

DIPLOMADO DE PROFUNDIZACION CISCO  
PRUEBA DE HABILIDADES PRÁCTICAS CCNP

JOHAN SEBASTIAN CAMACHO ACOSTA

UNIVERSIDAD NACIONAL ABIERTA Y A DISTANCIA - UNAD  
ESCUELA DE CIENCIAS BÁSICAS, TECNOLOGÍA E INGENIERÍA - ECBTI  
INGENIERÍA TELECOMUNICACIONES  
BOGOTA  
2022

DIPLOMADO DE PROFUNDIZACION CISCO  
PRUEBA DE HABILIDADES PRÁCTICAS CCNP

JOHAN SEBASTINA CAMACHO ACOSTA

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

DIRECTOR:  
John Harold Pérez Calderón

UNIVERSIDAD NACIONAL ABIERTA Y A DISTANCIA - UNAD  
ESCUELA DE CIENCIAS BÁSICAS, TECNOLOGÍA E INGENIERÍA - ECBTI  
INGENIERÍA TELECOMUNICACIONES  
BOGOTA  
2022

Nota de Aceptación

---

---

---

---

Presidente del Jurado

---

Jurado

---

Jurado

BOGOTA, 18 de noviembre 2022

## AGRADECIMIENTOS

Primeramente, agradezco a dios por la oportunidad de terminar esta etapa de mi vida y darme la fortaleza de culminar este proyecto y carrera, con la ayuda de mi mama, mis abuelos, he sacado la carrera adelante, como a nivel personal y profesional, mejorando mi presente y mi futuro.

Se agradece a los tutores que ayudaron a construir el conocimiento durante todo el trayecto de la educación, haciendo posible el rápido aprendizaje, el fortalecimiento de conocimientos previos y nuevos, buscando que el futuro egresado sea competitivo en el entorno profesional y laboral.

## CONTENIDO

AGRADECIMIENTO.....	4
CONTENIDO.....	5
LISTA DE TABLA.....	7
LISTA DE FIGURAS.....	8
GLOSARIO.....	9
RESUMEN.....	10
ABSTRACT.....	11
INTRODUCCION.....	12
PARTE 1: CONSTRUIR LA RED Y CONFIGURAR LOS PARÁMETROS BÁSICOS DE LOS DISPOSITIVOS Y EL DIRECCIONAMIENTO DE LAS INTERFACES...13	
Paso 1: Cablear la red como se muestra en la topología.....	13
Paso 2: Configurar los parámetros básicos para cada dispositivo.....	15
PARTE 2: CONFIGURAR LA CAPA 2 DE LA RED Y EL SOPORTE DE HOST..30	
Paso 2.1: Configurar las interfaces troncales .....	33
Paso 2.2: Configurar la VLAN 99 como nativa: .....	34
Paso 2.3: Habilitar protocolo Rapid Spanning-Tree (RSTP).....	36
Paso 2.4: Configurar los puentes raíz (root bridges).....	36
Paso 2.5: crear los LACP.....	37
Paso 2.6: Configurar los puertos de acceso a los PC.....	40
Paso 2.7: Verificar los PC en DHCP.....	41
Paso 2.8: Verificación de la conectividad de la LAN local.....	42
PARTE 3: CONFIGURAR LOS PROTOCOLOS DE ENRUTAMIENTO.....	44
Paso 3.1: Configuración OSPFv2.....	47
Paso 3.2: Configuración de OSPFv3.....	48
Paso 3.3: Configuración MP-BGP en la red ISP R2.....	50
Paso 3.4: Configuración MP-BGP en la red ISP R1 .....	50
Paso 3.5: Verificación del MP-BGP con Pin.....	53

PARTE 4: CONFIGURAR LA REDUNDANCIA DEL PRIMER SALTO (FIRST HOP REDUNDANCY) .....	61
Paso 4.1: En D1, cree IP SLAs que prueben la accesibilidad de la interfaz R1 G1/0.....	66
Paso 4.2: En D2, cree IP SLAs que prueben la accesibilidad de la interfaz R3 G1/0.....	66
Paso 4.3: En D1 configure HSRPv2.....	68
Paso 4.4: En D2 configure HSRPv2.....	69
CONCLUSIONES.....	73
BIBLIOGRAFÍAS.....	74

## LISTA DE TABLAS

Tabla 1. Tabla de direccionamiento.....	12
Tabla 2. Configuración de las capas 2.....	30
Tabla 3. Configurar protocolos de enrutamiento 1.....	44
Tabla 4. Configurar protocolos de enrutamiento 2.....	61

## LISTA DE FIGURAS

Figura 1. Montaje del escenario propuesto.....	13
Figura 2. Simulación de escenario.....	14
Figura 3. Configuración del router 1.....	17
Figura 4. Configuración del roter 2.....	18
Figura 5. Configuración del router 3.....	20
Figura 6. Configuración del Switch D1.....	23
Figura 7. Configuración del Switch D2.....	26
Figura 8. Configuración de Switch A1.....	28
Figura 9. Asignación de ip al PC1.....	29
Figura 10. Asignación de ip al PC2 .....	29
Figura 11. Asignación de ip en DHCP en PC2.....	29
Figura 12. Asignación de ip en DHCP en PC2 .....	30
Figura 13. Verificación de los enlaces troncales Switch D1.....	35
Figura 14. Verificación de los enlaces troncales Switch D2.....	35
Figura 15. Verificación de los enlaces troncales Switch A1.....	35
Figura 16. Verificación de spanning-tree.....	36
Figura 17. Verificación servicios DHCP en PC2.....	41
Figura 18. Verificación servicios DHCP en PC3.....	41
Figura 19. Verificación conectividad LAN en PC1.....	42
Figura 20. Verificación conectividad LAN en PC4.....	42
Figura 21. Verificación conectividad LAN en PC2.....	43
Figura 22. Verificación conectividad LAN en PC3.....	43
Figura 23. Verificación de la table IPV4 en Switch D1 y D2.....	52
Figura 24. Ping D1 y D2 hacia Loopback 0.....	53
Figura 25. verificación de vecinos router 1.....	55
Figura 26. verificación de vecinos router 3.....	57
Figura 27. verificación de vecinos switch D1.....	58
Figura 28. verificación de vecinos switch D2.....	60
Figura 29. Verificación de los SLAS.....	67
Figura 30. Verificación del standby.....	70
Figura 31. Configuración del standby switch D1.....	71
Figura 32. Verificación interfaces y vlan switch D1.....	71
Figura 33. Configuración del standby switch D2.....	72
Figura 34. Verificación interfaces y vlan switch D2.....	72

## GLOSARIO

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

**LACP:** LACP forma parte de una especificación IEEE (802.3ad) que permite agrupar varios puertos físicos para formar un único canal lógico. LACP permite que un switch negocie un grupo automático mediante el envío de paquetes LACP al peer.

**SLAAC:** Es un método en el cual un dispositivo puede obtener una dirección IPv6 de unidifusión global sin los servicios de un servidor de DHCPv6. ICMPv6 se encuentra en el centro de SLAAC. ICMPv6 es similar a ICMPv4, pero incluye funcionalidad adicional y es un protocolo mucho más sólido.

**HSRP:** Proporciona una alta disponibilidad de red, ya que proporciona redundancia de routing de primer salto para los hosts IPv4 en las redes configuradas con una dirección IPv4 de gateway predeterminado. HSRP se utiliza en un grupo de routers para seleccionar un dispositivo activo y un dispositivo de reserva.

**VTP:** (Vlan Trunking Protocol), es un protocolo propietario de Cisco que propaga la definición de vlans entre los switches que estén configurados en un mismo dominio. Se establece un switch con el rol de server y éste propaga las vlans que tenga configuradas a todos los switches que funcionen en el rol de cliente.

## RESUMEN

El primer escenario propone, la configuración de una red en la cual se realiza un enrutamiento, con el objetivo de comunicar un extremo con el otro, que los protocolos implementados sean operativos dentro de la red de la compañía, por medio de dispositivos CISCO especializados en la conmutación y enrutamiento de paquetes.

El segundo escenario comprende la parte de autenticación, listas de control de acceso (ACL), HSRP versión 2 para brindar redundancia a los hosts, configuración de mecanismos de seguridad para las redes y sus dispositivos.

El diplomado de profundización cisco ccnp, el cual consta de 6 partes las cuales se dividen en dos escenarios y se realizan en dos entregas.

Palabra clave: Router, Cisco, hosts, Algoritmo, vlans.

## ABSTRACT

The first scenario proposed, the configuration of a network in which a routing is carried out, with the aim of communicating one end with the other, that the implemented protocols are operative within the company's network, through CISCO devices specialized in packet switching and routing.

The second scenario includes the authentication part, access control lists (ACLs), HSRP version 2 to provide redundancy to hosts, configuration of security mechanisms for networks and their devices.

The diploma de deepening cisco ccnp, which consists of 6 parts which are divided into two scenarios and are carried out in two deliveries.

Keyword: Router, Cisco, hosts, Algorithm, vlans.

## INTRODUCCIÓN

Es importante que el futuro ingeniero en Telecomunicaciones entienda estas redes y aprenda a configurar los diferentes protocolos que permiten dicha interconexión; para ello se realiza el siguiente trabajo, donde se plantea un escenario el cual consta de 3 router, 3 switches y 4 PCs simulando las redes a las que se va a ver expuesto en un futuro el ingeniero.

El primer escenario que se propuso fue, la configuración de una red en la cual se realiza un enrutamiento, con el objetivo de comunicar un extremo con el otro, que los protocolos implementados sean operativos dentro de la red de la compañía, por medio de dispositivos CISCO especializados en la conmutación y enrutamiento de paquetes.

Inicialmente se configura el direccionamiento IP en todos los dispositivos tanto IPv4 e IPv6, luego utilizando 2 switches multicapa como si fueran los CORE de la red encargados de la conmutación cada uno enfatizado en VLAN diferente, enlaces redundantes adicional 1 switch de capa 2 utilizado como el acceso a los clientes, en general en la capa 2 se debe trabajar el RSTP Rapid Spanning Tree Protocol y enlaces LACP, a nivel de capa 3 se soluciona la convergencia de la red totalmente, donde se configura el OSPFv2 para IPV4 y OSPF para IPv6 de la LAN; el enrutamiento BGP para IPv4 y MP-BGP para IPv6 para conectar el sistema autónomo de las dos redes planteadas, esta primera parte asegura la interconexión de los equipos de la LAN, permitiendo que los equipos den respuesta sin ninguna novedad.

El segundo escenario comprende la parte de autenticación, listas de control de acceso (ACL), HSRP versión 2 para brindar redundancia a los hosts, configuración de mecanismos de seguridad para las redes y sus dispositivos.

# PARTE 1: CONSTRUIR LA RED Y CONFIGURAR LOS PARÁMETROS BÁSICOS DE LOS DISPOSITIVOS Y EL DIRECCIONAMIENTO DE LAS INTERFACES

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

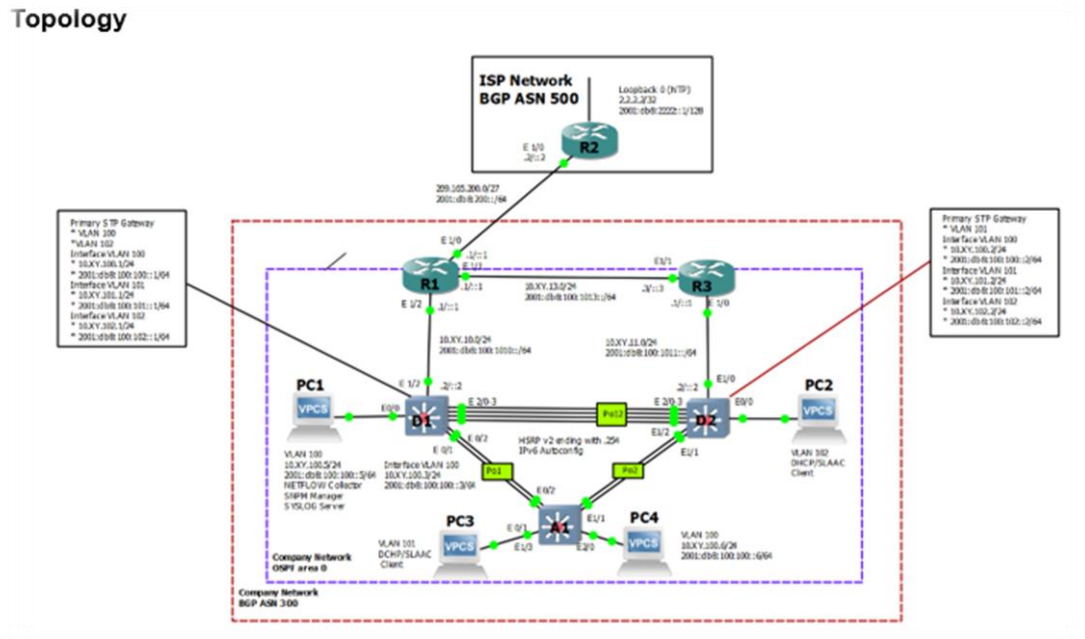


Figura 1. Montaje del escenario propuesto

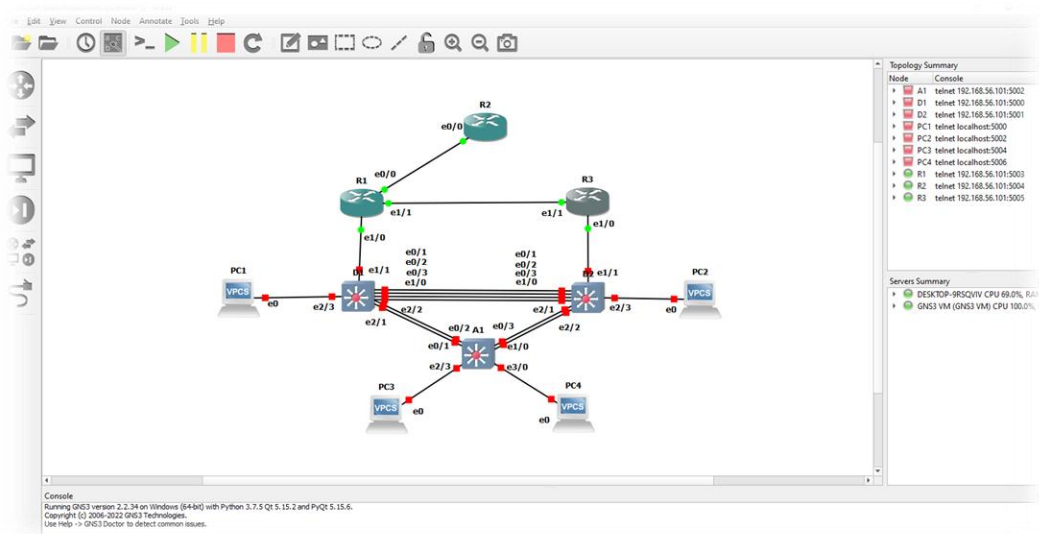


Figura 2. Simulación de escenario

Tabla 1. Table de direccionamiento

Device	Interface	IPv4 Address	IPv6 Address	IPv6 Link-Local
R1	E0/0	209.165.200.2 25/27	2001:db8:200::1/ 64	fe80::1:1
	E1/0	10.78.10.1/24	2001:db8:100:10 10::1/64	fe80::1:2
	E1/1	10.78.13.1/24	2001:db8:100:10 13::1/64	fe80::1:3
R2	E0/0	209.165.200.2 26/27	2001:db8:200::2/ 64	fe80::2:1
	Loopback 0	2.2.2.2/32	2001:db8:2222::1 /128	fe80::2:3
R3	E1/0	10.78.11.1/24	2001:db8:100:10 11::1/64	fe80::3:2
	E1/1	10.78.13.3/24	2001:db8:100:10 13::3/64	fe80::3:3
D1	E1/1	10.78.10.2/24	2001:db8:100:10 10::2/64	fe80::d1:1

Device	Interface	IPv4 Address	IPv6 Address	IPv6 Link-Local
	VLAN 100	10.78.100.1/24	2001:db8:100:100::1/64	fe80::d1:2
	VLAN 101	10.78.101.1/24	2001:db8:100:101::1/64	fe80::d1:3
	VLAN 102	10.78.102.1/24	2001:db8:100:102::1/64	fe80::d1:4
D2	E1/1	10.78.11.2/24	2001:db8:100:1011::2/64	fe80::d2:1
	VLAN 100	10.78.100.2/24	2001:db8:100:100::2/64	fe80::d2:2
	VLAN 101	10.78.101.2/24	2001:db8:100:101::2/64	fe80::d2:3
	VLAN 102	10.78.102.2/24	2001:db8:100:102::2/64	fe80::d2:4
A1	VLAN 100	10.78.100.3/23	2001:db8:100:100::3/64	fe80::a1:1
PC1	NIC	10.78.100.5/24	2001:db8:100:100::5/64	EUI-64
PC2	NIC	DHCP	SLAAC	EUI-64
PC3	NIC	DHCP	SLAAC	EUI-64
PC4	NIC	10.78.100.6/24	2001:db8:100:100::6/64	EUI-64

## Paso 2: Configurar los parámetros básicos para cada dispositivo

Se configura los parámetros básicos de los dispositivos como los nombres, textos de para cada equipo, específicamente las IP de cada interfaz tanto en IPV4 como en IPV6 de cada uno de los router, 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.

Router 1:

R1#conf term ---- Ingreso a modo configuración global

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

R1(config)#hostname R1 ---- Se nombra el router

R1(config)#ipv6 unicast-routing ---- Habilita el routing en IPV6

R1(config)#no ip domain lookup ---- Desactiva la traducción de nombres a dirección

R1(config)#banner motd # R1, ENCOR Skills Assessment# ---- Mensaje cuando se conecta a consola

R1(config)#line con 0 ---- Configuración de la línea de consola

R1(config-line)# exec-timeout 0 0

R1(config-line)# logging synchronous

R1(config-line)# exit

R1(config)#interface ethernet1/0 ---- 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

R1(config-if)# exit

R1(config)#interface ethernet1/2

R1(config-if)# ip address 10.78.10.1 255.255.255.0

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 ethernet1/1

R1(config-if)# ip address 10.78.13.1 255.255.255.0

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 R2 R3 D1 D2 A1
*Oct 13 01:43:21.247: %SYS-5-RESTART: System restarted --
Cisco IOS Software, 7200 Software (C7200-ADVIPSERVICESK9-M), Version 15.2(4)SS, RELEASE SOFTWARE (fc1)
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 1986-2014 by Cisco Systems, Inc.
Compiled Thu 20-Feb-14 06:51 by prod_rel_team
*Oct 13 01:43:22.215: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to down
*Oct 13 01:43:22.227: %LINEPROTO-5-UPDOWN: Line protocol on Interface Ethernet1/0, changed state to down
*Oct 13 01:43:22.227: %LINEPROTO-5-UPDOWN: Line protocol on Interface Ethernet1/1, changed state to down
*Oct 13 01:43:22.231: %LINEPROTO-5-UPDOWN: Line protocol on Interface Ethernet1/2, changed state to down
*Oct 13 01:43:22.235: %LINEPROTO-5-UPDOWN: Line protocol on Interface Ethernet1/3, changed state to down
*Oct 13 01:43:22.239: %LINEPROTO-5-UPDOWN: Line protocol on Interface Ethernet1/4, changed state to down
*Oct 13 01:43:22.243: %LINEPROTO-5-UPDOWN: Line protocol on Interface Ethernet1/5, changed state to down
*Oct 13 01:43:22.247: %LINEPROTO-5-UPDOWN: Line protocol on Interface Ethernet1/6, changed state to down
R1#
R1#
R1#
R1#
R1#
R1#
R1#conf term
Enter configuration commands, one per line. End with CNTL/Z.
R1(config)#hostname R1
R1(config)#ipv6 unicast-routing
R1(config)#no ip domain lookup
R1(config)#banner motd # R1, ENCOR Skills Assessment#
R1(config)#line con 0
R1(config-line)# exec-timeout 0 0
R1(config-line)# logging synchronous
R1(config-line)# exit
R1(config)#interface ethernet1/0
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
R1(config-if)# exit
R1(config)#interface ethernet1/2
R1(config-if)# ip address 10.78.10.1 255.255.255.0
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 ethernet1/1
R1(config-if)# ip address 10.78.13.1 255.255.255.0
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
*Oct 13 01:44:17.759: %LINK-3-UPDOWN: Interface Ethernet1/0, changed state to up
*Oct 13 01:44:18.407: %LINK-3-UPDOWN: Interface Ethernet1/2, changed state to up
*Oct 13 01:44:18.759: %LINEPROTO-5-UPDOWN: Line protocol on Interface Ethernet1/0, changed state to up
solarwinds Solar-PuTTY free tool © 2019 SolarWinds Worldwide, LLC. All rights reserved.
```

Figura 3. Configuración del router 1

Router 2:

R2#conf term

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

R2(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 ethernet1/0

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

```

```

*Oct 13 01:43:34.975: %LINEPROTO-5-UPDOWN: Line protocol on Interface Ethernet1/6, changed state to down
*Oct 13 01:43:34.979: %LINEPROTO-5-UPDOWN: Line protocol on Interface Ethernet1/7, changed state to down
*Oct 13 01:43:56.963: %SYS-3-CPUHOG: Task is running for (2040)msecs, more than (2000)msecs (0/0), process = Crypto CA.
-Traceback= 0x62A428ACz 0x62A7A4C4z 0x62A7A544z 0x62A68788z 0x62A689B0z 0x62A52858z 0x62A4D518z 0x62A4D598z 0x62A4CF74z 0x62A82B88z 0x62A8293Cz 0x62A8293Cz 0x62A82D40z 0x62A51DBCz 0x62A4C4B0z 0x62A59FDCz
R2#
R2#
R2#conf term
Enter configuration commands, one per line. End with CNTL/Z.
R2(config)#hostname R2
R2(config)#ipv6 unicast-routing
R2(config)#no ip domain lookup
R2(config)#banner motd # R2, ENCORA 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 ethernet1/0
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
*Oct 13 01:49:53.375: %LINEPROTO-5-UPDOWN: Line protocol on Interface Loopback0, changed state to up
R2(config-if)# exit

```

Figura 4. Configuración del router 2

```
Router 3:
R3#conf term
Enter configuration commands, one per line. End with CNTL/Z.
R3(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 ethernet1/0
R3(config-if)# ip address 10.78.11.1 255.255.255.0
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 ethernet1/1
R3(config-if)# ip address 10.78.13.3 255.255.255.0
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
```

```
R1 R2 R3 x D1 D2 A1
*Oct 13 01:43:29.511: %LINEPROTO-5-UPDOWN: Line protocol on Interface Ethernet1/
0, changed state to down
*Oct 13 01:43:29.515: %LINEPROTO-5-UPDOWN: Line protocol on Interface Ethernet1/
1, changed state to down
*Oct 13 01:43:29.519: %LINEPROTO-5-UPDOWN: Line protocol on Interface Ethernet1/
2, changed state to down
*Oct 13 01:43:29.523: %LINEPROTO-5-UPDOWN: Line protocol on Interface Ethernet1/
3, changed state to down
*Oct 13 01:43:29.527: %LINEPROTO-5-UPDOWN: Line protocol on Interface Ethernet1/
4, changed state to down
*Oct 13 01:43:29.531: %LINEPROTO-5-UPDOWN: Line protocol on Interface Ethernet1/
5, changed state to down
*Oct 13 01:43:29.535: %LINEPROTO-5-UPDOWN: Line protocol on Interface Ethernet1/
6, changed state to down
*Oct 13 01:43:29.547: %LINEPROTO-5-UPDOWN: Line protocol on Interface Ethernet1/
7, changed state to down
*Oct 13 01:43:51.559: %SYS-3-CPUHOG: Task is running for (2060)msecs, more than
(2000)msecs (0/0),process = Crypto CA.
-Traceback= 0x61E2E6C0z 0x62A42B94z 0x62A68170z 0x62A52808z 0x62A4D518z 0x62A4D5
98z 0x62A4CF74z 0x62A82B88z 0x62A8293Cz 0x62A8293Cz 0x62A82D40z 0x62A51DBcz 0x62
A4C4B0z 0x62A59FDCz 0x62A5A374z 0x628DBFBCz
R3#
R3#
R3#conf term
Enter configuration commands, one per line. End with CNTL/Z.
R3(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 ethernet1/0
R3(config-if)# ip address 10.78.11.1 255.255.255.0
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 ethernet1/1
R3(config-if)# ip address 10.78.13.3 255.255.255.0
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
*Oct 13 01:51:50.195: %LINK-3-UPDOWN: Interface Ethernet1/0, changed state to up
*Oct 13 01:51:50.775: %LINK-3-UPDOWN: Interface Ethernet1/1, changed state to up
*Oct 13 01:51:51.195: %LINEPROTO-5-UPDOWN: Line protocol on Interface Ethernet1/0, changed state to up
R3(config-if)# exit
*Oct 13 01:51:51.775: %LINEPROTO-5-UPDOWN: Line protocol on Interface Ethernet1/1, changed state to up
```

Figura 5. Configuración del router 3

Switch D1:

```
D1(config-if)#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
```

```

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 e1/1
D1(config-if)# no switchport
D1(config-if)# ip address 10.78.10.2 255.255.255.0
D1(config-if)# ipv6 address fe80::d1:1 link-local
D1(config-if)# ipv6 address 2001:db8:100:1010::2/64
%Ethernet1/1: Informational: 2001:DB8:100:1010::2/64 is in use on Ethernet1/2
D1(config-if)# no shutdown
% 10.78.10.0 overlaps with Ethernet1/2
Ethernet1/1: incorrect IP address assignment
D1(config-if)# exit
D1(config)#interface vlan 100
D1(config-if)# ip address 10.78.100.1 255.255.255.0
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 10.78.101.1 255.255.255.0
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 10.78.102.1 255.255.255.0
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 10.78.101.1 10.78.101.109
D1(config)#ip dhcp excluded-address 10.78.101.141 10.78.101.254
D1(config)#ip dhcp excluded-address 10.78.102.1 10.78.102.109
D1(config)#ip dhcp excluded-address 10.78.102.141 10.78.102.254
D1(config)#ip dhcp pool VLAN-101
D1(dhcp-config)# network 10.78.101.0 255.255.255.0
D1(dhcp-config)# default-router 10.78.101.254
D1(dhcp-config)# exit
D1(config)#ip dhcp pool VLAN-102
D1(dhcp-config)# network 10.78.102.0 255.255.255.0
D1(dhcp-config)# default-router 10.78.102.254
D1(dhcp-config)# exit
D1(config)#interface range e0/0-3,e1/0,e1/3,e2/0-3,e3/0-3
D1(config-if-range)# shutdown
D1(config-if-range)# exit
```

```

R1 R2 R3 D1 x D2 A1
D1(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
D1(config-vlan)# name Management
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 ethernet1/2
D1(config-if)# no switchport
D1(config-if)# ip address 10.78.10.2 255.255.255.0
D1(config-if)# ipv6 address fe80::d1:1 link-local
D1(config-if)# ipv6 address 2001:db8:100:101::2/64
D1(config-if)# no shutdown
D1(config-if)# exit
D1(config)#interface vlan 100
D1(config-if)# ip address 10.78.100.1 255.255.255.0
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 10.78.101.1 255.255.255.0
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 10.78.102.1 255.255.255.0
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 10.78.101.1 10.78.101.109
D1(config)#ip dhcp excluded-address 10.78.101.141 10.78.101.254
D1(config)#ip dhcp excluded-address 10.78.102.1 10.78.102.109
D1(config)#ip dhcp excluded-address 10.78.102.141 10.78.102.254
solarwinds Solar-PuTTY free tool © 2019 SolarWinds Worldwide, LLC. All rights reserved.

```

Figura 6. Configuración del Switch D1

Switch D2:

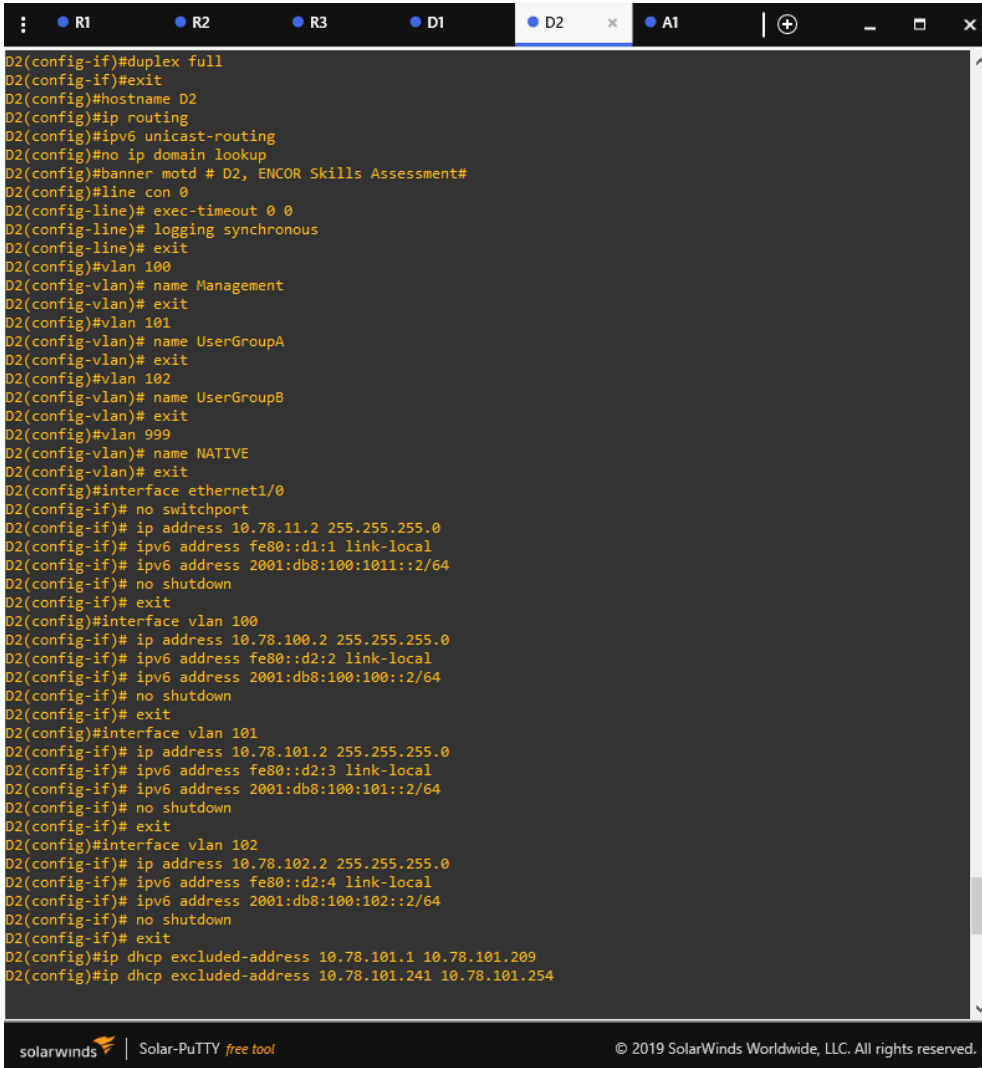
```

D2(config-if)#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 e1/1
D2(config-if)# no switchport
D2(config-if)# ip address 10.78.11.2 255.255.255.0
D2(config-if)# ipv6 address fe80::d1:1 link-local
D2(config-if)# ipv6 address 2001:db8:100:1011::2/64
%Ethernet1/1: Informational: 2001:DB8:100:1011::2/64 is in use on shutdown
Ethernet1/0
D2(config-if)# no shutdown
%Ethernet1/1: Informational: 2001:DB8:100:1011::/64 is in use on shutdown
Ethernet1/0
%Ethernet1/1: Informational: 2001:DB8:100:1011::2/64 is in use on shutdown
Ethernet1/0
D2(config-if)# exit
D2(config)#interface vlan 100
D2(config-if)# ip address 10.78.100.2 255.255.255.0
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 10.78.101.2 255.255.255.0
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 10.78.102.2 255.255.255.0
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 10.78.101.1 10.78.101.209
D2(config)#ip dhcp excluded-address 10.78.101.241 10.78.101.254
D2(config)#ip dhcp excluded-address 10.78.102.1 10.78.102.209
D2(config)#ip dhcp excluded-address 10.78.102.241 10.78.102.254
D2(config)#ip dhcp pool VLAN-101
D2(dhcp-config)# network 10.78.101.0 255.255.255.0
D2(dhcp-config)# default-router 10.78.101.254
D2(dhcp-config)# exit
D2(config)#ip dhcp pool VLAN-102
D2(dhcp-config)# network 10.78.102.0 255.255.255.0
D2(dhcp-config)# default-router 10.78.102.254
D2(dhcp-config)# exit
D2(config)#interface range e0/0-3,e1/0,e1/3,e2/0-3,e3/0-3
D2(config-if-range)# shutdown
D2(config-if-range)# exit
```



```
D2(config-if)#duplex full
D2(config-if)#exit
D2(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 ethernet1/0
D2(config-if)# no switchport
D2(config-if)# ip address 10.78.11.2 255.255.255.0
D2(config-if)# ipv6 address fe80::d1:1 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 10.78.100.2 255.255.255.0
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 10.78.101.2 255.255.255.0
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 10.78.102.2 255.255.255.0
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 10.78.101.1 10.78.101.209
D2(config)#ip dhcp excluded-address 10.78.101.241 10.78.101.254
```

Figura 7. Configuración del Switch D2

Switch A1:

```
A1(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 10.78.100.3 255.255.255.0
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 e1/1-3,e2/0-3,e3/0-3
A1(config-if-range)# shutdown
A1(config-if-range)# exit
```

```
net3/3, changed state to
up
*Oct 13 01:59:09.501: %LI
NEPROTO-5-UPDOWN: Line pr
otocol on Interface Vlan1
, changed state to down
*Oct 13 01:59:10.506: %LI
NK-5-CHANGED: Interface V
lan1, changed state to ad
ministratively down
A1#
A1#conf term
Enter configuration commands, one per line. End with CNTL/Z.
A1(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 10.78.100.3 255.255.255.0
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)#$net0/0, ethernet0/3, ethernet1/0, ethernet2/1-3, ethernet3/0-3
A1(config-if-range)# shutdown
A1(config-if-range)# exit
*Oct 13 02:47:03.284: %LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan100, changed state to down
*Oct 13 02:47:04.392: %LINK-3-UPDOWN: Interface Vlan100, changed state to down
*Oct 13 02:47:04.472: %LINK-5-CHANGED: Interface Ethernet0/0, changed state to administratively down
*Oct 13 02:47:04.488: %LINK-5-CHANGED: Interface Ethernet0/3, changed state to administratively down
*Oct 13 02:47:04.494: %LINK-5-CHANGED: Interface Ethernet1/0, changed state to administratively down
*Oct 13 02:47:04.519: %LINK-5-CHANGED: Interface Ethernet2/1, changed state to administratively down
*Oct 13 02:47:04.519: %LINK-5-CHANGED: Interface Ethernet2/2, changed state to administratively down
*Oct 13 02:47:04.533: %LINK-5-CHANGED: Interface Ethernet2/3, changed state to administratively down
A1(config-if-range)# exit
```

Figura 8. Configuración de Switch A1

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

D1#copy running-config startup-config

Configure el direccionamiento de host de PC 1 y PC 4 como se muestra en la tabla de direccionamiento. Asigne una dirección de puerta de enlace predeterminada de 10.78.100.254, que será la dirección IP virtual de HSRP utilizada en la Parte 4.

Se asigna la siguiente IP

PC1: Ip 10.78.100.5/24 10.78.100.254

```

PC1> ip 10.78.100.5/24 10.78.100.254
Checking for duplicate address...
PC1 : 10.78.100.5 255.255.255.0 gateway 10.78.100.254

PC1> save
Saving startup configuration to startup.vpc
. done

PC1> sh

NAME IP/MASK GATEWAY MAC LPORT RHOST:PORT
PC1 10.78.100.5/24 10.78.100.254 00:50:79:66:68:04 20088 127.0.0.1:20089
fe80::250:79ff:fe66:6804/64

PC1>

```

Figura 9. Asignación de ip al PC1

PC4: ip 10.78.100.6/24 10.78.100.254

```

PC4> ip 10.78.100.6/24 10.78.100.254
Checking for duplicate address...
PC4 : 10.78.100.6 255.255.255.0 gateway 10.78.100.254

PC4> save
Saving startup configuration to startup.vpc
. done

PC4> sh

NAME IP/MASK GATEWAY MAC LPORT RHOST:PORT
PC4 10.78.100.6/24 10.78.100.254 00:50:79:66:68:06 20094 127.0.0.1:20095
fe80::250:79ff:fe66:6806/64

```

Figura 10. Asignación de ip al PC2

PC2 DHCP

```

PC2> sh

NAME IP/MASK GATEWAY MAC LPORT RHOST:PORT
PC2 10.78.102.210/24 10.78.102.254 00:50:79:66:68:01 20046 127.0.0.1:20047
fe80::250:79ff:fe66:6801/64
2001:db8:100:102:2050:79ff:fe66:6801/64 eui-64

```

Figura 11. Asignación de ip en DHCP en PC2

## PC3 DHCP

```
PC3> sh
NAME      IP/MASK      GATEWAY      MAC          LPORT  RHOST:PORT
PC3      10.78.101.210/24  10.78.101.254  00:50:79:66:68:02  20048  127.0.0.1:20049
fe80::250:79ff:fe66:6802/64
2001:db8:100:101:2050:79ff:fe66:6802/64 eui-64
```

Figura 12. Asignación de ip en DHCP en PC2

## PARTE 2: CONFIGURAR LA CAPA 2 DE LA RED Y EL SOPORTE DE HOST

Tabla 2. Configuración de las capas 2

Task#	Task	Specification	Points
2.1	On all switches, configure IEEE 802.1Q trunk interfaces on interconnecting switch links	Enable 802.1Q trunk links between: <ul style="list-style-type: none"> <li>• D1 and D2</li> <li>• D1 and A1</li> <li>• D2 and A1</li> </ul>	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

<b>Task#</b>	<b>Task</b>	<b>Specification</b>	<b>Points</b>
2.5	On all switches, create LACP EtherChannels as shown in the topology diagram.	Use the following channel numbers: <ul style="list-style-type: none"> <li>• D1 to D2 – Port channel 12</li> <li>• D1 to A1 – Port channel 1</li> <li>• D2 to A1 – Port channel 2</li> </ul>	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.	<p>PC1 should successfully ping:</p> <ul style="list-style-type: none"> <li>• D1: 10.XY.100.1</li> <li>• D2: 10.XY.100.2</li> <li>• PC4: 10.XY.100.6</li> </ul> <p>PC2 should successfully ping:</p> <ul style="list-style-type: none"> <li>• D1: 10.XY.102.1</li> <li>• D2: 10.XY.102.2</li> </ul> <p>PC3 should successfully ping:</p> <ul style="list-style-type: none"> <li>• D1: 10.XY.101.1</li> <li>• D2: 10.XY.101.2</li> </ul> <p>PC4 should successfully ping:</p> <ul style="list-style-type: none"> <li>• D1: 10.XY.100.1</li> <li>• D2: 10.XY.100.2</li> <li>• PC1: 10.XY.100.5</li> </ul>	1

## **Paso 2.1: Configurar las interfaces troncales**

Switch D1:

interface range e0/1-3,e1/0 --- configura un grupo de interfaces

switchport trunk encapsulation dot1q ---- establece la encapsulación en el estándar IEEE 802.1Q

switchport mode trunk ---- configura la interfaz troncal

interface range e2/1-2

switchport trunk encapsulation dot1q

switchport mode trunk

Switch D2:

interface range ethernet1/0/1-4

switchport mode trunk

interface range ethernet1/0/5-6

switchport mode trunk

Switch A1:

Interface range ethernet0/1-2

switchport mode trunk

interface range ethernet0/3-4

switchport mode trunk

## **Paso 2.2: Configurar la VLAN 99 como nativa**

Switch D1:

```
interface range ethernet1/0/1-4
switchport mode trunk
switchport trunk native vlan 999
interface range ethernet1/0/5-6
switchport mode trunk
switchport trunk native vlan 999
```

Switch D2

```
interface range ethernet1/0/1-4
switchport mode trunk
switchport trunk native vlan 999
interface range ethernet1/0/5-6
switchport mode trunk
switchport trunk native vlan 999
```

Switch A1

```
interfacerange ethernet0/1-2
switchport mode trunk
switchport trunk native vlan 999
interface range ethernet0/3-4
switchport mode trunk
switchport trunk native vlan 999
```

```
D1#show int trunk

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

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

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

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

Figura 13. Verificación de los enlaces troncales Switch D1

```
D2#show int trunk

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

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

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

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

Figura 14. Verificación de los enlaces troncales Switch D2

```
A1#show int trunk

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

Port      Vlans allowed on trunk
Po1       1-4094

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

Port      Vlans in spanning tree forwarding state and not pruned
Po1       1,100-102,999
A1#
```

Figura 15. Verificación de los enlaces troncales Switch A1

### Paso 2.3: Habilitar protocolo Rapid Spanning-Tree (RSTP)

Switch D1:

Switch D1: spanning-tree mode rapid-pvst

Switch D2: spanning-tree mode rapid-pvst

Switch A1: spanning-tree mode rapid-pvst

### Paso 2.4: Configurar los puentes raíz (root bridges)

Switch D1:

spanning-tree vlan 100,102 root primary

spanning-tree vlan 101 root secondary

Switch D2:

spanning-tree vlan 101 root primary

spanning-tree vlan 100,102 root secondary

```
D1# show run | include spanning-tree
spanning-tree mode rapid-pvst
spanning-tree extend system-id
spanning-tree vlan 100,102 priority 8192
spanning-tree vlan 101 priority 28672
D1#
```

```
D2#show run | include spanning-tree
spanning-tree mode rapid-pvst
spanning-tree extend system-id
spanning-tree vlan 100,102 priority 28672
spanning-tree vlan 101 priority 8192
D2#
```

*Figura 15. Verificación de spanning-tree*

## Paso 2.5: crear los LACP

Switch D1:

```
i D1(config)#interface range e0/1-3,e1/0
D1(config-if-range)# switchport trunk encapsulation dot1q
D1(config-if-range)# switchport mode trunk
D1(config-if-range)# switchport trunk native vlan 999
D1(config-if-range)# channel-group 12 mode active
D1(config-if-range)# no shutdown
D1(config-if-range)# exit
D1(config)#interface range e2/1-2
D1(config-if-range)# switchport trunk encapsulation dot1q
D1(config-if-range)# switchport mode trunk
D1(config-if-range)# switchport trunk native vlan 999
D1(config-if-range)# channel-group 1 mode active
D1(config-if-range)# no shutdown
D1(config-if-range)# exit
D1(config)#spanning-tree mode rapid-pvst
D1(config)#spanning-tree vlan 100,102 root primary
D1(config)#spanning-tree vlan 101 root secondary
D1(config)#interface e2/3
D1(config-if)# switchport mode access
D1(config-if)# switchport access vlan 100
D1(config-if)# spanning-tree portfast
D1(config-if)# no shutdown
D1(config-if)# exit
D1(config)#end
```

```
switch D2
D2(config)#interface range e0/1-3,e1/0
D2(config-if-range)# switchport trunk encapsulation dot1q
D2(config-if-range)# switchport mode trunk
D2(config-if-range)# switchport trunk native vlan 999
D2(config-if-range)# channel-group 12 mode active
D2(config-if-range)# no shutdown
D2(config-if-range)# exit
D2(config)#interface range e2/1-2
D2(config-if-range)# switchport trunk encapsulation dot1q
D2(config-if-range)# switchport mode trunk
D2(config-if-range)# switchport trunk native vlan 999
D2(config-if-range)# channel-group 2 mode active
D2(config-if-range)# no shutdown
D2(config-if-range)# exit
D2(config)#spanning-tree mode rapid-pvst
D2(config)#spanning-tree vlan 101 root primary
D2(config)#spanning-tree vlan 100,102 root secondary
D2(config)#interface e2/3
D2(config-if)# switchport mode access
D2(config-if)# switchport access vlan 102
D2(config-if)# spanning-tree portfast
D2(config-if)# no shutdown
D2(config-if)# exit
D2(config)#end
```

```
switch A1
```

```
A1(config)#interface range e0/1-2
A1(config-if-range)#switchport trunk encapsulation dot1q
A1(config-if-range)#switchport mode trunk
A1(config-if-range)#switchport trunk native vlan 999
A1(config-if-range)#channel-group 1 mode active
A1(config-if-range)#no shutdown
A1(config-if-range)#exit
A1(config)#interface range e0/3,e1/0
A1(config-if-range)#switchport trunk encapsulation dot1q
A1(config-if-range)#switchport mode trunk
A1(config-if-range)#switchport trunk native vlan 999
A1(config-if-range)#channel-group 2 mode active
A1(config-if-range)#no shutdown
A1(config-if-range)#exit
A1(config)#interface e2/3
A1(config-if)#switchport mode access
A1(config-if)#switchport access vlan 101
A1(config-if)#spanning-tree portfast
A1(config-if)#no shutdown
A1(config-if)#exit
A1(config)#interface e3/0
A1(config-if)#switchport mode access
A1(config-if)#switchport access vlan 100
A1(config-if)#spanning-tree portfast
A1(config-if)#no shutdown
A1(config-if)#exit
A1(config)#end
```

## **Paso 2.6: Configurar los puertos de acceso a los PC**

Switch D1

```
interface e2/3  
switchport mode access  
switchport access vlan 100  
spanning-tree portfast  
no shutdown
```

Switch D2

```
interface e2/3  
switchport mode access  
switchport access vlan 102  
spanning-tree portfast  
no shutdown  
exit
```

Switch A1

```
interface e2/3  
switchport mode access  
switchport access vlan 101  
spanning-tree portfast  
no shutdown  
exit
```

## Paso 2.7: Verificar los PC en DHCP:

```
DDORRA IP 10.78.102.210/24
4 GW 10.78.102.254

PC2> sh

NAME IP/MASK GATEWAY MAC LPORT RHOST:PORT
PC2 10.78.102.210/24 10.78.102.254 00:50:79:66:68:01 20046 127.0.0.1:20047
fe80::250:79ff:fe66:6801/64
2001:db8:100:102:2050:79ff:fe66:6801/64 eui-64

PC2> sh ip

NAME : PC2[1]
IP/MASK : 10.78.102.210/24
GATEWAY : 10.78.102.254
DNS :
DHCP SERVER : 10.78.102.2
DHCP LEASE : 86180, 86400/43200/75600
MAC : 00:50:79:66:68:01
LPORT : 20046
RHOST:PORT : 127.0.0.1:20047
MTU : 1500
```

Figura 17. Verificación servicios DHCP en PC2

```
DDORA IP 10.78.101.210/24
GW 10.78.101.254

PC3> sh

NAME IP/MASK GATEWAY MAC LPORT RHOST:PORT
PC3 10.78.101.210/24 10.78.101.254 00:50:79:66:68:02 20048 127.0.0.1:20049
fe80::250:79ff:fe66:6802/64
2001:db8:100:101:2050:79ff:fe66:6802/64 eui-64

PC3> ip sh
Invalid address

PC3> sh ip

NAME : PC3[1]
IP/MASK : 10.78.101.210/24
GATEWAY : 10.78.101.254
DNS :
DHCP SERVER : 10.78.101.2
DHCP LEASE : 86120, 86400/43200/75600
MAC : 00:50:79:66:68:02
LPORT : 20048
RHOST:PORT : 127.0.0.1:20049
MTU : 1500
```

Figura 18. Verificación servicios DHCP en PC3

## Paso 2.8: Verificación de la conectividad de la LAN local

```
PC1> sh ip
fe80::250:79ff:fe66:6800/64
2001:db8:100:100:2050:79ff:fe66:6800/64

PC1> sh ip
NAME          : PC1[1]
IP/MASK       : 10.78.100.5/24
GATEWAY       : 10.78.100.254
DNS           :
MAC           : 00:50:79:66:68:00
LPORT        : 20044
RHOST:PORT    : 127.0.0.1:20045
MTU           : 1500

PC1> ping 10.78.100.1
84 bytes from 10.78.100.1 icmp_seq=1 ttl=255 time=4.206 ms
84 bytes from 10.78.100.1 icmp_seq=2 ttl=255 time=1.512 ms
84 bytes from 10.78.100.1 icmp_seq=3 ttl=255 time=3.168 ms
84 bytes from 10.78.100.1 icmp_seq=4 ttl=255 time=2.756 ms
84 bytes from 10.78.100.1 icmp_seq=5 ttl=255 time=1.662 ms

PC1> ping 10.78.100.2
84 bytes from 10.78.100.2 icmp_seq=1 ttl=255 time=2.853 ms
84 bytes from 10.78.100.2 icmp_seq=2 ttl=255 time=4.028 ms
84 bytes from 10.78.100.2 icmp_seq=3 ttl=255 time=3.085 ms
84 bytes from 10.78.100.2 icmp_seq=4 ttl=255 time=4.433 ms
84 bytes from 10.78.100.2 icmp_seq=5 ttl=255 time=3.895 ms

PC1> ping 10.78.100.6
84 bytes from 10.78.100.6 icmp_seq=1 ttl=64 time=6.456 ms
84 bytes from 10.78.100.6 icmp_seq=2 ttl=64 time=3.924 ms
84 bytes from 10.78.100.6 icmp_seq=3 ttl=64 time=4.246 ms
84 bytes from 10.78.100.6 icmp_seq=4 ttl=64 time=8.363 ms
84 bytes from 10.78.100.6 icmp_seq=5 ttl=64 time=4.433 ms

PC1> save
Saving startup configuration to startup.vpc
. done
```

Figura 19. Verificación conectividad LAN en PC1

```
PC4> sh ip
fe80::250:79ff:fe66:6803/64
2001:db8:100:100:2050:79ff:fe66:6803/64

PC4> sh ip
NAME          : PC4[1]
IP/MASK       : 10.78.100.6/24
GATEWAY       : 10.78.100.254
DNS           :
MAC           : 00:50:79:66:68:03
LPORT        : 20050
RHOST:PORT    : 127.0.0.1:20051
MTU           : 1500

PC4> ping 10.78.100.1
84 bytes from 10.78.100.1 icmp_seq=1 ttl=255 time=5.988 ms
84 bytes from 10.78.100.1 icmp_seq=2 ttl=255 time=4.170 ms
84 bytes from 10.78.100.1 icmp_seq=3 ttl=255 time=3.236 ms
84 bytes from 10.78.100.1 icmp_seq=4 ttl=255 time=3.543 ms
84 bytes from 10.78.100.1 icmp_seq=5 ttl=255 time=3.244 ms

PC4> ping 10.78.100.2
84 bytes from 10.78.100.2 icmp_seq=1 ttl=255 time=5.942 ms
84 bytes from 10.78.100.2 icmp_seq=2 ttl=255 time=7.177 ms
84 bytes from 10.78.100.2 icmp_seq=3 ttl=255 time=152.291 ms
84 bytes from 10.78.100.2 icmp_seq=4 ttl=255 time=4.739 ms
84 bytes from 10.78.100.2 icmp_seq=5 ttl=255 time=5.177 ms

PC4> ping 10.78.100.5
84 bytes from 10.78.100.5 icmp_seq=1 ttl=64 time=6.654 ms
84 bytes from 10.78.100.5 icmp_seq=2 ttl=64 time=8.069 ms
84 bytes from 10.78.100.5 icmp_seq=3 ttl=64 time=8.290 ms
84 bytes from 10.78.100.5 icmp_seq=4 ttl=64 time=119.378 ms
84 bytes from 10.78.100.5 icmp_seq=5 ttl=64 time=8.380 ms

PC4> save
Saving startup configuration to startup.vpc
. done

PC4>
```

Figura 20. Verificación conectividad LAN en PC4

```
4 GW 10.78.102.254
PC2> sh
NAME IP/MASK GATEWAY MAC LPORT RHOST:PORT
PC2 10.78.102.210/24 10.78.102.254 00:50:79:66:68:01 20046 127.0.0.1:20047
    fe80::250:79ff:fe66:6801/64
    2001:db8:100:102:2050:79ff:fe66:6801/64 eui-64
PC2> sh ip
NAME : PC2[1]
IP/MASK : 10.78.102.210/24
GATEWAY : 10.78.102.254
DNS :
DHCP SERVER : 10.78.102.2
DHCP LEASE : 86180, 86400/43200/75600
MAC : 00:50:79:66:68:01
LPORT : 20046
RHOST:PORT : 127.0.0.1:20047
MTU : 1500
PC2> ping 10.78.102.1
84 bytes from 10.78.102.1 icmp_seq=1 ttl=255 time=36.241 ms
84 bytes from 10.78.102.1 icmp_seq=2 ttl=255 time=4.487 ms
84 bytes from 10.78.102.1 icmp_seq=3 ttl=255 time=3.384 ms
84 bytes from 10.78.102.1 icmp_seq=4 ttl=255 time=4.020 ms
84 bytes from 10.78.102.1 icmp_seq=5 ttl=255 time=6.959 ms
PC2> ping 10.78.102.2
84 bytes from 10.78.102.2 icmp_seq=1 ttl=255 time=2.137 ms
84 bytes from 10.78.102.2 icmp_seq=2 ttl=255 time=1.378 ms
84 bytes from 10.78.102.2 icmp_seq=3 ttl=255 time=2.069 ms
84 bytes from 10.78.102.2 icmp_seq=4 ttl=255 time=1.923 ms
84 bytes from 10.78.102.2 icmp_seq=5 ttl=255 time=3.319 ms
PC2> save
Saving startup configuration to startup.vpc
. done
PC2>
```

Figura 21. Verificación conectividad LAN en PC2

```
NAME IP/MASK GATEWAY MAC LPORT RHOST:PORT
PC3 10.78.101.210/24 10.78.101.254 00:50:79:66:68:02 20048 127.0.0.1:20049
    fe80::250:79ff:fe66:6802/64
    2001:db8:100:101:2050:79ff:fe66:6802/64 eui-64
PC3> ip sh
Invalid address
PC3> sh ip
NAME : PC3[1]
IP/MASK : 10.78.101.210/24
GATEWAY : 10.78.101.254
DNS :
DHCP SERVER : 10.78.101.2
DHCP LEASE : 86120, 86400/43200/75600
MAC : 00:50:79:66:68:02
LPORT : 20048
RHOST:PORT : 127.0.0.1:20049
MTU : 1500
PC3> ping 10.78.101.1
84 bytes from 10.78.101.1 icmp_seq=1 ttl=255 time=65.817 ms
84 bytes from 10.78.101.1 icmp_seq=2 ttl=255 time=8.627 ms
84 bytes from 10.78.101.1 icmp_seq=3 ttl=255 time=11.620 ms
84 bytes from 10.78.101.1 icmp_seq=4 ttl=255 time=5.263 ms
84 bytes from 10.78.101.1 icmp_seq=5 ttl=255 time=16.861 ms
PC3> ping 10.78.101.2
84 bytes from 10.78.101.2 icmp_seq=1 ttl=255 time=3.789 ms
84 bytes from 10.78.101.2 icmp_seq=2 ttl=255 time=4.738 ms
84 bytes from 10.78.101.2 icmp_seq=3 ttl=255 time=3.771 ms
84 bytes from 10.78.101.2 icmp_seq=4 ttl=255 time=6.405 ms
84 bytes from 10.78.101.2 icmp_seq=5 ttl=255 time=4.884 ms
PC3> save
Saving startup configuration to startup.vpc
. done
PC3>
```

Figura 22. Verificación conectividad LAN en PC3

### PARTE 3: CONFIGURAR LOS PROTOCOLOS DE ENRUTAMIENTO

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

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

Tabla 3. Configurar protocolos de enrutamiento 1

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

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

Task#	Task	Specification	Points
3.3	On R2 in the "ISP Network", configure MP-BGP.	<p>Configure two default static routes via interface Loopback 0:</p> <ul style="list-style-type: none"> <li>• An IPv4 default static route.</li> <li>• An IPv6 default static route.</li> </ul> <p>Configure R2 in BGP ASN <b>500</b> and use the router-id 2.2.2.2.</p> <p>Configure and enable an IPv4 and IPv6 neighbor relationship with R1 in ASN 300.</p> <p>In IPv4 address family, advertise:</p> <ul style="list-style-type: none"> <li>• The Loopback 0 IPv4 network (/32).</li> <li>• The default route (0.0.0.0/0).</li> </ul> <p>In IPv6 address family, advertise:</p> <ul style="list-style-type: none"> <li>• The Loopback 0 IPv4 network (/128).</li> <li>• The default route (::/0).</li> </ul>	4

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

### Paso 3.1: Configuración OSPFv2

```

Router 1
router ospf 4
router-id 0.0.4.1
network 10.78.10.0 0.0.0.255 area 0
network 10.78.13.0 0.0.0.255 area 0
default-information originate

```

```
Router 3
router ospf 4
router-id 0.0.4.3
network 10.78.11.0 0.0.0.255 area 0
network 10.78.13.0 0.0.0.255 area 0
```

```
Switch D1
router ospf 4
router-id 0.0.4.131
network 10.78.100.0 0.0.0.255 area 0
network 10.78.101.0 0.0.0.255 area 0
network 10.78.102.0 0.0.0.255 area 0
network 10.78.10.0 0.0.0.255 area 0
passive-interface default
no passive-interface e1/0/11
```

```
Switch D2
router ospf 4
router-id 0.0.4.132
network 10.78.100.0 0.0.0.255 area 0
network 10.78.101.0 0.0.0.255 area 0
network 10.78.102.0 0.0.0.255 area 0
network 10.78.11.0 0.0.0.255 area 0
passive-interface default
no passive-interface e1/0/11
```

### **Paso 3.2: Configuración de OSPFv3**

```
Router 1
ipv6 router ospf 6
router-id 0.0.6.1
default-information originate
exitinterface e0/0/1
ipv6 ospf 6 area 0
exit
interface s0/1/0
ipv6 ospf 6 area 0
exit
```

```
Router 2
ipv6 router ospf 6
router-id 0.0.6.3
exit
interface e0/0/1
ipv6 ospf 6 area 0
exit
interface s0/1/0
ipv6 ospf 6 area 0
exit
end
```

```
Switch D1
passive-interface default
no passive-interface e1/0/11
```

```
interface e1/0/11
ipv6 ospf 6 area 0
exit
interface vlan 100
ipv6 ospf 6 area 0
exit
interface vlan 101
ipv6 ospf 6 area 0
exit
interface vlan 102
ipv6 ospf 6 area 0
exit
```

```
Switch D2
passive-interface default
no passive-interface e1/0/11
```

```
interface e1/0/11
ipv6 ospf 6 area 0
exit
interface vlan 100
ipv6 ospf 6 vlan 0
```

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

### **Paso 3.3: Configuración MP-BGP en la red ISP R2**

```
Router 2
ip router 0.0.0.0 0.0.0.0 loopback 0
ipv6 router::/o 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
address-family ipv4
neighbor 209.165.200.225 activate
no neighbor 2001:db8:200::1 activate
network 2.2.2.2 mask 255.255.255.255
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
```

### **Paso 3.4: Configuración MP-BGP en la red ISP R1**

```
Router 1
ip router 10.78.0.0 255.0.0.0 null0
ipv6 router 2001:db8:100::/48 null0
```

```
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 10.78.0.0 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
```

```

D1#
D1#
D1#
*Nov 19 03:52:28.438: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethernet1/1 (not full duplex), with R1 Ethernet1
/0 (full duplex).
D1#show ip route
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
E1 - OSPF external type 1, E2 - OSPF external type 2
i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
ia - IS-IS inter area, * - candidate default, U - per-user static route
o - ODR, P - periodic downloaded static route, H - NHRP, l - LISP
a - application route
+ - replicated route, % - next hop override

Gateway of last resort is 10.78.10.1 to network 0.0.0.0

O*E2 0.0.0.0/0 [110/1] via 10.78.10.1, 00:15:05, Ethernet1/1
10.0.0.0/8 is variably subnetted, 10 subnets, 2 masks
C 10.78.10.0/24 is directly connected, Ethernet1/1
L 10.78.10.2/32 is directly connected, Ethernet1/1
O 10.78.11.0/24 [110/30] via 10.78.10.1, 00:15:05, Ethernet1/1
O 10.78.13.0/24 [110/20] via 10.78.10.1, 00:15:15, Ethernet1/1
C 10.78.100.0/24 is directly connected, Vlan100
L 10.78.100.1/32 is directly connected, Vlan100
C 10.78.101.0/24 is directly connected, Vlan101
L 10.78.101.1/32 is directly connected, Vlan101
C 10.78.102.0/24 is directly connected, Vlan102
L 10.78.102.1/32 is directly connected, Vlan102
D1#

D2#
D2#
D2#
*Nov 19 03:51:47.328: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethernet1/1 (not full duplex), with R3 Ethernet1
/0 (full duplex).
*Nov 19 03:52:37.737: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethernet1/1 (not full duplex), with R3 Ethernet1
/0 (full duplex).
*Nov 19 03:53:33.202: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethernet1/1 (not full duplex), with R3 Ethernet1
/0 (full duplex). D2, ENCOR Skills Assessment
D2#
D2#
D2#show ip route
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
E1 - OSPF external type 1, E2 - OSPF external type 2
i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
ia - IS-IS inter area, * - candidate default, U - per-user static route
o - ODR, P - periodic downloaded static route, H - NHRP, l - LISP
a - application route
+ - replicated route, % - next hop override

Gateway of last resort is 10.78.11.1 to network 0.0.0.0

O*E2 0.0.0.0/0 [110/1] via 10.78.11.1, 00:17:04, Ethernet1/1
10.0.0.0/8 is variably subnetted, 10 subnets, 2 masks
O 10.78.10.0/24 [110/30] via 10.78.11.1, 00:17:08, Ethernet1/1
C 10.78.11.0/24 is directly connected, Ethernet1/1
L 10.78.11.2/32 is directly connected, Ethernet1/1
O 10.78.13.0/24 [110/20] via 10.78.11.1, 00:18:02, Ethernet1/1
C 10.78.100.0/24 is directly connected, Vlan100
L 10.78.100.2/32 is directly connected, Vlan100
C 10.78.101.0/24 is directly connected, Vlan101
L 10.78.101.2/32 is directly connected, Vlan101
--More--
*Nov 19 03:54:30.509: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethernet1/1 (not full duplex), with R3 Ethernet1
/0 (full duplex).
C 10.78.102.0/24 is directly connected, Vlan102
L 10.78.102.2/32 is directly connected, Vlan102
D2#
D2#

```

Figura 23. Verificación de la table IPV4 en Switch D1 y D2

### Paso 3.5: Verificación del MP-BGP con Ping

```
/0 (full duplex).
D1#
*Nov 19 03:58:27.015: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethernet1/1 (not full duplex), with R1 Ethernet1
/0 (full duplex).
D1#ping 2.2.2.2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 2.2.2.2, timeout is 2 seconds:
.....
Success rate is 0 percent (0/5)
D1#ping 2001:db8:2222::1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 2001:DB8:2222::1, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 29/31/33 ms
D1#

solarwinds | Solar-PuTTY free tool | © 2019 SolarWinds Worldwide, LLC. All rights reserved.

D2#
D2#
D2#ping 2.2.2.2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 2.2.2.2, timeout is 2 seconds:
.....
Success rate is 0 percent (0/5)
D2#
*Nov 19 03:58:02.540: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethernet1/1 (not full duplex), with R3 Ethernet1
/0 (full duplex).
D2#ping 2001:db8:2222::1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 2001:DB8:2222::1, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 31/41/57 ms
D2#
*Nov 19 03:58:54.769: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethernet1/1 (not full duplex), with R3 Ethernet1
/0 (full duplex).
D2#

solarwinds | Solar-PuTTY free tool | © 2019 SolarWinds Worldwide, LLC. All rights reserved.
```

Figura 24. Ping D1 y D2 hacia Loopback 0

Router 1

```
R1(config-router)#router ospf 4
```

```
R1(config-router)#router-id 0.0.4.1
```

```
R1(config-router)#network 10.78.10.0 0.0.0.255 area 0
```

```
R1(config-router)#network 10.78.13.0 0.0.0.255 area 0
```

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

```
R1(config-router)#exit
```

```
R1(config)#ipv6 router ospf 6
```

```
R1(config-rtr)#router-id 0.0.6.1
```

```
R1(config-rtr)#default-information originate
```

```
R1(config-rtr)#exit
```

```
R1(config)#interface e1/0
```

```
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
```

```
R1(config)#ip route 10.78.0.0 255.0.0.0 null0
```

```
%Inconsistent address and mask
```

```
R1(config)#ipv6 route 2001:db8:100::/48 null0
```

```
R1(config)#
```

```
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 10.78.0.0 mask 255.0.0.0
% BGP: Incorrect network or mask/prefix-length configured
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

```

```

R1#
R1#show ip ospf neig
*Nov 10 01:29:35.799: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethernet1/0 (not half duplex), with D1 Ethernet1/1 (half duplex).
R1#show ip ospf neighbor
Neighbor ID      Pri   State           Dead Time   Address        Interface
0.0.4.3          1    FULL/BDR        00:00:39   10.78.13.3    Ethernet1/1
0.0.4.131        1    FULL/BDR        00:00:37   10.78.10.2    Ethernet1/0
R1#
*Nov 10 01:30:25.759: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethernet1/0 (not half duplex), with D1 Ethernet1/1 (half duplex).
R1#

```

*Figura 25. verificacion de vecinos router 1*

Router 2

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

%Default route without gateway, if not a point-to-point interface, may impact performance

```
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::/128
R2(config-router-af)#network ::/0
R2(config-router-af)#exit-address-family
```

Router 3

```
R3(config)#router ospf 4
R3(config-router)#router-id 0.0.4.3
R3(config-router)#network 10.78.11.0 0.0.0.255 area 0
R3(config-router)#network 10.78.13.0 0.0.0.255 area 0
R3(config-router)#exit
R3(config)#ipv6 router ospf 6
R3(config-rtr)#router-id 0.0.6.3
```

```

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

```

```

R3#
R3#show ip ospf neighbor

```

Neighbor ID	Pri	State	Dead Time	Address	Interface
0.0.4.1	1	FULL/DR	00:00:31	10.78.13.1	Ethernet1/1
0.0.4.132	1	FULL/BDR	00:00:33	10.78.11.2	Ethernet1/0

```

R3#

```

*Figura 26. verificacion de vecinos router 3*

```

Switch D1
D1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
D1(config)#router ospf 4
D1(config-router)#router-id 0.0.4.131
D1(config-router)#network 10.78.100.0 0.0.0.255 area 0
D1(config-router)#network 10.78.101.0 0.0.0.255 area 0
D1(config-router)#network 10.78.102.0 0.0.0.255 area 0
D1(config-router)#network 10.78.10.0 0.0.0.255 area 0
D1(config-router)#passive-interface default
D1(config-router)#no passive-interface e1/1

```

```

D1(config-router)#exit
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 e1/1
D1(config-rtr)#exit
D1(config)#interface e1/1
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

```

```

*Nov 10 02:11:00.893: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethernet1/1 (not full duplex), with R1 Ethernet1/0 (full duplex).
D1#show ip ospf neighbor
Neighbor ID    Pri   State           Dead Time   Address        Interface
0.0.4.1        1    FULL/DR         00:00:34   10.78.10.1    Ethernet1/1
D1#
*Nov 10 02:11:56.436: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethernet1/1 (not full duplex), with R1 Ethernet1/0 (full duplex).
D1#

```

*Figura 27. verificacion de vecinos switch D1*

Switch D2

```
D2(config)#router ospf 4
```

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

```
D2(config-router)#network 10.78.100.0 0.0.0.255 area 0
```

```
D2(config-router)#network 10.78.101.0 0.0.0.255 area 0
```

```
D2(config-router)#network 10.78.102.0 0.0.0.255 area 0
```

```
D2(config-router)#network 10.78.11.0 0.0.0.255 area 0
```

```
D2(config-router)#passive-interface default
```

```
D2(config-router)#no passive-interface e1/1
```

```
D2(config-router)#exit
```

```
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 e1/1
```

```
D2(config-rtr)#exit
```

```
D2(config)#interface e1/1
```

```
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
```

```
D2#
D2#show ip ospf neighbor

Neighbor ID      Pri   State           Dead Time   Address        Interface
0.0.0.3          1    FULL/DR         00:00:31   10.78.11.1    Ethernet1/1
D2#
```

*Figura 28. verificacion de vecinos switch D2*

## PARTE 4: CONFIGURAR LA REDUNDANCIA DEL PRIMER SALTO (FIRST HOP REDUNDANCY)

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

Sus tareas de configuración son las siguientes:

Tabla 4. Configurar protocolos de enrutamiento 2

Task#	Task	Specification	Points
4.1	On D1, create IP SLAs that test the reachability of R1 interface G0/0/1.	<p>Create two IP SLAs.</p> <ul style="list-style-type: none"> <li>• Use SLA number <b>4</b> for IPv4.</li> <li>• Use SLA number <b>6</b> for IPv6.</li> </ul> <p>The IP SLAs will test availability of R1 E1/2 interface every 5 seconds.</p> <p>Schedule the SLA for immediate implementation with no end time.</p> <p>Create an IP SLA object for IP SLA 4 and one for IP SLA 6.</p> <ul style="list-style-type: none"> <li>• Use track number <b>4</b> for IP SLA 4.</li> <li>• Use track number <b>6</b> for IP SLA 6.</li> </ul> <p>The tracked objects should notify D1 if the IP SLA state changes from down to up after 10 seconds, or from up to down after 15 seconds.</p>	2

Task#	Task	Specification	Points
4.2	On D2, create IP SLAs that test the reachability of R3 interface G0/0/1.	<p>Create two IP SLAs.</p> <ul style="list-style-type: none"> <li>• Use SLA number <b>4</b> for IPv4.</li> <li>• Use SLA number <b>6</b> for IPv6.</li> </ul> <p>The IP SLAs will test availability of R3 E1/0 interface every 5 seconds.</p> <p>Schedule the SLA for immediate implementation with no end time.</p> <p>Create an IP SLA object for IP SLA 4 and one for IP SLA 6.</p> <ul style="list-style-type: none"> <li>• Use track number <b>4</b> for IP SLA 4.</li> <li>• Use track number <b>6</b> for IP SLA 6.</li> </ul> <p>The tracked objects should notify D1 if the IP SLA state changes from down to up after 10 seconds, or from up to down after 15 seconds.</p>	2

4.3	On D1, configure HSRPv2.	<p>D1 is the primary router for VLANs 100 and 102; therefore, their priority will also be changed to 150.</p> <p>Configure HSRP version 2.</p> <p>Configure IPv4 HSRP group <b>104</b> for VLAN 100:</p> <ul style="list-style-type: none"> <li>• Assign the virtual IP address <b>10.XY.100.254</b>.</li> <li>• Set the group priority to <b>150</b>.</li> <li>• Enable preemption.</li> <li>• Track object 4 and decrement by 60.</li> </ul> <p>Configure IPv4 HSRP group <b>114</b> for VLAN 101:</p> <ul style="list-style-type: none"> <li>• Assign the virtual IP address <b>10.XY.101.254</b>.</li> <li>• Enable preemption.</li> <li>• Track object 4 to decrement by 60.</li> </ul> <p>Configure IPv4 HSRP group <b>124</b> for VLAN 102:</p> <ul style="list-style-type: none"> <li>• Assign the virtual IP address <b>10.XY.102.254</b>.</li> <li>• Set the group priority to <b>150</b>.</li> <li>• Enable preemption.</li> <li>• Track object 4 to decrement by 60.</li> </ul> <p>Configure IPv6 HSRP group <b>106</b> for VLAN 100:</p> <ul style="list-style-type: none"> <li>• Assign the virtual IP address using <b>ipv6 autoconfig</b>.</li> <li>• Set the group priority to <b>150</b>.</li> <li>• Enable preemption.</li> <li>• Track object 6 and decrement by 60.</li> </ul> <p>Configure IPv6 HSRP group <b>116</b> for VLAN 101:</p>	8
-----	--------------------------	---	---

Task#	Task	Specification	Points
		<ul style="list-style-type: none"> <li>• Assign the virtual IP address using <b>ipv6 autoconfig</b>.</li> <li>• Enable preemption.</li> <li>• Track object 6 and decrement by 60.</li> </ul> <p>Configure IPv6 HSRP group <b>126</b> for VLAN 102:</p> <ul style="list-style-type: none"> <li>• Assign the virtual IP address using <b>ipv6 autoconfig</b>.</li> <li>• Set the group priority to <b>150</b>.</li> <li>• Enable preemption.</li> <li>• Track object 6 and decrement by 60.</li> </ul>	

	<p>On D2, configure HSRPv2.</p>	<p>D2 is the primary router for VLAN 101; therefore, the priority will also be changed to 150.</p> <p>Configure HSRP version 2.</p> <p>Configure IPv4 HSRP group <b>104</b> for VLAN 100:</p> <ul style="list-style-type: none"> <li>• Assign the virtual IP address <b>10.XY.100.254</b>.</li> <li>• Enable preemption.</li> <li>• Track object 4 and decrement by 60.</li> </ul> <p>Configure IPv4 HSRP group <b>114</b> for VLAN 101:</p> <ul style="list-style-type: none"> <li>• Assign the virtual IP address <b>10.XY.101.254</b>.</li> <li>• Set the group priority to <b>150</b>.</li> <li>• Enable preemption.</li> <li>• Track object 4 to decrement by 60.</li> </ul> <p>Configure IPv4 HSRP group <b>124</b> for VLAN 102:</p> <ul style="list-style-type: none"> <li>• Assign the virtual IP address <b>10.XY.102.254</b>.</li> <li>• Enable preemption.</li> <li>• Track object 4 to decrement by 60.</li> </ul> <p>Configure IPv6 HSRP group <b>106</b> for VLAN 100:</p> <ul style="list-style-type: none"> <li>• Assign the virtual IP address using <b>ipv6 autoconfig</b>.</li> <li>• Enable preemption.</li> <li>• Track object 6 and decrement by 60.</li> </ul> <p>Configure IPv6 HSRP group <b>116</b> for VLAN 101:</p> <ul style="list-style-type: none"> <li>• Assign the virtual IP address using <b>ipv6 autoconfig</b>.</li> <li>• Set the group priority to <b>150</b>.</li> </ul>	
--	---------------------------------	---	--

Task#	Task	Specification	Points
		<ul style="list-style-type: none"> <li>• Enable preemption.</li> <li>• Track object 6 and decrement by 60.</li> </ul> <p>Configure IPv6 HSRP group <b>126</b> for VLAN 102:</p> <ul style="list-style-type: none"> <li>• Assign the virtual IP address using ipv6 autoconfig.</li> <li>• Enable preemption.</li> <li>• Track object 6 and decrement by 60.</li> </ul>	

**Paso 4.1: En D1, cree IP SLAs que prueben la accesibilidad de la interfaz R1 G1/0**

```

switch D1
ip sla 4 - Crea el SLA
icmp-echo 10.78.10.1 - define el destino y la fuente
frequency 5 - define cada cuanto segundo
exit
ip sla 6 - Crea el SLA
icmp-echo 2001:db8:100:1010::1
frequency 5
exit
ip sla schedule 4 life forever start-time now
ip sla schedule 6 life forever start-time now
track 4 ip sla 4 - crea el objeto para saber si down o up
delay down 10 up 15 - se dan los retardos solicitados
exit
track 6 ip sla 6
delay down 10 up 15
exit

```

**Paso 4.2: En D2, cree IP SLAs que prueben la accesibilidad de la interfaz R3 G1/0**

```

switch D2

```

```

ip sla 4
icmp-echo 10.78.11.1
frequency
exit
ip sla 6
icmp-echo 2001:db8:100::1011::1
frequency
exit
ip sla schedule 4 life forever start-time now
ip sla schedule 6 life forever start-time now
track 4 ip sla 4
delay down 10 up 15
exit
track 6 ip sla 6
delay down 10 up 15
exit

```

```

D1#
*Nov 19 04:17:30.504: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethernet1/1 (not full duplex), with R1 Ethernet1
/0 (full duplex).
D1#Show run | section ip sla
track 4 ip sla 4
  delay down 10 up 15
track 6 ip sla 6
  delay down 10 up 15
ip sla 4
  icmp-echo 10.78.10.1
  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
D1#

```

```

*Nov 19 04:17:52.122: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethernet1/1 (not full duplex), with R3 Ethernet1
/0 (full duplex).
D2#Show run | section ip sla
track 4 ip sla 4
  delay down 10 up 15
track 6 ip sla 6
  delay down 10 up 15
ip sla 4
  icmp-echo 10.78.11.1
  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
D2#

```

Figura 29. Verificación de los SLAS

### **Paso 4.3: En D1 configure HSRPv2**

Switch D1:

```
interface vlan 100
standby version 2 - active la version 2 para ipv6
standby 104 ip 10.78.100.254 - crea el grupo con la ip virtual
standby 104 priority 150 - se cambia la prioridad defecto de 100
standby 104 preempt - sera el equipo principal
standby 104 track 4 decrement 60 - /rastrea el objeto 4
standby 106 ipv6 auticonfig
standby 106 priority 150
standby 106 preempt
standby 106 track 6 decrement 60
exit
interface vlan 101
standby version 2
standby 114 ip 10.78.101.254
standby 114 preempt
standby 114 track 4 decrement 60
standby 116 ipv6 auticonfig
standby 116 preempt
standby 116 track 6 decrement 60
exit
interface vlan 102
standby version 2
standby 124 ip 10.78.102.254
standby 124 priority 150
standby 124 preempt
standby 124 track 4 decrement 60
standby 126 ipv6 auticonfig
standby 126 priority 150
standby 126 preempt
standby 126 track 6 decrement 60
exit
end
```

#### **Paso 4.4: En D2 configure HSRPv2**

Switch D2:

```
interface vlan 100
standby version 2
standby 104 ip 10.78.100.254
standby 104 preempt
standby 104 track 4 decrement 60
standby 106 ipv6 autoconfig
standby 106 preempt
standby 106 track 6 decrement 60
exit
interface vlan 101
standby version 2
standby 114 ip 10.78.101.254
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
exit
interface vlan 102
standby version 2
standby 124 ip 10.78.102.254
standby 124 preempt
standby 124 track 4 decrement 60
standby 126 ipv6 autoconfig
standby 126 preempt
standby 126 track 6 decrement 60
exit
end
```

```
Nov 19 04:13:59.705: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethernet1/1 (not full duplex), with R1 Ethernet1/0 (full duplex).
D1#Show run | section standby
standby version 2
standby 104 ip 10.78.100.254
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
standby version 2
standby 114 ip 10.78.101.254
standby 114 preempt
standby 114 track 4 decrement 60
standby 116 ipv6 autoconfig
standby 116 preempt
standby 116 track 6 decrement 60
standby version 2
standby 124 ip 10.78.102.254
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
D1#
D1#
D1#
D1#
D1#
Nov 19 04:13:59.139: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethernet1/1 (not full duplex), with R2 Ethernet1/0 (full duplex).
D2#Show run | section standby
standby version 2
standby 104 ip 10.78.100.254
standby 104 preempt
standby 104 track 4 decrement 60
standby 106 ipv6 autoconfig
standby 106 preempt
standby 106 track 6 decrement 60
standby version 2
standby 114 ip 10.78.101.254
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
standby version 2
standby 124 ip 10.78.102.254
standby 124 preempt
standby 124 track 4 decrement 60
standby 126 ipv6 autoconfig
standby 126 preempt
standby 126 track 6 decrement 60
--More--
```

Figura 30. Verificación del standby

```

Nov 11 01:54:20.329: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethernet1/1 (not full duplex), with R1 Ethernet1/0 (full duplex).
D1(config)#ip sla 4
D1(config-ip-sla)#icmp-echo 10.78.10.1
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 down 10 up 15
D1(config-track)#exit
D1(config)#track 6 ip sla 6
D1(config-track)#delay down 10 up 15
D1(config-track)#exit
D1(config)#interface vlan 100
D1(config-if)#standby version 2
D1(config-if)#standby 104 ip 10.78.100.254
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 10.78.101.254
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 10.78.102.254
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

```

Figura 31. Configuración del standby switch D1

```

D1#
D1#show standby brief
P indicates configured to preempt.
|
Interface  Grp  Pri P State  Active          Standby          Virtual IP
Vl100     104  150 P Active local          10.78.100.2     10.78.100.254
Vl100     106  150 P Active local          FE80::D2:2     FE80::5:73FF:FEA0:6A
Vl101     114  100 P Standby 10.78.101.2     local           10.78.101.254
Vl101     116  100 P Standby FE80::D2:3     local           FE80::5:73FF:FEA0:74
Vl102     124  150 P Active local          10.78.102.2     10.78.102.254
Vl102     126  150 P Active local          FE80::D2:4     FE80::5:73FF:FEA0:7E
D1#
*Nov 11 02:43:29.115: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethernet1/1 (not fu
/0 (full duplex).

```

Figura 32. Verificación interfaces y vlan switch D1

```

Nov 11 02:33:41.118: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethernet1/1 (not full duplex), with R3 Ethernet1
/0 (full duplex).
D2(config)#ip sla 4
D2(config-ip-sla-echo)#icmp-echo 10.78.11.1
^
% Invalid input detected at '^' marker.
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 down 10 up 15
D2(config-track)#exit
D2(config)#track 6 ip sla 6
D2(config-track)#delay down 10 up 15
D2(config-track)#exit
D2(config)#interface vlan 100
D2(config-if)#standby version 2
D2(config-if)#standby 104 ip 10.78.100.254
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 10.78.101.254
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 10.78.102.254
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

```

Figura 33. Configuración del standby switch D2

```

Nov 11 03:06:58.065: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethernet1/1 (
/0 (full duplex).
D2#show standby brief
      P indicates configured to preempt.
      |
Interface  Grp  Pri P State  Active             Standby            Virtual IP
Vl100     104  100 P Standby 10.78.100.1       local              10.78.100.254
Vl100     106  100 P Standby FE80::D1:2        local              FE80::5:73FF:FEA0:6A
Vl101     114  150 P Active  local             10.78.101.1       10.78.101.254
Vl101     116  150 P Active  local             FE80::D1:3        FE80::5:73FF:FEA0:74
Vl102     124  100 P Standby 10.78.102.1       local              10.78.102.254
Vl102     126  100 P Standby FE80::D1:4        local              FE80::5:73FF:FEA0:7E
D2#

```

Figura 34. Verificación interfaces y vlan switch D2

## CONCLUSIONES

Los diseños hardware y software para telecomunicaciones como CISCO, los estudiantes y profesionales logran desarrollara destrezas que en entornos de pruebas son difíciles de adquirir, es una gran herramienta, pues se practica y se aprende bajo sus parámetros, parámetros que son actualizados constantemente, aplicados en las en las telecomunicaciones y por ende en la vida profesional.

Las técnicas y protocolos como Redundancia de enlaces, Spanning tree y LACP para sacar el mejor provecho a la conexión en capa 2; donde el primero permite dar tolerancia a las fallas y protección contra la inoperatividad, el segundo asegura que solo exista una ruta lógica y evita bucles en estas redundancias, finalmente el LACP combina las redundancias físicas en un solo enlace lógico de alta velocidad.

la importancia de las redundancias a nivel de capa 3 también se utilizan para evitar que los dispositivos locales queden fuera de red por algún fallo en el Gateway, utilizando SLAs para monitorear continuamente las interfaces del Gateway y el protocolo HSRP para tener un router activo con la interfaz virtual.

## BIBLIOGRAFÍA

Edgeworth, B., Garza Rios, B., Gooley, J., Hucaby, D. (2020). CISCO Press (Ed). *Multicast*. CCNP and CCIE Enterprise Core ENCOR 350-401.  
<https://1drv.ms/b/s!AAIGg5JUgUBthk8>

Edgeworth, B., Garza Rios, B., Gooley, J., Hucaby, D. (2020). CISCO Press (Ed). *QoS*. CCNP and CCIE Enterprise Core ENCOR 350-401.  
<https://1drv.ms/b/s!AAIGg5JUgUBthk8>

Edgeworth, B., Garza Rios, B., Gooley, J., Hucaby, D. (2020). CISCO Press (Ed). *IP Services*. CCNP and CCIE Enterprise Core ENCOR 350-401.  
<https://1drv.ms/b/s!AAIGg5JUgUBthk8>