PASO 11 INFORME FINAL: PRUBA DE HABILIDADES PRACTICAS CCNP

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INGENIERIA ELECTRONICA
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GLOSARIO

GNS3: Se puede definir como un simulador gráfico, el cual es utilizado para diseñar topologías de red complejas permitiéndonos la simulación de elementos para ayudarnos a realizar simulaciones para configurar una red virtual, pero asemejándose a la realidad.

CISCO PACKET TRACER: Se puede definir como un simulador de red de enseñanza y aprendizaje que utilizan los estudiantes en el área de topologías de redes para realizar practicas virtuales de diseño y configuración.

IP: Se define como una dirección numérica única y que identifica a un dispositivo en internet o una red local.

VLAN: Se define como una red de área local virtual creada a partir de varias LAN, utilizado para crear redes privadas.

ROUTERS: Es un dispositivo de enrutamiento que permite interconectar redes con distintos prefijos en su dirección.

SWITCHS: Es un dispositivo que permite la conexión de computadoras y periféricas a la red pueden comunicarse entre si y otras redes.

RESUMEN

En el siguiente trabajo el estudiante pondrá en práctica los conocimientos adquiridos en el transcurso de sus estudios profesionales y con el apoyo de este Diplomado se mostrarán diferentes escenarios de simulaciones de red realizadas a través del simulador grafico GNS3, el cual nos permitió diseñar topologías de redes complejas que se implementaron según el comportamiento que iban mostrando durante el desarrollo de la actividad, haciendo uso del protocolo STP y configuraciones VLANs.
A medida que se va desarrolla el trabajo, se mostraran a través de las imágenes el comportamiento y cumplimiento de la actividad.

PALABRAS CLAVE: VLANs, SWITCHS, ROUTERS, CISCO, CCNP, Redes.

ABSTRACT

In the following work, the student will put into practice the knowledge acquired in the course of his professional studies and with the support of this Diploma, different network simulation scenarios will be shown through the GNS3 graphic simulator, which allowed us to design network topologies. complex that were implemented according to the behavior that they were showing during the development of the activity, making use of the STP protocol and VLAN configurations.
As the work is developed, the behavior and fulfillment of the activity will be shown through the images.

KEY WORDS: VLANs, SWITCHS, ROUTERS, CISCO, CCNP, Redes.

INTRODUCCIÓN

Durante el desarrollo de este trabajo, se realizará un análisis al caso entregado en la guía de actividades con respecto a la configuración de redes conmutadas usando el protocolo STP y la configuración de VLANs. Además de configurar, diseñar e implementar redes jerárquicas convergentes brindándonos la oportunidad de poner en práctica las habilidades aprendidas para solucionar problemas de redes básicos y avanzados en protocolos de enrutamiento.

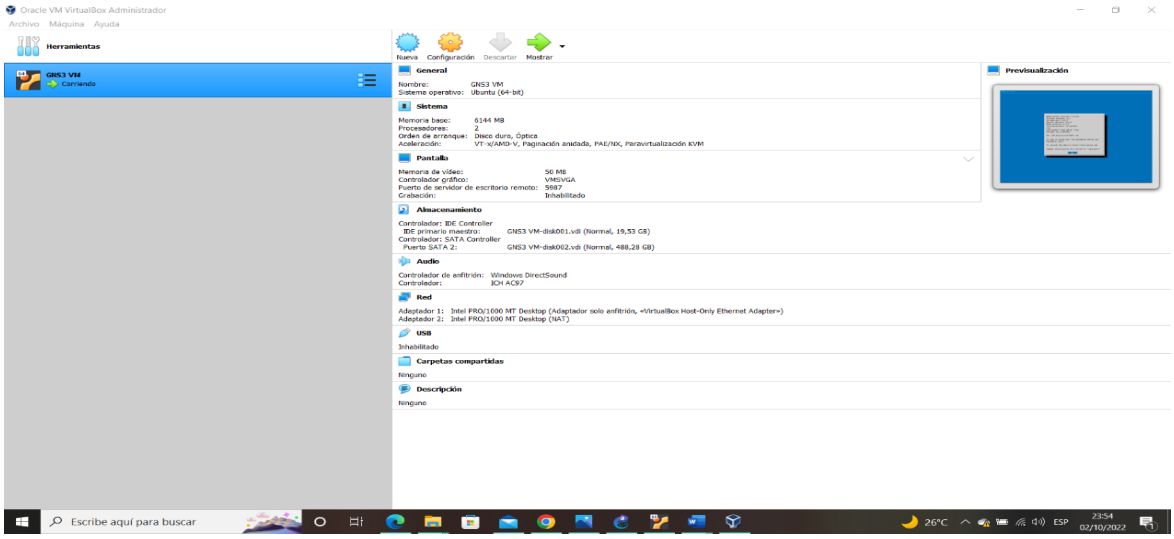
Continuando con lo anterior, también se van a diseñar diferentes soluciones de redes escalables con el uso de configuraciones básicas y avanzadas de protocolos de enrutamiento, logrando así la implementación de servicios IP con calidad en redes empresariales LAN y WAN, lo que permitirá crear un acceso seguro mediante la automatización y virtualización de la red en este tipo de ambientes corporativos en el que la información es confidencial y muchas veces las empresas se encuentran vulnerables ante cualquier tipo de ataques

DESARROLLO DEL ESCENARIO 1 PRUEBA DE HABILIDADES

Instalación de la VM

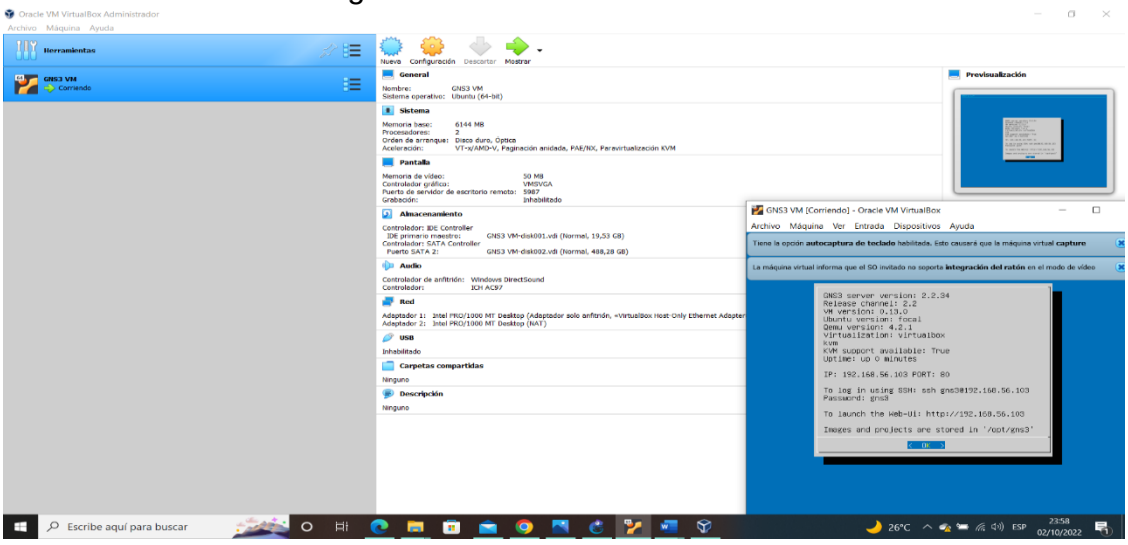
De acuerdo a los requenetos establecidos en la guía de actividades, se procede a descargar, instalar y configurar los softwares de simulación con los que se va a trabajar en el desarrollo de esta actividad

Figura 1. importación de la VM en VirtualBox y su configuración



A continuación, se muestra la configuración de la maquina VM de acuerdo a los recursos con los que dispone el computador.

Figura 2. VM en funcionamiento



Siguiendo las indicaciones de la guía de actividades y las recomendaciones entregadas por el tutor, se procede a configurar el simulador GNS3 en nuestro PC.

A continuación, se procede a importar las imágenes del Routers y los Switchs que se van a utilizar durante el desarrollo de la actividad.

Figura 3. Importación de imagen del Router c7200

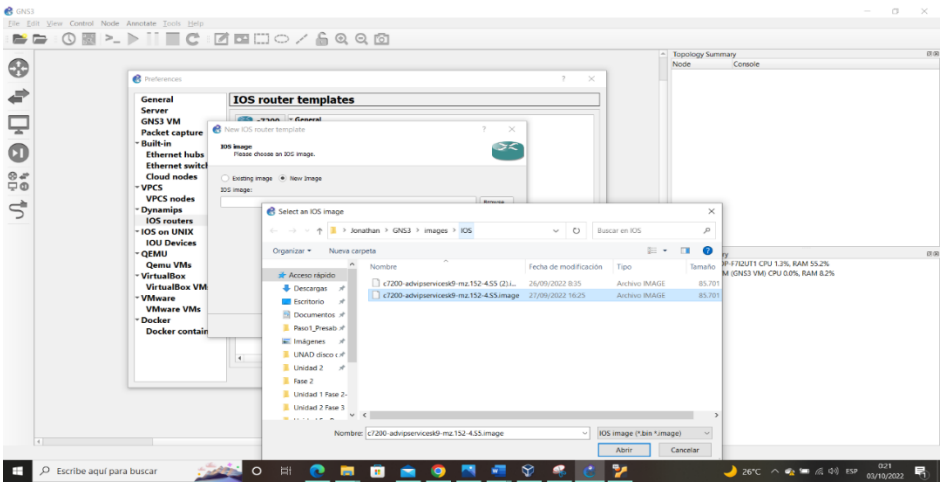
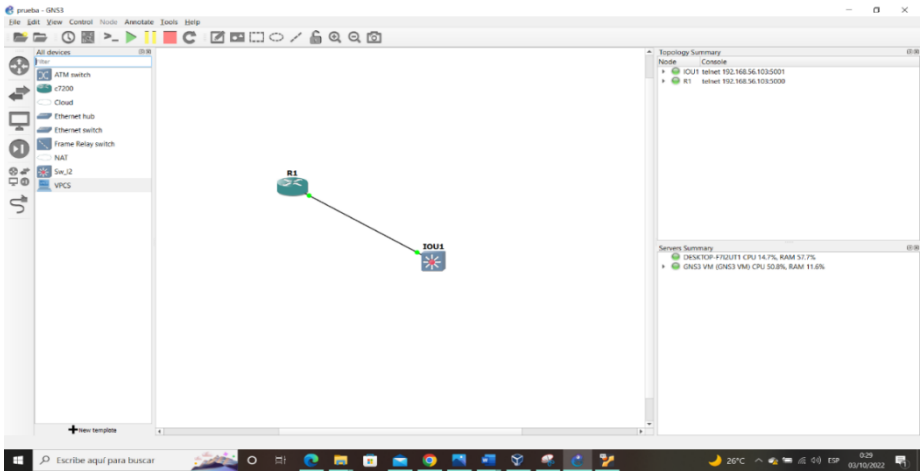


Figura 4. Pruebas al Routers y Switchs



Topology

Figura 5. Escenario 1

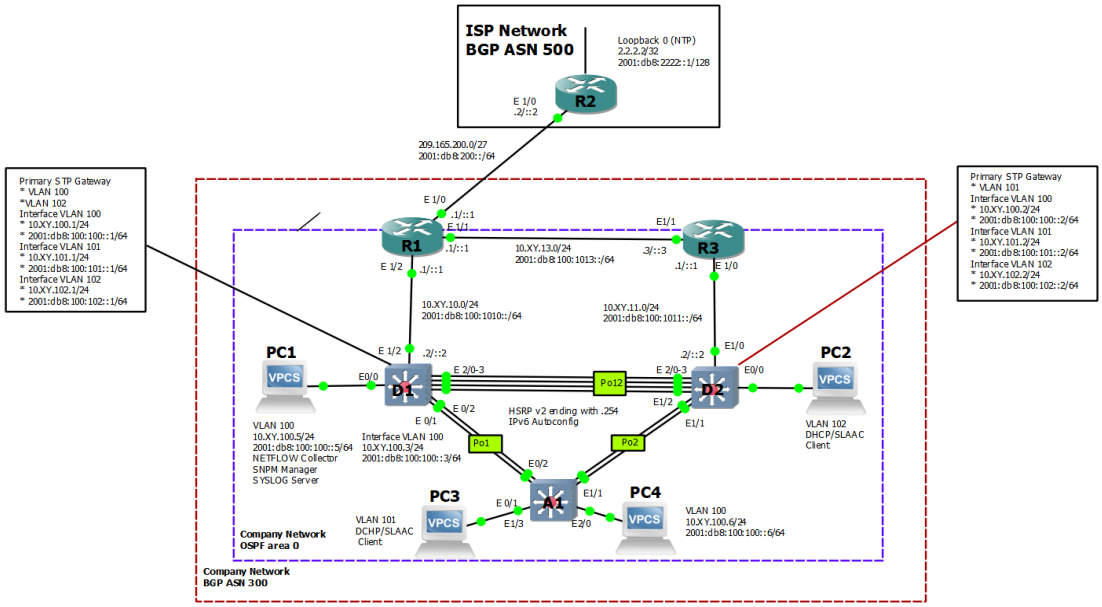


Tabla N0. 1. Tabla de Direccionamiento

Device	Interface	IPv4 Address	IPv6 Address	IPv6 Link - Local
R1	E1/0	209.165.200.225/27	2001:db8:200::1/64	fe80::1:1
	E1/2	10.32.10.1/24	2001:db8:100:1010::1/64	fe80::1:2
	E1/1	10. 32.13.1/24	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
	Loopback0	2.2.2.2/32	2001:db8:2222::1/128	fe80::2:3
R3	E1/0	10. 32.11.1/24	2001:db8:100:1011::1/64	fe80::3:2
	E1/1	10. 32.13.3/24	2001:db8:100:1013::3/64	fe80::3:3
D1	E1/2	10. 32.10.2/24	2001:db8:100:1010::2/64	fe80::d1:1
	VLAN 100	10. 32.100.1/24	2001:db8:100:100::1/64	fe80::d1:2
	VLAN 101	10.32.101.1/24	2001:db8:100:101::1/64	fe80::d1:3
	VLAN 102	10.32.102.1/24	2001:db8:100:102::1/64	fe80::d1:4
D2	E1/0	10.32.11.2/24	2001:db8:100:1011::2/64	fe80::d2:1
	VLAN 100	10.32.100.2/24	2001:db8:100:100::2/64	fe80::d2:2
	VLAN 101	10.32.101.2/24	2001:db8:100:101::2/64	fe80::d2:3
	VLAN 102	10.32.102.2/24	2001:db8:100:102::2/64	fe80::d2:4
A1	VLAN 100	10.32.100.3/23	2001:db8:100:100::3/64	fe80::a1:1
PC1	NIC	10.32.100.5/24	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

Objectives

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

Addressing Part 2: Configure the Layer 2 Network and Host Support

Part 3: Configure Routing

Protocols Part 4: Configure First-

Hop Redundancy

Background / Scenario

In this skills assessment, you are responsible for completing the configuration of the network so there is full end-to-end reachability, so the hosts have reliable default gateway support, and so that management protocols are operational within the “Company Network” part of the topology.

Be careful to verify that your configurations meet the provided specifications and that the devices perform as required.

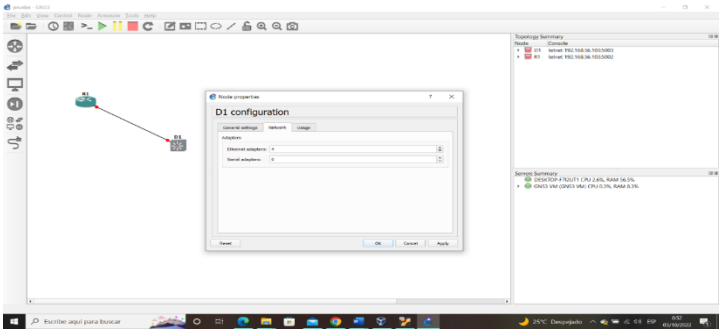
Note: The routers used with CCNP hands-on labs are Cisco 7200 routers. The switches used in the labs are Cisco Catalyst L2 switches Other routers, switches, and Cisco IOS versions can be used. Depending on the model and Cisco IOS version, the commands available and the output produced might vary from what is shown in the labs.

Note: Make sure that the switches have been erased and have no startup configurations. If you are unsure, contact your instructor.

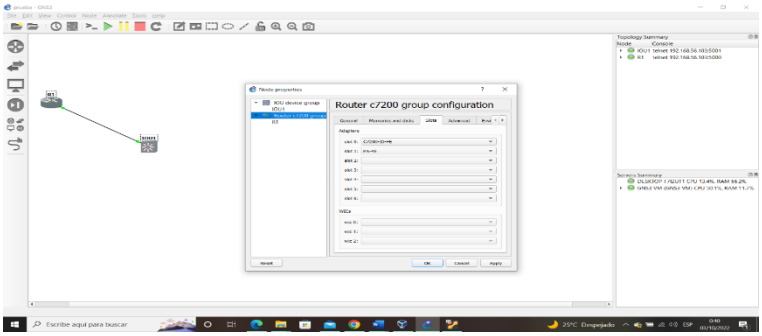
Note: The letters "X, Y" represent the last two digits of your ID number (cédula).

Required Resources

- 3 Routers (Cisco 7200). Click on the download link of the images for GNS3.
- 3 Switches (Cisco IOU L2). Click on the download link of the images for GNS3.
- 4 PCs (Use the GNS3’s VPCS)
- After the configuration of devices in GNS3, the Slots of the network adapters of the SW must be configured as follows:



And of the Routers like this:



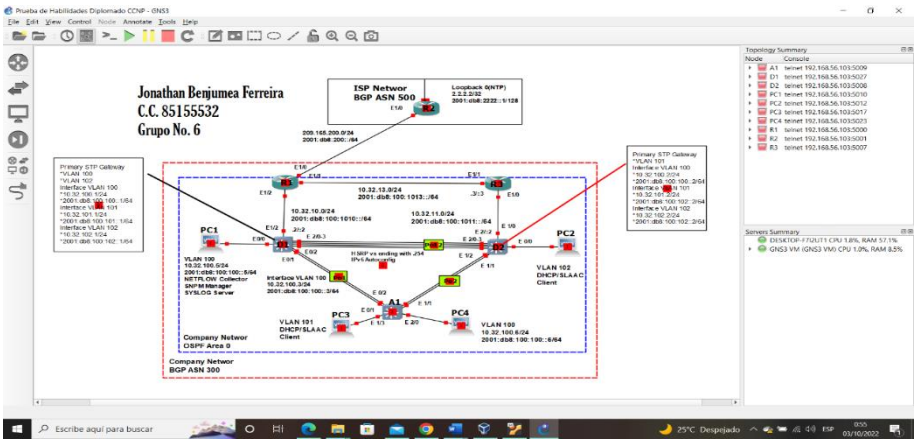
Build the Network and Configure Basic Device Settings and Interface Addressing

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

Cable the network as shown in the topology.

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

Figura 6. Escenario propio



Configure basic settings for each device.

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

Router R1

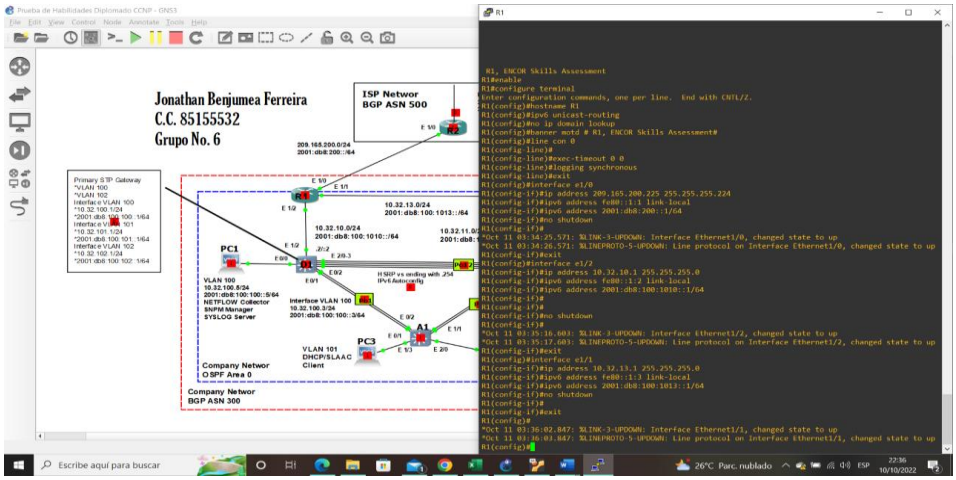
hostname R1

ipv6 unicast-routing

no ip domain lookup

banner motd # R1, ENCOR Skills Assessment#
line con 0
exec-timeout 0 0
logging synchronous
exit
interface e1/0
ip address 209.165.200.225 255.255.255.224
ipv6 address fe80::1:1 link-local
ipv6 address 2001:db8:200::1/64
no shutdown
exit
interface e1/2
ip address 10.32.10.1 255.255.255.0
ipv6 address fe80::1:2 link-local
ipv6 address 2001:db8:100:1010::1/64
no shutdown
exit
interface e1/1
ip address 10.32.13.1 255.255.255.0
ipv6 address fe80::1:3 link-local
ipv6 address 2001:db8:100:1013::1/64
no shutdown
exit

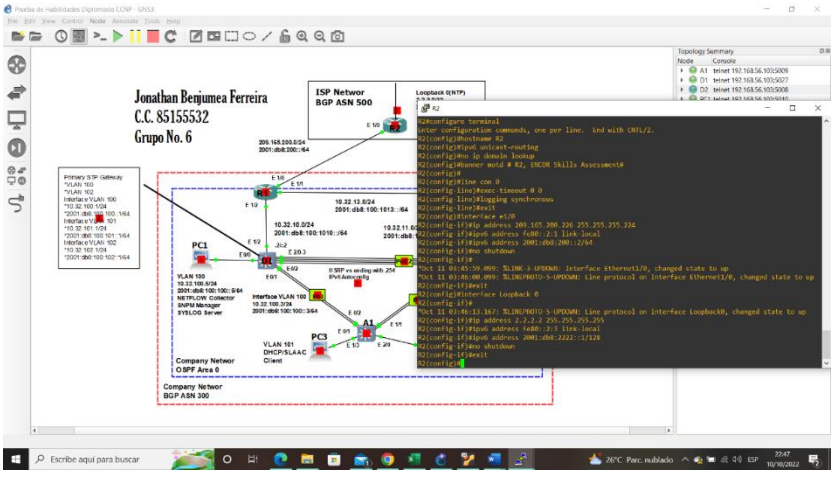
Figura 7. Configuración de R1



Router R2

```
hostname R2
ipv6 unicast-routing
no ip domain lookup
banner motd # R2, ENCOR Skills Assessment#
line con 0
exec-timeout 0 0
logging synchronous
exit
interface e1/0
ip address 209.165.200.226 255.255.255.224
ipv6 address fe80::2:1 link-local
ipv6 address 2001:db8:200::2/64
no shutdown
exit
interface Loopback 0
ip address 2.2.2.2 255.255.255.255
ipv6 address fe80::2:3 link-local
ipv6 address 2001:db8:2222::1/128
no shutdown
exit
```

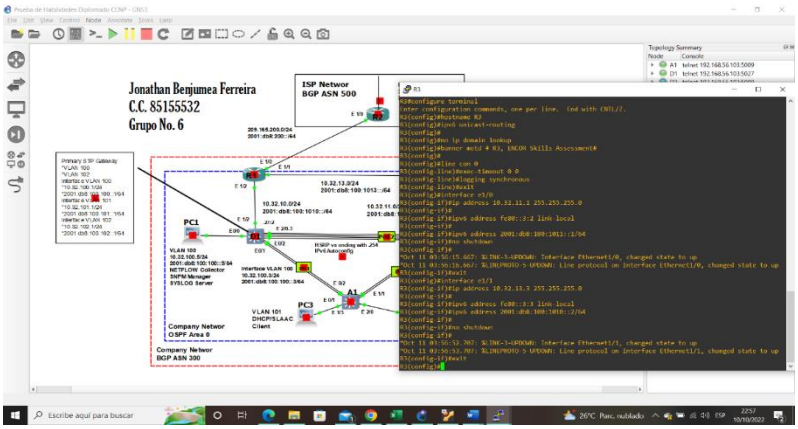
Figura 8. Configuración de R2



Router R3

```
hostname R3
ipv6 unicast-routing
no ip domain lookup
banner motd # R3, ENCOR Skills Assessment#
line con 0
exec-timeout 0 0
logging synchronous
exit
interface e1/0
ip address 10.32.11.1 255.255.255.0
ipv6 address fe80::3:2 link-local
ipv6 address 2001:db8:100:1011::1/64
no shutdown
exit
interface e1/1
ip address 10.32.13.3 255.255.255.0
ipv6 address fe80::3:3 link-local
ipv6 address 2001:db8:100:1010::2/64
no shutdown
exit
```

Figura 9. Configuración de R3



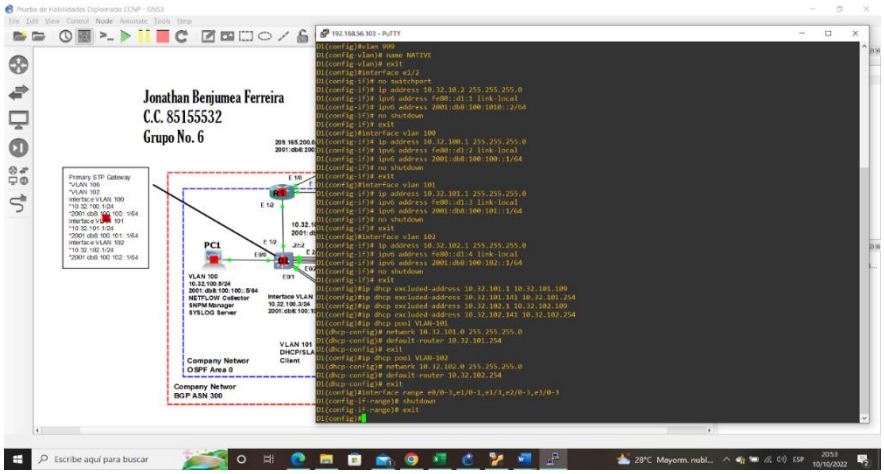
Switch D1

```
hostname D1
ip routing
ipv6 unicast-routing
no ip domain lookup
banner motd # D1, ENCOR Skills Assessment#
line con 0
exec-timeout 0 0
logging synchronous
exit
vlan 100
name Management
exit
vlan 101
name UserGroupA
exit
vlan 102
name UserGroupB
exit
vlan 999
name NATIVE
exit
interface e1/2
no switchport
ip address 10.32.10.2 255.255.255.0
```

```
ipv6 address fe80::d1:1 link-local
ipv6 address 2001:db8:100:1010::2/64
no shutdown
exit
interface vlan 100
ip address 10.32.100.1 255.255.255.0
ipv6 address fe80::d1:2 link-local
ipv6 address 2001:db8:100:100::1/64
no shutdown
exit
interface vlan 101
ip address 10.32.101.1 255.255.255.0
ipv6 address fe80::d1:3 link-local
ipv6 address 2001:db8:100:101::1/64
no shutdown
exit
interface vlan 102
ip address 10.32.102.1 255.255.255.0
  ipv6 address fe80::d1:4 link-local
ipv6 address 2001:db8:100:102::1/64
no shutdown
exit
ip dhcp excluded-address 10.32.101.1 10.32.101.109
ip dhcp excluded-address 10.32.101.141 10.32.101.254
ip dhcp excluded-address 10.32.102.1 10.32.102.109
ip dhcp excluded-address 10.32.102.141 10.32.102.254
ip dhcp pool VLAN-101
 network 10.32.101.0 255.255.255.0
 default-router 10.32.101.254


exit
ip dhcp pool VLAN-102
network 10.32.102.0 255.255.255.0
default-router 10.32.102.254
exit
interface range e0/0-3,e1/0-1,e1/3,e2/0-3,e3/0-3
shutdown
exit
```

Figura 10. Configuración de Switch D1

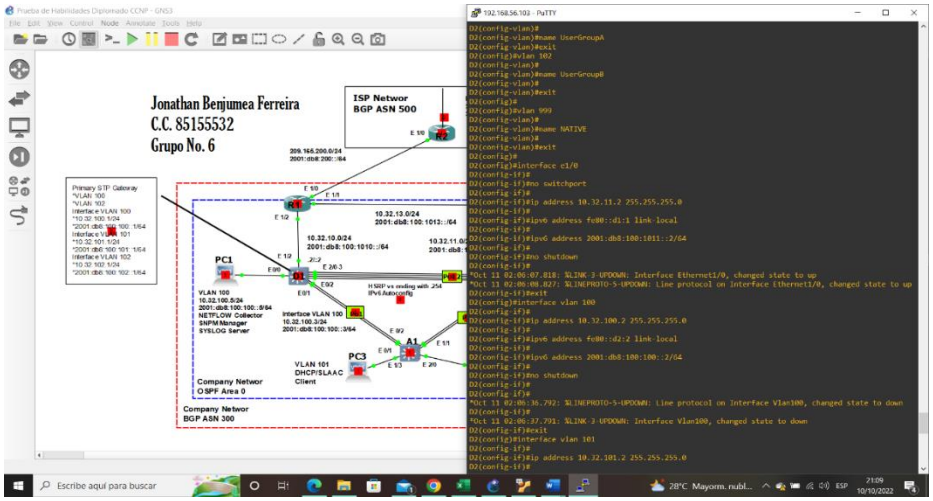


Switch D2

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

```
ip address 10.32.11.2 255.255.255.0
ipv6 address fe80::d1:1 link-local
ipv6 address 2001:db8:100:1011::2/64
no shutdown
exit
interface vlan 100
ip address 10.32.100.2 255.255.255.0
ipv6 address fe80::d2:2 link-local
ipv6 address 2001:db8:100:100::2/64
no shutdown
exit
interface vlan 101
ip address 10.32.101.2 255.255.255.0
ipv6 address fe80::d2:3 link-local
ipv6 address 2001:db8:100:101::2/64
no shutdown
exit
interface vlan 102
ip address 10.32.102.2 255.255.255.0
ipv6 address fe80::d2:4 link-local
ipv6 address 2001:db8:100:102::2/64
no shutdown
exit
ip dhcp excluded-address 10.32.101.1 10.0.101.209 ip
dhcp excluded-address 10.32.101.241 10.0.101.254 ip
dhcp excluded-address 10.32.102.1 10.0.102.209
ip dhcp excluded-address 10.32.102.241 10.0.102.254 ip
dhcp pool VLAN-101
network 10.32.101.0 255.255.255.0
default-router 32.0.101.254
exit
ip dhcp pool VLAN-102
network 10.32.102.0 255.255.255.0
default-router 10.32.102.254
exit
interface range e0/0-3,e1/1-3,e2/0-3,e3/0-3
shutdown
exit
```

Figura 11. Configuración de Switch D2



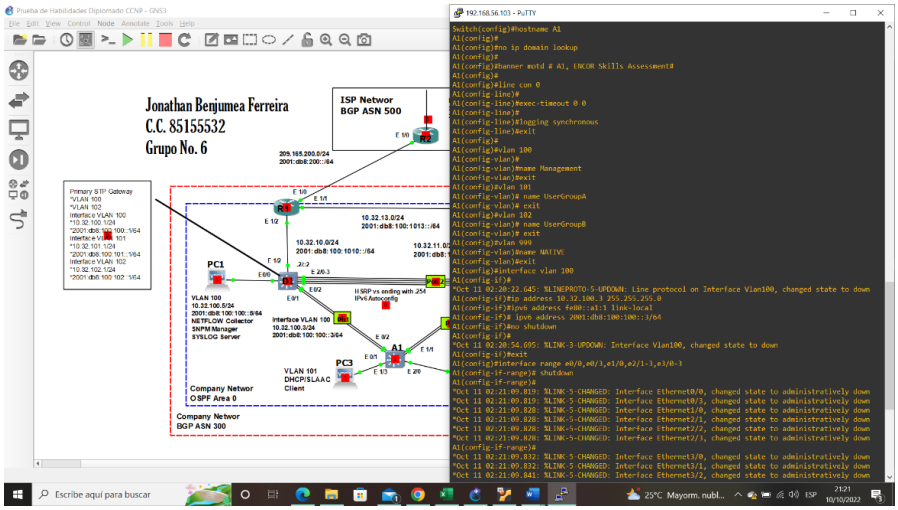
Switch A1

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 101exit
name UserGroupA
exit
vlan 102
name UserGroupB
exit
vlan 999
name NATIVE
exit
interface vlan 100
ip address 10.32.100.3 255.255.255.0
ipv6 address fe80::a1:1 link-local

ipv6 address 2001:db8:100:100::3/64
no shutdown
exit
interface range e0/0,e0/3,e1/0,e2/1-3,e3/0-3
shutdown
exit

Figura 12. Configuración de Switch A1



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

c. Configure PC 1 and PC 4 host addressing as shown in the addressing table. Assign a default gateway address of 10.30.100.254 which will be the HSRP virtual IP address used in Part 4.

PC1> ip 10.32.100.5/24 255.255.255.0 10.32.100.254
Checking for duplicate address...
PC1 : 10.32.100.5 255.255.255.0 gateway 10.32.100.254
PC1> ip 2001:db8:100:100::5/64
PC1 : 2001:db8:100:100::5/64

PC4> ip 10.32.100.6/24 255.255.255.0 10.32.100.254
Checking for duplicate address...
PC4 : 10.32.100.6 255.255.255.0 gateway 10.32.100.254
PC4> ip 2001:db8:100:100::6/64
PC1 : 2001:db8:100:100::6/64

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.

```
PC3> ip auto
GLOBAL SCOPE      : 2001:db8:100:1010:2050:79ff:fe66:6803/64
ROUTER LINK-LAYER : ca:01:06:e3:00:1e
```

```
PC2> ip auto
GLOBAL SCOPE      : 2001:db8:100:102:2050:79ff:fe66:6801/64
ROUTER LINK-LAYER : aa:bb:cc:80:01:00
```

Your configuration tasks are as follows:

Tabla N0. 2. Tabla de Tarea

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

Task #	Task	Specification	Points
2.3	On all switches, enable the Rapid Spanning-Tree Protocol.	Use Rapid Spanning Tree.	3
2.4	On D1 and D2, configure the appropriate RSTP root bridges based on the information in the topology diagram. D1 and D2 must provide backup in case of root bridge failure.	Configure D1 and D2 as root for the appropriate VLANs with mutually supporting priorities in case of switch failure.	2
2.5	On all switches, create LACP EtherChannels as shown in the topology diagram.	Use the following channel numbers: D1 to D2 – Port channel • 12 • D1 to A1 – Port channel 1 • D2 to A1 – Port channel 2	3
2.6	On all switches, configure host access ports connecting to PC1, PC2, PC3, and PC4.	Configure access ports with appropriate VLAN settings as shown in the topology diagram. Host ports should transition immediately to forwarding state.	4
2.7	Verify IPv4 DHCP services.	PC2 and PC3 are DHCP clients and should be receiving valid IPv4	1

		addresses.	
2.8	Verify local LAN connectivity.	PC1 should successfully ping: • D1: 10.32.100.1 • D2: 10.32.100.2 • PC4: 10.32.100.6 PC2 should successfully ping: • D1: 10.32.102.1 • D2: 10.32.102.2 PC3 should successfully ping: • D1: 10.32.101.1 • D2: 10.32.101.2 PC4 should successfully ping: • D1: 10.32.100.1 • D2: 10.32.100.2 • PC1: 10.32.100.5	1

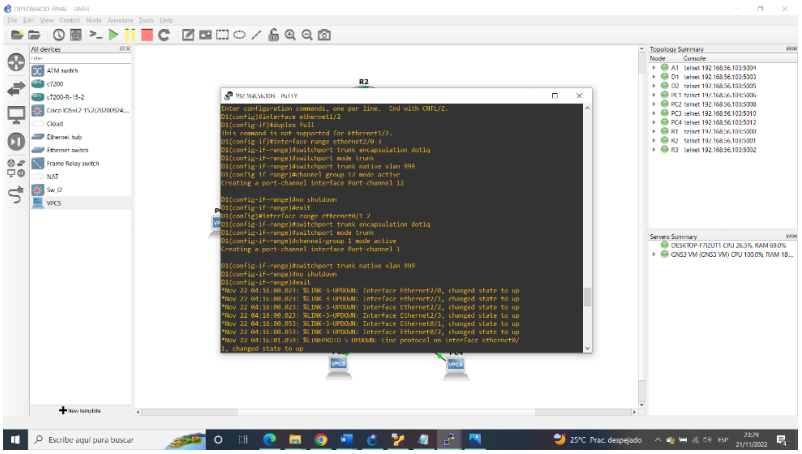
Comprobación de la tabla Task#2.1 – 2.8

Investigando y consultando en el libro se logra la configuración y de esta manera solucionar cada ítem requerido en la tabla anterior así:

Switch D1

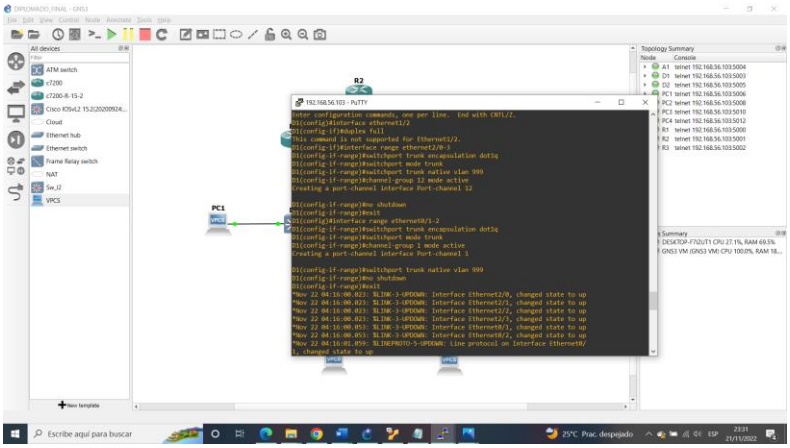
```
interface ethernet1/2
duplex full
interface range ethernet2/0-3
switchport trunk encapsulation dot1q
switchport mode trunk
channel-group 12 mode active
switchport trunk native vlan 999
no shutdown
exit
```

Figura 13. Configuración en D1 a D2 -Port channel 12



interface range ethernet0/1-2
switchport trunk encapsulation dot1q
switchport mode trunk
channel-group 1 mode active
switchport trunk native vlan 999
no shutdown
exit

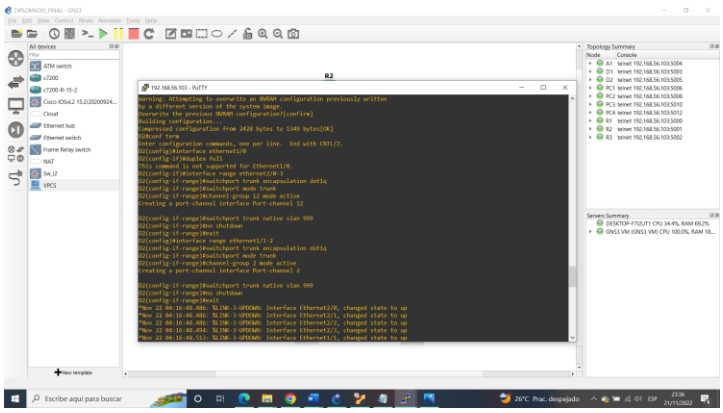
Figura 14. Configuración en D1 a D2 Port channel 1



Switch D2

```
interface ethernet1/0
duplex full
interface range ethernet2/0-3
switchport trunk encapsulation dot1q
switchport mode trunk
channel-group 12 mode active
switchport trunk native vlan 999
no shutdown
exit
interface range ethernet1/1-2
switchport trunk encapsulation dot1q
switchport mode trunk
channel-group 2 mode active
switchport trunk native vlan 999
no shutdown
exit
spanning-tree mode rapid-pvst spanning-
tree vlan 101 root primary spanning-tree
vlan 102,102 root secondary interface
ethernet0/0 switchport mode access
switchport access vlan 102
SPanning-tree portfast
no shutdown
exit
end
```

Figura 15. A1 a D1 – Port channel 1, y de A1 a D2 – Port channel

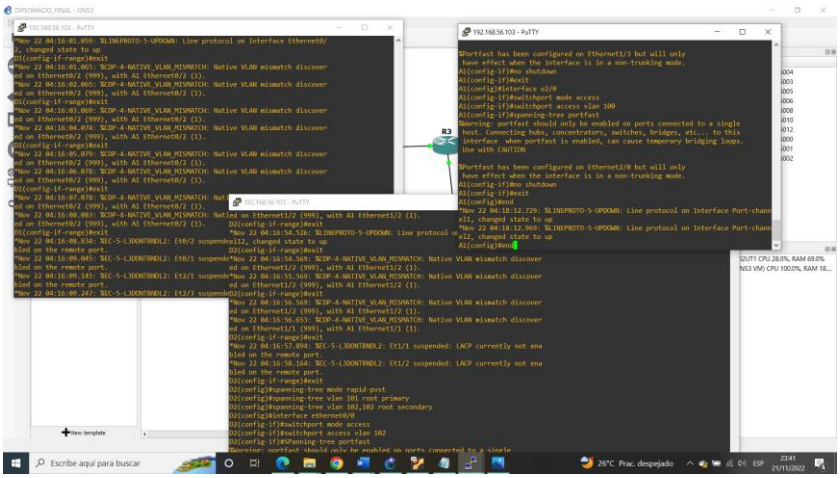


Switch A1

```
spanning-tree mode rapid-pvst
interface range ethernet0/1-2
switchport trunk encapsulation dot1q
switchport mode trunk
switchport trunk native vlan 999
channel-group 1 mode active
no shutdown
exit
interface range ethernet1/1-2
switchport trunk encapsulation dot1q
switchport mode trunk
switchport trunk native vlan 999
channel-group 2 mode active
no shutdown
exit
interface e1/3
switchport mode access
switchport access vlan 101
spanning-tree portfast
no shutdown
exit
interface e2/0
switchport mode access
switchport access vlan 100
```

spanning-tree portfast
no shutdown
exit
end

Figura 16. spanning-tree, VLAN, trunk, Port Channel 1 y 2



En las anteriores imágenes y comandos suministrados se puede evidenciar como se configuro de manera correcta en cada dispositivo cada uno de los requerimientos solicitados en la guía, logrando configurar todos los switchs, las interfaces troncales IEEE 802.1Q en los enlaces de conmutador de interconexión, se cambió la VLAN nativa en los enlaces troncales, se habilitó el protocolo Rapid Spanning-Tree, se configuró los puentes raíz RSTP apropiados según la información del diagrama de la topología, en todos los switches, se creó la LACP EtherChannels como se muestra en el diagrama de topología, así mismo se configuró los puertos de acceso de host que se conectan a PC1, PC2, PC3 y PC4.

Verificación de las configuraciones:

Figura 17. Configuración PC1

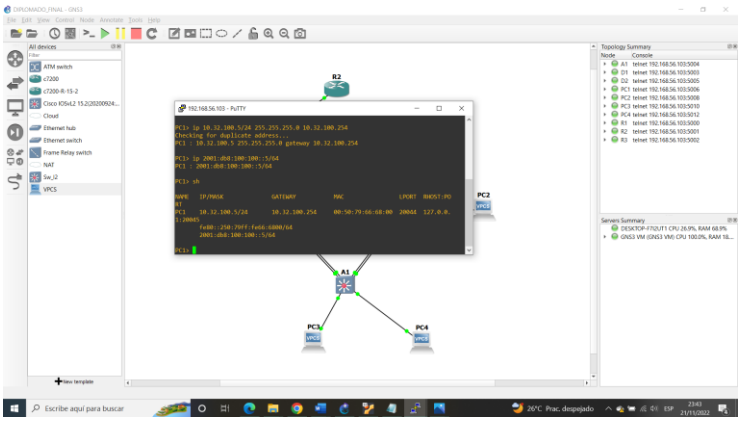


Figura 18. Verificación en D1 spanning-tree, VLAN, trunk, Port Channel

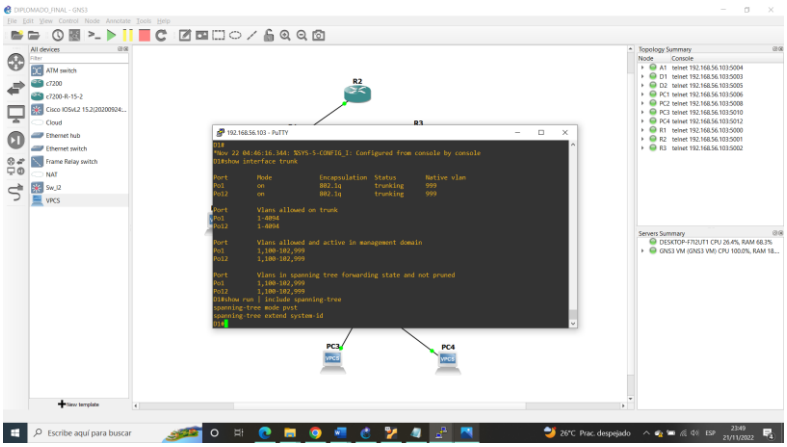


Figura 19. Verificación en A1 spanning-tree, VLAN, trunk, Port Channel

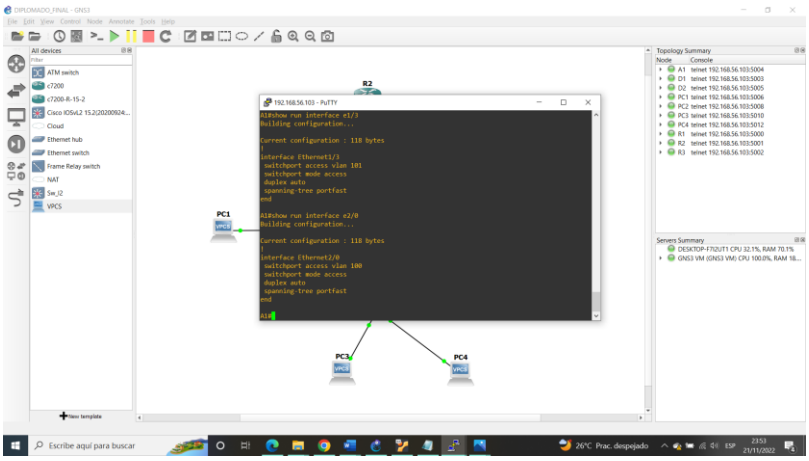


Figura 20. Verificación en A1, D1 y D2

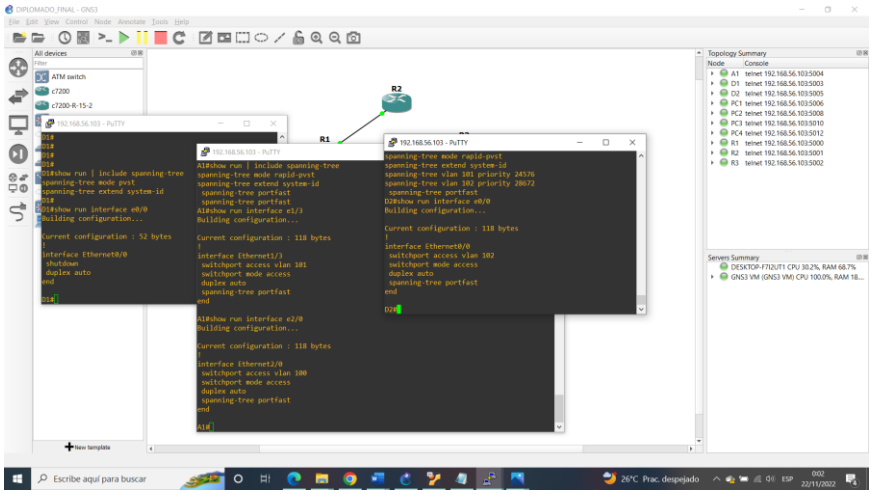
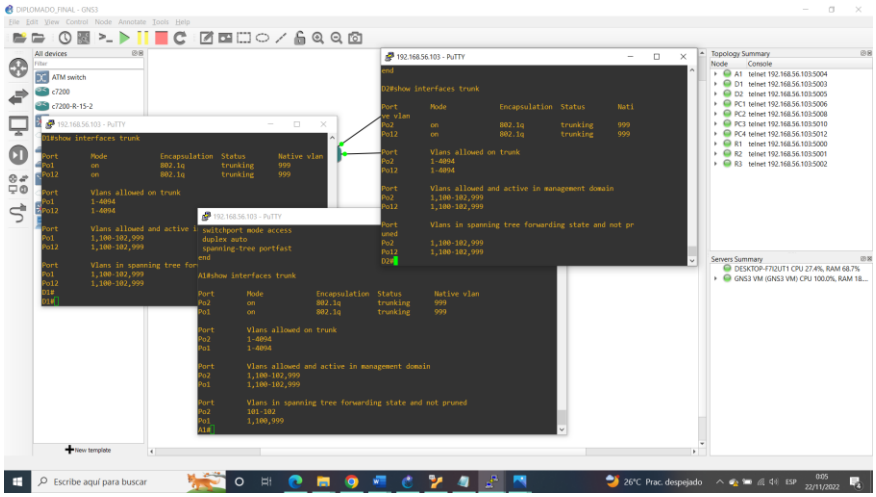


Figura 20.1. Verificación en A1, D1 y D2



Comandos utilizados en la comprobación.

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

interface range ethernet2/0-3
switchport trunk encapsulation dot1q
switchport mode trunk

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

switchport trunk native vlan 999

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

spanning-tree mode rapid-pvst

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

D1

spanning-tree vlan 100,102 root primary
spanning-tree vlan 101 root secondary
D2
spanning-tree vlan 101 root primary
spanning-tree vlan 100,102 root secondary

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 24576
spanning-tree portfast edge

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

D1

interface range ethernet2/0-3
channel-group 12 mode active
no shutdown
interface range ethernet0/1-2
channel-group 1 mode active
no shutdown

D2

interface range ethernet2/0-3
channel-group 12 mode active
no shutdown
interface range ethernet1/1-2
channel-group 2 mode active
no shutdown

A1

interface range ethernet0/1-2
channel-group 1 mode active
no shutdown

interface range ethernet1/1-2
channel-group 2 mode active
no shutdown

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

D1

interface ethernet0/0
switchport mode access
switchport access mode vlan 100
spanning-tree portfast
no shutdown

D2

interface ethernet0/0
switchport mode access
switchport access vlan 102
spanning-tree portfast
no shutdown

A1

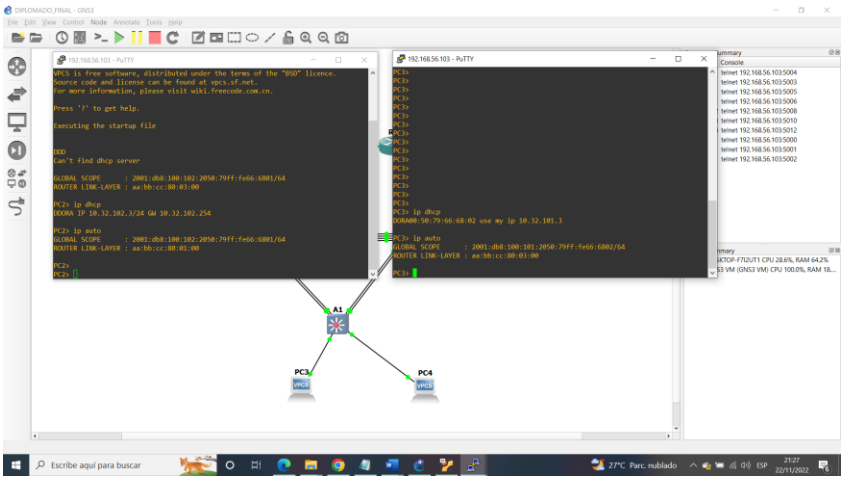
interface ethernet2/0
switchport mode access
switchport access vlan 100
spanning-tree portfast
no shutdown
interface ethernet1/3
switchport mode access
switchport access vlan 101
spanning-tree portfast
no shutdown

2.7 PC2 and PC3 are DHCP clients and should be receiving valid IPv4 addresses.

PC2> ip dhcp
DDORA IP 10.32.102.3/24 GW 10.32.102.254
PC2> ip auto
GLOBAL SCOPE : 2001:db8:100:102:2050:79ff:fe66:6801/64

ROUTER LINK-LAYER : aa:bb:cc:80:01:00
PC3> ip dhcp
DDORA IP 10.32.101.210/24 GW 10.32.101.254
PC3> ip auto
GLOBAL SCOPE : 2001:db8:100:101:2050:79ff:fe66:6802/64
ROUTER LINK-LAYER : aa:bb:cc:80:03:00

Figura 21. Configuración PC2 y PC3



2.8 Verify local LAN connectivity.

PC1> ping 10.32.100.1

84 bytes from 10.32.100.1 icmp_seq=1 ttl=255 time=0.348 ms
84 bytes from 10.32.100.1 icmp_seq=2 ttl=255 time=0.297 ms
84 bytes from 10.32.100.1 icmp_seq=3 ttl=255 time=0.262 ms
84 bytes from 10.32.100.1 icmp_seq=4 ttl=255 time=0.221 ms
84 bytes from 10.32.100.1 icmp_seq=5 ttl=255 time=0.228 ms

PC1> ping 10.32.100.2

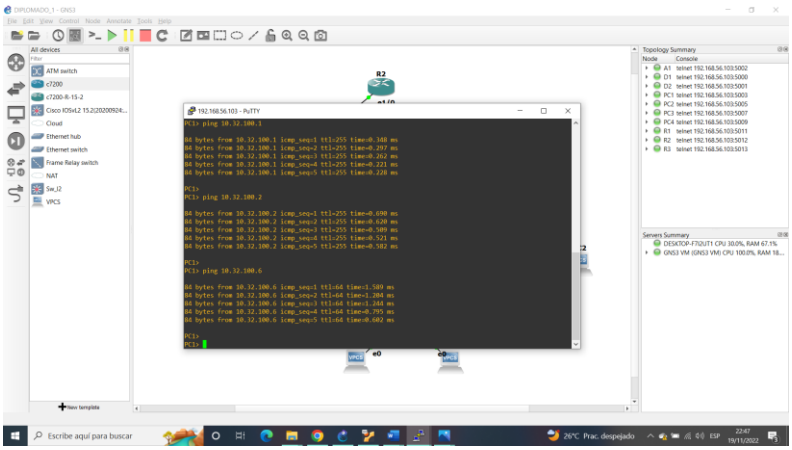
84 bytes from 10.32.100.2 icmp_seq=1 ttl=255 time=0.690 ms
84 bytes from 10.32.100.2 icmp_seq=2 ttl=255 time=0.620 ms
84 bytes from 10.32.100.2 icmp_seq=3 ttl=255 time=0.509 ms

84 bytes from 10.32.100.2 icmp_seq=4 ttl=255 time=0.521 ms
84 bytes from 10.32.100.2 icmp_seq=5 ttl=255 time=0.582 ms

PC1> ping 10.32.100.6

84 bytes from 10.32.100.6 icmp_seq=1 ttl=64 time=1.589 ms
84 bytes from 10.32.100.6 icmp_seq=2 ttl=64 time=1.204 ms
84 bytes from 10.32.100.6 icmp_seq=3 ttl=64 time=1.244 ms
84 bytes from 10.32.100.6 icmp_seq=4 ttl=64 time=0.795 ms
84 bytes from 10.32.100.6 icmp_seq=5 ttl=64 time=0.602 ms

Figura 22. Conectividad LAN PC1



PC4> ping 10.32.100.1

84 bytes from 10.32.100.1 icmp_seq=1 ttl=255 time=0.916 ms
84 bytes from 10.32.100.1 icmp_seq=2 ttl=255 time=0.897 ms
84 bytes from 10.32.100.1 icmp_seq=3 ttl=255 time=1.018 ms
84 bytes from 10.32.100.1 icmp_seq=4 ttl=255 time=1.050 ms
84 bytes from 10.32.100.1 icmp_seq=5 ttl=255 time=2.165 ms

PC4> ping 10.32.100.2

84 bytes from 10.32.100.2 icmp_seq=2 ttl=255 time=0.655 ms
84 bytes from 10.32.100.2 icmp_seq=3 ttl=255 time=0.554 ms
84 bytes from 10.32.100.2 icmp_seq=4 ttl=255 time=0.663 ms

84 bytes from 10.32.100.2 icmp_seq=5 ttl=255 time=0.778 ms

PC4> ping 10.32.100.5

84 bytes from 10.32.100.5 icmp_seq=1 ttl=64 time=2.326 ms
84 bytes from 10.32.100.5 icmp_seq=2 ttl=64 time=4.918 ms
84 bytes from 10.32.100.5 icmp_seq=3 ttl=64 time=3.795 ms
84 bytes from 10.32.100.5 icmp_seq=4 ttl=64 time=6.152 ms
84 bytes from 10.32.100.5 icmp_seq=5 ttl=64 time=3.442 ms

Figura 23. Conectividad LAN PC4

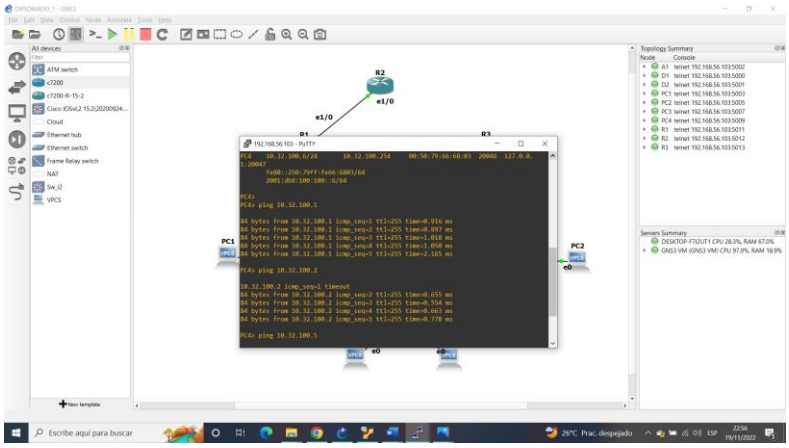
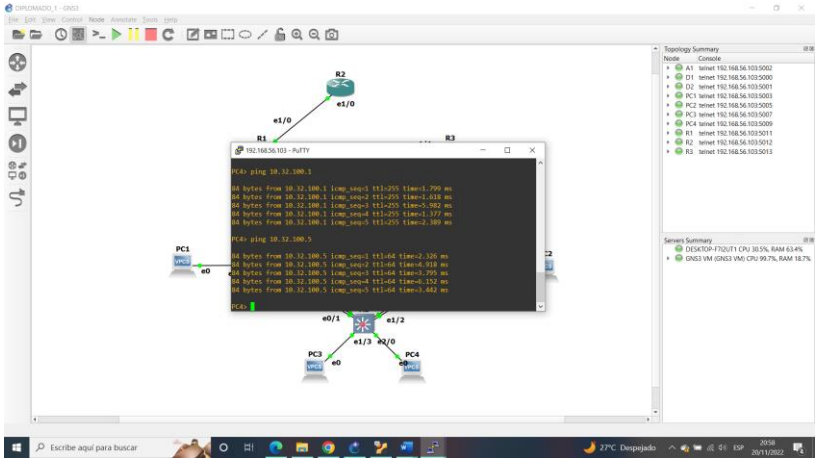


Figura 23.1. Conectividad LAN PC4



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

  router ospf 4
  router-id 0.0.4.1

- R3: 0.0.4.3

  router ospf 4
  router-id 0.0.4.3

- D1: 0.0.4.131

  router ospf 4
  router-id 0.0.4.131

- D2: 0.0.4.132

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

On R1, R3, D1, and D2, advertise all directly connected networks / VLANs in Area 0.

```
R1(config-router)#network 10.32.10.0 0.0.0.255 area 0
R1(config-router)#network 10.32.13.0 0.0.0.255 area 0

R3(config-router)#network 10.32.11.0 0.0.0.255 area 0
R3(config-router)#network 10.32.13.0 0.0.0.255 area 0

D1(config-router)#network 10.32.100.0 0.0.0.255 area 0
D1(config-router)#network 10.32.101.0 0.0.0.255 area 0
D1(config-router)#network 10.32.102.0 0.0.0.255 area 0
D1(config-router)#network 10.32.10.0 0.0.0.255 area 0

D2(config-router)#network 10.32.100.0 0.0.0.255 area 0
D2(config-router)#network 10.32.101.0 0.0.0.255 area 0
D2(config-router)#network 10.32.102.0 0.0.0.255 area 0
D2(config-router)#network 10.32.11.0 0.0.0.255 area 0
```

- On R1, do not advertise the R1 – R2 network.

  R1(config-router)#default-information originate

- On R1, propagate a default route. Note that the default route will be provided by BGP.

  D1(config-router)#passive-interface default
  D1(config-router)#no passive-interface e1/2

  D2(config-router)#passive-interface default
  D2(config-router)#no passive-interface e1/0

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(config)#ipv6 router ospf 6

D2(config)#ipv6 router ospf 6

R3(config)#ipv6 router ospf 6

D1(config)#ipv6 router ospf 6

- R1: 0.0.6.1

  R1(config-rtr)#router-id 0.0.6.1

- R3: 0.0.6.3

  R3(config-rtr)#router-id 0.0.6.3

- D1: 0.0.6.131

  D1(config-rtr)#router-id 0.0.6.131

- D2: 0.0.6.132

  D2(config-rtr)#router-id 0.0.6.132

On R1, R3, D1, and D2, advertise all directly connected networks / VLANs in Area 0.

R1(config)#interface e1/1

R1(config-if)#ipv6 ospf 6 area 0

R1(config-if)#exit

R1(config)#interface e1/2

R1(config-if)#ipv6 ospf 6 area 0

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

D1(config)#interface e1/2
D1(config-if)#ipv6 ospf 6 area 0
D1(config-if)#exit
D1(config)#interface vlan 100
D1(config-if)#ipv6 ospf 6 area 0
D1(config-if)#exit
D1(config)#interface vlan 101
D1(config-if)#ipv6 ospf 6 area 0
D1(config-if)#exit
D1(config)#interface vlan 102
D1(config-if)#ipv6 ospf 6 area 0

D2(config)#interface e1/0
D2(config-if)#ipv6 ospf 6 area 0
D2(config-if)#exit
D2(config)#interface vlan 100
D2(config-if)#ipv6 ospf 6 area 0
D2(config-if)#exit
D2(config)#interface vlan 101
D2(config-if)#ipv6 ospf 6 area 0
D2(config-if)#exit
D2(config)#interface vlan 102
D2(config-if)#ipv6 ospf 6 area 0
```

Disable OSPFv3 advertisements on:

- D1: All interfaces except E1/2

  D1(config-router)#passive-interface default

  D1(config-router)#no passive-interface e1/2

- D2: All interfaces except E1/0

  D2(config-rtr)#passive-interface default

  D2(config-rtr)#no passive-interface e1/0

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.

  R2(config)#ip route 0.0.0.0 0.0.0.0 loopback 0

- An IPv6 default static route.

  R2(config)#ipv6 route ::/0 loopback 0

Configure R2 in BGP ASN **500** and use the router-id 2.2.2.2.

R2(config)#router bgp 500

R2(config-router)#bgp router-id 2.2.2.2

Configure and enable an IPv4 and IPv6 neighbor relationship with R1 in ASN 300.

R2(config-router)#neighbor 209.165.200.225 remote-as 300

R2(config-router)#neighbor 2001:db8:200::1 remote-as 300

In IPv4 address family, advertise:

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

- The Loopback 0 IPv4 network (/32).

  R2(config-router-af)#network 2.2.2.2 mask 255.255.255.255

- The default route (0.0.0.0/0).

  R2(config-router-af)#network 0.0.0.0

In IPv6 address family, advertise:

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

- The Loopback 0 IPv4 network (/128).

  R2(config-router-af)#network 2001:db8:2222::1/128

- The default route (::/0).

  R2(config-router-af)#network ::/0

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 10.32.0.0/8.

  R1(config)#ip route 10.32.0.0 255.0.0.0 null0

- A summary IPv6 route for 2001:db8:100::/48.

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

Configure R1 in BGP ASN **300** and use the router-id 1.1.1.1.

R1(config)#router bgp 300

R1(config-router)#bgp router-id 1.1.1.1

Configure an IPv4 and IPv6 neighbor relationship with R2 in ASN 500.

R1(config-router)#neighbor 209.165.200.226 remote-as 500

R1(config-router)#neighbor 2001:db8:200::2 remote-as 500

In IPv4 address family:

R1(config-router)#address-family ipv4 unicast

- Disable the IPv6 neighbor relationship.

  R1(config-router-af)#neighbor 209.165.200.226 activate

- Enable the IPv4 neighbor relationship.

  R1(config-router-af)#no neighbor 2001:db8:200::2 activate

- Advertise the 10.32.0.0/8 network.

  R1(config-router-af)#network 10.32.0.0 mask 255.0.0.0

In IPv6 address family:

R1(config-router)#address-family ipv6 unicast

- Disable the IPv4 neighbor relationship.

  R1(config-router-af)#no neighbor 209.165.200.226 activate

- Enable the IPv6 neighbor relationship.

  R1(config-router-af)#neighbor 2001:db8:200::2 activate

- Advertise the 2001:db8:100::/48 network.

  R1(config-router-af)#network 2001:db8:100::/48

Configure First Hop Redundancy

4.1 On D1, create IP SLAs that test the reachability of R1 interface E1/2.

Create two IP SLAs.

- Use SLA number **4** for IPv4.
  ip SLA 4

- Use SLA number **6** for IPv6.
  ip SLA 6

The IP SLAs will test availability of R1 E1/2 interface every 5 seconds.

```
icmp-echo 10.32.10.1
frequency 5
icmp-echo 2001:db8:100:1010::1
frequency 5
```

Schedule the SLA for immediate implementation with no end time.

```
D1(config)#ip sla schedule 4 life forever start-time now
D1(config)#ip sla schedule 6 life forever start-time now
```

D1(config)#ip sla schedule 6 life forever start-time now

Create an IP SLA object for IP SLA 4 and one for IP SLA 6.

- Use track number **4** for IP SLA 4.
  D1(config)#track 4 ip sla 4
- Use track number **6** for IP SLA 6.

  D1(config)#track 6 ip sla 6

The tracked objects should notify D1 if the IP SLA state changes from down to up after 10 seconds, or from up to down after 15 seconds.

```
D1(config-track)#delay down 10 up 15
```

4.2 On D2, create IP SLAs that test the reachability of R3 interface E1/0.

Create two IP SLAs.

- Use SLA number **4** for IPv4.
  ip SLA 4
- Use SLA number **6** for IPv6.
  ip SLA 6

The IP SLAs will test availability of R3 E1/0 interface every 5 seconds.

```
icmp-echo 10.32.11.1
frequency 5
icmp-echo 2001:db8:100:1011::1
```

frequency 5

Schedule the SLA for immediate implementation with no end time.

```
D2(config)#ip sla schedule 4 life forever start-time now
D2(config)#ip sla schedule 6 life forever start-time now
```

D1(config)#ip sla schedule 6 life forever start-time now

Create an IP SLA object for IP SLA 4 and one for IP SLA 6.

- Use track number **4** for IP SLA 4.
  ```
  D2(config)#track 4 ip sla 4
  ```
- Use track number **6** for IP SLA 6.

  ```
  D2(config)#track 6 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.

```
D2(config-track)#delay down 10 up 15
```

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.

```
D1(config)#interface vlan 100
D1(config-if)#standby 104 priority 150
D1(config)#interface vlan 102
D1(config-if)#standby 124 priority 150
```

Configure HSRP version 2.

```
D1(config-if)#standby version 2
```

Configure IPv4 HSRP group **104** for VLAN 100:

```
D1(config)#interface vlan 100
D1(config-if)#standby version 2
D1(config-if)#standby 104 ip 10.32.100.254
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

- Assign the virtual IP address **10.32.100.254**.
  ```
  D1(config-if)#standby 104 ip 10.32.100.254
  ```
- Set the group priority to **150**.

```
D1(config-if)#standby 104 priority 150
```

- Enable preemption.

```
D1(config-if)#standby 104 preempt
```

- Track object 4 and decrement by 60.

```
D1(config-if)#standby 104 track 4 decrement 60
D1(config-if)#standby 106 track 6 decrement 60
```

Configure IPv4 HSRP group **114** for VLAN 101:

```
D1(config)#interface vlan 101
D1(config-if)#standby version 2
D1(config-if)#standby 114 ip 10.32.101.254
D1(config-if)#standby 114 preempt
D1(config-if)#standby 114 track 4 decrement 60
```

- Assign the virtual IP address **10.32.101.254**.

```
D1(config-if)#standby 114 ip 10.32.101.254
```

- Enable preemption.

```
D1(config-if)#standby 114 preempt
```

- Track object 4 to decrement by 60.

```
D1(config-if)#standby 114 track 4 decrement 60
```

Configure IPv4 HSRP group **124** for VLAN 102:

```
D1(config)#interface vlan 102
D1(config-if)#standby version 2
D1(config-if)#standby 124 ip 10.32.102.254
D1(config-if)#standby 124 priority 150
D1(config-if)#standby 124 preempt
D1(config-if)#standby 124 track 4 decrement 60
```

- Assign the virtual IP address **10.32.102.254**.

```
D1(config-if)#standby 124 ip 10.32.102.254
```

- Set the group priority to **150**.

```
D1(config-if)#standby 124 priority 150
```

- Enable preemption.

```
D1(config-if)#standby 124 preempt
```

- Track object 4 to decrement by 60.

```
D1(config-if)#standby 124 track 4 decrement 60
```

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

```
D1(config)#interface vlan 100
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
```

- Assign the virtual IP address using **ipv6 autoconfig**.

```
D1(config-if)#standby 106 ipv6 autoconfig
```

- Set the group priority to **150**.

```
D1(config-if)#standby 106 priority 150
```

- Enable preemption.

```
D1(config-if)#standby 106 preempt
```

- Track object 6 and decrement by 60.

```
D1(config-if)#standby 106 track 6 decrement 60
```

Configure IPv6 HSRP group **116** for VLAN 101:

```
D1(config)#interface vlan 101
D1(config-if)#standby 116 ipv6 autoconfig
D1(config-if)#standby 116 preempt
D1(config-if)#standby 116 track 6 decrement 60
```

- Assign the virtual IP address using **ipv6 autoconfig**.

```
D1(config-if)#standby 116 ipv6 autoconfig
```

- Enable preemption.

```
D1(config-if)#standby 116 preempt
```

- Track object 6 and decrement by 60.

```
D1(config-if)#standby 116 track 6 decrement 60
```

Configure IPv6 HSRP group **126** for VLAN 102:

```
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
```

- Assign the virtual IP address using **ipv6 autoconfig**.

```
D1(config-if)#standby 126 ipv6 autoconfig
```

- Set the group priority to **150**.

```
D1(config-if)#standby 126 priority 150
```

- Enable preemption.

```
D1(config-if)#standby 126 preempt
```

- Track object 6 and decrement by 60.

```
D1(config-if)#standby 126 track 6 decrement 60
```

Figura 24. Verificación protocolo enrutamiento en R1

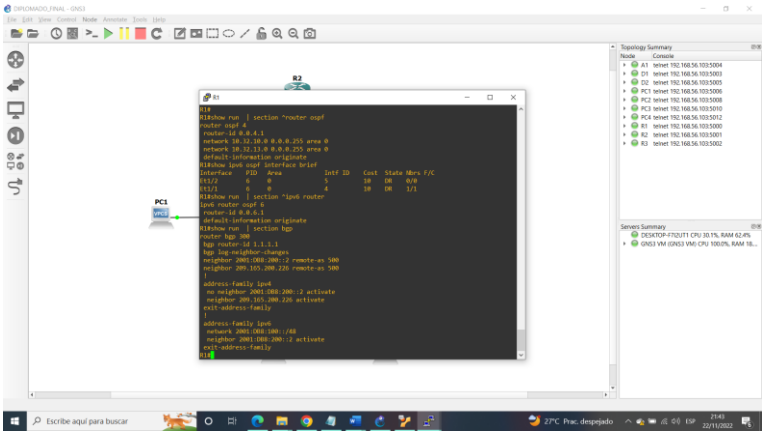


Figura 25. Verificación BGP y tablas de enrutamiento en R1

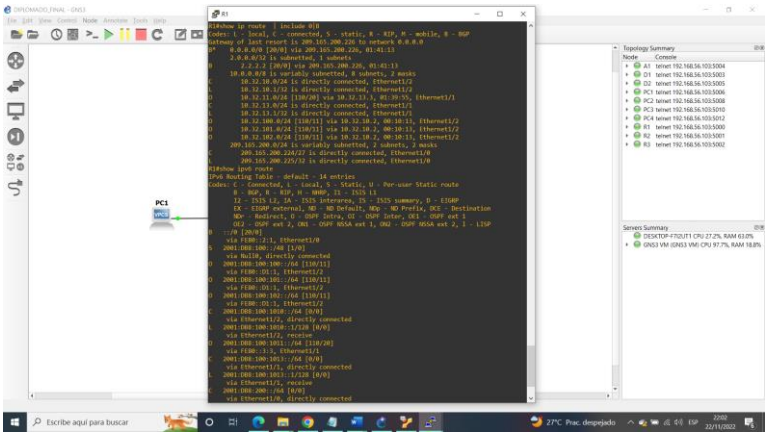


Figura 26. Verificación protocolo enrutamiento R2

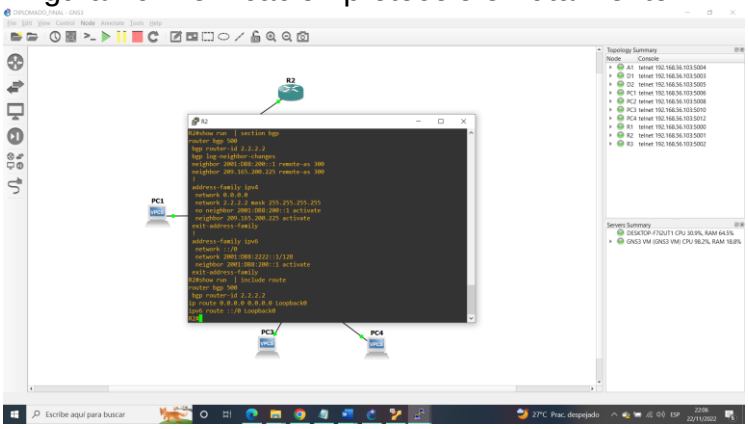


Figura 27. Verificación protocolo enrutamiento R3

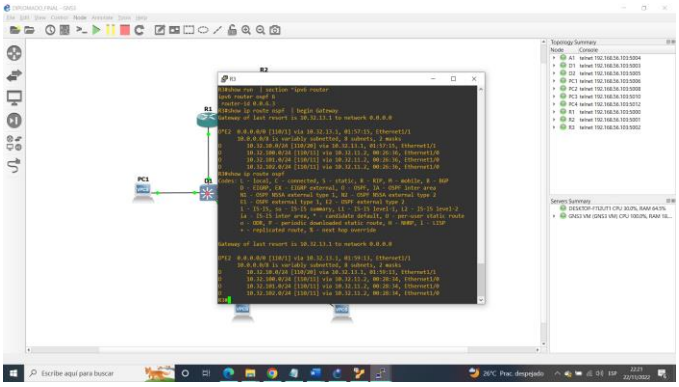


Figura 28. Verificación protocolo enrutamiento D1

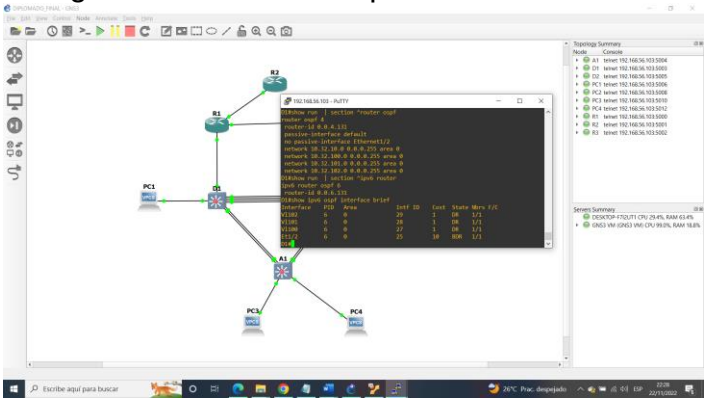
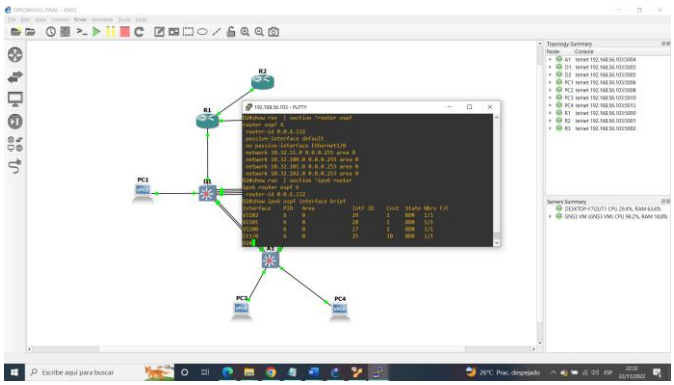


Figura 29. Verificación protocolo enrutamiento D2



4.4 On D2, configure HSRPv2

D1 is the primary router for VLANs 101; therefore, their priority will also be changed to 150.

```
D2(config)#interface vlan 101
D2(config-if)#standby 114 priority 150
```

Configure HSRP version 2.

```
D2(config-if)#standby version 2
```

Configure IPv4 HSRP group **104** for VLAN 100:

```
D2(config)#interface vlan 100
D2(config-if)#standby version 2
D2(config-if)#standby 104 ip 10.32.100.254
D2(config-if)#standby 104 preempt
D2(config-if)#standby 104 track 4 decrement 60
```

- Assign the virtual IP address **10.32.101.254**.
  ```
  D2(config-if)#standby 104 ip 10.32.101.254
  ```
- Set the group priority to **150**.
  ```
  D2(config-if)#standby 104 priority 150
  ```
- Enable preemption.
  ```
  D2(config-if)#standby 104 preempt
  ```
- Track object 4 and decrement by 60.
  ```
  D2(config-if)#standby 104 track 4 decrement 60
  ```

Configure IPv4 HSRP group **124** for VLAN 102:

```
D2(config)#interface vlan 102
D2(config-if)#standby version 2
D2(config-if)#standby 124 ip 10.32.102.254
D2(config-if)#standby 124 preempt
```

```
D2(config-if)#standby 124 track 4 decrement 60
```

- Assign the virtual IP address **10.32.102.254**.
  ```
  D2(config-if)#standby 124 ip 10.32.102.254
  ```
- Enable preemption.
  ```
  D2(config-if)#standby 124 preempt
  ```
- Track object 4 to decrement by 60.
  ```
  D2(config-if)#standby 124 track 4 decrement 60
  ```

Configure IPv4 HSRP group **106** for VLAN 100:

```
D2(config-if)#standby 106 ipv6 autoconfig
D2(config-if)#standby 106 preempt
D2(config-if)#standby 106 track 6 decrement 60
```

- Assign the virtual IP address using **ipv6 autoconfig**.
  ```
  D2(config-if)#standby 106 ipv6 autoconfig
  ```
- Set the group priority to **150**.
  ```
  D2(config-if)#standby 106 priority 150
  ```
- Enable preemption.
  ```
  D2(config-if)#standby 106 preempt
  ```
- Track object 6 and decrement by 60.
  ```
  D2(config-if)#standby 106 track 6 decrement 60
  ```

Configure IPv6 HSRP group **116** for VLAN 101:

```
D2(config)#interface vlan 101
D2(config-if)#standby 116 ipv6 autoconfig
D2(config-if)#standby 116 preempt
D2(config-if)#standby 116 track 6 decrement 60
```

- Assign the virtual IP address using **ipv6 autoconfig**.
  ```
  D2(config-if)#standby 116 ipv6 autoconfig
  ```
- Enable preemption.
  ```
  D2(config-if)#standby 116 preempt
  ```
- Track object 6 and decrement by 60.
  ```
  D2(config-if)#standby 116 track 6 decrement 60
  ```

Configure IPv6 HSRP group **126** for VLAN 102:

```
D2(config-if)#standby 126 ipv6 autoconfig
D2(config-if)#standby 126 priority 150
D2(config-if)#standby 126 preempt
D2(config-if)#standby 126 track 6 decrement 60
```

- Assign the virtual IP address using **ipv6 autoconfig**.
  ```
  D2(config-if)#standby 126 ipv6 autoconfig
  ```
- Set the group priority to **150**.
  ```
  D2(config-if)#standby 126 priority 150
  ```
- Enable preemption.

D2(config-if)#standby 126 preempt

- Track object 6 and decrement by 60.
  D2(config-if)#standby 126 track 6 decrement 60

Figura 30. Verificación configuración de SLA y HSRPv2 en D1

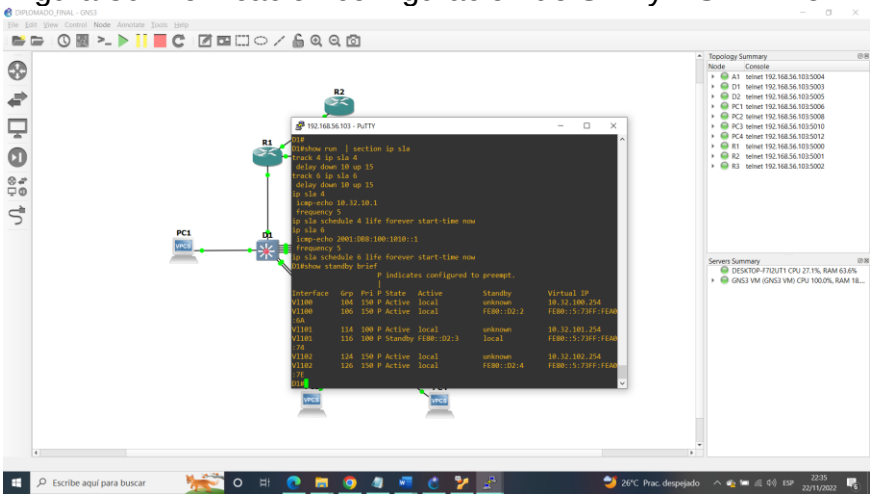
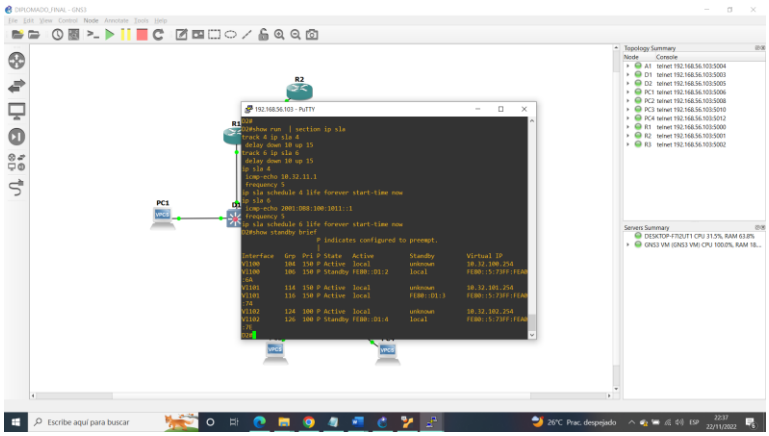


Figura 31. Verificación configuración de SLA y HSRPv2 en D2



CONCLUSIONES

Una vez finalizado el desarrollo del presente trabajo, se puede concluir la importancia que tiene para los estudiantes aprender el manejo adecuado de las herramientas como el software packet Tracer y el simulador de redes GNS3 implementado mediante una máquina virtual, el cual permitió simular casos prácticos de situaciones que se nos pueden presentar en el ejercicio de nuestra profesión con un acercamiento mas real a una red.

Además, se configuraron redes conmutadas haciendo uso de protocolos STP; con el cual me permitió tener enlaces redundantes, OSPF; por medio de este pude cambiar la ruta en poco tiempo, según la variación de la topología de la red, y también la versión 4 y 6 de ip (Protocolo de Internet) para establecer conexiones, todo esto con el fin de ejecutar los escenarios propuestos y siempre vigilando que se cumpliera con los requerimientos solicitados realizando las verificaciones pertinentes en cada configuración para administrar y crear redes seguras y con altos estándares de calidad y de rendimiento que puedan brindar confiabilidad y confidencialidad en la red.

Continuando con lo planteado para esta actividad, también se diseñaron redes escalables con el uso de configuraciones básicas y avanzadas de protocolos de enrutamiento, logrando así la implementación de servicios IP con calidad en redes empresariales LAN y WAN, lo que permitirá crear un acceso seguro mediante la automatización y virtualización de la red en este tipo de ambientes corporativos en el que la información es confidencial y muchas veces las empresas se encuentran vulnerables ante cualquier tipo de ataques.

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