DIPLOMADO DE PROFUNDIZACION CISCO CCNP

INFORME - PRUEBA DE HABILIDADES PRÁCTICA

JUAN DAVID GARCIA AGUIRRE

UNIVERSIDAD NACIONAL ABIERTA Y A DISTANCIA - UNAD

ESCUELA DE CIENCIAS BÁSICAS, TECNOLOGÍA E INGENIERÍA - ECBTI

INGENIERÍA ELECTRONICA

DOSQUEBRADAS

2022

DIPLOMADO DE PROFUNDIZACION CISCO CCNP

INFORME - PRUEBA DE HABILIDADES PRÁCTICA

JUAN DAVID GARCIA AGUIRRE

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

DIRECTOR:

JUAN ESTEBAN TAPIAS

UNIVERSIDAD NACIONAL ABIERTA Y A DISTANCIA - UNAD

ESCUELA DE CIENCIAS BÁSICAS, TECNOLOGÍA E INGENIERÍA - ECBTI

INGENIERÍA ELECTRONICA

DOSQUEBRADAS

2022

NOTA DE ACEPTACIÓN

_____

_____

_____

_____

_____

Firma del Presidente del Jurado

_____

Firma del Jurado

_____

Firma del Jurado

Dosquebradas, 25 de noviembre de 2022.

AGRADECIMIENTOS

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.

En segundo lugar, dar mil gracias a mi familia que siempre estuvo ahí apoyando mi proceso de formación siempre acompañando y dando fuerzas en los momentos difíciles, dando apoyo moral y esa motivación que en muchas ocasiones perdemos.

En tercer lugar, este agradecimiento está dirigido a todos los tutores de todos y cada uno de los semestres que me ayudaron a construir el conocimiento, dando fortalezas a los conocimientos previos y mostrando nuevos conocimientos, ayudando a abrir la mente y pensar más lógicamente, de esta manera aportar para que le futuro egresado pueda ser más competitivo en un entorno profesional.

TABLA DE CONTENIDO

LISTA DE TABLAS

LISTA DE IMAGENES

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 practico 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.

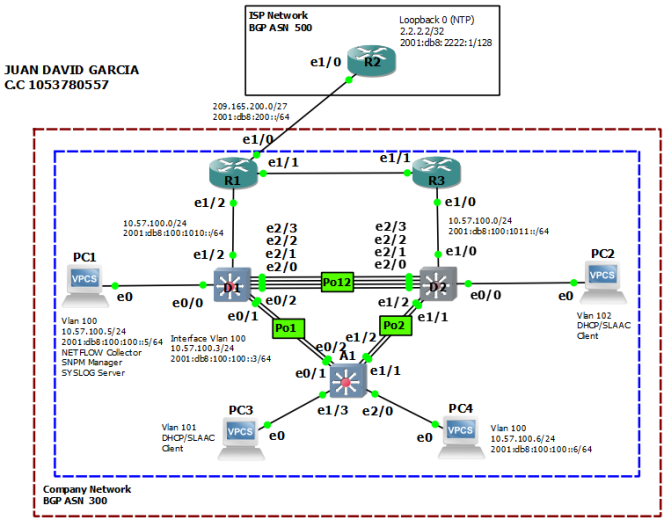


Tabla 1 Tabla de direccionamiento.

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

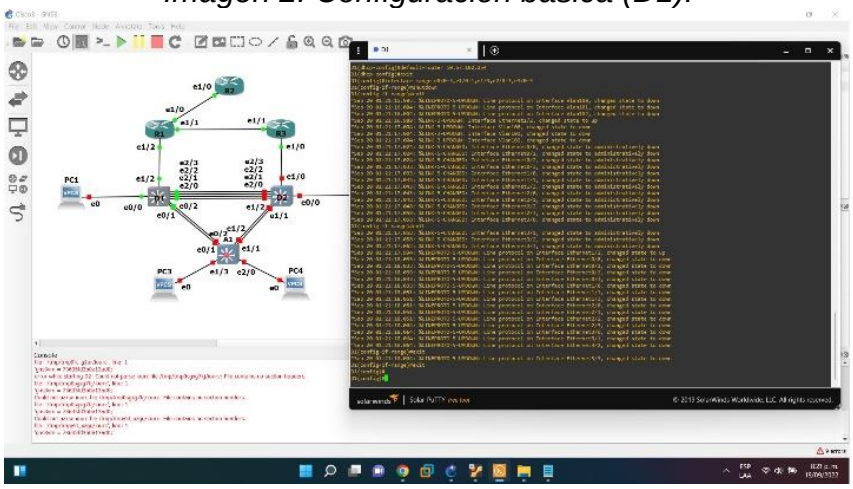
Destination filename [startup-config]?

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

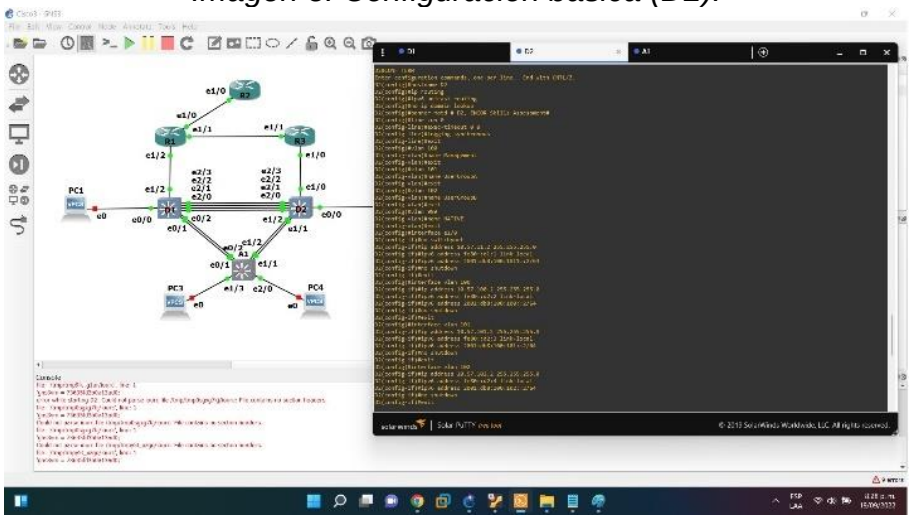
Destination filename [startup-config]?

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

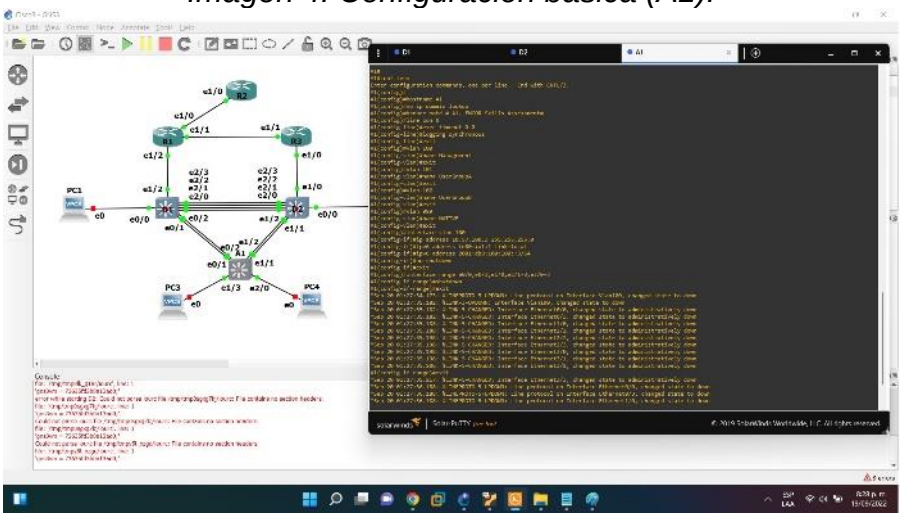
A1(config-vlan)#name Management

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: • 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: • 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: • D1: 10.XY.100.1 • D2: 10.XY.100.2 • PC4: 10.XY.100.6 PC2 should successfully ping: • D1: 10.XY.102.1 • D2: 10.XY.102.2 PC3 should successfully ping: • D1: 10.XY.101.1 • D2: 10.XY.101.2 PC4 should successfully ping: • 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.

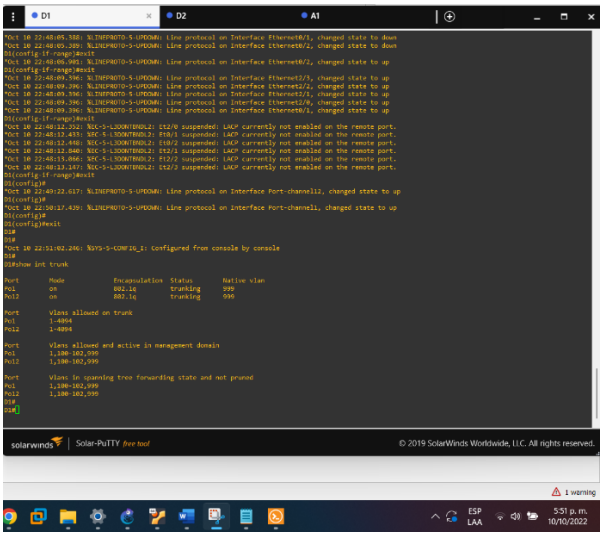


Imagen 6. Verificación enlaces troncales D2.

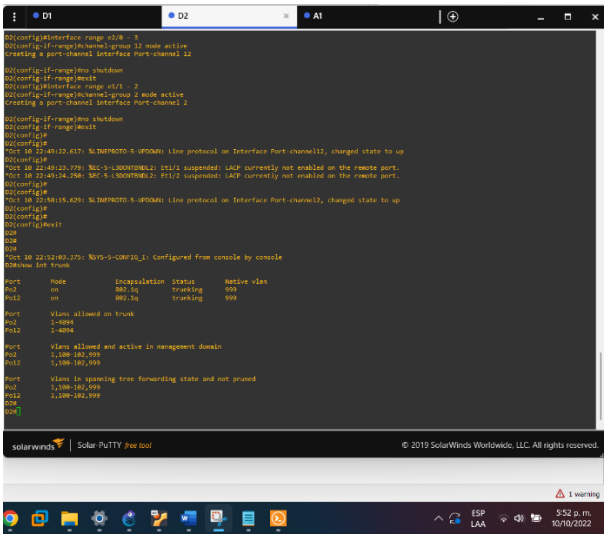
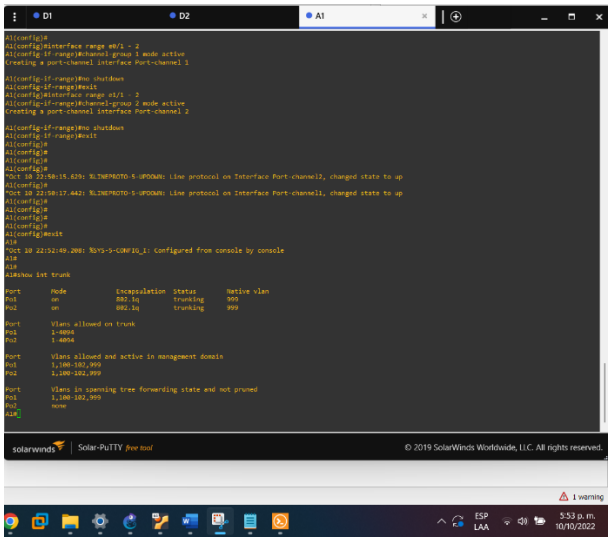


Imagen 7. Verificación enlaces troncales A1



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

D1(config)# spanning-tree vlan 100,102 root primary

D1(config)# spanning-tree vlan 101 root secondary

D2

D2(config)# spanning-tree vlan 101root primary

D2(config)# spanning-tree vlan 100,102 root secondary

Imagen 8. Configuración spanning-tree y RSTP en D1.

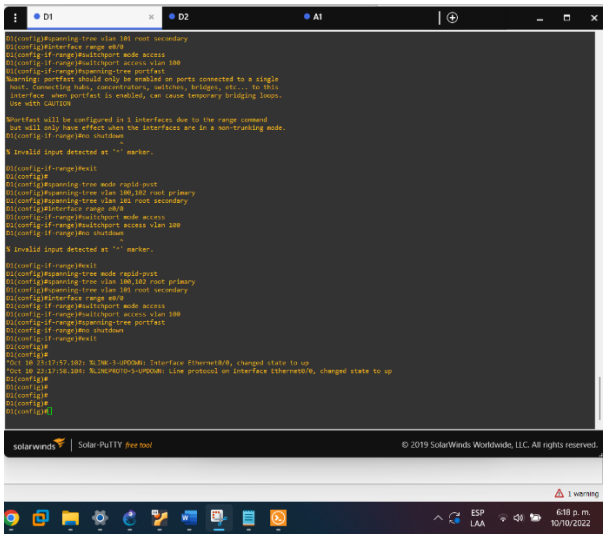
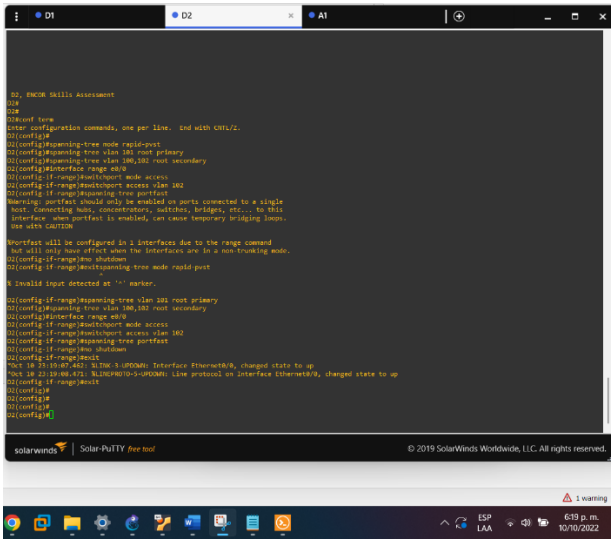


Imagen 9. Configuración spanning-tree y RSTP en D2.



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.

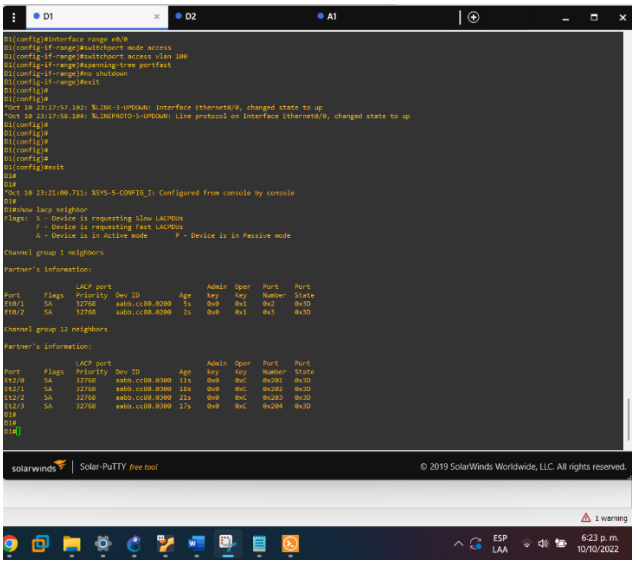


Imagen 11. Verificación LACP en D2.

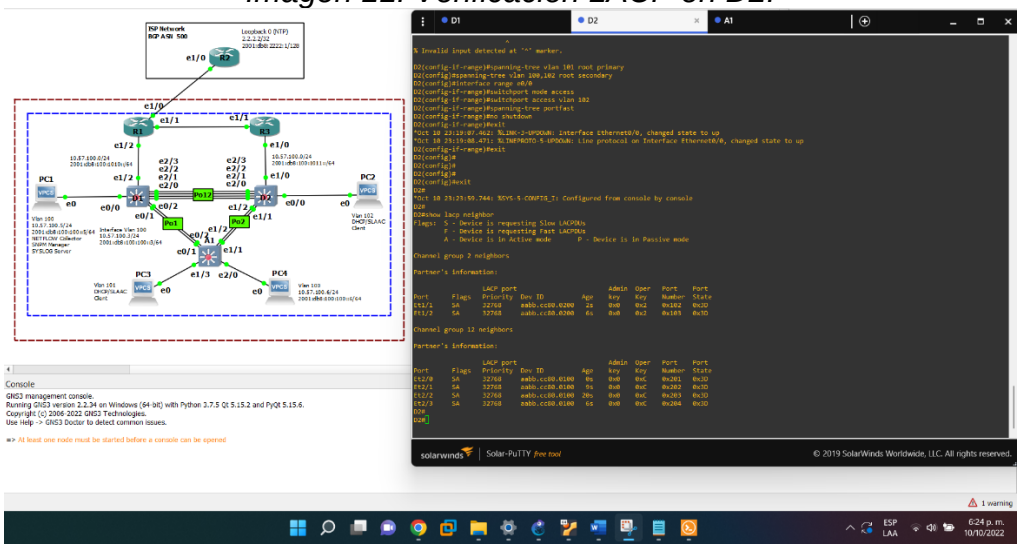
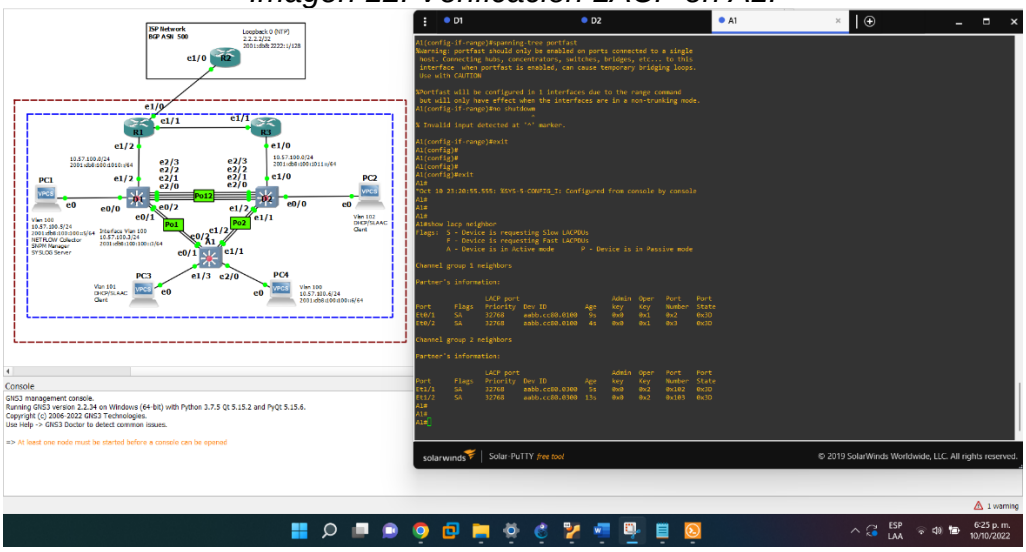


Imagen 12. Verificación LACP en A1.



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.

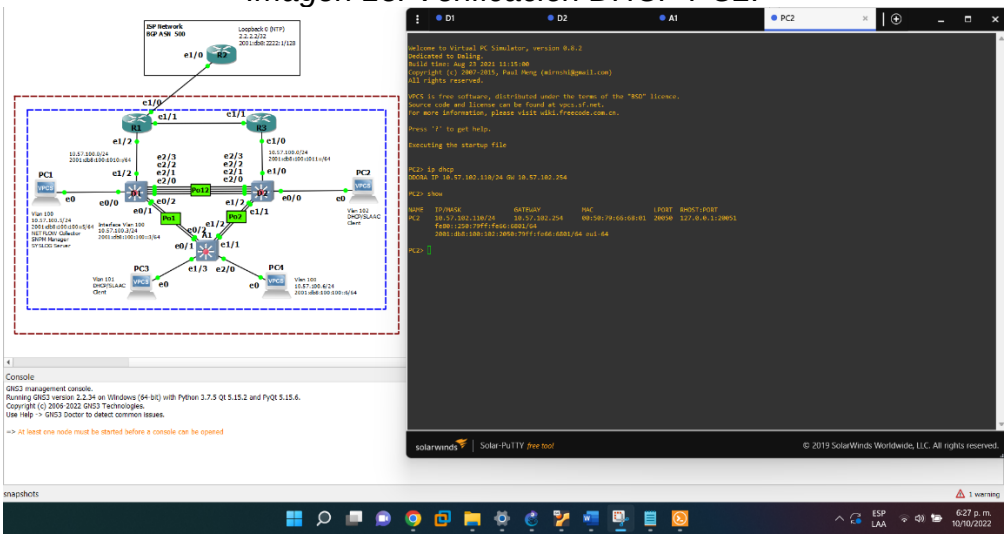
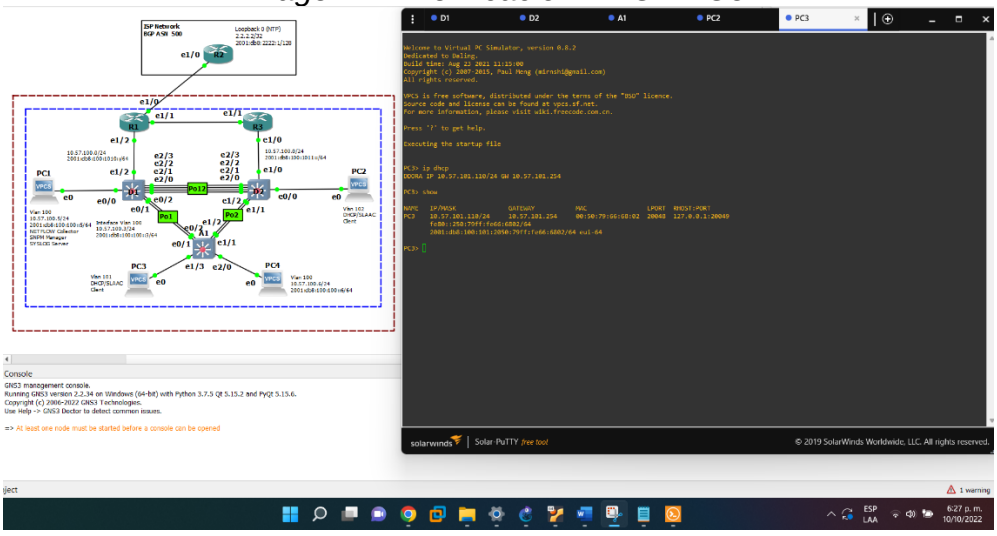


Imagen 14. Verificación DHCP PC3.



2.8 Verify local LAN connectivity.

Imagen 15. Verificación conectividad LAN PC1.

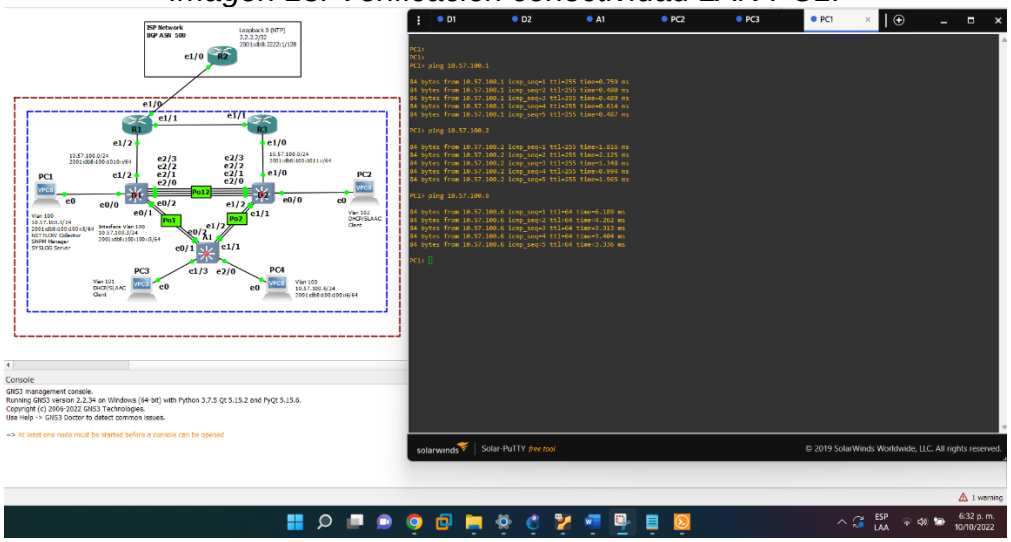


Imagen 16. Verificación conectividad LAN PC2.

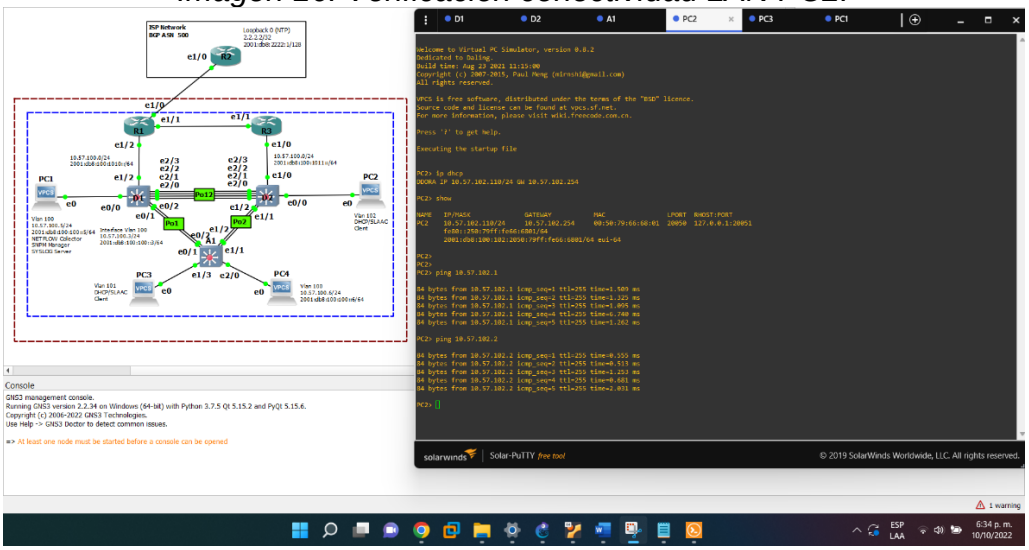


Imagen 17. Verificación conectividad LAN PC3.

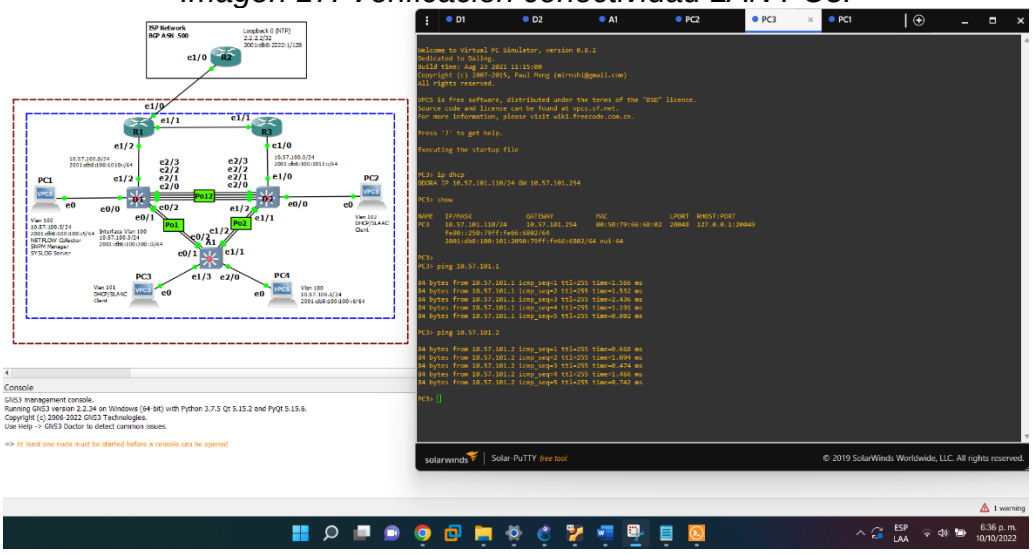
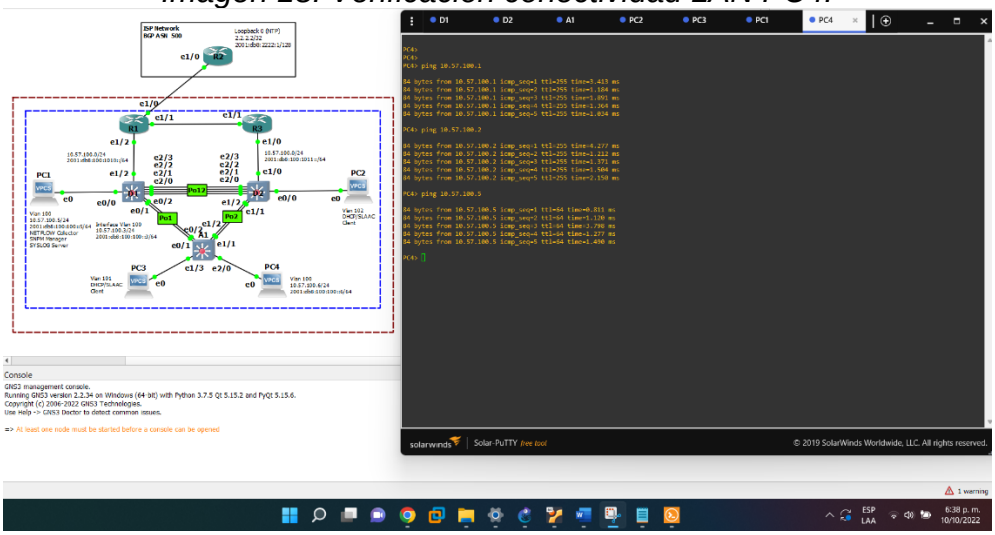


Imagen 18. Verificación conectividad LAN PC4.



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.

Tabla 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.	Use OSPF Process ID **4** and assign the following router-IDs: • R1: 0.0.4.1 • R3: 0.0.4.3 • D1: 0.0.4.131 • D2: 0.0.4.132 On R1, R3, D1, and D2, advertise all directly connected networks / VLANs in Area 0. • 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. Disable OSPFv2 advertisements on: • 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.	Use OSPF Process ID **6** and assign the following router-IDs: • R1: 0.0.6.1 • R3: 0.0.6.3 • D1: 0.0.6.131 • D2: 0.0.6.132 On R1, R3, D1, and D2, advertise all directly connected networks / VLANs in Area 0. • 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. Disable OSPFv3 advertisements on: • 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.	Configure two default static routes via interface Loopback 0: • An IPv4 default static route. • An IPv6 default static route. Configure R2 in BGP ASN **500** and use the router-id 2.2.2.2. Configure and enable an IPv4 and IPv6 neighbor relationship with R1 in ASN 300. In IPv4 address family, advertise: • The Loopback 0 IPv4 network (/32). • The default route (0.0.0.0/0). In IPv6 address family, advertise: • The Loopback 0 IPv4 network (/128). • The default route (::/0).	4
3.4	On R1 in the “ISP Network”, configure MP-BGP.	Configure two static summary routes to interface Null 0: • A summary IPv4 route for 10.XY.0.0/8. • A summary IPv6 route for 2001:db8:100::/48. Configure R1 in BGP ASN **300** and use the router-id 1.1.1.1. Configure an IPv4 and IPv6 neighbor relationship with R2 in ASN 500. In IPv4 address family: • Disable the IPv6 neighbor relationship. • Enable the IPv4 neighbor relationship. • Advertise the 10.XY.0.0/8 network. In IPv6 address family: • 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.

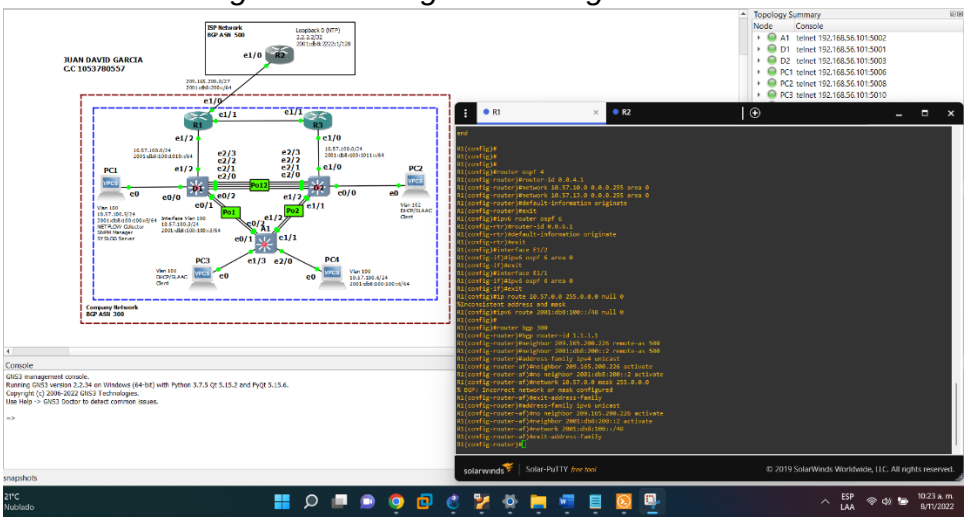
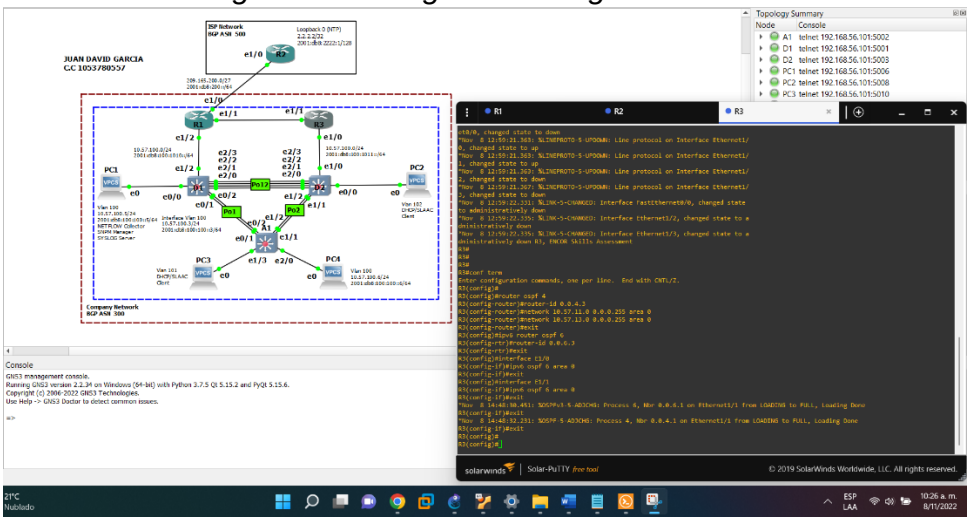


Imagen 20. Configure Routing Protocol R3.



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.

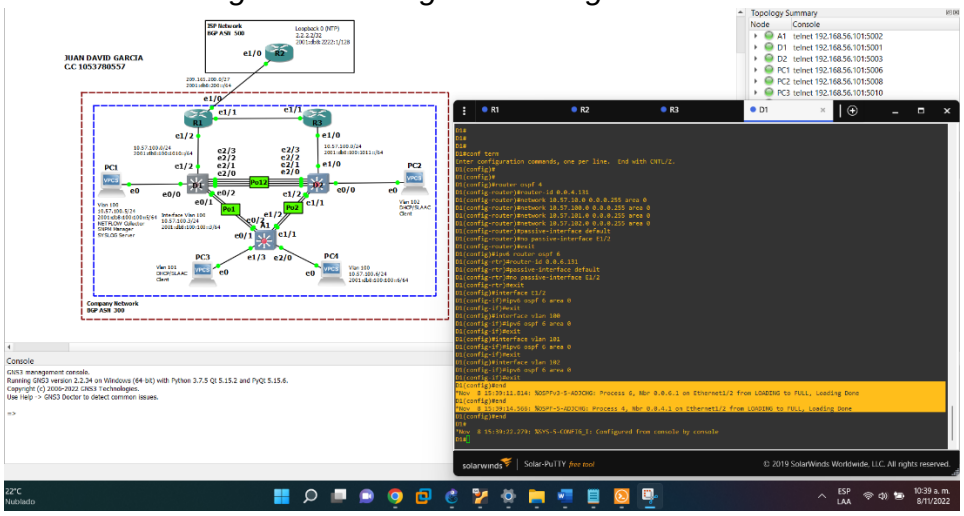
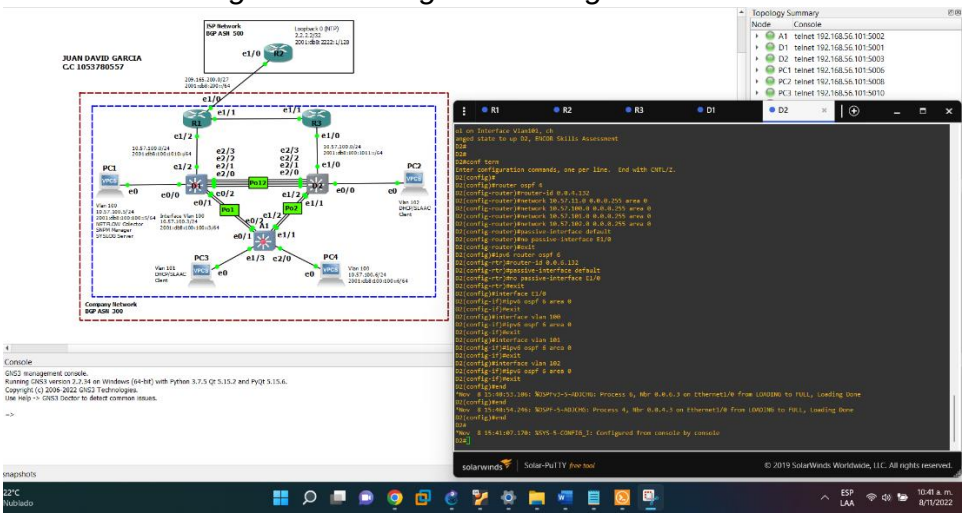


Imagen 22. Configure Routing Protocol D2.

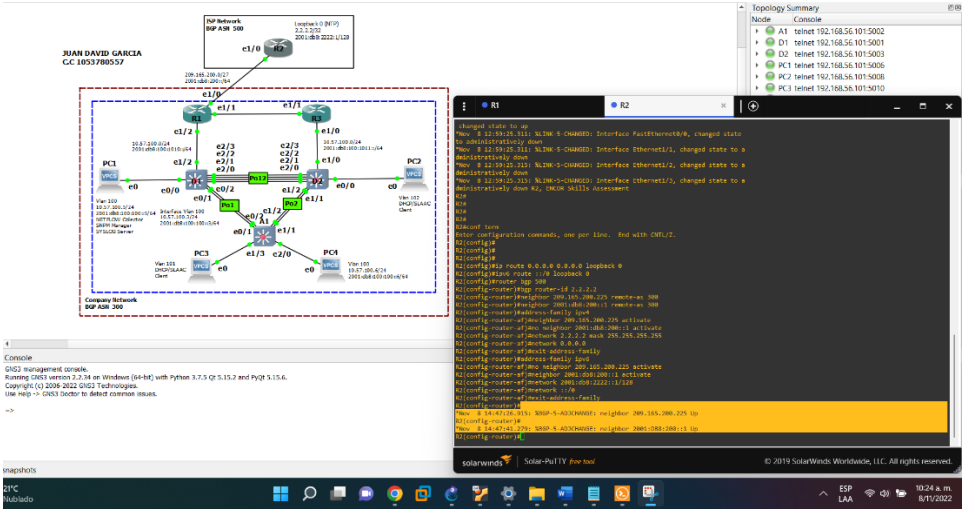


3.3 Configuración MP-BGP en la red ISP R2.

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.

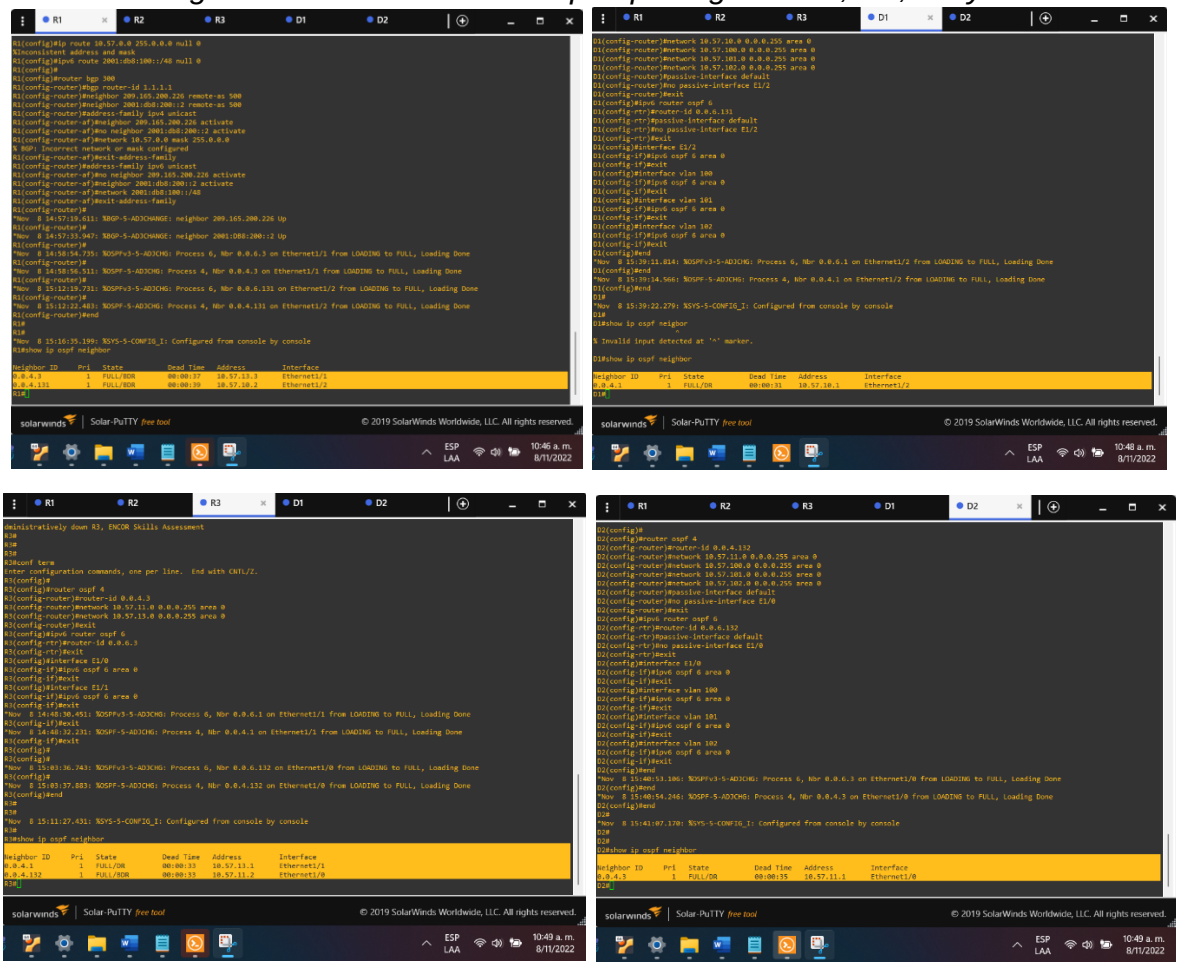


Imagen 25. Verificación show ip route R1, R2 y R3.

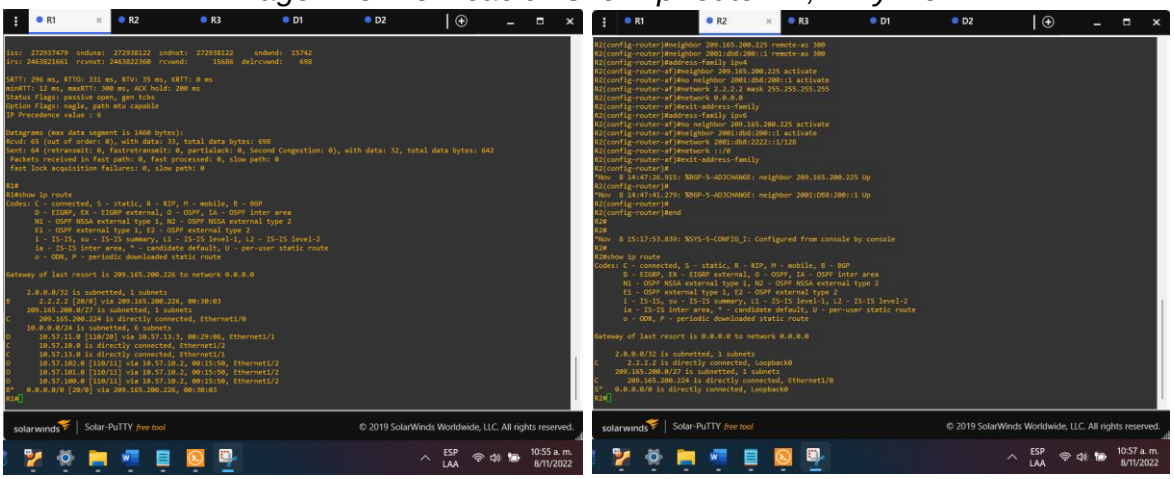
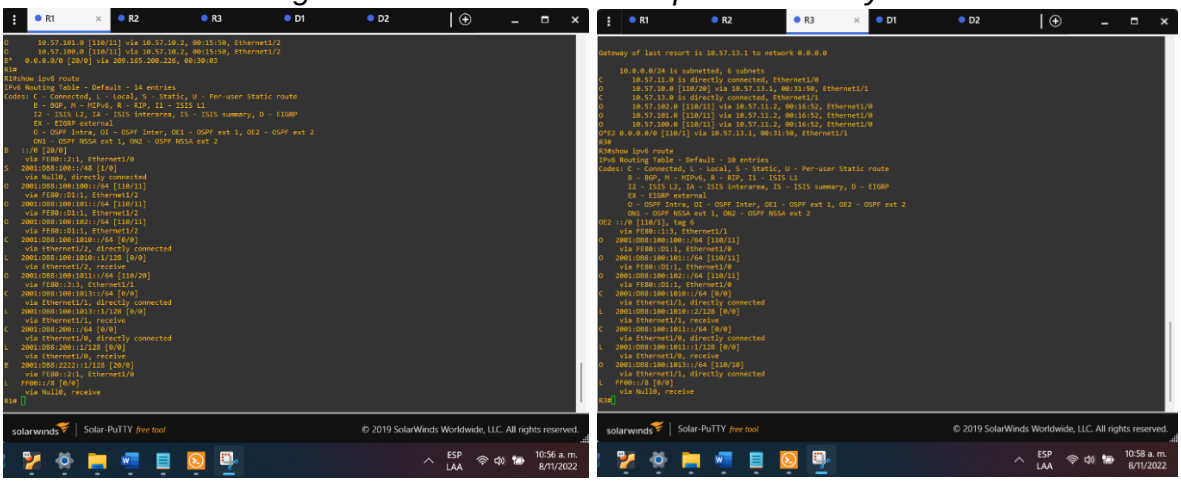


Imagen 26. Verificación show ipv6 route R1 y R3.



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.	Create two IP SLAs. • Use SLA number **4** for IPv4. • Use SLA number **6** for IPv6. The IP SLAs will test availability of R1 E1/2 interface every 5 seconds. Schedule the SLA for immediate implementation with no end time. Create an IP SLA object for IP SLA 4 and one for IP SLA 6. • Use track number **4** for IP SLA 4. • Use track number **6** for IP SLA 6. 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.	2

Task#	Task	Specification	Points
4.2	On D2, create IP SLAs that test the reachability of R3 interface E1/0.	Create two IP SLAs. • Use SLA number **4** for IPv4. • Use SLA number **6** for IPv6. The IP SLAs will test availability of R3 E1/0 interface every 5 seconds. Schedule the SLA for immediate implementation with no end time. Create an IP SLA object for IP SLA 4 and one for IP SLA 6. • Use track number **4** for IP SLA 4. • Use track number **6** for IP SLA 6. 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.	2

4.3	On D1, configure HSRPv2.	D1 is the primary router for VLANs 100 and 102; therefore, their priority will also be changed to 150. Configure HSRP version 2. Configure IPv4 HSRP group **104** for VLAN 100: • Assign the virtual IP address **10.57.100.254**. • Set the group priority to **150**. • Enable preemption. • Track object 4 and decrement by 60. Configure IPv4 HSRP group **114** for VLAN 101: • Assign the virtual IP address **10.57.101.254**. • Enable preemption. • Track object 4 to decrement by 60. Configure IPv4 HSRP group **124** for VLAN 102: • Assign the virtual IP address **10.57.102.254**. • Set the group priority to **150**. • Enable preemption. • Track object 4 to decrement by 60. Configure IPv6 HSRP group **106** for VLAN 100: • Assign the virtual IP address using **ipv6 autoconfig**. • Set the group priority to **150**. • Enable preemption. • Track object 6 and decrement by 60. Configure IPv6 HSRP group **116** for VLAN 101: • Assign the virtual IP address using **ipv6 autoconfig**. • Enable preemption. • Track object 6 and decrement by 60. Configure IPv6 HSRP group **126** for VLAN 102:	8

Task#	Task	Specification	Points
		• Assign the virtual IP address using **ipv6 autoconfig**. • Set the group priority to **150**. • Enable preemption. • Track object 6 and decrement by 60.	

	On D2, configure HSRPv2.	D2 is the primary router for VLAN 101; therefore, the priority will also be changed to 150. Configure HSRP version 2. Configure IPv4 HSRP group **104** for VLAN 100: • Assign the virtual IP address **10.57.100.254**. • Enable preemption. • Track object 4 and decrement by 60. Configure IPv4 HSRP group **114** for VLAN 101: • Assign the virtual IP address **10.57.101.254**. • Set the group priority to **150**. • Enable preemption. • Track object 4 to decrement by 60. Configure IPv4 HSRP group **124** for VLAN 102: • Assign the virtual IP address **10.57.102.254**. • Enable preemption. • Track object 4 to decrement by 60. Configure IPv6 HSRP group **106** for VLAN 100: • Assign the virtual IP address using **ipv6 autoconfig**. • Enable preemption. • Track object 6 and decrement by 60. Configure IPv6 HSRP group **116** for VLAN 101: • Assign the virtual IP address using **ipv6 autoconfig**. • Set the group priority to **150**. • Enable preemption. • Track object 6 and decrement by 60. Configure IPv6 HSRP group **126** for VLAN 102: • Assign the virtual IP address using **ipv6 autoconfig**.	

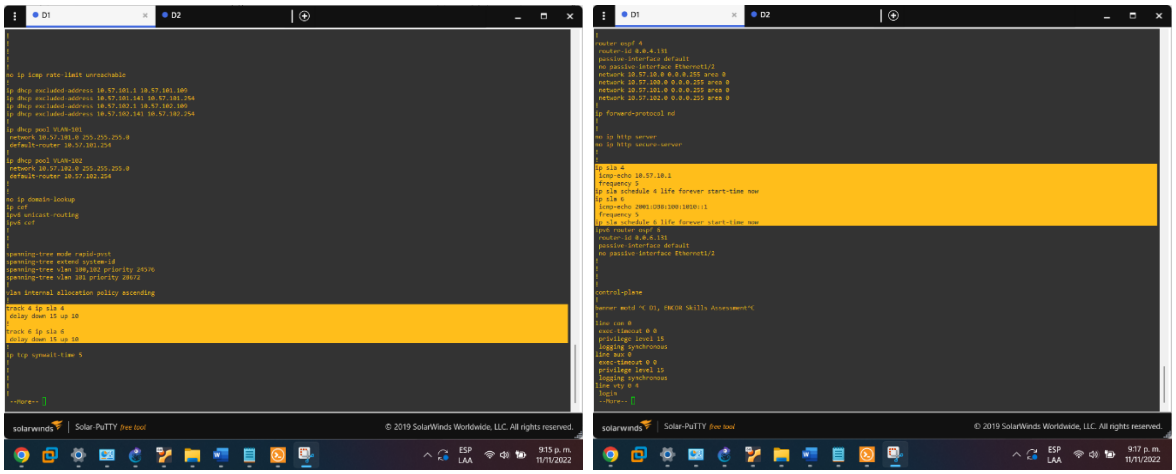
Task#	Task	Specification	Points
		• Enable preemption. • Track object 6 and decrement by 60.	

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.

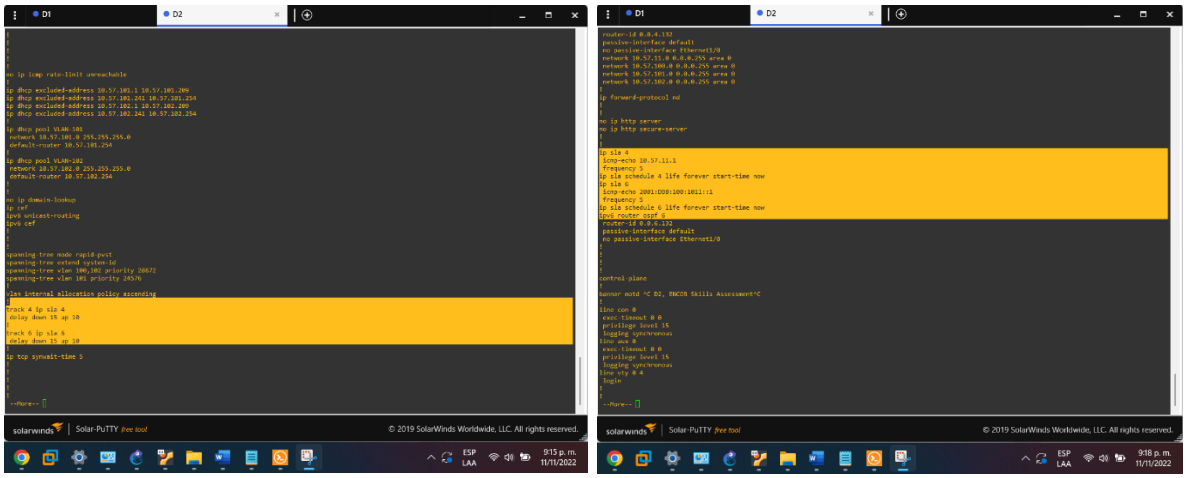


4.2 En D2, crear IP SLAs que prueben la accesibilidad de la interfaz R3 E1/0.

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

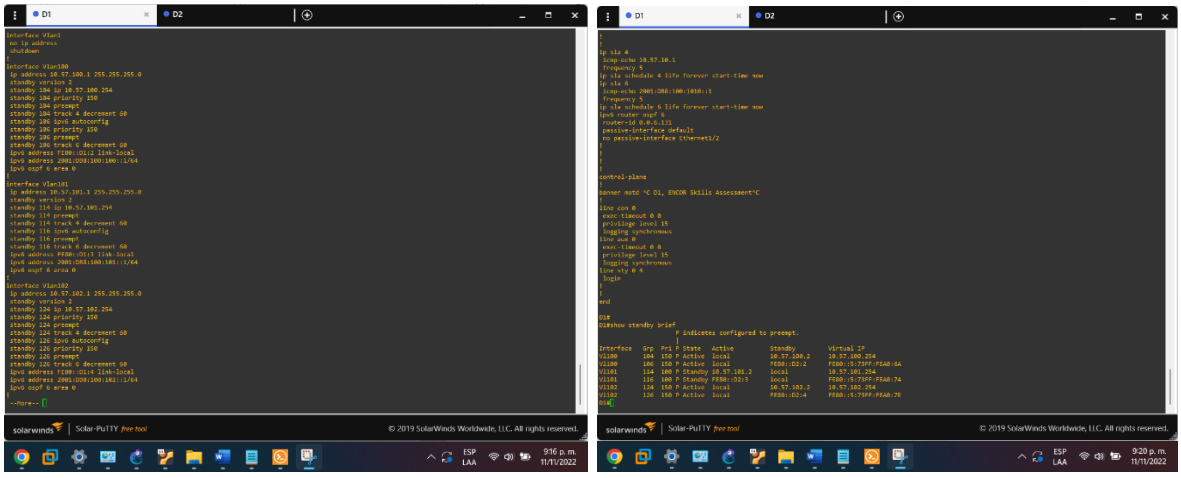
D1(config-if)#standby 114 ip 10.57.101.254

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.

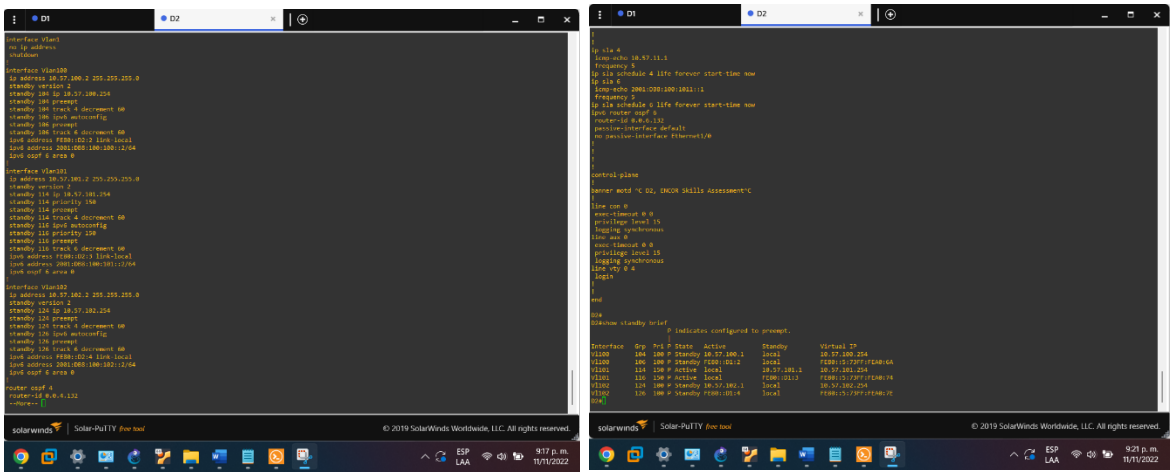
D2

```
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 gatewey, 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.

BIBLIOGRAFIA

JM, Cristobal. Etherchannel PAgP y LACP. 19 de Febrero de 2021. https://jmcristobal.com/es/2021/02/19/etherchannel-pagp-y-lacp/

Citrix Staff. Configuración de rutas dinámicas: Configuración de OSPF. 2 de Diciembre de 2021. https://docs.citrix.com/es-es/citrix-adc/current-release/networking/ip-routing/configuring-dynamic-routes/configuring-ospf.html

PEREZ, Eugenio. Como configurar IP SLA tracking. 24 de Agosto de 2020. https://estudiaredes.com/cisco/como-configurar-ip-sla-tracking/

DUARTE, Eugenio. Cómo configurar OSPF en Cisco router. 10 de Abril de 2019. https://blog.cloudacia.com/2019/04/10/como-configurar-ospf-en-cisco-router/