

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 DE TELECOMUNICACIONES  
PASTO-NARIÑO  
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Diplomado como opción de grado para optar el título de INGENIERO DE  
TELECOMUNICACIONES

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2023

## 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

Pasto, abril 2023

## **AGRADECIMIENTOS**

A Dios gracias, he podido llegar a este punto de mi formación profesional, aun cuando he logrado objetivos claros en mi vida y me he desempeñado a lo largo de varios años en el campo de las telecomunicaciones. Agradezco a los tutores y a la educación virtual de la Universidad UNAD, al facilitar y brindar herramientas para la profesionalización de personas trabajadoras y cabezas de hogar; también extendo mi infinito agradecimiento a mis padres y a mi esposa por apoyarme en cada paso que doy, siendo condescendientes con mis ocupaciones y permitiendo que me convierta en un profesional.

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## GLOSARIO

**INTERFACE:** es una conexión de un sistema o dispositivo con otro para transmitir algún tipo de información, teniendo en cuenta que cada sistema funciona por separado. Dentro de las interfaces de red que se conocen para trabajar, encontramos diferentes tipos como son: serial, gigabyte, ethernet, entre otras.

**PROTOCOLO IP:** conjunto de reglas para trabajo en redes, que permite el intercambio de paquetes de datos que a su vez viajan por distintas rutas y caminos.

**TABLA DE ENRUTAMIENTO:** es un documento electrónico que almacena las rutas a los diferentes nodos en una red informática. Los nodos pueden ser cualquier tipo de dispositivo electrónico conectado a la red.

**TOPOLOGÍA:** esquema o mapa físico o lógico que muestra los dispositivos de red y sus correspondientes interconexiones, para dar al lector una idea aproximada de la red en general y de esta manera ponerlo en contexto.

**VLAN:** se trata de la división lógica de una red física de cobertura local, donde las redes lógicas creadas cuentan con independencia debido a que existe una segmentación de los equipos que intervienen.

**VRF:** Enrutamiento Virtual y Reenvío, es una particularidad de los Router, que permite tener varias instancias dentro de una tabla de enrutamiento para un trabajo simultaneo de redes pequeñas, dentro de una red compartiendo los mismos recursos de hardware con la posibilidad de crear redes virtuales privadas.

## RESUMEN

Este documento corresponde el desarrollo de una prueba de habilidades, que se incluye en el Diplomado de Profundización CISCO CCNP, donde se plantea de manera general, una topología de dos redes del tipo **VRF** Virtual Routing and Forwarding, compuesta por dispositivos de red como: routers, switchs, computadores y diferentes conexiones. Se ejecutan dos escenarios de la siguiente manera:

**Escenario 1**, se realiza la configuración básica a cada dispositivo, posteriormente, se configura dos VRF, una para usuarios generales y otra para usuarios especiales; cada una con sus correspondientes enrutamientos IPV4 e IPV6 y el ajuste de rutas estáticas. Este escenario llega hasta la comunicación de routers y el paso de paquetes entre los mismos.

**Escenario 2**, una vez sea posible el envío de paquetes del R1 a R3, se procede con la configuración de equipos tipo Switch nombrados como D1, D2 y A1, para que pueda pasar la vlan 13 y la vlan 8 por puertos específicos donde sea posible tener puertos configurados como troncales y como acceso, según la necesidad, además de enlaces redundantes.

Para llevar a cabo este trabajo, se utiliza herramientas virtuales como GNS3, un emulador de redes y VirtualBox para actividades con máquinas virtuales, en procura de hacer una práctica muy cercana al trabajo con equipos reales.

**Palabras clave:** VRF, VLAN, CISCO, CCNP, IPV4, IPV6, Redes, Enrutamiento, Virtual, Conmutación, Electrónica, Equipos.

## ABSTRACT

This document corresponds to the development of a skills test, which is included in the CISCO CCNP Deepening Diploma, where a topology of two networks of the **VRF** Virtual Routing and Forwarding type, composed of network devices such as: Routers, Switches, Computers and different connections. Two scenarios are executed as follows:

**Scenario 1**, the basic configuration is carried out for each device, later, two VRFs are configured, one for general users and the other for special users; each one with its corresponding IPV4 and IPV6 routing and the setting of static routes. This scenario reaches the communication of routers and the passing of packets between them.

**Scenario 2**, once it is possible to send packets from R1 to R3, we proceed with the configuration of Switch type equipment named as D1, D2 and A1, so that vlan 13 and vlan 8 can pass through specific ports where possible have ports configured as trunk and access, as needed, in addition to redundant links.

To carry out this work, virtual tools such as GNS3, a network emulator and VirtualBox are used for activities with virtual machines, in an attempt to make a practice very close to working with real equipment.

**Keywords:** VRF, VLAN, CISCO, CCNP, IPV4, IPV6, Networks, Routing, Virtual, Switching, Electronics, Equipment.

## INTRODUCCION

La importancia del desarrollo de habilidades prácticas en la etapa final de la carrera de telecomunicaciones, radica en asumir la configuración de una red poniendo a prueba los conocimientos adquiridos durante la formación profesional, usándolos como herramienta para enfrentar problemas reales en entornos empresariales y del hogar; donde se logre conectividad y disponibilidad de red, pero con privacidad y limitaciones necesarias para que cada grupo de usuarios acceda a su información, sin irrumpir en la de otros miembros de la red; propósito que se logra con la realización del Diplomado de profundización CCNP de CISCO.

Aunado a esto, se parte de conocimientos alineados a la parte académica y disciplinar de la ingeniería de telecomunicaciones, cuyo despliegue en el campo laboral depende del desempeño estudiantil y la destreza adquirida al asumir proyectos de configuración de redes como el propuesto en estos dos escenarios.

Por otra parte, la metodología adoptada para llevar a cabo el Diplomado de profundización CCNP, se deriva de la utilización de entornos virtuales dispuestos para el aprendizaje, con posibilidades de realizar montajes con diversas conexiones y empleando varios equipos, que posibilitan hacer ensayos y pruebas, sin tener que arriesgar dispositivos reales.

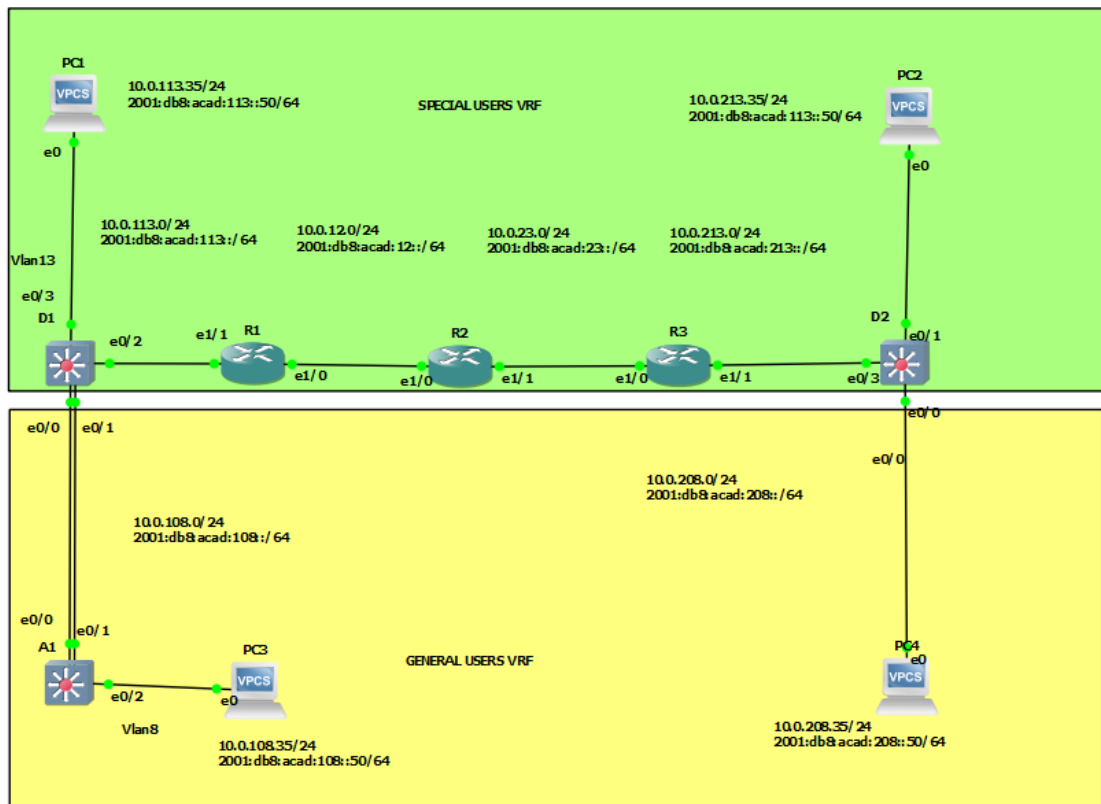
Finalmente, el alcance de este diplomado, es contextualizar al profesional en las tareas a desempeñar en su vida laboral, dotándolo de herramientas prácticas que brinden alternativas para la solución de conflictos de red y sirvan de preparación y entrenamiento, puesto que, en la mayoría de los casos, no se cuenta con dispositivos para ensayo, ni tampoco se puede cometer errores con los equipos reales; por tanto, la utilización de entornos prácticos es una alternativa confiable y eficaz.

# DIPLOMADO DE PROFUNDIZACIÓN CISCO PRUEBA DE HABILIDADES PRÁCTICAS CCNP

## ESCENARIO 1

La primera parte de este trabajo de Diplomado CCNP corresponde al desarrollo del escenario 1. Para ello se propone una topología mostrada a continuación, sobre la cual se adelantarán las partes 1 y 2.

Figura 1. Topología de red Virtual Routing and Forwarding, sigla en inglés que significa Enrutamiento Virtual y Reenvío.



Fuente: elaboración propia a partir de pantallazo de GNS3

Tabla 1. Tabla de direccionamiento

Dispositivo	Interfaz	Dirección IPv4	Dirección IPv6	Enlace local IPv6
R1	E1/0.1	10.0.12.3/24	2001:db8:acad:12::1/64	fe80::1:1
	E1/0.2	10.0.12.3/24	2001:db8:acad:12::1/64	fe80::1:2
	E1/1.1	10.0.113.3/24	2001:db8:acad:113::1/64	fe80::1:3
	E1/1.2	10.0.108.3/24	2001:db8:acad:108::1/64	fe80::1:4
R2	E1/0.1	10.0.12.5/24	2001:db8:acad:12::2/64	fe80::2:1
	E1/0.2	10.0.12.5/24	2001:db8:acad:12::2/64	fe80::2:2
	E1/1.1	10.0.23.5/24	2001:db8:acad:23::2/64	fe80::2:3
	E1/1.2	10.0.23.5/24	2001:db8:acad:23::2/64	fe80::2:4
R3	E1/0.1	10.0.23.3/24	2001:db8:acad:23::3/64	fe80::3:1
	E1/0.2	10.0.23.3/24	2001:db8:acad:23::3/64	fe80::3:2
	E1/1.1	10.0.213.3/24	2001:db8:acad:213::1/64	fe80::3:3
	E1/1.2	10.0.208.3/24	2001:db8:acad:208::1/64	fe80::3:4
PC1	NIC	10.0.113.35/24	2001:db8:acad:113::50/64	EUI-64
PC2	NIC	10.0.213.35/24	2001:db8:acad:213::50/64	EUI-64
PC3	NIC	10.0.108.35/24	2001:db8:acad:108::50/64	EUI-64
PC4	NIC	10.0.208.35/24	2001:db8:acad:208::50/64	EUI-64

Fuente: guía de actividades prueba de habilidades Diplomado CCNP

## PARTE 1: CONSTRUIR LA RED Y CONFIGURAR LOS AJUSTES BÁSICOS DEL DISPOSITIVO Y EL DIRECCIONAMIENTO DE LA INTERFAZ.

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

### 1.1 Paso 1: Cablee la red como se muestra en la topología.

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

### 1.2 Paso 2: Configure los ajustes básicos para cada dispositivo.

a. Ingrese al modo de configuración global en cada uno de los dispositivos y aplique la configuración básica. Las configuraciones de inicio para cada dispositivo se proporcionan a continuación.

#### 1.2.1 AJUSTES BÁSICOS R1

```
hostname RR1 //asigna nombre el dispositivo
ipv6 unicast-routing //habilita el tráfico IPV6
no ip domain lookup //deshabilita la búsqueda de dominio
banner motd # R1, ENCOR Skills Assessment, Scenario 2 #
line con 0 //modo de configuración de línea
exec-timeout 0 0 //establece el modo de espera inactivo
logging synchronous //sincroniza mensajes
exit //salida del nivel de configuración
```

#### 1.2.2 AJUSTES BÁSICOS R2

```
hostname RR2 //asigna nombre el dispositivo
ipv6 unicast-routing //habilita el tráfico IPV6
no ip domain lookup //deshabilita la búsqueda de dominio
banner motd # R2, ENCOR Skills Assessment, Scenario 2 #
line con 0 //modo de configuración de línea
exec-timeout 0 0 //establece el modo de espera inactivo
logging synchronous //sincroniza mensajes
exit //salida del nivel de configuración
```

#### 1.2.3 AJUSTES BÁSICOS R3

```
hostname RR3 //asigna nombre el dispositivo
ipv6 unicast-routing //habilita el tráfico IPV6
no ip domain lookup //deshabilita la búsqueda de dominio
banner motd # R3, ENCOR Skills Assessment, Scenario 2 #
line con 0 //modo de configuración de línea
```

```
exec-timeout 0 0 //establece el modo de espera inactivo
logging synchronous //sincroniza mensajes
exit //salida del nivel de configuración
```

#### 1.2.4 AJUSTES BÁSICOS SWITCH D1

```
hostname D1 //asigna nombre el dispositivo
ip routing //habilita rutas estáticas
ipv6 unicast-routing //habilita el tráfico IPV6
no ip domain lookup //deshabilita la búsqueda de dominio
banner motd # D1, ENCOR Skills Assessment, Scenario 2 #
line con 0 //modo de configuración de línea
exec-timeout 0 0 //establece el modo de espera inactivo
logging synchronous //sincroniza mensajes
exit //salida del nivel de configuración
vlan 8 //crea la vlan 8
name General-Users //asigna nombre a la vlan
exit //salida
vlan 13 //crea la vlan 8
name Special-Users //asigna nombre a la vlan
exit
```

#### 1.2.5 AJUSTES BÁSICOS SWITCH D2

```
hostname D2 //asigna nombre el dispositivo
ip routing //habilita rutas estáticas
ipv6 unicast-routing //habilita el tráfico IPV6
no ip domain lookup //deshabilíta la búsqueda de dominio
banner motd # D2, ENCOR Skills Assessment, Scenario 2 #
line con 0 //modo de configuración de línea
exec-timeout 0 0 //establece el modo de espera inactivo
logging synchronous //sincroniza mensajes
exit //salida del nivel de configuración
vlan 8 //crea la vlan 8
name General-Users //asigna nombre a la vlan
exit
vlan 13 //crea la vlan 8
name Special-Users //asigna nombre a la vlan
exit
```

## 1.2.6 AJUSTES BÁSICOS SWITCH A1

```
hostname A1 //asigna nombre el dispositivo
ipv6 unicast-routing //habilita el tráfico IPV6
no ip domain lookup //deshabilita la búsqueda de dominio
banner motd # A1, ENCOR Skills Assessment, Scenario 2 #
line con 0 //modo de configuración de línea
exec-timeout 0 0 //establece el modo de espera inactivo
logging synchronous //sincroniza mensajes
exit //salida
vlan 8 //crea la vlan 8
name General-Users //asigna nombre a la vlan
exit
```

b. Guarde las configuraciones en cada uno de los dispositivos.

### Nota:

- En mi caso, tengo dos equipos de cómputo donde elaboro la prueba de habilidades, por tanto, es posible que en los pantallazos se evidencie que no todos corresponden al mismo equipo.
- A todos los equipos, después de digitar o copiar los códigos de configuración, se les debe ejecutar el comando **copy running-config startup-config** o en su defecto **wr** para que guarden la configuración y se pueda retomar el trabajo después de cerrar sesión o apagar el computador. También se puede usar **wr** para escribir el dispositivo.

## PARTE 2: CONFIGURE VRF AND STATIC ROUTING

En esta parte de la evaluación de habilidades, configurará VRF-Lite en los tres enrutadores y las rutas estáticas adecuadas para admitir la accesibilidad de un extremo a otro. Al final de esta parte, R1 debería poder hacer ping a R3 en cada VRF.

Sus tareas de configuración son las siguientes:

Tabla 2.Tabla de configuración de VRF y enrutamiento estático

Task#	Task	Specification
2.1	En R1, R2 y R3, configure VRF-Lite VRF como se muestra en el diagrama de topología.	Configure dos VRF: <ul style="list-style-type: none"> <li>• Usuarios generales</li> <li>• Usuarios especiales</li> </ul> Las VRF deben admitir IPv4 e IPv6.
2.2	En R1, R2 y R3, configure las interfaces IPv4 e IPv6 en cada VRF como se detalla en la tabla de direccionamiento anterior.	Todos los enrutadores utilizarán Router-On-A-Stick en sus interfaces G0/0/1.x para admitir la separación de los VRF. Sub-interfaz 1: <ul style="list-style-type: none"> <li>• En la VRF de Usuarios Especiales</li> <li>• Usar encapsulamiento dot1q 13</li> <li>• IPv4 e IPv6 GUA y direcciones link-local</li> <li>• Habilitar las interfaces</li> </ul> Sub-interfaz 2: <ul style="list-style-type: none"> <li>• En la VRF de Usuarios Generales</li> <li>• Usar encapsulamiento dot1q 8</li> <li>• IPv4 e IPv6 GUA y direcciones locales de enlace</li> <li>• Habilite las interfaces</li> </ul>
2.3	En R1 y R3, configure las rutas estáticas predeterminadas que apuntan a R2.	Configure rutas estáticas VRF para IPv4 e IPv6 en ambos VRF.
2.4	Verifique la conectividad en cada VRF.	Desde R1, verifique la conectividad con R3: <ul style="list-style-type: none"> <li>• ping vrf General-Users 10.0.208.3</li> <li>• ping vrf General-Users 2001:db8:acad:208::1</li> <li>• ping vrf Special-Users 10.0.213.1</li> <li>• ping vrf Special-Users 2001:db8:acad:213::1</li> </ul>

Fuente: guía de actividades prueba de habilidades Diplomado CCNP

## 2.1 CONFIGURACION DE LAS VRF

### Configuración de las VRF en R1

```
vrf definition General-Users //define VRF General-Users
address-family ipv4 //habilita familia IPV4
address-family ipv6 //habilita familia IPV6
exit
vrf definition Special-Users //define VRF Special-Users
address-family ipv4 //habilita familia IPV4
address-family ipv6 //habilita familia IPV6
exit
interface e1/0.1 //habilita la interface
encapsulation dot1q 13 //asocia la VLAN a la interfaz
vrf forwarding Special-Users / /crea la VRF
ip address 10.0.12.3 255.255.255.0 //asigna una IPV4 y mascara a la VRF
ipv6 address fe80::1:1 link-local //se usa para reconocer el router facilmente
ipv6 address 2001:db8:acad:12::1/64 //asigna una IPV6 y mascara a la VRF
no shutdown //activa la interfaz
exit
interface e1/0.2 //habilita la interface
encapsulation dot1q 8 //asocia la VLAN a la interfaz
vrf forwarding General-Users //crea la VRF
ip address 10.0.12.3 255.255.255.0 //asigna una IPV4 y mascara a la VRF
ipv6 address fe80::1:2 link-local //asigna una IP y mascara a la VRF
ipv6 address 2001:db8:acad:12::1/64 //asigna una IPV6 y mascara a la VRF
no shutdown //activa la interfaz
exit
interface e1/0
no ip address
no shutdown
exit
interface e1/1.1
encapsulation dot1q 13
vrf forwarding Special-Users
ip address 10.0.113.3 255.255.255.0
ipv6 address fe80::1:3 link-local
ipv6 address 2001:db8:acad:113::1/64
no shutdown
exit
interface e1/1.2
encapsulation dot1q 8
vrf forwarding General-Users
ip address 10.0.108.3 255.255.255.0
ipv6 address fe80::1:4 link-local
ipv6 address 2001:db8:acad:108::1/64
```

```

no shutdown
exit
interface e1/1
no ip address
no shutdown
exit
ip route vrf Special-Users 0.0.0.0 0.0.0.0 10.0.12.2
ip route vrf General-Users 0.0.0.0 0.0.0.0 10.0.12.2
//habilita las rutas estáticas en las vrf con dirección IPV4
ipv6 route vrf Special-Users ::/0 2001:db8:acad:12::2
ipv6 route vrf General-Users ::/0 2001:db8:acad:12::2
//habilita las rutas estáticas en las vrf con dirección IPV6
end
interface e1/3
no ip address
no shutdown
exit

```

### **Configuración de las VRF en R2**

```

vrf definition General-Users
address-family ipv4
address-family ipv6
exit
vrf definition Special-Users
address-family ipv4
address-family ipv6
exit
interface e1/0.1
encapsulation dot1q 13
vrf forwarding Special-Users
ip address 10.0.12.5 255.255.255.0
ipv6 address fe80::2:1 link-local
ipv6 address 2001:db8:acad:12::2/64
no shutdown
exit
interface e1/0.2
encapsulation dot1q 8
vrf forwarding General-Users
ip address 10.0.12.5 255.255.255.0
ipv6 address fe80::2:2 link-local
ipv6 address 2001:db8:acad:12::2/64
no shutdown
exit
interface e1/0

```

```

no ip address
no shutdown
exit
interface e1/1.1
encapsulation dot1q 13
vrf forwarding Special-Users
ip address 10.0.23.5 255.255.255.0
ipv6 address fe80::2:3 link-local
ipv6 address 2001:db8:acad:23::2/64
no shutdown
exit
interface e1/1.2
encapsulation dot1q 8
vrf forwarding General-Users
ip address 10.0.23.5 255.255.255.0
ipv6 address fe80::2:4 link-local
ipv6 address 2001:db8:acad:23::2/64
no shutdown
exit
interface e1/1
no ip address
no shutdown
exit
interface e1/3
no ip address
no shutdown
exit
ip route vrf Special-Users 10.0.113.0 255.255.255.0 10.0.12.1
ip route vrf Special-Users 10.0.213.0 255.255.255.0 10.0.23.3
ipv6 route vrf Special-Users 2001:db8:acad:113::/64 2001:db8:acad:12::1
ipv6 route vrf Special-Users 2001:db8:acad:213::/64 2001:db8:acad:23::3
ip route vrf General-Users 10.0.108.0 255.255.255.0 10.0.12.1
ip route vrf General-Users 10.0.208.0 255.255.255.0 10.0.23.3
ipv6 route vrf General-Users 2001:db8:acad:108::/64 2001:db8:acad:12::1
ipv6 route vrf General-Users 2001:db8:acad:208::/64 2001:db8:acad:23::3
end

```

**Nota:** los comentarios de los comandos utilizados, son los mismos en R1, R2 y R4. Por tanto, solo se indican completamente en R1.

### **Configuración de las VRF en R3**

```

vrf definition General-Users
address-family ipv4
address-family ipv6

```

```
exit
vrf definition Special-Users
address-family ipv4
address-family ipv6
exit
interface e1/0.1
encapsulation dot1q 13
vrf forwarding Special-Users
ip address 10.0.23.3 255.255.255.0
ipv6 address fe80::3:1 link-local
ipv6 address 2001:db8:acad:23::3/64
no shutdown
exit
interface e1/0.2
encapsulation dot1q 8
vrf forwarding General-Users
ip address 10.0.23.3 255.255.255.0
ipv6 address fe80::3:2 link-local
ipv6 address 2001:db8:acad:23::3/64
no shutdown
exit
interface e1/0
no ip address
no shutdown
exit
interface e1/1.1
encapsulation dot1q 13
vrf forwarding Special-Users
ip address 10.0.213.3 255.255.255.0
ipv6 address fe80::3:3 link-local
ipv6 address 2001:db8:acad:213::1/64
no shutdown
exit
interface e1/1.2
encapsulation dot1q 8
vrf forwarding General-Users
ip address 10.0.208.3 255.255.255.0
ipv6 address fe80::3:4 link-local
ipv6 address 2001:db8:acad:208::1/64
no shutdown
exit
interface e1/1
no ip address
no shutdown
exit
```

```

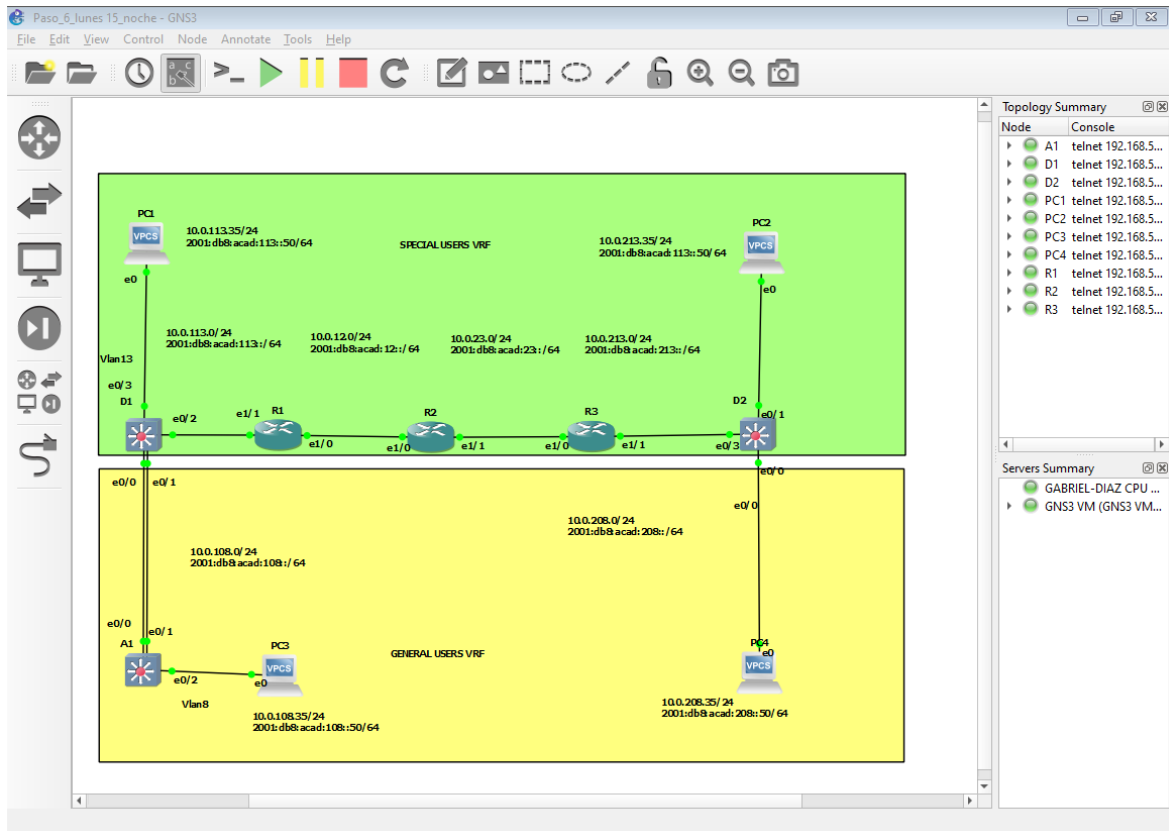
interface e1/3
no ip address
no shutdown
exit
ip route vrf Special-Users 0.0.0.0 0.0.0.0 10.0.23.2
ip route vrf General-Users 0.0.0.0 0.0.0.0 10.0.23.2
ipv6 route vrf Special-Users ::/0 2001:db8:acad:23::2
ipv6 route vrf General-Users ::/0 2001:db8:acad:23::2
end

```

**Nota:** Los comentarios de los comandos utilizados, son los mismos en R1, R2 y R4. Por tanto, solo se indican completamente en R1.

## 2.2 CONECTIVIDAD EN CADA VRF

Figura 2. Topología en GNS3 con los equipos funcionando



Fuente: elaboración propia a partir de pantallazo de GNS3

## Conectividad desde R1 a R3

Figura 3. ping vrf General-Users 10.0.208.3 desde R1 a R3

```
R1
^
% Invalid input detected at '^' marker.
RR1#ping vrf General-Users 10.0.208.3
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.0.208.3, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 40/44/56 ms
RR1#ping vrf General-Users 10.0.208.3
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.0.208.3, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 36/40/44 ms
RR1#ping vrf General-Users 10.0.208.3
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.0.208.3, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 36/41/48 ms
RR1#ping vrf General-Users 10.0.208.3
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.0.208.3, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 48/51/60 ms
RR1#
```

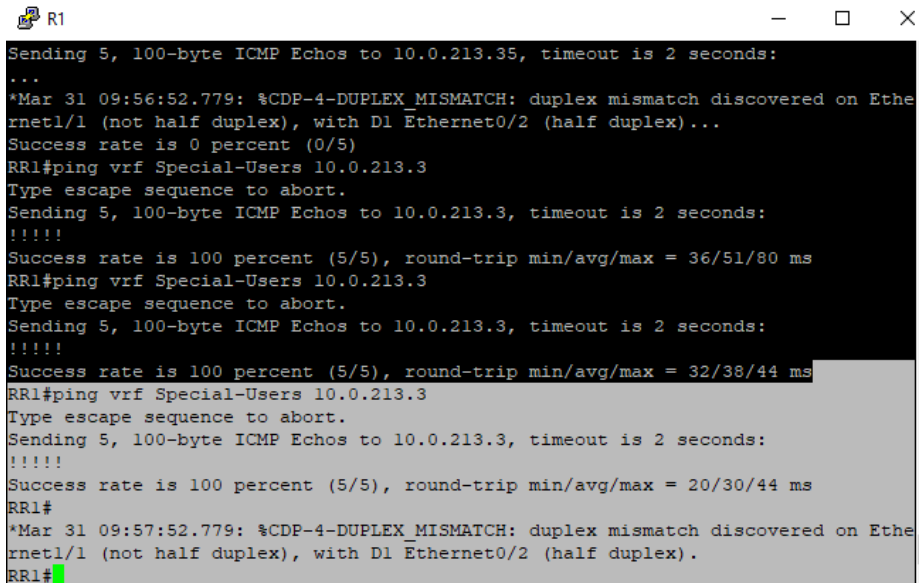
Fuente: elaboración propia a partir de pantallazo de GNS3

Figura 4. ping vrf General-Users 2001:db8:acad:208::1 desde R1 a R3

```
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.0.208.3, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 36/40/44 ms
RR1#ping vrf General-Users 10.0.208.3
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.0.208.3, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 32/44/68 ms
RR1#ping vrf General-Users 10.0.208.3
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.0.208.3, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 16/36/48 ms
RR1#
*Mar 29 15:12:31.547: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethernet1/1 (not half duplex), w
ith D1 Ethernet0/2 (half duplex).
RR1#
*Mar 29 15:13:31.555: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethernet1/1 (not half duplex), w
ith D1 Ethernet0/2 (half duplex).
RR1#
*Mar 29 15:14:31.555: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethernet1/1 (not half duplex), w
ith D1 Ethernet0/2 (half duplex).
RR1#
*Mar 29 15:15:31.563: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethernet1/1 (not half duplex), w
ith D1 Ethernet0/2 (half duplex).
RR1#ping vrf General-Users 2001:db8:acad:208::1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 2001:DB8:ACAD:208::1, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 36/61/144 ms
RR1#
*Mar 29 15:16:31.567: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethernet1/1 (not half duplex), w
ith D1 Ethernet0/2 (half duplex).
RR1#
```

Fuente: elaboración propia a partir de pantallazo de GNS3

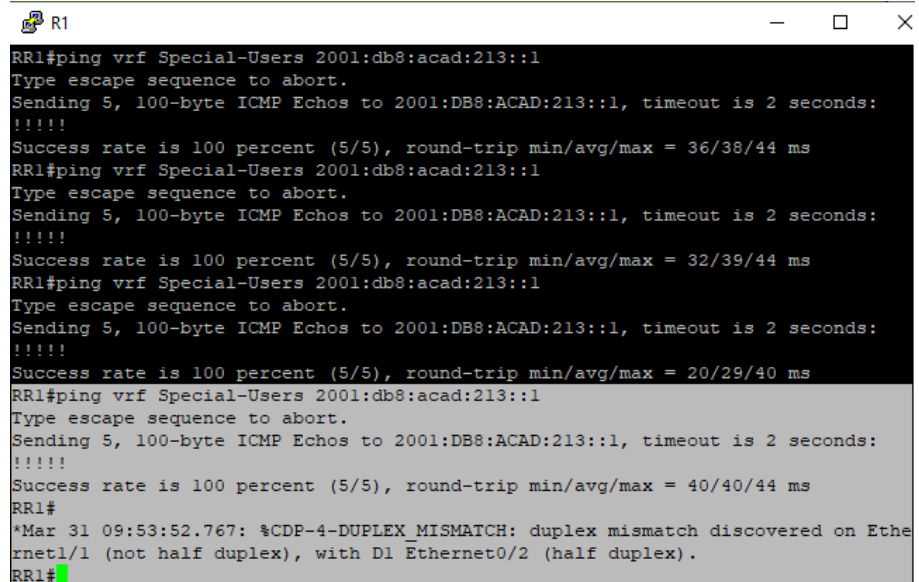
Figura 5. ping vrf Special-Users 10.0.213.3 desde R1 a R3



```
R1
Sending 5, 100-byte ICMP Echos to 10.0.213.35, timeout is 2 seconds:
...
*Mar 31 09:56:52.779: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethe
rnet1/1 (not half duplex), with D1 Ethernet0/2 (half duplex)...
Success rate is 0 percent (0/5)
RR1#ping vrf Special-Users 10.0.213.3
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.0.213.3, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 36/51/80 ms
RR1#ping vrf Special-Users 10.0.213.3
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.0.213.3, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 32/38/44 ms
RR1#ping vrf Special-Users 10.0.213.3
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.0.213.3, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 20/30/44 ms
RR1#
*Mar 31 09:57:52.779: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethe
rnet1/1 (not half duplex), with D1 Ethernet0/2 (half duplex).
RR1#
```

Fuente: elaboración propia a partir de pantallazo de GNS3

Figura 6. ping vrf Special-Users 2001:db8:acad:213::1 desde R1 a R3



```
R1
RR1#ping vrf Special-Users 2001:db8:acad:213::1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 2001:DB8:ACAD:213::1, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 36/38/44 ms
RR1#ping vrf Special-Users 2001:db8:acad:213::1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 2001:DB8:ACAD:213::1, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 32/39/44 ms
RR1#ping vrf Special-Users 2001:db8:acad:213::1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 2001:DB8:ACAD:213::1, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 20/29/40 ms
RR1#ping vrf Special-Users 2001:db8:acad:213::1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 2001:DB8:ACAD:213::1, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 40/40/44 ms
RR1#
*Mar 31 09:53:52.767: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethe
rnet1/1 (not half duplex), with D1 Ethernet0/2 (half duplex).
RR1#
```

Fuente: elaboración propia a partir de pantallazo de GNS3

Para verificar las interfaces VRF ajustadas usamos el comando show ip vrf interfaces desde cada router o switch:

Figura 7. Uso del comando show ip vrf interfaces en R1

```
RR1#
*Mar 31 10:51:53.039: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethernet1/1 (not half duplex), with D1 Ethernet0/2 (half duplex).
RR1#
*Mar 31 10:52:53.039: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethernet1/1 (not half duplex), with D1 Ethernet0/2 (half duplex).
RR1#show run
*Mar 31 10:53:53.039: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethernet1/1 (not half duplex), with D1 Ethernet0/2 (half duplex).
RR1#show run | inc route
ip route vrf General-Users 0.0.0.0 0.0.0.0 10.0.12.5
ip route vrf Special-Users 0.0.0.0 0.0.0.0 10.0.12.5
ipv6 route vrf Special-Users ::/0 2001:DB8:ACAD:12::2
ipv6 route vrf General-Users ::/0 2001:DB8:ACAD:12::2
RR1#show ip vrf interfaces
Interface          IP-Address      VRF              Protocol
Et1/0.2            10.0.12.3       General-Users    up
Et1/1.2            10.0.108.3      General-Users    up
Et1/0.1            10.0.12.3       Special-Users    up
Et1/1.1            10.0.113.3      Special-Users    up
RR1#
*Mar 31 10:54:53.091: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethernet1/1 (not half duplex), with D1 Ethernet0/2 (half duplex).
RR1#
```

Fuente: elaboración propia a partir de pantallazo de GNS3

Figura 8. Uso del comando show ip vrf interfaces en R2

```
RR2#$d on Ethernet1/1 (not half duplex), with D1 Ethernet0/2 (half duplex).
*Mar 31 10:54:53.091: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethernet1/1 (not half duplex), with D1 Ethernet0/2 (half duplex).

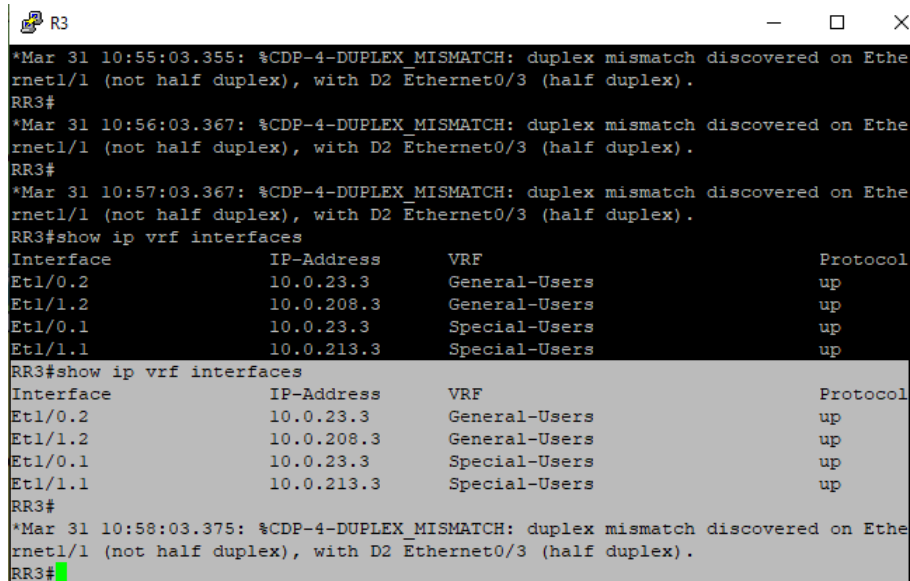
% Invalid input detected at '^' marker.

RR2#RR1#
^
% Invalid input detected at '^' marker.

RR2#show ip vrf interfaces
Interface          IP-Address      VRF              Protocol
Et1/0.2            10.0.12.5       General-Users    up
Et1/1.2            10.0.23.5       General-Users    up
Et1/0.1            10.0.12.5       Special-Users    up
Et1/1.1            10.0.23.5       Special-Users    up
RR2#show ip vrf interfaces
Interface          IP-Address      VRF              Protocol
Et1/0.2            10.0.12.5       General-Users    up
Et1/1.2            10.0.23.5       General-Users    up
Et1/0.1            10.0.12.5       Special-Users    up
Et1/1.1            10.0.23.5       Special-Users    up
RR2#
```

Fuente: elaboración propia a partir de pantallazo de GNS3

Figura 9. Uso del comando show ip vrf interfaces en R3



```
*Mar 31 10:55:03.355: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethe
rnet1/1 (not half duplex), with D2 Ethernet0/3 (half duplex).
RR3#
*Mar 31 10:56:03.367: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethe
rnet1/1 (not half duplex), with D2 Ethernet0/3 (half duplex).
RR3#
*Mar 31 10:57:03.367: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethe
rnet1/1 (not half duplex), with D2 Ethernet0/3 (half duplex).
RR3#show ip vrf interfaces
Interface                IP-Address      VRF              Protocol
Et1/0.2                  10.0.23.3      General-Users    up
Et1/1.2                  10.0.208.3    General-Users    up
Et1/0.1                  10.0.23.3      Special-Users    up
Et1/1.1                  10.0.213.3    Special-Users    up
RR3#show ip vrf interfaces
Interface                IP-Address      VRF              Protocol
Et1/0.2                  10.0.23.3      General-Users    up
Et1/1.2                  10.0.208.3    General-Users    up
Et1/0.1                  10.0.23.3      Special-Users    up
Et1/1.1                  10.0.213.3    Special-Users    up
RR3#
*Mar 31 10:58:03.375: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethe
rnet1/1 (not half duplex), with D2 Ethernet0/3 (half duplex).
RR3#
```

Fuente: elaboración propia a partir de pantallazo de GNS3

## 2.3 RUTAS ESTÁTICAS

**Nota:** dentro de este trabajo con VRF y en general las labores con redes donde existan dentro de una topología varios router, se hace indispensable manejar el concepto de *Rutas Estáticas*, toda vez que su estructura para una correcta configuración, permite intercomunicar distintas redes, por medio de saltos, con los cuales es posible el envío de paquetes de un router a otro ubicado en otra red, que a su vez realizará reenvíos de paquetes a las terminales de usuario o a otros equipos activos dentro de la topología de red.

Usando el comando show run | inc route se puede verificar las rutas estáticas de cada router:

Figura 10. Usa del comando show run | inc route en R1

```
R1
Etl/0.1          10.0.12.3      Special-Users    up
Etl/1.1          10.0.113.3     Special-Users    up
RR1#
*Mar 31 10:54:53.091: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethe
rnet1/1 (not half duplex), with D1 Ethernet0/2 (half duplex).
RR1#
*Mar 31 10:55:53.051: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethe
rnet1/1 (not half duplex), with D1 Ethernet0/2 (half duplex).
RR1#
*Mar 31 10:56:53.051: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethe
rnet1/1 (not half duplex), with D1 Ethernet0/2 (half duplex).
RR1#
*Mar 31 10:57:53.051: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethe
rnet1/1 (not half duplex), with D1 Ethernet0/2 (half duplex).
RR1#
*Mar 31 10:58:53.051: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethe
rnet1/1 (not half duplex), with D1 Ethernet0/2 (half duplex).
RR1#show run | inc rout
ipv6 unicast-routing
ip route vrf General-Users 0.0.0.0 0.0.0.0 10.0.12.5
ip route vrf Special-Users 0.0.0.0 0.0.0.0 10.0.12.5
ipv6 route vrf Special-Users ::/0 2001:DB8:ACAD:12::2
ipv6 route vrf General-Users ::/0 2001:DB8:ACAD:12::2
RR1#
```

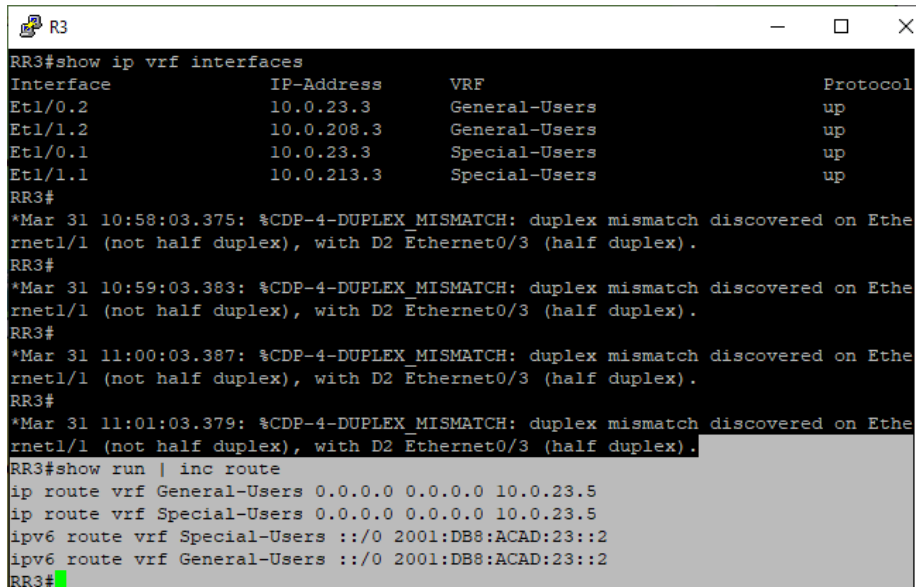
Fuente: elaboración propia a partir de pantallazo de GNS3

Figura 11. Uso del comando show run | inc route en R2

```
R2
% Invalid input detected at '^' marker.
RR2#show ip vrf interfaces
Interface      IP-Address      VRF              Protocol
Etl/0.2        10.0.12.5       General-Users    up
Etl/1.2        10.0.23.5       General-Users    up
Etl/0.1        10.0.12.5       Special-Users    up
Etl/1.1        10.0.23.5       Special-Users    up
RR2#show ip vrf interfaces
Interface      IP-Address      VRF              Protocol
Etl/0.2        10.0.12.5       General-Users    up
Etl/1.2        10.0.23.5       General-Users    up
Etl/0.1        10.0.12.5       Special-Users    up
Etl/1.1        10.0.23.5       Special-Users    up
RR2#show run | inc route
ip route vrf General-Users 10.0.108.0 255.255.255.0 10.0.12.3
ip route vrf General-Users 10.0.208.0 255.255.255.0 10.0.23.3
ip route vrf Special-Users 10.0.113.0 255.255.255.0 10.0.12.3
ip route vrf Special-Users 10.0.213.0 255.255.255.0 10.0.23.3
ipv6 route vrf General-Users 2001:DB8:ACAD:108::/64 2001:DB8:ACAD:12::1
ipv6 route vrf Special-Users 2001:DB8:ACAD:113::/64 2001:DB8:ACAD:12::1
ipv6 route vrf General-Users 2001:DB8:ACAD:208::/64 2001:DB8::3
ipv6 route vrf Special-Users 2001:DB8:ACAD:213::/64 2001:DB8:ACAD:23::3
RR2#
```

Fuente: elaboración propia a partir de pantallazo de GNS3

Figura 12. Uso del comando show run | inc route en R3



```
RR3#show ip vrf interfaces
Interface          IP-Address      VRF              Protocol
Et1/0.2            10.0.23.3      General-Users    up
Et1/1.2            10.0.208.3     General-Users    up
Et1/0.1            10.0.23.3      Special-Users    up
Et1/1.1            10.0.213.3     Special-Users    up
RR3#
*Mar 31 10:58:03.375: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethe
rnet1/1 (not half duplex), with D2 Ethernet0/3 (half duplex).
RR3#
*Mar 31 10:59:03.383: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethe
rnet1/1 (not half duplex), with D2 Ethernet0/3 (half duplex).
RR3#
*Mar 31 11:00:03.387: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethe
rnet1/1 (not half duplex), with D2 Ethernet0/3 (half duplex).
RR3#
*Mar 31 11:01:03.379: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethe
rnet1/1 (not half duplex), with D2 Ethernet0/3 (half duplex).
RR3#show run | inc route
ip route vrf General-Users 0.0.0.0 0.0.0.0 10.0.23.5
ip route vrf Special-Users 0.0.0.0 0.0.0.0 10.0.23.5
ipv6 route vrf Special-Users ::/0 2001:DB8:ACAD:23::2
ipv6 route vrf General-Users ::/0 2001:DB8:ACAD:23::2
RR3#
```

Fuente: elaboración propia a partir de pantallazo de GNS3

## 2.4 SHOW IP ROUTE VRF

Al ejecutar los comandos show ip route vrf más el nombre dado a la VRF tanto para IPV4 e IPV6 muestran la tabla de enrutamiento IP asociada a las VRF, tal como se muestra en las siguientes imágenes:

```
RR1#show ip route vrf General-Users
RR1#show ipv6 route vrf General-Users
```

Figura 13. Tabla de enrutamiento VRF en R1

```

o - ODR, P - periodic downloaded static route, H - NHRP, I - LISP
+ - replicated route, % - next hop override

Gateway of last resort is 10.0.12.5 to network 0.0.0.0

S* 0.0.0.0/0 [1/0] via 10.0.12.5
10.0.0.0/8 is variably subnetted, 4 subnets, 2 masks
C 10.0.12.0/24 is directly connected, Ethernet1/0.2
L 10.0.12.3/32 is directly connected, Ethernet1/0.2
C 10.0.108.0/24 is directly connected, Ethernet1/1.2
L 10.0.108.3/32 is directly connected, Ethernet1/1.2
RR1#show ipv6 route vrf
% Incomplete command.

RR1#show ipv6 route vrf General-Users
IPv6 Routing Table - General-Users - 6 entries
Codes: C - Connected, L - Local, S - Static, U - Per-user Static route
B - BGP, R - RIP, H - NHRP, I1 - ISIS L1
I2 - ISIS L2, IA - ISIS interarea, IS - ISIS summary, D - EIGRP
EX - EIGRP external, 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, I - LISP
S ::/0 [1/0]
via 2001:DB8:ACAD:12::2
C 2001:DB8:ACAD:12::/64 [0/0]
via Ethernet1/0.2, directly connected
L 2001:DB8:ACAD:12::1/128 [0/0]
via Ethernet1/0.2, receive
C 2001:DB8:ACAD:108::/64 [0/0]
via Ethernet1/1.2, directly connected
L 2001:DB8:ACAD:108::1/128 [0/0]
via Ethernet1/1.2, receive
L FF00::/8 [0/0]
via Null0, receive
RR1#

```

Fuente: elaboración propia a partir de pantallazo de GNS3

```

RR1#show ip route vrf Special-Users
RR1#show ipv6 route vrf Special-Users

```

Figura 14. Tabla de enrutamiento VRF en R1

```

i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
ia - IS-IS inter area, * - candidate default, U - per-user static route
o - ODR, P - periodic downloaded static route, H - NHRP, I - LISP
+ - replicated route, % - next hop override

Gateway of last resort is 10.0.12.5 to network 0.0.0.0

S* 0.0.0.0/0 [1/0] via 10.0.12.5
10.0.0.0/8 is variably subnetted, 5 subnets, 2 masks
C 10.0.12.0/24 is directly connected, Ethernet1/0.1
L 10.0.12.3/32 is directly connected, Ethernet1/0.1
C 10.0.113.0/24 is directly connected, Ethernet1/1.1
L 10.0.113.3/32 is directly connected, Ethernet1/1.1
S 10.0.213.0/24 [1/0] via 10.0.12.5
RR1#show ipv6 route vrf Special-Users
IPv6 Routing Table - Special-Users - 6 entries
Codes: C - Connected, L - Local, S - Static, U - Per-user Static route
B - BGP, R - RIP, H - NHRP, I1 - ISIS L1
I2 - ISIS L2, IA - ISIS interarea, IS - ISIS summary, D - EIGRP
EX - EIGRP external, 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, I - LISP
S ::/0 [1/0]
via 2001:DB8:ACAD:12::2
C 2001:DB8:ACAD:12::/64 [0/0]
via Ethernet1/0.1, directly connected
L 2001:DB8:ACAD:12::1/128 [0/0]
via Ethernet1/0.1, receive
C 2001:DB8:ACAD:113::/64 [0/0]
via Ethernet1/1.1, directly connected
L 2001:DB8:ACAD:113::1/128 [0/0]
via Ethernet1/1.1, receive
L FF00::/8 [0/0]
via Null0, receive
RR1#

```

Fuente: elaboración propia a partir de pantallazo de GNS3

```
RR2#show ip route vrf General-Users
RR2#show ipv6 route vrf General-Users
```

Figura 15. Tabla de entutamiento y VRF en R2

```
RR2(config)#end
RR2#
*Mar 29 14:55:29.371: %SYS-5-CONFIG_I: Configured from console by console
RR2#show ip route vrf General-Users

Routing Table: General-Users
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
        I - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
        ia - IS-IS inter area, * - candidate default, U - per-user static route
        o - ODR, P - periodic downloaded static route, H - NHRP, l - LISP
        + - replicated route, % - next hop override

Gateway of last resort is not set

    10.0.0.0/8 is variably subnetted, 6 subnets, 2 masks
C       10.0.12.0/24 is directly connected, Ethernet1/0.2
L       10.0.12.5/32 is directly connected, Ethernet1/0.2
C       10.0.23.0/24 is directly connected, Ethernet1/1.2
L       10.0.23.5/32 is directly connected, Ethernet1/1.2
S       10.0.108.0/24 [1/0] via 10.0.12.3
S       10.0.208.0/24 [1/0] via 10.0.23.3
RR2#show ipv6 route vrf General-Users
IPv6 Routing Table - General-Users - 7 entries
Codes: C - Connected, L - Local, S - Static, U - Per-user Static route
        B - BGP, R - RIP, H - NHRP, I1 - ISIS L1
        I2 - ISIS L2, IA - ISIS interarea, IS - ISIS summary, D - EIGRP
        EX - EIGRP external, 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, l - LISP
C       2001:DB8:ACAD:12::/64 [0/0]
        via Ethernet1/0.2, directly connected
L       2001:DB8:ACAD:12::2/128 [0/0]
        via Ethernet1/0.2, receive
C       2001:DB8:ACAD:23::/64 [0/0]
        via Ethernet1/1.2, directly connected
L       2001:DB8:ACAD:23::2/128 [0/0]
        via Ethernet1/1.2, receive
S       2001:DB8:ACAD:108::/64 [1/0]
        via 2001:DB8:ACAD:12::1
S       2001:DB8:ACAD:208::/64 [1/0]
        via 2001:DB8:ACAD:23::3
L       FF00::/8 [0/0]
        via Null0, receive
RR2#
```

Fuente: elaboración propia a partir de pantallazo de GNS3

```
RR2#show ip route vrf Special-Users
RR2#show ipv6 route vrf Special-Users
```

Figura 16. Tabla de enrutamiento y VRF en R2

```

via 2001:DB8:ACAD:23::3
L FF00::8 [0/0]
via Null0, receive
RR2#show ip route vrf Special-Users

Routing Table: Special-Users
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
        I - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
        ia - IS-IS inter area, * - candidate default, U - per-user static route
        o - ODR, P - periodic downloaded static route, H - NHRP, l - LISP
        + - replicated route, % - next hop override

Gateway of last resort is not set

10.0.0.0/8 is variably subnetted, 6 subnets, 2 masks
C    10.0.12.0/24 is directly connected, Ethernet1/0.1
L    10.0.12.5/32 is directly connected, Ethernet1/0.1
C    10.0.23.0/24 is directly connected, Ethernet1/1.1
L    10.0.23.5/32 is directly connected, Ethernet1/1.1
S    10.0.113.0/24 [1/0] via 10.0.12.3
S    10.0.213.0/24 [1/0] via 10.0.23.3
RR2#show ipv6 route vrf Special-Users
IPv6 Routing Table - Special-Users - 7 entries
Codes: C - Connected, L - Local, S - Static, U - Per-user Static route
        B - BGP, R - RIP, H - NHRP, I1 - ISIS L1
        I2 - ISIS L2, IA - ISIS interarea, IS - ISIS summary, D - EIGRP
        EX - EIGRP external, 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, l - LISP
C    2001:DB8:ACAD:12::/64 [0/0]
        via Ethernet1/0.1, directly connected
L    2001:DB8:ACAD:12::2/128 [0/0]
        via Ethernet1/0.1, receive
C    2001:DB8:ACAD:23::/64 [0/0]
        via Ethernet1/1.1, directly connected
L    2001:DB8:ACAD:23::2/128 [0/0]
        via Ethernet1/1.1, receive
S    2001:DB8:ACAD:113::/64 [1/0]
        via 2001:DB8:ACAD:12::1
S    2001:DB8:ACAD:213::/64 [1/0]
        via 2001:DB8:ACAD:23::3
L    FF00::8 [0/0]
        via Null0, receive
RR2#

```

Fuente: elaboración propia a partir de pantallazo de GNS3

```

RR3#show ip route vrf General-Users
RR3#show ipv6 route vrf General-Users

```

Figura 17. Tabla de enrutamiento y VRF en R3

```

ith D2 Ethernet0/3 (half duplex).
RR3#
*Mar 30 10:47:35.295: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethernet1/1 (not half duplex), w
ith D2 Ethernet0/3 (half duplex).
RR3#
RR3#
RR3#show ip route vrf General-Users
Routing Table: General-Users
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
i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
ia - IS-IS inter area, * - candidate default, U - per-user static route
o - ODR, P - periodic downloaded static route, H - NHRP, l - LISP
+ - replicated route, % - next hop override

Gateway of last resort is 10.0.23.5 to network 0.0.0.0

S* 0.0.0.0/0 [1/0] via 10.0.23.5
10.0.0.0/8 is variably subnetted, 4 subnets, 2 masks
C 10.0.23.0/24 is directly connected, Ethernet1/0.2
L 10.0.23.3/32 is directly connected, Ethernet1/0.2
C 10.0.208.0/24 is directly connected, Ethernet1/1.2
L 10.0.208.3/32 is directly connected, Ethernet1/1.2
RR3#show ipv6 route vrf General-Users
IPv6 Routing Table - General-Users - 6 entries
Codes: C - Connected, L - Local, S - Static, U - Per-user Static route
B - BGP, R - RIP, H - NHRP, I1 - ISIS L1
I2 - ISIS L2, IA - ISIS interarea, IS - ISIS summary, D - EIGRP
EX - EIGRP external, 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, l - LISP
S ::/0 [1/0]
via 2001:DB8:ACAD:23::2
C 2001:DB8:ACAD:23::/64 [0/0]
via Ethernet1/0.2, directly connected
L 2001:DB8:ACAD:23::3/128 [0/0]
via Ethernet1/0.2, receive
C 2001:DB8:ACAD:208::/64 [0/0]
via Ethernet1/1.2, directly connected
L 2001:DB8:ACAD:208::1/128 [0/0]
via Ethernet1/1.2, receive
L FF00::/8 [0/0]
via Null0, receive
RR3#

```

Fuente: elaboración propia a partir de pantallazo de GNS3

```

RR3#show ip route vrf Special-Users
RR3#show ipv6 route vrf Special-Users

```

Figura 18. Tabla de enrutamiento y VRF en R3

```

C 2001:DB8:ACAD:208::/64 [0/0]
via Ethernet1/1.2, directly connected
L 2001:DB8:ACAD:208::1/128 [0/0]
via Ethernet1/1.2, receive
L FF00::/8 [0/0]
via Null0, receive
RR3#show ip route vrf Special-Users
Routing Table: Special-Users
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
i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
ia - IS-IS inter area, * - candidate default, U - per-user static route
o - ODR, P - periodic downloaded static route, H - NHRP, l - LISP
+ - replicated route, % - next hop override

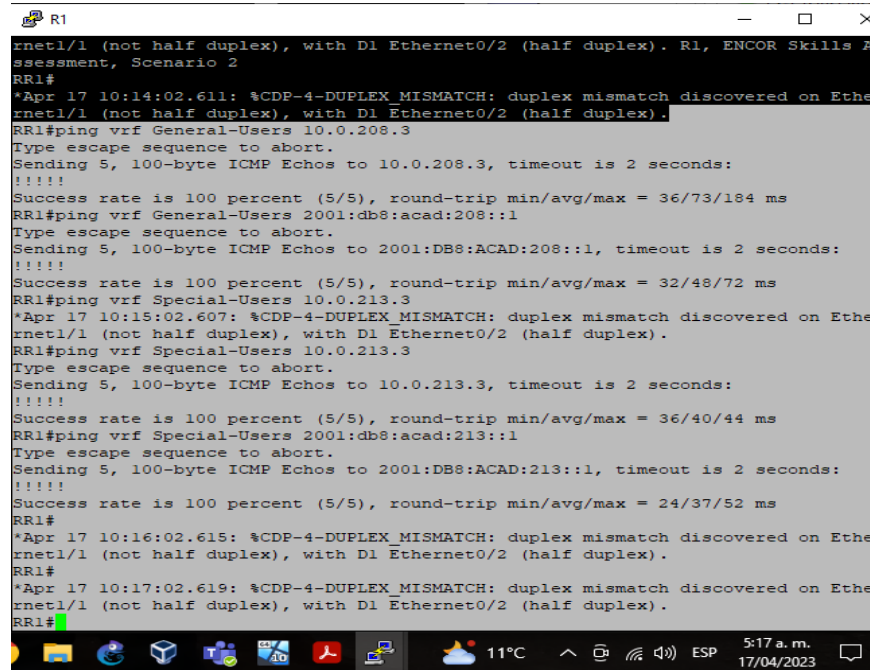
Gateway of last resort is 10.0.23.5 to network 0.0.0.0

S* 0.0.0.0/0 [1/0] via 10.0.23.5
10.0.0.0/8 is variably subnetted, 4 subnets, 2 masks
C 10.0.23.0/24 is directly connected, Ethernet1/0.1
L 10.0.23.3/32 is directly connected, Ethernet1/0.1
C 10.0.213.0/24 is directly connected, Ethernet1/1.1
L 10.0.213.3/32 is directly connected, Ethernet1/1.1
RR3#show ipv6 route vrf Special-Users
IPv6 Routing Table - Special-Users - 6 entries
Codes: C - Connected, L - Local, S - Static, U - Per-user Static route
B - BGP, R - RIP, H - NHRP, I1 - ISIS L1
I2 - ISIS L2, IA - ISIS interarea, IS - ISIS summary, D - EIGRP
EX - EIGRP external, 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, l - LISP
S ::/0 [1/0]
via 2001:DB8:ACAD:23::2
C 2001:DB8:ACAD:23::/64 [0/0]
via Ethernet1/0.1, directly connected
L 2001:DB8:ACAD:23::3/128 [0/0]
via Ethernet1/0.1, receive
C 2001:DB8:ACAD:213::/64 [0/0]
via Ethernet1/1.1, directly connected
L 2001:DB8:ACAD:213::1/128 [0/0]
via Ethernet1/1.1, receive
L FF00::/8 [0/0]
via Null0, receive
RR3#

```

Fuente: elaboración propia a partir de pantallazo de GNS3

Figura 19. ping satisfactorio de R1 a R3 a todas las VRF creadas



```
RR1#
*Apr 17 10:14:02.611: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Eth
rnet1/1 (not half duplex), with D1 Ethernet0/2 (half duplex).
RR1#ping vrf General-Users 10.0.208.3
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.0.208.3, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 36/73/184 ms
RR1#ping vrf General-Users 2001:db8:acad:208::1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 2001:DB8:ACAD:208::1, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 32/48/72 ms
RR1#ping vrf Special-Users 10.0.213.3
*Apr 17 10:15:02.607: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Eth
rnet1/1 (not half duplex), with D1 Ethernet0/2 (half duplex).
RR1#ping vrf Special-Users 10.0.213.3
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.0.213.3, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 36/40/44 ms
RR1#ping vrf Special-Users 2001:db8:acad:213::1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 2001:DB8:ACAD:213::1, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 24/37/52 ms
RR1#
*Apr 17 10:16:02.615: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Eth
rnet1/1 (not half duplex), with D1 Ethernet0/2 (half duplex).
RR1#
*Apr 17 10:17:02.619: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Eth
rnet1/1 (not half duplex), with D1 Ethernet0/2 (half duplex).
RR1#
```

Fuente: elaboración propia a partir de pantallazo de GNS3

ping desde R1, verify connectivity to R3:  
ping vrf General-Users 10.0.208.3  
ping vrf General-Users 2001:db8:acad:208::1  
ping vrf Special-Users 10.0.213.3  
ping vrf Special-Users 2001:db8:acad:213::1

## ESCENARIO 2

La segunda parte de este trabajo de Diplomado CCNP corresponde al desarrollo del escenario 2. Con la misma topología propuesta en el escenario 1, se realizarán las siguientes dos partes, parte 3 y parte 4, cuyas actividades aparecen en la siguiente tabla:

Configuración de los switches para conectividad con los usuarios finales, según tabla:

Tabla 3. Especificaciones de configuración en Switches D1, D2 y A1

Task#	Task	Specification
3.1	On D1, D2, and A1, disable all interfaces.	On D1 and D2, shutdown G1/0/1 to G1/0/24. On A1, shutdown F0/1 – F0/24, G0/1 – G0/2.
3.2	On D1 and D2, configure the trunk links to R1 and R3.	Configure and enable the G1/0/11 link as a trunk link.
3.3	On D1 and A1, configure the EtherChannel.	On D1, configure and enable: <ul style="list-style-type: none"> <li>• Interface G1/0/5 and G1/0/6</li> <li>• Port Channel 1 using PAgP</li> </ul> On A1, configure enable: <ul style="list-style-type: none"> <li>• Interface F0/1 and F0/2</li> <li>• Port Channel 1 using PAgP</li> </ul>
3.4	On D1, D2, and A1, configure access ports for PC1, PC2, PC3, and PC4.	Configure and enable the access ports as follows: On D1, configure interface G1/0/23 as an access port in VLAN 13 and enable Portfast.  On D2, configure interface G1/0/23 as an access port in VLAN 13 and enable Portfast.  On D2, configure interface G1/0/24 as an access port in VLAN 8 and enable Portfast.  On A1, configure interface F0/23 as an access port in VLAN 8 and enable Portfast.
3.5	Verify PC to PC connectivity.	From PC1, verify IPv4 and IPv6 connectivity to PC2.  From PC3, verify IPv4 and IPv6 connectivity to PC4.

Fuente: prueba de habilidades Escenario 2 Diplomado CCNP

## PARTE 3. CONFIGURAR CAPA 2

### 3.1 Apagar interfaces

Aplicamos el comando:

```
interface range e0/1-3, e1/0-3, e2/0-3, e3/0-3
shutdown
```

### 3.2 Habilitamos el enlace troncal en las interfaces en D1 y D2

Usamos las siguientes líneas de comando:

```
switchport trunk encapsulation dot1q
switchport mode trunk
no shutdown
```

### 3.3 Configurar EtherChannel

Para configurar EtherChannel se usa el comando:

```
channel-group 1 mode desirable
no shutdown
```

### 3.4 Configurar puertos de acceso

Para configurar el modo acceso y poder ingresar a una determinada VLAN, se usa los comandos:

```
switchport mode access
switchport access vlan 13-8
```

La configuración completa de los Switch D1, D2 y A1 se presenta a continuación:

#### Switch D1

```
interface range e0/1-3, e1/0-3, e2/0-3, e3/0-3 //Marca un rango de interface
shutdown //Deshabilita las interfaces
exit //Salir de la configuración
interface e0/2 //Ingresa a la interfaz seleccionada
switchport trunk encapsulation dot1q //Encapsula la interfaz
switchport mode trunk //Pone la int. como enlace troncal
no shutdown //Habilita la interfaz
exit //Salida
interface e0/3 //Ingresa a la interfaz indicada
switchport mode access //Ordena al puerto a ser de acceso
switchport access vlan 13 //Permite acceso a la vlan indicada
spanning-tree portfast //Permite enlaces redundantes LAN
```

```

no shutdown //Habilita la interfaz
exit //Salida
interface range e0/0-1 //Ingresa a la interfaz seleccionada
switchport trunk encapsulation dot1q //Permite un enlace troncal
switchport mode trunk //Pone la int. como enlace troncal
channel-group 1 mode desirable //Permite agregar enlaces
no shutdown //Habilita la interfaz
exit //Salida

```

### **Switch D2**

```

interface range e0/1-3, e1/0-3, e2/0-3, e3/0-3
shutdown
exit
interface e0/3
switchport trunk encapsulation dot1q
switchport mode trunk
no shutdown
exit
interface e0/1
switchport mode access
switchport access vlan 13
spanning-tree portfast
no shutdown
exit
interface e0/0
switchport mode access
switchport access vlan 8
spanning-tree portfast
no shutdown
exit

```

### **Switch A1**

```

interface range e0/1-3, e1/0-3, e2/0-3, e3/0-3
shutdown
exit
interface e0/2
switchport mode access
switchport access vlan 8
spanning-tree portfast
no shutdown
exit
interface range e0/1, e0/0
switchport trunk encapsulation dot1q
switchport mode trunk
channel-group 1 mode desirable

```

```
no shutdown
exit
```

**Nota:** la configuración de los Switch D1, D2 y A1 es muy similar y solo difiere en el uso de las interfaces, por tanto, los comentarios son los mismos y solo se describen en D1, pero aplican también para D2 y A1.

### Configuración de IPV4 e IPV6 en los computadores:

VPCS1

```
ip 10.0.113.35/24 10.0.113.3
ip 2001:db8:acad:113::50/64 2001:db8:acad:113::1
```

VPCS2

```
ip 10.0.213.35/24 10.0.213.3
ip 2001:db8:acad:213::50/64 2001:db8:acad:213::1
```

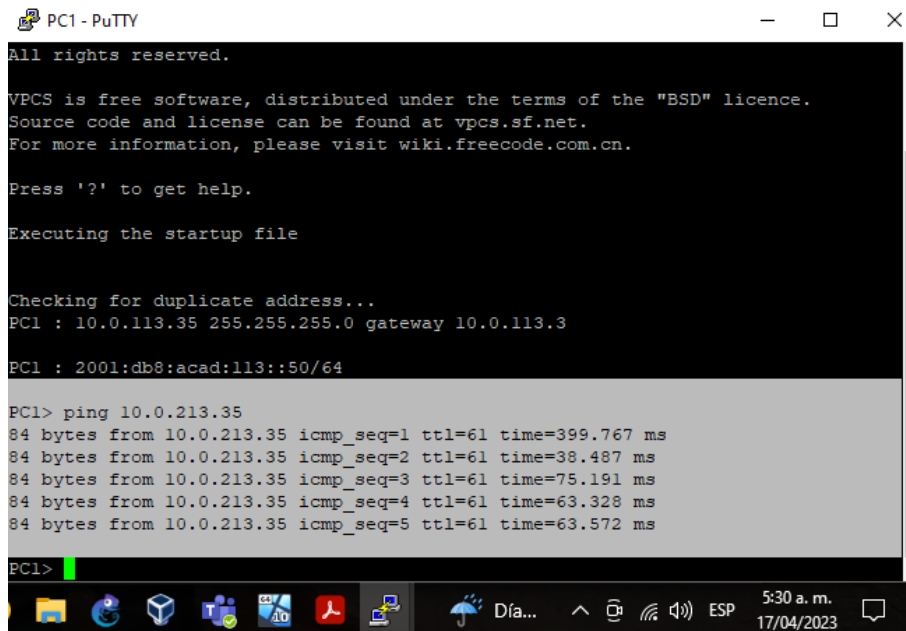
VPCS3

```
ip 10.0.108.35/24 10.0.108.3
ip 2001:db8:acad:108::50/64 2001:db8:acad:108::1
```

VPCS4

```
ip 10.0.208.35/24 10.0.213.3
ip 2001:db8:acad:208::50/64 2001:db8:acad:208::1
```

Figura 20. Ping con respuesta desde PC1 a PC2 10.0.213.35 en IPV4



```
PC1 - PuTTY
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 : 10.0.113.35 255.255.255.0 gateway 10.0.113.3

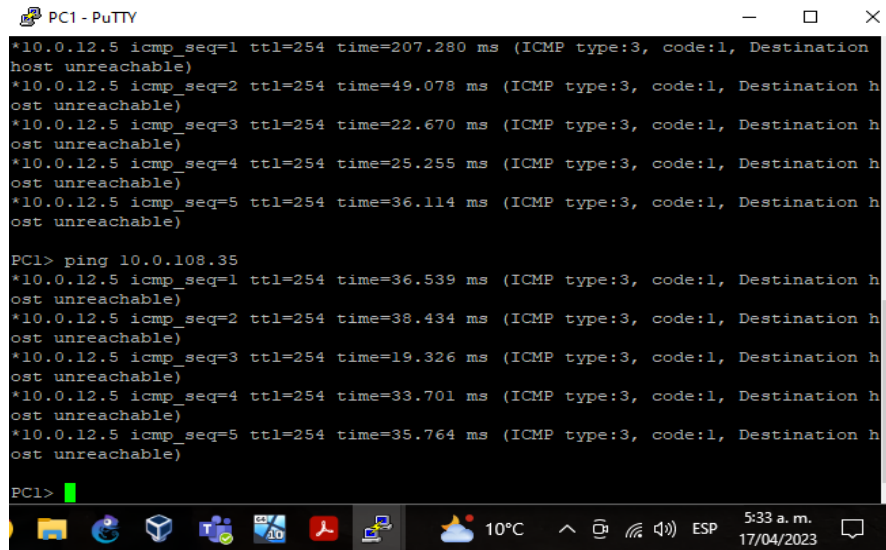
PC1 : 2001:db8:acad:113::50/64

PC1> ping 10.0.213.35
84 bytes from 10.0.213.35 icmp_seq=1 ttl=61 time=399.767 ms
84 bytes from 10.0.213.35 icmp_seq=2 ttl=61 time=38.487 ms
84 bytes from 10.0.213.35 icmp_seq=3 ttl=61 time=75.191 ms
84 bytes from 10.0.213.35 icmp_seq=4 ttl=61 time=63.328 ms
84 bytes from 10.0.213.35 icmp_seq=5 ttl=61 time=63.572 ms

PC1>
```

Fuente: elaboración propia a partir de pantallazo de GNS3

Figura 21. Ping sin respuesta desde PC1 a PC3 10.0.108.35 en IPV4



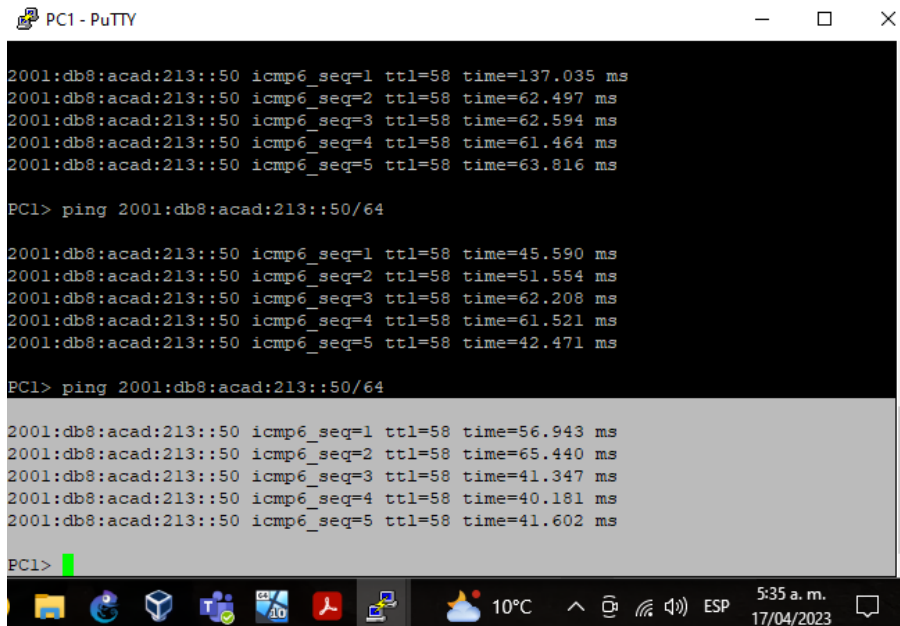
```
PC1 - PuTTY
*10.0.12.5 icmp_seq=1 ttl=254 time=207.280 ms (ICMP type:3, code:1, Destination host unreachable)
*10.0.12.5 icmp_seq=2 ttl=254 time=49.078 ms (ICMP type:3, code:1, Destination host unreachable)
*10.0.12.5 icmp_seq=3 ttl=254 time=22.670 ms (ICMP type:3, code:1, Destination host unreachable)
*10.0.12.5 icmp_seq=4 ttl=254 time=25.255 ms (ICMP type:3, code:1, Destination host unreachable)
*10.0.12.5 icmp_seq=5 ttl=254 time=36.114 ms (ICMP type:3, code:1, Destination host unreachable)

PC1> ping 10.0.108.35
*10.0.12.5 icmp_seq=1 ttl=254 time=36.539 ms (ICMP type:3, code:1, Destination host unreachable)
*10.0.12.5 icmp_seq=2 ttl=254 time=38.434 ms (ICMP type:3, code:1, Destination host unreachable)
*10.0.12.5 icmp_seq=3 ttl=254 time=19.326 ms (ICMP type:3, code:1, Destination host unreachable)
*10.0.12.5 icmp_seq=4 ttl=254 time=33.701 ms (ICMP type:3, code:1, Destination host unreachable)
*10.0.12.5 icmp_seq=5 ttl=254 time=35.764 ms (ICMP type:3, code:1, Destination host unreachable)

PC1>
```

Fuente: elaboración propia a partir de pantallazo de GNS3

Figura 22. Ping con respuesta desde PC1 a PC2 10.0.213.35 en IPV6



```
PC1 - PuTTY
2001:db8:acad:213::50 icmp6_seq=1 ttl=58 time=137.035 ms
2001:db8:acad:213::50 icmp6_seq=2 ttl=58 time=62.497 ms
2001:db8:acad:213::50 icmp6_seq=3 ttl=58 time=62.594 ms
2001:db8:acad:213::50 icmp6_seq=4 ttl=58 time=61.464 ms
2001:db8:acad:213::50 icmp6_seq=5 ttl=58 time=63.816 ms

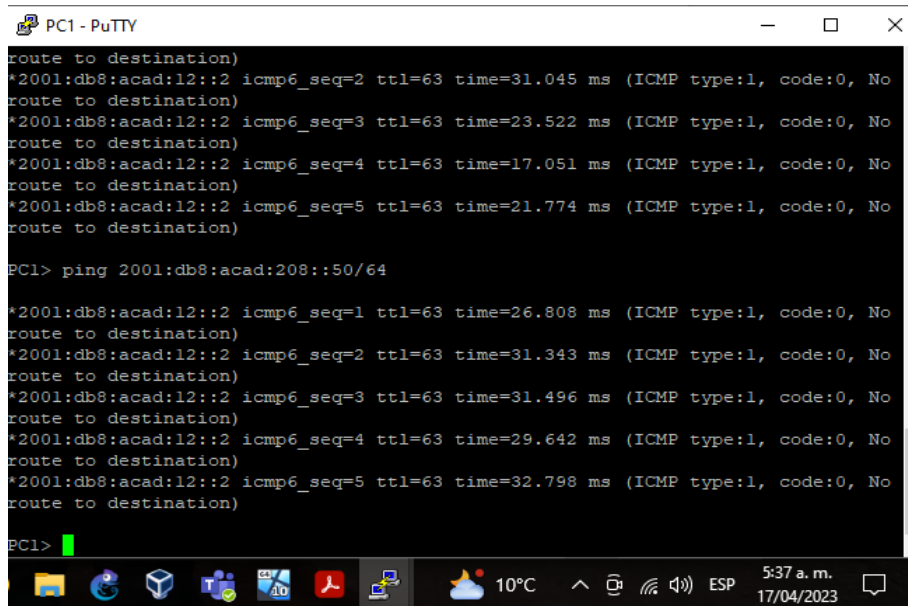
PC1> ping 2001:db8:acad:213::50/64
2001:db8:acad:213::50 icmp6_seq=1 ttl=58 time=45.590 ms
2001:db8:acad:213::50 icmp6_seq=2 ttl=58 time=51.554 ms
2001:db8:acad:213::50 icmp6_seq=3 ttl=58 time=62.208 ms
2001:db8:acad:213::50 icmp6_seq=4 ttl=58 time=61.521 ms
2001:db8:acad:213::50 icmp6_seq=5 ttl=58 time=42.471 ms

PC1> ping 2001:db8:acad:213::50/64
2001:db8:acad:213::50 icmp6_seq=1 ttl=58 time=56.943 ms
2001:db8:acad:213::50 icmp6_seq=2 ttl=58 time=65.440 ms
2001:db8:acad:213::50 icmp6_seq=3 ttl=58 time=41.347 ms
2001:db8:acad:213::50 icmp6_seq=4 ttl=58 time=40.181 ms
2001:db8:acad:213::50 icmp6_seq=5 ttl=58 time=41.602 ms

PC1>
```

Fuente: elaboración propia a partir de pantallazo de GNS3

Figura 23. Ping sin respuesta desde PC1 a PC4 2001:db8:acad:208::50/64 en IPV6



```
PC1 - PuTTY
route to destination)
*2001:db8:acad:12::2 icmp6_seq=2 ttl=63 time=31.045 ms (ICMP type:1, code:0, No
route to destination)
*2001:db8:acad:12::2 icmp6_seq=3 ttl=63 time=23.522 ms (ICMP type:1, code:0, No
route to destination)
*2001:db8:acad:12::2 icmp6_seq=4 ttl=63 time=17.051 ms (ICMP type:1, code:0, No
route to destination)
*2001:db8:acad:12::2 icmp6_seq=5 ttl=63 time=21.774 ms (ICMP type:1, code:0, No
route to destination)

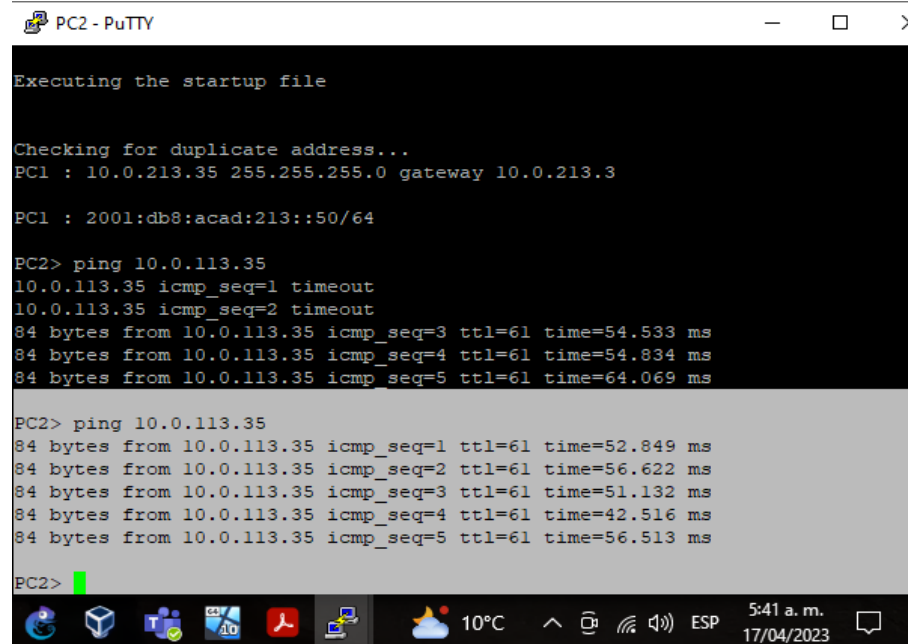
PC1> ping 2001:db8:acad:208::50/64

*2001:db8:acad:12::2 icmp6_seq=1 ttl=63 time=26.808 ms (ICMP type:1, code:0, No
route to destination)
*2001:db8:acad:12::2 icmp6_seq=2 ttl=63 time=31.343 ms (ICMP type:1, code:0, No
route to destination)
*2001:db8:acad:12::2 icmp6_seq=3 ttl=63 time=31.496 ms (ICMP type:1, code:0, No
route to destination)
*2001:db8:acad:12::2 icmp6_seq=4 ttl=63 time=29.642 ms (ICMP type:1, code:0, No
route to destination)
*2001:db8:acad:12::2 icmp6_seq=5 ttl=63 time=32.798 ms (ICMP type:1, code:0, No
route to destination)

PC1>
```

Fuente: elaboración propia a partir de pantallazo de GNS3

Figura 24. Ping con respuesta desde PC2 a PC1 10.0.213.35 en IPV4



```
PC2 - PuTTY
Executing the startup file

Checking for duplicate address...
PC1 : 10.0.213.35 255.255.255.0 gateway 10.0.213.3

PC1 : 2001:db8:acad:213::50/64

PC2> ping 10.0.113.35
10.0.113.35 icmp_seq=1 timeout
10.0.113.35 icmp_seq=2 timeout
84 bytes from 10.0.113.35 icmp_seq=3 ttl=61 time=54.533 ms
84 bytes from 10.0.113.35 icmp_seq=4 ttl=61 time=54.834 ms
84 bytes from 10.0.113.35 icmp_seq=5 ttl=61 time=64.069 ms

PC2> ping 10.0.113.35
84 bytes from 10.0.113.35 icmp_seq=1 ttl=61 time=52.849 ms
84 bytes from 10.0.113.35 icmp_seq=2 ttl=61 time=56.622 ms
84 bytes from 10.0.113.35 icmp_seq=3 ttl=61 time=51.132 ms
84 bytes from 10.0.113.35 icmp_seq=4 ttl=61 time=42.516 ms
84 bytes from 10.0.113.35 icmp_seq=5 ttl=61 time=56.513 ms

PC2>
```

Fuente: elaboración propia a partir de pantallazo de GNS3

Figura 25. Ping sin respuesta desde PC2 a PC3 10.0.108.35 en IPV4

```
PC2 - PuTTY
PC2> ping 10.0.108.35
*10.0.23.5 icmp_seq=1 ttl=254 time=29.978 ms (ICMP type:3, code:1, Destination host unreachable)
*10.0.23.5 icmp_seq=2 ttl=254 time=28.585 ms (ICMP type:3, code:1, Destination host unreachable)
*10.0.23.5 icmp_seq=3 ttl=254 time=31.866 ms (ICMP type:3, code:1, Destination host unreachable)
*10.0.23.5 icmp_seq=4 ttl=254 time=27.955 ms (ICMP type:3, code:1, Destination host unreachable)
*10.0.23.5 icmp_seq=5 ttl=254 time=24.690 ms (ICMP type:3, code:1, Destination host unreachable)

PC2> ping 10.0.108.35
*10.0.23.5 icmp_seq=1 ttl=254 time=19.791 ms (ICMP type:3, code:1, Destination host unreachable)
*10.0.23.5 icmp_seq=2 ttl=254 time=30.099 ms (ICMP type:3, code:1, Destination host unreachable)
*10.0.23.5 icmp_seq=3 ttl=254 time=26.162 ms (ICMP type:3, code:1, Destination host unreachable)
*10.0.23.5 icmp_seq=4 ttl=254 time=27.617 ms (ICMP type:3, code:1, Destination host unreachable)
*10.0.23.5 icmp_seq=5 ttl=254 time=43.422 ms (ICMP type:3, code:1, Destination host unreachable)

PC2>
```

Fuente: elaboración propia a partir de pantallazo de GNS3

Figura 26. Ping con respuesta desde PC2 a PC1 2001:db8:acad:113::50/64 2001 en IPV6

```
PC2 - PuTTY
2001:db8:acad:113::50 icmp6_seq=1 ttl=58 time=92.612 ms
2001:db8:acad:113::50 icmp6_seq=2 ttl=58 time=53.446 ms
2001:db8:acad:113::50 icmp6_seq=3 ttl=58 time=50.481 ms
2001:db8:acad:113::50 icmp6_seq=4 ttl=58 time=40.118 ms
2001:db8:acad:113::50 icmp6_seq=5 ttl=58 time=42.431 ms

PC2>
PC2> ping 2001:db8:acad:113::50/64 2001

2001:db8:acad:113::50 icmp6_seq=1 ttl=58 time=59.704 ms
2001:db8:acad:113::50 icmp6_seq=2 ttl=58 time=52.063 ms
2001:db8:acad:113::50 icmp6_seq=3 ttl=58 time=51.705 ms
2001:db8:acad:113::50 icmp6_seq=4 ttl=58 time=73.335 ms
2001:db8:acad:113::50 icmp6_seq=5 ttl=58 time=61.972 ms

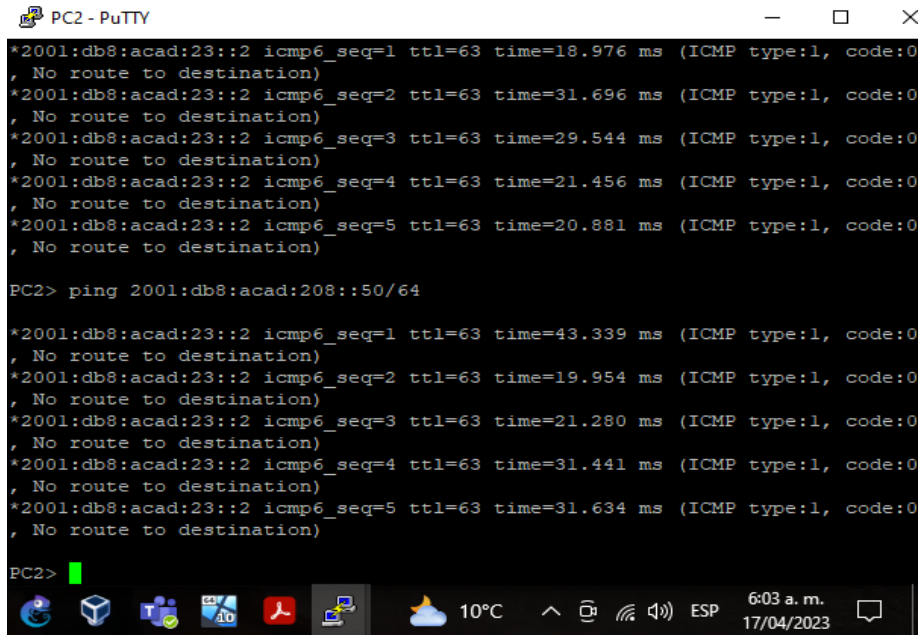
PC2> ping 2001:db8:acad:113::50/64 2001

2001:db8:acad:113::50 icmp6_seq=1 ttl=58 time=74.999 ms
2001:db8:acad:113::50 icmp6_seq=2 ttl=58 time=52.418 ms
2001:db8:acad:113::50 icmp6_seq=3 ttl=58 time=62.686 ms
2001:db8:acad:113::50 icmp6_seq=4 ttl=58 time=61.600 ms
2001:db8:acad:113::50 icmp6_seq=5 ttl=58 time=74.594 ms

PC2>
```

Fuente: elaboración propia a partir de pantallazo de GNS3

Figura 27. Ping sin respuesta desde PC2 a PC4 2001:db8:acad:208::50/64 2001 en IPV6



```
PC2 - PuTTY
*2001:db8:acad:23::2 icmp6_seq=1 ttl=63 time=18.976 ms (ICMP type:1, code:0, No route to destination)
*2001:db8:acad:23::2 icmp6_seq=2 ttl=63 time=31.696 ms (ICMP type:1, code:0, No route to destination)
*2001:db8:acad:23::2 icmp6_seq=3 ttl=63 time=29.544 ms (ICMP type:1, code:0, No route to destination)
*2001:db8:acad:23::2 icmp6_seq=4 ttl=63 time=21.456 ms (ICMP type:1, code:0, No route to destination)
*2001:db8:acad:23::2 icmp6_seq=5 ttl=63 time=20.881 ms (ICMP type:1, code:0, No route to destination)

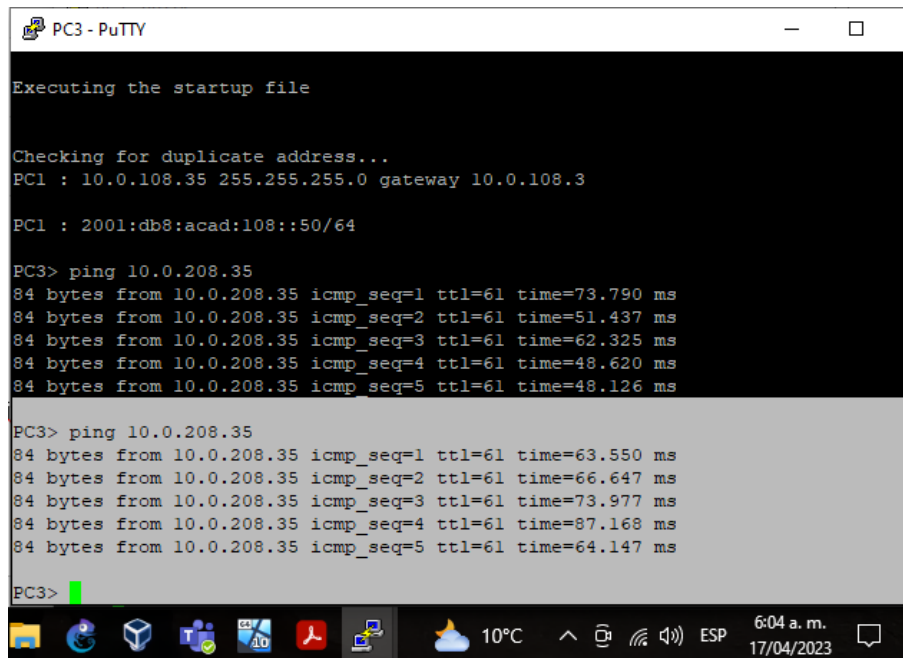
PC2> ping 2001:db8:acad:208::50/64

*2001:db8:acad:23::2 icmp6_seq=1 ttl=63 time=43.339 ms (ICMP type:1, code:0, No route to destination)
*2001:db8:acad:23::2 icmp6_seq=2 ttl=63 time=19.954 ms (ICMP type:1, code:0, No route to destination)
*2001:db8:acad:23::2 icmp6_seq=3 ttl=63 time=21.280 ms (ICMP type:1, code:0, No route to destination)
*2001:db8:acad:23::2 icmp6_seq=4 ttl=63 time=31.441 ms (ICMP type:1, code:0, No route to destination)
*2001:db8:acad:23::2 icmp6_seq=5 ttl=63 time=31.634 ms (ICMP type:1, code:0, No route to destination)

PC2>
```

Fuente: elaboración propia a partir de pantallazo de GNS3

Figura 28. Ping con respuesta desde PC3 a PC4 10.0.208.35 en IPV4



```
PC3 - PuTTY
Executing the startup file

Checking for duplicate address...
PC1 : 10.0.108.35 255.255.255.0 gateway 10.0.108.3

PC1 : 2001:db8:acad:108::50/64

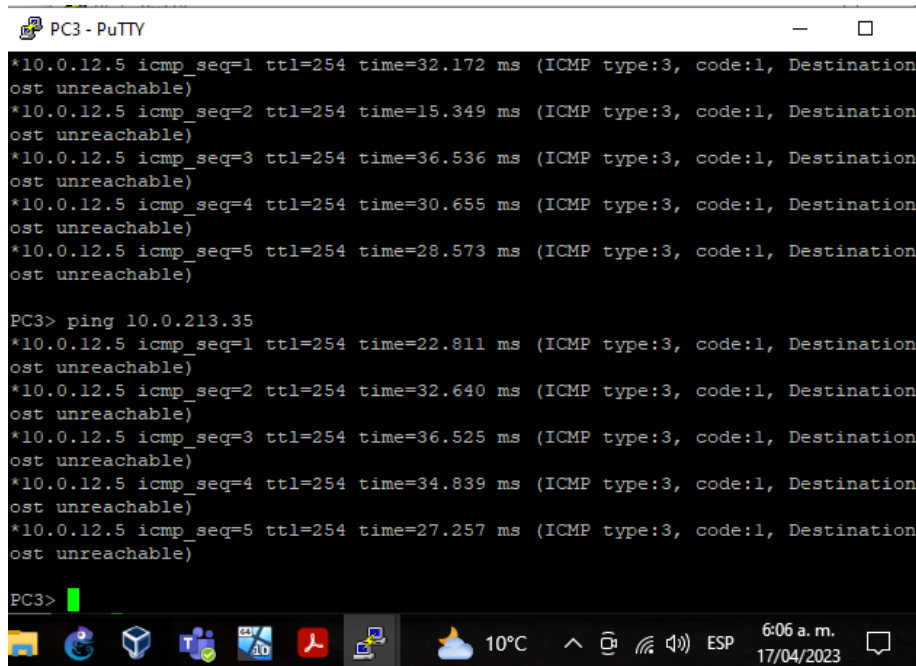
PC3> ping 10.0.208.35
84 bytes from 10.0.208.35 icmp_seq=1 ttl=61 time=73.790 ms
84 bytes from 10.0.208.35 icmp_seq=2 ttl=61 time=51.437 ms
84 bytes from 10.0.208.35 icmp_seq=3 ttl=61 time=62.325 ms
84 bytes from 10.0.208.35 icmp_seq=4 ttl=61 time=48.620 ms
84 bytes from 10.0.208.35 icmp_seq=5 ttl=61 time=48.126 ms

PC3> ping 10.0.208.35
84 bytes from 10.0.208.35 icmp_seq=1 ttl=61 time=63.550 ms
84 bytes from 10.0.208.35 icmp_seq=2 ttl=61 time=66.647 ms
84 bytes from 10.0.208.35 icmp_seq=3 ttl=61 time=73.977 ms
84 bytes from 10.0.208.35 icmp_seq=4 ttl=61 time=87.168 ms
84 bytes from 10.0.208.35 icmp_seq=5 ttl=61 time=64.147 ms

PC3>
```

Fuente: elaboración propia a partir de pantallazo de GNS3

Figura 29. Ping sin respuesta desde PC3 a PC2 10.0.213.35 en IPV4



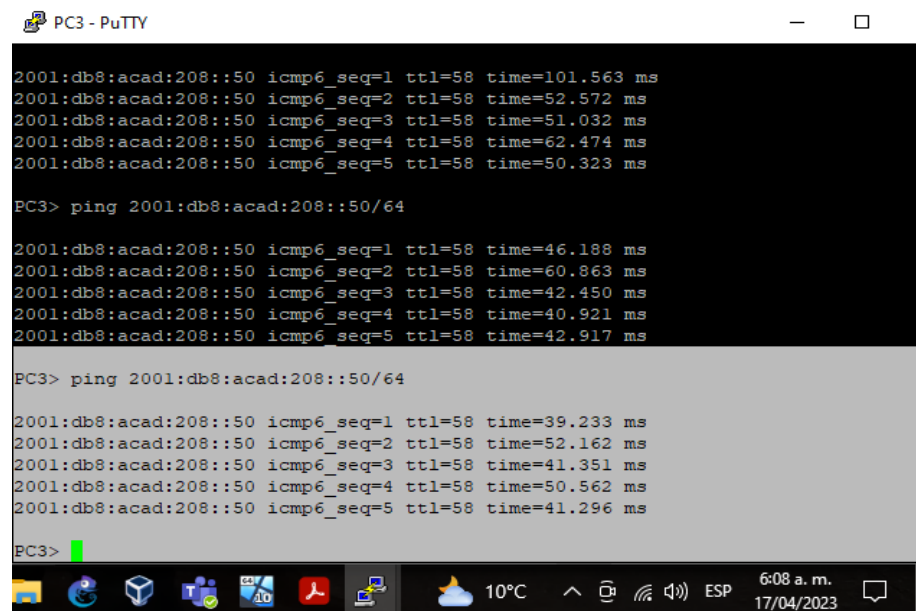
```
PC3 - PuTTY
*10.0.12.5 icmp_seq=1 ttl=254 time=32.172 ms (ICMP type:3, code:1, Destination
ost unreachable)
*10.0.12.5 icmp_seq=2 ttl=254 time=15.349 ms (ICMP type:3, code:1, Destination
ost unreachable)
*10.0.12.5 icmp_seq=3 ttl=254 time=36.536 ms (ICMP type:3, code:1, Destination
ost unreachable)
*10.0.12.5 icmp_seq=4 ttl=254 time=30.655 ms (ICMP type:3, code:1, Destination
ost unreachable)
*10.0.12.5 icmp_seq=5 ttl=254 time=28.573 ms (ICMP type:3, code:1, Destination
ost unreachable)

PC3> ping 10.0.213.35
*10.0.12.5 icmp_seq=1 ttl=254 time=22.811 ms (ICMP type:3, code:1, Destination
ost unreachable)
*10.0.12.5 icmp_seq=2 ttl=254 time=32.640 ms (ICMP type:3, code:1, Destination
ost unreachable)
*10.0.12.5 icmp_seq=3 ttl=254 time=36.525 ms (ICMP type:3, code:1, Destination
ost unreachable)
*10.0.12.5 icmp_seq=4 ttl=254 time=34.839 ms (ICMP type:3, code:1, Destination
ost unreachable)
*10.0.12.5 icmp_seq=5 ttl=254 time=27.257 ms (ICMP type:3, code:1, Destination
ost unreachable)

PC3>
```

Fuente: elaboración propia a partir de pantallazo de GNS3

Figura 30. Ping con respuesta desde PC3 a PC4 2001:db8:acad:208::50/64 en IPV6



```
PC3 - PuTTY
2001:db8:acad:208::50 icmp6_seq=1 ttl=58 time=101.563 ms
2001:db8:acad:208::50 icmp6_seq=2 ttl=58 time=52.572 ms
2001:db8:acad:208::50 icmp6_seq=3 ttl=58 time=51.032 ms
2001:db8:acad:208::50 icmp6_seq=4 ttl=58 time=62.474 ms
2001:db8:acad:208::50 icmp6_seq=5 ttl=58 time=50.323 ms

PC3> ping 2001:db8:acad:208::50/64
2001:db8:acad:208::50 icmp6_seq=1 ttl=58 time=46.188 ms
2001:db8:acad:208::50 icmp6_seq=2 ttl=58 time=60.863 ms
2001:db8:acad:208::50 icmp6_seq=3 ttl=58 time=42.450 ms
2001:db8:acad:208::50 icmp6_seq=4 ttl=58 time=40.921 ms
2001:db8:acad:208::50 icmp6_seq=5 ttl=58 time=42.917 ms

PC3> ping 2001:db8:acad:208::50/64
2001:db8:acad:208::50 icmp6_seq=1 ttl=58 time=39.233 ms
2001:db8:acad:208::50 icmp6_seq=2 ttl=58 time=52.162 ms
2001:db8:acad:208::50 icmp6_seq=3 ttl=58 time=41.351 ms
2001:db8:acad:208::50 icmp6_seq=4 ttl=58 time=50.562 ms
2001:db8:acad:208::50 icmp6_seq=5 ttl=58 time=41.296 ms

PC3>
```

Fuente: elaboración propia a partir de pantallazo de GNS3

Figura 31. Ping sin respuesta desde PC3 a PC2 2001:db8:acad:213::50/64 en IPV6

```
PC3 - PuTTY
route to destination)
*2001:db8:acad:12::2 icmp6_seq=2 ttl=63 time=30.918 ms (ICMP type:1, code:0, No
route to destination)
*2001:db8:acad:12::2 icmp6_seq=3 ttl=63 time=30.325 ms (ICMP type:1, code:0, No
route to destination)
*2001:db8:acad:12::2 icmp6_seq=4 ttl=63 time=30.262 ms (ICMP type:1, code:0, No
route to destination)
*2001:db8:acad:12::2 icmp6_seq=5 ttl=63 time=31.291 ms (ICMP type:1, code:0, No
route to destination)

PC3> ping 2001:db8:acad:213::50/64

*2001:db8:acad:12::2 icmp6_seq=1 ttl=63 time=31.186 ms (ICMP type:1, code:0, No
route to destination)
*2001:db8:acad:12::2 icmp6_seq=2 ttl=63 time=29.764 ms (ICMP type:1, code:0, No
route to destination)
*2001:db8:acad:12::2 icmp6_seq=3 ttl=63 time=31.051 ms (ICMP type:1, code:0, No
route to destination)
*2001:db8:acad:12::2 icmp6_seq=4 ttl=63 time=36.827 ms (ICMP type:1, code:0, No
route to destination)
*2001:db8:acad:12::2 icmp6_seq=5 ttl=63 time=39.373 ms (ICMP type:1, code:0, No
route to destination)

PC3>
```

Fuente: elaboración propia a partir de pantallazo de GNS3

Figura 32. Ping con respuesta desde PC4 a PC3 10.0.108.35 en IPV4

```
PC4 - PuTTY
PC1 : 2001:db8:acad:208::50/64

PC4> ping 10.0.108.35
10.0.108.35 icmp_seq=1 timeout
10.0.108.35 icmp_seq=2 timeout
84 bytes from 10.0.108.35 icmp_seq=3 ttl=61 time=48.007 ms
84 bytes from 10.0.108.35 icmp_seq=4 ttl=61 time=43.133 ms
84 bytes from 10.0.108.35 icmp_seq=5 ttl=61 time=64.351 ms

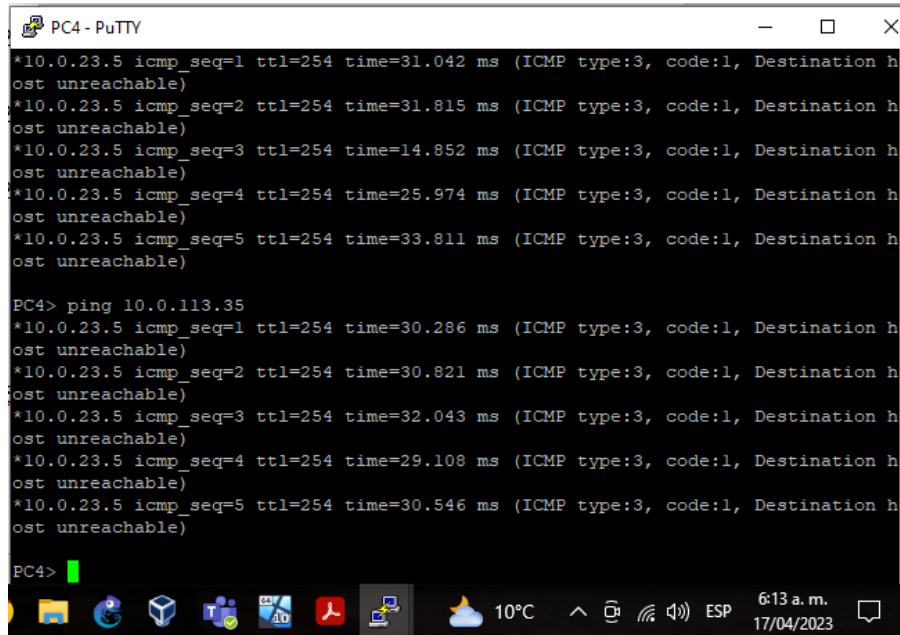
PC4> ping 10.0.108.35
84 bytes from 10.0.108.35 icmp_seq=1 ttl=61 time=49.426 ms
84 bytes from 10.0.108.35 icmp_seq=2 ttl=61 time=46.629 ms
84 bytes from 10.0.108.35 icmp_seq=3 ttl=61 time=51.560 ms
84 bytes from 10.0.108.35 icmp_seq=4 ttl=61 time=37.643 ms
84 bytes from 10.0.108.35 icmp_seq=5 ttl=61 time=50.235 ms

PC4> ping 10.0.108.35
84 bytes from 10.0.108.35 icmp_seq=1 ttl=61 time=61.413 ms
84 bytes from 10.0.108.35 icmp_seq=2 ttl=61 time=51.257 ms
84 bytes from 10.0.108.35 icmp_seq=3 ttl=61 time=63.264 ms
84 bytes from 10.0.108.35 icmp_seq=4 ttl=61 time=64.427 ms
84 bytes from 10.0.108.35 icmp_seq=5 ttl=61 time=64.787 ms

PC4>
```

Fuente: elaboración propia a partir de pantallazo de GNS3

Figura 33. Ping sin respuesta desde PC4 a PC1 10.0.113.35 en IPV4



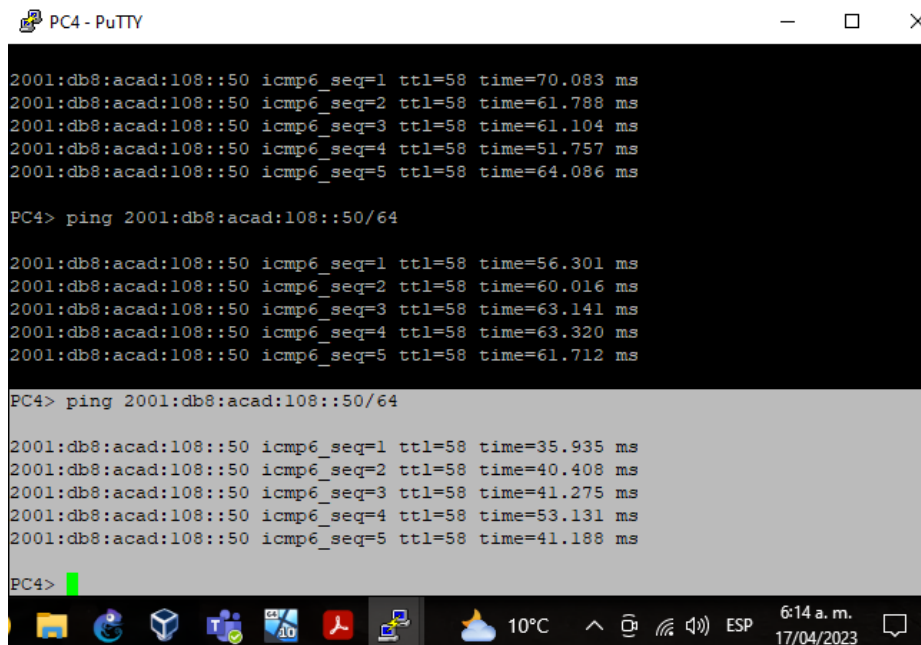
```
PC4 - PuTTY
*10.0.23.5 icmp_seq=1 ttl=254 time=31.042 ms (ICMP type:3, code:1, Destination host unreachable)
*10.0.23.5 icmp_seq=2 ttl=254 time=31.815 ms (ICMP type:3, code:1, Destination host unreachable)
*10.0.23.5 icmp_seq=3 ttl=254 time=14.852 ms (ICMP type:3, code:1, Destination host unreachable)
*10.0.23.5 icmp_seq=4 ttl=254 time=25.974 ms (ICMP type:3, code:1, Destination host unreachable)
*10.0.23.5 icmp_seq=5 ttl=254 time=33.811 ms (ICMP type:3, code:1, Destination host unreachable)

PC4> ping 10.0.113.35
*10.0.23.5 icmp_seq=1 ttl=254 time=30.286 ms (ICMP type:3, code:1, Destination host unreachable)
*10.0.23.5 icmp_seq=2 ttl=254 time=30.821 ms (ICMP type:3, code:1, Destination host unreachable)
*10.0.23.5 icmp_seq=3 ttl=254 time=32.043 ms (ICMP type:3, code:1, Destination host unreachable)
*10.0.23.5 icmp_seq=4 ttl=254 time=29.108 ms (ICMP type:3, code:1, Destination host unreachable)
*10.0.23.5 icmp_seq=5 ttl=254 time=30.546 ms (ICMP type:3, code:1, Destination host unreachable)

PC4>
```

Fuente: elaboración propia a partir de pantallazo de GNS3

Figura 34. Ping con respuesta desde PC4 a PC3 2001:db8:acad:108::50/64 en IPV6



```
PC4 - PuTTY
2001:db8:acad:108::50 icmp6_seq=1 ttl=58 time=70.083 ms
2001:db8:acad:108::50 icmp6_seq=2 ttl=58 time=61.788 ms
2001:db8:acad:108::50 icmp6_seq=3 ttl=58 time=61.104 ms
2001:db8:acad:108::50 icmp6_seq=4 ttl=58 time=51.757 ms
2001:db8:acad:108::50 icmp6_seq=5 ttl=58 time=64.086 ms

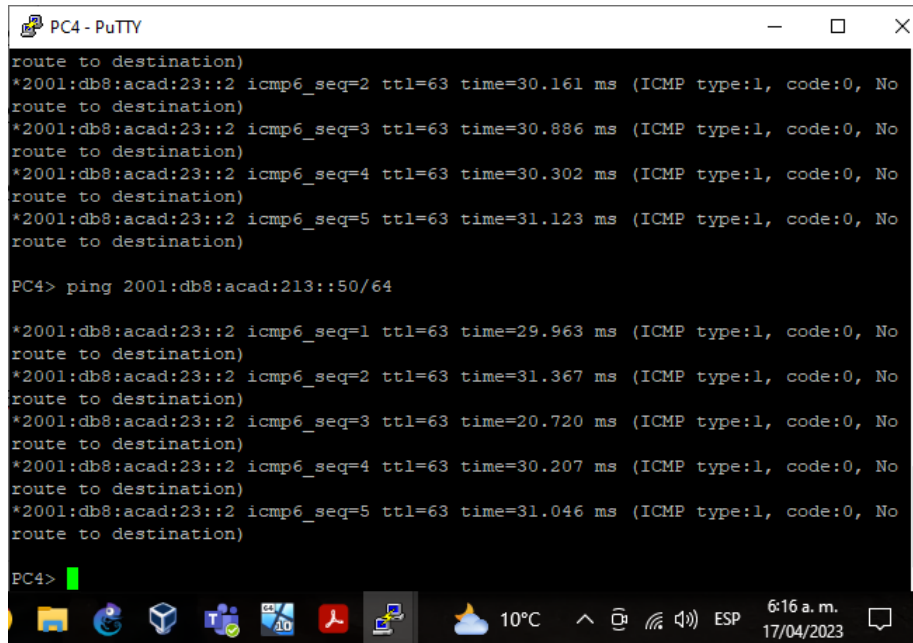
PC4> ping 2001:db8:acad:108::50/64
2001:db8:acad:108::50 icmp6_seq=1 ttl=58 time=56.301 ms
2001:db8:acad:108::50 icmp6_seq=2 ttl=58 time=60.016 ms
2001:db8:acad:108::50 icmp6_seq=3 ttl=58 time=63.141 ms
2001:db8:acad:108::50 icmp6_seq=4 ttl=58 time=63.320 ms
2001:db8:acad:108::50 icmp6_seq=5 ttl=58 time=61.712 ms

PC4> ping 2001:db8:acad:108::50/64
2001:db8:acad:108::50 icmp6_seq=1 ttl=58 time=35.935 ms
2001:db8:acad:108::50 icmp6_seq=2 ttl=58 time=40.408 ms
2001:db8:acad:108::50 icmp6_seq=3 ttl=58 time=41.275 ms
2001:db8:acad:108::50 icmp6_seq=4 ttl=58 time=53.131 ms
2001:db8:acad:108::50 icmp6_seq=5 ttl=58 time=41.188 ms

PC4>
```

Fuente: elaboración propia a partir de pantallazo de GNS3

Figura 35. Ping sin respuesta desde PC4 a PC3 2001:db8:acad:213::50/64 en IPV6



```
route to destination)
*2001:db8:acad:23::2 icmp6_seq=2 ttl=63 time=30.161 ms (ICMP type:1, code:0, No
route to destination)
*2001:db8:acad:23::2 icmp6_seq=3 ttl=63 time=30.886 ms (ICMP type:1, code:0, No
route to destination)
*2001:db8:acad:23::2 icmp6_seq=4 ttl=63 time=30.302 ms (ICMP type:1, code:0, No
route to destination)
*2001:db8:acad:23::2 icmp6_seq=5 ttl=63 time=31.123 ms (ICMP type:1, code:0, No
route to destination)

PC4> ping 2001:db8:acad:213::50/64

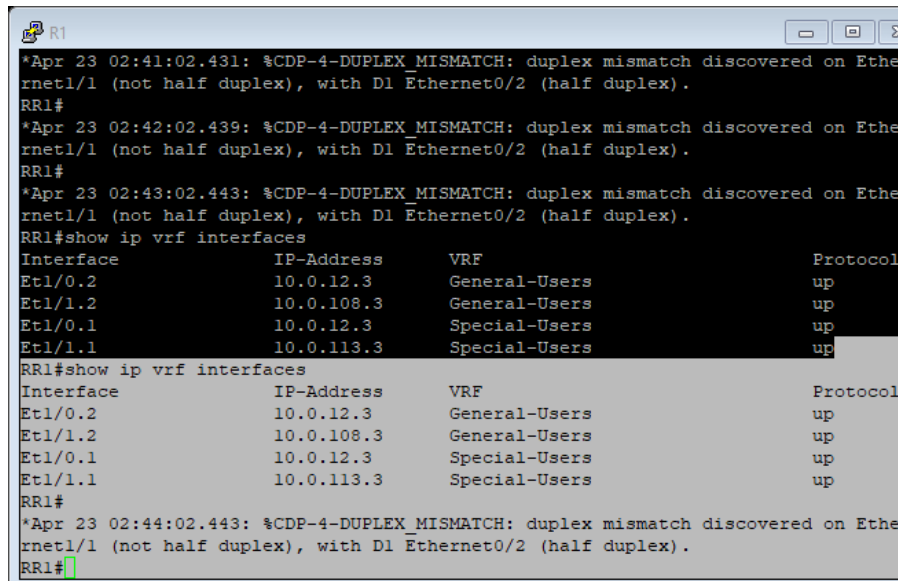
*2001:db8:acad:23::2 icmp6_seq=1 ttl=63 time=29.963 ms (ICMP type:1, code:0, No
route to destination)
*2001:db8:acad:23::2 icmp6_seq=2 ttl=63 time=31.367 ms (ICMP type:1, code:0, No
route to destination)
*2001:db8:acad:23::2 icmp6_seq=3 ttl=63 time=20.720 ms (ICMP type:1, code:0, No
route to destination)
*2001:db8:acad:23::2 icmp6_seq=4 ttl=63 time=30.207 ms (ICMP type:1, code:0, No
route to destination)
*2001:db8:acad:23::2 icmp6_seq=5 ttl=63 time=31.046 ms (ICMP type:1, code:0, No
route to destination)

PC4>
```

Fuente: elaboración propia a partir de pantallazo de GNS3

### 3.5 Comandos de verificación de las VRF creadas

Figura 36. show ip vrf interfaces en R1



```
*Apr 23 02:41:02.431: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethe
rnet1/1 (not half duplex), with D1 Ethernet0/2 (half duplex).
RR1#
*Apr 23 02:42:02.439: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethe
rnet1/1 (not half duplex), with D1 Ethernet0/2 (half duplex).
RR1#
*Apr 23 02:43:02.443: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethe
rnet1/1 (not half duplex), with D1 Ethernet0/2 (half duplex).
RR1#show ip vrf interfaces
Interface      IP-Address      VRF              Protocol
Et1/0.2        10.0.12.3       General-Users    up
Et1/1.2        10.0.108.3      General-Users    up
Et1/0.1        10.0.12.3       Special-Users    up
Et1/1.1        10.0.113.3      Special-Users    up
RR1#show ip vrf interfaces
Interface      IP-Address      VRF              Protocol
Et1/0.2        10.0.12.3       General-Users    up
Et1/1.2        10.0.108.3      General-Users    up
Et1/0.1        10.0.12.3       Special-Users    up
Et1/1.1        10.0.113.3      Special-Users    up
RR1#
*Apr 23 02:44:02.443: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethe
rnet1/1 (not half duplex), with D1 Ethernet0/2 (half duplex).
RR1#
```

Fuente: elaboración propia a partir de pantallazo de GNS3

Figura 37. show ip vrf interfaces en R2

```

R2
*Apr 23 02:34:00.607: %LINK-5-CHANGED: Interface Ethernet1/2, changed state to a
dministratively down
*Apr 23 02:34:00.859: %SYS-5-CONFIG_I: Configured from memory by console
*Apr 23 02:34:01.787: %LINEPROTO-5-UPDOWN: Line protocol on Interface Ethernet1/
2, changed state to down
*Apr 23 02:34:07.555: %SYS-5-RESTART: System restarted --
Cisco IOS Software, 7200 Software (C7200-ADVIPSERVICESK9-M), Version 15.2(4)S5,
RELEASE SOFTWARE (fcl)
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 1986-2014 by Cisco Systems, Inc.
Compiled Thu 20-Feb-14 06:51 by prod rel team
RR2#show ip vrf interfaces
Interface          IP-Address      VRF              Protocol
Et1/0.2            10.0.12.5      General-Users    up
Et1/1.2            10.0.23.5      General-Users    up
Et1/0.1            10.0.12.5      Special-Users    up
Et1/1.1            10.0.23.5      Special-Users    up
RR2#show ip vrf interfaces
Interface          IP-Address      VRF              Protocol
Et1/0.2            10.0.12.5      General-Users    up
Et1/1.2            10.0.23.5      General-Users    up
Et1/0.1            10.0.12.5      Special-Users    up
Et1/1.1            10.0.23.5      Special-Users    up
RR2#

```

Fuente: elaboración propia a partir de pantallazo de GNS3

Figura 38. show ip vrf interfaces en R3

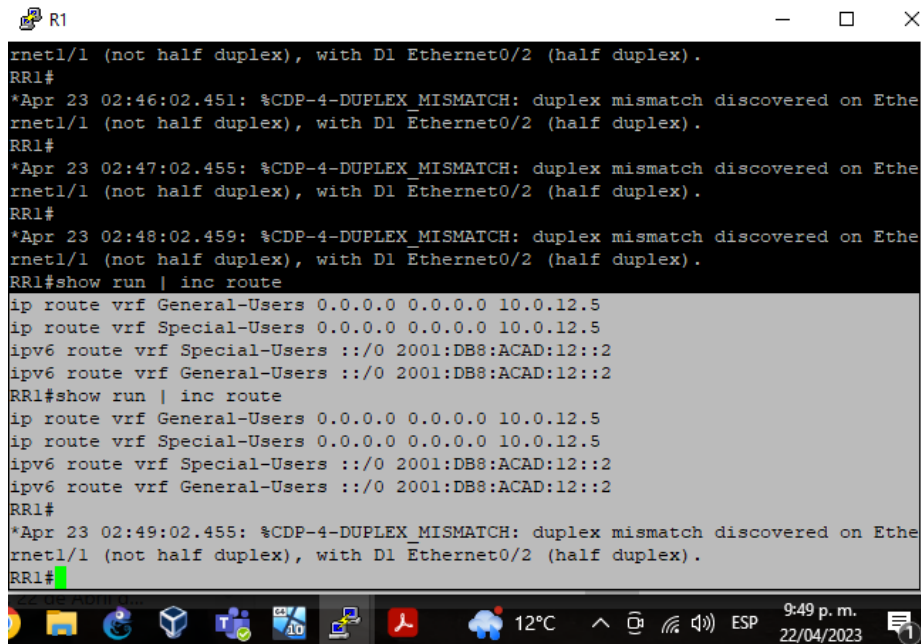
```

R3
*Apr 23 02:44:12.195: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethe
rnet1/1 (not half duplex), with D2 Ethernet0/3 (half duplex).
RR3#
*Apr 23 02:45:12.199: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethe
rnet1/1 (not half duplex), with D2 Ethernet0/3 (half duplex).
RR3#
*Apr 23 02:46:12.203: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethe
rnet1/1 (not half duplex), with D2 Ethernet0/3 (half duplex).
RR3#show ip vrf interfaces
Interface          IP-Address      VRF              Protocol
Et1/0.2            10.0.23.3      General-Users    up
Et1/1.2            10.0.208.3     General-Users    up
Et1/0.1            10.0.23.3      Special-Users    up
Et1/1.1            10.0.213.3     Special-Users    up
RR3#
*Apr 23 02:47:12.199: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethe
rnet1/1 (not half duplex), with D2 Ethernet0/3 (half duplex).
RR3#show ip vrf interfaces
Interface          IP-Address      VRF              Protocol
Et1/0.2            10.0.23.3      General-Users    up
Et1/1.2            10.0.208.3     General-Users    up
Et1/0.1            10.0.23.3      Special-Users    up
Et1/1.1            10.0.213.3     Special-Users    up
RR3#

```

Fuente: elaboración propia a partir de pantallazo de GNS3

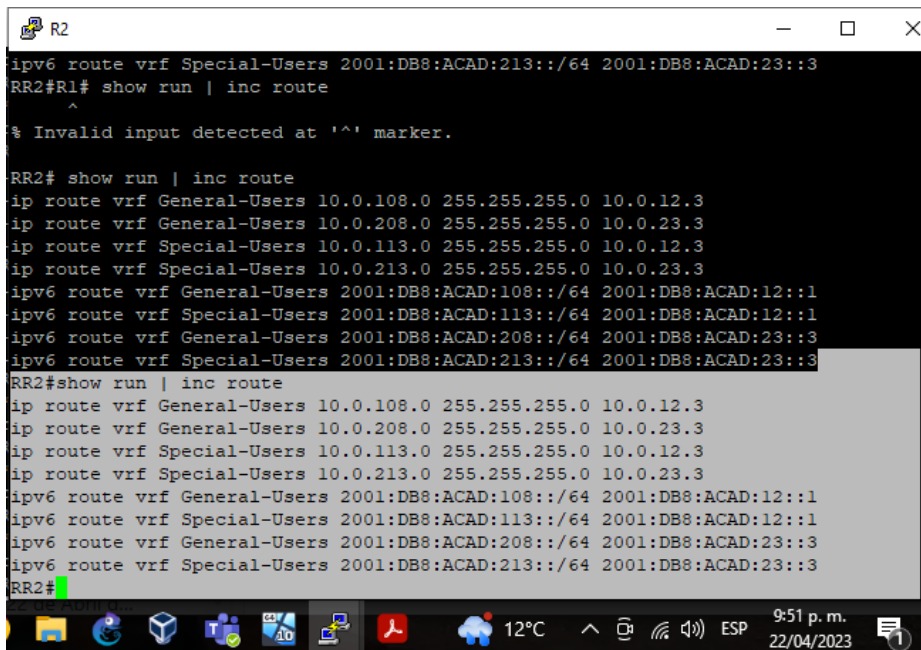
Figura 39. Comandos de verificación de rutas estáticas R1# show run | inc route



```
R1
rnet1/1 (not half duplex), with D1 Ethernet0/2 (half duplex).
RR1#
*Apr 23 02:46:02.451: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethe
rnet1/1 (not half duplex), with D1 Ethernet0/2 (half duplex).
RR1#
*Apr 23 02:47:02.455: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethe
rnet1/1 (not half duplex), with D1 Ethernet0/2 (half duplex).
RR1#
*Apr 23 02:48:02.459: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethe
rnet1/1 (not half duplex), with D1 Ethernet0/2 (half duplex).
RR1#show run | inc route
ip route vrf General-Users 0.0.0.0 0.0.0.0 10.0.12.5
ip route vrf Special-Users 0.0.0.0 0.0.0.0 10.0.12.5
ipv6 route vrf Special-Users ::/0 2001:DB8:ACAD:12::2
ipv6 route vrf General-Users ::/0 2001:DB8:ACAD:12::2
RR1#show run | inc route
ip route vrf General-Users 0.0.0.0 0.0.0.0 10.0.12.5
ip route vrf Special-Users 0.0.0.0 0.0.0.0 10.0.12.5
ipv6 route vrf Special-Users ::/0 2001:DB8:ACAD:12::2
ipv6 route vrf General-Users ::/0 2001:DB8:ACAD:12::2
RR1#
*Apr 23 02:49:02.455: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethe
rnet1/1 (not half duplex), with D1 Ethernet0/2 (half duplex).
RR1#
```

Fuente: elaboración propia a partir de pantallazo de GNS3

Figura 40. R2# show run | inc route



```
R2
ipv6 route vrf Special-Users 2001:DB8:ACAD:213::/64 2001:DB8:ACAD:23::3
RR2#R1# show run | inc route
^
% Invalid input detected at '^' marker.

RR2# show run | inc route
ip route vrf General-Users 10.0.108.0 255.255.255.0 10.0.12.3
ip route vrf General-Users 10.0.208.0 255.255.255.0 10.0.23.3
ip route vrf Special-Users 10.0.113.0 255.255.255.0 10.0.12.3
ip route vrf Special-Users 10.0.213.0 255.255.255.0 10.0.23.3
ipv6 route vrf General-Users 2001:DB8:ACAD:108::/64 2001:DB8:ACAD:12::1
ipv6 route vrf Special-Users 2001:DB8:ACAD:113::/64 2001:DB8:ACAD:12::1
ipv6 route vrf General-Users 2001:DB8:ACAD:208::/64 2001:DB8:ACAD:23::3
ipv6 route vrf Special-Users 2001:DB8:ACAD:213::/64 2001:DB8:ACAD:23::3
RR2#show run | inc route
ip route vrf General-Users 10.0.108.0 255.255.255.0 10.0.12.3
ip route vrf General-Users 10.0.208.0 255.255.255.0 10.0.23.3
ip route vrf Special-Users 10.0.113.0 255.255.255.0 10.0.12.3
ip route vrf Special-Users 10.0.213.0 255.255.255.0 10.0.23.3
ipv6 route vrf General-Users 2001:DB8:ACAD:108::/64 2001:DB8:ACAD:12::1
ipv6 route vrf Special-Users 2001:DB8:ACAD:113::/64 2001:DB8:ACAD:12::1
ipv6 route vrf General-Users 2001:DB8:ACAD:208::/64 2001:DB8:ACAD:23::3
ipv6 route vrf Special-Users 2001:DB8:ACAD:213::/64 2001:DB8:ACAD:23::3
RR2#
```

Fuente: elaboración propia a partir de pantallazo de GNS3

Figura 41.R3# show run | inc route

```

R3
Et1/1.2          10.0.208.3      General-Users    up
Et1/0.1          10.0.23.3       Special-Users    up
Et1/1.1          10.0.213.3      Special-Users    up
RR3#
*Apr 23 02:48:12.207: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethe
rnet1/1 (not half duplex), with D2 Ethernet0/3 (half duplex).
RR3#
*Apr 23 02:49:12.211: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethe
rnet1/1 (not half duplex), with D2 Ethernet0/3 (half duplex).
RR3#
*Apr 23 02:50:12.211: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethe
rnet1/1 (not half duplex), with D2 Ethernet0/3 (half duplex).
RR3#
*Apr 23 02:51:12.215: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethe
rnet1/1 (not half duplex), with D2 Ethernet0/3 (half duplex).
RR3#
*Apr 23 02:52:12.211: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethe
rnet1/1 (not half duplex), with D2 Ethernet0/3 (half duplex).
RR3#show run | inc route
ip route vrf General-Users 0.0.0.0 0.0.0.0 10.0.23.5
ip route vrf Special-Users 0.0.0.0 0.0.0.0 10.0.23.5
ipv6 route vrf Special-Users ::/0 2001:DB8:ACAD:23::2
ipv6 route vrf General-Users ::/0 2001:DB8:ACAD:23::2
RR3#

```

Fuente: elaboración propia a partir de pantallazo de GNS3

Figura 42.D1 show interfaces trunk

```

D1 - PuTTY
D1#
*Apr 23 02:54:56.110: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethe
rnet0/2 (not full duplex), with R1 Ethernet1/1 (full duplex).
D1#show interfaces trunk

Port        Mode        Encapsulation  Status        Native vlan
Et0/2       on          802.1q         trunking      1
Po1         on          802.1q         trunking      1

Port        Vlans allowed on trunk
Et0/2       1-4094
Po1         1-4094

Port        Vlans allowed and active in management domain
Et0/2       1,8,13
Po1         1,8,13

Port        Vlans in spanning tree forwarding state and not pruned
Et0/2       1,8,13
Po1         1,8,13
D1#
*Apr 23 02:55:49.392: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethe
rnet0/2 (not full duplex), with R1 Ethernet1/1 (full duplex).
D1#

```

Fuente: elaboración propia a partir de pantallazo de GNS3

Figura 43.D1 show etherchannel summary

```

D1-PuTTY
D1#show etherchannel summary
*Apr 23 02:56:47.561: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethernet0/2 (not full duplex), with RRI Ethernet1/1 (full duplex).
D1#show etherchannel summary
Flags: D - down                P - bundled in port-channel
       I - stand-alone          s - suspended
       H - Hot-standby (LACP only)
       R - Layer3              S - Layer2
       U - in use              f - failed to allocate aggregator

       M - not in use, minimum links not met
       u - unsuitable for bundling
       w - waiting to be aggregated
       d - default port

Number of channel-groups in use: 1
Number of aggregators:          1

Group  Port-channel  Protocol    Ports
-----+-----+-----+-----
1      Pol(SU)        PAgP        Et0/0(P)   Et0/1(P)

D1#
  
```

Fuente: elaboración propia a partir de pantallazo de GNS3

Figura 44.D1 show ip interface brief

```

D1-PuTTY
D1#show interface brief
*Apr 23 03:00:27.824: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethernet0/2 (not full duplex), with RRI Ethernet1/1 (full duplex).
D1#show ip interface brief
Interface          IP-Address      OK? Method Status        Protocol
Ethernet0/0        unassigned      YES unset  up            up
Ethernet0/1        unassigned      YES unset  up            up
Ethernet0/2        unassigned      YES unset  up            up
Ethernet0/3        unassigned      YES unset  up            up
Ethernet1/0        unassigned      YES unset  administratively down down
Ethernet1/1        unassigned      YES unset  administratively down down
Ethernet1/2        unassigned      YES unset  administratively down down
Ethernet1/3        unassigned      YES unset  administratively down down
Ethernet2/0        unassigned      YES unset  administratively down down
Ethernet2/1        unassigned      YES unset  administratively down down
Ethernet2/2        unassigned      YES unset  administratively down down
Ethernet2/3        unassigned      YES unset  administratively down down
Ethernet3/0        unassigned      YES unset  administratively down down
Ethernet3/1        unassigned      YES unset  administratively down down
Ethernet3/2        unassigned      YES unset  administratively down down
Ethernet3/3        unassigned      YES unset  administratively down down
Port-channell     unassigned      YES unset  up            up
Vlan1              unassigned      YES unset  administratively down down
D1#
  
```

Fuente: elaboración propia a partir de pantallazo de GNS3

Figura 45.D2 show interfaces trunk

```
D2 - PuTTY
rnet0/3 (not full duplex), with RR3 Ethernet1/1 (full duplex).
D2#
*Apr 23 03:02:42.622: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethe
rnet0/3 (not full duplex), with RR3 Ethernet1/1 (full duplex).
D2#
*Apr 23 03:03:38.564: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethe
rnet0/3 (not full duplex), with RR3 Ethernet1/1 (full duplex).
D2#show interfaces trunk

Port          Mode          Encapsulation  Status        Native vlan
Et0/3         on            802.1q         trunking      1

Port          Vlans allowed on trunk
Et0/3         1-4094

Port          Vlans allowed and active in management domain
Et0/3         1,8,13

Port          Vlans in spanning tree forwarding state and not pruned
Et0/3         1,8,13
D2#
*Apr 23 03:04:29.340: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethe
rnet0/3 (not full duplex), with RR3 Ethernet1/1 (full duplex).
D2#
```

Fuente: elaboración propia a partir de pantallazo de GNS3

Figura 46.D2 show etherchannel summary

```
D2 - PuTTY
rnet0/3 (not full duplex), with RR3 Ethernet1/1 (full duplex).
D2#
*Apr 23 03:05:27.971: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethe
rnet0/3 (not full duplex), with RR3 Ethernet1/1 (full duplex).
D2#show etherchannel summary
Flags: D - down          P - bundled in port-channel
       I - stand-alone  s - suspended
       H - Hot-standby (LACP only)
       R - Layer3       S - Layer2
       U - in use       f - failed to allocate aggregator

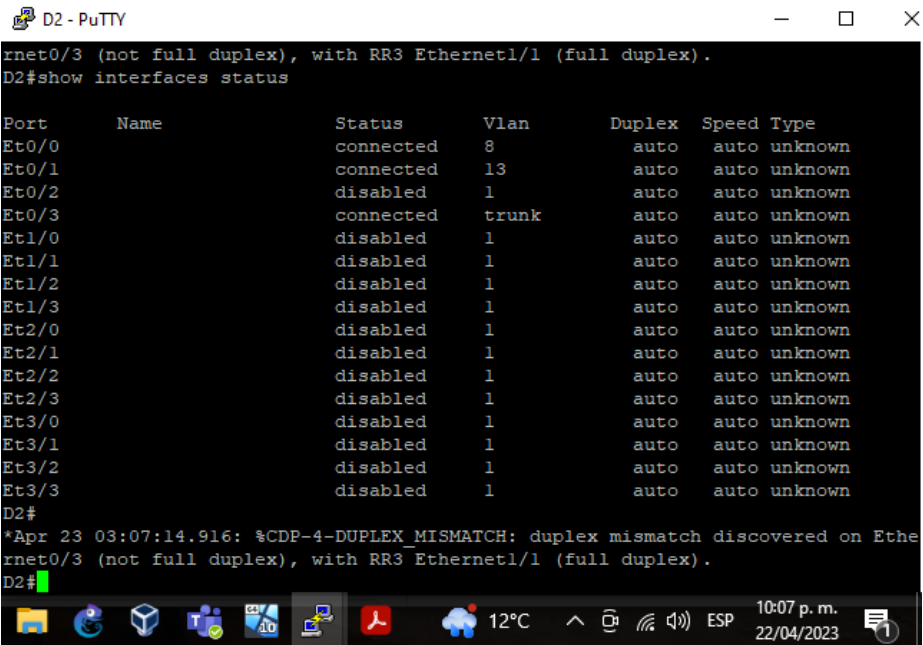
       M - not in use, minimum links not met
       u - unsuitable for bundling
       w - waiting to be aggregated
       d - default port

Number of channel-groups in use: 0
Number of aggregators:          0

Group  Port-channel  Protocol    Ports
-----+-----+-----+-----
D2#
```

Fuente: elaboración propia a partir de pantallazo de GNS3

Figura 47.D2 show interfaces status



```
D2 - PuTTY
rnet0/3 (not full duplex), with RR3 Ethernet1/1 (full duplex).
D2#show interfaces status

Port      Name      Status      Vlan      Duplex  Speed  Type
-----
Et0/0     connected 8          auto     auto    unknown
Et0/1     connected 13         auto     auto    unknown
Et0/2     disabled  1          auto     auto    unknown
Et0/3     connected trunk       auto     auto    unknown
Et1/0     disabled  1          auto     auto    unknown
Et1/1     disabled  1          auto     auto    unknown
Et1/2     disabled  1          auto     auto    unknown
Et1/3     disabled  1          auto     auto    unknown
Et2/0     disabled  1          auto     auto    unknown
Et2/1     disabled  1          auto     auto    unknown
Et2/2     disabled  1          auto     auto    unknown
Et2/3     disabled  1          auto     auto    unknown
Et3/0     disabled  1          auto     auto    unknown
Et3/1     disabled  1          auto     auto    unknown
Et3/2     disabled  1          auto     auto    unknown
Et3/3     disabled  1          auto     auto    unknown
D2#
*Apr 23 03:07:14.916: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethe
rnet0/3 (not full duplex), with RR3 Ethernet1/1 (full duplex).
D2#
```

Fuente: elaboración propia a partir de pantallazo de GNS3

## PARTE 4. CONFIGURAR SEGURIDAD

Configurar mecanismos de seguridad en los dispositivos de la topología. Para realizar este paso debemos ingresar en los equipos las siguientes líneas de comando:

### 4.1 Configurar enable secret

```
enable secret oswald353
```

### 4.2 Configurar usuario local

```
username admin secret oswald353  
username admin privilege 15 secret oswald353
```

### 4.3 Habilitar autenticación AAA

```
aaa new-model  
aaa authentication login default local  
aaa authentication login consola local
```

### R1 ERROR

```
R1#config terminal  
Enter configuration commands, one per line. End with CNTL/Z.  
R1(config)#enable algorithm-type SCRYPT secret oswald353
```

```
% Invalid input detected at '^' marker.
```

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

```
% Invalid input detected at '^' marker.
```

**Nota:** Al tratar de configurar R1 usando la línea de comandos “**algorithm-type Scrypt**” en R1, aparece un error que corresponde a la incompatibilidad de la versión de la imagen usada para cada dispositivo, por consiguiente, aparecerá el mismo error en R2, R3, D1, D2 y A1. Por tal motivo, se utilizarán las siguientes líneas de comando soportadas por los equipos:

Figura 48. Error presentado al ingresar el comando enable algorithm-type scrypt secret

```

RR1(config)#Enable algorithm-type scrypt secret oswaldXYZ
      ^
% Invalid input detected at '^' marker.

RR1(config)#$min privilege 15 algorithm-type scrypt secret oswaldXYZ
      ^
% Invalid input detected at '^' marker.

RR1(config)#Aaa new-model
RR1(config)#Aaa authentication login default local
RR1(config)#Enable algorithm-type scrypt secret oswaldXYZ
      ^
% Invalid input detected at '^' marker.

RR1(config)#$min privilege 15 algorithm-type scrypt secret oswaldXYZ
      ^
% Invalid input detected at '^' marker.

RR1(config)#Aaa new-model
RR1(config)#Aaa authentication login default local
RR1(config)#
*Apr 23 10:08:44.515: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethernet1/1 (not half duplex), with D1 Ethernet0/2 (half duplex).
RR1(config)#
  
```

Fuente: elaboración propia a partir de pantallazo de GNS3

## R1

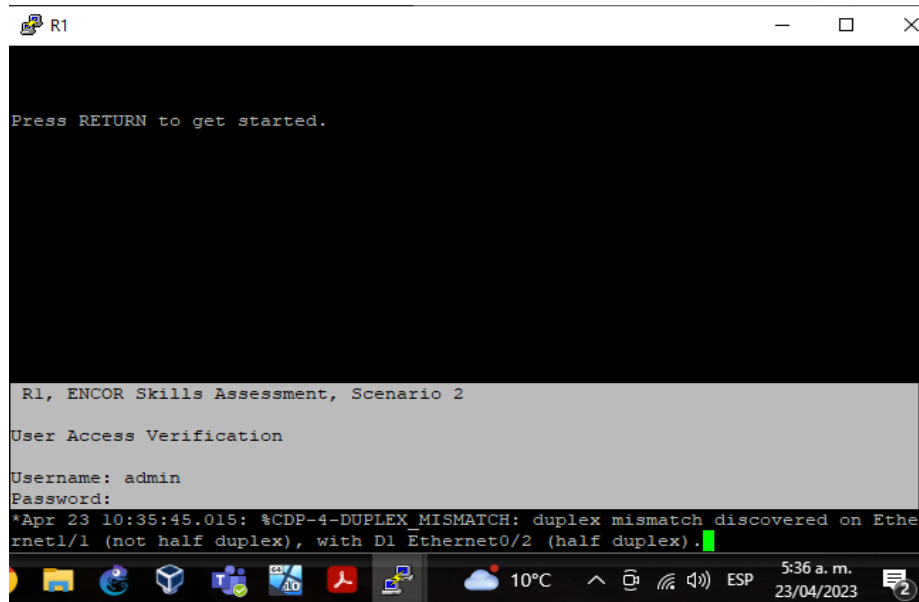
Conf term	//Accede al modo configuración del equipo
enable secret oswald353	//Habilita encriptación secreta
username admin secret oswald353	//Habilita usuario y contraseña
username admin privilege 15 secret oswald353	//Da privilegio al usuario
aaa new-model	//Habilita autenticación, autorización y contabilización
authentication login default local	//Se trata de autenticación local
aaa authentication login console local	//Se trata de autenticación local consola

**Nota:** la configuración de seguridad y los comentarios son iguales para todos los dispositivos R1, R2, R3, D1, D2 y A1. Así mismo el ingreso a los mismos se realizará con los siguientes datos:

Usuario: **admin**  
 Password: **oswald353**



Figura 51.Verificación de autenticación en Router R1

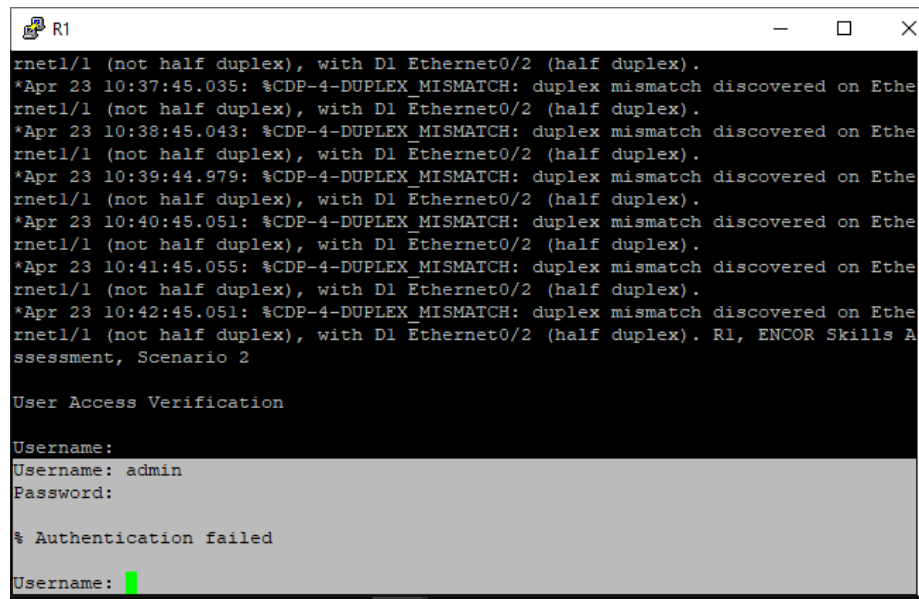


```
R1
Press RETURN to get started.

R1, ENCOR Skills Assessment, Scenario 2
User Access Verification
Username: admin
Password:
*Apr 23 10:35:45.015: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethernet1/1 (not half duplex), with D1 Ethernet0/2 (half duplex).
```

Fuente: elaboración propia a partir de pantallazo de GNS3

Figura 52.Falla al ingresar un password erroneo en Router R1



```
rnet1/1 (not half duplex), with D1 Ethernet0/2 (half duplex).
*Apr 23 10:37:45.035: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethernet1/1 (not half duplex), with D1 Ethernet0/2 (half duplex).
*Apr 23 10:38:45.043: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethernet1/1 (not half duplex), with D1 Ethernet0/2 (half duplex).
*Apr 23 10:39:44.979: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethernet1/1 (not half duplex), with D1 Ethernet0/2 (half duplex).
*Apr 23 10:40:45.051: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethernet1/1 (not half duplex), with D1 Ethernet0/2 (half duplex).
*Apr 23 10:41:45.055: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethernet1/1 (not half duplex), with D1 Ethernet0/2 (half duplex).
*Apr 23 10:42:45.051: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethernet1/1 (not half duplex), with D1 Ethernet0/2 (half duplex).
R1, ENCOR Skills Assessment, Scenario 2
User Access Verification
Username:
Username: admin
Password:
% Authentication failed
Username: 
```

Fuente: elaboración propia a partir de pantallazo de GNS3

## R2

Conf term

```
enable secret oswald353
```

```
username admin secret oswald353
```

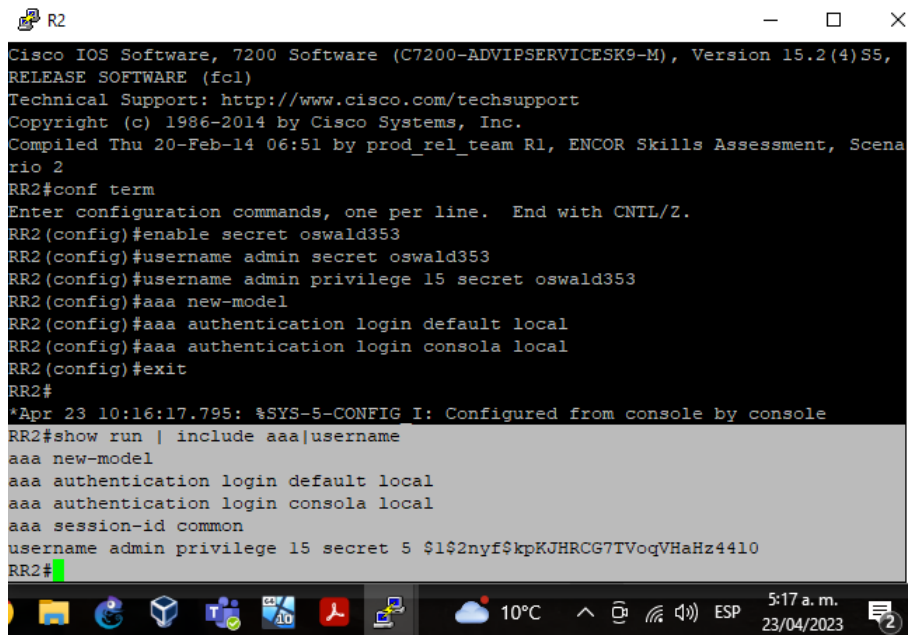
```
username admin privilege 15 secret oswald353
```

```
aaa new-model
```

```
aaa authentication login default local
```

```
aaa authentication login consola local
```

Figura 53. Configuración correcta de seguridad en R2



```
R2
Cisco IOS Software, 7200 Software (C7200-ADVIPSERVICESK9-M), Version 15.2(4)S5,
RELEASE SOFTWARE (fcl)
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 1986-2014 by Cisco Systems, Inc.
Compiled Thu 20-Feb-14 06:51 by prod_rel_team R1, ENCOR Skills Assessment, Scenario 2
RR2#conf term
Enter configuration commands, one per line. End with CNTL/Z.
RR2(config)#enable secret oswald353
RR2(config)#username admin secret oswald353
RR2(config)#username admin privilege 15 secret oswald353
RR2(config)#aaa new-model
RR2(config)#aaa authentication login default local
RR2(config)#aaa authentication login consola local
RR2(config)#exit
RR2#
*Apr 23 10:16:17.795: %SYS-5-CONFIG I: Configured from console by console
RR2#show run | include aaa|username
aaa new-model
aaa authentication login default local
aaa authentication login consola local
aaa session-id common
username admin privilege 15 secret 5 $1$2nyf$kpKJHRCG7TVoqVHaHz4410
RR2#
```

Fuente: elaboración propia a partir de pantallazo de GNS3



## R3

Conf term

```
enable secret oswald353
```

```
username admin secret oswald353
```

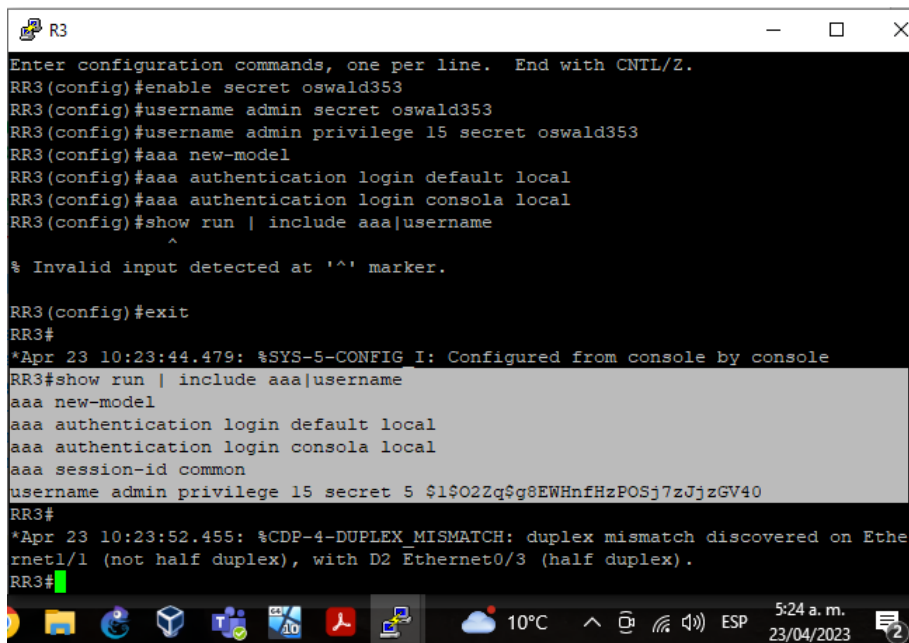
```
username admin privilege 15 secret oswald353
```

```
aaa new-model
```

```
aaa authentication login default local
```

```
aaa authentication login consola local
```

Figura 56. Configuración correcta de seguridad en R3 verificada con show run | include aaa|username



```
R3
Enter configuration commands, one per line. End with CNTL/Z.
RR3(config)#enable secret oswald353
RR3(config)#username admin secret oswald353
RR3(config)#username admin privilege 15 secret oswald353
RR3(config)#aaa new-model
RR3(config)#aaa authentication login default local
RR3(config)#aaa authentication login consola local
RR3(config)#show run | include aaa|username
^
% Invalid input detected at '^' marker.

RR3(config)#exit
RR3#
*Apr 23 10:23:44.479: %SYS-5-CONFIG I: Configured from console by console
RR3#show run | include aaa|username
aaa new-model
aaa authentication login default local
aaa authentication login consola local
aaa session-id common
username admin privilege 15 secret 5 $1$O2Zq$g8EWHnfHzPOSj7zJjzGV40
RR3#
*Apr 23 10:23:52.455: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethe
rnet1/1 (not half duplex), with D2 Ethernet0/3 (half duplex).
RR3#
```

Fuente: elaboración propia a partir de pantallazo de GNS3



## D1

Conf term

```
enable secret oswald353
```

```
username admin secret oswald353
```

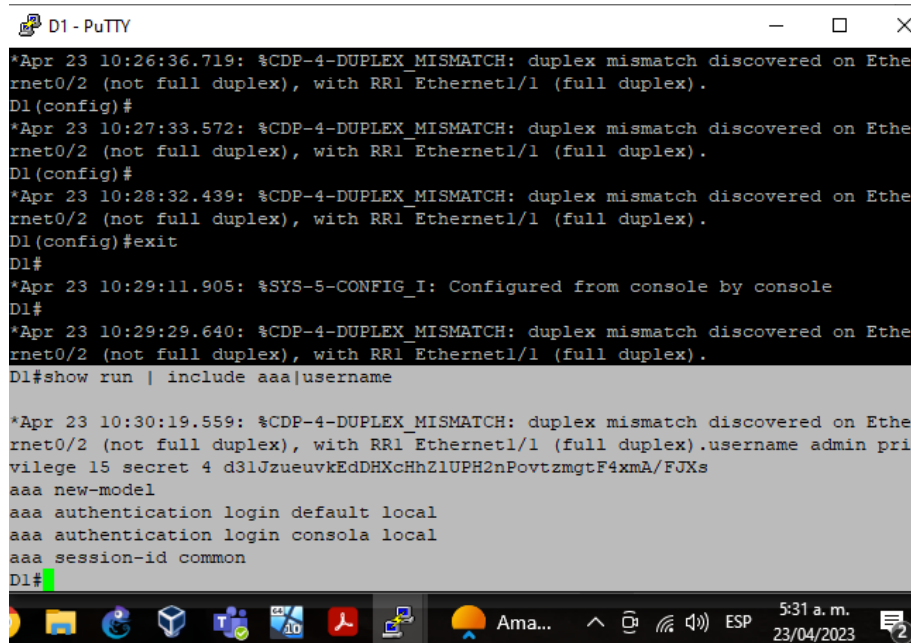
```
username admin privilege 15 secret oswald353
```

```
aaa new-model
```

```
aaa authentication login default local
```

```
aaa authentication login consola local
```

Figura 59. Configuración correcta de seguridad en D1 verificada con `show run | include aaa|username`

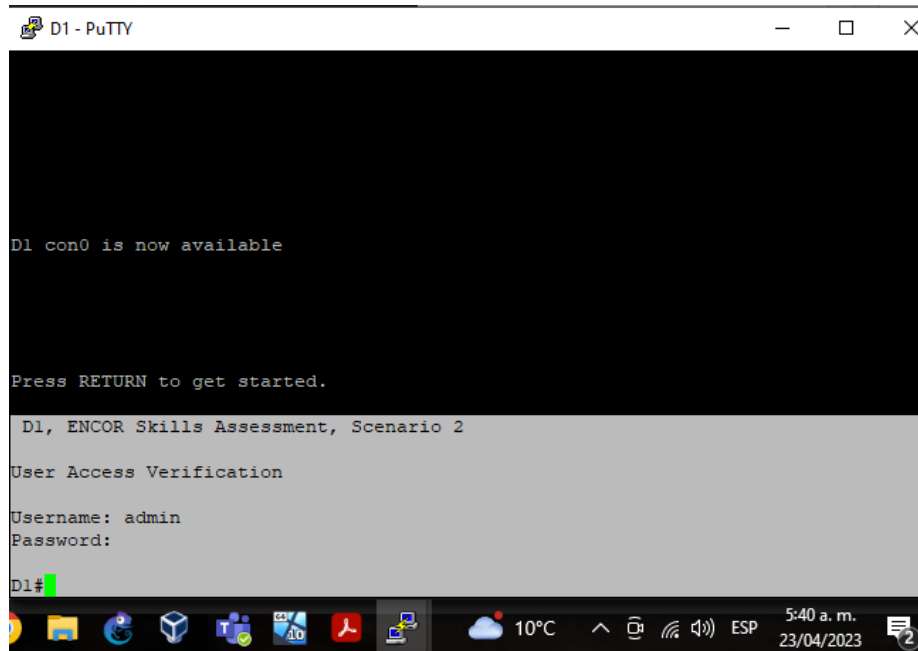


```
D1 - PuTTY
*Apr 23 10:26:36.719: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethe
rnet0/2 (not full duplex), with RR1 Ethernet1/1 (full duplex).
D1(config)#
*Apr 23 10:27:33.572: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethe
rnet0/2 (not full duplex), with RR1 Ethernet1/1 (full duplex).
D1(config)#
*Apr 23 10:28:32.439: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethe
rnet0/2 (not full duplex), with RR1 Ethernet1/1 (full duplex).
D1(config)#exit
D1#
*Apr 23 10:29:11.905: %SYS-5-CONFIG_I: Configured from console by console
D1#
*Apr 23 10:29:29.640: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethe
rnet0/2 (not full duplex), with RR1 Ethernet1/1 (full duplex).
D1#show run | include aaa|username

*Apr 23 10:30:19.559: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethe
rnet0/2 (not full duplex), with RR1 Ethernet1/1 (full duplex).username admin pri
vilege 15 secret 4 d3lJzueuvkEdDHXcHhZ1UPH2nPovtzmgtF4xmA/FJXs
aaa new-model
aaa authentication login default local
aaa authentication login consola local
aaa session-id common
D1#
```

Fuente: elaboración propia a partir de pantallazo de GNS3

Figura 60.Verificación de autenticación en switch D1



Fuente: elaboración propia a partir de pantallazo de GNS3

## D2

Conf term

```
enable secret oswald353
```

```
username admin secret oswald353
```

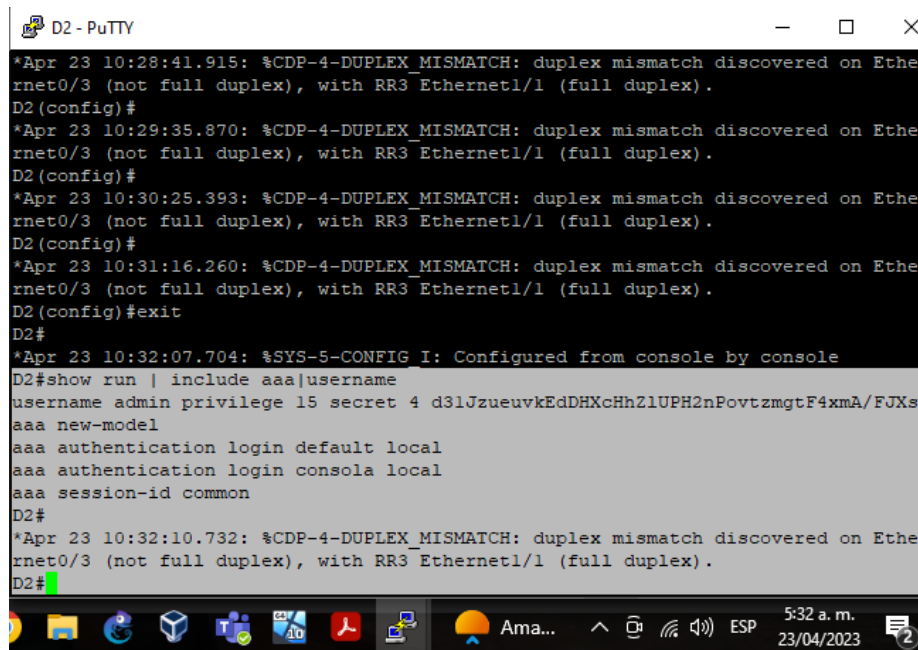
```
username admin privilege 15 secret oswald353
```

```
aaa new-model
```

```
aaa authentication login default local
```

```
aaa authentication login consola local
```

Figura 61. Configuración correcta de seguridad en D2 verificada con show run | include aaa|username



```
D2 - PuTTY
*Apr 23 10:28:41.915: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethe
rnet0/3 (not full duplex), with RR3 Ethernet1/1 (full duplex).
D2(config)#
*Apr 23 10:29:35.870: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethe
rnet0/3 (not full duplex), with RR3 Ethernet1/1 (full duplex).
D2(config)#
*Apr 23 10:30:25.393: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethe
rnet0/3 (not full duplex), with RR3 Ethernet1/1 (full duplex).
D2(config)#
*Apr 23 10:31:16.260: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethe
rnet0/3 (not full duplex), with RR3 Ethernet1/1 (full duplex).
D2(config)#exit
D2#
*Apr 23 10:32:07.704: %SYS-5-CONFIG I: Configured from console by console
D2#show run | include aaa|username
username admin privilege 15 secret 4 d31JzueuvkEdDHXcHhZ1UPH2nPovtzmgtF4xmA/FUXs
aaa new-model
aaa authentication login default local
aaa authentication login consola local
aaa session-id common
D2#
*Apr 23 10:32:10.732: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on Ethe
rnet0/3 (not full duplex), with RR3 Ethernet1/1 (full duplex).
D2#
```

Fuente: elaboración propia a partir de pantallazo de GNS3

## A1

Conf term

enable secret oswald353

username admin secret oswald353

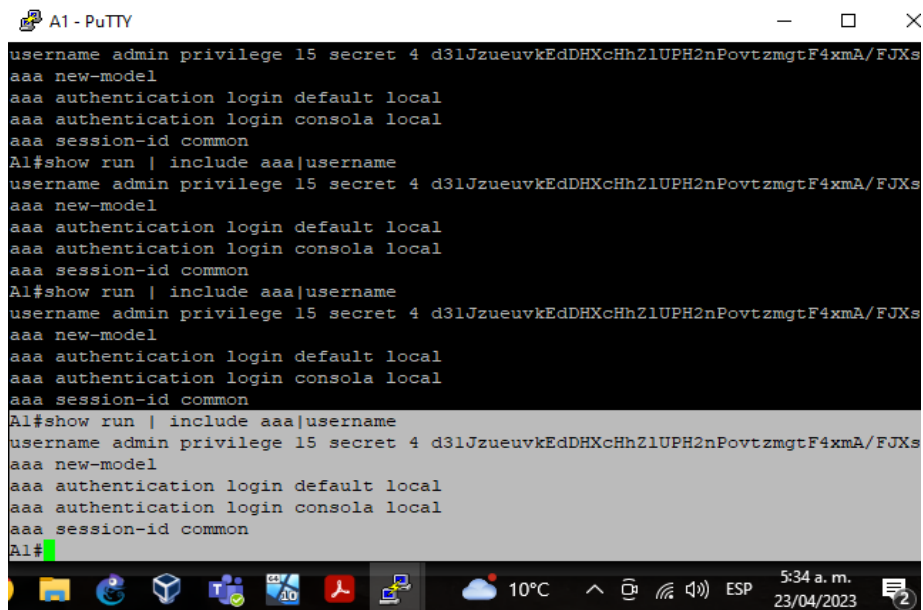
username admin privilege 15 secret oswald353

aaa new-model

aaa authentication login default local

aaa authentication login consola local

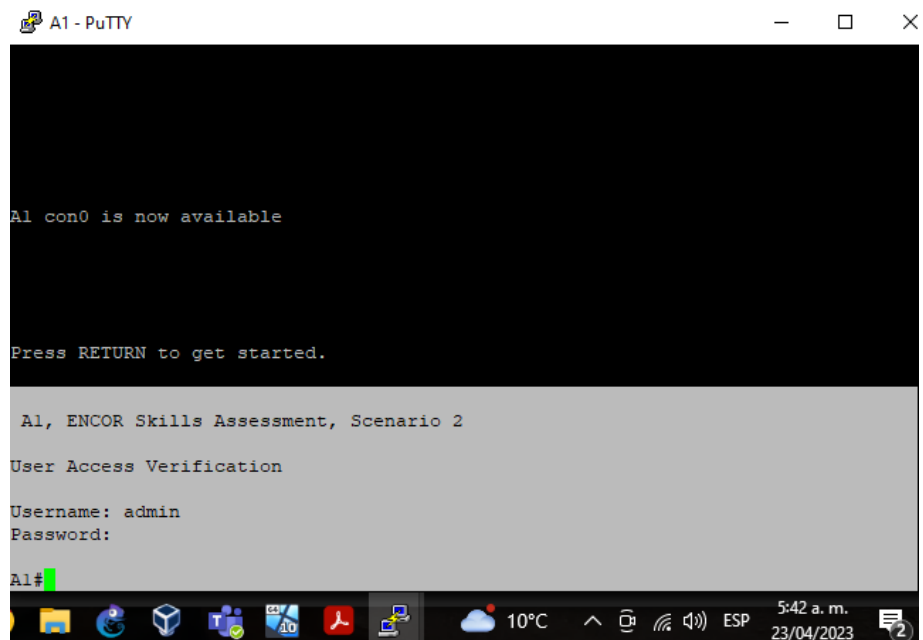
Figura 62. Configuración correcta de seguridad en A1 verificada con show run | include aaa|username



```
A1 - PuTTY
username admin privilege 15 secret 4 d31JzueuvkEdDHXcHhZ1UPH2nPovtzmgtF4xmA/FJXs
aaa new-model
aaa authentication login default local
aaa authentication login consola local
aaa session-id common
Al#show run | include aaa|username
username admin privilege 15 secret 4 d31JzueuvkEdDHXcHhZ1UPH2nPovtzmgtF4xmA/FJXs
aaa new-model
aaa authentication login default local
aaa authentication login consola local
aaa session-id common
Al#show run | include aaa|username
username admin privilege 15 secret 4 d31JzueuvkEdDHXcHhZ1UPH2nPovtzmgtF4xmA/FJXs
aaa new-model
aaa authentication login default local
aaa authentication login consola local
aaa session-id common
Al#
```

Fuente: elaboración propia a partir de pantallazo de GNS3

Figura 63. Verificación de autenticación en switch A1



```
A1 - PuTTY

A1 con0 is now available

Press RETURN to get started.

A1, ENCOR Skills Assessment, Scenario 2

User Access Verification

Username: admin
Password:

Al#
```

Fuente: elaboración propia a partir de pantallazo de GNS3

## CONCLUSIONES

Se conocieron las diferencias entre nivel capa 2 y nivel capa 3, donde capa 2 enmarca la gestión de equipos a partir de las MAC sin tener en cuenta la IP, mientras que nivel capa 3 ejecuta funciones de enrutamiento estático y dinámico, además de relacionar direcciones MAC con tablas de enrutamiento IP. En tal sentido, **VRF** es una segmentación a nivel de capa tres, mientras que las Vlan están en capa 2.

Se abordó la temática relacionada con **VRF** Virtual Routing and Forwarding, lo cual significa Enrutamiento Virtual y Reenvío, siendo esta una tecnología que permite crear instancias de Router virtuales en una misma plataforma física, tal como se haría con un computador o servidor al crear máquinas virtuales dentro de su sistema operativo. Las instancias virtuales se crean usando las interfaces físicas del router, es decir conexiones de un cable físico con dos sub-interfaces o interfaces virtuales, cuya interfaz física se debe habilitar, sin embargo, dos interfaces de red no pueden pertenecer al mismo segmento porque aparece un error.

Las VRF o segmentaciones se hacen para aislar el tráfico cuando no se necesita que redes virtuales conectadas a un mismo router se comuniquen entre sí, esto se hace por seguridad y privacidad a la hora de enviar paquetes, direccionándolos a los usuarios finales que lo necesitan.

Se trabajó con la creación de VLANs y la configuración de interfaces de router, donde se hizo necesario realizar enrutamiento estático en cada router, para poder comunicar diferentes redes, compartiendo recursos de una misma topología dividida en varias redes.

Se configuraron los dispositivos activos tipo Switch donde se incluyó comandos para ajustar puertos troncales y puertos de acceso, donde se logró la redundancia de rutas y paso de vlan 13 y vlan 8, según los requerimientos y la esencia de la guía de actividades.

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