DIPLOMADO DE PROFUNDIZACION CISCO
PRUEBA DE HABILIDADES PRÁCTICA CCNP

EDIVER ANTONIO LADINO CADENA

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

DIPLOMADO DE PROFUNDIZACION CISCO
PRUEBA DE HABILIDADES PRÁCTICA CCNP

EDIVER ANTONIO LADINO CADENA

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

DIRECTOR:
JOHN HAROL PÉREZ CALDERÓN

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

NOTA DE ACEPTACIÓN

Firma del presidente del Jurado

Firma del Jurado

Firma del Jurado

BOGOTA, 16 de noviembre de 2022

AGRADECIMIENTOS

Al finalizar este proyecto el cual fue escogido como opción de grado para el título de Ingeniero de Telecomunicaciones.

Quiero agradecer a mis padres por su apoyo y confianza en todo el proceso de mi carrera, también a mis hermanos que de alguna manera contribuyeron en todo el paso por la universidad dando una voz de aliento para continuar avanzando en el proceso de realizarme como profesional.

Agradezco a mis hijos, quienes son mi motor y mi fuerza para lograr este objetivo tan importante en mi vida profesional, agradezco a toda la red de tutores de la universidad los cuales me acompañaron en este proceso, gracias al conocimiento, sus habilidades de enseñanza y de formación profesional.

CONTENIDO

LISTA DE TABLAS

LISTA DE FIGURAS

GLOSARIO

Gns3: Es un simulador gráfico de red que permite diseñar topologías de red complejas.

Hostname: Nombre de un dispositivo dentro de una red.

Hsrp: HSRP es un protocolo que actúa en la capa 3 del modelo OSI administrando las direcciones virtuales que identifican al enrutador que actúa como maestro en un momento dado.

Ip: Significa dirección del Protocolo de Internet. Este protocolo es un conjunto de reglas para la comunicación a través de Internet, ya sea el envío de correo electrónico, la transmisión de vídeo o la conexión a un sitio web. Una dirección IP identifica una red o dispositivo en Internet**.**

Ipv4: Es el nombre del protocolo de Internet utilizado actualmente para las direcciones IP de los dominios. Es la cuarta versión del Internet Protocol, empleado para la interconexión de redes basadas en Internet

Ipv6: Es una actualización al protocolo IPv4, diseñado para resolver el problema de agotamiento de direcciones.

Spanning tree: El STP (Spanning Tree Protocol) asegura que exista sólo una ruta lógica entre todos los destinos de la red, al realizar un bloqueo de forma intencional a aquellas rutas redundantes que puedan ocasionar un bucle.

Switch: Es un dispositivo que permite que la conexión de computadoras y periféricos a la red para que puedan comunicarse entre sí y con otras redes.

Switchport: Coloca la interfaz o el llamado puerto de acceso en un modo de enlace conocido como enlace no troncal permanente

Vlan: Las VLAN conocidas como redes de área local virtuales, es una tecnología de red que permite crear redes lógicas.

RESUMEN

Este proyecto consiste en el desarrollo de laboratorios prácticos relacionados al Diplomado de Profundización CCNP CISCO que permitieron afianzar conocimientos en los cuales se logra realizar transmisión de datos, conectividad de redes virtuales. Todo a través de redes simuladas, las cuales permitieron llegar a conclusiones respecto a como se aplican protocolos, reglas, comandos en una red de un entorno real y físico.

La implementación de sistemas, enlaces y redes permite llevar a cabo la implementación de estructuras, así como sus características técnicas, las cuales difieren según su modo de uso. Con el desarrollo de enlaces y direccionamiento IP se puede lograr establecer diferentes diseños de redes de varias topologías con la herramienta GNS3 la cual es un software muy completo, el cual permite dar solución a cada uno de los métodos propuestos, destacando el uso de este en el informe realizado.

Conceptos importantes vistos desde la carrera de ingeniería de telecomunicaciones en unión con la plataforma CISCO y GNS3, aplicaciones con las cuales realizamos los procesos de enrutamiento, swiching, seguridad, conectividad de dispositivos.

Palabras Clave: CISCO, CCNP, Conmutación, Enrutamiento, Redes, Electrónica, GNS3

ABSTRACT

This project consists of the development of practical laboratories related to the CCNP CISCO Deepening Diploma that allowed consolidating knowledge in which data transmission and virtual network connectivity are achieved. All through simulated networks, which allowed reaching conclusions regarding how protocols, rules, and commands are applied in a network in a real and physical environment.

The implementation of systems, links and networks allows carrying out the implementation of structures, as well as their technical characteristics, which differ according to their mode of use. With the development of links and IP addressing, it is possible to establish different network designs of various topologies with the GNS3 tool, which is a very complete software, which allows solving each of the proposed methods, highlighting its use in the report made.

Important concepts seen from the telecommunications engineering career in conjunction with the CISCO and GNS3 platform, applications with which we carry out the processes of routing, switching, security, device connectivity.

Keywords: CISCO, CCNP, Routing, Switching, Networking, Electronics, GNS3

INTRODUCCION

El crecimiento que al día de hoy se tiene en cuanto a redes, aplicaciones, infraestructura, nube, y todo tipo de soluciones tecnológicas nos lleva a involucrarnos en aplicaciones como **gns3**, **VirtualBox**, **cisco**, las cuales permiten simular redes virtuales, casi que llegando a un 90 % de lo que se ve en la realidad dentro de una red física de una mediana o grande compañía.

Teniendo en cuenta que se debe tener una administración y configuración que permita cumplir con las necesidades, estándares de la compañía y permitiendo acceder a los recursos de la red, al igual que brindando seguridad a la información que se transmite por medio de los diversos dispositivos que la componen.

Establecer una prueba de habilidades corresponde a fortalecer los conocimientos dada la importancia de los niveles de seguridad, así como las tecnologías y protocolos utilizados para la construcción y diseño de redes basadas en topologías y direccionamiento en cuanto a ajustes básicos. Llevar a cabo lo anterior es posible gracias a herramientas y entornos de simulación complejos que logran realizar análisis detallados y comportamientos lógicos según la disponibilidad y configuración de cada máquina.

GNS3 es uno de tantos programas completos que permite realizar diversas tareas gracias a la utilidad de herramientas, donde se destacan periféricos, routers, switches, pcs y demás, contemplando la asignación de IP, máscaras y submascaras de red, puntos de enlace entre otros, configuración de vlan, protocolos.

Con la implementación de herramientas de software se busca establecer en cada dispositivo del sistema de red configuraciones completas y detalladas permitiendo comprobar su conectividad y acceso a recursos muy semejantes a la realidad dentro de una red física.

DESARROLLO DEL TRABAJO

Escenario 1

Tabla 1. Direccionamiento **XY = 11**

Device	Interface	IPv4 Address	IPv6 Address	IPv6 Link-Local
R1	E1/0	209.165.200.225 /27	2001:db8:200::1/64	fe80::1:1
R1	E1/2	10.XY.10.1/24	2001:db8:100:1010::1/ 64	fe80::1:2
R1	E1/1	10. XY.13.1/24	2001:db8:100:1013::1/ 64	fe80::1:3
R2	E1/0	209.165.200.226 /27	2001:db8:200::2/64	fe80::2:1
R2	Loopback0	2.2.2.2/32	2001:db8:2222::1/128	fe80::2:3
R3	E1/0	10. XY.11.1/24	2001:db8:100:1011::1/ 64	fe80::3:2
R3	E1/1	10. XY.13.3/24	2001:db8:100:1013::3/ 64	fe80::3:3
D1	E1/2	10. XY.10.2/24	2001:db8:100:1010::2/ 64	fe80::d1:1
D1	VLAN 100	10. XY.100.1/24	2001:db8:100:100::1/6 4	fe80::d1:2
D1	VLAN 101	10.XY.101.1/24	2001:db8:100:101::1/6 4	fe80::d1:3
D1	VLAN 102	10.XY.102.1/24	2001:db8:100:102::1/6 4	fe80::d1:4
D2	E1/0	10.XY.11.2/24	2001:db8:100:1011::2/ 64	fe80::d2:1
D2	VLAN 100	10.XY.100.2/24	2001:db8:100:100::2/6 4	fe80::d2:2
D2	VLAN 101	10.XY.101.2/24	2001:db8:100:101::2/6 4	fe80::d2:3
D2	VLAN 102	10.XY.102.2/24	2001:db8:100:102::2/6 4	fe80::d2:4

Device	Interface	IPv4 Address	IPv6 Address	IPv6 Link-Local
A1	VLAN 100	10.XY.100.3/23	2001:db8:100:100::3/64	fe80::a1:1
PC1	NIC	10.XY.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	10.0.100.6/24	2001:db8:100:100::6/64	EUI-64

Part 1: Build the Network and Configure Basic Device Settings and Interface Addressing

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

Step 1: Cable the network as shown in the topology.

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

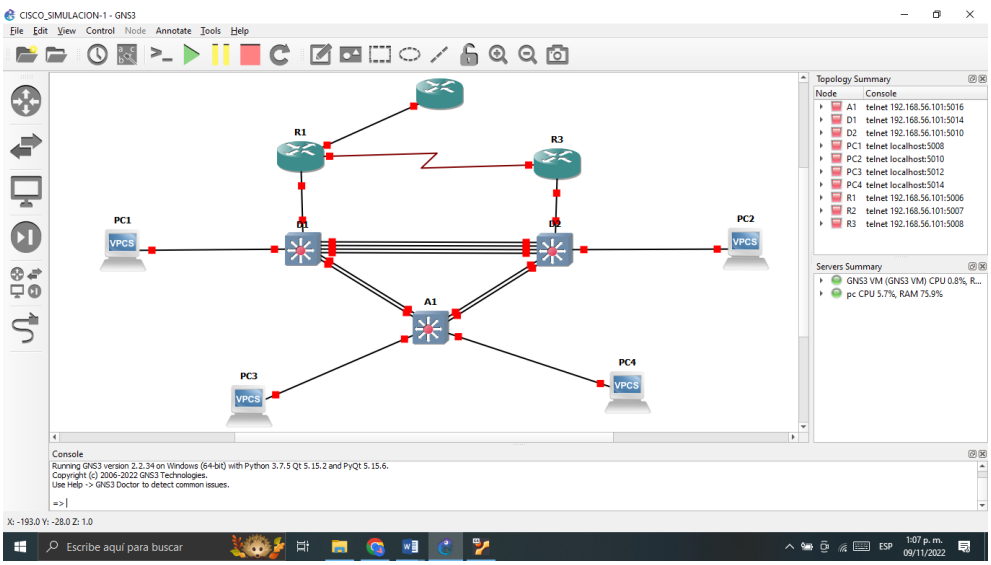

Figura1. Esquema general

Configure basic settings for each device.

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

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 g0/0
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 g1/0
ip address 10**.11.**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 s3/0
ip address 10.**11**.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 g0/0
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 g1/0
ip address 10.**11**.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 s3/0
ip address 10.**11**.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 g1/1
no switchport
ip address 10.**11**.10.2 255.255.255.0
ipv6 address fe80::d1:1 link-local
ipv6 address 2001:db8:100:1010::2/64
no shutdown
exit

interface vlan 100
ip address 10.**11**.100.1 255.255.255.0
ipv6 address fe80::d1:2 link-local
ipv6 address 2001:db8:100:100::1/64
no shutdown
exit

interface vlan 101
ip address 10.**11**.101.1 255.255.255.0
ipv6 address fe80::d1:3 link-local
ipv6 address 2001:db8:100:101::1/64
no shutdown
exit

interface vlan 102
ip address 10**.11**.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.**11.**101.1 10.0.101.109
ip dhcp excluded-address 10.**11**.101.141 10.0.101.254
ip dhcp excluded-address 10.**11**.102.1 10.0.102.109
ip dhcp excluded-address 10.**11**.102.141 10.0.102.254
ip dhcp pool VLAN-101
network 10.**11**.101.0 255.255.255.0
default-router 10.**11**.101.254
exit

ip dhcp pool VLAN-102
network 10.**11**.102.0 255.255.255.0
default-router 10.**11**.102.254
exit
interface range g0/0-3, g1/0, g1/2-3, g2/0-3, g3/0-3
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 g1/1
no switchport
ip address 10.**11**.11.2 255.255.255.0
ipv6 address fe80::d1:1 link-local
ipv6 address 2001:db8:100:1011::2/64
no shutdown
exit
interface vlan 100
ip address 10.**11**.100.2 255.255.255.0
ipv6 address fe80::d2:2 link-local
ipv6 address 2001:db8:100:100::2/64
no shutdown
exit

interface vlan 101
ip address 10.**11**.101.2 255.255.255.0
ipv6 address fe80::d2:3 link-local
ipv6 address 2001:db8:100:101::2/64
no shutdown
exit

interface vlan 102
ip address 10.**11**.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.**11**.101.1 10.0.101.209
ip dhcp excluded-address 10.**11**.101.241 10.0.101.254
ip dhcp excluded-address 10.**11**.102.1 10.0.102.209
ip dhcp excluded-address 10.**11**.102.241 10.0.102.254

ip dhcp pool VLAN-101
network 10.**11**.101.0 255.255.255.0
default-router **11**.0.101.254
exit
ip dhcp pool VLAN-102
network 10.**11**.102.0 255.255.255.0
default-router 10.**11**.102.254
exit
interface range g0/0-3, g1/0, g1/2-3,g2/0-3,g3/0-3
shutdown
exit

Switch A1

hostname A1
no ip domain lookup
banner motd # A1, ENCOR Skills Assessment#
line con 0
exec-timeout 0 0
logging synchronous
exit
vlan 100
name Management
exit
vlan 101
name UserGroupA
exit
vlan 102
name UserGroupB
exit
vlan 999
name NATIVE
exit
interface vlan 100
ip address 10.**11**.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 g1/1-3, g2/0-3, g3/0-3
shutdown
exit

b. Save the running configuration to startup-config on all devices.

R1

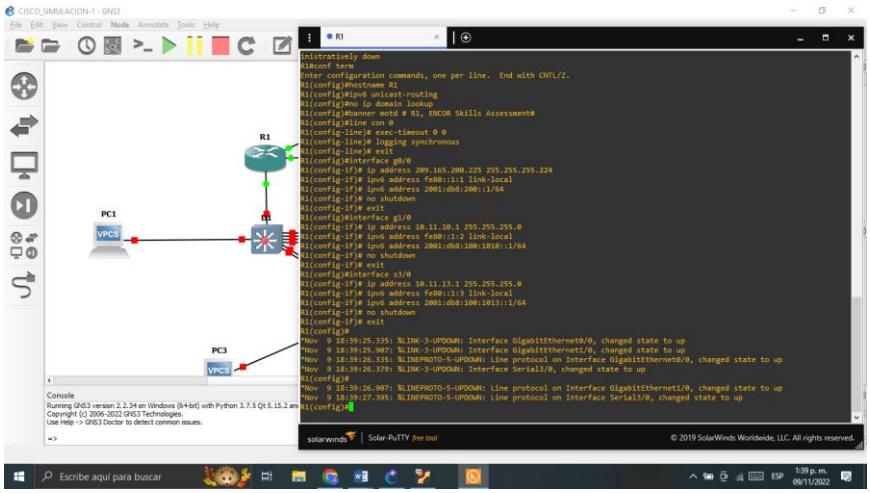

Figura 2. Configuración modo consola R1

R2

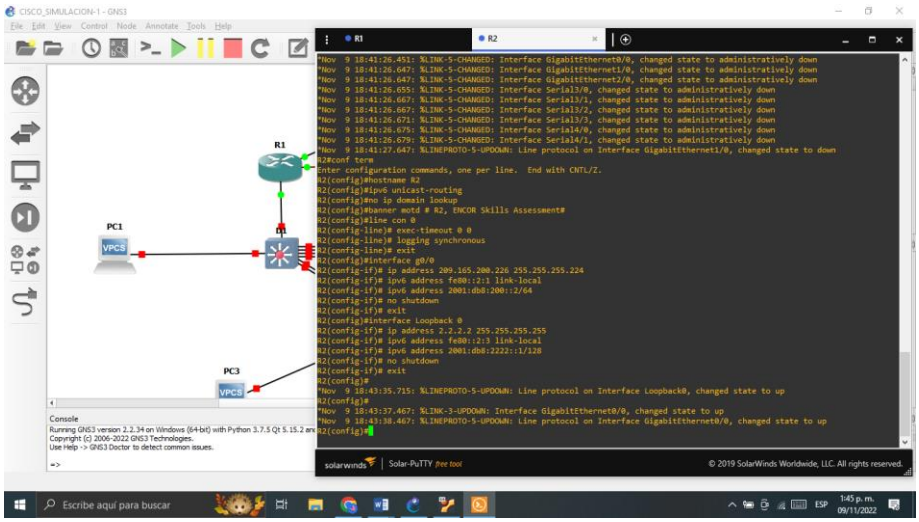

Figura 3. Configuración modo consola R2

R3

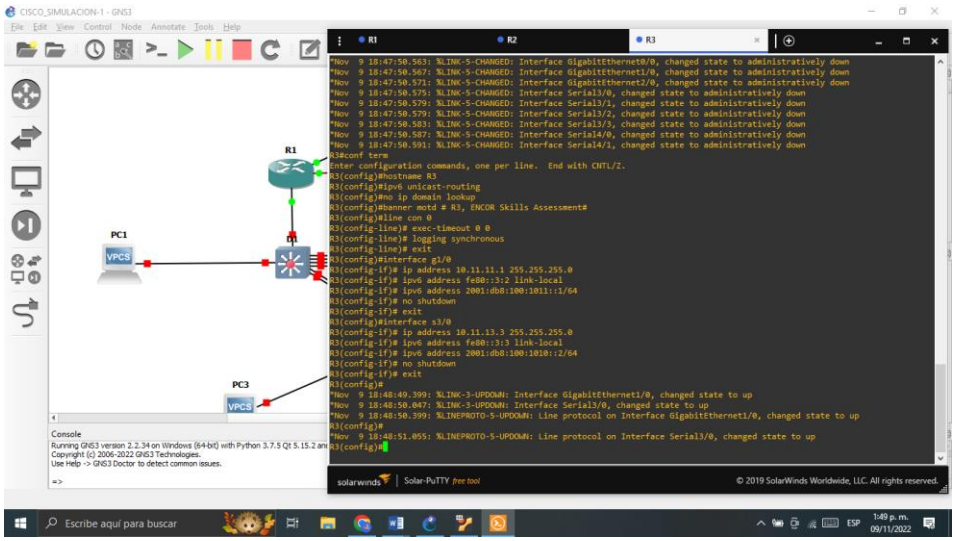

Figura 4. Configuración modo consola R3

D1

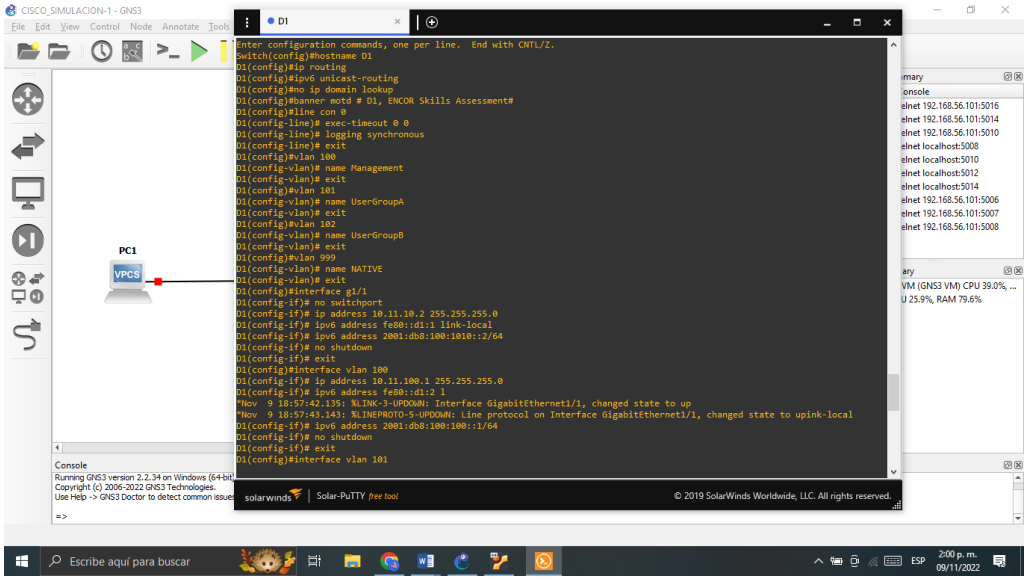

Figura 5. Configuración modo consola D1

D2

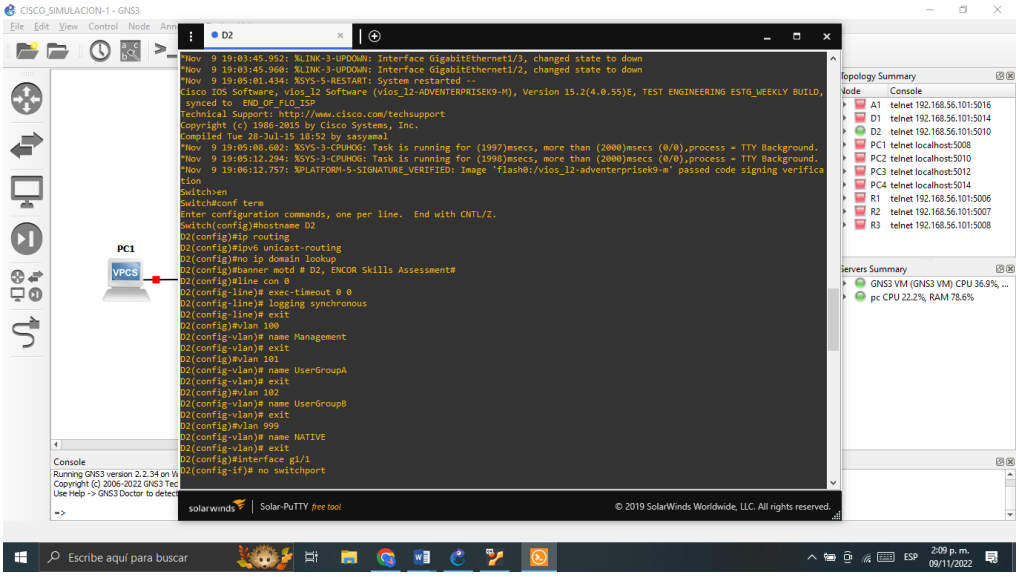

Figura 6. Configuración modo consola D2

A1

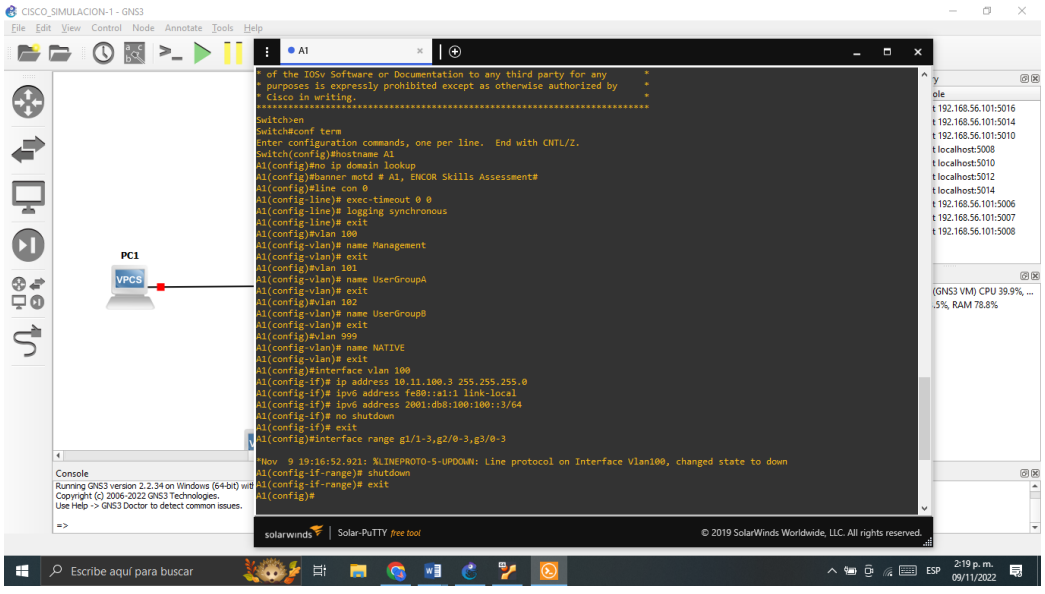

Figura 7. Configuracion modo consola A1

2. Configure the Layer 2 Network and Host Support

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

Your configuration tasks are as follows:

Tabla 2. Configuraciones

Task#	Task	Specification	Points
2.1	On all switches, configure IEEE 802.1Q trunk interfaces on interconnecting switch links	Enable 802.1Q trunk links between: • D1 and D2 • D1 and A1 • D2 and A1	6
2.2	On all switches, change the native VLAN on trunk links.	Use VLAN 999 as the native VLAN.	6
2.3	On all switches, enable the Rapid Spanning-Tree Protocol.	Use Rapid Spanning Tree.	3
2.4	On D1 and D2, configure the appropriate RSTP root bridges based on the information in the topology diagram. D1 and D2 must provide backup in case of root bridge failure.	Configure D1 and D2 as root for the appropriate VLANs with mutually supporting priorities in case of switch failure.	2
2.5	On all switches, create LACP EtherChannel as shown in the topology diagram.	Use the following channel numbers: • D1 to D2 – Port channel 12 • D1 to A1 – Port channel 1 • D2 to A1 – Port channel 2	3

Task#	Task	Specification	Points
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
2.8	Verify local LAN connectivity.	PC1 should successfully ping: • D1: 10.11.100.1 • D2: 10.11.100.2 • PC4: 10.68.100.6 PC2 should successfully ping: • D1: 10.11.102.1 • D2: 10.68.102.2 PC3 should successfully ping: • D1: 10.11.101.1 • D2: 10.11.101.2 PC4 should successfully ping: • D1: 10.11.100.1 • D2: 10.11.100.2 • PC1: 10.11.100.5	1

2.1 Enable 802.1Q trunk links between:

D1 and D2

D1 and A1

D2 and A1

switch D1
interface range g0/1-3, g1/0
switchport trunk encapsulation dot1q
switchport mode trunk
interface range g2/1-2
switchport trunk encapsulation dot1q
switchport mode trunk
Switch D2

interface range g0/1-3, g1/0
switchport trunk encapsulation dot1q
switch mode trunk
interface range g2/1-2
switchport trunk encapsulation dot1q
switchport mode trunk

switch A1

spanning-tree mode rapid-pvst
interface range g0/1-2
switchport trunk encapsulation dot1q
switchport mode trunk
interface range g0/3, g1/0
switchport trunk encapsulation dot1q
switchport mode trunk

2.2 Use VLAN 999 as the native VLAN.

Switch D1

interface range g0/1-3, g1/0
switchport trunk encapsulation dot1q
switchport mode trunk
switchport trunk native vlan 999

Interface range g2/1-2
switchport trunk encapsulation dot1q
switchport mode trunk
switchport trunk native vlan 999

Switch D2

```
interface range g0/1-3, g1/0
switchport trunk encapsulation dot1q
switch mode trunk
switchport trunk native vlan 999


interface range g2/1-2
switchport trunk encapsulation dot1q
switchport mode trunk
switchport trunk native vlan 999
```

Switch A1

```
spanning-tree mode rapid-pvst
interface range g0/1-2
switchport trunk encapsulation dot1q
switchport mode trunk
switchport trunk native vlan 999
interface range g0/3,g1/0
switchport trunk encapsulation dot1q
switchport mode trunk
switchport trunk native vlan 999
```

2.3 Use Rapid Spanning Tree.
Switch D1

```
interface range g0/1-3, g1/0
switchport trunk encapsulation dot1q
switchport mode trunk
switchport trunk native vlan 999
spanning-tree mode rapid-pvst
interface range g2/1-2
switchport trunk encapsulation dot1q
switchport mode trunk
switchport trunk native vlan 999
spanning-tree mode rapid-pvst
```

Switch D2

```
interface range g0/1-3, g1/0
switchport trunk encapsulation dot1q
switch mode trunk
```

switchport trunk native vlan 999
spanning-tree mode rapid-pvst
interface range g2/1-2
switchport trunk encapsulation dot1q
switchport mode trunk
switchport trunk native vlan 999
spanning-tree mode rapid-pvst

Switch A1

spanning-tree mode rapid-pvst
interface range g0/1-2
switchport trunk encapsulation dot1q
switchport mode trunk
switchport trunk native vlan 999
spanning-tree mode rapid-pvst
interface range g0/3, g1/0
switchport trunk encapsulation dot1q
switchport mode trunk
switchport trunk native vlan 999
spanning-tree mode rapid-pvst

2.4 Configure D1 and D2 as root for the appropriate VLANs with mutually supporting priorities in case of switch failure.

Switch D1

interface range g0/1-3, g1/0
switchport trunk encapsulation dot1q
switchport mode trunk
switchport trunk native vlan 999
interface range g2/1-2
switchport trunk encapsulation dot1q
switchport mode trunk
switchport trunk native vlan 999
spanning-tree mode rapid-pvst
spanning-tree vlan 100,102 root primary
spanning-tree vlan 101 root secondary

Switch D2

interface range g0/1-3, g1/0
switchport trunk encapsulation dot1q
switch mode trunk

switchport trunk native vlan 999
spanning-tree mode rapid-pvst
interface range g2/1-2
switchport trunk encapsulation dot1q
switchport mode trunk
switchport trunk native vlan 999
spanning-tree mode rapid-pvst
spanning-tree vlan 101 root primary
spanning-tree vlan 100,102 root secondary

Switch A1

spanning-tree mode rapid-pvst
interface range g0/1-2
switchport trunk encapsulation dot1q
switchport mode trunk
switchport trunk native vlan 999
interface range g0/3, g1/0
switchport trunk encapsulation dot1q
switchport mode trunk
switchport trunk native vlan 999
spanning-tree mode rapid-pvst
spanning-tree portfast

2.5 Use the following channel numbers:
D1 to D2 – Port channel 12
D1 to A1 – Port channel 1
D2 to A1 – Port channel 2

Switch D1

interface range g0/1-3, g1/0
switchport trunk encapsulation dot1q
switchport mode trunk
switchport trunk native vlan 999
channel-group 12 mode active
no shutdown
exit

interface range g2/1-2
switchport trunk encapsulation dot1q
switchport mode trunk

```
switchport trunk native vlan 999
channel-group 12 mode active
no shutdown
exit

spanning-tree mode rapid-pvst
spanning-tree vlan 100,102 root primary
spanning-tree vlan 101 root secondary
interface g2/3
switchport mode access
switchport access vlan 100
spanning-tree portfast
no shutdown
exit
end
```

Switch D2

```
interface range g0/1-3,g1/0
switchport trunk encapsulation dot1q
switch mode trunk
switchport trunk native vlan 999
channel-group 12 mode active
no shutdown
exit


interface range g2/1-2
switchport trunk encapsulation dot1q
switchport mode trunk
switchport trunk native vlan 999
channel-group 12 mode active
no shutdown
exit

spanning-tree mode rapid-pvst
spanning-tree vlan 101 root primary
spanning-tree vlan 100,102 root secondary
interface g2/3
switchport mode access
switchport access vlan 102
spanning-tree portfast
no shutdown
exit
end
```

switch A1

```
spanning-tree mode rapid-pvst
interface range g0/1-2
switchport trunk encapsulation dot1q
switchport mode trunk
switchport trunk native vlan 999
channel-group 1 mode active
no shutdown
exit

interface range g0/3, g1/0
switchport trunk encapsulation dot1q
switchport mode trunk
switchport trunk native vlan 999
channel-group 2 mode active
no shutdown
exit

interface range g2/3
switchport mode access
switchport access vlan 999
spanning-tree portfast
no shutdown
exit

interface range g3/0
switchport mode access
switchport access vlan 999
spanning-tree portfast
no shutdown
exit
end
```

2.6 Configure access ports with appropriate VLAN settings as shown in the topology diagram.
Host ports should transition immediately to forwarding state.

Switch D1

```
interface range g0/1-3, g1/0
switchport trunk encapsulation dot1q
switchport mode trunk
switchport trunk native vlan 999
channel-group 12 mode active
no shutdown
exit

interface range g2/1-2
switchport trunk encapsulation dot1q
switchport mode trunk
switchport trunk native vlan 999
channel-group 12 mode active
no shutdown
exit


spanning-tree mode rapid-pvst
spanning-tree vlan 100,102 root primary
spanning-tree vlan 101 root secondary
interface g2/3
switchport mode access
switchport access vlan 100
spanning-tree portfast
no shutdown
exit
end
```

Switch D2

```
interface range g0/1-3,g1/0
switchport trunk encapsulation dot1q
switch mode trunk
switchport trunk native vlan 999
channel-group 12 mode active
no shutdown
exit

interface range g2/1-2
switchport trunk encapsulation dot1q
switchport mode trunk
switchport trunk native vlan 999
channel-group 12 mode active
```

no shutdown
exit
spanning-tree mode rapid-pvst
spanning-tree vlan 101 root primary
spanning-tree vlan 100,102 root secondary
interface g2/3
switchport mode access
switchport access vlan 102
spanning-tree portfast
no shutdown
exit
end

switch A1

spanning-tree mode rapid-pvst
interface range g0/1-2
switchport trunk encapsulation dot1q
switchport mode trunk
switchport trunk native vlan 999
channel-group 1 mode active
no shutdown
exit
interface range g0/3,g1/0
switchport trunk encapsulation dot1q
switchport mode trunk
switchport trunk native vlan 999
channel-group 2 mode active
no shutdown
exit
interface range g2/3
switchport mode access
switchport access vlan 999
spanning-tree portfast
no shutdown
exit
interface range g3/0
switchport mode access
switchport access vlan 999
spanning-tree portfast
no shutdown
exit
end

A continuación, se presentan los comandos llevados a cabo en modo consola para D1, D2 y A1, en donde se resume lo realizado en los puntos 2.1, 2.2, 2.3, 2.4, 2.5, 2.6.2.7, 2.8

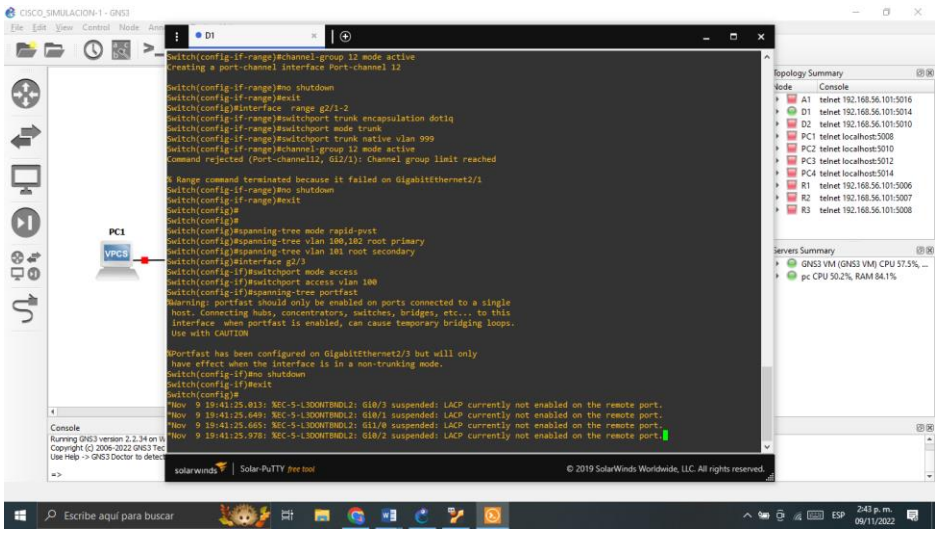

Figura 8. Configuración modo consola D1

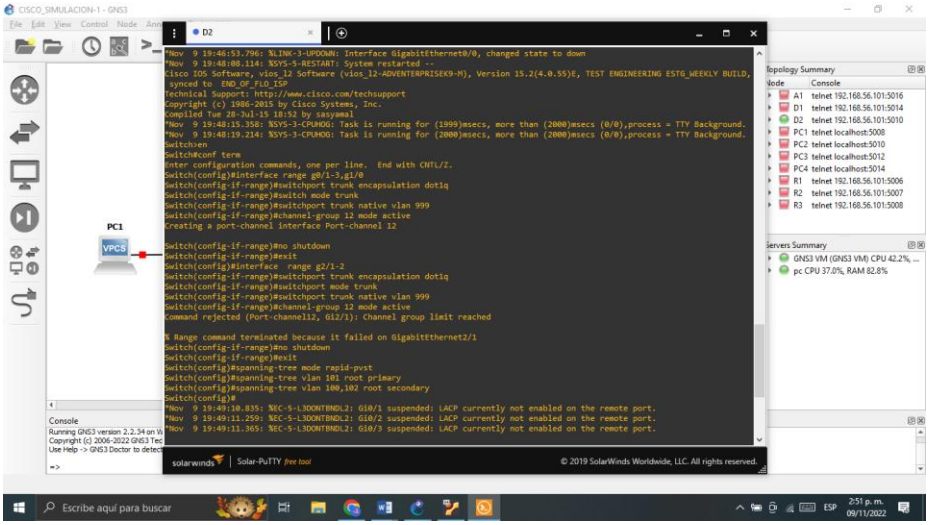

Figura 9. Configuración modo consola D2

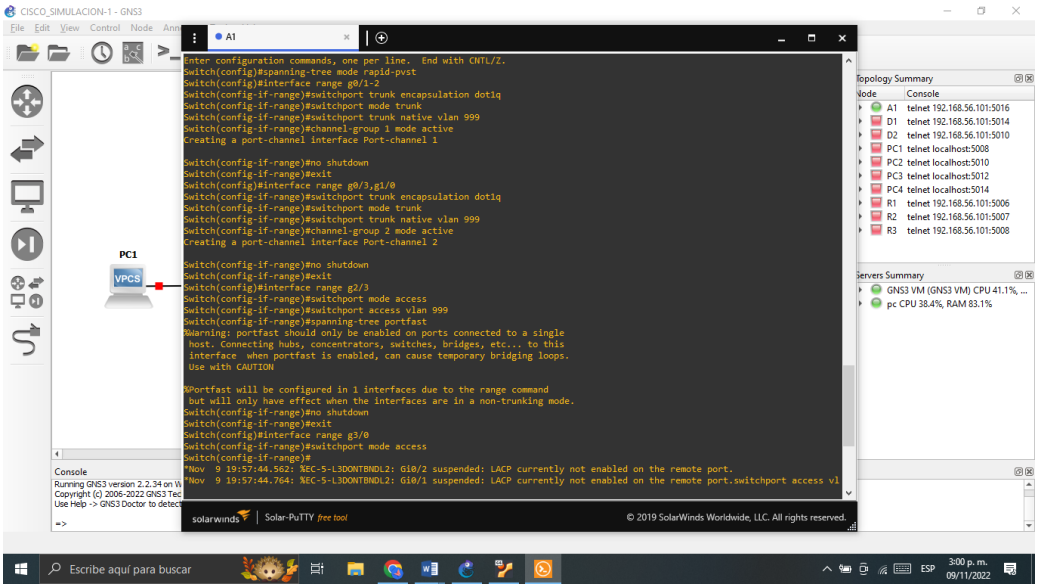

Figura 10. Configuración modo consola A1

Para ejecutar la simulación se debe tener instalado el virtual box con la configuración del nombre de la maquina

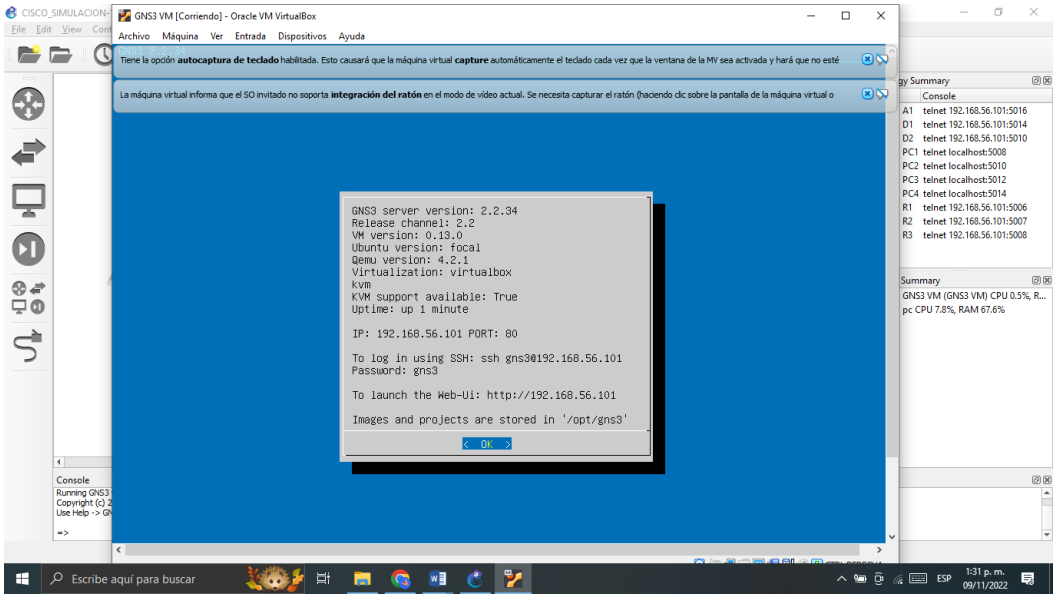

Figura 11. Ejecución GN3S server.

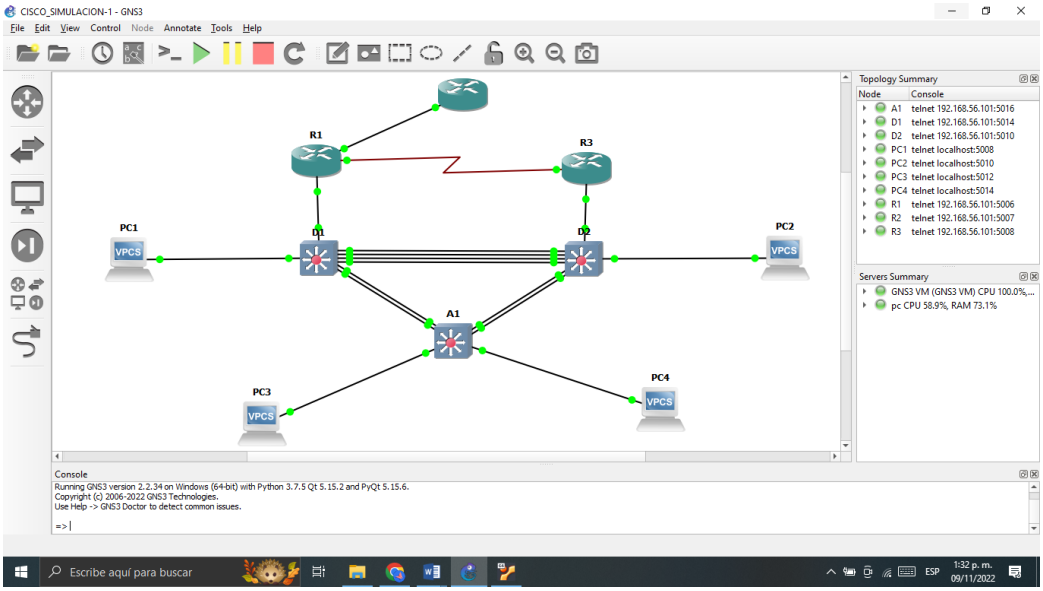

Figura 12. Esquema en funcionamiento.

Escenario 2

Part 3: Configure Routing Protocols

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

Tabla 3. Protocolos

Task#	Task	Specification	Points
3.1	On the “Company Network” (i.e., R1, R3, D1, and D2), configure single-area OSPFv2 in area 0.	Use OSPF Process ID **4** and assign the following router-IDs: • R1: 0.0.4.1 • R3: 0.0.4.3 • D1: 0.0.4.131 • D2: 0.0.4.132 On R1, R3, D1, and D2, advertise all directly connected networks / VLANs in Area 0. • On R1, do not advertise the R1 – R2 network. • On R1, propagate a default route. Note that the default route will be provided by BGP. Disable OSPFv2 advertisements on: • D1: All interfaces except E1/2 • D2: All interfaces except E1/0	8
3.2	On the “Company Network” (i.e., R1, R3, D1, and D2), configure classic single-area OSPFv3 in area 0.	Use OSPF Process ID **6** and assign the following router-IDs: • R1: 0.0.6.1 • R3: 0.0.6.3 • D1: 0.0.6.131 • D2: 0.0.6.132 On R1, R3, D1, and D2, advertise all directly connected networks / VLANs in Area 0. • On R1, do not advertise the R1 – R2 network. • On R1, propagate a default route. Note that the default route will be provided by BGP. Disable OSPFv3 advertisements on: • D1: All interfaces except E1/2 • D2: All interfaces except E1/0	8

Task#	Task	Specification	Points
3.3	On R2 in the “ISP Network”, configure MP-BGP.	Configure two default static routes via interface Loopback 0: • An IPv4 default static route. • An IPv6 default static route. Configure R2 in BGP ASN **500** and use the router-id 2.2.2.2. Configure and enable an IPv4 and IPv6 neighbor relationship with R1 in ASN 300. In IPv4 address family, advertise: • The Loopback 0 IPv4 network (/32). • The default route (0.0.0.0/0). In IPv6 address family, advertise: • The Loopback 0 IPv4 network (/128). • The default route (::/0).	4
3.4	On R1 in the “ISP Network”, configure MP-BGP.	Configure two static summary routes to interface Null 0: • A summary IPv4 route for 10.XY.0.0/8. • A summary IPv6 route for 2001:db8:100::/48. Configure R1 in BGP ASN **300** and use the router-id 1.1.1.1. Configure an IPv4 and IPv6 neighbor relationship with R2 in ASN 500. In IPv4 address family: • Disable the IPv6 neighbor relationship. • Enable the IPv4 neighbor relationship. • Advertise the 10.XY.0.0/8 network. In IPv6 address family: • Disable the IPv4 neighbor relationship. • Enable the IPv6 neighbor relationship. • Advertise the 2001:db8:100::/48 network.	4

3.1

R1# show run | section router ospf

```
router ospf 4
router-id 0.0.4.1
network 10.11.10.0 0.0.0.255 area 0
network 10.11.13.0 0.0.0.255 area 0
default-information originate
```

R3# show run | section router ospf

```
router ospf 4
router-id 0.0.4.3
network 10.11.11.0 0.0.0.255 area 0
network 10.11.13.0 0.0.0.255 area 0
```

D1# show run | section ^router ospf

```
router ospf 4
router-id 0.0.4.131
passive-interface default
no passive-interface GigabitEthernet1/0/11
network 10.11.10.0 0.0.0.255 area 0
network 10.11.100.0 0.0.0.255 area 0
network 10.11.101.0 0.0.0.255 area 0
network 10.11.102.0 0.0.0.255 area 0
```

D2# show run | section router ospf

```
router ospf 4
router-id 0.0.4.132
passive-interface default
no passive-interface GigabitEthernet1/0/11
network 10.11.11.0 0.0.0.255 area 0
network 10.11.100.0 0.0.0.255 area 0
network 10.11.101.0 0.0.0.255 area 0
network 10.11.102.0 0.0.0.255 area 0
```

3.2

R1# show run | section ipv6 router

```
ipv6 router ospf 6
router-id 0.0.6.1
default-information originate
R1# show ipv6 ospf interface brief
Interface    PID   Area            Intf ID    Cost  State Nbrs F/C
Se0/1/0      6     0               7          49    P2P   1/1
Gi0/0/1      6     0               6          1     DR    1/1
```

R3# show run | section ^ipv6 router
ipv6 router ospf 6
router-id 0.0.6.3
R3# show ipv6 ospf interface brief

Interface	PID	Area	Intf ID	Cost	State	Nbrs F/C
Se0/1/0	6	0	7	50	P2P	1/1
Gi0/0/1	6	0	6	1	DR	1/1

D1# show run | section ^ipv6 router
ipv6 router ospf 6
router-id 0.0.6.131
passive-interface default
no passive-interface GigabitEthernet1/0/11
D1# show ipv6 ospf interface brief

Interface	PID	Area	Intf ID	Cost	State	Nbrs F/C
Vl102	6	0	41	1	DR	0/0
Vl101	6	0	40	1	DR	0/0
Vl100	6	0	39	1	DR	0/0
Gi1/0/11	6	0	38	1	BDR	1/1

D2# show run | section ^ipv6 router
ipv6 router ospf 6
router-id 0.0.6.132
passive-interface default
no passive-interface GigabitEthernet1/0/11
D2# show ipv6 ospf interface brief

Interface	PID	Area	Intf ID	Cost	State	Nbrs F/C
Vl102	6	0	41	1	DR	0/0
Vl101	6	0	40	1	DR	0/0
Vl100	6	0	39	1	DR	0/0
Gi1/0/11	6	0	38	1	BDR	1/1

3.3
R2# show run | section router bgp
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
network 2.2.2.2 mask 255.255.255.255
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

R2# show run | include route
router bgp 500
bgp route-id 2.2.2.2
ip route 0.0.0.0 0.0.0.0 Loopback0
ipv6 route::/0 Loopback0

3.4

R1# show run | section bgp
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
network 10.0.0.0
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

Part 4: Configure First Hop Redundancy

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

Your configuration tasks are as follows:

Tabla 4. Configuraciones de redundancia

Task#	Task	Specification	Points
4.1	On D1, create IP SLAs that test the reachability of R1 interface G0/0/1.	Create two IP SLAs. • Use SLA number **4** for IPv4. • Use SLA number **6** for IPv6. The IP SLAs will test availability of R1 E1/2 interface every 5 seconds. Schedule the SLA for immediate implementation with no end time. Create an IP SLA object for IP SLA 4 and one for IP SLA 6. • Use track number **4** for IP SLA 4. • Use track number **6** for IP SLA 6. The tracked objects should notify D1 if the IP SLA state changes from down to up after 10 seconds, or from up to down after 15 seconds.	2
4.2	On D2, create IP SLAs that test the reachability of R3 interface G0/0/1.	Create two IP SLAs. • Use SLA number **4** for IPv4. • Use SLA number **6** for IPv6. The IP SLAs will test availability of R3 E1/0 interface every 5 seconds. Schedule the SLA for immediate implementation with no end time. Create an IP SLA object for IP SLA 4 and one for IP SLA 6. • Use track number **4** for IP SLA 4. • Use track number **6** for IP SLA 6. The tracked objects should notify D1 if the IP SLA state changes from down to up after 10 seconds, or from up to down after 15 seconds.	2

Task#	Task	Specification	Points
4.3	On D1, configure HSRPv2	D1 is the primary router for VLANs 100 and 102; therefore, their priority will also be changed to 150. Configure HSRP version 2. Configure IPv4 HSRP group **104** for VLAN 100: • Assign the virtual IP address **10.XY.100.254**. • Set the group priority to **150**. • Enable preemption. • Track object 4 and decrement by 60. Configure IPv4 HSRP group **114** for VLAN 101: • Assign the virtual IP address **10.XY.101.254**. • Enable preemption. • Track object 4 to decrement by 60. Configure IPv4 HSRP group **124** for VLAN 102: • Assign the virtual IP address **10.XY.102.254**. • Set the group priority to **150**. • Enable preemption. • Track object 4 to decrement by 60. Configure IPv6 HSRP group **106** for VLAN 100: • Assign the virtual IP address using **ipv6 autoconfig**. • Set the group priority to **150**. • Enable preemption. • Track object 6 and decrement by 60. Configure IPv6 HSRP group **116** for VLAN 101: • Assign the virtual IP address using **ipv6 autoconfig**. • Enable preemption.	8

Task#	Task	Specification	Points
		• Track object 6 and decrement by 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.	
	On D2, configure HSRPv2.	D2 is the primary router for VLAN 101; therefore, the priority will also be changed to 150. Configure HSRP version 2. Configure IPv4 HSRP group **104** for VLAN 100: • Assign the virtual IP address **10.XY.100.254**. • Enable preemption. • Track object 4 and decrement by 60. Configure IPv4 HSRP group **114** for VLAN 101: • Assign the virtual IP address **10.XY.101.254**. • Set the group priority to **150**. • Enable preemption. • Track object 4 to decrement by 60. Configure IPv4 HSRP group **124** for VLAN 102: • Assign the virtual IP address **10.XY.102.254**. • Enable preemption. • Track object 4 to decrement by 60. Configure IPv6 HSRP group **106** for VLAN 100: • Assign the virtual IP address using **ipv6 autoconfig**. • Enable preemption.	

Task#	Task	Specification	Points
		• Track object 6 and decrement by 60. Configure IPv6 HSRP group **116** for VLAN 101: • Assign the virtual IP address using **ipv6 autoconfig**. • Set the group priority to **150**. • Enable preemption. • Track object 6 and decrement by 60. Configure IPv6 HSRP group **126** for VLAN 102: • Assign the virtual IP address using **ipv6 autoconfig**. • Enable preemption. Track object 6 and decrement by 60.	

4.1

```
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 10.11.10.1
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
```

4.2

```
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 10.11.11.1
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

4.3

D1

ip sla 4
icmp-echo 10.11.10.1
frequency 5
exit
ip sla 6
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
delay down 10 up 15
exit
track 6 ip sla 6
delay down 10 up 15
exit
interface vlan 100
standby version 2
standby 104 ip 10.11.100.254
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
exit

```
interface vlan 101
standby version 2
standby 114 ip 10.0.101.254
standby 114 preempt
standby 114 track 4 decrement 60
standby 116 ipv6 autoconfig
standby 116 preempt
standby 116 track 6 decrement 60
exit
interface vlan 102
standby version 2
standby 124 ip 10.11.102.254
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
exit
end
```

D2

```
ip sla 4
icmp-echo 10.11.11.1
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
interface vlan 100
standby version 2
standby 104 ip 10.11.100.254
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 10.11.101.254
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 10.11.102.254
standby 124 preempt
standby 124 track 4 decrement 60
standby 126 ipv6 autoconfig
standby 126 preempt
standby 126 track 6 decrement 60
exit
end
```

CONCLUSION

En conclusión, respecto al trabajo realizado se logra identificar como las herramientas indicadas por la universidad como son: En este caso: Gns3, Packet Tracer, VirtualBox. Se permitió profundizar en conceptos al igual que en procesos que se deben tener en cuenta al realizar un diagrama de red o simplemente una configuración que requiera de limitaciones a ciertos dispositivos dentro de una red o lo contrario, permitir conectividad en dispositivos configurados de la red teniendo en cuenta comandos, protocolos, reglas, todo esto mediante consolas de gestión.

Se llevó a cabo cada uno de los enrutamientos de red, esquema y protocolos, así como la configuración de dispositivos para la correcta comunicación entre ellos, permitiendo el flujo de datos a través de los medios de conexión.

A partir del uso de las diferentes herramientas dispuestas en Packet Tracer, Gns3, se pudo llevar a cabo cada uno de los pasos propuestos, teniendo en cuenta los diferentes protocolos de administración de redes, desempeño del router, esquemas de direccionamiento IP, enrutamiento y herramientas de simulación. En ambientes de red de alto rango donde la disponibilidad de los recursos se consume en gran tamaño, se hace necesario la implementación de soluciones redundantes donde soluciones como HSRP para los Router y Etherchannel permiten alternativas de solución a la necesidad.

REFERENCIAS BIBLIOGRAFICAS

Edgeworth, B., Garza Rios, B., Gooley, J., Hucaby, D. (2020). CISCO Press (Ed). Multiple Spanning Tree Protocol. CCNP and CCIE Enterprise Core ENCOR 350-401. Recuperado de https://1drv.ms/b/s!AAIGg5JUgUBthk8

Froom, R., Frahim, E. (2015). CISCO Press (Ed). Spanning Tree Implementation. Implementing Cisco IP Switched Networks (SWITCH) Foundation Learning Guide CCNP SWITCH 300-115. Recuperado de https://1drv.ms/b/s!AmIJYeiNT1llnWR0hoMxgBNv1CJ

Edgeworth, B., Garza Rios, B., Gooley, J., Hucaby, D. (2020). “CISCO Press (Ed). Multicast. CCNP and CCIE Enterprise Core ENCOR 350-401”. {En línea}. {20 de octubre de 2022}. Disponible en: https://1drv.ms/b/s!AAIGg5JUgUBthk8

HSRP Versión 2 (s.f), 27 Mayo de 2018, recuperado de https://www.cisco.com/c/en/us/td/docs/ios-xml/ios/ipapp_fhrp/configuration/xe3s/fhp-xe-3s-book/fhp-hsr

CISCO. (2019). VLAN. Principios de Enrutamiento y Conmutación. Recuperado de: https://static-course-assets.s3.amazonaws.com/RSE6/es/index.html#6