
  exec-timeout 0 0
  logging synchronous
  exit
vlan 100
  name Management
  exit
vlan 101
  name UserGroupA
  exit
vlan 102
  name UserGroupB
  exit
vlan 999
  name NATIVE
  exit
interface e1/2
  no switchport
  ip address 10.57.10.2 255.255.255.0
  ipv6 address fe80::d1:1 link-local
  ipv6 address 2001:db8:100:1010::2/64
  no shutdown
  exit
interface vlan 100
  ip address 10.57.100.1 255.255.255.0
  ipv6 address fe80::d1:2 link-local
  ipv6 address 2001:db8:100:100::1/64
  no shutdown
  exit
interface vlan 101
  ip address 10.57.101.1 255.255.255.0
  ipv6 address fe80::d1:3 link-local
  ipv6 address 2001:db8:100:101::1/64
```

```

no shutdown
exit
interface vlan 102
ip address 10.57.102.1 255.255.255.0
ipv6 address fe80::d1:4 link-local
ipv6 address 2001:db8:100:102::1/64
no shutdown
exit
ip dhcp excluded-address 10.57.101.1 10.0.101.109
ip dhcp excluded-address 10.57.101.141 10.0.101.254
ip dhcp excluded-address 10.57.102.1 10.0.102.109
ip dhcp excluded-address 10.57.102.141 10.0.102.254
ip dhcp pool VLAN-101
network 10.57.101.0 255.255.255.0
default-router 10.57.101.254
exit
ip dhcp pool VLAN-102
network 10.57.102.0 255.255.255.0
default-router 10.57.102.254
exit
interface range e0/0-3,e1/0-1,e1/3,e2/0-3,e3/0-3
shutdown
exit

```

Switch D2

```

hostname D2
ip routing
ipv6 unicast-routing
no ip domain lookup
banner motd # D2, ENCOR Skills Assessment#
line con 0
exec-timeout 0 0
logging synchronous
exit
vlan 100
name Management
exit
vlan 101
name UserGroupA

```

```

    exit
vlan 102
    name UserGroupB
    exit
vlan 999
    name NATIVE
    exit
interface e1/0
    no switchport
    ip address 10.57.11.2 255.255.255.0
    ipv6 address fe80::d1:1 link-local
    ipv6 address 2001:db8:100:1011::2/64
    no shutdown
    exit
interface vlan 100
    ip address 10.57.100.2 255.255.255.0
    ipv6 address fe80::d2:2 link-local
    ipv6 address 2001:db8:100:100::2/64
    no shutdown
    exit
interface vlan 101
    ip address 10.57.101.2 255.255.255.0
    ipv6 address fe80::d2:3 link-local
    ipv6 address 2001:db8:100:101::2/64
    no shutdown
    exit
interface vlan 102
    ip address 10.57.102.2 255.255.255.0
    ipv6 address fe80::d2:4 link-local
    ipv6 address 2001:db8:100:102::2/64
    no shutdown
    exit
ip dhcp excluded-address 10.57.101.1 10.0.101.209
ip dhcp excluded-address 10.57.101.241 10.0.101.254
ip dhcp excluded-address 10.57.102.1 10.0.102.209
ip dhcp excluded-address 10.57.102.241 10.0.102.254
ip dhcp pool VLAN-101
    network 10.57.101.0 255.255.255.0
    default-router 57.0.101.254

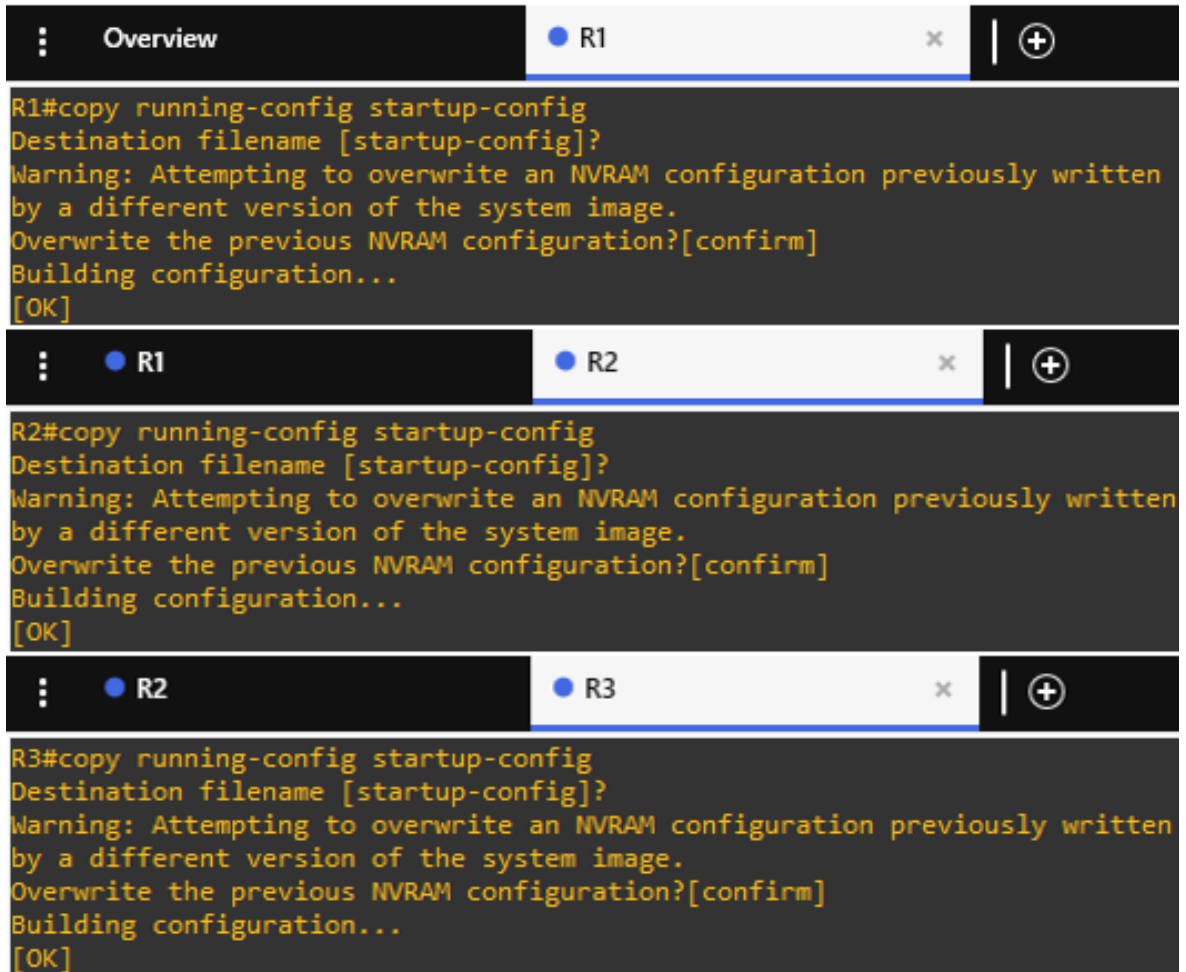
```

```
exit
ip dhcp pool VLAN-102
  network 10.57.102.0 255.255.255.0
  default-router 10.57.102.254
  exit
interface range e0/0-3,e1/1-3,e2/0-3,e3/0-3
  shutdown
  exit
```

Switch A1

```
hostname A1
no ip domain lookup
banner motd # A1, ENCOR Skills Assessment#
line con 0
  exec-timeout 0 0
  logging synchronous
  exit
vlan 100
  name Management
  exit
vlan 101
  name UserGroupA
  exit
vlan 102
  name UserGroupB
  exit
vlan 999
  name NATIVE
  exit
interface vlan 100
  ip address 10.57.100.3 255.255.255.0
  ipv6 address fe80::a1:1 link-local
  ipv6 address 2001:db8:100:100::3/64
  no shutdown
  exit
interface range e0/0,e0/3,e1/0,e2/1-3,e3/0-3
  shutdown
  exit
```

- b. Guarde la configuración en ejecución en startup-config en todos los dispositivos.



```
R1#copy running-config startup-config
Destination filename [startup-config]?
Warning: Attempting to overwrite an NVRAM configuration previously written
by a different version of the system image.
Overwrite the previous NVRAM configuration?[confirm]
Building configuration...
[OK]

R2#copy running-config startup-config
Destination filename [startup-config]?
Warning: Attempting to overwrite an NVRAM configuration previously written
by a different version of the system image.
Overwrite the previous NVRAM configuration?[confirm]
Building configuration...
[OK]

R3#copy running-config startup-config
Destination filename [startup-config]?
Warning: Attempting to overwrite an NVRAM configuration previously written
by a different version of the system image.
Overwrite the previous NVRAM configuration?[confirm]
Building configuration...
[OK]
```

Figura 5. Guardado de configuración en RTS.


```

Overview D1 x
D1#copy running-config startup-config
Destination filename [startup-config]?
Building configuration...
Compressed configuration from 3363 bytes to 1722 bytes[OK]

D1 D2 x
D2#copy running-config startup-config
Destination filename [startup-config]?
Building configuration...
Compressed configuration from 3362 bytes to 1739 bytes[OK]

D2 A1 x
A1#copy running-config startup-config
Destination filename [startup-config]?
Building configuration...
Compressed configuration from 2532 bytes to 1362 bytes[OK]

```

Figura 6. Guardado de configuración en SW.

- c. Configure el direccionamiento de host de PC 1 y PC 4 como se muestra en la tabla de direcciones. Asigne una dirección de puerta de enlace predeterminada de 10.XY.100.254, que será la dirección IP virtual HSRP utilizada en la Parte 4.

```

PC1 x | +
PC1>
PC1> sh
NAME IP/MASK GATEWAY MAC LPORT RHOST:PORT
PC1 10.57.100.5/24 10.57.100.254 00:50:79:66:68:00 10004 127.0.0.1:10005
fe80::250:79ff:fe66:6800/64
2001:db8:100:100:2050:79ff:fe66:6800/64 eui-64

PC1 PC4 x | +
PC4>
PC4> sh
NAME IP/MASK GATEWAY MAC LPORT RHOST:PORT
PC4 10.57.100.6/24 10.57.100.254 00:50:79:66:68:03 10006 127.0.0.1:10007
fe80::250:79ff:fe66:6803/64
2001:db8:100:100:2050:79ff:fe66:6803/64 eui-64

```

Figura 7. Direccionamiento de host de PC 1 y PC 4

Parte 2: configurar la capa 2 de la red y el soporte de host

En esta parte de la Evaluación de habilidades, completará la configuración de red de capa 2 y establecerá el soporte básico de host. Al final de esta parte, todos los interruptores deben poder comunicarse. PC2 y PC3 deben recibir direcciones de DHCP y SLAAC.

Las tareas de configuración son las siguientes:

Tarea 1: Configurar las interfaces troncales

Switch D1:

```
interface range e2/0-3
  switchport trunk encapsulation dot1q
  switchport mode trunk
```

```
interface range e0/1-2
  switchport trunk encapsulation dot1q
  switchport mode trunk
```

Switch D2:

```
interface range e2/0-3
  switchport trunk encapsulation dot1q
  switchport mode trunk
```

```
interface range e1/1-2
  switchport trunk encapsulation dot1q
  switchport mode trunk
```

Switch A1:

```
interface range e0/1-2
  switchport trunk encapsulation dot1q
  switchport mode trunk
```

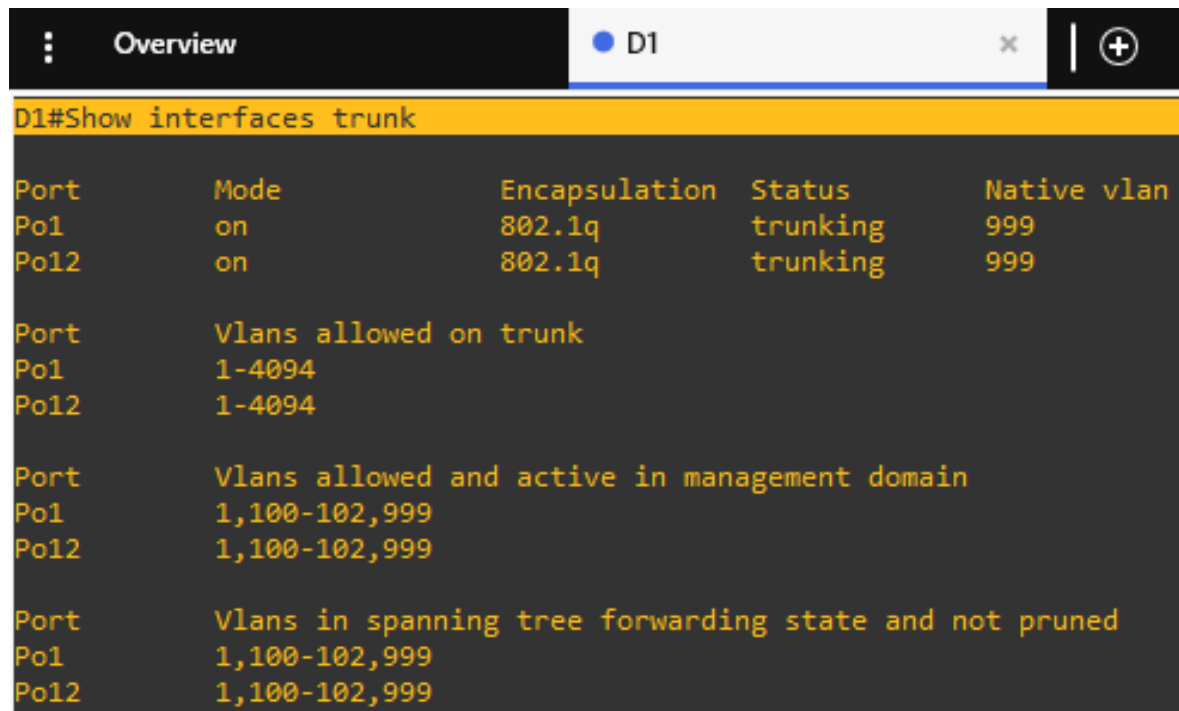
```
interface range e1/1-2
  switchport trunk encapsulation dot1q
  switchport mode trunk
```

Tarea 2: Configurar la VLAN 99 como nativa:

Switch D1:

```
interface range e2/0-3
  switchport trunk native vlan 999
```

```
interface range e0/1-2
  switchport trunk native vlan 999
```



The screenshot shows a terminal window titled "Overview" for switch "D1". The command "D1#Show interfaces trunk" is entered, resulting in the following output:

Port	Mode	Encapsulation	Status	Native vlan
Po1	on	802.1q	trunking	999
Po12	on	802.1q	trunking	999

Port	Vlans allowed on trunk
Po1	1-4094
Po12	1-4094

Port	Vlans allowed and active in management domain
Po1	1,100-102,999
Po12	1,100-102,999

Port	Vlans in spanning tree forwarding state and not pruned
Po1	1,100-102,999
Po12	1,100-102,999

Figura 8. Configuración Tarea 1 y 2 en SW D1

Switch D2:

```
interface range e2/0-3
  switchport trunk native vlan 999
```

```
interface range e1/1-2
  switchport trunk native vlan 999
```

```
Overview D2
D2#Show interfaces trunk

Port      Mode      Encapsulation  Status      Native vlan
Po2       on        802.1q         trunking    999
Po12      on        802.1q         trunking    999

Port      Vlans allowed on trunk
Po2       1-4094
Po12      1-4094

Port      Vlans allowed and active in management domain
Po2       1,100-102,999
Po12      1,100-102,999

Port      Vlans in spanning tree forwarding state and not pruned
Po2       1,100-102,999
Po12      1,100-102,999
D2#
```

Figura 9. Configuración Tarea 1 y 2 en SW D2

Switch A1:

```
interface range e0/1-2
  switchport trunk native vlan 999
```

```
interface range e1/1-2
  switchport trunk native vlan 999
```

```
Overview A1 x +
A1#Show interfaces trunk

Port      Mode      Encapsulation  Status      Native vlan
Po1       on        802.1q         trunking    999
Po2       on        802.1q         trunking    999

Port      Vlans allowed on trunk
Po1       1-4094
Po2       1-4094

Port      Vlans allowed and active in management domain
Po1       1,100-102,999
Po2       1,100-102,999

Port      Vlans in spanning tree forwarding state and not pruned
Po1       1,100,102,999
Po2       101
```

Figura 10. Configuración Tarea 1 y 2 en SW A1

Tarea 3: Habilitar protocolo Rapid Spanning-Tree (RSTP).

Switch D1:

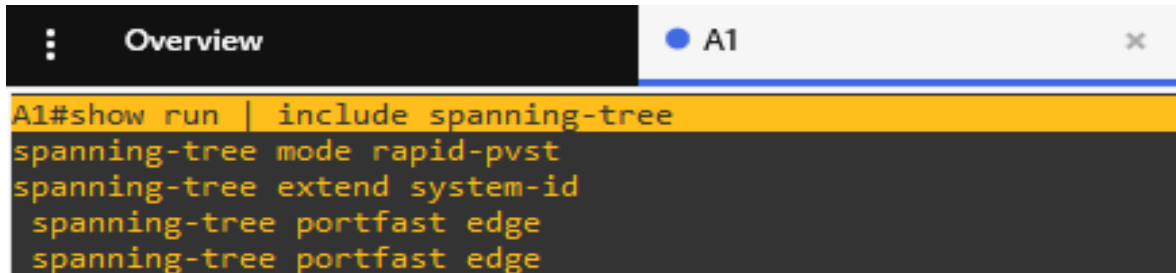
```
spanning-tree mode rapid-pvst
```

Switch D2:

```
spanning-tree mode rapid-pvst
```

Switch A1:

```
spanning-tree mode rapid-pvst
```



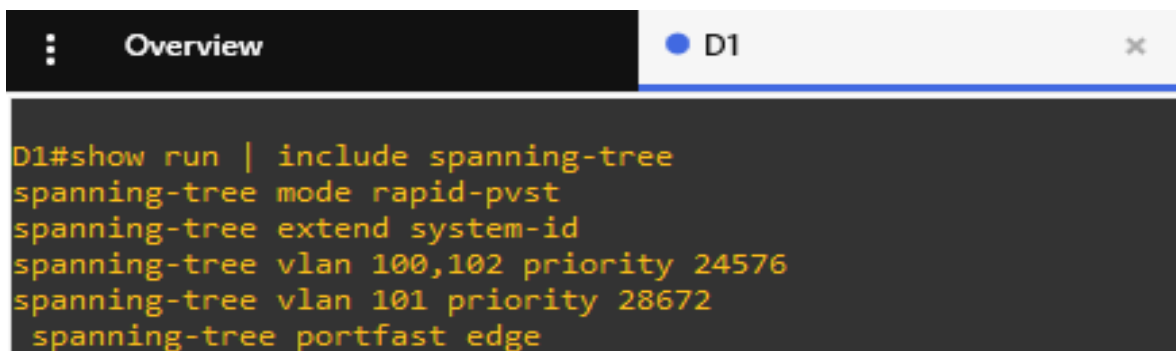
```
Overview A1 x
A1#show run | include spanning-tree
spanning-tree mode rapid-pvst
spanning-tree extend system-id
spanning-tree portfast edge
spanning-tree portfast edge
```

Figura 11. Protocolo Rapid Spanning-Tree SW A1

Tarea 4: Configurar los puentes raíz (root bridges)

Switch D1:

```
spanning-tree vlan 100, 102 root primary
spanning-tree vlan 101 root secondary
```

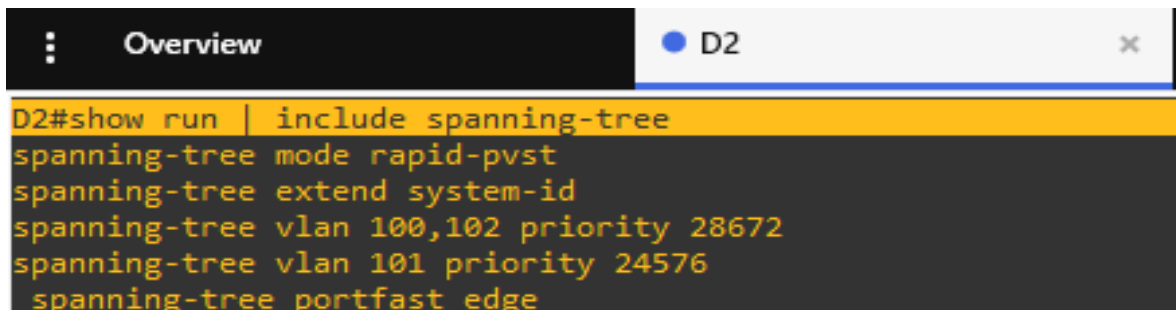


```
Overview D1 x
D1#show run | include spanning-tree
spanning-tree mode rapid-pvst
spanning-tree extend system-id
spanning-tree vlan 100,102 priority 24576
spanning-tree vlan 101 priority 28672
spanning-tree portfast edge
```

Figura 12. Protocolo Rapid Spanning-Tree y root bridges SW D1

Switch D2:

```
spanning-tree vlan 101 root primary
spanning-tree vlan 100, 102 root secondary
```



```
Overview D2 x
D2#show run | include spanning-tree
spanning-tree mode rapid-pvst
spanning-tree extend system-id
spanning-tree vlan 100,102 priority 28672
spanning-tree vlan 101 priority 24576
spanning-tree portfast edge
```

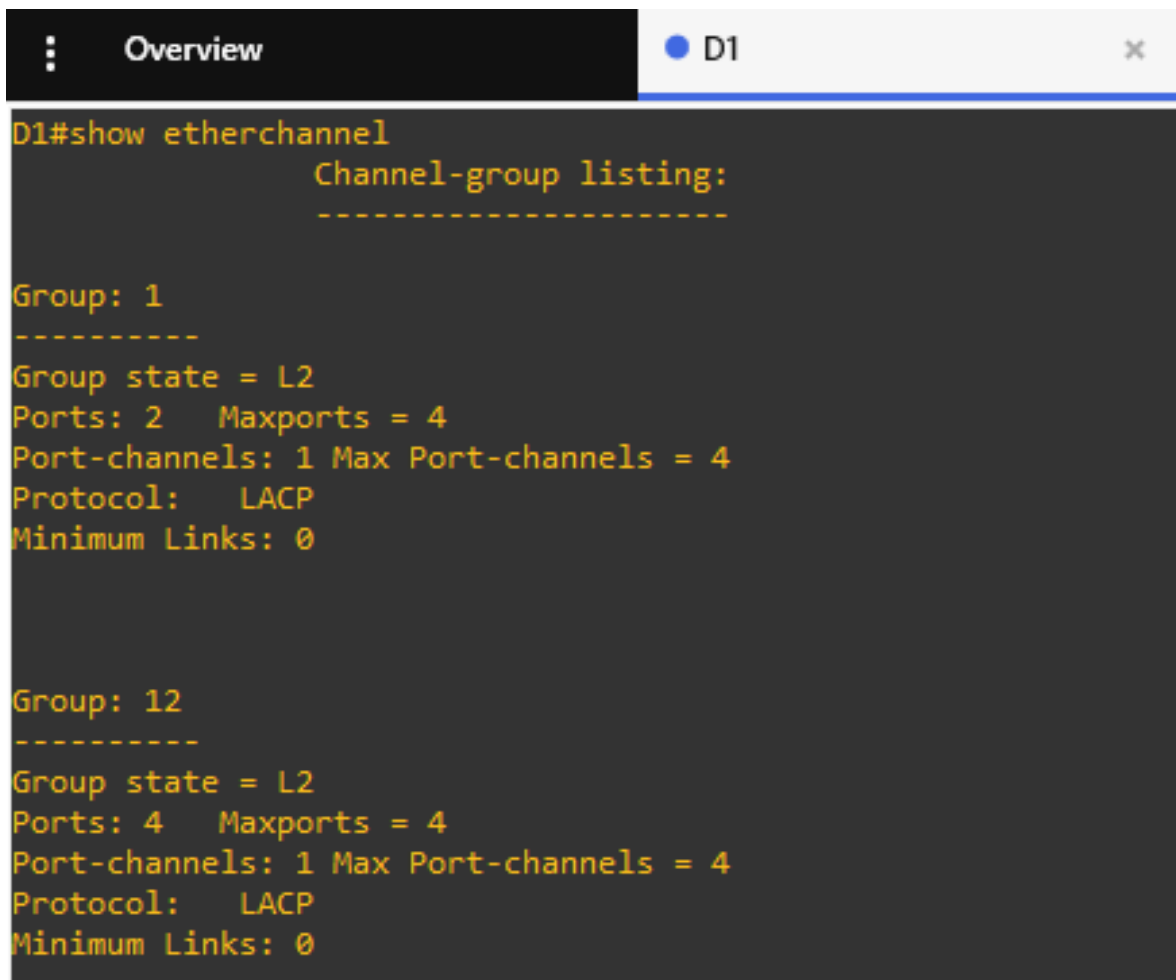
Figura 13. Protocolo Rapid Spanning-Tree y root bridges SW D2

Tarea 5: crear los LACP.

Switch D1:

```
interface range e2/0-3
  channel-group 12 mode active
  no shutdown
exit
```

```
interface range e0/1-2
  channel-group 1 mode active
  no shutdown
exit
```



The screenshot shows a terminal window titled "Overview" with a tab for "D1". The terminal displays the output of the command "D1#show etherchannel". The output is as follows:

```
D1#show etherchannel
      Channel-group listing:
      -----

Group: 1
-----
Group state = L2
Ports: 2   Maxports = 4
Port-channels: 1 Max Port-channels = 4
Protocol:  LACP
Minimum Links: 0

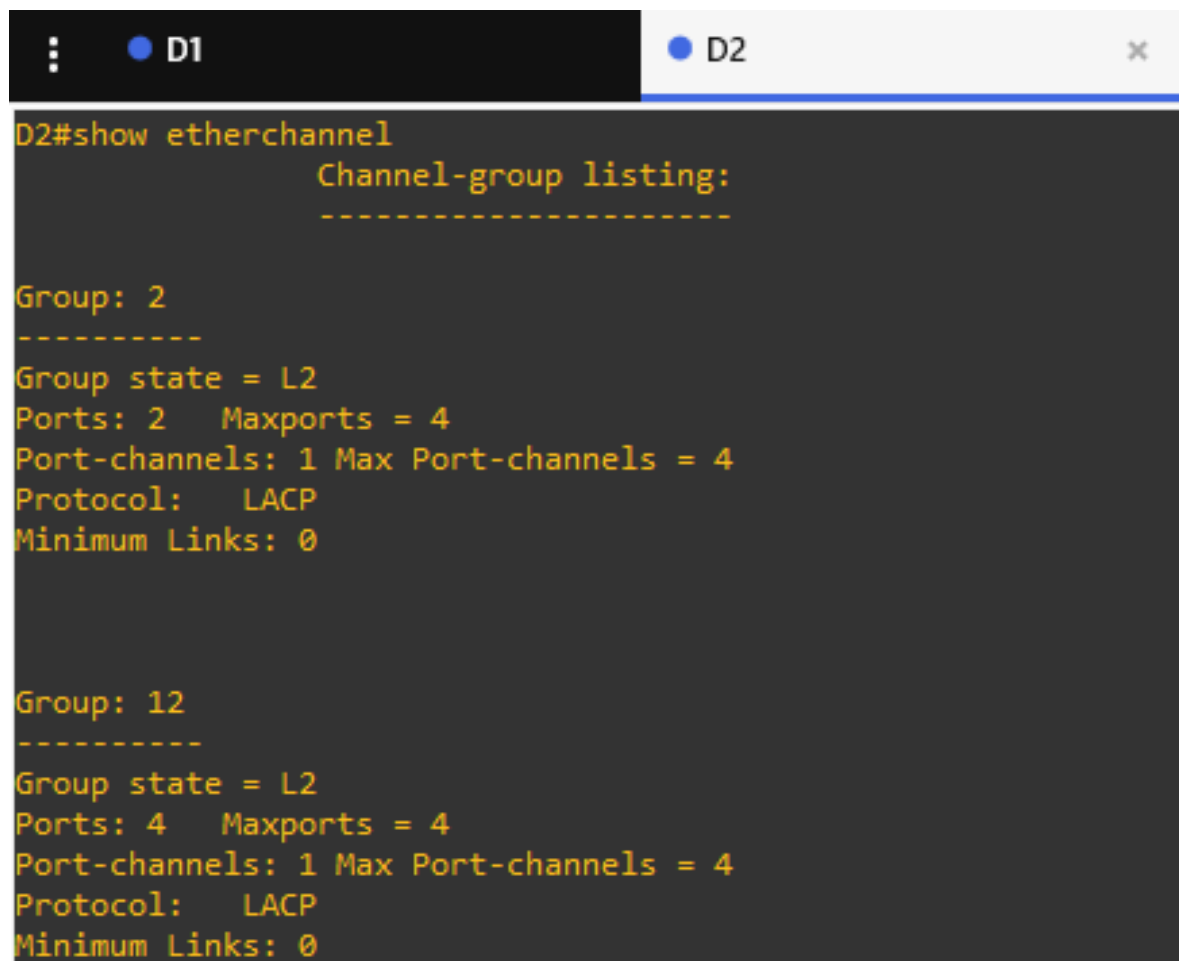
Group: 12
-----
Group state = L2
Ports: 4   Maxports = 4
Port-channels: 1 Max Port-channels = 4
Protocol:  LACP
Minimum Links: 0
```

Figura 14. Protocolo LACP y Port-Channel SW D1

Switch D2:

```
interface range e2/0-3
  channel-group 12 mode active
  no shutdown
exit
```

```
interface range e1/1-2
  channel-group 2 mode active
  no shutdown
exit
```



```
D2#show etherchannel
      Channel-group listing:
      -----

Group: 2
-----
Group state = L2
Ports: 2   Maxports = 4
Port-channels: 1 Max Port-channels = 4
Protocol:  LACP
Minimum Links: 0

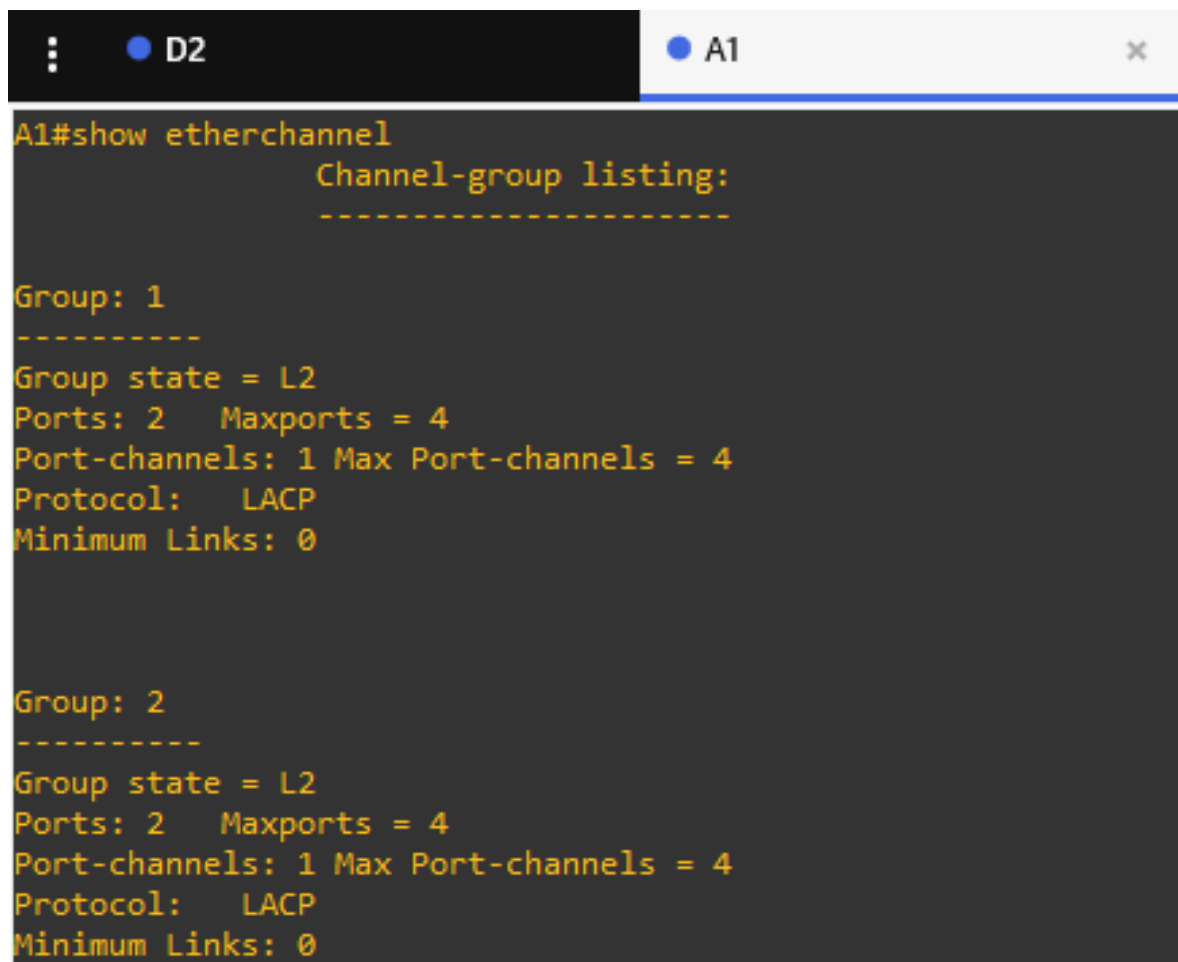
Group: 12
-----
Group state = L2
Ports: 4   Maxports = 4
Port-channels: 1 Max Port-channels = 4
Protocol:  LACP
Minimum Links: 0
```

Figura 15. Protocolo LACP y Port-Channel SW D2

Switch A1:


```
interface range e0/1-2
  channel-group 1 mode active
  no shutdown
  exit
```

```
interface range e1/1-2
  channel-group 2 mode active
  no shutdown
  exit
```



```
A1#show etherchannel
      Channel-group listing:
      -----

Group: 1
-----
Group state = L2
Ports: 2   Maxports = 4
Port-channels: 1 Max Port-channels = 4
Protocol:  LACP
Minimum Links: 0


Group: 2
-----
Group state = L2
Ports: 2   Maxports = 4
Port-channels: 1 Max Port-channels = 4
Protocol:  LACP
Minimum Links: 0
```

Figura 16. Protocolo LACP y Port-Channel SW A1

Tarea 6: Configurar los puertos de acceso a los PC.

Switch D1:

```
interface e0/0
  switchport mode access
  switchport access vlan 100
  spanning-tree portfast
  no shutdown
  exit
```

A screenshot of a network switch terminal window. The window has a dark background with yellow text. The title bar shows "Overview" and "D1". The terminal output shows the command "D1#show run int e0/0" and the resulting configuration for interface Ethernet0/0.

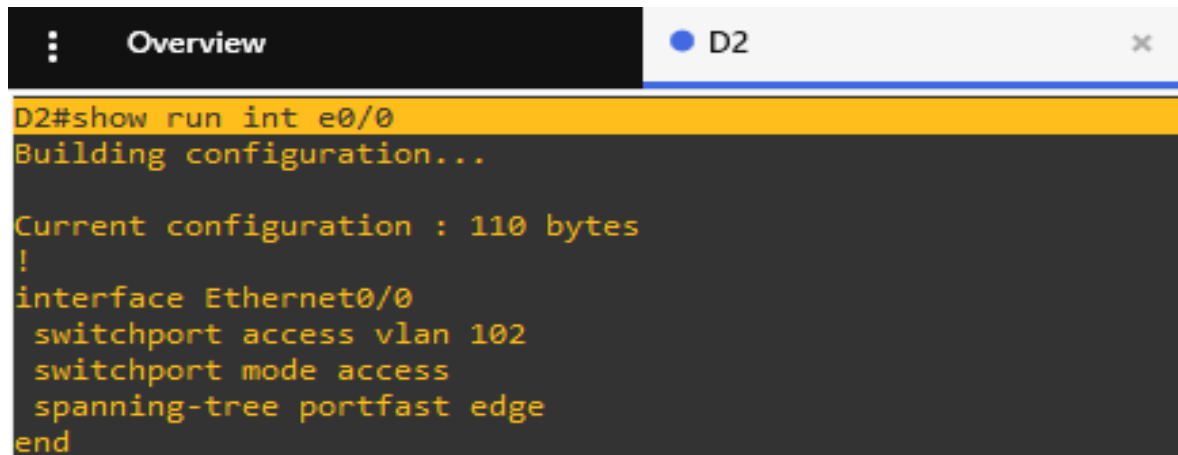
```
D1#show run int e0/0
Building configuration...

Current configuration : 110 bytes
!
interface Ethernet0/0
  switchport access vlan 100
  switchport mode access
  spanning-tree portfast edge
end
```

Figura 17. Puertos de acceso D1

Switch D2:

```
interface e0/0
  switchport mode access
  switchport access vlan 102
  spanning-tree portfast
  no shutdown
  exit
```



The screenshot shows a terminal window with a dark background and yellow text. The window title is "Overview" and the active tab is "D2". The terminal output shows the command "D2#show run int e0/0" and the resulting configuration for interface Ethernet0/0. The configuration includes setting the port to access mode, assigning it to VLAN 102, and enabling portfast.

```
D2#show run int e0/0
Building configuration...

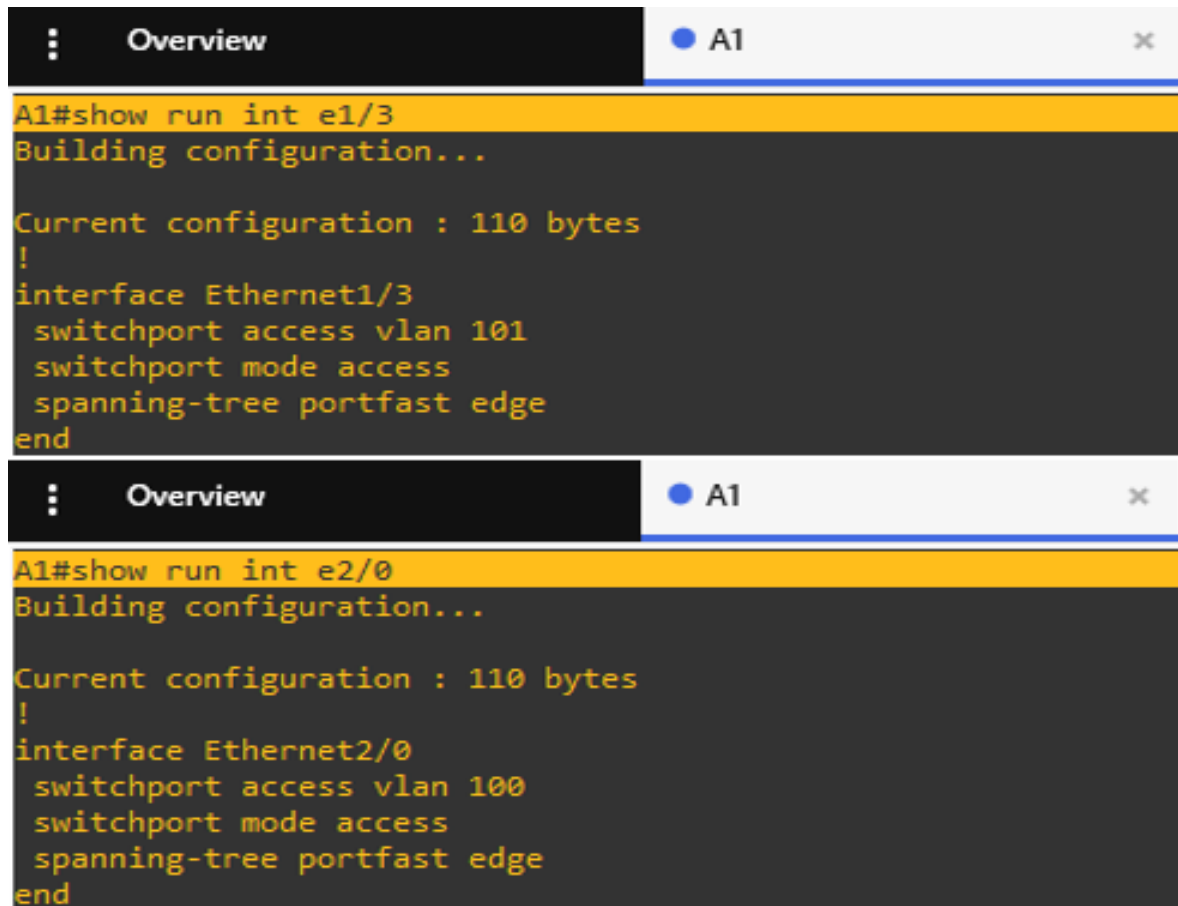
Current configuration : 110 bytes
!
interface Ethernet0/0
  switchport access vlan 102
  switchport mode access
  spanning-tree portfast edge
end
```

Figura 18. Puertos de acceso D2

Switch A1:

```
interface e1/3
  switchport mode access
  switchport access vlan 101
  spanning-tree portfast
  no shutdown
  exit

interface e2/0
  switchport mode access
  switchport access vlan 100
  spanning-tree portfast
  no shutdown
  exit
```



The image displays two screenshots of a network device terminal window. Each window has a title bar with 'Overview' and 'A1'. The first screenshot shows the command 'A1#show run int e1/3' and its output, which includes the configuration for interface Ethernet1/3: 'switchport access vlan 101', 'switchport mode access', and 'spanning-tree portfast edge'. The second screenshot shows the command 'A1#show run int e2/0' and its output, which includes the configuration for interface Ethernet2/0: 'switchport access vlan 100', 'switchport mode access', and 'spanning-tree portfast edge'.

```
A1#show run int e1/3
Building configuration...

Current configuration : 110 bytes
!
interface Ethernet1/3
  switchport access vlan 101
  switchport mode access
  spanning-tree portfast edge
end

A1#show run int e2/0
Building configuration...

Current configuration : 110 bytes
!
interface Ethernet2/0
  switchport access vlan 100
  switchport mode access
  spanning-tree portfast edge
end
```

Figura 19. Puertos de acceso A1

Tarea 7: Verificar los PC en DHCP:

```
PC2> sh
NAME      IP/MASK      GATEWAY      MAC          LPORT  RHOST:PORT
PC2       10.57.102.3/24  10.57.102.254  00:50:79:66:68:01  10008  127.0.0.1:10009
          fe80::250:79ff:fe66:6801/64
          2001:db8:100:102:2050:79ff:fe66:6801/64 eui-64

PC3> sh
NAME      IP/MASK      GATEWAY      MAC          LPORT  RHOST:PORT
PC3       10.57.101.3/24  57.0.101.254  00:50:79:66:68:02  10004  127.0.0.1:10005
          fe80::250:79ff:fe66:6802/64
          2001:db8:100:101:2050:79ff:fe66:6802/64 eui-64
```

Figura 20. Verificación DHCP PCs 2 y 3

Tarea 8: Verificación de la conectividad de la LAN local

PC1 should successfully ping:

- D1: 10.57.100.1
- D2: 10.57.100.2
- PC4: 10.57.100.6

```
PC1> sh
NAME      IP/MASK      GATEWAY      MAC      LPORT  RHOST:PORT
PC1      10.57.100.5/24  10.57.100.254  00:50:79:66:68:00  10006  127.0.0.1:10007
         fe80::250:79ff:fe66:6800/64
         2001:db8:100:100:2050:79ff:fe66:6800/64

PC1> ping 10.57.100.1
84 bytes from 10.57.100.1 icmp_seq=1 ttl=255 time=1.862 ms
84 bytes from 10.57.100.1 icmp_seq=2 ttl=255 time=1.584 ms
84 bytes from 10.57.100.1 icmp_seq=3 ttl=255 time=1.742 ms
84 bytes from 10.57.100.1 icmp_seq=4 ttl=255 time=1.954 ms
84 bytes from 10.57.100.1 icmp_seq=5 ttl=255 time=1.557 ms

PC1> ping 10.57.100.2
84 bytes from 10.57.100.2 icmp_seq=1 ttl=255 time=2.219 ms
84 bytes from 10.57.100.2 icmp_seq=2 ttl=255 time=2.382 ms
84 bytes from 10.57.100.2 icmp_seq=3 ttl=255 time=2.508 ms
84 bytes from 10.57.100.2 icmp_seq=4 ttl=255 time=2.433 ms
84 bytes from 10.57.100.2 icmp_seq=5 ttl=255 time=2.144 ms

PC1> ping 10.57.100.6
84 bytes from 10.57.100.6 icmp_seq=1 ttl=64 time=3.321 ms
84 bytes from 10.57.100.6 icmp_seq=2 ttl=64 time=4.216 ms
84 bytes from 10.57.100.6 icmp_seq=3 ttl=64 time=4.244 ms
84 bytes from 10.57.100.6 icmp_seq=4 ttl=64 time=4.061 ms
84 bytes from 10.57.100.6 icmp_seq=5 ttl=64 time=3.627 ms
```

Figura 21. Ping en PC 1

PC2 should successfully ping:

- D1: 10.57.102.1
- D2: 10.57.102.2

```
PC2> sh
NAME      IP/MASK      GATEWAY      MAC      LPORT  RHOST:PORT
PC2       10.57.102.3/24  10.57.102.254  00:50:79:66:68:01  10008  127.0.0.1:10009
          fe80::250:79ff:fe66:6801/64
          2001:db8:100:102:2050:79ff:fe66:6801/64 eui-64

PC2> ping 10.57.102.1
84 bytes from 10.57.102.1 icmp_seq=1 ttl=255 time=2.844 ms
84 bytes from 10.57.102.1 icmp_seq=2 ttl=255 time=1.882 ms
84 bytes from 10.57.102.1 icmp_seq=3 ttl=255 time=2.144 ms
84 bytes from 10.57.102.1 icmp_seq=4 ttl=255 time=2.596 ms
84 bytes from 10.57.102.1 icmp_seq=5 ttl=255 time=5.755 ms

PC2> ping 10.57.102.2
84 bytes from 10.57.102.2 icmp_seq=1 ttl=255 time=1.077 ms
84 bytes from 10.57.102.2 icmp_seq=2 ttl=255 time=2.202 ms
84 bytes from 10.57.102.2 icmp_seq=3 ttl=255 time=1.326 ms
84 bytes from 10.57.102.2 icmp_seq=4 ttl=255 time=1.633 ms
84 bytes from 10.57.102.2 icmp_seq=5 ttl=255 time=1.927 ms
```

Figura 22. Ping en PC 2

PC3 should successfully ping:

- D1: 10.57.101.1
- D2: 10.57.101.2

```
PC3> sh
NAME      IP/MASK      GATEWAY      MAC      LPORT  RHOST:PORT
PC3       10.57.101.3/24  57.0.101.254  00:50:79:66:68:02  10004  127.0.0.1:10005
          fe80::250:79ff:fe66:6802/64
          2001:db8:100:101:2050:79ff:fe66:6802/64 eui-64

PC3> ping 10.57.101.1
84 bytes from 10.57.101.1 icmp_seq=1 ttl=255 time=3.029 ms
84 bytes from 10.57.101.1 icmp_seq=2 ttl=255 time=3.354 ms
84 bytes from 10.57.101.1 icmp_seq=3 ttl=255 time=3.353 ms
84 bytes from 10.57.101.1 icmp_seq=4 ttl=255 time=3.545 ms
84 bytes from 10.57.101.1 icmp_seq=5 ttl=255 time=2.583 ms

PC3> ping 10.57.101.2
84 bytes from 10.57.101.2 icmp_seq=1 ttl=255 time=3.105 ms
84 bytes from 10.57.101.2 icmp_seq=2 ttl=255 time=2.854 ms
84 bytes from 10.57.101.2 icmp_seq=3 ttl=255 time=2.203 ms
84 bytes from 10.57.101.2 icmp_seq=4 ttl=255 time=2.230 ms
84 bytes from 10.57.101.2 icmp_seq=5 ttl=255 time=2.481 ms
```

Figura 23. Ping en PC 3

PC4 should successfully ping:

- D1: 10.57.100.1
- D2: 10.57.100.2
- PC1: 10.57.100.5


```
PC4> sh
NAME      IP/MASK      GATEWAY      MAC      LPORT  RHOST:PORT
PC4      10.57.100.6/24  10.57.100.254  00:50:79:66:68:03  10010  127.0.0.1:10011
        fe80::250:79ff:fe66:6803/64
        2001:db8:100:100:2050:79ff:fe66:6803/64

PC4> ping 10.57.100.1
84 bytes from 10.57.100.1 icmp_seq=1 ttl=255 time=2.788 ms
84 bytes from 10.57.100.1 icmp_seq=2 ttl=255 time=2.823 ms
84 bytes from 10.57.100.1 icmp_seq=3 ttl=255 time=2.710 ms
84 bytes from 10.57.100.1 icmp_seq=4 ttl=255 time=2.890 ms
84 bytes from 10.57.100.1 icmp_seq=5 ttl=255 time=2.223 ms

PC4> ping 10.57.100.2
84 bytes from 10.57.100.2 icmp_seq=1 ttl=255 time=3.111 ms
84 bytes from 10.57.100.2 icmp_seq=2 ttl=255 time=3.547 ms
84 bytes from 10.57.100.2 icmp_seq=3 ttl=255 time=7.374 ms
84 bytes from 10.57.100.2 icmp_seq=4 ttl=255 time=3.339 ms
84 bytes from 10.57.100.2 icmp_seq=5 ttl=255 time=3.577 ms

PC4> ping 10.57.100.5
84 bytes from 10.57.100.5 icmp_seq=1 ttl=64 time=4.489 ms
84 bytes from 10.57.100.5 icmp_seq=2 ttl=64 time=4.131 ms
84 bytes from 10.57.100.5 icmp_seq=3 ttl=64 time=2.979 ms
84 bytes from 10.57.100.5 icmp_seq=4 ttl=64 time=3.876 ms
84 bytes from 10.57.100.5 icmp_seq=5 ttl=64 time=4.304 ms
```

Figura 24. Ping en PC 4

Parte 3: Configurar protocolos de enrutamiento

En esta parte, configurará los protocolos de enrutamiento IPv4 e IPv6. Al final de esta parte, la red debe ser completamente convergente. Los pings IPv4 e IPv6 a la interfaz Loopback 0 desde D1 y D2 deberían realizarse correctamente.

Nota: Los pings de los hosts no se realizarán correctamente porque sus puertos de enlace predeterminadas apuntan a la dirección HSRP que se habilitará en la Parte 4.

Las tareas de configuración son las siguientes:

Tarea 1: En la "Red de la empresa" (es decir, R1, R3, D1 y D2), configure OSPFv2 de área única en el área 0.

Utilice OSPF Procesos ID 4 y asigne los siguientes ID de router:

- R1: 0.0.4.1

```
router ospf 4  
router-id 0.0.4.1
```

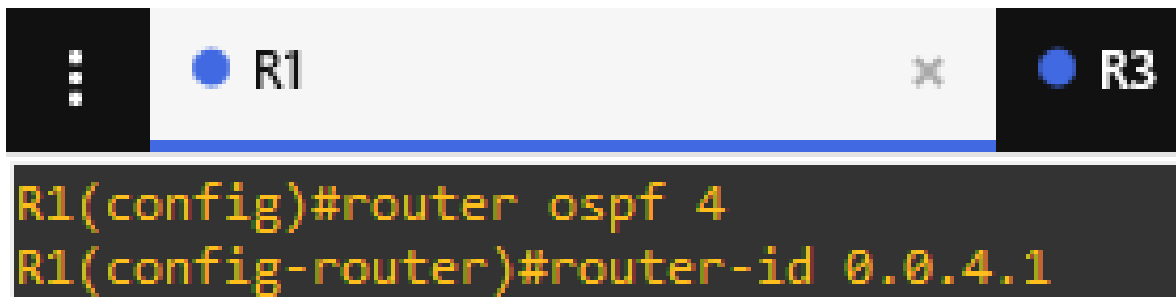


Figura 25. OSPF ID 4 en R1

- R3: 0.0.4.3

```
router ospf 4  
router-id 0.0.4.3
```

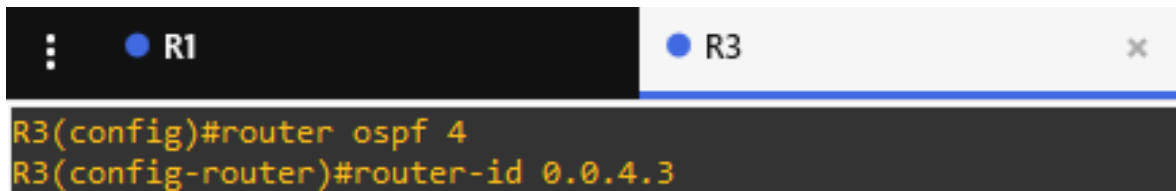
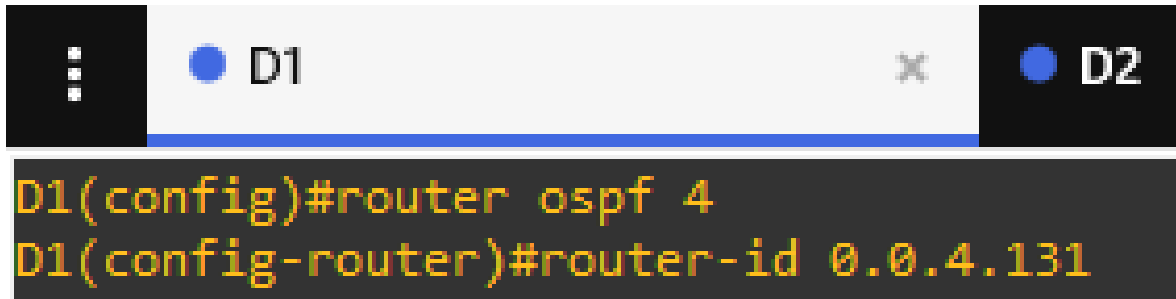


Figura 26. OSPF ID 4 en R3

- D1: 0.0. 4.131

```
router ospf 4  
router-id 0.0.4.131
```



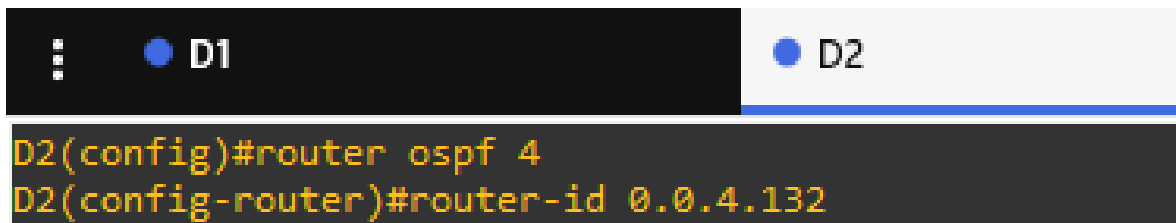
A terminal window with a title bar containing a menu icon, a blue dot, and the text 'D1'. To the right of the title bar is a close button 'x' and another tab with a blue dot and the text 'D2'. The terminal content shows the following commands and prompts:

```
D1(config)#router ospf 4
D1(config-router)#router-id 0.0.4.131
```

Figura 27. OSPF ID 4 en D1

- D2: 0.0.4.132

```
router ospf 4
router-id 0.0.4.132
```



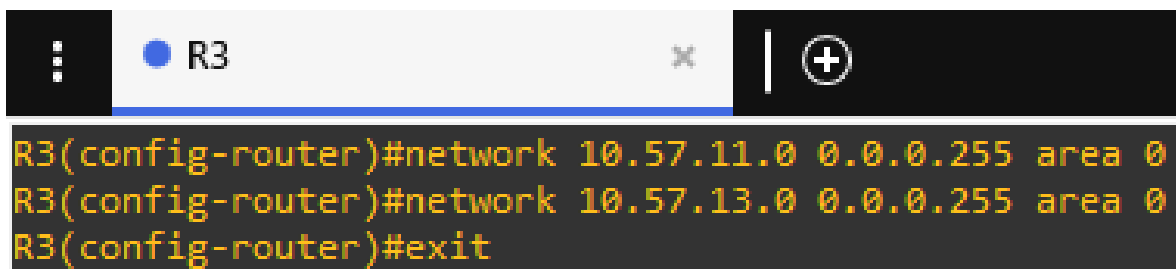
A terminal window with a title bar containing a menu icon, a blue dot, and the text 'D1'. To the right of the title bar is another tab with a blue dot and the text 'D2'. The terminal content shows the following commands and prompts:

```
D2(config)#router ospf 4
D2(config-router)#router-id 0.0.4.132
```

Figura 28. OSPF ID 4 en D2

En R1, R3, D1 y D2, anuncie todas las redes / VLAN conectadas directamente en el Área 0.

```
network 10.57.11.0 0.0.0.255 area 0
network 10.57.13.0 0.0.0.255 area 0
```



A terminal window with a title bar containing a menu icon, a blue dot, and the text 'R3'. To the right of the title bar is a close button 'x' and a plus sign icon. The terminal content shows the following commands and prompts:

```
R3(config-router)#network 10.57.11.0 0.0.0.255 area 0
R3(config-router)#network 10.57.13.0 0.0.0.255 area 0
R3(config-router)#exit
```

Figura 29. Redes en R3

```
network 10.57.100.0 0.0.0.255 area 0
network 10.57.101.0 0.0.0.255 area 0
network 10.57.102.0 0.0.0.255 area 0
network 10.57.10.0 0.0.0.255 area 0
```

```

D1(config-router)#network 10.57.100.0 0.0.0.255 area 0
D1(config-router)#network 10.57.101.0 0.0.0.255 area 0
D1(config-router)#network 10.57.102.0 0.0.0.255 area 0
D1(config-router)#network 10.57.10.0 0.0.0.255 area 0

```

Figura 30. Redes en D1

```

network 10.57.100.0 0.0.0.255 area 0
network 10.57.101.0 0.0.0.255 area 0
network 10.57.102.0 0.0.0.255 area 0
network 10.57.11.0 0.0.0.255 area 0

```

```

D2(config-router)#network 10.57.100.0 0.0.0.255 area 0
D2(config-router)#network 10.57.101.0 0.0.0.255 area 0
D2(config-router)#network 10.57.102.0 0.0.0.255 area 0
D2(config-router)#network 10.57.11.0 0.0.0.255 area 0

```

Figura 31. Redes en D2

- En R1, no anuncie la red R1 – R2.

```

network 10.57.10.0 0.0.0.255 area 0
network 10.57.13.0 0.0.0.255 area 0

```

```

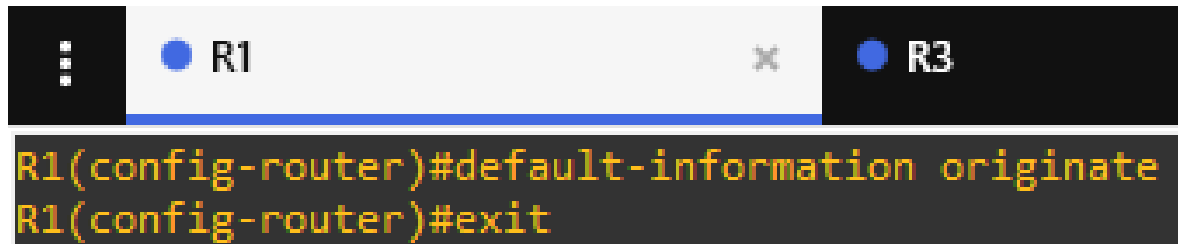
R1(config-router)#network 10.57.10.0 0.0.0.255 area 0
R1(config-router)#network 10.57.13.0 0.0.0.255 area 0

```

Figura 32. Redes en R1

- En R1, propague una ruta predeterminada. Tenga en cuenta que BGP proporcionará la ruta predeterminada.

```
default-information originate
```



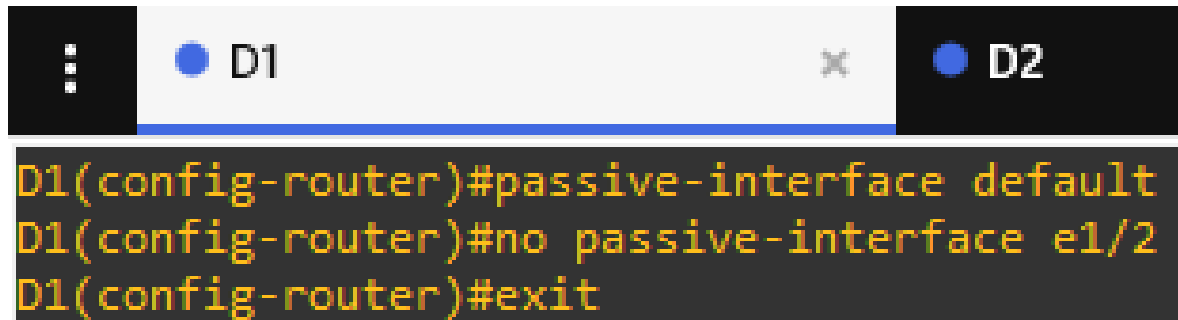
```
R1
R1(config-router)#default-information originate
R1(config-router)#exit
```

Figura 33. Predeterminada en R1

Desactive los anuncios de OSPF v2 en:

- D1: Todas las interfaces excepto E1/2

```
passive-interface default
no passive-interface e1/2
```

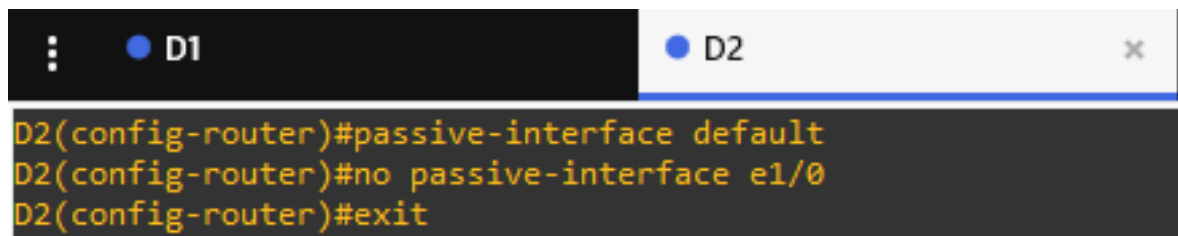


```
D1
D1(config-router)#passive-interface default
D1(config-router)#no passive-interface e1/2
D1(config-router)#exit
```

Figura 34. Desactivando anuncios OSPF en D1

- D2: Todas las interfaces excepto E1/0

```
passive-interface default
no passive-interface e1/0
```



```
D2
D2(config-router)#passive-interface default
D2(config-router)#no passive-interface e1/0
D2(config-router)#exit
```

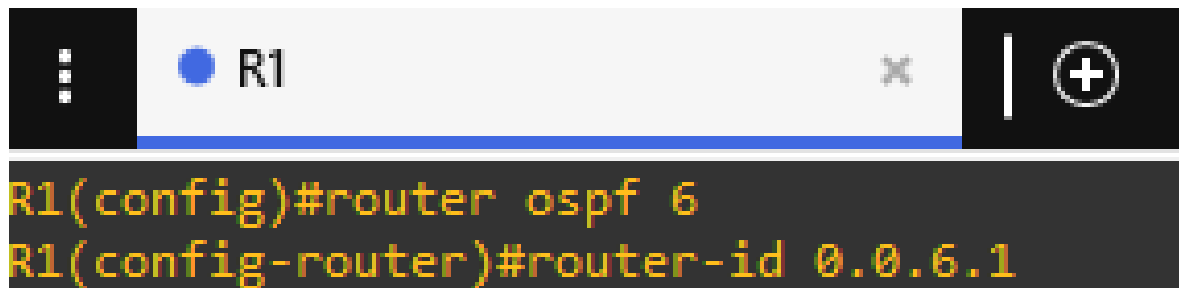
Figura 35. Desactivando anuncios OSPF en D2

Tarea 2: En la "Red de la empresa" (es decir, R1, R3, D1 y D2), configure OSPFv3 clásico de área única en el área 0.

Utilice OSPF Procesos ID 6 y asigne los siguientes ID de router:

- R1: 0.0.6.1

```
router ospf 6  
router-id 0.0.6.1
```

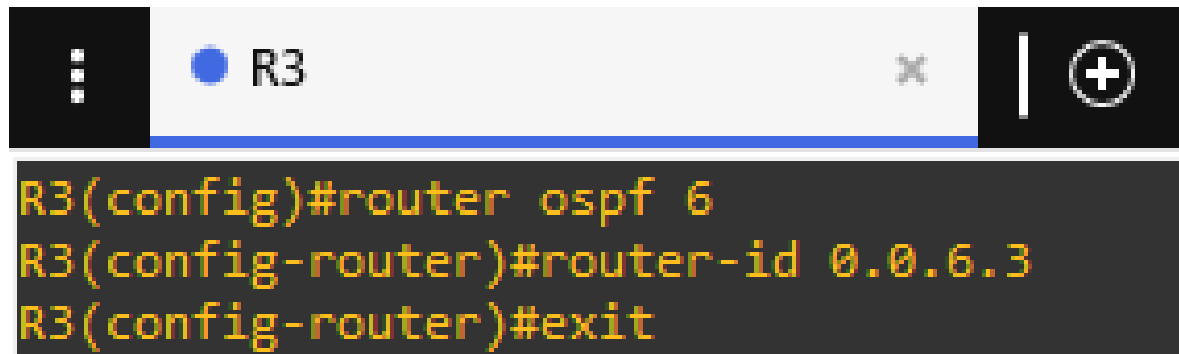
A screenshot of a terminal window for router R1. The window title bar shows a blue dot and the text 'R1'. The terminal output is as follows:

```
R1(config)#router ospf 6  
R1(config-router)#router-id 0.0.6.1
```

Figura 36. OSPF ID 6 en R1

- R3: 0.0.6.3

```
router ospf 6  
router-id 0.0.6.3
```

A screenshot of a terminal window for router R3. The window title bar shows a blue dot and the text 'R3'. The terminal output is as follows:

```
R3(config)#router ospf 6  
R3(config-router)#router-id 0.0.6.3  
R3(config-router)#exit
```

Figura 37. OSPF ID 6 en R3

- D1: 0.0.6.131

```
router ospf 6  
router-id 0.0.6.131
```

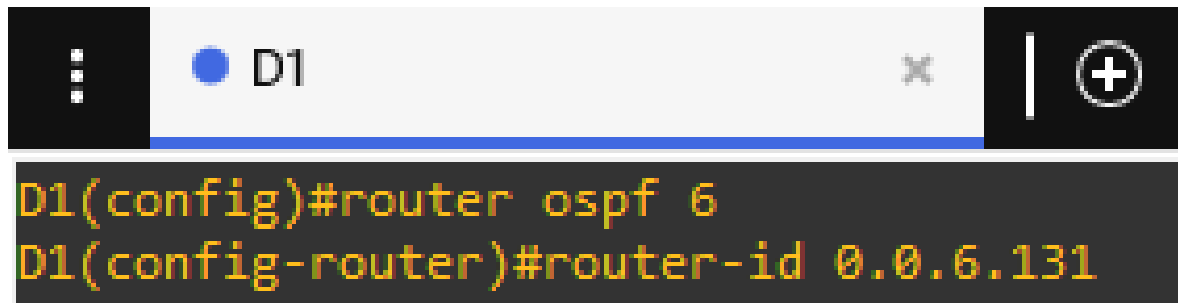


Figura 38. OSPF ID 6 en D1

- D2: 0.0.6.132

```
router ospf 6  
router-id 0.0.6.132
```

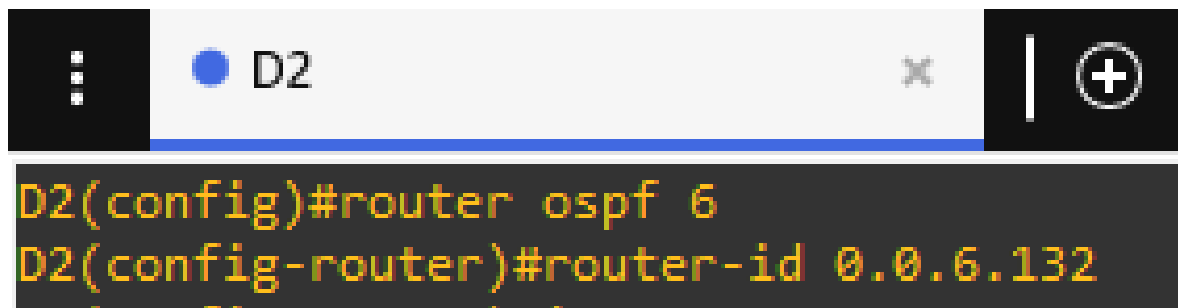
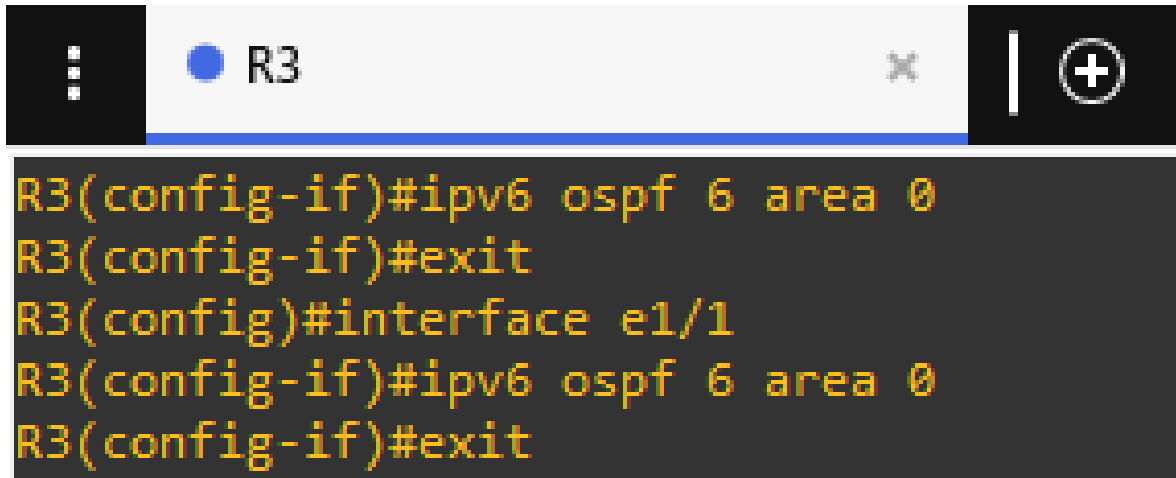


Figura 39. OSPF ID 6 en D2

En R1, R3, D1 y D2, anuncie todas las redes / VLAN conectadas directamente en el Área 0.

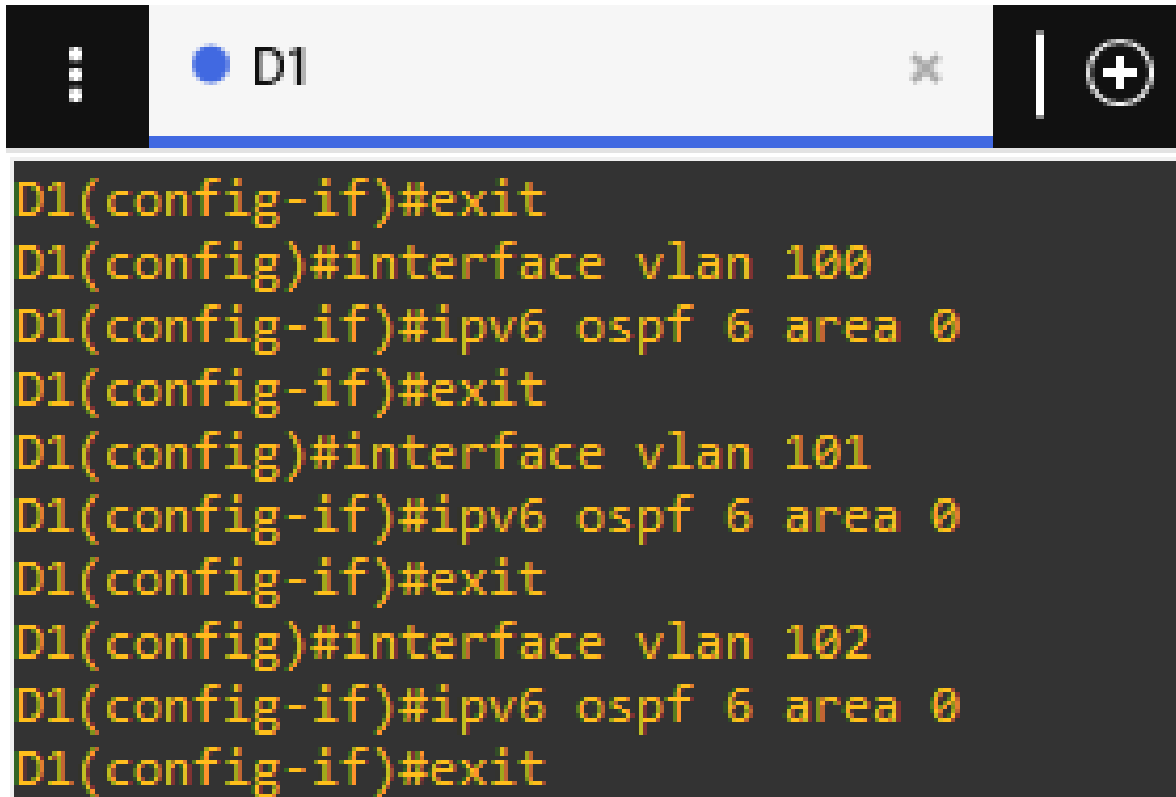
```
interface e1/0  
ipv6 ospf 6 area 0  
exit  
interface e1/1  
ipv6 ospf 6 area 0  
exit
```

A terminal window titled 'R3' with a blue dot icon on the left and a close 'x' icon on the right. The terminal content shows the following commands and prompts:

```
R3(config-if)#ipv6 ospf 6 area 0
R3(config-if)#exit
R3(config)#interface e1/1
R3(config-if)#ipv6 ospf 6 area 0
R3(config-if)#exit
```

Figura 40. Redes en R3

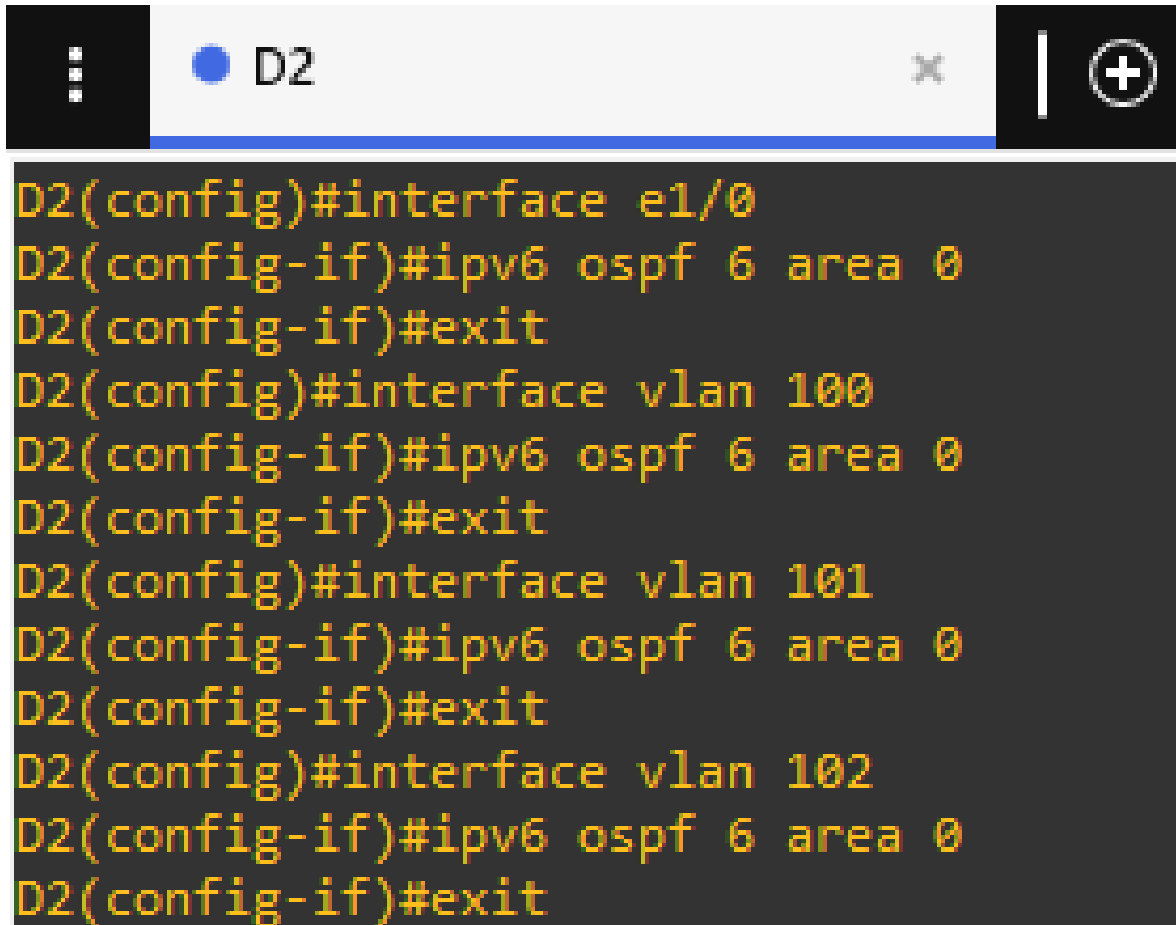
```
interface e1/2
ipv6 ospf 6 area 0
exit
interface vlan 100
ipv6 ospf 6 area 0
exit
interface vlan 101
ipv6 ospf 6 area 0
exit
interface vlan 102
ipv6 ospf 6 area 0
exit
```

```
D1(config-if)#exit
D1(config)#interface vlan 100
D1(config-if)#ipv6 ospf 6 area 0
D1(config-if)#exit
D1(config)#interface vlan 101
D1(config-if)#ipv6 ospf 6 area 0
D1(config-if)#exit
D1(config)#interface vlan 102
D1(config-if)#ipv6 ospf 6 area 0
D1(config-if)#exit
```

Figura 41. Redes en D1

```
interface e1/0
ipv6 ospf 6 area 0
exit
interface vlan 100
ipv6 ospf 6 area 0
exit
interface vlan 101
ipv6 ospf 6 area 0
exit
interface vlan 102
ipv6 ospf 6 area 0
exit
```

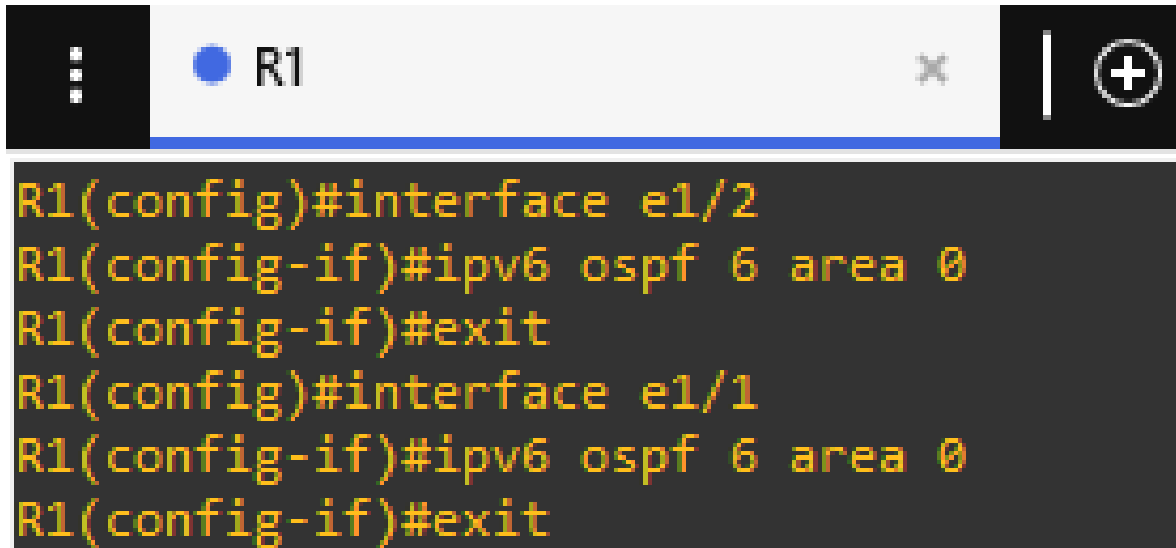


```
D2(config)#interface e1/0
D2(config-if)#ipv6 ospf 6 area 0
D2(config-if)#exit
D2(config)#interface vlan 100
D2(config-if)#ipv6 ospf 6 area 0
D2(config-if)#exit
D2(config)#interface vlan 101
D2(config-if)#ipv6 ospf 6 area 0
D2(config-if)#exit
D2(config)#interface vlan 102
D2(config-if)#ipv6 ospf 6 area 0
D2(config-if)#exit
```

Figura 42. Redes en D2

- En R1, no anuncie la red R1 – R2.

```
interface e1/2
ipv6 ospf 6 area 0
exit
interface e1/1
ipv6 ospf 6 area 0
exit
```

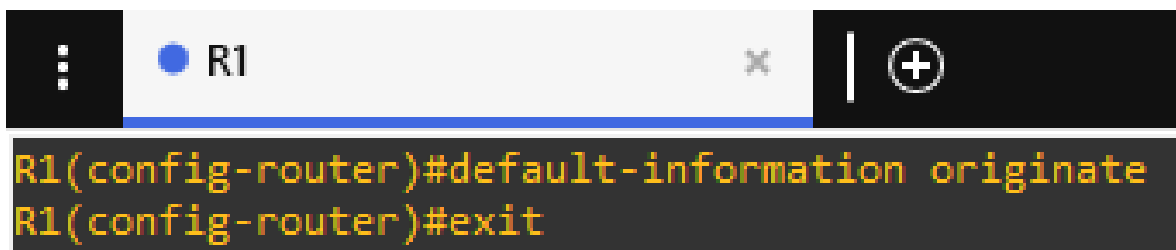


```
R1(config)#interface e1/2
R1(config-if)#ipv6 ospf 6 area 0
R1(config-if)#exit
R1(config)#interface e1/1
R1(config-if)#ipv6 ospf 6 area 0
R1(config-if)#exit
```

Figura 43. Redes en R1

- En R1, propague una ruta predeterminada. Tenga en cuenta que BGP proporcionará la ruta predeterminada

```
default-information originate
exit
```



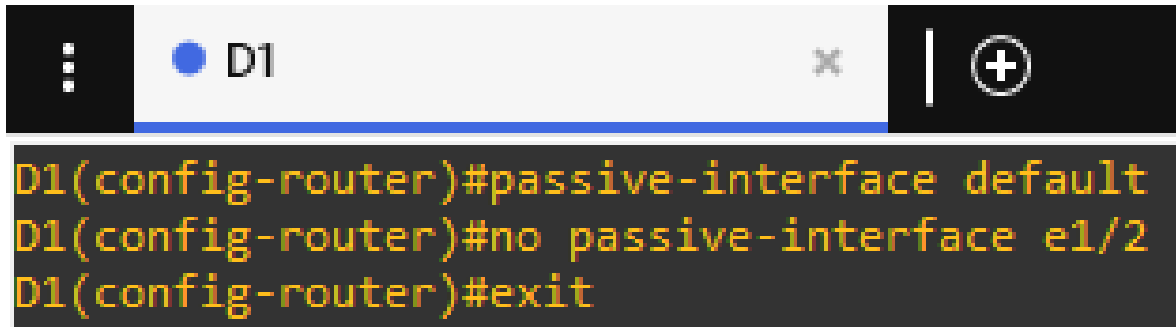
```
R1(config-router)#default-information originate
R1(config-router)#exit
```

Figura 44. Predeterminada R1

Desactive los anuncios de OSPFv3 en:

- D1: Todas las interfaces excepto E1/2

```
passive-interface default
no passive-interface e1/2
exit
```

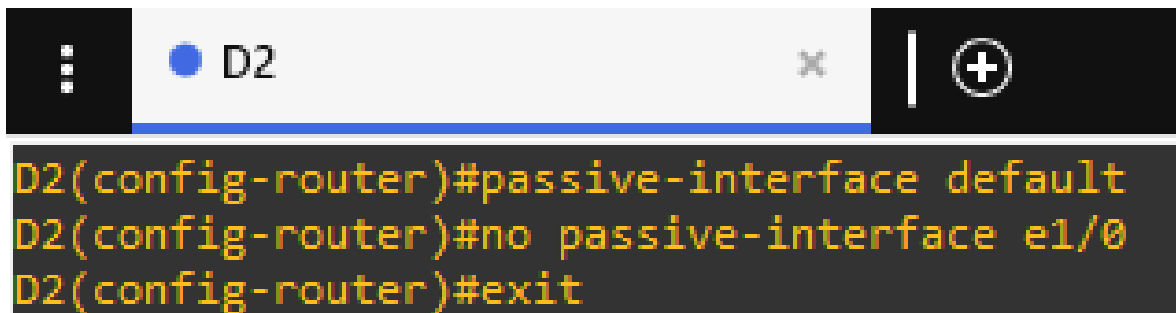


```
D1(config-router)#passive-interface default
D1(config-router)#no passive-interface e1/2
D1(config-router)#exit
```

Figura 45. Anuncios OSPF v3 en D1

- D2: Todas las interfaces excepto E1/0

```
passive-interface default
no passive-interface e1/0
exit
```



```
D2(config-router)#passive-interface default
D2(config-router)#no passive-interface e1/0
D2(config-router)#exit
```

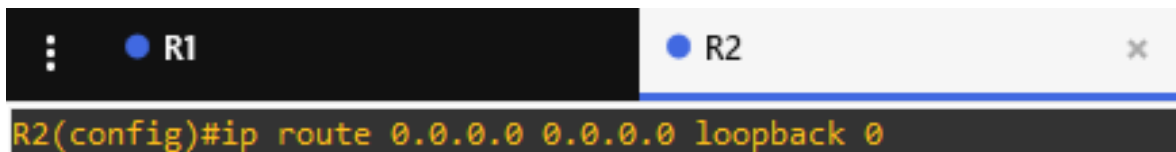
Figura 46. Anuncios OSPF v3 en D2

Tarea 3: En R2 en la "Red ISP", cen la figura MP-BGP.

Configure dos rutas estáticas predeterminadas a través de la interfaz Loopback 0:

- Una ruta estática predeterminada IPv4.

```
ip route 0.0.0.0 0.0.0.0 loopback 0
```

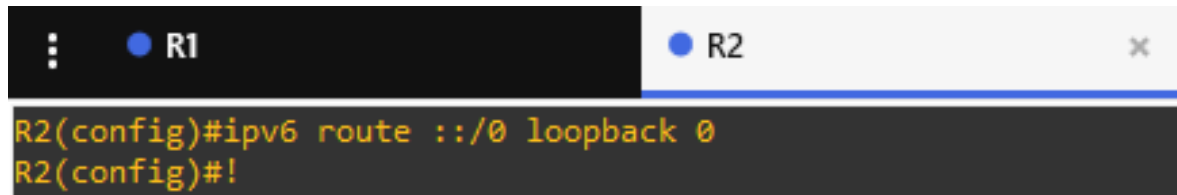


```
R2(config)#ip route 0.0.0.0 0.0.0.0 loopback 0
```

Figura 47. Estática en R2

- Una ruta estática predeterminada IPv6.

```
ipv6 route ::/0 loopback 0
```

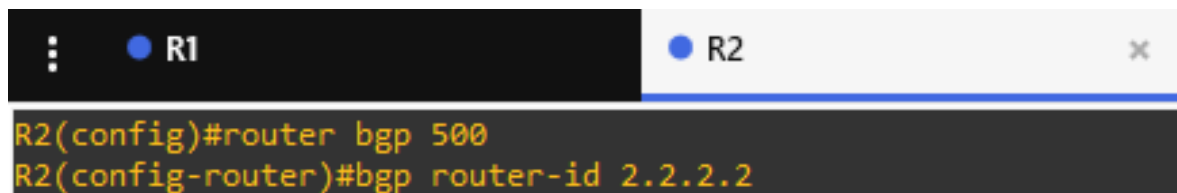


```
R2(config)#ipv6 route ::/0 loopback 0
R2(config)#!
```

Figura 48. Estática IPv6 en R2

Configure R2 en BGP ASN 500 y utilice el router-id 2.2.2.2.

```
router bgp 500
bgp router-id 2.2.2.2
```

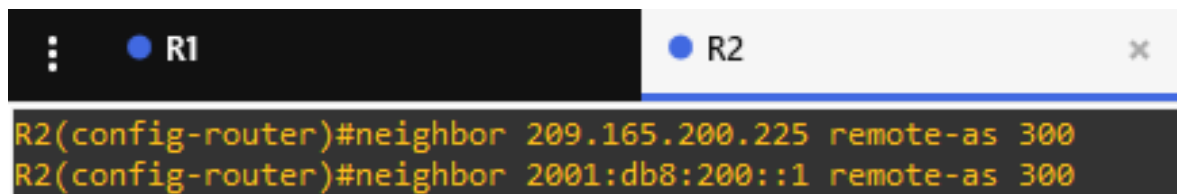


```
R2(config)#router bgp 500
R2(config-router)#bgp router-id 2.2.2.2
```

Figura 49. BGP 500 en R2

Configure y habilite una relación de vecino IPv4 e IPv6 con R1 en ASN 300.

```
neighbor 209.165.200.225 remote-as 300
neighbor 2001:db8:200::1 remote-as 300
```



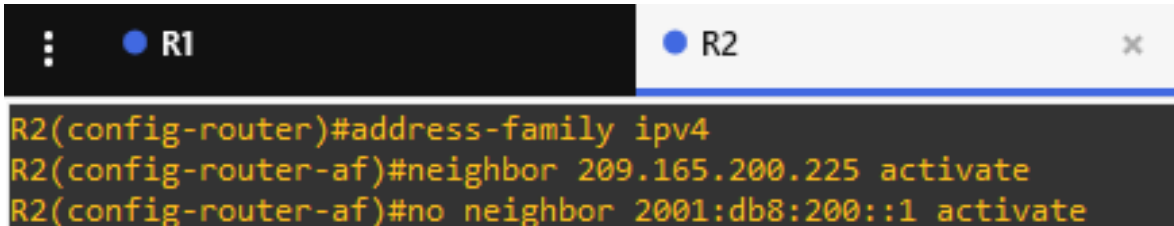
```
R2(config-router)#neighbor 209.165.200.225 remote-as 300
R2(config-router)#neighbor 2001:db8:200::1 remote-as 300
```

Figura 50. ANS 300 en R2

En la familia de direcciones IPv4, anuncie:

- La red IPv4 de bucle invertido 0 (/32).

```
address-family ipv4
neighbor 209.165.200.225 activate
no neighbor 2001:db8:200::1 activate
```

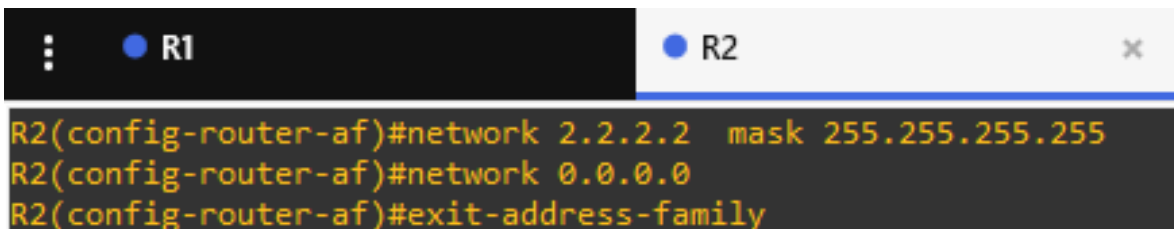


```
R2(config-router)#address-family ipv4
R2(config-router-af)#neighbor 209.165.200.225 activate
R2(config-router-af)#no neighbor 2001:db8:200::1 activate
```

Figura 51. Familia IPv4 en R2

- La ruta predeterminada (0.0.0.0/0).

```
network 2.2.2.2 mask 255.255.255.255
network 0.0.0.0
exit-address-family
```



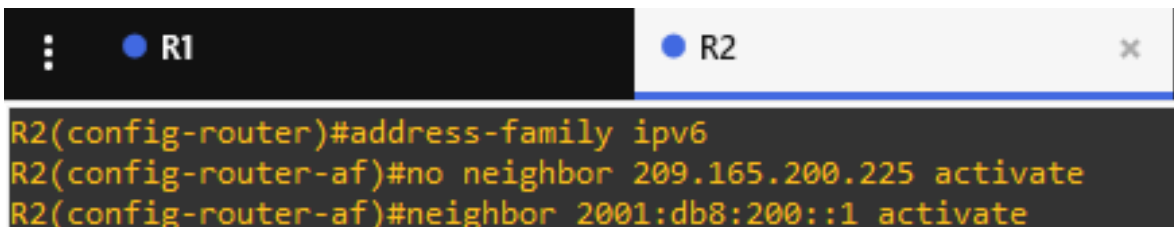
```
R2(config-router-af)#network 2.2.2.2 mask 255.255.255.255
R2(config-router-af)#network 0.0.0.0
R2(config-router-af)#exit-address-family
```

Figura 52. Ruta predeterminada en R2

En Familia de direcciones IPv6 , anuncie:

- La red IPv4 de bucle invertido 0 (/128).

```
address-family ipv6
no neighbor 209.165.200.225 activate
neighbor 2001:db8:200::1 activate
```



```
R2(config-router)#address-family ipv6
R2(config-router-af)#no neighbor 209.165.200.225 activate
R2(config-router-af)#neighbor 2001:db8:200::1 activate
```

Figura 53. Familia IPv6

- La ruta predeterminada (::/0).

```
network 2001:db8:2222::/128
network ::/0
exit-address-family
```

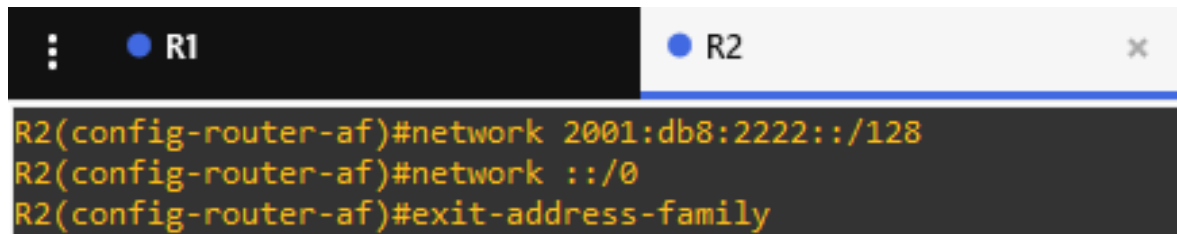


Figura 54. Predeterminada IPv6

Tarea 4: En R1 en la "Red ISP", configure MP-BGP.

Configure dos rutas de resumen estáticas para la interfaz Null 0:

- Un resumen de la ruta IPv4 para 10.XY.0.0/8

```
ip route 10.57.0.0 255.255.0.0 null0
```

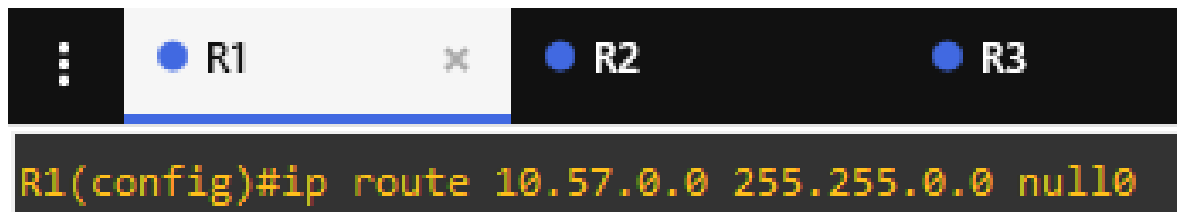


Figura 55. Null para IPv4 en R1

- Un resumen de la ruta IPv6 para 2001:db8:100::/48

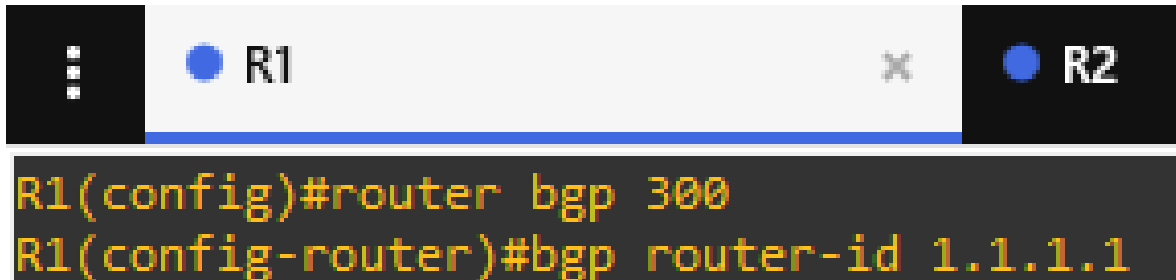
```
ipv6 route 2001:db8:100::/48 null0
```



Figura 56. Null para IPv6 en R1

Configure R1 en BGP ASN 300 y utilice el router-id 1.1.1.1.

```
router bgp 300  
bgp router-id 1.1.1.1
```

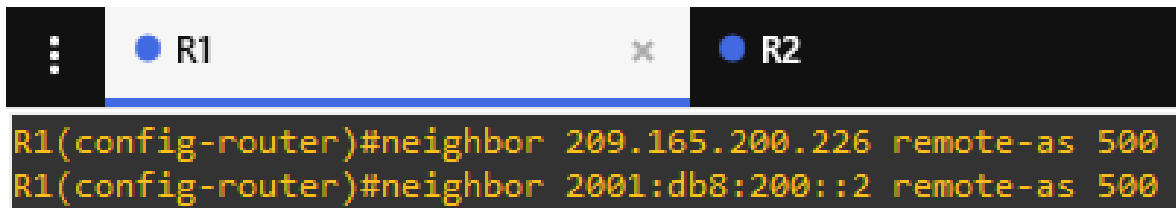


```
R1(config)#router bgp 300  
R1(config-router)#bgp router-id 1.1.1.1
```

Figura 57. ASN 300 en R1

Configure una relación de vecino IPv4 e IPv6 con R2 en ASN 500.

```
neighbor 209.165.200.226 remote-as 500  
neighbor 2001:db8:200::2 remote-as 500
```



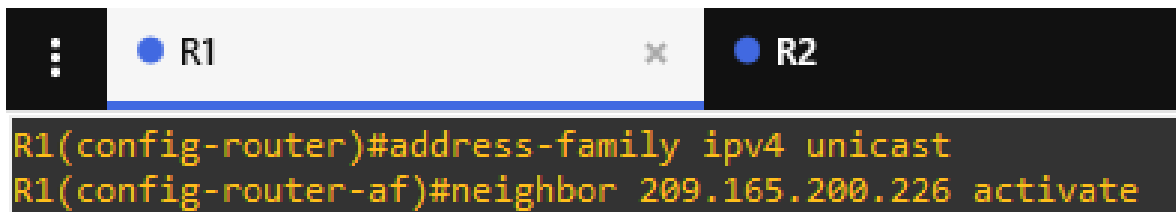
```
R1(config-router)#neighbor 209.165.200.226 remote-as 500  
R1(config-router)#neighbor 2001:db8:200::2 remote-as 500
```

Figura 58. ASN 500 en R1

En la familia de direcciones IPv4:

- Habilite la relación de vecino IPv4.

```
address-family ipv4 unicast  
neighbor 209.165.200.226 activate
```

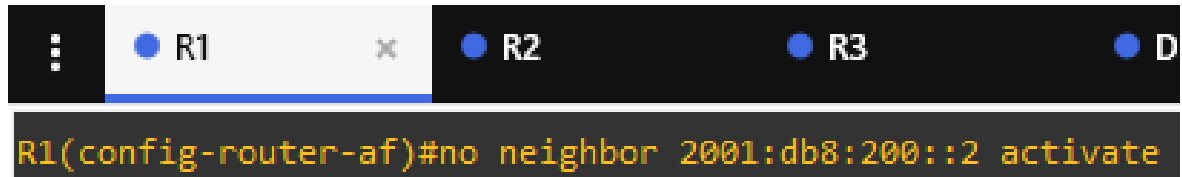


```
R1(config-router)#address-family ipv4 unicast  
R1(config-router-af)#neighbor 209.165.200.226 activate
```

Figura 59. Familia IPv4 en R1

- Deshabilite la relación de vecino IPv6.

```
no neighbor 2001:db8:200::2 activate
```

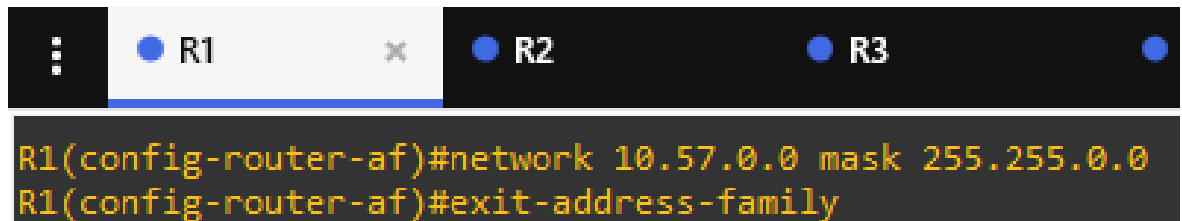


```
R1(config-router-af)#no neighbor 2001:db8:200::2 activate
```

Figura 60. Deshabilitando vecino IPv6 en R1

- Anuncie la red 10.XY0.0/8.

```
network 10.57.0.0 mask 255.255.0.0  
exit-address-family
```



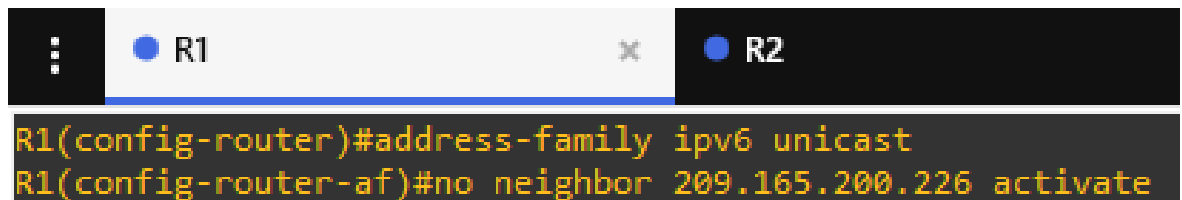
```
R1(config-router-af)#network 10.57.0.0 mask 255.255.0.0  
R1(config-router-af)#exit-address-family
```

Figura 61. Red 10.57.0.0 en R1

En la familia de direcciones IPv6:

- Deshabilite la relación de vecino IPv4.

```
address-family ipv6 unicast  
no neighbor 209.165.200.226 activate
```



```
R1(config-router)#address-family ipv6 unicast  
R1(config-router-af)#no neighbor 209.165.200.226 activate
```

Figura 62. Deshabilitando vecino IPv4 en R1

- Habilite la relación de vecino IPv6.

```
neighbor 2001:db8:200::2 activate
```

- Anuncie la red 2001:db8:100::/48

```
network 2001:db8:100::/48  
exit-address-family
```

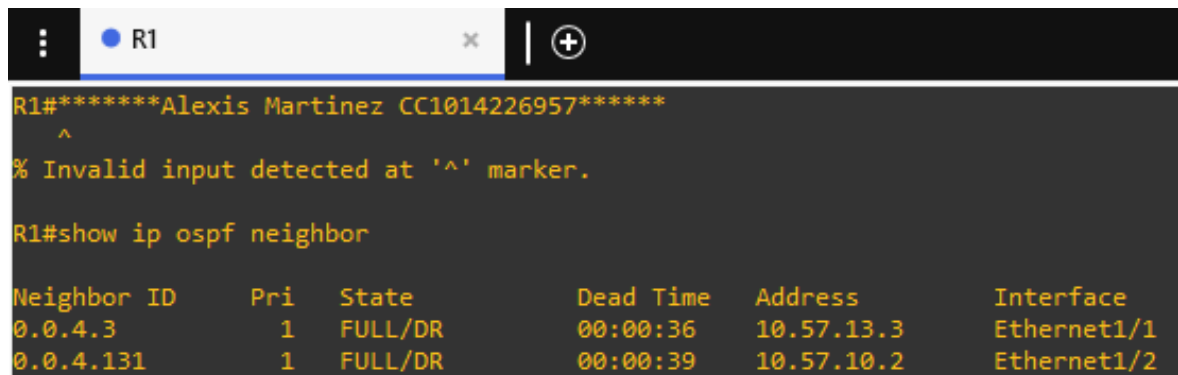


```
R1(config-router-af)#neighbor 2001:db8:200::2 activate  
R1(config-router-af)#!  
R1(config-router-af)#network 2001:db8:100::/48  
R1(config-router-af)#exit-address-family
```

Figura 63. Habilitando vecino IPv6 en R1

Comandos de verificación

```
show ip ospf neighbor
```



```
R1#*****Alexis Martinez CC1014226957*****  
^  
% Invalid input detected at '^' marker.  
R1#show ip ospf neighbor
```

Neighbor ID	Pri	State	Dead Time	Address	Interface
0.0.4.3	1	FULL/DR	00:00:36	10.57.13.3	Ethernet1/1
0.0.4.131	1	FULL/DR	00:00:39	10.57.10.2	Ethernet1/2

Figura 64. ospf neighbor en R1

```

Overview R3
R3#*****Alexis Martinez CC1014226957*****
^
% Invalid input detected at '^' marker.

R3#show ip ospf neighbor

Neighbor ID      Pri   State           Dead Time   Address      Interface
0.0.4.1          1    FULL/BDR        00:00:39   10.57.13.1   Ethernet1/1
0.0.4.132        1    FULL/DR         00:00:39   10.57.11.2   Ethernet1/0

```

Figura 65. ospf neighbor en R3

```

Overview D1
D1#*****Alexis Martinez CC1014226957*****
^
% Invalid input detected at '^' marker.

D1#show ip ospf neighbor

Neighbor ID      Pri   State           Dead Time   Address      Interface
0.0.4.1          1    FULL/BDR        00:00:29   10.57.10.1   Ethernet1/2

```

Figura 66. ospf neighbor en D1

```

Overview D2
D2#*****Alexis Martinez CC1014226957*****
^
% Invalid input detected at '^' marker.

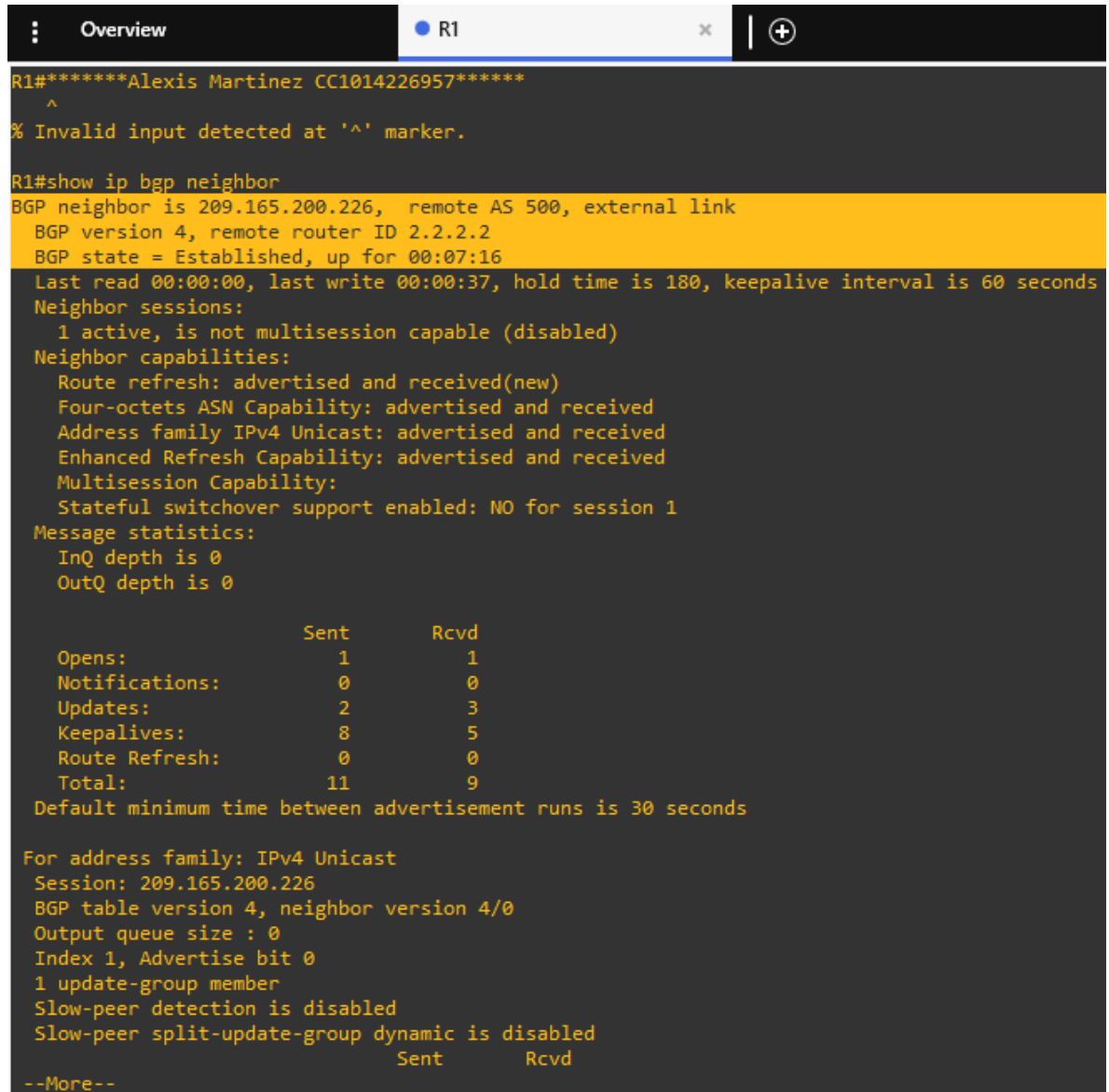
D2#show ip ospf neighbor

Neighbor ID      Pri   State           Dead Time   Address      Interface
0.0.4.3          1    FULL/BDR        00:00:39   10.57.11.1   Ethernet1/0

```

Figura 67. ospf neighbor en D2

```
show ip bgp neighbor
```



```
R1#*****Alexis Martinez CC1014226957*****
^
% Invalid input detected at '^' marker.

R1#show ip bgp neighbor
BGP neighbor is 209.165.200.226, remote AS 500, external link
BGP version 4, remote router ID 2.2.2.2
BGP state = Established, up for 00:07:16
Last read 00:00:00, last write 00:00:37, hold time is 180, keepalive interval is 60 seconds
Neighbor sessions:
  1 active, is not multisession capable (disabled)
Neighbor capabilities:
  Route refresh: advertised and received(new)
  Four-octets ASN Capability: advertised and received
  Address family IPv4 Unicast: advertised and received
  Enhanced Refresh Capability: advertised and received
  Multisession Capability:
  Stateful switchover support enabled: NO for session 1
Message statistics:
  InQ depth is 0
  OutQ depth is 0

              Sent          Rcvd
Opens:          1             1
Notifications:  0             0
Updates:        2             3
Keepalives:     8             5
Route Refresh:  0             0
Total:         11             9
Default minimum time between advertisement runs is 30 seconds

For address family: IPv4 Unicast
Session: 209.165.200.226
BGP table version 4, neighbor version 4/0
Output queue size : 0
Index 1, Advertise bit 0
1 update-group member
Slow-peer detection is disabled
Slow-peer split-update-group dynamic is disabled
              Sent          Rcvd
--More--
```

Figura 68. bgp neighbor en R1

```
Overview R2 +
R2#*****Alexis Martinez CC1014226957*****
^
% Invalid input detected at '^' marker.

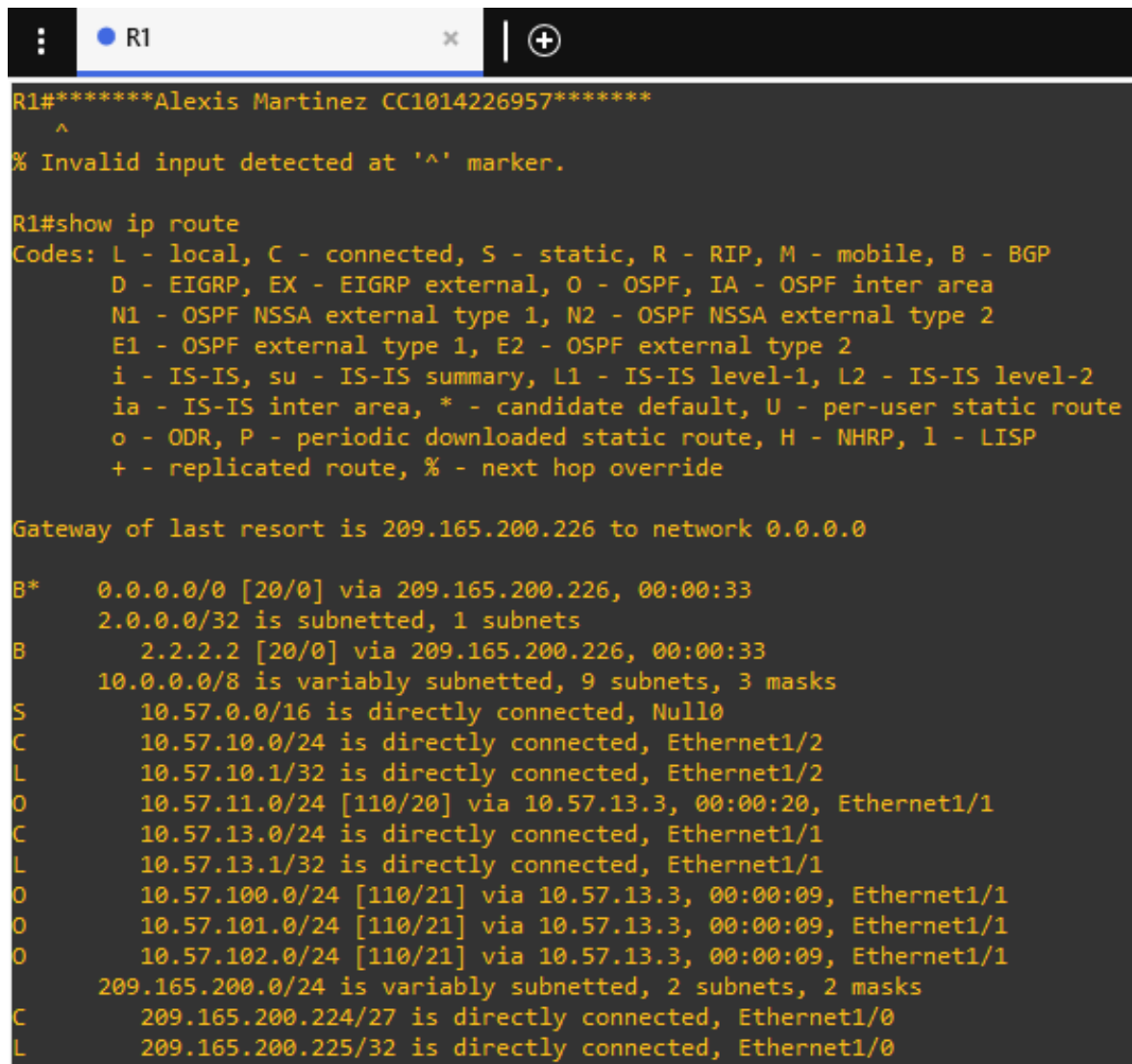
R2#show ip bgp neighbor
BGP neighbor is 209.165.200.225, remote AS 300, external link
BGP version 4, remote router ID 1.1.1.1
BGP state = Established, up for 00:04:26
Last read 00:00:21, last write 00:00:48, hold time is 180, keepalive
Neighbor sessions:
  1 active, is not multisession capable (disabled)
Neighbor capabilities:
  Route refresh: advertised and received(new)
  Four-octets ASN Capability: advertised and received
  Address family IPv4 Unicast: advertised and received
  Enhanced Refresh Capability: advertised and received
  Multisession Capability:
  Stateful switchover support enabled: NO for session 1
Message statistics:
  InQ depth is 0
  OutQ depth is 0

                Sent          Rcvd
Opens:           1             1
Notifications:  0             0
Updates:         3             2
Keepalives:      5            10
Route Refresh:   0             0
Total:           9            13
Default minimum time between advertisement runs is 30 seconds

For address family: IPv4 Unicast
Session: 209.165.200.225
BGP table version 4, neighbor version 4/0
Output queue size : 0
Index 1, Advertise bit 0
1 update-group member
Slow-peer detection is disabled
--More--
```

Figura 69. bgp neighbor en R2

show ip route



```
R1#*****Alexis Martinez CC1014226957*****
^
% Invalid input detected at '^' marker.

R1#show ip route
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route, H - NHRP, l - LISP
       + - replicated route, % - next hop override

Gateway of last resort is 209.165.200.226 to network 0.0.0.0

B*    0.0.0.0/0 [20/0] via 209.165.200.226, 00:00:33
      2.0.0.0/32 is subnetted, 1 subnets
B      2.2.2.2 [20/0] via 209.165.200.226, 00:00:33
      10.0.0.0/8 is variably subnetted, 9 subnets, 3 masks
S      10.57.0.0/16 is directly connected, Null0
C      10.57.10.0/24 is directly connected, Ethernet1/2
L      10.57.10.1/32 is directly connected, Ethernet1/2
O      10.57.11.0/24 [110/20] via 10.57.13.3, 00:00:20, Ethernet1/1
C      10.57.13.0/24 is directly connected, Ethernet1/1
L      10.57.13.1/32 is directly connected, Ethernet1/1
O      10.57.100.0/24 [110/21] via 10.57.13.3, 00:00:09, Ethernet1/1
O      10.57.101.0/24 [110/21] via 10.57.13.3, 00:00:09, Ethernet1/1
O      10.57.102.0/24 [110/21] via 10.57.13.3, 00:00:09, Ethernet1/1
      209.165.200.0/24 is variably subnetted, 2 subnets, 2 masks
C      209.165.200.224/27 is directly connected, Ethernet1/0
L      209.165.200.225/32 is directly connected, Ethernet1/0
```

Figura 70. Show ip route en R1

```
R1 R2
R2#*****Alexis Martinez CC1014226957*****
^
% Invalid input detected at '^' marker.

R2#show ip route
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
E1 - OSPF external type 1, E2 - OSPF external type 2
i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
ia - IS-IS inter area, * - candidate default, U - per-user static route
o - ODR, P - periodic downloaded static route, H - NHRP, l - LISP
+ - replicated route, % - next hop override

Gateway of last resort is 0.0.0.0 to network 0.0.0.0

S* 0.0.0.0/0 is directly connected, Loopback0
   2.0.0.0/32 is subnetted, 1 subnets
C   2.2.2.2 is directly connected, Loopback0
B   10.0.0.0/16 is subnetted, 1 subnets
   10.57.0.0 [20/0] via 209.165.200.225, 00:00:40
   209.165.200.0/24 is variably subnetted, 2 subnets, 2 masks
C   209.165.200.224/27 is directly connected, Ethernet1/0
L   209.165.200.226/32 is directly connected, Ethernet1/0
```

Figura 71. Show ip route en R2

```
R3#*****Alexis Martinez CC1014226957*****
^
% Invalid input detected at '^' marker.

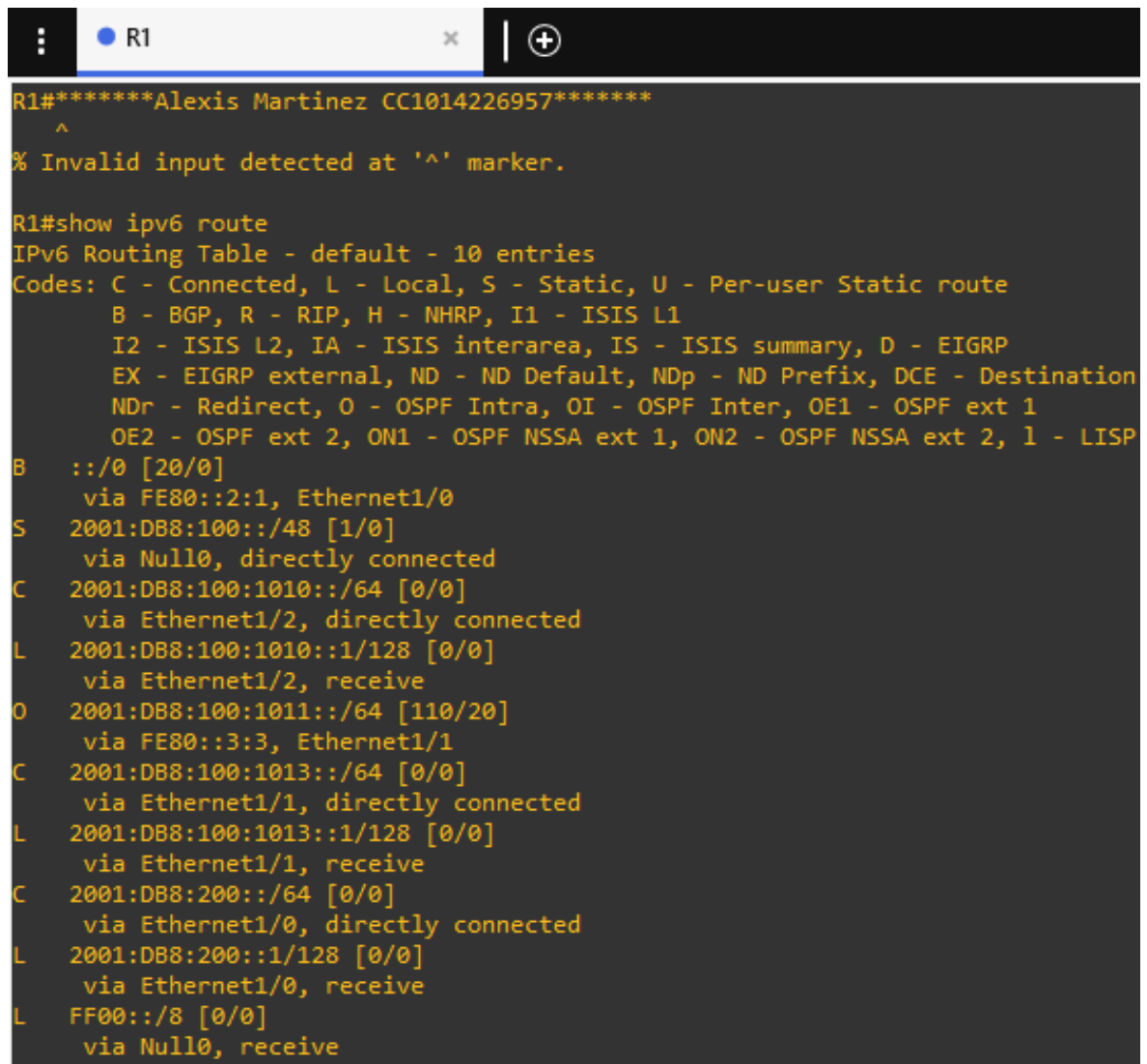
R3#show ip route
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route, H - NHRP, l - LISP
       + - replicated route, % - next hop override

Gateway of last resort is 10.57.13.1 to network 0.0.0.0

O*E2  0.0.0.0/0 [110/1] via 10.57.13.1, 00:00:50, Ethernet1/1
      10.0.0.0/8 is variably subnetted, 8 subnets, 2 masks
O      10.57.10.0/24 [110/20] via 10.57.13.1, 00:00:28, Ethernet1/1
C      10.57.11.0/24 is directly connected, Ethernet1/0
L      10.57.11.1/32 is directly connected, Ethernet1/0
C      10.57.13.0/24 is directly connected, Ethernet1/1
L      10.57.13.3/32 is directly connected, Ethernet1/1
O      10.57.100.0/24 [110/11] via 10.57.11.2, 00:00:50, Ethernet1/0
O      10.57.101.0/24 [110/11] via 10.57.11.2, 00:00:50, Ethernet1/0
O      10.57.102.0/24 [110/11] via 10.57.11.2, 00:00:50, Ethernet1/0
```

Figura 72. Show ip route en R3

show ipv6 route



```
R1#*****Alexis Martinez CC1014226957*****
^
% Invalid input detected at '^' marker.

R1#show ipv6 route
IPv6 Routing Table - default - 10 entries
Codes: C - Connected, L - Local, S - Static, U - Per-user Static route
       B - BGP, R - RIP, H - NHRP, I1 - ISIS L1
       I2 - ISIS L2, IA - ISIS interarea, IS - ISIS summary, D - EIGRP
       EX - EIGRP external, ND - ND Default, NDp - ND Prefix, DCE - Destination
       NDR - Redirect, O - OSPF Intra, OI - OSPF Inter, OE1 - OSPF ext 1
       OE2 - OSPF ext 2, ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2, l - LISP
B ::/0 [20/0]
  via FE80::2:1, Ethernet1/0
S 2001:DB8:100::/48 [1/0]
  via Null0, directly connected
C 2001:DB8:100:1010::/64 [0/0]
  via Ethernet1/2, directly connected
L 2001:DB8:100:1010::1/128 [0/0]
  via Ethernet1/2, receive
O 2001:DB8:100:1011::/64 [110/20]
  via FE80::3:3, Ethernet1/1
C 2001:DB8:100:1013::/64 [0/0]
  via Ethernet1/1, directly connected
L 2001:DB8:100:1013::1/128 [0/0]
  via Ethernet1/1, receive
C 2001:DB8:200::/64 [0/0]
  via Ethernet1/0, directly connected
L 2001:DB8:200::1/128 [0/0]
  via Ethernet1/0, receive
L FF00::/8 [0/0]
  via Null0, receive
```

Figura 73. Show ipv6 route en R1

```
R1 R2 +
R2#*****Alexis Martinez CC1014226957*****
^
% Invalid input detected at '^' marker.

R2#show ipv6 route
IPv6 Routing Table - default - 6 entries
Codes: C - Connected, L - Local, S - Static, U - Per-user Static route
        B - BGP, R - RIP, H - NHRP, I1 - ISIS L1
        I2 - ISIS L2, IA - ISIS interarea, IS - ISIS summary, D - EIGRP
        EX - EIGRP external, ND - ND Default, NDp - ND Prefix, DCE - Destination
        NDr - Redirect, O - OSPF Intra, OI - OSPF Inter, OE1 - OSPF ext 1
        OE2 - OSPF ext 2, ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2, I - LISP
S  ::/0 [1/0]
   via Loopback0, directly connected
B  2001:DB8:100::/48 [20/0]
   via FE80::1:1, Ethernet1/0
C  2001:DB8:200::/64 [0/0]
   via Ethernet1/0, directly connected
L  2001:DB8:200::2/128 [0/0]
   via Ethernet1/0, receive
LC 2001:DB8:2222::1/128 [0/0]
   via Loopback0, receive
L  FF00::/8 [0/0]
   via Null0, receive
```

Figura 74. Show ipv6 route en R2

```
R3#*****Alexis Martinez CC1014226957*****
^
% Invalid input detected at '^' marker.

R3#show ipv6 route
IPv6 Routing Table - default - 6 entries
Codes: C - Connected, L - Local, S - Static, U - Per-user Static route
       B - BGP, R - RIP, H - NHRP, I1 - ISIS L1
       I2 - ISIS L2, IA - ISIS interarea, IS - ISIS summary, D - EIGRP
       EX - EIGRP external, ND - ND Default, NDp - ND Prefix, DCE - Destination
       NDr - Redirect, O - OSPF Intra, OI - OSPF Inter, OE1 - OSPF ext 1
       OE2 - OSPF ext 2, ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2, I - LISP
C 2001:DB8:100:1010::/64 [0/0]
  via Ethernet1/1, directly connected
L 2001:DB8:100:1010::2/128 [0/0]
  via Ethernet1/1, receive
C 2001:DB8:100:1011::/64 [0/0]
  via Ethernet1/0, directly connected
L 2001:DB8:100:1011::1/128 [0/0]
  via Ethernet1/0, receive
O 2001:DB8:100:1013::/64 [110/10]
  via Ethernet1/1, directly connected
L FF00::/8 [0/0]
  via Null0, receive
```

Figura 75. Show ipv6 route en R3

Parte 4: Configurar redundancia de primer salto

En esta parte, configurará HSRP versión 2 para proporcionar redundancia de primer salto para hosts en la "Red de la empresa".

Las tareas de configuración son las siguientes:

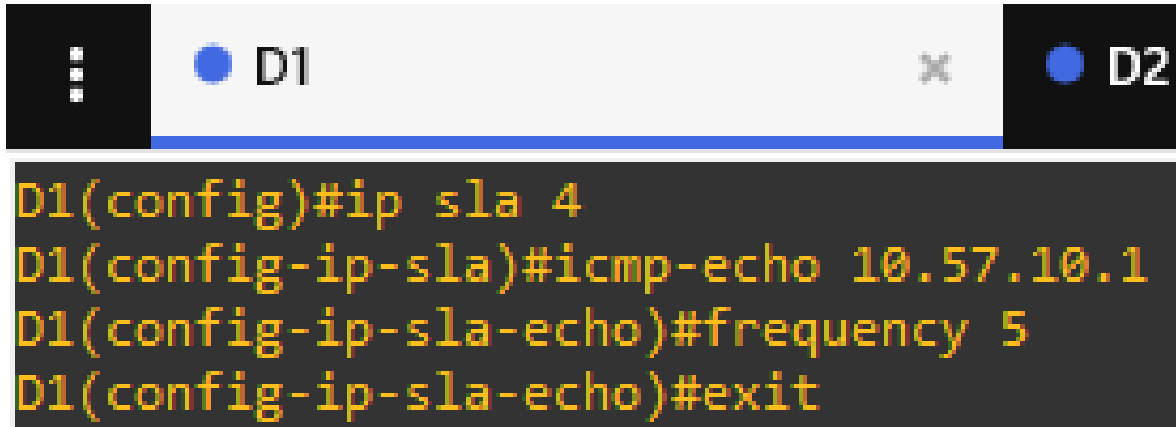
Tarea 1: En D1, cree SLA IP que prueben la accesibilidad de la interfaz R1 E1/2.

Cree dos SLA IP.

- Utilice el SLA número 4 para IPv4.
- Utilice el SLA número 6 para IPv6.

Los SLA IP probarán la disponibilidad de la interfaz R1 E1/2 cada 5 segundos.

```
ip sla 4
icmp-echo 10.57.10.1
frequency 5
exit
```

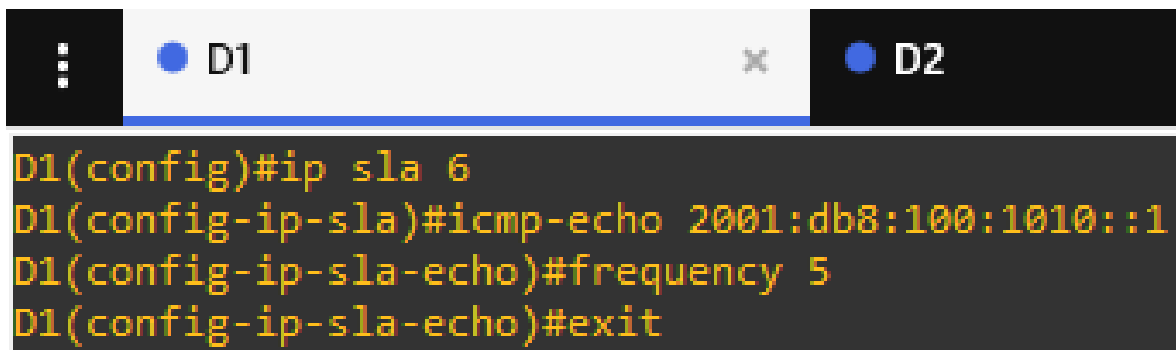


The screenshot shows a terminal window with a title bar containing a menu icon, a blue dot, and the text 'D1'. Below the title bar, the terminal output is as follows:

```
D1(config)#ip sla 4
D1(config-ip-sla)#icmp-echo 10.57.10.1
D1(config-ip-sla-echo)#frequency 5
D1(config-ip-sla-echo)#exit
```

Figura 76. IP SLA 4 frecuencia 5 en D1

```
ip sla 6
icmp-echo 2001:db8:100:1010::1
frequency 5
exit
```



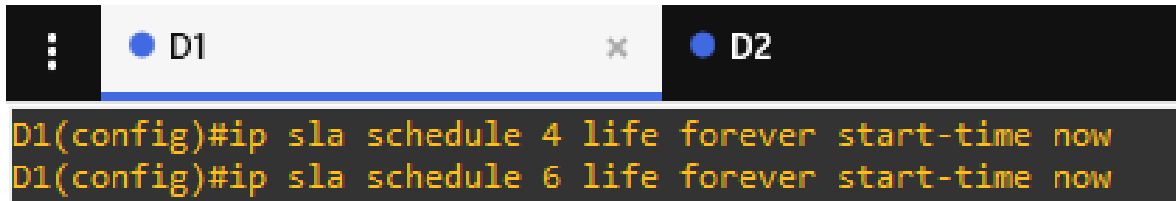
The screenshot shows a terminal window with a title bar containing a menu icon, a blue dot, and the text 'D1'. Below the title bar, the terminal output is as follows:

```
D1(config)#ip sla 6
D1(config-ip-sla)#icmp-echo 2001:db8:100:1010::1
D1(config-ip-sla-echo)#frequency 5
D1(config-ip-sla-echo)#exit
```

Figura 77. IPv6 SLA 4 frecuencia 5 en D1

Programa el SLA para su implementación inmediata sin hora de finalización.

```
ip sla schedule 4 life forever start-time now
ip sla schedule 6 life forever start-time now
```

A terminal window with two tabs, D1 and D2. The D1 tab is active. The terminal output shows two configuration commands: 'D1(config)#ip sla schedule 4 life forever start-time now' and 'D1(config)#ip sla schedule 6 life forever start-time now'.

```
D1(config)#ip sla schedule 4 life forever start-time now
D1(config)#ip sla schedule 6 life forever start-time now
```

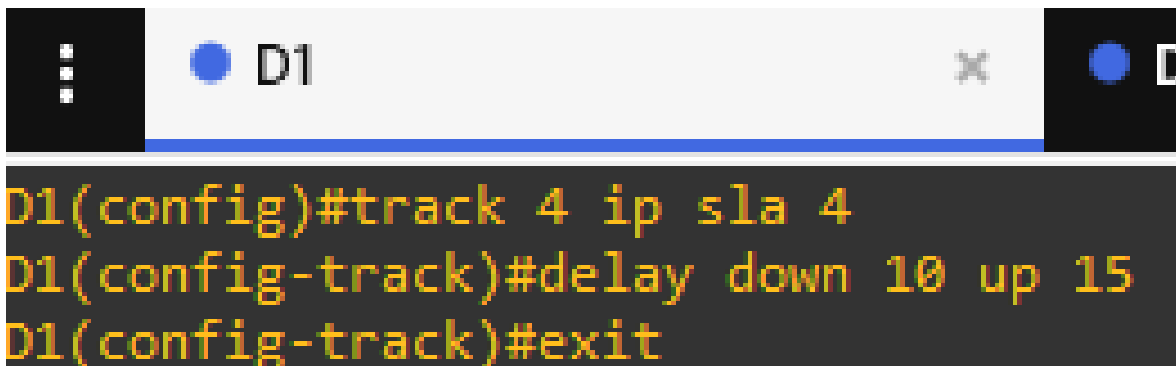
Figura 78. SLA sin finalización en D1

Cree un objeto de SLA de IP para el SLA 4 y otro para el SLA de IP 6.

- Utilice el número de pista 4 para IP SLA 4
- Utilice el número de pista 6 para IP SLA 6

Los objetos rastreados deben notificar a D1 si el estado del SLA IP cambia de abajo a arriba después de 10 segundos, o de arriba a abajo después de 15 segundos.

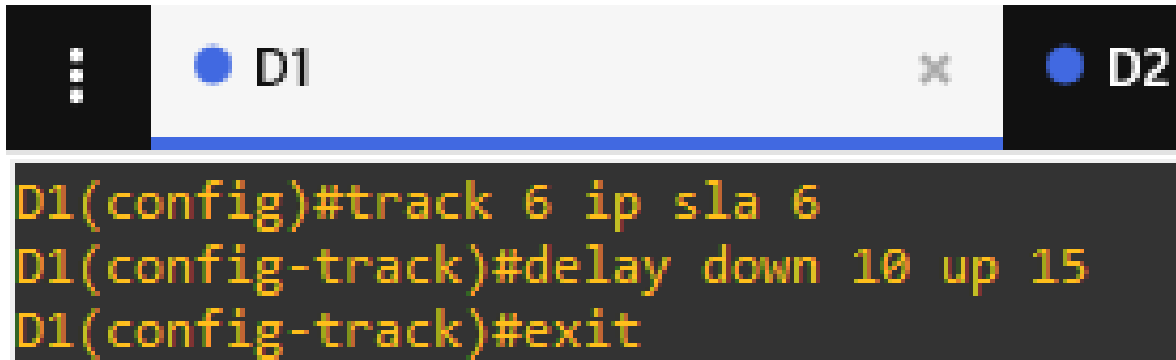
```
track 4 ip sla 4
delay down 10 up 15
exit
```

A terminal window with two tabs, D1 and D2. The D1 tab is active. The terminal output shows three configuration commands: 'D1(config)#track 4 ip sla 4', 'D1(config-track)#delay down 10 up 15', and 'D1(config-track)#exit'.

```
D1(config)#track 4 ip sla 4
D1(config-track)#delay down 10 up 15
D1(config-track)#exit
```

Figura 79. Track 4 en D1

```
track 6 ip sla 6
delay down 10 up 15
exit
```



```
D1
D1(config)#track 6 ip sla 6
D1(config-track)#delay down 10 up 15
D1(config-track)#exit
```

Figura 80. Track 6 en D1

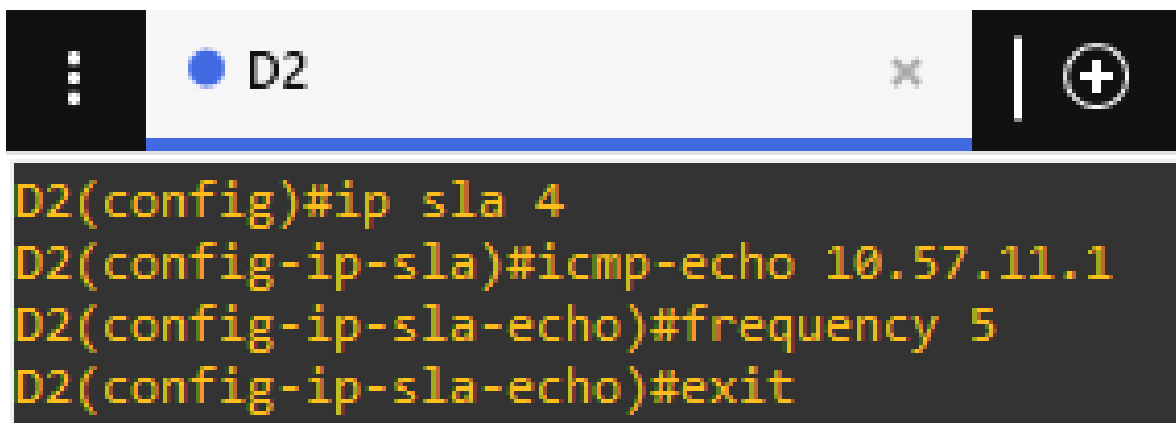
Tarea 2: En D2, cree SLA IP que prueben la accesibilidad de la interfaz R3 E1/0.

Cree dos SLA IP.

- Utilice el SLA número 4 para IPv4.
- Utilice el SLA número 6 para IPv6.

Los SLA IP probarán la disponibilidad de la interfaz R3 E1/0 cada 5 segundos.

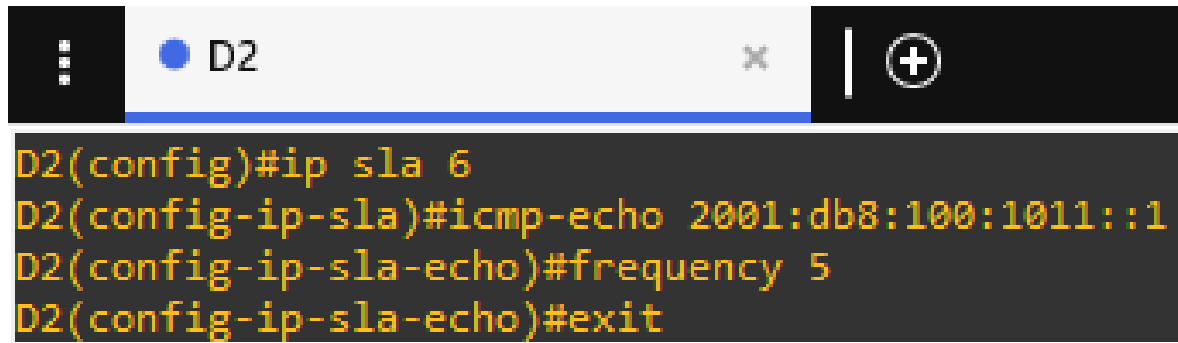
```
ip sla 4
icmp-echo 10.57.11.1
frequency 5
exit
```



```
D2
D2(config)#ip sla 4
D2(config-ip-sla)#icmp-echo 10.57.11.1
D2(config-ip-sla-echo)#frequency 5
D2(config-ip-sla-echo)#exit
```

Figura 81. IP SLA 4 frecuencia 5 en D2

```
ip sla 6
icmp-echo 2001:db8:100:1011::1
frequency 5
exit
```

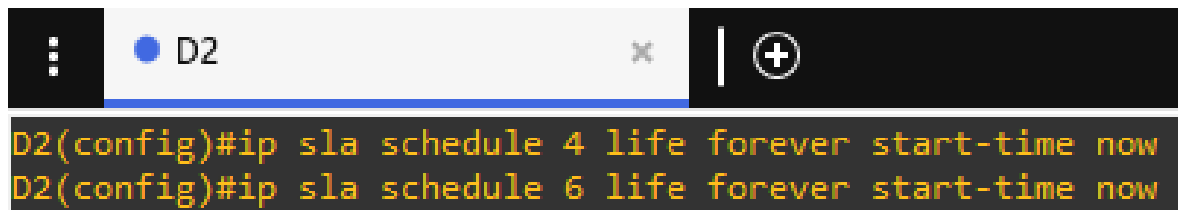


```
D2(config)#ip sla 6
D2(config-ip-sla)#icmp-echo 2001:db8:100:1011::1
D2(config-ip-sla-echo)#frequency 5
D2(config-ip-sla-echo)#exit
```

Figura 82. IPv6 SLA 4 frecuencia 5 en D2

Programa el SLA para su implementación inmediata sin hora de finalización.

```
ip sla schedule 4 life forever start-time now
ip sla schedule 6 life forever start-time now
```



```
D2(config)#ip sla schedule 4 life forever start-time now
D2(config)#ip sla schedule 6 life forever start-time now
```

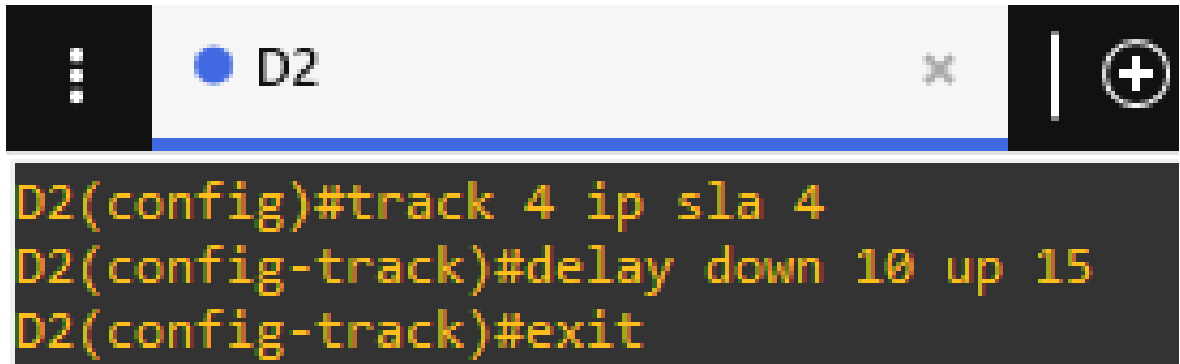
Figura 83. Sin finalización en D2

Cree un objeto de SLA de IP para el SLA 4 y otro para el SLA de IP 6.

- Utilice el número de pista 4 para IP SLA 4.
- Utilice el número de pista 6 para IP SLA 6.

Los objetos rastreados deben notificar a D1 si el estado del SLA IP cambia de abajo a arriba después de 10 segundos, o de arriba a abajo después de 15 segundos.

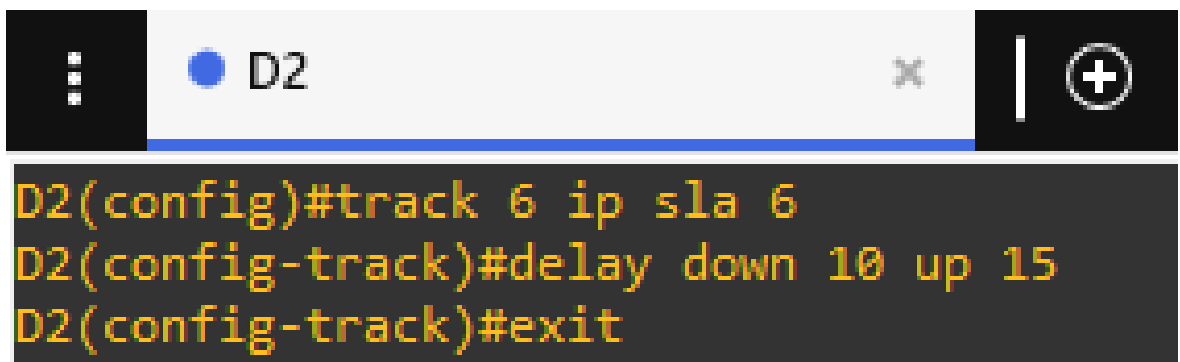
```
track 4 ip sla 4
delay down 10 up 15
exit
```



```
D2(config)#track 4 ip sla 4
D2(config-track)#delay down 10 up 15
D2(config-track)#exit
```

Figura 84. Track 4 de abajo a arriba en 10 y 15 sec en D2

```
track 6 ip sla 6
delay down 10 up 15
exit
```



```
D2(config)#track 6 ip sla 6
D2(config-track)#delay down 10 up 15
D2(config-track)#exit
```

Figura 85. Track 6 de abajo a arriba en 10 y 15 sec en D2

Tarea 3: En D1, configure HSRPv2.

D1 es el router principal para VLAN 100 y 102; por lo tanto, su prioridad también se cambiará a 150.

Configure HSRP versión 2.

Configure el grupo 104 de HSRP IPv4 para VLAN 100:

- Asigne la dirección IP virtual 10.XY.100.254.
- Establezca la prioridad del grupo en 150.
- Habilite la preferencia.

- Realice un seguimiento del objeto 4 y disminuya en 60.

```
interface vlan 100
standby version 2
standby 104 ip 10.57.100.254
standby 104 priority 150
standby 104 preempt
standby 104 track 4 decrement 60
```

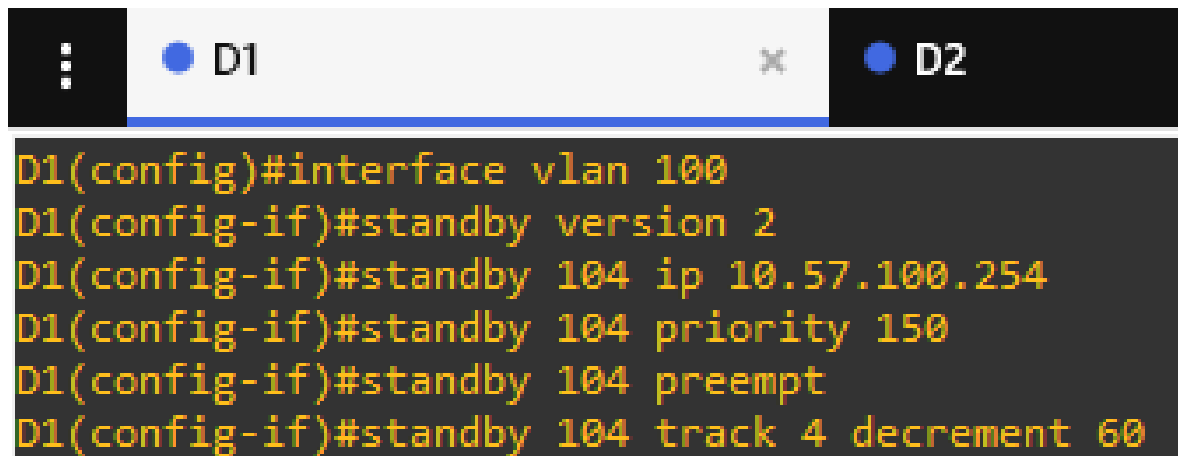
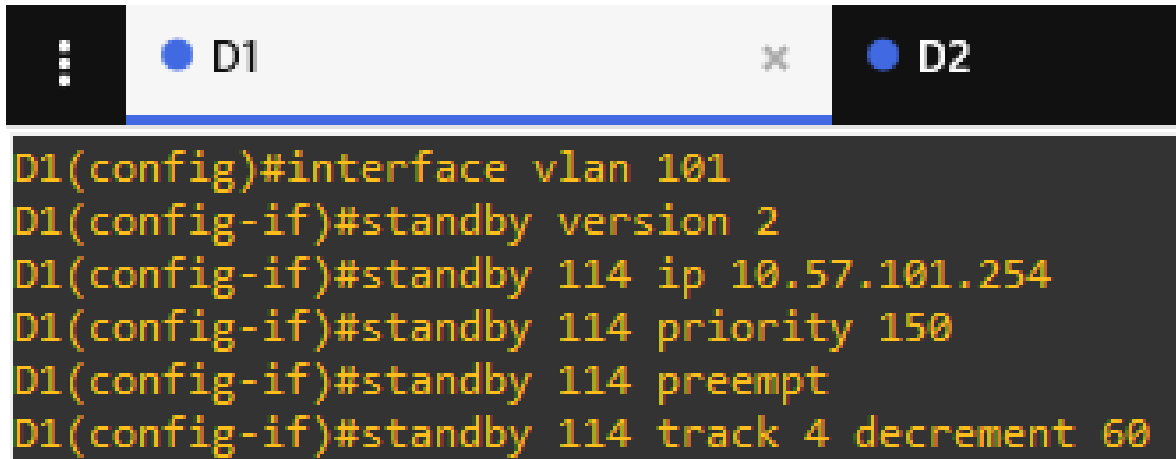


Figura 86. Grupo 104 IPv4

Configure el grupo 114 de HSRP IPv4 para VLAN 101:

- Asigne la dirección IP virtual 10.XY.10 1.254.
- Habilite la preferencia.
- Realice un seguimiento del objeto 4 hasta disminuir en 60.

```
interface vlan 101
standby version 2
standby 114 ip 10.57.101.254
standby 114 priority 150
standby 114 preempt
standby 114 track 4 decrement 60
```



The image shows a terminal window with two tabs labeled 'D1' and 'D2'. The 'D1' tab is active. The terminal output shows the following configuration commands for HSRP group 114 on VLAN 101:

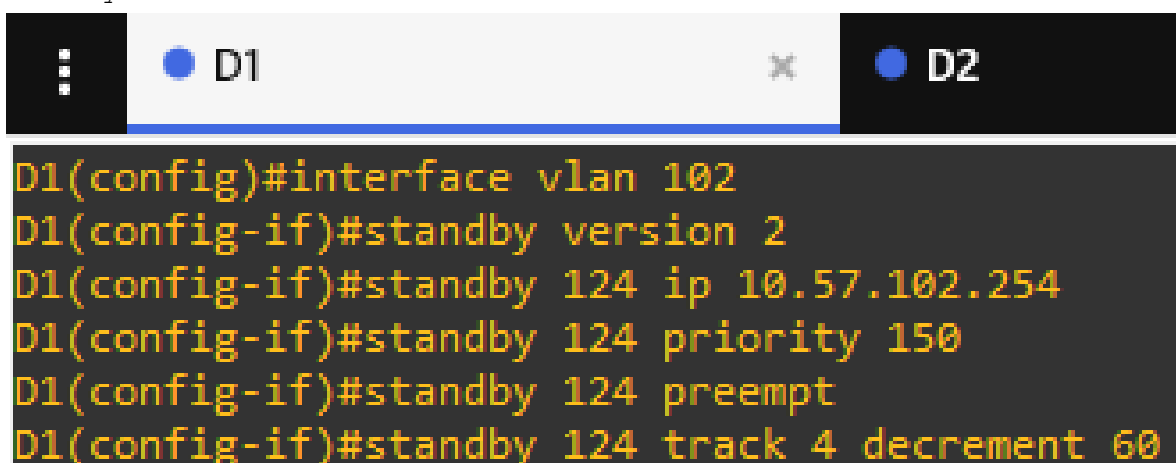
```
D1(config)#interface vlan 101
D1(config-if)#standby version 2
D1(config-if)#standby 114 ip 10.57.101.254
D1(config-if)#standby 114 priority 150
D1(config-if)#standby 114 preempt
D1(config-if)#standby 114 track 4 decrement 60
```

Figura 87. Grupo 114 IPv4

Configure el grupo HSRP IPv4 124 para VLAN 102:

- Asigne la dirección IP virtual 10.XY.10 2.254.
- Establezca la prioridad del grupo en 150.
- Habilite la preferencia.
- Realice un seguimiento del objeto 4 hasta disminuir en 60.

```
interface vlan 102
standby version 2
standby 124 ip 10.57.102.254
standby 124 priority 150
standby 124 preempt
standby 124 track 4 decrement 60
```



The image shows a terminal window with two tabs labeled 'D1' and 'D2'. The 'D1' tab is active. The terminal output shows the following configuration commands for HSRP group 124 on VLAN 102:

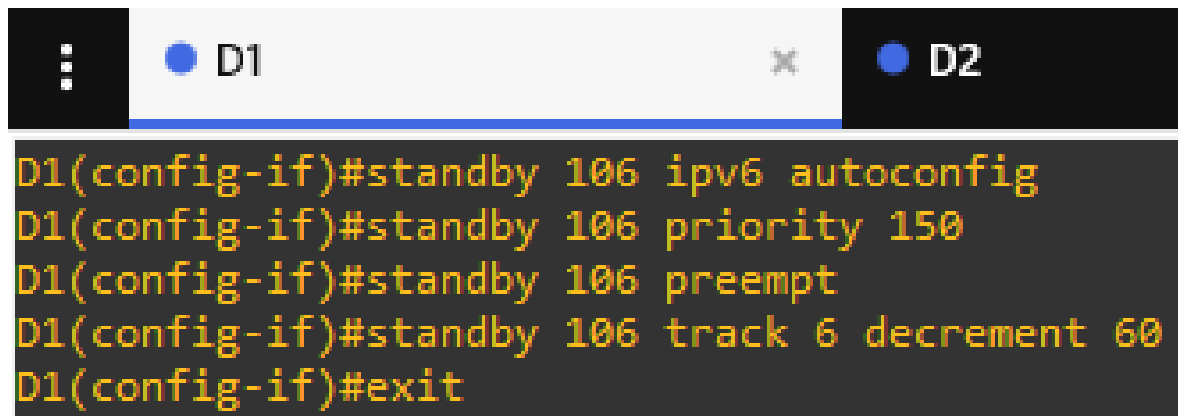
```
D1(config)#interface vlan 102
D1(config-if)#standby version 2
D1(config-if)#standby 124 ip 10.57.102.254
D1(config-if)#standby 124 priority 150
D1(config-if)#standby 124 preempt
D1(config-if)#standby 124 track 4 decrement 60
```

Figura 88. Grupo 124 IPv4

Configure IPv6 HSRP grupo 106 para VLAN 100:

- Asigne la dirección IP virtual mediante la configuración automática de ipv6.
- Establezca la prioridad del grupo en 150.
- Habilite la preferencia.
- Realice un seguimiento del objeto 6 y disminuya en 60.

```
standby 106 ipv6 autoconfig
standby 106 priority 150
standby 106 preempt
standby 106 track 6 decrement 60
exit
```

The image shows a terminal window with two tabs labeled 'D1' and 'D2'. The 'D1' tab is active. The terminal output shows the following commands being entered:

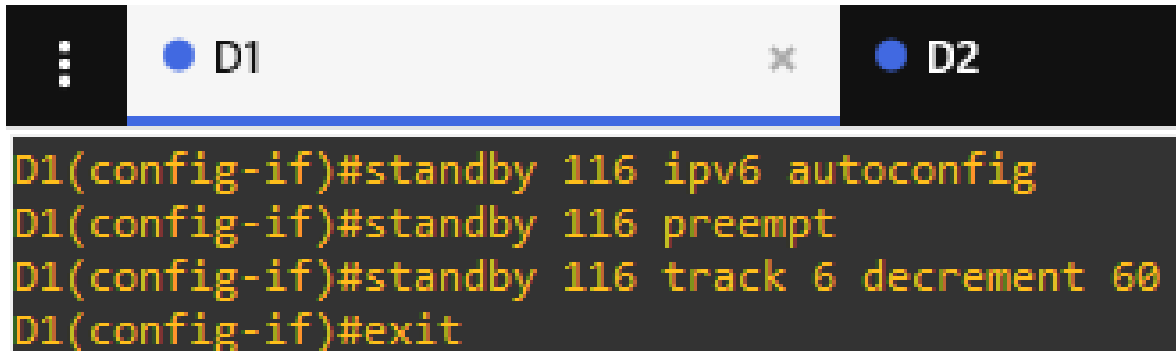
```
D1(config-if)#standby 106 ipv6 autoconfig
D1(config-if)#standby 106 priority 150
D1(config-if)#standby 106 preempt
D1(config-if)#standby 106 track 6 decrement 60
D1(config-if)#exit
```

Figura 89. Grupo 106 IPv6

Configure el grupo HSRP IPv6 11 6 para VLAN 101:

- Asigne la dirección IP virtual mediante la configuración automática de ipv6.
- Habilite la preferencia.
- Realice un seguimiento del objeto 6 y disminuya en 60.

```
standby 116 ipv6 autoconfig
standby 116 preempt
standby 116 track 6 decrement 60
exit
```



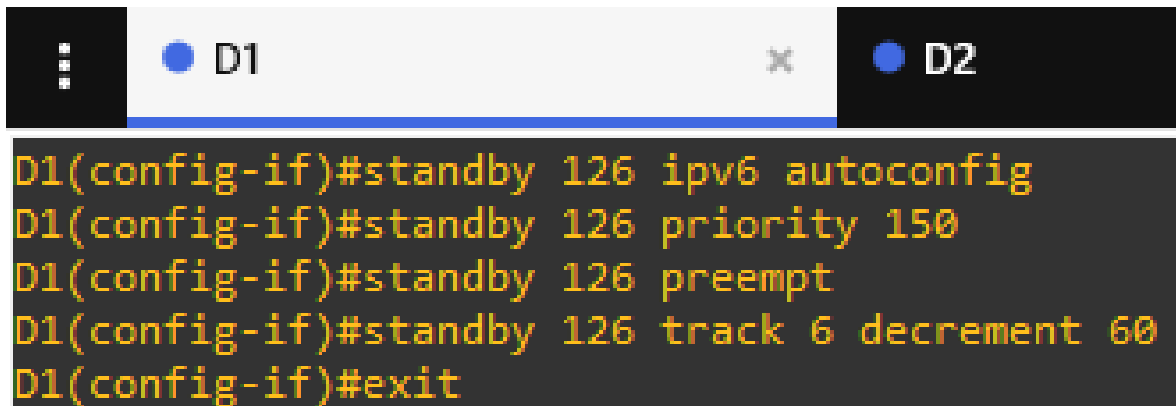
```
D1
D1(config-if)#standby 116 ipv6 autoconfig
D1(config-if)#standby 116 preempt
D1(config-if)#standby 116 track 6 decrement 60
D1(config-if)#exit
```

Figura 90. Grupo 116 IPv6

Configure IPv6 HSRP grupo 126 para VLAN 102:

- Asigne la dirección IP virtual mediante la configuración automática de ipv6.
- Establezca la prioridad del grupo en 150.
- Habilite la preferencia.
- Realice un seguimiento del objeto 6 y disminuya en 60

```
standby 126 ipv6 autoconfig
standby 126 priority 150
standby 126 preempt
standby 126 track 6 decrement 60
exit
```



```
D1
D1(config-if)#standby 126 ipv6 autoconfig
D1(config-if)#standby 126 priority 150
D1(config-if)#standby 126 preempt
D1(config-if)#standby 126 track 6 decrement 60
D1(config-if)#exit
```

Figura 91. Grupo 126 IPv6

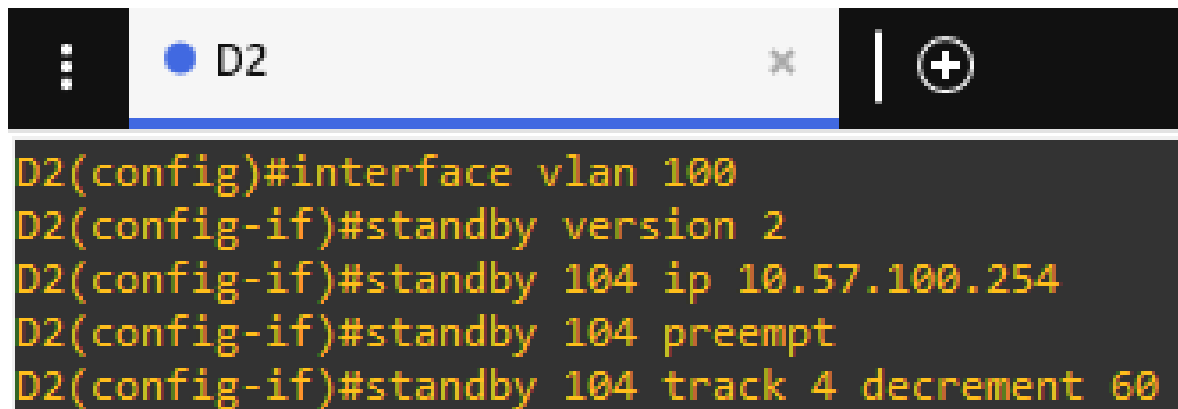
D2 es el router principal para VLAN 101; por lo tanto, la prioridad también se cambiará a 150.

Configure HSRP versión 2.

Configure el grupo 104 de HSRP IPv4 para VLAN 100:

- Asigne la dirección IP virtual 10.XY.100.254.
- Habilite la preferencia.
- Realice un seguimiento del objeto 4 y disminuya en 60.

```
interface vlan 100
standby version 2
standby 104 ip 10.57.100.254
standby 104 preempt
standby 104 track 4 decrement 60
```

A screenshot of a terminal window with a dark background and yellow text. The window title bar shows a blue dot, the text 'D2', and a close button 'x'. On the right side of the title bar, there is a vertical line and a plus sign icon. The terminal output shows the following configuration commands:

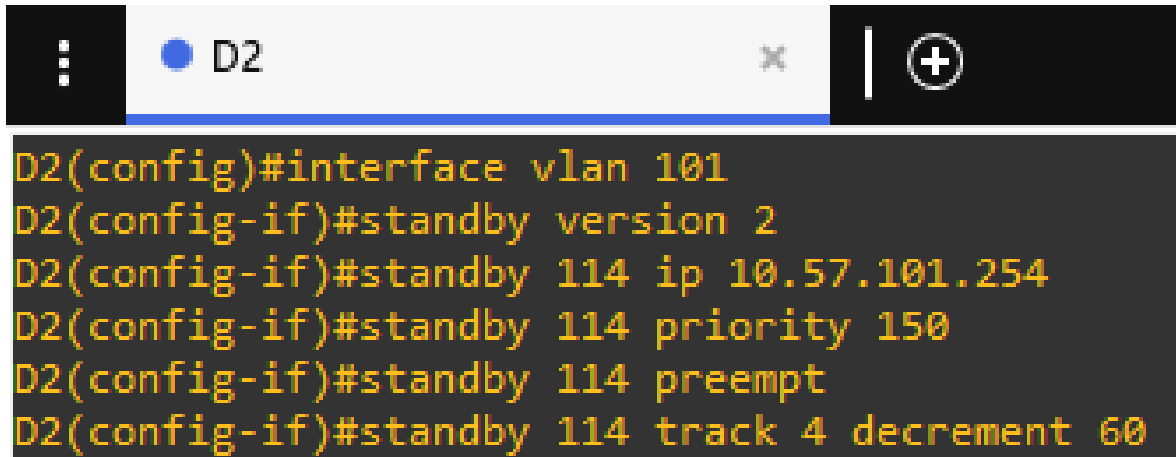
```
D2(config)#interface vlan 100
D2(config-if)#standby version 2
D2(config-if)#standby 104 ip 10.57.100.254
D2(config-if)#standby 104 preempt
D2(config-if)#standby 104 track 4 decrement 60
```

Figura 92. Grupo 104 IPv6

Configure el grupo 114 de HSRP IPv4 para VLAN 101:

- Asigne la dirección IP virtual 10. XY.10 1,254.
- Establezca la prioridad del grupo en 150.
- Habilite la preferencia.
- Realice un seguimiento del objeto 4 hasta disminuir en 60.

```
interface vlan 101
standby version 2
standby 114 ip 10.57.101.254
standby 114 priority 150
standby 114 preempt
standby 114 track 4 decrement 60
```



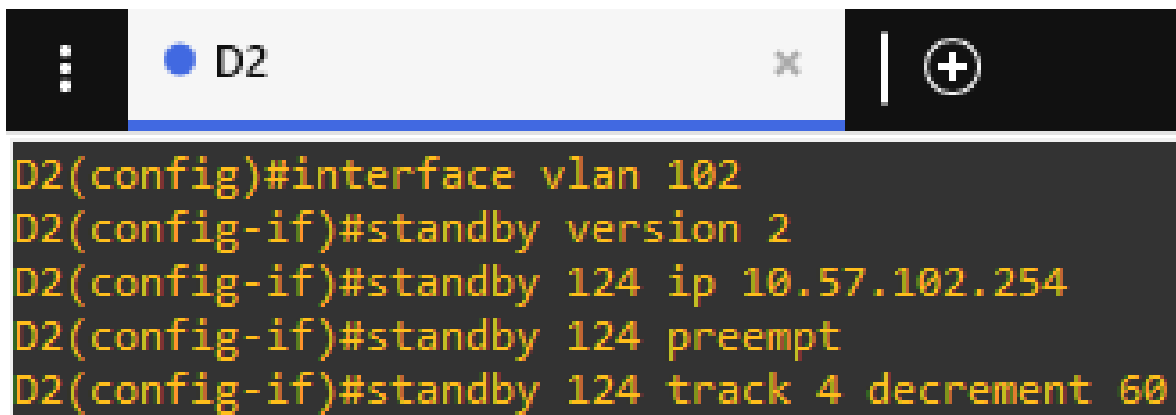
```
D2
D2(config)#interface vlan 101
D2(config-if)#standby version 2
D2(config-if)#standby 114 ip 10.57.101.254
D2(config-if)#standby 114 priority 150
D2(config-if)#standby 114 preempt
D2(config-if)#standby 114 track 4 decrement 60
```

Figura 93. Grupo 114 IPv4 D2

Configure el grupo HSRP IPv4 124 para VLAN 102:

- Asigne la dirección IP virtual 10. XY.10 2.254.
- Habilite la preferencia.
- Realice un seguimiento del objeto 4 hasta disminuir en 60.

```
interface vlan 102
standby version 2
standby 124 ip 10.57.102.254
standby 124 preempt
standby 124 track 4 decrement 60
```



```
D2
D2(config)#interface vlan 102
D2(config-if)#standby version 2
D2(config-if)#standby 124 ip 10.57.102.254
D2(config-if)#standby 124 preempt
D2(config-if)#standby 124 track 4 decrement 60
```

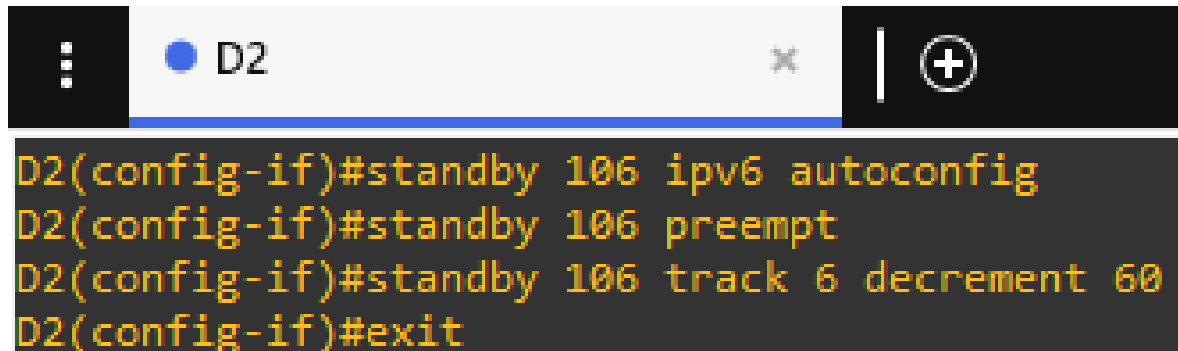
Figura 94. Grupo 124 IPv4 D2

Configure IPv6 HSRP grupo 106 para VLAN 100:

- Asigne la dirección IP virtual mediante la configuración automática de ipv6.
- Habilite la preferencia.

- Realice un seguimiento del objeto 6 y disminuya en 60.

```
standby 106 ipv6 autoconfig
standby 106 preempt
standby 106 track 6 decrement 60
exit
```



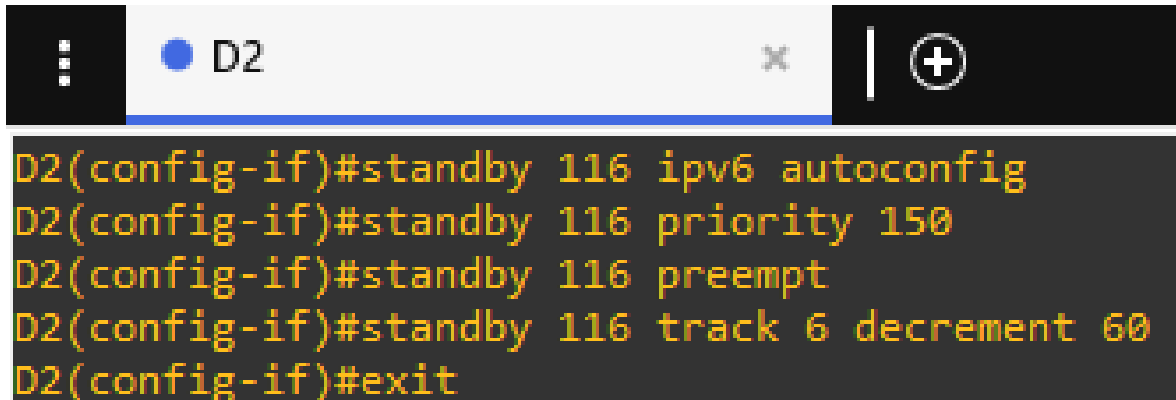
```
D2(config-if)#standby 106 ipv6 autoconfig
D2(config-if)#standby 106 preempt
D2(config-if)#standby 106 track 6 decrement 60
D2(config-if)#exit
```

Figura 95. Grupo 106 IPv6 D2

Configure el grupo HSRP IPv6 11 6 para VLAN 101:

- Asigne la dirección IP virtual mediante la configuración automática de ipv6.
- Establezca la prioridad del grupo en 150.
- Habilite la preferencia.
- Realice un seguimiento del objeto 6 y disminuya en 60.

```
standby 116 ipv6 autoconfig
standby 116 priority 150
standby 116 preempt
standby 116 track 6 decrement 60
exit
```



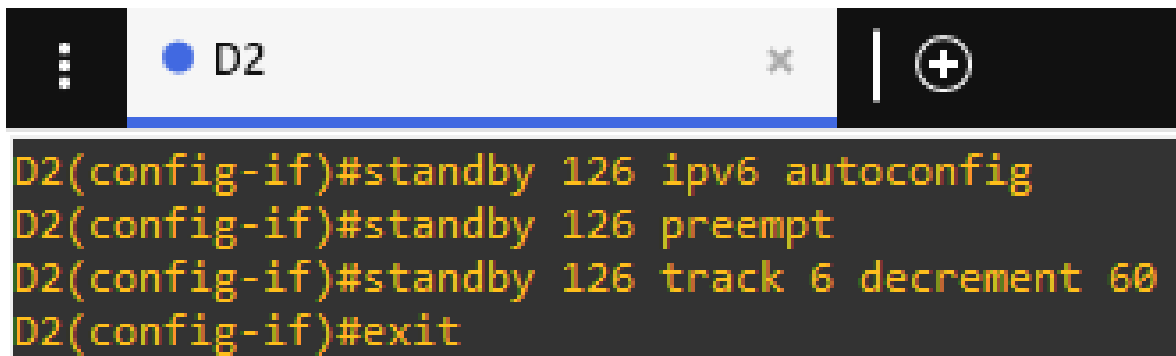
```
D2
D2(config-if)#standby 116 ipv6 autoconfig
D2(config-if)#standby 116 priority 150
D2(config-if)#standby 116 preempt
D2(config-if)#standby 116 track 6 decrement 60
D2(config-if)#exit
```

Figura 96. Grupo 116 IPv6 D2

Configure IPv6 HSRP grupo 126 para VLAN 102:

- Asigne la dirección IP virtual mediante la configuración automática de ipv6.
- Habilite la preferencia.
- Realice un seguimiento del objeto 6 y disminuya en 60

```
standby 126 ipv6 autoconfig
standby 126 preempt
standby 126 track 6 decrement 60
exit
```



```
D2
D2(config-if)#standby 126 ipv6 autoconfig
D2(config-if)#standby 126 preempt
D2(config-if)#standby 126 track 6 decrement 60
D2(config-if)#exit
```

Figura 97. Grupo 126 IPv6 D2

Comandos de verificación

show standby brief

```

D1#*****Aelxis Martinez CC1014226957
^
% Invalid input detected at '^' marker.

D1#show standby brief
          P indicates configured to preempt.
          |
Interface  Grp  Pri P State  Active      Standby      Virtual IP
Vl100      104  90 P Speak  unknown    unknown      10.57.100.254
Vl100      106  90 P Speak  unknown    unknown      FE80::5:73FF:FEA0:6A
Vl101      114  90 P Speak  unknown    unknown      10.57.101.254
Vl101      116  40 P Speak  unknown    unknown      FE80::5:73FF:FEA0:74
Vl102      124  90 P Init   unknown    unknown      10.57.102.254
Vl102      126  90 P Init   unknown    unknown      FE80::5:73FF:FEA0:7E
  
```

Figura 98. Show Standby en D1

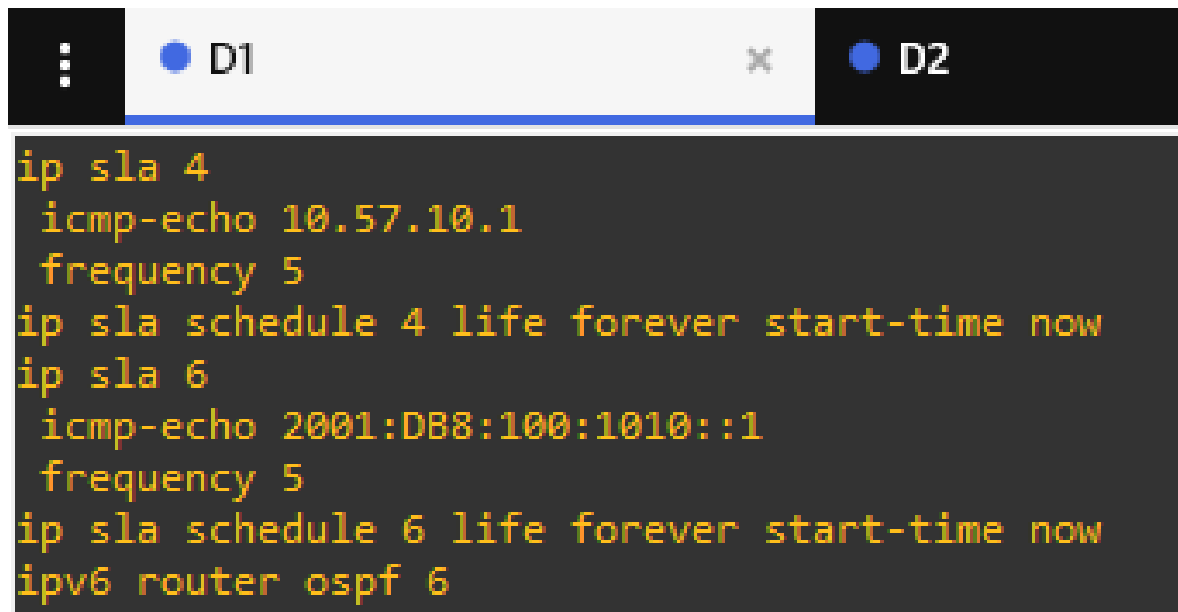
```

D2#*****Aelxis Martinez CC1014226957
^
% Invalid input detected at '^' marker.

D2#show standby brief
          P indicates configured to preempt.
          |
Interface  Grp  Pri P State  Active      Standby      Virtual IP
Vl100      104  40 P Standby 10.57.100.1 local        10.57.100.254
Vl100      106  40 P Standby FE80::D1:2  local        FE80::5:73FF:FEA0:6A
Vl101      114  90 P Standby 10.57.101.1 local        10.57.101.254
Vl101      116  90 P Active  local      FE80::D1:3  FE80::5:73FF:FEA0:74
Vl102      124  40 P Standby 10.57.102.1 local        10.57.102.254
Vl102      126  40 P Standby FE80::D1:4  local        FE80::5:73FF:FEA0:7E
  
```

Figura 99. Show Standby en D2

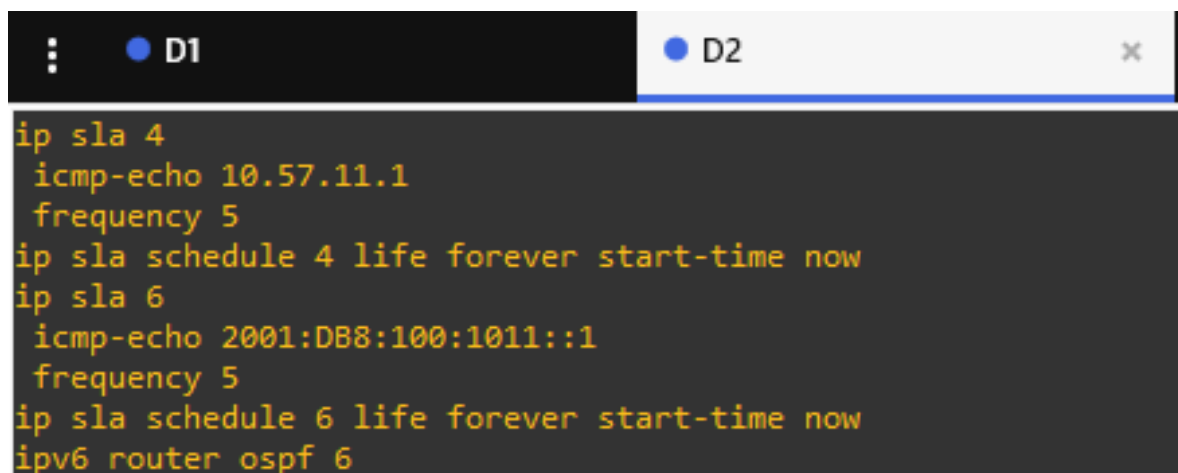
Show run



A terminal window with two tabs: 'D1' (active) and 'D2'. The output shows the configuration for D1:

```
ip sla 4
  icmp-echo 10.57.10.1
  frequency 5
ip sla schedule 4 life forever start-time now
ip sla 6
  icmp-echo 2001:DB8:100:1010::1
  frequency 5
ip sla schedule 6 life forever start-time now
ipv6 router ospf 6
```

Figura 100. Show run en D1



A terminal window with two tabs: 'D1' and 'D2' (active). The output shows the configuration for D2:

```
ip sla 4
  icmp-echo 10.57.11.1
  frequency 5
ip sla schedule 4 life forever start-time now
ip sla 6
  icmp-echo 2001:DB8:100:1011::1
  frequency 5
ip sla schedule 6 life forever start-time now
ipv6 router ospf 6
```

Figura 101. Show run en D2

```
interface Vlan100
 ip address 10.57.100.1 255.255.255.0
 standby version 2
 standby 104 ip 10.57.100.254
 standby 104 priority 150
 standby 104 preempt
 standby 104 track 4 decrement 60
 standby 106 ipv6 autoconfig
 standby 106 priority 150
 standby 106 preempt
 standby 106 track 6 decrement 60
 ipv6 address FE80::D1:2 link-local
 ipv6 address 2001:DB8:100:100::1/64
 ipv6 ospf 6 area 0
!
interface Vlan101
 ip address 10.57.101.1 255.255.255.0
 standby version 2
 standby 114 ip 10.57.101.254
 standby 114 priority 150
 standby 114 preempt
 standby 114 track 4 decrement 60
 standby 116 ipv6 autoconfig
 standby 116 preempt
 standby 116 track 6 decrement 60
 ipv6 address FE80::D1:3 link-local
 ipv6 address 2001:DB8:100:101::1/64
 ipv6 ospf 6 area 0
!
interface Vlan102
 ip address 10.57.102.1 255.255.255.0
 standby version 2
 standby 124 ip 10.57.102.254
 standby 124 priority 150
 standby 124 preempt
 standby 124 track 4 decrement 60
 standby 126 ipv6 autoconfig
 standby 126 priority 150
 standby 126 preempt
 standby 126 track 6 decrement 60
 ipv6 address FE80::D1:4 link-local
```

Figura 102. Show run en D1

```
⋮ ● D1 ● D2 ×
interface Vlan100
 ip address 10.57.100.2 255.255.255.0
 standby version 2
 standby 104 ip 10.57.100.254
 standby 104 preempt
 standby 104 track 4 decrement 60
 standby 106 ipv6 autoconfig
 standby 106 preempt
 standby 106 track 6 decrement 60
 ipv6 address FE80::D2:2 link-local
 ipv6 address 2001:DB8:100:100::2/64
 ipv6 ospf 6 area 0
!
interface Vlan101
 ip address 10.57.101.2 255.255.255.0
 standby version 2
 standby 114 ip 10.57.101.254
 standby 114 priority 150
 standby 114 preempt
 standby 114 track 4 decrement 60
 standby 116 ipv6 autoconfig
 standby 116 priority 150
 standby 116 preempt
 standby 116 track 6 decrement 60
 ipv6 address FE80::D2:3 link-local
 ipv6 address 2001:DB8:100:101::2/64
 ipv6 ospf 6 area 0
!
interface Vlan102
 ip address 10.57.102.2 255.255.255.0
 standby version 2
 standby 124 ip 10.57.102.254
 standby 124 preempt
 standby 124 track 4 decrement 60
 standby 126 ipv6 autoconfig
 standby 126 preempt
 standby 126 track 6 decrement 60
 ipv6 address FE80::D2:4 link-local
 ipv6 address 2001:DB8:100:102::2/64
 ipv6 ospf 6 area 0
!
```

Figura 103. Show run en D2

CONCLUSIONES

Podemos concluir que la solución implementada hace uso de enlaces en modo troncal, EtherChannel a través del protocolo LACP de agrupación de puertos, protocolo Rapid Spanning-Tree, configuración de puente raíz, y puertos de acceso con DHCP, todo esto con el propósito de sacar el mejor provecho a la conexión en capa 2; donde permite dar tolerancia a las fallas y protección contra la inoperatividad, garantizando la eliminación de bucles las conexiones redundantes.

Podemos concluir que gracias al uso de protocolos de enrutamientos como lo son OSPF nuestra configuración nos permite ver nuestro vecinos de red capa tres en donde se tiene un identificador de área y con BGP compartir esta información de enrutamiento dependiendo de su sistema autónomo (AS) el cual puede ser interno o externo.

Podemos concluir que gracias al protocolo HSRP nuestra red nos permite crear redundancia debido a su funcionamiento el cual mantiene uno de los dos router en modo activo, el cual se encargará de rutear todo el tráfico en caso de que el otro falle, también se puede concluir que la configuración de una IP SLA nos permitirá mantener nuestra red monitorizada a través de mensajes ICMP.

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