

**DIPLOMADO DE PROFUNDIZACION CISCO CCNP
INFORME - PRUEBA DE HABILIDADES PRÁCTICA**

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**UNIVERSIDAD NACIONAL ABIERTA Y A DISTANCIA - UNAD
ESCUELA DE CIENCIAS BÁSICAS, TECNOLOGÍA E INGENIERÍA - ECBTI
INGENIERÍA ELECTRONICA
DOSQUEBRADAS
2022**

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**Diplomado de opción de grado presentado para obtener el
título de INGENIERO ELECTRONICO**

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2022

NOTA DE ACEPTACIÓN

Firma del Presidente del Jurado

Firma del Jurado

Firma del Jurado

Dosquebradas, 25 de noviembre de 2022.

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Inicialmente dar gracias a dios por poner personas en mi camino que siempre me alentaron a continuar y no desfallecer en el principal objetivo de mi vida académica en el momento, ayudando a superar innumerables obstáculos en el camino que me trajo hasta este momento.

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GLOSARIO

DHCP: funciona en un modelo cliente/servidor, el cual proporciona automáticamente direcciones IP, así como otra información relacionada como la máscara de subred y el Gateway.

LACP: es característico de la capa 2, donde podemos decir que une puertos físicos de la red en un único puerto lógico de gran ancho de banda.

OSPFv2: protocolo de enrutamiento dinámico el cual detecta cambios en la topología, también fallas de enlace y converge en una nueva estructura rápidamente, está diseñado específicamente para IPv4.

OSPFv3: protocolo de enrutamiento dinámico el cual detecta cambios en la topología, también fallas de enlace y converge en una nueva estructura rápidamente, está diseñado específicamente para IPv6.

RESUMEN

En el siguiente documento vamos a encontrar el desarrollo práctico de la prueba de habilidades para el presente diplomado de profundización como opción de grado para la ingeniería electrónica, aplicando todas nuestras habilidades aprendidas en el diplomado CCNP teniendo presente los escenarios planteados, este desarrollo se realizó utilizando el simulador GNS3 y una máquina Virtual, inicialmente se realizaron las configuraciones solicitadas, las cuales nos generaron un desafío para descargar y poner a punto el simulador y máquina virtual para el desarrollo del mismo. Se pusieron a prueba habilidades para el conocimiento de redes de comunicación donde se configuraron diferentes protocolos para la conmutación en la capa 2 del modelo OSI, de la misma manera se configuraron protocolos de la capa 3 y así establecimos enrutamiento en la propia LAN, obtuvimos redes convergentes que se comunican entre sí, algunas con políticas de seguridad, todo este desarrollo de los escenarios planteados nos permite comprender de mejor manera los posibles escenarios que vamos a enfrentar en el ámbito industrial.

Palabras clave: Cisco, IPV4, IPV6, WAN, LAN, Routers.

ABSTRACT

In the next document we will find the practical development of the skills for this deepening diploma course as a graduation option for electronic engineering, applying our skills learned in the CCNP course having in mind the scenarios proposed. This development was carried out using the GNS3 simulator and a Virtual Machine. First the requested configurations were made, which generated a challenge for us to download and fine-tune the simulator and virtual machine for this development. Skills for knowledge of communication networks were put to the test where different protocols were configured for switching in layer 2 of the OSI model, in the same way, layer 3 protocols were configured and thus we established routing

in the LAN itself, we obtained networks convergent that communicate with each other, some with security policie. Doing this development in proposed scenarios allows us to figure out the possible scenarios that we are going to face in the industrial field.

Key words: Cisco, IPV4, IPV6, WAN, LAN, Routers.

INTRODUCCIÓN

En la actualidad las redes de comunicación toman más fuerza año tras año tanto en los hogares, universidades, empresas, etc. Estas nos permiten compartir la información de manera rápida y asertiva, nos facilita la interacción entre las personas y el mundo que nos rodea; por tal motivo es importante que durante el desarrollo del presente documento se aprenda cómo funcionan las redes de comunicación, los protocolos que nos permiten dicha interconexión; para el actual escenario contamos con 3 router, 3 Switch y 4 PCs donde simularemos la interacción entre ellos con ayuda de las herramientas necesarias para el mismo.

En el desarrollo de la prueba de habilidades realizaremos las configuraciones básicas para cada elemento de la actual red, usaremos diferentes comandos por medio de la consola para realizar esta actividad, paso a paso y siguiendo las indicaciones del documento base.

Podemos configurar troncales entre los dispositivos así mismo las VLANs necesarias, todo esto teniendo un ambiente de desarrollo con lo es el Software GNS3, donde configuramos y verificamos cada uno de los puntos a realizar en la presente actividad.

Prueba de habilidades.

Topology

Imagen 1. Escenario propuesto.

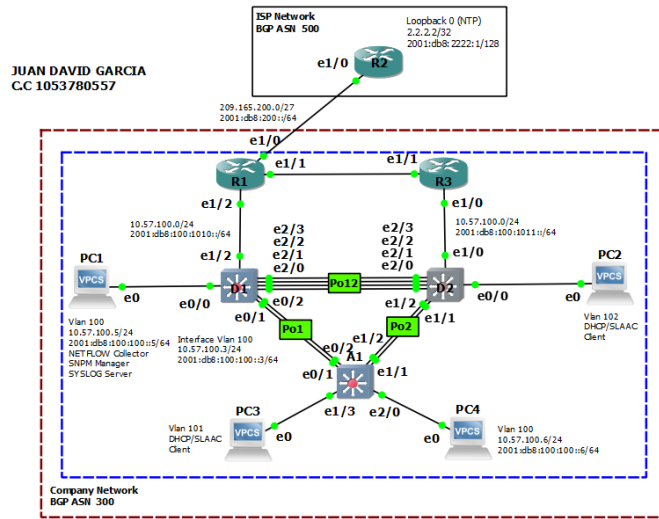


Tabla 1 Tabla de direccionamiento.

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
	E1/2	10.57.10.1/24	2001:db8:100:1010::1/64	fe80::1:2
	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

Device	Interface	IPv4 Address	IPv6 Address	IPv6 Link-Local
	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
	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
	VLAN 100	10.57.100.1/24	2001:db8:100:100::1/64	fe80::d1:2
	VLAN 101	10.57.101.1/24	2001:db8:100:101::1/64	fe80::d1:3
	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
	VLAN 100	10.57.100.2/24	2001:db8:100:100::2/64	fe80::d2:2
	VLAN 101	10.57.101.2/24	2001:db8:100:101::2/64	fe80::d2:3
	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

1. Build the Network and Configure Basic Device Settings and Interface Addressing

In Part 1, you will set up the network topology and configure basic settings and interface addressing.

1.1 Cable the network as shown in the topology.

Attach the devices as shown in the topology diagram, and cable as necessary.

1.2 Configure basic settings for each device.

- a. Console into each device, enter global configuration mode, and apply the basic settings. The startup configurations for each device are provided below.

A continuación, vamos a proceder a configurar los dispositivos según los parámetros básicos tales como los nombres, textos de banner para cada equipo, específicamente las IP de cada interfaz tanto en IPV4 como en IPV6, en el caso de los switches la creación de las VLAN con sus nombres, las direcciones IP, y se crea un pool DHCP con sus respectivas exclusiones.

R1:

```
Router>en
Router#conf term //Ingresar a modo configuración global
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#hostname R1 //se da nombre al router
R1(config)#ipv6 unicast-routing //se habilita el routing en IPV6
R1(config)#no ip domain-lookup //desactivar la traducción de nombres a
dirección
R1(config)# banner motd # R1, ENCOR Skills Assessment# //Mensaje
cuando se conecta a la consola
```

```
R1(config)#line con 0 //configuración para la línea de consola
R1(config-line)#exec-timeout 0 0
R1(config-line)#logging synchronous
R1(config-line)#exit
R1(config)#inter e1/0 //configuración de la interfaz
R1(config-if)#ip address 209.165.200.225 255.255.255.224
R1(config-if)#ipv6 address fe80::1:1 link-local
R1(config-if)#ipv6 address 2001:db8:200::1/64
R1(config-if)#no shutdown //enciende la interfaz
R1(config-if)#exit
R1(config)#interface e1/2
R1(config-if)#ip address 10.57.10.1 255.255.255.0
R1(config-if)#ipv6 address fe80::1:2 link-local
R1(config-if)#ipv6 address 2001:db8:100:1010::1/64
R1(config-if)#no shutdown
R1(config-if)#exit
R1(config)#interface e1/1
R1(config-if)#ip address 10.57.13.1 255.255.255.0
R1(config-if)#ipv6 address fe80::1:3 link-local
R1(config-if)#ipv6 address 2001:db8:100:1013::1/64
R1(config-if)#no shutdown
R1(config-if)#exit
R1(config)#exit
R1#copy run star //guarda la configuración actual Destination filename
[startup-config]?
Building configuration...
[OK]
R1#
```

R2:


```
Router>en
Router#conf term
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#hostname R2
R2(config)#ipv6 unicast-routing
R2(config)#no ip domain lookup
R2(config)#banner motd # R2, ENCOR Skills Assessment #
R2(config)#line con 0
R2(config-line)#exec-timeout 0 0
R2(config-line)#logging synchronous
R2(config-line)#exit
R2(config)#interface e1/0
R2(config-if)#ip address 209.165.200.226 255.255.255.224
R2(config-if)#ipv6 address fe80::2:1 link-local
R2(config-if)#ipv6 address 2001:db8:200::2/64
R2(config-if)#no shutdown
R2(config-if)#exit
R2(config)#interface Loopback 0
R2(config-if)#ip address 2.2.2.2 255.255.255.255
R2(config-if)#ipv6 address fe80::2:3 link-local
R2(config-if)#ipv6 address 2001:db8:2222::1/128
R2(config-if)#no shutdown
R2(config-if)#exit
R2(config)#exit
R2#copy run star
Destination filename [startup-config]?
Building configuration...
[OK]
```

R3:

```
Router>en
Router#conf term
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#hostname R3
R3(config)#ipv6 unicast-routing
R3(config)#no ip domain lookup
R3(config)#banner motd # R3, ENCOR Skills Assessment #
R3(config)#line con 0
R3(config-line)#exec-timeout 0 0
R3(config-line)#logging synchronous
R3(config-line)#exit
R3(config)#interface e1/0
R3(config-if)#ip address 10.57.11.1 255.255.255.0
R3(config-if)#ipv6 address fe80::3:2 link-local
R3(config-if)#ipv6 address 2001:db8:100:1011::1/64
R3(config-if)#no shutdown
R3(config-if)#exit
R3(config)#interface e1/1
R3(config-if)#ip address 10.57.13.3 255.255.255.0
R3(config-if)#ipv6 address fe80::3:3 link-local
R3(config-if)#ipv6 address 2001:db8:100:1010::2/64
R3(config-if)#no shutdown
R3(config-if)#exit
R3(config)#exit
R3#copy run star
Destination filename [startup-config]?
Building configuration...
[OK]
R3#
```

D1

```
Switch>en
Switch#conf term
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#hostname D1
D1(config)#ip routing
D1(config)#ipv6 unicast-routing
D1(config)#no ip domain lookup
D1(config)#banner motd # D1, ENCOR Skills Assessment #
D1(config)#line con 0
D1(config-line)#exec-timeout 0 0
D1(config-line)#logging synchronous
D1(config-line)#exit
D1(config)#vlan 100 //se crea la VLAN
D1(config-vlan)#name Management //se nombra la VLAN
D1(config-vlan)#exit
D1(config)#vlan 101
D1(config-vlan)#name UserGroupA
D1(config-vlan)#exit
D1(config)#vlan 102
D1(config-vlan)#name UserGroupB
D1(config-vlan)#exit
D1(config)#vlan 999
D1(config-vlan)#name NATIVE
D1(config-vlan)#exit
D1(config)#interface e1/2
D1(config-if)#no switchport //brinda la capacidad capa 3 al puerto
D1(config-if)#ip address 10.57.10.2 255.255.255.0
D1(config-if)#ipv6 address fe80::d1:1 link-local
```

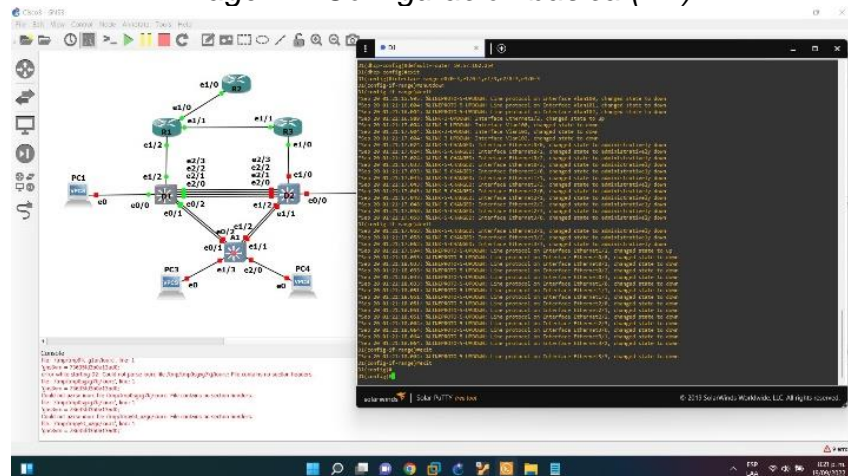
```
D1(config-if)#ipv6 address 2001:db8:100:1010::2/64
D1(config-if)#no shutdown
D1(config-if)#exit
D1(config)#interface vlan 100 //se configuran las IP de la VLAN
D1(config-if)#ip address 10.57.100.1 255.255.255.0
D1(config-if)#ipv6 address fe80::d1:2 link-local
D1(config-if)#ipv6 address 2001:db8:100:100::1/64
D1(config-if)#no shutdown
D1(config-if)#exit
D1(config)#interface vlan 101
D1(config-if)#ip address 10.57.101.1 255.255.255.0
D1(config-if)#ipv6 address fe80::d1:3 link-local
D1(config-if)#ipv6 address 2001:db8:100:101::1/64
D1(config-if)#no shutdown
D1(config-if)#exit
D1(config)#interface vlan 102
D1(config-if)#ip address 10.57.102.1 255.255.255.0
D1(config-if)#ipv6 address fe80::d1:4 link-local
D1(config-if)#ipv6 address 2001:db8:100:102::1/64
D1(config-if)#no shutdown
D1(config-if)#exit
D1(config)#ip dhcp excluded-address 10.57.101.1 10.57.101.109
D1(config)#ip dhcp excluded-address 10.57.101.141 10.57.101.254
D1(config)#ip dhcp excluded-address 10.57.102.1 10.57.102.109
D1(config)#ip dhcp excluded-address 10.57.102.141 10.57.102.254
D1(config)#ip dhcp pool VLAN-101 //Crea el pool para la VLAN
D1(dhcp-config)#network 10.57.101.0 255.255.255.0
D1(dhcp-config)#default-router 10.57.101.254
D1(dhcp-config)#exit
D1(config)#ip dhcp pool VLAN-102
```

```

D1(dhcp-config)#network 10.57.102.0 255.255.255.0
D1(dhcp-config)#default-router 10.57.102.254
D1(dhcp-config)#interface range e0/0-3,e1/0-1,e1/3,e2/0-3,e3/0-3
D1(dhcp-config)#exit
D1(config)# interface range e0/0-3,e1/0-1,e1/3,e2/0-3,e3/0-3
D1(config-if-range)#shutdown
D1(config-if-range)#exit
D1(config)#exit
D1#copy run star
Destination filename [startup-config]?
Building configuration...
[OK]
D1#

```

Imagen 2. Configuración básica (D1).



D2

```

Switch>en
Switch#conf term
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#hostname D2
D2(config)#ip routing
D2(config)#ipv6 unicast-routing

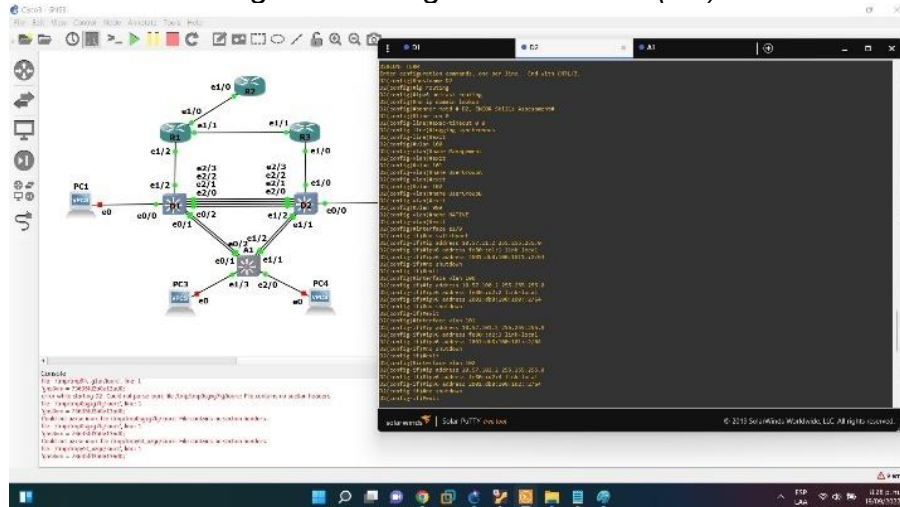
```

```
D2(config)#no ip domain lookup
D2(config)#banner motd # D2, ENCOR Skills Assessment #
D2(config)#line con 0
D2(config-line)#exec-timeout 0 0
D2(config-line)#logging synchronous
D2(config-line)#exit
D2(config)#vlan 100
D2(config-vlan)#name Management
D2(config-vlan)#exit
D2(config)#vlan 101
D2(config-vlan)#name UserGroupA
D2(config-vlan)#exit
D2(config)#vlan 102
D2(config-vlan)#name UserGroupB
D2(config-vlan)#exit
D2(config)#vlan 999
D2(config-vlan)#name NATIVE
D2(config-vlan)#exit
D2(config)#interface e1/0
D2(config-if)#no switchport
D2(config-if)#ip address 10.57.11.2 255.255.255.0
D2(config-if)#ipv6 address fe80::d2:1 link-local
D2(config-if)#ipv6 address 2001:db8:100:1011::2/64
D2(config-if)#no shutdown
D2(config-if)#exit
D2(config)#interface vlan 100
D2(config-if)#ip address 10.57.100.2 255.255.255.0
D2(config-if)#ipv6 address fe80::d2:2 link-local
D2(config-if)#ipv6 address 2001:db8:100:100::2/64
D2(config-if)#no shutdown
```

```
D2(config-if)#exit
D2(config)#interface vlan 101
D2(config-if)#ip address 10.57.101.2 255.255.255.0
D2(config-if)#ipv6 address fe80::d2:3 link-local
D2(config-if)#ipv6 address 2001:db8:100:101::2/64
D2(config-if)#no shutdown
D2(config-if)#exit
D2(config)#interface vlan 102
D2(config-if)#ip address 10.57.102.2 255.255.255.0
D2(config-if)#ipv6 address fe80::d2:4 link-local
D2(config-if)#ipv6 address 2001:db8:100:102::2/64
D2(config-if)#no shutdown
D2(config-if)#exit
D2(config)#ip dhcp excluded-address 10.57.101.1 10.57.101.209
D2(config)#ip dhcp excluded-address 10.57.101.241 10.57.101.254
D2(config)#ip dhcp excluded-address 10.57.102.1 10.57.102.209
D2(config)#ip dhcp excluded-address 10.57.102.241 10.57.102.254
D2(config)#ip dhcp pool VLAN-101
D2(dhcp-config)#network 10.57.101.0 255.255.255.0
D2(dhcp-config)#default-router 10.57.101.254
D2(dhcp-config)#exit
D2(config)#ip dhcp pool VLAN-102
D2(dhcp-config)#network 10.57.102.0 255.255.255.0
D2(dhcp-config)#default-router 10.57.102.254
D2(dhcp-config)#exit
D2(config)#exit
D2(config)# interface range e0/0-3,e1/1-3,e2/0-3,e3/0-3
D2(config-if-range)#shutdown
D2(config-if-range)#exit
D2(config)#exit
```

D2#copy run star
 Destination filename [startup-config]?
 Building configuration...
 [OK]
 D2#

Imagen 3. Configuración básica (D2).



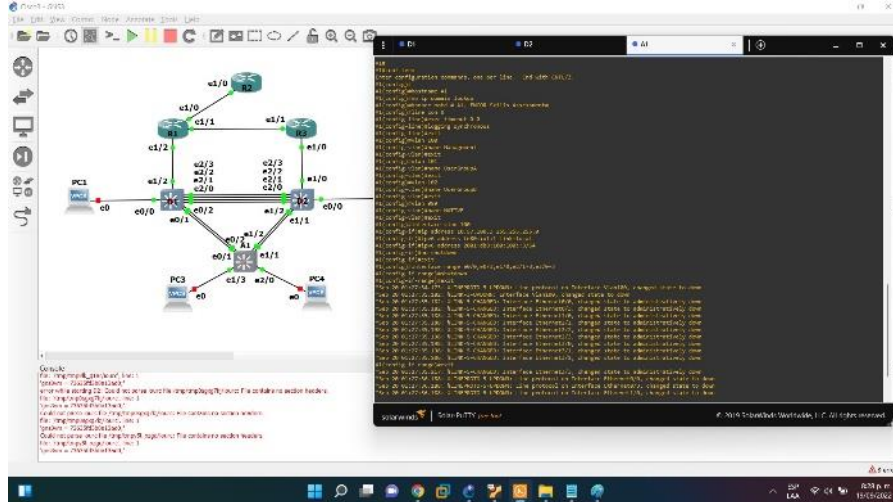
A1

```
Switch>en
Switch#conf term
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#hostname A1
A1(config)#no ip domain lookup
A1(config)#banner motd # A1, ENCOR Skills Assessment#
A1(config)#line con 0
A1(config-line)#exec-timeout 0 0
A1(config-line)#logging synchronous
A1(config-line)#exit
A1(config)#vlan 100
A1(config-vlan)#name Management
A1(config-vlan)#exit
A1(config)#vlan 101
```



```
A1(config-vlan)#name UserGroupA
A1(config-vlan)#exit
A1(config)#vlan 102
A1(config-vlan)#name UserGroupB
A1(config-vlan)#exit
A1(config)#vlan 999
A1(config-vlan)#name NATIVE
A1(config-vlan)#exit
A1(config)#interface vlan 100
A1(config-if)#ip address 10.57.100.3 255.255.255.0
A1(config-if)#ipv6 address fe80::a1:1 link-local
A1(config-if)#ipv6 address 2001:db8:100:100::3/64
A1(config-if)#no shutdown
A1(config-if)#exit
A1(config)# interface range e0/0,e0/3,e1/0,e2/1-3,e3/0-3
A1(config-if-range)#shutdown
A1(config-if-range)#exit
A1(config)#exit
A1#copy run star
Destination filename [startup-config]?
Building configuration...
[OK]
A1#
```

Imagen 4. Configuración básica (A1).



- b. Save the running configuration to startup-config on all devices.
- c. Configure PC 1 and PC 4 host addressing as shown in the addressing table. Assign a default gateway address of 10.XY.100.254 which will be the HSRP virtual IP address used in Part 4.

2 Configure the Layer 2 Network and Host Support

In this part of the Skills Assessment, you will complete the Layer 2 network configuration and set up basic host support. At the end of this part, all the switches should be able to communicate. PC2 and PC3 should receive addressing from DHCP and SLAAC.

Tabla 2. Your configuration tasks are as follows:

Task#	Task	Specification	Points
2.1	On all switches, configure IEEE 802.1Q trunk interfaces on interconnecting switch links	Enable 802.1Q trunk links between: <ul style="list-style-type: none"> • D1 and D2 • D1 and A1 • D2 and A1 	6
2.2	On all switches, change the native VLAN on trunk links.	Use VLAN 999 as the native VLAN.	6
2.3	On all switches, enable the Rapid Spanning-Tree Protocol.	Use Rapid Spanning Tree.	3
2.4	On D1 and D2, configure the appropriate RSTP root bridges based on the information in the topology diagram. D1 and D2 must provide backup in case of root bridge failure.	Configure D1 and D2 as root for the appropriate VLANs with mutually supporting priorities in case of switch failure.	2
2.5	On all switches, create LACP EtherChannels as shown in the topology diagram.	Use the following channel numbers: <ul style="list-style-type: none"> • D1 to D2 – Port channel 12 • D1 to A1 – Port channel 1 • D2 to A1 – Port channel 2 	3
2.6	On all switches, configure host access ports connecting to PC1, PC2, PC3, and PC4.	Configure access ports with appropriate VLAN settings as shown in the topology diagram. Host ports should transition immediately to forwarding state.	4
2.7	Verify IPv4 DHCP services.	PC2 and PC3 are DHCP clients and should be receiving valid IPv4 addresses.	1

Task#	Task	Specification	Points
2.8	Verify local LAN connectivity.	PC1 should successfully ping: <ul style="list-style-type: none"> • D1: 10.XY.100.1 • D2: 10.XY.100.2 • PC4: 10.XY.100.6 PC2 should successfully ping: <ul style="list-style-type: none"> • D1: 10.XY.102.1 • D2: 10.XY.102.2 PC3 should successfully ping: <ul style="list-style-type: none"> • D1: 10.XY.101.1 • D2: 10.XY.101.2 PC4 should successfully ping: <ul style="list-style-type: none"> • D1: 10.XY.100.1 • D2: 10.XY.100.2 • PC1: 10.XY.100.5 	1

2.1 On all switches, configure IEEE 802.1Q trunk interfaces on interconnecting switch

D1

D1>en

D1#conf term

Enter configuration commands, one per line. End with CNTL/Z.

D1(config)# interface range e2/0 - 3

D1(config-if-range)# switchport trunk encapsulation dot1q

D1(config-if-range)# switchport mode trunk

D1>en

D1#conf term

Enter configuration commands, one per line. End with CNTL/Z.

```
D1(config)# interface range e0/1 - 2
```

```
D1(config-if-range)# switchport trunk encapsulation dot1q
```

```
D1(config-if-range)# switchport mode trunk
```

D2

```
D2>en
```

```
D2#conf term
```

Enter configuration commands, one per line. End with CNTL/Z.

```
D2(config)# interface range e2/0 - 3
```

```
D2(config-if-range)# switchport trunk encapsulation dot1q
```

```
D2(config-if-range)# switchport mode trunk
```

```
D1>en
```

```
D1#conf term
```

Enter configuration commands, one per line. End with CNTL/Z.

```
D1(config)# interface range e1/1 - 2
```

```
D1(config-if-range)# switchport trunk encapsulation dot1q
```

```
D1(config-if-range)# switchport mode trunk
```

A1

```
A1>en
```

```
A1#conf term
```

Enter configuration commands, one per line. End with CNTL/Z.

```
A1(config)# interface range e0/1 - 2
```

```
A1(config-if-range)# switchport trunk encapsulation dot1q
```

```
A1(config-if-range)# switchport mode trunk
```

```
A1>en
```

```
A1#conf term
```

Enter configuration commands, one per line. End with CNTL/Z.

```
A1(config)# interface range e1/1 - 2
```

```
A1(config-if-range)# switchport trunk encapsulation dot1q
A1(config-if-range)# switchport mode trunklinks
```

2.2 On all switches, change the native VLAN on trunk links.

D1

```
D1(config)# interface range e2/0 - 3
D1(config-if-range)# switchport trunk native vlan 999
```

```
D1(config)# interface range e0/1 - 2
D1(config-if-range)# switchport trunk native vlan 999
```

D2

```
D2(config)# interface range e2/0 - 3
D2(config-if-range)# switchport trunk native vlan 999
```

```
D1(config)# interface range e1/1 - 2
D1(config-if-range)# switchport trunk native vlan 999
```

A1

```
A1(config)# interface range e0/1 - 2
A1(config-if-range)# switchport trunk native vlan 999
```

```
A1(config)# interface range e1/1 - 2
A1(config-if-range)# switchport trunk native vlan 999
```

Imagen 5. Verificación enlaces troncales D1.

```
D1 D2 A1
R01: 22:40:05.388: %DTPROTO-5-UPDOWN: Line protocol on Interface Ethernet0/1, changed state to down
R02: 22:40:05.399: %DTPROTO-5-UPDOWN: Line protocol on Interface Ethernet0/2, changed state to down
R01(config-if-range)#exit
R02: 22:40:05.981: %DTPROTO-5-UPDOWN: Line protocol on Interface Ethernet0/1, changed state to up
R01(config-if-range)#exit
R02: 22:40:05.986: %DTPROTO-5-UPDOWN: Line protocol on Interface Ethernet0/2, changed state to up
R01: 22:40:09.296: %DTPROTO-5-UPDOWN: Line protocol on Interface Ethernet0/1, changed state to up
R02: 22:40:09.306: %DTPROTO-5-UPDOWN: Line protocol on Interface Ethernet0/2, changed state to up
R01: 22:40:09.396: %DTPROTO-5-UPDOWN: Line protocol on Interface Ethernet0/1, changed state to up
R02: 22:40:09.396: %DTPROTO-5-UPDOWN: Line protocol on Interface Ethernet0/2, changed state to up
R01(config-if-range)#exit
R02: 22:40:12.024: %SFP-S-1000FIBER2: S12/0 suspended: LACP currently not enabled on the remote port.
R01: 22:40:12.451: %SFP-S-1000FIBER2: S18/1 suspended: LACP currently not enabled on the remote port.
R02: 22:40:12.486: %SFP-S-1000FIBER2: S18/2 suspended: LACP currently not enabled on the remote port.
R01: 22:40:12.840: %SFP-S-1000FIBER2: S12/2 suspended: LACP currently not enabled on the remote port.
R02: 22:40:13.086: %SFP-S-1000FIBER2: S12/2 suspended: LACP currently not enabled on the remote port.
R01: 22:40:13.147: %SFP-S-1000FIBER2: S12/2 suspended: LACP currently not enabled on the remote port.
R02(config-if-range)#exit
R01: 22:40:22.637: %DTPROTO-5-UPDOWN: Line protocol on Interface Port-channel11, changed state to up
R02(config)#
R01: 22:40:27.439: %DTPROTO-5-UPDOWN: Line protocol on Interface Port-channel1, changed state to up
R02(config)#
R01(config)#exit
R02
R01: 22:51:02.026: %SYS-5-CONF0L_1: Configured from console by console
R02
R01#show int trunk
Port      Mode          Encapsulation  Status        Native vlan
-----
Po12     on             802.1q         trunking     999
Po13     on             802.1q         trunking     999

Port      Vlans allowed on trunk
-----
Po12     1-4094
Po13     1-4094

Port      Vlans allowed and active in management domain
-----
Po12     1,398-182,999
Po13     1,398-182,999

Port      Vlans in spanning tree forwarding state and not pruned
-----
Po12     1,398-182,999
Po13     1,398-182,999
R02#
R02#
R02#
```

Imagen 6. Verificación enlaces troncales D2.

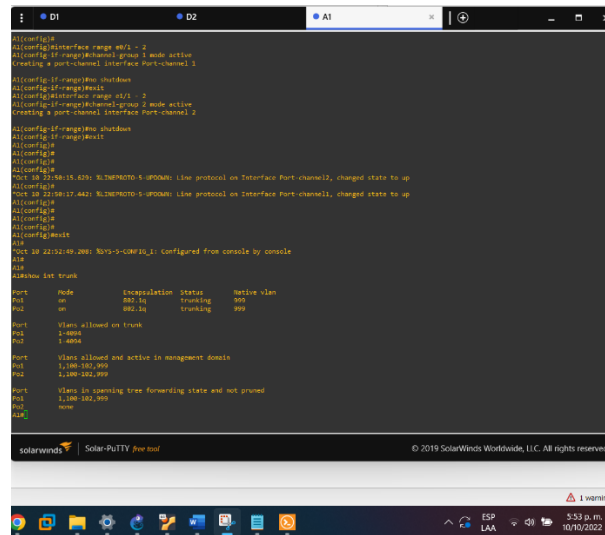
```
D1 D2 A1
R02(config)#interface range po18 - 1
R02(config-if-range)#channel-group 12 mode active
R02(config-if-range)#no shutdown
R02(config-if-range)#exit
R02(config)#interface range po13 - 2
R02(config-if-range)#channel-group 2 mode active
R02(config-if-range)#no shutdown
R02(config-if-range)#exit
R02(config)#
R02: 22:51:01.637: %DTPROTO-5-UPDOWN: Line protocol on Interface Port-channel11, changed state to up
R02(config)#
R02: 22:51:02.979: %SFP-S-1000FIBER2: S12/2 suspended: LACP currently not enabled on the remote port.
R01: 22:51:04.258: %SFP-S-1000FIBER2: P11/2 suspended: LACP currently not enabled on the remote port.
R02(config)#
R02: 22:51:05.639: %DTPROTO-5-UPDOWN: Line protocol on Interface Port-channel12, changed state to up
R02(config)#
R02(config)#exit
R02
R01: 22:52:09.079: %SYS-5-CONF0L_1: Configured from console by console
R02#show int trunk
Port      Mode          Encapsulation  Status        Native vlan
-----
Po12     on             802.1q         trunking     999
Po13     on             802.1q         trunking     999

Port      Vlans allowed on trunk
-----
Po12     1-4094
Po13     1-4094

Port      Vlans allowed and active in management domain
-----
Po12     1,398-182,999
Po13     1,398-182,999

Port      Vlans in spanning tree forwarding state and not pruned
-----
Po12     1,398-182,999
Po13     1,398-182,999
R02#
R02#
R02#
```

Imagen 7. Verificación enlaces troncales A1



2.3 On all switches, enable the Rapid Spanning-Tree Protocol.

D1

D1(config)#spanning-tree mode rapid-pvst

D2

D2(config)#spanning-tree mode rapid-pvst

A1

A1(config)#spanning-tree mode rapid-pvst

2.4 On D1 and D2, configure the appropriate RSTP root bridges based on the information in the topology diagram.

D1 and D2 must provide backup in case of root bridge failure.

D1

2.5 On all switches, create LACP EtherChannels as shown in the topology diagram.

D1

```
D1(config)# interface range e2/0 - 3
D1(config-if-range)# channel-group 12 mode active
D1(config)# interface range e0/1 - 2
D1(config-if-range)# channel-group 1 mode active
```

D2

```
D2(config)# interface range e2/0 - 3
D2(config-if-range)# channel-group 12 mode active
D2(config)# interface range e1/1 - 2
D2(config-if-range)# channel-group 2 mode active
```

A1

```
A1(config)# interface range e0/1 - 2
A1(config-if-range)# channel-group 1 mode active

A1(config)# interface range e1/1 - 2
A1(config-if-range)# channel-group 2 mode active
```

Imagen 10. Verificación LACP en D1.

```

D1:
D1(config)#interface range e0/0
D1(config-if-range)#shutdown
D1(config-if-range)#shutdown access vlan 100
D1(config-if-range)#spanning-tree portfast
D1(config-if-range)#no shutdown
D1(config-if-range)#exit
D1(config)#
D1#
*Oct 10 21:27:15.182: %LINK-3-UPDOWN: Interface Ethernet0/0, changed state to up
*Oct 10 21:27:15.184: %LINEPROTO-3-UPDOWN: Line protocol on Interface Ethernet0/0, changed state to up
D1(config)#
D1(config)#
D1(config)#
D1(config)#
D1(config)#exit
D1#
*Oct 10 21:21:00.711: SVS-5-COMP1_7: Configured from console by console
D1#show lacp neighbor
Flags: S - Device is requesting Slow LACPDU
      P - Device is requesting Fast LACPDU
      A - Device is in Active mode      P - Device is in Passive mode

Channel group 1 neighbors
Partner's information:
Port:  Flags  Priority  Dev ID   Age  Key  Key  Number  State
-----
e1/2/0 SA  32768  aabb.cc00.8300  25  0x0  0x0  0x20  OK/0

Channel group 12 neighbors
Partner's information:
Port:  Flags  Priority  Dev ID   Age  Key  Key  Number  State
-----
e2/2/0 SA  32768  aabb.cc00.8300  11  0x0  0x0  0x20  OK/0
e2/2/1 SA  32768  aabb.cc00.8300  18  0x0  0x0  0x20  OK/0
e2/2/2 SA  32768  aabb.cc00.8300  23  0x0  0x0  0x20  OK/0
e2/2/3 SA  32768  aabb.cc00.8300  17  0x0  0x0  0x20  OK/0
D1#
D1#
D1#

```

Imagen 11. Verificación LACP en D2.

The image shows a network diagram on the left and a terminal screenshot on the right. The diagram illustrates a network topology with three switches (S1, S2, S3) and four PCs (PC1, PC2, PC3, PC4). S1 and S2 are connected to S3. S1 and S2 are also connected to PC1 and PC2. S2 and S3 are connected to PC3 and PC4. The terminal screenshot shows the configuration of interface e1/0 on switch D2, including LACP settings and neighbor information for channel groups 1 and 12.

```

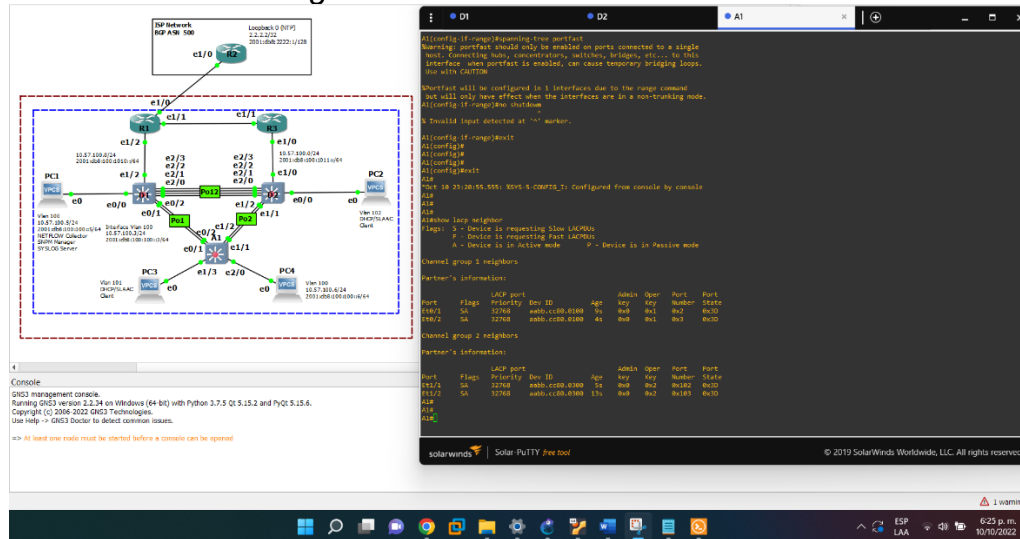
D2:
D2#
D2(config)#spanning-tree vlan 100 root primary
D2(config)#interface range e0/0
D2(config-if-range)#shutdown
D2(config-if-range)#shutdown access vlan 100
D2(config-if-range)#spanning-tree portfast
D2(config-if-range)#no shutdown
D2(config-if-range)#exit
D2(config)#
D2#
*Oct 10 21:29:07.042: %LINK-3-UPDOWN: Interface Ethernet0/0, changed state to up
*Oct 10 21:29:07.044: %LINEPROTO-3-UPDOWN: Line protocol on Interface Ethernet0/0, changed state to up
D2(config)#
D2(config)#
D2(config)#
D2(config)#
D2(config)#exit
D2#
*Oct 10 21:21:01.744: SVS-5-COMP1_7: Configured from console by console
D2#show lacp neighbor
Flags: S - Device is requesting Slow LACPDU
      P - Device is requesting Fast LACPDU
      A - Device is in Active mode      P - Device is in Passive mode

Channel group 2 neighbors
Partner's information:
Port:  Flags  Priority  Dev ID   Age  Key  Key  Number  State
-----
e1/2/0 SA  32768  aabb.cc00.8300  25  0x0  0x0  0x102  OK/0
e1/2/2 SA  32768  aabb.cc00.8300  6  0x0  0x0  0x102  OK/0

Channel group 12 neighbors
Partner's information:
Port:  Flags  Priority  Dev ID   Age  Key  Key  Number  State
-----
e2/2/0 SA  32768  aabb.cc00.8300  11  0x0  0x0  0x20  OK/0
e2/2/1 SA  32768  aabb.cc00.8300  18  0x0  0x0  0x20  OK/0
e2/2/2 SA  32768  aabb.cc00.8300  23  0x0  0x0  0x20  OK/0
e2/2/3 SA  32768  aabb.cc00.8300  17  0x0  0x0  0x20  OK/0
D2#
D2#
D2#

```

Imagen 12. Verificación LACP en A1.



2.6 On all switches, configure host access ports connecting to PC1, PC2, PC3, and PC4.

D1

```

D1(config)# interface range e0/0
D1(config-if-range)# switchport mode Access
D1(config-if-range)# switchport access vlan 100
D1(config-if-range)# spanning-tree portfast
  
```

D2

```

D2(config)# interface range e0/0
D2(config-if-range)# switchport mode Access
D2(config-if-range)# switchport access vlan 102
D2(config-if-range)# spanning-tree portfast
  
```

A1

```

A1(config)# interface range e1/3
A1(config-if-range)# switchport mode Access
A1(config-if-range)# switchport access vlan 101
  
```

A1(config-if-range)# spanning-tree portfast

A1(config)# interface range e2/0

A1(config-if-range)# switchport mode Access

A1(config-if-range)# switchport access vlan 100

A1(config-if-range)# spanning-tree portfast

2.7 Verify IPv4 DHCP services.

Imagen 13. Verificación DHCP PC2.

The screenshot displays a GNS3 simulation environment. On the left, a network topology diagram shows a central switch A1 connected to several other switches (A2, A3, A4, A5) and four PCs (PC1, PC2, PC3, PC4). A1 is configured with a Vlan 100. On the right, the console window for PC2 shows the following output:

```
Welcome to Virtual PC Simulator, version 0.8.2
Powered by QEMU
Build time: Aug 22 2021 11:11:00
Copyright (c) 2007-2021, Paul Meng (edrolid@gmail.com)
All rights reserved.

PC2 is Free Software, distributed under the terms of the "BSD" license.
Source code and license can be found at http://freebsd.org.
For more information, please visit http://freebsd.com.cn.

Press '?' to get help.

Loading the startup file

PC2: ip dhcp
IPADDR: 10.37.180.110/24 GW: 10.37.180.254
PC2: show
NAME IP/NETMASK GATEWAY VNIC LHOST RHOST-PORT
PC2 10.37.180.110/24 10.37.201.254 10/37/180/110 20040 127.0.0.1:20040
2001:db8:100:100::100/64 2001:db8:100:100::100:64
PC2: |
```

Imagen 14. Verificación DHCP PC3.

The screenshot displays a GNS3 simulation environment. On the left, a network topology diagram shows a central switch A1 connected to several other switches (A2, A3, A4, A5) and four PCs (PC1, PC2, PC3, PC4). A1 is configured with a Vlan 100. On the right, the console window for PC3 shows the following output:

```
Welcome to Virtual PC Simulator, version 0.8.2
Powered by QEMU
Build time: Aug 22 2021 11:11:00
Copyright (c) 2007-2021, Paul Meng (edrolid@gmail.com)
All rights reserved.

PC3 is Free Software, distributed under the terms of the "BSD" license.
Source code and license can be found at http://freebsd.org.
For more information, please visit http://freebsd.com.cn.

Press '?' to get help.

Loading the startup file

PC3: ip dhcp
IPADDR: 10.37.180.110/24 GW: 10.37.180.254
PC3: show
NAME IP/NETMASK GATEWAY VNIC LHOST RHOST-PORT
PC3 10.37.180.110/24 10.37.201.254 10/37/180/110 20040 127.0.0.1:20040
2001:db8:100:100::100/64 2001:db8:100:100::100:64
PC3: |
```

2.8 Verify local LAN connectivity.

Imagen 15. Verificación conectividad LAN PC1.

The screenshot displays the SolarWinds VM simulator interface. On the left, a network diagram shows a central switch (S1) connected to several PCs (PC1-PC4) and a server (S1). The diagram highlights the connections between S1 and PC1. The console window shows the GNS3 management console output, including the version (2.2.34) and the operating system (Windows 10). The terminal window shows the execution of the following commands:

```

PC1:
PC1> ping 10.57.100.1
Pinging 10.57.100.1 with 32 bytes of data:
30 bytes from 10.57.100.1: icmp_seq=1 ttl=255 time=0.763 ms
30 bytes from 10.57.100.1: icmp_seq=2 ttl=255 time=0.688 ms
30 bytes from 10.57.100.1: icmp_seq=3 ttl=255 time=0.609 ms
30 bytes from 10.57.100.1: icmp_seq=4 ttl=255 time=0.616 ms
30 bytes from 10.57.100.1: icmp_seq=5 ttl=255 time=0.607 ms

PC1> ping 10.57.100.2
Pinging 10.57.100.2 with 32 bytes of data:
30 bytes from 10.57.100.2: icmp_seq=1 ttl=255 time=1.033 ms
30 bytes from 10.57.100.2: icmp_seq=2 ttl=255 time=0.715 ms
30 bytes from 10.57.100.2: icmp_seq=3 ttl=255 time=1.368 ms
30 bytes from 10.57.100.2: icmp_seq=4 ttl=255 time=0.595 ms
30 bytes from 10.57.100.2: icmp_seq=5 ttl=255 time=1.005 ms

PC1> ping 10.57.100.6
Pinging 10.57.100.6 with 32 bytes of data:
30 bytes from 10.57.100.6: icmp_seq=1 ttl=64 time=1.189 ms
30 bytes from 10.57.100.6: icmp_seq=2 ttl=64 time=1.282 ms
30 bytes from 10.57.100.6: icmp_seq=3 ttl=64 time=1.313 ms
30 bytes from 10.57.100.6: icmp_seq=4 ttl=64 time=0.686 ms
30 bytes from 10.57.100.6: icmp_seq=5 ttl=64 time=1.206 ms

PC1: |
    
```

Imagen 16. Verificación conectividad LAN PC2.

The screenshot displays the SolarWinds VM simulator interface. On the left, a network diagram shows a central switch (S1) connected to several PCs (PC1-PC4) and a server (S1). The diagram highlights the connections between S1 and PC2. The console window shows the GNS3 management console output, including the version (2.2.34) and the operating system (Windows 10). The terminal window shows the execution of the following commands:

```

PC2:
PC2> ipconfig
Windows IP Configuration

Ethernet adapter VMXNET3:

   . . . . .

   DHCPv6 IP . . . . . 10.57.100.110/24  10.57.100.2/24

PC2> show
NAME          IPADDRESS          GATEWAY          MAC          PORT          HOST:PORT
-----
PC2           10.57.100.110/24    10.57.100.2/24    08:00:27:00:00:00  20058  127.0.0.1:20051
PC2           2001:000:100:100:2006:ffff:fe08:64  e1-64

PC2> ping 10.57.100.1
Pinging 10.57.100.1 with 32 bytes of data:
30 bytes from 10.57.100.1: icmp_seq=1 ttl=255 time=1.009 ms
30 bytes from 10.57.100.1: icmp_seq=2 ttl=255 time=0.912 ms
30 bytes from 10.57.100.1: icmp_seq=3 ttl=255 time=1.095 ms
30 bytes from 10.57.100.1: icmp_seq=4 ttl=255 time=0.768 ms
30 bytes from 10.57.100.1: icmp_seq=5 ttl=255 time=1.012 ms

PC2> ping 10.57.100.2
Pinging 10.57.100.2 with 32 bytes of data:
30 bytes from 10.57.100.2: icmp_seq=1 ttl=255 time=0.355 ms
30 bytes from 10.57.100.2: icmp_seq=2 ttl=255 time=0.511 ms
30 bytes from 10.57.100.2: icmp_seq=3 ttl=255 time=1.253 ms
30 bytes from 10.57.100.2: icmp_seq=4 ttl=255 time=0.811 ms
30 bytes from 10.57.100.2: icmp_seq=5 ttl=255 time=0.811 ms

PC2: |
    
```

Imagen 17. Verificación conectividad LAN PC3.

The screenshot displays a network simulation environment. On the left, a network diagram shows a central switch (A1) connected to three PCs (PC1, PC2, PC3) and a DHCP server (D1). PC3 is highlighted with a red dashed box. The console window shows the following output:

```

gns3 management console.
Running GNS3 version 2.2.34 on Windows (64-bit) with Python 3.7.5 Qt 5.15.2 and PyQt 5.15.6.
Copyright (C) 2005-2022 GNS3 Technologies.
Use Help -> GNS3 Doctor to detect common issues.
=> At least one node must be started before a console can be opened
  
```

The terminal window shows the execution of the following commands and their output:

```

PC3: dhcp
DHCPA TP 10.57.180.1/24 94 10.57.180.254

PC3: show
NAME IP/PROT 0/0/0/0 N/A LPORT INNOV1:PORT
PC3 10.57.180.1/24 10.57.180.254 94 10.57.180.1/24 2048 137.0.0.1.2048
FAHRI:250:78ff:fe0d:682/64
2003:0000:1000:0000:0000:0000:0000:0000

PC3: ping 10.57.180.1
64 bytes from 10.57.180.1: icmp_seq=1 ttl=250 time=1.156 ms
64 bytes from 10.57.180.1: icmp_seq=2 ttl=250 time=1.153 ms
64 bytes from 10.57.180.1: icmp_seq=3 ttl=250 time=1.436 ms
64 bytes from 10.57.180.1: icmp_seq=4 ttl=250 time=1.151 ms
64 bytes from 10.57.180.1: icmp_seq=5 ttl=250 time=1.402 ms

PC3: ping 10.57.180.2
64 bytes from 10.57.180.2: icmp_seq=1 ttl=250 time=1.605 ms
64 bytes from 10.57.180.2: icmp_seq=2 ttl=250 time=1.494 ms
64 bytes from 10.57.180.2: icmp_seq=3 ttl=250 time=1.474 ms
64 bytes from 10.57.180.2: icmp_seq=4 ttl=250 time=1.466 ms
64 bytes from 10.57.180.2: icmp_seq=5 ttl=250 time=1.743 ms

PC3: !
  
```

Imagen 18. Verificación conectividad LAN PC4.

The screenshot displays a network simulation environment. On the left, a network diagram shows a central switch (A1) connected to four PCs (PC1, PC2, PC3, PC4) and a DHCP server (D1). PC4 is highlighted with a red dashed box. The console window shows the following output:

```

gns3 management console.
Running GNS3 version 2.2.34 on Windows (64-bit) with Python 3.7.5 Qt 5.15.2 and PyQt 5.15.6.
Copyright (C) 2005-2022 GNS3 Technologies.
Use Help -> GNS3 Doctor to detect common issues.
=> At least one node must be started before a console can be opened
  
```

The terminal window shows the execution of the following commands and their output:

```

PC4:
PC4: ping 10.57.180.1
64 bytes from 10.57.180.1: icmp_seq=1 ttl=250 time=1.413 ms
64 bytes from 10.57.180.1: icmp_seq=2 ttl=250 time=1.186 ms
64 bytes from 10.57.180.1: icmp_seq=3 ttl=250 time=1.181 ms
64 bytes from 10.57.180.1: icmp_seq=4 ttl=250 time=1.164 ms
64 bytes from 10.57.180.1: icmp_seq=5 ttl=250 time=1.158 ms

PC4: ping 10.57.180.2
64 bytes from 10.57.180.2: icmp_seq=1 ttl=250 time=1.277 ms
64 bytes from 10.57.180.2: icmp_seq=2 ttl=250 time=1.222 ms
64 bytes from 10.57.180.2: icmp_seq=3 ttl=250 time=1.171 ms
64 bytes from 10.57.180.2: icmp_seq=4 ttl=250 time=1.164 ms
64 bytes from 10.57.180.2: icmp_seq=5 ttl=250 time=1.158 ms

PC4: ping 10.57.180.5
64 bytes from 10.57.180.5: icmp_seq=1 ttl=64 time=0.811 ms
64 bytes from 10.57.180.5: icmp_seq=2 ttl=64 time=1.110 ms
64 bytes from 10.57.180.5: icmp_seq=3 ttl=64 time=1.290 ms
64 bytes from 10.57.180.5: icmp_seq=4 ttl=64 time=1.277 ms
64 bytes from 10.57.180.5: icmp_seq=5 ttl=64 time=1.400 ms

PC4: !
  
```

3. Configure Routing Protocols

In this part, you will configure IPv4 and IPv6 routing protocols. At the end of this part, the network should be fully converged. IPv4 and IPv6 pings to the Loopback 0 interface from D1 and D2 should be successful.

Note: Pings from the hosts will not be successful because their default gateways are pointing to the HSRP address which will be enabled in Part 4.

Table 3. Your configuration tasks are as follows:

Task#	Task	Specification	Points
3.1	On the “Company Network” (i.e., R1, R3, D1, and D2), configure single-area OSPFv2 in area 0.	<p>Use OSPF Process ID 4 and assign the following router-IDs:</p> <ul style="list-style-type: none"> • R1: 0.0.4.1 • R3: 0.0.4.3 • D1: 0.0.4.131 • D2: 0.0.4.132 <p>On R1, R3, D1, and D2, advertise all directly connected networks / VLANs in Area 0.</p> <ul style="list-style-type: none"> • On R1, do not advertise the R1 – R2 network. • On R1, propagate a default route. Note that the default route will be provided by BGP. <p>Disable OSPFv2 advertisements on:</p> <ul style="list-style-type: none"> • D1: All interfaces except E1/2 • D2: All interfaces except E1/0 	8
3.2	On the “Company Network” (i.e., R1, R3, D1, and D2), configure classic single-area OSPFv3 in area 0.	<p>Use OSPF Process ID 6 and assign the following router-IDs:</p> <ul style="list-style-type: none"> • R1: 0.0.6.1 • R3: 0.0.6.3 • D1: 0.0.6.131 • D2: 0.0.6.132 <p>On R1, R3, D1, and D2, advertise all directly connected networks / VLANs in Area 0.</p> <ul style="list-style-type: none"> • On R1, do not advertise the R1 – R2 network. • On R1, propagate a default route. Note that the default route will be provided by BGP. <p>Disable OSPFv3 advertisements on:</p> <ul style="list-style-type: none"> • D1: All interfaces except E1/2 • D2: All interfaces except E1/0 	8

Task#	Task	Specification	Points
3.3	On R2 in the “ISP Network”, configure MP-BGP.	<p>Configure two default static routes via interface Loopback 0:</p> <ul style="list-style-type: none"> • An IPv4 default static route. • An IPv6 default static route. <p>Configure R2 in BGP ASN 500 and use the router-id 2.2.2.2.</p> <p>Configure and enable an IPv4 and IPv6 neighbor relationship with R1 in ASN 300.</p> <p>In IPv4 address family, advertise:</p> <ul style="list-style-type: none"> • The Loopback 0 IPv4 network (/32). • The default route (0.0.0.0/0). <p>In IPv6 address family, advertise:</p> <ul style="list-style-type: none"> • The Loopback 0 IPv4 network (/128). • The default route (::/0). 	4
3.4	On R1 in the “ISP Network”, configure MP-BGP.	<p>Configure two static summary routes to interface Null 0:</p> <ul style="list-style-type: none"> • A summary IPv4 route for 10.XY.0.0/8. • A summary IPv6 route for 2001:db8:100::/48. <p>Configure R1 in BGP ASN 300 and use the router-id 1.1.1.1.</p> <p>Configure an IPv4 and IPv6 neighbor relationship with R2 in ASN 500.</p> <p>In IPv4 address family:</p> <ul style="list-style-type: none"> • Disable the IPv6 neighbor relationship. • Enable the IPv4 neighbor relationship. • Advertise the 10.XY.0.0/8 network. <p>In IPv6 address family:</p> <ul style="list-style-type: none"> • Disable the IPv4 neighbor relationship. • Enable the IPv6 neighbor relationship. • Advertise the 2001:db8:100::/48 network. 	4

3.1 Configuración OSPFv2

R1

```
R1(config)#router ospf 4
R1(config-router)#router-id 0.0.4.1
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
R1(config-router)#default-information originate
R1(config-router)#exit
```

R3

```
R3(config)#router ospf 4
R3(config-router)#router-id 0.0.4.3
R3(config-router)#network 10.0.11.0 0.0.0.255 area 0
R3(config-router)#network 10.0.13.0 0.0.0.255 area 0
R3(config-router)#exit
```

D1

```
D1(config)#router ospf 4
D1(config-router)#router-id 0.0.4.131
D1(config-router)#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)#passive-interface default
D1(config-router)#no passive-interface E1/2
D1(config-router)#exit
```

D2

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

```

D2(config-router)#network 10.57.10.0 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)#passive-interface default
D2(config-router)#no passive-interface E1/0
D2(config-router)#exit

```

Imagen 19. Configure Routing Protocol R1.

The screenshot shows a network topology diagram on the left and a terminal window on the right. The terminal window displays the configuration for R1:

```

R1
conf t
R1(config)#interface e1/0
R1(config-if)#ip address 192.168.56.101 255.255.255.0
R1(config-if)#no shutdown
R1(config-if)#exit
R1(config)#interface e1/1
R1(config-if)#ip address 10.57.10.1 255.255.255.0
R1(config-if)#no shutdown
R1(config-if)#exit
R1(config)#interface e1/2
R1(config-if)#ip address 10.57.100.1 255.255.255.0
R1(config-if)#no shutdown
R1(config-if)#exit
R1(config)#interface e1/3
R1(config-if)#ip address 10.57.101.1 255.255.255.0
R1(config-if)#no shutdown
R1(config-if)#exit
R1(config)#router ospf 1
R1(config-router)#network 10.57.10.0 0.0.0.255 area 0
R1(config-router)#network 10.57.100.0 0.0.0.255 area 0
R1(config-router)#network 10.57.101.0 0.0.0.255 area 0
R1(config-router)#passive-interface default
R1(config-router)#no passive-interface e1/0
R1(config-router)#exit

```

Imagen 20. Configure Routing Protocol R3.

The screenshot shows a network topology diagram on the left and a terminal window on the right. The terminal window displays the configuration for R3:

```

R3
conf t
R3(config)#interface e1/0
R3(config-if)#ip address 192.168.56.101 255.255.255.0
R3(config-if)#no shutdown
R3(config-if)#exit
R3(config)#interface e1/1
R3(config-if)#ip address 10.57.10.1 255.255.255.0
R3(config-if)#no shutdown
R3(config-if)#exit
R3(config)#interface e1/2
R3(config-if)#ip address 10.57.100.1 255.255.255.0
R3(config-if)#no shutdown
R3(config-if)#exit
R3(config)#interface e1/3
R3(config-if)#ip address 10.57.101.1 255.255.255.0
R3(config-if)#no shutdown
R3(config-if)#exit
R3(config)#router ospf 1
R3(config-router)#network 10.57.10.0 0.0.0.255 area 0
R3(config-router)#network 10.57.100.0 0.0.0.255 area 0
R3(config-router)#network 10.57.101.0 0.0.0.255 area 0
R3(config-router)#passive-interface default
R3(config-router)#no passive-interface e1/0
R3(config-router)#exit

```

3.2 Configuración OSPFv3

R1

```
R1(config)#ipv6 router ospf 6
R1(config-rtr)#router-id 0.0.6.1
R1(config-router)#default-information originate
R1(config-rtr)#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
```

R2

```
R2(config)#ipv6 router ospf 6
R2(config-rtr)#router-id 0.0.6.3
R2(config-rtr)#exit
R2(config)#interface E1/0
R2(config-if)#ipv6 ospf 6 area 0
R2(config-if)#exit
R2(config)#interface E1/1
R2(config-if)#ipv6 ospf 6 area 0
R2(config-if)#exit
```

D1

```
D1(config)#ipv6 router ospf 6
D1(config-rtr)#router-id 0.0.6.131
D1(config-rtr)#passive-interface default
D1(config-rtr)# no passive-interface E1/2
D1(config-rtr)#exit
```

```
D1(config)#interface E1/2
D1(config-if)#ipv6 ospf 6 area 0
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
D1(config)#end
```

D2

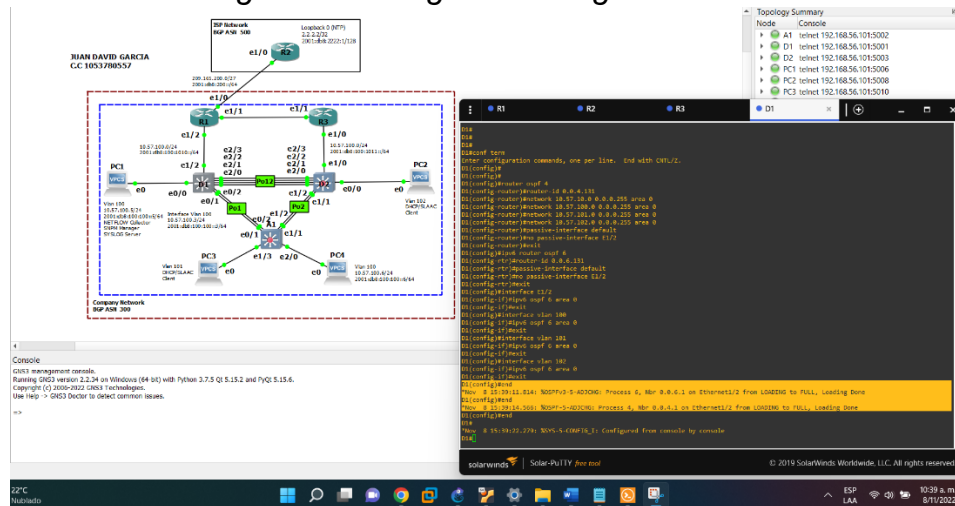
```
D2(config)#ipv6 router ospf 6
D2(config-rtr)#router-id 0.0.6.132
D2(config-rtr)#passive-interface default
D2(config-rtr)# no passive-interface E1/0
D2(config-rtr)#exit
D2(config)#interface E1/0
D2(config-if)#ipv6 ospf 6 area 0
D2(config-if)#exit
D2(config)#interface vlan 100
D2(config-if)#ipv6 ospf 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

D2(config)#end

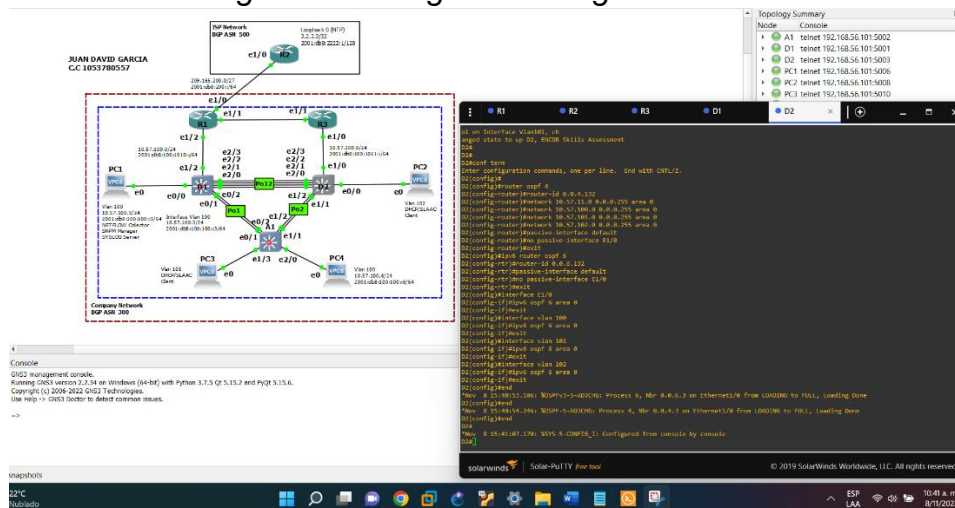
Imagen 21. Configure Routing Protocol D1.



The screenshot shows a GNS3 virtualization environment with a network topology and a console window for router D1. The topology includes routers R1, R2, R3, and D1, along with several PCs. The console window shows the following configuration:

```
R1>en
R1(config)#router ospf 6
R1(config-router)#network 192.168.56.0 0.0.255.255 area 0
R1(config-router)#network 192.168.56.192 0.0.255.255 area 0
R1(config-router)#network 192.168.56.101 0.0.255.255 area 0
R1(config-router)#passive-interface default
R1(config-router)#passive-interface e1/0
R1(config-router)#passive-interface e1/1
R1(config-router)#passive-interface e1/2
R1(config-router)#passive-interface e1/3
R1(config-router)#passive-interface e1/4
R1(config-router)#passive-interface e0/0
R1(config-router)#passive-interface e0/1
R1(config-router)#passive-interface e0/2
R1(config-router)#passive-interface e0/3
R1(config-router)#passive-interface e0/4
R1(config-router)#exit
R1#sh ip ospf neighbor
Neighbor 192.168.56.101, 0/0/0/0 on Ethernet1/2 from LSDBIG to FULL, Loading Done
Neighbor 192.168.56.192, 0/0/0/0 on Ethernet1/3 from LSDBIG to FULL, Loading Done
Neighbor 192.168.56.193, 0/0/0/0 on Ethernet1/4 from LSDBIG to FULL, Loading Done
```

Imagen 22. Configure Routing Protocol D2.



The screenshot shows a GNS3 virtualization environment with a network topology and a console window for router D2. The topology is identical to Imagen 21. The console window shows the following configuration:

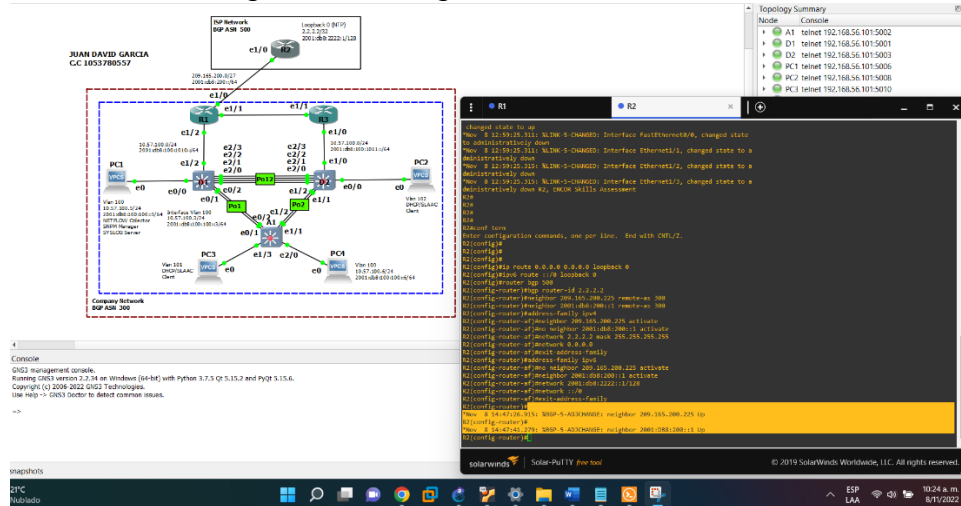
```
R1>en
R1(config)#router ospf 6
R1(config-router)#network 192.168.56.0 0.0.255.255 area 0
R1(config-router)#network 192.168.56.192 0.0.255.255 area 0
R1(config-router)#network 192.168.56.101 0.0.255.255 area 0
R1(config-router)#passive-interface default
R1(config-router)#passive-interface e1/0
R1(config-router)#passive-interface e1/1
R1(config-router)#passive-interface e1/2
R1(config-router)#passive-interface e1/3
R1(config-router)#passive-interface e1/4
R1(config-router)#passive-interface e0/0
R1(config-router)#passive-interface e0/1
R1(config-router)#passive-interface e0/2
R1(config-router)#passive-interface e0/3
R1(config-router)#passive-interface e0/4
R1(config-router)#exit
R1#sh ip ospf neighbor
Neighbor 192.168.56.101, 0/0/0/0 on Ethernet1/2 from LSDBIG to FULL, Loading Done
Neighbor 192.168.56.192, 0/0/0/0 on Ethernet1/3 from LSDBIG to FULL, Loading Done
Neighbor 192.168.56.193, 0/0/0/0 on Ethernet1/4 from LSDBIG to FULL, Loading Done
```

3.3 Configuración MP-BGP en la red ISP R2.

R2

```
R2(config)#ip route 0.0.0.0 0.0.0.0 loopback 0
R2(config)#ipv6 route ::/0 loopback 0
R2(config)#router bgp 500
R2(config-router)#bgp router-id 2.2.2.2
R2(config-router)#neighbor 209.165.200.225 remote-as 300
R2(config-router)#neighbor 2001:db8:200::1 remote-as 300
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
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
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
R2(config-router-af)#network 2001:db8:2222::1/128
R2(config-router-af)#network ::/0
R2(config-router-af)#exit-address-family
```

Imagen 23. Configure MP-BGP in ISP R2.



3.4 Configuración MP-BGP en la red ISP R1.

R1

```
R1(config)#ip route 10.57.0.0 255.0.0.0 null 0
R1(config)#ipv6 route 2001:db8:100::/48 null 0
R1(config)#router bgp 300
R1(config-router)#bgp router-id 1.1.1.1
R1(config-router)#neighbor 209.165.200.226 remote-as 500
R1(config-router)#neighbor 2001:db8:200::2 remote-as 500
R1(config-router)#address-family ipv4 unicast
R1(config-router-af)#neighbor 209.165.200.226 activate
R1(config-router-af)#no neighbor 2001:db8:200::2 activate
R1(config-router-af)#network 10.0.0.0 mask 255.0.0.0
R1(config-router-af)#exit-address-family
R1(config-router)#address-family ipv6 unicast
R1(config-router-af)#no neighbor 209.165.200.226 activate
R1(config-router-af)#neighbor 2001:db8:200::2 activate
R1(config-router-af)#network 2001:db8:100::/48
R1(config-router-af)#exit-address-family
```


Imagen 24. Verificación show ip ospf neighbor R1, R3, D1 y D2.

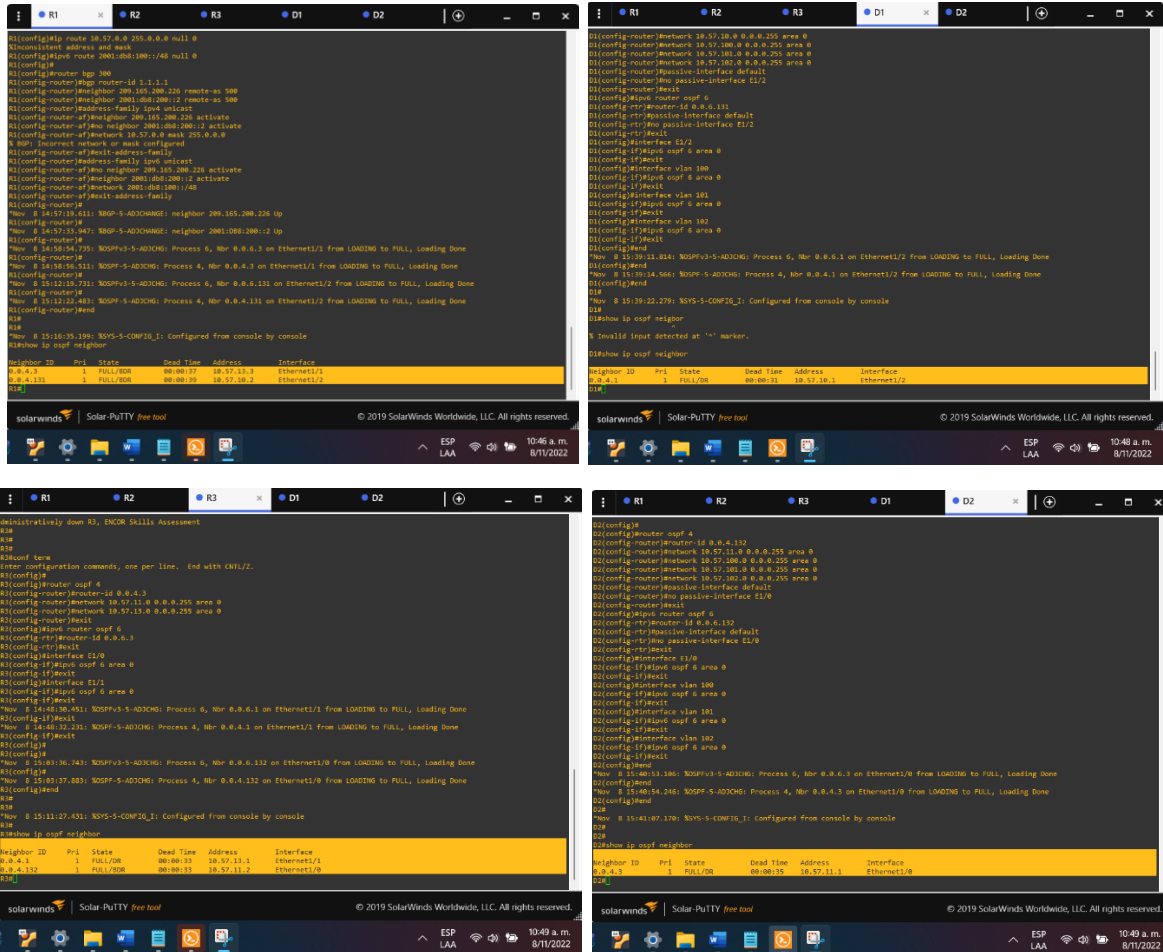


Imagen 25. Verificación show ip route R1, R2 y R3.

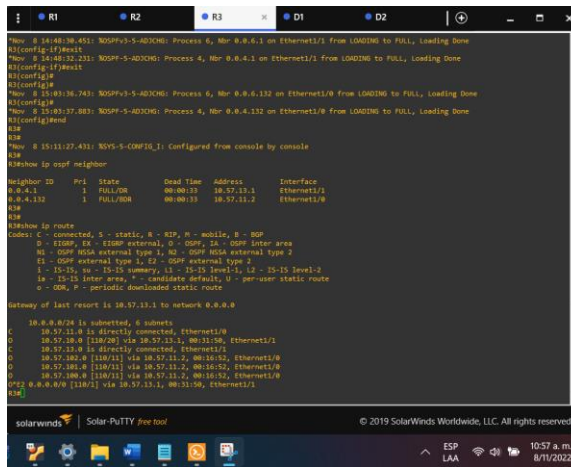
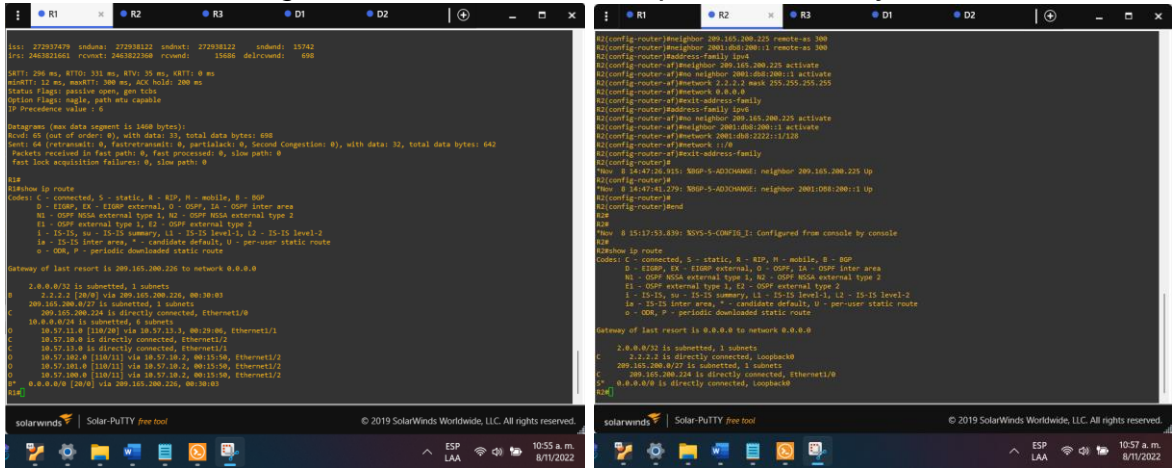
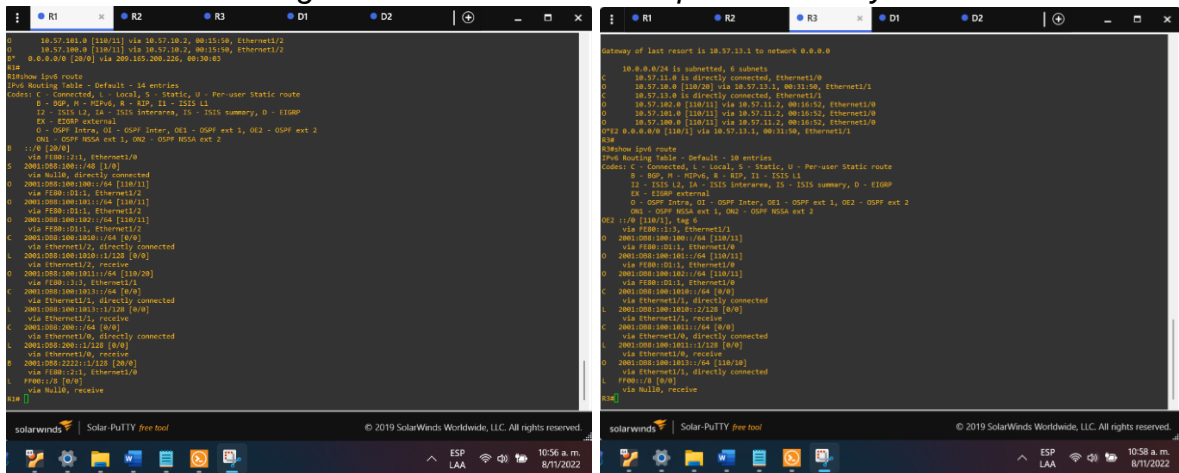


Imagen 26. Verificación show ipv6 route R1 y R3.



4. Configure First Hop Redundancy

In this part, you will configure HSRP version 2 to provide first-hop redundancy for hosts in the “Company Network”.

Tabla 4. Your configuration tasks are as follows:

Task#	Task	Specification	Points
4.1	On D1, create IP SLAs that test the reachability of R1 interface E1/2.	<p>Create two IP SLAs.</p> <ul style="list-style-type: none">• Use SLA number 4 for IPv4.• Use SLA number 6 for IPv6. <p>The IP SLAs will test availability of R1 E1/2 interface every 5 seconds.</p> <p>Schedule the SLA for immediate implementation with no end time.</p> <p>Create an IP SLA object for IP SLA 4 and one for IP SLA 6.</p> <ul style="list-style-type: none">• Use track number 4 for IP SLA 4.• Use track number 6 for IP SLA 6. <p>The tracked objects should notify D1 if the IP SLA state changes from down to up after 10 seconds, or from up to down after 15 seconds.</p>	2

Task#	Task	Specification	Points
4.2	On D2, create IP SLAs that test the reachability of R3 interface E1/0.	<p>Create two IP SLAs.</p> <ul style="list-style-type: none"> • Use SLA number 4 for IPv4. • Use SLA number 6 for IPv6. <p>The IP SLAs will test availability of R3 E1/0 interface every 5 seconds.</p> <p>Schedule the SLA for immediate implementation with no end time.</p> <p>Create an IP SLA object for IP SLA 4 and one for IP SLA 6.</p> <ul style="list-style-type: none"> • Use track number 4 for IP SLA 4. • Use track number 6 for IP SLA 6. <p>The tracked objects should notify D1 if the IP SLA state changes from down to up after 10 seconds, or from up to down after 15 seconds.</p>	2

4.3	<p>On D1, configure HSRPv2.</p>	<p>D1 is the primary router for VLANs 100 and 102; therefore, their priority will also be changed to 150.</p> <p>Configure HSRP version 2.</p> <p>Configure IPv4 HSRP group 104 for VLAN 100:</p> <ul style="list-style-type: none"> • Assign the virtual IP address 10.57.100.254. • Set the group priority to 150. • Enable preemption. • Track object 4 and decrement by 60. <p>Configure IPv4 HSRP group 114 for VLAN 101:</p> <ul style="list-style-type: none"> • Assign the virtual IP address 10.57.101.254. • Enable preemption. • Track object 4 to decrement by 60. <p>Configure IPv4 HSRP group 124 for VLAN 102:</p> <ul style="list-style-type: none"> • Assign the virtual IP address 10.57.102.254. • Set the group priority to 150. • Enable preemption. • Track object 4 to decrement by 60. <p>Configure IPv6 HSRP group 106 for VLAN 100:</p> <ul style="list-style-type: none"> • Assign the virtual IP address using ipv6 autoconfig. • Set the group priority to 150. • Enable preemption. • Track object 6 and decrement by 60. <p>Configure IPv6 HSRP group 116 for VLAN 101:</p> <ul style="list-style-type: none"> • Assign the virtual IP address using ipv6 autoconfig. • Enable preemption. • Track object 6 and decrement by 60. <p>Configure IPv6 HSRP group 126 for VLAN 102:</p>	8
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Task#	Task	Specification	Points
		<ul style="list-style-type: none">• Assign the virtual IP address using ipv6 autoconfig.• Set the group priority to 150.• Enable preemption.• Track object 6 and decrement by 60.	

	<p>On D2, configure HSRPv2.</p>	<p>D2 is the primary router for VLAN 101; therefore, the priority will also be changed to 150.</p> <p>Configure HSRP version 2.</p> <p>Configure IPv4 HSRP group 104 for VLAN 100:</p> <ul style="list-style-type: none"> • Assign the virtual IP address 10.57.100.254. • Enable preemption. • Track object 4 and decrement by 60. <p>Configure IPv4 HSRP group 114 for VLAN 101:</p> <ul style="list-style-type: none"> • Assign the virtual IP address 10.57.101.254. • Set the group priority to 150. • Enable preemption. • Track object 4 to decrement by 60. <p>Configure IPv4 HSRP group 124 for VLAN 102:</p> <ul style="list-style-type: none"> • Assign the virtual IP address 10.57.102.254. • Enable preemption. • Track object 4 to decrement by 60. <p>Configure IPv6 HSRP group 106 for VLAN 100:</p> <ul style="list-style-type: none"> • Assign the virtual IP address using ipv6 autoconfig. • Enable preemption. • Track object 6 and decrement by 60. <p>Configure IPv6 HSRP group 116 for VLAN 101:</p> <ul style="list-style-type: none"> • Assign the virtual IP address using ipv6 autoconfig. • Set the group priority to 150. • Enable preemption. • Track object 6 and decrement by 60. <p>Configure IPv6 HSRP group 126 for VLAN 102:</p> <ul style="list-style-type: none"> • Assign the virtual IP address using ipv6 autoconfig. 	
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Task#	Task	Specification	Points
		<ul style="list-style-type: none"> • Enable preemption. • Track object 6 and decrement by 60. 	

4.1 En D1, crear IP SLAs que prueben la accesibilidad de la interfaz R1 E1/2.

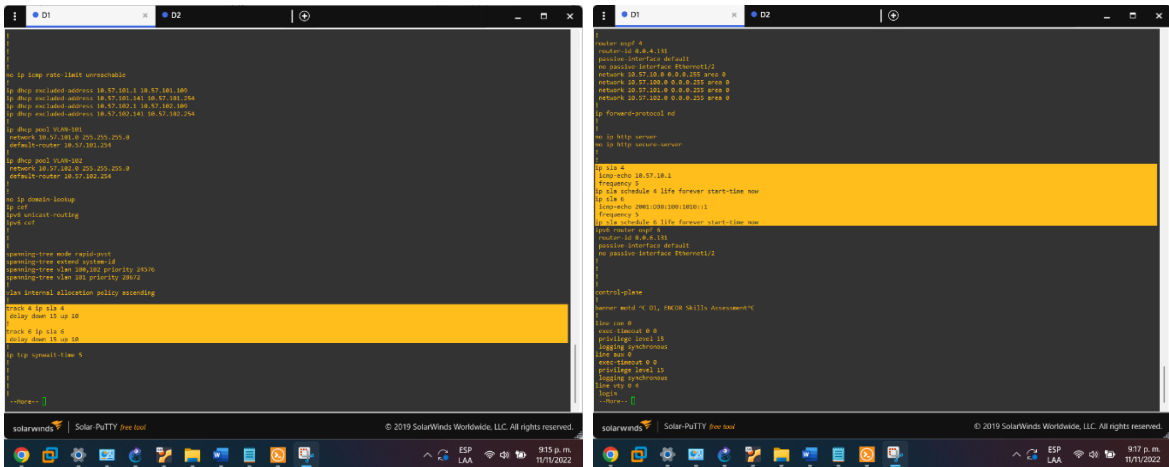
D1

```

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
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
D1(config)#ip sla schedule 4 life forever start-time now
D1(config)#ip sla schedule 6 life forever start-time now
D1(config)#track 4 ip sla 4
D1(config-track)#delay up 10 down 15
D1(config-track)#exit
D1(config)#track 6 ip sla 6
D1(config-track)#delay up 10 down 15
D1(config-track)#exit

```

Imagen 27. Verificación IP SLAs en D1.



4.2 En D2, crear IP SLAs que prueben la accesibilidad de la interfaz R3 E1/0.

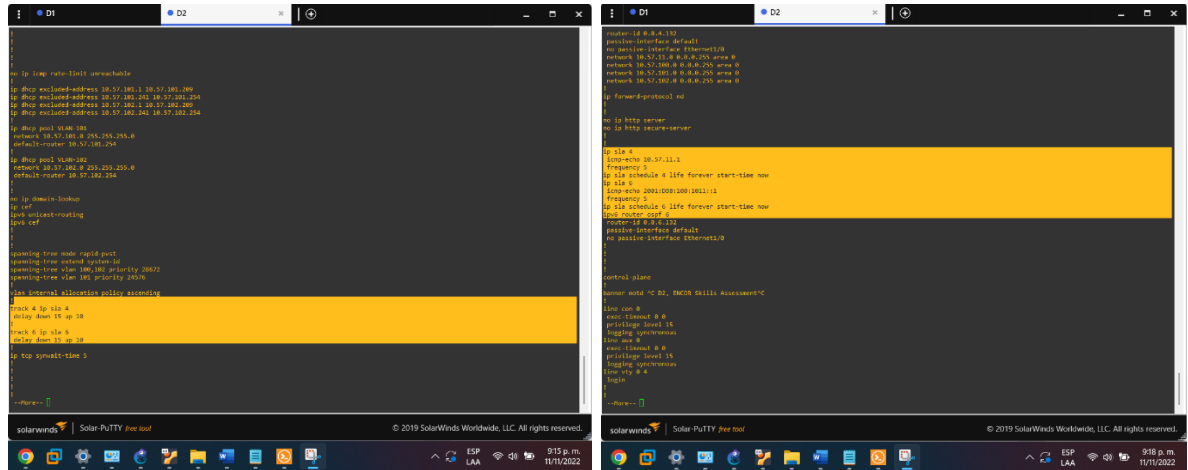
D2

```

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
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
D2(config)#ip sla schedule 4 life forever start-time now
D2(config)#ip sla schedule 6 life forever start-time now
D2(config)#track 4 ip sla 4
D2(config-track)#delay up 10 down 15
D2(config-track)#exit
D2(config)#track 6 ip sla 6
D2(config-track)#delay up 10 down 15
D2(config-track)#exit

```

Imagen 28. Verificación IP SLAs en D2.



4.3 En D1 configure HSRPv2.

D1

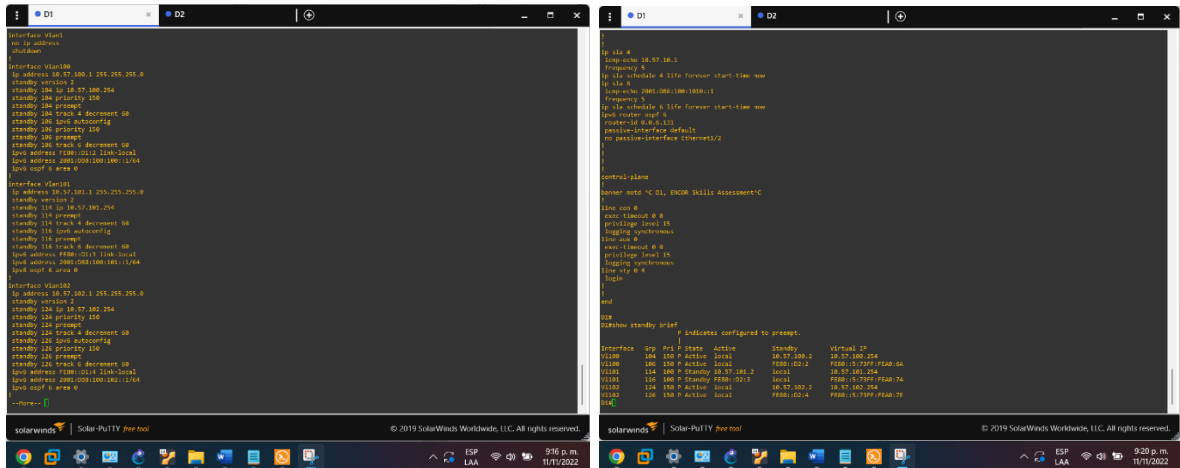
```
D1(config)#interface vlan 100
D1(config-if)#standby version 2
D1(config-if)#standby 104 ip 10.57.100.254
D1(config-if)#standby 104 priority 150
D1(config-if)#standby 104 preempt
D1(config-if)#standby 104 track 4 decrement 60
D1(config-if)#standby 106 ipv6 autoconfig
D1(config-if)#standby 106 priority 150
D1(config-if)#standby 106 preempt
D1(config-if)#standby 106 track 6 decrement 60
D1(config-if)#exit
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 preempt
D1(config-if)#standby 114 track 4 decrement 60
```

```

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
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
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
D1(config)#end

```

Imagen 29. Verificación HSRPv2 en D1.



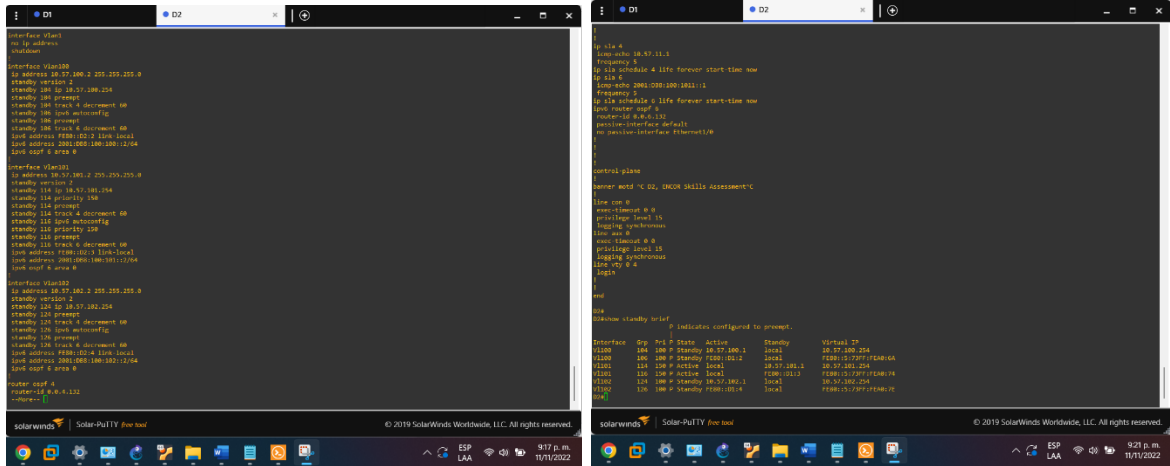
4.3 En D2 configure HSRPv2.

D2

```
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
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
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
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
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
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
D2(config)#end
```

Imagen 30. Verificación HSRPv2 en D2.



CONCLUSIONES

Con la configuración del RSTP podemos garantizar la eliminación de los bucles en la red ya que nos permite activar o desactivar los enlaces de conexión; es una evolución del RSTP, por otra parte decimos que mediante la asignación de VLANs podemos crear redes lógicamente independientes dentro de una misma red física, todo esto con ayuda de un hardware con los Switch que cuentan con estas características, también es muy importante que los routers también soporten estas VLAN, de no ser así no tendríamos una gestión adecuada de nuestra red, toda esta configuración nos permite tener una mayor seguridad. De acuerdo con lo desarrollado anteriormente vemos la importancia de las redundancias a nivel de capa 3, las cuales podemos utilizar para evitar que nuestros dispositivos locales queden por fuera de nuestra red al momento de presentar un fallo el gateway, todo esto ayudado por las SLAs que nos monitorean continuamente las interfaces y el protocolo HSRP, teniendo así un router activo con la interface virtual y el otro de reserva.

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