

DIPLOMADO DE PROFUNDIZACIÓN CISCO  
PRUEBA DE HABILIDADES PRÁCTICAS CCNP

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UNIVERSIDAD NACIONAL ABIERTA Y A DISTANCIA UNAD  
ESCUELA DE CIENCIAS BÁSICAS, TECNOLOGÍA E INGENIERÍA -ECBTI  
INGENIERÍA ELECTRÓNICA  
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DIPLOMADO DE OPCIÓN DE GRADO PRESENTADO PARA OPTAR EL TÍTULO  
DE INGENIERO ELECTRONICO

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INGENIERÍA ELECTRÓNICA  
2021

NOTA DE ACEPTACIÓN

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Firma del Presidente del Jurado

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Firma del Jurado

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Firma del Jurado

Popayán Cauca, 27 de noviembre de 2021

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## GLOSARIO

**OPSF:** Es un protocolo de encaminamiento jerárquico que calcula el camino más corto entre nodos dentro de un sistema autónomo. OPSF cumple con muchas características y una de ellas es que se puede descomponer en áreas más pequeñas una en especial llamada área backbone que hace parte de la red central a la cual se conecta el resto red, cada ruta e deben estar configuradas dentro de Backbone.

**DHCP:** Es un protocolo cliente/servidor que proporciona automáticamente un host de protocolo de Internet (IP) con su dirección IP y otra información de configuración relacionada, como la máscara de subred y la puerta de enlace predeterminada.

**LOOPBACK:** es una interfaz de red virtual que maneja una dirección de red especial en los host, permite dirigir el tráfico de datos hacia ellos mismos.

**EIGRP:** es un protocolo de enrutamiento donde dispone un tipo de vector a distancia avanzado. Los eigrp poseen las mejores rutas destino, mantienen una tabla de encaminamiento en cada uno de los protocolos de red.

**LACP:** Es un elemento de una especificación IEEE (802.3ad) que proporciona orientación sobre la práctica de agregación de enlaces para conexiones de datos.

## RESUMEN

Este escenario busca implementar y dar solución a la red de la compañía que requiere el servicio de configuración y administración de la red. Se configura una estructura de red que pueda permitir tener una comunicación amplia y segura para la compañía. Para ello se implementan los conocimientos adquiridos en todo el proceso y se configuro cada una de la topología cumpliendo con los requerimientos y especificaciones dadas por la compañía.

Se cumple con las especificaciones entregadas y se realiza el trabajo bajo la metodología de aprendizaje diplomado de profundización cisco CCNP por el cual se configuro y administro la red.

En el trabajo desarrollado se muestra la solución y ejecución del escenario donde se evidencia cada una de las configuraciones y conexión de red de la compañía, realizando su verificación por medio de distintos comandos a cada proceso realizado.

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

## ABSTRACT

This scenario seeks to implement and solve the company network that requires the network configuration and administration service. A network structure is configured that can allow wide and secure communication for the company. To do this, the knowledge acquired throughout the process is implemented and each of the topologies is configured in accordance with the requirements and specifications given by the company.

The specifications provided are met and the work is carried out under the deep learning methodology of the Cisco CCNP diploma through which the network was configured and managed.

The work carried out shows the solution and execution of the scenario where each of the configurations and connection to the company network is evidenced, verifying it by means of different commands to each process carried out.

Keywords: CISCO, CCNP, Routing, Swicthing, Networking, Electronics.

## INTRODUCCIÓN

Este trabajo se realiza con el propósito de sustentar de manera práctica las configuraciones de redes estudiadas en los anteriores ejercicios y evaluaciones cisco CCNP como habilidades necesarias para ser implementadas en redes estables y dar solución de problemas. Se pone en evidencia los conocimientos adquiridos durante el curso, en donde se aplicó las direcciones ip en cada uno de los dispositivos y donde se aplican distintos protocolos de enrutamiento como, EIGRP, OSPF, BGP y protocolos en IPv6, entre otros, en donde se abordará el direccionamiento de tipo de enlaces de estados, así mismo la configuración de los puertos troncales, EtherChannel, VLANs, LACP y Spanning Tree, entre otros, para la configuración del servidor. Cumpliendo lo requerido y como resultado del escenario propuesto, se muestran la solución la cual cumple con cada una de especificaciones de configuración requeridas por la compañía en donde se realizará mediante el simulador GNS3.

# DESARROLLO

## ESCENARIO

Figura 1. Escenario

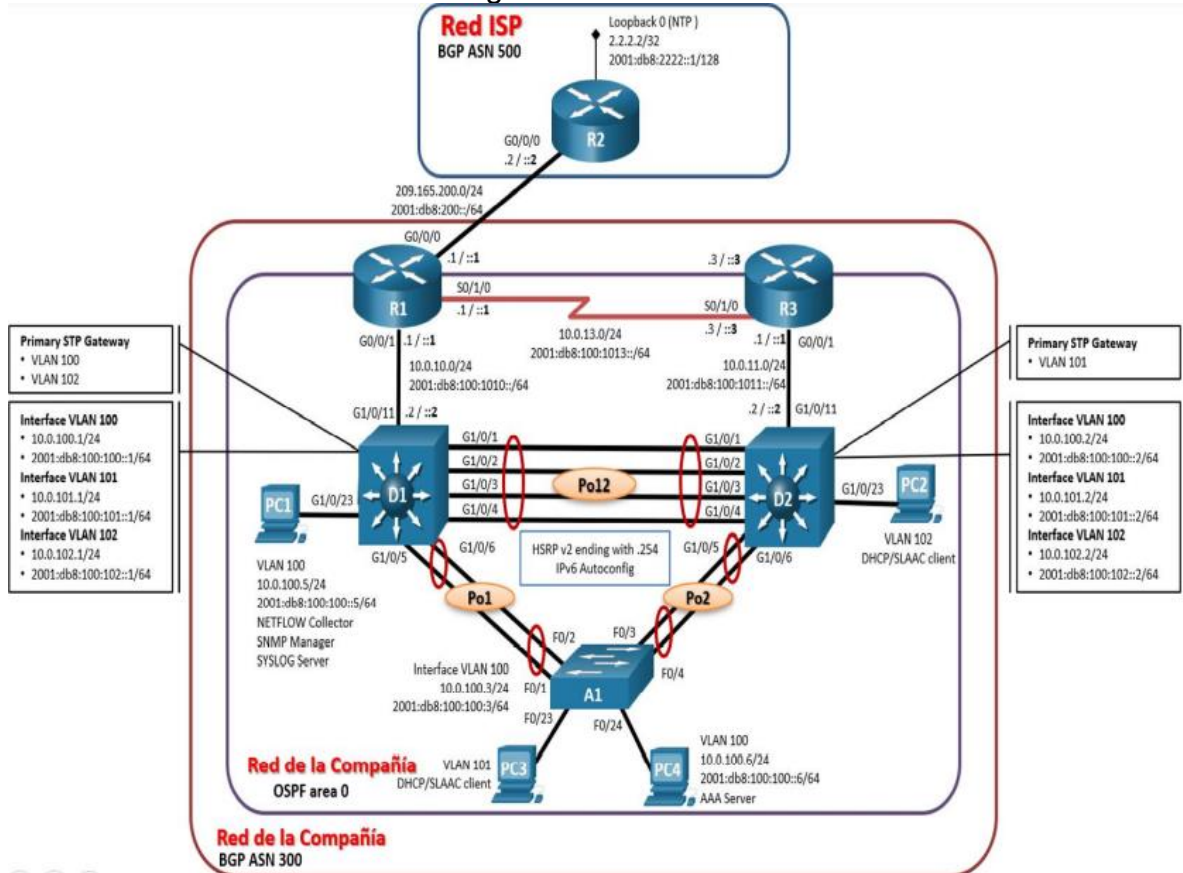
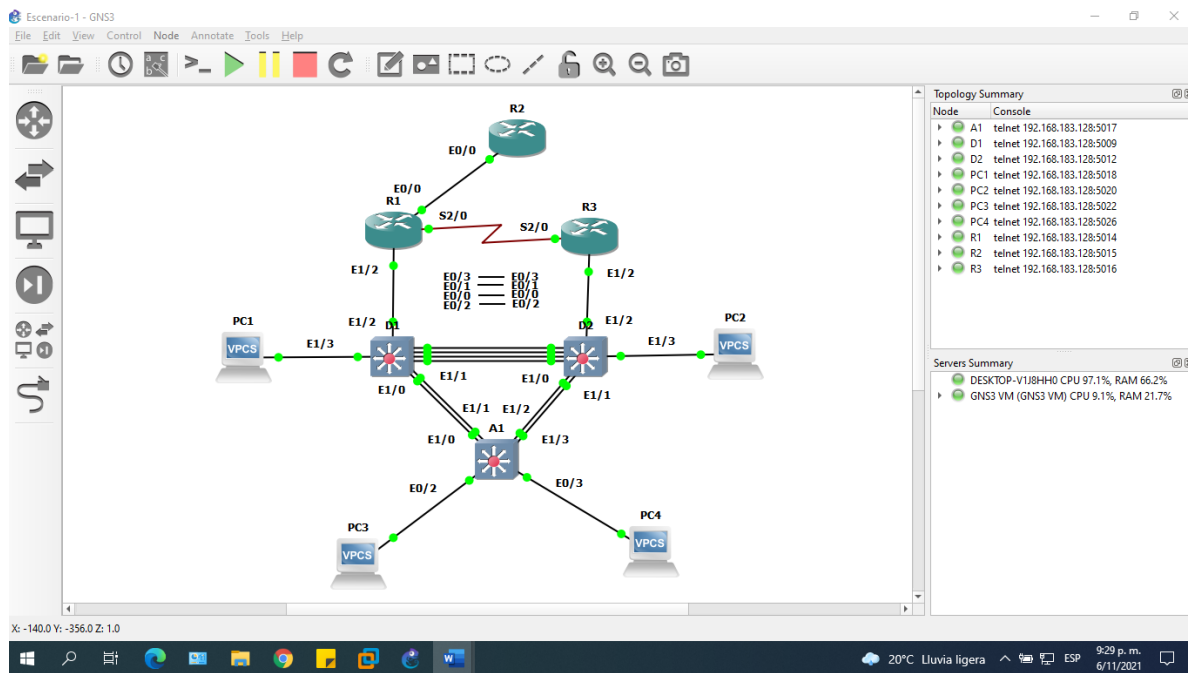


Figura 2. Escenario autoría propia



## Herramientas

Routers: Cisco IOU L3 - i86bi\_linux-adventerprisek9-ms.155-2.T.bin

Switches: Cisco IOU L2 - i86bi-linux-l2-adventerprisek9-15.2d.bin

Tabla 1. Construir la red y configurar los parámetros básicos de los dispositivos y el direccionamiento de las interfaces.

Mediante una conexión de consola ingrese en cada dispositivo, entre al modo de configuración global y aplique los parámetros básicos.

- Configuración inicial de cada uno de los dispositivos R1, R2, R3, D1, D2 y A1.

Router>enable

Se ingresa a modo privilegiado

Router#configure terminal

Se ingresa a modo de configuración

Router(config)#hostname R1, R2...

Se asigna nombre al router

### Router 1

Router>enable

Router#configure terminal

Router(config)#hostname R1

R1(config)#ipv6 unicast-routing

```
R1(config)#no ip domain lookup
R1(config)#banner motd # R1, ENCOR Skills Assessment, Scenario 1 #
R1(config)#line con 0
R1(config-line)#exec-timeout 0 0
R1(config-line)#logging synchronous
R1(config-line)#exit
R1(config)#interface e0/0
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 10.0.10.1 255.255.255.0
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 s2/0
R1(config-if)#ip address 10.0.13.1 255.255.255.0
R1(config-if)#ipv6 address fe80::1:3 link-local
R1(config-if)#ipv6 address 2001:db8:100:1013::1/64
R1(config-if)#no shutdown
R1(config-if)#exit
R1(config)#
```

## **Router 2**

```
R2(config)#ipv6 unicast-routing
R2(config)#no ip domain lookup
R2(config)#banner motd # R2, ENCOR Skills Assessment, Scenario 1 #
R2(config)#line con 0
R2(config-line)#exec-timeout 0 0
R2(config-line)#logging synchronous
R2(config-line)#exit
R2(config)#interface e0/0
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 3**

```
R3(config)#ipv6 unicast-routing
R3(config)#no ip domain lookup
R3(config)#banner motd # R3, ENCOR Skills Assessment, Scenario 1 #
R3(config)#line con 0
R3(config-line)#exec-timeout 0 0
R3(config-line)#logging synchronous
R3(config-line)#exit
R3(config)#interface e1/2
R3(config-if)#ip address 10.0.11.1 255.255.255.0
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 s2/0
R3(config-if)#ip address 10.0.13.3 255.255.255.0
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**

```
D1(config)#ip routing
D1(config)#ipv6 unicast-routing
D1(config)#no ip domain lookup
D1(config)#banner motd # D1, ENCOR Skills Assessment, Scenario 1 #
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 10.0.10.2 255.255.255.0
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 10.0.100.1 255.255.255.0
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 10.0.101.1 255.255.255.0
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 10.0.102.1 255.255.255.0
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 10.0.101.1 10.0.101.109
D1(config)#ip dhcp excluded-address 10.0.101.141 10.0.101.254
D1(config)#ip dhcp excluded-address 10.0.102.1 10.0.102.109
D1(config)#ip dhcp excluded-address 10.0.102.141 10.0.102.254
D1(config)#ip dhcp pool VLAN-101
D1(dhcp-config)#network 10.0.101.0 255.255.255.0
D1(dhcp-config)#default-router 10.0.101.254
D1(dhcp-config)#exit
D1(config)#ip dhcp pool VLAN-102
D1(dhcp-config)#network 10.0.102.0 255.255.255.0
D1(dhcp-config)#default-router 10.0.102.254
D1(dhcp-config)#exit
D1(config)#interface range e0/0-3, e1/0-1, e1/3
D1(config-if-range)#shutdown
D1(config-if-range)#exit

```

## Switch D2

```
D2(config)#ip routing
```

```
D2(config)#ipv6 unicast-routing
D2(config)#no ip domain lookup
D2(config)#banner motd # D2, ENCOR Skills Assessment, Scenario 1 #
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 e1/2
D2(config-if)#no switchport
D2(config-if)#ip address 10.0.11.2 255.255.255.0
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 10.0.100.2 255.255.255.0
D2(config-if)#ipv6 address fe80::d1:2 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 10.0.101.2 255.255.255.0
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 10.0.102.2 255.255.255.0
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 10.0.101.1 10.0.101.209
D2(config)#ip dhcp excluded-address 10.0.101.241 10.0.101.254
D2(config)#ip dhcp excluded-address 10.0.102.1 10.0.102.209
D2(config)#ip dhcp excluded-address 10.0.102.241 10.0.102.254
D2(config)#ip dhcp pool VLAN-101
D2(dhcp-config)#network 10.0.101.0 255.255.255.0
D2(dhcp-config)#default-router 10.0.101.254
D2(dhcp-config)#exit
D2(config)#ip dhcp pool VLAN-102
D2(dhcp-config)#network 10.0.102.0 255.255.255.0
D2(dhcp-config)#default-router 10.0.102.254
D2(dhcp-config)#exit
D2(config)#interface range e0/0-3, e1/0-1, e1/3
D2(config-if-range)#shutdown
D2(config-if-range)#exit
```

### **Switch A1**

```
A1(config)#no ip domain lookup
A1(config)#banner motd # A1, ENCOR Skills Assessment, Scenario 1 #
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 10.0.100.3 255.255.255.0
A1(config-if)#ipv6 address fe80::a1:1 link-local
A1(config-if)#ipv6 address 2001:db8:100:100::3/64
A1(config-if)#no shutdown
A1(config-if)#exit
A1(config)#interface range e1/0-3
A1(config-if-range)#shutdown
A1(config-if-range)#exit
```

b. Copie el archivo running-config al archivo startup-config en todos los dispositivos.

Este paso lo realizamos para cada uno de los dispositivos configurados R1, R2, R3, D1, D2 y A1.

```
copy running-config start
copy running-config startup-config
Destination filename [startup-config]?
Building configuration...
[OK]
```

c. Configure el direccionamiento de los host PC 1 y PC 4 como se muestra en la tabla de direccionamiento. Asigne una dirección de puerta de enlace predeterminada de 10.0.100.254, la cual será la dirección IP virtual HSRP utilizada en la Parte 4.

Figura 3. Direccionamiento de los host PC 1



```
Welcome to Virtual PC Simulator, version 0.8.2
Dedicated to Daling.
Build time: Aug 23 2021 11:15:00
Copyright (c) 2007-2015, Paul Meng (mirnshi@gmail.com)
All rights reserved.

VPCS is free software, distributed under the terms of the "BSD" licence.
Source code and license can be found at vpcs.sf.net.
For more information, please visit wiki.freecode.com.cn.

Press '?' to get help.

Executing the startup file

Checking for duplicate address...
PC1 : 10.0.100.5 255.255.255.0 gateway 10.0.100.254

PC1> █
```

Figura 4. Direccionamiento de los host PC 4

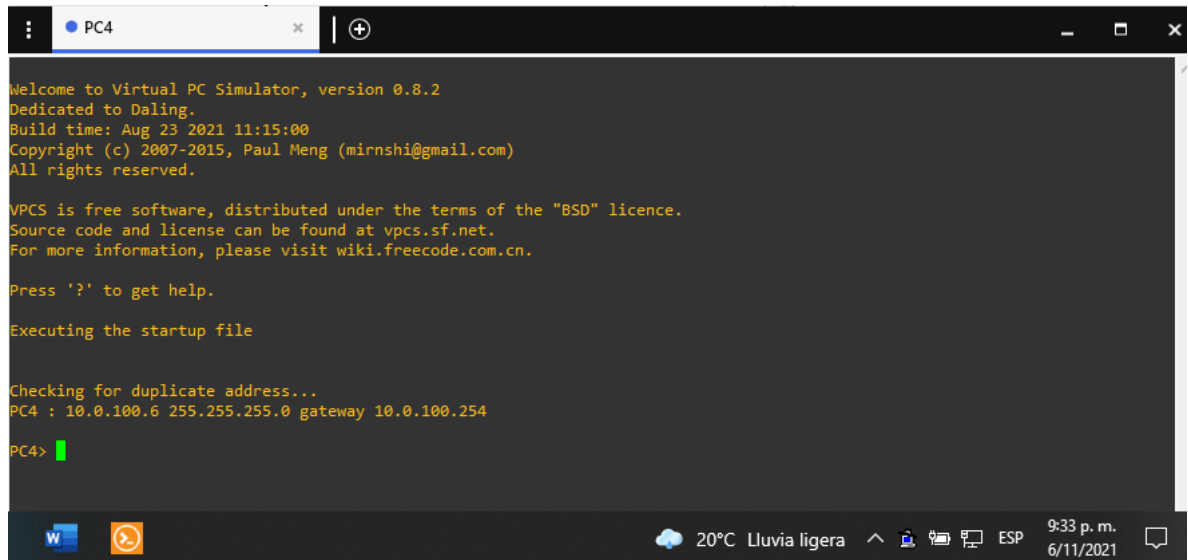


Tabla 2. Configurar la capa 2 de la red y el soporte de Host

2.1 En todos los switches configure interfaces troncales IEEE 802.1Q sobre los enlaces de interconexión entre switches.

### Switch D1

```
D1(config)#interface range e0/0-3
D1(config-if-range)#switchport mode trunk
D1(config-if-range)#switchport trunk encapsulation dot1q
D1(config)#interface range e1/0-1
D1(config-if-range)#switchport mode trunk
D1(config-if-range)#switchport trunk encapsulation dot1q
```

### Switch D2

```
D2(config)#interface range e0/0-3
D2(config-if-range)#switchport mode trunk
D2(config-if-range)#switchport trunk encapsulation dot1q
D2(config)#interface range e1/0-1
D2(config-if-range)#switchport mode trunk
D2(config-if-range)#switchport trunk encapsulation dot1q
```

### Switch A1

```
A1(config)#interface range e1/0-1
A1(config-if-range)#switchport mode trunk
A1(config-if-range)#switchport trunk encapsulation dot1q
A1(config)#interface range e1/2-3
```

```
A1(config-if-range)#switchport mode trunk
A1(config-if-range)#switchport trunk encapsulation dot1q
```

2.2 En todos los switches cambie la VLAN nativa en los enlaces troncales.

#### **Switch D1**

```
D1(config)#interface range e0/0-3
D1(config-if-range)#switchport trunk native vlan 999
D1(config-if-range)#exit
D1(config)#interface range e1/0-1
D1(config-if-range)#switchport trunk native vlan 999
D1(config-if-range)#exit
```

#### **Switch D2**

```
D2(config)#interface range e0/0-3
D2(config-if-range)#switchport trunk native vlan 999
D2(config-if-range)#exit
D2(config)#interface range e1/0-1
D2(config-if-range)#switchport trunk native vlan 999
D2(config-if-range)#exit
```

#### **Switch A1**

```
A1(config)#interface range e1/0-1
A1(config-if-range)#switchport trunk native vlan 999
A1(config-if-range)#exit
A1(config)#interface range e1/2-3
A1(config-if-range)#switchport trunk native vlan 999
A1(config-if-range)#exit
```

2.3 En todos los switches habilite el protocolo Rapid Spanning-Tree (RSTP)

#### **Switch D1**

```
D1(config)#spanning-tree mode rapid-pvst
D1(config-if-range)#no shutdown
D1(config-if-range)#exit
```

#### **Switch D2**

```
D2(config)#spanning-tree mode rapid-pvst
D2(config-if-range)#no shutdown
D2(config-if-range)#exit
```

#### **Switch A1**

```
A1(config)#spanning-tree mode rapid-pvst
A1(config-if-range)#no shutdown
```

```
A1(config-if)#exit
```

2.4 En D1 y D2, configure los puentes raíz RSTP (root bridges) según la información del diagrama de topología.

D1 y D2 deben proporcionar respaldo en caso de falla del puente raíz (root bridge).

#### **Switch D1**

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

```
D1(config)#spanning-tree vlan 101 root secondary
```

#### **Switch D2**

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

```
D2(config)#spanning-tree vlan 100,102 root secondary
```

2.5 En todos los switches, cree EtherChannels LACP como se muestra en el diagrama de topología.

#### **Switch D1**

```
D1(config)#interface range e0/0-3
```

```
D1(config-if-range)#channel-group 12 mode active
```

```
D1(config-if-range)#no shutdown
```

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

```
D1(config)#interface range e1/0-1
```

```
D1(config-if-range)#channel-group 1 mode active
```

```
D1(config-if-range)#no shutdown
```

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

#### **Switch D2**

```
D2(config)#interface range e0/0-3
```

```
D2(config-if-range)#channel-group 12 mode active
```

```
D2(config-if-range)#no shutdown
```

```
D2(config-if-range)#exit
```

```
D2(config)#interface range e1/0-1
```

```
D2(config-if-range)#channel-group 1 mode active
```

```
D2(config-if-range)#no shutdown
```

```
D2(config-if-range)#exit
```

#### **Switch A1**

```
A1(config)#interface range e1/0-1
```

```
A1(config-if-range)#channel-group 1 mode active
```

```
A1(config-if-range)#no shutdown
```

```
A1(config)#interface range e1/2-3
```

```
A1(config-if-range)#channel-group 2 mode active
```

```
A1(config-if-range)#no shutdown
```

```
A1(config-if)#spanning-tree portfast
A1(config-if)#no shutdown
A1(config-if)#exit
```

2.6 En todos los switches, configure los puertos de acceso del host (host access port) que se conectan a PC1, PC2, PC3 y PC4.

#### **Switch D1**

```
D1(config)#interface e1/3
D1(config-if-range)#switchport mode access
D1(config-if-range)#switchport access vlan 100
D1(config-if-range)#spanning-tree portfast
D1(config-if-range)#no shutdown
D1(config-if-range)#exit
```

#### **Switch D2**

```
D2(config-if-range)#interface e1/3
D2(config-if-range)#switchport mode access
D2(config-if-range)#switchport access vlan 102
D2(config-if-range)#spanning-tree portfast
D2(config-if-range)#no shutdown
D2(config-if-range)#exit
```

#### **Switch A1**

```
A1(config)#interface e0/2
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)#interface e0/3
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 Verifique los servicios DHCP IPv4.



Figura 5. PC2 cliente DHCP dirección IPv4 válida



```
Welcome to Virtual PC Simulator, version 0.8.2
Dedicated to Daling.
Build time: Aug 23 2021 11:15:00
Copyright (c) 2007-2015, Paul Meng (mirnshi@gmail.com)
All rights reserved.

VPCS is free software, distributed under the terms of the "BSD" licence.
Source code and license can be found at vpcs.sf.net.
For more information, please visit wiki.freecode.com.cn.

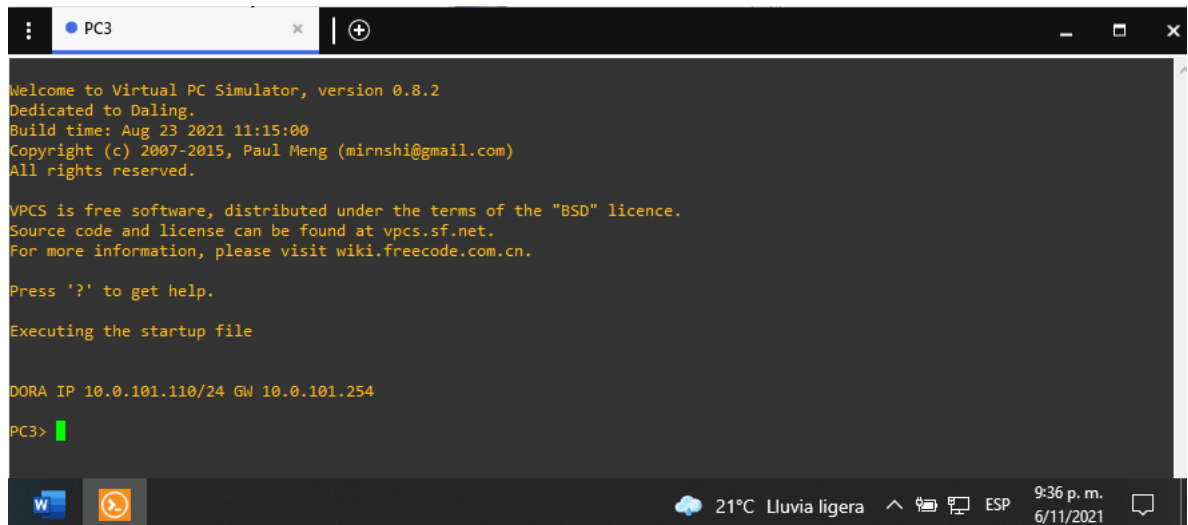
Press '?' to get help.

Executing the startup file

DORA IP 10.0.102.210/24 GW 10.0.102.254

PC2> █
```

Figura 6. PC3 cliente DHCP dirección IPv4 válida



```
Welcome to Virtual PC Simulator, version 0.8.2
Dedicated to Daling.
Build time: Aug 23 2021 11:15:00
Copyright (c) 2007-2015, Paul Meng (mirnshi@gmail.com)
All rights reserved.

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Source code and license can be found at vpcs.sf.net.
For more information, please visit wiki.freecode.com.cn.

Press '?' to get help.

Executing the startup file

DORA IP 10.0.101.110/24 GW 10.0.101.254

PC3> █
```

## 2.8 Verifique la conectividad de la LAN local

Figura 7. PC1 ping a D1, D2 y PC4

```
PC3 PC2 PC1 PC4
All rights reserved.
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Source code and license can be found at vpcs.sf.net.
For more information, please visit wiki.freecode.com.cn.
Press '?' to get help.
Executing the startup file
Checking for duplicate address...
PC1 : 10.0.100.5 255.255.255.0 gateway 10.0.100.254
PC1 : 2001:db8:100:100::5/64
PC1> ping 10.0.100.1
84 bytes from 10.0.100.1 icmp_seq=1 ttl=255 time=267.142 ms
84 bytes from 10.0.100.1 icmp_seq=2 ttl=255 time=151.745 ms
84 bytes from 10.0.100.1 icmp_seq=3 ttl=255 time=66.887 ms
84 bytes from 10.0.100.1 icmp_seq=4 ttl=255 time=24.263 ms
84 bytes from 10.0.100.1 icmp_seq=5 ttl=255 time=35.465 ms
PC1> ping 10.0.100.2
84 bytes from 10.0.100.2 icmp_seq=1 ttl=255 time=111.530 ms
84 bytes from 10.0.100.2 icmp_seq=2 ttl=255 time=153.444 ms
84 bytes from 10.0.100.2 icmp_seq=3 ttl=255 time=195.737 ms
84 bytes from 10.0.100.2 icmp_seq=4 ttl=255 time=186.312 ms
84 bytes from 10.0.100.2 icmp_seq=5 ttl=255 time=129.072 ms
PC1> ping 10.0.100.6
84 bytes from 10.0.100.6 icmp_seq=1 ttl=64 time=66.090 ms
84 bytes from 10.0.100.6 icmp_seq=2 ttl=64 time=77.687 ms
84 bytes from 10.0.100.6 icmp_seq=3 ttl=64 time=46.475 ms
84 bytes from 10.0.100.6 icmp_seq=4 ttl=64 time=40.377 ms
84 bytes from 10.0.100.6 icmp_seq=5 ttl=64 time=56.748 ms
PC1> █
20°C Lluvia 9:07 p. m.
25/10/2021
```

Figura 8. PC2 ping a D1 y D2

```

Welcome to Virtual PC Simulator, version 0.8.2
Dedicated to Daling.
Build time: Aug 23 2021 11:15:00
Copyright (c) 2007-2015, Paul Meng (mirnshi@gmail.com)
All rights reserved.

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Source code and license can be found at vpcs.sf.net.
For more information, please visit wiki.freecode.com.cn.

Press '?' to get help.

Executing the startup file

DORA IP 10.0.102.210/24 GW 10.0.102.254

PC2> ping 10.0.102.1

84 bytes from 10.0.102.1 icmp_seq=1 ttl=255 time=246.874 ms
84 bytes from 10.0.102.1 icmp_seq=2 ttl=255 time=157.829 ms
84 bytes from 10.0.102.1 icmp_seq=3 ttl=255 time=37.586 ms
84 bytes from 10.0.102.1 icmp_seq=4 ttl=255 time=55.989 ms
84 bytes from 10.0.102.1 icmp_seq=5 ttl=255 time=179.601 ms

PC2> ping 10.0.102.2

84 bytes from 10.0.102.2 icmp_seq=1 ttl=255 time=85.749 ms
84 bytes from 10.0.102.2 icmp_seq=2 ttl=255 time=57.868 ms
84 bytes from 10.0.102.2 icmp_seq=3 ttl=255 time=30.731 ms
84 bytes from 10.0.102.2 icmp_seq=4 ttl=255 time=44.141 ms
84 bytes from 10.0.102.2 icmp_seq=5 ttl=255 time=104.076 ms

PC2> █

9:08 p. m.
25/10/2021
```

Figura 9. PC3 ping a D1 y D2

```

Welcome to Virtual PC Simulator, version 0.8.2
Dedicated to Daling.
Build time: Aug 23 2021 11:15:00
Copyright (c) 2007-2015, Paul Meng (mirnshi@gmail.com)
All rights reserved.

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Source code and license can be found at vpcs.sf.net.
For more information, please visit wiki.freecode.com.cn.

Press '?' to get help.

Executing the startup file

DDORA IP 10.0.101.110/24 GW 10.0.101.254

PC3> ping 10.0.101.1

84 bytes from 10.0.101.1 icmp_seq=1 ttl=255 time=97.877 ms
84 bytes from 10.0.101.1 icmp_seq=2 ttl=255 time=85.955 ms
84 bytes from 10.0.101.1 icmp_seq=3 ttl=255 time=313.563 ms
84 bytes from 10.0.101.1 icmp_seq=4 ttl=255 time=128.889 ms
84 bytes from 10.0.101.1 icmp_seq=5 ttl=255 time=84.351 ms

PC3> ping 10.0.101.2

84 bytes from 10.0.101.2 icmp_seq=1 ttl=255 time=156.693 ms
84 bytes from 10.0.101.2 icmp_seq=2 ttl=255 time=102.282 ms
84 bytes from 10.0.101.2 icmp_seq=3 ttl=255 time=58.267 ms
84 bytes from 10.0.101.2 icmp_seq=4 ttl=255 time=76.088 ms
84 bytes from 10.0.101.2 icmp_seq=5 ttl=255 time=87.682 ms

PC3> █

```

20°C Lluvia 9:09 p. m. 25/10/2021

Figura 10. PC4 ping a D1, D2 y PC1

```
⋮ ● PC3 ● PC2 ● PC1 ● PC4
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Source code and license can be found at vpcs.sf.net.
For more information, please visit wiki.freecode.com.cn.

Press '?' to get help.

Executing the startup file

Checking for duplicate address...
PC4 : 10.0.100.6 255.255.255.0 gateway 10.0.100.254

PC1 : 2001:db8:100:100::6/64

PC4> ping 10.0.100.1

84 bytes from 10.0.100.1 icmp_seq=1 ttl=255 time=176.645 ms
84 bytes from 10.0.100.1 icmp_seq=2 ttl=255 time=83.186 ms
84 bytes from 10.0.100.1 icmp_seq=3 ttl=255 time=199.150 ms
84 bytes from 10.0.100.1 icmp_seq=4 ttl=255 time=143.659 ms
84 bytes from 10.0.100.1 icmp_seq=5 ttl=255 time=200.375 ms

PC4> ping 10.0.100.2

84 bytes from 10.0.100.2 icmp_seq=1 ttl=255 time=129.608 ms
84 bytes from 10.0.100.2 icmp_seq=2 ttl=255 time=207.778 ms
84 bytes from 10.0.100.2 icmp_seq=3 ttl=255 time=95.179 ms
84 bytes from 10.0.100.2 icmp_seq=4 ttl=255 time=366.901 ms
84 bytes from 10.0.100.2 icmp_seq=5 ttl=255 time=144.586 ms

PC4> ping 10.0.100.5

84 bytes from 10.0.100.5 icmp_seq=1 ttl=64 time=56.479 ms
84 bytes from 10.0.100.5 icmp_seq=2 ttl=64 time=25.031 ms
84 bytes from 10.0.100.5 icmp_seq=3 ttl=64 time=66.307 ms
84 bytes from 10.0.100.5 icmp_seq=4 ttl=64 time=59.571 ms
84 bytes from 10.0.100.5 icmp_seq=5 ttl=64 time=58.002 ms

PC4> █

20°C Lluvia 9:09 p. m.
ESP 25/10/2021
```

Tabla 3. Configurar los protocolos de enrutamiento

3.1 En la “Red de la Compañía” (es decir, R1, R3, D1, y D2), configure single-area OSPFv2 en area 0.

### **Router 1**

```
R1(config)#router ospf 4
R1(config-router)#router-id 0.0.4.1
R1(config-router)#network 10.0.10.0 0.0.0.255 area 0
R1(config-router)#network 10.0.13.0 0.0.0.255 area 0
R1(config-router)#default-information originate
R1(config-router)#exit
```

### **Router 3**

```
R3(config)#router ospf 4
R3(config-router)#router-id 0.0.4.3
R3(config-router)#network 10.0.11.0 0.0.0.255 area 0
R3(config-router)#network 10.0.13.0 0.0.0.255 area 0
R3(config-router)#exit
```

### **Switch D1**

```
D1(config)#router ospf 4
D1(config-router)#router-id 0.0.4.131
D1(config-router)#network 10.0.100.0 0.0.0.255 area 0
D1(config-router)#network 10.0.101.0 0.0.0.255 area 0
D1(config-router)#network 10.0.102.0 0.0.0.255 area 0
D1(config-router)#network 10.0.10.0 0.0.0.255 area 0
D1(config-router)#passive-interface default
D1(config-router)#no passive-interface e1/2
D1(config-router)#exit
```

### **Switch D2**

```
D2(config)#router ospf 4
D2(config-router)#router-id 0.0.4.132
D2(config-router)#network 10.0.100.0 0.0.0.255 area 0
D2(config-router)#network 10.0.101.0 0.0.0.255 area 0
D2(config-router)#network 10.0.102.0 0.0.0.255 area 0
D2(config-router)#network 10.0.11.0 0.0.0.255 area 0
D2(config-router)#passive-interface default
D2(config-router)#no passive-interface e1/2
D2(config-router)#exit
```

3.2 En la “Red de la Compañía” (es decir, R1, R3, D1, y D2), configure classic single-area OSPFv3 en area 0.

### **Router 1**

```
R1(config)#ipv6 router ospf 6
R1(config-rtr)#router-id 0.0.6.1
R1(config-rtr)#default-information originate
```

```
R1(config-rtr)#exit
R1(config)#interface e1/2
R1(config-if)#ipv6 ospf 6 area 0
R1(config-if)#exit
R1(config)#interface s2/0
R1(config-if)#ipv6 ospf 6 area 0
R1(config-if)#exit
```

### **Router 3**

```
R3(config)#ipv6 router ospf 6
R3(config-rtr)#router-id 0.0.6.3
R3(config-rtr)#exit
R3(config)#interface e1/2
R3(config-if)#ipv6 ospf 6 area 0
R3(config-if)#exit
R3(config)#interface s2/0
R3(config-if)#ipv6 ospf 6 area 0
R3(config-if)#exit
```

### **Switch D1**

```
D1(config)#ipv6 router ospf 6
D1(config-rtr)#router-id 0.0.6.131
D1(config-rtr)#passive-interface default
D1(config-rtr)#no passive-interface e1/2
D1(config-rtr)#exit
D1(config)#interface e1/2
D1(config-if)#ipv6 ospf 6 area 0
D1(config-if)#exit
D1(config)#interface vlan 100
D1(config-if)#ipv6 ospf 6 area 0
D1(config-if)#exit
D1(config)#interface vlan 101
D1(config-if)#ipv6 ospf 6 area 0
D1(config-if)#exit
D1(config)#interface vlan 102
D1(config-if)#ipv6 ospf 6 area 0
D1(config-if)#exit
```

### **Switch D2**

```
D2(config)#ipv6 router ospf 6
D2(config-rtr)#router-id 0.0.6.132
D2(config-rtr)#passive-interface default
D2(config-rtr)#no passive-interface e1/2
D2(config-rtr)#exit
```

```
D2(config)#interface e1/2
D2(config-if)#ipv6 ospf 6 area 0
D2(config-if)#exit
D2(config)#interface vlan 100
D2(config-if)#ipv6 ospf 6 area 0
D2(config-if)#exit
D2(config)#interface vlan 101
D2(config-if)#ipv6 ospf 6 area 0
D2(config-if)#exit
D2(config)#interface vlan 102
D2(config-if)#ipv6 ospf 6 area 0
D2(config-if)#exit
```

3.3 En R2 en la “Red ISP”, configure MP- BGP.

#### **Router 2**

```
R2(config)#ip route 0.0.0.0 0.0.0.0 loopback 0
R2(config)#router bgp 500
R2(config-router)#bgp router-id 2.2.2.2
R2(config-router)#neighbor 209.165.200.225 remote-as 300
R2(config-router)#neighbor 2001:db8:200::1 remote-as 300
R2(config-router)#address-family ipv4
R2(config-router)#neighbor 209.165.200.225 activate
R2(config-router)#no neighbor 2001:db8:200::1 activate
R2(config-router)#network 2.2.2.2 mask 255.255.255.255
R2(config-router)#network 0.0.0.0
R2(config-router)#exit-address-family
R2(config)#address-family ipv6
R2(config-router)#no neighbor 209.165.200.225 activate
R2(config-router)#neighbor 2001:db8:200::1 activate
R2(config-router)#network 2001:db8:2222::/128
R2(config-router)#network ::/0
R2(config-router)#exit-address-family
```

3.4 En R1 en la “Red ISP”, configure MP- BGP.

#### **Router 1**

```
R1(config)#ip route 10.0.0.0 255.0.0.0 null0
R1(config)#ipv6 route 2001:db8:100::/48 null0
R1(config)#router bgp 300
R1(config-router)#bgp router-id 1.1.1.1
R1(config-router)#neighbor 209.165.200.226 remote-as 500
R1(config-router)#%BGP-5-ADJCHANGE: neighbor 209.165.200.226 Up
R1(config-router)#neighbor 2001:db8:200::2 remote-as 500
```



```

R1(config-router)#address-family ipv4 unicast
R1(config-router)#neighbor 209.165.200.226 activate
R1(config-router)#no neighbor 2001:db8:200::2 activate
R1(config-router)#network 10.0.0.0 mask 255.0.0.0
R1(config-router)#exit-address-family
R1(config-router)#address-family ipv6 unicast
R1(config-router)#no neighbor 209.165.200.226 activate
R1(config-router)#neighbor 2001:db8:200::2 activate
R1(config-router)#network 2001:db8:100::/48
R1(config-router)#exit-address-family

```

Tabla 4. Configurar la Redundancia del Primer Salto (First Hop Redundancy)

En esta parte, debe configurar HSRP version 2 para proveer redundancia de primer salto para los host en la “Red de la Compañía”.

Las tareas de configuración son las siguientes:

4.1 En D1, cree IP SLAs que prueben la accesibilidad de la interfaz R1 G0/0/1.

```

D1(config)#ip sla 4
D1(config-ip-sla)#icmp-echo 10.0.10.1
D1(config-ip-sla-echo)#frequency 5
D1(config-ip-sla-echo)#exit
D1(config)#ip sla 6
D1(config-ip-sla)#icmp-echo 2001:db8:100:1010::1
D1(config-ip-sla-echo)#frequency 5
D1(config-ip-sla-echo)#exit
D1(config)#ip sla schedule 4 life forever start-time now
D1(config)#ip sla schedule 6 life-forever start-time now
D1(config)#track 4 ip sla 4
D1(config-track)#delay down 10 up 15
D1(config-track)#exit
D1(config)#track 6 ip sla 6
D1(config-track)#delay down 10 up 15
D1(config-track)#exit

```

4.2 En D2, cree IP SLAs que prueben la accesibilidad de la interfaz R3 G0/0/1.

```

D2(config)#ip sla 4
D2(config-ip-sla)#icmp-echo 10.0.11.1
D2(config-ip-sla-echo)#frequency 5
D2(config-ip-sla-echo)#exit

```

```
D2(config)#ip sla 6
D2(config-ip-sla)#icmp-echo 2001:db8:100:1011::1
D2(config-ip-sla-echo)#frequency 5
D2(config-ip-sla-echo)#exit
D2(config)#ip sla schedule 4 life forever start-time now
D2(config)#ip sla schedule 6 life forever start-time now
D2(config)#track 4 ip sla 4
D2(config-track)#delay down 10 up 15
D2(config-track)#exit
D2(config)#track 6 ip sla 6
D2(config-track)#delay down 10 up 15
D2(config-track)#exit
```

#### 4.3 En D1 configure HSRPv2.

```
D1(config)#interface vlan 100
D1(config-if)#standby version 2
D1(config-if)#standby 104 ip 10.0.100.254
D1(config-if)#standby 104 priority 150
D1(config-if)#standby 104 preempt
D1(config-if)#standby 104 track 4 decrement 60
D1(config-if)#standby 106 ipv6 autoconfig
D1(config-if)#standby 106 priority 150
D1(config-if)#standby 106 preempt
D1(config-if)#standby 106 track 6 decrement 60
D1(config-if)#exit
D1(config)#interface vlan 101
D1(config-if)#standby version 2
D1(config-if)#standby 114 ip 10.0.101.254
D1(config-if)#standby 114 preempt
D1(config-if)#standby 114 track 4 decrement 60
D1(config-if)#standby 116 ipv6 autoconfig
D1(config-if)#standby 116 preempt
D1(config-if)#standby 116 track 6 decrement 60
D1(config-if)#exit
D1(config)#interface vlan 102
D1(config-if)#standby version 2
D1(config-if)#standby 124 ip 10.0.102.254
D1(config-if)#standby 124 priority 150
D1(config-if)#standby 124 preempt
D1(config-if)#standby 124 track 4 decrement 60
D1(config-if)#standby 126 ipv6 autoconfig
D1(config-if)#standby 126 priority 150
D1(config-if)#standby 126 priority 150
```

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

En D2, configure HSRPv2.

```
D2(config)#interface vlan 100
D2(config-if)#standby version 2
D2(config-if)#standby 104 ip 10.0.100.254
D2(config-if)#standby 104 preempt
D2(config-if)#standby 104 track 4 decrement 60
D2(config-if)#standby 106 ipv6 autoconfig
D2(config-if)#standby 106 preempt
D2(config-if)#standby 106 track 6 decrement 60
D2(config-if)#exit
D2(config)#interface vlan 101
D2(config-if)#standby version 2
D2(config-if)#standby 114 ip 10.0.101.254
D2(config-if)#standby 114 priority 150
D2(config-if)#standby 114 preempt
D2(config-if)#standby 114 track 4 decrement 60
D2(config-if)#standby 116 ipv6 autoconfig
D2(config-if)#standby 116 priority 150
D2(config-if)#standby 116 preempt
D2(config-if)#standby 116 track 6 decrement 60
D2(config-if)#exit
D2(config)#interface vlan 102
D2(config-if)#standby version 2
D2(config-if)#standby 124 ip 10.0.102.254
D2(config-if)#standby 124 preempt
D2(config-if)#standby 124 track 4 decrement 60
D2(config-if)#standby 126 ipv6 autoconfig
D2(config-if)#standby 126 preempt
D2(config-if)#standby 126 track 6 decrement 60
D2(config-if)#exit
D2(config)#end
```

#### Tabla 5. Seguridad

En esta parte debe configurar varios mecanismos de seguridad en los dispositivos de la topología. Las tareas de configuración son las siguientes:

5.1 En todos los dispositivos, proteja el EXEC privilegiado usando el algoritmo de encriptación SCRYPT. Contraseña: cisco12345cisco

```
R1(config)#enable algorithm-type SCRYPT secret cisco12345cisco
R2(config)#enable algorithm-type SCRYPT secret cisco12345cisco
R3(config)#enable algorithm-type SCRYPT secret cisco12345cisco
D1(config)#enable algorithm-type SCRYPT secret cisco12345cisco
D2(config)#enable algorithm-type SCRYPT secret cisco12345cisco
A1(config)#enable algorithm-type SCRYPT secret cisco12345cisco
```

5.2 En todos los dispositivos, cree un usuario local y protéjalo usando el algoritmo de encriptación SCRYPT.

- Nombre de usuario Local: sadmin
- Nivel de privilegio 15
- Contraseña: cisco12345cisco

```
R1(config)# username sadmin privilege 15 algorithm-type SCRYPT secret
cisco12345cisco
R1(config)#exit
```

```
R2(config)# username sadmin privilege 15 algorithm-type SCRYPT secret
cisco12345cisco
R2(config)#exit
```

```
R3(config)# username sadmin privilege 15 algorithm-type SCRYPT secret
cisco12345cisco
R3(config)#exit
```

```
D1(config)# username sadmin privilege 15 algorithm-type SCRYPT secret
cisco12345cisco
D1(config)#exit
```

```
D2(config)# username sadmin privilege 15 algorithm-type SCRYPT secret
cisco12345cisco
D2(config)#exit
```

```
A1(config)# username sadmin privilege 15 algorithm-type SCRYPT secret
cisco12345cisco
A1(config)#exit
```

5.3 En todos los dispositivos (excepto R2), habilite AAA.

```
R1(config)#aaa new-mode
```

```
R3(config)#aaa new-mode
D1(config)#aaa new-mode
D2(config)#aaa new-mode
A1(config)#aaa new-mode
```

5.4 En todos los dispositivos (excepto R2), configure las especificaciones del servidor RADIUS.

```
R1(config)#radius server RADIUS
```

- Dirección IP del servidor RADIUS es 10.0.100.6.
- Puertos UDP del servidor RADIUS son 1812 y 1813.
- Contraseña: \$strongPass

```
R1(config-radius-server)#$4 10.0.100.6 auth-port 1812 acct-port 1813
R1(config-radius-server)#key $strongPass
R1(config-radius-server)#exit
R3(config)#radius server RADIUS
R3(config-radius-server)#$4 10.0.100.6 auth-port 1812 acct-port 1813
R3(config-radius-server)#key $strongPass
R3(config-radius-server)#exit
D1(config)#radius server RADIUS
D1(config-radius-server)#$4 10.0.100.6 auth-port 1812 acct-port 1813
D1(config-radius-server)#key $strongPass
D1(config-radius-server)#exit
D2(config)#radius server RADIUS
D2 (config-radius-server)#$4 10.0.100.6 auth-port 1812 acct-port 1813
D2 (config-radius-server)#key $strongPass
D2 (config-radius-server)#exit
A1(config)#radius server RADIUS
A1(config-radius-server)#$4 10.0.100.6 auth-port 1812 acct-port 1813
A1(config-radius-server)#key $strongPass
A1(config-radius-server)#exit Especificaciones del servidor RADIUS.:
```

5.5 En todos los dispositivos (excepto R2), configure la lista de métodos de autenticación AAA

```
R1(config)#aaa authentication login default group radius local
R1(config)#exit
```

```
R3(config)#aaa authentication login default group radius local
R3(config)#exit
```

```
D1(config)#aaa authentication login default group radius local
D1(config)#exit
```

```
D2(config)#aaa authentication login default group radius local
D2(config)#exit
```

```
A1(config)#aaa authentication login default group radius local
A1(config)#exit
```

5.6 Verifique el servicio AAA en todos los dispositivos (except R2). Cierre e inicie sesión en todos los dispositivos (except R2) con el usuario: raduser y la contraseña: upass123.

Figura 11. Valido ingreso al dispositivo R1 con usuario raduser

```
R1, ENCOR Skills Assessment, Scenario 1
User Access Verification
Username: raduser
Password:
% Authentication failed
Username: raduser
Password:
% Authentication failed
Username: [ ]
```

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Figura 12. Valido ingreso al dispositivo R1 con usuario raduser

```
R3, ENCOR Skills Assessment, Scenario 1
User Access Verification
Username: raduser
Password:
% Authentication failed
Username: [ ]
```

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Figura 13. Valido ingreso al dispositivo D1 con usuario raduser

```
D1, ENCOR Skills Assessment, Scenario 1
User Access Verification
Username: raduser
Password:
% Authentication failed
Username: []
```

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Figura 14. Valido ingreso al dispositivo D2 con usuario raduser

```
y D2, ENCOR Skills Assessment, Scenario 1
User Access Verification
Username: raduser
Password:
% Authentication failed
Username: []
```

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Figura 15. Valido ingreso al dispositivo A1 con usuario raduser

```
ell, changed state to u A1, ENCOR Skills Assessment, Scenario 1
User Access Verification
Username: raduser
Password:
% Authentication failed
Username: []
```

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## Tabla 6. Configure las funciones de Administración de Red

En esta parte, debe configurar varias funciones de administración de red.

6.1 En todos los dispositivos, configure el reloj local a la hora UTC actual.

```
R1(config)#clock timezone UTC -5
R2(config)#clock timezone UTC -5
R3(config)#clock timezone UTC -5
D1(config)#clock timezone UTC -5
D2(config)#clock timezone UTC -5
A1(config)#clock timezone UTC -5
```

6.2 Configure R2 como un NTP maestro en el nivel de estrato 3.

```
R2(config)#ntp master 3
R2(config)#exit
```

6.3 Configure NTP en R1, R3, D1, D2, y A1.

- R1 debe sincronizar con R2.
- R3, D1 y A1 para sincronizar la hora con R1.
- D2 para sincronizar la hora con R3.

```
R1(config)#ntp server 2.2.2.2
R1(config)#logging trap warning
R3(config)#ntp server 10.0.10.1
R3(config)#logging trap warning
D1(config)#ntp server 10.0.10.1
D1(config)#logging trap warning
D2(config)#ntp server 10.0.10.1
D2(config)#logging trap warning
A1(config)#ntp server 10.0.10.1
A1(config)#logging trap warning
```

6.4 Configure Syslog en todos los dispositivos excepto R2. Syslogs deben enviarse a la PC1 en 10.0.100.5 en el nivel WARNING.

```
R1(config)#logging host 10.0.100.5
R1(config)#logging on
```

```
R3(config)#logging host 10.0.100.5
R3(config)#logging on
```

```
D1(config)#logging host 10.0.100.5
D1(config)#logging on
```

```
D2(config)#logging host 10.0.100.5
D2(config)#logging on
A1(config)#logging host 10.0.100.5
A1(config)#logging on
```

6.5 Configure SNMPv2c en todos los dispositivos excepto R2

```
R1(config)#ip access-list standard SNMP-NMS
R1(config-std-nacl)#permit host 10.0.100.5
R1(config-std-nacl)#exit
```



```
R1(config)#snmp-server contact Cisco Student
R1(config)#snmp-server community ENCORSA ro SNMP-NMS
R1(config)#snmp-server host 10.0.100.5 version 2c ENCORSA
R1(config)#snmp-server ifindex persist
R1(config)#snmp-server enable traps bgp
R1(config)#snmp-server enable traps config
R1(config)#snmp-server enable traps ospf
R1(config)#end
```

```
R3(config)#ip access-list standard SNMP-NMS
R3(config-std-nacl)#permit host 10.0.100.5
R3(config-std-nacl)#exit
R3(config)#snmp-server contact Cisco Student
R3(config)#snmp-server community ENCORSA ro SNMP-NMS
R3(config)#snmp-server host 10.0.100.5 version 2c ENCORSA
R3(config)#snmp-server ifindex persist
R3(config)#snmp-server enable traps config
R3(config)#snmp-server enable traps ospf
R3(config)#end
```

```
D1(config)#ip access-list standard SNMP-NMS
D1(config-std-nacl)#permit host 10.0.100.5
D1(config-std-nacl)#exit
D1(config)#snmp-server contact Cisco Student
D1(config)#snmp-server community ENCORSA ro SNMP-NMS
D1(config)#snmp-server host 10.0.100.5 version 2c ENCORSA
D1(config)#snmp-server ifindex persist
D1(config)#snmp-server enable traps ospf
D1(config)#end
```

```
D2(config)#ip access-list standard SNMP-NMS
D2(config-std-nacl)#permit host 10.0.100.5
D2(config-std-nacl)#exit
D2(config)#snmp-server contact Cisco Student
D2(config)#snmp-server community ENCORSA ro SNMP-NMS
D2(config)#snmp-server host 10.0.100.5 version 2c ENCORSA
D2(config)#snmp-server enable traps ospf
D2(config)#end
```

```
A1(config)#ip access-list standard SNMP-NMS
A1(config-std-nacl)#permit host 10.0.100.5
A1(config-std-nacl)#exit
A1(config)#snmp-server contact Cisco Student
A1(config)#snmp-server community ENCORSA ro SNMP-NMS
A1(config)#snmp-server host 10.0.100.5 version 2c ENCORSA
A1(config)#snmp-server ifindex persist
A1(config)#snmp-server enable traps ospf
```

A1(config)#end

Figura 16. Show interfaces trunk command en D1

```
D1, ENCOR Skills Assessment, Scenario 1
User Access Verification
Username: sadmin
Password:

D1#show interface trunk

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

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

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

Port      Vlans in spanning tree forwarding state and not pruned
Po1       1,100-102,999
Po12      1,100-102,999
D1#
```

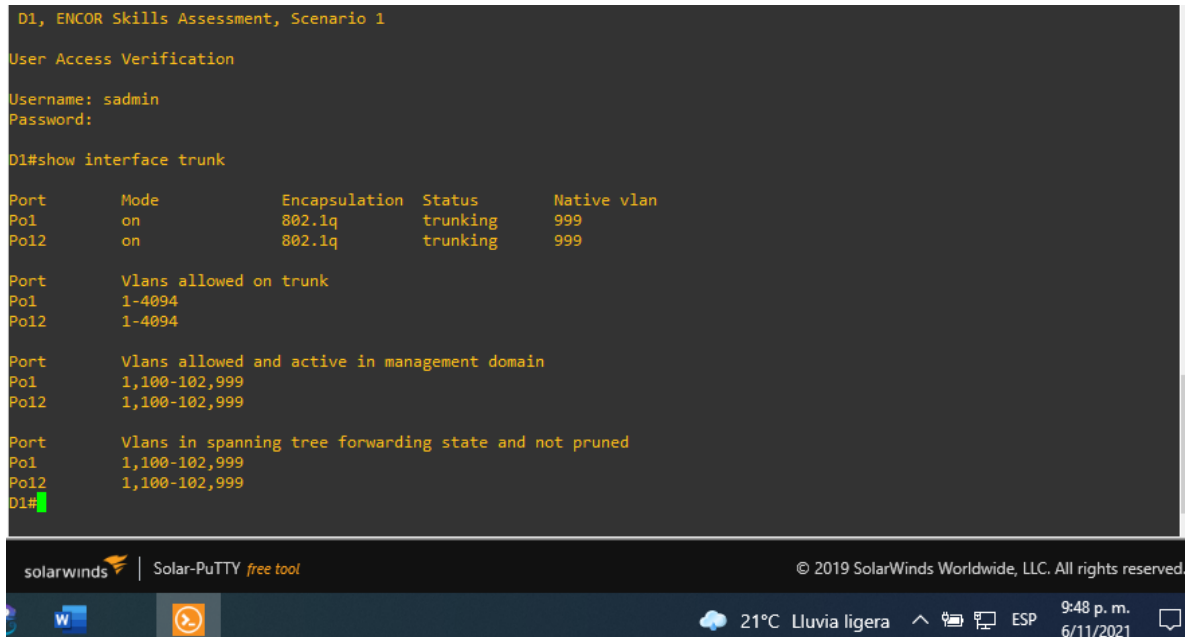


Figura 17. D1# show run | include spanning-tree

```
D1#show run | include spanning-tree
spanning-tree mode rapid-pvst
spanning-tree extend system-id
spanning-tree vlan 100,102 priority 24576
spanning-tree vlan 101 priority 28672
spanning-tree portfast edge
D1#
```

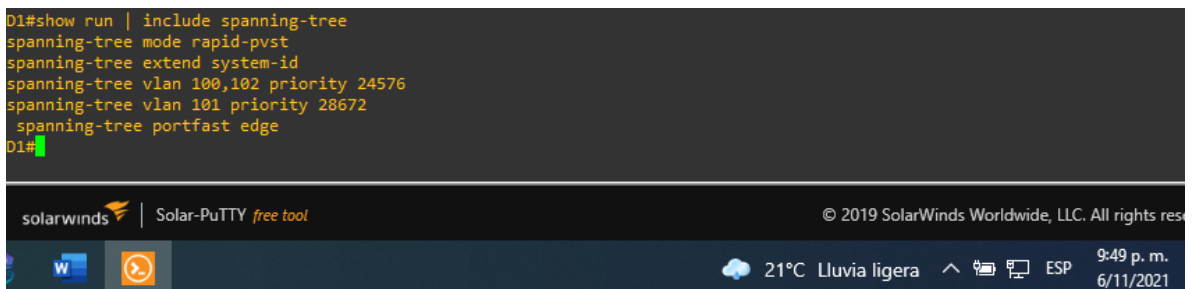


Figura 18. D1# show run interface e1/3

```
D1#show run interface e1/3
Building configuration...

Current configuration : 110 bytes
!
interface Ethernet1/3
  switchport access vlan 100
  switchport mode access
  spanning-tree portfast edge
end
D1#
```

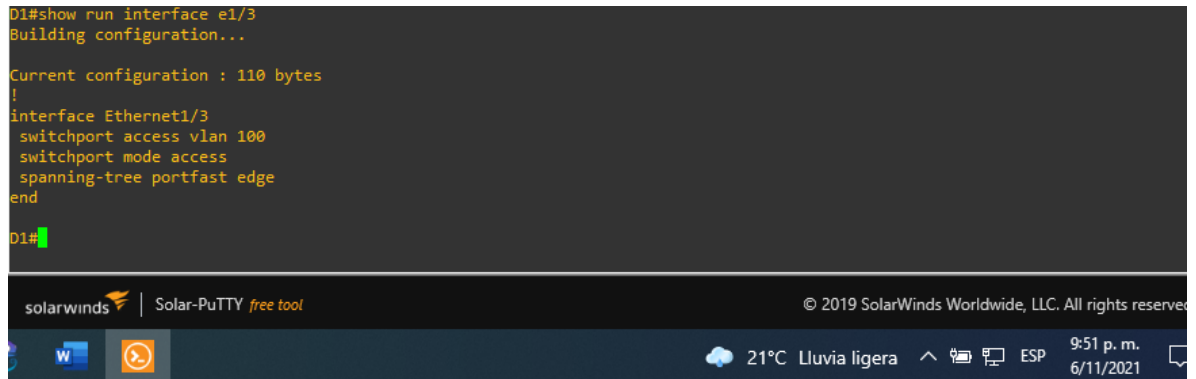


Figura 19. D2# show interfaces trunk

```
User Access Verification
Username: sadmin
Password:

D2#show interfaces trunk

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

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

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

Port      Vlans in spanning tree forwarding state and not pruned
-----
Po2       1,100-102,999
Po12      1,100-102,999
D2#
```

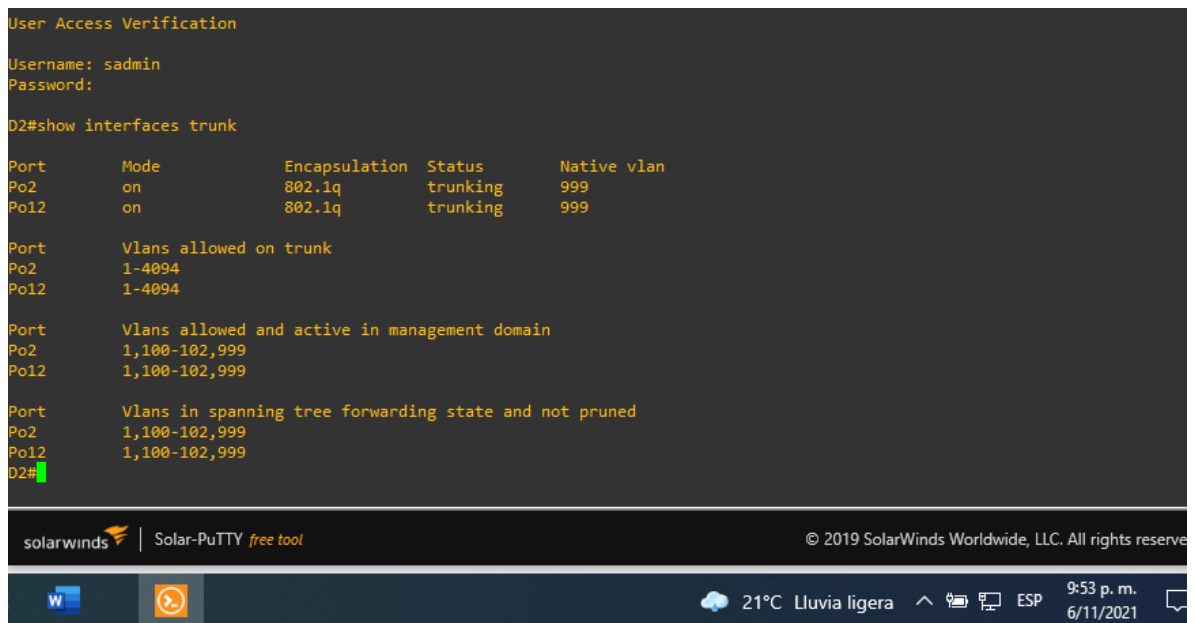


Figura 20. D2# show run | include spanning-tree

```
D2#show run | include spanning-tree
spanning-tree mode rapid-pvst
spanning-tree extend system-id
spanning-tree vlan 100,102 priority 28672
spanning-tree vlan 101 priority 24576
spanning-tree portfast edge
D2#
```

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21°C Lluvia ligera ESP 9:54 p. m. 6/11/2021

Figura 21. D2# show run interface e1/3

```
D2#show run interface e1/3
Building configuration...

Current configuration : 110 bytes
!
interface Ethernet1/3
 switchport access vlan 102
 switchport mode access
 spanning-tree portfast edge
end
D2#
```

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Figura 22. A1# show run interface e0/2 y e0/3

```
User Access Verification
Username: sadmin
Password:

A1#show run interface e0/2
Building configuration...

Current configuration : 110 bytes
!
interface Ethernet0/2
 switchport access vlan 101
 switchport mode access
 spanning-tree portfast edge
end

A1#show run interface e0/3
Building configuration...

Current configuration : 110 bytes
!
interface Ethernet0/3
 switchport access vlan 100
 switchport mode access
 spanning-tree portfast edge
end

A1#
```

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Figura 23. R1# show run | section ^router ospf

```
User Access Verification
Username: sadmin
Password:

R1#
Nov 7 03:01:06.150: %OSPF-5-ADJCHG: Process 4, Nbr 0.0.4.131 on Ethernet1/2 from FULL to DOWN, Neighbor Down: Dead timer expired
R1#
Nov 7 03:01:08.064: %OSPFv3-5-ADJCHG: Process 6, Nbr 0.0.6.131 on Ethernet1/2 from FULL to DOWN, Neighbor Down: Dead timer expired
R1#show run | section ^router ospf
router ospf 4
 router-id 0.0.4.1
 network 10.0.10.0 0.0.0.255 area 0
 network 10.0.13.0 0.0.0.255 area 0
 default-information originate
R1#
```

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Figura 24. R3# show run | section ^router ospf

```
User Access Verification
Username: sadmin
Password:

R3#show run | section ^router ospf
router ospf 4
  router-id 0.0.4.3
  network 10.0.11.0 0.0.0.255 area 0
  network 10.0.13.0 0.0.0.255 area 0
R3#
```

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Figura 25. D1# show run | section ^router ospf

```
D1#show run | section ^router ospf
router ospf 4
  router-id 0.0.4.131
  passive-interface default
  no passive-interface Ethernet1/2
  network 10.0.10.0 0.0.0.255 area 0
  network 10.0.100.0 0.0.0.255 area 0
  network 10.0.101.0 0.0.0.255 area 0
  network 10.0.102.0 0.0.0.255 area 0
D1#
```

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Figura 26. D2# show run | section ^router ospf

```
D2#show run | section ^router ospf
router ospf 4
  router-id 0.0.4.132
  passive-interface default
  no passive-interface Ethernet1/2
  network 10.0.11.0 0.0.0.255 area 0
  network 10.0.100.0 0.0.0.255 area 0
  network 10.0.101.0 0.0.0.255 area 0
  network 10.0.102.0 0.0.0.255 area 0
D2#
```

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Figura 27. R1# show run | section ^ipv6 router

```
R1#show run | section ^ipv6 router
ipv6 router ospf 6
  router-id 0.0.6.1
  default-information originate
R1#
```



Figura 28. R1# show ipv6 ospf interface brief

```
R1#show ipv6 ospf interface brief
Interface  PID  Area      Intf ID  Cost  State Nbrs F/C
Se2/0      6    0         11       64   P2P   1/1
Et1/2      6    0         9        10   DR    0/0
R1#
```

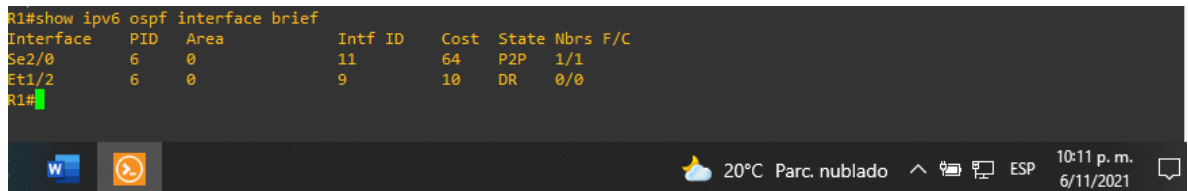


Figura 29. R3# show run | section ^ipv6 router

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

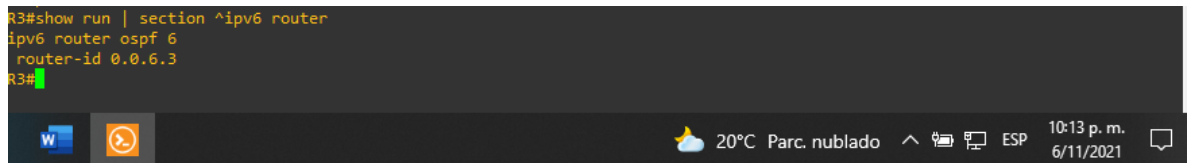


Figura 30. D1# show run | section ^ipv6 router

```
D1#show run | section ^ipv6 router
ipv6 router ospf 6
  router-id 0.0.6.131
  passive-interface default
  no passive-interface Ethernet1/2
D1#
```

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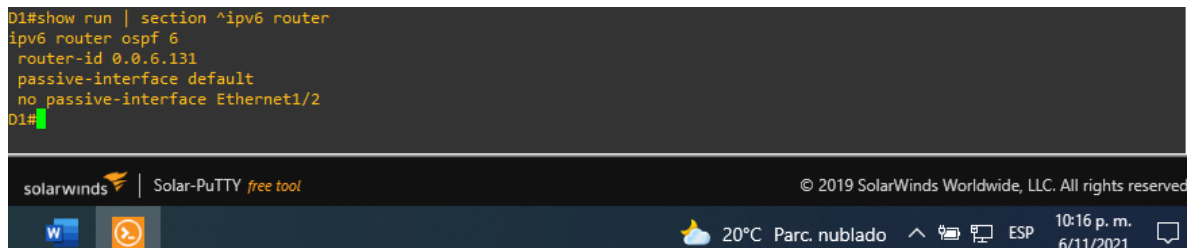


Figura 31. D1# show ipv6 ospf interface brief

```
D1#show ipv6 ospf interface brief
Interface  PID  Area      Intf ID  Cost  State Nbrs F/C
V1102     6   0         17       1    DR   0/0
V1101     6   0         16       1    DR   0/0
V1100     6   0         15       1    DR   0/0
Et1/2     6   0         13      10   BDR  1/1
D1#
```

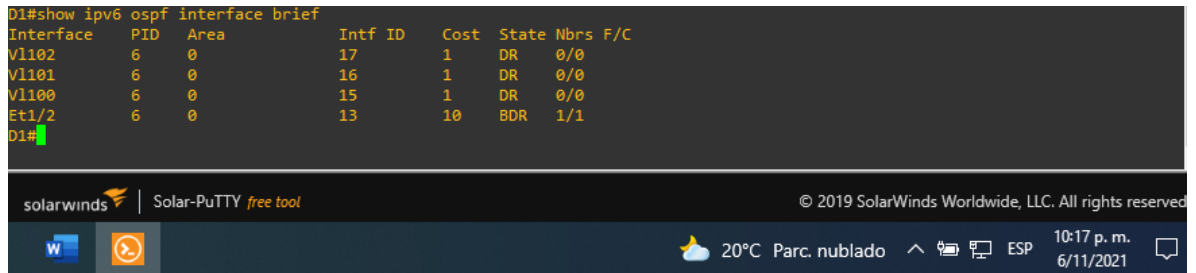


Figura 32. D2# show run | section ^ipv6 router

```
D2#show run | section ^ipv6 router
ipv6 router ospf 6
router-id 0.0.6.132
passive-interface default
no passive-interface Ethernet1/2
D2#
```

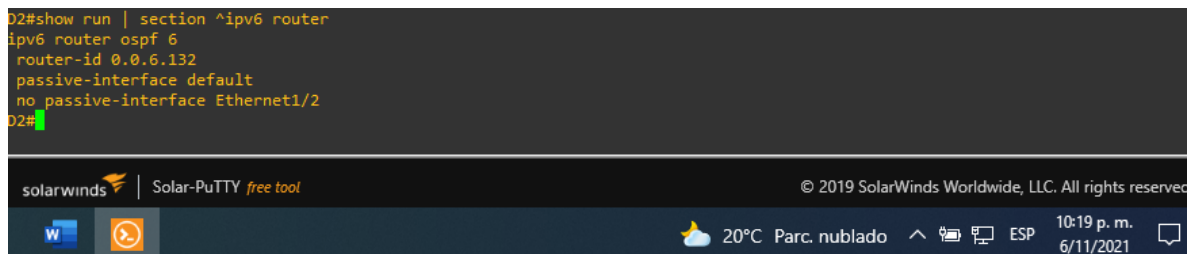


Figura 33. D2# show ipv6 ospf interface brief

```
D2#show ipv6 ospf interface brief
Interface  PID  Area      Intf ID  Cost  State Nbrs F/C
V1102     6   0         17       1    DR   0/0
V1101     6   0         16       1    DR   0/0
V1100     6   0         15       1    DR   0/0
Et1/2     6   0         13      10   BDR  1/1
D2#
```

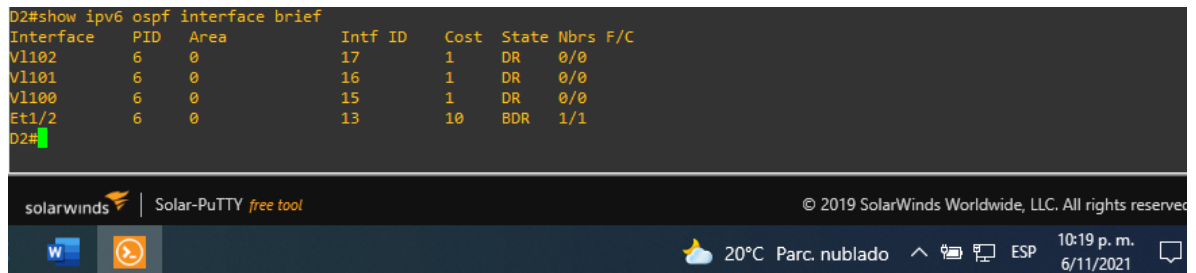




Figura 34. R2# show run | section router bgp

```
R2#show run | section router bgp
router bgp 500
  bgp router-id 2.2.2.2
  bgp log-neighbor-changes
  neighbor 2001:DB8:200::1 remote-as 300
  neighbor 209.165.200.225 remote-as 300
  !
  address-family ipv4
    network 0.0.0.0
    network 2.2.2.2 mask 255.255.255.255
    no neighbor 2001:DB8:200::1 activate
    neighbor 209.165.200.225 activate
  exit-address-family
  !
  address-family ipv6
    network ::/0
    network 2001:DB8:2222::/128
    neighbor 2001:DB8:200::1 activate
  exit-address-family
R2#
```

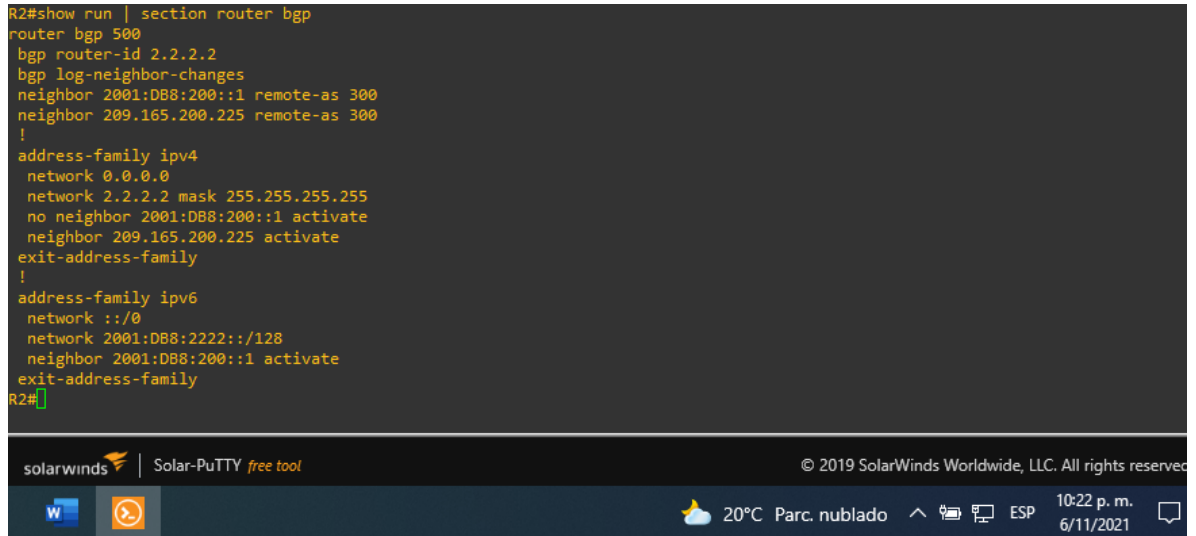


Figura 35. R2# show run | include route

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

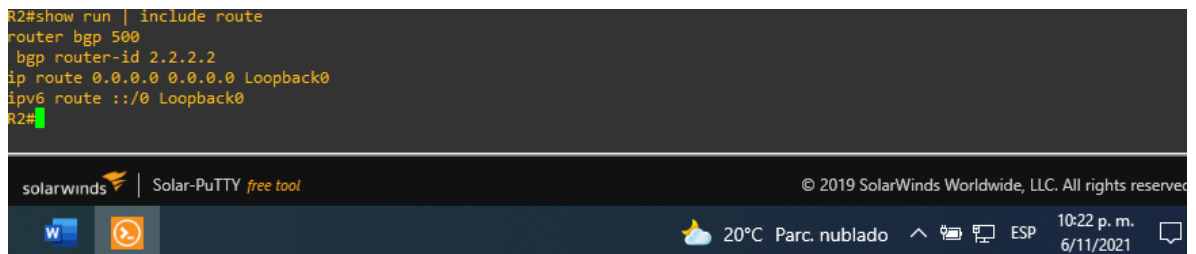


Figura 36. R1# show run | section bgp

```
R1#show run | section bgp
router bgp 300
  bgp router-id 1.1.1.1
  bgp log-neighbor-changes
  neighbor 2001:DB8:200::2 remote-as 500
  neighbor 209.165.200.226 remote-as 500
  !
  address-family ipv4
    network 10.0.0.0
    no neighbor 2001:DB8:200::2 activate
    neighbor 209.165.200.226 activate
  exit-address-family
  !
  address-family ipv6
    network 2001:DB8:100::/48
    neighbor 2001:DB8:200::2 activate
  exit-address-family
snmp-server enable traps bgp
R1#
```

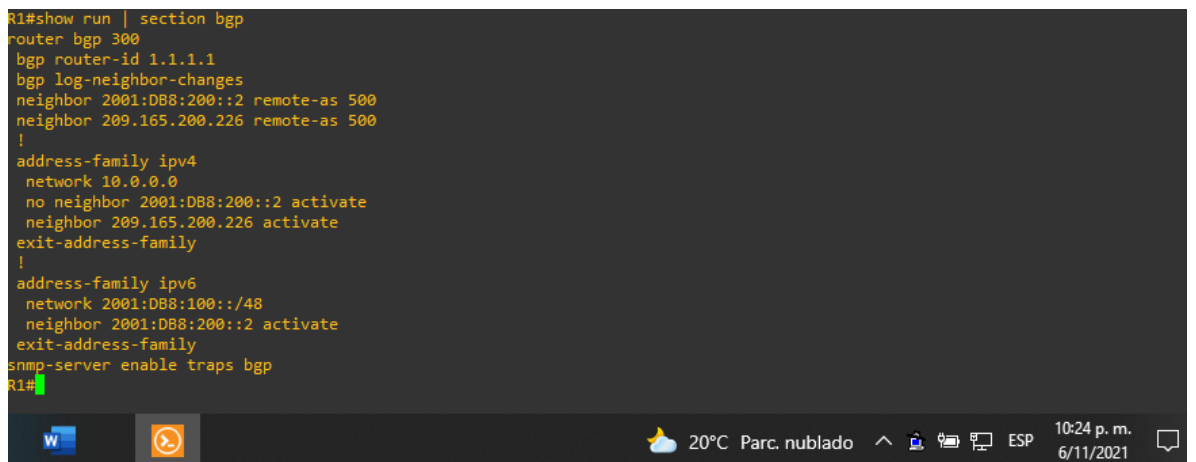


Figura 37. R1# show ip route | include O|B

```
R1#show ip route | include O|B
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       o - ODR, P - periodic downloaded static route, H - NHRP, l - LISP
B* 0.0.0.0/0 [20/0] via 209.165.200.226, 00:55:42
B  2.2.2.2 [20/0] via 209.165.200.226, 00:55:42
O  10.0.11.0/24 [110/74] via 10.0.13.3, 00:22:37, Serial2/0
O  10.0.100.0/24 [110/75] via 10.0.13.3, 00:00:29, Serial2/0
O  10.0.101.0/24 [110/75] via 10.0.13.3, 00:00:29, Serial2/0
O  10.0.102.0/24 [110/75] via 10.0.13.3, 00:00:29, Serial2/0
R1#
```

Figura 38. R1# show ipv6 route

```
R1#show ipv6 route
IPv6 Routing Table - default - 13 entries
Codes: C - Connected, L - Local, S - Static, U - Per-user Static route
       B - BGP, HA - Home Agent, MR - Mobile Router, R - RIP
       H - NHRP, I1 - ISIS L1, I2 - ISIS L2, IA - ISIS interarea
       IS - ISIS summary, D - EIGRP, EX - EIGRP external, NM - NEMO
       ND - ND Default, NDp - ND Prefix, DCE - Destination, NDr - Redirect
       O - OSPF Intra, OI - OSPF Inter, OE1 - OSPF ext 1, OE2 - OSPF ext 2
       ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2, la - LISP alt
       lr - LISP site-registrations, ld - LISP dyn-eid, a - Application
B ::/0 [20/0]
   via FE80::2:1, Ethernet0/0
S 2001:DB8:100::/48 [1/0]
   via Null0, directly connected
O 2001:DB8:100:100::/64 [110/75]
   via FE80::3:3, Serial2/0
O 2001:DB8:100:101::/64 [110/75]
   via FE80::3:3, Serial2/0
O 2001:DB8:100:102::/64 [110/75]
   via FE80::3:3, Serial2/0
C 2001:DB8:100:1010::/64 [0/0]
   via Ethernet1/2, directly connected
L 2001:DB8:100:1010::1/128 [0/0]
   via Ethernet1/2, receive
O 2001:DB8:100:1011::/64 [110/74]
   via FE80::3:3, Serial2/0
C 2001:DB8:100:1013::/64 [0/0]
   via Serial2/0, directly connected
L 2001:DB8:100:1013::1/128 [0/0]
   via Serial2/0, receive
C 2001:DB8:200::/64 [0/0]
   via Ethernet0/0, directly connected
L 2001:DB8:200::1/128 [0/0]
   via Ethernet0/0, receive
L FF00::/8 [0/0]
   via Null0, receive
R1#
```

Figura 39. R3# show ip route ospf | begin Gateway

```
R3#show ip route ospf | begin Gateway
Gateway of last resort is 10.0.13.1 to network 0.0.0.0

O*E2 0.0.0.0/0 [110/1] via 10.0.13.1, 00:58:06, Serial2/0
    10.0.0.0/8 is variably subnetted, 8 subnets, 2 masks
O    10.0.10.0/24 [110/74] via 10.0.13.1, 00:26:18, Serial2/0
O    10.0.100.0/24 [110/11] via 10.0.11.2, 00:12:47, Ethernet1/2
O    10.0.101.0/24 [110/75] via 10.0.13.1, 00:00:13, Serial2/0
O    10.0.102.0/24 [110/11] via 10.0.11.2, 00:12:47, Ethernet1/2
R3#
```

Figura 40. show ipv6 route ospf R3

```
R3#show ipv6 route ospf
IPv6 Routing Table - default - 10 entries
Codes: C - Connected, L - Local, S - Static, U - Per-user Static route
        B - BGP, HA - Home Agent, MR - Mobile Router, R - RIP
        H - NHRP, I1 - ISIS L1, I2 - ISIS L2, IA - ISIS interarea
        IS - ISIS summary, D - EIGRP, EX - EIGRP external, NM - NEMO
        ND - ND Default, NDp - ND Prefix, DCE - Destination, NDR - Redirect
        O - OSPF Intra, OI - OSPF Inter, OE1 - OSPF ext 1, OE2 - OSPF ext 2
        ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2, la - LISP alt
        lr - LISP site-registrations, ld - LISP dyn-eid, a - Application

OE2 :::/0 [110/1], tag 6
    via FE80::1:3, Serial2/0
O   2001:DB8:100:100::/64 [110/11]
    via FE80::D1:1, Ethernet1/2
O   2001:DB8:100:101::/64 [110/11]
    via FE80::D1:1, Ethernet1/2
O   2001:DB8:100:102::/64 [110/11]
    via FE80::D1:1, Ethernet1/2
O   2001:DB8:100:1013::/64 [110/128]
    via FE80::1:3, Serial2/0
R3#
```

Figura 41. D1# show run | section ip sla

```
D1#show run | section ip sla
track 4 ip sla 4
  delay down 10 up 15
track 6 ip sla 6
  delay down 10 up 15
ip sla 4
  icmp-echo 10.0.10.1
  frequency 5
ip sla schedule 4 life forever start-time now
ip sla 6
  icmp-echo 2001:DB8:100:1010::1
  frequency 5
ip sla schedule 6 life forever start-time now
D1#
```

Figura 42. D1# show standby brief

```
D1#show standby brief
P indicates configured to preempt.
Interface Grp Pri P State Active Standby Virtual IP
Vl100 104 150 P Active local 10.0.100.2 10.0.100.254
Vl100 106 150 P Active local FE80::D2:2 FE80::5:73FF:FEA0:6A
Vl101 114 100 P Standby 10.0.101.2 local 10.0.101.254
Vl101 116 100 P Standby FE80::D2:3 local FE80::5:73FF:FEA0:74
Vl102 124 150 P Active local 10.0.102.2 10.0.102.254
Vl102 126 150 P Active local FE80::D2:4 FE80::5:73FF:FEA0:7E
D1#
```

Figura 43. D2# show run | section ip sla

```
D2#show run | section ip sla
track 4 ip sla 4
delay down 10 up 15
track 6 ip sla 6
delay down 10 up 15
ip sla 4
icmp-echo 10.0.11.1
frequency 5
ip sla schedule 4 life forever start-time now
ip sla 6
icmp-echo 2001:DB8:100:1011::1
frequency 5
ip sla schedule 6 life forever start-time now
D2#
```

Figura 44. R1# show run | include secret

```
R1#show run | include secret
enable secret 9 $9$ZFjcm/okYOHU01$p/hIkEcv8vU716DUN8Gr84jYBBr1i370utm1hs2L272
username sadmin privilege 15 secret 9 $9$mqhj82XsTkZgPn$jQvOmE8ct8JXtKF0XEKbT60J6J4V48gLBwmZXs4nFVg
R1#
```

Figura 45. R1# show run aaa | exclude !

```
R1#show run aaa | exclude !
aaa authentication login default group radius local
username sadmin privilege 15 secret 9 $9$mqhj82XsTkZgPn$jQvOmE8ct8JXtKF0XEKbT60J6J4V48gLBwmZXs4nFVg
radius server RADIUS
address ipv4 10.0.100.6 auth-port 1812 acct-port 1813
key $strongPass
aaa new-model
aaa session-id common
R1#
```

Figura 46. R1# show ntp status | include stratum

```
R1#show ntp status | include stratum
Clock is synchronized, stratum 4, reference is 2.2.2.2
R1#
```

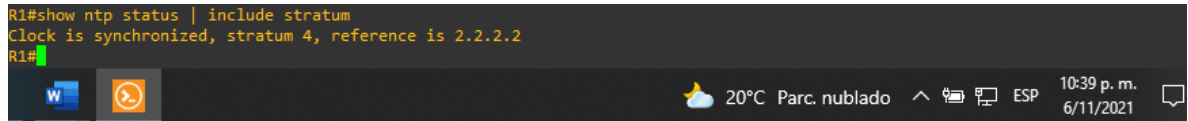


Figura 47. R2# show run | include ntp

```
R2#show run | include ntp
ntp master 3
R2#
```

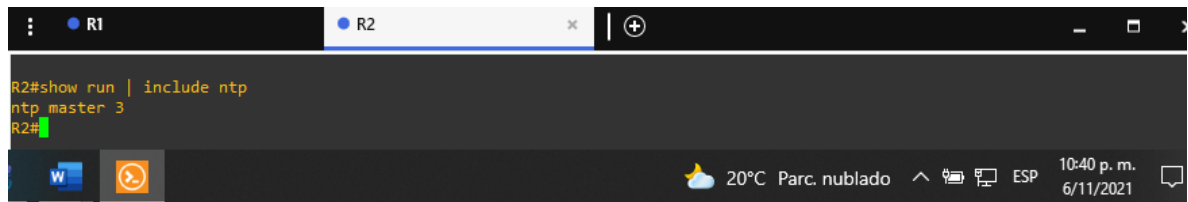


Figura 48. R1# show ntp status | include stratum

```
R1#show ntp status | include stratum
Clock is synchronized, stratum 4, reference is 2.2.2.2
R1#
```

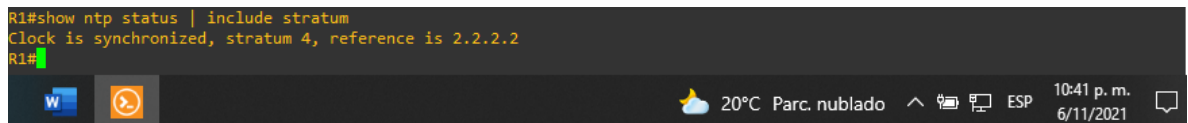


Figura 49. R1# show run | include logging

```
R1#show run | include logging
cts logging verbose
logging trap warnings
logging host 10.0.100.5
logging synchronous
logging synchronous
R1#
```

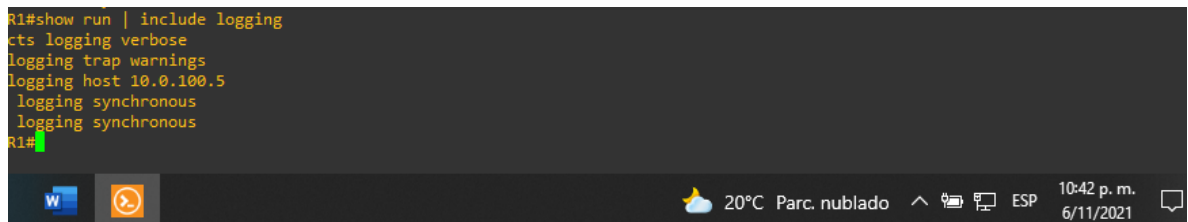


Figura 50. R1# show run | include snmp

```
R1#show run | include snmp
mmi snmp-timeout 180
snmp-server community ENCORSA RO SNMP-NMS
snmp-server ifindex persist
snmp-server contact Cisco Student
snmp-server enable traps ospf state-change
snmp-server enable traps ospf errors
snmp-server enable traps ospf retransmit
snmp-server enable traps ospf lsa
snmp-server enable traps ospf cisco-specific state-change nssa-trans-change
snmp-server enable traps ospf cisco-specific state-change shamlink interface
snmp-server enable traps ospf cisco-specific state-change shamlink neighbor
snmp-server enable traps ospf cisco-specific errors
snmp-server enable traps ospf cisco-specific retransmit
snmp-server enable traps ospf cisco-specific lsa
snmp-server enable traps bgp
snmp-server enable traps config
snmp-server host 10.0.100.5 version 2c ENCORSA
R1#
```

Figura 51. D1# show ip access-list SNMP-NMS

```
D1#show ip access-list SNMP-NMS
Standard IP access list SNMP-NMS
 10 permit 10.0.100.5
D1#
```

Figura 52. A1# show run | include snmp

```
snmp-server host 10.0.100.5 version 2c ENCORSA
```

Figura 53. R3# show run | include snmp

```
R3#show run | include snmp
mmi snmp-timeout 180
snmp-server community ENCORSA RO SNMP-NMS
snmp-server ifindex persist
snmp-server contact Cisco Student
snmp-server enable traps ospf state-change
snmp-server enable traps ospf errors
snmp-server enable traps ospf retransmit
snmp-server enable traps ospf lsa
snmp-server enable traps ospf cisco-specific state-change nssa-trans-change
snmp-server enable traps ospf cisco-specific state-change shamlink interface
snmp-server enable traps ospf cisco-specific state-change shamlink neighbor
snmp-server enable traps ospf cisco-specific errors
snmp-server enable traps ospf cisco-specific retransmit
snmp-server enable traps ospf cisco-specific lsa
snmp-server enable traps config
snmp-server host 10.0.100.5 version 2c ENCORSA
R3#
```

Figura 54. D1# show run | include snmp

```
D1#show run | include snmp
snmp-server community ENCORSA RO SNMP-NMS
snmp-server contact Cisco Student
snmp-server enable traps snmp authentication linkdown linkup coldstart warmstart
snmp-server enable traps flowmon
snmp-server enable traps tty
snmp-server enable traps ospf state-change
snmp-server enable traps ospf errors
snmp-server enable traps ospf retransmit
snmp-server enable traps ospf lsa
snmp-server enable traps ospf cisco-specific state-change nssa-trans-change
snmp-server enable traps ospf cisco-specific state-change shamlink interface
snmp-server enable traps ospf cisco-specific state-change shamlink neighbor
snmp-server enable traps ospf cisco-specific errors
snmp-server enable traps ospf cisco-specific retransmit
snmp-server enable traps ospf cisco-specific lsa
snmp-server enable traps eigrp
```

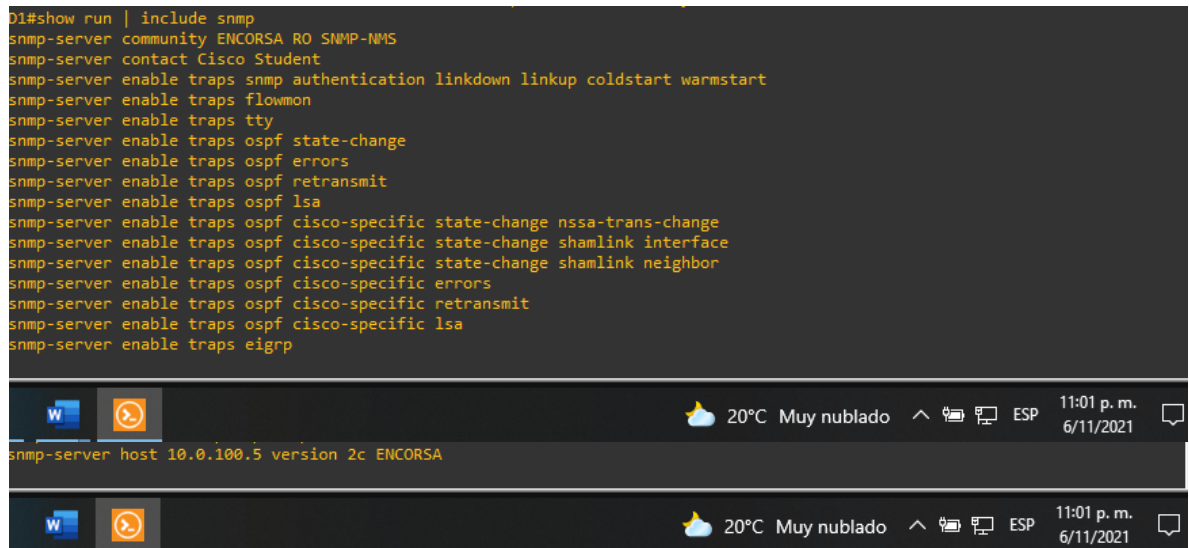
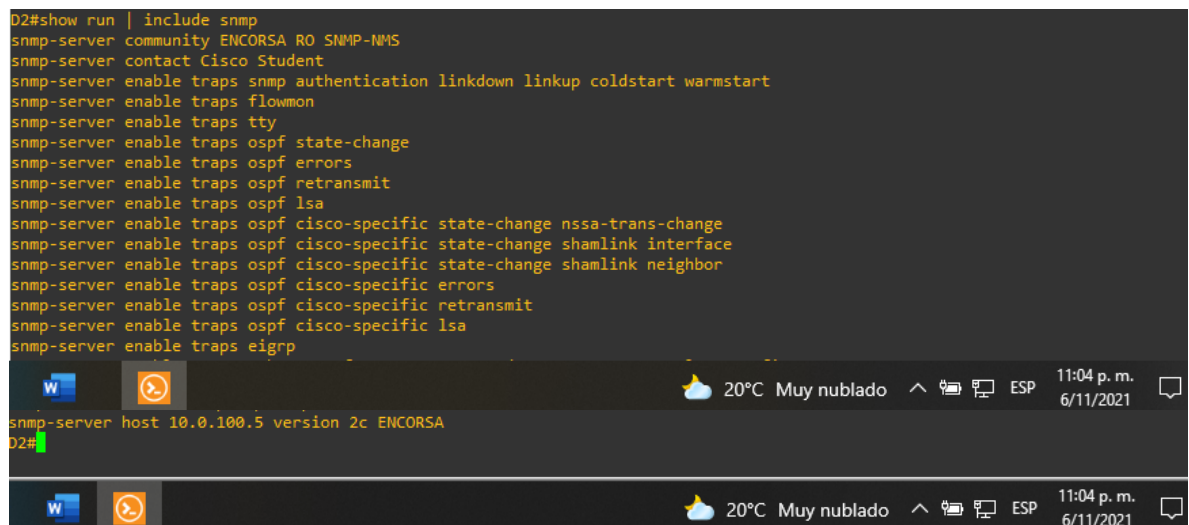


Figura 55. D2# show run | include snmp

```
D2#show run | include snmp
snmp-server community ENCORSA RO SNMP-NMS
snmp-server contact Cisco Student
snmp-server enable traps snmp authentication linkdown linkup coldstart warmstart
snmp-server enable traps flowmon
snmp-server enable traps tty
snmp-server enable traps ospf state-change
snmp-server enable traps ospf errors
snmp-server enable traps ospf retransmit
snmp-server enable traps ospf lsa
snmp-server enable traps ospf cisco-specific state-change nssa-trans-change
snmp-server enable traps ospf cisco-specific state-change shamlink interface
snmp-server enable traps ospf cisco-specific state-change shamlink neighbor
snmp-server enable traps ospf cisco-specific errors
snmp-server enable traps ospf cisco-specific retransmit
snmp-server enable traps ospf cisco-specific lsa
snmp-server enable traps eigrp
```



## CONCLUSIONES

Durante el desarrollo de esta actividad se evidencia la implementación de la topología propuesta y sus configuraciones, utilizando los diferentes protocolos de enrutamientos como OSPF, BGP, interfaces Loopback y protocolos en IPv4 e IPv6 entre otros.

Se logro entender el funcionamiento de un sistema de enrutamiento avanzado y su importancia a la hora de implementar en una red de datos. Se identifico y soluciono problemas propios de conmutación y enrutamiento, mediante el uso adecuado de estrategias basadas en comandos del IOS basada en agrupamiento lógico entre varios enlaces físicos con el fin de resolver problemas de configuración, conectividad y enrutamiento.

Se concluyó implementado los lineamientos establecidos con los direccionamientos IP, VLANs, etherchannels, entre otros. Cada configuración fue verificada que cumpliera la funcionalidad de red en cada uno de los dispositivos, utilizando los diferentes comandos implementados en la consola.

La solución de este ejercicio pone en marcha todos los conocimientos adquiridos en este proceso de formación, demostrando las capacidades y habilidades adquiridas para luego ponerlos en práctica en nuestra vida laboral.



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