

# **SOLUCIÓN DE ESTUDIOS DE CASO BAJO EL USO DE TECNOLOGÍA CISCO**

**ALFONSO NAHOR PINILLA SANCHEZ  
79942779**

**DIPLOMADO DE PROFUNDIZACION CISCO (DISEÑO E  
IMPLEMETACION DE SOLUCIONES INTEGRADAS WAN/LAN)  
PROGRAMA DE INGENIERIA DE TELECOMUNICACIONES  
ESCUELA DE CIENCIAS BASICAS, TECNOLOGÍA E  
INGENIERIA (ECBTI)**



**UNIVERSIDAD NACIONAL ABIERTA Y A DISTANCIA (UNAD)  
BOGOTA, diciembre 13 de 2018**

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**ALFONSO NAHOR PINILLA SANCHEZ**

**Trabajo de grado presentado como requisito para optar al título de  
INGENIERO DE TELECOMUNICACIONES**

**Director: JUAN CARLOS VESGA**  
[jvesgag@unadvirtual.edu.co](mailto:jvesgag@unadvirtual.edu.co)

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# SOLUCIÓN DE ESTUDIOS DE CASO BAJO EL USO DE TECNOLOGÍA CISCO

Pinilla Alfonso

*UNIVERSIDAD NACIONAL ABIERTA Y A DISTANCIA (UNAD)*

*BOGOTÁ, diciembre 13 de 2018*

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## **Resumen**

En este documento se muestran las evidencias a los problemas planteados como prueba de las habilidades técnicas adquiridas en el desarrollo del diplomado de profundización CISCO. El despliegue de los escenarios propuestos desarrolla cada uno de los temas aprendidos y afianza mediante la aplicación práctica cada uno de los conceptos. Se realiza mediante la implementación en el simulador Packet Tracer de CISCO el cual cuenta con todas las herramientas necesarias y se anexan los enlaces para descargar los archivos de extensión pka que son evidencia adicional de los conocimientos adquiridos y desarrollados. El desarrollo consta de una simulación para cada escenario y concluye de forma exitosa el funcionamiento claro y preciso de cada uno de los comandos de configuración del sistema operativo IOS de CISCO.

Palabras clave: CISCO;CCNA;HABILIDADES

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## **Abstract**

This document show evidences about the scenarios required by the academy. It probes the skills needed to satisfice the porpouse of “Diplomado de Profundización CISCO”. It deploys every items and reinforce its application in each context learned. The implementation was made using CISCO Packet Tracer Simulator Tool, which is the most complete tool to accomplish the goals required. This document contains two links to download the simulations that probes their function and completes the evidences of this work. Each simulation has the correct commands to achieve each goal and demonstrates that work correctly.

Keywords: CISCO;CCNA;SKILLS

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## **1. INTRODUCCION**

El desarrollo y la evolución continua de las tecnologías de la información plantea un desafío constante para los nuevos ingenieros de telecomunicaciones a nivel global. La Universidad Nacional Abierta y a Distancia (UNAD) nos ha permitido desarrollar mediante este Diplomado De Profundizacion Cisco (Diseño E Implemetacion De Soluciones Integradas WAN/LAN) el conocimiento teórico y práctico como un importante paso para lograr las habilidades necesarias para lograrlo.

Mediante el aprendizaje interactivo de los fundamentos teóricos y su aplicación práctica se logra un afianzamiento de las habilidades de muy alto nivel. Este trabajo pretende mostrar los resultados de este diplomado demostrando la calidad y beneficios para nosotros como estudiantes en los retos como futuros Ingenieros de Telecomunicaciones.



## **2. JUSTIFICACION**

Este trabajo se realiza como parte del Diplomado De Profundizacion Cisco (Diseño E Implemetacion De Soluciones Integradas WAN/LAN) con el propósito de evaluar y comprobar las habilidades técnicas aprendidas en él. Este trabajo beneficia a el estudiante como importante evidencia del afianzamiento del conocimiento y pericia técnica aprendida y beneficia a la comunidad universitaria en general como modelo de aprendizaje basado en la experiencia.

### **3. OBJETIVOS**

#### **3.1 OBJETIVO GENERAL**

Este trabajo tiene como objetivo afianzar el conocimiento teórico y práctico adquirido en el Diplomado De Profundización Cisco (Diseño E Implementación De Soluciones Integradas WAN/LAN).

#### **3.2 OBJETIVOS ESPECÍFICOS**

Mediante el desarrollo del contenido de este trabajo de habilidades prácticas CCNA se logrará conocer en profundidad la aplicación y conocimientos técnicos para la implementación de los siguientes temas:

- Configuración de enlaces WAN y LAN aplicando VLSM y los tipos de interfaces Ethernet y Seriales.
- Configuración de protocolos de enrutamiento estático y de enrutamiento dinámico IGP de Link State (RIPv2 y OSPF).
- Configuración de DHCPv4 y DHCPv6 utilizando como servidores los routers de la simulación, así como la delegación de asignación de direccionamiento IPv6 a un servidor DHCP configurado con este rol.
- Configuración de NAT y PAT para simular la conectividad hacia Internet para todos los segmentos de red LAN permitidos por este fin.
- Configuración de parámetros de seguridad en switch LAN mediante la aplicación de las mejores prácticas aprendidas en el diplomado.
- Redistribución de enrutamiento estático de la ruta predeterminada en el protocolo de enrutamiento dinámico interno.
- Aplicación de costos sobre las interfaces WAN para el adecuado cálculo de métrica en el protocolo dinámico a conveniencia del diseño de red presentado.
- Comprobación de operación y funcionamiento de las ACL estándar y extendidas como filtro básico de seguridad en los routers internos y su utilización para el funcionamiento de PAT (NAT con sobrecarga).

## 4. PRUEBA DE HABILIDADES PRACTICAS CCNA

### 4.1 DESCRIPCIÓN GENERAL DE LA PRUEBA DE HABILIDADES

La evaluación denominada “Prueba de habilidades prácticas”, forma parte de las actividades evaluativas del Diplomado de Profundización CCNA, y busca identificar el grado de desarrollo de competencias y habilidades que fueron adquiridas a lo largo del diplomado. Lo esencial es poner a prueba los niveles de comprensión y solución de problemas relacionados con diversos aspectos de Networking.

El proceso de configuración se realizó mediante la herramienta: Packet Tracer.

#### 4.1.1 ESCENARIO 1.

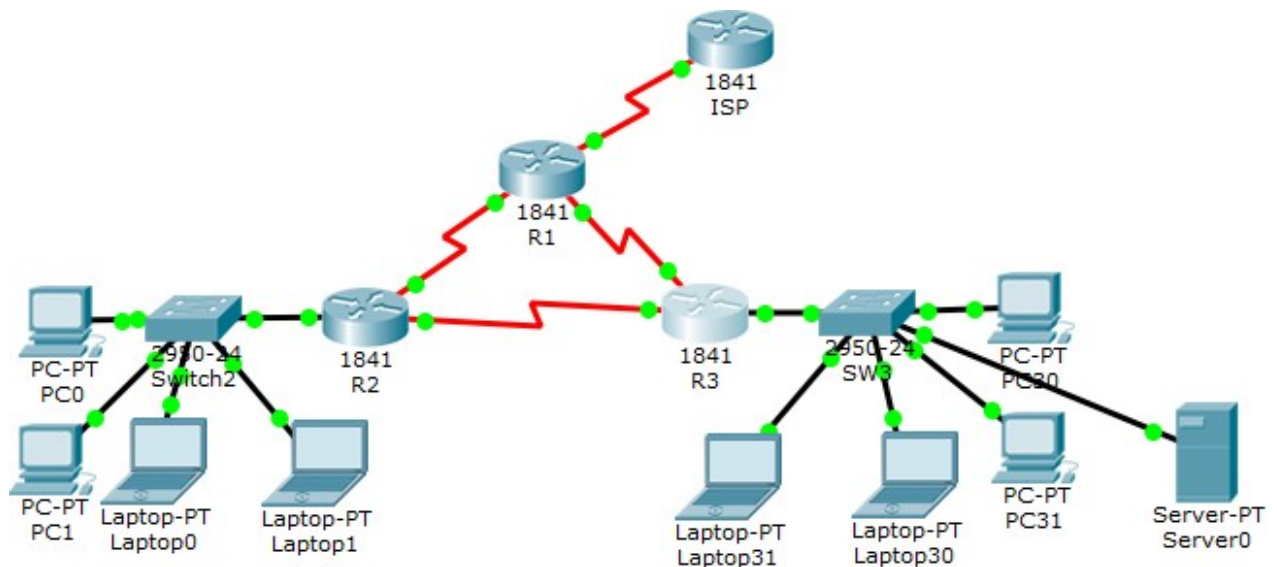


Tabla de direccionamiento

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

Tabla de asignación de VLAN y de puertos

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

Tabla de enlaces troncales

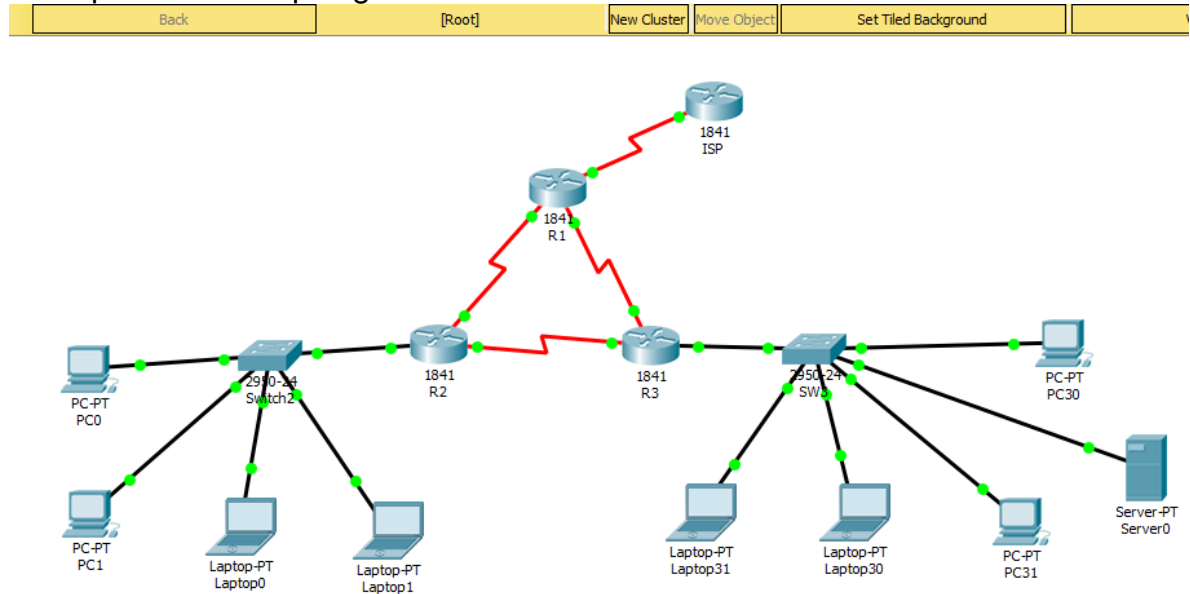
Dispositivo local	Interfaz local	Dispositivo remoto
SW2	Fa0/2-3	100

Situación.

En esta actividad, demostrará y reforzará su capacidad para implementar NAT, servidor de DHCP, RIPV2 y el routing entre VLAN, incluida la configuración de

direcciones IP, las VLAN, los enlaces troncales y las subinterfaces. Todas las pruebas de alcance deben realizarse a través de ping únicamente.

Se implementa la topología del escenario 1 en Packet Tracer:



## Descripción de las actividades

4.1.1.1 SW1 VLAN y las asignaciones de puertos de VLAN deben cumplir con la tabla 1.

A continuación, se muestra el procedimiento empleado para configurar el SW2 y SW3 de acuerdo a los nombres sugeridos en la topología:

```
SW2#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
SW2(config)#vlan 100
SW2(config-vlan)#name LAPTOPS
SW2(config-vlan)#exit
SW2(config)#vlan 200
SW2(config-vlan)#name DESKTOPS
SW2(config-vlan)#exit
SW2(config)#interface FastEthernet0/1
SW2(config-if)# description HACIA R2
SW2(config-if)# switchport mode trunk
SW2(config-if)#exit
SW2(config)#interface range Fa0/2-3
SW2(config-if-range)#
SW2(config-if-range)# description LAPTOPS VL100
SW2(config-if-range)# switchport access vlan 100
```

```
SW2(config-if-range)# switchport mode access
SW2(config-if-range)#exit
SW2(config)#interface range Fa0/4-5
SW2(config-if-range)# description DESKTOPS VL200
SW2(config-if-range)# switchport access vlan 200
SW2(config-if-range)# switchport mode access
SW2(config-if-range)#exit
```

```
SW3#conf t
Enter configuration commands, one per line. End with CNTL/Z.
SW3(config)#vlan 1
SW3(config-vlan)#name VLAN1
Default VLAN 1 may not have its name changed.
SW3(config-vlan)#end
SW3#
```

```
SW3#conf t
Enter configuration commands, one per line. End with CNTL/Z.
SW3(config)#interface range Fa0/1-24
SW3(config-if-range)#
SW3(config-if-range)# description VLAN1
SW3(config-if-range)# switchport mode access
SW3(config-if-range)# switchport access vlan 1
```

4.1.1.2 Los puertos de red que no se utilizan se deben deshabilitar.

```
SW2(config)#interface range Fa0/6-24
SW2(config-if-range)#shutdown
SW2(config-if-range)#end
SW2#
```

```
SW3#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
SW3(config)#interface range Fa0/6-23
SW3(config-if-range)#shutdown
```

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

A continuación se muestra el procedimiento empleado para configurar el R1, R2 y R3 de acuerdo a los nombres sugeridos en la topología:

```
R1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
R1(config)#interface Serial0/0/0
R1(config-if)# description Hacia R2
```

```
R1(config-if)# ip address 200.123.211.2 255.255.255.0
R1(config-if)#
R1(config-if)#interface Serial0/1/0
R1(config-if)# description Hacia R2
R1(config-if)# ip address 10.0.0.1 255.255.255.252
R1(config-if)# clock rate 128000
R1(config-if)#
R1(config-if)#interface Serial0/1/1
R1(config-if)# description Hacia R3
R1(config-if)# ip address 10.0.0.5 255.255.255.252
```

```
R2#conf t
```

```
Enter configuration commands, one per line. End with CNTL/Z.
```

```
R2(config)#interface FastEthernet0/0
R2(config-if)# description Hacia SW2
R2(config-if)# no ip address
R2(config-if)# duplex auto
R2(config-if)# speed auto
R2(config-if)#!
R2(config-if)#interface FastEthernet0/0.100
R2(config-subif)# description Hacia SW2 VLAN 100
R2(config-subif)# encapsulation dot1Q 100
R2(config-subif)# ip address 192.168.20.1 255.255.255.0
R2(config-subif)#!
R2(config-subif)#interface FastEthernet0/0.200
R2(config-subif)# description Hacia SW2 VLAN 200
R2(config-subif)# encapsulation dot1Q 200
R2(config-subif)# ip address 192.168.21.1 255.255.255.0
R2(config-subif)#!
R2(config-subif)#interface FastEthernet0/1
R2(config-if)# no ip address
R2(config-if)# duplex auto
R2(config-if)# speed auto
R2(config-if)# shutdown
R2(config-if)#!
R2(config-if)#interface Serial0/0/0
R2(config-if)# description Hacia R1
R2(config-if)# ip address 10.0.0.2 255.255.255.252
R2(config-if)#!
R2(config-if)#interface Serial0/0/1
R2(config-if)# description Hacia R3
R2(config-if)# ip address 10.0.0.9 255.255.255.252
R2(config-if)# clock rate 128000
R2(config-if)#
```

```

R3#conf t
Enter configuration commands, one per line. End with CNTL/Z.
R3(config)#interface FastEthernet0/0
R3(config-if)# description Hacia S3
R3(config-if)# ip address 192.168.30.1 255.255.255.0
R3(config-if)# duplex auto
R3(config-if)# speed auto
R3(config-if)# ipv6 address 2001:DB8:130::9C0:80F:301/64
R3(config-if)#!
R3(config-if)#interface FastEthernet0/1
R3(config-if)# no ip address
R3(config-if)# duplex auto
R3(config-if)# speed auto
R3(config-if)# shutdown
R3(config-if)#!
R3(config-if)#interface Serial0/0/0
R3(config-if)# description Hacia R1
R3(config-if)# ip address 10.0.0.6 255.255.255.252
R3(config-if)# clock rate 128000
R3(config-if)#!
R3(config-if)#interface Serial0/0/1
R3(config-if)# description Hacia R2
R3(config-if)# ip address 10.0.0.10 255.255.255.252

```

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

Se configuran los PCs y Laptop con opción DHCP para IPv4 y para IPv6.  
Se configura dhcp para ipv4 en R2 y helper address en R3 para ipv4, dhcpv6 con estado en R3 y el servicio dchpv6 en el server0.

```

R2#conf t
Enter configuration commands, one per line. End with CNTL/Z.
R2(config)#ip dhcp excluded-address 192.168.20.1
R2(config)#ip dhcp excluded-address 192.168.21.1
R2(config)#!
R2(config)#ip dhcp pool POOL_VL100
R2(dhcp-config)# network 192.168.20.0 255.255.255.0
R2(dhcp-config)# default-router 192.168.20.1
R2(dhcp-config)#ip dhcp pool POOL_VL200
R2(dhcp-config)# network 192.168.21.0 255.255.255.0
R2(dhcp-config)# default-router 192.168.21.1
R2(dhcp-config)#end

```

```

R3#conf t

```



Enter configuration commands, one per line. End with CNTL/Z.

```
R3(config)#ipv6 dhcp pool PoolIPv6_VLAN1
R3(config-dhcpv6)# prefix-delegation pool PoolIPv6_VLAN1
R3(config-dhcpv6)# dns-server 2001:DB8:130::9C0:80F:302
R3(config-dhcpv6)# domain-name ipv6_vl1
R3(config-dhcpv6)#exit
R3(config)#int f0/0
R3(config-if)#ip helper-address 192.168.20.1
R3(config-if)# ipv6 address FE80::1 link-local
R3(config-if)# ipv6 address 2001:DB8:130::9C0:80F:301/64
R3(config-if)# ipv6 nd managed-config-flag
R3(config-if)# ipv6 enable
R3(config-if)# ipv6 dhcp server PoolIPv6_VLAN1
R3(config-if)#end
```

4.1.1.5 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.

Se crea ACL y se aplica PAT referenciando el rol de cada una de las interfaces del router:

```
R1(config)#ip access-list standard INSIDE-DEVS
R1(config-std-nacl)#permit 192.168.20.0 0.0.0.255
R1(config-std-nacl)#permit 192.168.21.0 0.0.0.255
R1(config-std-nacl)#permit 192.168.30.0 0.0.0.255
R1(config-std-nacl)#
```

```
R1(config-std-nacl)#int s0/0/0
R1(config-if)#ip nat outside
R1(config-if)#int s0/1/0
R1(config-if)#ip nat inside
R1(config-if)#int s0/1/1
R1(config-if)#ip nat inside
R1(config-if)#
```

```
R1(config)#ip nat inside source list INSIDE-DEVS interface s0/0/0 overload
```

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

Se configura ruta predeterminada con dirección de siguiente salto:

```
R1(config)#ip route 0.0.0.0 0.0.0.0 200.123.211.1
```

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

Se configura DHCP se acuerdo con la configuración solicitada:

```
R2#conf t
Enter configuration commands, one per line. End with CNTL/Z.
R2(config)#ip dhcp excluded-address 192.168.20.1
R2(config)#ip dhcp excluded-address 192.168.21.1
R2(config)#!
R2(config)#ip dhcp pool POOL_VL100
R2(dhcp-config)# network 192.168.20.0 255.255.255.0
R2(dhcp-config)# default-router 192.168.20.1
R2(dhcp-config)#ip dhcp pool POOL_VL200
R2(dhcp-config)# network 192.168.21.0 255.255.255.0
R2(dhcp-config)# default-router 192.168.21.1
R2(dhcp-config)#end
```

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

Se realiza la configuración de enrutamiento dinámico interior RIPv2 acorde con las indicaciones suministradas:

```
R2#conf t
Enter configuration commands, one per line. End with CNTL/Z.
R2(config)#router rip
R2(config-router)# version 2
R2(config-router)# passive-interface FastEthernet0/0.100
R2(config-router)# passive-interface FastEthernet0/0.200
R2(config-router)# network 10.0.0.0
R2(config-router)# network 192.168.20.0
R2(config-router)# network 192.168.21.0
R2(config-router)# no auto-summary
R2(config-router)#end
```

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

Se configura ACL que restringe ICMPv6 hacia el servidor DHCPv6:

```
R3#conf t
Enter configuration commands, one per line. End with CNTL/Z.
R3(config)#ipv6 access-list SERVER0_PROTECTION
```

```

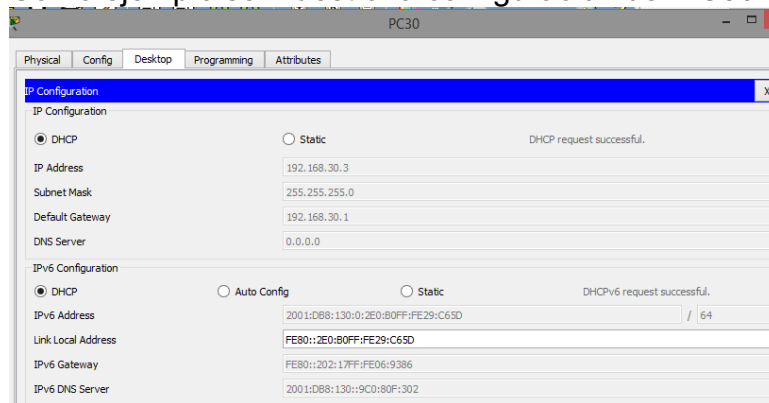
R3(config-ipv6-acl)# permit icmp 2001:DB8:130::/64 host
2001:DB8:130::9C0:80F:302
R3(config-ipv6-acl)# deny icmp any host 2001:DB8:130::9C0:80F:302
R3(config-ipv6-acl)# permit ipv6 any any
R3(config-ipv6-acl)#exit
R3(config)#int f0/0
R3(config-if)# ipv6 traffic-filter SERVER0_PROTECTION out
R3(config-if)#end

```

4.1.1.10 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.

Se configuran los PCs y Laptop con opción DHCP para IPv4 y para IPv6 (Dual Stack):

Como ejemplo se muestra la configuración del PC30:



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

Se muestra la configuración de Dual Stack sobre la interface LAN del router R3:

```

interface FastEthernet0/0
description Hacia S3
ip address 192.168.30.1 255.255.255.0
ip helper-address 192.168.20.1
ipv6 traffic-filter SERVER0_PROTECTION out
duplex auto
speed auto
ipv6 address FE80::1 link-local
ipv6 address 2001:DB8:130::9C0:80F:301/64
ipv6 nd managed-config-flag
ipv6 enable

```

## ipv6 dhcp server PoolIPv6\_VLAN1

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

Se incluyen los pantallazos asociados a las revisiones de protocolo IP:

```
R1#show ip protocols
Routing Protocol is "rip"
  Sending updates every 30 seconds, next due in 17 seconds
  Invalid after 180 seconds, hold down 180, flushed after 240
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Redistributing: rip
  Default version control: send version 2, receive 2
  Interface          Send Recv Triggered RIP Key-chain
  Serial0/1/0        2     2
  Serial0/1/1        2     2
Automatic network summarization is not in effect
Maximum path: 4
Routing for Networks:
  10.0.0.0
Passive Interface(s):
  Serial0/0/0
Routing Information Sources:
  Gateway         Distance    Last Update
  10.0.0.6         120         00:00:13
  10.0.0.2         120         00:00:10
Distance: (default is 120)
R1#

R2#show ip protocols
Routing Protocol is "rip"
  Sending updates every 30 seconds, next due in 18 seconds
  Invalid after 180 seconds, hold down 180, flushed after 240
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Redistributing: rip
  Default version control: send version 2, receive 2
  Interface          Send Recv Triggered RIP Key-chain
  Serial0/0/1        2     2
  Serial0/0/0        2     2
Automatic network summarization is not in effect
Maximum path: 4
Routing for Networks:
  10.0.0.0
  192.168.20.0
  192.168.21.0
Passive Interface(s):
  FastEthernet0/0.100
  FastEthernet0/0.200
Routing Information Sources:
  Gateway         Distance    Last Update
  10.0.0.1         120         00:00:09
  10.0.0.10        120         00:00:16
Distance: (default is 120)
R2#

R3#show ip protocols
Routing Protocol is "rip"
  Sending updates every 30 seconds, next due in 16 seconds
  Invalid after 180 seconds, hold down 180, flushed after 240
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Redistributing: rip
  Default version control: send version 2, receive 2
  Interface          Send Recv Triggered RIP Key-chain
  Serial0/0/0        2     2
  Serial0/0/1        2     2
Automatic network summarization is not in effect
Maximum path: 4
Routing for Networks:
  10.0.0.0
  192.168.30.0
Passive Interface(s):
  FastEthernet0/0
Routing Information Sources:
  Gateway         Distance    Last Update
  10.0.0.5         120         00:00:07
  10.0.0.9         120         00:00:09
Distance: (default is 120)
R3#
```

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

Se comprueba la tabla de enrutamiento en cada uno de los routers para evidenciar la operación correcta de la configuración y la redistribución de la ruta predeterminada:

```

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 200.123.211.1 to network 0.0.0.0

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

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 10.0.0.10, 00:00:07, Serial0/0/1
[120/1] via 10.0.0.1, 00:00:04, Serial0/0/0
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, 00:00:07, Serial0/0/1
R* 0.0.0.0/0 [120/1] via 10.0.0.1, 00:00:04, Serial0/0/0

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

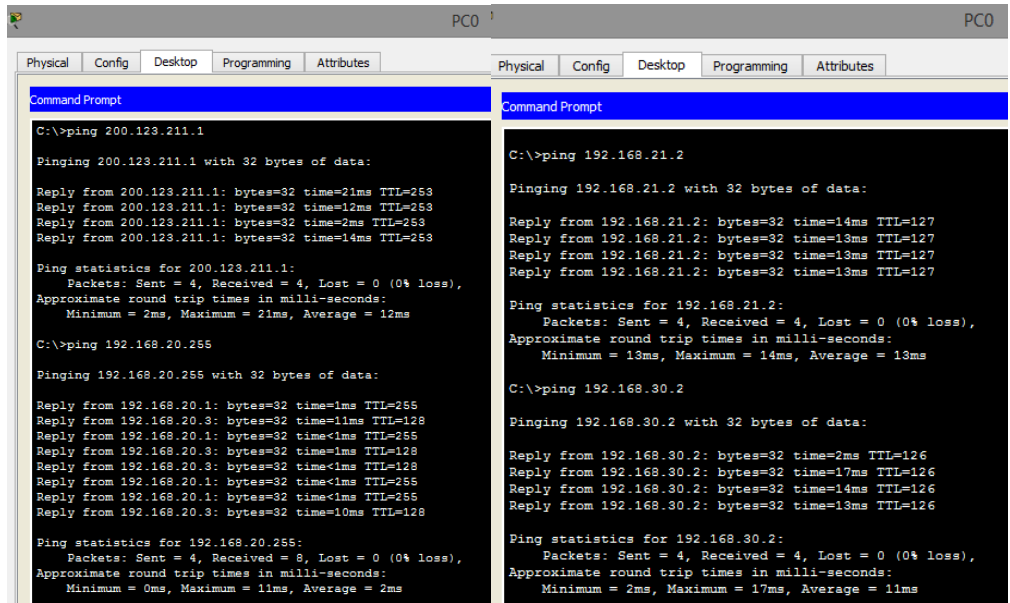
10.0.0.0/30 is subnetted, 3 subnets
R 10.0.0.0 [120/1] via 10.0.0.5, 00:00:18, Serial0/0/0
[120/1] via 10.0.0.9, 00:00:21, Serial0/0/1
C 10.0.0.4 is directly connected, Serial0/0/0
C 10.0.0.8 is directly connected, Serial0/0/1
R 192.168.20.0/24 [120/1] via 10.0.0.9, 00:00:21, Serial0/0/1
R 192.168.21.0/24 [120/1] via 10.0.0.9, 00:00:21, Serial0/0/1
C 192.168.30.0/24 is directly connected, FastEthernet0/0
R* 0.0.0.0/0 [120/1] via 10.0.0.5, 00:00:18, Serial0/0/0

```

4.1.1.14 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.

Se realizan las pruebas de ICMP desde los PC para evidenciar el correcto funcionamiento y operación de la configuración de enrutamiento y PAT:

Desde PC0:



## Desde PC1:

```
PC1
Physical Config Desktop Programming Attributes
Command Prompt
Packet Tracer PC Command Line 1.0
C:\>
C:\>
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=10ms TTL=253
Reply from 200.123.211.1: bytes=32 time=3ms TTL=253
Reply from 200.123.211.1: bytes=32 time=8ms 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 = 13ms, Average = 8ms

C:\>ping 192.168.20.255

Pinging 192.168.20.255 with 32 bytes of data:

Reply from 192.168.20.1: bytes=32 time=1ms TTL=255
Reply from 192.168.20.2: bytes=32 time=12ms TTL=128
Reply from 192.168.20.1: bytes=32 time<1ms TTL=255
Reply from 192.168.20.2: bytes=32 time<1ms TTL=128
Reply from 192.168.20.1: bytes=32 time=1ms TTL=255
Reply from 192.168.20.2: bytes=32 time=2ms TTL=128
Reply from 192.168.20.1: bytes=32 time=10ms TTL=255
Reply from 192.168.20.2: bytes=32 time=10ms TTL=128

Ping statistics for 192.168.20.255:
    Packets: Sent = 4, Received = 8, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 12ms, Average = 4ms

C:\>|

PC1
Physical Config Desktop Programming Attributes
Command Prompt
C:\>ping 192.168.21.3

Pinging 192.168.21.3 with 32 bytes of data:

Reply from 192.168.21.3: bytes=32 time=23ms TTL=127
Reply from 192.168.21.3: bytes=32 time=12ms TTL=127
Reply from 192.168.21.3: bytes=32 time=12ms TTL=127
Reply from 192.168.21.3: bytes=32 time=12ms TTL=127

Ping statistics for 192.168.21.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 12ms, Maximum = 23ms, Average = 14ms

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=2ms TTL=126
Reply from 192.168.30.3: bytes=32 time=16ms TTL=126
Reply from 192.168.30.3: bytes=32 time=13ms TTL=126
Reply from 192.168.30.3: bytes=32 time=12ms TTL=126

Ping statistics for 192.168.30.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 2ms, Maximum = 16ms, Average = 10ms
```

## Desde Laptop0:

```
Laptop0
Physical Config Desktop Programming Attributes
Command Prompt
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=12ms TTL=253
Reply from 200.123.211.1: bytes=32 time=12ms 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 = 12ms, Average = 9ms

C:\>ping 192.168.21.255

Pinging 192.168.21.255 with 32 bytes of data:

Reply from 192.168.21.1: bytes=32 time=2ms TTL=255
Reply from 192.168.21.2: bytes=32 time=16ms TTL=128
Reply from 192.168.21.1: bytes=32 time<1ms TTL=255
Reply from 192.168.21.2: bytes=32 time=1ms TTL=128
Reply from 192.168.21.1: bytes=32 time<1ms TTL=255
Reply from 192.168.21.2: bytes=32 time=2ms TTL=128
Reply from 192.168.21.1: bytes=32 time<1ms TTL=255
Reply from 192.168.21.2: bytes=32 time=1ms TTL=128

Ping statistics for 192.168.21.255:
    Packets: Sent = 4, Received = 8, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 16ms, Average = 2ms

Laptop0
Physical Config Desktop Programming Attributes
Command Prompt
C:\>ping 192.168.20.3

Pinging 192.168.20.3 with 32 bytes of data:

Reply from 192.168.20.3: bytes=32 time=14ms TTL=127
Reply from 192.168.20.3: bytes=32 time=20ms 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 = 20ms, Average = 8ms

C:\>ping 192.168.30.4

Pinging 192.168.30.4 with 32 bytes of data:

Reply from 192.168.30.4: bytes=32 time=15ms TTL=126
Reply from 192.168.30.4: bytes=32 time=1ms TTL=126
Reply from 192.168.30.4: bytes=32 time=19ms TTL=126
Reply from 192.168.30.4: bytes=32 time=19ms TTL=126

Ping statistics for 192.168.30.4:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 19ms, Average = 13ms
```

## Desde Laptop1:

Laptop1					Laptop1				
Physical	Config	Desktop	Programming	Attributes	Physical	Config	Desktop	Programming	Attributes
<b>Command Prompt</b> Packet Tracer PC Command Line 1.0 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=13ms TTL=253 Reply from 200.123.211.1: bytes=32 time=11ms 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 = 13ms, Average = 9ms C:\>ping 192.168.21.255 Pinging 192.168.21.255 with 32 bytes of data: Reply from 192.168.21.1: bytes=32 time=1ms TTL=255 Reply from 192.168.21.3: bytes=32 time=1ms TTL=128 Reply from 192.168.21.1: bytes=32 time=10ms TTL=255 Reply from 192.168.21.3: bytes=32 time=11ms TTL=128 Reply from 192.168.21.1: bytes=32 time<1ms TTL=255 Reply from 192.168.21.3: bytes=32 time=10ms TTL=128 Reply from 192.168.21.1: bytes=32 time=1ms TTL=255 Reply from 192.168.21.3: bytes=32 time=1ms TTL=128 Ping statistics for 192.168.21.255: Packets: Sent = 4, Received = 8, Lost = 0 (0% loss), Approximate round trip times in milli-seconds: Minimum = 0ms, Maximum = 11ms, Average = 4ms					<b>Command Prompt</b> 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=11ms TTL=127 Reply from 192.168.20.2: bytes=32 time=11ms TTL=127 Reply from 192.168.20.2: bytes=32 time=11ms 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 = 1ms, Maximum = 11ms, Average = 8ms C:\>ping 192.168.30.5 Pinging 192.168.30.5 with 32 bytes of data: Reply from 192.168.30.5: bytes=32 time=4ms TTL=126 Reply from 192.168.30.5: bytes=32 time=12ms TTL=126 Reply from 192.168.30.5: bytes=32 time=13ms TTL=126 Reply from 192.168.30.5: bytes=32 time=13ms TTL=126 Ping statistics for 192.168.30.5: Packets: Sent = 4, Received = 4, Lost = 0 (0% loss), Approximate round trip times in milli-seconds: Minimum = 4ms, Maximum = 13ms, Average = 10ms				

### Desde Laptop31:

Laptop31					Laptop31				
Physical	Config	Desktop	Programming	Attributes	Physical	Config	Desktop	Programming	Attributes
<b>Command Prompt</b> C:\>ping 2001:DB8:130::9C0:80F:302 Pinging 2001:DB8:130::9C0:80F:302 with 32 bytes of data: Reply from 2001:DB8:130::9C0:80F:302: bytes=32 time=11ms TTL=128 Reply from 2001:DB8:130::9C0:80F:302: bytes=32 time<1ms TTL=128 Reply from 2001:DB8:130::9C0:80F:302: bytes=32 time<1ms TTL=128 Reply from 2001:DB8:130::9C0:80F:302: bytes=32 time<1ms TTL=128 Ping statistics for 2001:DB8:130::9C0:80F:302: Packets: Sent = 4, Received = 4, Lost = 0 (0% loss), Approximate round trip times in milli-seconds: Minimum = 0ms, Maximum = 11ms, Average = 2ms 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=15ms TTL=253 Reply from 200.123.211.1: bytes=32 time=10ms TTL=253 Reply from 200.123.211.1: bytes=32 time=6ms 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 = 6ms, Maximum = 15ms, Average = 11ms C:\>ping 192.168.30.255 Pinging 192.168.30.255 with 32 bytes of data: Reply from 192.168.30.1: bytes=32 time=1ms TTL=255 Reply from 192.168.30.4: bytes=32 time=1ms TTL=128 Reply from 192.168.30.2: bytes=32 time=1ms TTL=128 Reply from 192.168.30.5: bytes=32 time=1ms TTL=128 Reply from 192.168.30.6: bytes=32 time=51ms TTL=128					<b>Command Prompt</b> C:\>ping 192.168.20.3 Pinging 192.168.20.3 with 32 bytes of data: Reply from 192.168.20.3: bytes=32 time=11ms TTL=126 Reply from 192.168.20.3: bytes=32 time=16ms TTL=126 Reply from 192.168.20.3: bytes=32 time=10ms TTL=126 Reply from 192.168.20.3: bytes=32 time=11ms TTL=126 Ping statistics for 192.168.20.3: Packets: Sent = 4, Received = 4, Lost = 0 (0% loss), Approximate round trip times in milli-seconds: Minimum = 10ms, Maximum = 16ms, Average = 12ms C:\>ping 192.168.21.3 Pinging 192.168.21.3 with 32 bytes of data: Reply from 192.168.21.3: bytes=32 time=23ms TTL=126 Reply from 192.168.21.3: bytes=32 time=12ms TTL=126 Reply from 192.168.21.3: bytes=32 time=1ms TTL=126 Reply from 192.168.21.3: bytes=32 time=15ms TTL=126 Ping statistics for 192.168.21.3: Packets: Sent = 4, Received = 4, Lost = 0 (0% loss), Approximate round trip times in milli-seconds: Minimum = 1ms, Maximum = 23ms, Average = 12ms				

### Desde Laptop30:

Laptop30					Laptop30				
Physical	Config	Desktop	Programming	Attributes	Physical	Config	Desktop	Programming	Attributes
<b>Command Prompt</b>					<b>Command Prompt</b>				
<pre> C:\&gt;ping 2001:DB8:130::9C0:80F:302  Pinging 2001:DB8:130::9C0:80F:302 with 32 bytes of data:  Reply from 2001:DB8:130::9C0:80F:302: bytes=32 time=1ms TTL=128 Reply from 2001:DB8:130::9C0:80F:302: bytes=32 time&lt;1ms TTL=128 Reply from 2001:DB8:130::9C0:80F:302: bytes=32 time&lt;1ms TTL=128 Reply from 2001:DB8:130::9C0:80F:302: bytes=32 time&lt;1ms TTL=128  Ping statistics for 2001:DB8:130::9C0:80F:302:     Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),     Approximate round trip times in milli-seconds:         Minimum = 0ms, Maximum = 1ms, Average = 0ms  C:\&gt;ping 200.123.211.1  Pinging 200.123.211.1 with 32 bytes of data:  Reply from 200.123.211.1: bytes=32 time=28ms TTL=253 Reply from 200.123.211.1: bytes=32 time=17ms TTL=253 Reply from 200.123.211.1: bytes=32 time=15ms TTL=253 Reply from 200.123.211.1: bytes=32 time=12ms 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 = 12ms, Maximum = 28ms, Average = 18ms  C:\&gt;ping 192.168.30.255  Pinging 192.168.30.255 with 32 bytes of data:  Reply from 192.168.30.3: bytes=32 time=2ms TTL=128 Reply from 192.168.30.2: bytes=32 time=2ms TTL=128 Reply from 192.168.30.5: bytes=32 time=2ms TTL=128 Reply from 192.168.30.6: bytes=32 time=30ms TTL=128 Reply from 192.168.30.1: bytes=32 time=32ms TTL=255 Reply from 192.168.30.3: bytes=32 time&lt;1ms TTL=128 Reply from 192.168.30.2: bytes=32 time&lt;1ms TTL=128 </pre>					<pre> C:\&gt;ping 192.168.21.2  Pinging 192.168.21.2 with 32 bytes of data:  Reply from 192.168.21.2: bytes=32 time=2ms TTL=126 Reply from 192.168.21.2: bytes=32 time=14ms TTL=126 Reply from 192.168.21.2: bytes=32 time=14ms TTL=126 Reply from 192.168.21.2: bytes=32 time=14ms TTL=126  Ping statistics for 192.168.21.2:     Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),     Approximate round trip times in milli-seconds:         Minimum = 2ms, Maximum = 14ms, Average = 11ms  C:\&gt;ping 192.168.20.2  Pinging 192.168.20.2 with 32 bytes of data:  Reply from 192.168.20.2: bytes=32 time=2ms TTL=126 Reply from 192.168.20.2: bytes=32 time=10ms TTL=126 Reply from 192.168.20.2: bytes=32 time=10ms TTL=126 Reply from 192.168.20.2: bytes=32 time=16ms TTL=126  Ping statistics for 192.168.20.2:     Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),     Approximate round trip times in milli-seconds:         Minimum = 2ms, Maximum = 16ms, Average = 9ms </pre>				

### Desde PC31:

PC31					PC31				
Physical	Config	Desktop	Programming	Attributes	Physical	Config	Desktop	Programming	Attributes
<b>Command Prompt</b>					<b>Command Prompt</b>				
<pre> C:\&gt;ping 2001:DB8:130::9C0:80F:302  Pinging 2001:DB8:130::9C0:80F:302 with 32 bytes of data:  Reply from 2001:DB8:130::9C0:80F:302: bytes=32 time=15ms TTL=128 Reply from 2001:DB8:130::9C0:80F:302: bytes=32 time=3ms TTL=128 Reply from 2001:DB8:130::9C0:80F:302: bytes=32 time=1ms TTL=128 Reply from 2001:DB8:130::9C0:80F:302: bytes=32 time&lt;1ms TTL=128  Ping statistics for 2001:DB8:130::9C0:80F:302:     Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),     Approximate round trip times in milli-seconds:         Minimum = 0ms, Maximum = 15ms, Average = 4ms  C:\&gt;ping 200.123.211.1  Pinging 200.123.211.1 with 32 bytes of data:  Reply from 200.123.211.1: bytes=32 time=14ms TTL=253 Reply from 200.123.211.1: bytes=32 time=13ms TTL=253 Reply from 200.123.211.1: bytes=32 time=13ms TTL=253 Reply from 200.123.211.1: bytes=32 time=15ms 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 = 13ms, Maximum = 15ms, Average = 13ms  C:\&gt;ping 192.168.30.255  Pinging 192.168.30.255 with 32 bytes of data:  Reply from 192.168.30.3: bytes=32 time=11ms TTL=128 Reply from 192.168.30.4: bytes=32 time=17ms TTL=128 Reply from 192.168.30.1: bytes=32 time=17ms TTL=255 Reply from 192.168.30.6: bytes=32 time=18ms TTL=128 Reply from 192.168.30.5: bytes=32 time=18ms TTL=128 Reply from 192.168.30.4: bytes=32 time=14ms TTL=128 Reply from 192.168.30.5: bytes=32 time=15ms TTL=128 </pre>					<pre> C:\&gt;ping 192.168.21.3  Pinging 192.168.21.3 with 32 bytes of data:  Reply from 192.168.21.3: bytes=32 time=13ms TTL=126 Reply from 192.168.21.3: bytes=32 time=16ms TTL=126 Reply from 192.168.21.3: bytes=32 time=14ms TTL=126 Reply from 192.168.21.3: bytes=32 time=11ms TTL=126  Ping statistics for 192.168.21.3:     Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),     Approximate round trip times in milli-seconds:         Minimum = 11ms, Maximum = 16ms, Average = 13ms  C:\&gt;ping 192.168.20.2  Pinging 192.168.20.2 with 32 bytes of data:  Reply from 192.168.20.2: bytes=32 time=13ms TTL=126 Reply from 192.168.20.2: bytes=32 time=10ms TTL=126 Reply from 192.168.20.2: bytes=32 time=1ms TTL=126 Reply from 192.168.20.2: bytes=32 time=15ms TTL=126  Ping statistics for 192.168.20.2:     Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),     Approximate round trip times in milli-seconds:         Minimum = 1ms, Maximum = 15ms, Average = 9ms </pre>				

### Desde PC30:



The image shows two side-by-side screenshots of a Windows Command Prompt window on a PC named 'PC30'. The window has tabs for 'Physical', 'Config', 'Desktop', 'Programming', and 'Attributes'. The 'Command Prompt' tab is active. The left screenshot shows the following commands and output:

```
C:\>ping 2001:DB8:130::9C0:80F:302

Pinging 2001:DB8:130::9C0:80F:302 with 32 bytes of data:

Reply from 2001:DB8:130::9C0:80F:302: bytes=32 time=16ms TTL=128
Reply from 2001:DB8:130::9C0:80F:302: bytes=32 time<1ms TTL=128
Reply from 2001:DB8:130::9C0:80F:302: bytes=32 time<1ms TTL=128
Reply from 2001:DB8:130::9C0:80F:302: bytes=32 time<1ms TTL=128

Ping statistics for 2001:DB8:130::9C0:80F:302:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 16ms, Average = 4ms

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=14ms TTL=253
Reply from 200.123.211.1: bytes=32 time=16ms TTL=253
Reply from 200.123.211.1: bytes=32 time=7ms 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 = 16ms, Average = 10ms

C:\>ping 192.168.30.255

Pinging 192.168.30.255 with 32 bytes of data:

Reply from 192.168.30.3: bytes=32 time=12ms TTL=128
Reply from 192.168.30.4: bytes=32 time=14ms TTL=128
Reply from 192.168.30.2: bytes=32 time=15ms TTL=128
Reply from 192.168.30.1: bytes=32 time=15ms TTL=255
Reply from 192.168.30.5: bytes=32 time=15ms TTL=128
Reply from 192.168.30.3: bytes=32 time=3ms TTL=128
```

The right screenshot shows the following commands and output:

```
C:\>ping 192.168.21.3

Pinging 192.168.21.3 with 32 bytes of data:

Reply from 192.168.21.3: bytes=32 time=2ms TTL=126
Reply from 192.168.21.3: bytes=32 time=16ms TTL=126
Reply from 192.168.21.3: bytes=32 time=14ms TTL=126
Reply from 192.168.21.3: bytes=32 time=13ms TTL=126

Ping statistics for 192.168.21.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 2ms, Maximum = 16ms, Average = 11ms

C:\>ping 192.168.20.3

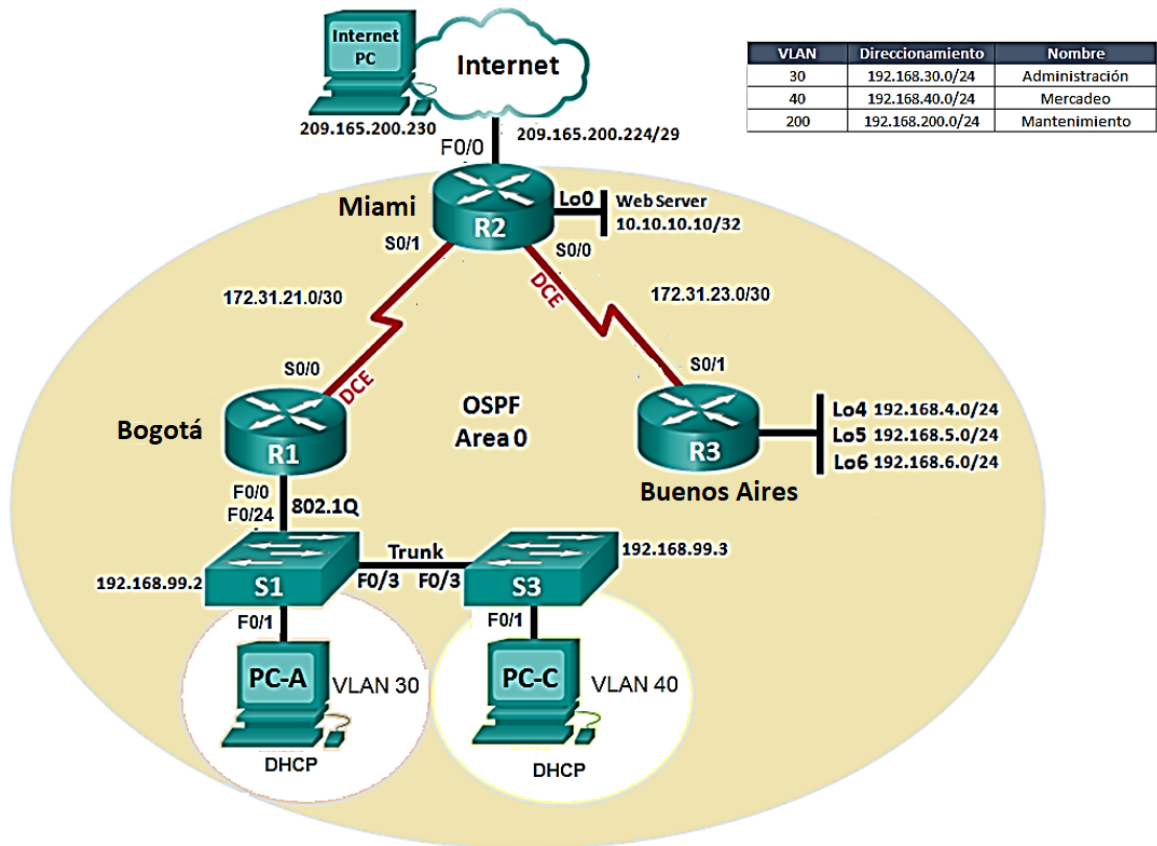
Pinging 192.168.20.3 with 32 bytes of data:

Reply from 192.168.20.3: bytes=32 time=12ms TTL=126
Reply from 192.168.20.3: bytes=32 time=15ms TTL=126
Reply from 192.168.20.3: bytes=32 time=13ms TTL=126
Reply from 192.168.20.3: bytes=32 time=14ms TTL=126

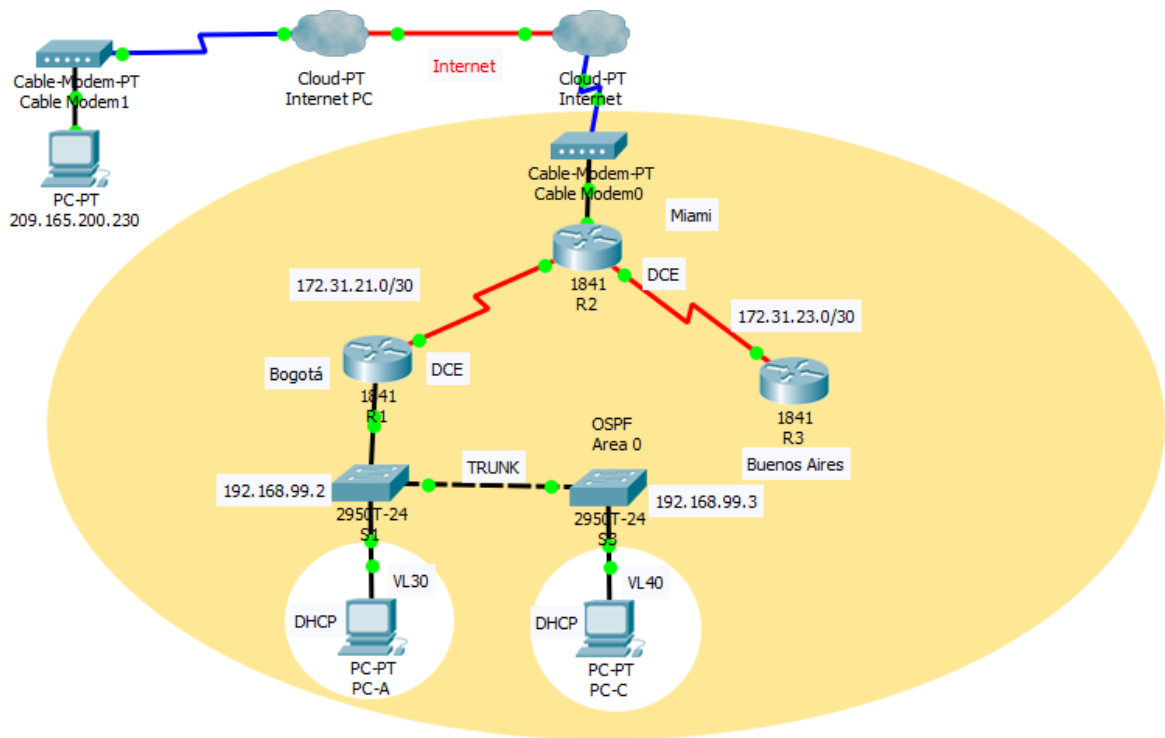
Ping statistics for 192.168.20.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 12ms, Maximum = 15ms, Average = 13ms
```

#### 4.1.2 ESCENARIO 2

Escenario: 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.



Se implementa la simulación en packet tracer:



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

A continuación se muestran los comandos de configuración utilizados para la implementación de la topología bajo los requerimientos suministrados:

```

R1# conf t
Enter configuration commands, one per line. End with CNTL/Z.
R1(config)#interface FastEthernet0/0
R1(config-if)# description GESTION SW
R1(config-if)# ip address 192.168.99.1 255.255.255.0
R1(config-if)# duplex auto
R1(config-if)# speed auto
R1(config-if)#!
R1(config-if)#interface FastEthernet0/0.30
R1(config-subif)# description ADMINISTRACION
R1(config-subif)# encapsulation dot1Q 30
R1(config-subif)# ip address 192.168.30.1 255.255.255.0
R1(config-subif)#!
R1(config-subif)#interface FastEthernet0/0.40
R1(config-subif)# description MERCADEO
R1(config-subif)# encapsulation dot1Q 40
R1(config-subif)# ip address 192.168.40.1 255.255.255.0
R1(config-subif)#!

```

```

R1(config-subif)#interface FastEthernet0/0.200
R1(config-subif)# description MANTENIMIENTO
R1(config-subif)# encapsulation dot1Q 200
R1(config-subif)# ip address 192.168.200.1 255.255.255.0
R1(config-subif)#!
R1(config-if)#!
R1(config-if)#interface Serial0/0/0
R1(config-if)# description Hacia R2
R1(config-if)# bandwidth 256
R1(config-if)# ip address 172.31.21.1 255.255.255.252
R1(config-if)# ip ospf cost 9500
R1(config-if)# clock rate 128000
R1(config-if)#end
R1#

R2#conf t
Enter configuration commands, one per line. End with CNTL/Z.
R2(config)#
R2(config)#interface Loopback0
R2(config-if)# description Web Server
R2(config-if)# ip address 10.10.10.11 255.255.255.255
R2(config-if)#!
R2(config-if)#interface FastEthernet0/0
R2(config-if)# description Hacia Internet
R2(config-if)# ip address 209.165.200.225 255.255.255.248
R2(config-if)# ip nat outside
R2(config-if)# duplex auto
R2(config-if)# speed auto
R2(config-if)#!
R2(config-if)#interface FastEthernet0/1
R2(config-if)# no ip address
R2(config-if)# duplex auto
R2(config-if)# speed auto
R2(config-if)# shutdown
R2(config-if)#!
R2(config-if)#interface Serial0/0/0
R2(config-if)# description HACIA R3
R2(config-if)# bandwidth 256
R2(config-if)# ip address 172.31.23.2 255.255.255.252
R2(config-if)# ip ospf cost 9500
R2(config-if)# ip nat inside
R2(config-if)# clock rate 128000
R2(config-if)#!
R2(config-if)#interface Serial0/1/0
R2(config-if)# description Hacia R1

```

```

R2(config-if)# bandwidth 256
R2(config-if)# ip address 172.31.21.2 255.255.255.252
R2(config-if)# ip nat inside
R2(config-if)#end
R2#

```

```

R3#conf t
Enter configuration commands, one per line. End with CNTL/Z.
R3(config)#interface Loopback4
R3(config-if)# description Loopback4
R3(config-if)# ip address 192.168.4.1 255.255.255.0
R3(config-if)#!
R3(config-if)#interface Loopback5
R3(config-if)# description Loopback5
R3(config-if)# ip address 192.168.5.1 255.255.255.0
R3(config-if)#!
R3(config-if)#interface Loopback6
R3(config-if)# description Loopback6
R3(config-if)# ip address 192.168.6.1 255.255.255.0
R3(config-if)#end
R3#

```

4.1.2.2 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

Se muestran los comandos de configuración de enrutamiento dinámico de estado de enlace indicados en la topología con los parámetros solicitados:

```

R1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
R1(config)#router ospf 1
R1(config-router)# router-id 1.1.1.1
R1(config-router)# log-adjacency-changes
R1(config-router)# passive-interface default
R1(config-router)# no passive-interface Serial0/0/0

```

```
R1(config-router)# network 172.31.21.0 0.0.0.3 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)# network 192.168.200.0 0.0.0.255 area 0
R1(config-router)#end
R1#
```

```
R2#conf t
Enter configuration commands, one per line. End with CNTL/Z.
R2(config)#router ospf 1
R2(config-router)# router-id 5.5.5.5
R2(config-router)# log-adjacency-changes
R2(config-router)# redistribute static
% Only classful networks will be redistributed
R2(config-router)# passive-interface default
R2(config-router)# no passive-interface Serial0/0/0
R2(config-router)# no passive-interface Serial0/1/0
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 10.10.10.11 0.0.0.0 area 0
R2(config-router)# default-information originate
R2(config-router)#
R2(config-router)#
R2(config-router)#end
R2#
```

```
R3#conf t
Enter configuration commands, one per line. End with CNTL/Z.
R3(config)#router ospf 1
R3(config-router)# router-id 8.8.8.8
R3(config-router)# log-adjacency-changes
R3(config-router)# passive-interface default
R3(config-router)# no passive-interface Serial0/0/0
R3(config-router)# network 172.31.23.0 0.0.0.3 area 0
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)#
R3(config-router)#end
R3#
```

4.1.2.3 Verificar información de OSPF. Visualizar tablas de enrutamiento y routers conectados por OSPFv2

Mediante los comandos tipo “show” se evidencia el correcto funcionamiento del protocolo dinámico en los tres routers de la topología:

```

R1#show ip ospf neighbor
Neighbor ID Pri State Dead Time Address Interface
S.5.5.5 0 FULL/ - 00:00:32 172.31.21.2 Serial0/0/0
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 172.31.21.2 to network 0.0.0.0

10.0.0.0/32 is subnetted, 1 subnets
O 10.10.10.11 [110/9501] via 172.31.21.2, 03:59:23, Serial0/0/0
172.31.0.0/30 is subnetted, 2 subnets
C 172.31.21.0 is directly connected, Serial0/0/0
O 172.31.23.0 [110/19000] via 172.31.21.2, 03:59:23, Serial0/0/0
192.168.4.0/32 is subnetted, 1 subnets
O 192.168.4.1 [110/19001] via 172.31.21.2, 00:01:51, Serial0/0/0
192.168.5.0/32 is subnetted, 1 subnets
O 192.168.5.1 [110/19001] via 172.31.21.2, 00:01:51, Serial0/0/0
192.168.6.0/32 is subnetted, 1 subnets
O 192.168.6.1 [110/19001] via 172.31.21.2, 00:01:51, Serial0/0/0
192.168.30.0/24 is directly connected, FastEthernet0/0.30
192.168.40.0/24 is directly connected, FastEthernet0/0.40
192.168.99.0/24 is directly connected, FastEthernet0/0
192.168.200.0/24 is directly connected, FastEthernet0/0.200
O*E2 0.0.0.0/0 [110/1] via 172.31.21.2, 03:59:23, Serial0/0/0
R1#

R2#show ip ospf neighbor
Neighbor ID Pri State Dead Time Address Interface
S.5.5.5 0 FULL/ - 00:00:30 172.31.23.1 Serial0/0/0
1.1.1.1 0 FULL/ - 00:00:30 172.31.21.1 Serial0/1/0
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 0.0.0.0 to network 0.0.0.0

10.0.0.0/32 is subnetted, 1 subnets
C 10.10.10.11 is directly connected, Loopback0
172.31.0.0/30 is subnetted, 2 subnets
C 172.31.21.0 is directly connected, Serial0/1/0
C 172.31.23.0 is directly connected, Serial0/0/0
192.168.4.0/32 is subnetted, 1 subnets
O 192.168.4.1 [110/9501] via 172.31.23.1, 00:02:08, Serial0/0/0
192.168.5.0/32 is subnetted, 1 subnets
O 192.168.5.1 [110/9501] via 172.31.23.1, 00:02:08, Serial0/0/0
192.168.6.0/32 is subnetted, 1 subnets
O 192.168.6.1 [110/9501] via 172.31.23.1, 00:02:08, Serial0/0/0
192.168.30.0/24 [110/391] via 172.31.21.1, 00:03:04, Serial0/1/0
O 192.168.40.0/24 [110/391] via 172.31.21.1, 00:03:04, Serial0/1/0
O 192.168.200.0/24 [110/391] via 172.31.21.1, 00:03:04, Serial0/1/0
209.165.200.0/29 is subnetted, 1 subnets
C 209.165.200.224 is directly connected, FastEthernet0/0
S* 0.0.0.0/0 is directly connected, FastEthernet0/0
R2#

R3#show ip ospf neighbor
Neighbor ID Pri State Dead Time Address Interface
S.5.5.5 0 FULL/ - 00:00:38 172.31.23.2 Serial0/0/0
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 172.31.23.2 to network 0.0.0.0

10.0.0.0/32 is subnetted, 1 subnets
O 10.10.10.11 [110/9501] via 172.31.23.2, 00:03:31, Serial0/0/0
172.31.0.0/30 is subnetted, 2 subnets
O 172.31.21.0 [110/9890] via 172.31.23.2, 00:03:31, Serial0/0/0
C 172.31.23.0 is directly connected, Serial0/0/0
C 192.168.4.0/24 is directly connected, Loopback4
C 192.168.5.0/24 is directly connected, Loopback5
C 192.168.6.0/24 is directly connected, Loopback6
O 192.168.30.0/24 [110/9891] via 172.31.23.2, 00:03:31, Serial0/0/0
O 192.168.40.0/24 [110/9891] via 172.31.23.2, 00:03:31, Serial0/0/0
O 192.168.200.0/24 [110/9891] via 172.31.23.2, 00:03:31, Serial0/0/0
O*E2 0.0.0.0/0 [110/1] via 172.31.23.2, 00:03:31, Serial0/0/0
R3#
    
```

4.1.2.4 Visualizar lista resumida de interfaces por OSPF en donde se ilustre el costo de cada interface. Visualizar el OSPF Process ID, Router ID, Address summarizations, Routing Networks, and passive interfaces configuradas en cada router.

El comando que nos permite ver al detalle la configuración del protocolo OSPF sobre cada una de las interfaces se muestra a continuación (aunque el comando que lista el resumen de las interfaces no está disponible en la versión de IOS del simulador Packet Tracer: 12.4(15)T1, el detalle del comando “show ip ospf interface” nos muestra mayor información):

R1#show ip ospf interface

```
FastEthernet0/0.30 is up, line protocol is up
Internet address is 192.168.30.1/24, Area 0
Process ID 1, Router ID 1.1.1.1, Network Type BROADCAST, Cost: 1
Transmit Delay is 1 sec, State DR, Priority 1
Designated Router (ID) 1.1.1.1, Interface address 192.168.30.1
No backup designated router on this network
Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
No Hellos (Passive interface)
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 0, Adjacent neighbor count is 0
Suppress hello for 0 neighbor(s)
FastEthernet0/0.40 is up, line protocol is up
Internet address is 192.168.40.1/24, Area 0
Process ID 1, Router ID 1.1.1.1, Network Type BROADCAST, Cost: 1
Transmit Delay is 1 sec, State DR, Priority 1
Designated Router (ID) 1.1.1.1, Interface address 192.168.40.1
No backup designated router on this network
Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
No Hellos (Passive interface)
Index 2/2, 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 0, Adjacent neighbor count is 0
Suppress hello for 0 neighbor(s)
FastEthernet0/0.200 is up, line protocol is up
Internet address is 192.168.200.1/24, Area 0
Process ID 1, Router ID 1.1.1.1, Network Type BROADCAST, Cost: 1
Transmit Delay is 1 sec, State DR, Priority 1
Designated Router (ID) 1.1.1.1, Interface address 192.168.200.1
No backup designated router on this network
Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
No Hellos (Passive interface)
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 0, Adjacent neighbor count is 0
Suppress hello for 0 neighbor(s)
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 00:00:06
Index 4/4, 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# 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
192.168.30.0 0.0.0.255 area 0
192.168.40.0 0.0.0.255 area 0
192.168.200.0 0.0.0.255 area 0
Passive Interface(s):
Vlan1
FastEthernet0/0
FastEthernet0/1
FastEthernet0/0.30
FastEthernet0/0.40
FastEthernet0/0.200
Routing Information Sources:
Gateway Distance Last Update
1.1.1.1 110 00:08:01
5.5.5.5 110 00:05:46
8.8.8.8 110 00:05:46
Distance: (default is 110)
```

```
R1#
```

```
R2#show ip ospf interface
```

```
Loopback0 is up, line protocol is up
Internet address is 10.10.10.11/32, Area 0
Process ID 1, Router ID 5.5.5.5, Network Type LOOPBACK, Cost: 1
Loopback interface is treated as a stub Host
Serial0/0/0 is up, line protocol is up
Internet address is 172.31.23.2/30, Area 0
Process ID 1, 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 00:00:04
Index 2/2, 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)
Serial0/1/0 is up, line protocol is up
Internet address is 172.31.21.2/30, Area 0
Process ID 1, Router ID 5.5.5.5, Network Type POINT-TO-POINT, Cost: 390
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 00:00:04
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 1.1.1.1
Suppress hello for 0 neighbor(s)
R2# 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 5.5.5.5
It is an autonomous system boundary router
Redistributing External Routes from,
static
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
172.31.23.0 0.0.0.3 area 0
10.10.10.11 0.0.0.0 area 0
Passive Interface(s):
Vlan1
FastEthernet0/0
FastEthernet0/1
Loopback0
Routing Information Sources:
Gateway Distance Last Update
1.1.1.1 110 00:10:25
5.5.5.5 110 00:08:11
8.8.8.8 110 00:08:11
Distance: (default is 110)
```

R2#

R3#show ip ospf interface

```
Loopback4 is up, line protocol is up
Internet address is 192.168.4.1/24, Area 0
Process ID 1, Router ID 8.8.8.8, Network Type LOOPBACK, Cost: 1
Loopback interface is treated as a stub Host
Loopback5 is up, line protocol is up
Internet address is 192.168.5.1/24, Area 0
Process ID 1, Router ID 8.8.8.8, Network Type LOOPBACK, Cost: 1
Loopback interface is treated as a stub Host
Loopback6 is up, line protocol is up
Internet address is 192.168.6.1/24, Area 0
Process ID 1, Router ID 8.8.8.8, Network Type LOOPBACK, Cost: 1
Loopback interface is treated as a stub Host
Serial0/0/0 is up, line protocol is up
Internet address is 172.31.23.1/30, Area 0
Process ID 1, Router ID 8.8.8.8, 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 00:00:00
Index 4/4, 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)
R3# 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 8.8.8.8
Number of areas in this router is 1. 1 normal 0 stub 0 nssa
Maximum path: 4
Routing for Networks:
172.31.23.0 0.0.0.3 area 0
192.168.4.0 0.0.0.255 area 0
192.168.5.0 0.0.0.255 area 0
192.168.6.0 0.0.0.255 area 0
Passive Interface(s):
Vlan1
FastEthernet0/0
FastEthernet0/1
Loopback4
Loopback5
Loopback6
Routing Information Sources:
Gateway Distance Last Update
1.1.1.1 110 00:11:28
5.5.5.5 110 00:09:14
8.8.8.8 110 00:09:14
Distance: (default is 110)
```

```
R3#
```

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

Se configuran ambos SW con password enable secret: ccna y usuario local: admin con password admin para el correcto funcionamiento de ssh. Tambien se muestra la configuración de seguridad aplicada de acuerdo a las buenas prácticas aprendidas en el diplomado:

```
S1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
S1(config)#service password-encryption
S1(config)#enable secret ccna
```

```
S1(config)#ip ssh version 2
S1(config)#no ip domain-lookup
S1(config)#ip domain-name ccna-unad.com
S1(config)#!
S1(config)#username admin secret ccna
S1(config)#!
S1(config)#vlan 30
S1(config-vlan)#name ADMINISTRACION
S1(config-vlan)#vlan 40
S1(config-vlan)#name MERCADEO
S1(config-vlan)#vlan 99
S1(config-vlan)#name GESTION_SW
S1(config-vlan)#vlan 200
S1(config-vlan)#name MANTENIMIENTO
S1(config-vlan)#vlan 4094
S1(config-vlan)#name VLAN_DE_SEGURIDAD
S1(config-vlan)#
S1(config-vlan)#exit
S1(config)#!
S1(config)#interface FastEthernet0/1
S1(config-if)# description HACIA PC-A
S1(config-if)# switchport access vlan 30
S1(config-if)# switchport mode access
S1(config-if)#!
S1(config-if)#interface FastEthernet0/2
S1(config-if)# description DESHABILITADO
S1(config-if)# switchport access vlan 4094
S1(config-if)# shutdown
S1(config-if)#!
S1(config-if)#interface FastEthernet0/3
S1(config-if)# description HACIA SW3
S1(config-if)# switchport trunk native vlan 99
S1(config-if)# switchport mode trunk
S1(config-if)# switchport nonegotiate
S1(config-if)#!
S1(config-if)#interface FastEthernet0/4
S1(config-if)# description DESHABILITADO
S1(config-if)# switchport access vlan 4094
S1(config-if)# shutdown
S1(config-if)#!
S1(config-if)#interface FastEthernet0/5
S1(config-if)# description DESHABILITADO
S1(config-if)# switchport access vlan 4094
S1(config-if)# shutdown
S1(config-if)#!
```

```
S1(config-if)#interface FastEthernet0/6
S1(config-if)# description DESHABILITADO
S1(config-if)# switchport access vlan 4094
S1(config-if)# shutdown
S1(config-if)#!
S1(config-if)#interface FastEthernet0/7
S1(config-if)# description DESHABILITADO
S1(config-if)# switchport access vlan 4094
S1(config-if)# shutdown
S1(config-if)#!
S1(config-if)#interface FastEthernet0/8
S1(config-if)# description DESHABILITADO
S1(config-if)# switchport access vlan 4094
S1(config-if)# shutdown
S1(config-if)#!
S1(config-if)#interface FastEthernet0/9
S1(config-if)# description DESHABILITADO
S1(config-if)# switchport access vlan 4094
S1(config-if)# shutdown
S1(config-if)#!
S1(config-if)#interface FastEthernet0/10
S1(config-if)# description DESHABILITADO
S1(config-if)# switchport access vlan 4094
S1(config-if)# shutdown
S1(config-if)#!
S1(config-if)#interface FastEthernet0/11
S1(config-if)# description DESHABILITADO
S1(config-if)# switchport access vlan 4094
S1(config-if)# shutdown
S1(config-if)#!
S1(config-if)#interface FastEthernet0/12
S1(config-if)# description DESHABILITADO
S1(config-if)# switchport access vlan 4094
S1(config-if)# shutdown
S1(config-if)#!
S1(config-if)#interface FastEthernet0/13
S1(config-if)# description DESHABILITADO
S1(config-if)# switchport access vlan 4094
S1(config-if)# shutdown
S1(config-if)#!
S1(config-if)#interface FastEthernet0/14
S1(config-if)# description DESHABILITADO
S1(config-if)# switchport access vlan 4094
S1(config-if)# shutdown
S1(config-if)#!
```

```
S1(config-if)#interface FastEthernet0/15
S1(config-if)# description DESHABILITADO
S1(config-if)# switchport access vlan 4094
S1(config-if)# shutdown
S1(config-if)#!
S1(config-if)#interface FastEthernet0/16
S1(config-if)# description DESHABILITADO
S1(config-if)# switchport access vlan 4094
S1(config-if)# shutdown
S1(config-if)#!
S1(config-if)#interface FastEthernet0/17
S1(config-if)# description DESHABILITADO
S1(config-if)# switchport access vlan 4094
S1(config-if)# shutdown
S1(config-if)#!
S1(config-if)#interface FastEthernet0/18
S1(config-if)# description DESHABILITADO
S1(config-if)# switchport access vlan 4094
S1(config-if)# shutdown
S1(config-if)#!
S1(config-if)#interface FastEthernet0/19
S1(config-if)# description DESHABILITADO
S1(config-if)# switchport access vlan 4094
S1(config-if)# shutdown
S1(config-if)#!
S1(config-if)#interface FastEthernet0/20
S1(config-if)# description DESHABILITADO
S1(config-if)# switchport access vlan 4094
S1(config-if)# shutdown
S1(config-if)#!
S1(config-if)#interface FastEthernet0/21
S1(config-if)# description DESHABILITADO
S1(config-if)# switchport access vlan 4094
S1(config-if)# shutdown
S1(config-if)#!
S1(config-if)#interface FastEthernet0/22
S1(config-if)# description DESHABILITADO
S1(config-if)# switchport access vlan 4094
S1(config-if)# shutdown
S1(config-if)#!
S1(config-if)#interface FastEthernet0/23
S1(config-if)# description DESHABILITADO
S1(config-if)# switchport access vlan 4094
S1(config-if)# shutdown
S1(config-if)#!
```

```
S1(config-if)#interface FastEthernet0/24
S1(config-if)# description HACIA R1
S1(config-if)# switchport trunk native vlan 99
S1(config-if)# switchport mode trunk
S1(config-if)#!
S1(config-if)#interface GigabitEthernet0/1
S1(config-if)# description DESHABILITADO
S1(config-if)# switchport access vlan 4094
S1(config-if)# shutdown
S1(config-if)#!
S1(config-if)#interface GigabitEthernet0/2
S1(config-if)# description DESHABILITADO
S1(config-if)# switchport access vlan 4094
S1(config-if)# shutdown
S1(config-if)#!
S1(config-if)#interface Vlan1
S1(config-if)# no ip address
S1(config-if)# shutdown
S1(config-if)#!
S1(config-if)#interface Vlan99
S1(config-if)# description GESTION_SW1
S1(config-if)# ip address 192.168.99.2 255.255.255.0
S1(config-if)#!
S1(config-if)#ip default-gateway 192.168.99.1
S1(config)#!
S1(config)#banner motd ^C
Enter TEXT message. End with the character '^'.
ESTA PROHIBIDO EL ACCESO SIN AUTORIZACION!
```

```
EN ESTE MOMENTO ESTE ACCESO ESTA SIENDO MONITOREADO...
^C
```

```
S1(config)#!
S1(config)#!
S1(config)#!
S1(config)#line con 0
S1(config-line)#!
S1(config-line)#line vty 0 4
S1(config-line)# login local
S1(config-line)# transport input ssh
S1(config-line)#line vty 5 15
S1(config-line)# login local
S1(config-line)# transport input ssh
S1(config-line)#end
S1#
```



```
S3#conf t
Enter configuration commands, one per line. End with CNTL/Z.
S3(config)#service password-encryption
S3(config)#enable secret ccna
S3(config)#!
S3(config)#!
S3(config)#vtp mode transparent
Setting device to VTP TRANSPARENT mode.
S3(config)#vlan 30
S3(config-vlan)#name ADMINISTRACION
S3(config-vlan)#vlan 40
S3(config-vlan)#name MERCADEO
S3(config-vlan)#vlan 99
S3(config-vlan)#name GESTION_SW
S3(config-vlan)#vlan 200
S3(config-vlan)#name MANTENIMIENTO
S3(config-vlan)#vlan 4094
S3(config-vlan)#name VLAN_DE_SEGURIDAD
S3(config-vlan)#exit
S3(config)#!
S3(config)#ip ssh version 2
S3(config)#no ip domain-lookup
S3(config)#ip domain-name ccna-unad.com
S3(config)#!
S3(config)#username admin secret ccna
S3(config)#!
S3(config)#!
S3(config)#spanning-tree mode pvst
S3(config)#!
S3(config)#interface FastEthernet0/1
S3(config-if)# description HACIA PC-C
S3(config-if)# switchport access vlan 40
S3(config-if)# switchport mode access
S3(config-if)#!
S3(config-if)#interface FastEthernet0/2
S3(config-if)# description DESHABILITADO
S3(config-if)# switchport access vlan 4094
S3(config-if)# shutdown
S3(config-if)#!
S3(config-if)#interface FastEthernet0/3
S3(config-if)# description HACIA SW1
S3(config-if)# switchport trunk native vlan 99
S3(config-if)# switchport mode trunk
S3(config-if)# switchport nonegotiate
```

```
S3(config-if)#!  
S3(config-if)#interface FastEthernet0/4  
S3(config-if)# description DESHABILITADO  
S3(config-if)# switchport access vlan 4094  
S3(config-if)# shutdown  
S3(config-if)#!  
S3(config-if)#interface FastEthernet0/5  
S3(config-if)# description DESHABILITADO  
S3(config-if)# switchport access vlan 4094  
S3(config-if)# shutdown  
S3(config-if)#!  
S3(config-if)#interface FastEthernet0/6  
S3(config-if)# description DESHABILITADO  
S3(config-if)# switchport access vlan 4094  
S3(config-if)# shutdown  
S3(config-if)#!  
S3(config-if)#interface FastEthernet0/7  
S3(config-if)# description DESHABILITADO  
S3(config-if)# switchport access vlan 4094  
S3(config-if)# shutdown  
S3(config-if)#!  
S3(config-if)#interface FastEthernet0/8  
S3(config-if)# description DESHABILITADO  
S3(config-if)# switchport access vlan 4094  
S3(config-if)# shutdown  
S3(config-if)#!  
S3(config-if)#interface FastEthernet0/9  
S3(config-if)# description DESHABILITADO  
S3(config-if)# switchport access vlan 4094  
S3(config-if)# shutdown  
S3(config-if)#!  
S3(config-if)#interface FastEthernet0/10  
S3(config-if)# description DESHABILITADO  
S3(config-if)# switchport access vlan 4094  
S3(config-if)# shutdown  
S3(config-if)#!  
S3(config-if)#interface FastEthernet0/11  
S3(config-if)# description DESHABILITADO  
S3(config-if)# switchport access vlan 4094  
S3(config-if)# shutdown  
S3(config-if)#!  
S3(config-if)#interface FastEthernet0/12  
S3(config-if)# description DESHABILITADO  
S3(config-if)# switchport access vlan 4094  
S3(config-if)# shutdown
```

```
S3(config-if)#!  
S3(config-if)#interface FastEthernet0/13  
S3(config-if)# description DESHABILITADO  
S3(config-if)# switchport access vlan 4094  
S3(config-if)# shutdown  
S3(config-if)#!  
S3(config-if)#interface FastEthernet0/14  
S3(config-if)# description DESHABILITADO  
S3(config-if)# switchport access vlan 4094  
S3(config-if)# shutdown  
S3(config-if)#!  
S3(config-if)#interface FastEthernet0/15  
S3(config-if)# description DESHABILITADO  
S3(config-if)# switchport access vlan 4094  
S3(config-if)# shutdown  
S3(config-if)#!  
S3(config-if)#interface FastEthernet0/16  
S3(config-if)# description DESHABILITADO  
S3(config-if)# switchport access vlan 4094  
S3(config-if)# shutdown  
S3(config-if)#!  
S3(config-if)#interface FastEthernet0/17  
S3(config-if)# description DESHABILITADO  
S3(config-if)# switchport access vlan 4094  
S3(config-if)# shutdown  
S3(config-if)#!  
S3(config-if)#interface FastEthernet0/18  
S3(config-if)# description DESHABILITADO  
S3(config-if)# switchport access vlan 4094  
S3(config-if)# shutdown  
S3(config-if)#!  
S3(config-if)#interface FastEthernet0/19  
S3(config-if)# description DESHABILITADO  
S3(config-if)# switchport access vlan 4094  
S3(config-if)# shutdown  
S3(config-if)#!  
S3(config-if)#interface FastEthernet0/20  
S3(config-if)# description DESHABILITADO  
S3(config-if)# switchport access vlan 4094  
S3(config-if)# shutdown  
S3(config-if)#!  
S3(config-if)#interface FastEthernet0/21  
S3(config-if)# description DESHABILITADO  
S3(config-if)# switchport access vlan 4094  
S3(config-if)# shutdown
```

```
S3(config-if)#!  
S3(config-if)#interface FastEthernet0/22  
S3(config-if)# description DESHABILITADO  
S3(config-if)# switchport access vlan 4094  
S3(config-if)# shutdown  
S3(config-if)#!  
S3(config-if)#interface FastEthernet0/23  
S3(config-if)# description DESHABILITADO  
S3(config-if)# switchport access vlan 4094  
S3(config-if)# shutdown  
S3(config-if)#!  
S3(config-if)#interface FastEthernet0/24  
S3(config-if)# description DESHABILITADO  
S3(config-if)# switchport access vlan 4094  
S3(config-if)# shutdown  
S3(config-if)#!  
S3(config-if)#interface GigabitEthernet0/1  
S3(config-if)# description DESHABILITADO  
S3(config-if)# switchport access vlan 4094  
S3(config-if)# shutdown  
S3(config-if)#!  
S3(config-if)#interface GigabitEthernet0/2  
S3(config-if)# description DESHABILITADO  
S3(config-if)# switchport access vlan 4094  
S3(config-if)# shutdown  
S3(config-if)#!  
S3(config-if)#interface Vlan1  
S3(config-if)# no ip address  
S3(config-if)# shutdown  
S3(config-if)#!  
S3(config-if)#interface Vlan99  
S3(config-if)# description GESTION_SW  
S3(config-if)# ip address 192.168.99.3 255.255.255.0  
S3(config-if)#!  
S3(config-if)#ip default-gateway 192.168.99.1  
S3(config)#!  
S3(config)#banner motd ^C  
Enter TEXT message. End with the character '^'.  
ESTA PROHIBIDO EL ACCESO SIN AUTORIZACION!
```

```
EN ESTE MOMENTO ESTE ACCESO ESTA SIENDO MONITOREADO...  
^C
```

```
S3(config)#!  
S3(config)#!
```

```
S3(config)#!  
S3(config)#line con 0  
S3(config-line)#!  
S3(config-line)#line vty 0 4  
S3(config-line)# login local  
S3(config-line)# transport input ssh  
S3(config-line)#line vty 5 15  
S3(config-line)# login local  
S3(config-line)# transport input ssh  
S3(config-line)#end  
S3#
```

#### 4.1.2.6 En el Switch 3 deshabilitar DNS lookup

Con el siguiente comando se confirma la des-habilitación de la búsqueda recursiva de dominios:

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

#### 4.1.2.7 Asignar direcciones IP a los Switches acorde a los lineamientos.

Se configuran la interface VLAN de Gestión en ambos switches:

```
S1(config-if)#interface Vlan99  
S1(config-if)# description GESTION_SW1  
S1(config-if)# ip address 192.168.99.2 255.255.255.0  
S1(config-if)#!  
S1(config-if)#ip default-gateway 192.168.99.1  
S1(config)#
```

```
S3(config-if)#interface Vlan99  
S3(config-if)# description GESTION_SW  
S3(config-if)# ip address 192.168.99.3 255.255.255.0  
S3(config-if)#!  
S3(config-if)#ip default-gateway 192.168.99.1  
S3(config)#
```

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

Se utiliza el comando “interface-range” para facilitar la configuración de desactivación de las interfaces que no están en uso:

```
S1(config-if-range)#interface range f0/2  
S1(config-if-range)#shut  
S1(config-if-range)#interface range f0/4-23
```

```
S1(config-if-range)#shut
S1(config-if-range)#end
S1#
```

```
S3#conf t
Enter configuration commands, one per line. End with CNTL/Z.
S3(config)#int range fa0/2
S3(config-if-range)#shut
S3(config-if-range)#int range fa0/4-24
S3(config-if-range)#shut
S3(config-if-range)#end
S3#
```

#### 4.1.2.9 Implement DHCP and NAT for IPv4

Implementando DHCP para IPv4 en R1:

```
R1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
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)#!
R1(config)#ip dhcp pool ADMINISTRACION
R1(dhcp-config)# network 192.168.30.0 255.255.255.0
R1(dhcp-config)# default-router 192.168.30.1
R1(dhcp-config)# dns-server 10.10.10.11
R1(dhcp-config)#ip dhcp pool MERCADEO
R1(dhcp-config)# network 192.168.40.0 255.255.255.0
R1(dhcp-config)# default-router 192.168.40.1
R1(dhcp-config)# dns-server 10.10.10.11
R1(dhcp-config)#end
R1#
```

Implementando NAT para IPv4 en R2:

```
R2#conf t
Enter configuration commands, one per line. End with CNTL/Z.
R2(config)#ip access-list standard NAT_INTERNET
R2(config-std-nacl)# permit 192.168.0.0 0.0.255.255
R2(config-std-nacl)#exit
R2(config)#ip nat inside source list NAT_INTERNET interface FastEthernet0/0
overload
R2(config)#
R2(config)#interface FastEthernet0/0
```

```

R2(config-if)# ip nat outside
R2(config-if)#interface Serial0/0/0
R2(config-if)# ip nat inside
R2(config-if)#interface Serial0/1/0
R2(config-if)# ip nat inside
R2(config-if)#end
R2#

```

4.1.2.10 Configurar R1 como servidor DHCP para las VLANs 30 y 40.

```

R1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
R1(config)#ip dhcp pool ADMINISTRACION
R1(dhcp-config)# network 192.168.30.0 255.255.255.0
R1(dhcp-config)# default-router 192.168.30.1
R1(dhcp-config)# dns-server 10.10.10.11
R1(dhcp-config)#ip dhcp pool MERCADEO
R1(dhcp-config)# network 192.168.40.0 255.255.255.0
R1(dhcp-config)# default-router 192.168.40.1
R1(dhcp-config)# dns-server 10.10.10.11
R1(dhcp-config)#end
R1#

```

4.1.2.11 Reservar las primeras 30 direcciones IP de las VLAN 30 y 40 para configuraciones estáticas.

```

R1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
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

```

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.

4.1.2.12 Configurar NAT en R2 para permitir que los host puedan salir a internet

Implementando NAT para IPv4 en R2:

```
R2#conf t
Enter configuration commands, one per line. End with CNTL/Z.
R2(config)#ip access-list standard NAT_INTERNET
R2(config-std-nacl)# permit 192.168.0.0 0.0.255.255
R2(config-std-nacl)#exit
R2(config)#ip nat inside source list NAT_INTERNET interface FastEthernet0/0
overload
R2(config)#
R2(config)#interface FastEthernet0/0
R2(config-if)# ip nat outside
R2(config-if)#interface Serial0/0/0
R2(config-if)# ip nat inside
R2(config-if)#interface Serial0/1/0
R2(config-if)# ip nat inside
R2(config-if)#end
R2#
```

4.1.2.13 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 configuran y aplican ACL para filtrar el acceso IP al segmento de red de gestión de la VLAN 99 desde otros dominios de difusión pertenecientes a los otros enrutadores:

```
R1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
R1(config)#access-list 10 deny 192.168.99.0 0.0.0.255
R1(config)#access-list 10 permit any
R1(config)#end
R1#
R1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
R1(config)#interface serial 0/0/0
R1(config-if)#ip access-group 10 out
R1(config-if)#end
R1#
```

```
R1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
R1(config)#access-list 11 deny 192.168.100.0 0.0.0.255
R1(config)#access-list 11 permit any
R1(config)#
R1(config)#int f0/0
```



```
R1(config-if)#ip access-group 11 in
R1(config-if)#end
R1#
```

4.1.2.14 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 configuran y aplican ACL extendidas para filtrar el acceso TCP puerto 8080 y 443 a dos host de prueba de cada uno de los segmentos de red asociados a las VLAN 30 y 40 sin afectar el flujo normal de tráfico IP para el resto de los dispositivos de cada segmento de red:

```
R1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
R1(config)#ip access-list extended FILTRO_8080
R1(config-ext-nacl)#deny tcp host 192.168.40.100 any eq 8080
R1(config-ext-nacl)#permit ip any any
R1(config-ext-nacl)#exit
R1(config)#int fa0/0.40
R1(config-subif)#ip access-group FILTRO_8080 in
R1(config-subif)#end
R1#
```

```
R1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
R1(config)#ip access-list extended FILTRO_443
R1(config-ext-nacl)#deny tcp host 192.168.30.101 any eq 443
R1(config-ext-nacl)#permit ip any any
R1(config-ext-nacl)#exit
R1(config)#int fa0/0.30
R1(config-subif)#ip access-group FILTRO_443 in
R1(config-subif)#end
R1#
```

4.1.2.15 Verificar procesos de comunicación y redireccionamiento de tráfico en los routers mediante el uso de Ping y Traceroute.

Se verifica en R2 tabla de enrutamiento, conectividad hacia internet y translaciones de PAT:

```

R2
Physical Config CLI Attributes
IOS Command Line Interface
R2#show ip route | be Gateway
Gateway of last resort is 0.0.0.0 to network 0.0.0.0

    10.0.0.0/32 is subnetted, 1 subnets
C       10.10.10.11 is directly connected, Loopback0
    172.31.0.0/30 is subnetted, 2 subnets
C       172.31.21.0 is directly connected, Serial0/1/0
C       172.31.23.0 is directly connected, Serial0/0/0
    192.168.4.0/32 is subnetted, 1 subnets
O       192.168.4.1 [110/9501] via 172.31.23.1, 00:13:02, Serial0/0/0
    192.168.5.0/32 is subnetted, 1 subnets
O       192.168.5.1 [110/9501] via 172.31.23.1, 00:13:02, Serial0/0/0
    192.168.6.0/32 is subnetted, 1 subnets
O       192.168.6.1 [110/9501] via 172.31.23.1, 00:13:02, Serial0/0/0
O       192.168.30.0/24 [110/391] via 172.31.21.1, 00:13:02, Serial0/1/0
O       192.168.40.0/24 [110/391] via 172.31.21.1, 00:13:02, Serial0/1/0
O       192.168.200.0/24 [110/391] via 172.31.21.1, 00:13:02, Serial0/1/0
    209.165.200.0/29 is subnetted, 1 subnets
C       209.165.200.224 is directly connected, FastEthernet0/0
S*    0.0.0.0/0 is directly connected, FastEthernet0/0

R2#ping 209.165.200.230

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 209.165.200.230, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 2/5/7 ms

R2#show ip nat translations
Pro Inside global      Inside local      Outside local      Outside global
icmp 209.165.200.225:1024 192.168.40.31:5   209.165.200.230:5  209.165.200.230:1024
icmp 209.165.200.225:1025 192.168.40.31:6   209.165.200.230:6  209.165.200.230:1025
icmp 209.165.200.225:1026 192.168.40.31:7   209.165.200.230:7  209.165.200.230:1026
icmp 209.165.200.225:1027 192.168.40.31:8   209.165.200.230:8  209.165.200.230:1027
icmp 209.165.200.225:5    192.168.30.31:5   209.165.200.230:5  209.165.200.230:5
icmp 209.165.200.225:6    192.168.30.31:6   209.165.200.230:6  209.165.200.230:6
icmp 209.165.200.225:7    192.168.30.31:7   209.165.200.230:7  209.165.200.230:7

```

Se verifica en R1 tabla de enrutamiento, conectividad hacia internet mediante ping y traceroute con el origen correspondiente a cada uno de los segmentos de red LAN configurados para evidenciar el óptimo funcionamiento del PAT en R1 y del enrutamiento:

```

R1
Physical Config CLI Attributes
IOS Command Line Interface

R1#show ip route 0.0.0.0
Routing entry for 0.0.0.0/0, supernet
Known via "ospf 1", distance 110, metric 1, candidate default path
  Tag 1, type extern 2, forward metric 1
  Last update from 172.31.21.2 on Serial0/0/0, 00:16:48 ago
Routing Descriptor Blocks:
  * 172.31.21.2, from 5.5.5.5, 00:16:48 ago, via Serial0/0/0
    Route metric is 1, traffic share count is 1

R1#traceroute
Protocol [ip]:
Target IP address: 209.165.200.230
Source address: 192.168.30.1
Numeric display [n]: y
Timeout in seconds [3]:
Probe count [3]:
Minimum Time to Live [1]:
Maximum Time to Live [30]:
Type escape sequence to abort.
Tracing the route to 209.165.200.230

  1  172.31.21.2      9 msec   1 msec   1 msec
  2  209.165.200.230 3 msec   14 msec  3 msec

R1#traceroute
Protocol [ip]:
Target IP address: 209.165.200.230
Source address: 192.168.40.1
Numeric display [n]: y
Timeout in seconds [3]:
Probe count [3]:
Minimum Time to Live [1]:
Maximum Time to Live [30]:
Type escape sequence to abort.
Tracing the route to 209.165.200.230

  1  172.31.21.2      1 msec   3 msec   0 msec
  2  209.165.200.230 10 msec  1 msec  12 msec

```

Se verifica en R3 tabla de enrutamiento, conectividad hacia internet mediante ping y traceroute con el origen correspondiente a cada uno de los segmentos de red LAN configurados para evidenciar el óptimo funcionamiento del PAT en R1 y del enrutamiento:

```

R3
Physical Config CLI Attributes
IOS Command Line Interface

R3#traceroute
Protocol [ip]:
Target IP address: 209.165.200.230
Source address: 192.168.4.1
Numeric display [n]: y
Timeout in seconds [3]:
Probe count [3]:
Minimum Time to Live [1]:
Maximum Time to Live [30]:
Type escape sequence to abort.
Tracing the route to 209.165.200.230

  1  172.31.23.2      1 msec   1 msec   1 msec
  2  209.165.200.230 3 msec   2 msec  12 msec

R3#traceroute
Protocol [ip]:
Target IP address: 209.165.200.230
Source address: 192.168.5.1
Numeric display [n]: y
Timeout in seconds [3]:
Probe count [3]:
Minimum Time to Live [1]:
Maximum Time to Live [30]:
Type escape sequence to abort.
Tracing the route to 209.165.200.230

  1  172.31.23.2      20 msec  1 msec   1 msec
  2  209.165.200.230 12 msec  1 msec   2 msec

R3#traceroute
Protocol [ip]:
Target IP address: 209.165.200.230
Source address: 192.168.6.1
Numeric display [n]: y
Timeout in seconds [3]:
Probe count [3]:
Minimum Time to Live [1]:
Maximum Time to Live [30]:
Type escape sequence to abort.
Tracing the route to 209.165.200.230

  1  172.31.23.2      1 msec   1 msec   0 msec
  2  209.165.200.230 11 msec  14 msec  11 msec

R3#show ip route 0.0.0.0
Routing entry for 0.0.0.0/0, supernet
Known via "ospf 1", distance 110, metric 1, candidate default path
  Tag 1, type extern 2, forward metric 1
  Last update from 172.31.23.2 on Serial0/0/0, 00:23:26 ago
Routing Descriptor Blocks:
  * 172.31.23.2, from 5.5.5.5, 00:23:26 ago, via Serial0/0/0
    Route metric is 1, traffic share count is 1

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

Neighbor ID  Pri  State           Dead Time   Address        Interface
5.5.5.5      0  FULL/ -         00:00:33    172.31.23.2    Serial0/0/0
R3#
R3#
R3#
R3#
R3#
R3#
R3#
R3#

```

R3				R3			
Physical	Config	CLI	Attributes	Physical	Config	CLI	Attributes
IOS Command Line Interface				IOS Command Line Interface			
<pre>R3#ping Protocol [ip]: Target IP address: 209.165.200.230 Repeat count [5]: Datagram size [100]: Timeout in seconds [2]: Extended commands [n]: y Source address or interface: 192.168.6.1 Type of service [0]: Set DF bit in IP header? [no]: Validate reply data? [no]: Data pattern [0xABCD]: Loose, Strict, Record, Timestamp, Verbose[none]: Sweep range of sizes [n]: Type escape sequence to abort. Sending 5, 100-byte ICMP Echos to 209.165.200.230, timeout is 2 seconds: Packet sent with a source address of 192.168.6.1 !!!! Success rate is 100 percent (5/5), round-trip min/avg/max = 3/7/11 ms</pre>				<pre>R3#ping Protocol [ip]: Target IP address: 209.165.200.230 Repeat count [5]: Datagram size [100]: Timeout in seconds [2]: Extended commands [n]: y Source address or interface: 192.168.5.1 Type of service [0]: Set DF bit in IP header? [no]: Validate reply data? [no]: Data pattern [0xABCD]: Loose, Strict, Record, Timestamp, Verbose[none]: Sweep range of sizes [n]: Type escape sequence to abort. Sending 5, 100-byte ICMP Echos to 209.165.200.230, timeout is 2 seconds: Packet sent with a source address of 192.168.5.1 !!!! Success rate is 100 percent (5/5), round-trip min/avg/max = 3/9/16 ms</pre>			

R3			
Physical	Config	CLI	Attributes
IOS Command Line Interface			
<pre>R3#ping Protocol [ip]: Target IP address: 209.165.200.230 Repeat count [5]: Datagram size [100]: Timeout in seconds [2]: Extended commands [n]: y Source address or interface: 192.168.4.1 Type of service [0]: Set DF bit in IP header? [no]: Validate reply data? [no]: Data pattern [0xABCD]: Loose, Strict, Record, Timestamp, Verbose[none]: Sweep range of sizes [n]: Type escape sequence to abort. Sending 5, 100-byte ICMP Echos to 209.165.200.230, timeout is 2 seconds: Packet sent with a source address of 192.168.4.1 !!!! Success rate is 100 percent (5/5), round-trip min/avg/max = 11/15/27 ms</pre>			

Se verifican translaciones del PAT en R2 para verificar su funcionamiento para los segmentos de red LAN en R3:

R2			
Physical	Config	CLI	Attributes
IOS Command Line Interface			
<pre>R2# R2#show ip nat translations Pro Inside global Inside local Outside local Outside global icmp 209.165.200.225:10192.168.5.1:10 209.165.200.230:10 209.165.200.230:10 icmp 209.165.200.225:11192.168.4.1:11 209.165.200.230:11 209.165.200.230:11 icmp 209.165.200.225:12192.168.4.1:12 209.165.200.230:12 209.165.200.230:12 icmp 209.165.200.225:13192.168.4.1:13 209.165.200.230:13 209.165.200.230:13 icmp 209.165.200.225:14192.168.4.1:14 209.165.200.230:14 209.165.200.230:14 icmp 209.165.200.225:15192.168.4.1:15 209.165.200.230:15 209.165.200.230:15 icmp 209.165.200.225:1 192.168.6.1:1 209.165.200.230:1 209.165.200.230:1 icmp 209.165.200.225:2 192.168.6.1:2 209.165.200.230:2 209.165.200.230:2 icmp 209.165.200.225:3 192.168.6.1:3 209.165.200.230:3 209.165.200.230:3 icmp 209.165.200.225:4 192.168.6.1:4 209.165.200.230:4 209.165.200.230:4 icmp 209.165.200.225:5 192.168.6.1:5 209.165.200.230:5 209.165.200.230:5 icmp 209.165.200.225:6 192.168.5.1:6 209.165.200.230:6 209.165.200.230:6 icmp 209.165.200.225:7 192.168.5.1:7 209.165.200.230:7 209.165.200.230:7 icmp 209.165.200.225:8 192.168.5.1:8 209.165.200.230:8 209.165.200.230:8 icmp 209.165.200.225:9 192.168.5.1:9 209.165.200.230:9 209.165.200.230:9</pre>			

Se verifica la conectividad hacia Internet para los PC configurados con DHCP IPv4 en las VLAN 30 y VLAN 40:

```

PC-A
-----
Physical Config Desktop Programming Attributes
Command Prompt
C:\>tracert -d 209.165.200.230
Invalid Command.

C:\>tracert 209.165.200.230

Tracing route to 209.165.200.230 over a maximum of 30 hops:

  1  1 ms   0 ms   0 ms   192.168.30.1
  2  3 ms   10 ms  4 ms   172.31.21.2
  3 12 ms   10 ms  11 ms  209.165.200.230

Trace complete.

C:\>ping 209.165.200.230

Pinging 209.165.200.230 with 32 bytes of data:

Reply from 209.165.200.230: bytes=32 time=13ms TTL=126
Reply from 209.165.200.230: bytes=32 time=11ms TTL=126
Reply from 209.165.200.230: bytes=32 time=11ms TTL=126
Reply from 209.165.200.230: bytes=32 time=20ms TTL=126

Ping statistics for 209.165.200.230:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 11ms, Maximum = 20ms, Average = 13ms

C:\>ipconfig

FastEthernet0 Connection: (default port)

Link-local IPv6 Address . . . . . : FE80::202:4AFF:FE73:4EAO
IP Address . . . . . : 192.168.30.31
Subnet Mask . . . . . : 255.255.255.0
Default Gateway . . . . . : 192.168.30.1

PC-C
-----
Physical Config Desktop Programming Attributes
Command Prompt
C:\>ping 209.165.200.230

Pinging 209.165.200.230 with 32 bytes of data:

Reply from 209.165.200.230: bytes=32 time=15ms TTL=126
Reply from 209.165.200.230: bytes=32 time=11ms TTL=126
Reply from 209.165.200.230: bytes=32 time=22ms TTL=126
Reply from 209.165.200.230: bytes=32 time=16ms TTL=126

Ping statistics for 209.165.200.230:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 11ms, Maximum = 22ms, Average = 16ms

C:\>tracert 209.165.200.230

Tracing route to 209.165.200.230 over a maximum of 30 hops:

  1  11 ms  3 ms   0 ms   192.168.40.1
  2  11 ms  13 ms  0 ms   172.31.21.2
  3  11 ms  13 ms  24 ms  209.165.200.230

Trace complete.

C:\>ipconfig

FastEthernet0 Connection: (default port)

Link-local IPv6 Address . . . . . : FE80::260:3EFF:FE1A:3950
IP Address . . . . . : 192.168.40.31
Subnet Mask . . . . . : 255.255.255.0
Default Gateway . . . . . : 192.168.40.1

```

## 5. CONCLUSIONES

Por medio de la elaboración de este trabajo práctico se ha logrado afianzar y reforzar el conocimiento teórico aprendido a través de la aplicación práctica en los escenarios propuestos. Se aplicaron los conocimientos en configuración de enlaces WAN y LAN aplicando VLSM y los tipos de interfaces Ethernet y Seriales, configuración de protocolos de enrutamiento estático y de enrutamiento dinámico IGP de Link State (RIPv2 y OSPF), configuración de DHCPv4 y DHCPv6 utilizando como servidores los router de la simulación, así como la delegación de asignación de direccionamiento IPv6 a un servidor DHCP configurado con este rol, configuración de NAT y PAT para simular la conectividad hacia Internet para todos los segmentos de red LAN permitidos para este fin, configuración de parámetros de seguridad en switch LAN mediante la aplicación de las mejores prácticas aprendidas en el diplomado, redistribución de enrutamiento estático de la ruta predeterminada en el protocolo de enrutamiento dinámico interno. Se aprendió a realizar la aplicación de costos sobre las interfaces WAN para el adecuado cálculo de métrica en el protocolo dinámico a conveniencia del diseño de red presentado. Se comprobó la operación y funcionamiento de las ACL estándar y extendidas como filtro básico de seguridad en los routers internos y su utilización para el funcionamiento de PAT (NAT con sobrecarga).

Se comprobó la versatilidad de la herramienta Packet Tracer para simular los escenarios de telecomunicaciones TCP/IP mediante la inclusión y configuración de los tipos de elementos de red utilizados durante el curso: router, switch capa 2, PC, Laptop, y Servidores; así como sus opciones disponibles de modularidad de hardware y configuración por línea de comandos y/o la emulación de las aplicaciones de configuración IP, terminal de consola y de servicios DHCP.

Mediante la práctica e interacción de los comandos de configuración de sistema operativo de Cisco (IOS) se adquirieron habilidades de alto nivel de troubleshooting consideradas de alto valor para el futuro desempeño laboral en ambientes reales de operación en sistemas de telecomunicaciones y redes de computación.

Se cumple el objetivo de un completo aprendizaje base de futuras certificaciones de la academia Cisco para la rama de Enrutamiento y conmutación de redes de telecomunicaciones.

## 6. REFERENCIAS BIBLIOGRÁFICAS

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Capitulo 11: Traducción de direcciones de red para IPv4. CP CCNA2 II-2018 (2018). Obtenido de: <https://www.netacad.com>

## 7. ANEXOS

### 7.1 ARCHIVO DE SIMULACIÓN DE PACKER TRACER PARA EL ESCENARIO 1.

[https://unadvirtualedu-my.sharepoint.com/:u:/g/personal/anpinillas\\_unadvirtual\\_edu\\_co/EQC9D9qVBN1Hux-r-Vy3-VUBKOXZRJgddRPqWlhaYbZZBw?e=C8jjVp](https://unadvirtualedu-my.sharepoint.com/:u:/g/personal/anpinillas_unadvirtual_edu_co/EQC9D9qVBN1Hux-r-Vy3-VUBKOXZRJgddRPqWlhaYbZZBw?e=C8jjVp)

### 7.2 ARCHIVO DE SIMULACIÓN DE PACKER TRACER PARA EL ESCENARIO 2.

[https://unadvirtualedu-my.sharepoint.com/:u:/g/personal/anpinillas\\_unadvirtual\\_edu\\_co/ES5AMW0bUYdHt3Cbf8sN2IUBGEInvf\\_mQVMXXU2uKZe-3A?e=pXFrGm](https://unadvirtualedu-my.sharepoint.com/:u:/g/personal/anpinillas_unadvirtual_edu_co/ES5AMW0bUYdHt3Cbf8sN2IUBGEInvf_mQVMXXU2uKZe-3A?e=pXFrGm)