

INFORME PRUEBAS DE HABILIDADES PRÁCTICAS CCNA

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**UNIVERSIDAD NACIONAL ABIERTA Y A DISTANCIA UNAD
FACULTAD DE CIENCIAS BÁSICAS E INGENIERÍA
PROGRAMA DE INGENIERÍA ELECTÓNICA
MEDELLÍN
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INTRODUCCIÓN

Desde hace tres décadas que la comunidad científica comenzó a buscar la forma de compartir información de forma rápida y efectiva, el internet ha evolucionado a pasos agigantados. La primera red que permitió la comunicación entre muchas universidades desarrolló la conmutación de paquetes los cuáles podían tomar diversos caminos dependiendo de la saturación de la red.

Con la expansión de las redes fue necesario implementar protocolos y estándares que permitieran la comunicación entre diversos dispositivos. El protocolo TCP/IP define cuidadosamente como se mueve la información desde el remitente hasta el usuario, mediante la aplicación de capas.

El routing consiste en mover paquetes o información a nivel de una red de internet hasta otra, buscando un camino entre todos los posibles por diferentes topologías que poseen gran conectividad. Se consideran parámetros como el número de saltos (los equipos por donde pasa el paquete de un punto a otro de la red), el tiempo de retardo, y el coste de comunicación de un paquete transmitido.

También es importante tener en cuenta la seguridad de la información, por lo que se deben implementar soluciones en varias capas puesto que no existe una solución única y el conocer como parametrizar los routers y switches permite mejorar la seguridad de la red.

En el presente trabajo se encuentra el desarrollo de dos escenarios que hacen parte del diplomado de profundización de Switching and Routing (CCNA 1 y CCNA 2) de CISCO de la Universidad Nacional Abierta y a Distancia UNAD del programa ingeniería electrónica. Mediante el análisis de los dos escenarios se pretende validar los conceptos y destrezas del software de simulación y de la solución de problemas en los elementos que componen las redes de datos.

1. DESARROLLO DE LOS ESCENARIOS

1.1 Escenario 1.

Topología:

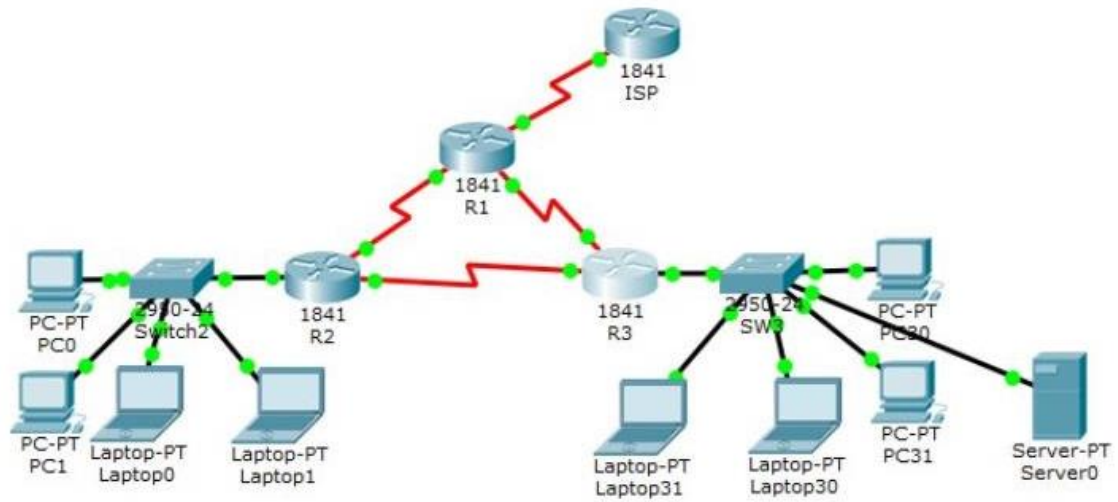


Figura 1 Topología

Tabla de direccionamiento:

El administrador	Interfaces	Dirección IP	Máscara de subred	Gateway predeterminado
ISP	S0/0/0	200.123.211.1	255.255.255.0	N/D
R1	Se0/0/0	200.123.211.2	255.255.255.0	N/D
	Se0/1/0	10.0.0.1	255.255.255.252	N/D
	Se0/1/1	10.0.0.5	255.255.255.252	N/D
R2	Fa0/0,100	192.168.20.1	255.255.255.0	N/D
	Fa0/0,200	192.168.21.1	255.255.255.0	N/D
	Se0/0/0	10.0.0.2	255.255.255.252	N/D
	Se0/0/1	10.0.0.9	255.255.255.252	N/D
R3	Fa0/0	192.168.30.1	255.255.255.0	N/D
		2001::db8:130::9C0:80F:301	/64	N/D
	Se0/0/0	10.0.0.6	255.255.255.252	N/D
	Se0/0/1	10.0.0.10	255.255.255.252	N/D
SW2	VLAN 100	N/D	N/D	N/D
	VLAN 200	N/D	N/D	N/D
SW3	VLAN1	N/D	N/D	N/D
PC20	NIC	DHCP	DHCP	DHCP
PC21	NIC	DHCP	DHCP	DHCP
PC30	NIC	DHCP	DHCP	DHCP
PC31	NIC	DHCP	DHCP	DHCP
Laptop20	NIC	DHCP	DHCP	DHCP
Laptop21	NIC	DHCP	DHCP	DHCP
Laptop30	NIC	DHCP	DHCP	DHCP
Laptop31	NIC	DHCP	DHCP	DHCP

Figura 2 Tabla de direcciones

Tabla de asignación de VLAN's y puertos

Dispositivo	VLAN	Nombre	Interfaz
SW2	100	LAPTOPS	Fa0/2-3
SW2	200	DESTOPS	Fa0/4-5
SW3	1	-	Todas las interfaces

Figura 3 Asignación de VLAN's

Tabla de enlaces troncales:

Dispositivo local	Interfaz local	Dispositivo remoto
SW2	Fa0/2-3	100

Figura 4 Enlaces

Descripción de la actividad:

- 1.1.1 SW2 VLAN y las asignaciones de puertos de VLAN deben cumplir con la tabla 1.

```

SW2(config)#vlan 100
SW2(config-vlan)#name LAPTOPS
SW2(config-vlan)#EXIT
SW2(config)#vlan 200
SW2(config-vlan)#name DESTOPS
SW2(config-vlan)#EXIT
SW2(config)#interface range fa0/2-3
SW2(config-if-range)#switchport access vlan 100
SW2(config-if-range)#exit
SW2(config)#interface range fa0/4-5
SW2(config-if-range)#switchport mode access
SW2(config-if-range)#switchport access vlan 200
SW2(config-if-range)#exit
SW2(config)#interface range fa0/4-5
SW2(config-if-range)#switchport mode trunk
SW2(config-if-range)#exit

```

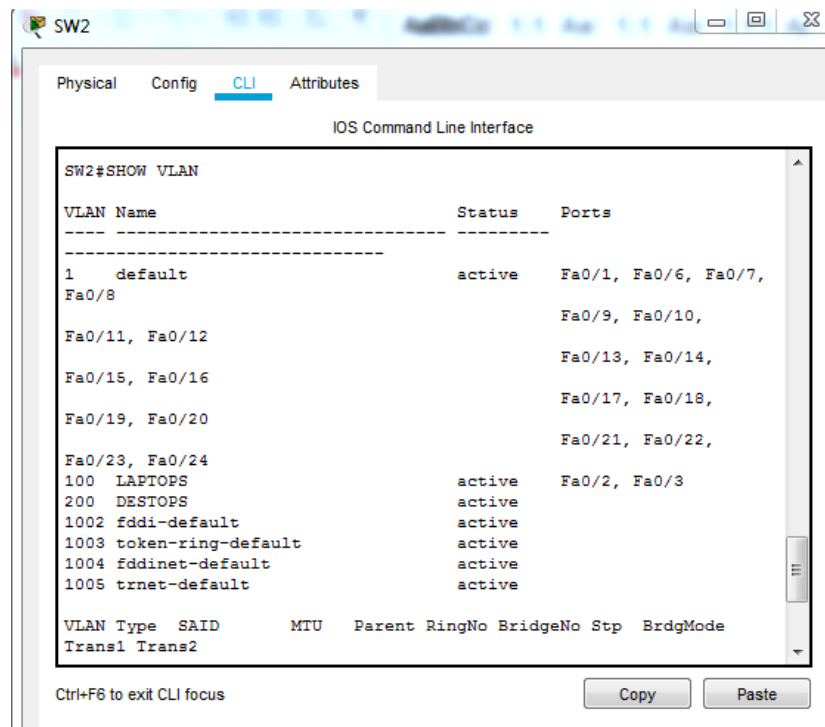


Figura 5 Configuración de interfaces SW2

SW3(config)#interface range fa0/1-24
 SW3(config-if-range)#switchport mode acces
 SW3(config-if-range)#switchport access vlan 1

Verificación:

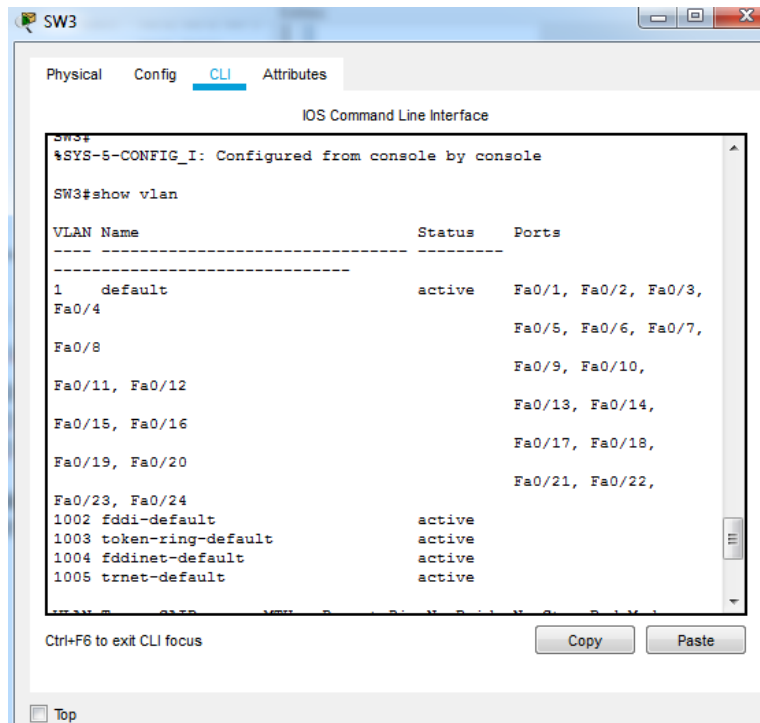


Figura 6 Configuración de interfaces SW3

1.1.2 Deshabilitar los puertos de red que no se utilizan.

Para el suiche 2:

```
SW2(config)#interface range fa0/6-24
SW2(config-if-range)#shutdown
```

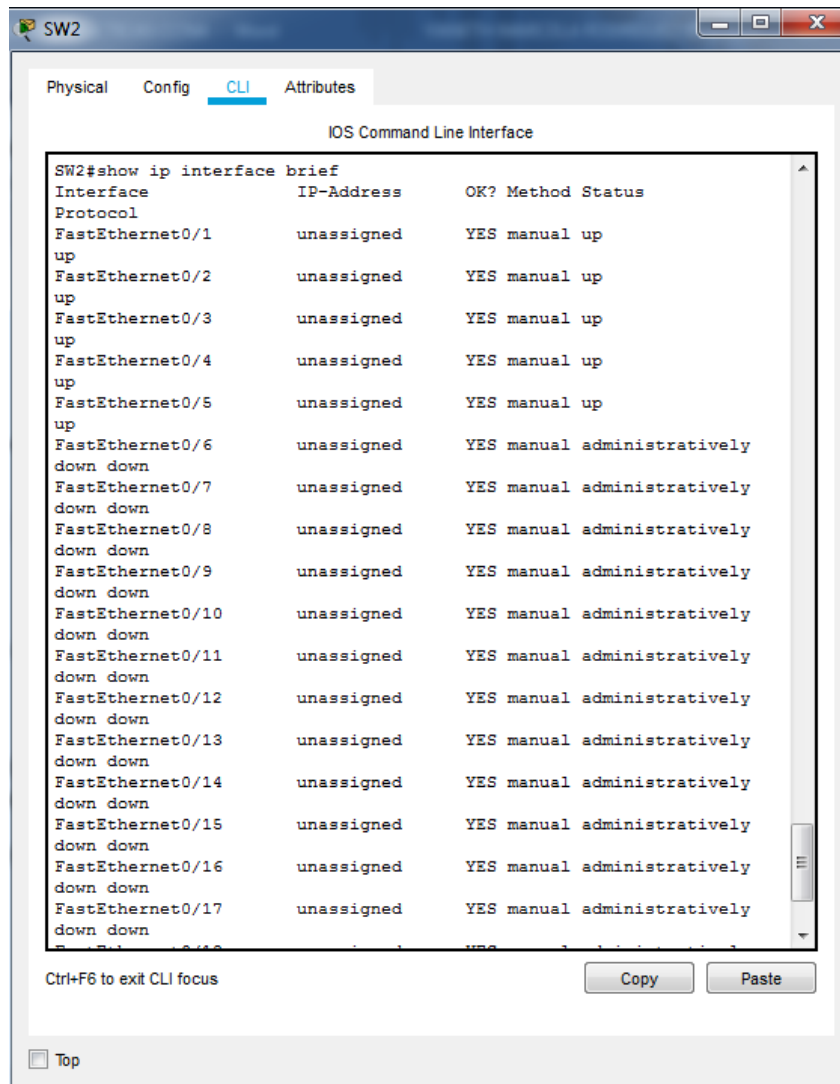


Figura 7 Puertos deshabilitados SW2

Para el suiche 3:
 SW3(config)#interface range fa0/7-24
 SW3(config-if-range)#shutdown

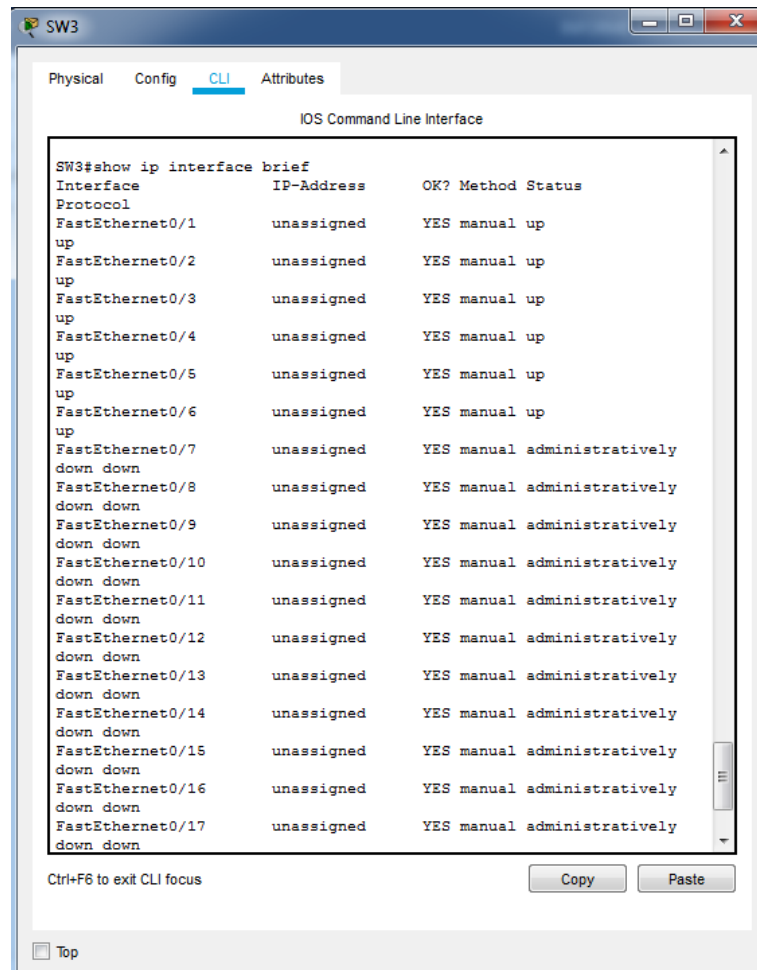


Figura 8 Puertos deshabilitados SW3

1.1.3 La información de dirección IP R1, R2 y R3 debe cumplir con la tabla 1.

Configuración del router 1:

Router>enable

Router#configure terminal

Router(config)#hostname R1

R1(config)#interface s0/0/0

R1(config-if)#ip address 200.123.211.2 255.255.255.0

R1(config-if)#clock rate 19200

R1(config-if)#no shutdown

R1(config)#interface s0/1/0

```
R1(config-if)#ip address 10.0.0.1 255.255.255.252
R1(config-if)#no shutdown
```

```
R1(config)#interface s0/1/1
R1(config-if)#ip address 10.0.0.5 255.255.255.252
R1(config-if)#clock rate 19200
R1(config-if)#no shutdown
```

Para el router 2:

```
R2(config)#interface s0/0/0
R2(config-if)#ip address 10.0.0.2 255.255.255.252
R2(config-if)#clock rate 19200
R2(config-if)#no shutdown
```

```
R2(config)#interface s0/0/1
R2(config-if)#ip address 10.0.0.9 255.255.255.252
R2(config-if)#clock rate 19200
R2(config-if)#no shutdown
R2#configure terminal
R2(config)#interface fa0/0.100
R2(config-subif)#encapsulation dot1Q 100
R2(config-subif)#ip address 192.168.20.1 255.255.255.0
R2(config-subif)#interface fa0/0.200
R2(config-subif)#encapsulation dot1Q 200
R2(config-subif)#ip address 192.168.21.1 255.255.255.0
```

Activación del Puerto:

```
R2(config)#interface fa0/0
R2(config-if)#no shutdown
```

Verificación:


```

R2#show ip interface brief
Interface          IP-Address      OK? Method Status
Protocol
FastEthernet0/0    unassigned      YES NVRAM  up
up
FastEthernet0/0.100 192.168.20.1   YES manual up
up
FastEthernet0/0.200 192.168.21.1   YES manual up
up
FastEthernet0/1     unassigned      YES NVRAM  administratively
down down
Serial0/0/0         10.0.0.2        YES NVRAM  up
down
Serial0/0/1         10.0.0.9        YES NVRAM  up
up

```

Figura 9 Verificación de puertos R2

Para el router 3:

```

Router>enable
Router#configure terminal
Router(config)#hostname R3

```

Para la IPv4

```

R3(config)#interface fa0/0
R3(config-if)#ip address 192.168.30.1 255.255.255.0
R3(config-if)#no shutdown

```

Para la IPv6

```

R3(config)#ipv6 unicast-routing
R3(config)#interface fa0/0
R3(config-if)#ipv6 address 2001:db8:130::9c0:80f:301/64
R3(config-if)#no shutdown

```

```

R3(config)#interface s0/0/0
R3(config-if)#ip address 10.0.0.6 255.255.255.252
R3(config-if)#no shutdown

```

```

R3(config)#interface s0/0/1
R3(config-if)#ip address 10.0.0.10 255.255.255.252
R3(config-if)#clock rate 19200
R3(config-if)#no shutdown

```

Verificación de las interfaces IPv4:

```

R3#show ip interface brief
Interface          IP-Address      OK? Method Status
Protocol
FastEthernet0/0    192.168.30.1    YES manual up
up
FastEthernet0/1    unassigned      YES unset  administratively
down down
Serial0/0/0        10.0.0.6        YES manual up
up
Serial0/0/1        10.0.0.10       YES manual down

```

Figura 10 Verificación de puertos R2

Verificación de las interfaces IPv6:

```

R3#show ipv6 interface brief
FastEthernet0/0    [up/up]
FE80::202:4AFF:FE9E:5301
2001:DB8:130::9C0:80F:301

```

Figura 11 Verificación de puertos R3

```

Router>enable
Router#configure terminal
Router(config)#hostname ISP

ISP(config)#interface s0/0/0
ISP(config-if)#ip address 200.123.211.1 255.255.255.0
ISP(config-if)#no shutdown
Verificación:

```

```

ISP#show ip interface brief
Interface          IP-Address      OK? Method Status
Protocol
FastEthernet0/0    unassigned      YES unset  administratively
down down
FastEthernet0/1    unassigned      YES unset  administratively
down down
Serial0/0/0        200.123.211.1   YES manual up

```

Figura 12 Configuración puerto ISP

1.1.4 Laptop20, Laptop21, PC20, PC21, Laptop30, Laptop31, PC30 y PC31 deben obtener información IPv4 del servidor DHCP.

A continuación, se muestra la configuración realizada a cada host:

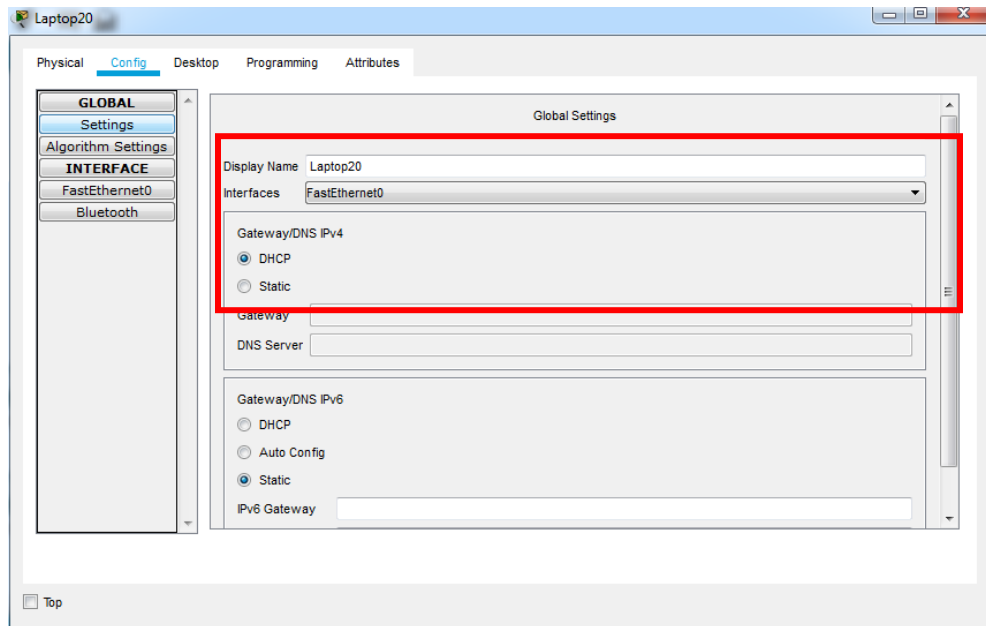


Figura 13 Configuración de puerto Laptop20

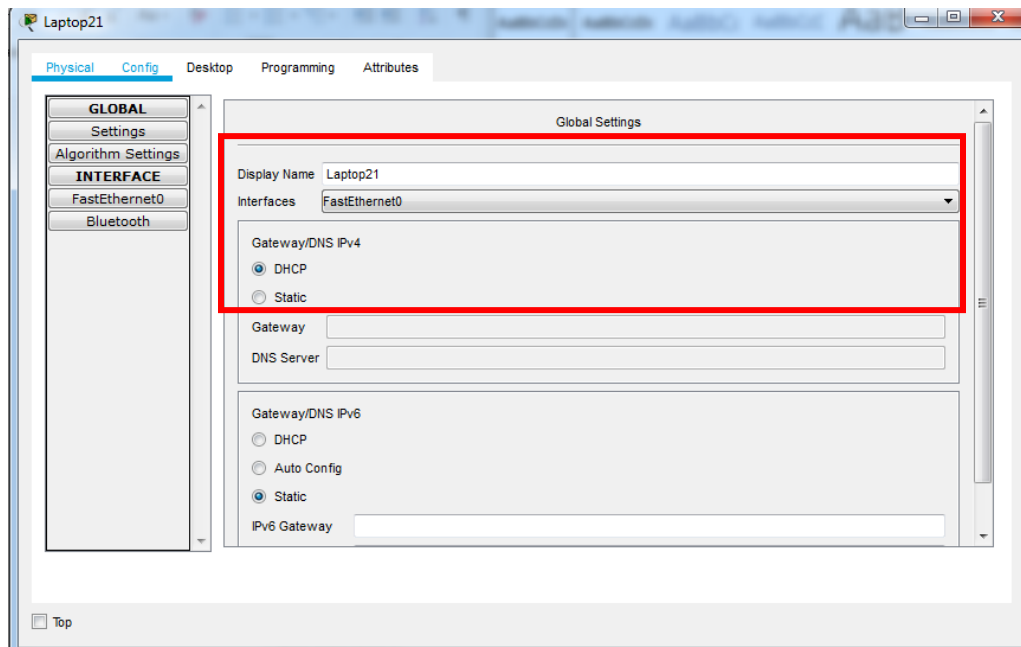


Figura 14 Configuración de puerto Laptop 21

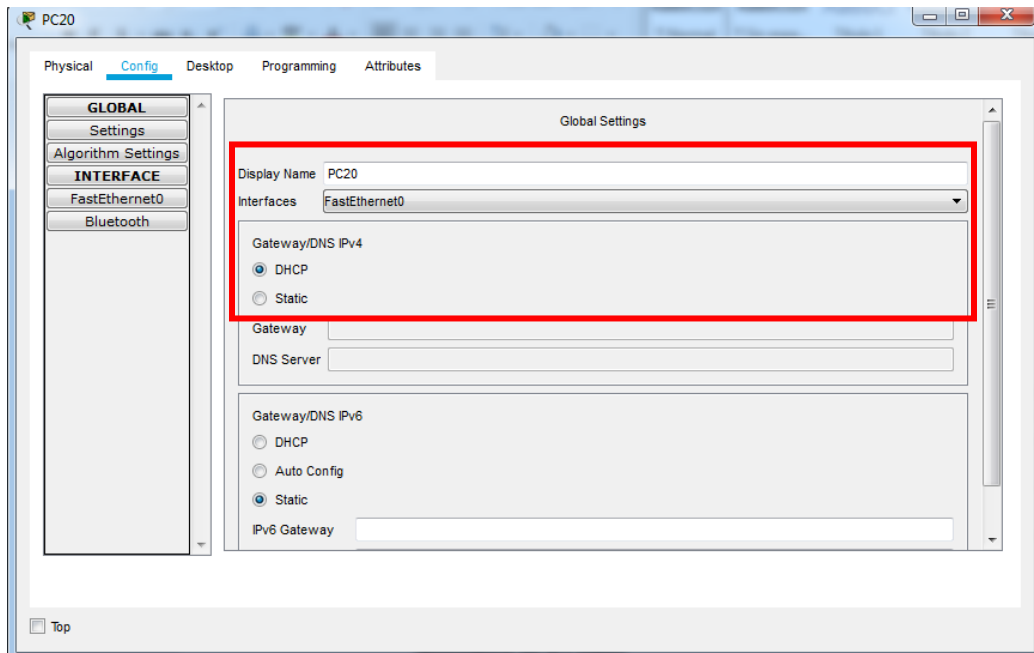


Figura 15 Configuración DHCP PC20

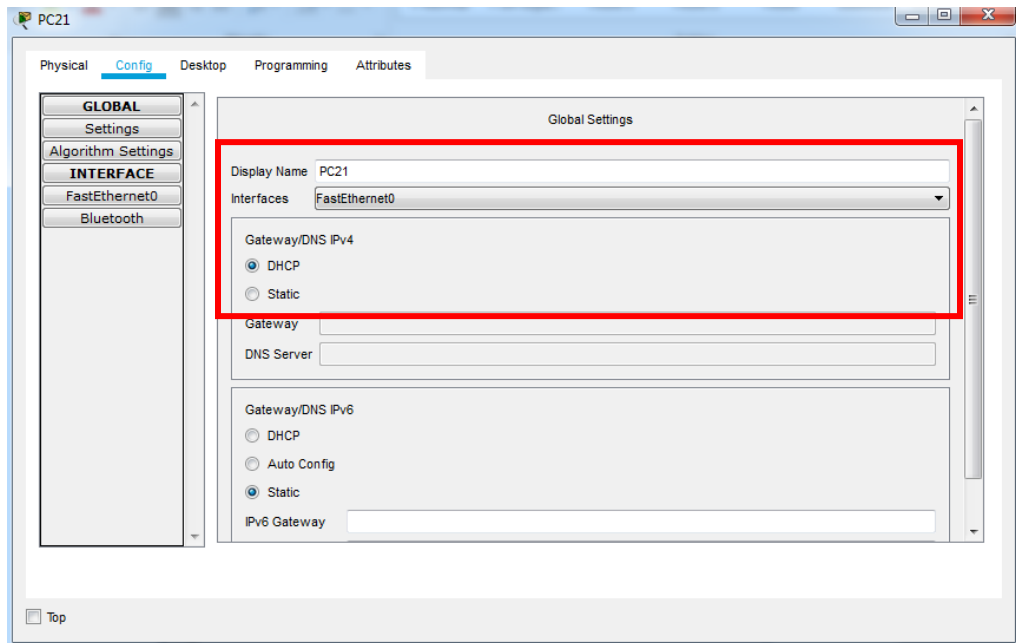


Figura 16 Configuración DHCP PC21

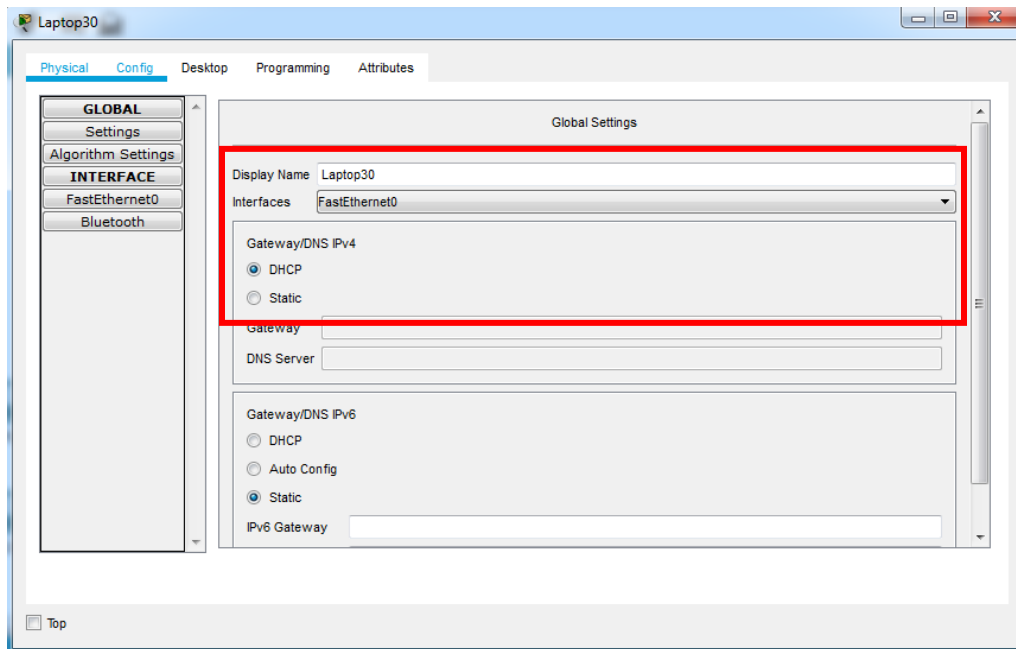


Figura 17 Configuración DHCP Laptop 30

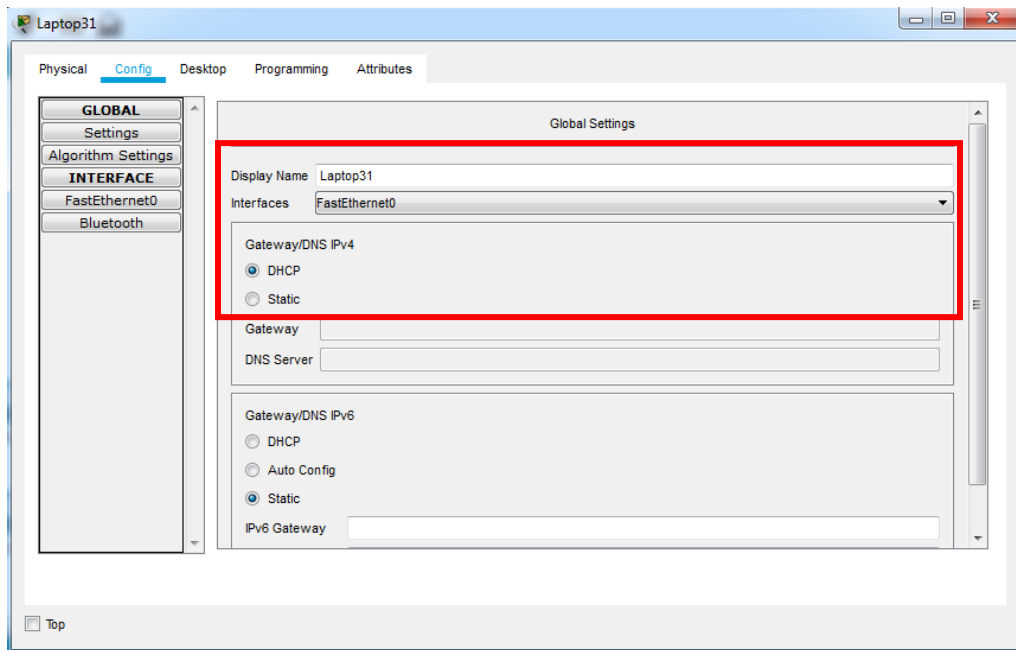


Figura 18 Configuración DHCP Laptop31

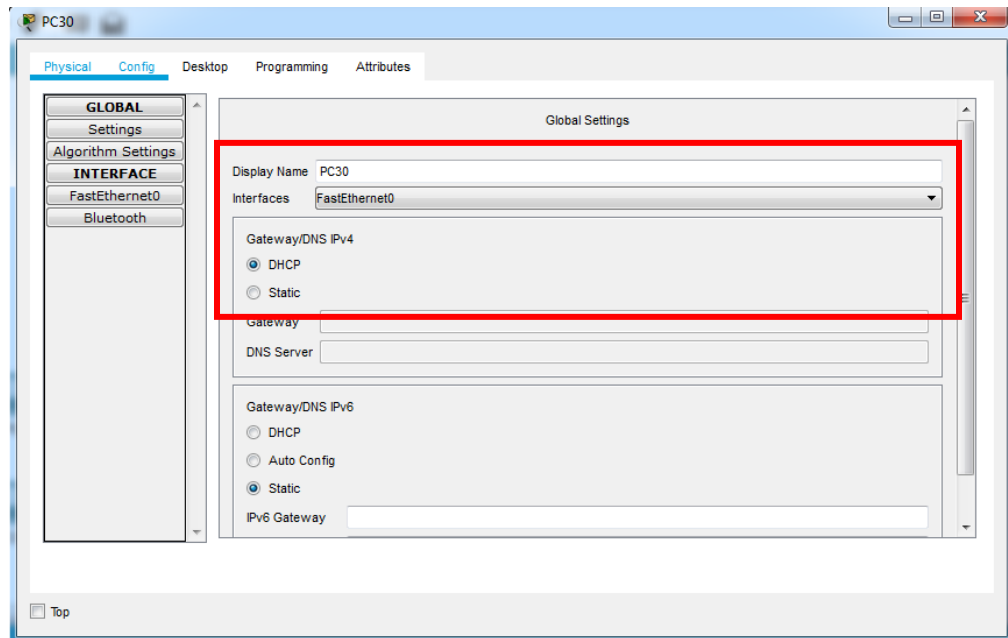


Figura 19 Configuración DHCP PC30

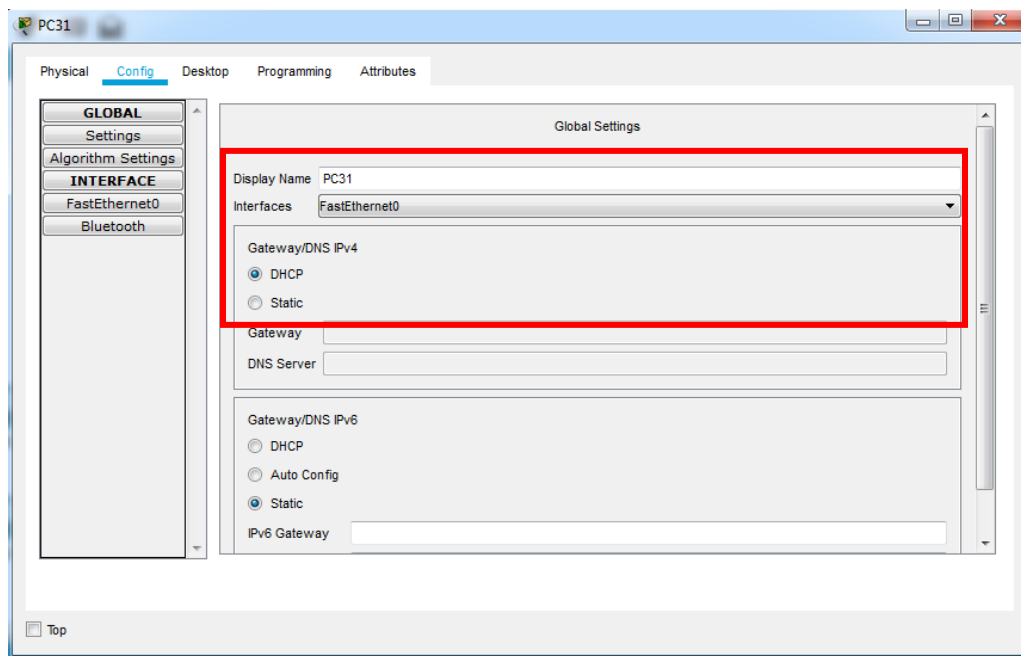


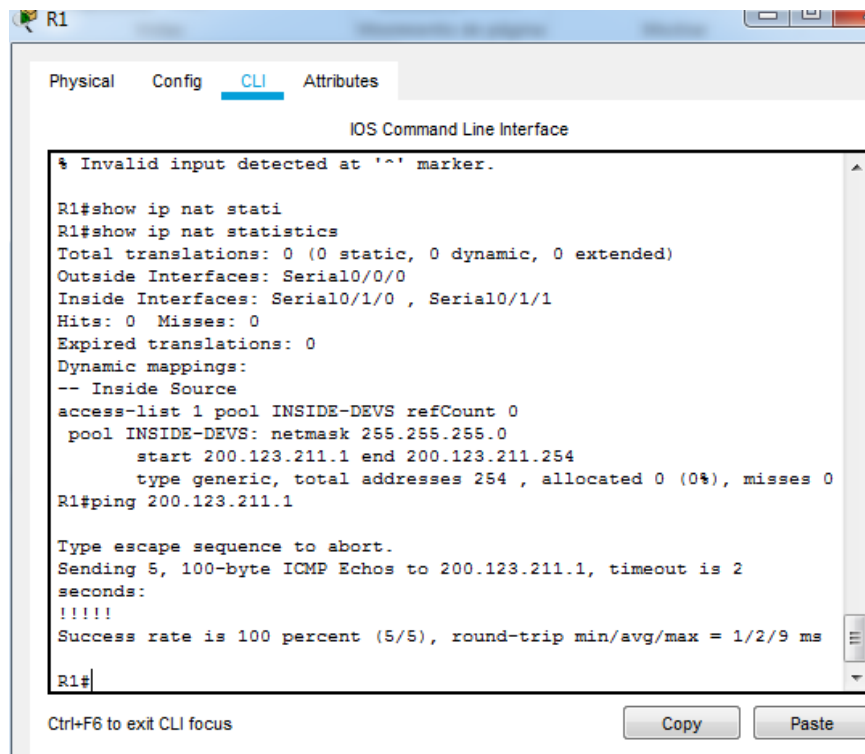
Figura 20 Configuración DHCP PC31

1.1.5 R1 debe realizar una NAT con sobrecarga sobre una dirección IPv4 pública. Asegúrese de que todos los terminales pueden comunicarse con Internet pública (haga ping a la dirección ISP) y la lista de acceso estándar se llama INSIDE-DEVS.

Configuración de la NAT

```
R1(config)#interface s0/1/0
R1(config-if)#ip nat inside
R1(config-if)#exit
R1(config)#interface s0/1/1
R1(config-if)#ip nat inside
R1(config-if)#exit
R1(config)#access-list 1 permit 192.168.0.0 0.0.255.255
R1(config)#ip nat pool INSIDE-DEVS 200.123.211.1 200.123.211.254
netmask 255.255.255.0
R1(config)#ip nat inside source list 1 pool INSIDE-DEVS overload
R1(config)#interface serial 0/0/0
R1(config-if)#ip nat inside
R1(config-if)#interface serial 0/0/0
R1(config-if)#ip nat outside
R1(config-if)#exit
```

Verificación:



```
R1
Physical Config CLI Attributes
IOS Command Line Interface
* Invalid input detected at '^' marker.

R1#show ip nat stati
R1#show ip nat statistics
Total translations: 0 (0 static, 0 dynamic, 0 extended)
Outside Interfaces: Serial0/0/0
Inside Interfaces: Serial0/1/0 , Serial0/1/1
Hits: 0 Misses: 0
Expired translations: 0
Dynamic mappings:
-- Inside Source
access-list 1 pool INSIDE-DEVS refCount 0
pool INSIDE-DEVS: netmask 255.255.255.0
start 200.123.211.1 end 200.123.211.254
type generic, total addresses 254 , allocated 0 (0%), misses 0
R1#ping 200.123.211.1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 200.123.211.1, timeout is 2
seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/2/9 ms

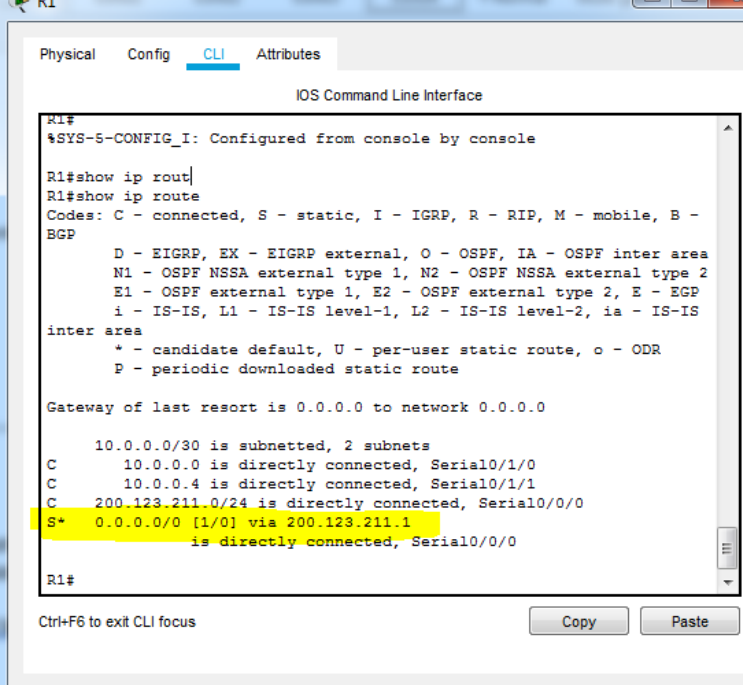
R1#
```

Figura 21 Verificación de NAT

- 1.1.6 R1 debe tener una ruta estática predeterminada al ISP que se configuró y que incluye esa ruta en el dominio RIPv2.

```
R1(config-router)#ip route 0.0.0.0 0.0.0.0 s0/0/0
```

Verificación:



```
R1#
%SYS-5-CONFIG_I: Configured from console by console
R1#show ip route
R1#show ip route
Codes: C - connected, S - static, I - IGRP, 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, E - EGP
      i - IS-IS, 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

Gateway of last resort is 0.0.0.0 to network 0.0.0.0

  10.0.0.0/30 is subnetted, 2 subnets
C    10.0.0.0 is directly connected, Serial0/1/0
C    10.0.0.4 is directly connected, Serial0/1/1
C    200.123.211.0/24 is directly connected, Serial0/0/0
S*  0.0.0.0/0 [1/0] via 200.123.211.1
      is directly connected, Serial0/0/0

R1#
```

Figura 22 Verificación ruta estática

- 1.1.7 R2 es un servidor de DHCP para los dispositivos conectados al puerto FastEthernet0/0.

```
R2(config)#ip dhcp excluded-address 10.0.0.2 10.0.0.9
R2(config)#ip dhcp pool INSIDE-DEVS
R2(dhcp-config)#network 192.168.21.100 255.255.255.0
R2(dhcp-config)#default-router 192.168.1.1
R2(dhcp-config)#dns-server 0.0.0.0
R2(dhcp-config)#exit
R2(config)#ip dhcp pool LAPTOPS
R2(dhcp-config)#network 192.168.20.100 255.255.255.0
R2(dhcp-config)#default-router 192.168.1.1
R2(dhcp-config)#dns-server 0.0.0.0
R2(dhcp-config)#exit
```


- 1.1.8 R2 debe, además de enrutamiento a otras partes de la red, ruta entre las VLAN 100 y 200.

```
R2(config)#int vlan 100
R2(config-if)#ip address 192.168.20.1 255.255.255.0
% 192.168.20.0 overlaps with FastEthernet0/0.100
R2(config-if)#exit
R2(config)#int vlan 200
R2(config-if)#ip address 192.168.21.1 255.255.255.0
% 192.168.21.0 overlaps with FastEthernet0/0.200
R2(config-if)#end
```

- 1.1.9 El Servidor0 es sólo un servidor IPv6 y solo debe ser accesibles para los dispositivos en R3 (ping).

```
R3(config)#ipv6 unicast-routing
R3(config)#int f0/0
R3(config-if)#ipv6 address 200:db8:130::9c0:80f:301/64
R3(config-if)#exit
```

Verificación de ping:

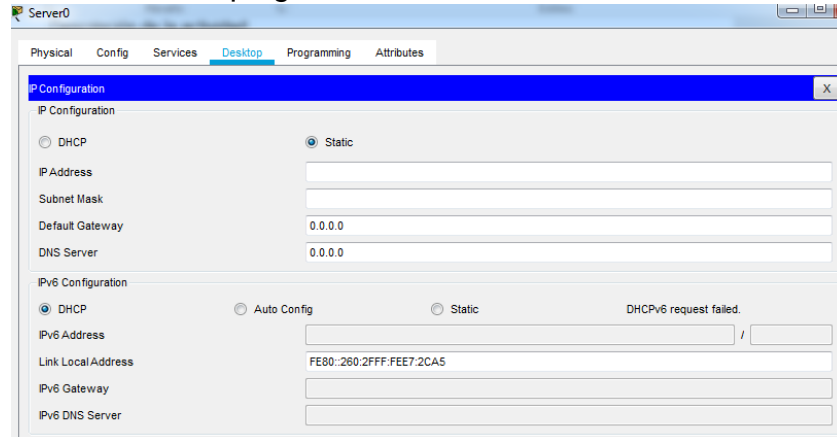


Figura 23 IPV6 del Server0

```
C:\>ping fe80::260:2fff:fee7:2ca5

Pinging fe80::260:2fff:fee7:2ca5 with 32 bytes of data:

Reply from FE80::260:2FFF:FEE7:2CA5: bytes=32 time=1ms TTL=128
Reply from FE80::260:2FFF:FEE7:2CA5: bytes=32 time<1ms TTL=128
Reply from FE80::260:2FFF:FEE7:2CA5: bytes=32 time<1ms TTL=128
Reply from FE80::260:2FFF:FEE7:2CA5: bytes=32 time<1ms TTL=128

Ping statistics for FE80::260:2FFF:FEE7:2CA5:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms
```

Figura 24 Verificación de ping a Server0 desde Laptop 31

```
Packet Tracer PC Command Line 1.0
C:\>ping fe80::260:2fff:fee7:2ca5

Pinging fe80::260:2fff:fee7:2ca5 with 32 bytes of data:

Reply from FE80::260:2FFF:FEE7:2CA5: bytes=32 time=12ms TTL=128
Reply from FE80::260:2FFF:FEE7:2CA5: bytes=32 time<1ms TTL=128
Reply from FE80::260:2FFF:FEE7:2CA5: bytes=32 time<1ms TTL=128
Reply from FE80::260:2FFF:FEE7:2CA5: bytes=32 time<1ms TTL=128

Ping statistics for FE80::260:2FFF:FEE7:2CA5:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 12ms, Average = 3ms
```

Figura 25 Verificación de ping a Server0 desde Laptop 30

```
PC30
Physical Config Desktop Programming Attributes
Command Prompt
C:\>ping fe80::260:2fff:fee7:2ca5

Pinging fe80::260:2fff:fee7:2ca5 with 32 bytes of data:

Reply from FE80::260:2FFF:FEE7:2CA5: bytes=32 time=12ms TTL=128
Reply from FE80::260:2FFF:FEE7:2CA5: bytes=32 time<1ms TTL=128
Reply from FE80::260:2FFF:FEE7:2CA5: bytes=32 time<1ms TTL=128
Reply from FE80::260:2FFF:FEE7:2CA5: bytes=32 time<1ms TTL=128

Ping statistics for FE80::260:2FFF:FEE7:2CA5:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 12ms, Average = 3ms
```

Figura 26 Verificación de ping a Server0 desde PC30

```
PC31
Physical Config Desktop Programming Attributes
Command Prompt
Packet Tracer PC Command Line 1.0
C:\>ping fe80::260:2fff:fee7:2ca5

Pinging fe80::260:2fff:fee7:2ca5 with 32 bytes of data:

Reply from FE80::260:2FFF:FEE7:2CA5: bytes=32 time=12ms TTL=128
Reply from FE80::260:2FFF:FEE7:2CA5: bytes=32 time<1ms TTL=128
Reply from FE80::260:2FFF:FEE7:2CA5: bytes=32 time<1ms TTL=128
Reply from FE80::260:2FFF:FEE7:2CA5: bytes=32 time<1ms TTL=128

Ping statistics for FE80::260:2FFF:FEE7:2CA5:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 12ms, Average = 3ms
```

Figura 27 Verificación de ping a Server0 desde PC31

Adicionalmente se verifica que desde un pc que se encuentra fuera del router 3 no hay ping con el Server0

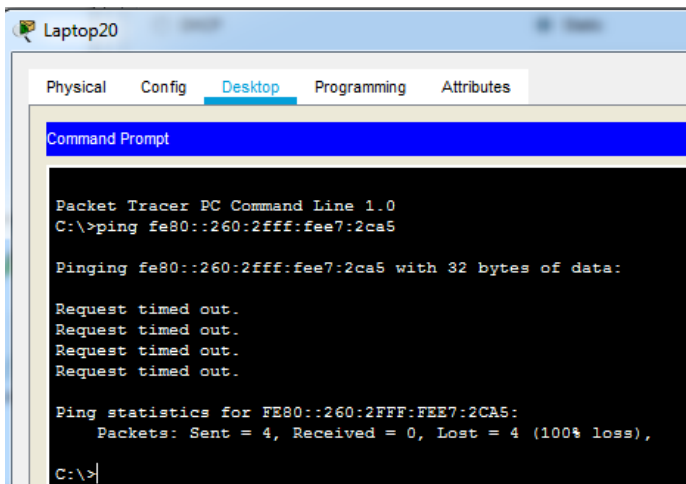


Figura 28 Verificación de No ping a Server0 desde Laptop 20

1.1.10 La NIC instalado en direcciones IPv4 e IPv6 de Laptop30, de Laptop31, de PC30 y obligación de configurados PC31 simultáneas (dual-stack). Las direcciones se deben configurar mediante DHCP y DHCPv6.

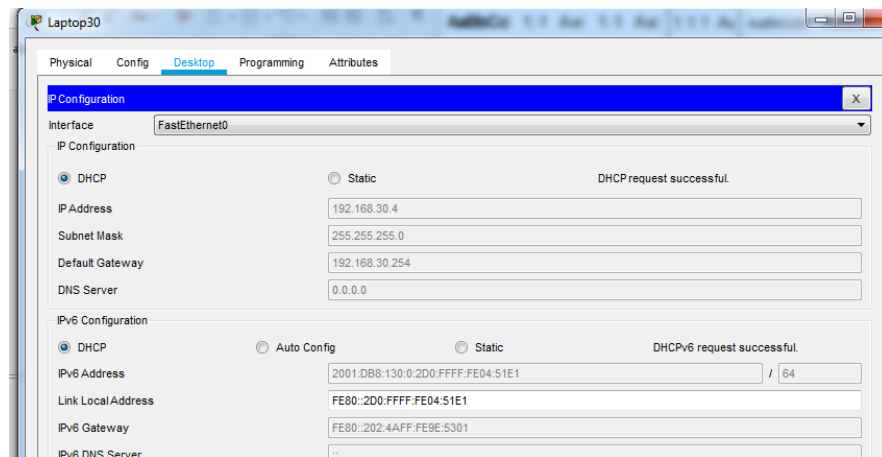


Figura 29 NIC dual Laptop30

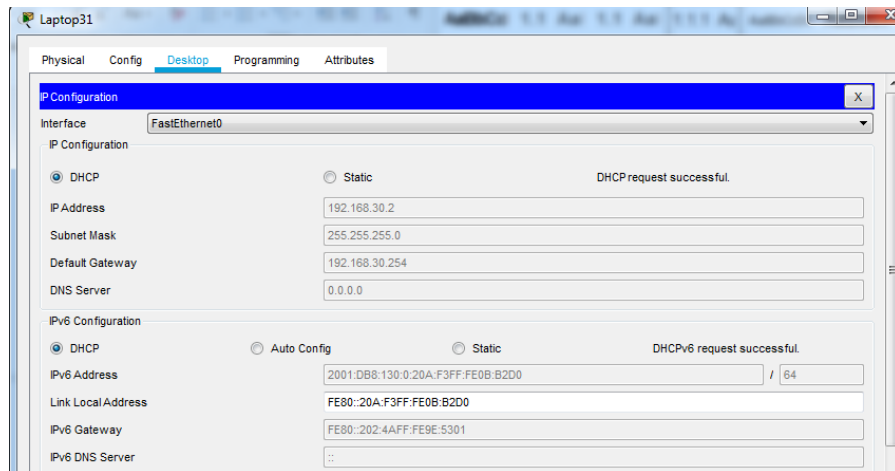


Figura 30 NIC dual Laptop31

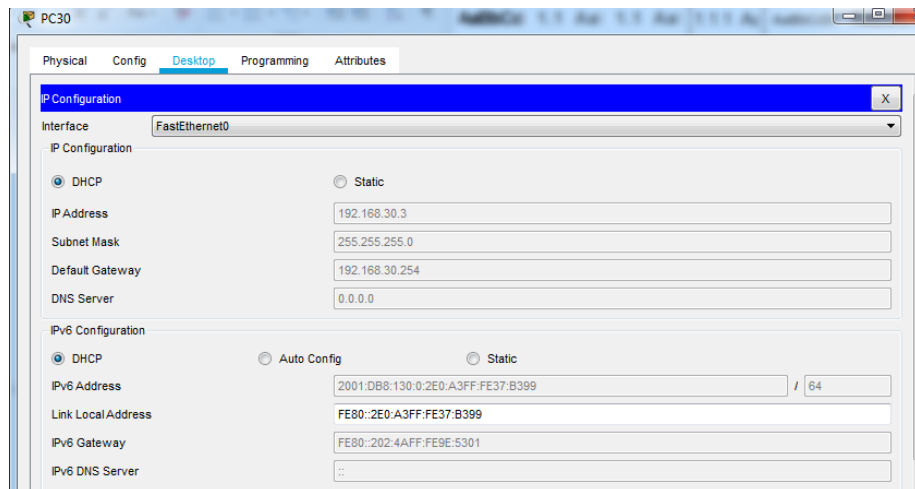


Figura 31 NIC dual PC30

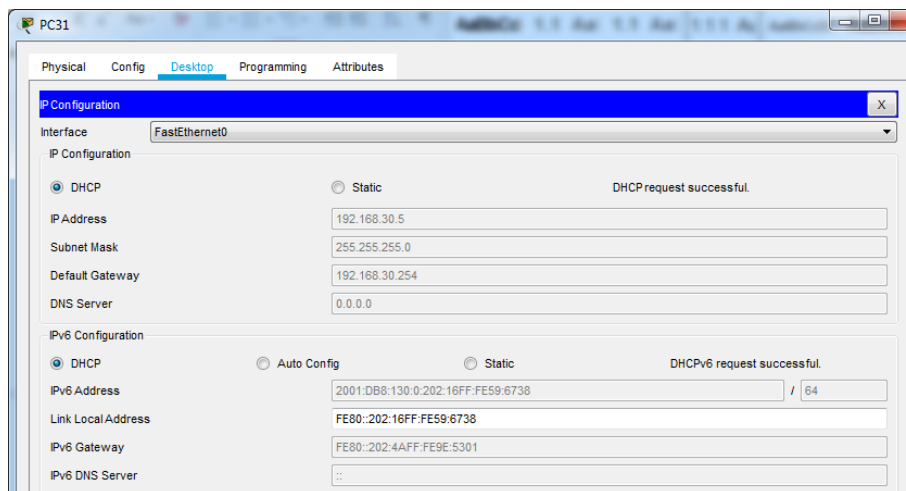


Figura 32 NIC dual PC31

1.1.11 La interfaz FastEthernet 0/0 del R3 también deben tener direcciones IPv4 e IPv6 configuradas (dual- stack).

```

R3(config)#ip dhcp pool DESKTOPS
R3(dhcp-config)#network 192.168.30.0 255.255.255.0
R3(dhcp-config)#default-router 192.168.1.1
R3(dhcp-config)#end
R3(config)#ipv6 dhcp pool servidor
R3(config-dhcpv6)#prefix-delegation pool servidor
R3(config-dhcpv6)#exit
R3(config)#ipv6 general-prefix servidor 2001:db8:130::9c0:80f:300/64
R3(config)#ipv6 local pool servidor 2001:db8:130::9c0:90f:310/40 64
R3(config)#interface f0/0
R3(config-if)#ipv6 dhcp server servidor
R3(config-if)#end

```

Verificación:

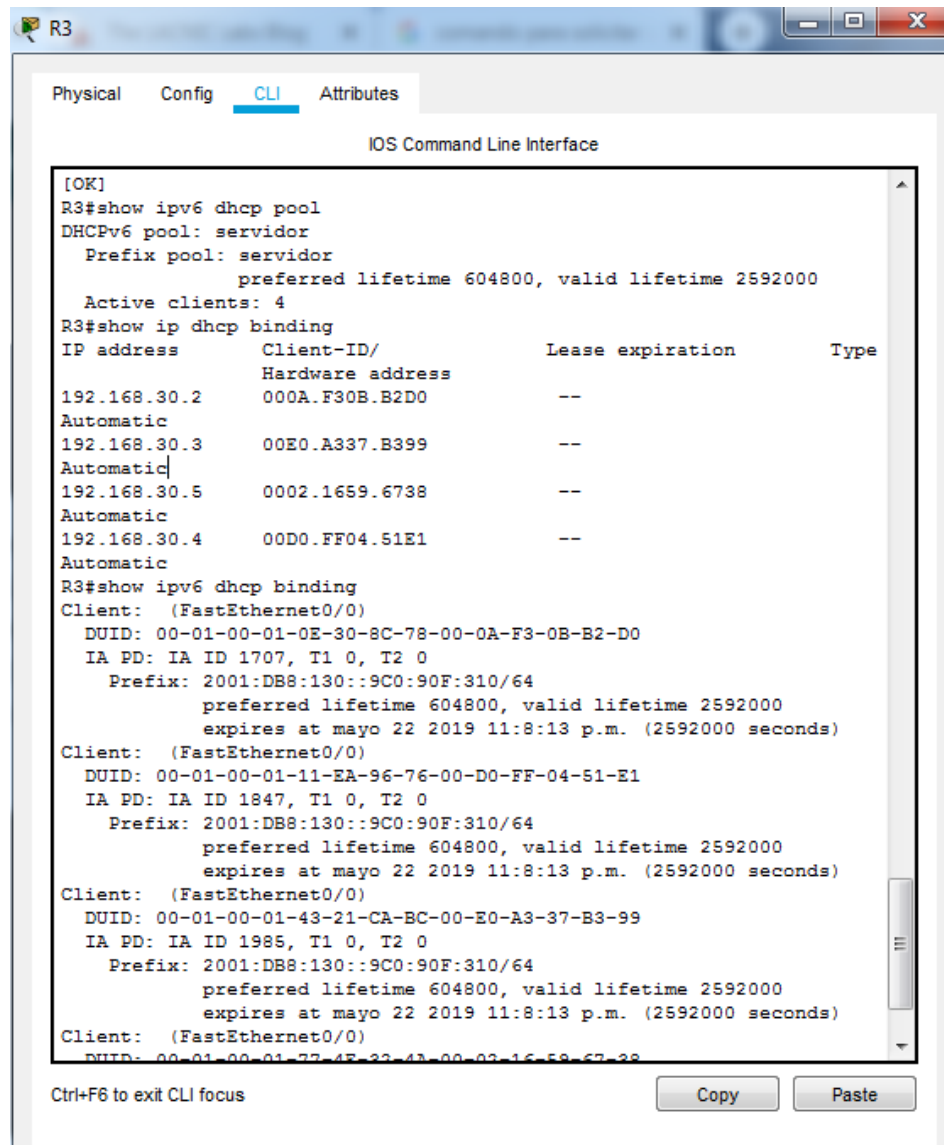


Figura 33 Verificación configuración DHCP

1.1.12 R1, R2 y R3 intercambian información de routing mediante RIP versión 2.

Para R1:

```
R1(config)#router rip
R1(config-router)#version 2
R1(config-router)#network 200.123.211.0
R1(config-router)#network 10.0.0.0
R1(config-router)#end
```

Para R2:

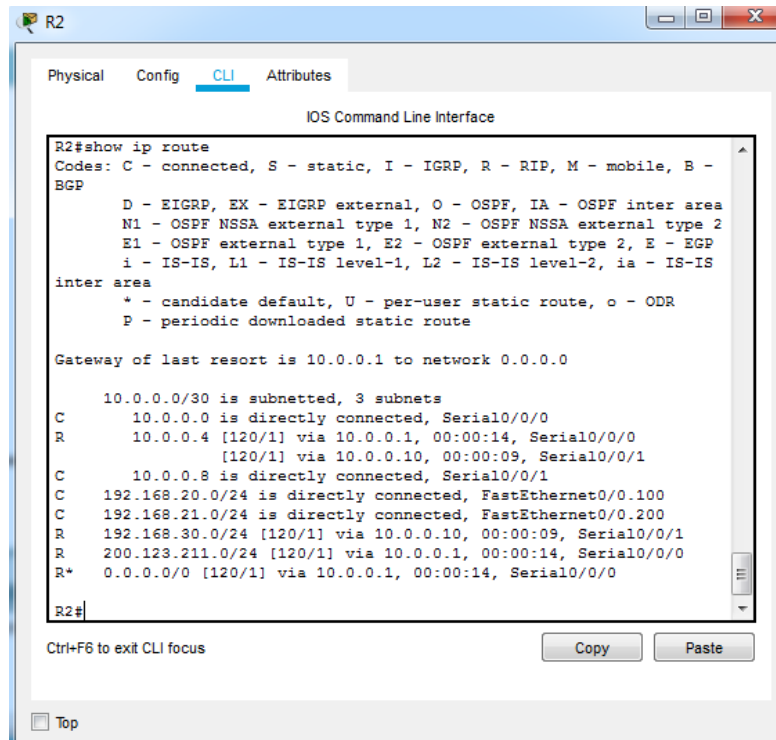
```
R2(config)#router rip
```

```
R2(config-router)#version 2
R2(config-router)#network 192.168.20.0
R2(config-router)#network 192.168.21.0
R2(config-router)#network 10.0.0.0
R2(config-router)#end
```

Para R3:

```
R3(config)#router rip
R3(config-router)#version 2
R3(config-router)#network 192.168.30.0
R3(config-router)#network 10.0.0.0
R3(config-router)#end
```

Verificación:



```
R2
Physical Config CLI Attributes
IOS Command Line Interface
R2#show ip route
Codes: C - connected, S - static, I - IGRP, 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, E - EGP
       i - IS-IS, 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

Gateway of last resort is 10.0.0.1 to network 0.0.0.0

 10.0.0.0/30 is subnetted, 3 subnets
C    10.0.0.0 is directly connected, Serial0/0/0
R    10.0.0.4 [120/1] via 10.0.0.1, 00:00:14, Serial0/0/0
     [120/1] via 10.0.0.10, 00:00:09, Serial0/0/1
C    10.0.0.8 is directly connected, Serial0/0/1
C    192.168.20.0/24 is directly connected, FastEthernet0/0.100
C    192.168.21.0/24 is directly connected, FastEthernet0/0.200
R    192.168.30.0/24 [120/1] via 10.0.0.10, 00:00:09, Serial0/0/1
R    200.123.211.0/24 [120/1] via 10.0.0.1, 00:00:14, Serial0/0/0
R+   0.0.0.0/0 [120/1] via 10.0.0.1, 00:00:14, Serial0/0/0
R2#
Ctrl+F6 to exit CLI focus
Copy Paste
Top
```

Figura 34 Verificación conexión RIP R2


```
[OK]
R3#show ip route
Codes: C - connected, S - static, I - IGRP, 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, E - EGP
       i - IS-IS, 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

Gateway of last resort is 10.0.0.5 to network 0.0.0.0

10.0.0.0/30 is subnetted, 3 subnets
R    10.0.0.0 [120/1] via 10.0.0.9, 00:00:05, Serial0/0/1
     [120/1] via 10.0.0.5, 00:00:25, Serial0/0/0
C    10.0.0.4 is directly connected, Serial0/0/0
C    10.0.0.8 is directly connected, Serial0/0/1
R    192.168.20.0/24 [120/1] via 10.0.0.9, 00:00:05, Serial0/0/1
R    192.168.21.0/24 [120/1] via 10.0.0.9, 00:00:05, Serial0/0/1
C    192.168.30.0/24 is directly connected, FastEthernet0/0
R    200.123.211.0/24 [120/1] via 10.0.0.5, 00:00:25, Serial0/0/0
R*   0.0.0.0/0 [120/1] via 10.0.0.5, 00:00:25, Serial0/0/0

R3#
```

Figura 35 Verificación conexión RIP R3

1.1.13 R1, R2 y R3 deben saber sobre las rutas de cada uno y la ruta predeterminada desde R1.

```
Building configuration...
[OK]
R1#show ip route
Codes: C - connected, S - static, I - IGRP, 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, E - EGP
       i - IS-IS, 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

Gateway of last resort is 0.0.0.0 to network 0.0.0.0

 10.0.0.0/30 is subnetted, 3 subnets
C    10.0.0.0 is directly connected, Serial0/1/0
C    10.0.0.4 is directly connected, Serial0/1/1
R    10.0.0.8 [120/1] via 10.0.0.2, 00:00:28, Serial0/1/0
      [120/1] via 10.0.0.6, 00:00:10, Serial0/1/1
R    192.168.20.0/24 [120/1] via 10.0.0.2, 00:00:28, Serial0/1/0
R    192.168.21.0/24 [120/1] via 10.0.0.2, 00:00:28, Serial0/1/0
R    192.168.30.0/24 [120/1] via 10.0.0.6, 00:00:10, Serial0/1/1
C    200.123.211.0/24 is directly connected, Serial0/0/0
S*   0.0.0.0/0 [1/0] via 200.123.211.1
      is directly connected, Serial0/0/0

R1#
```

Ctrl+F6 to exit CLI focus

Copy Paste

Figura 36 Rutas R1

```
R2#show ip route
Codes: C - connected, S - static, I - IGRP, 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, E - EGP
       i - IS-IS, 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

Gateway of last resort is 10.0.0.1 to network 0.0.0.0

   10.0.0.0/30 is subnetted, 3 subnets
C       10.0.0.0 is directly connected, Serial0/0/0
R       10.0.0.4 [120/1] via 10.0.0.1, 00:00:14, Serial0/0/0
        [120/1] via 10.0.0.10, 00:00:09, Serial0/0/1
C       10.0.0.8 is directly connected, Serial0/0/1
C       192.168.20.0/24 is directly connected, FastEthernet0/0.100
C       192.168.21.0/24 is directly connected, FastEthernet0/0.200
R       192.168.30.0/24 [120/1] via 10.0.0.10, 00:00:09, Serial0/0/1
R       200.123.211.0/24 [120/1] via 10.0.0.1, 00:00:14, Serial0/0/0
R*      0.0.0.0/0 [120/1] via 10.0.0.1, 00:00:14, Serial0/0/0

R2#
```

Ctrl+F6 to exit CLI focus

Copy Paste

Top

Figura 37 Rutas R2

```
[OK]
R3#show ip route
Codes: C - connected, S - static, I - IGRP, 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, E - EGP
       i - IS-IS, 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

Gateway of last resort is 10.0.0.5 to network 0.0.0.0

 10.0.0.0/30 is subnetted, 3 subnets
R    10.0.0.0 [120/1] via 10.0.0.9, 00:00:05, Serial0/0/1
     [120/1] via 10.0.0.5, 00:00:25, Serial0/0/0
C    10.0.0.4 is directly connected, Serial0/0/0
C    10.0.0.8 is directly connected, Serial0/0/1
R    192.168.20.0/24 [120/1] via 10.0.0.9, 00:00:05, Serial0/0/1
R    192.168.21.0/24 [120/1] via 10.0.0.9, 00:00:05, Serial0/0/1
C    192.168.30.0/24 is directly connected, FastEthernet0/0
R    200.123.211.0/24 [120/1] via 10.0.0.5, 00:00:25, Serial0/0/0
R*  0.0.0.0/0 [120/1] via 10.0.0.5, 00:00:25, Serial0/0/0

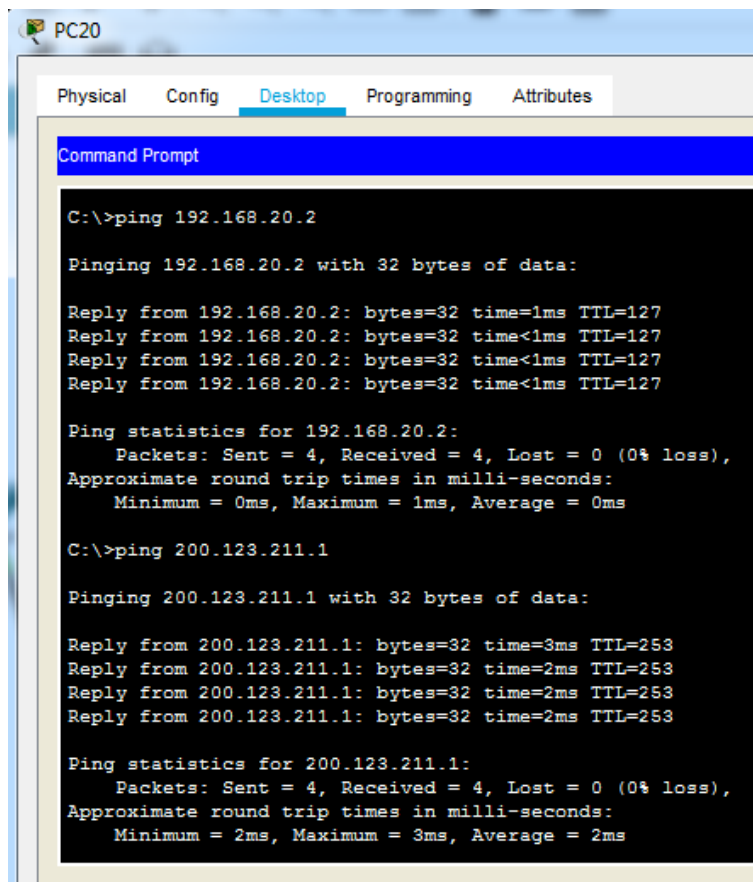
R3#
```

Figura 38 Rutas R3

1.1.14 Verifique la conectividad. Todos los terminales deben poder hacer ping entre sí y a la dirección IP del ISP. Los terminales bajo el R3 deberían poder hacer IPv6-ping entre ellos y el servidor.

Verificación:

Ping desde PC20 a Laptop20 e ISP



The image shows a screenshot of a Windows Command Prompt window titled "PC20". The window has tabs for "Physical", "Config", "Desktop", "Programming", and "Attributes", with "Desktop" selected. The Command Prompt displays the following text:

```
C:\>ping 192.168.20.2

Pinging 192.168.20.2 with 32 bytes of data:

Reply from 192.168.20.2: bytes=32 time=1ms TTL=127
Reply from 192.168.20.2: bytes=32 time<1ms TTL=127
Reply from 192.168.20.2: bytes=32 time<1ms TTL=127
Reply from 192.168.20.2: bytes=32 time<1ms TTL=127

Ping statistics for 192.168.20.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms

C:\>ping 200.123.211.1

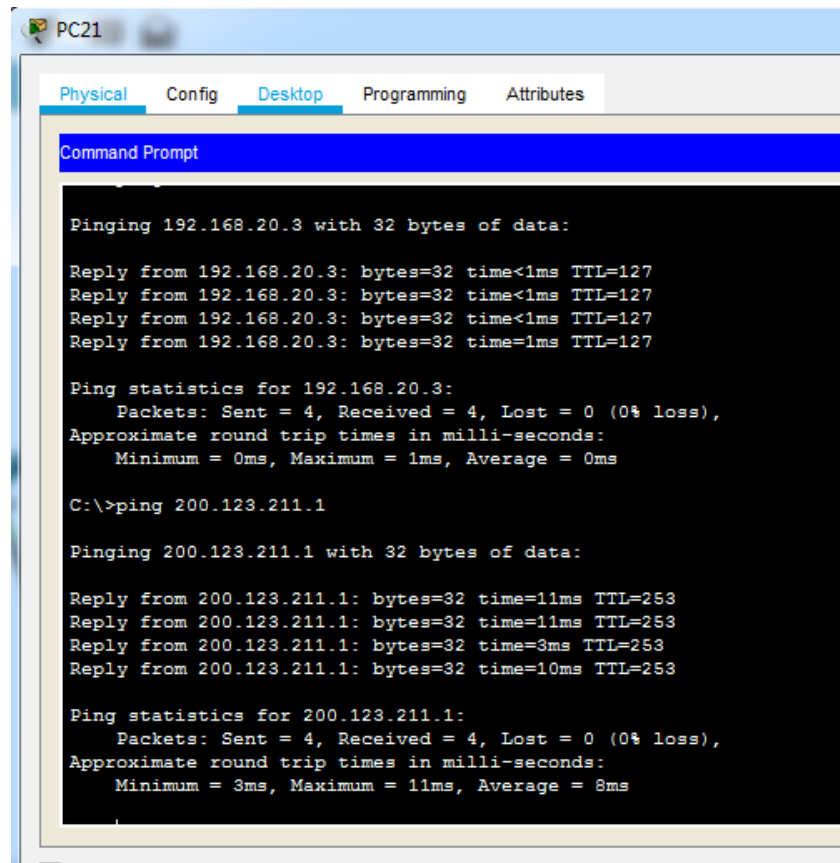
Pinging 200.123.211.1 with 32 bytes of data:

Reply from 200.123.211.1: bytes=32 time=3ms TTL=253
Reply from 200.123.211.1: bytes=32 time=2ms TTL=253
Reply from 200.123.211.1: bytes=32 time=2ms TTL=253
Reply from 200.123.211.1: bytes=32 time=2ms TTL=253

Ping statistics for 200.123.211.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 2ms, Maximum = 3ms, Average = 2ms
```

Figura 39 Verificación ping PC20, Laptop20 e ISP

Ping desde PC21 a Laptop21 e ISP.



The image shows a screenshot of a PC21 desktop environment. The 'Desktop' tab is selected in the top navigation bar. A 'Command Prompt' window is open, displaying the results of two ping commands. The first command is 'ping 192.168.20.3', which shows four successful replies with a time of less than 1ms and a TTL of 127. The second command is 'ping 200.123.211.1', which shows four successful replies with times of 11ms, 11ms, 3ms, and 10ms, and a TTL of 253. Both commands show 0% packet loss.

```
PC21
Physical Config Desktop Programming Attributes
Command Prompt

Pinging 192.168.20.3 with 32 bytes of data:

Reply from 192.168.20.3: bytes=32 time<1ms TTL=127
Reply from 192.168.20.3: bytes=32 time<1ms TTL=127
Reply from 192.168.20.3: bytes=32 time<1ms TTL=127
Reply from 192.168.20.3: bytes=32 time=1ms TTL=127

Ping statistics for 192.168.20.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 1ms, Average = 0ms

C:\>ping 200.123.211.1

Pinging 200.123.211.1 with 32 bytes of data:

Reply from 200.123.211.1: bytes=32 time=11ms TTL=253
Reply from 200.123.211.1: bytes=32 time=11ms TTL=253
Reply from 200.123.211.1: bytes=32 time=3ms TTL=253
Reply from 200.123.211.1: bytes=32 time=10ms TTL=253

Ping statistics for 200.123.211.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 3ms, Maximum = 11ms, Average = 8ms
```

Figura 40 Verificación ping PC21, Laptop21 e ISP

Verificación ping Laptop20 a PC21 e ISP.

The screenshot shows a Packet Tracer PC Command Line window for 'Laptop20'. The window has tabs for 'Physical', 'Config', 'Desktop', 'Programming', and 'Attributes', with 'Desktop' selected. The Command Prompt displays the following text:

```
Packet Tracer PC Command Line 1.0
C:\>PING 192.168.21.2

Pinging 192.168.21.2 with 32 bytes of data:

Reply from 192.168.21.2: bytes=32 time=1ms TTL=127
Reply from 192.168.21.2: bytes=32 time<1ms TTL=127
Reply from 192.168.21.2: bytes=32 time<1ms TTL=127
Reply from 192.168.21.2: bytes=32 time=1ms TTL=127

Ping statistics for 192.168.21.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 1ms, Average = 0ms

C:\>PING 200.123.211.1

Pinging 200.123.211.1 with 32 bytes of data:

Reply from 200.123.211.1: bytes=32 time=3ms TTL=253
Reply from 200.123.211.1: bytes=32 time=10ms TTL=253
Reply from 200.123.211.1: bytes=32 time=11ms TTL=253
Reply from 200.123.211.1: bytes=32 time=2ms TTL=253

Ping statistics for 200.123.211.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 2ms, Maximum = 11ms, Average = 6ms
```

Figura 41 Verificación de ping Laptop20, PC21 e ISP

Verificación ping Laptop21 a PC20 e ISP.

The screenshot shows the Packet Tracer interface for Laptop21. The 'Desktop' tab is active, displaying a Command Prompt window. The prompt shows two ping commands and their results. The first ping is to 192.168.21.1, which returns four successful replies with 32 bytes of data, a time of less than 1ms, and a TTL of 255. The statistics for this ping show 4 packets sent and received, 0% loss, and an average round trip time of 0ms. The second ping is to 200.123.211.1, which also returns four successful replies with 32 bytes of data, a time of 3ms or 10ms, and a TTL of 253. The statistics for this ping show 4 packets sent and received, 0% loss, and an average round trip time of 8ms.

```
Packet Tracer PC Command Line 1.0
C:\>ping 192.168.21.1

Pinging 192.168.21.1 with 32 bytes of data:

Reply from 192.168.21.1: bytes=32 time<1ms TTL=255
Reply from 192.168.21.1: bytes=32 time<1ms TTL=255
Reply from 192.168.21.1: bytes=32 time<1ms TTL=255
Reply from 192.168.21.1: bytes=32 time<1ms TTL=255

Ping statistics for 192.168.21.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms

C:\>ping 200.123.211.1

Pinging 200.123.211.1 with 32 bytes of data:

Reply from 200.123.211.1: bytes=32 time=3ms TTL=253
Reply from 200.123.211.1: bytes=32 time=10ms TTL=253
Reply from 200.123.211.1: bytes=32 time=10ms TTL=253
Reply from 200.123.211.1: bytes=32 time=10ms TTL=253

Ping statistics for 200.123.211.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 3ms, Maximum = 10ms, Average = 8ms
```

Figura 42 Verificación ping Laptop21, PC20 e ISP

Ping desde PC30 a Laptop31 e ISP


```
PC30
Physical Config Desktop Programming Attributes
Command Prompt
C:\>ping 192.168.30.3
Pinging 192.168.30.3 with 32 bytes of data:
Reply from 192.168.30.3: bytes=32 time=1ms TTL=128
Reply from 192.168.30.3: bytes=32 time=1ms TTL=128
Reply from 192.168.30.3: bytes=32 time<1ms TTL=128
Reply from 192.168.30.3: bytes=32 time=2ms TTL=128
Ping statistics for 192.168.30.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 2ms, Average = 1ms
C:\>ping 200.123.211.1
Pinging 200.123.211.1 with 32 bytes of data:
Reply from 200.123.211.1: bytes=32 time=13ms TTL=253
Reply from 200.123.211.1: bytes=32 time=2ms TTL=253
Reply from 200.123.211.1: bytes=32 time=2ms TTL=253
Reply from 200.123.211.1: bytes=32 time=10ms TTL=253
Ping statistics for 200.123.211.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 2ms, Maximum = 13ms, Average = 6ms
```

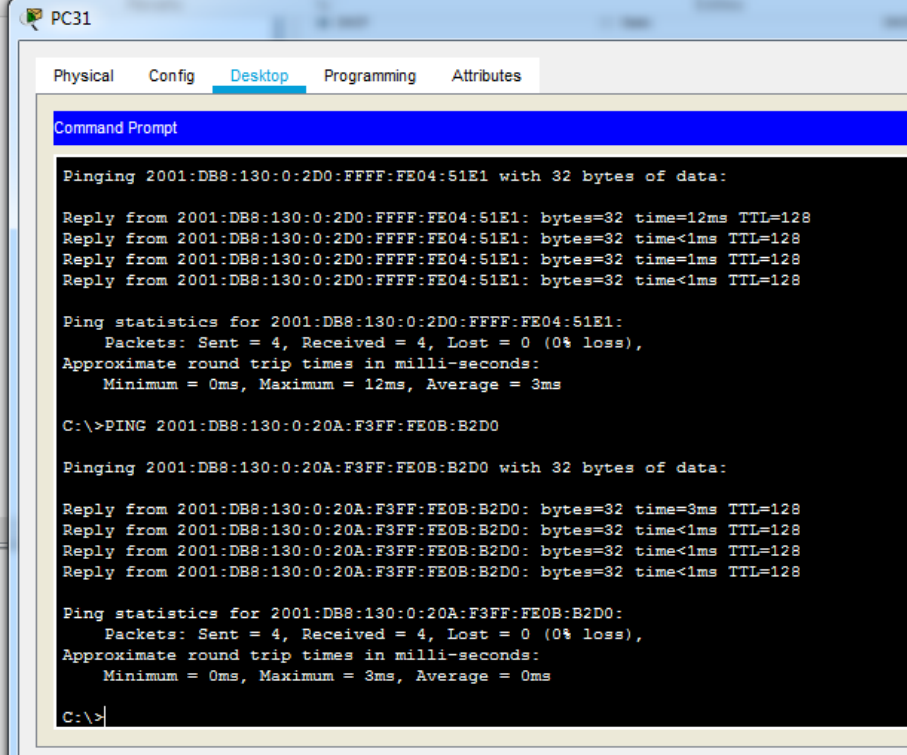
Figura 43 Verificación ping PC30, Laptop31 e ISP

Ping desde PC31 a Laptop30 e ISP

```
PC31
Physical Config Desktop Programming Attributes
Command Prompt
C:\>ping 192.168.30.2
Pinging 192.168.30.2 with 32 bytes of data:
Reply from 192.168.30.2: bytes=32 time=2ms TTL=128
Reply from 192.168.30.2: bytes=32 time=10ms TTL=128
Reply from 192.168.30.2: bytes=32 time<1ms TTL=128
Reply from 192.168.30.2: bytes=32 time<1ms TTL=128
Ping statistics for 192.168.30.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 10ms, Average = 3ms
C:\>ping 200.123.211.1
Pinging 200.123.211.1 with 32 bytes of data:
Reply from 200.123.211.1: bytes=32 time=12ms TTL=253
Reply from 200.123.211.1: bytes=32 time=11ms TTL=253
Reply from 200.123.211.1: bytes=32 time=3ms TTL=253
Reply from 200.123.211.1: bytes=32 time=10ms TTL=253
Ping statistics for 200.123.211.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 3ms, Maximum = 12ms, Average = 9ms
C:\>
```

Figura 44 Verificación ping PC31, Laptop30 e ISP

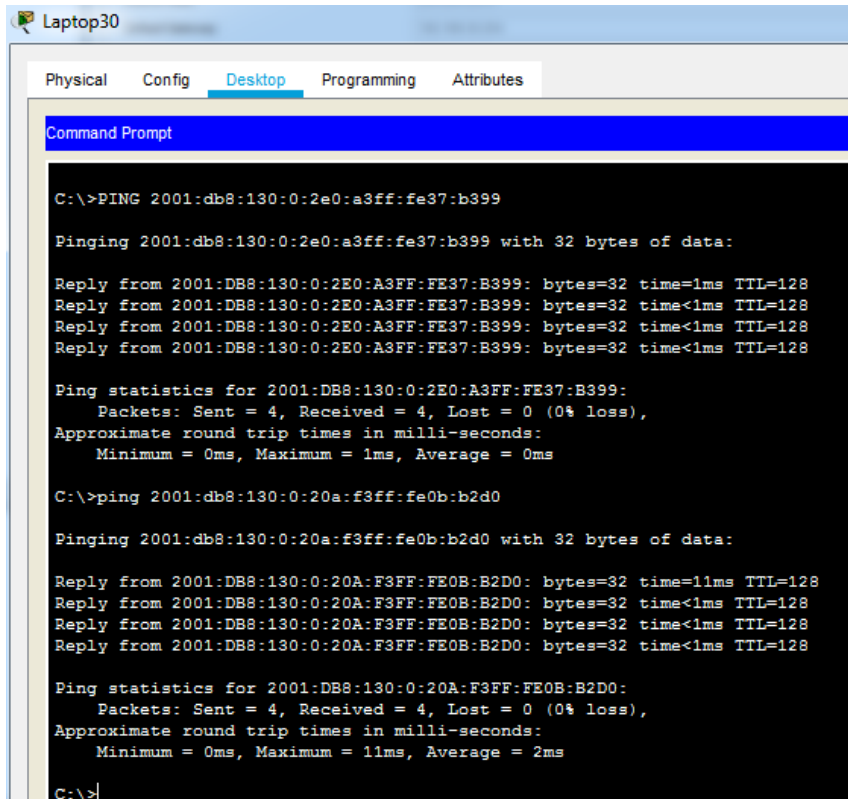
Ping desde PC31 a PC30 y Laptop31



```
PC31
Physical Config Desktop Programming Attributes
Command Prompt
Pinging 2001:DB8:130:0:2D0:FFFF:FE04:51E1 with 32 bytes of data:
Reply from 2001:DB8:130:0:2D0:FFFF:FE04:51E1: bytes=32 time=12ms TTL=128
Reply from 2001:DB8:130:0:2D0:FFFF:FE04:51E1: bytes=32 time<1ms TTL=128
Reply from 2001:DB8:130:0:2D0:FFFF:FE04:51E1: bytes=32 time=1ms TTL=128
Reply from 2001:DB8:130:0:2D0:FFFF:FE04:51E1: bytes=32 time<1ms TTL=128
Ping statistics for 2001:DB8:130:0:2D0:FFFF:FE04:51E1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 12ms, Average = 3ms
C:\>PING 2001:DB8:130:0:20A:F3FF:FE0B:B2D0
Pinging 2001:DB8:130:0:20A:F3FF:FE0B:B2D0 with 32 bytes of data:
Reply from 2001:DB8:130:0:20A:F3FF:FE0B:B2D0: bytes=32 time=3ms TTL=128
Reply from 2001:DB8:130:0:20A:F3FF:FE0B:B2D0: bytes=32 time<1ms TTL=128
Reply from 2001:DB8:130:0:20A:F3FF:FE0B:B2D0: bytes=32 time<1ms TTL=128
Reply from 2001:DB8:130:0:20A:F3FF:FE0B:B2D0: bytes=32 time<1ms TTL=128
Ping statistics for 2001:DB8:130:0:20A:F3FF:FE0B:B2D0:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 3ms, Average = 0ms
C:\>
```

Figura 45 Verificación de ping IPv6 PC31 a PC30 y Laptop31

Ping desde Laptop30 a PC30 y Laptop31.



```
C:\>PING 2001:db8:130:0:2e0:a3ff:fe37:b399

Pinging 2001:db8:130:0:2e0:a3ff:fe37:b399 with 32 bytes of data:

Reply from 2001:DB8:130:0:2E0:A3FF:FE37:B399: bytes=32 time=1ms TTL=128
Reply from 2001:DB8:130:0:2E0:A3FF:FE37:B399: bytes=32 time<1ms TTL=128
Reply from 2001:DB8:130:0:2E0:A3FF:FE37:B399: bytes=32 time<1ms TTL=128
Reply from 2001:DB8:130:0:2E0:A3FF:FE37:B399: bytes=32 time<1ms TTL=128

Ping statistics for 2001:DB8:130:0:2E0:A3FF:FE37:B399:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms

C:\>ping 2001:db8:130:0:20a:f3ff:fe0b:b2d0

Pinging 2001:db8:130:0:20a:f3ff:fe0b:b2d0 with 32 bytes of data:

Reply from 2001:DB8:130:0:20A:F3FF:FE0B:B2D0: bytes=32 time=11ms TTL=128
Reply from 2001:DB8:130:0:20A:F3FF:FE0B:B2D0: bytes=32 time<1ms TTL=128
Reply from 2001:DB8:130:0:20A:F3FF:FE0B:B2D0: bytes=32 time<1ms TTL=128
Reply from 2001:DB8:130:0:20A:F3FF:FE0B:B2D0: bytes=32 time<1ms TTL=128

Ping statistics for 2001:DB8:130:0:20A:F3FF:FE0B:B2D0:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 11ms, Average = 2ms

C:\>
```

Figura 46 Verificación ping IPv6 Laptop30 a PC30 y Laptop31

1.2 Escenario 2

Una empresa de Tecnología posee tres sucursales distribuidas en las ciudades de Miami, Bogotá y Buenos Aires, en donde el estudiante será el administrador de la red, el cual deberá configurar e interconectar entre sí cada uno de los dispositivos que forman parte del escenario, acorde con los lineamientos establecidos para el direccionamiento IP, protocolos de enrutamiento y demás aspectos que forman parte de la topología de red.

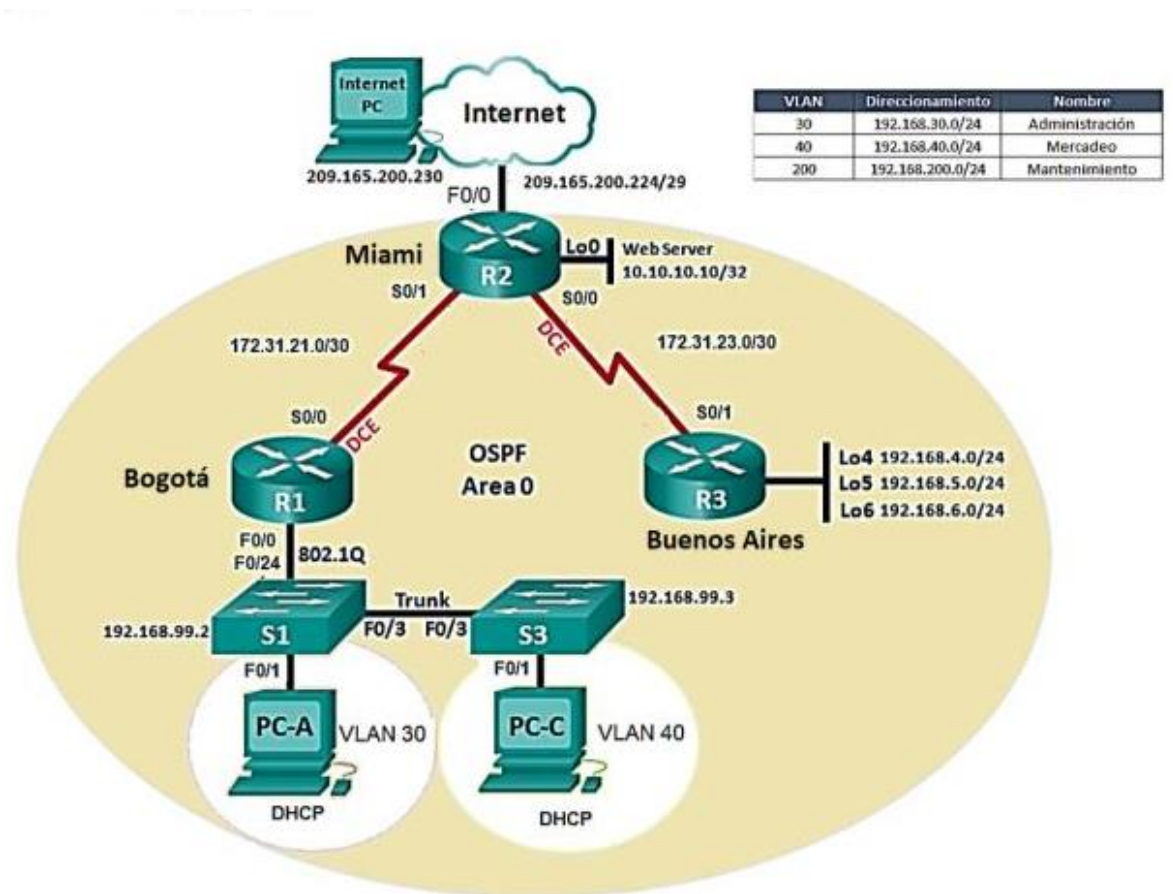


Figura 47 Topología escenario 2

1.2.1 Configurar el direccionamiento IP acorde con la topología de red para cada uno de los dispositivos que forman parte del escenario.

A continuación, se muestra la tabla de direccionamiento utilizada:

Dispositivo	Interfaces	Dirección IP	Mascara de subred	de	Gateway predeterminado
R1	S0/0	172.31.21.1	255.255.255.252		N/A
	G0/0	192.168.99.1	255.255.255.0		N/A
	F0/0.30	192.168.30.1	255.255.255.0		N/A
	F0/0.40	192.168.40.1	255.255.255.0		N/A
R2	S0/1	172.31.21.2	255.255.255.252		N/A
	S0/0	172.31.23.1	255.255.255.252		N/A
	G0/0	209.165.200.225	255.255.255.248		
	Lo0	10.10.10.10	255.255.255.255		N/A
R3	S0/1	172.31.23.2	255.255.255.252		N/A

	Lo4	192.168.4.1	255.255.255.0	N/A
	Lo5	192.168.5.1	255.255.255.0	N/A
	Lo6	192.168.6.1	255.255.255.0	N/A
S1	VLAN 1	192.168.99.2	255.255.255.0	192.168.99.1
S3	VLAN 1	192.168.99.3	255.255.255.0	192.168.99.1
PC-A	NIC	DHCP	DHCP	DHCP
PC-B	NIC	DHCP	DHCP	DHCP
PC-INTERNET	NIC	209.165.200.230	255.255.255.248	

Configuración de puertos de suiches:

Puertos	Asignaciones	Red
S1 F0/3	Enlace troncal	NA
S1 F0/24	Enlace troncal 802.1Q	NA
S1 F0/1	VLAN 30: Administración	192.168.30.0/24
S3 F0/3	Enlace troncal	NA
S3 F0/3	VLAN 40: Mercadeo	192.168.40.0/24
	VLAN 200: Mantenimiento	192.168.200.0/24

1.2.2 Configurar el protocolo de enrutamiento OSPFv2 bajo los siguientes criterios:

OSPFv2 area 0

Configuration Item or Task	Specification
Router ID R1	1.1.1.1
Router ID R2	5.5.5.5
Router ID R3	8.8.8.8
Configurar todas las interfaces LAN como pasivas	
Establecer el ancho de banda para enlaces seriales en	256 Kb/s
Ajustar el costo en la métrica de S0/0 a	9500

Figura 48 Características del OSPF

Inicialmente se reinician los routers, se habilita el modo EXEC privilegiado y se ejecuta el comando `erase startup-config` para eliminar el archivo de configuración de inicio de la NVRAM. Posterior a ello se ejecuta el comando `reload` para eliminar la configuración antigua de la memoria. A continuación, se listan los comandos utilizados para los tres routers:

```
Router>enable
Router#erase startup-config
Router#reload
```

Adicionalmente se configuran los nombres de los mismos y se deshabilita la búsqueda por DNS:

```
Router>enable
Router#configure terminal
Router(config)#hostname R1
R1(config)#
R1(config)#no ip domain-lookup
```

```
Router>enable
Router#configure terminal
Router(config)#hostname R2
R2(config)#
R2(config)#no ip domain-lookup
```

```
Router>enable
Router#configure terminal
Router(config)#hostname R3
R3(config)#
R3(config)#no ip domain-lookup
```

Ahora se procede a asignar las direcciones IP según la tabla de direcciones.

Para R1:

```
R1(config)#interface s0/0/0
R1(config-if)#ip address 172.31.21.1 255.255.255.252
R1(config-if)#clock rate 128000
R1(config-if)#no shutdown
```

Para R2:

```
R2(config)#interface s0/0/0
R2(config-if)#ip address 172.31.23.1 255.255.255.252
R2(config-if)#clock rate 128000
R2(config-if)#no shutdown
R2(config)#interface s0/0/1
R2(config-if)#ip address 172.31.21.2 255.255.255.252
R2(config-if)#no shutdown
R2(config)#interface lo0
```

```
R2(config-if)#
R2(config-if)#ip address 10.10.10.10 255.255.255.255
R2(config-if)#no shutdown
R2(config)#interface g0/0
```

```
R2(config-if)#ip address 209.165.200.225 255.255.255.248
R2(config-if)#no shutdown
Para R3
R3(config)#interface s0/0/1
R3(config-if)#ip address 172.31.23.2 255.255.255.252
R3(config-if)#no shutdown
R3(config)#interface lo4
R3(config-if)#ip address 192.168.4.1 255.255.255.0
R3(config-if)#no shutdown
R3(config)#interface lo5
R3(config-if)#ip address 192.168.5.1 255.255.255.0
R3(config-if)#no shutdown
R3(config)#interface lo5
R3(config-if)#ip address 192.168.5.1 255.255.255.0
R3(config-if)#no shutdown
```

Ahora se procede a configurar el OSPF programando las interfaces que participan en el proceso del routing mediante el comando network.

Para el router 1:

```
R1(config)#router ospf 1
R1(config-router)#network 172.31.21.0 0.0.0.3 area 0
R1(config-router)#network 192.168.99.0 0.0.0.255 area 0
R1(config-router)#network 192.168.30.0 0.0.0.255 area 0
R1(config-router)#network 192.168.40.0 0.0.0.255 area 0
R1(config-router)#exit
```

Para el router 2:

```
R2(config)#router ospf 2
R2(config-router)#network 172.31.21.0 0.0.0.3 area 0
R2(config-router)#network 172.31.23.0 0.0.0.3 area 0
R2(config-router)#network 10.10.10.10 0.0.0.0 area 0
R2(config-router)#exit
```

Para el router 3:

```
R3(config)#router ospf 3
R3(config-router)#network 192.168.4.0 0.0.0.255 area 0
R3(config-router)#network 192.168.5.0 0.0.0.255 area 0
R3(config-router)#network 192.168.6.0 0.0.0.255 area 0
R3(config-router)#network 172.31.23.0 0.0.0.3 area 0
R3(config-router)#exit
```

A continuación se configura el router ID:

```
R1(config)#router ospf 1
```

```
R1(config-router)#router-id 1.1.1.1
R1(config-router)#Reload or use "clear ip ospf process" command, for this to take effect
R1(config-router)#end
R1#clear ip ospf process
Reset ALL OSPF processes? [no]: yes
```

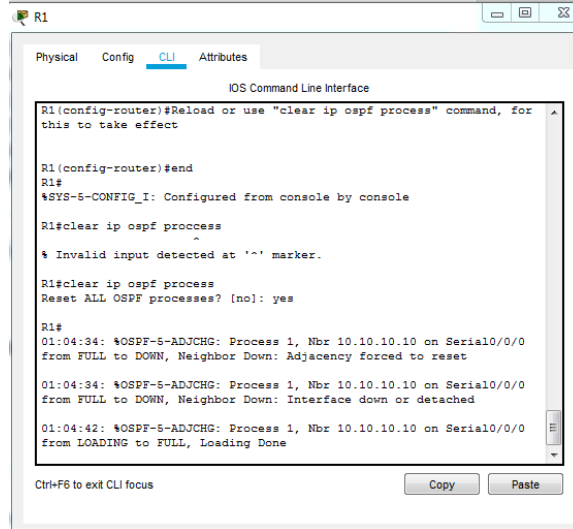


Figura 49 Reset para activar OSPF R1

```
Para R2:
R2(config)#router ospf 2
R2(config-router)#router-id 5.5.5.5
R2(config-router)#Reload or use "clear ip ospf process" command, for this to take effect
R2(config-router)#end
R2#clear ip ospf process
Reset ALL OSPF processes? [no]: yes
```

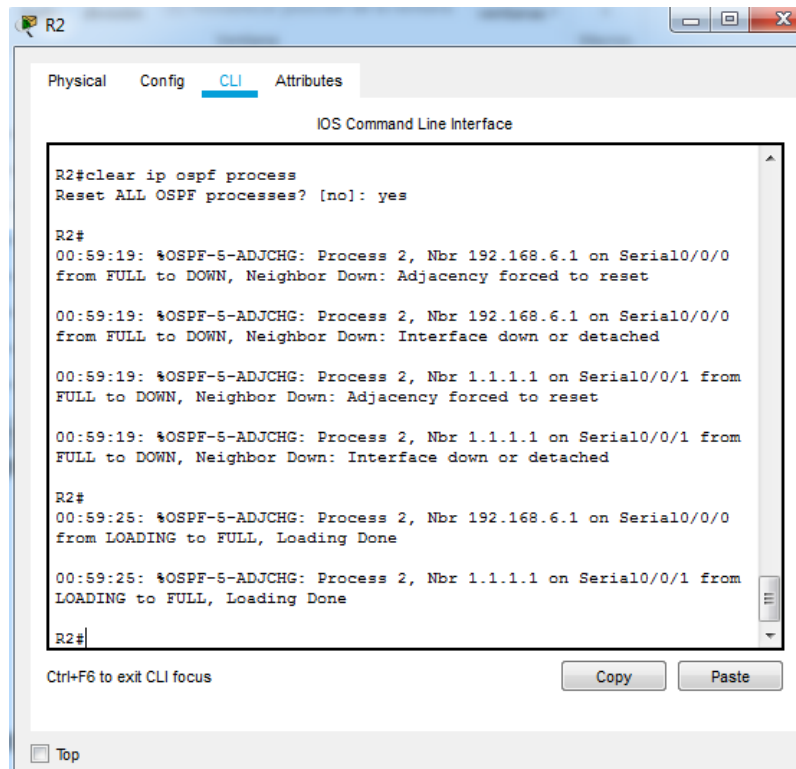



Figura 50 Reset para activar OSPF R2

Para R3:

```
R3(config)#router ospf 3
```

```
R3(config-router)#router-id 8.8.8.8
```

```
R3(config-router)#Reload or use "clear ip ospf process" command, for this to take effect
```

```
R3(config-router)#end
```

```
R3#clear ip ospf process
```

```
Reset ALL OSPF processes? [no]: yes
```

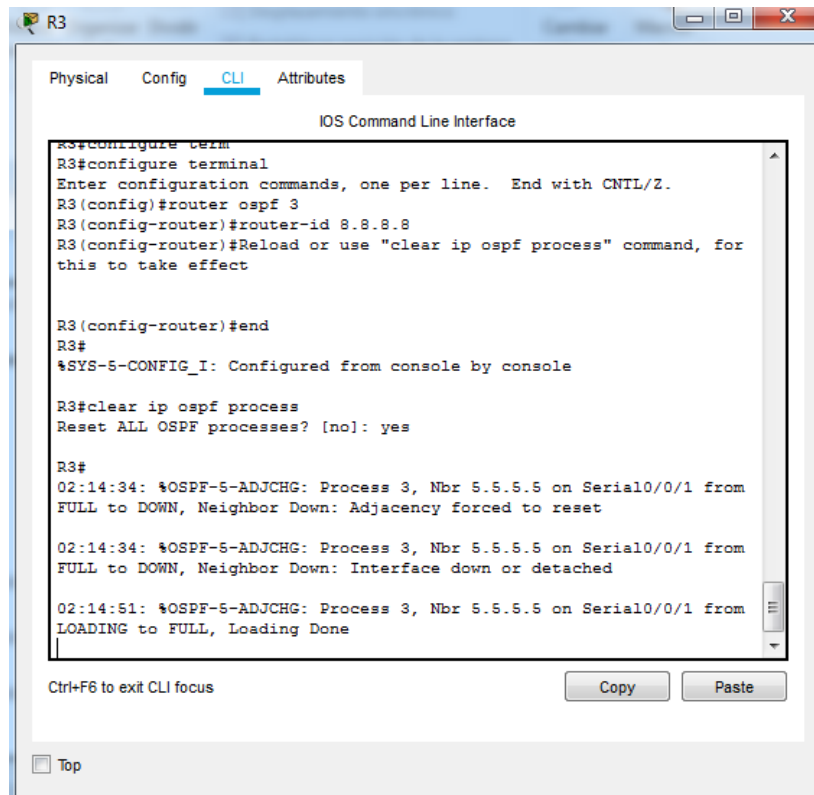


Figura 51 Reset para activar OSPF R3

Ahora se configuran las interfaces pasivas a las que no deben llegar los mensajes OSPF, es decir, la interfaz G0/0 del router 1, puesto que los demás no tienen interfaces LAN pasivas:

```
R1(config-router)#passive-interface gigabitEthernet 0/0
R1(config-router)#end
```

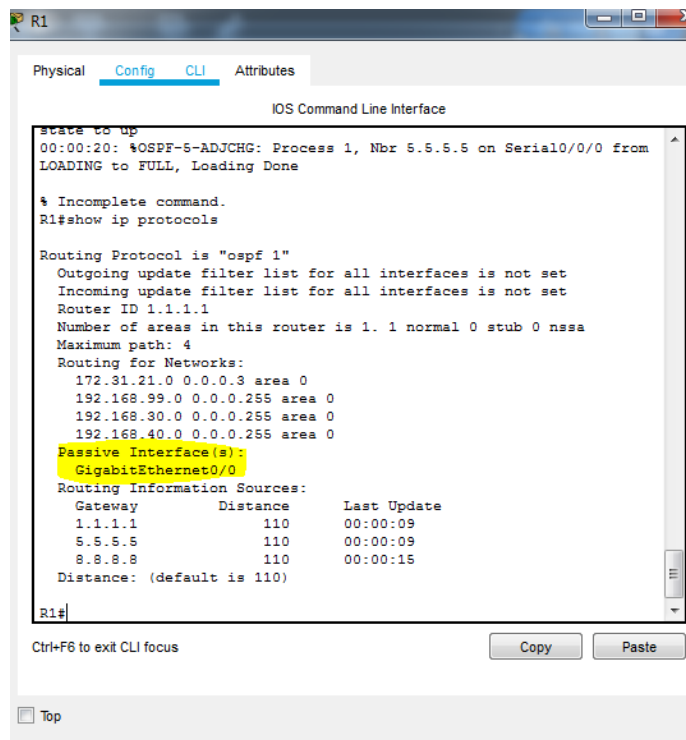


Figura 52 Interfaz pasiva

Configurando el ancho de banda de las interfaces a 256 kb/s

```
R1
R1(config)#interface s0/0/0
R1(config-if)#bandwidth 256
R1(config-if)#end
```

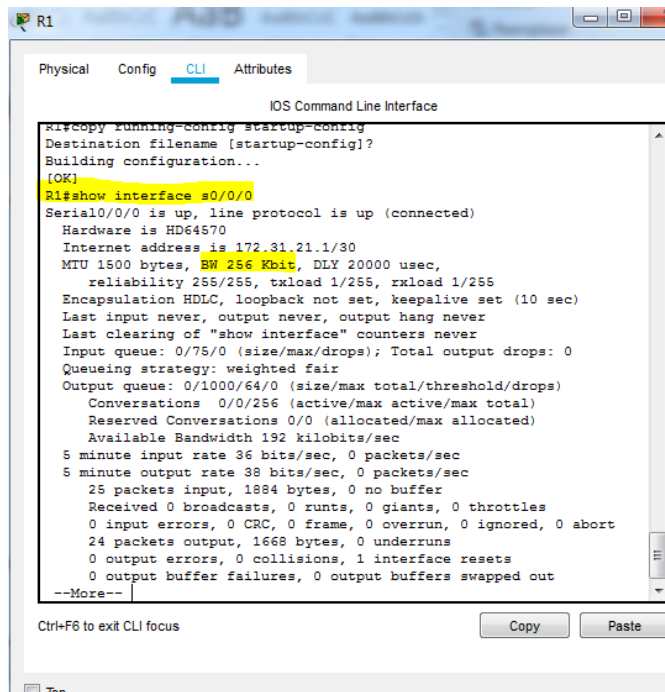
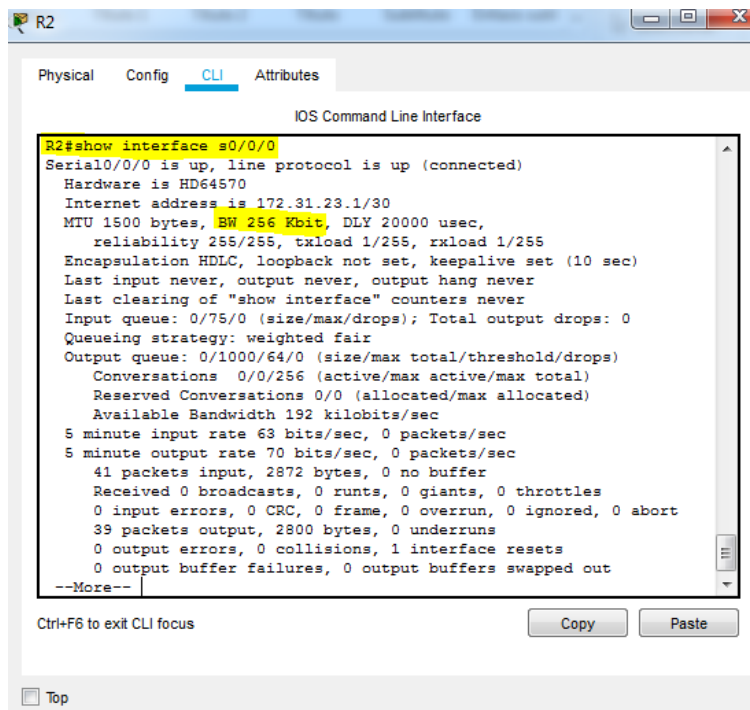


Figura 53 Verificación del ancho de banda R1

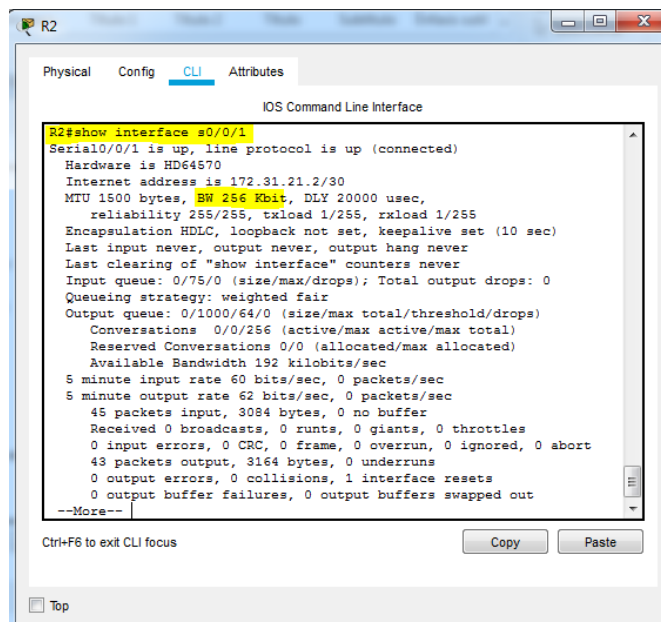
```
R2
R2(config)#interface s0/0/0
R2(config-if)#bandwidth 256
R2(config-if)#exit
R2(config)#interface s0/0/1
R2(config-if)#bandwidth 256
R2(config-if)#exit
```



The screenshot shows the CLI of router R2. The command `R2#show interface s0/0/0` has been executed. The output displays the configuration and statistics for the Serial0/0/0 interface. The bandwidth is set to 256 Kbit, and the available bandwidth is 192 kilobits/sec. The 5-minute output rate is 70 bits/sec.

```
R2#show interface s0/0/0
Serial0/0/0 is up, line protocol is up (connected)
Hardware is HD64570
Internet address is 172.31.23.1/30
MTU 1500 bytes, BW 256 Kbit, DLY 20000 usec,
  reliability 255/255, txload 1/255, rxload 1/255
Encapsulation HDLC, loopback not set, keepalive set (10 sec)
Last input never, output never, output hang never
Last clearing of "show interface" counters never
Input queue: 0/75/0 (size/max/drops); Total output drops: 0
Queueing strategy: weighted fair
Output queue: 0/1000/64/0 (size/max total/threshold/drops)
  Conversations 0/0/256 (active/max active/max total)
  Reserved Conversations 0/0 (allocated/max allocated)
  Available Bandwidth 192 kilobits/sec
5 minute input rate 63 bits/sec, 0 packets/sec
5 minute output rate 70 bits/sec, 0 packets/sec
  41 packets input, 2872 bytes, 0 no buffer
Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
39 packets output, 2800 bytes, 0 underruns
0 output errors, 0 collisions, 1 interface resets
0 output buffer failures, 0 output buffers swapped out
--More--
```

Figura 54 Verificación del ancho de banda R2 s0/0/0



The screenshot shows the CLI of router R2. The command `R2#show interface s0/0/1` has been executed. The output displays the configuration and statistics for the Serial0/0/1 interface. The bandwidth is set to 256 Kbit, and the available bandwidth is 192 kilobits/sec. The 5-minute output rate is 62 bits/sec.

```
R2#show interface s0/0/1
Serial0/0/1 is up, line protocol is up (connected)
Hardware is HD64570
Internet address is 172.31.21.2/30
MTU 1500 bytes, BW 256 Kbit, DLY 20000 usec,
  reliability 255/255, txload 1/255, rxload 1/255
Encapsulation HDLC, loopback not set, keepalive set (10 sec)
Last input never, output never, output hang never
Last clearing of "show interface" counters never
Input queue: 0/75/0 (size/max/drops); Total output drops: 0
Queueing strategy: weighted fair
Output queue: 0/1000/64/0 (size/max total/threshold/drops)
  Conversations 0/0/256 (active/max active/max total)
  Reserved Conversations 0/0 (allocated/max allocated)
  Available Bandwidth 192 kilobits/sec
5 minute input rate 60 bits/sec, 0 packets/sec
5 minute output rate 62 bits/sec, 0 packets/sec
  45 packets input, 3084 bytes, 0 no buffer
Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
43 packets output, 3164 bytes, 0 underruns
0 output errors, 0 collisions, 1 interface resets
0 output buffer failures, 0 output buffers swapped out
--More--
```

Figura 55 Verificación del ancho de banda R2 s0/0/1

```
R3
R3(config)#interface s0/0/1
R3(config-if)#bandwidth 256
R3(config-if)#exit
```

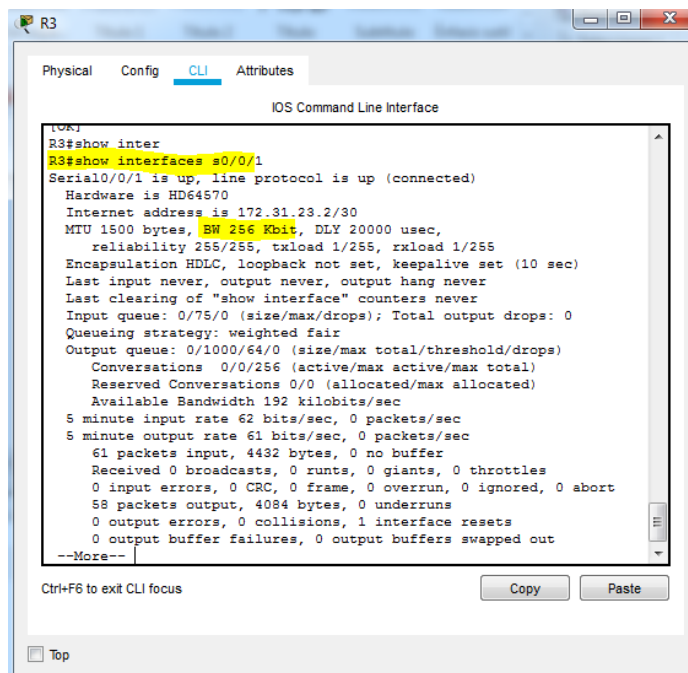


Figura 56 Verificación del ancho de banda R3

Dado que el costo de la métrica se debe configurar en 9500, se utiliza el comando `ip ospf cost` para los puertos seriales S0/0/0 de los routers 1 y 2.

Para R1:

```
R1(config)#interface s0/0/0
R1(config-if)#ip ospf cost 9500
R1(config-if)#end
```

Mediante el comando `show ip ospf interface serial 0/0/0` se puede verificar el cambio de métrica realizado:

```
R1#
%SYS-5-CONFIG_I: Configured from console by console
R1#copy running-config startup-config
Destination filename [startup-config]?
Building configuration...
[OK]
R1#show ip ospf interface s0/0/0

Serial0/0/0 is up, line protocol is up
Internet address is 172.31.21.1/30, Area 0
Process ID 1, Router ID 1.1.1.1, Network Type POINT-TO-POINT, Cost:
9500
Transmit Delay is 1 sec, State POINT-TO-POINT, Priority 0
No designated router on this network
No backup designated router on this network
Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit
5
Hello due in 00:00:07
Index 1/1, flood queue length 0
Next 0x0(0)/0x0(0)
Last flood scan length is 1, maximum is 1
Last flood scan time is 0 msec, maximum is 0 msec
Neighbor Count is 1, Adjacent neighbor count is 1
Adjacent with neighbor 5.5.5.5
Suppress hello for 0 neighbor(s)
R1#
R1#
```

Figura 57 Verificación del costo R1

Para R2:
R2(config)#interface s0/0/0
R2(config-if)#ip ospf cost 9500
R2(config-if)#end

Verificación:

```
R2#
R2#copy running-config startup-config
Destination filename [startup-config]?
Building configuration...
[OK]
R2#show ip ospf interface s0/0/0

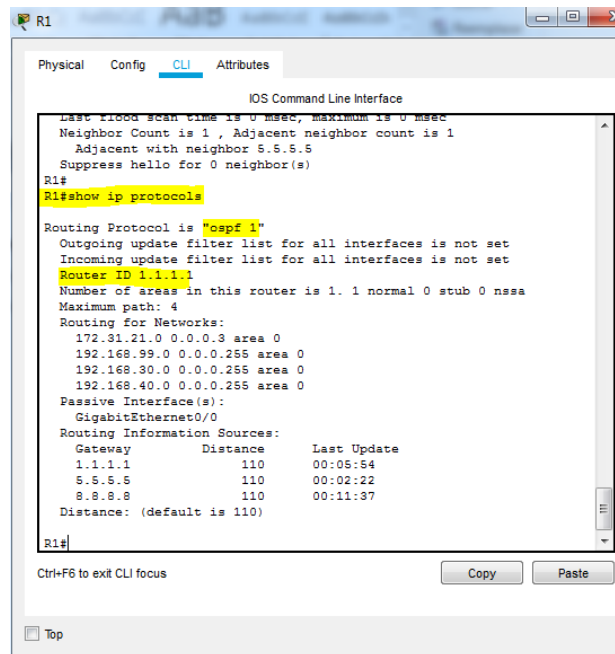
Serial0/0/0 is up, line protocol is up
Internet address is 172.31.23.1/30, Area 0
Process ID 2, Router ID 5.5.5.5, Network Type POINT-TO-POINT, Cost:
9500
Transmit Delay is 1 sec, State POINT-TO-POINT, Priority 0
No designated router on this network
No backup designated router on this network
Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit
5
Hello due in 00:00:08
Index 3/3, flood queue length 0
Next 0x0(0)/0x0(0)
Last flood scan length is 1, maximum is 1
Last flood scan time is 0 msec, maximum is 0 msec
Neighbor Count is 1, Adjacent neighbor count is 1
Adjacent with neighbor 8.8.8.8
Suppress hello for 0 neighbor(s)
R2#
```

Figura 58 Verificación del costo R2

Verificar información de OSPF.

Para verificar la información básica de OSPF se utiliza el comando show ip protocols. La información incluye la ID del proceso OSPF, la ID del router, las redes que anuncia el router, los vecinos de los que el router recibe actualizaciones y la distancia administrativa predeterminada, que para OSPF es 110.

Para R1:



```
R1# show ip protocols
Routing Protocol is "ospf 1"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Router ID 1.1.1.1
  Number of areas in this router is 1. 1 normal 0 stub 0 nssa
  Maximum path: 4
  Routing for Networks:
    172.31.21.0 0.0.0.3 area 0
    192.168.99.0 0.0.0.255 area 0
    192.168.30.0 0.0.0.255 area 0
    192.168.40.0 0.0.0.255 area 0
  Passive Interface(s):
    GigabitEthernet0/0
  Routing Information Sources:
    Gateway         Distance      Last Update
    1.1.1.1          110          00:05:54
    5.5.5.5          110          00:02:22
    8.8.8.8          110          00:11:37
  Distance: (default is 110)
```

Figura 59 Verificación OSPF R1

Para R2:

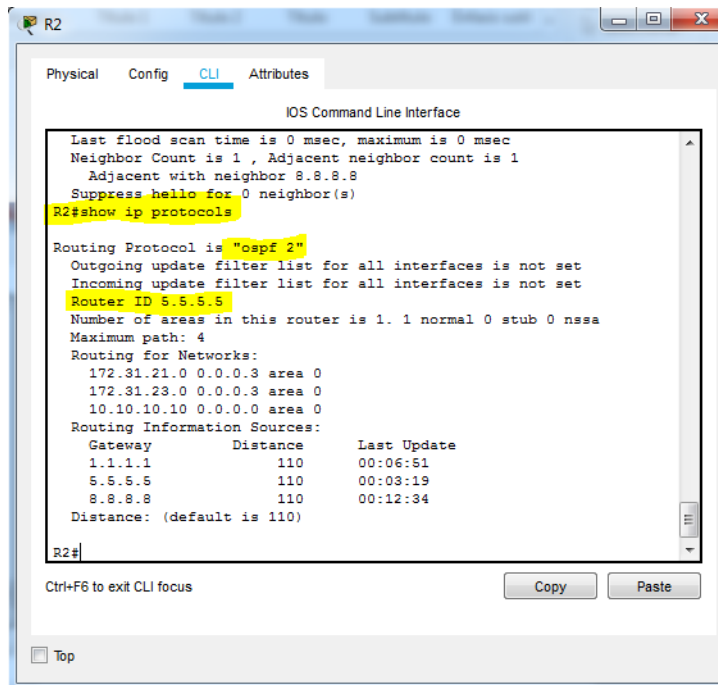


Figura 60 Verificación OSPF R2

Para R3:

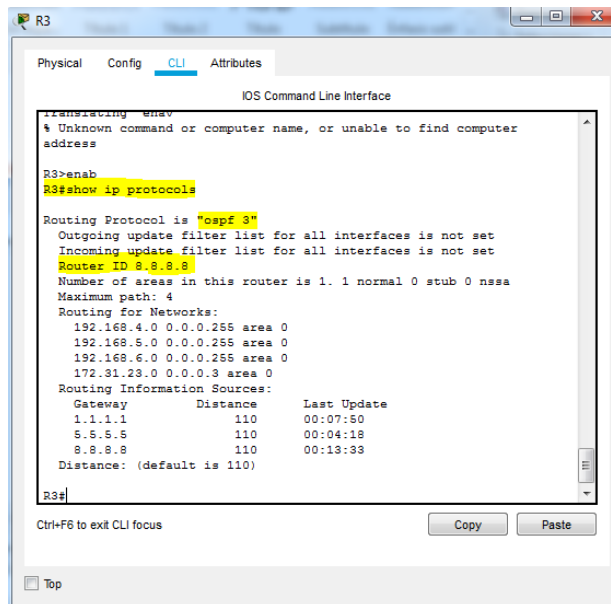


Figura 61 Verificación OSPF R3

Visualizar tablas de enrutamiento y routers conectados por OSPFv2

```

R1
Physical Config CLI Attributes
IOS Command Line Interface
R1#show ip route
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, E - EGP
i - IS-IS, 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

Gateway of last resort is not set

10.0.0.0/32 is subnetted, 1 subnets
O 10.10.10.10/32 [110/9501] via 172.31.21.2, 00:09:11,
Serial0/0/0
172.31.0.0/16 is variably subnetted, 3 subnets, 2 masks
C 172.31.21.0/30 is directly connected, Serial0/0/0
L 172.31.21.1/32 is directly connected, Serial0/0/0
O 172.31.23.0/30 [110/19000] via 172.31.21.2, 00:05:38,
Serial0/0/0
192.168.4.0/32 is subnetted, 1 subnets
O 192.168.4.1/32 [110/19001] via 172.31.21.2, 00:05:38,
Serial0/0/0
192.168.5.0/32 is subnetted, 1 subnets
O 192.168.5.1/32 [110/19001] via 172.31.21.2, 00:05:38,
Serial0/0/0
192.168.6.0/32 is subnetted, 1 subnets
O 192.168.6.1/32 [110/19001] via 172.31.21.2, 00:05:38,
Serial0/0/0
R1#
Ctrl+F6 to exit CLI focus
Copy Paste

```

Figura 62 Enrutamiento R1

```

R2
Physical Config CLI Attributes
IOS Command Line Interface
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, E - EGP
i - IS-IS, 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

Gateway of last resort is not set

10.0.0.0/32 is subnetted, 1 subnets
C 10.10.10.10/32 is directly connected, Loopback0
172.31.0.0/16 is variably subnetted, 4 subnets, 2 masks
C 172.31.21.0/30 is directly connected, Serial0/0/1
L 172.31.21.2/32 is directly connected, Serial0/0/1
C 172.31.23.0/30 is directly connected, Serial0/0/0
L 172.31.23.1/32 is directly connected, Serial0/0/0
192.168.4.0/32 is subnetted, 1 subnets
O 192.168.4.1/32 [110/9501] via 172.31.23.2, 00:06:51,
Serial0/0/0
192.168.5.0/32 is subnetted, 1 subnets
O 192.168.5.1/32 [110/9501] via 172.31.23.2, 00:06:51,
Serial0/0/0
192.168.6.0/32 is subnetted, 1 subnets
O 192.168.6.1/32 [110/9501] via 172.31.23.2, 00:06:51,
Serial0/0/0
R2#
Ctrl+F6 to exit CLI focus
Copy Paste

```

Figura 63 Enrutamiento R2

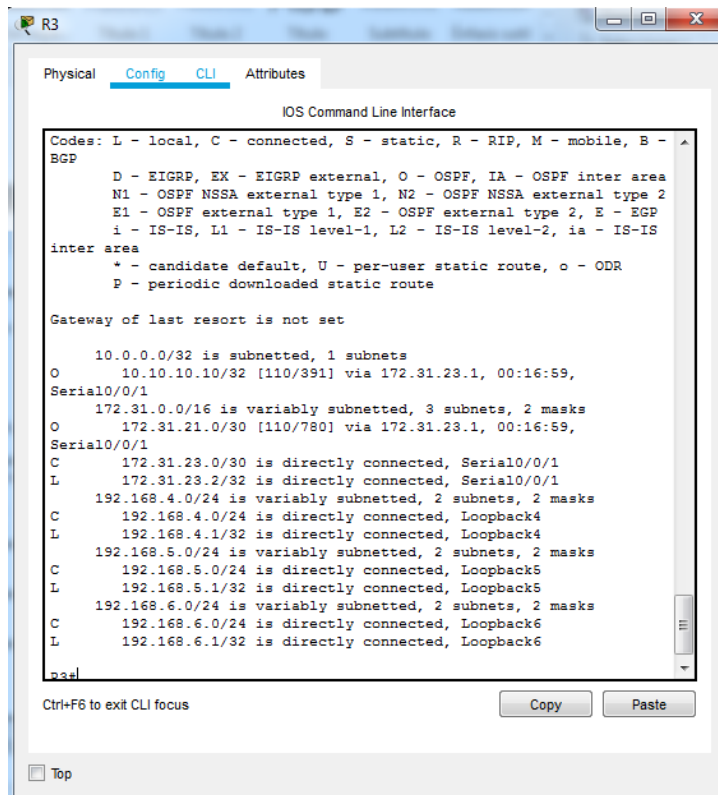


Figura 64 Enrutamiento R3

Se procede a verificar la adyacencia para los 3 routers con el comando show ip ospf neighbor

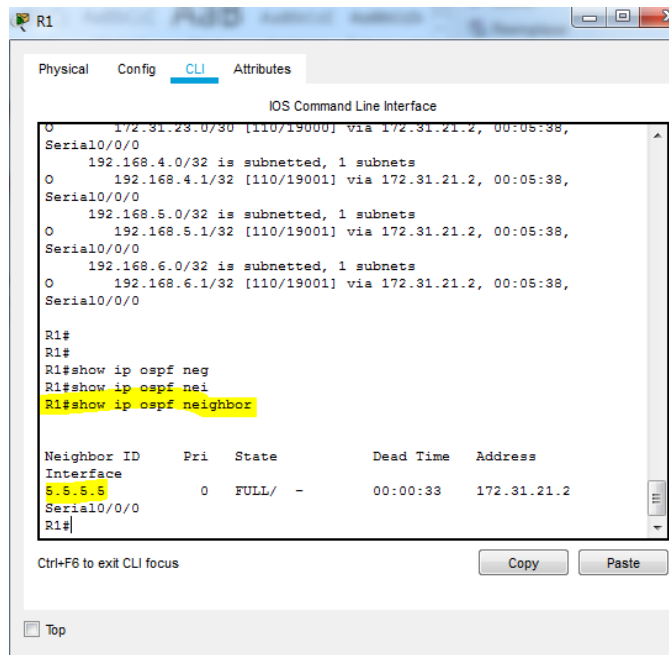


Figura 65 Verificación de adyacencias R1

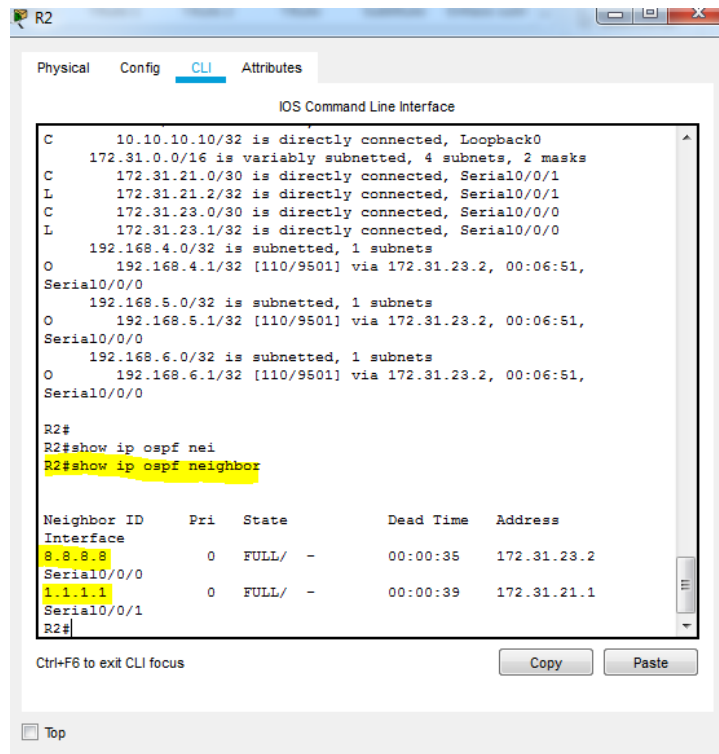


Figura 66 Verificación de adyacencias R2

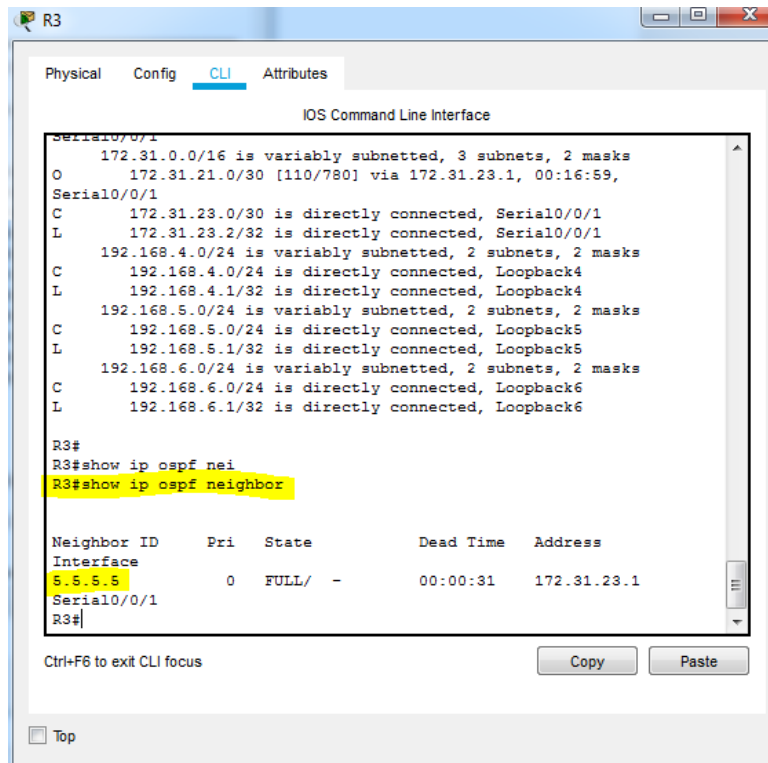


Figura 67 Verificación de adyacencias R3

Ahora se usa el comando `show ip route ospf` para mostrar solo las rutas OSPF descubiertas en la tabla de routing. A continuación, se muestra solo las rutas OSPF para los router 1,2 y 3 aplicando el comando `show ip route ospf`.

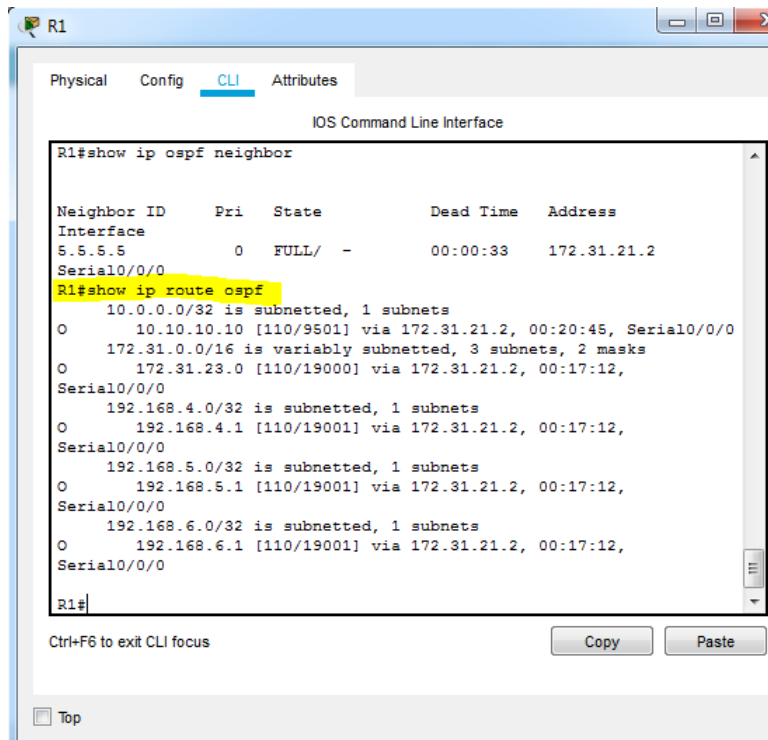


Figura 68 IP route desde OSPF R1

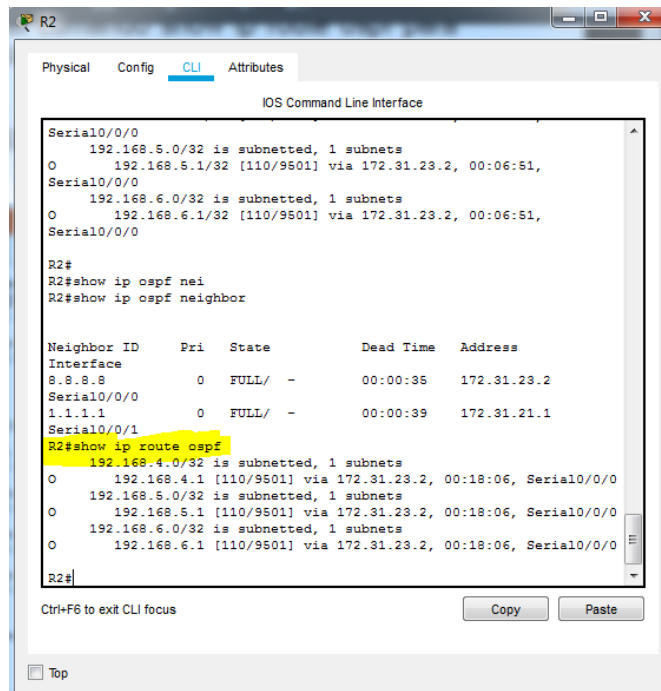


Figura 69 IP route desde OSPF R2

```

R3#
R3#show ip ospf nei
R3#show ip ospf neighbor

Neighbor ID      Pri   State           Dead Time   Address
Interface
5.5.5.5          0    FULL/ -         00:00:31   172.31.23.1
Serial0/0/1
R3#show ip route ospf
O        10.0.0.0/32 is subnetted, 1 subnets
O        10.10.10.10 [110/391] via 172.31.23.1, 00:28:45, Serial0/0/1
O        172.31.0.0/16 is variably subnetted, 3 subnets, 2 masks
O        172.31.21.0 [110/780] via 172.31.23.1, 00:28:45, Serial0/0/1
R3#

```

Figura 70 IP route desde OSPF R3

Visualizar lista resumida de interfaces por OSPF en donde se ilustre el costo de cada interface.

Para esto se utiliza el comando show ip ospf interface s0/0/0

```

R1#show ip ospf interface s0/0/0

Serial0/0/0 is up, line protocol is up
 Internet address is 172.31.21.1/30, Area 0
  Process ID 1, Router ID 1.1.1.1, Network Type POINT-TO-POINT, Cost:
  9500
  Transmit Delay is 1 sec, State POINT-TO-POINT, Priority 0
  No designated router on this network
  No backup designated router on this network
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit
  5
    Hello due in 00:00:03
  Index 1/1, flood queue length 0
  Next 0x0(0)/0x0(0)
  Last flood scan length is 1, maximum is 1
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 1, Adjacent neighbor count is 1
    Adjacent with neighbor 5.5.5.5
  Suppress hello for 0 neighbor(s)
R1#
R1#
R1#
R1#

```

Figura 71 Verificación del costo de la interface R1

Router 2:

```
R2#  
R2#show ip ospf interface s0/0/0  
  
Serial0/0/0 is up, line protocol is up  
Internet address is 172.31.23.1/30, Area 0  
Process ID 2, Router ID 5.5.5.5, Network Type POINT-TO-POINT, Cost:  
9500  
Transmit Delay is 1 sec, State POINT-TO-POINT, Priority 0  
No designated router on this network  
No backup designated router on this network  
Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit  
5  
Hello due in 00:00:05  
Index 3/3, flood queue length 0  
Next 0x0(0)/0x0(0)  
Last flood scan length is 1, maximum is 1  
Last flood scan time is 0 msec, maximum is 0 msec  
Neighbor Count is 1, Adjacent neighbor count is 1  
Adjacent with neighbor 8.8.8.8  
Suppress hello for 0 neighbor(s)  
R2#  
R2#  
R2#  
R2#
```

Figura 72 Verificación del costo de la interface R2

Visualizar el OSPF Process ID, Router ID, Address summarizations, Routing Networks, and passive interfaces configuradas en cada router.

Para visualizar la ID del proceso OSPF y la ID del router se utiliza el comando show ip ospf para cada uno de los routers:

R1

Physical Config CLI Attributes

IOS Command Line Interface

```
R1#
R1#show ip ospf
Routing Process "ospf 1" with ID 1.1.1.1
Supports only single TOS(TOS0) routes
Supports opaque LSA
SPF schedule delay 5 secs, Hold time between two SPFs 10 secs
Minimum LSA interval 5 secs. Minimum LSA arrival 1 secs
Number of external LSA 0. Checksum Sum 0x000000
Number of opaque AS LSA 0. Checksum Sum 0x000000
Number of DCbitless external and opaque AS LSA 0
Number of DoNotAge external and opaque AS LSA 0
Number of areas in this router is 1. 1 normal 0 stub 0 nssa
External flood list length 0
Area BACKBONE(0)
  Number of interfaces in this area is 1
  Area has no authentication
  SPF algorithm executed 9 times
  Area ranges are
  Number of LSA 3. Checksum Sum 0x0134cc
  Number of opaque link LSA 0. Checksum Sum 0x000000
  Number of DCbitless LSA 0
  Number of indication LSA 0
  Number of DoNotAge LSA 0
  Flood list length 0
R1#
```

Ctrl+F6 to exit CLI focus

Copy Paste

Top

Figura 73 OSPF 1 R1

R2

Physical Config CLI Attributes

IOS Command Line Interface

```
R2#
R2#show ip ospf
Routing Process "ospf 2" with ID 5.5.5.5
Supports only single TOS(TOS0) routes
Supports opaque LSA
SPF schedule delay 5 secs, Hold time between two SPFs 10 secs
Minimum LSA interval 5 secs. Minimum LSA arrival 1 secs
Number of external LSA 0. Checksum Sum 0x000000
Number of opaque AS LSA 0. Checksum Sum 0x000000
Number of DCbitless external and opaque AS LSA 0
Number of DoNotAge external and opaque AS LSA 0
Number of areas in this router is 1. 1 normal 0 stub 0 nssa
External flood list length 0
Area BACKBONE(0)
  Number of interfaces in this area is 3
  Area has no authentication
  SPF algorithm executed 11 times
  Area ranges are
  Number of LSA 3. Checksum Sum 0x0132cd
  Number of opaque link LSA 0. Checksum Sum 0x000000
  Number of DCbitless LSA 0
  Number of indication LSA 0
  Number of DoNotAge LSA 0
  Flood list length 0
R2#
```

Ctrl+F6 to exit CLI focus

Copy Paste

Top

Figura 74 OSPF 2 R2

```

R3#show ip ospf
Routing Process "ospf 3" with ID 8.8.8.8
Supports only single TOS(TOS0) routes
Supports opaque LSA
SPF schedule delay 5 secs, Hold time between two SPFs 10 secs
Minimum LSA interval 5 secs. Minimum LSA arrival 1 secs
Number of external LSA 0. Checksum Sum 0x0000000
Number of opaque AS LSA 0. Checksum Sum 0x0000000
Number of DCbitless external and opaque AS LSA 0
Number of DoNotAge external and opaque AS LSA 0
Number of areas in this router is 1. 1 normal 0 stub 0 nssa
External flood list length 0
Area BACKBONE(0)
Number of interfaces in this area is 4
Area has no authentication
SPF algorithm executed 11 times
Area ranges are
Number of LSA 3. Checksum Sum 0x0132cd
Number of opaque link LSA 0. Checksum Sum 0x0000000
Number of DCbitless LSA 0
Number of indication LSA 0
Number of DoNotAge LSA 0
Flood list length 0
R3#

```

Figura 75 OSPF 3 R3

1.2.3 Configurar VLANs, Puertos troncales, puertos de acceso, encapsulamiento, Inter-VLAN Routing y Seguridad en los Switches acorde a la topología de red establecida.

A continuación, se muestra la topología establecida para dar claridad sobre las VLAN que se implementarán en los switches:

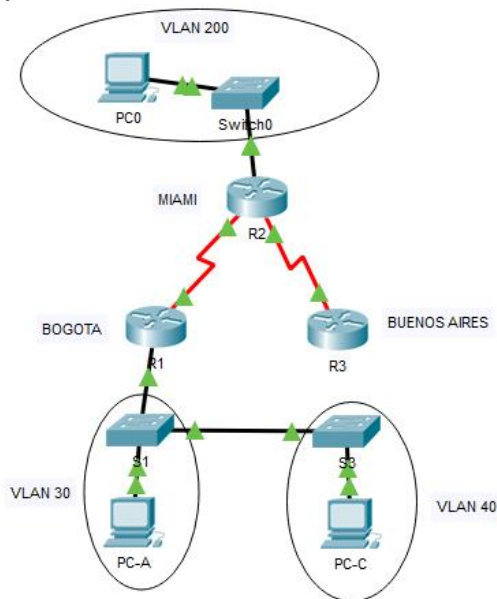
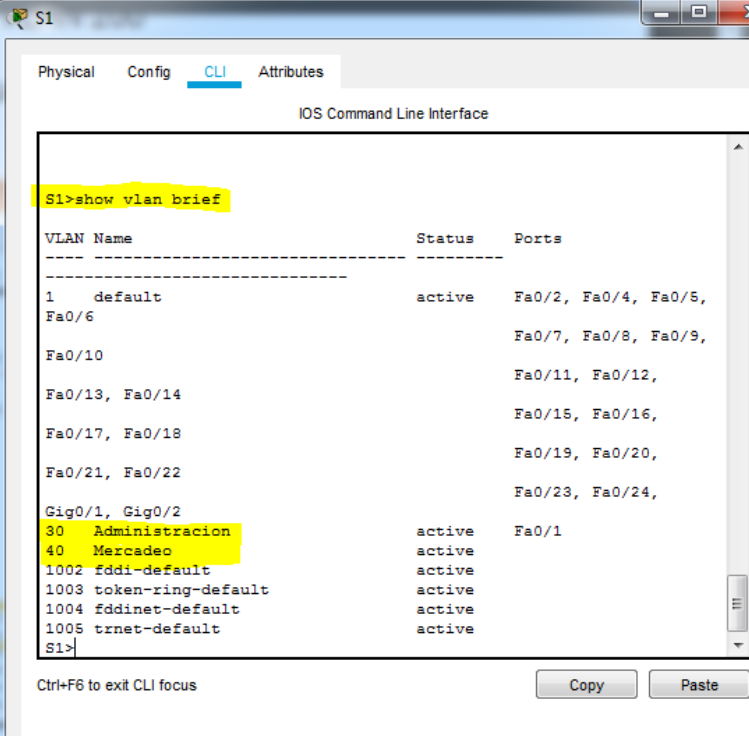


Figura 76 Topología implementada

Configuración para el suiche 1:

```
Switch(config)#hostname S1
S1(config)#vlan 30
S1(config-vlan)#name Administracion
S1(config-vlan)#vlan 40
S1(config-vlan)#name Mercadeo
S1(config-vlan)#exit
S1(config)#interface f0/3
S1(config-if)#switchport mode trunk
S1(config-if)#
S1(config-if)#exit
S1(config)#interface f0/1
S1(config-if)#switchport mode access
S1(config-if)#switchport access vlan 30
S1(config-if)#exit
S1(config)#interface f0/24
S1(config-if)#switchport mode trunk
```

Verificación mediante el comando show vlan brief

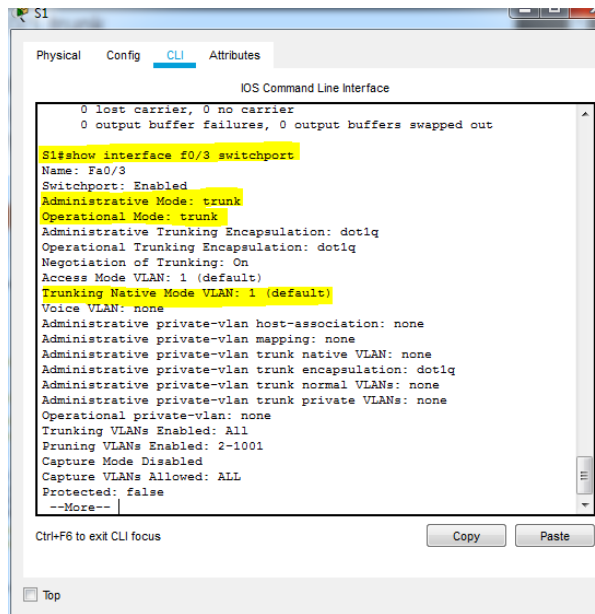


```
S1>show vlan brief
```

VLAN Name	Status	Ports
1 default	active	Fa0/2, Fa0/4, Fa0/5, Fa0/6, Fa0/7, Fa0/8, Fa0/9, Fa0/10, Fa0/11, Fa0/12, Fa0/13, Fa0/14, Fa0/15, Fa0/16, Fa0/17, Fa0/18, Fa0/19, Fa0/20, Fa0/21, Fa0/22, Fa0/23, Fa0/24, Gig0/1, Gig0/2
30 Administracion	active	Fa0/1
40 Mercadeo	active	
1002 fddi-default	active	
1003 token-ring-default	active	
1004 fddinet-default	active	
1005 vtrnet-default	active	

Figura 77 Verificación de VLAN S1

Con el fin de comprobar los enlaces troncales se utiliza el comando show interfaces ID-interfaz switchport.



```
IOS Command Line Interface
0 lost carrier, 0 no carrier
0 output buffer failures, 0 output buffers swapped out
S1#show interface f0/3 switchport
Name: Fa0/3
Switchport: Enabled
Administrative Mode: trunk
Operational Mode: trunk
Administrative Trunking Encapsulation: dot1q
Operational Trunking Encapsulation: dot1q
Negotiation of Trunking: On
Access Mode VLAN: 1 (default)
Trunking Native Mode VLAN: 1 (default)
Voice VLAN: none
Administrative private-vlan host-association: none
Administrative private-vlan mapping: none
Administrative private-vlan trunk native VLAN: none
Administrative private-vlan trunk encapsulation: dot1q
Administrative private-vlan trunk normal VLANs: none
Administrative private-vlan trunk private VLANs: none
Operational private-vlan: none
Trunking VLANs Enabled: All
Pruning VLANs Enabled: 2-1001
Capture Mode Disabled
Capture VLANs Allowed: ALL
Protected: false
--More--
```

Figura 78 Verificación de enlaces troncales S1

```
Para el suiche 3:
Switch(config)#hostname S3
S3(config)#vlan 30
S3(config-vlan)#name Administracion
S3(config-vlan)#vlan 40
S3(config-vlan)#name Mercadeo
S3(config-vlan)#exit
S3(config)#interface f0/3
S3(config-if)#switchport mode trunk
S3(config-if)#exit
S3(config)#interface f0/1
S3(config-if)#switchport access vlan 40
S3(config-if)#exit
```

Verificación:

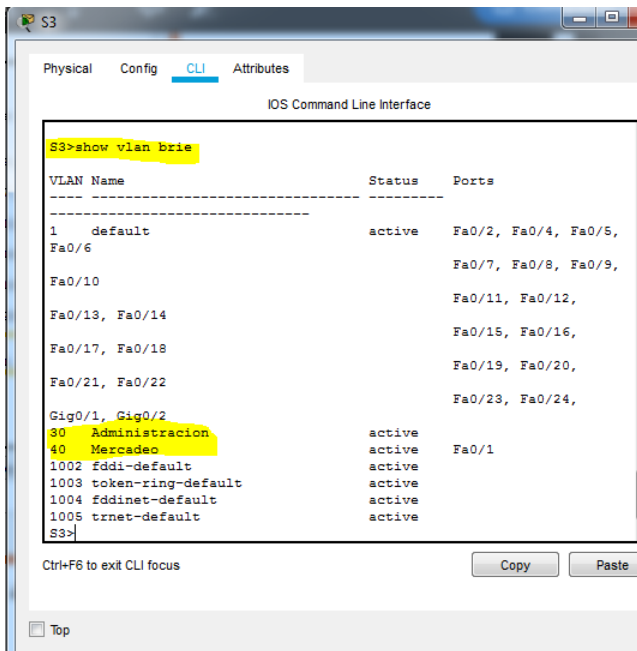


Figura 79 Verificación VLAN S3

Con el fin de comprobar los enlaces troncales se utiliza el comando show interfaces ID-interfaz switchport.

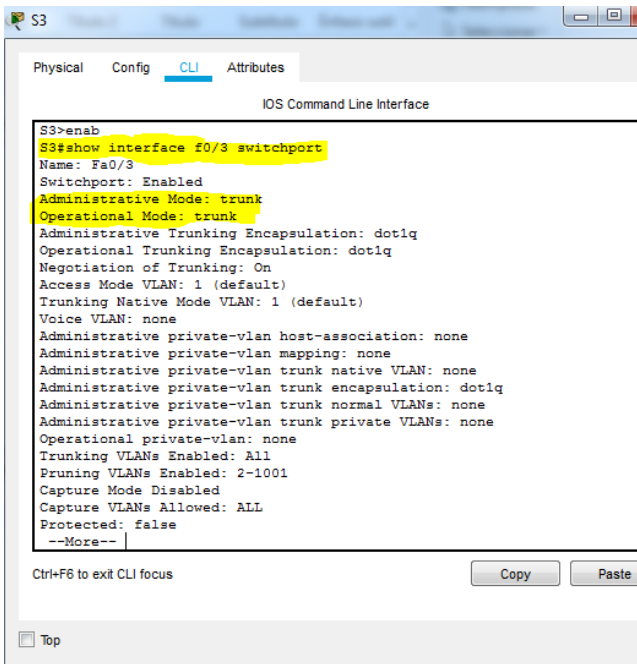


Figura 80 Verificación de enlaces troncales S3

Para el suiche 0

```
Switch(config)#hostname S0
S0(config)#vlan 200
S0(config-vlan)#name Mantenimiento
S0(config-vlan)#exit
S0(config)#interface f0/1
S0(config-if)#switchport mode trunk
S0(config-if)#exit
S0(config)#interface f0/2
S0(config-if)#switchport access vlan 200
S0(config-if)#exit
```

Verificación

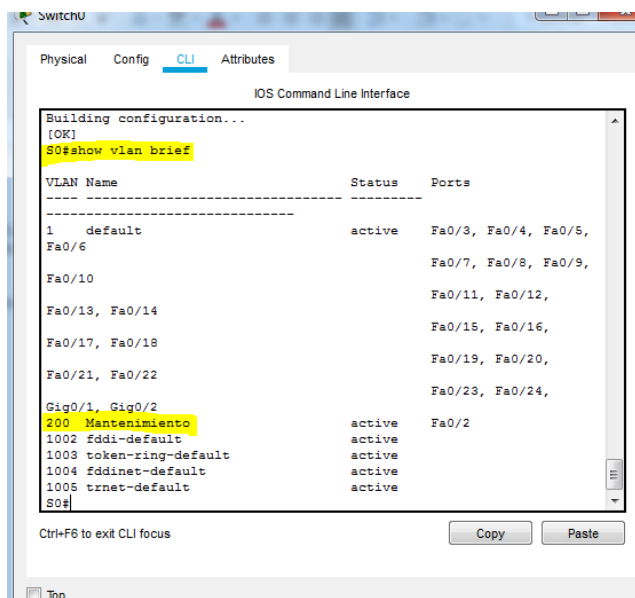


Figura 81 Verificación VLAN S0

Con el fin de comprobar los enlaces troncales se utiliza el comando show interfaces ID-interfaz switchport.

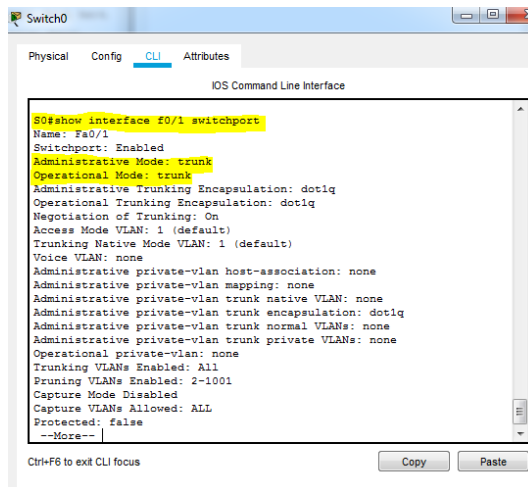


Figura 82 Verificación de enlaces troncales S0

Como se están usando switches Cisco Catalyst 2960 se utiliza de manera automática la encapsulación 802.1Q en los enlaces troncales. para otros switches generalmente se requiere la configuración manual de la encapsulación.

Paso seguido se configura el puerto G0/0 del router 1 para las subinterfaces de las VLAN 30 y 40.

```
R1(config)#interface g0/0.1
R1(config-subif)#encapsulation dot1Q 1
R1(config-subif)#ip address 192.168.99.1 255.255.255.0
R1(config-subif)#end
R1(config)#interface g0/0.30
R1(config-subif)#encapsulation dot1Q 30
R1(config-subif)#ip address 192.168.30.1 255.255.255.0
R1(config-subif)#end
R1(config)#interface g0/0.40
R1(config-subif)#encapsulation dot1Q 40
R1(config-subif)#ip address 192.168.40.1 255.255.255.0
R1(config-subif)#end
R1(config)#interface g0/0
R1(config-if)#no shutdown
```

Comprobación:

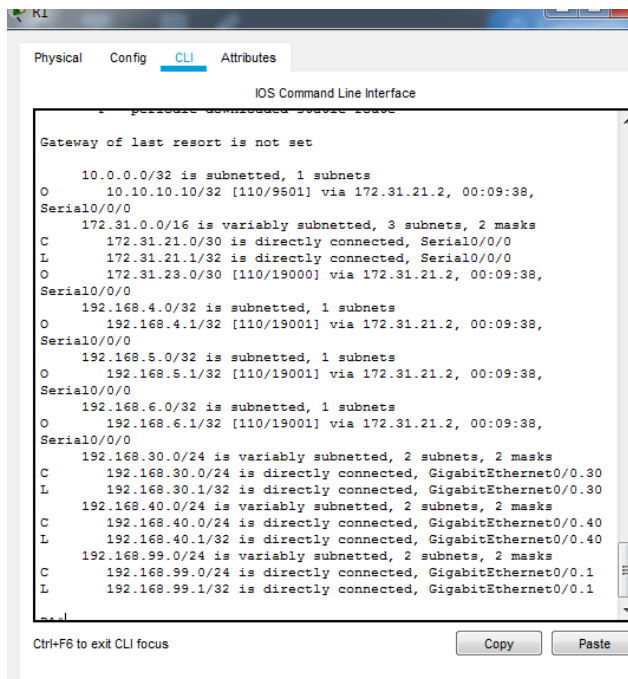


Figura 83 Verificación puerto G0/0 VLAN en R1

En R2 se habilita la subinterfaz 200

```

R2(config)#interface g0/0.200
R2(config-subif)#encapsulation dot1Q 200
R2(config-subif)#ip address 192.168.200.1 255.255.255.0
R2(config-subif)#end
R2(config)#interface g0/0
R2(config-if)#no shutdown

```

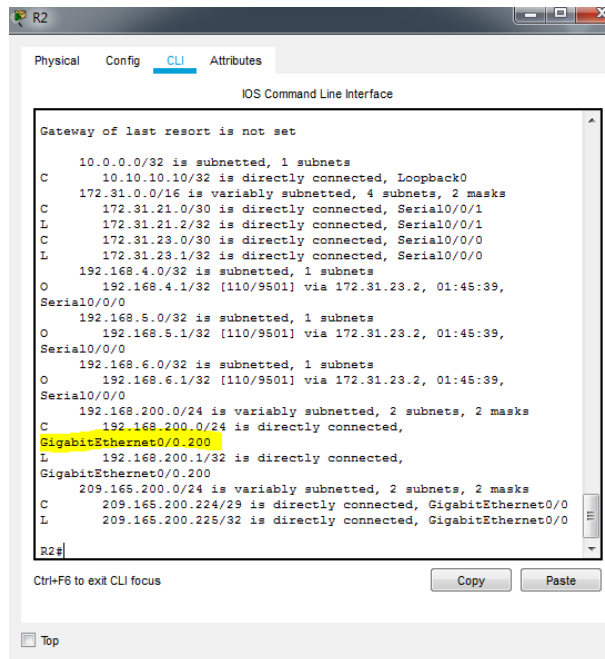



Figura 84 Verificación puerto G0/0 VLAN en R2

1.2.4 En el Switch 3 deshabilitar DNS lookup

Para deshabilitar el DNS, se utiliza el comando no ip domain-lookup:

```

S3(config)#no ip domain-lookup
S3(config)#exit

```

1.2.5 Asignar direcciones IP a los Switches acorde a los lineamientos.

Suiche 1:

```

S1(config)#interface vlan 1
S1(config-if)#ip address 192.168.99.2 255.255.255.0
S1(config-if)#no shutdown
S1(config-if)#ip default-gateway 192.168.99.1
S1(config)#exit

```

```

S3(config)#interface vlan 1
S3(config-if)#ip address 192.168.99.3 255.255.255.0
S3(config-if)#no shutdown
S3(config-if)#ip default-gateway 192.168.99.1
S3(config)#exit
S0(config)#ip default-gateway 192.168.200.1

```

1.2.6 Desactivar todas las interfaces que no sean utilizadas en el esquema de red.

Para S1:

```
S1(config)#interface range fa0/4-23
S1(config-if-range)#shutdown
S1(config)#interface f0/2
S1(config-if)#shutdown
S1(config)#interface range gigabitEthernet 0/1-2
S1(config-if-range)#shutdown
```

Para S3:

```
S3(config)#interface range fa0/4-24
S3(config-if-range)#shutdown
S3(config)#interface fa0/2
S3(config-if)#shutdown
S3(config)#interface range gigabitEthernet 0/1-2
S3(config-if-range)#shutdown
```

Para S0:

```
S0(config)#interface range fa0/3-24
S0(config-if-range)#shutdown
S0(config)#interface range gigabitEthernet 0/1-2
S0(config-if-range)#shutdown
```

1.2.7 Configurar R1 como servidor DHCP para las VLANs 30 y 40. Reservar las primeras 30 direcciones IP de las VLAN 30 y 40 para configuraciones estáticas.

Configurar DHCP pool para VLAN 30	Name: ADMINISTRACION DNS-Server: 10.10.10.11 Domain-Name: ccna-unad.com Establecer default gateway.
Configurar DHCP pool para VLAN 40	Name: MERCADEO DNS-Server: 10.10.10.11 Domain-Name: ccna-unad.com Establecer default gateway.

Figura 85 Configuraciones DHCP

Primero se reservarán las primeras 30 direcciones IP de las VLAN 30 y 40:

```
R1(config)#ip dhcp excluded-address 192.168.30.1 192.168.30.30
R1(config)#ip dhcp excluded-address 192.168.40.1 192.168.40.30
R1(config)#exit
```

Ahora se configura el DHCP pool

```
R1(config)#ip dhcp pool ADMINISTRACION
R1(dhcp-config)#network 192.168.30.0 255.255.255.0
R1(dhcp-config)#default-router 192.168.99.1
R1(dhcp-config)#dns-server 10.10.10.11
R1(dhcp-config)#end
R1(config)#ip dhcp pool MERCADEO
R1(dhcp-config)#network 192.168.40.0 255.255.255.0
R1(dhcp-config)#default-router 192.168.99.1
R1(dhcp-config)#dns-server 10.10.10.11
R1(dhcp-config)#exit
```

Dado que Packet Tracer no soporta algunos comandos, no se configuro el nombre de dominio con el comando domain-name ni la duración del arrendamiento mediante el comando lease. En este caso el valor de arrendamiento predeterminado para la dirección IP asignada es un día.

Ya que el servidor se encuentra en la misma LAN no es necesario un agente de retransmisión para el caso de estudio.

Verificación configuración del pool:

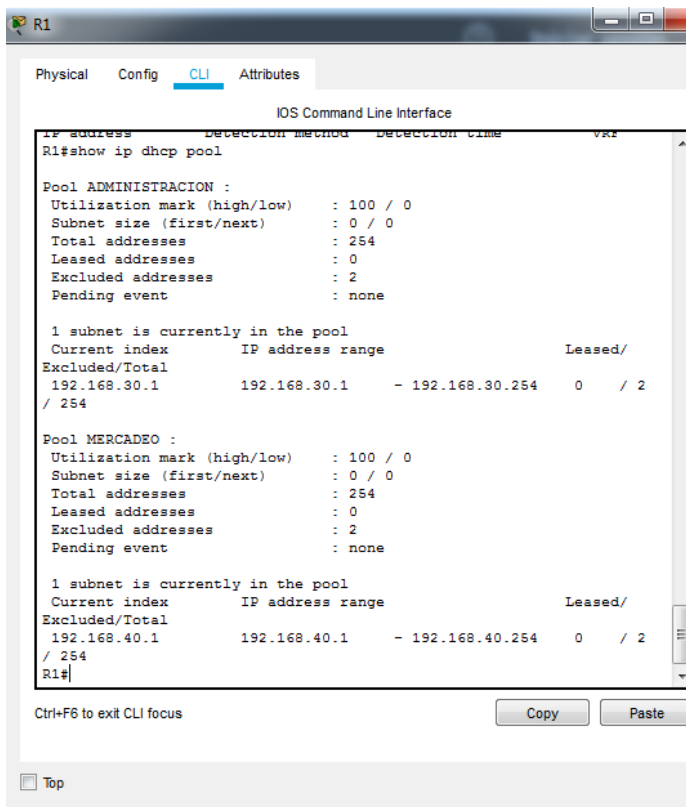


Figura 86 Verificación del pool R1

verificación del DHCP en los PC:

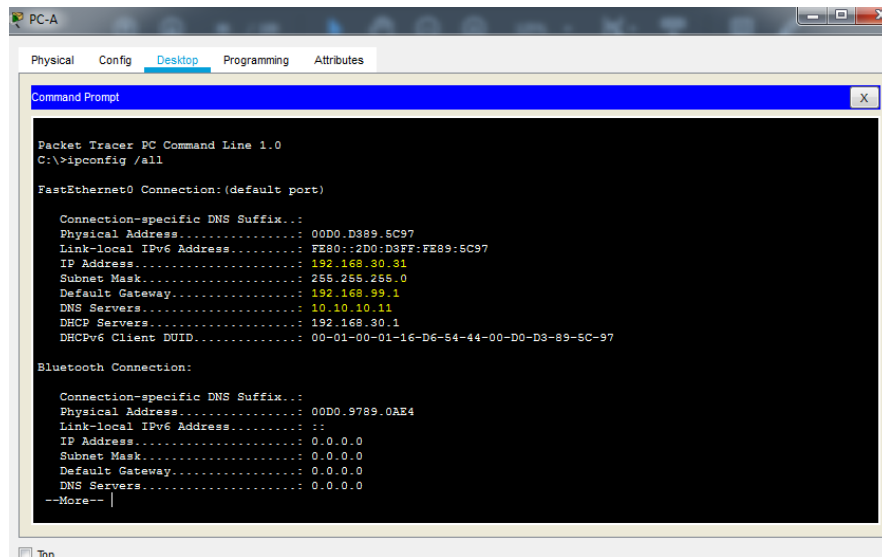


Figura 87 Validación del DHCP PC-A

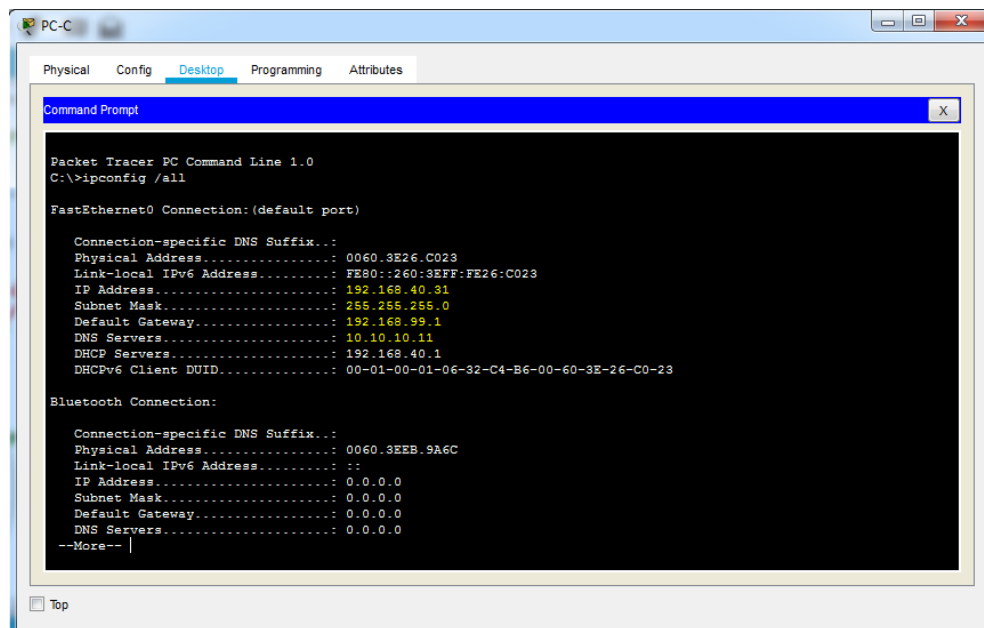


Figura 88 Validación del DHCP PC-C

1.2.8 Configurar NAT en R2 para permitir que los hosts puedan salir a internet.

Para configurar una NAT dinámica se utiliza se debe usar el comando ip nat pool.

```

R2(config)#ip nat pool NAT-POOL1 209.165.200.225 209.165.200.230
netmask 255.255.255.248
R2(config)#access-list 1 permit 192.168.0.0 0.0.255.255
R2(config)#ip nat inside source list 1 pool NAT-POOL1
R2(config)#interface s0/0/1
R2(config-if)#ip nat inside
R2(config-if)#exit
R2(config)#interfa gigabitEthernet 0/0
R2(config-if)#ip nat outside
R2(config-if)#end
  
```

Verificación:

```

R2 (config-if)#end
R2#
%SYS-5-CONFIG_I: Configured from console by console

R2#copy r
R2#copy running-config st
R2#copy running-config startup-config
Destination filename [startup-config]?
Building configuration...
[OK]
R2#show ip nat statics
^
% Invalid input detected at '^' marker.

R2#show ip nat st
R2#show ip nat statistics
Total translations: 0 (0 static, 0 dynamic, 0 extended)
Outside Interfaces: GigabitEthernet0/0
Inside Interfaces: Serial0/0/1
Hits: 0 Misses: 0
Expired translations: 0
Dynamic mappings:
-- Inside Source
access-list 1 pool NAT-POOL1 refCount 0
pool NAT-POOL1: netmask 255.255.255.248
start 209.165.200.225 end 209.165.200.230
type generic, total addresses 6, allocated 0 (0%), misses 0
R2#

```

Figura 89 Verificación de NAT en R2

1.2.9 Configurar al menos dos listas de acceso de tipo estándar a su criterio en para restringir o permitir tráfico desde R1 o R3 hacia R2.

Se decide configurar dos listas de acceso para permitir o denegar tráfico, para ello configuramos una ACL. Para el router R3 se bloquea el tráfico del pc con la IP 19.168.40.55, pero se permite el resto de tráfico:

```

R3(config)#access-list 1 deny host 192.168.40.55
R3(config)#access-list 1 permit any
R3(config)#interface g0/0.1
R3(config-subif)#ip access-group 1 in
R3(config-subif)#

```

Para verificar la programación utilizamos el comando show access list:

```
R3#show access-list
Standard IP access list 1
 10 deny host 192.168.40.55
 20 permit any
R3#
```

Ctrl+F6 to exit CLI focus

Copy Paste

Figura 90 Verificación de listas de acceso R3

Ahora denegamos el acceso de la ip 192.168.30.99 para el router R1:

```
R1(config)#access-list 1 deny host 192.168.30.99
R1(config)#access-list 1 permit any
R1(config)#interface g0/0
R1(config-if)#ip access-group 1 in
R1(config-if)#exit
```

Verificación:

```
R1>enab
R1#conf
R1#configure ter
R1#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
R1(config)#access-list 1 deny hosto 192.168.30.99
^
% Invalid input detected at '^' marker.

R1(config)#access-list 1 deny host 192.168.30.99
R1(config)#access-list 1 permit any
R1(config)#interface g0/0
R1(config-if)#ip access-group 1 in
R1(config-if)#exit
R1(config)#exit
R1#
%SYS-5-CONFIG_I: Configured from console by console
show access-list
Standard IP access list 1
 10 deny host 192.168.30.99
 20 permit any
R1#
R1#
```

Ctrl+F6 to exit CLI focus

Copy Paste

Top

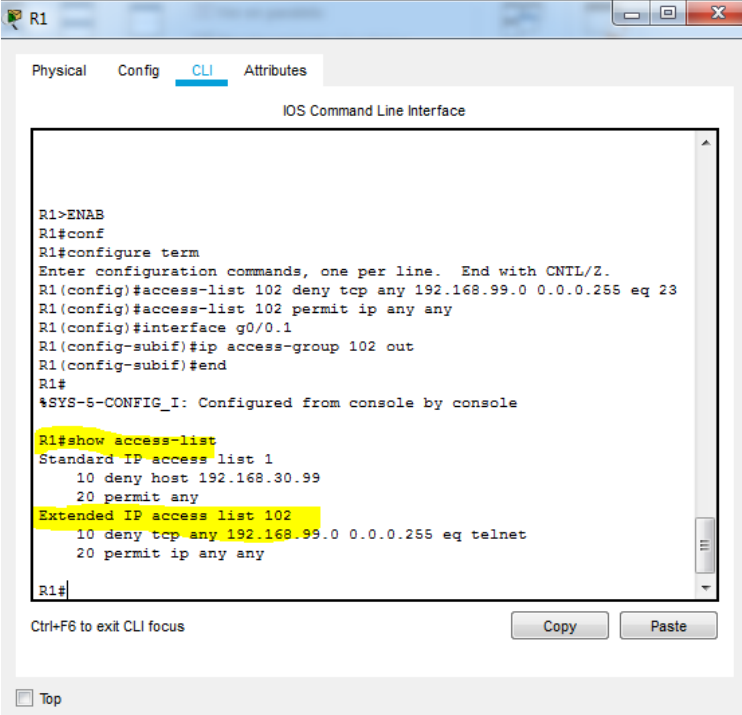
Figura 91 Verificación de listas de acceso R1

1.2.10 Configurar al menos dos listas de acceso de tipo extendido o nombradas a su criterio en para restringir o permitir tráfico desde R1 o R3 hacia R2.

Se debe utilizar el comando `ip access-list extended nombre` para definir un nombre para la ACL extendida. Para este caso se deniega el tráfico telnet de cualquier origen a la LAN 192.168.99.0/24 pero el permite el tráfico IP a través de la interfaz G0/0.1:

```
R1(config)#access-list 102 deny tcp any 192.168.99.0 0.0.0.255 eq 23
R1(config)#access-list 102 permit ip any any
R1(config)#interface g0/0.1
R1(config-subif)#ip access-group 102 out
R1(config-subif)#end
```

Verificación:



```
R1
Physical Config CLI Attributes
IOS Command Line Interface

R1>ENAB
R1#conf
R1#configure term
Enter configuration commands, one per line. End with CNTL/Z.
R1(config)#access-list 102 deny tcp any 192.168.99.0 0.0.0.255 eq 23
R1(config)#access-list 102 permit ip any any
R1(config)#interface g0/0.1
R1(config-subif)#ip access-group 102 out
R1(config-subif)#end
R1#
%SYS-5-CONFIG_I: Configured from console by console

R1#show access-list
Standard IP access list 1
 10 deny host 192.168.30.99
 20 permit any
Extended IP access list 102
 10 deny tcp any 192.168.99.0 0.0.0.255 eq telnet
 20 permit ip any any

R1#
```

Figura 92 Verificación de listas extendidas R1

1.2.11 Verificar procesos de comunicación y redireccionamiento de tráfico en los routers mediante el uso de Ping y Trace route.


```
PC-A
Physical Config Desktop Programming Attributes
Command Prompt

Pinging 192.168.99.2 with 32 bytes of data:

Reply from 192.168.99.2: bytes=32 time<1ms TTL=254
Reply from 192.168.99.2: bytes=32 time<1ms TTL=254
Reply from 192.168.99.2: bytes=32 time=1ms TTL=254
Reply from 192.168.99.2: bytes=32 time=1ms TTL=254

Ping statistics for 192.168.99.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms

C:\>ping 192.168.99.3

Pinging 192.168.99.3 with 32 bytes of data:

Reply from 192.168.99.3: bytes=32 time<1ms TTL=254
Reply from 192.168.99.3: bytes=32 time<1ms TTL=254
Reply from 192.168.99.3: bytes=32 time<1ms TTL=254
Reply from 192.168.99.3: bytes=32 time<1ms TTL=254

Ping statistics for 192.168.99.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>
```

Figura 93 Verificación de pings PC-A

```
PC-A
Physical Config Desktop Programming Attributes
Command Prompt

C:\>tracert 192.168.99.2

Tracing route to 192.168.99.2 over a maximum of 30 hops:

  0  0 ms  0 ms  0 ms  192.168.30.1
  1  1 ms  0 ms  0 ms  192.168.30.1
  2  0 ms  0 ms  0 ms  192.168.99.2

Trace complete.

C:\>tracert 192.168.99.3

Tracing route to 192.168.99.3 over a maximum of 30 hops:

  0  0 ms  0 ms  0 ms  192.168.30.1
  1  0 ms  0 ms  0 ms  192.168.30.1
  2  0 ms  1 ms  0 ms  192.168.99.3

Trace complete.

C:\>
```

Figura 94 Tracert PC-A

```
PC-C
Physical Config Desktop Programming Attributes
Command Prompt
Pinging 192.168.99.2 with 32 bytes of data:
Reply from 192.168.99.2: bytes=32 time<1ms TTL=254
Reply from 192.168.99.2: bytes=32 time<1ms TTL=254
Reply from 192.168.99.2: bytes=32 time<1ms TTL=254
Reply from 192.168.99.2: bytes=32 time<1ms TTL=254
Ping statistics for 192.168.99.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms
C:\>ping 192.168.99.3
Pinging 192.168.99.3 with 32 bytes of data:
Reply from 192.168.99.3: bytes=32 time<1ms TTL=254
Reply from 192.168.99.3: bytes=32 time<1ms TTL=254
Reply from 192.168.99.3: bytes=32 time<1ms TTL=254
Reply from 192.168.99.3: bytes=32 time<1ms TTL=254
Ping statistics for 192.168.99.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms
C:\>
```

Figura 95 Verificación de pings PC-C

```
PC-C
Physical Config Desktop Programming Attributes
Command Prompt
C:\>tracert 192.168.99.2
Tracing route to 192.168.99.2 over a maximum of 30 hops:
  0  0 ms  0 ms  0 ms  192.168.40.1
  1  1 ms  0 ms  0 ms  192.168.40.1
  2  0 ms  0 ms  0 ms  192.168.99.2
Trace complete.
C:\>tracert 192.168.99.3
Tracing route to 192.168.99.3 over a maximum of 30 hops:
  0  0 ms  0 ms  0 ms  192.168.40.1
  1  0 ms  0 ms  0 ms  192.168.40.1
  2  0 ms  0 ms  0 ms  192.168.99.3
Trace complete.
C:\>
```

Figura 96 Tracert PC-C

CONCLUSIONES

- Con la elaboración del trabajo fue posible adquirir destrezas y conocimientos en el manejo del software Cisco Packet Tracer, además de solucionar problemas de la vida en un entorno de simulación.
- El uso de VLAN o redes locales virtuales permite la creación de redes lógicas diferentes dentro de una misma red física, facilitando la administración de la red y disminuyendo el dominio de difusión. El protocolo de etiquetado que más se utiliza es el IEEE 802.1Q.
- Se comprobó que el protocolo de configuración dinámica del servidor o DHCP permite que más de host obtengan la configuración de red de forma totalmente automática, sin que exista la necesidad de configurar manualmente las direcciones IP, máscara de subred y puerta de enlace predeterminada.
- Se puede usar la separación de privilegios mediante el uso de listas de control de acceso o ACL, permitiendo o denegando el tráfico de red de acuerdo a alguna condición en particular como bloquear protocolos en puertos específicos, lo que ayuda a prevenir tráfico indeseado en la red.
- Otra medida de seguridad que se debe tomar para prevenir el acceso no autorizado es deshabilitar los puertos que no se están usando tanto en los switches como en los routers.
- El OSPF es un protocolo de direccionamiento llamado de estado de enlace que utiliza unos paquetes específicos para conocer dicho estado. Es muy práctico en redes heterogéneas y de gran tamaño puesto que puede recalcular las rutas en poco tiempo cuando se modifica la topología de la red.

REFERENCIAS BIBLIOGRÁFICAS

- LAN. (2018, 1 de octubre). Wikipedia, La enciclopedia libre. Fecha de consulta: 05:50, diciembre 13, 2018 desde <https://es.wikipedia.org/w/index.php?title=VLAN&oldid=110982165>.
- VLANs CISCO. (2018). VLANs. Principios de Enrutamiento y Conmutación. Recuperado de: <https://static-course-assets.s3.amazonaws.com/RSE50ES/module3/index.html#3.0.1.1>
- Open Shortest Path First. (2018, 14 de agosto). Wikipedia, La enciclopedia libre. Fecha de consulta: 00:47, diciembre 12, 2018 desde <https://es.wikipedia.org/w/index.php?title=Open Shortest Path First&oldid=109955865>.
- Protocolo de configuración dinámica de host. (2018, 22 de septiembre). Wikipedia, La enciclopedia libre. Fecha de consulta: 00:48, diciembre 11, 2018 desde <https://es.wikipedia.org/w/index.php?title=Protocolo de configuraci%C3%B3n din%C3%A1mica de host&oldid=110778632>.
- DHCP CISCO. (2018). DHCP. Principios de Enrutamiento y Conmutación. Recuperado de: <https://static-course-assets.s3.amazonaws.com/RSE50ES/module10/index.html#10.0.1.1>
- OSPF de una sola área CISCO. (2018). OSPF de una sola área. Principios de Enrutamiento y Conmutación. Recuperado de: <https://static-course-assets.s3.amazonaws.com/RSE50ES/module8/index.html#8.0.1.1>
- Listas de control de acceso CISCO. (2018). Listas de control de acceso. Principios de Enrutamiento y Conmutación. Recuperado de: <https://static-course-assets.s3.amazonaws.com/RSE50ES/module9/index.html#9.0.1.1>