DIPLOMADO DE PROFUNDIZACION CISCO

INFORME PRUEBA DE HABILIDADES PRÁCTICAS CCNP

JUAN CARLOS HUERTAS MOYANO

UNIVERSIDAD NACIONAL ABIERTA Y A DISTANCIA - UNAD ESCUELA DE CIENCIAS BÁSICAS, TECNOLOGÍA E INGENIERÍA - ECBTI
INGENIERÍA ELECTRONICA
BOGOTÁ D.C.
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JUAN CARLOS HUERTAS MOYANO

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

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NOTA DE ACEPTACIÓN

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Bogotá D.C., 08 de noviembre de 2022.

AGRADECIMIENTOS

Antes que nada, le doy gracias a Dios por darme la vida, y su sabiduría para superar los objetivos propuestos para realizar la actividad, todo para lograr terminar el desarrollo de las habilidades y poder cumplir con la meta.

Por otra parte, agradezco a mi familia y compañeros, gracias a ellos siempre estuve apoyado y estuvieron conmigo para superar cada una de mis decisiones, llevando a culminar la realización de mi trabajo.

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CONTENIDO

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GLOSARIO

BGP (Border Gateway Protocol): utilizado para conectar distintos sistemas autónomos principalmente con el canal de internet.

DHCP: es un servidor que usa protocolo de red de tipo cliente/servidor en el que generalmente un servidor posee una lista de direcciones IP dinámicas y las va asignando a los clientes conforme éstas van quedando libres, sabiendo en todo momento quién ha estado en posesión de esa IP, cuánto tiempo la ha tenido y a quién se la ha asignado después.

ISP (Internet Service Provider): término que identifica las compañías que proveen acceso a internet.

OSPFv2: es la versión del protocolo OSPF que actualmente utilizamos en redes IPv4. En este caso, el formato del router ID coincide con el formato de las direcciones IP utilizadas en las interfaces por lo que es posible utilizar la dirección IP de una interfaz como router ID, de manera tal que no es obligatorio configurar un router-id y el sistema operativo puede tomar la dirección IP de una interfaz para ser utilizada en esta función.

ROOT BRIDGE: punto de referencia dentro de la red que puede soportar más conmutación, todos los switches deben estar conectados hacia él con el mejor coste.

SMART LAB: es un centro especializado en difusión de conocimiento, intercambio de experiencias y espacios compartidos de trabajo vinculado a las ciudades inteligentes, su objetivo es crear un entorno compartido que estimule el intercambio de ideas y la generación de proyectos innovadores.

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

RESUMEN

El siguiente trabajo se desarrolló en el marco del diplomado de profundización Cisco CCNP, siendo este la opción de grado con el fin de culminar la carrera profesional de ingeniería electrónica. Por medio del presente, se busca implementar los conocimientos y habilidades adquiridas en la formación.

En la etapa inicial realizamos un montaje, mediante un simulador llamado “GNS3”, una máquina virtual denominada “Virtual Box” y varios dispositivos utilizados en el software Cisco, lo anterior, con el fin de presentar un escenario donde debemos realizar distintas configuraciones para el funcionamiento de una red profesional.

Finalmente, demostramos nuestros conocimientos obtenidos para el manejo de las redes, configuración de distintos protocolos en especial de etapa 2 y 3, se establecen enrutamientos tanto en redes LAN como en sistemas autónomos y como resultado de las distintas configuraciones realizadas, se estructuran redes que se comunican entre sí a las cuales se incorporan políticas de seguridad, tal y como lo encontramos en una red empresarial en nuestra vida diaria.

PALABRAS CLAVE: CISCO, REDES, ELECTRÓNICA, LAN, WAN, PROTOCOLOS.

ABSTRACT

The following work was developed within the framework of the Cisco CCNP in-depth diploma, this being the degree option in order to complete the professional career in electronic engineering. Through this, it seeks to implement the knowledge and skills acquired in training.

In the initial stage we carried out an assembly, through a simulator called "GNS3", a virtual machine called "Virtual Box" and several devices used in the Cisco software, the above, in order to present a scenario where we must make different configurations for the operation of a professional network.

Finally, we demonstrate our knowledge obtained for network management, configuration of different protocols, especially stage 2 and 3, routing is established both in LAN networks and in autonomous systems and as a result of the different configurations carried out, networks will be structured communicate with each other to which security policies are incorporated, just as we find in a business network in our daily lives.

KEYWORDS: CISCO, NETWORKS, ELECTRONICS, LAN, WAN, PROTOCOLS.

INTRODUCCION

En el siguiente trabajo encontraremos el desarrollo de las pruebas de habilidades prácticas CCNP, donde por medio de una máquina virtual; para este caso Virtual Box y un software de simulador llamado “GNS3” realizaremos distintas configuraciones aplicadas al desarrollo de ambientes en redes empresariales.

Para el desarrollo de la actividad simularemos un escenario compuesto por 3 router, 2 switch y 4 PCS, en la primera parte vamos a estructurar redes conmutadas usando protocolo STP y la configuración de VLANs, esto nos ayudara a entender la composición de una infraestructura de red jerárquica.

En la segunda parte vamos a diseñar soluciones de red mediante la configuración básica y avanzada de protocolos de enrutamiento para la implementación de servicios IP en ambientes de red empresariales LAN y WAN.

Finalmente se configurarán los protocolos de enrutamiento en IPV4 e IPV6 para que sean convergentes, se configura la interfaz loopback 0 para los dos switches, también, se realizara la configuración versión 2 de HSRP para proporcionar redundancia para hosts en la red empresarial.

EVALUACION DE HABILIDADES ESCENARIO 1

Topología:

Figura 1. Escenario 1

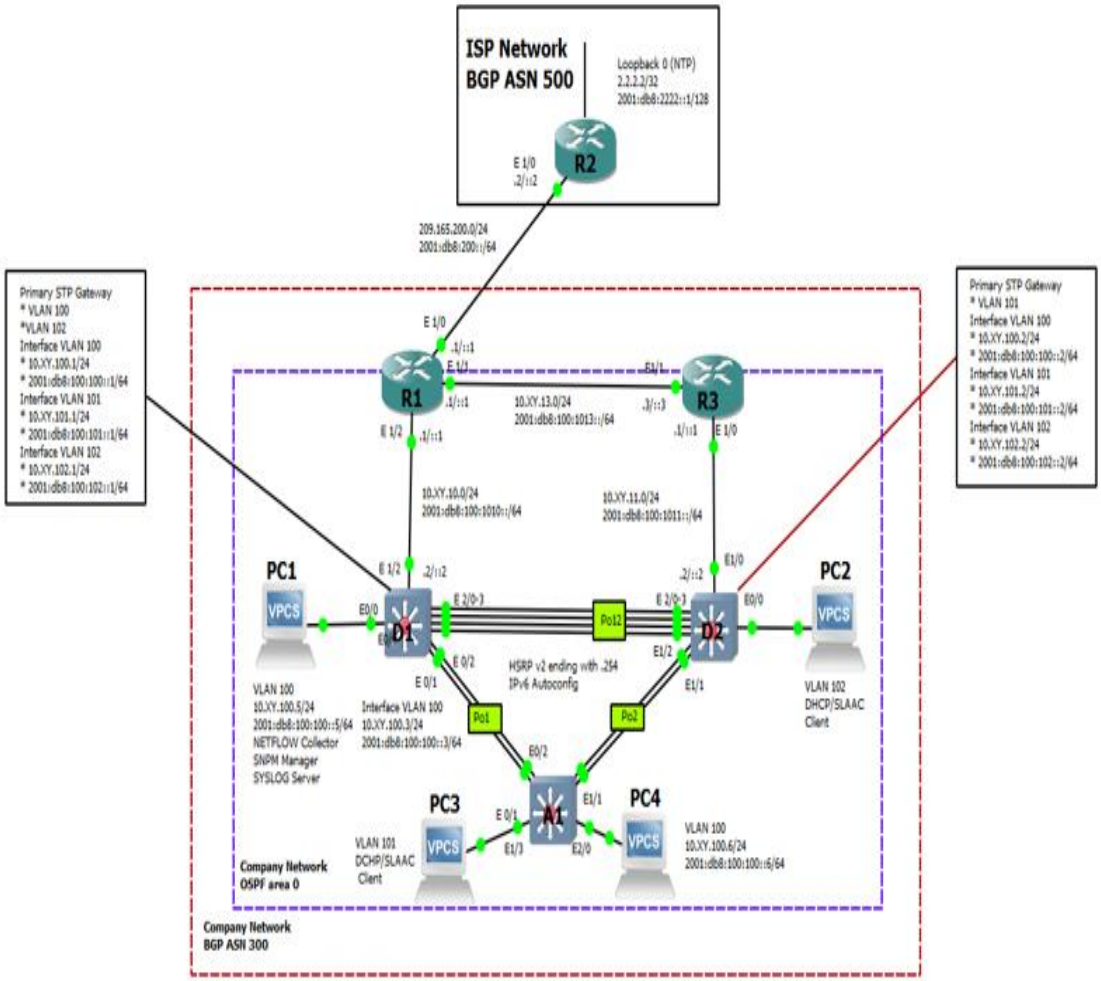


Figura 2. Simulación Escenario 1

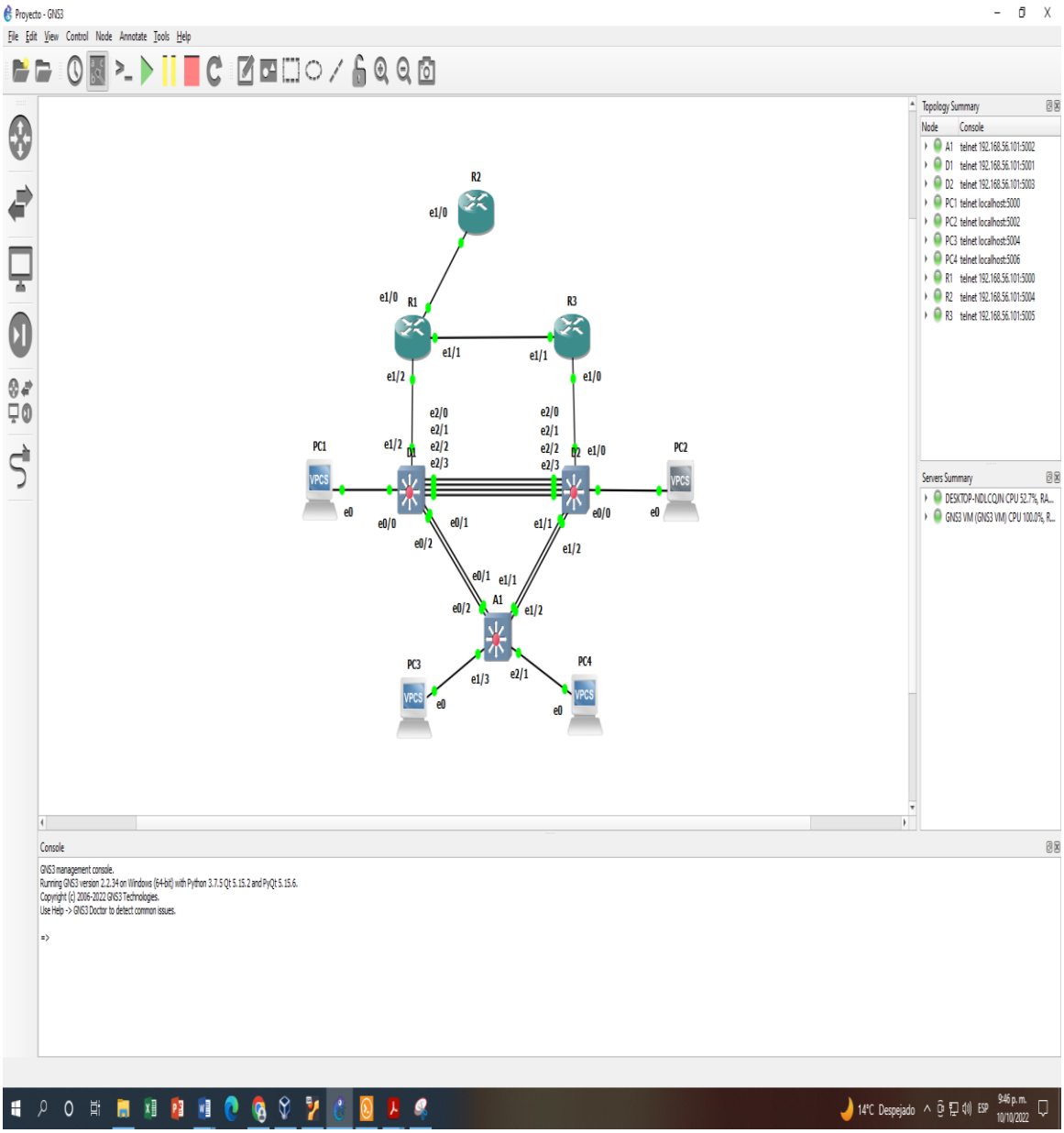


Tabla 1. Tabla de direccionamiento

Device	Interface	IPv4 Address	IPv6 Address	IPv6 Link-Local
R1	E1/0	209.165.200.225/27	2001:db8:200::1/64	fe80::1:1
	E1/2	10.XY.10.1/24	2001:db8:100:1010::1/64	fe80::1:2
	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
	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
	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
	VLAN 100	10. XY.100.1/24	2001:db8:100:100::1/64	fe80::d1:2
	VLAN 101	10.XY.101.1/24	2001:db8:100:101::1/64	fe80::d1:3
	VLAN 102	10.XY.102.1/24	2001:db8:100:102::1/64	fe80::d1:4
D2	E1/0	10.XY.11.2/24	2001:db8:100:1011::2/64	fe80::d2:1
	VLAN 100	10.XY.100.2/24	2001:db8:100:100::2/64	fe80::d2:2
	VLAN 101	10.XY.101.2/24	2001:db8:100:101::2/64	fe80::d2:3
	VLAN 102	10.XY.102.2/24	2001:db8:100:102::2/64	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

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

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

1.2. Paso 1: cablee la red como se muestra en la topología.

Conecte los dispositivos como se muestra en el diagrama de topología y cablee según sea necesario.

1.3. Paso 2: Configure los ajustes básicos para cada dispositivo.

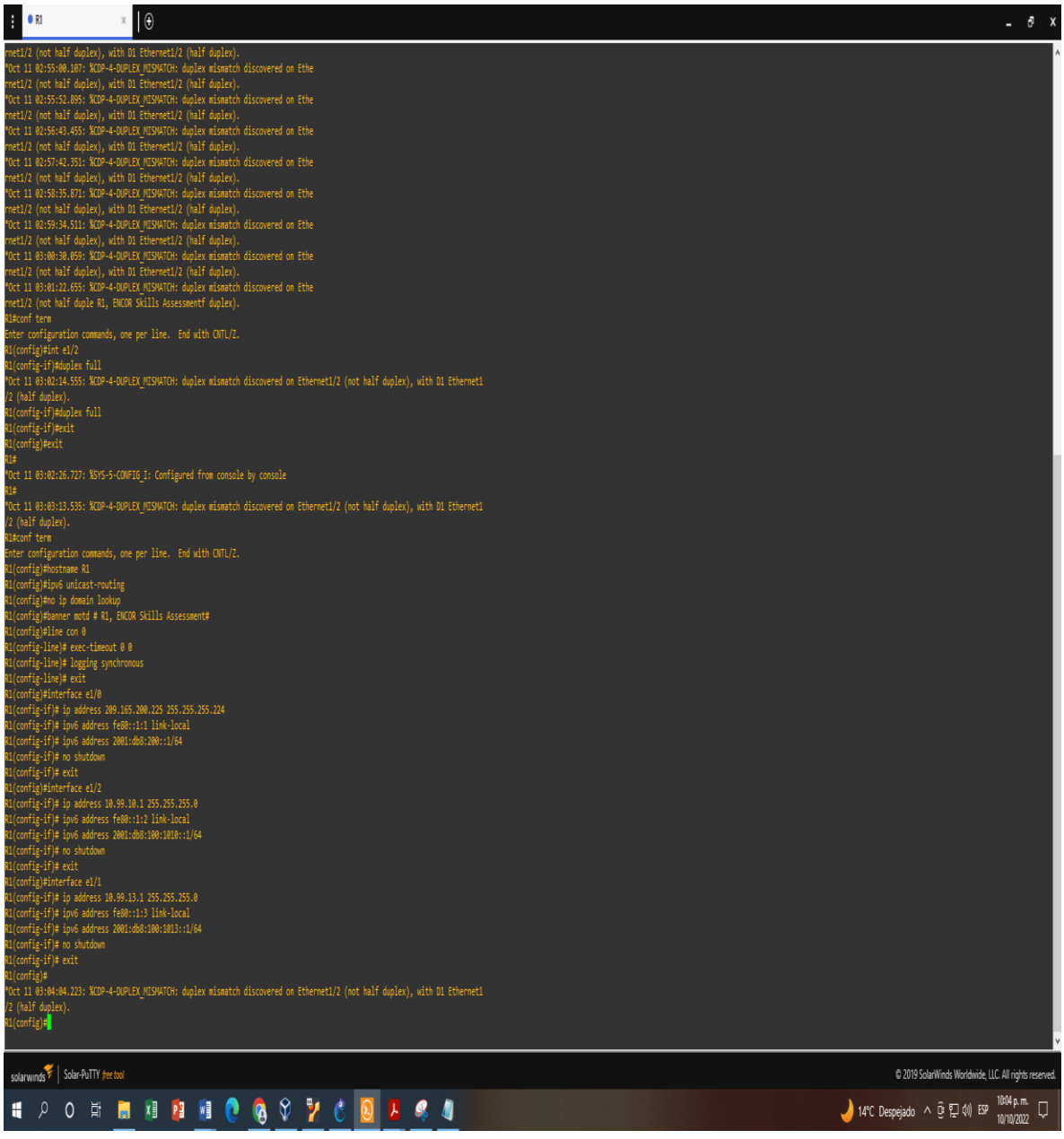
Consola en cada dispositivo, ingrese al modo de configuración global y aplique la configuración básica. Las configuraciones de inicio para cada dispositivo se proporcionan a continuación.

Router1

```
Configure terminal
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 10.99.10.1 255.255.255.0
ipv6 address fe80::1:2 link-local
ipv6 address 2001:db8:100:1010::1/64
no shutdown
exit
interface e1/1
ip address 10.99.13.1 255.255.255.0
ipv6 address fe80::1:3 link-local
ipv6 address 2001:db8:100:1013::1/64
no shutdown
```

exit
wr

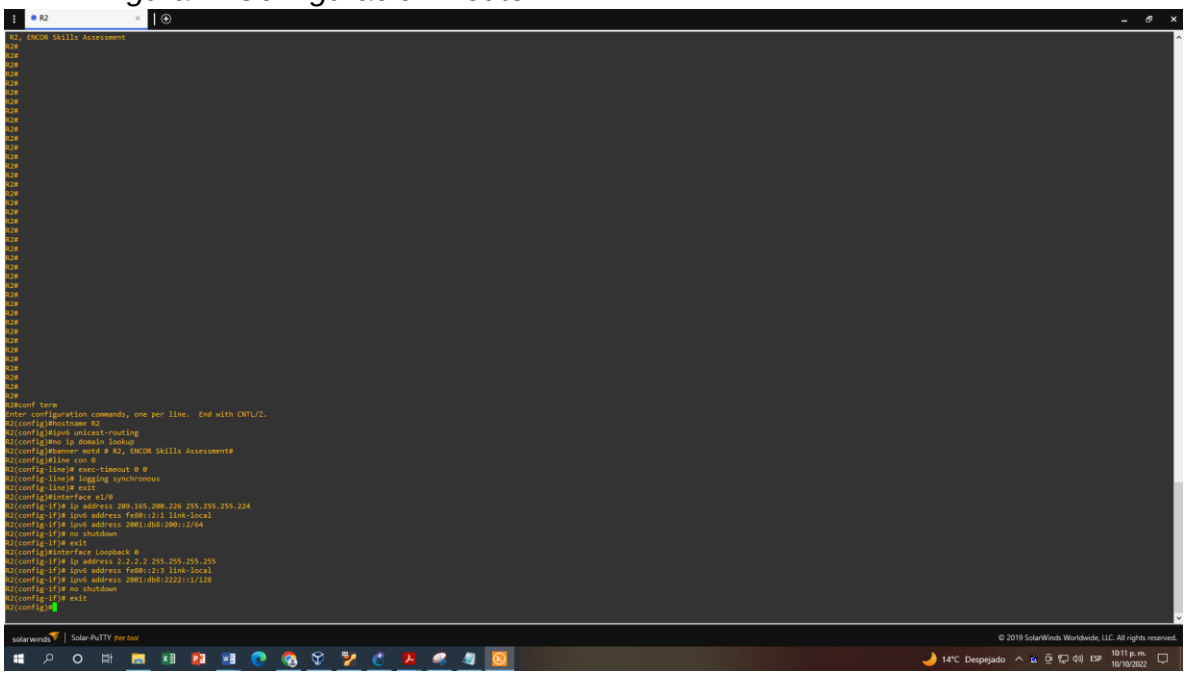
Figura 3. Configuración Router 1



Router R2

Configure terminal
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
wr

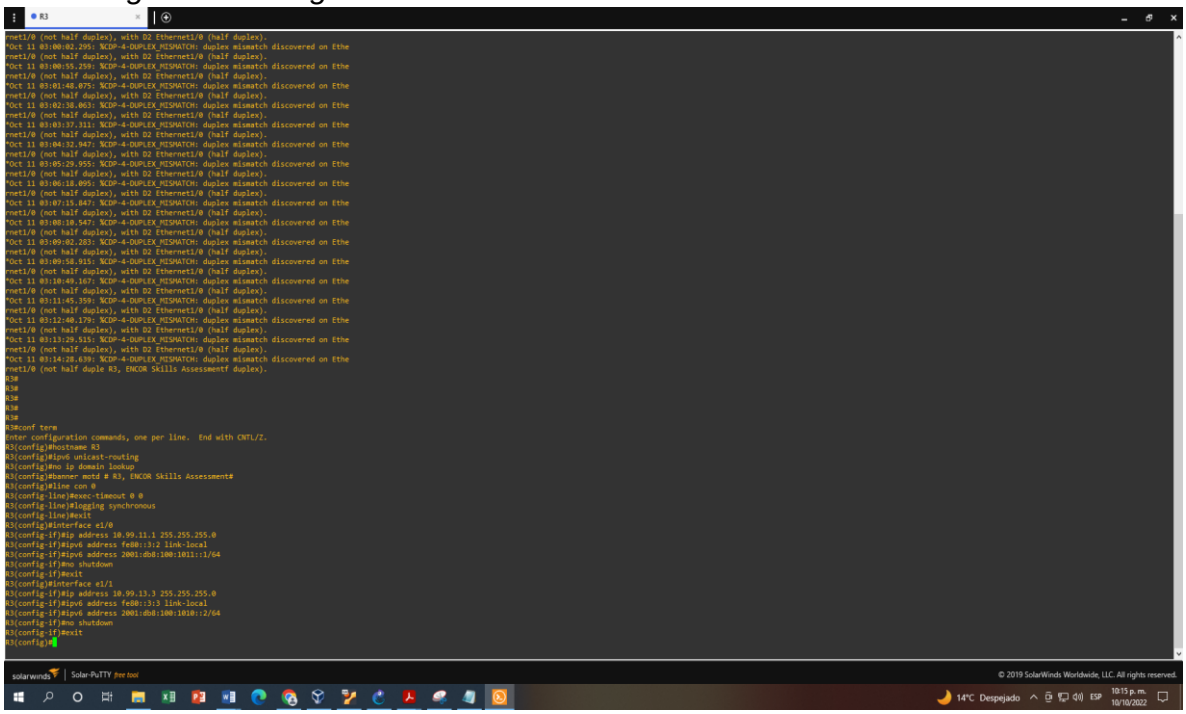
Figura 4. Configuración Router 2



Router R3

Configure terminal
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 10.99.11.1 255.255.255.0
ipv6 address fe80::3:2 link-local
ipv6 address 2001:db8:100:1011::1/64
no shutdown
exit
interface e1/1
ip address 10.99.13.3 255.255.255.0
ipv6 address fe80::3:3 link-local
ipv6 address 2001:db8:100:1010::2/64
no shutdown
exit
wr

Figura 5. Configuración Router 3

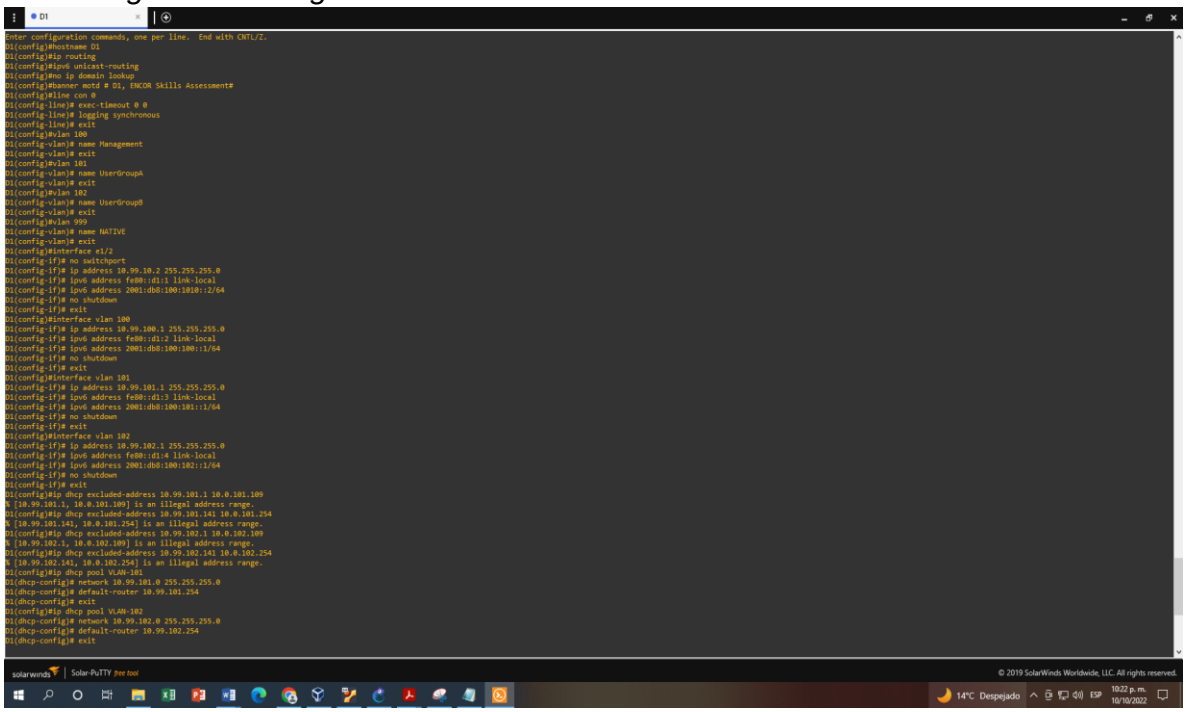


Switch D1

```
Configure terminal
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 10.99.10.2 255.255.255.0
ipv6 address fe80::d1:1 link-local
ipv6 address 2001:db8:100:1010::2/64
no shutdown
exit
interface vlan 100
ip address 10.99.100.1 255.255.255.0
ipv6 address fe80::d1:2 link-local
ipv6 address 2001:db8:100:100::1/64
no shutdown
exit
interface vlan 101
ip address 10.99.101.1 255.255.255.0
ipv6 address fe80::d1:3 link-local
ipv6 address 2001:db8:100:101::1/64
no shutdown
```

```
exit
interface vlan 102
ip address 10.99.102.1 255.255.255.0
ipv6 address fe80::d1:4 link-local
ipv6 address 2001:db8:100:102::1/64
no shutdown
exit
ip dhcp excluded-address 10.99.101.1 10.0.101.109
ip dhcp excluded-address 10.99.101.141 10.0.101.254
ip dhcp excluded-address 10.99.102.1 10.0.102.109
ip dhcp excluded-address 10.99.102.141 10.0.102.254
ip dhcp pool VLAN-101
network 10.99.101.0 255.255.255.0
default-router 10.99.101.254
exit
ip dhcp pool VLAN-102
network 10.99.102.0 255.255.255.0
default-router 10.99.102.254
exit
interface range e0/0-3,e1/0-1,e1/3,e2/0-3,e3/0-3
shutdown
exit
wr
```

Figura 6. Configuración Switch D1

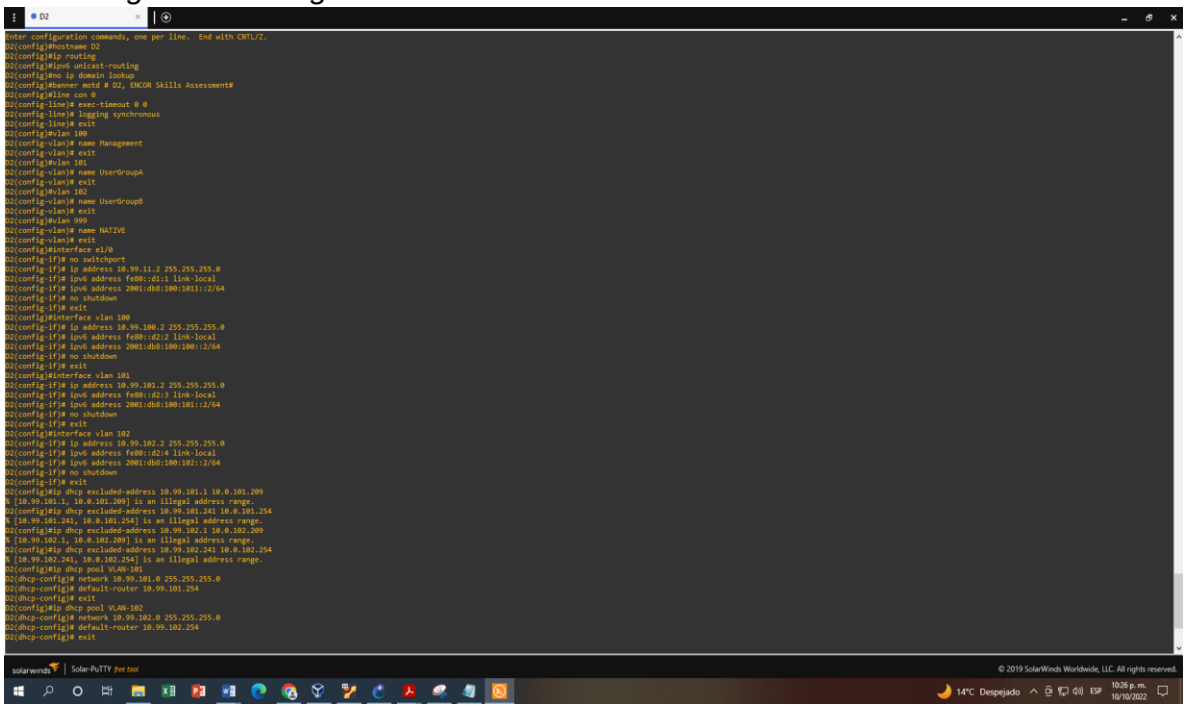


Switch D2

```
Configure terminal
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 10.99.11.2 255.255.255.0
ipv6 address fe80::d1:1 link-local
ipv6 address 2001:db8:100:1011::2/64
no shutdown
exit
interface vlan 100
ip address 10.99.100.2 255.255.255.0
ipv6 address fe80::d2:2 link-local
ipv6 address 2001:db8:100:100::2/64
no shutdown
exit
interface vlan 101
ip address 10.99.101.2 255.255.255.0
ipv6 address fe80::d2:3 link-local
ipv6 address 2001:db8:100:101::2/64
no shutdown
```

```
exit
interface vlan 102
ip address 10.99.102.2 255.255.255.0
ipv6 address fe80::d2:4 link-local
ipv6 address 2001:db8:100:102::2/64
no shutdown
exit
ip dhcp excluded-address 10.99.101.1 10.0.101.209
ip dhcp excluded-address 10.99.101.241 10.0.101.254
ip dhcp excluded-address 10.99.102.1 10.0.102.209
ip dhcp excluded-address 10.99.102.241 10.0.102.254
ip dhcp pool VLAN-101
network 10.99.101.0 255.255.255.0
default-router 10.99.101.254
exit
ip dhcp pool VLAN-102
network 10.99.102.0 255.255.255.0
default-router 10.99.102.254
exit
interface range e0/0-3,e1/1-3,e2/0-3,e3/0-3
shutdown
exit
wr
```

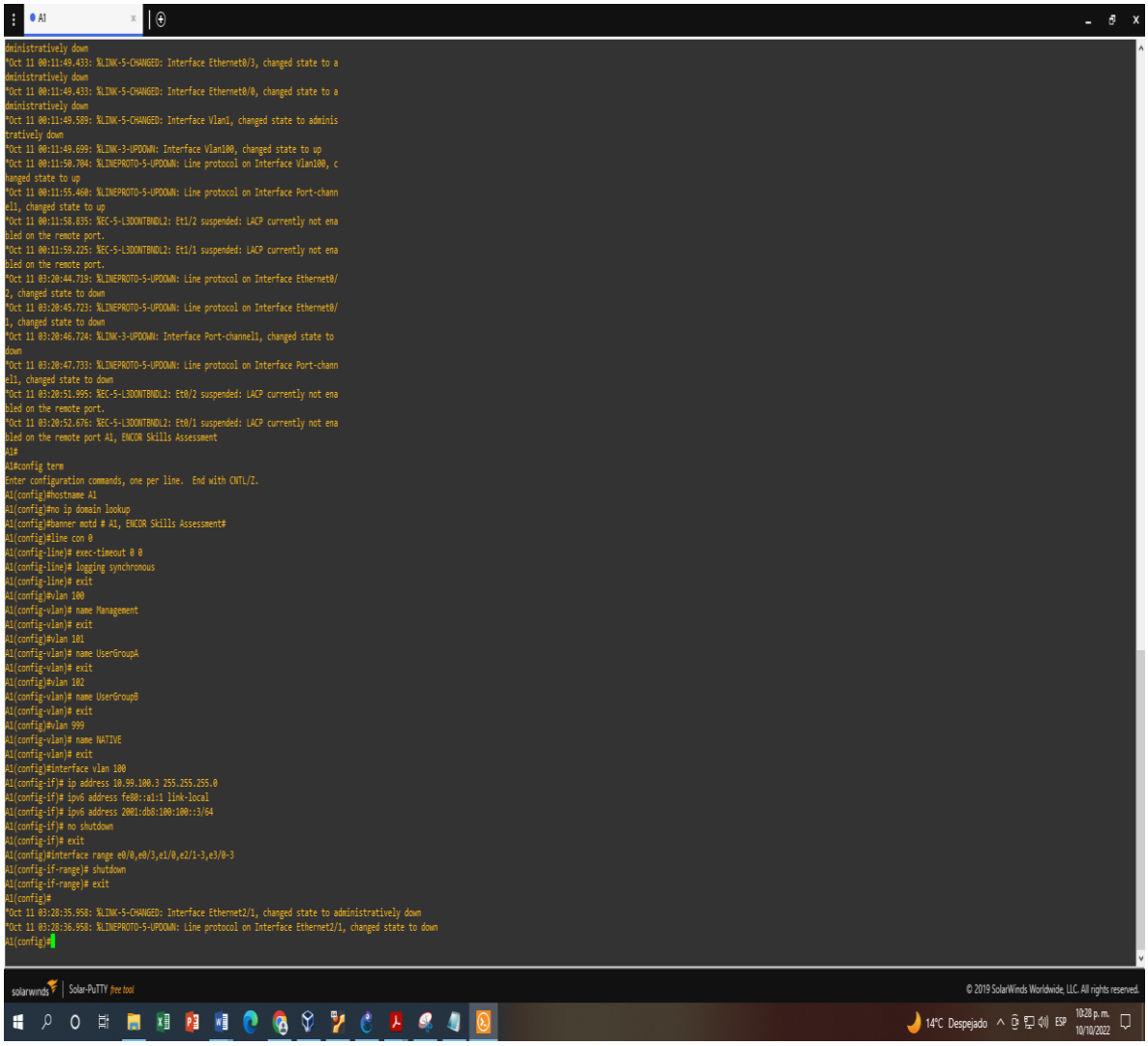
Figura 7. Configuración Switch D2



Switch A1

```
Configure terminal
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 10.99.100.3 255.255.255.0
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
wr
```

Figura 8. Configuración Switch A1



1.4. Paso 3: guarde la configuración en ejecución en startup-config en todos los dispositivos.

1.5. Paso 4: 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.XY.100.254, que será la dirección IP virtual de HSRP utilizada en la Parte 4.

Figura 9. Configuración IP PC4

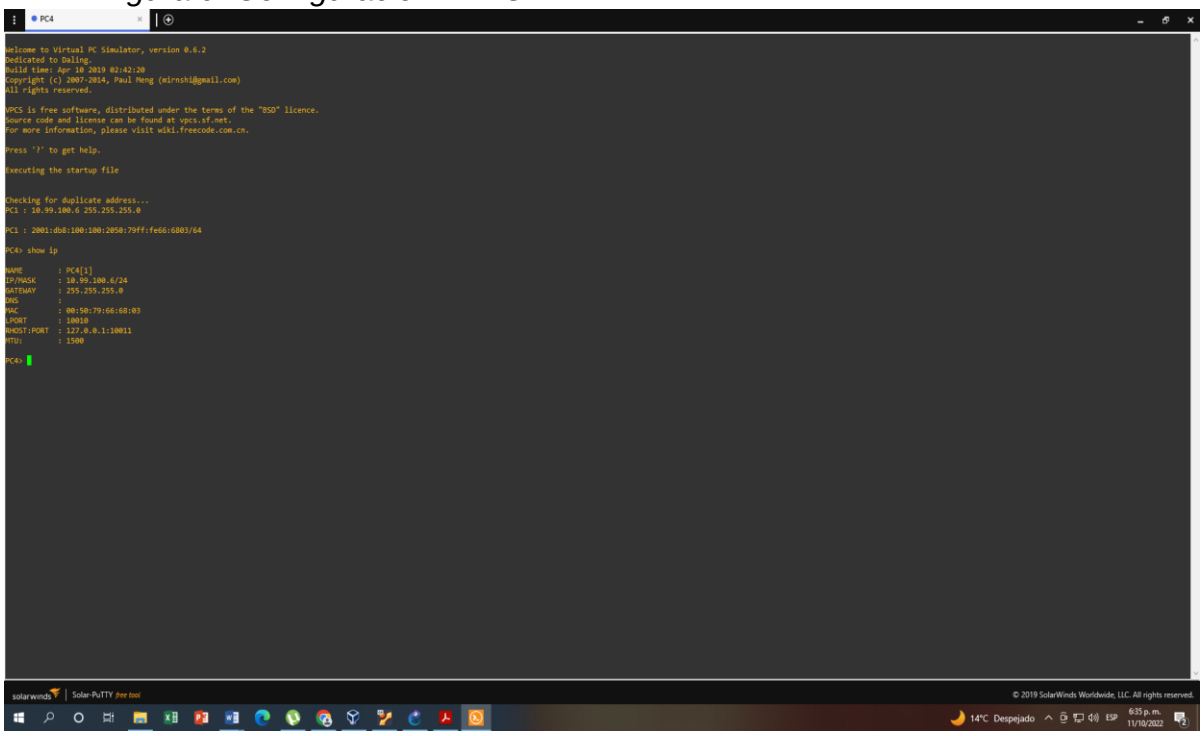
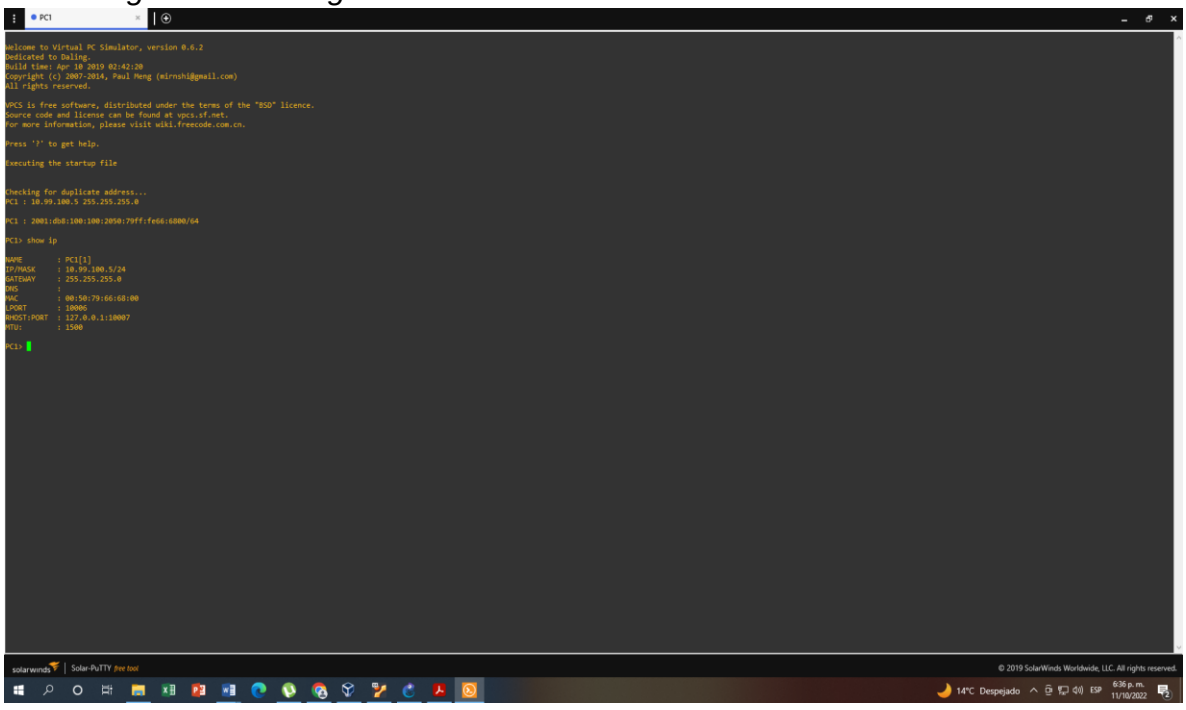


Figura 10. Configuración IP PC1



2. Parte 2: configurar la red de capa 2 y la compatibilidad con el host
   En esta parte de la evaluación de habilidades, completará la configuración de la red de capa 2 y configurará el soporte de host básico. Al final de esta parte, todos los interruptores deberían poder comunicarse. PC2 y PC3 deben recibir direccionamiento de DHCP y SLAAC.
   Sus tareas de configuración son las siguientes:

Tabla 2. Tareas de configuración parte 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: • D1 and D2 • D1 and A1 • D2 and A1	6
2.2	On all switches, change the native VLAN on trunk links.	Use VLAN 999 as the native VLAN.	6
2.3	On all switches, enable the Rapid Spanning-Tree Protocol.	Use Rapid Spanning Tree.	3
2.4	On D1 and D2, configure the appropriate RSTP root bridges based on the information in the topology diagram. D1 and D2 must provide backup in case of root bridge failure.	Configure D1 and D2 as root for the appropriate VLANs with mutually supporting priorities in case of switch failure.	2
2.5	On all switches, create LACP EtherChannels as shown in the topology diagram.	Use the following channel numbers: • D1 to D2 – Port channel 12 • D1 to A1 – Port channel 1 • D2 to A1 – Port channel 2	3

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: 10.99.100.1 • D2: 10.99.100.2 • PC4: 10.99.100.6 PC2 should successfully ping: • D1: 10.99.102.1 • D2: 10.99.102.2 PC3 should successfully ping: • D1: 10.99.101.1 • D2: 10.99.101.2 PC4 should successfully ping: • D1: 10.99.100.1 • D2: 10.99.100.2 • PC1: 10.99.100.5	1

2.1. Enable 802.1Q trunk links between:

- D1 and D2
- D1 and A1
- D2 and A1

Switch D1

```
interface range e2/0-3
switchport trunk encapsulation dot1q
switchport mode trunk

interface range e0/1-2
switchport trunk encapsulation dot1q
switchport mode trunk
```

Switch D2

```
interface range e2/0-3
switchport trunk encapsulation dot1q
switchport mode trunk

interface range e1/1-2
switchport trunk encapsulation dot1q
switchport mode trunk

interface range e0/1-2
switchport trunk encapsulation dot1q
switchport mode trunk
```

Switch A1

```
interface range e0/1-2
switchport trunk encapsulation dot1q
switchport mode trunk

interface range e1/1-2
switchport trunk encapsulation dot1q
switchport mode trunk
```

2.2. Use VLAN 999 as the native VLAN.

Switch D1

```
interface range e2/0-3
switchport trunk native vlan 999

interface range e0/1-2
switchport trunk native vlan 999
```

Switch D2

```
interface range e2/0-3
switchport trunk native vlan 999

interface range e0/1-2
switchport trunk native vlan 999
```

Switch A1

```
interface range e0/1-2
switchport trunk native vlan 999

interface range e1/1-2
switchport trunk native vlan 999
```

2.3. Use Rapid Spanning Tree.

```
Switch D1
spanning-tree mode rapid-pvst

Switch D2
spanning-tree mode rapid-pvst

Switch A1
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
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

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 e2/0-3
channel-group 12 mode active

interface range e0/1-2
channel-group 1 mode active

Switch D2
interface range e2/0-3
channel-group 12 mode active

interface range e1/1-2
channel-group 2 mode active

Switch A1

interface range e0/1-2
channel-group 1 mode active

interface range e1/1-2
channel-group 2 mode active

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 e0/0
switchport mode access
switchport access vlan 100
spanning-tree portfast

Switch D2

interface e0/0
switchport mode access
switchport access vlan 102
spanning-tree portfast

Switch A1

interface e1/3
switchport mode access
switchport access vlan 101
spanning-tree portfast

interface e2/1
switchport mode access
switchport access vlan 100
spanning-tree portfast

2.7. Verify IPv4 DHCP services.
Figura 11. DHCP en PC2

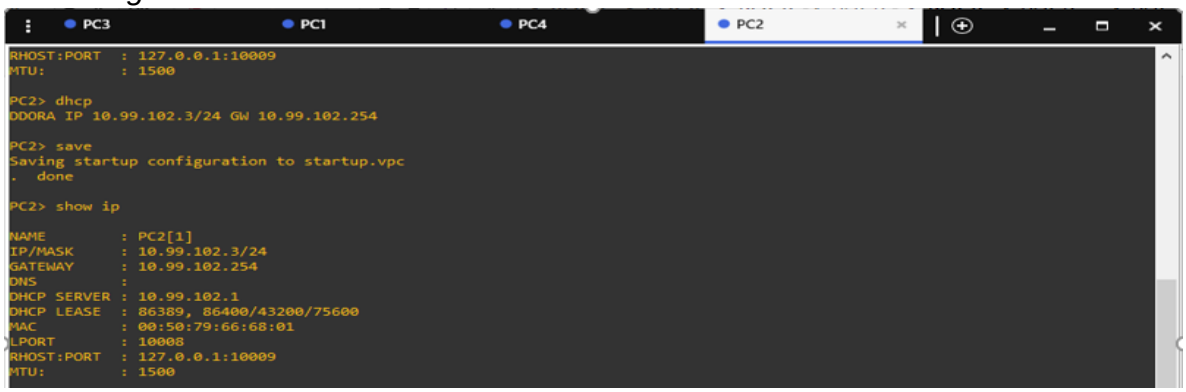


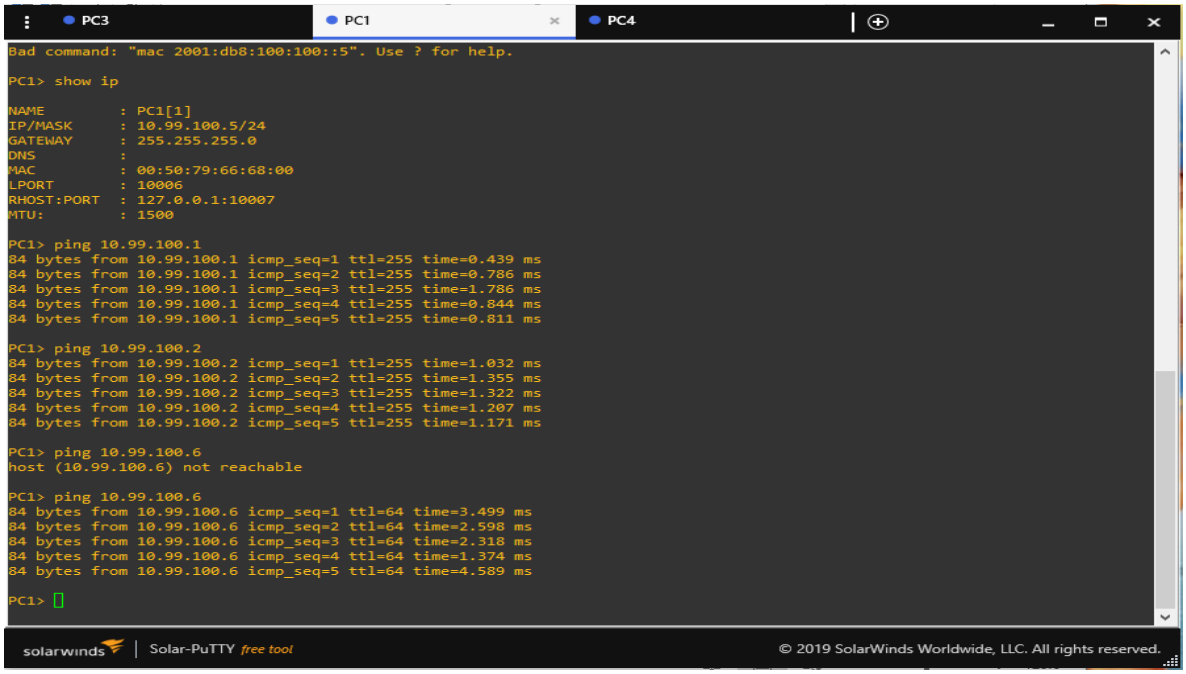
Figura 12. DHCP en PC3

2.8. Verify local LAN connectivity.

PC1 should successfully ping:

- D1: 10.99.100.1
- D2: 10.99.100.2
- PC4: 10.99.100.6

Figura 13. Ping desde el PC1



PC2 should successfully ping:

- D1: 10.99.102.1
- D2: 10.99.102.2

Figura 14. Ping desde PC2

PC3 should successfully ping:

- D1: 10.99.101.1
- D2: 10.99.101.2

Figura 15. Ping desde PC3

PC4 should successfully ping:

- D1: 10.99.100.1
- D2: 10.99.100.2
- PC1: 10.99.100.5

Figura 16. Ping desde PC4

3. Evaluación de habilidades ENCOR (Escenario 2)

Parte 1: Configurar protocolos de enrutamiento
En esta parte, configurará los protocolos de enrutamiento IPv4 e IPv6. Al final de esta parte, la red debe estar completamente convergente. Los pings de IPv4 e IPv6 a la interfaz Loopback 0 desde D1 y D2 deberían ser exitosos.
Nota: Los pings de los hosts no tendrán éxito porque sus puertas de enlace predeterminadas apuntan a la dirección HSRP que se habilitará en la Parte 4.
Sus tareas de configuración son las siguientes:

Tabla 3. Tareas de configuración parte 3

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

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.	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

Task#	Task	Specification	Points
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. On the “Company Network” (i.e., R1, R3, D1, and D2), configure single-area OSPFv2 in area 0.

Configuración OSPFv2 con ID4

Router 1

```
conf t
router ospf 4
router-id 0.0.4.1
network 10.99.10.0 0.0.0.255 area 0
```

network 10.99.13.0 0.0.0.255 area 0
default-information originate
exit

Router 3

conf t
router ospf 4
router-id 0.0.4.3
network 10.99.11.0 0.0.0.255 area 0
network 10.99.13.0 0.0.0.255 area 0
exit

Switch D1

conf t
router ospf 4
router-id 0.0.4.131
network 10.99.100.0 0.0.0.255 area 0
network 10.99.101.0 0.0.0.255 area 0
network 10.99.102.0 0.0.0.255 area 0
network 10.99.10.0 0.0.0.255 area 0
passive-interface default
no passive-interface e1/2
exit

Switch D2

conf t
router ospf 4
router-id 0.0.4.132
network 10.99.100.0 0.0.0.255 area 0
network 10.99.101.0 0.0.0.255 area 0
network 10.99.102.0 0.0.0.255 area 0
network 10.99.11.0 0.0.0.255 area 0
passive-interface default
no passive-interface e1/0
exit

3.2. On the “Company Network” (i.e., R1, R3, D1, and D2), configure classic single-area OSPFv3 in area 0.

Configuración OSPFv3 con ID6

Router 1

```
ipv6 router ospf 6
router-id 0.0.6.1
default-information originate
exit
interface e1/2
ipv6 ospf 6 area 0
exit
interface e1/1
ipv6 ospf 6 area 0
exit
```

Router 3

```
ipv6 router ospf 6
router-id 0.0.6.3
exit
interface e1/0
ipv6 ospf 6 area 0
exit
interface e1/1
ipv6 ospf 6 area 0
exit
end
```

Switch D1

```
ipv6 router ospf 6
router-id 0.0.6.131
passive-interface default
no passive-interface e1/2
exit
interface e1/2
ipv6 ospf 6 area 0
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
```

Switch D2

```
ipv6 router ospf 6
router-id 0.0.6.132
passive-interface default
no passive-interface e1/0
exit
interface e1/0
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
```

3.3. On R2 in the “ISP Network”, configure MP-BGP.

Router 2

```
conf t
ip route 0.0.0.0 0.0.0.0 loopback 0
ipv6 route ::/0 loopback 0
router bgp 500
bgp router-id 2.2.2.2
neighbor 209.165.200.225 remote-as 300
```

```
neighbor 2001:db8:200::1 remote-as 300
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
```

3.4. On R1 in the “ISP Network”, configure MP-BGP.

Router 1

```
ip route 10.99.0.0 255.0.0.0 null0
ipv6 route 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 10.99.0.0 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
```

Figura 17. Prueba configuración Router 1

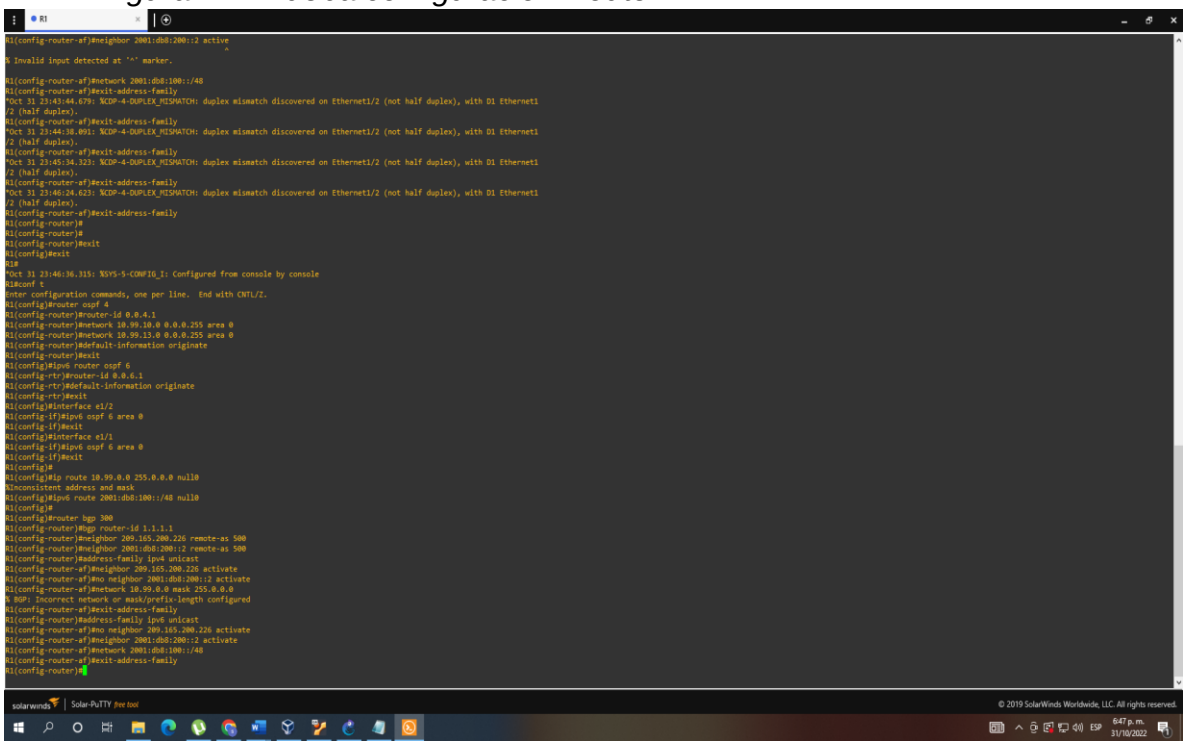


Figura 18. Prueba configuración Router 2

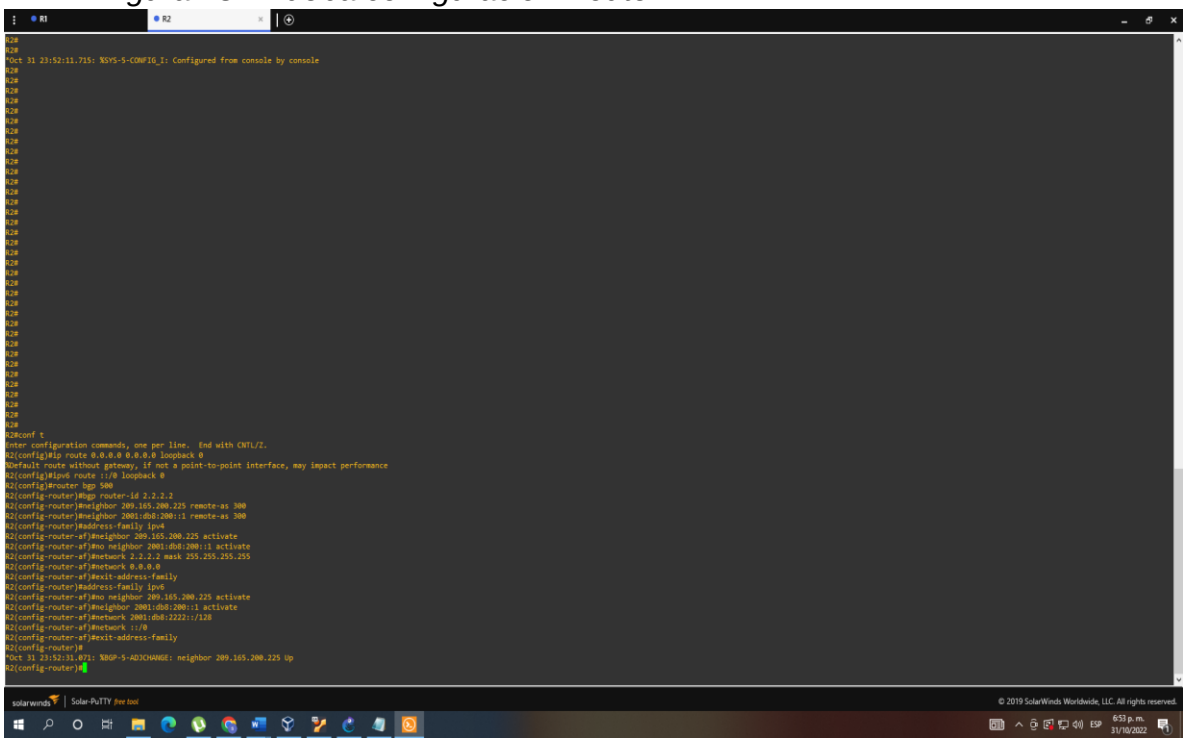


Figura 19. Prueba configuración Router 3

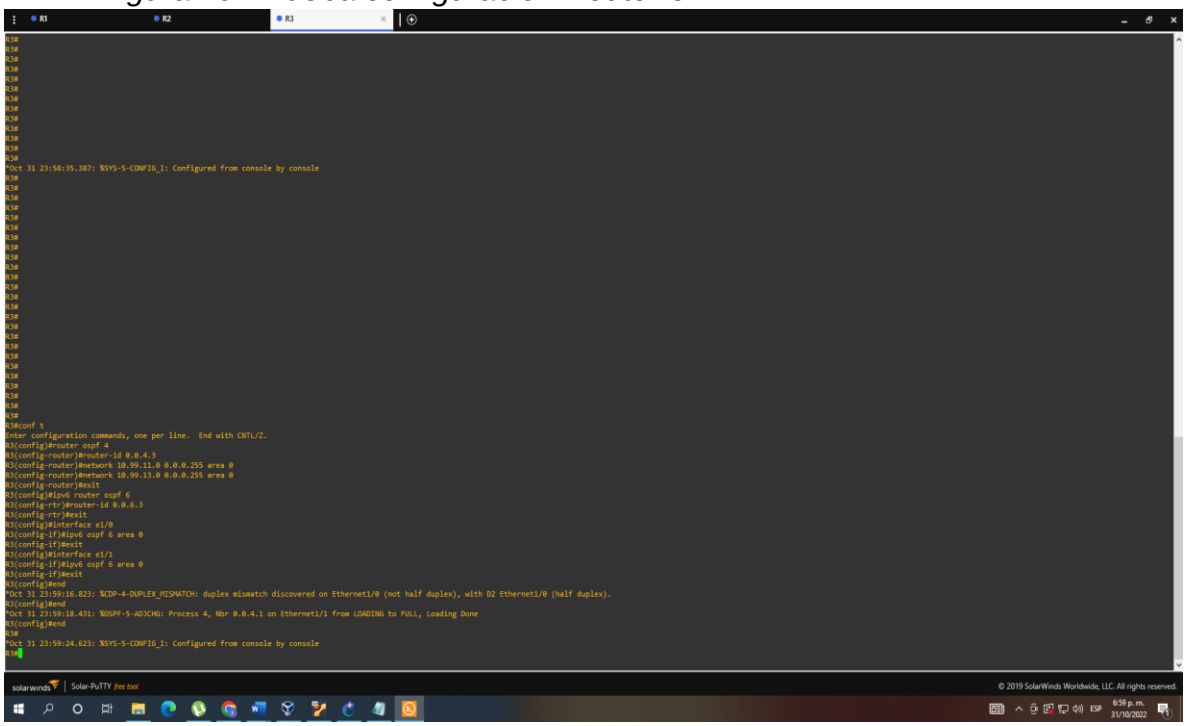


Figura 20. Prueba configuración Switch D1

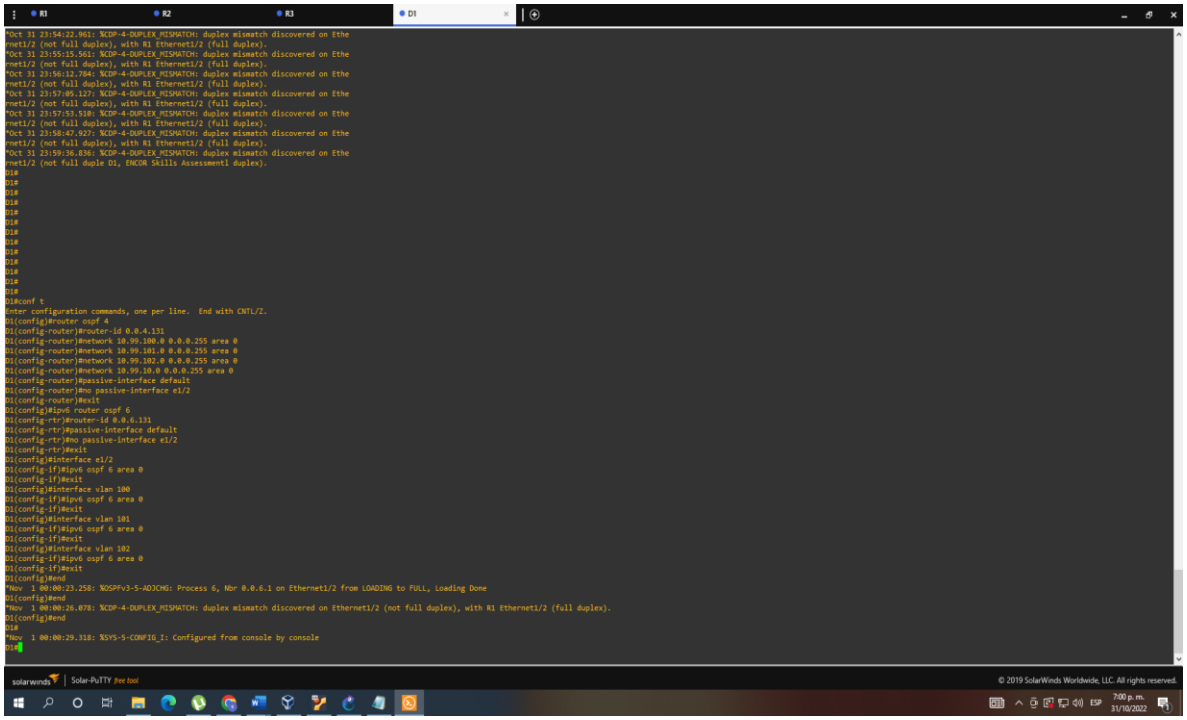
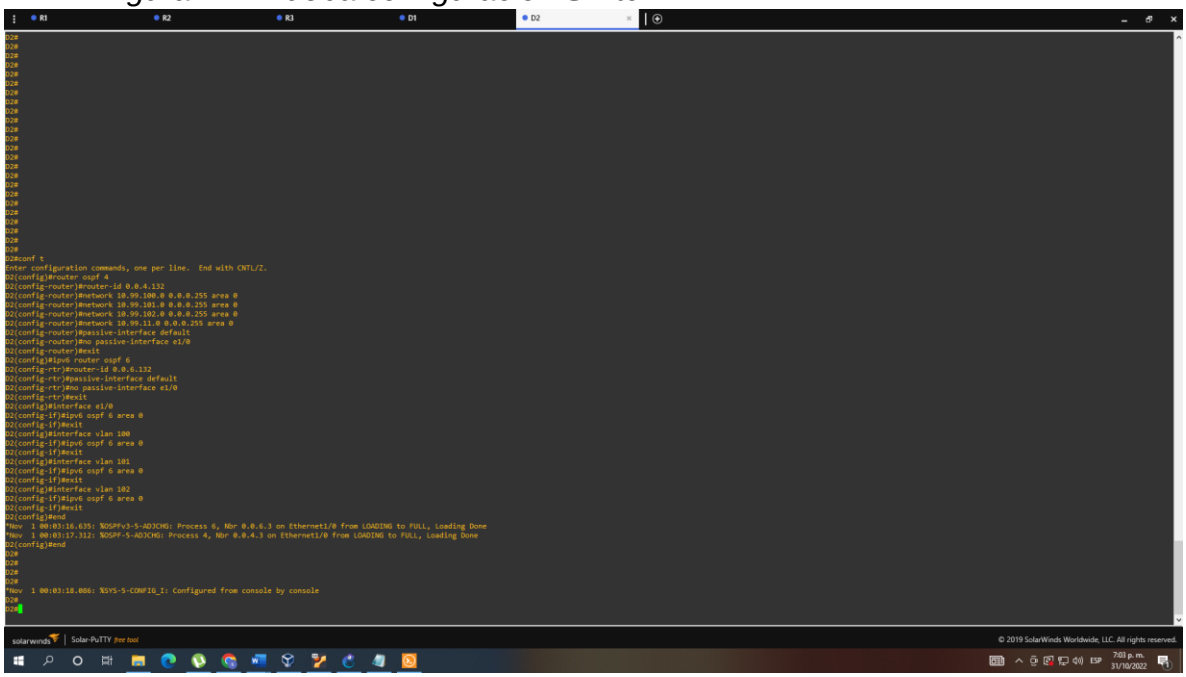


Figura 21. Prueba configuración Switch D2



4. En esta parte, configurará la versión 2 de HSRP para proporcionar redundancia de primer salto para hosts en la "Red de la empresa".
   Sus tareas de configuración son las siguientes:

Tabla 4. Tareas de configuración parte 4.

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

4.3	On D1, configure HSRPv2.	D1 is the primary router for VLANs 100 and 102; therefore, their priority will also be changed to 150. Configure HSRP version 2. Configure IPv4 HSRP group **104** for VLAN 100: • Assign the virtual IP address **10.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. • Track object 6 and decrement by 60.	8

Task#	Task	Specification	Points
		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.	

4.4	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. • 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.	

Task#	Task	Specification	Points
		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. On D1, create IP SLAs that test the reachability of R1 interface E1/2.

Switch D1

```
conf t
ip sla 4
icmp-echo 10.99.10.1
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
```

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

Switch D2

```
conf t
ip sla 4
icmp-echo 10.99.11.1
frequency 5
exit
ip sla 6
icmp-echo 2001:db8:100:1011::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
```

4.3. On D1, configure HSRPv2.

Switch D1

```
interface vlan 100
standby version 2
standby 104 ip 10.99.100.254
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 10.99.101.254
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 10.99.102.254
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
```

4.4. On D2, configure HSRPv2.

Switch D2

```
interface vlan 100
standby version 2
standby 104 ip 10.99.100.254
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 10.99.101.254
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 10.99.102.254
standby 124 preempt
standby 124 track 4 decrement 60
standby 126 ipv6 autoconfig
standby 126 preempt
standby 126 track 6 decrement 60
exit
```

Figura 22. Configuración Switch D1

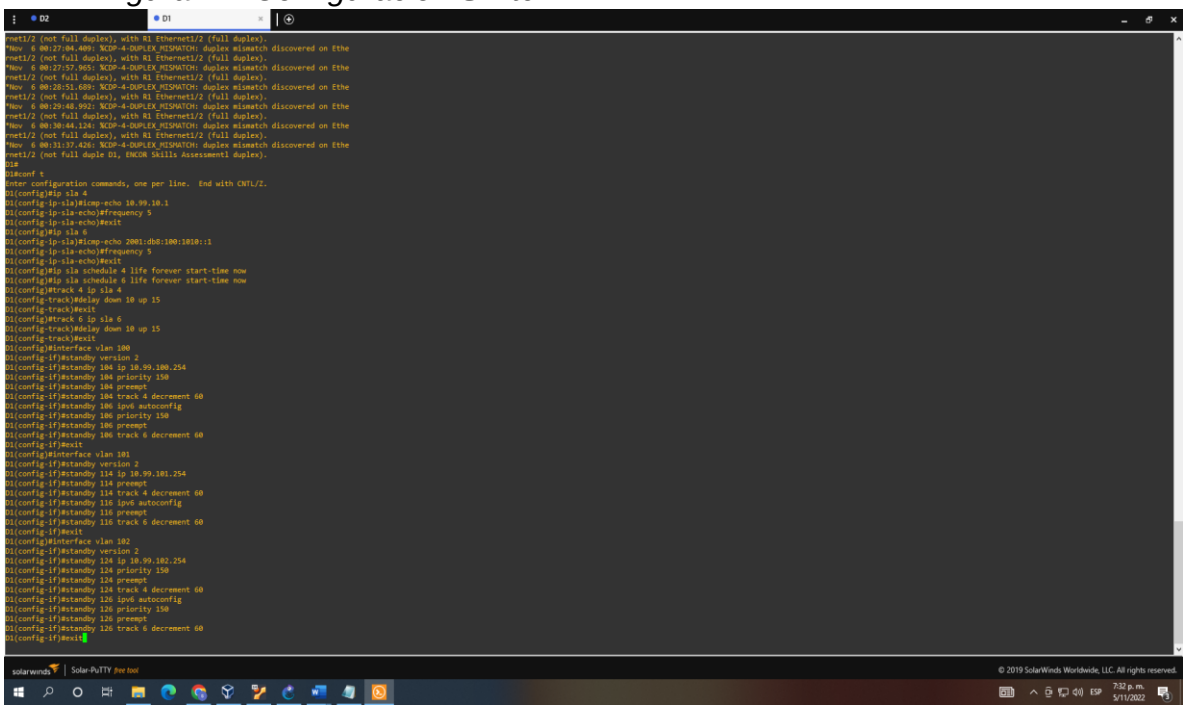


Figura 23. Configuración Switch D2

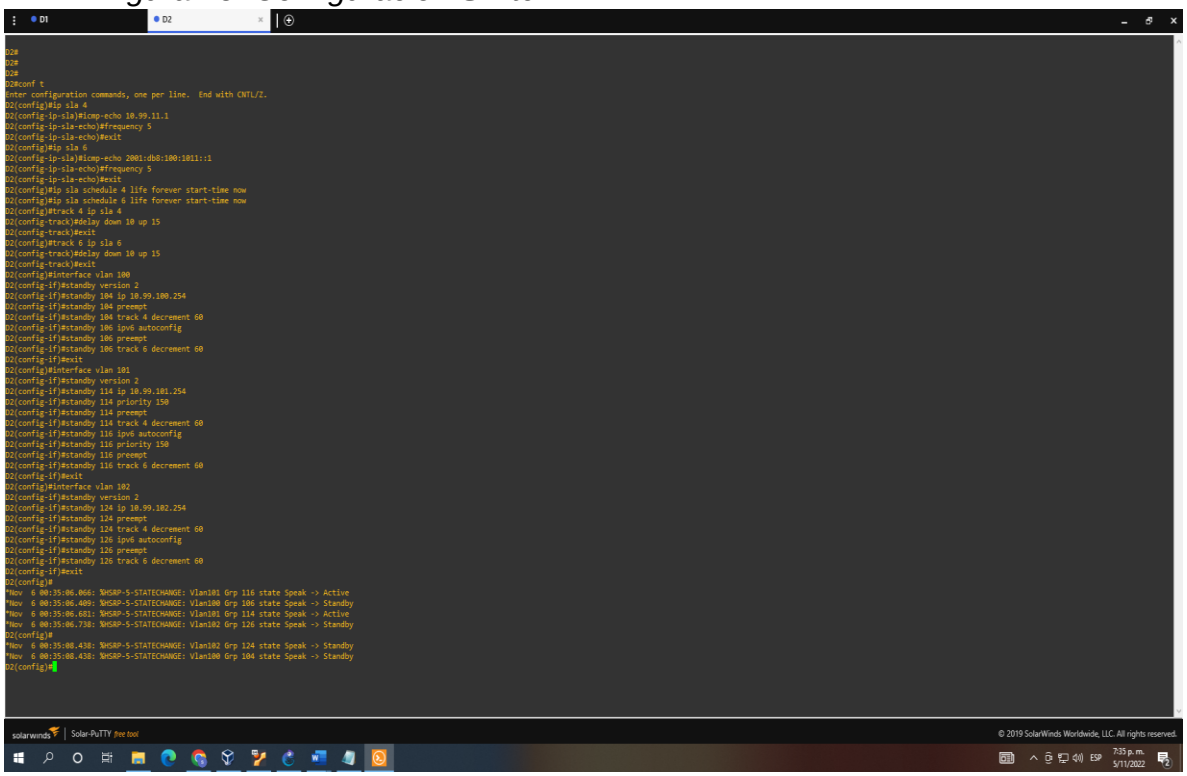


Figura 24. Verificación Switch D1

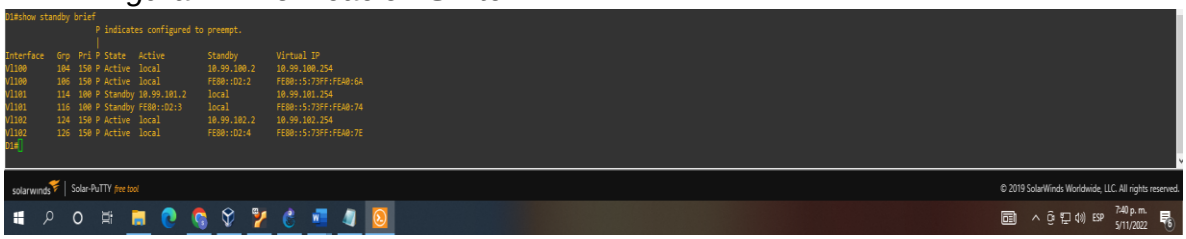
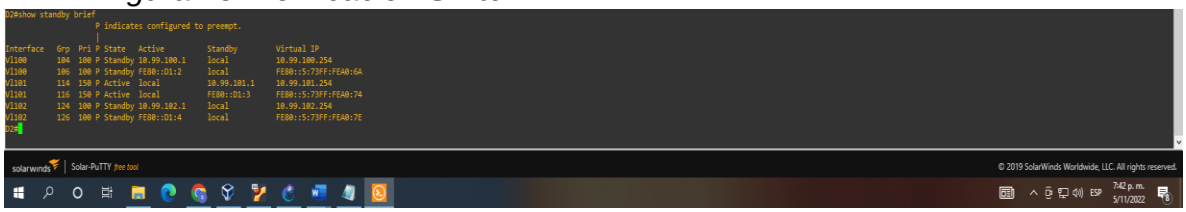


Figura 25. Verificación Switch D2



CONCLUSIONES

En el desarrollo del trabajo podemos concluir que aprendimos a manejar un software especializado GNS3 apoyado con una máquina virtual llamada Virtual Box, y un software complementario llamada Putty para el desarrollo de la prueba de habilidades prácticas CCNP, donde se repasaron todos los conceptos aprendidos en los módulos enfocando todo a los diseños de las redes y realizamos configuraciones aplicadas al desarrollo de ambientes en redes empresariales.

En la primera parte estructuramos redes conmutadas usando protocolo STP y la configuración de VLANs, aprendiendo a realizar la composición de una infraestructura de red jerárquica. Cada capa en la jerarquía proporciona funciones específicas que definen su función dentro de la red general, esto ayuda a optimizar y seleccionar las características, el hardware y el software de red adecuados para llevar a cabo las funciones específicas de esa capa de red. Evidenciamos el funcionamiento de la red por medio del software GNS3.

En la segunda parte diseñamos soluciones de red mediante la configuración básica y avanzada de protocolos de enrutamiento para la implementación de servicios IP en ambientes de red empresariales LAN y WAN, se asignaron grupos, VLAN y se realizaron pines desde los PCS hacia diferentes dispositivos corroborando el funcionamiento y la conectividad de los dispositivos.

Aprendí a configurar los protocolos de enrutamiento en IPV4 e IPV6 para que sean convergentes, se realizaron configuraciones en la interfaz loopback 0 para los dos switches, también, se configuro la versión 2 de HSRP para proporcionar redundancia para hosts en la red empresarial, todo esto para entender las amenazas que afectan nuestras redes y la importancia de una buena estructura en la conexión de nuestros dispositivos complementado por unos protocolos de seguridad, de esta manera administramos mejor el manejo de la información a través, de estas redes sin correr el riesgo que llegue a personas no deseadas.

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