DIPLOMADO DE PROFUNDIZACIÓN CISCO
PRUEBA DE HABILIDADES PRÁCTICAS CCNP

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Diplomado de opción de grado presentado para optar el
título de IINGENIERO ELECTRÓNICO

DIRECTOR:
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NOTA DE ACEPTACIÓN

Firma del presidente del Jurado

Firma del Jurado

Firma del Jurado

MARIQUITA, 27 de noviembre de 2022

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“Gracias por creer en mí”

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“Gracias por estar siempre allí.”

CONTENIDO

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GLOSARIO

BGP: El Border Gateway Protocol (BGP) es un protocolo escalable de dynamic routing usado en la Internet por grupos de enrutadores para compartir información de enrutamiento. BGP usa parámetros de ruta o atributos para definir políticas de enrutamiento y crear un entorno de enrutamiento estable. Ese protocolo permite que divulgue más de un camino hacia y desde la Internet a su red y recursos, lo que le ofrece caminos redundantes y puede aumentar su tiempo de actividad.

OSPF: Open Shortest Path First (OSPF) es un protocolo de direccionamiento de tipo enlaceestado, desarrollado para las redes IP y basado en el algoritmo de primera vía más corta (SPF).

Topología de red: Se define como un mapa físico o lógico de una red para intercambiar datos. En otras palabras, es la forma en que está diseñada la red, sea en el plano físico o lógico.

Router: Es un dispositivo que permite interconectar computadoras que funcionan en el marco de una red. Su función es la de establecer la ruta que destinará a cada paquete de datos dentro de una red informática.

GNS3: Es un simulador gráfico de red lanzado en 2008, que te permite diseñar topologías de red complejas y poner en marcha simulaciones sobre ellos, permitiendo la combinación de dispositivos tanto reales como virtuales.

HOST: El término host o anfitrión se usa en informática para referirse a las computadoras u otros dispositivos conectados a una red que proveen y utilizan servicios de ella.

Redundancia: Empleo de palabras innecesarias para expresar una idea o concepto por estar ya expresado con otras palabras o por sobreentenderse sin ellas.

RESUMEN

Para el desarrollo de este trabajo se utilizó el simulador GNS3 y protocolos de enrutamiento: OSPF protocolo de enrutamiento interior y un BGP protocolo de enrutamiento exterior; estos protocolos tienen la habilidad de almacenar rutas independientes de otros routers para así seleccionar la conmutación de paquetes y hacer más rápido el tráfico entre ellos.

El Diplomado de profundización Cisco prueba de habilidades prácticas CCNP está dividido en cuatro partes:

Construir la red y configurar los parámetros básicos de los dispositivos y el direccionamiento de las interfaces.

Configurar la capa 2 de la red y el soporte del Host.

Configurar los protocolos de enrutamiento.

Configurar la redundancia del primer salto.

Estas partes pretenden dotar a los estudiantes de los conocimientos suficientes para que sean capaces de reproducir simulaciones y por medio de estas poder analizar su comportamiento e impacto frente a las distintas variables que se presenten lo cual es de gran ayuda a la hora de medir el riesgo y optimizar decisiones en la parte de redes electrónicas.

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

ABSTRACT

For the development of this work we used the GNS3 simulator and routing protocols: OSPF interior routing protocol and BGP exterior routing protocol. These protocols have the ability to store routes independent of other routers in order to select the that a packet switching and make the traffic between them faster.

The Cisco proficiency has practical skills CCNP and is divided into four parts

Build the network and configure the basic parameters of the devices and interface addressing.

Configure the network layer 2 and Host support.

Configure routing protocols.

Configure first hop redundancy.

These parts are intended to provide students with sufficient knowledge to be able to reproduce simulations and through these to be able to analyze their behavior and impact against of the different variables that are presented, making it a great help in measuring risk and optimizing decisions electronics networks.

Keywords: CISCO, CCNP, Switching, Routing, Networks, Electronics.

INTRODUCIÓN

Las redes de datos que utilizamos en nuestra vida diaria para aprender, jugar y trabajar se pueden establecer desde redes locales hasta grandes redes globales. Posiblemente tengamos en nuestra casa un router y dos o más pc; en el trabajo, su empresa probablemente tenga varios routers y switches que atienden las necesidades de comunicación.

Para el desarrollo del escenario planteado utilizamos el emulador GNS3 (Graphical Network Simulator), aplicación libre, con gran utilidad tanto en el mundo empresarial como en el mundo académico, ya que su uso reduce el coste de implementación de las redes, este nos permite probar y experimentar nuevas funcionalidades de CISCO sin poner en peligro la integridad de una red real con configuraciones erróneas que ocasionen pérdidas en cuanto a tiempo e inversión de recursos.

En este trabajo se da solución a las actividades aplicando los conocimientos adquiridos a lo largo del curso; se verán temas como configuración de routers y protocolos de enrutamiento de acuerdo a lo solicitado, configuración de interfaces de acuerdo a una topología de red, conceptos para configuración de switches llevando a cabo unas configuraciones determinadas, configuración de la capa 2 de la red y el soporte del Host, configuración de varios mecanismos de seguridad en los dispositivos de la topología, etc.

DESARROLLO DEL ESCENARIO DE LA PRUEBA DE HABILIDADES

Topology

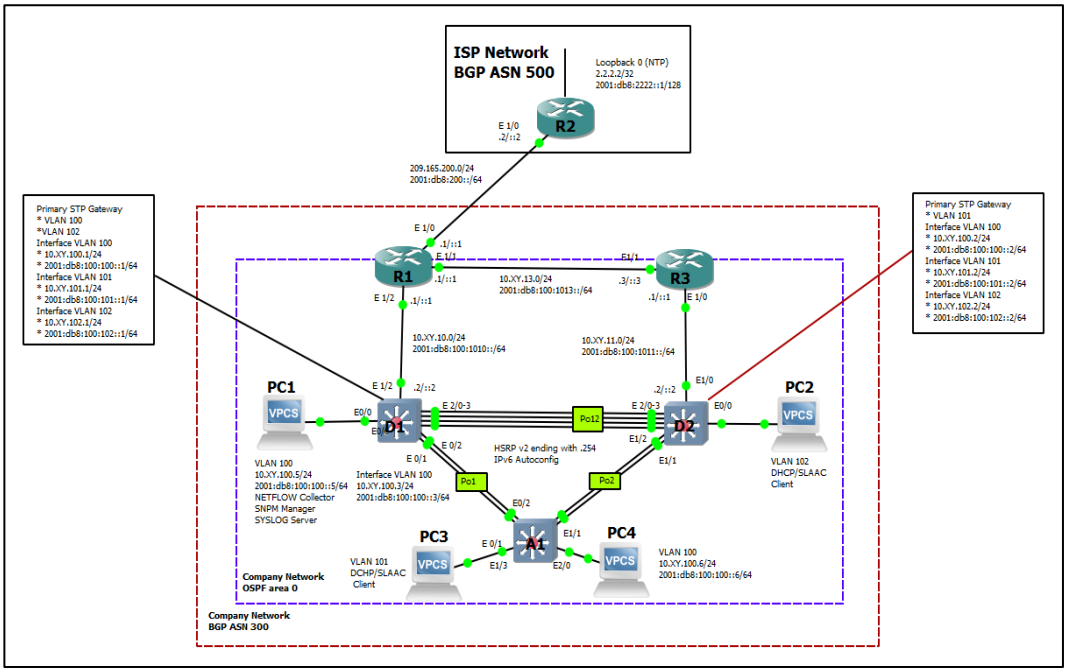

Ilustración 1:Escenario propuesto

ADDRESSING TABLE

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	10.02.10.1/24	2001:db8:100:1010::1/64	fe80::1:2
	E1/1	10. 02.13.1/24	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
	Loopback 0	2.2.2.2/32	2001:db8:2222::1/128	fe80::2:3
R3	E1/0	10. 02.11.1/24	2001:db8:100:1011::1/64	fe80::3:2
	E1/1	10. 02.13.3/24	2001:db8:100:1013::3/64	fe80::3:3
D1	E1/2	10. 02.10.2/24	2001:db8:100:1010::2/64	fe80::d1:1
	VLAN 100	10. 02.100.1/24	2001:db8:100:100::1/64	fe80::d1:2
	VLAN 101	10.02.101.1/24	2001:db8:100:101::1/64	fe80::d1:3
	VLAN 102	10.02.102.1/24	2001:db8:100:102::1/64	fe80::d1:4
D2	E1/0	10.02.11.2/24	2001:db8:100:1011::2/64	fe80::d2:1
	VLAN 100	10.02.100.2/24	2001:db8:100:100::2/64	fe80::d2:2
	VLAN 101	10.02.101.2/24	2001:db8:100:101::2/64	fe80::d2:3
	VLAN 102	10.02.102.2/24	2001:db8:100:102::2/64	fe80::d2:4

Device	Interface	IPv4 Address	IPv6 Address	IPv6 Link-Local
A1	VLAN 100	10.02.100.3/23	2001:db8:100:100::3/64	fe80::a1:1
PC1	NIC	10.02.100.5/24	2001:db8:100:100::5/64	EUI-64
PC2	NIC	DHCP	SLAAC	EUI-64
PC3	NIC	DHCP	SLAAC	EUI-64
PC4	NIC	10.02.100.6/24	2001:db8:100:100::6/64	EUI-64

Tabla 1:Tabla de direccionamiento

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.

Se hace la topología en GNS3 teniendo como guía del escenario propuesto y cableamos los dispositivos.

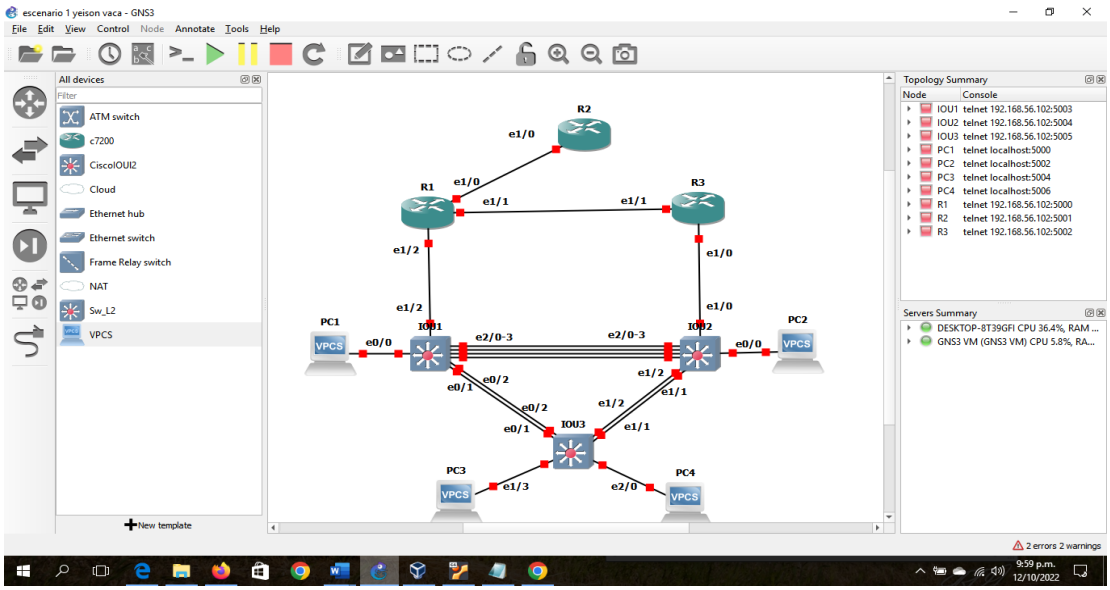

Ilustración 2: Topología escenario propuesto en GNS3

Step 2: 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

```
R1#en
R1#conf term
Enter configuration commands, one per line.  End with CNTL/Z.
R1(config)#hostname R1
R1(config)#ipv6 unicast-routing
R1(config)#no ip domain lookup
R1(config)#banner motd # R1, ENCOR Skills Assessment#
R1(config)#line con 0
R1(config-line)# exec-timeout 0 0
R1(config-line)# logging synchronous
R1(config-line)# exit
R1(config)#interface e1/0
R1(config-if)# ip address 209.165.200.225 255.255.255.224
R1(config-if)# ipv6 address fe80::1:1 link-local
R1(config-if)# ipv6 address 2001:db8:200::1/64
R1(config-if)# no shutdown
R1(config-if)# exit
R1(config)#interface e1/2
R1(config-if)# ip address 10.02.10.1 255.255.255.0
R1(config-if)# ipv6 address fe80::1:2 link-local
R1(config-if)# ipv6 address 2001:db8:100:1010::1/64
R1(config-if)# no shutdown
R1(config-if)# exit
R1(config)#interface e1/1
R1(config-if)# ip address 10.02.13.1 255.255.255.0
R1(config-if)# ipv6 address fe80::1:3 link-local
R1(config-if)# ipv6 address 2001:db8:100:1013::1/64
R1(config-if)# no shutdown
R1(config-if)# exit
```

Router R2

```
R2#en
R2#conf term
Enter configuration commands, one per line.  End with CNTL/Z.
```

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

Router R3

```
R3#en
R3#conf term
Enter configuration commands, one per line.  End with CNTL/Z.
R3(config)#hostname R3
R3(config)#ipv6 unicast-routing
R3(config)#no ip domain lookup
R3(config)#banner motd # R3, ENCOR Skills Assessment#
R3(config)#line con 0
R3(config-line)# exec-timeout 0 0
R3(config-line)# logging synchronous
R3(config-line)# exit
R3(config)#interface e1/0
R3(config-if)# ip address 10.02.11.1 255.255.255.0
R3(config-if)# ipv6 address fe80::3:2 link-local
R3(config-if)# ipv6 address 2001:db8:100:1011::1/64
R3(config-if)# no shutdown
R3(config-if)# exit
R3(config)#interface e1/1
R3(config-if)# ip address 10.02.13.3 255.255.255.0
R3(config-if)# ipv6 address fe80::3:3 link-local
R3(config-if)# ipv6 address 2001:db8:100:1010::2/64
R3(config-if)# no shutdown
```

R3(config-if)# exit

Switch D1

IOU1#en
IOU1#conf term
Enter configuration commands, one per line. End with CNTL/Z.
IOU1(config)#hostname D1
D1(config)#ip routing
D1(config)#ipv6 unicast-routing
D1(config)#no ip domain lookup
D1(config)#banner motd # D1, ENCOR Skills Assessment#
D1(config)#line con 0
D1(config-line)# exec-timeout 0 0
D1(config-line)# logging synchronous
D1(config-line)# exit
D1(config)#vlan 100
D1(config-vlan)# name Management
D1(config-vlan)# exit
D1(config)#vlan 101
D1(config-vlan)# name UserGroupA
D1(config-vlan)# exit
D1(config)#vlan 102
D1(config-vlan)# name UserGroupB
D1(config-vlan)# exit
D1(config)#vlan 999
D1(config-vlan)# name NATIVE
D1(config-vlan)# exit
D1(config)#interface e1/2
D1(config-if)# no switchport
D1(config-if)# ip address 10.02.10.2 255.255.255.0
D1(config-if)# ipv6 address fe80::d1:1 link-local
D1(config-if)# ipv6 address 2001:db8:100:1010::2/64
D1(config-if)# no shutdown
D1(config-if)# exit
D1(config)#interface vlan 100
D1(config-if)# ip address 10.02.100.1 255.255.255.0
D1(config-if)# ipv6 address fe80::d1:2 link-local
D1(config-if)# ipv6 address 2001:db8:100:100::1/64
D1(config-if)# no shutdown
D1(config-if)# exit
D1(config)#interface vlan 101
D1(config-if)# ip address 10.02.101.1 255.255.255.0
D1(config-if)# ipv6 address fe80::d1:3 link-local
D1(config-if)# ipv6 address 2001:db8:100:101::1/64

```
D1(config-if)# no shutdown
D1(config-if)# exit
D1(config)#interface vlan 102
D1(config-if)# ip address 10.02.102.1 255.255.255.0
D1(config-if)# ipv6 address fe80::d1:4 link-local
D1(config-if)# ipv6 address 2001:db8:100:102::1/64
D1(config-if)# no shutdown
D1(config-if)# exit
D1(config)#ip dhcp excluded-address 10.02.101.1 10.0.101.109
D1(config)#ip dhcp excluded-address 10.02.101.141 10.0.101.254
D1(config)#ip dhcp excluded-address 10.02.102.1 10.0.102.109
D1(config)#ip dhcp excluded-address 10.02.102.141 10.0.102.254
D1(config)#ip dhcp pool VLAN-101
D1(dhcp-config)# network 10.02.101.0 255.255.255.0
D1(dhcp-config)# default-router 10.02.101.254
D1(dhcp-config)# exit
D1(config)#ip dhcp pool VLAN-102
D1(dhcp-config)# network 10.02.102.0 255.255.255.0
D1(dhcp-config)# default-router 10.02.102.254
D1(dhcp-config)# exit
D1(config)#interface range e0/0-3,e1/0-1,e1/3,e2/0-3,e3/0-3
D1(config-if-range)# shutdown
D1(config-if-range)# exit
```

Switch D2

```
D2#en
D2#conf term
Enter configuration commands, one per line.  End with CNTL/Z.
D2(config)#hostname D2
D2(config)#ip routing
D2(config)#ipv6 unicast-routing
D2(config)#no ip domain lookup
D2(config)#banner motd # D2, ENCOR Skills Assessment#
D2(config)#line con 0
D2(config-line)# exec-timeout 0 0
D2(config-line)# logging synchronous
D2(config-line)# exit
D2(config)#vlan 100
D2(config-vlan)# name Management
D2(config-vlan)# exit
D2(config)#vlan 101
D2(config-vlan)# name UserGroupA
D2(config-vlan)# exit
D2(config)#vlan 102
```

```
D2(config-vlan)# name UserGroupB
D2(config-vlan)# exit
D2(config)#vlan 999
D2(config-vlan)# name NATIVE
D2(config-vlan)# exit
D2(config)#interface e1/0
D2(config-if)# no switchport
D2(config-if)# ip address 10.02.11.2 255.255.255.0
D2(config-if)# ipv6 address fe80::d1:1 link-local
D2(config-if)# ipv6 address 2001:db8:100:1011::2/64
D2(config-if)# no shutdown
D2(config-if)# exit
D2(config)#interface vlan 100
D2(config-if)# ip address 10.02.100.2 255.255.255.0
D2(config-if)# ipv6 address fe80::d2:2 link-local
D2(config-if)# ipv6 address 2001:db8:100:100::2/64
D2(config-if)# no shutdown
D2(config-if)# exit
D2(config)#interface vlan 101
D2(config-if)# ip address 10.02.101.2 255.255.255.0
D2(config-if)# ipv6 address fe80::d2:3 link-local
D2(config-if)# ipv6 address 2001:db8:100:101::2/64
D2(config-if)# no shutdown
D2(config-if)# exit
D2(config)#interface vlan 102
D2(config-if)# ip address 10.02.102.2 255.255.255.0
D2(config-if)# ipv6 address fe80::d2:4 link-local
D2(config-if)# ipv6 address 2001:db8:100:102::2/64
D2(config-if)# no shutdown
D2(config-if)# exit
D2(config)#ip dhcp excluded-address 10.02.101.1 10.0.101.209
D2(config)#ip dhcp excluded-address 10.02.101.241 10.0.101.254
D2(config)#ip dhcp excluded-address 10.02.102.1 10.0.102.209
D2(config)#ip dhcp excluded-address 10.02.102.241 10.0.102.254
D2(config)#ip dhcp pool VLAN-101
D2(dhcp-config)# network 10.02.101.0 255.255.255.0
D2(dhcp-config)# default-router 10.02.101.254
D2(dhcp-config)# exit
D2(config)#ip dhcp pool VLAN-102
D2(dhcp-config)# network 10.02.102.0 255.255.255.0
D2(dhcp-config)# default-router 10.02.102.254
D2(dhcp-config)# exit
D2(config)#interface range e0/0-3,e1/1-3,e2/0-3,e3/0-3
D2(config-if-range)# shutdown
D2(config-if-range)# exit
```

Switch A1

```
IOU3#en
IOU3#conf term
Enter configuration commands, one per line.  End with CNTL/Z.
IOU3(config)#hostname A1
A1(config)#no ip domain lookup
A1(config)#banner motd # A1, ENCOR Skills Assessment#
A1(config)#line con 0
A1(config-line)# exec-timeout 0 0
A1(config-line)# logging synchronous
A1(config-line)# exit
A1(config)#vlan 100
A1(config-vlan)# name Management
A1(config-vlan)# exit
A1(config)#vlan 101
A1(config-vlan)# name UserGroupA
A1(config-vlan)# exit
A1(config)#vlan 102
A1(config-vlan)# name UserGroupB
A1(config-vlan)# exit
A1(config)#vlan 999
A1(config-vlan)# name NATIVE
A1(config-vlan)# exit
A1(config)#interface vlan 100
A1(config-if)# ip address 10.02.100.3 255.255.255.0
A1(config-if)# ipv6 address fe80::a1:1 link-local
A1(config-if)# ipv6 address 2001:db8:100:100::3/64
A1(config-if)# no shutdown
A1(config-if)# exit
A1(config)#interface range e0/0,e0/3,e1/0,e2/1-3,e3/0-3
A1(config-if-range)# shutdown
A1(config-if-range)# exit
```

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

Utilizamos el commando copy running-config startup-config en cada uno de los dispositivos para tener una copia de seguridad.

```
R1#copy running-config startup-config
Destination filename [startup-config]?
Warning: Attempting to overwrite an NVRAM configuration previously written
```

by a different version of the system image.
Overwrite the previous NVRAM configuration?[confirm]
Building configuration...
[OK]

Ilustración 3:Configuración guardada en R1

R2#copy running-config startup-config
Destination filename [startup-config]?
Warning: Attempting to overwrite an NVRAM configuration previously written
by a different version of the system image.
Overwrite the previous NVRAM configuration?[confirm]
Building configuration...[OK]

Ilustración 4: Configuración guardada en R2

R3#copy running-config startup-config
Destination filename [startup-config]?
Warning: Attempting to overwrite an NVRAM configuration previously written
by a different version of the system image.
Overwrite the previous NVRAM configuration?[confirm]
Building configuration...
[OK]

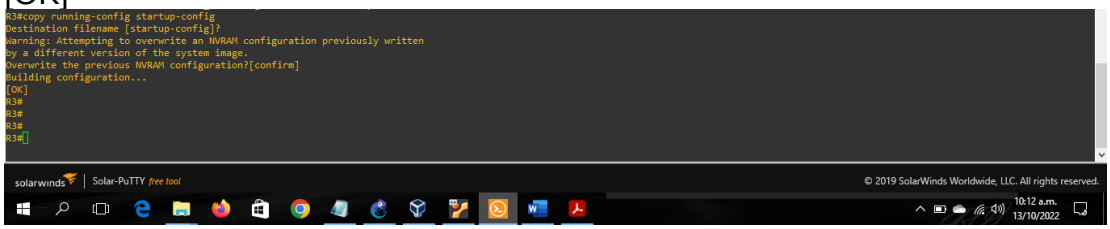

Ilustración 5: Configuración guardada en R3

D1#copy running-config startup-config
Destination filename [startup-config]?
Warning: Attempting to overwrite an NVRAM configuration previously written by a different version of the system image.
Overwrite the previous NVRAM configuration?[confirm]
Building configuration...
Compressed configuration from 2274 bytes to 1277 bytes[OK]

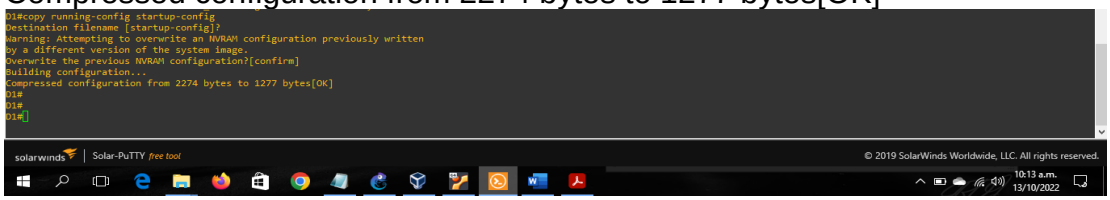

Ilustración 6: Configuración guardada en D1

D2#copy running-config startup-config
Destination filename [startup-config]?
Warning: Attempting to overwrite an NVRAM configuration previously written by a different version of the system image.
Overwrite the previous NVRAM configuration?[confirm]
Building configuration...
Compressed configuration from 2274 bytes to 1281 bytes[OK]

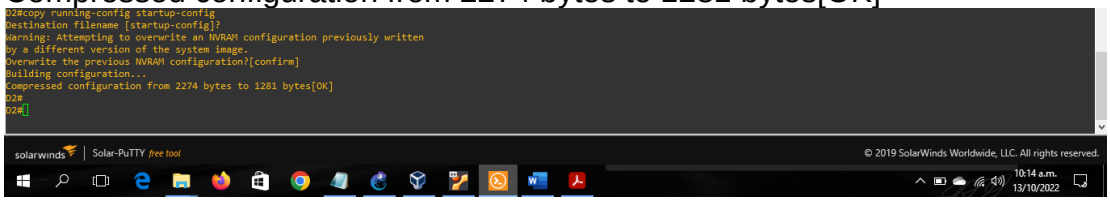

Ilustración 7: Configuración guardada en D2

A1#copy running-config startup-config
Destination filename [startup-config]?
Warning: Attempting to overwrite an NVRAM configuration previously written by a different version of the system image.
Overwrite the previous NVRAM configuration?[confirm]
Building configuration...
Compressed configuration from 1632 bytes to 986 bytes[OK]

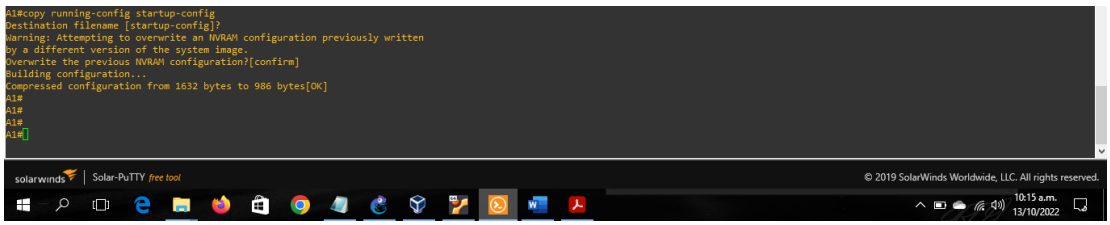

Ilustración 8: Configuración guardada en A1

Configure PC 1 and PC 4 host addressing as shown in the addressing table. Assign a default gateway address of 10.02.100.254 which will be the HSRP virtual IP address used in Part 4.

Configuramos el PC1 Con la dirección IP que se encuentra en la table de dieccionamiento y la Puerta de enlace predeterminada 10.02.100.254

PC1> ip 10.02.100.5/24 10.02.100.254
Checking for duplicate address...
PC1 : 10.2.100.5 255.255.255.0 gateway 10.2.100.254

PC1>
PC1> show ip

NAME : PC1[1]
IP/MASK : 10.2.100.5/24
GATEWAY : 10.2.100.254
DNS :
MAC : 00:50:79:66:68:00
LPORT : 10006
RHOST:PORT : 127.0.0.1:10007
MTU: : 1500
Escribimos sabe para guardar los cambios
PC1> save
Saving startup configuration to startup.vpc. done

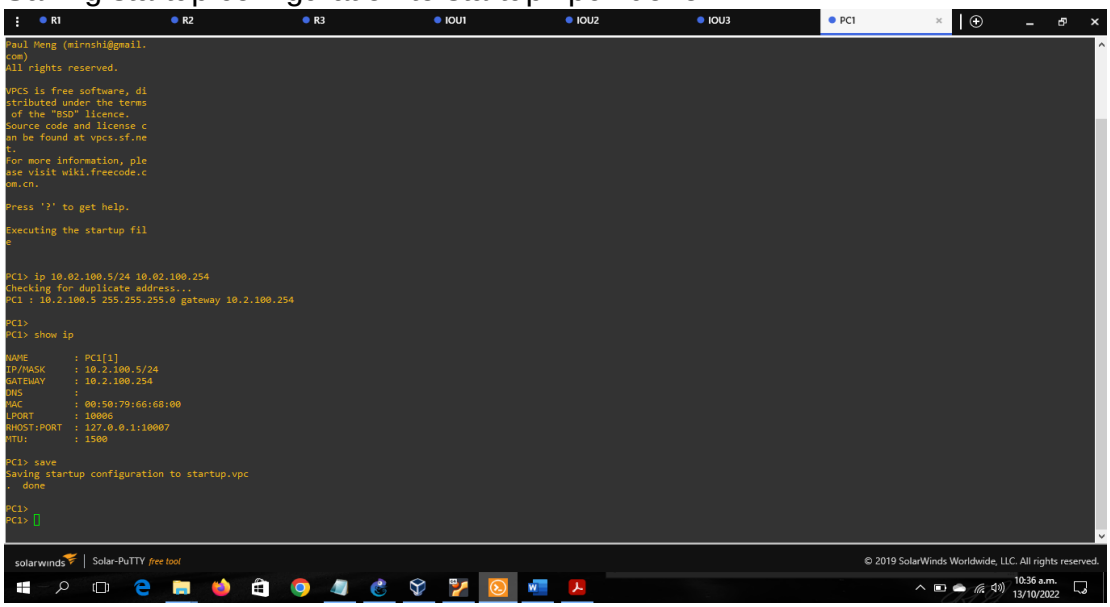

Ilustración 9: Direccionamiento PC1

El mismo proceso en PC4

PC4> ip 10.02.100.6/24 10.02.100.254
Checking for duplicate address...
PC1 : 10.2.100.6 255.255.255.0 gateway 10.2.100.254
PC4> show ip
NAME : PC4[1]
IP/MASK : 10.2.100.6/24
GATEWAY : 10.2.100.254
DNS :
MAC : 00:50:79:66:68:03
LPORT : 10010
RHOST:PORT : 127.0.0.1:10011
MTU: : 1500
PC4> save
Saving startup configuration to startup.vpc done

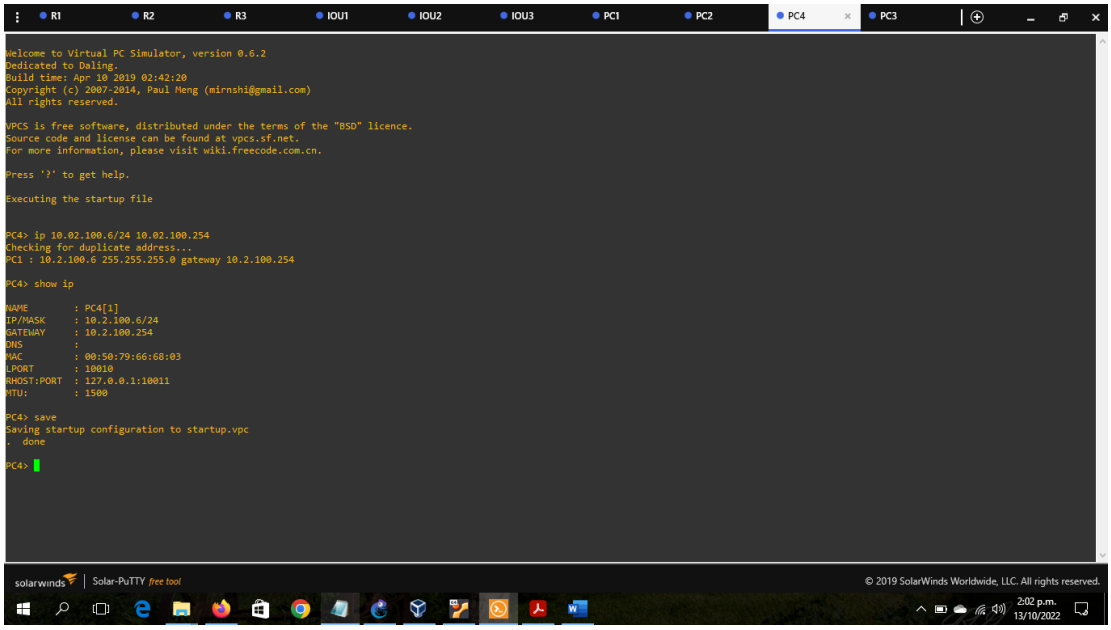

Ilustración 10: Dirccionamiento PC4

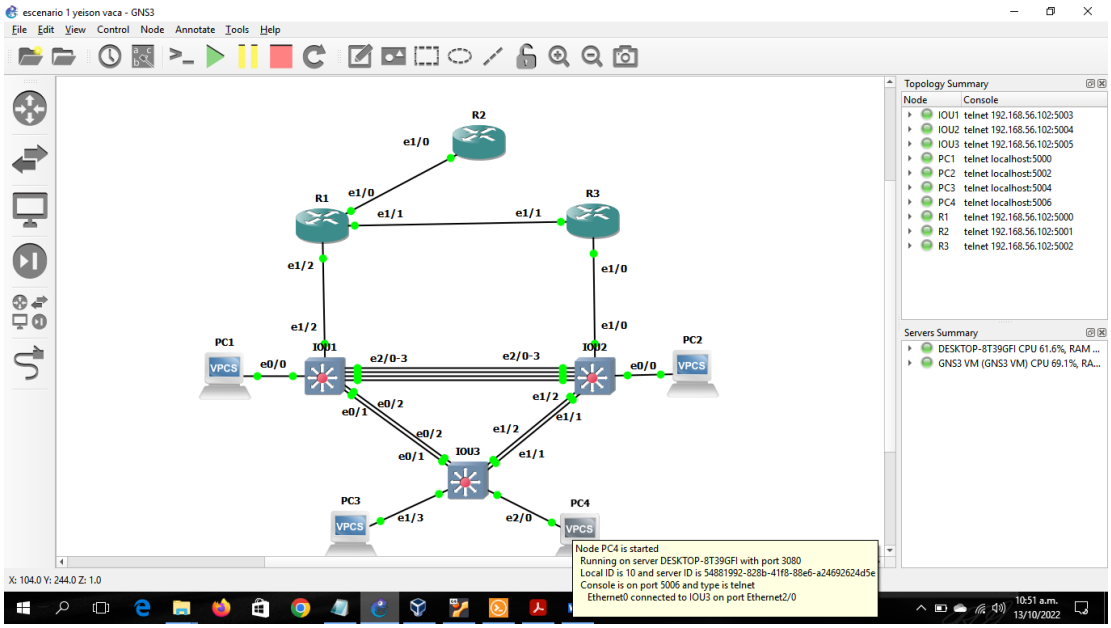

Ilustración 11: Escenario propuesto en GNS3

Part 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:

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

Task#	Task	Specification	Points
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 addresses.	1
2.8	Verify local LAN connectivity.	PC1 should successfully ping: D1: 10.XY.100.1 D2: 10.XY.100.2 PC4: 10.XY.100.6 PC2 should successfully ping: D1: 10.XY.102.1 D2: 10.XY.102.2 PC3 should successfully ping: D1: 10.XY.101.1 D2: 10.XY.101.2 PC4 should successfully ping: D1: 10.XY.100.1 D2: 10.XY.100.2 PC1: 10.XY.100.5	1

Tabla 2: Tarea 2

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

Elegimos las interfaces troncales de cada switch según la topología y utilizamos el comando switchport trunk encapsulation dot1q y se habilita la encapsulación luego switchport mode trunky y habiltamos el mode de la troncal.

D1y D2
D1(config)#interface range e2/0-3
D1(config-if-range)#switchport trunk encapsulation dot1q
D1(config-if-range)#switchport mode trunk

D1y A1
D1(config)#interface range e0/1-2
D1(config-if-range)#switchport trunk encapsulation dot1q
D1(config-if-range)#switchport mode trunk
D2 y D1
D2(config)#interface range e2/0-3
D2(config-if-range)#switchport trunk encapsulation dot1q
D2(config-if-range)#switchport mode trunk

D2 y A1
D2(config)#interface range e1/1-2
D2(config-if-range)#switchport trunk encapsulation dot1q
D2(config-if-range)#switchport mode trunk

A1 y D1
A1(config)#interface range e0/1-2
A1(config-if-range)#switchport trunk encapsulation dot1q
A1(config-if-range)#switchport mode trunk

A1 y D2
A1(config)#interface range e1/1-2
A1(config-if-range)#switchport trunk encapsulation dot1q
A1(config-if-range)#switchport mode trunk

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

Use VLAN 999 as the native VLAN.
Se usa el comando switchport trunk native vlan 999 en los enlaces troncales de todos los switches.
D1
D1(config)#interface range e2/0-3,e0/1-2
D1(config-if-range)#switchport trunk native vlan 999

D2
D2(config)#interface range e2/0-3,e1/1-2
D2(config-if-range)#switchport trunk native vlan 999

A1
A1(config)#interface range e0/1-2,e1/1-2
A1(config-if-range)#switchport trunk native vlan 999

2.3 On all switches, enable the Rapid Spanning-Tree Protocol.
Use Rapid Spanning Tree.
Se utiliza el comando spanning-tree mode rapid- en cada uno de los switches y se habilita el protocolo.

D1
D1(config)#spanning-tree mode rapid-pvst

A1
A1(config)#spanning-tree mode rapid-pvst

D2
D2(config)#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 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.
Se configura el puente raíz entre las vlan 100,102 en D1 usando el comando spanning-tree vlan 100,102 root primary, y la vlan 101 en D2 y las vlan quedan como raíz primaria.

D1 y D2 deben proporcionar respaldo en caso de falla del puente raíz (root bridge).
Se configura la vlan de apoyo 100,102 en D1 usando el comando spanning-tree vlan 100,102 root secundary, y la vlan 101 en D2.

D1
D1(config)#spanning-tree vlan 100,102 root primary
D1(config)#spanning-tree vlan 101 root secondary

D2(config)#spanning-tree vlan 101 root primary
D2(config)#spanning-tree vlan 100.102 root secondary

2.5 On all switches, create LACP EtherChannels as shown in the topology diagram. Use the following channel numbers:
Elegimos las interfaces del switch y se configura el canal del grupo y modo activo con el comando channel-group mode active y Se crea EtherChannels LACP en el rango de la interfaz.

D1 to D2 – Port channel 12
D1(config)#interface range e2/0-3
D1(config-if-range)#channel-group 12 mode active
D1(config-if-range)#no shutdown
D1(config-if-range)#exit
D1 to A1 Port channel 1
D1(config)#interface range e1/1-2
D1(config-if-range)#channel-group 1 mode active
D1(config-if-range)#no shutdown
D1(config-if-range)#exit
D2 to D1 – Port channel 12
D2(config)#interface range e2/0-3
D2(config-if-range)#channel-group 2 mode active
D2(config-if-range)#no shutdown
D2(config-if-range)#exit

D2 to A1 – Port channel 2
D2(config)#interface range e1/1-2
D2(config-if-range)#channel-group 2 mode active
D2(config-if-range)#no shutdown
D2(config-if-range)#exit

A1 to D1 – Port channel 1
A1(config)#interface range e0/1-2
A1 (config-if-range)#channel-group 2 mode active
A1 (config-if-range)#no shutdown

A1 (config-if-range)#exit

A1 to D2 – Port channel 2
A1(config)#interface range e1/1-2
A1 (config-if-range)#channel-group 2 mode active
A1 (config-if-range)#no shutdown
A1 (config-if-range)#exit

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.
Configuramos los puertos con la configuración de VLAN como se muestra en la topología, elegimos la interfaz y la configuamos en modo de acceso con el comando switchport mode access y se habilita la vlan del puerto usando switchport access vlan y habiltamos portfast con spanning-tree portfast.

D1
D1(config)#interface e0/0
D1(config-if)#switchport mode access
D1(config-if)#switchport access vlan 100
D1(config-if)#spanning-tree portfast
D1(config-if)#no shutdown
D1(config-if)#exit

D2
D2(config)#interface e0/0
D2(config-if)#switchport mode access
D2(config-if)#switchport access vlan 102
D2(config-if)#spanning-tree portfast
D2(config-if)#no shutdown
D2(config-if)#exit
A1
A1(config)#interface e1/3
A1(config-if)#switchport mode access
A1(config-if)#switchport access vlan 101
A1(config-if)#spanning-tree portfast
A1(config-if)#no shutdown
A1(config-if)#exit

A1(config)#interface e2/0
A1(config-if)#switchport mode access
A1(config-if)#switchport access vlan 100
A1(config-if)#spanning-tree portfast
A1(config-if)#no shutdown
A1(config-if)#exit

2.7 Verify IPv4 DHCP services PC2 and PC3 are DHCP clients and should be receiving valid IPv4 addresses
Se verifican los servicios DHCP IPv4 en PC2 y PC3 con el comadndo ip dhcp y show ip

El PC2 toma la dirección IP 10.02.110/24 GW 10.02.012.254

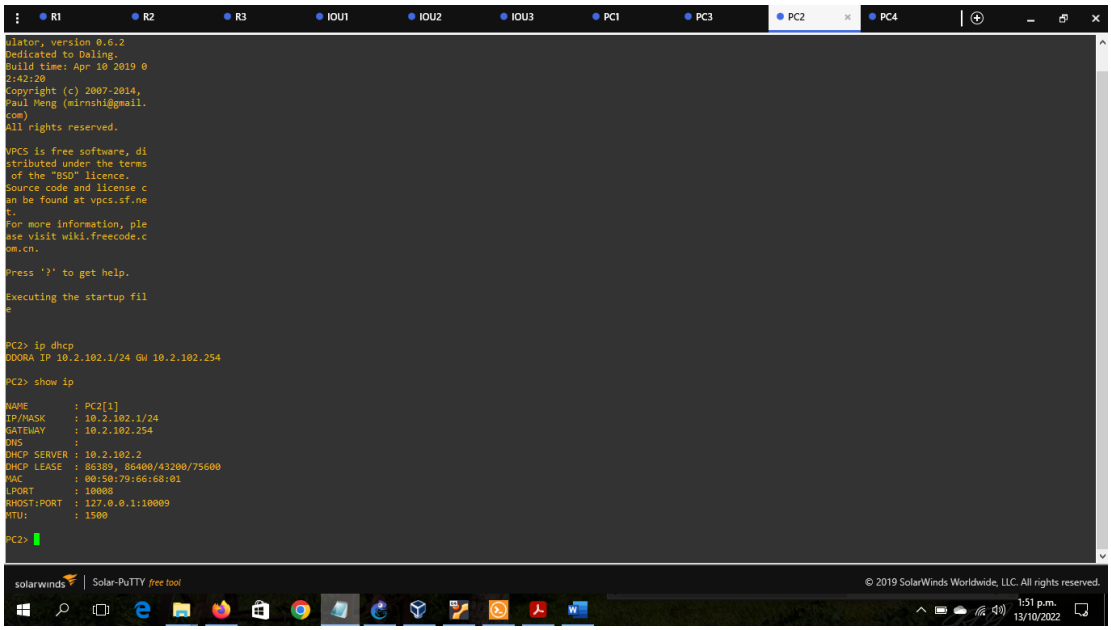

Ilustración 12: Servicios IP en PC2

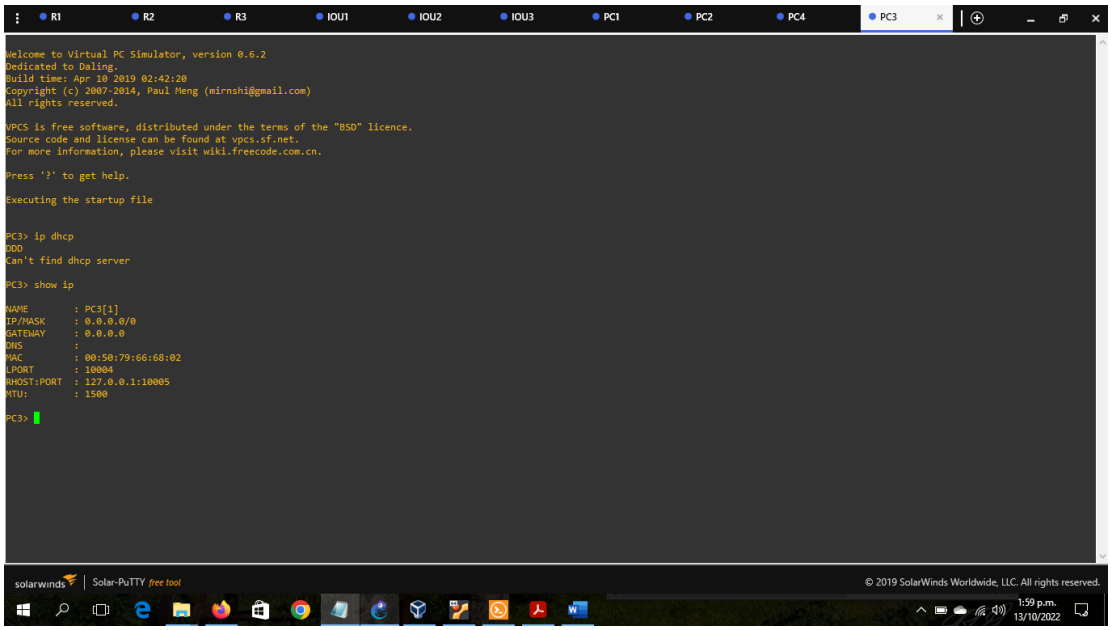

Ilustración 13: Servicios IP en PC3

2.8 Verify local LAN connectivity.
PC1 should successfully ping:
D1: 10.02.100.1
D2: 10.02.100.2
PC4: 10.02.100.6

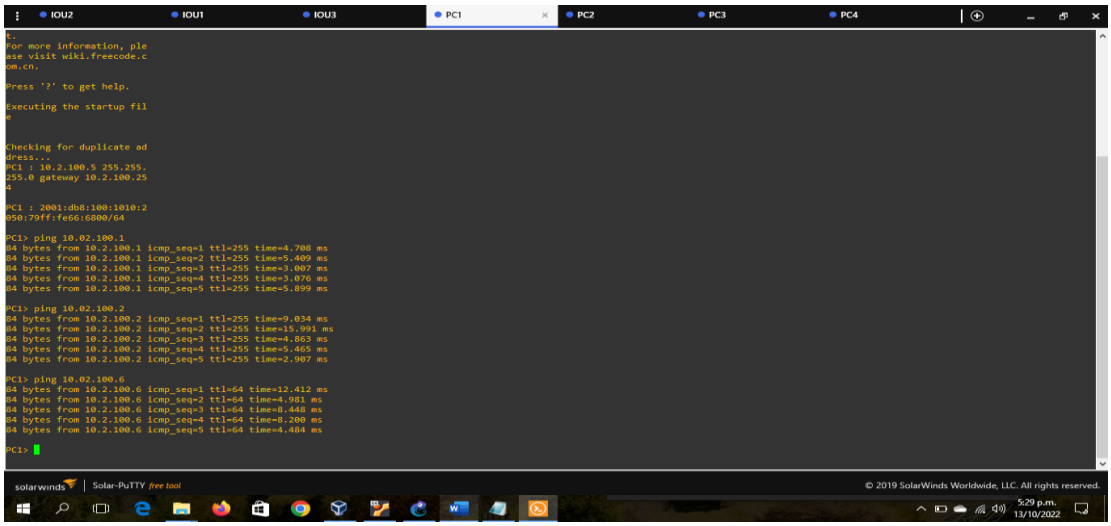

Ilustración 14: Conectividad LAN local en PC1

PC2 should successfully ping:
D1: 10.02.102.1
D2: 10.02.102.2

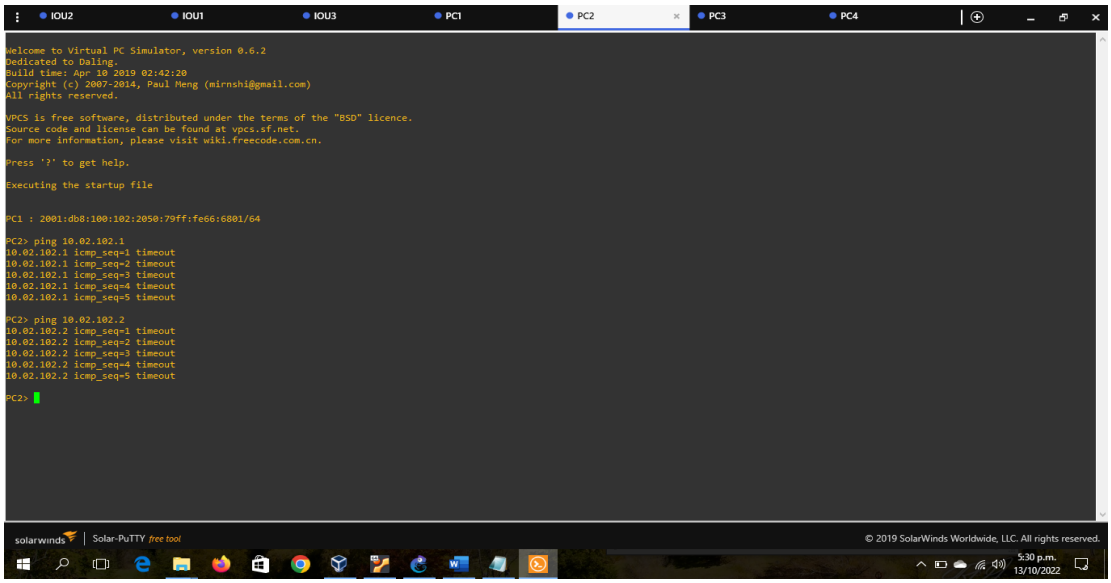

Ilustración 15: Conectividad LAN local en PC2

PC3 should successfully ping:
D1: 10.02.101.1
D2: 10.02.101.2

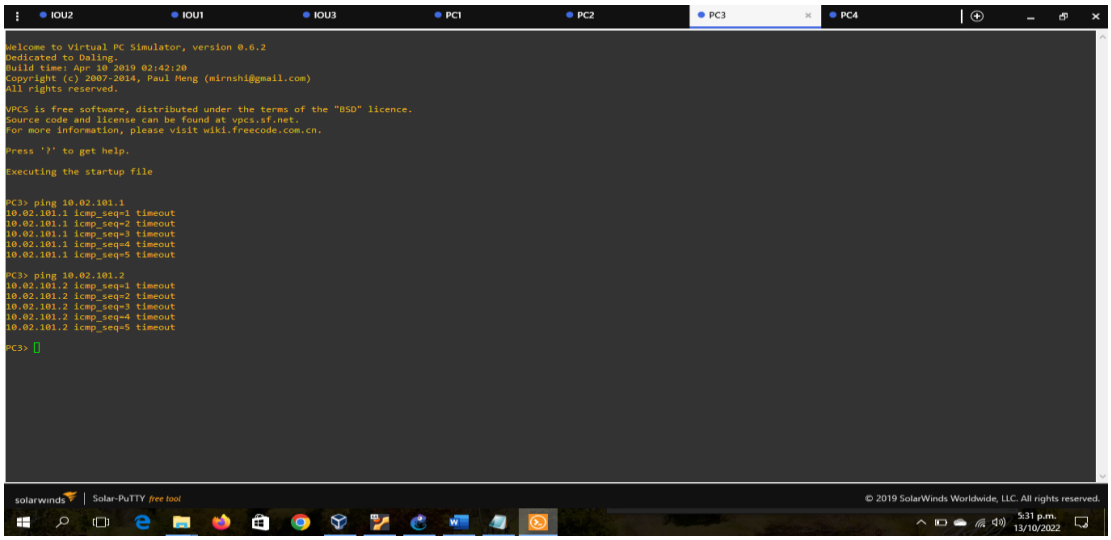

Ilustración 16: Conectividad LAN local en PC3

PC4 should successfully ping:
D1: 10.02.100.1
D2: 10.02.100.2
PC1: 10.02.100.5

Ilustracón 17: Conectividad LAN local en PC4

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.

Note: Pings from the hosts will not be successful because their default gateways are pointing to the HSRP address which will be enabled in Part 4.
Your configuration tasks are as follows:

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

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

Tabla 3: Tarea 3

3.1 On the “Company Network” (i.e., R1, R3, D1, and D2), configure single-area OSPFv2 in area 0.
Se ingresa a la consola para realizar la configuración de R1.R3,D1 y D3 y habilitamos OSPF se usa el comando router ospf 4, configuramos el identificador.con router-id .
Use OSPF Process ID 4 and assign the following router-IDs:

- R1: 0.0.4.1

```
R1(config)#router ospf 4
R1(config-router)#router-id 0.0.4.1
```

- R3: 0.0.4.3

```
R3(config)#router ospf 4
R3(config-router)#router-id 0.0.4.3
```

- D1: 0.0.4.131
  D1 (config)#router ospf 4
  D1 (config-router)#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.
  se anuncian todas las redes en el Area utilizando network la VLAN y el area 0
  R1
  R1(config-router)#network 10.02.10.0 0.0.0.255 area 0
  R1(config-router)#network 10.02.13.0 0.0.0.255 area 0

  R3
  R3(config-router)#network 10.02.11.0 0.0.0.255 area 0
  R3(config-router)#network 10.02.13.0 0.0.0.255 area 0

  D1
  D1(config-router)#network 10.02.100.0 0.0.0.255 area 0
  D1(config-router)#network 10.02.101.0 0.0.0.255 area 0
  D1(config-router)#network 10.02.102.0 0.0.0.255 area 0
  D1(config-router)#network 10.02.10.0 0.0.0.255 area 0

  D2
  D2(config-router)#network 10.02.100.0 0.0.0.255 area 0
  D2(config-router)#network 10.02.101.0 0.0.0.255 area 0
  D2(config-router)#network 10.02.102.0 0.0.0.255 area 0
  D2(config-router)#network 10.02.11.0 0.0.0.255 area 0

- On R1, do not advertise the R1 – R2 network.
  No se utiliza la red ya que R2 provee el internet

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

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

Disable OSPFv2 advertisements on:

D1: All interfaces except E1/2
Se deshabilitan las publicaciones OSPF menos en e1/2
D1(config-router)#passive-interface default
D1(config-router)#no passive-interface e1/2
D1(config-router)#exit
D2: All interfaces except E1/0
Se deshabilitan las publicaciones OSPF menos en e1/0
D2(config-router)#passive-interface default
D2(config-router)#no passive-interface e1/0
D2(config-router)#exit

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

En la parte de configuración de consola de R1, R3, D1, y D2; se habilita OSPF utilizando ipv6 router ospf 6 y se configura el identificador router-id

Use OSPF Process ID 6 and assign the following router-IDs:

R1(config-rtr)#default-information originate
R1(config-rtr)#exit
R1(config)#interface e1/2
R1(config-if)#ipv6 ospf 6 area 0
R1(config-if)#exit
R1(config)#interface e1/1
R1(config-if)#ipv6 ospf 6 area 0
R1(config-if)#exit

- R1: 0.0.6.1
  R1(config)#ipv6 router ospf 6
  R1(config-rtr)#router-id 0.0.6.1

- R3: 0.0.6.3
  R3(config)#ipv6 router ospf 6
  R3(config-rtr)#router-id 0.0.6.3

- D1: 0.0.6.131
  D1(config)#ipv6 router ospf 6
  D1(config-rtr)#router-id 0.0.6.131

- D2: 0.0.6.132
  D2(config)#ipv6 router ospf 6
  D2(config-rtr)#router-id 0.0.6.132

  On R1, R3, D1, and D2, advertise all directly connected networks / VLANs in Area 0.
  se anuncian todas las redes en el Area utilizando network la VLAN y el area 0
  R1
  R1(config-router)#network 10.02.10.0 0.0.0.255 area 0
  R1(config-router)#network 10.02.13.0 0.0.0.255 area 0

  R3
  R3(config-router)#network 10.02.11.0 0.0.0.255 area 0
  R3(config-router)#network 10.02.13.0 0.0.0.255 area 0

  D1
  D1(config-router)#network 10.02.100.0 0.0.0.255 area 0
  D1(config-router)#network 10.02.101.0 0.0.0.255 area 0
  D1(config-router)#network 10.02.102.0 0.0.0.255 area 0
  D1(config-router)#network 10.02.10.0 0.0.0.255 area 0

  D2
  D2(config-router)#network 10.02.100.0 0.0.0.255 area 0
  D2(config-router)#network 10.02.101.0 0.0.0.255 area 0
  D2(config-router)#network 10.02.102.0 0.0.0.255 area 0
  D2(config-router)#network 10.02.11.0 0.0.0.255 area 0

- On R1, do not advertise the R1 – R2 network.
  No se utiliza la red ya que R2 provee el internet

- On R1, propagate a default route. Note that the default route will be provided by BGP.
  R1(config-router)#default-information originate
  R1(config-router)#exit

D1: All interfaces except E1/2
Se deshabilitan las publicaciones OSPF menos en e1/2
D1(config-router)#passive-interface default
D1(config-router)#no passive-interface e1/2
D1(config-router)#exit

D2: All interfaces except E1/0
Se deshabilitan las publicaciones OSPF menos en e1/0
D2(config-router)#passive-interface default
D2(config-router)#no passive-interface e1/0
D2(config-router)#exit

3.3 On R2 in the “ISP Network”, configure MP-BGP.
Configure two default static routes via interface Loopback 0:
ingresamos a la parte de consola del R2 y realizamos la configuración.

- An IPv4 default static route.
- An IPv6 default static route.

Se configura la ruta por defecto en IPv6
Router R2
R2#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Ruta predeterminada y salida llopback
R2(config)#ip route 0.0.0.0 0.0.0.0 loopback 0
R2(config)#ipv6 route ::/0 loopback 0

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

Se propaga una ruta por drfecto provista por BGP Se asigna el identificador

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.

Se configuran los vecinos en el Sistema autonomo 300 para IPv4 e IPv6
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:

- The Loopback 0 IPv4 network (/32).
- The default route (0.0.0.0/0).

Se configura la relación vecino activa
R2(config-router)#address-family ipv4
R2(config-router-af)#neighbor 209.165.200.225 activate

Se excluye la dirección IPv6
R2(config-router-af)#no neighbor 2001:db8:200::1 activate
Se configura con la interfaz loopback de R2
R2(config-router-af)#network 2.2.2.2 mask 255.255.255.255

Se configuran las redes predeterminadas
R2(config-router-af)#network 0.0.0.0
R2(config-router-af)#exit-address-family

In IPv6 address family, advertise:

- The Loopback 0 IPv4 network (/128).
- The default route (::/0).

R2(config-router)#address-family ipv6
R2(config-router-af)#no neighbor 209.165.200.225 activate
R2(config-router-af)#neighbor 2001:db8:200::1 activate
R2(config-router-af)#network 2001:db8:2222::/128

Redes predeterminadas
R2(config-router-af)#network ::/0
R2(config-router-af)#exit-address-family
R2(config-router)#end

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

Configure two static summary routes to interface Null 0:

se configura MP-BGP, se crean dos rutas estáticas a la interfaz Null0:
una ruta resumen IPv4 para 10.02.0.0/8 una ruta resumen IPv6 para 2001:db8::/48

- A summary IPv4 route for 10.02.0.0/8.

R1(config)#ip route 10.02.0.0 255.0.0.0 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.
  Configure an IPv4 and IPv6 neighbor relationship with R2 in ASN 500.

  Se configura R1 en BGP ASN 300 y se usa el router.id 1.1.1.1.
  R1(config)#router bgp 300

  Se configura el identificador
  R1(config-router)#bgp router-id 1.1.1.1

  Se configura la relación con R2 en 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.
  Se configura la relación con el vecino activa
  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 10.02.0.0/8 network.
  R1(config-router-af)#network 10.02.0.0 mask 255.0.0.0
  R1(config-router-af)#exit-address-family

  In IPv6 address family:
  R1(config-router)#address-family ipv6 unicast
  Disable the IPv4 neighbor relationship.
  Se deshabilita la relación con el vecino activa
  R1(config-router-af)#no neighbor 209.165.200.226 activate

- Enable the IPv6 neighbor relationship.
  Se configura la relación con el vecino activa
  R1(config-router-af)#neighbor 2001:db8:200::2 activate

- Advertise the 2001:db8:100::/48 network
  Se configura la dirección ipv6

R1(config-router-af)#network 2001:db8:100::/48
R1(config-router-af)#exit-address-family
R1(config-router)#
R1(config-router)#end

Se verifica la tarea en los dispositivos R1, R2, R3, D1 y D2 con los siguientes comandos:
show run | section ^router ospf
show run | section ^ipv6 router
show run | section bgp
show run | include router

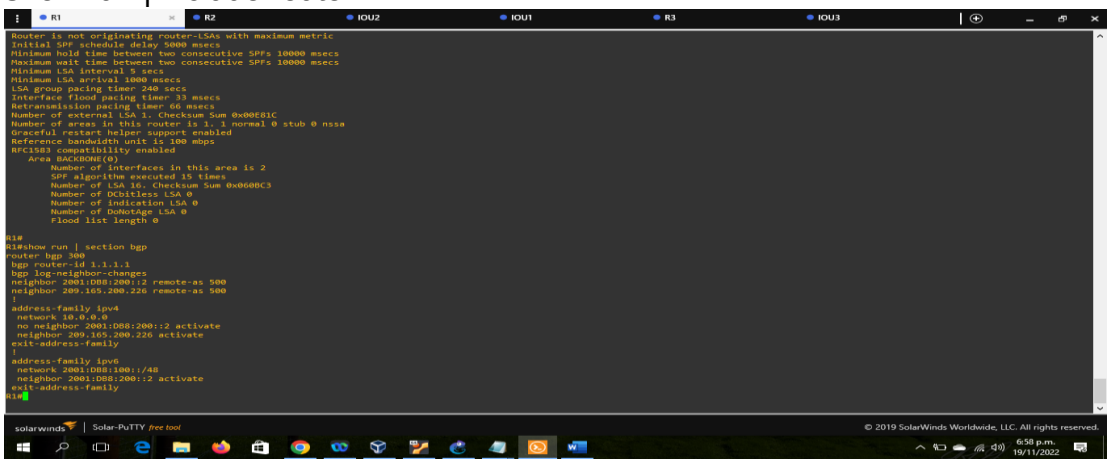

Ilustración 18: Tarea 3 en R1

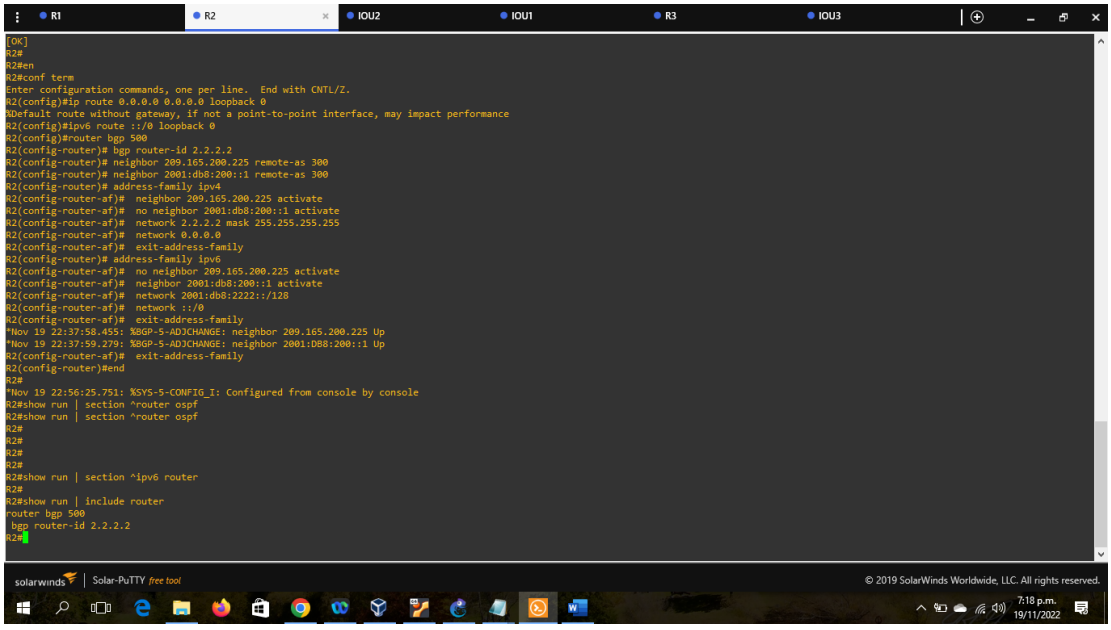

Ilustración 19: Tarea 3 en R2

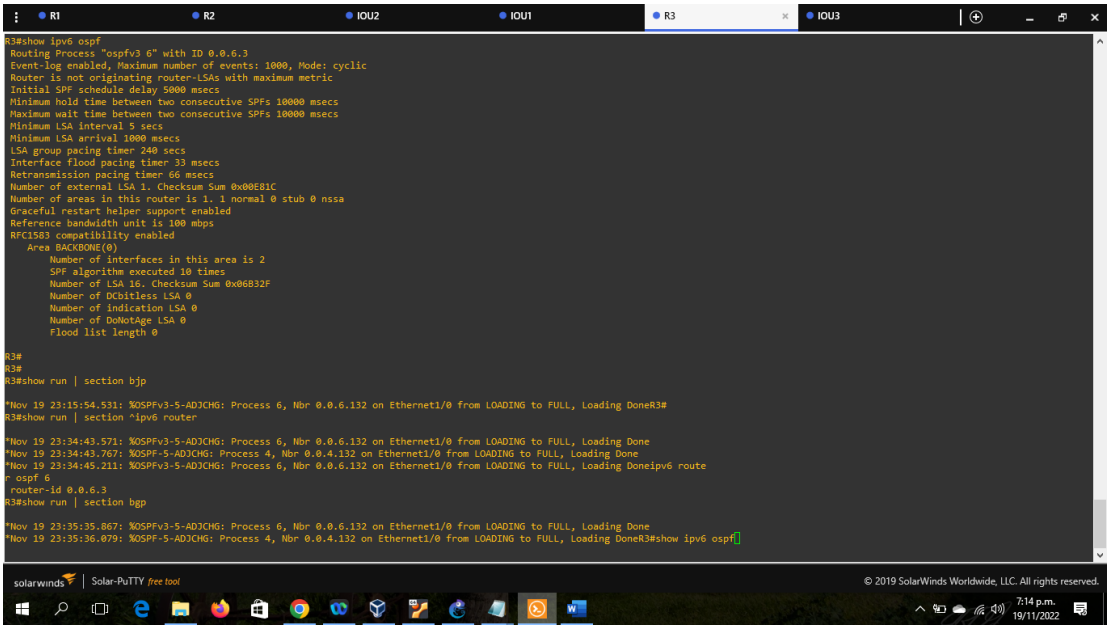

Ilustración 20:Tarea 3 en R3

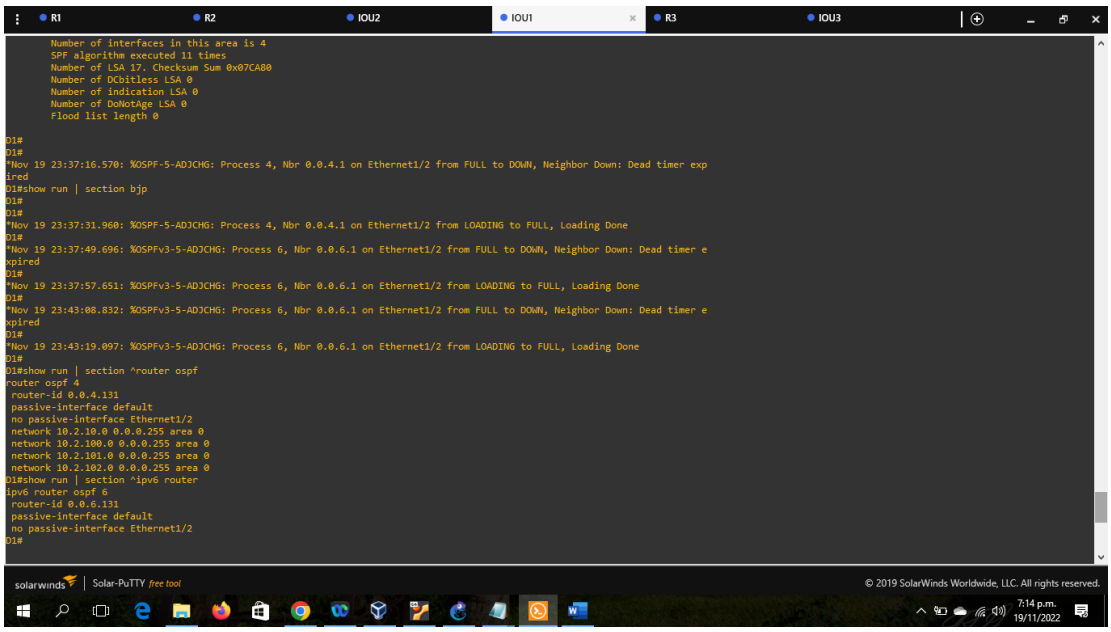

Ilustración 21: Tarea 3 en D1

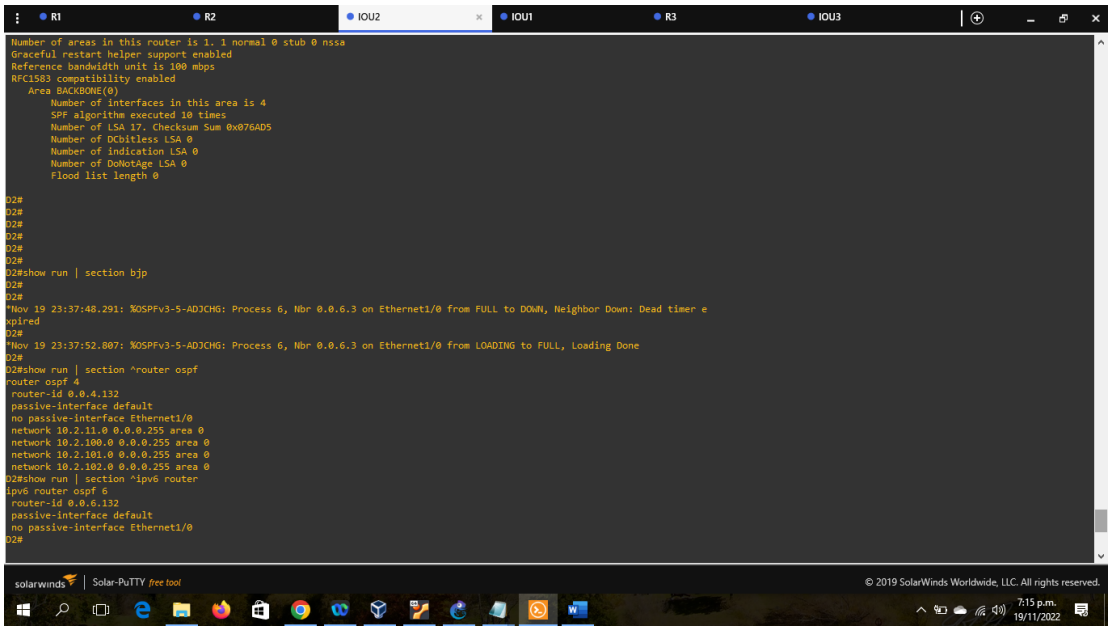

Ilustración 22: Tarea 3 en D2

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:

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

Task#	Task	Specification	Points
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. Configure IPv6 HSRP group 126 for VLAN 102: Assign the virtual IP address using ipv6 autoconfig. Set the group priority to 150.	8

Task#	Task	Specification	Points
		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. 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.	

Task#	Task	Specification	Points
		Track object 6 and decrement by 60.	

Tabla 4: Tarea 4

4.1 On D1, create IP SLAs that test the reachability of R1 interface E1/2.
creamos dos IP slas y se configuran las sla con el comando ip sla y se configura la la interfaz a probar, la frecuencia utilizando icmp-echo, también activamos la operación de sla.

Create two IP SLAs.

- Use SLA number 4 for IPv4.
  D1(config)#ip sla 4
  D1(config-ip-sla)# icmp-echo 10.02.10.1
  D1(config-ip-sla-echo)# frequency 5
  D1(config-ip-sla-echo)# exit

- Use SLA number 6 for IPv6.
  D1(config)#track 6 ip sla 6
  D1(config-track)# delay down 10 up 15
  D1(config-track)# exit

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.
  D1(config)#track 4 ip sla 4
  D1(config-track)# delay down 10 up 15
  D1(config-track)# exit

- Use track number 6 for IP SLA 6.
  D1(config)#track 6 ip sla 6
  D1(config-track)# delay down 10 up 15
  D1(config-track)# exit

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.

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

- Use SLA number 6 for IPv6.
- D2(config)#ip sla schedule 6 life forever start-time now
  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.
  D2(config)#track 4 ip sla 4
  D2(config-track)# delay down 10 up 15
  D2(config-track)# exit

- Use track number 6 for IP SLA 6.
  D2(config)#track 6 ip sla 6
  D2(config-track)# delay down 10 up 15
  D2(config-track)# exit

  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.
  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 10.02.100.254.
- Set the group priority to 150.
- Enable preemption.
- Track object 4 and decrement by 60.

  D1(config)#interface vlan 100
  D1(config-if)# standby version 2
  D1(config-if)# standby 104 ip 10.02.100.254
  D1(config-if)# standby 104 priority 150
  D1(config-if)# standby 104 preempt
  D1(config-if)# standby 104 track 4 decrement 60

Configure IPv4 HSRP group 114 for VLAN 101:

- Assign the virtual IP address 10.02.101.254.
- Enable preemption.
- Track object 4 to decrement by 60.

```
D1(config)#interface vlan 101
D1(config-if)# standby version 2
D1(config-if)# standby 114 ip 10.02.101.254
D1(config-if)# standby 114 preempt
D1(config-if)# standby 114 track 4 decrement 60
```

Configure IPv4 HSRP group 124 for VLAN 102:

- Assign the virtual IP address 10.02.102.254.
- Set the group priority to 150.
- Enable preemption.
- Track object 4 to decrement by 60.

```
D1(config)#interface vlan 102
D1(config-if)# standby version 2
D1(config-if)# standby 124 ip 10.02.102.254
D1(config-if)# standby 124 priority 150
D1(config-if)# standby 124 preempt
D1(config-if)# standby 124 track 4 decrement 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.

```
D1(config-if)# standby 106 ipv6 autoconfig
D1(config-if)# standby 106 priority 150
D1(config-if)# standby 106 preempt
D1(config-if)# standby 106 track 6 decrement 60
D1(config-if)# exit
```

Configure IPv6 HSRP group 116 for VLAN 101:

- Assign the virtual IP address using ipv6 autoconfig.
- Enable preemption.
- Track object 6 and decrement by 60.

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

Configure IPv6 HSRP group 126 for VLAN 102:

- Assign the virtual IP address using ipv6 autoconfig.
- Set the group priority to 150.
- Enable preemption.
- Track object 6 and decrement by 60.

```
D1(config-if)# standby 126 ipv6 autoconfig
D1(config-if)# standby 126 priority 150
D1(config-if)# standby 126 preempt
D1(config-if)# standby 126 track 6 decrement 60
D1(config-if)#exit
D1(config)#end
```

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 10.02.100.254.
- Enable preemption.
- Track object 4 and decrement by 60.

```
D2(config)#interface vlan 100
D2(config-if)# standby version 2
D2(config-if)# standby 104 ip 10.02.100.254
D2(config-if)# standby 104 priority 150
D2(config-if)# standby 104 preempt
D2(config-if)# standby 104 track 4 decrement 60
```

Configure IPv4 HSRP group 114 for VLAN 101:

- Assign the virtual IP address 10.02.101.254.
- Set the group priority to 150.
- Enable preemption.
- Track object 4 to decrement by 60.

```
D2(config)#interface vlan 101
D2(config-if)# standby version 2
D2(config-if)# standby 114 ip 10.02.101.254
D2(config-if)# standby 114 preempt
D2(config-if)# standby 114 track 4 decrement 60
```

Configure IPv4 HSRP group 124 for VLAN 102:

- Assign the virtual IP address 10.02.102.254.
- Enable preemption.
- Track object 4 to decrement by 60.

```
D2(config)#interface vlan 101
D2(config-if)# standby version 2
D2(config-if)# standby 124 ip 10.02.101.254
D2(config-if)# standby 124 preempt
D2(config-if)# standby 124 track 4 decrement 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.

```
D2(config-if)# standby 106 ipv6 autoconfig
D2(config-if)# standby 106 priority 150
D2(config-if)# standby 106 preempt
D2(config-if)# standby 106 track 6 decrement 60
D2(config-if)# exit
```

Configure IPv6 HSRP group 116 for VLAN 101:

- Assign the virtual IP address using ipv6 autoconfig.
- Set the group priority to 150.
- Enable preemption.
- Track object 6 and decrement by 60.

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

Configure IPv6 HSRP group 126 for VLAN 102:

- Assign the virtual IP address using ipv6 autoconfig.
- Enable preemption.

- Track object 6 and decrement by 60
  D2(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
  D2(config-if)#exit
  D2(config)#end

  Se verifica la tarea 4 en los dispositivos D1 y D2 con los commandos:
  show run | section ip sla
  show standby brief

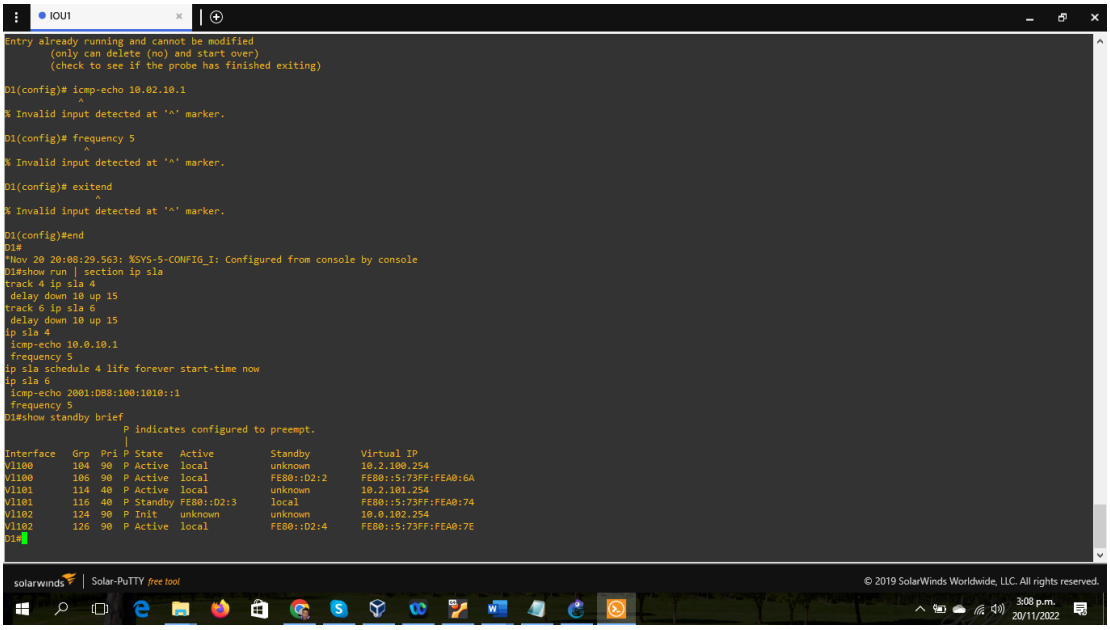

Ilustración 23:Tarea 4 en D1

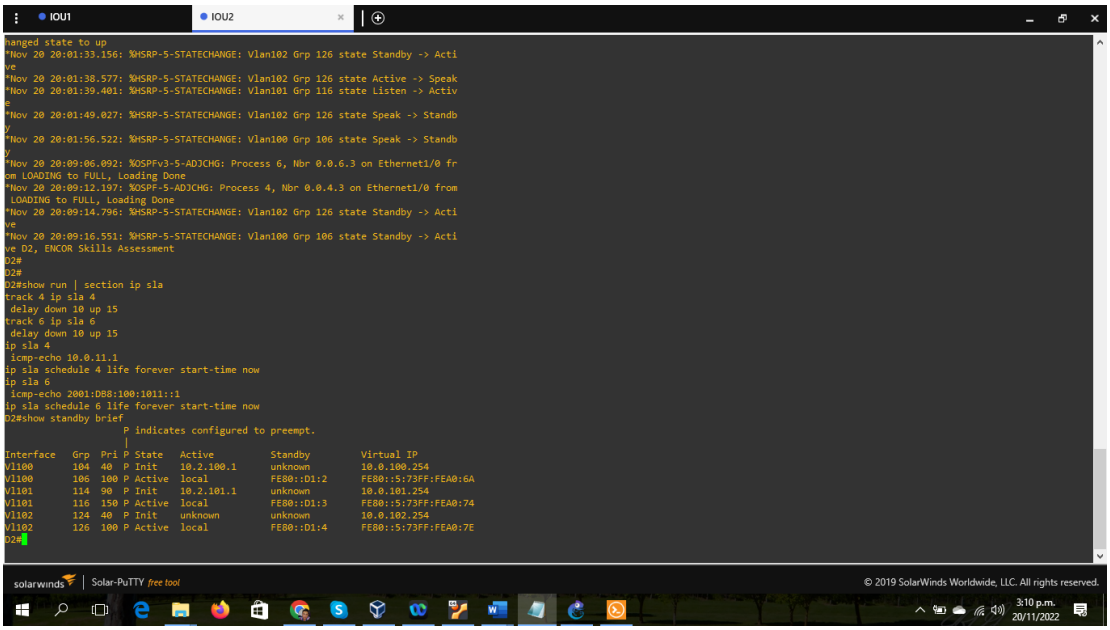

Ilustración 24: Tarea 4 en D2

CONCLUSIONES

Se utilizó GNS3 para la simulación del escenario propuesto, además de este programa necesitamos la máquina virtual de GNS3 y VirtualBox, para que funcione debemos permitir el acceso en el antivirus para que no lo bloquee y revisar que la virtualización de la BIOS este activada.

En la parte 2 donde se configuran los Routers y Switches hay que tener en cuenta las terminales de los dispositivos, ya que la topología en el escenario propuesto cambia al que se hace en GNS3 y sus interfaces no son las mismas.

Al momento de crear una topología en GNS3 debemos importar los dispositivos que vamos a utilizar en el proyecto y saber cual es el más óptimo, aparte tener un archivo donde se encuentren las imágenes de los Router y Switches.

Si al momento de crear la topología no aparecen los Switches se debe verificar la licencia en la configuración del IOU y así continuar con nuestro proyecto.

Cuando estemos configurando los dispositivos y tengamos que salir de la configuración en consola debemos guardar utilizando el comando wr y/o copy running-config startup-config.

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