DIPLOMADO DE PROFUNDIZACIÓN CISCO PRUEBA DE HABILIDADES PRÁCTICAS CCNP

DANIELA PARRA

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Diplomado de opción de grado presentado para optar el título de INGENIERO DE TELECOMUNICACIONES

DIRECTOR:

JUAN ESTEBAN TAPIAS BAENA

UNIVERSIDAD NACIONAL ABIERTA Y A DISTANCIA-UNAD

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GLOSARIO

CCNP: (Cisco Certified Network Professional) te aprueba la habilidad para planificar, implementar, verificar y resolver problemas de redes locales. De igual forma te permite trabajar en colaboración con especialistas en soluciones avanzadas de seguridad, voz, wireless y video.

ETHERCHANNEL: Es una tecnología de Cisco construida de acuerdo con los estándares 802.3 full-duplex Fast Ethernet.

IPV4: La dirección IPv4 es un número de 32 bits que identifica de forma exclusiva una interfaz de red en un sistema, tal como se explica en aplicación de las direcciones IP a las interfaces de red. Una dirección IPv4 se escribe en dígitos decimales, y se divide en cuatro campos de 8 bits separados por puntos.

VLAN: Una VLAN, acrónimo de virtual LAN, es un método para crear redes lógicas independientes dentro de una misma red física. Varias VLAN pueden coexistir en un único conmutador físico o en una única red física.

RESÚMEN

El siguiente trabajo contiene información del módulo CCNP ROUTE, cuyas temáticas se representan mediante dos escenarios, donde se evalúa el nivel de conocimientos y habilidades practicas adquiridos durante el desarrollo del diplomado de profundización CCNP CISCO. En la solución de cada escenario propuesto, se explica de manera detallada los códigos con los que fue desarrollada cada configuración y su solución, donde se incluyen temas relacionados como enrutamiento de redes, asignación de VLANs, spanning-tree mode, enlaces troncales entre otros; utilizando los protocolos de enrutamiento OSPF, BGP, HRSP y realizando correctamente la configuración de routers y switches según la topología propuesta en los laboratorios, haciendo uso del simulador GNS3.
Este proyecto se realiza con el fin de otorgar el titulo de la carrera ingeniería de Telecomunicaciones.

Palabras clave: CISCO, CCNP, GNS3, redes, ingeniería, VLANs.

ABSTRACT

The following work contains information on the CCNP ROUTE module, whose themes are represented by two scenarios, where the level of knowledge and practical skills acquired during the development of the CCNP CISCO in-depth diploma is evaluated. In the solution of each proposed scenario, the codes with which each configuration and its solution were developed are explained in detail, which includes related topics such as network routing, VLAN assignment, spanning-tree mode, trunk links, among others; using OSPF, BGP, HRSP routing protocols and correctly configuring routers and switches according to the topology proposed in the laboratories, using the GNS3 simulator.

This project is carried out in order to grant the title of the Telecommunications Engineering career.

Keywords: CISCO, CCNP, GNS3, networks, engineering, VLANs.

INTRODUCCIÓN

CCNP CISCO tiene un avanzado currículo sobre la implementación, configuración y operación de redes LAN Y WAN, centradas en el desarrollo de las habilidades necesarias para ser implementadas en redes escalables, construcción de redes, diseño e instalación de intranets globales, así como la detección y solución de problemas.

El presente documento constituye la evidencia del desarrollo del primer escenario propuesto en el Diplomado de Profundización CISCO CCNP ofrecido como opción de grado en la Universidad Nacional Abierta y a Distancia – UNAD.
Los laboratorios aquí plasmados, se realizarán mediante el simulador GNS3 las diferentes soluciones soportadas para el enrutamiento avanzado.

DESARROLLO

1- ESCENARIO 1

Figura 1 - Topología escenario 1 y 2
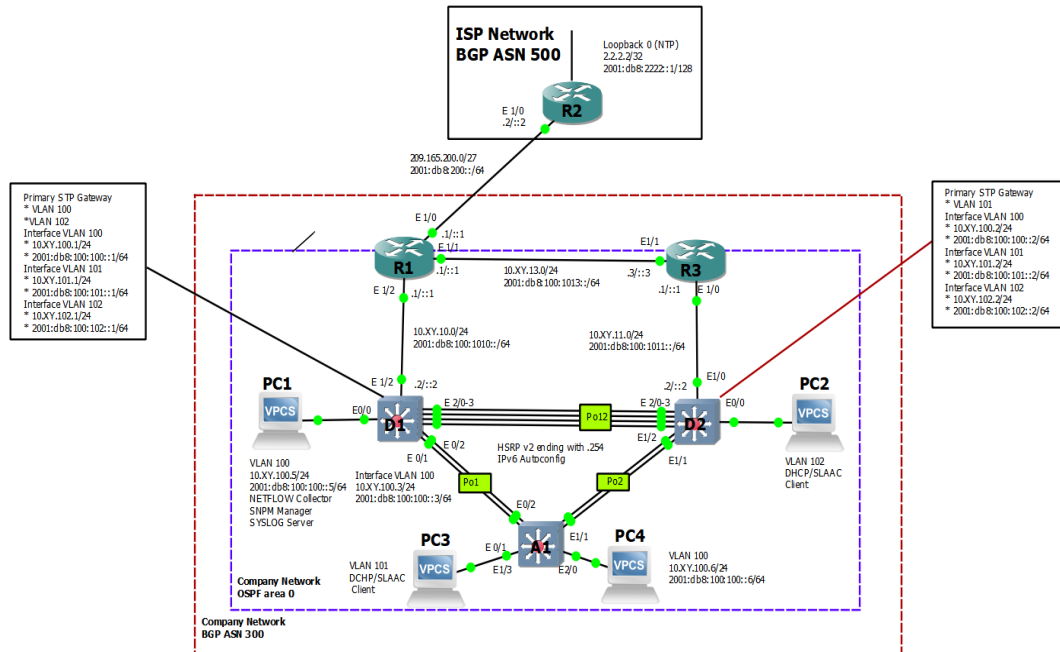
Fuente: Parra, D, (2022).

Tabla de direcciones

Tabla 1 - Tabla de direcciones escenario 1

Dispositivo	Interfaz	Dirección IPv4	Dirección IPv6	Enlace IPv6 local
R1	E1/0	209.165.200.225/27	2001:db8:200::1/64	fe80::1:1
	E1/2	10.97.10.1/24	2001:db8:100:1010::1/64	fe80::1:2
	E1/1	10. 97.13.1/24	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

Dispositivo	Interfaz	Dirección IPv4	Dirección IPv6	Enlace IPv6 local
	Bucle invertido0	2.2.2.2/32	2001:db8:2222::1/128	fe80::2:3
R3	E1/0	10. 97.11.1/24	2001:db8:100:1011::1/64	fe80::3:2
	E1/1	10. 97.13.3/24	2001:db8:100:1013::3/64	fe80::3:3
D1	E1/2	10. 97.10.2/24	2001:db8:100:1010::2/64	fe80::d1:1
	vlan 100	10. 97.100.1/24	2001:db8:100:100::1/64	fe80::d1:2
	vlan 101	10.97.101.1/24	2001:db8:100:101::1/64	fe80::d1:3
	vlan 102	10.97.102.1/24	2001:db8:100:102::1/64	fe80::d1:4
D2	E1/0	10.97.11.2/24	2001:db8:100:1011::2/64	fe80::d2:1
	vlan 100	10.97.100.2/24	2001:db8:100:100::2/64	fe80::d2:2
	vlan 101	10.97.101.2/24	2001:db8:100:101::2/64	fe80::d2:3
	vlan 102	10.97.102.2/24	2001:db8:100:102::2/64	fe80::d2:4
A1	vlan 100	10.97.100.3/23	2001:db8:100:100::3/64	fe80::a1:1
PC1	Nada	10.97.100.5/24	2001:db8:100:100::5/64	EUI-64
PC2	Nada	DHCP	SLAAC	EUI-64
PC3	Nada	DHCP	SLAAC	EUI-64
PC4	Nada	10.97.100.6/24	2001:db8:100:100::6/64	EUI-64

Objetivos

Parte 1: Construir la red y configurar los ajustes básicos del dispositivo y el direccionamiento de la interfaz

Parte 2: Configurar la compatibilidad con redes y hosts de capa 2

Parte 3: Configurar protocolos de enrutamiento

Parte 4: Configurar la redundancia de primer salto

Antecedentes / Escenario

En esta evaluación de habilidades, usted es responsable de completar la configuración de la red para que haya una accesibilidad completa de extremo a extremo, para que los hosts tengan soporte de puerta de enlace predeterminado confiable y para que los protocolos de administración estén operativos dentro de la parte "Red de la empresa" de la topología. Tenga cuidado de verificar que sus configuraciones cumplan con las especificaciones proporcionadas y que los dispositivos funcionen según sea necesario.

Nota: Los routers utilizadoscon ccNP hands-on labs son routers Cisco 7200. Los switches utilizados en los laboratorios son Cisco Catalyst L2 switches se pueden usar otros routers, switches y versiones de Cisco IOS. Dependiendo del modelo y la versión de Cisco IOS, los comandos disponibles y la salida producida pueden variar de lo que se muestra enlos laboratorios.

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

Nota: Las letras "X, Y" representan los dos últimos dígitos de su número de identificación (cédula).

Recursos requeridos

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

Figura 2- Configuración switch D1

13
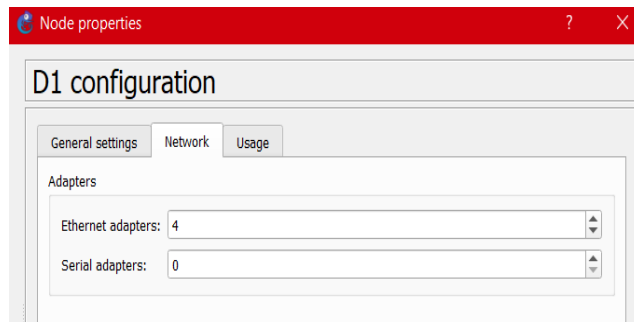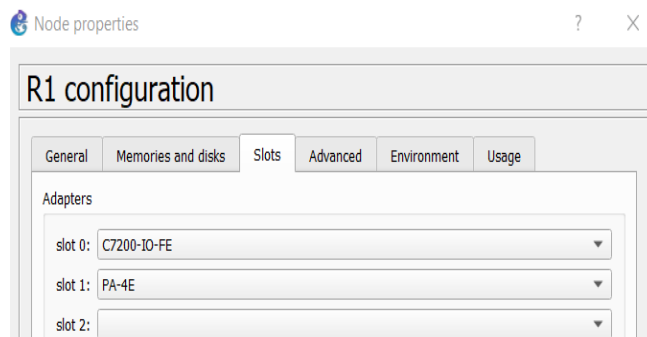
Fuente: Parra, D, (2022).

Y de los Routers así:

Figura 3 - Configuración Router 1

Fuente: Parra, D, (2022).

Parte 1: Cree la red y configure los ajustes básicos del dispositivo y el direccionamiento de la interfaz

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

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

Conecte los dispositivos como se muestra en el diagrama de topología y cablee según sea necesario. En el software GNS3, se implementa el escenario de red 1, para esto se utilizan 3 Routers Cisco 7000, 3 Switches Cisco IOU L2 y 4 PCs que vienen por defecto en el programa (VPCS). Posteriormente se realiza las conexiones teniendo en cuenta las interfaces descritas en la tabla de direccionamiento, dando como resultado la topología que se muestra en la figura 1:
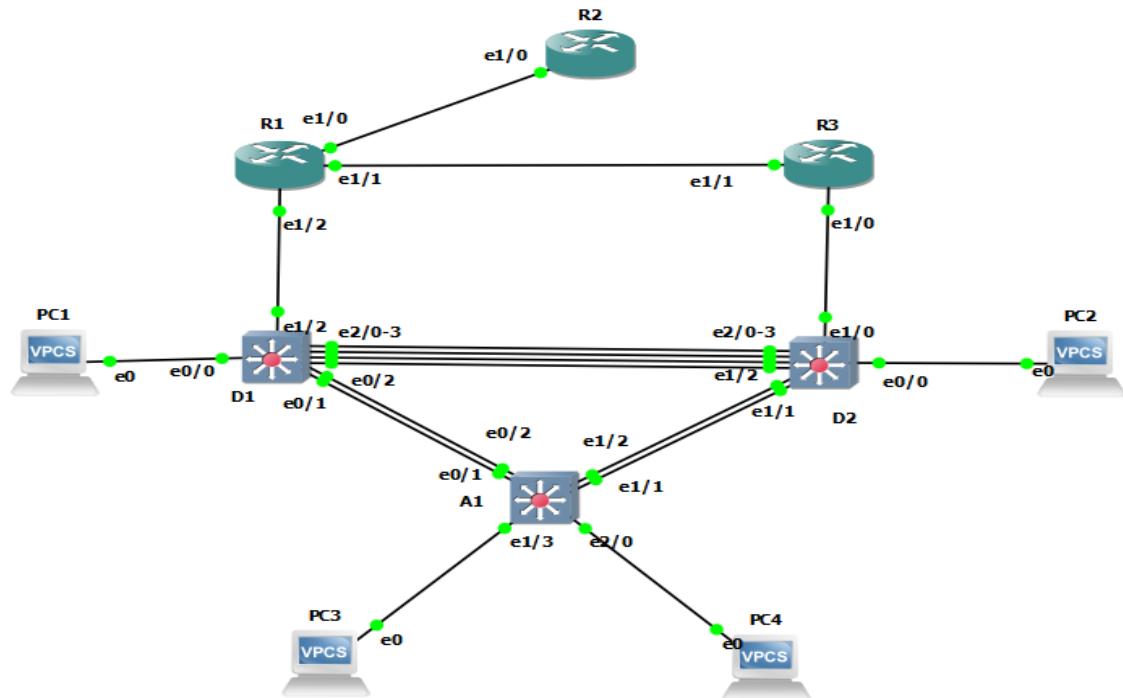
Figura 4 - Escenario de red 1 en simulador GNS3
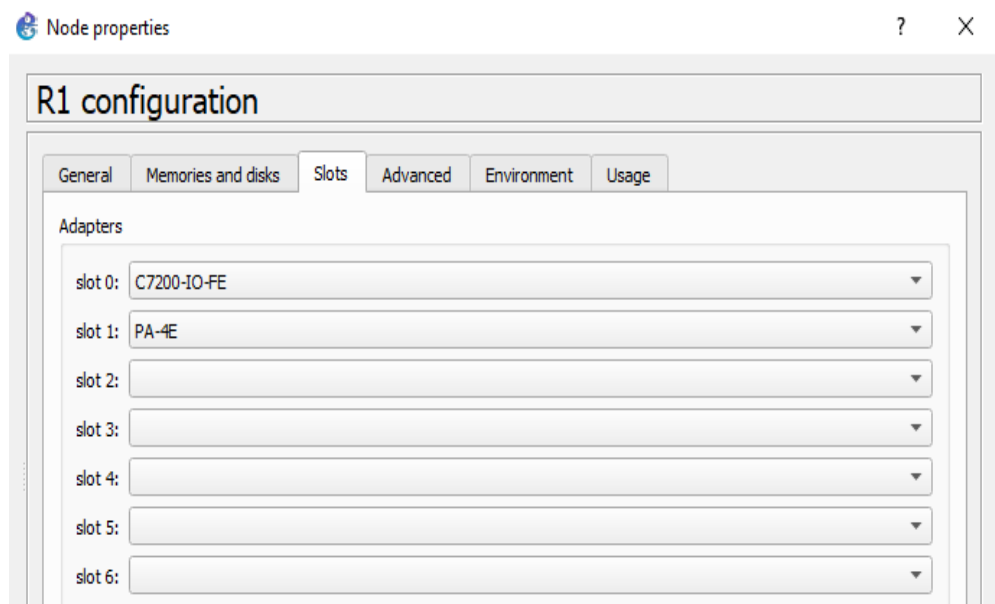
Fuente: Parra, D, (2022).

La configuración establecida para los 3 routers y 3 switches usados en la topología, se muestra a continuación:

Figura 5- Configuración Router 1
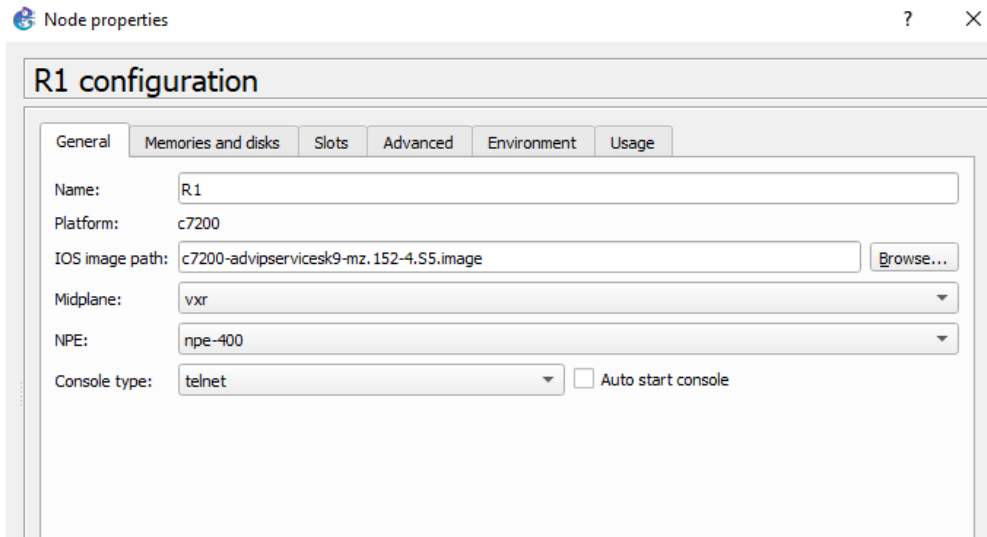
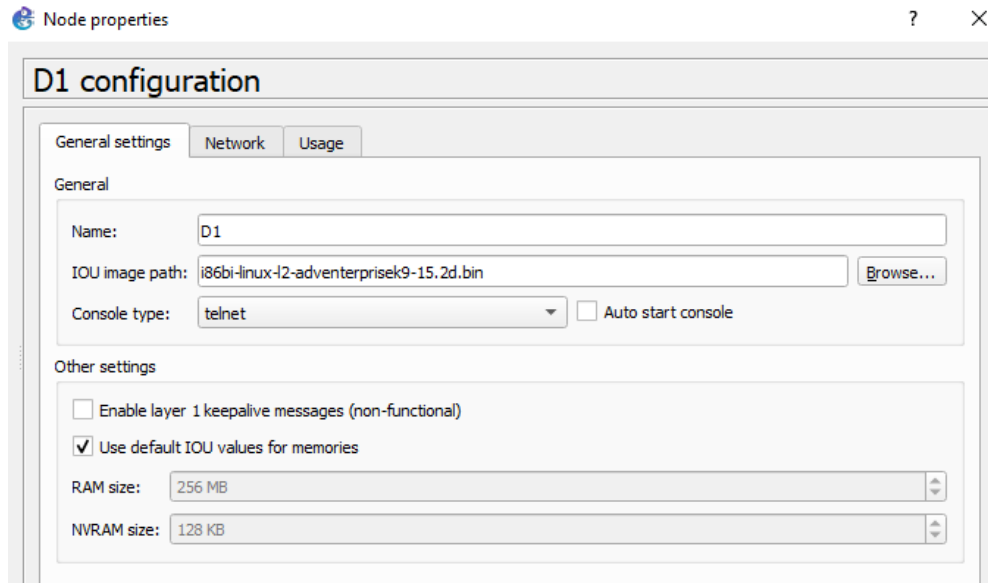Fuente: Parra, D, (2022).

Figura 6 - Configuración Router 1

Fuente: Parra, D, (2022).

Figura 7 - Configuración switch D1

Fuente: Parra, D, (2022).

Figura 8 - Configuración switch D1
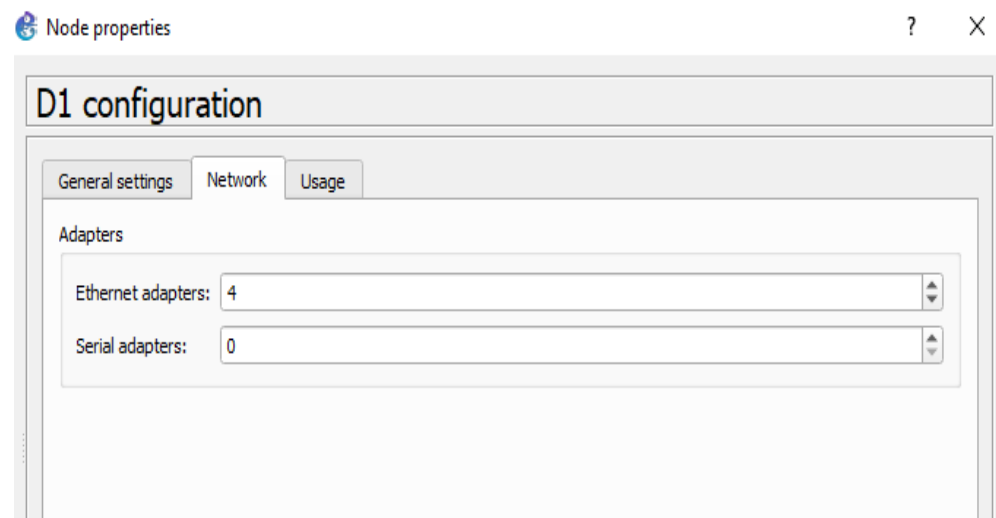
Fuente: Parra, D, (2022).

Paso 2: Configure los ajustes básicos para cada dispositivo.

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

Router R1

hostname R1
ipv6 unicast-routing
no ip domain lookup
banner motd # R1, ENCOR Skills Assessment#
line con 0
 exec-timeout 0 0
 logging synchronous
 exit
interface e1/0
 ip address 209.165.200.225 255.255.255.224
 ipv6 address fe80::1:1 link-local
 ipv6 address 2001:db8:200::1/64
 no shutdown
 exit
interface e1/2
ip address 10.97.10.1 255.255.255.0
 ipv6 address fe80::1:2 link-local
 ipv6 address 2001:db8:100:1010::1/64
 no shutdown
 exit
interface e1/1
 ip address 10.97.13.1 255.255.255.0
 ipv6 address fe80::1:3 link-local
 ipv6 address 2001:db8:100:1013::1/64
 no shutdown
 exit

Router R2

hostname R2
ipv6 unicast-routing
no ip domain lookup
banner motd # R2, ENCOR Skills Assessment#
line con 0
 exec-timeout 0 0
 logging synchronous

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

Router R3

```
hostname R3
ipv6 unicast-routing
no ip domain lookup
banner motd # R3, ENCOR Skills Assessment#
line con 0
 exec-timeout 0 0
 logging synchronous
 exit
interface e1/0
 ip address 10.97.11.1 255.255.255.0
 ipv6 address fe80::3:2 link-local
 ipv6 address 2001:db8:100:1011::1/64
 no shutdown
 exit
interface e1/1
 ip address 10.97.13.3 255.255.255.0
 ipv6 address fe80::3:3 link-local
 ipv6 address 2001:db8:100:1010::2/64
 no shutdown
 exit
```

Switch D1

```
hostname D1
ip routing
ipv6 unicast-routing
no ip domain lookup
```

```
banner motd # D1, ENCOR Skills Assessment#
line con 0
 exec-timeout 0 0
 logging synchronous
 exit
vlan 100
 name Management
 exit
vlan 101
 name UserGroupA
 exit
vlan 102
 name UserGroupB
 exit
vlan 999
 name NATIVE
 exit
interface e1/2
 no switchport
 ip address 10.97.10.2 255.255.255.0
 ipv6 address fe80::d1:1 link-local
 ipv6 address 2001:db8:100:1010::2/64
 no shutdown
 exit
interface Vlan100
 ip address 10.97.100.1 255.255.255.0
 ipv6 address fe80::d1:2 link-local
 ipv6 address 2001:db8:100:100::1/64
 no shutdown
 exit
interface Vlan101
 ip address 10.97.101.1 255.255.255.0
 ipv6 address fe80::d1:3 link-local
 ipv6 address 2001:db8:100:101::1/64
 no shutdown
 exit
interface Vlan102
 ip address 10.97.102.1 255.255.255.0
 ipv6 address fe80::d1:4 link-local
 ipv6 address 2001:db8:100:102::1/64
 no shutdown
```

```
 exit
ip dhcp excluded-address 10.97.101.1 10.97.101.109
ip dhcp excluded-address 10.97.101.141 10.97.101.254
ip dhcp excluded-address 10.97.102.1 10.97.102.109
ip dhcp excluded-address 10.97.102.141 10.97.102.254
ip dhcp pool VLAN-101
 network 10.97.101.0 255.255.255.0
 default-router 10.97.101.254
 exit
ip dhcp pool VLAN-102
 network 10.97.102.0 255.255.255.0
 default-router 10.97.102.254
 exit
interface range e0/0-3,e1/0-1,e1/3,e2/0-3,e3/0-3
 shutdown
 exit


 Switch D2

hostname D2
ip routing
ipv6 unicast-routing
no ip domain lookup
banner motd # D2, ENCOR Skills Assessment#
line con 0
 exec-timeout 0 0
 logging synchronous
 exit
vlan 100
 name Management
 exit
vlan 101
 name UserGroupA
 exit
vlan 102
 name UserGroupB
 exit
vlan 999
 name NATIVE
 exit
interface e1/0
```

```
 no switchport
 ip address 10.97.11.2 255.255.255.0
 ipv6 address fe80::d1:1 link-local
 ipv6 address 2001:db8:100:1011::2/64
 no shutdown
 exit
interface Vlan100
 ip address 10.97.100.2 255.255.255.0
 ipv6 address fe80::d2:2 link-local
 ipv6 address 2001:db8:100:100::2/64
 no shutdown
 exit
interface Vlan101
 ip address 10.97.101.2 255.255.255.0
 ipv6 address fe80::d2:3 link-local
 ipv6 address 2001:db8:100:101::2/64
 no shutdown
 exit
interface Vlan102
 ip address 10.97.102.2 255.255.255.0
 ipv6 address fe80::d2:4 link-local
 ipv6 address 2001:db8:100:102::2/64
 no shutdown
 exit
ip dhcp excluded-address 10.97.101.1 10.97.101.209
ip dhcp excluded-address 10.97.101.241 10.97.101.254
ip dhcp excluded-address 10.97.102.1 10.97.102.209
ip dhcp excluded-address 10.97.102.241 10.97.102.254
ip dhcp pool VLAN-101
 network 10.97.101.0 255.255.255.0
 default-router 97.0.101.254
 exit
ip dhcp pool VLAN-102
 network 10.97.102.0 255.255.255.0
 default-router 10.97.102.254
 exit
interface range e0/0-3,e1/1-3,e2/0-3,e3/0-3
 shutdown
 exit

Switch A1
```

```
hostname A1
no ip domain lookup
banner motd # A1, ENCOR Skills Assessment#
line con 0
 exec-timeout 0 0
 logging synchronous
 exit
vlan 100
 name Management
 exit
vlan 101
 name UserGroupA
 exit
vlan 102
 name UserGroupB
 exit
vlan 999
 name NATIVE
 exit
interface Vlan100
 ip address 10.97.100.3 255.255.255.0
 ipv6 address fe80::a1:1 link-local
 ipv6 address 2001:db8:100:100::3/64
 no shutdown
 exit
interface range e0/0,e0/3,e1/0,e2/1-3,e3/0-3
 shutdown
 exit
```

Figura 9 - IP PC1

```
PC1> ip 10.97.100.5/24 10.97.100.254
Checking for duplicate address...
PC1 : 10.97.100.5 255.255.255.0 gateway 10.97.100.254

PC1> ip 2001:db8:100:100::5/64 10.97.100.254
PC1 : 2001:db8:100:100::5/64

PC1> show

NAME    IP/MASK                 GATEWAY         MAC                LPORT  RHOST:PORT
PC1     10.97.100.5/24          10.97.100.254   00:50:79:66:68:00  10004  127.0.0.1:10005
        fe80::250:79ff:fe66:6800/64
        2001:db8:100:100::5/64
```

Fuente: Parra, D, (2022).

Figura 10 - IP PC4

```
PC4> ip 10.97.100.6/24 10.97.100.254
Checking for duplicate address...
PC1 : 10.97.100.6 255.255.255.0 gateway 10.97.100.254

PC4> ip 2001:db8:100:100::6/64 10.97.100.254
PC1 : 2001:db8:100:100::6/64

PC4> show

NAME    IP/MASK              GATEWAY          MAC                LPORT  RHOST:PORT
PC4     10.97.100.6/24       10.97.100.254    00:50:79:66:68:02  10010  127.0.0.1:10011
        fe80::250:79ff:fe66:6802/64
        2001:db8:100:100::6/64
```

Fuente: Parra, D, (2022).

Parte 2: Configurar la compatibilidad de red y host de capa 2

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

Las tareas de configuración son las siguientes:

Tabla 2 – Tabla de configuración de compatibilidad de red y host de capa 2

Tarea	Especificación

En todos los conmutadores, cambie la VLAN nativa en los enlaces troncales.	Utilice VLAN 999 como VLAN nativa.
	D1
	
	    interface range e2/0-3
	    switchport trunk native vlan 999
	    interface e0/1
	    switchport trunk native vlan 999
	    interface e0/2
	    switchport trunk native vlan 999
	D2
	
	    interface range e2/0-3
	    switchport trunk native vlan 999
	    interface e1/1
	    switchport trunk native vlan 999
	    interface e1/2
	    switchport trunk native vlan 999
	A1

Tarea	Especificación
	interface e0/1 switchport trunk native vlan 999 interface e0/2 switchport trunk native vlan 999 interface e1/1 switchport trunk native vlan 999 interface e1/2 switchport trunk native vlan 999
En todos los conmutadores, habilite el protocolo De árbol de expansión rápida.	Utilice el árbol de expansión rápida. D1 spanning-tree mode rapid-pvst D2 spanning-tree mode rapid-pvst A1 spanning-tree mode rapid-pvst
En D1 y D2, configure los puentes raíz RSTP adecuados en función de la información del diagrama de topología. D1 y D2 deben proporcionar copia de seguridad en caso de fallo del puente raíz.	Configure D1 y D2 como raíz para las VLAN adecuadas con prioridades de apoyo mutuo en caso de fallo del conmutador. D1 spanning-tree vlan 100,102 root primary spanning-tree vlan 101 root secondary D2 spanning-tree vlan 101 root primary spanning-tree vlan 100,102 root secondary
En todos los switches, cree LACP EtherChannels como se muestra en el	Utilice los siguientes números de canal: D1 a D2 – Canal de puerto 12

Tarea	Especificación
| diagrama de topología. | ```
D1(config)#interface range e2/0-3
D1(config-if-range)#channel-group 12 mode active
Creating a port-channel interface Port-channel 12
```<br><br>Fuente: Parra, D, (2022).<br><br>D1 a A1 – Puerto canal 1<br><br>```
D2(config)#interface range e2/0-3
D2(config-if-range)#channel-group 12 mode active
Creating a port-channel interface Port-channel 12
```<br><br>Fuente: Parra, D, (2022).<br><br>```
D2(config)#interface e0/1
D2(config-if)#channel-group 1 mode active
Creating a port-channel interface Port-channel 1

D2(config-if)#interface e0/2
D2(config-if)#channel-group 1 mode active
D2(config-if)#
```<br><br>```
D2(config-if)#interface e1/1
D2(config-if)#channel-group 2 mode active
Creating a port-channel interface Port-channel 2

D2(config-if)#interface e1/2
D2(config-if)#channel-group 2 mode active
D2(config-if)#
```<br>Fuente: Parra, D, (2022).<br><br>D2 a A1 – Puerto canal 2<br><br>```
A1(config)#interface e1/1
A1(config-if)#channel-group 2 mode active
Creating a port-channel interface Port-channel 2

A1(config-if)#interface e1/2
A1(config-if)#channel-group 2 mode active
A1(config-if)#
```<br><br>Fuente: Parra, D, (2022). |
| En todos los conmutadores, configure los puertos de acceso al host que se conectan a PC1, PC2, | Configure los puertos de acceso con la configuración de VLAN adecuada, como se muestra en el diagrama de topología.

Los puertos host deben pasar inmediatamente al estado de reenvío.

D1-PC1 |

Tarea	Especificación
PC3 y PC4.	interface e0/0 switchport mode access switchport access vlan 100 spanning-tree portfast D2-PC2 interface e0/0 switchport mode access switchport access vlan 102 spanning-tree portfast A1-PC3 y PC4 interface e1/3 switchport mode access switchport access vlan 101 spanning-tree portfast no shutdown interface e2/0 switchport mode access switchport access vlan 100 spanning-tree portfast no shutdown
Compruebe los servicios DHCP IPv4.	PC2 y PC3 son clientes DHCP y deben recibir direcciones IPv4 válidas. En el PC2 y PC3, con el comando dhcp se solicita una dirección IP al servidor DHCP, después con el comando show ip se puede visualizar la dirección IP asignada y la dirección del served or DHCP

Tarea	Especificación
| | ```
PC2> dhcp
DORA IP 10.97.102.210/24 GW 10.97.102.254

PC2> show ip

NAME        : PC2[1]
IP/MASK     : 10.97.102.210/24
GATEWAY     : 10.97.102.254
DNS         :
DHCP SERVER : 10.97.102.2
DHCP LEASE  : 86396, 86400/43200/75600
MAC         : 00:50:79:66:68:03
LPORT       : 10006
RHOST:PORT  : 127.0.0.1:10007
MTU:        : 1500
``` <br> Fuente: Parra, D, (2022). <br><br> ```
PC3> dhcp
DDORA IP 10.97.101.210/24 GW 97.0.101.254

PC3> show ip

NAME        : PC3[1]
IP/MASK     : 10.97.101.210/24
GATEWAY     : 97.0.101.254
DNS         :
DHCP SERVER : 10.97.101.2
DHCP LEASE  : 86394, 86400/43200/75600
MAC         : 00:50:79:66:68:01
LPORT       : 10008
RHOST:PORT  : 127.0.0.1:10009
MTU:        : 1500
``` <br> Fuente: Parra, D, (2022). |
| Compruebe la conectividad LAN local. | PC1 debería hacer ping con éxito: <br> D1: 10.97.100.1 <br><br> ```
PC1> ping 10.97.100.1
84 bytes from 10.97.100.1 icmp_seq=1 ttl=255 time=0.837 ms
84 bytes from 10.97.100.1 icmp_seq=2 ttl=255 time=0.865 ms
84 bytes from 10.97.100.1 icmp_seq=3 ttl=255 time=0.729 ms
84 bytes from 10.97.100.1 icmp_seq=4 ttl=255 time=0.702 ms
84 bytes from 10.97.100.1 icmp_seq=5 ttl=255 time=0.836 ms
``` <br> Fuente: Parra, D, (2022). <br><br> D2: 10.97.100.2 |

Tarea	Especificación
|       | ```
PC1> ping 10.97.100.2
84 bytes from 10.97.100.2 icmp_seq=1 ttl=255 time=1.120 ms
84 bytes from 10.97.100.2 icmp_seq=2 ttl=255 time=1.692 ms
84 bytes from 10.97.100.2 icmp_seq=3 ttl=255 time=1.061 ms
84 bytes from 10.97.100.2 icmp_seq=4 ttl=255 time=1.008 ms
84 bytes from 10.97.100.2 icmp_seq=5 ttl=255 time=1.895 ms
``` <br><br> Fuente: Parra, D, (2022). <br><br> PC4: 10.97.100.6 <br><br> ```
PC1> ping 10.97.100.6
84 bytes from 10.97.100.6 icmp_seq=1 ttl=64 time=1.504 ms
84 bytes from 10.97.100.6 icmp_seq=2 ttl=64 time=1.543 ms
84 bytes from 10.97.100.6 icmp_seq=3 ttl=64 time=2.122 ms
84 bytes from 10.97.100.6 icmp_seq=4 ttl=64 time=2.364 ms
84 bytes from 10.97.100.6 icmp_seq=5 ttl=64 time=1.635 ms
``` <br><br> Fuente: Parra, D, (2022). <br><br> PC2 debería hacer ping correctamente: <br><br> D1: 10.97.102.1 <br><br> ```
PC2> ping 10.97.102.1
84 bytes from 10.97.102.1 icmp_seq=1 ttl=255 time=1.038 ms
84 bytes from 10.97.102.1 icmp_seq=2 ttl=255 time=1.632 ms
84 bytes from 10.97.102.1 icmp_seq=3 ttl=255 time=1.545 ms
84 bytes from 10.97.102.1 icmp_seq=4 ttl=255 time=1.309 ms
84 bytes from 10.97.102.1 icmp_seq=5 ttl=255 time=2.015 ms
``` <br><br> Fuente: Parra, D, (2022). <br><br> D2: 10.97.102.2 <br><br> ```
PC2> ping 10.97.102.2
84 bytes from 10.97.102.2 icmp_seq=1 ttl=255 time=0.514 ms
84 bytes from 10.97.102.2 icmp_seq=2 ttl=255 time=0.751 ms
84 bytes from 10.97.102.2 icmp_seq=3 ttl=255 time=0.691 ms
84 bytes from 10.97.102.2 icmp_seq=4 ttl=255 time=0.739 ms
84 bytes from 10.97.102.2 icmp_seq=5 ttl=255 time=0.740 ms
``` <br><br> Fuente: Parra, D, (2022). <br><br> PC3 debería hacer ping correctamente: |

Tarea	Especificación
	D2: 10.97.101.2
| | ```
PC3> ping 10.97.101.2
84 bytes from 10.97.101.2 icmp_seq=1 ttl=255 time=0.706 ms
84 bytes from 10.97.101.2 icmp_seq=2 ttl=255 time=0.952 ms
84 bytes from 10.97.101.2 icmp_seq=3 ttl=255 time=1.019 ms
84 bytes from 10.97.101.2 icmp_seq=4 ttl=255 time=1.153 ms
84 bytes from 10.97.101.2 icmp_seq=5 ttl=255 time=1.000 ms
``` |
| | Fuente: Parra, D, (2022). |
| | PC4 debería hacer ping correctamente: D1: 10.97.100.1 |
| | ```
PC4> ping 10.97.100.1
84 bytes from 10.97.100.1 icmp_seq=1 ttl=255 time=1.832 ms
84 bytes from 10.97.100.1 icmp_seq=2 ttl=255 time=1.507 ms
84 bytes from 10.97.100.1 icmp_seq=3 ttl=255 time=1.298 ms
84 bytes from 10.97.100.1 icmp_seq=4 ttl=255 time=1.450 ms
84 bytes from 10.97.100.1 icmp_seq=5 ttl=255 time=1.317 ms
``` |
| | Fuente: Parra, D, (2022). |
| | D2: 10.97.100.2 |
| | ```
PC4> ping 10.97.100.2
84 bytes from 10.97.100.2 icmp_seq=1 ttl=255 time=0.739 ms
84 bytes from 10.97.100.2 icmp_seq=2 ttl=255 time=1.054 ms
84 bytes from 10.97.100.2 icmp_seq=3 ttl=255 time=0.943 ms
84 bytes from 10.97.100.2 icmp_seq=4 ttl=255 time=0.916 ms
84 bytes from 10.97.100.2 icmp_seq=5 ttl=255 time=0.981 ms
``` |
| | Fuente: Parra, D, (2022). |

Se adjunta el código de configuración en su totatilidad de los diferentes dispositivos, lo anterior con el fin de dar cumplimientos a los requisitos descritos en la evaluación de habilidades:

R1

```
interface FastEthernet0/0
 no ip address
 shutdown
```

```
 duplex full
!
interface Ethernet1/0
 ip address 209.165.200.225 255.255.255.224
 duplex full
 ipv6 address FE80::1:1 link-local
 ipv6 address 2001:DB8:200::1/64
!
interface Ethernet1/1
 ip address 10.97.13.1 255.255.255.0
 duplex full
 ipv6 address FE80::1:3 link-local
 ipv6 address 2001:DB8:100:1013::1/64
!
interface Ethernet1/2
 ip address 10.97.10.1 255.255.255.0
 duplex full
 ipv6 address FE80::1:2 link-local
 ipv6 address 2001:DB8:100:1010::1/64
!
interface Ethernet1/3
 no ip address
 shutdown
 duplex full
!
ip forward-protocol nd
!
!
no ip http server
no ip http secure-server
!
!
!
control-plane
!
banner motd
!
line con 0
 exec-timeout 0 0
 privilege level 15
 logging synchronous
```

```
 stopbits 1
line aux 0
 exec-timeout 0 0
 privilege level 15
 logging synchronous
 stopbits 1
line vty 0 4
 login
!
!
```

R2

```
interface Loopback0
 ip address 2.2.2.2 255.255.255.255
 ipv6 address FE80::2:3 link-local
 ipv6 address 2001:DB8:2222::1/128
!
interface FastEthernet0/0
 no ip address
 shutdown
 duplex full
!
interface Ethernet1/0
 ip address 209.165.200.226 255.255.255.224
 duplex full
 ipv6 address FE80::2:1 link-local
 ipv6 address 2001:DB8:200::2/64
!
interface Ethernet1/1
 no ip address
 shutdown
 duplex full
!
interface Ethernet1/2
 no ip address
 shutdown
 duplex full
!
interface Ethernet1/3
 no ip address
```

```
 shutdown
 duplex full
!
ip forward-protocol nd
!
!
no ip http server
no ip http secure-server
!
!
!
!
control-plane
!
banner motd
!
line con 0
 exec-timeout 0 0
 privilege level 15
 logging synchronous
 stopbits 1
line aux 0
 exec-timeout 0 0
 privilege level 15
 logging synchronous
 stopbits 1
line vty 0 4
 login
!
!
end
```

R3

```
interface FastEthernet0/0
 no ip address
 shutdown
 duplex full
!
interface Ethernet1/0
 ip address 10.97.11.1 255.255.255.0
```

```
 duplex full
 ipv6 address FE80::3:2 link-local
 ipv6 address 2001:DB8:100:1011::1/64
!
interface Ethernet1/1
 ip address 10.97.13.3 255.255.255.0
 duplex full
 ipv6 address FE80::3:3 link-local
 ipv6 address 2001:DB8:100:1010::2/64
!
interface Ethernet1/2
 no ip address
 shutdown
 duplex full
!
interface Ethernet1/3
 no ip address
 shutdown
 duplex full
!
ip forward-protocol nd
!
!
no ip http server
no ip http secure-server
!
!
!
control-plane
!
banner motd
!
line con 0
 exec-timeout 0 0
 privilege level 15
 logging synchronous
 stopbits 1
line aux 0
 exec-timeout 0 0
 privilege level 15
 logging synchronous
```

```
 stopbits 1
line vty 0 4
 login
!
!
end
```

D1

```
hostname D1
!
boot-start-marker
boot-end-marker
!
!
logging discriminator EXCESS severity drops 6 msg-body drops
EXCESSCOLL
logging buffered 50000
logging console discriminator EXCESS
!
no aaa new-model
!
!
!
no ip icmp rate-limit unreachable
!
ip dhcp excluded-address 10.97.101.1 10.97.101.109
ip dhcp excluded-address 10.97.101.141 10.97.101.254
ip dhcp excluded-address 10.97.102.1 10.97.102.109
ip dhcp excluded-address 10.97.102.141 10.97.102.254
!
ip dhcp pool VLAN-101
 network 10.97.101.0 255.255.255.0
 default-router 10.97.101.254
!
ip dhcp pool VLAN-102
 network 10.97.102.0 255.255.255.0
 default-router 10.97.102.254
!
!
no ip domain-lookup
ip cef
```

```
ipv6 unicast-routing
ipv6 cef
!
!
!
spanning-tree mode rapid-pvst
spanning-tree extend system-id
spanning-tree vlan 100,102 priority 24576
spanning-tree vlan 101 priority 28672
!
vlan internal allocation policy ascending
!
ip tcp synwait-time 5
!
!
!
interface Port-channel12
 switchport trunk encapsulation dot1q
 switchport trunk native vlan 999
 switchport mode trunk
!
interface Ethernet0/0
 switchport access vlan 100
 switchport mode access
 spanning-tree portfast edge
!
interface Ethernet0/1
 switchport trunk encapsulation dot1q
 switchport trunk native vlan 999
 switchport mode trunk
!
interface Ethernet0/2
 switchport trunk encapsulation dot1q
 switchport trunk native vlan 999
 switchport mode trunk
!
interface Ethernet0/3
 shutdown
!
interface Ethernet1/0
 shutdown
```

```
!
interface Ethernet1/1
 shutdown
!
interface Ethernet1/2
 no switchport
 ip address 10.97.10.2 255.255.255.0
 ipv6 address FE80::D1:1 link-local
 ipv6 address 2001:DB8:100:1010::2/64
!
interface Ethernet1/3
 shutdown
!
interface Ethernet2/0
 switchport trunk encapsulation dot1q
 switchport trunk native vlan 999
 switchport mode trunk
 channel-group 12 mode active
!
interface Ethernet2/1
 switchport trunk encapsulation dot1q
 switchport trunk native vlan 999
 switchport mode trunk
 channel-group 12 mode active
!
interface Ethernet2/2
 switchport trunk encapsulation dot1q
 switchport trunk native vlan 999
 switchport mode trunk
 channel-group 12 mode active
!
interface Ethernet2/3
 switchport trunk encapsulation dot1q
 switchport trunk native vlan 999
 switchport mode trunk
 channel-group 12 mode active
!
interface Ethernet3/0
 shutdown
!
interface Ethernet3/1
```

```
 shutdown
!
interface Ethernet3/2
 shutdown
!
interface Ethernet3/3
 shutdown
!
interface Vlan1
 no ip address
 shutdown
!
interface Vlan100
 ip address 10.97.100.1 255.255.255.0
 ipv6 address FE80::D1:2 link-local
 ipv6 address 2001:DB8:100:100::1/64
!
interface Vlan101
 ip address 10.97.101.1 255.255.255.0
 ipv6 address FE80::D1:3 link-local
 ipv6 address 2001:DB8:100:101::1/64
!
interface Vlan102
 ip address 10.97.102.1 255.255.255.0
 ipv6 address FE80::D1:4 link-local
 ipv6 address 2001:DB8:100:102::1/64
!
ip forward-protocol nd
!
!
no ip http server
no ip http secure-server
!
!
!
control-plane
!
banner motd
!
line con 0
 exec-timeout 0 0
```

```
 privilege level 15
 logging synchronous
line aux 0
 exec-timeout 0 0
 privilege level 15
 logging synchronous
line vty 0 4
 login
!
!

end
```

D2

```
hostname D2
!
boot-start-marker
boot-end-marker
!
!
logging discriminator EXCESS severity drops 6 msg-body drops
EXCESSCOLL
logging buffered 50000
logging console discriminator EXCESS
!
no aaa new-model
!
!
!
no ip icmp rate-limit unreachable
!
ip dhcp excluded-address 10.97.101.1 10.97.101.209
ip dhcp excluded-address 10.97.101.241 10.97.101.254
ip dhcp excluded-address 10.97.102.1 10.97.102.209
ip dhcp excluded-address 10.97.102.241 10.97.102.254
!
ip dhcp pool VLAN-101
 network 10.97.101.0 255.255.255.0
 default-router 97.0.101.254
!
```

```
ip dhcp pool VLAN-102
 network 10.97.102.0 255.255.255.0
 default-router 10.97.102.254
!
!
no ip domain-lookup
ip cef
ipv6 unicast-routing
ipv6 cef
!
!
!
spanning-tree mode rapid-pvst
spanning-tree extend system-id
spanning-tree vlan 100,102 priority 28672
spanning-tree vlan 101 priority 24576
!
vlan internal allocation policy ascending
!
ip tcp synwait-time 5
!
!
!
interface Port-channel1
!
interface Port-channel2
 switchport trunk encapsulation dot1q
 switchport trunk native vlan 999
 switchport mode trunk
!
interface Port-channel12
 switchport trunk encapsulation dot1q
 switchport trunk native vlan 999
 switchport mode trunk
!
interface Ethernet0/0
 switchport access vlan 102
 switchport mode access
 spanning-tree portfast edge
!
interface Ethernet0/1
```

```
 shutdown
 channel-group 1 mode active
!
interface Ethernet0/2
 shutdown
 channel-group 1 mode active
!
interface Ethernet0/3
 shutdown
!
interface Ethernet1/0
 no switchport
 ip address 10.97.11.2 255.255.255.0
 ipv6 address FE80::D1:1 link-local
 ipv6 address 2001:DB8:100:1011::2/64
!
interface Ethernet1/1
 switchport trunk encapsulation dot1q
 switchport trunk native vlan 999
 switchport mode trunk
 channel-group 2 mode active
!
interface Ethernet1/2
 switchport trunk encapsulation dot1q
 switchport trunk native vlan 999
 switchport mode trunk
 channel-group 2 mode active
!
interface Ethernet1/3
 shutdown
!
interface Ethernet2/0
 switchport trunk encapsulation dot1q
 switchport trunk native vlan 999
 switchport mode trunk
 channel-group 12 mode active
!
interface Ethernet2/1
 switchport trunk encapsulation dot1q
 switchport trunk native vlan 999
 switchport mode trunk
```

```
  channel-group 12 mode active
!
interface Ethernet2/2
 switchport trunk encapsulation dot1q
 switchport trunk native vlan 999
 switchport mode trunk
 channel-group 12 mode active
!
interface Ethernet2/3
 switchport trunk encapsulation dot1q
 switchport trunk native vlan 999
 switchport mode trunk
 channel-group 12 mode active
!
interface Ethernet3/0
 shutdown
!
interface Ethernet3/1
 shutdown
!
interface Ethernet3/2
 shutdown
!
interface Ethernet3/3
 shutdown
!
interface Vlan1
 no ip address
 shutdown
!
interface Vlan100
 ip address 10.97.100.2 255.255.255.0
 ipv6 address FE80::D2:2 link-local
 ipv6 address 2001:DB8:100:100::2/64
!
interface Vlan101
 ip address 10.97.101.2 255.255.255.0
 ipv6 address FE80::D2:3 link-local
 ipv6 address 2001:DB8:100:101::2/64
!
interface Vlan102
```

```
 ip address 10.97.102.2 255.255.255.0
 ipv6 address FE80::D2:4 link-local
 ipv6 address 2001:DB8:100:102::2/64
!
ip forward-protocol nd
!
!
no ip http server
no ip http secure-server
!
!
!
control-plane
!
banner motd
!
line con 0
 exec-timeout 0 0
 privilege level 15
 logging synchronous
line aux 0
 exec-timeout 0 0
 privilege level 15
 logging synchronous
line vty 0 4
 login
!
!
 end


A1

hostname A1
!
boot-start-marker
boot-end-marker
!
!
logging discriminator EXCESS severity drops 6 msg-body drops
EXCESSCOLL
```

```
logging buffered 50000
logging console discriminator EXCESS
!
no aaa new-model
!
!
no ip icmp rate-limit unreachable
!
!
!
no ip domain-lookup
ip cef
no ipv6 cef
!
!
!
spanning-tree mode rapid-pvst
spanning-tree extend system-id
!
vlan internal allocation policy ascending
!
ip tcp synwait-time 5
!
!
!
interface Port-channel1
!
interface Port-channel2
 switchport trunk encapsulation dot1q
 switchport trunk native vlan 999
 switchport mode trunk
!
interface Ethernet0/0
 shutdown
!
interface Ethernet0/1
 switchport trunk encapsulation dot1q
 switchport trunk native vlan 999
 switchport mode trunk
 channel-group 1 mode active
!
```

```
interface Ethernet0/2
 switchport trunk encapsulation dot1q
 switchport trunk native vlan 999
 switchport mode trunk
 channel-group 1 mode active
!
interface Ethernet0/3
 shutdown
!
interface Ethernet1/0
 shutdown
!
interface Ethernet1/1
 switchport trunk encapsulation dot1q
 switchport trunk native vlan 999
 switchport mode trunk
 channel-group 2 mode active
!
interface Ethernet1/2
 switchport trunk encapsulation dot1q
 switchport trunk native vlan 999
 switchport mode trunk
 channel-group 2 mode active
!
interface Ethernet1/3
 switchport access vlan 101
 switchport mode access
 spanning-tree portfast edge
!
interface Ethernet2/0
 switchport access vlan 100
 switchport mode access
 spanning-tree portfast edge
!
interface Ethernet2/1
 shutdown
!
interface Ethernet2/2
 shutdown
!
interface Ethernet2/3
```

```
 shutdown
!
interface Ethernet3/0
 shutdown
!
interface Ethernet3/1
 shutdown
!
interface Ethernet3/2
 shutdown
!
interface Ethernet3/3
 shutdown
!
interface Vlan1
 no ip address
 shutdown
!
interface Vlan100
 ip address 10.97.100.6 255.255.255.0
 ipv6 address FE80::A1:1 link-local
 ipv6 address 2001:DB8:100:100::3/64
!
ip forward-protocol nd
!
!
no ip http server
no ip http secure-server
!
!
!
control-plane
!
banner motd
!
line con 0
 exec-timeout 0 0
 privilege level 15
 logging synchronous
line aux 0
 exec-timeout 0 0
```

```
 privilege level 15
 logging synchronous
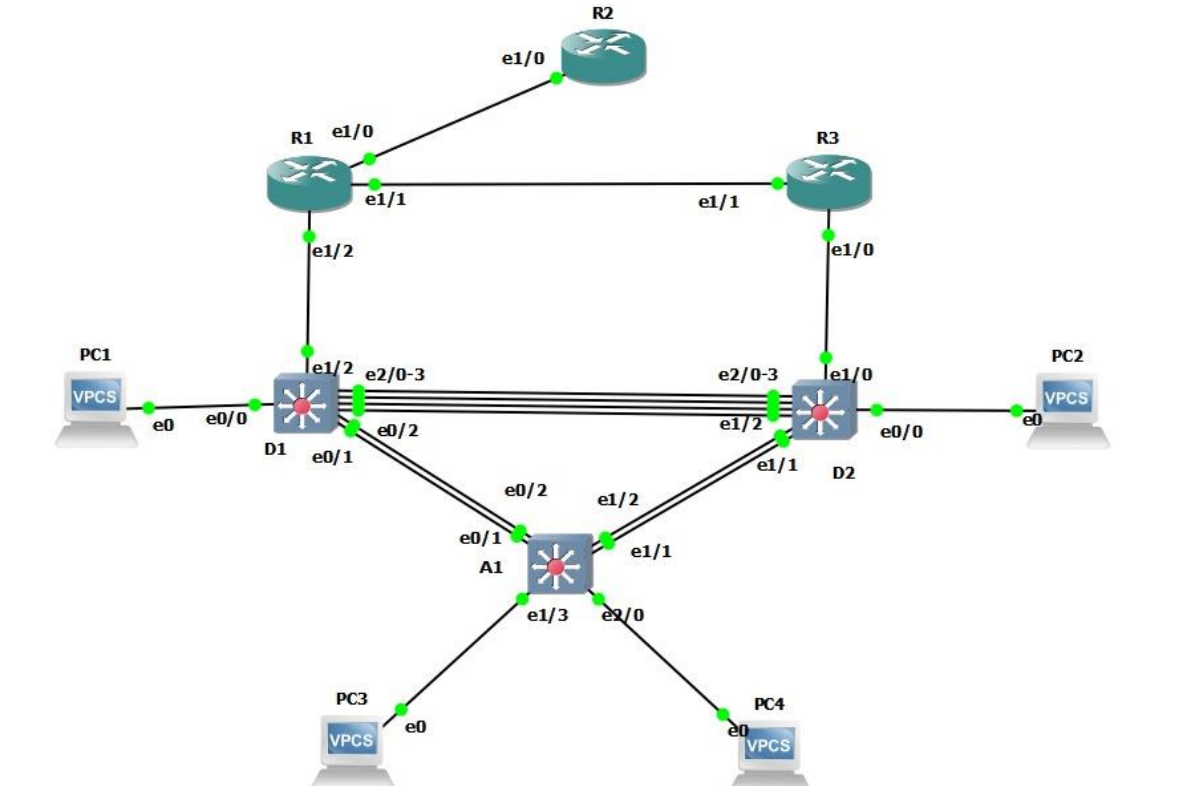line vty 0 4
 login
!
!
End
```

2- ESCENARIO 2

Configurar protocolos de enrutamiento.

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

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

Figura 11 - Escenario de red 2 en simulador GNS3

Las tareas de configuración son las siguientes:

Tarea #	Tarea	Especificación
3.1	En la "Red de la empresa" (es decir, R1, R3, D1 y D2), configure OSPFv2 de área única en el área 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 • R1 router ospf 4 router-id 0.0.4.1 network 10.97.13.1 255.255.255.0 area 0 network 10.97.10.1 255.255.255.0 area 0 default-information originate • R3 router ospf 4 router-id 0.0.4.3 network 10.97.11.1 255.255.255.0 area 0 network 10.97.13.3 255.255.255.0 area 0 • D1 router ospf 4 router-id 0.0.4.131 network 10.97.10.2 255.255.255.0 area 0

Tarea #	Tarea	Especificación
		network 10.97.100.1 255.255.255.0 area 0 network 10.97.101.1 255.255.255.0 area 0 network 10.97.102.1 255.255.255.0 area 0 passive-interface default no passive-interface e1/2 • D2 router ospf 4 router-id 0.0.4.132 network 10.97.11.2 255.255.255.0 area 0 network 10.97.100.2 255.255.255.0 area 0 network 10.97.101.2 255.255.255.0 area 0 network 10.97.102.2 255.255.255.0 area 0 passive-interface default no passive-interface e1/0
3.2	En la "Red de la empresa" (es decir, R1, R3, D1 y D2), configure OSPFv3 clásico de área única en el área 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

Tarea #	Tarea	Especificación
		• R1 ipv6 router ospf 6 router-id 0.0.6.1 default-information originate exit interface e1/1 ipv6 ospf 6 area 0 interface e1/2 ipv6 ospf 6 area 0 exit • R3 ipv6 router ospf 6 router-id 0.0.6.3 exit interface e1/1 ipv6 ospf 6 area 0 interface e1/0 ipv6 ospf 6 area 0 exit • D1 ipv6 router ospf 6 router-id 0.0.6.131 passive-interface default no passive-interface e1/2 exit interface e1/2 ipv6 ospf 6 area 0 interface Vlan100 ipv6 ospf 6 area 0 interface Vlan101 ipv6 ospf 6 area 0 interface Vlan102 ipv6 ospf 6 area 0 exit • D2 ipv6 router ospf 6 router-id 0.0.6.132 passive-interface default no passive-interface e1/0 exit

Tarea #	Tarea	Especificación
		interface e1/0 ipv6 ospf 6 area 0 interface Vlan100 ipv6 ospf 6 area 0 interface Vlan101 ipv6 ospf 6 area 0 interface Vlan102 ipv6 ospf 6 area 0 exit
3.3	En R2 en la "Red ISP", cen la figura 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). • R2 ip route 0.0.0.0 0.0.0.0 loopback 0 ipv6 route ::/0 loopback 0 router bgp 500 bgp router-id 2.2.2.2 neighbor 209.165.200.225 remote-as 300 neighbor 2001:db8:200::1 remote-as 300

Tarea #	Tarea	Especificación
		address-family ipv4 neighbor 209.165.200.225 activate no neighbor 2001:db8:200::1 activate network 0.0.0.0 exit-address-family address-family ipv6 no neighbor 209.165.200.225 activate neighbor 2001:db8:200::1 activate network 2001:db8:2222::/128 network ::/0 exit-address-family
3.4	En R1 en la "Red ISP", configure MP-BGP.	Configure two static summary routes to interface Null 0: • A summary IPv4 route for 10.97.0.0/8. • 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 10.97.0.0/8 network. In IPv6 address family: • Disable the IPv4 neighbor relationship. • Enable the IPv6 neighbor relationship. • Advertise the 2001:db8:100::/48 network. • R1 ip route 10.97.0.0 255.0.0.0 null0 ipv6 route 2001:db8:100::/48 null0

Tarea #	Tarea	Especificación
		router bgp 300 bgp router-id 1.1.1.1 neighbor 209.165.200.226 remote-as 500 neighbor 2001:db8:200::2 remote-as 500 address-family ipv4 unicast neighbor 209.165.200.226 activate no neighbor 2001:db8:200::2 activate network 10.97.0.0 mask 255.0.0.0 exit-address-family address-family ipv6 unicast no neighbor 209.165.200.226 activate neighbor 2001:db8:200::2 activate network 2001:db8:100::/48 exit-address-family

Tabla 3 - Tareas escenario 2

Configurar redundancia de primer salto

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

Las tareas de configuración son las siguientes:

Tarea #	Tarea	Especificación
4.1	En D1, cree SLA IP que prueben la accesibilidad de la interfaz R1 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. D1 ip sla 4 icmp-echo 10.97.10.1 frequency 5 ip sla 6 icmp-echo 2001:db8:100:1010::1 frequency 5 exit ip sla schedule 4 start-time now life forever ip sla schedule 6 start-time now life forever track 4 ip sla 4 delay down 10 up 15 exit track 6 ip sla 6 delay down 10 up 15 exit

Tarea #	Tarea	Especificación

4.2	En D2, cree SLA IP que prueben la accesibilidad de la interfaz R3 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.
		
		<pre>D2
		
		ip sla 4
		icmp-echo 10.97.11.1
		frequency 5
		ip sla 6
		icmp-echo 2001:db8:100:1011::1
		frequency 5
		exit
		ip sla schedule 4 start-time now life forever
		ip sla schedule 6 start-time now life forever
		track 4 ip sla 4
		delay down 10 up 15
		exit
		track 6 ip sla 6
		delay down 10 up 15
		exit</pre>

4.3	En 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.

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 **10.97.100.254**.
- Set the group priority to **150**.
- Enable preemption.
- Track object 4 and decrement by 60.

   D1
   interface Vlan100
   standby version 2
   standby 104 ip 10.97.100.254
   standby 104 priority 150
   standby 104 preempt
   standby 104 track 4 decrement 60

Configure IPv4 HSRP group **114** for VLAN 101:
- Assign the virtual IP address **10.97.101.254**.
- Enable preemption.
- Track object 4 to decrement by 60.

   D1
   interface Vlan101
   standby version 2
   standby 114 ip 10.97.101.254
   standby 114 preempt
   standby 114 track 4 decrement 60

Configure IPv4 HSRP group **124** for VLAN 102:
- Assign the virtual IP address **10.97.102.254**.
- Set the group priority to **150**.
- Enable preemption.
- Track object 4 to decrement by 60.

   D1
   interface Vlan102
   standby version 2
   standby 124 ip 10.97.102.254
   standby 124 priority 150
   standby 124 preempt
   standby 124 track 4 decrement 60

Configure IPv6 HSRP group **106** for VLAN 100:

Tarea #	Tarea	Especificación

		• Assign the virtual IP address using **ipv6 autoconfig**.
		• Set the group priority to **150**.
		• Enable preemption.
		• Track object 6 and decrement by 60.
		
		  D1
		  interface Vlan100
		  standby 106 ipv6 autoconfig
		  standby 106 priority 150
		  standby 106 preempt
		  standby 106 track 6 decrement 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.
		
		  D1
		  interface Vlan101
		  standby 116 ipv6 autoconfig
		  standby 116 preempt
		  standby 116 track 6 decrement 60
		Configure IPv6 HSRP group **126** for VLAN 102:
		• Assign the virtual IP address using **ipv6 autoconfig**.
		• Set the group priority to **150**.
		• Enable preemption.
		• Track object 6 and decrement by 60.
		  D1
		  interface Vlan102
		  standby 126 ipv6 autoconfig
		  standby 126 priority 150
		  standby 126 preempt
		  standby 126 track 6 decrement 60

	En 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 **10.97.100.254**.
		• Enable preemption.
		• Track object 4 and decrement by 60.
		
		    D2
		    interface Vlan100
		    standby version 2
		    standby 104 ip 10.97.100.254
		    standby 104 preempt
		    standby 104 track 4 decrement 60
		
		Configure IPv4 HSRP group **114** for VLAN 101:
		• Assign the virtual IP address **10.97.101.254**.
		• Set the group priority to **150**.
		• Enable preemption.
		• Track object 4 to decrement by 60.
		
		    D2
		    interface Vlan101
		    standby version 2
		    standby 114 ip 10.97.101.254
		    standby 114 priority 150
		    standby 114 preempt
		    standby 114 track 4 decrement 60
		Configure IPv4 HSRP group **124** for VLAN 102:
		• Assign the virtual IP address **10.97.102.254**.
		• Enable preemption.
		• Track object 4 to decrement by 60.
		
		    D2
		    interface Vlan102
		    standby version 2
		    standby 124 ip 10.97.102.254
		    standby 124 preempt
		    standby 124 track 4 decrement 60
		
		Configure IPv6 HSRP group **106** for VLAN 100:

Tarea #	Tarea	Especificación

		• Assign the virtual IP address using **ipv6 autoconfig**.
		• Enable preemption.
		• Track object 6 and decrement by 60.
		
		   D2
		   interface Vlan100
		   standby 106 ipv6 autoconfig
		   standby 106 preempt
		   standby 106 track 6 decrement 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.
		
		   D2
		   interface Vlan101
		   standby 116 ipv6 autoconfig
		   standby 116 priority 150
		   standby 116 preempt
		   standby 116 track 6 decrement 60
		
		Configure IPv6 HSRP group **126** for VLAN 102:
		• Assign the virtual IP address using **ipv6 autoconfig**.
		• Enable preemption.
		• Track object 6 and decrement by 60.
		
		   D2
		   interface Vlan102
		   standby 126 ipv6 autoconfig
		   standby 126 preempt
		   standby 126 track 6 decrement 60

Por último, se adjuntan las diferentes configuraciones realizadas a cada dispositivo con el fin de dar cumplimientos a los requisitos descritos para este escenario:

- R1

```
interface FastEthernet0/0
 no ip address
 shutdown
 duplex full
!
interface Ethernet1/0
 ip address 209.165.200.225 255.255.255.224
 duplex full
 ipv6 address FE80::1:1 link-local
 ipv6 address 2001:DB8:200::1/64
!
interface Ethernet1/1
 ip address 10.97.13.1 255.255.255.0
 duplex full
 ipv6 address FE80::1:3 link-local
 ipv6 address 2001:DB8:100:1013::1/64
 ipv6 ospf 6 area 0
!
interface Ethernet1/2
 ip address 10.97.10.1 255.255.255.0
 duplex full
 ipv6 address FE80::1:2 link-local
 ipv6 address 2001:DB8:100:1010::1/64
 ipv6 ospf 6 area 0
!
interface Ethernet1/3
 no ip address
 shutdown
 duplex full
!
router ospf 4
 router-id 0.0.4.1
 network 10.97.10.0 0.0.0.255 area 0
 network 10.97.13.0 0.0.0.255 area 0
 default-information originate
!
router bgp 300
 bgp router-id 1.1.1.1
 bgp log-neighbor-changes
 neighbor 2001:DB8:200::2 remote-as 500
```

```
 neighbor 209.165.200.226 remote-as 500
 !
 address-family ipv4
  no neighbor 2001:DB8:200::2 activate
  neighbor 209.165.200.226 activate
 exit-address-family
 !
 address-family ipv6
  network 2001:DB8:100::/48
  neighbor 2001:DB8:200::2 activate
 exit-address-family
!
ip forward-protocol nd
!
!
no ip http server
no ip http secure-server
!
ipv6 route 2001:DB8:100::/48 Null0
ipv6 router ospf 6
 router-id 0.0.6.1
 default-information originate
!
!
!
control-plane
!
banner motd ^C R1, ENCOR Skills Assessment^C
!
line con 0
 exec-timeout 0 0
 privilege level 15
 logging synchronous
 stopbits 1
line aux 0
 exec-timeout 0 0
 privilege level 15
 logging synchronous
 stopbits 1
line vty 0 4
 login
```

```
!
!
end


 R2
interface Loopback0
 ip address 2.2.2.2 255.255.255.255
 ipv6 address FE80::2:3 link-local
 ipv6 address 2001:DB8:2222::1/128
!
interface FastEthernet0/0
 no ip address
 shutdown
 duplex full
!
interface Ethernet1/0
 ip address 209.165.200.226 255.255.255.224
 duplex full
 ipv6 address FE80::2:1 link-local
 ipv6 address 2001:DB8:200::2/64
!
interface Ethernet1/1
 no ip address
 shutdown
 duplex full
!
interface Ethernet1/2
 no ip address
 shutdown
 duplex full
!
interface Ethernet1/3
 no ip address
 shutdown
 duplex full
!
router bgp 500
 bgp router-id 2.2.2.2
 bgp log-neighbor-changes
 neighbor 2001:DB8:200::1 remote-as 300
```

```
 neighbor 209.165.200.225 remote-as 300
 !
 address-family ipv4
  network 0.0.0.0
  no neighbor 2001:DB8:200::1 activate
  neighbor 209.165.200.225 activate
 exit-address-family
 !
 address-family ipv6
  network ::/0
  network 2001:DB8:2222::/128
  neighbor 2001:DB8:200::1 activate
 exit-address-family
!
ip forward-protocol nd
!
!
no ip http server
no ip http secure-server
ip route 0.0.0.0 0.0.0.0 Loopback0
!
ipv6 route ::/0 Loopback0
!
!
!
control-plane
!
banner motd ^C R2, ENCOR Skills Assessment^C
!
line con 0
 exec-timeout 0 0
 privilege level 15
 logging synchronous
 stopbits 1
line aux 0
 exec-timeout 0 0
 privilege level 15
 logging synchronous
 stopbits 1
line vty 0 4
 login
```

!
!
End

R3
interface FastEthernet0/0
 no ip address
 shutdown
 duplex full
!
interface Ethernet1/0
 ip address 10.97.11.1 255.255.255.0
 duplex full
 ipv6 address FE80::3:2 link-local
 ipv6 address 2001:DB8:100:1011::1/64
 ipv6 ospf 6 area 0
!
interface Ethernet1/1
 ip address 10.97.13.3 255.255.255.0
 duplex full
 ipv6 address FE80::3:3 link-local
 ipv6 address 2001:DB8:100:1010::2/64
 ipv6 ospf 6 area 0
!
interface Ethernet1/2
 no ip address
 shutdown
 duplex full
!
interface Ethernet1/3
 no ip address
 shutdown
 duplex full
!
router ospf 4
 router-id 0.0.4.3
 network 10.97.11.0 0.0.0.255 area 0
 network 10.97.13.0 0.0.0.255 area 0
!
ip forward-protocol nd
!

```
!
no ip http server
no ip http secure-server
!
ipv6 router ospf 6
 router-id 0.0.6.3
!
!
control-plane
!
banner motd ^C R3, ENCOR Skills Assessment^C
!
line con 0
 exec-timeout 0 0
 privilege level 15
 logging synchronous
 stopbits 1
line aux 0
 exec-timeout 0 0
 privilege level 15
 logging synchronous
 stopbits 1
line vty 0 4
 login
!
!
End
```

D1

```
interface Port-channel12
 switchport trunk encapsulation dot1q
 switchport trunk native vlan 999
 switchport mode trunk
!
interface Ethernet0/0
 switchport access vlan 100
 switchport mode access
 spanning-tree portfast edge
!
interface Ethernet0/1
```

```
 switchport trunk encapsulation dot1q
 switchport trunk native vlan 999
 switchport mode trunk
!
interface Ethernet0/2
 switchport trunk encapsulation dot1q
 switchport trunk native vlan 999
 switchport mode trunk
!
interface Ethernet0/3
 shutdown
!
interface Ethernet1/0
 shutdown
!
interface Ethernet1/1
 shutdown
!
interface Ethernet1/2
 no switchport
 ip address 10.97.10.2 255.255.255.0
 ipv6 address FE80::D1:1 link-local
 ipv6 address 2001:DB8:100:1010::2/64
 ipv6 ospf 6 area 0
!
interface Ethernet1/3
 shutdown
!
interface Ethernet2/0
 switchport trunk encapsulation dot1q
 switchport trunk native vlan 999
 switchport mode trunk
 channel-group 12 mode active
!
interface Ethernet2/1
 switchport trunk encapsulation dot1q
 switchport trunk native vlan 999
 switchport mode trunk
 channel-group 12 mode active
!
interface Ethernet2/2
```

```
 switchport trunk encapsulation dot1q
 switchport trunk native vlan 999
 switchport mode trunk
 channel-group 12 mode active
!
interface Ethernet2/3
 switchport trunk encapsulation dot1q
 switchport trunk native vlan 999
 switchport mode trunk
 channel-group 12 mode active
!
interface Ethernet3/0
 shutdown
!
interface Ethernet3/1
 shutdown
!
interface Ethernet3/2
 shutdown
!
interface Ethernet3/3
 shutdown
!
interface Vlan1
 no ip address
 shutdown
!
interface Vlan100
 ip address 10.97.100.1 255.255.255.0
 standby version 2
 standby 104 ip 10.97.100.254
 standby 104 priority 150
 standby 104 preempt
 standby 104 track 4 decrement 60
 standby 106 ipv6 autoconfig
 standby 106 priority 150
 standby 106 preempt
 standby 106 track 6 decrement 60
 ipv6 address FE80::D1:2 link-local
 ipv6 address 2001:DB8:100:100::1/64
 ipv6 ospf 6 area 0
```

```
!
interface Vlan101
 ip address 10.97.101.1 255.255.255.0
 standby version 2
 standby 114 ip 10.97.101.254
 standby 114 preempt
 standby 114 track 4 decrement 60
 standby 116 ipv6 autoconfig
 standby 116 preempt
 standby 116 track 6 decrement 60
 ipv6 address FE80::D1:3 link-local
 ipv6 address 2001:DB8:100:101::1/64
 ipv6 ospf 6 area 0
!
interface Vlan102
 ip address 10.97.102.1 255.255.255.0
 standby version 2
 standby 124 ip 10.97.102.254
 standby 124 priority 150
 standby 124 preempt
 standby 124 track 4 decrement 60
 standby 126 ipv6 autoconfig
 standby 126 priority 150
 standby 126 preempt
 standby 126 track 6 decrement 60
 ipv6 address FE80::D1:4 link-local
 ipv6 address 2001:DB8:100:102::1/64
 ipv6 ospf 6 area 0
!
router ospf 4
 router-id 0.0.4.131
 passive-interface default
 no passive-interface Ethernet1/2
 network 10.97.10.0 0.0.0.255 area 0
 network 10.97.100.0 0.0.0.255 area 0
 network 10.97.101.0 0.0.0.255 area 0
 network 10.97.102.0 0.0.0.255 area 0
!
ip forward-protocol nd
!
!
```

```
no ip http server
no ip http secure-server
!
!
ip sla 4
 icmp-echo 10.97.10.1
 frequency 5
ip sla schedule 4 life forever start-time now
ip sla 6
 icmp-echo 2001:DB8:100:1010::1
 frequency 5
ip sla schedule 6 life forever start-time now
ipv6 router ospf 6
 router-id 0.0.6.131
 passive-interface default
 no passive-interface Ethernet1/2
!
!
!!
control-plane
!
banner motd ^C D1, ENCOR Skills Assessment^C
!
line con 0
 exec-timeout 0 0
 privilege level 15
 logging synchronous
line aux 0
 exec-timeout 0 0
 privilege level 15
 logging synchronous
line vty 0 4
 login
!
!
End
```

D2
```
interface Port-channel1
!
interface Port-channel2
```

```
 switchport trunk encapsulation dot1q
 switchport trunk native vlan 999
 switchport mode trunk
!
interface Port-channel12
 switchport trunk encapsulation dot1q
 switchport trunk native vlan 999
 switchport mode trunk
!
interface Ethernet0/0
 switchport access vlan 102
 switchport mode access
 spanning-tree portfast edge
!
interface Ethernet0/1
 shutdown
 channel-group 1 mode active
!
interface Ethernet0/2
 shutdown
 channel-group 1 mode active
!
interface Ethernet0/3
 shutdown
!
interface Ethernet1/0
 no switchport
 ip address 10.97.11.2 255.255.255.0
 ipv6 address FE80::D1:1 link-local
 ipv6 address 2001:DB8:100:1011::2/64
 ipv6 ospf 6 area 0
!
interface Ethernet1/1
 switchport trunk encapsulation dot1q
 switchport trunk native vlan 999
 switchport mode trunk
 channel-group 2 mode active
!
interface Ethernet1/2
 switchport trunk encapsulation dot1q
 switchport trunk native vlan 999
```

```
 switchport mode trunk
 channel-group 2 mode active
!
interface Ethernet1/3
 shutdown
!
interface Ethernet2/0
 switchport trunk encapsulation dot1q
 switchport trunk native vlan 999
 switchport mode trunk
 channel-group 12 mode active
!
interface Ethernet2/1
 switchport trunk encapsulation dot1q
 switchport trunk native vlan 999
 switchport mode trunk
 channel-group 12 mode active
!
interface Ethernet2/2
 switchport trunk encapsulation dot1q
 switchport trunk native vlan 999
 switchport mode trunk
 channel-group 12 mode active
!
interface Ethernet2/3
 switchport trunk encapsulation dot1q
 switchport trunk native vlan 999
 switchport mode trunk
 channel-group 12 mode active
!
interface Ethernet3/0
 shutdown
!
interface Ethernet3/1
 shutdown
!
interface Ethernet3/2
 shutdown
!
interface Ethernet3/3
 shutdown
```

```
!
interface Vlan1
 no ip address
 shutdown
!
interface Vlan100
 ip address 10.97.100.2 255.255.255.0
 standby version 2
 standby 104 ip 10.97.100.254
 standby 104 preempt
 standby 104 track 4 decrement 60
 standby 106 ipv6 autoconfig
 standby 106 preempt
 standby 106 track 6 decrement 60
 ipv6 address FE80::D2:2 link-local
 ipv6 address 2001:DB8:100:100::2/64
 ipv6 ospf 6 area 0
!
interface Vlan101
 ip address 10.97.101.2 255.255.255.0
 standby version 2
 standby 114 ip 10.97.101.254
 standby 114 priority 150
 standby 114 preempt
 standby 114 track 4 decrement 60
 standby 116 ipv6 autoconfig
 standby 116 priority 150
 standby 116 preempt
 standby 116 track 6 decrement 60
 ipv6 address FE80::D2:3 link-local
 ipv6 address 2001:DB8:100:101::2/64
 ipv6 ospf 6 area 0
!
interface Vlan102
 ip address 10.97.102.2 255.255.255.0
 standby version 2
 standby 124 ip 10.97.102.254
 standby 124 preempt
 standby 124 track 4 decrement 60
 standby 126 ipv6 autoconfig
 standby 126 preempt
```

```
 standby 126 track 6 decrement 60
 ipv6 address FE80::D2:4 link-local
 ipv6 address 2001:DB8:100:102::2/64
 ipv6 ospf 6 area 0
!
router ospf 4
 router-id 0.0.4.132
 passive-interface default
 no passive-interface Ethernet1/0
 network 10.97.11.0 0.0.0.255 area 0
 network 10.97.100.0 0.0.0.255 area 0
 network 10.97.101.0 0.0.0.255 area 0
 network 10.97.102.0 0.0.0.255 area 0
!
ip forward-protocol nd
!
!
no ip http server
no ip http secure-server
!
!
ip sla 4
 icmp-echo 10.97.11.1
 frequency 5
ip sla schedule 4 life forever start-time now
ip sla 6
 icmp-echo 2001:DB8:100:1011::1
 frequency 5
ip sla schedule 6 life forever start-time now
ipv6 router ospf 6
 router-id 0.0.6.132
 passive-interface default
 no passive-interface Ethernet1/0
!
!
!
!
control-plane
!
banner motd ^C D2, ENCOR Skills Assessment^C
!
```

```
line con 0
 exec-timeout 0 0
 privilege level 15
 logging synchronous
line aux 0
 exec-timeout 0 0
 privilege level 15
 logging synchronous
line vty 0 4
 login
!
!
end

 A1
interface Port-channel1
!
interface Port-channel2
 switchport trunk encapsulation dot1q
 switchport trunk native vlan 999
 switchport mode trunk
!
interface Ethernet0/0
 shutdown
!
interface Ethernet0/1
 switchport trunk encapsulation dot1q
 switchport trunk native vlan 999
 switchport mode trunk
 channel-group 1 mode active
!
interface Ethernet0/2
 switchport trunk encapsulation dot1q
 switchport trunk native vlan 999
 switchport mode trunk
 channel-group 1 mode active
!
interface Ethernet0/3
 shutdown
!
interface Ethernet1/0
```

```
 shutdown
!
interface Ethernet1/1
 switchport trunk encapsulation dot1q
 switchport trunk native vlan 999
 switchport mode trunk
 channel-group 2 mode active
!
interface Ethernet1/2
 switchport trunk encapsulation dot1q
 switchport trunk native vlan 999
 switchport mode trunk
 channel-group 2 mode active
!
interface Ethernet1/3
 switchport access vlan 101
 switchport mode access
 spanning-tree portfast edge
!
interface Ethernet2/0
 switchport access vlan 100
 switchport mode access
 spanning-tree portfast edge
!
interface Ethernet2/1
 shutdown
!
interface Ethernet2/2
 shutdown
!
interface Ethernet2/3
 shutdown
!
interface Ethernet3/0
 shutdown
!
interface Ethernet3/1
 shutdown
!
interface Ethernet3/2
 shutdown
```

```
!
interface Ethernet3/3
 shutdown
!
interface Vlan1
 no ip address
 shutdown
!
interface Vlan100
 ip address 10.97.100.6 255.255.255.0
 ipv6 address FE80::A1:1 link-local
 ipv6 address 2001:DB8:100:100::3/64
!
ip forward-protocol nd
!
!
no ip http server
no ip http secure-server
!
!
!
control-plane
!
banner motd ^C A1, ENCOR Skills Assessment^C
!
line con 0
 exec-timeout 0 0
 privilege level 15
 logging synchronous
line aux 0
 exec-timeout 0 0
 privilege level 15
 logging synchronous
line vty 0 4
 login
!
!
End
```

CONCLUSIONES

Para tener un buen funcionamiento de la topología de red implementada, se debe tener claridad en cuanto a las interfaces asignadas al igual que las VLANs y sus respectivas direcciones IP, debido a que, si existen errores de configuración de direccionamiento, la comunicación entre equipos será inviable.

El hacer uso del protocolo DHCP para la asignación automática de direcciones IP mejora la eficiencia de la red, dado que permite la expansión de esta sin necesidad de requerir de equipo humando que fije direcciones para equipos nuevos, sin embargo, se debe considerar la exclusión de las direcciones que dentro de la organización permanecerán fijas por largos periodos de tiempo y no requieren emplear servidores DHCP.

Al momento de realizar las respectivas pruebas de conectividad, se deben hacer las validaciones de que las interfaces involucradas en la comunicación estén levantadas, dado que, si esto no sucede, el intercambio de paquetes no podrá realizarse sin importar que la configuración sea la correcta.

Para la solución de las tareas propuestas se hizo uso de los protocolos de enrutamiento OSPF y BGP, los cuales son muy comunes en las redes actuales, dado que por ejemplo, OSPF permite visualizar toda la red mediante la tabla de enrutamiento de cada router, lo que facilita el manejo de la red, evitando los retardos provocados por los loops, actualizando además la topología con cada cambio ejecutado. Por otra parte, el protocolo BGP posibilita la interconexión de sistemas autónomos, de tal manera que no exista la obligación de utilizar un mismo protocolo de enrutamiento.

De igual manera, en el desarrollo de este escenario, se le dio solución a los problemas de falta de redundancia mediante SLAs, que permiten monitorear las interfaces de red y el protocolo HSRP para garantizar que exista un router activo y otro de respaldo en caso de fallas.

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