

EVALUACIÓN - PRUEBA DE HABILIDADES PRACTICAS CCNA

CRISTIAN ALBERTO GÓMEZ RODRÍGUEZ

**UNIVERSIDAD NACIONAL ABIERTA Y A DISTANCIA - UNAD
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FLORENCIA
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**CRISTIAN ALBERTO GÓMEZ RODRÍGUEZ
GRUPO 30**

Informe final

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RESUMEN

El diseño e implementación de soluciones integradas LAN/WAN a través del uso de herramientas de simulación y laboratorios de acceso remoto nos permitió obtener la capacidad de configurar y administrar los diferentes dispositivos de Networking orientados al diseño de redes y a su vez optimizar el rendimiento de las redes e incorporar de manera adecuada el uso de tecnologías y protocolos de conmutación y enrutamiento.

Se presenta a continuación dos (2) escenarios propuestos, acompañados de los respectivos procesos de documentación de la solución, correspondientes al registro de la configuración de cada uno de los dispositivos, la descripción detallada del paso a paso de cada una de las etapas realizadas durante su desarrollo, el registro de los procesos de verificación de conectividad mediante el uso de comandos ping, traceroute, show ip route, entre otros.

ABSTRACT

The design and implementation of integrated LAN / WAN solutions through the use of simulation tools and remote access laboratories allowed us to obtain the ability to configure and manage the different Networking devices aimed at network design and at the same time optimize the performance of the networks and adequately incorporate the use of routing and routing technologies and protocols.

Two (2) proposed scenarios are presented below, accompanied by the respective documentation processes of the solution, corresponding to the registration of the configuration of each of the devices, the detailed description of the step by step of each of the stages performed during its development, the registration of connectivity verification processes through the use of ping, traceroute, show ip route commands, among others.

INTRODUCCIÓN

El presente trabajo contiene el desarrollo y solución de dos ejercicios prácticos en los cuales se aplican los conocimientos adquiridos en los dos módulos que componen el Diplomado de Profundización CISCO: Network Fundamentals (CCNA1 R&S) y Routing and Switching Fundamentals (CCNA2 R&S).

Para analizar cada escenario propuesto se aplicaron los diferentes niveles de comprensión y solución de problemas relacionados con diversos aspectos de Networking.

El objetivo principal es profundizar en el campo emergente de las Redes y Telecomunicaciones de tal manera que se tenga la capacidad ante la creciente demanda de personal especializado en el área de las tecnologías de la información.

1. OBJETIVOS

1.1 OBJETIVO GENERAL

Fomentar y fortalecer la capacidad de configurar y administrar los diferentes dispositivos de networking para optimizar el el rendimiento de las redes e incorporar de manera adecuada las nuevas tecnologías en los escenarios propuestos.

1.2 OBJETIVOS ESPECÍFICOS

- Identificar los dispositivos necesarios para la construcción de la topología de red.
- Realizar las configuraciones básicas en los dispositivos de comunicación Routers, switch y servidores.
- Emplear comandos de configuración avanzada en routers, implementando RIP, OSPF y enrutamiento estático.
- Establecer una lista de control de acceso de acuerdo con los criterios señalados.
- Configuración de NAT estático y de sobrecarga.

DESARROLLO DE LOS ESCENARIOS

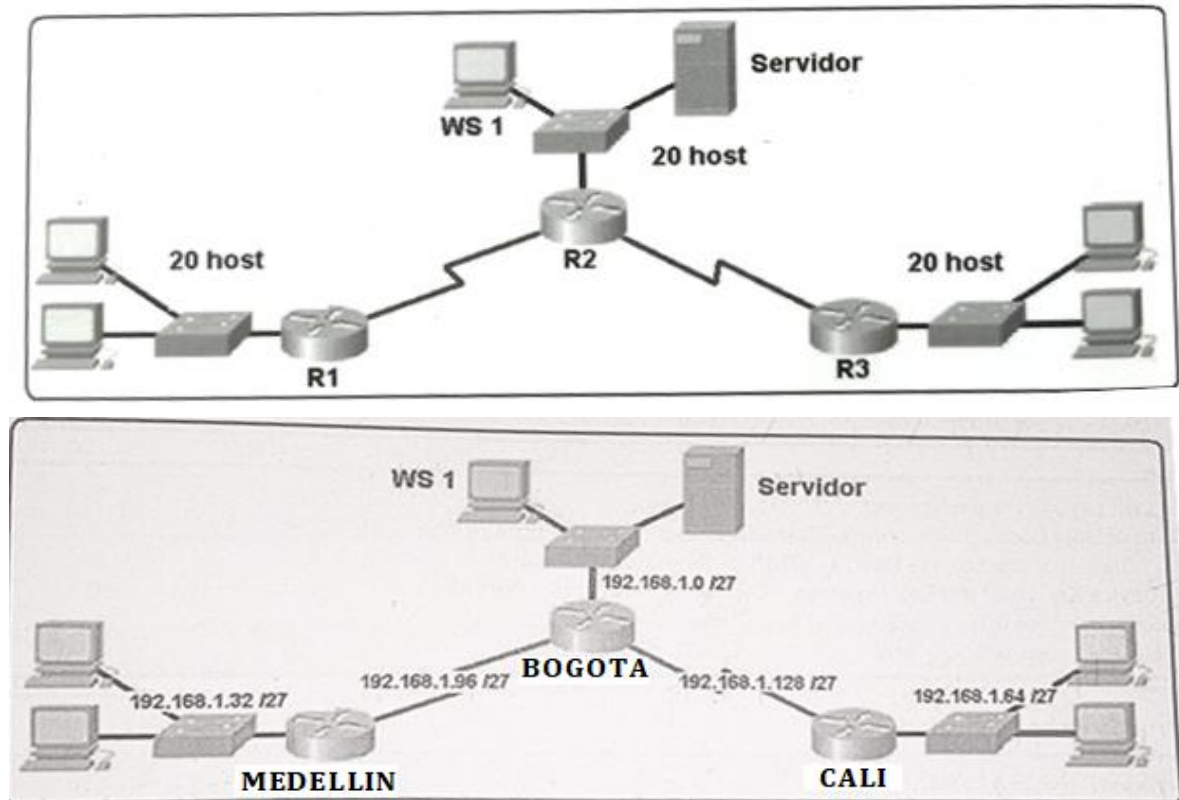
2. ESCENARIO 1:

Una empresa posee sucursales distribuidas en las ciudades de Bogotá, Medellín y Cali 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.

Dispositivos requeridos:

- ❖ 3 Routers (Cisco 1941)
- ❖ 3 Switches (2960-24TT)
- ❖ 5 Equipos de Computo
- ❖ 1 Servidor (Genérico PT)

Ilustración 1. Topología de red escenario 1.



Fuente: (UNAD, 2019).

Rutinas de diagnóstico y preparación de los equipos para su configuración.

Inicialmente se define el tipo y la cantidad de dispositivos de comunicación, posteriormente se aplica a cada Router y switch de la topología las siguientes configuraciones básicas:

- Router 1: nombrarlo "RBogota"
- Router 2: nombrarlo "RMedellin"
- Router 3: nombrarlo "RCali"
- Switch 1: nombrarlo "SBogota"
- Switch 2: nombrarlo "SMedellin"
- Switch 3: nombrarlo "SCali"
- Encriptar contraseñas
- A cada Router y Switch deshabilitar DNS lookup
- MOTD banner: Advertencia: Acceso no autorizado!!\$
- Exec Password: classclass
- Console Access Password: ciscocisco
- Telnet Access Password: ciscocisco

ROUTER BOGOTA:

```
Router>en
Router#conf term
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#hostname RBogota
RBogota(config)#no ip domain-lookup
RBogota(config)#service password-encryption
RBogota(config)#banner motd $Advertencia: Acceso no autorizado!!$
RBogota(config)#enable secret classclass
RBogota(config)#line console 0
RBogota(config-line)#password ciscocisco
RBogota(config-line)#login
RBogota(config-line)#line vty 0 4
RBogota(config-line)#password ciscocisco
RBogota(config-line)#login
RBogota(config-line)#
```

ROUTER MEDELLIN:

```
Router>en
Router#conf term
```

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

```
Router(config)#hostname RMedellin
RMedellin(config)#no ip domain-lookup
RMedellin(config)#service password-encryption
RMedellin(config)#banner motd $Advertencia: Acceso no autorizado!!$
RMedellin(config)#enable secret classclass
RMedellin(config)#line console 0
RMedellin(config-line)#password ciscocisco
RMedellin(config-line)#login
RMedellin(config-line)#line vty 0 4
RMedellin(config-line)#password ciscocisco
RMedellin(config-line)#login
RMedellin(config-line)#
```

ROUTER CALI:

```
Router>en
```

```
Router#conf term
```

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

```
Router(config)#hostname RCali
RCali(config)#no ip domain-lookup
RCali(config)#service password-encryption
RCali(config)#banner motd $Advertencia: Acceso no autorizado!!$
RCali(config)#enable secret classclass
RCali(config)#line console 0
RCali(config-line)#password ciscocisco
RCali(config-line)#login
RCali(config-line)#line vty 0 4
RCali(config-line)#password ciscocisco
RCali(config-line)#login
RCali(config-line)#
```

SWITCH BOGOTA:

```
Switch>en
```

```
Switch#conf term
```

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

```
Switch(config)#hostname SBogota
SBogota(config)#no ip domain-lookup
SBogota(config)#service password-encryption
SBogota(config)#banner motd $Advertencia: Acceso no autorizado!!$
```

```
SBogota(config)#enable secret classclass
SBogota(config)#line console 0
SBogota(config-line)#password ciscocisco
SBogota(config-line)#login
SBogota(config-line)#line vty 0 4
SBogota(config-line)#password ciscocisco
SBogota(config-line)#login
SBogota(config-line)#
```

SWITCH MEDELLIN:

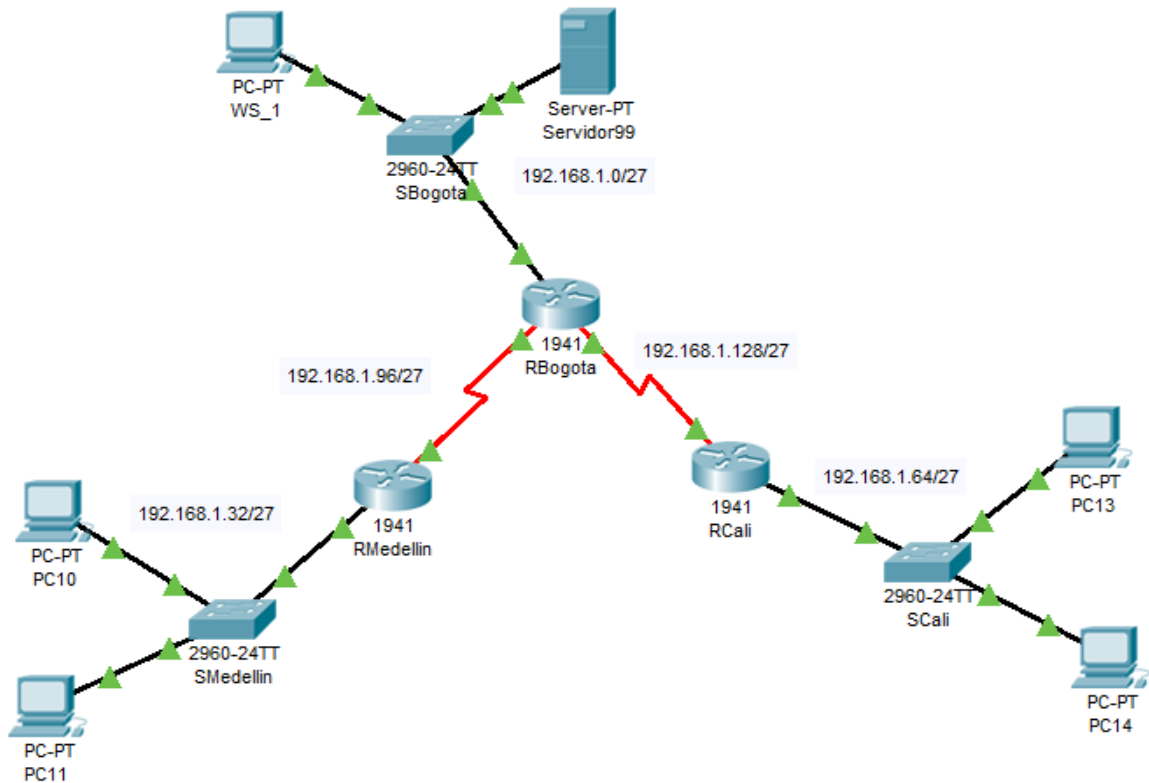
```
Switch>en
Switch#conf term
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#hostname SMedellin
SMedellin(config)#no ip domain-lookup
SMedellin(config)#service password-encryption
SMedellin(config)#banner motd $Advertencia: Acceso no autorizado!!$
SMedellin(config)#enable secret classclass
SMedellin(config)#line console 0
SMedellin(config-line)#password ciscocisco
SMedellin(config-line)#login
SMedellin(config-line)#line vty 0 4
SMedellin(config-line)#password ciscocisco
SMedellin(config-line)#login
SMedellin(config-line)#
```

SWITCH CALI:

```
Switch>en
Switch#conf term
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#hostname SCali
SCali(config)#no ip domain-lookup
SCali(config)#service password-encryption
SCali(config)#banner motd $Advertencia: Acceso no autorizado!!$
SCali(config)#enable secret classclass
SCali(config)#line console 0
SCali(config-line)#password ciscocisco
SCali(config-line)#login
SCali(config-line)#line vty 0 4
```

```
SCali(config-line)#password ciscocisco  
SCali(config-line)#login  
SCali(config-line)#
```

Ilustración 2. Conexión física de los equipos escenario 1.



Fuente: Gomez, Cristian Alberto. 2019 [Captura de pantalla].

Configurar la topología de red, de acuerdo con las siguientes especificaciones.

2.1 Parte 1: Asignación de direcciones IP:

Se divide (subnetear) la red creando una segmentación en ocho partes, para permitir crecimiento futuro de la red corporativa y se asigna una dirección IP a la red.

Bogotá LAN

Dirección de Red: 192.168.1.0
Máscara: 255.255.255.224

Medellín LAN

Dirección de Red: 192.168.1.32
Máscara: 255.255.255.224

Cali LAN

Dirección de Red: 192.168.1.64
Máscara: 255.255.255.224

Bogotá Medellín

Dirección de Red: 192.168.1.96
Máscara: 255.255.255.224

Bogotá Cali

Dirección de Red: 192.168.1.128
Máscara: 255.255.255.224

Futuro

Dirección de Red: 192.168.1.160
Máscara: 255.255.255.224

Futuro

Dirección de Red: 192.168.1.192
Máscara: 255.255.255.224

Futuro

Dirección de Red: 192.168.1.224
Máscara: 255.255.255.224

2.2 Parte 2: Configuraciónón Básica.

Tabla con la configuración básica de los routers, teniendo en cuenta las subredes diseñadas.

	R1	R2	R3
Nombre de Host	RMEDELLIN	RBOGOTA	RCALI
Dirección de Ip en interfaz Serial 0/0	192.168.1.99	192.168.1.98	192.168.1.131
Dirección de Ip en interfaz Serial 0/1		192.168.1.130	
Dirección de Ip en interfaz G0/0	192.168.1.33	192.168.1.1	192.168.1.65
Protocolo de enrutamiento	Eigrp	Eigrp	Eigrp
Sistema Autónomo	200	200	200
Afirmaciones de red	192.168.1.0	192.168.1.0	192.168.1.0

Una vez establecida la configuración básica para cada router procedemos a aplicar la configuración a cada uno de estos desde el modo exec.

ROUTER BOGOTA:

```
RBogota(config)#int s0/0/0
RBogota(config-if)#ip address 192.168.1.98 255.255.255.224
RBogota(config-if)#no shutdown
%LINK-5-CHANGED: Interface Serial0/0/0, changed state to down
```

```
RBogota(config-if)#
RBogota(config-if)#int s0/0/1
RBogota(config-if)#ip address 192.168.1.130 255.255.255.224
RBogota(config-if)#no shutdown
%LINK-5-CHANGED: Interface Serial0/0/1, changed state to down
RBogota(config-if)#
RBogota(config-if)#int g0/0
RBogota(config-if)#ip address 192.168.1.1 255.255.255.224
RBogota(config-if)#no shutdown
RBogota(config-if)#
RBogota(config-if)#router eigrp 200
RBogota(config-router)#no auto-summary
RBogota(config-router)#network 192.168.1.0
RBogota(config-router)#end
RBogota#
%LINK-5-CHANGED: Interface GigabitEthernet0/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0,
changed state to up
%SYS-5-CONFIG_I: Configured from console by console
```

ROUTER MEDELLIN:

```
RMedellin(config-line)#int s0/0/0
RMedellin(config-if)#ip address 192.168.1.99 255.255.255.224
RMedellin(config-if)#no shutdown
RMedellin(config-if)#
RMedellin(config-if)#int g0/0
RMedellin(config-if)#ip address 192.168.1.33 255.255.255.224
RMedellin(config-if)#no shutdown
RMedellin(config-if)#
RMedellin(config-if)#router eigrp 200
RMedellin(config-router)#no auto-summary
RMedellin(config-router)#network 192.168.1.0
RMedellin(config-router)#end
RMedellin#
RMedellin#
%LINK-5-CHANGED: Interface Serial0/0/0, changed state to up
%LINK-5-CHANGED: Interface GigabitEthernet0/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0,
changed state to up
```



```
%SYS-5-CONFIG_I: Configured from console by console
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0, changed state
to up
%DUAL-5-NBRCHANGE: IP-EIGRP 200: Neighbor 192.168.1.98 (Serial0/0/0) is up:
new adjacency
```

ROUTER CALI:

```
RCali(config-line)#int s0/0/0
RCali(config-if)#ip address 192.168.1.131 255.255.255.224
RCali(config-if)#no shutdown
RCali(config-if)#int g0/0
RCali(config-if)#ip address 192.168.1.65 255.255.255.224
RCali(config-if)#no shutdown
RCali(config-if)#
RCali(config-if)#router eigrp 200
RCali(config-router)#no auto-summary
RCali(config-router)#network 192.168.1.0
RCali(config-router)#end
RCali#
%LINK-5-CHANGED: Interface Serial0/0/0, changed state to up
%LINK-5-CHANGED: Interface GigabitEthernet0/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0,
changed state to up
%SYS-5-CONFIG_I: Configured from console by console
```

Después de cargada la configuración en los dispositivos, verificar la tabla de enrutamiento en cada uno de los routers para comprobar las redes y sus rutas utilizando el comando **SHOW IP ROUTE**.

ROUTER BOGOTA:

```
RBogota#show ip route
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
* - candidate default, U - per-user static route, o - ODR
P - periodic downloaded static route
```

Gateway of last resort is not set

192.168.1.0/24 is variably subnetted, 8 subnets, 2 masks
C 192.168.1.0/27 is directly connected, GigabitEthernet0/0
L 192.168.1.1/32 is directly connected, GigabitEthernet0/0
D 192.168.1.32/27 [90/2170112] via 192.168.1.99, 00:02:18, Serial0/0/0
D 192.168.1.64/27 [90/2170112] via 192.168.1.131, 00:01:05, Serial0/0/1
C 192.168.1.96/27 is directly connected, Serial0/0/0
L 192.168.1.98/32 is directly connected, Serial0/0/0
C 192.168.1.128/27 is directly connected, Serial0/0/1
L 192.168.1.130/32 is directly connected, Serial0/0/1

ROUTER MEDELLIN:

RMedellin#show ip route

Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
* - candidate default, U - per-user static route, o - ODR
P - periodic downloaded static route

Gateway of last resort is not set

192.168.1.0/24 is variably subnetted, 7 subnets, 2 masks
D 192.168.1.0/27 [90/2170112] via 192.168.1.98, 00:03:43, Serial0/0/0
C 192.168.1.32/27 is directly connected, GigabitEthernet0/0
L 192.168.1.33/32 is directly connected, GigabitEthernet0/0
D 192.168.1.64/27 [90/2682112] via 192.168.1.98, 00:02:30, Serial0/0/0
C 192.168.1.96/27 is directly connected, Serial0/0/0
L 192.168.1.99/32 is directly connected, Serial0/0/0
D 192.168.1.128/27 [90/2681856] via 192.168.1.98, 00:02:39, Serial0/0/0

ROUTER CALI:

RCali#show ip route

Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2

E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
* - candidate default, U - per-user static route, o - ODR
P - periodic downloaded static route

Gateway of last resort is not set

```
192.168.1.0/24 is variably subnetted, 7 subnets, 2 masks
D 192.168.1.0/27 [90/2170112] via 192.168.1.130, 00:00:26, Serial0/0/0
D 192.168.1.32/27 [90/2682112] via 192.168.1.130, 00:00:26, Serial0/0/0
C 192.168.1.64/27 is directly connected, GigabitEthernet0/0
L 192.168.1.65/32 is directly connected, GigabitEthernet0/0
D 192.168.1.96/27 [90/2681856] via 192.168.1.130, 00:00:26, Serial0/0/0
C 192.168.1.128/27 is directly connected, Serial0/0/0
L 192.168.1.131/32 is directly connected, Serial0/0/0
```

Luego verificar la tabla de enrutamiento en cada uno de los routers se procede a verificar el balanceo de carga que presentan los routers utilizando el comando **SHOW IP EIGRP TOPOLOGY**.

ROUTER BOGOTA:

```
RBogota#show ip eigrp topology
IP-EIGRP Topology Table for AS 200/ID(192.168.1.130)
```

Codes: P - Passive, A - Active, U - Update, Q - Query, R - Reply,
r - Reply status

```
P 192.168.1.0/27, 1 successors, FD is 2816
via Connected, GigabitEthernet0/0
P 192.168.1.32/27, 1 successors, FD is 2170112
via 192.168.1.99 (2170112/2816), Serial0/0/0
P 192.168.1.64/27, 1 successors, FD is 2170112
via 192.168.1.131 (2170112/2816), Serial0/0/1
P 192.168.1.96/27, 1 successors, FD is 2169856
via Connected, Serial0/0/0
P 192.168.1.128/27, 1 successors, FD is 2169856
via Connected, Serial0/0/1
```

ROUTER MEDELLIN:

RMedellin#show ip eigrp topology

IP-EIGRP Topology Table for AS 200/ID(192.168.1.99)

Codes: P - Passive, A - Active, U - Update, Q - Query, R - Reply,
r - Reply status

P 192.168.1.0/27, 1 successors, FD is 2170112
via 192.168.1.98 (2170112/2816), Serial0/0/0
P 192.168.1.32/27, 1 successors, FD is 2816
via Connected, GigabitEthernet0/0
P 192.168.1.64/27, 1 successors, FD is 2682112
via 192.168.1.98 (2682112/2170112), Serial0/0/0
P 192.168.1.96/27, 1 successors, FD is 2169856
via Connected, Serial0/0/0
P 192.168.1.128/27, 1 successors, FD is 2681856
via 192.168.1.98 (2681856/2169856), Serial0/0/0

ROUTER CALI:

RCali#show ip eigrp topology

IP-EIGRP Topology Table for AS 200/ID(192.168.1.131)

Codes: P - Passive, A - Active, U - Update, Q - Query, R - Reply,
r - Reply status

P 192.168.1.0/27, 1 successors, FD is 2170112
via 192.168.1.130 (2170112/2816), Serial0/0/0
P 192.168.1.32/27, 1 successors, FD is 2682112
via 192.168.1.130 (2682112/2170112), Serial0/0/0
P 192.168.1.64/27, 1 successors, FD is 2816
via Connected, GigabitEthernet0/0
P 192.168.1.96/27, 1 successors, FD is 2681856
via 192.168.1.130 (2681856/2169856), Serial0/0/0
P 192.168.1.128/27, 1 successors, FD is 2169856
via Connected, Serial0/0/0

Verificado el balanceo de carga en cada uno de los routers, procedemos a realizar un diagnóstico de vecinos usando el comando **SHOW CDP NEIGHBOR**, en donde podemos observar que cada router identifica el dispositivo próximo en cada tramo de ruta.

ROUTER BOGOTA:

RBogota#show cdp neighbor

Capability Codes: R - Router, T - Trans Bridge, B - Source Route Bridge

S - Switch, H - Host, I - IGMP, r - Repeater, P - Phone

Device ID	Local Intrfce	Holdtme	Capability	Platform	Port ID
SBogota	Gig 0/0	151	S	2960	Gig 0/1
RMedellin	Ser 0/0/0	161	R	C1900	Ser 0/0/0
Rcali	Ser 0/0/1	174	R	C1900	Ser 0/0/0

ROUTER MEDELLIN:

RMedellin#show cdp neighbor

Capability Codes: R - Router, T - Trans Bridge, B - Source Route Bridge

S - Switch, H - Host, I - IGMP, r - Repeater, P - Phone

Device ID	Local Intrfce	Holdtme	Capability	Platform	Port ID
SMedellin	Gig 0/0	130	S	2960	Gig 0/1
RBogota	Ser 0/0/0	141	R	C1900	Ser 0/0/0

ROUTER CALI:

RCali#show cdp neighbor

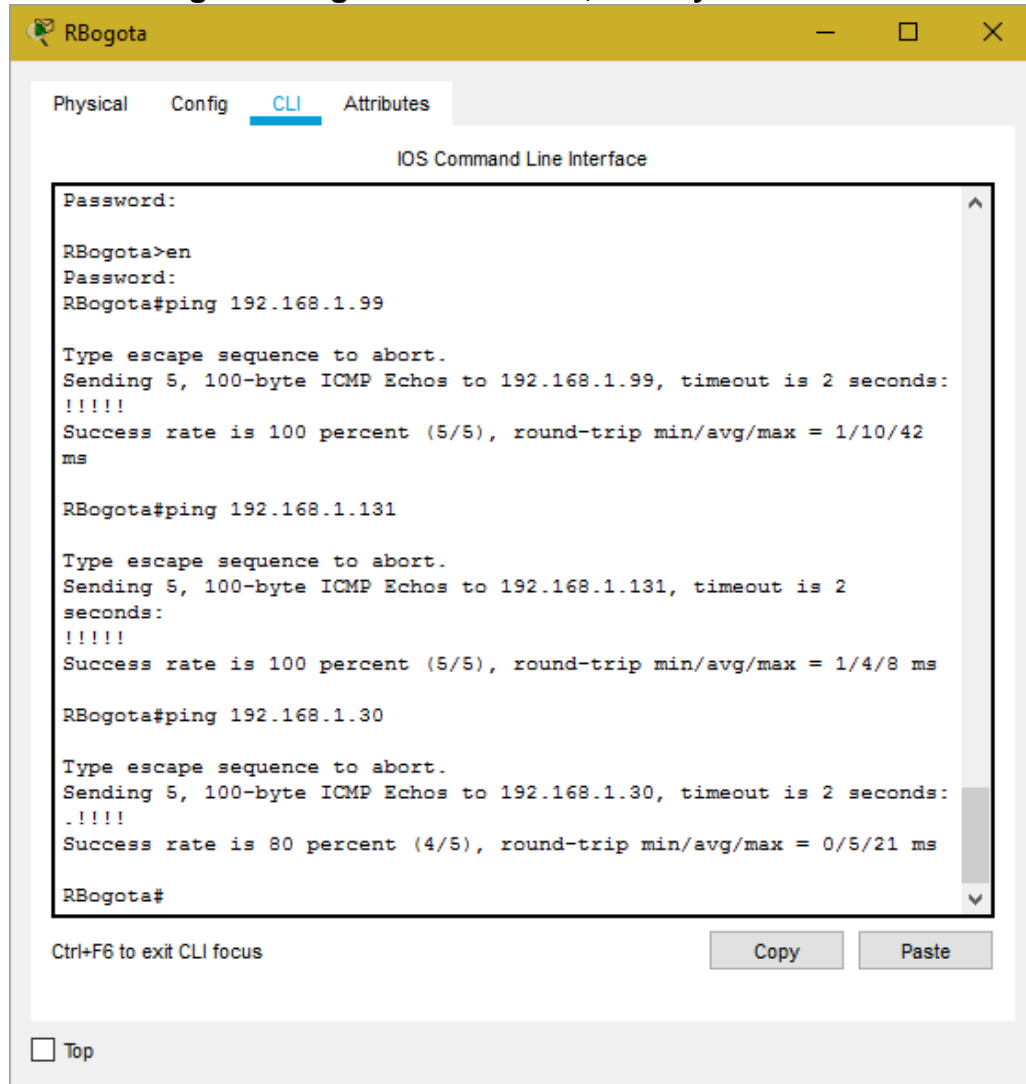
Capability Codes: R - Router, T - Trans Bridge, B - Source Route Bridge

S - Switch, H - Host, I - IGMP, r - Repeater, P - Phone

Device ID	Local Intrfce	Holdtme	Capability	Platform	Port ID
SCali	Gig 0/0	173	S	2960	Gig 0/1
RBogota	Ser 0/0/0	173	R	C1900	Ser 0/0/1

Revisados los equipos vecinos en cada tramo de ruta, realizamos una prueba de conectividad en cada tramo de la ruta usando Ping; Desde el router **Rbogota** hacemos un ping hacia el router **RMedellin**, luego router **RCali** y finalmente ping al **servidor**, en donde observamos que las respuestas a los pings son exitosas.

Ilustración 3. Ping de RBogotá a RMedellín, RCali y Servidor.



```
RBogota
Physical Config CLI Attributes
IOS Command Line Interface
Password:
RBogota>en
Password:
RBogota#ping 192.168.1.99

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.99, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/10/42
ms

RBogota#ping 192.168.1.131

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.131, timeout is 2
seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/4/8 ms

RBogota#ping 192.168.1.30

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.30, timeout is 2 seconds:
.!!!!
Success rate is 80 percent (4/5), round-trip min/avg/max = 0/5/21 ms

RBogota#
```

Ctrl+F6 to exit CLI focus Copy Paste

Top

Fuente: Gomez, Cristian Alberto. 2019 [Captura de pantalla].

2.3 Parte 3: Configuración de Enrutamiento.

Asignado el protocolo de enrutamiento EIGRP a los routers considerando el direccionamiento diseñado usamos el comando **SHOW IP EIGRP TOPOLOGY** para verificar el enrutamiento. Posteriormente usamos el comando **SHOW IP EIGRP NEIGHBORS** para verificar si existe vecindad con los routers configurados con EIGRP.

- **SHOW IP EIGRP TOPOLOGY**

ROUTER BOGOTA:

RBogota#show ip eigrp topology

IP-EIGRP Topology Table for AS 200/ID(192.168.1.130)

Codes: P - Passive, A - Active, U - Update, Q - Query, R - Reply,
r - Reply status

P 192.168.1.0/27, 1 successors, FD is 2816
via Connected, GigabitEthernet0/0
P 192.168.1.32/27, 1 successors, FD is 2170112
via 192.168.1.99 (2170112/2816), Serial0/0/0
P 192.168.1.64/27, 1 successors, FD is 2170112
via 192.168.1.131 (2170112/2816), Serial0/0/1
P 192.168.1.96/27, 1 successors, FD is 2169856
via Connected, Serial0/0/0
P 192.168.1.128/27, 1 successors, FD is 2169856
via Connected, Serial0/0/1

ROUTER MEDELLIN:

RMedellin#show ip eigrp topology

IP-EIGRP Topology Table for AS 200/ID(192.168.1.99)

Codes: P - Passive, A - Active, U - Update, Q - Query, R - Reply,
r - Reply status

P 192.168.1.0/27, 1 successors, FD is 2170112
via 192.168.1.98 (2170112/2816), Serial0/0/0
P 192.168.1.32/27, 1 successors, FD is 2816
via Connected, GigabitEthernet0/0
P 192.168.1.64/27, 1 successors, FD is 2682112
via 192.168.1.98 (2682112/2170112), Serial0/0/0
P 192.168.1.96/27, 1 successors, FD is 2169856
via Connected, Serial0/0/0
P 192.168.1.128/27, 1 successors, FD is 2681856
via 192.168.1.98 (2681856/2169856), Serial0/0/0

ROUTER CALI:

RCali#show ip eigrp topology
IP-EIGRP Topology Table for AS 200/ID(192.168.1.131)

Codes: P - Passive, A - Active, U - Update, Q - Query, R - Reply,
r - Reply status

P 192.168.1.0/27, 1 successors, FD is 2170112
via 192.168.1.130 (2170112/2816), Serial0/0/0
P 192.168.1.32/27, 1 successors, FD is 2682112
via 192.168.1.130 (2682112/2170112), Serial0/0/0
P 192.168.1.64/27, 1 successors, FD is 2816
via Connected, GigabitEthernet0/0
P 192.168.1.96/27, 1 successors, FD is 2681856
via 192.168.1.130 (2681856/2169856), Serial0/0/0
P 192.168.1.128/27, 1 successors, FD is 2169856
via Connected, Serial0/0/0

- **SHOW IP EIGRP NEIGHBORS**

ROUTER BOGOTA:

RBogota#show ip eigrp neighbor
IP-EIGRP neighbors for process 200

H	Address	Interface	Hold Uptime (sec)	SRTT (ms)	RTO Cnt	Q Num	Seq
0	192.168.1.99	Se0/0/0	12 00:05:27	40	1000	0	13
1	192.168.1.131	Se0/0/1	13 00:04:54	40	1000	0	14

ROUTER MEDELLIN:

RMedellin#show ip eigrp neighbor
IP-EIGRP neighbors for process 200

H	Address	Interface	Hold Uptime (sec)	SRTT (ms)	RTO Cnt	Q Num	Seq
0	192.168.1.98	Se0/0/0	12 00:10:48	40	1000	0	12

ROUTER CALI:

RCali#show ip eigrp neighbor
IP-EIGRP neighbors for process 200

H	Address	Interface	Hold Uptime (sec)	SRTT (ms)	RTO Cnt	Q Num	Seq
0	192.168.1.130	Se0/0/0	14 00:12:47	40	1000	0	13

Mediante el uso del comando **SHOW IP ROUTE** realizamos la comprobación de las tablas de enrutamiento en cada uno de los routers para verificar cada una de las rutas establecidas.

ROUTER BOGOTA:

RBogota#show ip route

Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
* - candidate default, U - per-user static route, o - ODR
P - periodic downloaded static route

Gateway of last resort is not set

```

192.168.1.0/24 is variably subnetted, 8 subnets, 2 masks
C    192.168.1.0/27 is directly connected, GigabitEthernet0/0
L    192.168.1.1/32 is directly connected, GigabitEthernet0/0
D    192.168.1.32/27 [90/2170112] via 192.168.1.99, 00:02:18, Serial0/0/0
D    192.168.1.64/27 [90/2170112] via 192.168.1.131, 00:01:05, Serial0/0/1
C    192.168.1.96/27 is directly connected, Serial0/0/0
L    192.168.1.98/32 is directly connected, Serial0/0/0
C    192.168.1.128/27 is directly connected, Serial0/0/1
L    192.168.1.130/32 is directly connected, Serial0/0/1

```

ROUTER MEDELLIN:

RMedellin#show ip route

Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
* - candidate default, U - per-user static route, o - ODR

P - periodic downloaded static route

Gateway of last resort is not set

192.168.1.0/24 is variably subnetted, 7 subnets, 2 masks

```
D    192.168.1.0/27 [90/2170112] via 192.168.1.98, 00:03:43, Serial0/0/0
C    192.168.1.32/27 is directly connected, GigabitEthernet0/0
L    192.168.1.33/32 is directly connected, GigabitEthernet0/0
D    192.168.1.64/27 [90/2682112] via 192.168.1.98, 00:02:30, Serial0/0/0
C    192.168.1.96/27 is directly connected, Serial0/0/0
L    192.168.1.99/32 is directly connected, Serial0/0/0
D    192.168.1.128/27 [90/2681856] via 192.168.1.98, 00:02:39, Serial0/0/0
```

ROUTER CALI:

RCali#show ip route

Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP

D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area

N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2

E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP

i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area

* - candidate default, U - per-user static route, o - ODR

P - periodic downloaded static route

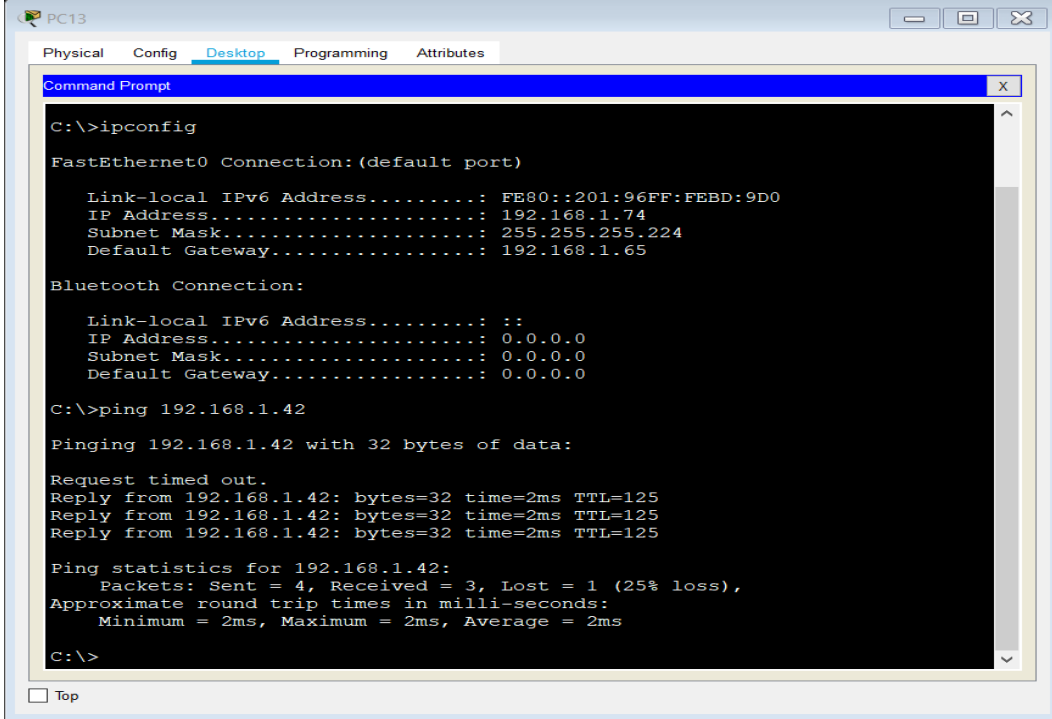
Gateway of last resort is not set

192.168.1.0/24 is variably subnetted, 7 subnets, 2 masks

```
D    192.168.1.0/27 [90/2170112] via 192.168.1.130, 00:00:26, Serial0/0/0
D    192.168.1.32/27 [90/2682112] via 192.168.1.130, 00:00:26, Serial0/0/0
C    192.168.1.64/27 is directly connected, GigabitEthernet0/0
L    192.168.1.65/32 is directly connected, GigabitEthernet0/0
D    192.168.1.96/27 [90/2681856] via 192.168.1.130, 00:00:26, Serial0/0/0
C    192.168.1.128/27 is directly connected, Serial0/0/0
L    192.168.1.131/32 is directly connected, Serial0/0/0
```

Se comprueba que cada uno de los puntos de la red se puedan ver y tengan conectividad entre sí. Para esta prueba haremos ping desde el host **PC13 (192.168.1.74)** de la red LAN del router **RCALI**, primero al host **PC10 (192.168.1.42)** de la red de **RMEDELLIN**, luego al **servidor (192.168.1.30)** y finalmente al host **WS_1 (192.168.1.10)**.

Ilustración 4. Ping desde PC13 a PC10.



```
C:\>ipconfig

FastEthernet0 Connection: (default port)

    Link-local IPv6 Address . . . . . : FE80::201:96FF:FEBD:9D0
    IP Address . . . . . : 192.168.1.74
    Subnet Mask . . . . . : 255.255.255.224
    Default Gateway . . . . . : 192.168.1.65

Bluetooth Connection:

    Link-local IPv6 Address . . . . . : ::
    IP Address . . . . . : 0.0.0.0
    Subnet Mask . . . . . : 0.0.0.0
    Default Gateway . . . . . : 0.0.0.0

C:\>ping 192.168.1.42

Pinging 192.168.1.42 with 32 bytes of data:

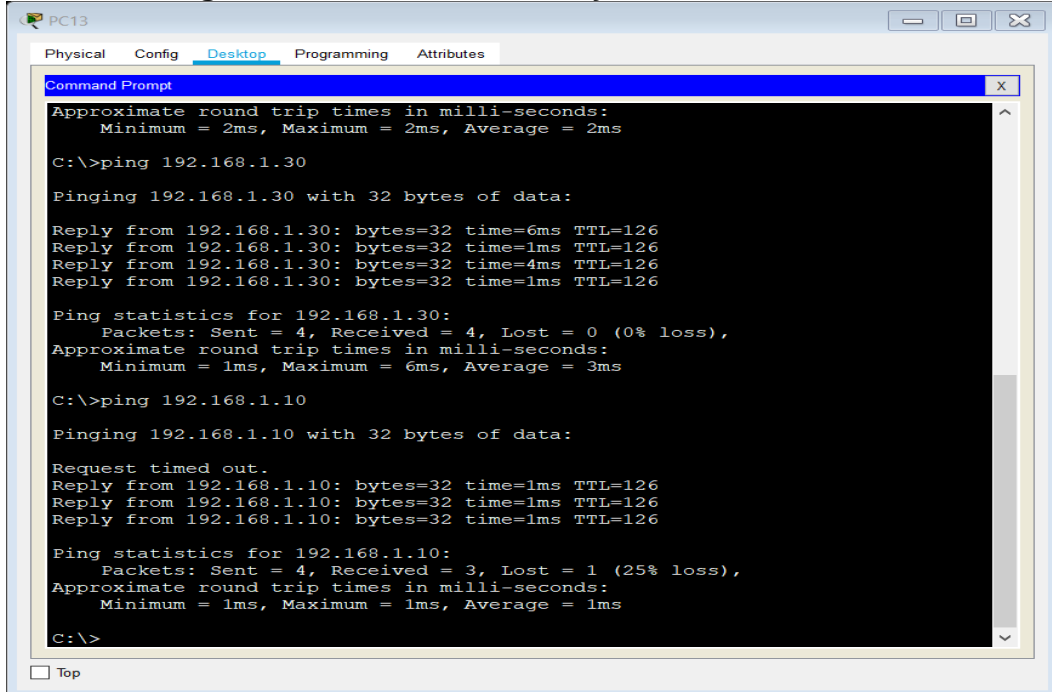
Request timed out.
Reply from 192.168.1.42: bytes=32 time=2ms TTL=125
Reply from 192.168.1.42: bytes=32 time=2ms TTL=125
Reply from 192.168.1.42: bytes=32 time=2ms TTL=125

Ping statistics for 192.168.1.42:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 2ms, Maximum = 2ms, Average = 2ms

C:\>
```

Fuente: Gomez, Cristian Alberto. 2019 [Captura de pantalla].

Ilustración 5. Ping desde PC13 al Servidor y WS_1.



```
Approximate round trip times in milli-seconds:
    Minimum = 2ms, Maximum = 2ms, Average = 2ms

C:\>ping 192.168.1.30

Pinging 192.168.1.30 with 32 bytes of data:

Reply from 192.168.1.30: bytes=32 time=6ms TTL=126
Reply from 192.168.1.30: bytes=32 time=1ms TTL=126
Reply from 192.168.1.30: bytes=32 time=4ms TTL=126
Reply from 192.168.1.30: bytes=32 time=1ms TTL=126

Ping statistics for 192.168.1.30:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 6ms, Average = 3ms

C:\>ping 192.168.1.10

Pinging 192.168.1.10 with 32 bytes of data:

Request timed out.
Reply from 192.168.1.10: bytes=32 time=1ms TTL=126
Reply from 192.168.1.10: bytes=32 time=1ms TTL=126
Reply from 192.168.1.10: bytes=32 time=1ms TTL=126

Ping statistics for 192.168.1.10:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 1ms, Average = 1ms

C:\>
```

Fuente: Gomez, Cristian Alberto. 2019 [Captura de pantalla].

2.4 Parte 4: Configuración de las Listas de Control de Acceso.

Debido a que en este momento cualquier usuario de la red tiene acceso a todos sus dispositivos y estaciones de trabajo, se debe implementar seguridad en la red, para lo cual se configuran listas de control de acceso (ACL) a los routers.

Las condiciones que se tuvieron en cuenta al momento de crear las ACL son las siguientes:

- a) Cada router debe estar habilitado para establecer conexiones Telnet con los demás routers y tener acceso a cualquier dispositivo en la red.

ROUTER BOGOTA:

```
RBogota(config-line)#line vty 0 4  
RBogota(config-line)#password ciscocisco  
RBogota(config-line)#login  
RBogota(config-line)#
```

ROUTER MEDELLIN:

```
RMedellin(config-line)#line vty 0 4  
RMedellin(config-line)#password ciscocisco  
RMedellin(config-line)#login  
RMedellin(config-line)#
```

ROUTER CALI:

```
RCali(config-line)#line vty 0 4  
RCali(config-line)#password ciscocisco  
RCali(config-line)#login  
RCali(config-line)#
```

SWITCH BOGOTA:

```
SBogota(config-line)#line vty 0 4  
SBogota(config-line)#password ciscocisco  
SBogota(config-line)#login  
SBogota(config-line)#
```

SWITCH MEDELLIN:

```
SMedellin(config-line)#line vty 0 4  
SMedellin(config-line)#password ciscocisco  
SMedellin(config-line)#login  
SMedellin(config-line)#
```

SWITCH CALI:

```
SCali(config-line)#line vty 0 4  
SCali(config-line)#password ciscocisco  
SCali(config-line)#login  
SCali(config-line)#
```

- b) El **servidor** de la subred de administración debe tener acceso a cualquier otro dispositivo en cualquier parte de la red.

ROUTER BOGOTA:

```
RBogota#conf t  
Enter configuration commands, one per line. End with CNTL/Z.  
RBogota(config)#access-list 151 permit ip host 192.168.1.30 any  
RBogota(config)#int g0/0  
RBogota(config-if)#ip access-group 151 in  
RBogota(config-if)#
```

- c) Las estaciones de trabajo en las LAN de **RMEDELLIN** y **RCALI** no deben tener acceso a ningún dispositivo fuera de su subred, excepto para interconectar con el **servidor**.

ROUTER MEDELLIN:

```
RMedellin#conf t  
Enter configuration commands, one per line. End with CNTL/Z.  
RMedellin(config)#access-list 151 permit ip 192.168.1.32 0.0.0.31 host  
192.168.1.30  
RMedellin(config)#int g0/0  
RMedellin(config-if)#ip access-group 151 in  
RMedellin(config-if)#
```

ROUTER CALI:

RCali#conf t

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

RCali(config)#access-list 151 permit ip 192.168.1.64 0.0.0.31 host 192.168.1.30

RCali(config)#int g0/0

RCali(config-if)#ip access-group 151 in

RCali(config-if)#

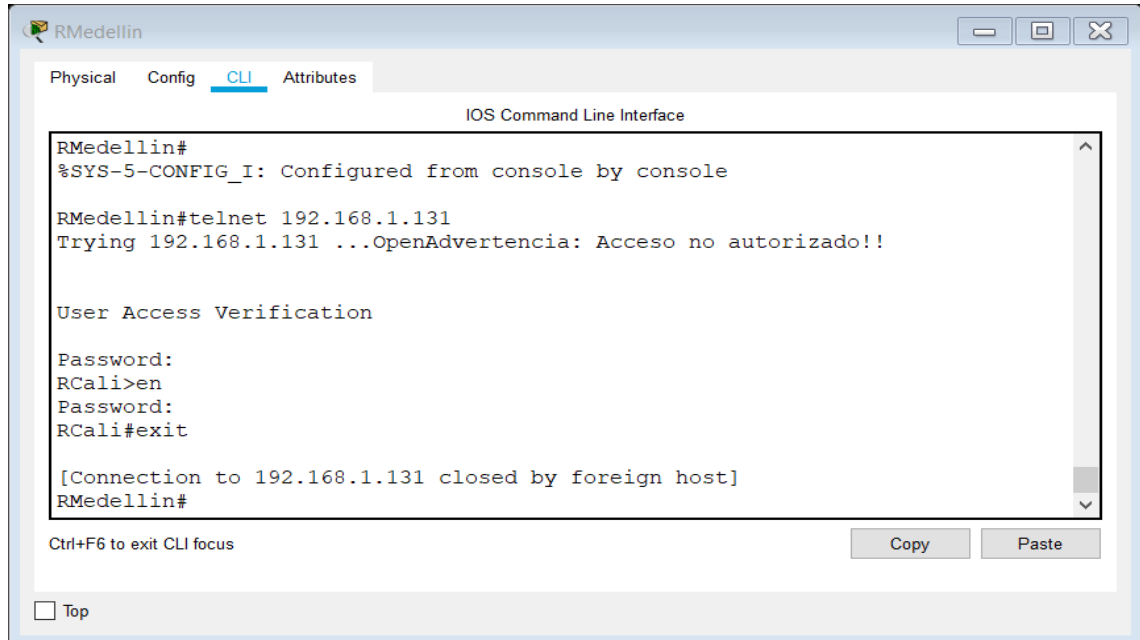
2.5 Parte 5: Comprobación de la red instalada.

Una vez configuradas las listas de acceso mediante la siguiente tabla de condiciones se comprueba el óptimo funcionamiento de la red.

	ORIGEN	DESTINO	RESULTADO
TELNET	Router RMEDELLIN	Router RCALI	Éxito
	WS_1	Router RBOGOTA	Falla
	Servidor	Router RCALI	Éxito
	Servidor	Router RMEDELLIN	Éxito
TELNET	LAN del Router RMEDELLIN	Router RCALI	Falla
	LAN del Router RCALI	Router RCALI	Falla
	LAN del Router RMEDELLIN	Router RMEDELLIN	Falla
	LAN del Router RCALI	Router RMEDELLIN	Falla
PING	LAN del Router RCALI	WS_1	Falla
	LAN del Router RMEDELLIN	WS_1	Falla
	LAN del Router RMEDELLIN	LAN del Router RCALI	Falla
PING	LAN del Router RCALI	Servidor	Éxito
	LAN del Router RMEDELLIN	Servidor	Éxito
	Servidor	LAN del Router RMEDELLIN	Éxito
	Servidor	LAN del Router RCALI	Éxito
	Router RCALI	LAN del Router RMEDELLIN	Falla
	Router RMEDELLIN	LAN del Router RCALI	Falla

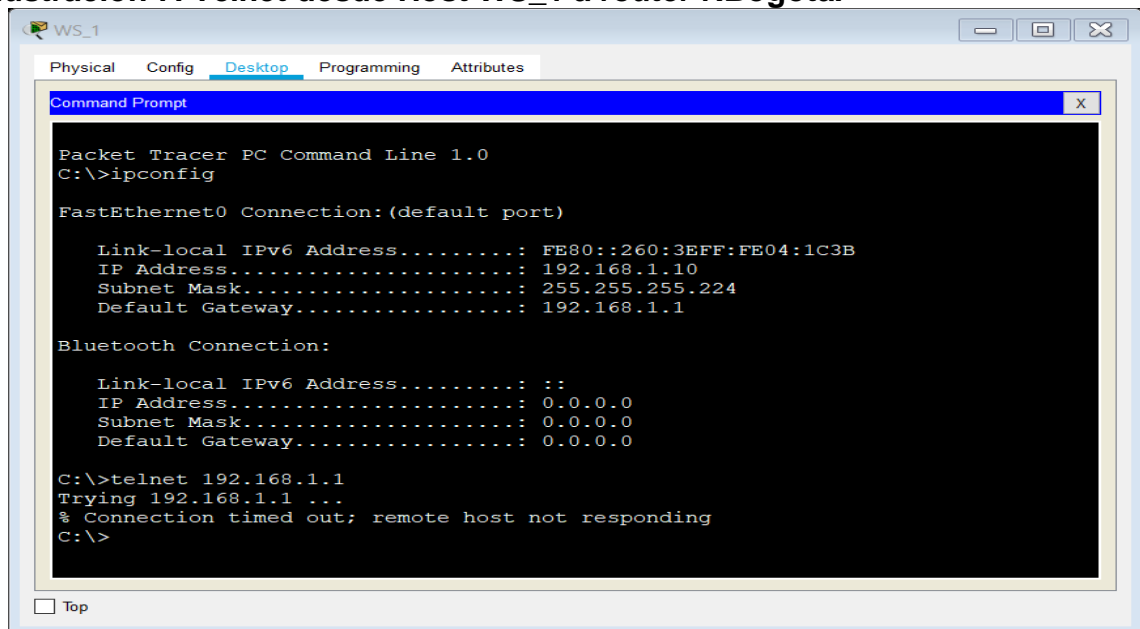
A continuación, se relacionan las capturas en el orden que se presenta en la tabla anterior, en donde se puede evidenciar que la configuración de las ACL fue exitosa.

Ilustración 6. Telnet desde router RMedellín a RCali.



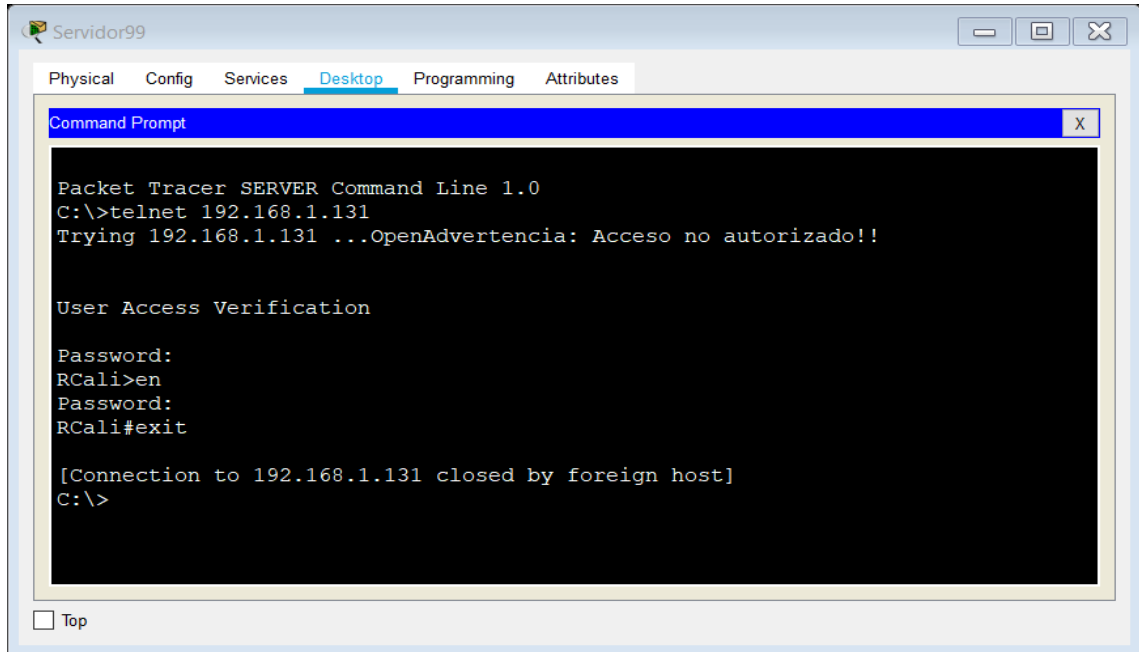
Fuente: Gomez, Cristian Alberto. 2019 [Captura de pantalla].

Ilustración 7. Telnet desde Host WS_1 a router RBogotá.



Fuente: Gomez, Cristian Alberto. 2019 [Captura de pantalla].

Ilustración 8. Telnet desde Servidor a router RCali.



```
Packet Tracer SERVER Command Line 1.0
C:\>telnet 192.168.1.131
Trying 192.168.1.131 ...OpenAdvertencia: Acceso no autorizado!!

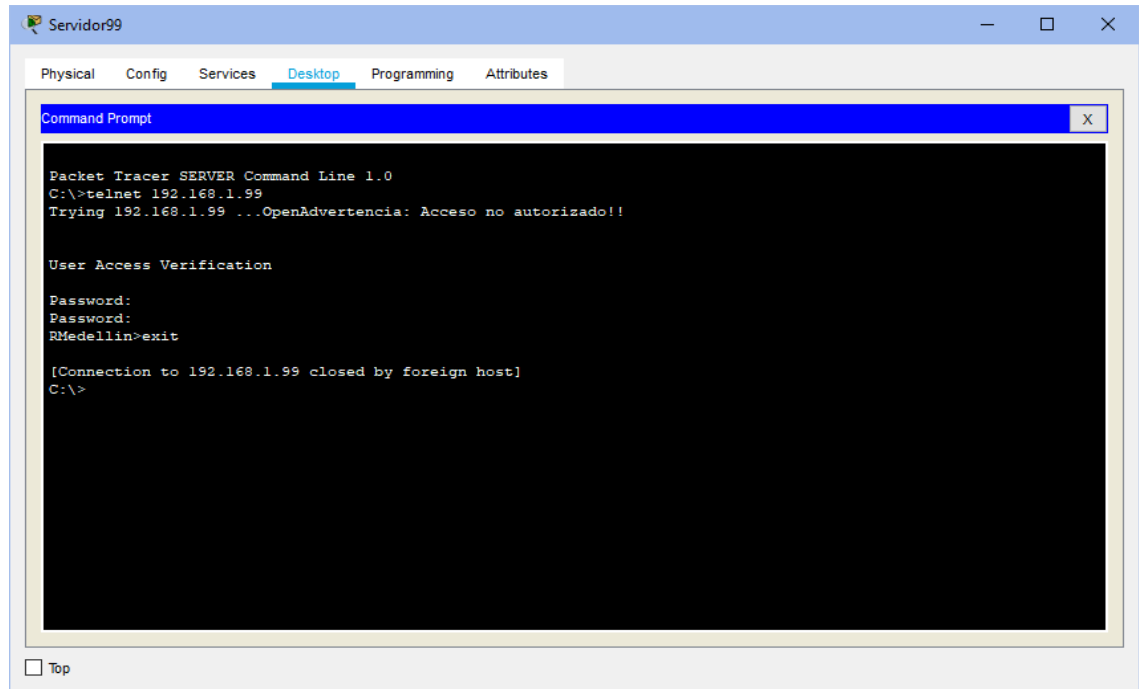
User Access Verification

Password:
RCali>en
Password:
RCali#exit

[Connection to 192.168.1.131 closed by foreign host]
C:\>
```

Fuente: Gomez, Cristian Alberto. 2019 [Captura de pantalla].

Ilustración 9. Telnet desde Servidor a router RMedellin.



```
Packet Tracer SERVER Command Line 1.0
C:\>telnet 192.168.1.99
Trying 192.168.1.99 ...OpenAdvertencia: Acceso no autorizado!!

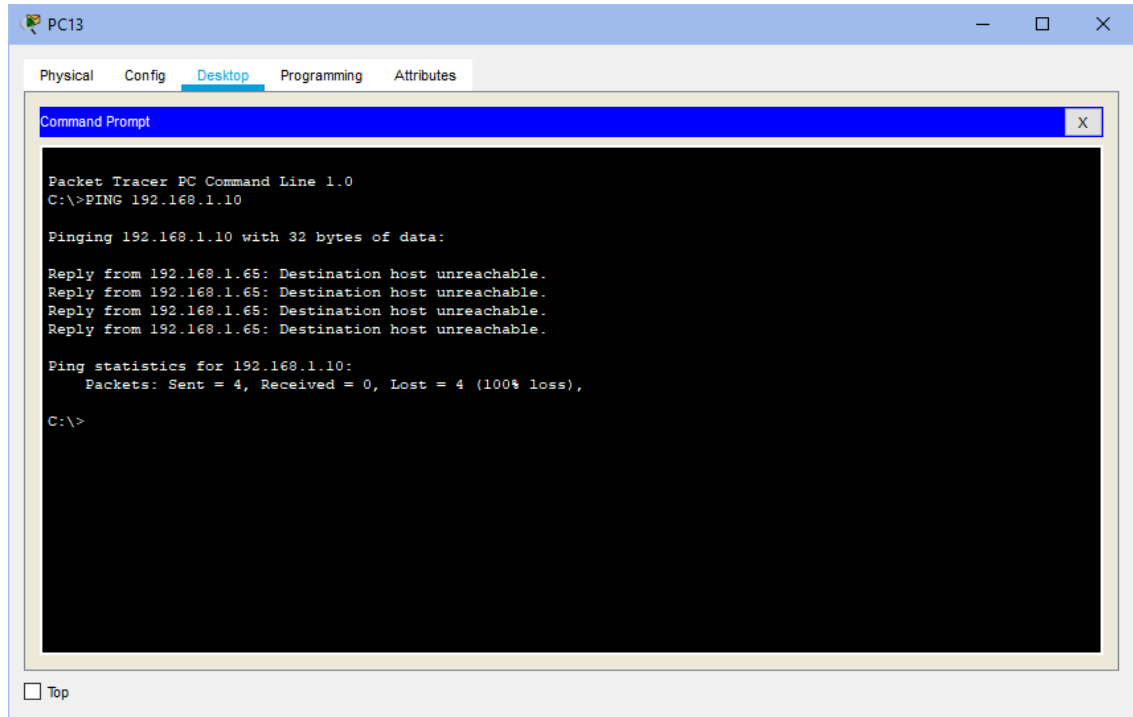
User Access Verification

Password:
RMedellin>exit

[Connection to 192.168.1.99 closed by foreign host]
C:\>
```

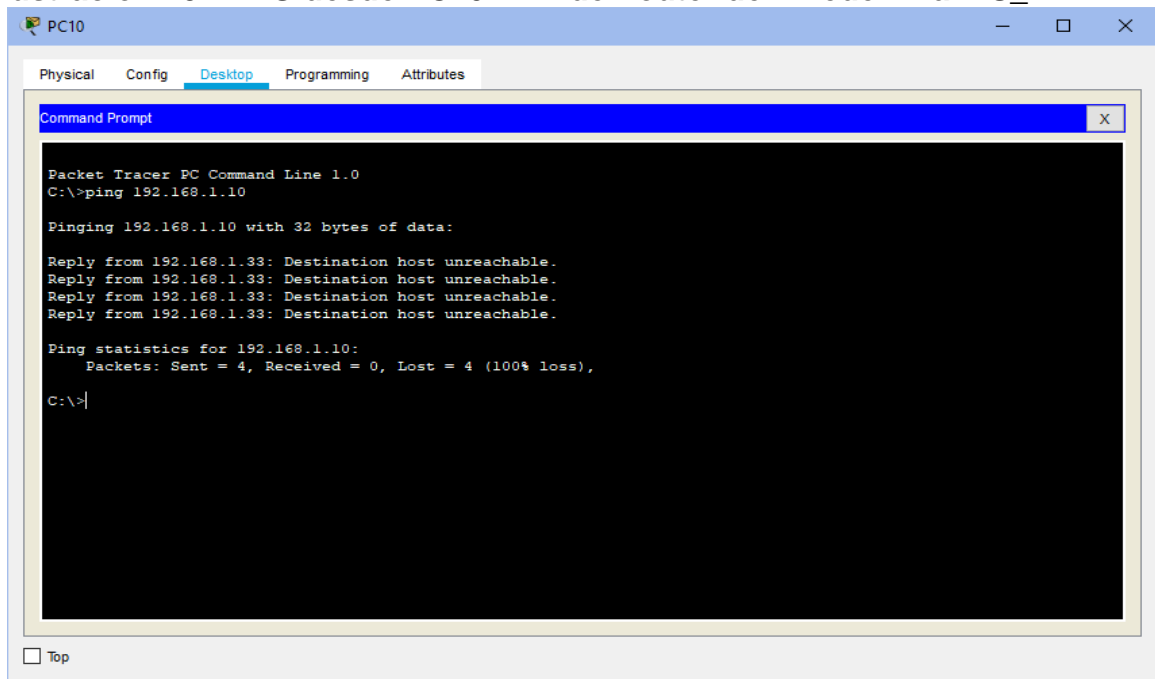
Fuente: Gomez, Cristian Alberto. 2019 [Captura de pantalla].

Ilustración 14. PING desde PC13 LAN del router RCali a host WS_1.



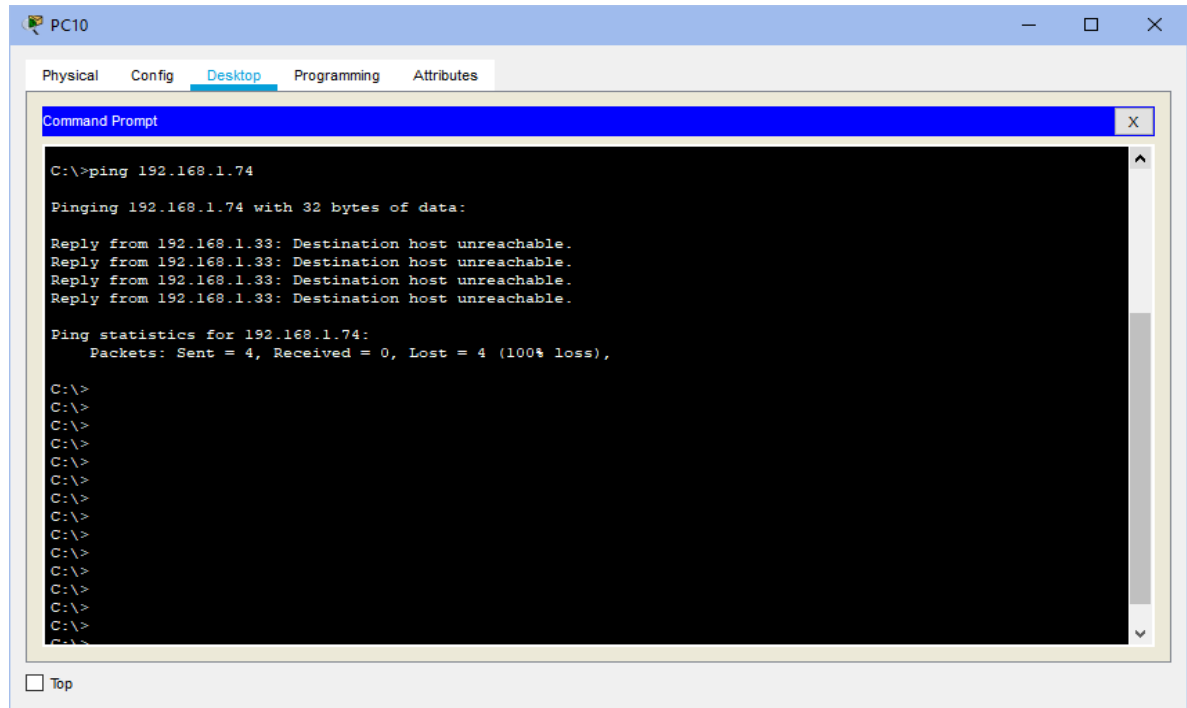
Fuente: Gomez, Cristian Alberto. 2019 [Captura de pantalla].

Ilustración 15. PING desde PC10 LAN del router de RMedellin a WS_1.



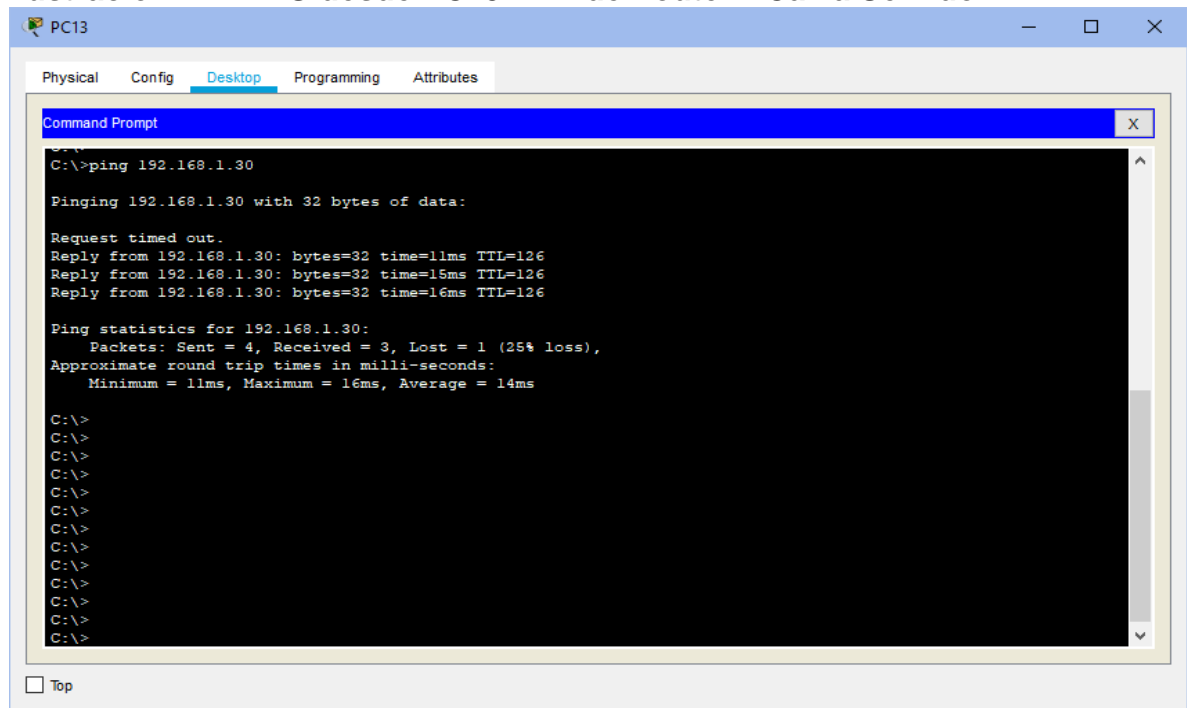
Fuente: Gomez, Cristian Alberto. 2019 [Captura de pantalla].

Ilustración 16. PING desde PC10 LAN del router RMedellin a PC13 LAN del router RCali.



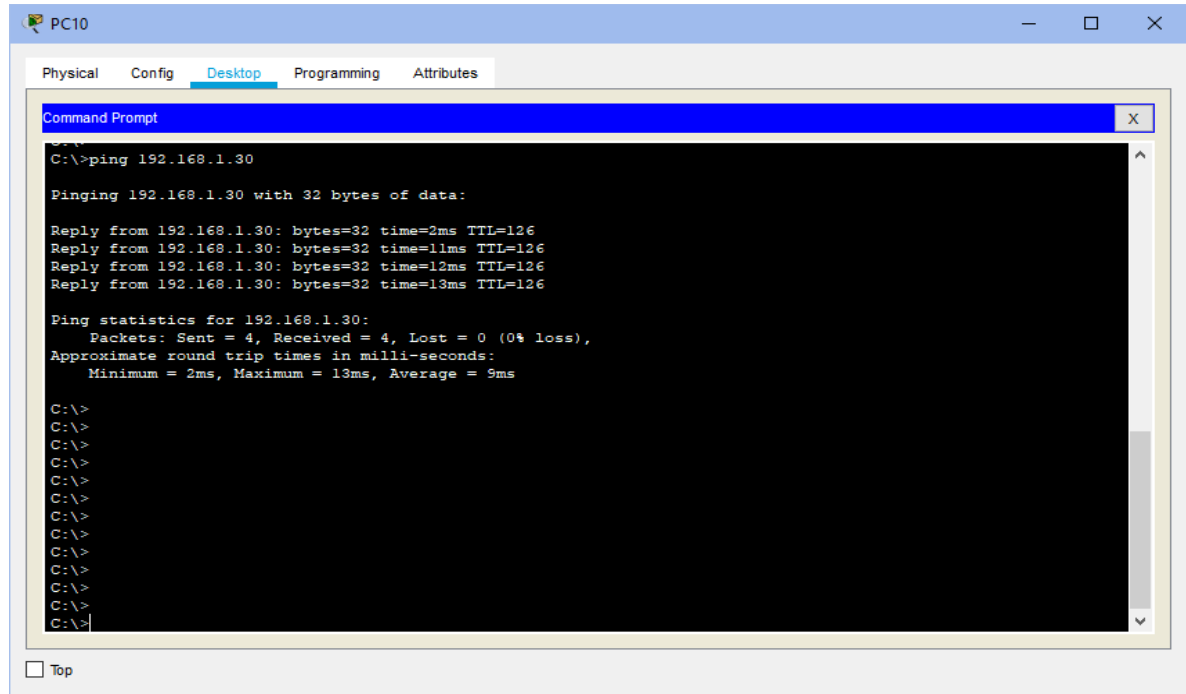
Fuente: Gomez, Cristian Alberto. 2019 [Captura de pantalla].

Ilustración 17. PING desde PC13 LAN del router RCali a Servidor.



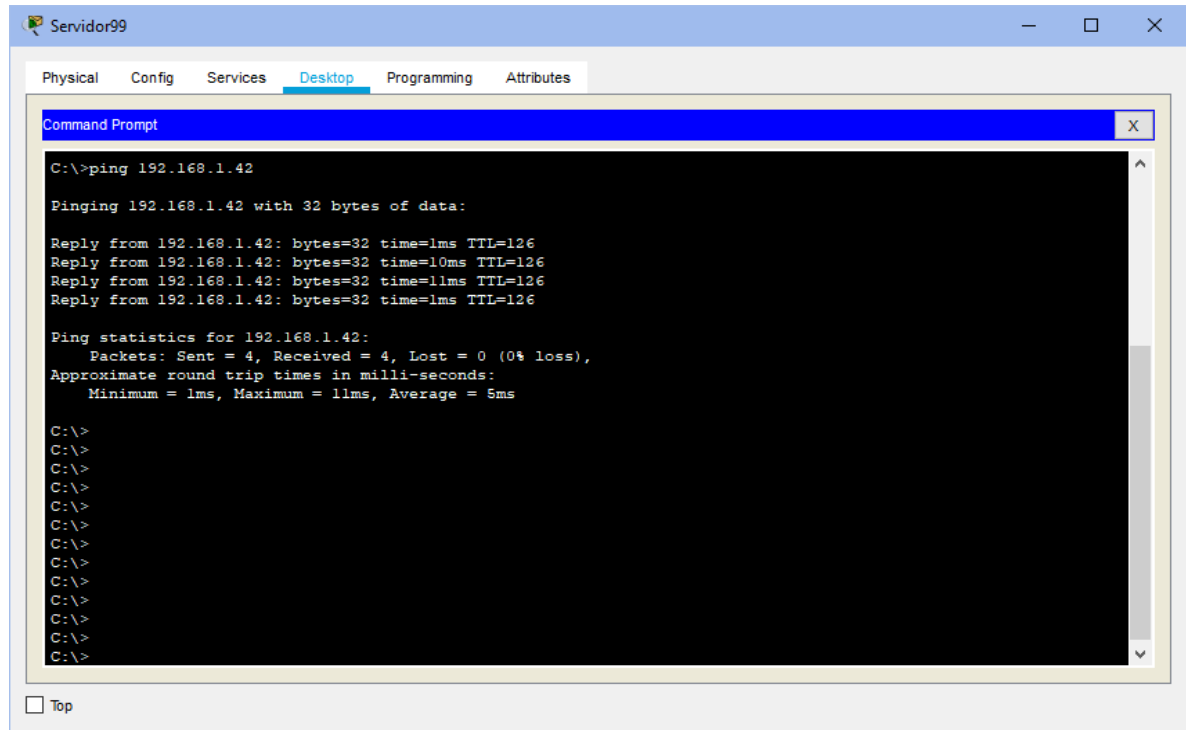
Fuente: Gomez, Cristian Alberto. 2019 [Captura de pantalla].

Ilustración 18. PING desde PC10 LAN del router RMedellin a Servidor.



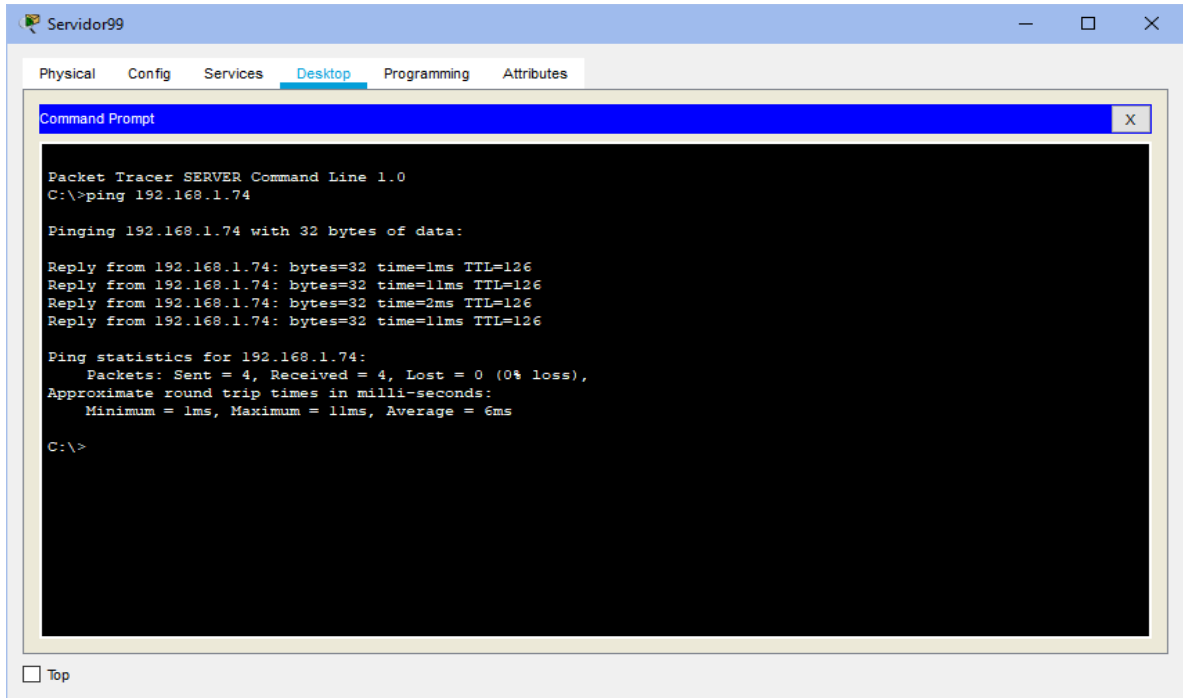
Fuente: Gomez, Cristian Alberto. 2019 [Captura de pantalla].

Ilustración 19. PING desde Servidor a PC10 LAN del router RMedellin.



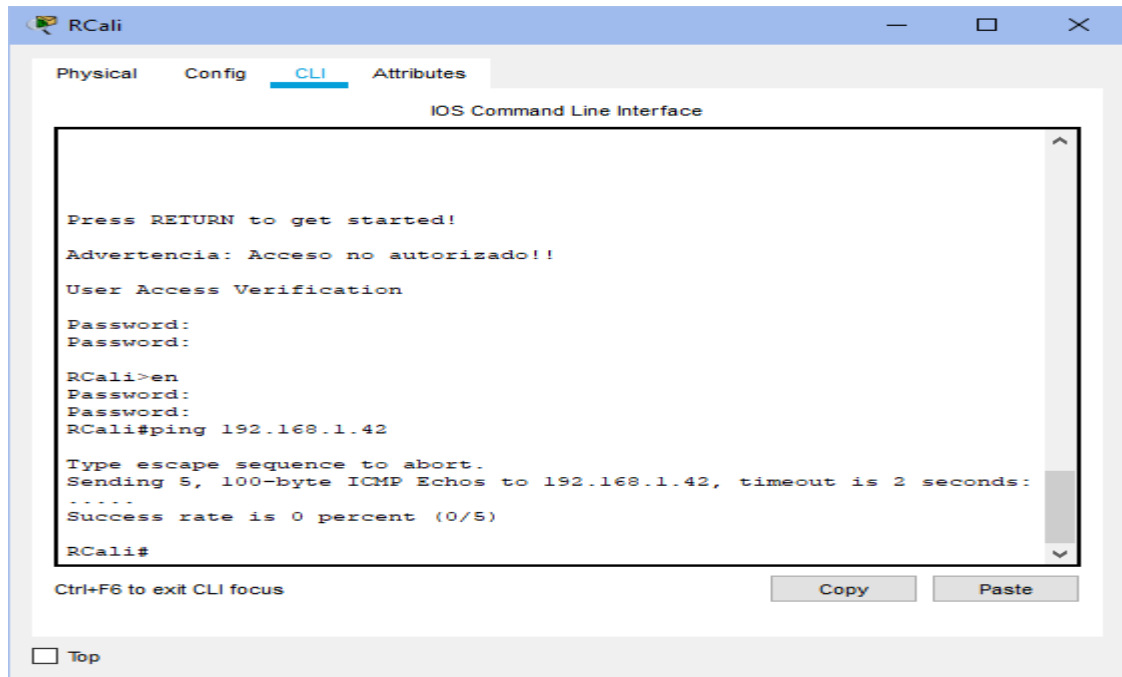
Fuente: Gomez, Cristian Alberto. 2019 [Captura de pantalla].

Ilustración 20. PING desde Servidor a PC13 LAN del router RCali.



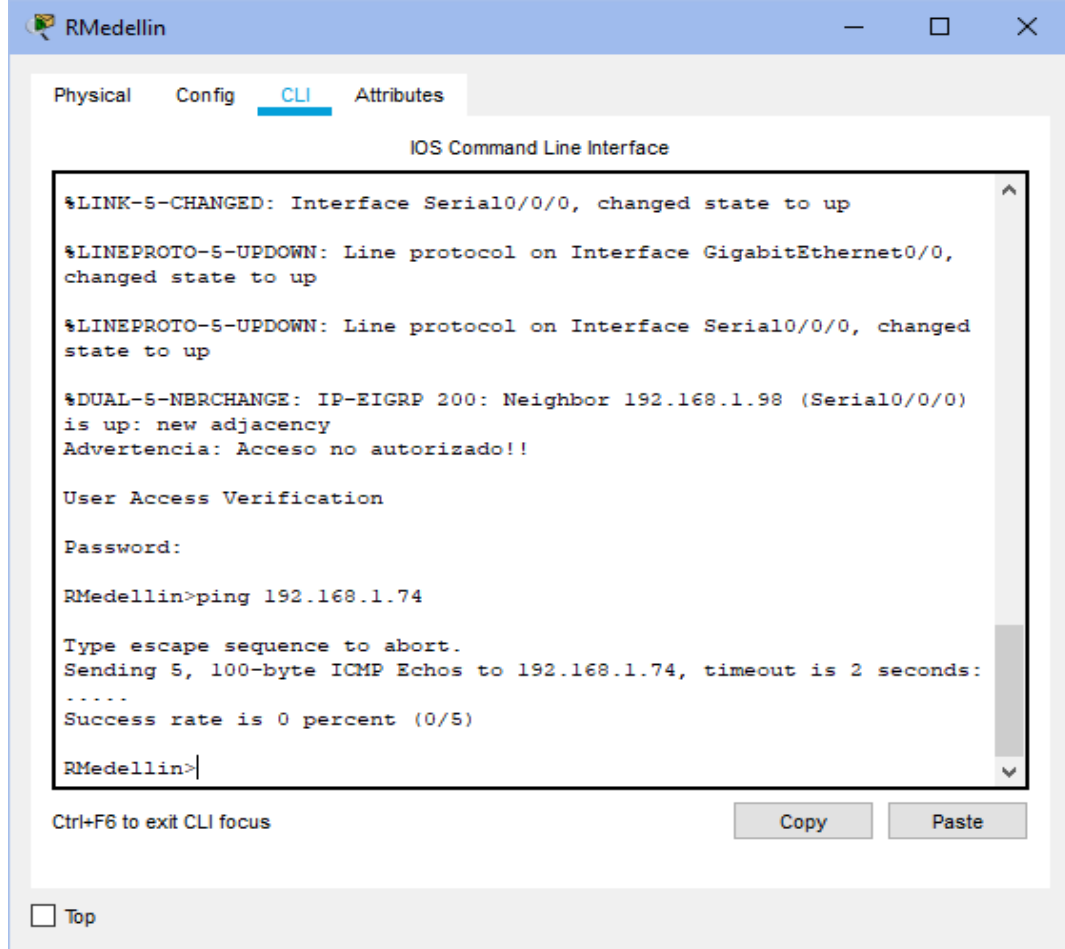
Fuente: Gomez, Cristian Alberto. 2019 [Captura de pantalla].

Ilustración 21. PING desde router RCali a PC10 LAN del router RMedellin.



Fuente: Gomez, Cristian Alberto. 2019 [Captura de pantalla].

Ilustración 22. PING desde router RMedellin a PC13 LAN del router RCali.



The screenshot shows the CLI interface of the RMedellin router. The interface has tabs for Physical, Config, CLI (selected), and Attributes. The main area displays the following text:

```
IOS Command Line Interface

%LINK-5-CHANGED: Interface Serial0/0/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0,
changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0, changed
state to up

%DUAL-5-NBRCHANGE: IP-EIGRP 200: Neighbor 192.168.1.98 (Serial0/0/0)
is up: new adjacency
Advertencia: Acceso no autorizado!!

User Access Verification

Password:

RMedellin>ping 192.168.1.74

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.74, timeout is 2 seconds:
.....
Success rate is 0 percent (0/5)

RMedellin>
```

At the bottom of the CLI window, there is a "Ctrl+F6 to exit CLI focus" instruction, "Copy" and "Paste" buttons, and a "Top" button.

Fuente: Gomez, Cristian Alberto. 2019 [Captura de pantalla].

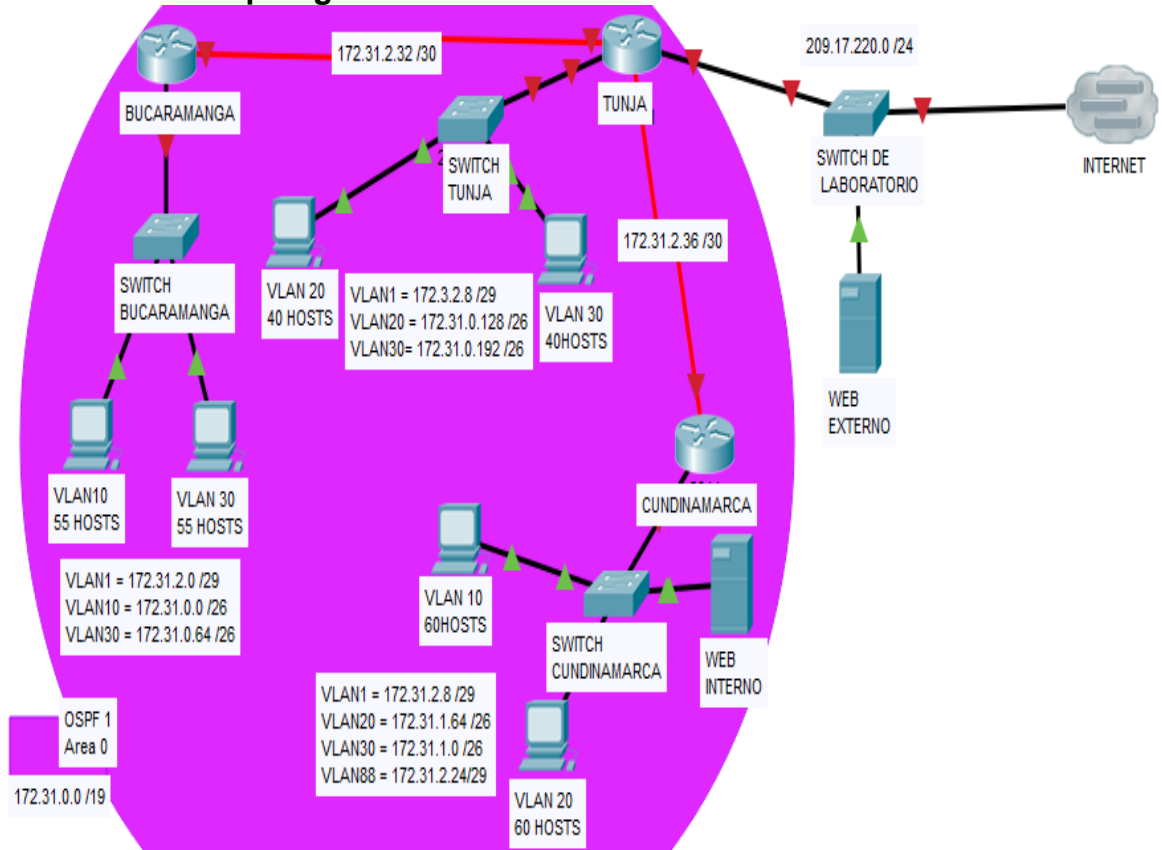
3. ESCENARIO 2:

Una empresa tiene la conexión a internet en una red Ethernet, lo cual deben adaptarlo para facilitar que sus routers y las redes que incluyen puedan, por esa vía, conectarse a internet, pero empleando las direcciones de la red LAN original.

Dispositivos requeridos:

- ❖ 3 Routers (Cisco 1941)
- ❖ 3 Switches (2960-24TT)
- ❖ 6 Equipos de Computo
- ❖ 2 Servidores (Genérico PT)

Ilustración 23. Topología de red escenario 2.



Fuente: (UNAD, 2019).

3.1 Parte 1: Todos los routers cuentan parámetros de configuración.

- **Configuración básica.**

ROUTERS:

- Router 1: nombrarlo "RBucaramanga"
- Router 2: nombrarlo "RTunja"
- Router 3: nombrarlo "RCundinamarca"
- Encriptar contraseñas
- DNS lookup deshabilitado.
- MOTD banner: Advertencia: Acceso no autorizado!!\$
- Exec Password: classclass
- Console Access Password: ciscocisco
- Telnet Access Password: ciscocisco
- Vlans administrativas en cada router usando el comando **encapsulation dot1Q** y asignación de las respectiva IPs.
- Asignación de IPs en las interfaces serial.
- Configuración protocolo OSPF para calcular la ruta idónea.

SWITCHS:

- Switch 1: nombrarlo "SBucaramanga"
- Switch 2: nombrarlo "STunja"
- Switch 3: nombrarlo "SCundinamarca"
- Vlans creadas en cada switch respectivamente.
- Configuración del puerto de acceso en cada en cada interfaz conectada y respectiva vlan
- Asignación de IP al puerto troncal que permitirá la comunicación entre las diferentes vlans

ROUTER BUCARAMANGA:

```
Router>en
```

```
Router#conf term
```

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

```
Router(config)#hostname RBucaramanga
```

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

```
RBucaramanga(config)#service password-encryption
```

```
RBucaramanga(config)#banner motd $Advertencia: Acceso no autorizado!!$
```

```
RBucaramanga(config)#enable secret classclass
```

```
RBucaramanga(config)#line console 0
```

```
RBucaramanga(config-line)#password ciscocisco
RBucaramanga(config-line)#login
RBucaramanga(config-line)#line vty 0 4
RBucaramanga(config-line)#password ciscocisco
RBucaramanga(config-line)#login
```

```
RBucaramanga(config)#int g0/0.1
RBucaramanga(config-subif)#encapsulation dot1q 1
RBucaramanga(config-subif)#ip address 172.31.2.1 255.255.255.248
RBucaramanga(config-subif)#int g0/0.10
RBucaramanga(config-subif)#encapsulation dot1q 10
RBucaramanga(config-subif)#ip address 172.31.0.1 255.255.255.192
RBucaramanga(config-subif)#int g0/0.30
RBucaramanga(config-subif)#encapsulation dot1q 30
RBucaramanga(config-subif)#ip address 172.31.0.65 255.255.255.192
RBucaramanga(config-subif)#int g0/0
RBucaramanga(config-if)#no shutdown
```

```
RBucaramanga(config-if)#
RBucaramanga(config-if)#
RBucaramanga(config-if)#int s0/0/0
RBucaramanga(config-if)#ip address 172.31.2.34 255.255.255.252
RBucaramanga(config-if)#no shutdown
%LINK-5-CHANGED: Interface Serial0/0/0, changed state to down
```

```
RBucaramanga(config-if)#
RBucaramanga(config-if)#router ospf 1
RBucaramanga(config-router)#network 172.31.0.0 0.0.0.63 area 0
RBucaramanga(config-router)#network 172.31.0.64 0.0.0.63 area 0
RBucaramanga(config-router)#network 172.31.2.0 0.0.0.7 area 0
RBucaramanga(config-router)#network 172.31.2.32 0.0.0.3 area 0
RBucaramanga(config-router)#end
RBucaramanga#
%LINK-5-CHANGED: Interface GigabitEthernet0/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0,
changed state to up
%LINK-5-CHANGED: Interface GigabitEthernet0/0.1, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0.1,
changed state to up
```

```
%LINK-5-CHANGED: Interface GigabitEthernet0/0.10, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0.10,
changed state to up
%LINK-5-CHANGED: Interface GigabitEthernet0/0.30, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0.30,
changed state to up
%SYS-5-CONFIG_I: Configured from console by console
```

ROUTER TUNJA:

```
Router>en
Router#conf term
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#hostname RTunja
RTunja(config)#no ip domain-lookup
RTunja(config)#service password-encryption
RTunja(config)#banner motd $Advertencia: Acceso no autorizado!!$
RTunja(config)#enable secret classclass
RTunja(config)#line console 0
RTunja(config-line)#password ciscocisco
RTunja(config-line)#login
RTunja(config-line)#line vty 0 4
RTunja(config-line)#password ciscocisco
RTunja(config-line)#login

RTunja(config)#int g0/0.1
RTunja(config-subif)#encapsulation dot1q 1
RTunja(config-subif)#ip address 172.3.2.9 255.255.255.248
RTunja(config-subif)#int g0/0.20
RTunja(config-subif)#encapsulation dot1q 20
RTunja(config-subif)#ip address 172.31.0.129 255.255.255.192
RTunja(config-subif)#int g0/0.30
RTunja(config-subif)#encapsulation dot1q 30
RTunja(config-subif)#ip address 172.31.0.193 255.255.255.192
RTunja(config-subif)#int g0/0
RTunja(config-if)#no shutdown

RTunja(config-if)#
RTunja(config-if)#int s0/0/0
RTunja(config-if)#ip address 172.31.2.33 255.255.255.252
```

```
RTunja(config-if)#no shutdown
```

```
RTunja(config-if)#
```

```
RTunja(config-if)#int s0/0/1
```

```
RTunja(config-if)#ip address 172.31.2.37 255.255.255.252
```

```
RTunja(config-if)#no shutdown
```

```
%LINK-5-CHANGED: Interface Serial0/0/1, changed state to down
```

```
RTunja(config-if)#int g0/1
```

```
RTunja(config-if)#ip address 209.165.220.1 255.255.255.0
```

```
RTunja(config-if)#no shutdown
```

```
RTunja(config-if)#
```

```
RTunja(config-if)#router ospf 1
```

```
RTunja(config-router)#network 172.3.2.8 0.0.0.7 area 0
```

```
RTunja(config-router)#network 172.31.0.128 0.0.0.63 area 0
```

```
RTunja(config-router)#network 172.31.0.192 0.0.0.63 area 0
```

```
RTunja(config-router)#network 172.31.2.32 0.0.0.3 area 0
```

```
RTunja(config-router)#network 172.31.2.36 0.0.0.3 area 0
```

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

```
RTunja#
```

```
%LINK-5-CHANGED: Interface GigabitEthernet0/0, changed state to up
```

```
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0,  
changed state to up
```

```
LINK-5-CHANGED: Interface GigabitEthernet0/0.1, changed state to up
```

```
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0.1,  
changed state to up
```

```
%LINK-5-CHANGED: Interface GigabitEthernet0/0.20, changed state to up
```

```
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0.20,  
changed state to up
```

```
%LINK-5-CHANGED: Interface GigabitEthernet0/0.30, changed state to up
```

```
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0.30,  
changed state to up
```

```
%LINK-5-CHANGED: Interface Serial0/0/0, changed state to up
```

```
%LINK-5-CHANGED: Interface GigabitEthernet0/1, changed state to up
```

```
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/1,  
changed state to up
```

```
%SYS-5-CONFIG_I: Configured from console by console
```

```
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0, changed
state to up
00:12:23: %OSPF-5-ADJCHG: Process 1, Nbr 172.31.2.34 on Serial0/0/0 from
LOADING to FULL, Loading Done
```

ROUTER CUNDINARMARCA:

```
Router>en
Router#conf term
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#hostname RCundinamarca
RCundinamarca(config)#no ip domain-lookup
RCundinamarca(config)#service password-encryption
RCundinamarca(config)#banner motd $Advertencia: Acceso no autorizado!!$
RCundinamarca(config)#enable secret classclass
RCundinamarca(config)#line console 0
RCundinamarca(config-line)#password ciscocisco
RCundinamarca(config-line)#login
RCundinamarca(config-line)#line vty 0 4
RCundinamarca(config-line)#password ciscocisco
RCundinamarca(config-line)#login

RCundinamarca(config)#int g0/0.1
RCundinamarca(config-subif)#encapsulation dot1q 1
RCundinamarca(config-subif)#ip address 172.31.2.9 255.255.255.248
RCundinamarca(config-subif)#int g0/0.10
RCundinamarca(config-subif)#encapsulation dot1q 10
RCundinamarca(config-subif)#ip address 172.31.1.65 255.255.255.192
RCundinamarca(config-subif)#int g0/0.20
RCundinamarca(config-subif)#encapsulation dot1q 20
RCundinamarca(config-subif)#ip address 172.31.1.1 255.255.255.192
RCundinamarca(config-subif)#int g0/0.88
RCundinamarca(config-subif)#encapsulation dot1q 88
RCundinamarca(config-subif)#ip address 172.31.2.25 255.255.255.248
RCundinamarca(config-subif)#int g0/0
RCundinamarca(config-if)#no shutdown

RCundinamarca(config-if)#
RCundinamarca(config-if)#int s0/0/0
RCundinamarca(config-if)#ip address 172.31.2.38 255.255.255.252
```

```
RCundinamarca(config-if)#no shutdown
```

```
RCundinamarca(config-if)#router ospf 1
```

```
RCundinamarca(config-router)#network 172.31.1.0 0.0.0.63 area 0
```

```
RCundinamarca(config-router)#network 172.31.1.64 0.0.0.63 area 0
```

```
RCundinamarca(config-router)#network 172.31.2.8 0.0.0.7 area 0
```

```
RCundinamarca(config-router)#network 172.31.2.24 0.0.0.7 area 0
```

```
RCundinamarca(config-router)#network 172.31.2.36 0.0.0.3 area 0
```

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

```
RCundinamarca#
```

```
%LINK-5-CHANGED: Interface GigabitEthernet0/0, changed state to up
```

```
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0,  
changed state to up
```

```
%LINK-5-CHANGED: Interface GigabitEthernet0/0.1, changed state to up
```

```
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0.1,  
changed state to up
```

```
%LINK-5-CHANGED: Interface GigabitEthernet0/0.10, changed state to up
```

```
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0.10,  
changed state to up
```

```
%LINK-5-CHANGED: Interface GigabitEthernet0/0.20, changed state to up
```

```
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0.20,  
changed state to up
```

```
%LINK-5-CHANGED: Interface GigabitEthernet0/0.88, changed state to up
```

```
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0.88,  
changed state to up
```

```
%LINK-5-CHANGED: Interface Serial0/0/0, changed state to up
```

```
%SYS-5-CONFIG_I: Configured from console by console
```

SWITCH BUCARAMANGA:

```
Switch>en
```

```
Switch#conf term
```

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

```
Switch(config)#hostname SBucaramanga
```

```
SBucaramanga(config)#vlan 1
```

```
SBucaramanga(config-vlan)#vlan 10
```

```
SBucaramanga(config-vlan)#vlan 30
```

```
SBucaramanga(config-vlan)#int f0/10
```

```
SBucaramanga(config-if)#switchport mode access
SBucaramanga(config-if)#switchport access vlan 10
SBucaramanga(config-if)#int f0/14
SBucaramanga(config-if)#switchport mode access
SBucaramanga(config-if)#switchport access vlan 30
```

```
SBucaramanga(config-if)#int g0/1
SBucaramanga(config-if)#switchport mode trunk
SBucaramanga(config-if)#int vlan 1
SBucaramanga(config-if)#ip address 172.31.2.3 255.255.255.248
SBucaramanga(config-if)#no shutdown
SBucaramanga(config-if)#ip default-gateway 172.31.2.1
SBucaramanga(config)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/1,
changed state to down
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/1,
changed state to up
%LINK-5-CHANGED: Interface Vlan1, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan1, changed state to
up
```

SWITCH TUNJA:

```
Switch>en
Switch#conf term
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#hostname STunja
```

```
STunja(config)#vlan 1
STunja(config-vlan)#vlan 20
STunja(config-vlan)#vlan 30
STunja(config-vlan)#int f0/10
```

```
STunja(config-if)#switchport mode access
STunja(config-if)#switchport access vlan 20
STunja(config-if)#int f0/14
STunja(config-if)#switchport mode access
STunja(config-if)#switchport access vlan 30
```

```
STunja(config-if)#int g0/1
```

```
STunja(config-if)#switchport mode trunk
STunja(config-if)#
STunja(config-if)#int vlan 1
STunja(config-if)#ip address 172.3.2.11 255.255.255.248
STunja(config-if)#no shutdown
STunja(config-if)#
STunja(config-if)#ip default-gateway 172.3.2.9
STunja(config)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/1,
changed state to down
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/1,
changed state to up
%LINK-5-CHANGED: Interface Vlan1, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan1, changed state to
up
```

SWITCH CUNDINAMARCA:

```
Switch>en
Switch#conf term
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#hostname SCundinamarca
```

```
SCundinamarca(config)#vlan 1
SCundinamarca(config-vlan)#vlan 10
SCundinamarca(config-vlan)#vlan 20
SCundinamarca(config-vlan)#vlan 88
```

```
SCundinamarca(config)#int f0/10
SCundinamarca(config-if)#switchport mode access
SCundinamarca(config-if)#switchport access vlan 10
SCundinamarca(config-if)#int f0/14
SCundinamarca(config-if)#switchport mode access
SCundinamarca(config-if)#switchport access vlan 20
SCundinamarca(config-if)#int f0/20
SCundinamarca(config-if)#switchport mode access
SCundinamarca(config-if)#switchport access vlan 88
SCundinamarca(config-if)#int g0/1
SCundinamarca(config-if)#switchport mode trunk
```


SCundinamarca(config-if)#

%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/1, changed state to down

%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/1, changed state to up

SCundinamarca(config-if)#switchport mode trunk

SCundinamarca(config-if)#int vlan 1

SCundinamarca(config-if)#ip address 172.31.2.11 255.255.255.248

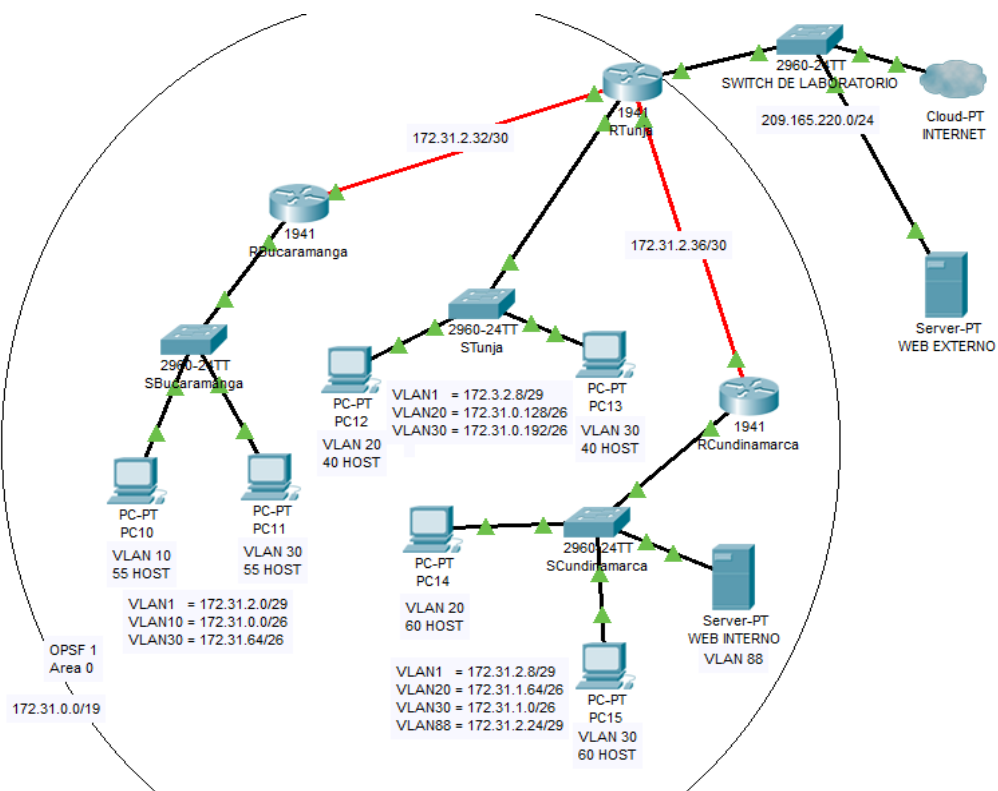
SCundinamarca(config-if)#no shutdown

SCundinamarca(config-if)#

SCundinamarca(config-if)#ip default-gateway 172.31.2.9

SCundinamarca(config)#

Ilustración 24. Conexión física de los equipos escenario 2.



- **Autenticación local con AAA.**

ROUTER BUCARAMANGA:

```
RBucaramanga(config-line)#username adminadmin secret passpass
RBucaramanga(config)#aaa new-model
RBucaramanga(config)#aaa authentication login AAA-LOGIN local
RBucaramanga(config)#line console 0
RBucaramanga(config-line)#login authentication AAA-LOGIN
RBucaramanga(config-line)#line vty 0 4
RBucaramanga(config-line)#login authentication AAA-LOGIN
```

ROUTER TUNJA:

```
RTunja(config-line)#username adminadmin secret passpass
RTunja(config)#aaa new-model
RTunja(config)#aaa authentication login AAA-LOGIN local
RTunja(config)#line console 0
RTunja(config-line)#login authentication AAA-LOGIN
RTunja(config-line)#line vty 0 4
RTunja(config-line)#login authentication AAA-LOGIN
```

ROUTER CUNDINARMARCA:

```
RCundinamarca(config-line)#username adminadmin secret passpass
RCundinamarca(config)#aaa new-model
RCundinamarca(config)#aaa authentication login AAA-LOGIN local
RCundinamarca(config)#line console 0
RCundinamarca(config-line)#login authentication AAA-LOGIN
RCundinamarca(config-line)#line vty 0 4
RCundinamarca(config-line)#login authentication AAA-LOGIN
```

- **Cifrado de contraseñas.**

ROUTER BUCARAMANGA:

```
RBucaramanga(config)#service password-encryption
```

ROUTER TUNJA:

```
RTunja(config)#service password-encryption
```

ROUTER CUNDINARMARCA:

RCundinamarca(config)#service password-encryption

- **Un máximo de intentos para acceder al router.**

Le indicamos que bloquee 10 segundos el acceso por ssh, telnet y http cuando se realicen 5 intentos fallidos en un intervalo de 60 segundos, esto para que se aplique al momento de detectar ataques.

ROUTER BUCARAMANGA:

RBucaramanga(config-line)#login block-for 10 attempts 5 within 60

ROUTER TUNJA:

RTunja(config-line)#login block-for 10 attempts 5 within 60

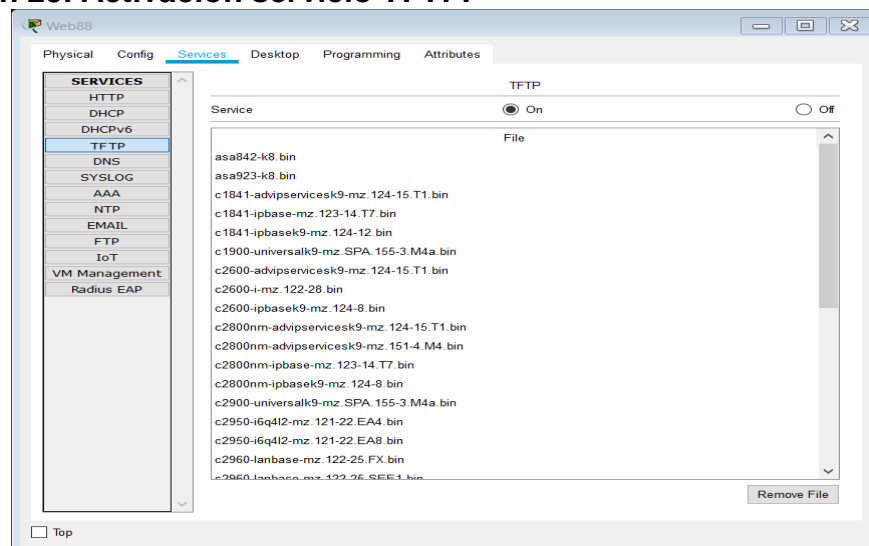
ROUTER CUNDINARMARCA:

RCundinamarca(config-line)#login block-for 10 attempts 5 within 60

- **Servidor TFTP que almacena todos los archivos necesarios de los routers.**

Utilizamos el Servidor Web Interno para activar el servicio TFTP.

Ilustración 25. Activación servicio TFTP.



Fuente: Gomez, Cristian Alberto. 2019 [Captura de pantalla].

3591768 bytes copied in 5.662 secs (622924 bytes/sec) RBucaramanga#

ROUTER TUNJA:

```
RTunja#!copy running-config tftp
RTunja#copy running-config tftp
Address or name of remote host []? 172.31.2.27
Destination filename [RTunja-config]? Backup_RTunja
```

Writing running-config...!! [OK - 3710 bytes]

3710 bytes copied in 0 secs
RTunja# RTunja#sh flash

System flash directory:

```
File Length Name/status
3 33591768 c1900-universalk9-mz.SPA.151-4.M4.bin
2 28282 sigdef-category.xml
1 227537 sigdef-default.xml
[33847587 bytes used, 221896413 available, 255744000 total]
249856K bytes of processor board System flash (Read/Write)
```

```
RTunja#copy flash: tftp
Source filename []? c1900-universalk9-mz.SPA.151-4.M4.bin
Address or name of remote host []? 172.31.2.27
Destination filename [c1900-universalk9-mz.SPA.151-4.M4.bin]?
BackupIOS_RTunja
```

```
Writing c1900-universalk9-mz.SPA.151-
4.M4.bin...!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!
[OK - 33591768 bytes]
```

33591768 bytes copied in 2.298 secs (1534811 bytes/sec) RTunja#

ROUTER CUNDINARMARCA:

```
RCundinamarca#copy running-config tftp Address or name of remote host []?
172.31.2.27
```

```
Destination filename [RCundinamarca-config]? Backup_RCundinamarca
```

```
Writing running-config...!! [OK - 2731 bytes]
```

```
2731 bytes copied in 0 secs
```

```
RCundinamarca#sh flash
```

```
System flash directory:
```

```
File Length Name/status
```

```
3 33591768 c1900-universalk9-mz.SPA.151-4.M4.bin
```

```
2 28282 sigdef-category.xml
```

```
1 227537 sigdef-default.xml
```

```
[33847587 bytes used, 221896413 available, 255744000 total]
```

```
249856K bytes of processor board System flash (Read/Write)
```

```
RCundinamarca#copy flash: tftp
```

```
Source filename []? c1900-universalk9-mz.SPA.151-4.M4.bin
```

```
Address or name of remote host []? 172.31.2.27
```

```
Destination filename [c1900-universalk9-mz.SPA.151-4.M4.bin]?
```

```
BackupIOS_RCundinamarca
```

```
Writing c1900-universalk9-mz.SPA.151-
```

```
4.M4.bin...!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
```

```
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
```

```
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
```

```
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
```

```
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
```

```
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
```

```
!!!!!!!!!!!!!!
```

```
[OK - 33591768 bytes]
```

```
33591768 bytes copied in 1.52 secs (2320392 bytes/sec) RCundinamarca#
```

3.2 Parte 2: El DHCP proporciona solo direcciones a los hosts de Bucaramanga y Cundinamarca.

ROUTER TUNJA:

```
RTunja#conf t
Enter configuration commands, one per line. End with CNTL/Z.
RTunja(config)#ip dhcp excluded-address 172.31.0.1 172.31.0.4
RTunja(config)#ip dhcp excluded-address 172.31.0.65 172.31.0.68
RTunja(config)#ip dhcp excluded-address 172.31.1.65 172.31.1.68
RTunja(config)#ip dhcp excluded-address 172.31.1.1 172.31.1.4
RTunja(config)#ip dhcp pool vlan10B
RTunja(dhcp-config)#network 172.31.0.0 255.255.255.192
RTunja(dhcp-config)#default-router 172.31.0.1
RTunja(dhcp-config)#dns-server 172.31.2.27
RTunja(dhcp-config)#ip dhcp pool vlan30B
RTunja(dhcp-config)#network 172.31.0.64 255.255.255.192
RTunja(dhcp-config)#default-router 172.31.0.65
RTunja(dhcp-config)#dns-server 172.31.2.27
RTunja(dhcp-config)#ip dhcp pool vlan20C
RTunja(dhcp-config)#network 172.31.1.64 255.255.255.192
RTunja(dhcp-config)#default-router 172.31.1.65
RTunja(dhcp-config)#dns-server 172.31.2.27
RTunja(dhcp-config)#ip dhcp pool vlan30C
RTunja(dhcp-config)#network 172.31.1.0 255.255.255.192
RTunja(dhcp-config)#default-router 172.31.1.1
RTunja(dhcp-config)#dns-server 172.31.2.27
RTunja(dhcp-config)#
```

ROUTER BUCARAMANGA:

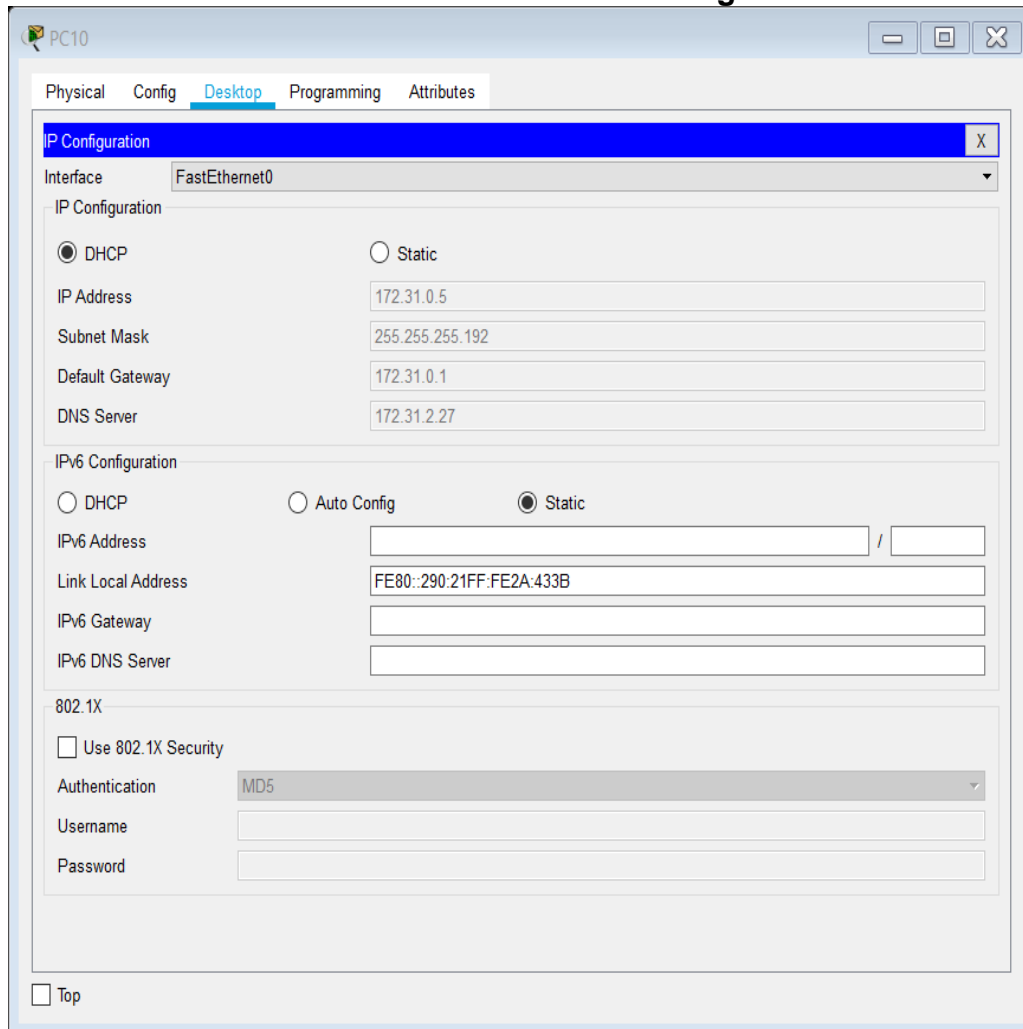
```
RBucaramanga(config)#int g0/0.10
RBucaramanga(config-subif)#ip helper-address 172.31.2.33
RBucaramanga(config-subif)#int g0/0.30
RBucaramanga(config-subif)#ip helper-address 172.31.2.33
RBucaramanga(config-subif)#end
RBucaramanga#
```

ROUTER CUNDINARMARCA:

```
RCundinamarca(config)#int g0/0.10
RCundinamarca(config-subif)#ip helper-address 172.31.2.37
```

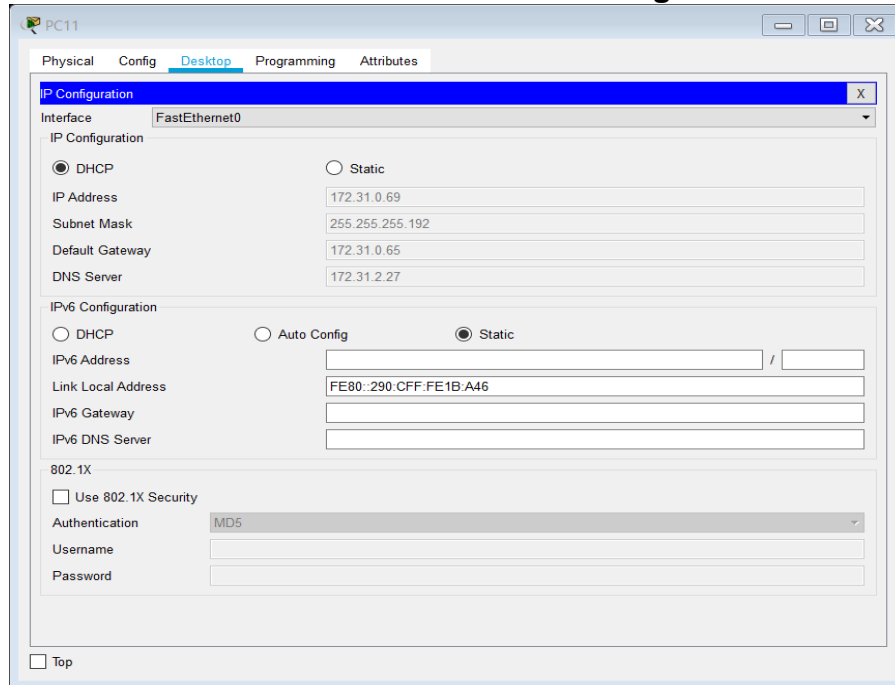
```
RCundinamarca(config-subif)#int g0/0.20  
RCundinamarca(config-subif)#ip helper-address 172.31.2.37  
RCundinamarca(config-subif)#end  
RCundinamarca#
```

Ilustración 26. DHCP host PC10 LAN de Bucaramanga.



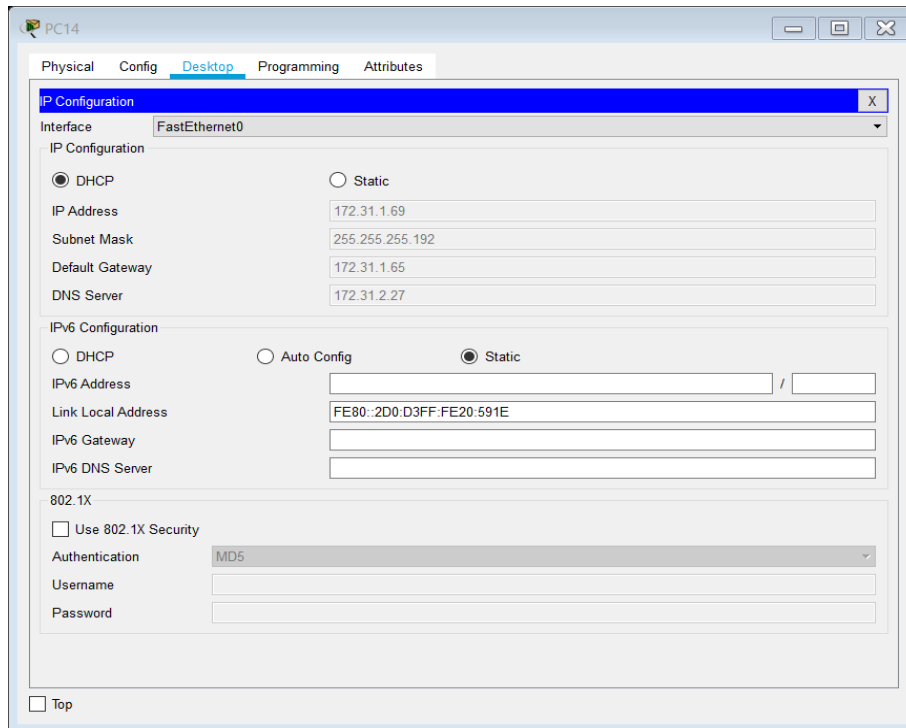
Fuente: Gomez, Cristian Alberto. 2019 [Captura de pantalla].

Ilustración 27. DHCP host PC11 LAN de Bucaramanga.



Fuente: Gomez, Cristian Alberto. 2019 [Captura de pantalla].

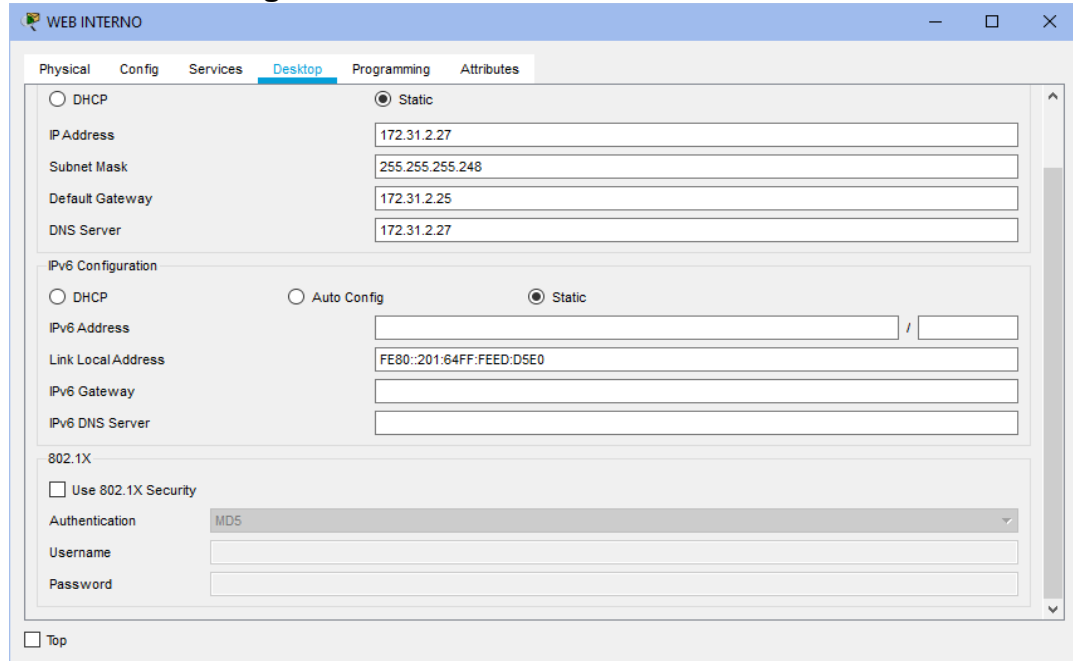
Ilustración 28. DHCP host PC14 LAN de Cundinamarca.



Fuente: Gomez, Cristian Alberto. 2019 [Captura de pantalla].

3.3 Parte 3: El web server tiene NAT estático y el resto de los equipos de la topología emplean NAT de sobrecarga (PAT).

Ilustración 29. Configuración Servidor Interno.



Fuente: Gomez, Cristian Alberto. 2019 [Captura de pantalla].

ROUTER TUNJA:

RTunja#conf t

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

RTunja(config)#ip nat inside source static 172.31.2.27 209.165.220.10

RTunja(config)#ip access-list standard NAT-ACL

RTunja(config-std-nacl)#permit 172.31.0.0 0.0.255.255

RTunja(config-std-nacl)#ip nat inside source list NAT-ACL interface g0/1 overload

RTunja(config)#int g0/1

RTunja(config-if)#ip nat outside

RTunja(config-if)#int g0/0.1

RTunja(config-subif)#ip nat inside

RTunja(config-subif)#int g0/0.20

RTunja(config-subif)#ip nat inside

RTunja(config-subif)#int g0/0.30

RTunja(config-subif)#ip nat inside

RTunja(config-subif)#int s0/0/0

RTunja(config-if)#ip nat inside

```
RTunja(config-if)#int s0/0/1
RTunja(config-if)#ip nat inside
RTunja(config-if)#exit
RTunja(config)#ip route 0.0.0.0 0.0.0.0 209.165.220.5
RTunja(config)#router ospf 1
RTunja(config-router)#default-information originate
RTunja(config-router)#end
RTunja#
%SYS-5-CONFIG_I: Configured from console by console
```

```
RTunja#show ip route
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
* - candidate default, U - per-user static route, o - ODR
P - periodic downloaded static route
```

Gateway of last resort is 209.165.220.5 to network 0.0.0.0

```
172.3.0.0/16 is variably subnetted, 2 subnets, 2 masks
C 172.3.2.8/29 is directly connected, GigabitEthernet0/0.1
L 172.3.2.9/32 is directly connected, GigabitEthernet0/0.1
172.31.0.0/16 is variably subnetted, 15 subnets, 4 masks
O 172.31.0.0/26 [110/65] via 172.31.2.34, 00:25:52, Serial0/0/0
O 172.31.0.64/26 [110/65] via 172.31.2.34, 00:25:52, Serial0/0/0
C 172.31.0.128/26 is directly connected, GigabitEthernet0/0.20
L 172.31.0.129/32 is directly connected, GigabitEthernet0/0.20
C 172.31.0.192/26 is directly connected, GigabitEthernet0/0.30
L 172.31.0.193/32 is directly connected, GigabitEthernet0/0.30
O 172.31.1.0/26 [110/65] via 172.31.2.38, 00:19:13, Serial0/0/1
O 172.31.1.64/26 [110/65] via 172.31.2.38, 00:19:13, Serial0/0/1
O 172.31.2.0/29 [110/65] via 172.31.2.34, 00:25:52, Serial0/0/0
O 172.31.2.8/29 [110/65] via 172.31.2.38, 00:23:49, Serial0/0/1
O 172.31.2.24/29 [110/65] via 172.31.2.38, 00:19:13, Serial0/0/1
C 172.31.2.32/30 is directly connected, Serial0/0/0
L 172.31.2.33/32 is directly connected, Serial0/0/0
C 172.31.2.36/30 is directly connected, Serial0/0/1
```

```
L 172.31.2.37/32 is directly connected, Serial0/0/1
209.165.220.0/24 is variably subnetted, 2 subnets, 2 masks
C 209.165.220.0/24 is directly connected, GigabitEthernet0/1
L 209.165.220.1/32 is directly connected, GigabitEthernet0/1
S* 0.0.0.0/0 [1/0] via 209.165.220.5
RTunja#
```

ROUTER BUCARAMANGA:

```
RBucaramanga#show ip route
```

Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
* - candidate default, U - per-user static route, o - ODR
P - periodic downloaded static route

Gateway of last resort is 172.31.2.33 to network 0.0.0.0

```
172.3.0.0/29 is subnetted, 1 subnets
O 172.3.2.8/29 [110/65] via 172.31.2.33, 00:26:19, Serial0/0/0
172.31.0.0/16 is variably subnetted, 15 subnets, 4 masks
C 172.31.0.0/26 is directly connected, GigabitEthernet0/0.10
L 172.31.0.1/32 is directly connected, GigabitEthernet0/0.10
C 172.31.0.64/26 is directly connected, GigabitEthernet0/0.30
L 172.31.0.65/32 is directly connected, GigabitEthernet0/0.30
O 172.31.0.128/26 [110/65] via 172.31.2.33, 00:26:19, Serial0/0/0
O 172.31.0.192/26 [110/65] via 172.31.2.33, 00:26:19, Serial0/0/0
O 172.31.1.0/26 [110/129] via 172.31.2.33, 00:19:40, Serial0/0/0
O 172.31.1.64/26 [110/129] via 172.31.2.33, 00:19:40, Serial0/0/0
C 172.31.2.0/29 is directly connected, GigabitEthernet0/0.1
L 172.31.2.1/32 is directly connected, GigabitEthernet0/0.1
O 172.31.2.8/29 [110/129] via 172.31.2.33, 00:24:06, Serial0/0/0
O 172.31.2.24/29 [110/129] via 172.31.2.33, 00:19:40, Serial0/0/0
C 172.31.2.32/30 is directly connected, Serial0/0/0
L 172.31.2.34/32 is directly connected, Serial0/0/0
O 172.31.2.36/30 [110/128] via 172.31.2.33, 00:24:26, Serial0/0/0
O*E2 0.0.0.0/0 [110/1] via 172.31.2.33, 00:01:17, Serial0/0/0
RBucaramanga#
```

ROUTER CUNDINARMAACA:

RCundinamarca#show ip route

Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP

D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area

N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2

E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP

i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area

* - candidate default, U - per-user static route, o - ODR

P - periodic downloaded static route

Gateway of last resort is 172.31.2.37 to network 0.0.0.0

172.3.0.0/29 is subnetted, 1 subnets

O 172.3.2.8/29 [110/65] via 172.31.2.37, 00:24:36, Serial0/0/0

172.31.0.0/16 is variably subnetted, 16 subnets, 4 masks

O 172.31.0.0/26 [110/129] via 172.31.2.37, 00:24:36, Serial0/0/0

O 172.31.0.64/26 [110/129] via 172.31.2.37, 00:24:36, Serial0/0/0

O 172.31.0.128/26 [110/65] via 172.31.2.37, 00:24:36, Serial0/0/0

O 172.31.0.192/26 [110/65] via 172.31.2.37, 00:24:36, Serial0/0/0

C 172.31.1.0/26 is directly connected, GigabitEthernet0/0.20

L 172.31.1.1/32 is directly connected, GigabitEthernet0/0.20

C 172.31.1.64/26 is directly connected, GigabitEthernet0/0.10

L 172.31.1.65/32 is directly connected, GigabitEthernet0/0.10

O 172.31.2.0/29 [110/129] via 172.31.2.37, 00:24:36, Serial0/0/0

C 172.31.2.8/29 is directly connected, GigabitEthernet0/0.1

L 172.31.2.9/32 is directly connected, GigabitEthernet0/0.1

C 172.31.2.24/29 is directly connected, GigabitEthernet0/0.88

L 172.31.2.25/32 is directly connected, GigabitEthernet0/0.88

O 172.31.2.32/30 [110/128] via 172.31.2.37, 00:24:36, Serial0/0/0

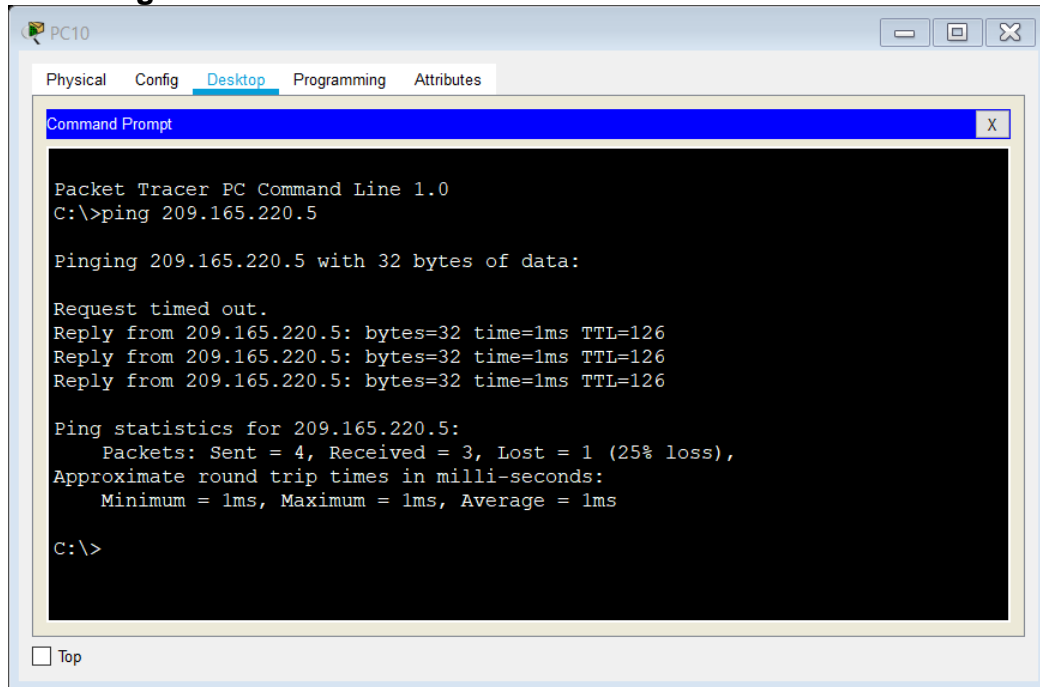
C 172.31.2.36/30 is directly connected, Serial0/0/0

L 172.31.2.38/32 is directly connected, Serial0/0/0

O*E2 0.0.0.0/0 [110/1] via 172.31.2.37, 00:01:37, Serial0/0/0

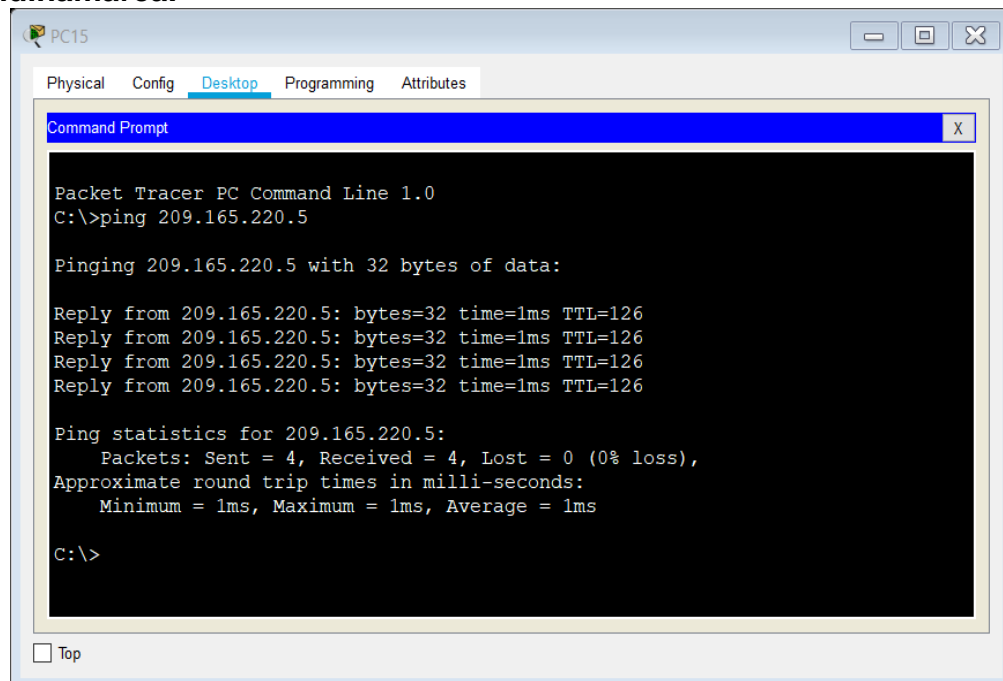
RCundinamarca#

Ilustración 30. PING prueba de conexión desde PC10 VLAN 10 LAN de RBucaramanga.



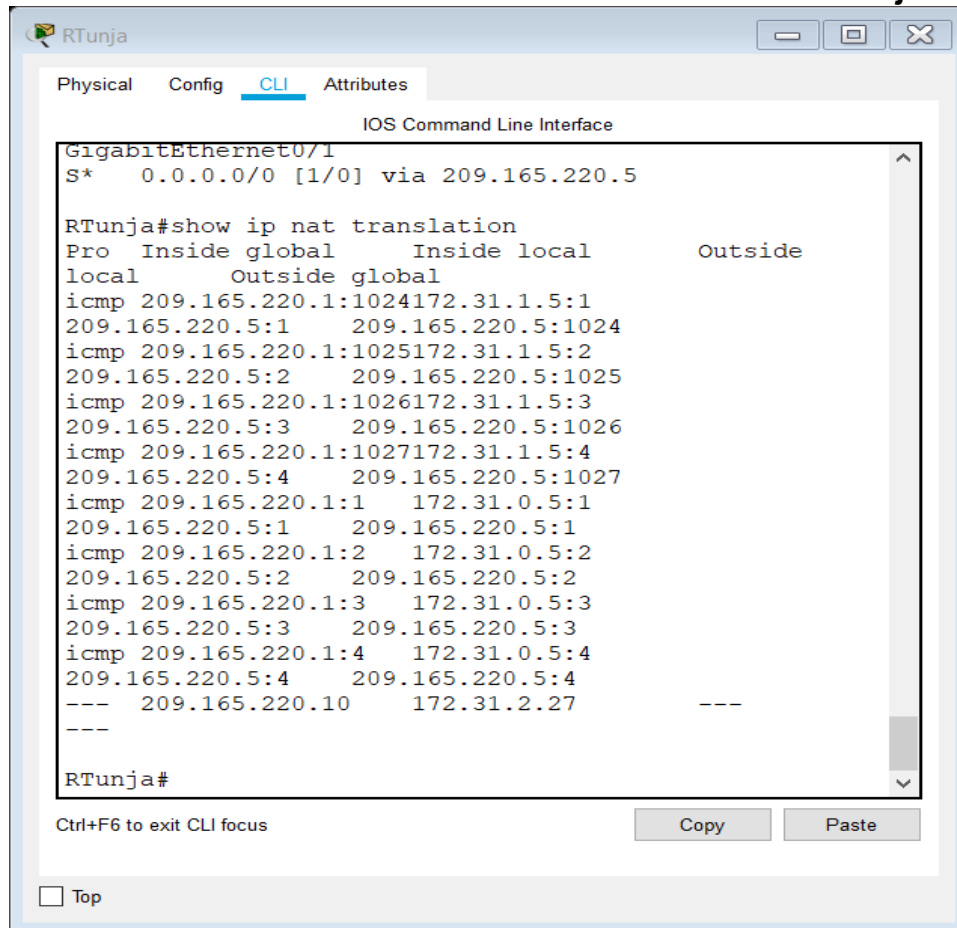
Fuente: Gomez, Cristian Alberto. 2019 [Captura de pantalla].

Ilustración 31. PING prueba de conexión desde PC15 VLAN 30 LAN de RCundinamarca.



Fuente: Gomez, Cristian Alberto. 2019 [Captura de pantalla].

Ilustración 32. Verificación de traducciones de entrada en el router RTunja.



Fuente: Gomez, Cristian Alberto. 2019 [Captura de pantalla].

3.4 Parte 4: El enrutamiento deberá tener autenticación.

En cada interfaz serial habilitada activamos la autenticación, fijamos el ID **1** y la clave **ospfospf**.

ROUTER BUCARAMANGA:

```

RBucaramanga#conf t
Enter configuration commands, one per line. End with CNTL/Z.
RBucaramanga(config)#int s0/0/0
RBucaramanga(config-if)#ip ospf authentication message-digest
RBucaramanga(config-if)#ip ospf message-digest-key 1 md5 ospfospf
RBucaramanga(config-if)#
  
```

ROUTER TUNJA:

```
RTunja#conf t
Enter configuration commands, one per line. End with CNTL/Z.
RTunja(config)#int s0/0/0
RTunja(config-if)#ip ospf authentication message-digest
RTunja(config-if)#ip ospf message-digest-key 1 md5 ospfospf
RTunja(config-if)#int s0/0/1
RTunja(config-if)#ip ospf authentication message-digest
RTunja(config-if)#ip ospf message-digest-key 1 md5 ospfospf
RTunja(config-if)#
```

ROUTER CUNDINAMARCA:

```
RCundinamarca#conf t
Enter configuration commands, one per line. End with CNTL/Z.
RCundinamarca(config)#int s0/0/0
RCundinamarca(config-if)#ip ospf authentication message-digest
RCundinamarca(config-if)#ip ospf message-digest-key 1 md5 ospfospf
RCundinamarca(config-if)#
```

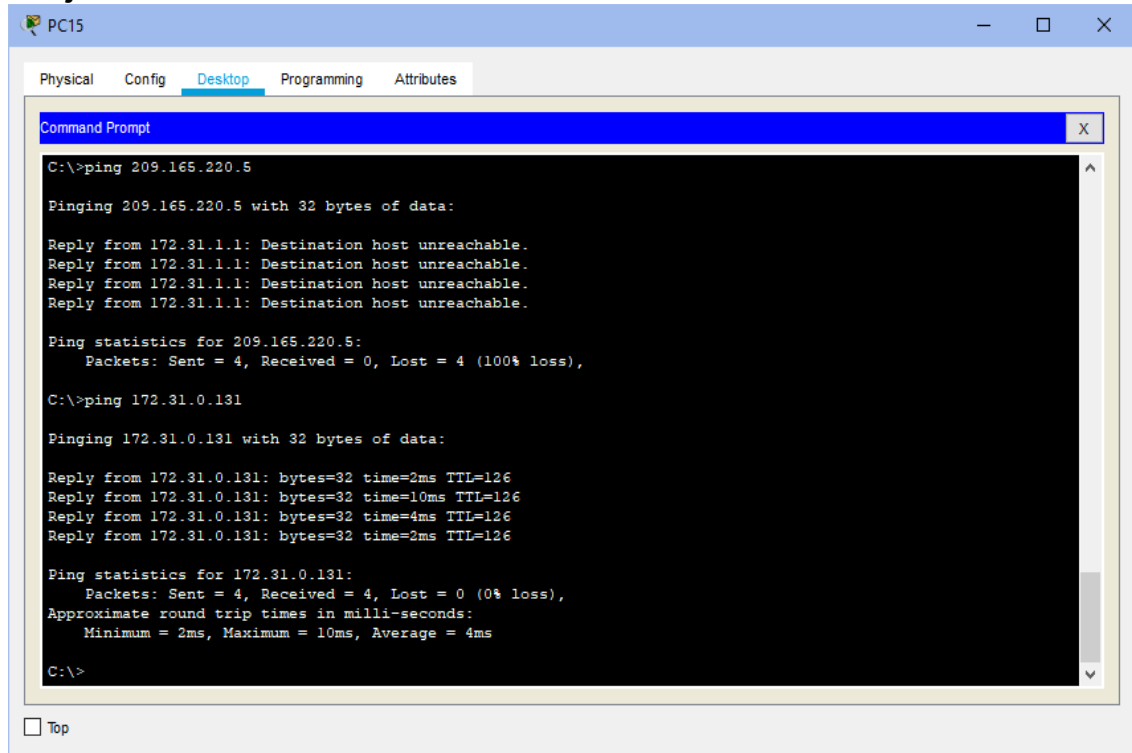
3.5 Parte 5: Listas de control de acceso:

- **Los hosts de VLAN 20 en Cundinamarca no acceden a internet, solo a la red interna de Tunja.**

ROUTER CUNDINAMARCA:

```
RCundinamarca(config-if)#access-list 151 deny ip 172.31.1.0 0.0.0.63
209.165.220.0 0.0.0.255
RCundinamarca(config)#access-list 151 permit ip any any
RCundinamarca(config)#int g0/0.20
RCundinamarca(config-subif)#ip access-group 151 in
RCundinamarca(config-subif)#
```


Ilustración 33. PING conexión a internet desde PC15 VLAN 20 LAN del router RCundinamarca a Servidor Web Externo y a PC12 VLAN20 LAN del router RTunja.



```
C:\>ping 209.165.220.5

Pinging 209.165.220.5 with 32 bytes of data:

Reply from 172.31.1.1: Destination host unreachable.
Reply from 172.31.1.1: Destination host unreachable.
Reply from 172.31.1.1: Destination host unreachable.
Reply from 172.31.1.1: Destination host unreachable.

Ping statistics for 209.165.220.5:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

C:\>ping 172.31.0.131

Pinging 172.31.0.131 with 32 bytes of data:

Reply from 172.31.0.131: bytes=32 time=2ms TTL=126
Reply from 172.31.0.131: bytes=32 time=10ms TTL=126
Reply from 172.31.0.131: bytes=32 time=4ms TTL=126
Reply from 172.31.0.131: bytes=32 time=2ms TTL=126

Ping statistics for 172.31.0.131:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 2ms, Maximum = 10ms, Average = 4ms

C:\>
```

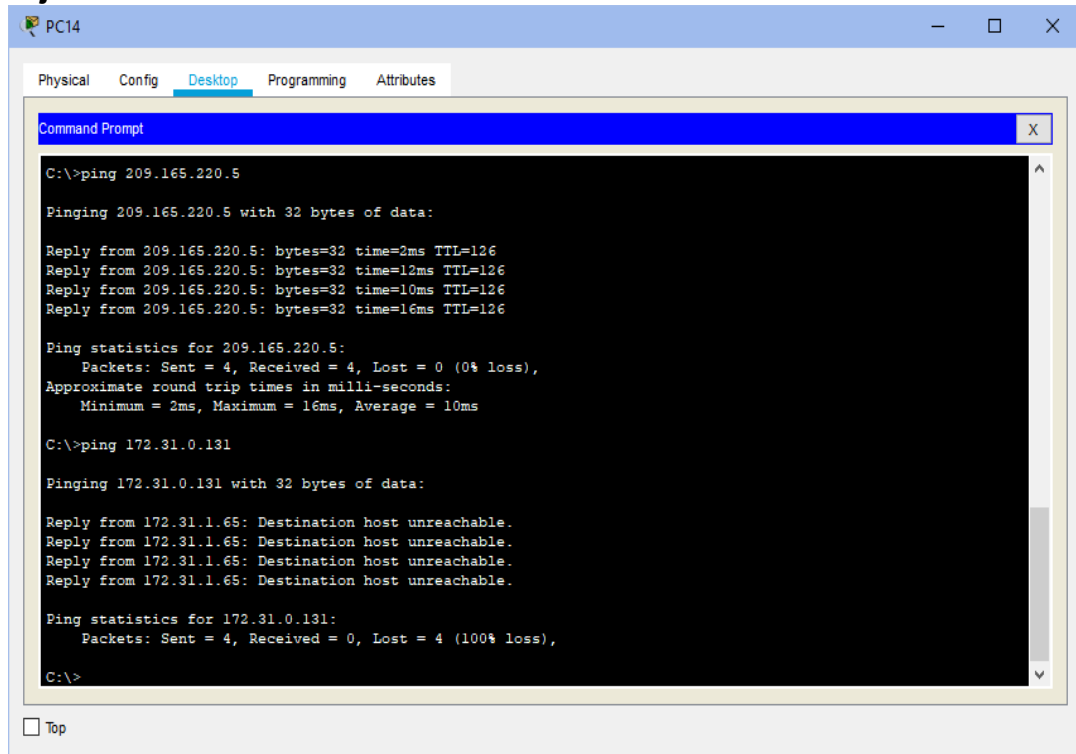
Fuente: Gomez, Cristian Alberto. 2019 [Captura de pantalla].

- **Los hosts de VLAN 10 en Cundinamarca si acceden a internet y no a la red interna de Tunja.**

ROUTER CUNDINAMARCA:

```
RCundinamarca(config-subif)#access-list 152 permit ip 172.31.1.64 0.0.0.63
209.165.220.0 0.0.0.255
RCundinamarca(config)#access-list 152 deny ip any any
RCundinamarca(config)#int g0/0.10
RCundinamarca(config-subif)#ip access-group 152 in
RCundinamarca(config-subif)#
```

Ilustración 34. PING conexión a internet desde PC14 VLAN 10 LAN del router RCundinamarca a Servidor Web Externo y a PC12 VLAN20 LAN del router RTunja.



```
PC14
Physical Config Desktop Programming Attributes
Command Prompt
C:\>ping 209.165.220.5

Pinging 209.165.220.5 with 32 bytes of data:

Reply from 209.165.220.5: bytes=32 time=2ms TTL=126
Reply from 209.165.220.5: bytes=32 time=12ms TTL=126
Reply from 209.165.220.5: bytes=32 time=10ms TTL=126
Reply from 209.165.220.5: bytes=32 time=16ms TTL=126

Ping statistics for 209.165.220.5:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 2ms, Maximum = 16ms, Average = 10ms

C:\>ping 172.31.0.131

Pinging 172.31.0.131 with 32 bytes of data:

Reply from 172.31.1.65: Destination host unreachable.
Reply from 172.31.1.65: Destination host unreachable.
Reply from 172.31.1.65: Destination host unreachable.
Reply from 172.31.1.65: Destination host unreachable.

Ping statistics for 172.31.0.131:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

C:\>
```

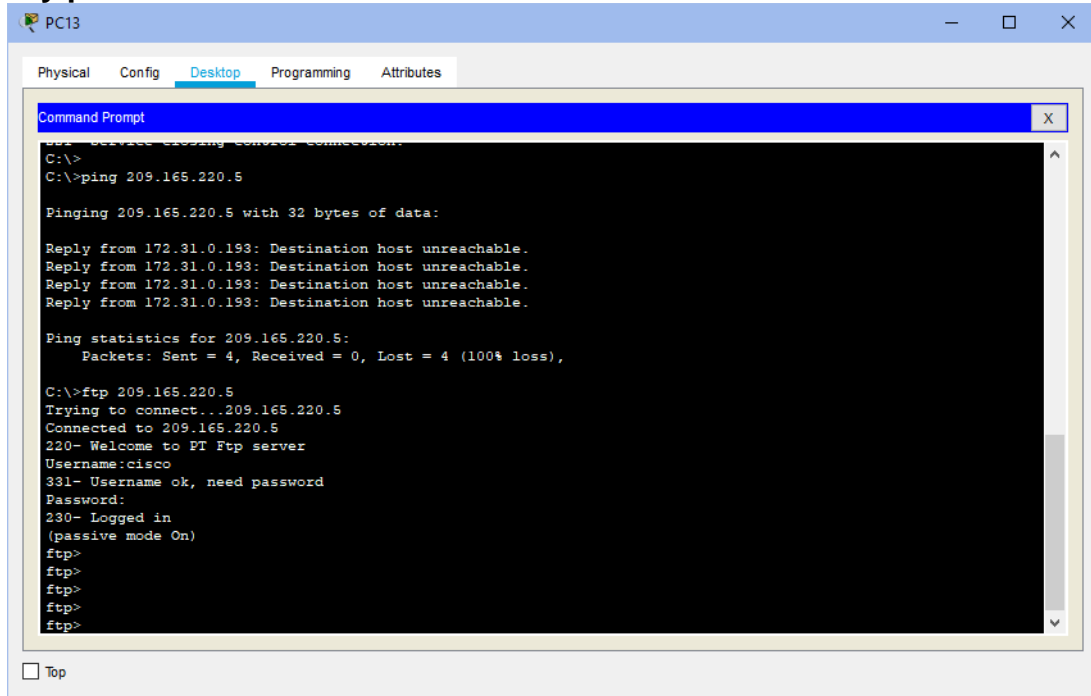
Fuente: Gomez, Cristian Alberto. 2019 [Captura de pantalla].

- **Los hosts de VLAN 30 en Tunja solo acceden a servidores web y ftp de internet.**

ROUTER TUNJA:

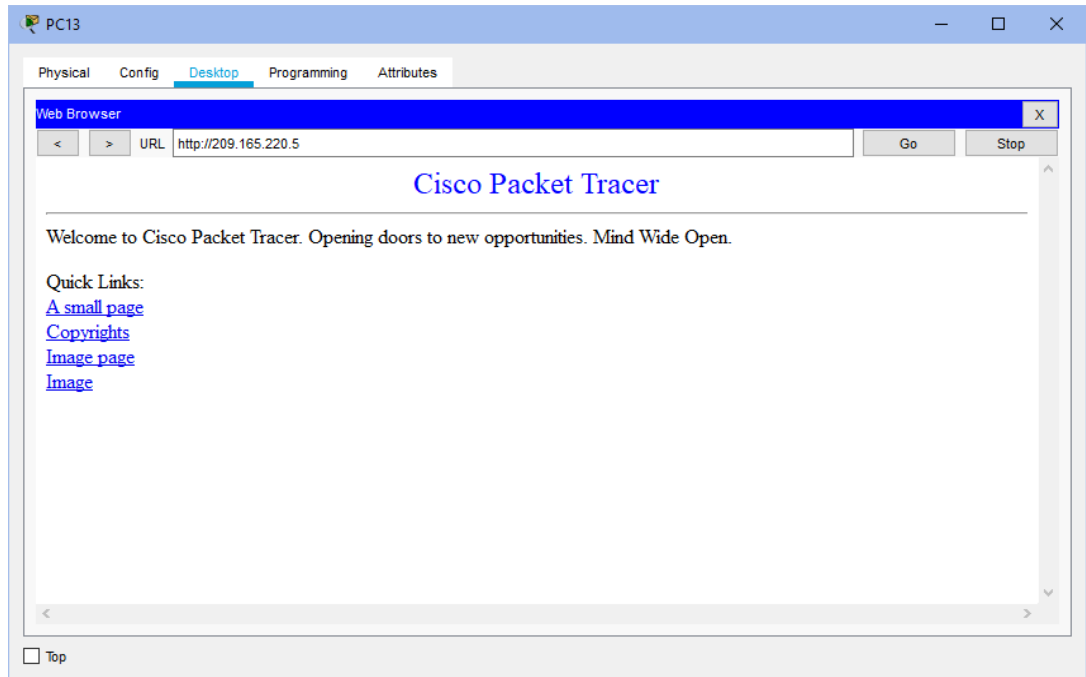
```
RTunja(config-if)#access-list 151 permit tcp 172.31.0.192 0.0.0.63 209.165.220.0
0.0.0.255 eq 80
RTunja(config)#access-list 151 permit tcp 172.31.0.192 0.0.0.63 209.165.220.0
0.0.0.255 eq 21
RTunja(config)#int g0/0.30
RTunja(config-subif)#ip access-group 151 in
RTunja(config-subif)#
```

Ilustración 35. PING desde PC13 VLAN30 LAN del router RTunja a Servidor Web y prueba de conexión FTP de internet.



Fuente: Gomez, Cristian Alberto. 2019 [Captura de pantalla].

Ilustración 36. Prueba de conexión desde PC13 VLAN30 LAN del router RTunja a Servidor Web.



Fuente: Gomez, Cristian Alberto. 2019 [Captura de pantalla].

- Los hosts de VLAN 20 en Tunja solo acceden a la VLAN 20 de Cundinamarca y VLAN 10 de Bucaramanga.

ROUTER TUNJA:

```
RTunja(config-subif)#access-list 152 permit ip 172.31.0.128 0.0.0.63 172.31.1.0 0.0.0.63
```

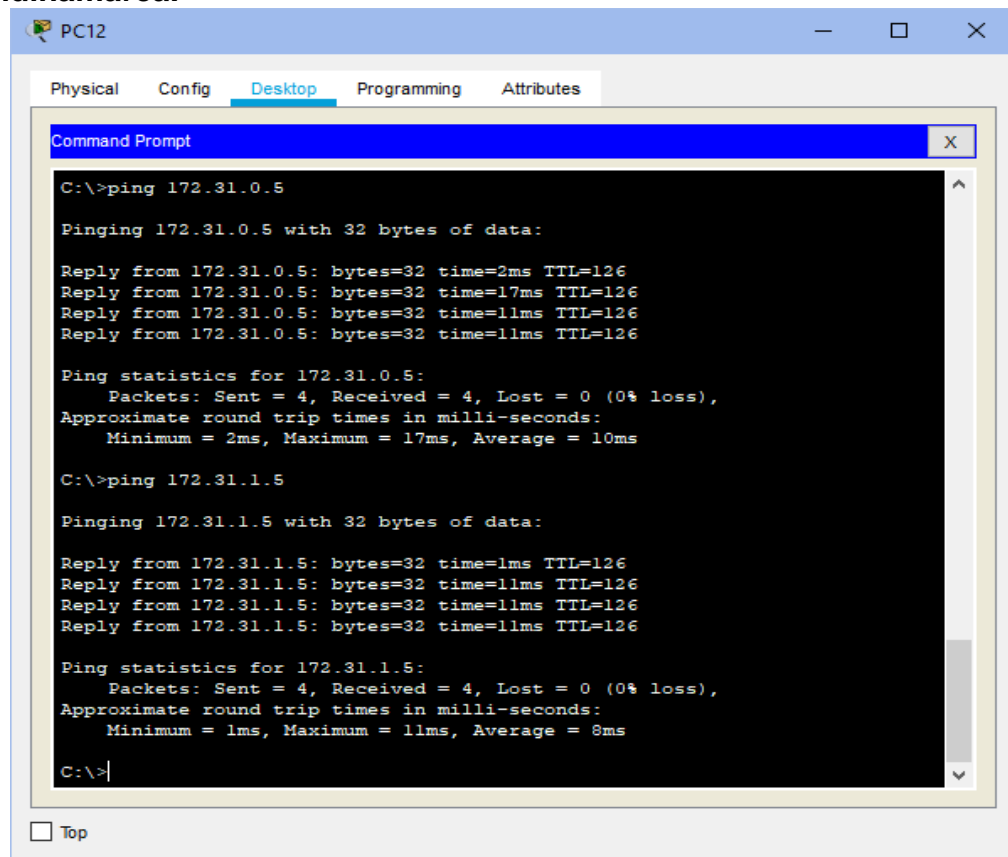
```
RTunja(config)#access-list 152 permit ip 172.31.0.128 0.0.0.63 172.31.0.0 0.0.0.63
```

```
RTunja(config)#int g0/0.20
```

```
RTunja(config-subif)#ip access-group 152 in
```

```
RTunja(config-subif)#
```

Ilustración 37. PING desde PC12 VLAN 20 LAN del router RTunja a PC10 VLAN10 LAN del router RBucaramanga y a PC15 VLAN20 LAN del router RCundinamarca.



```
PC12
Physical Config Desktop Programming Attributes
Command Prompt
C:\>ping 172.31.0.5

Pinging 172.31.0.5 with 32 bytes of data:

Reply from 172.31.0.5: bytes=32 time=2ms TTL=126
Reply from 172.31.0.5: bytes=32 time=17ms TTL=126
Reply from 172.31.0.5: bytes=32 time=11ms TTL=126
Reply from 172.31.0.5: bytes=32 time=11ms TTL=126

Ping statistics for 172.31.0.5:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 2ms, Maximum = 17ms, Average = 10ms

C:\>ping 172.31.1.5

Pinging 172.31.1.5 with 32 bytes of data:

Reply from 172.31.1.5: bytes=32 time=1ms TTL=126
Reply from 172.31.1.5: bytes=32 time=11ms TTL=126
Reply from 172.31.1.5: bytes=32 time=11ms TTL=126
Reply from 172.31.1.5: bytes=32 time=11ms TTL=126

Ping statistics for 172.31.1.5:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 11ms, Average = 8ms

C:\>|
```

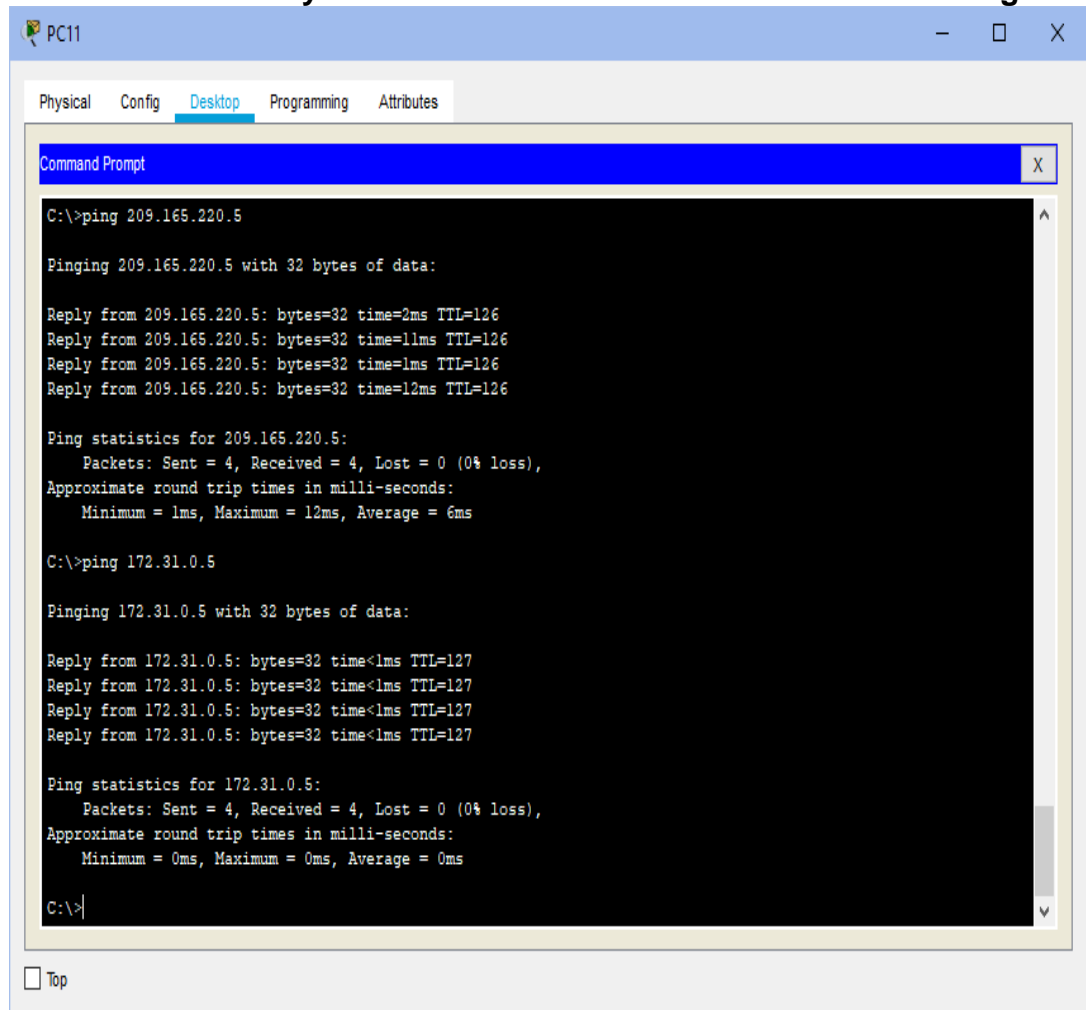
Fuente: Gomez, Cristian Alberto. 2019 [Captura de pantalla].

- **Los hosts de VLAN 30 de Bucaramanga acceden a internet y a cualquier equipo de VLAN 10.**

ROUTER BUCARAMANGA:

```
RBucaramanga(config)#access-list 151 permit ip 172.31.0.64 0.0.0.63  
209.165.220.0 0.0.0.255  
RBucaramanga(config)#int g0/0.30  
RBucaramanga(config-subif)#ip access-group 151 in  
RBucaramanga(config-subif)#
```

Ilustración 38. PING desde PC11 VLAN30 LAN del router RBucaramanga a Servidor Web Externo y a PC10 VLAN10 LAN del router Rbucaramanga.



Fuente: Gomez, Cristian Alberto. 2019 [Captura de pantalla].

- Los hosts de VLAN 10 en Bucaramanga acceden a la red de Cundinamarca (VLAN 20) y Tunja (VLAN 20), no internet.

ROUTER BUCARAMANGA:

```
RBucaramanga(config-subif)#access-list 152 permit ip 172.31.0.0 0.0.0.63  
172.31.1.64 0.0.0.63
```

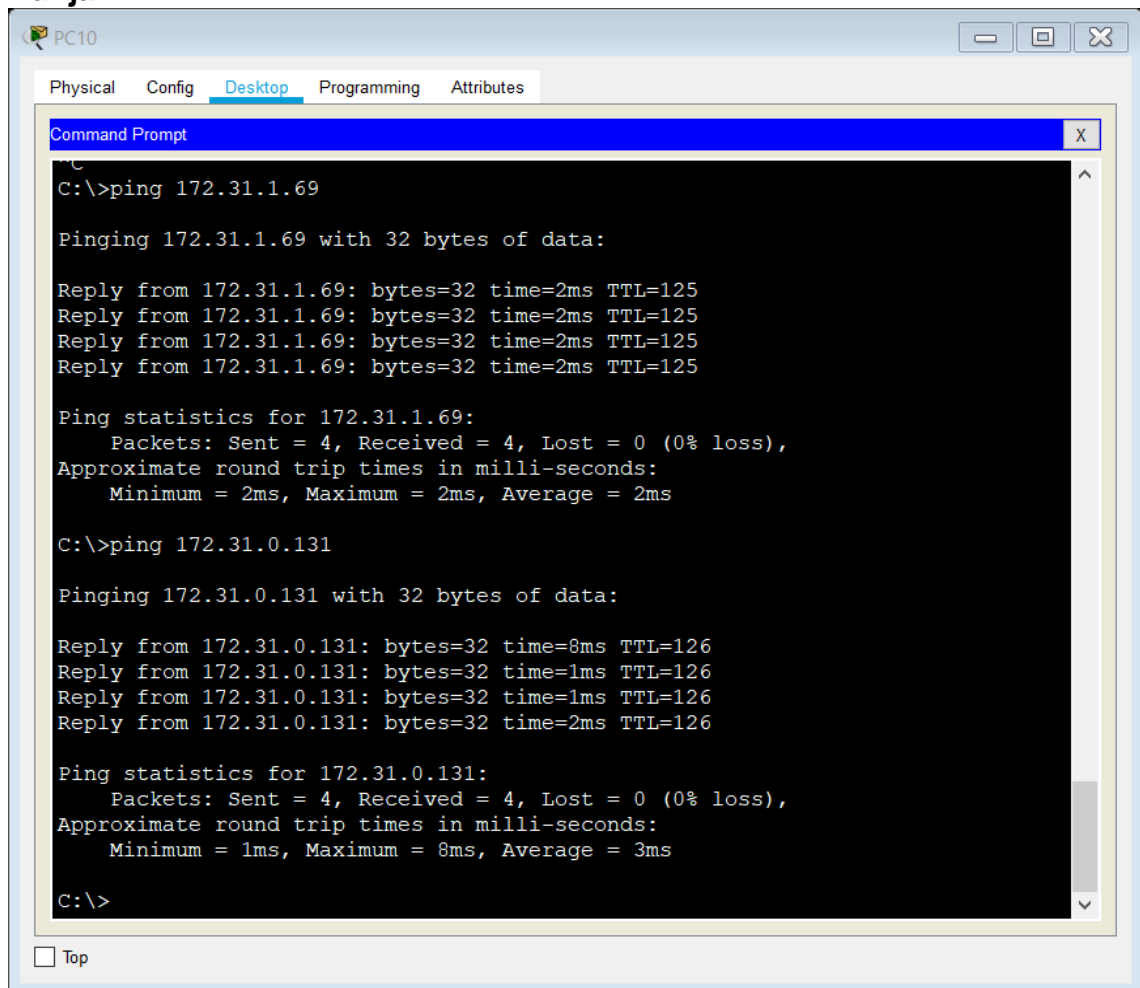
```
RBucaramanga(config)#access-list 152 permit ip 172.31.0.0 0.0.0.63 172.31.0.128  
0.0.0.63
```

```
RBucaramanga(config)#int g0/0.10
```

```
RBucaramanga(config-subif)#ip access-group 152 in
```

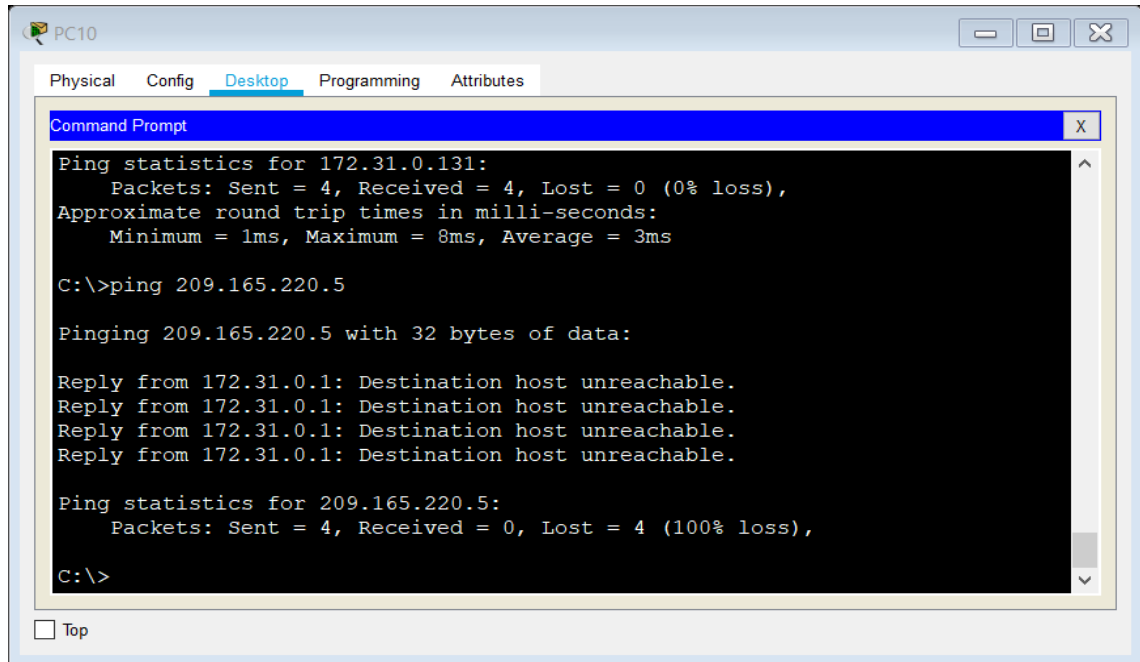
```
RBucaramanga(config-subif)#
```

Ilustración 39. PING desde PC10 VLAN30 LAN de router RBucaramanga a PC14 VLAN20 LAN del router RCundinamarca y a PC12 VLAN20 LAN del router RTunja.



Fuente: Gomez, Cristian Alberto. 2019 [Captura de pantalla].

Ilustración 40. PING desde PC10 VLAN10 LAN del router RBucaramanga a Servidor Web.



Fuente: Gomez, Cristian Alberto. 2019 [Captura de pantalla].

- **Los hosts de una VLAN no pueden acceder a los de otra VLAN en una ciudad.**

ROUTER BUCARAMANGA:

```
RBucaramanga(config-subif)#access-list 153 deny ip 172.31.2.0 0.0.0.7 172.31.0.0 0.0.0.63
```

```
RBucaramanga(config)#access-list 153 deny ip 172.31.0.64 0.0.0.63 172.31.0.0 0.0.0.63
```

```
RBucaramanga(config)#access-list 153 permit ip any any
```

```
RBucaramanga(config)#int g0/0.10
```

```
RBucaramanga(config-subif)#ip access-group 153 out
```

```
RBucaramanga(config-subif)#
```

ROUTER TUNJA:

```
RTunja(config)#access-list 153 deny ip 172.3.2.8 0.0.0.7 172.31.0.128 0.0.0.63
```

```
RTunja(config)#access-list 153 deny ip 172.3.0.192 0.0.0.63 172.31.0.128 0.0.0.63
```

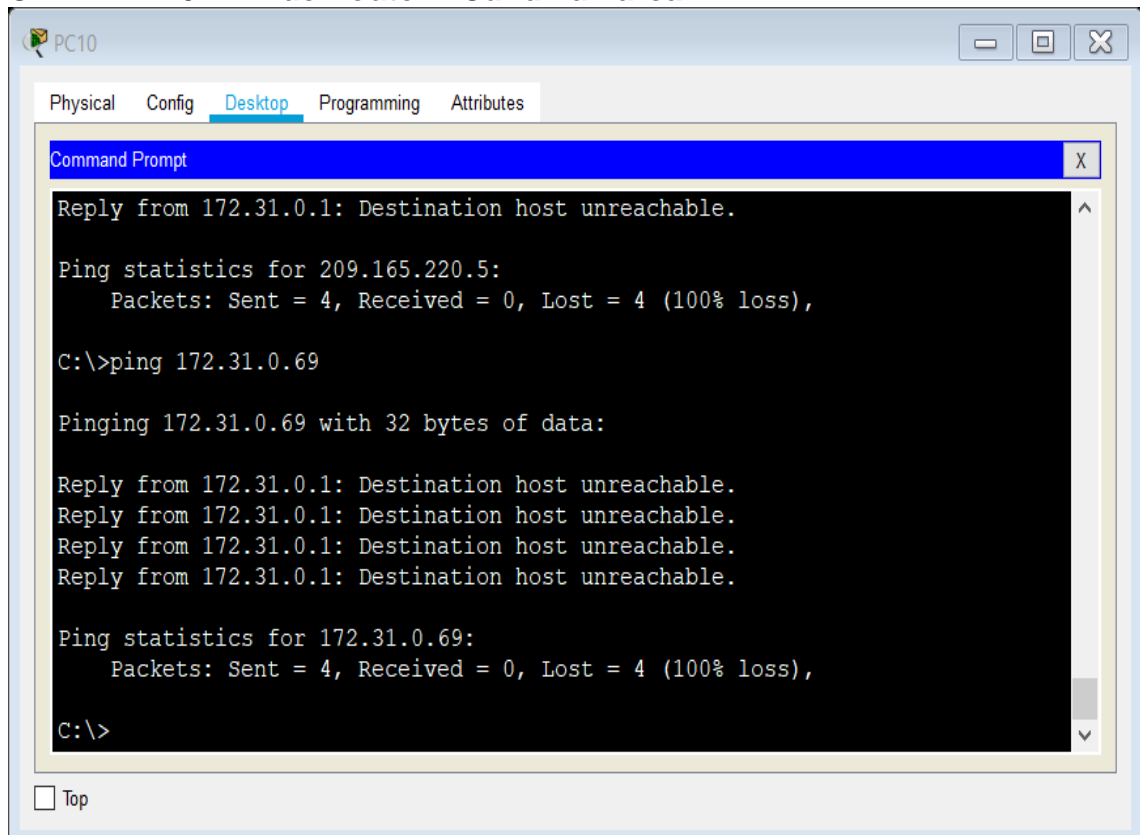
```
RTunja(config)#access-list 153 permit ip any any
```

```
RTunja(config)#int g0/0.20  
RTunja(config-subif)#ip access-group 153 out  
RTunja(config-subif)#
```

ROUTER CUNDINAMARCA:

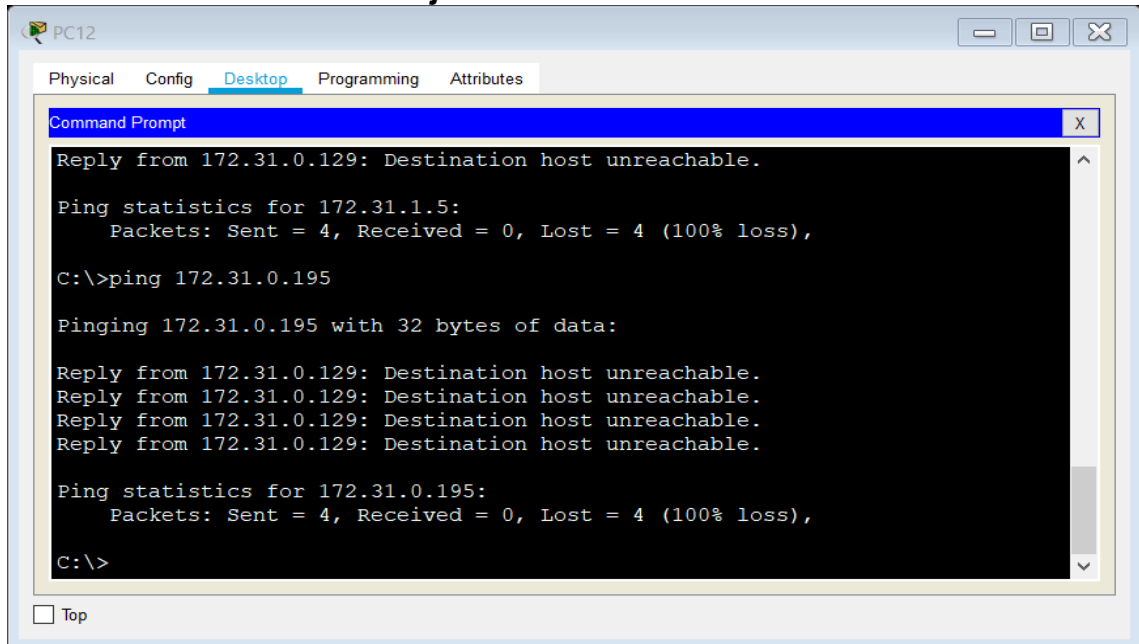
```
RCundinamarca(config)#access-list 153 deny ip 172.31.2.8 0.0.0.7 172.31.1.64  
0.0.0.63  
RCundinamarca(config)#access-list 153 deny ip 172.31.1.0 0.0.0.63 172.31.1.64  
0.0.0.63  
RCundinamarca(config)#access-list 153 deny ip 172.31.2.24 0.0.0.7 172.31.1.64  
0.0.0.63  
RCundinamarca(config)#access-list 153 permit ip any any  
RCundinamarca(config)#int g0/0.20  
RCundinamarca(config-subif)#ip access-group 153 out  
RCundinamarca(config-subif)#
```

Ilustración 41. PING desde PC10 VLAN10 LAN del router RBucaramanga a PC14 VLAN20 LAN del router RCundinamarca.



Fuente: Gomez, Cristian Alberto. 2019 [Captura de pantalla].

Ilustración 42. PING desde PC12 VLAN20 LAN del router RTunja a PC13 VLAN30 LAN del router RTunja.



```
PC12
Physical Config Desktop Programming Attributes
Command Prompt
Reply from 172.31.0.129: Destination host unreachable.

Ping statistics for 172.31.1.5:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

C:\>ping 172.31.0.195

Pinging 172.31.0.195 with 32 bytes of data:

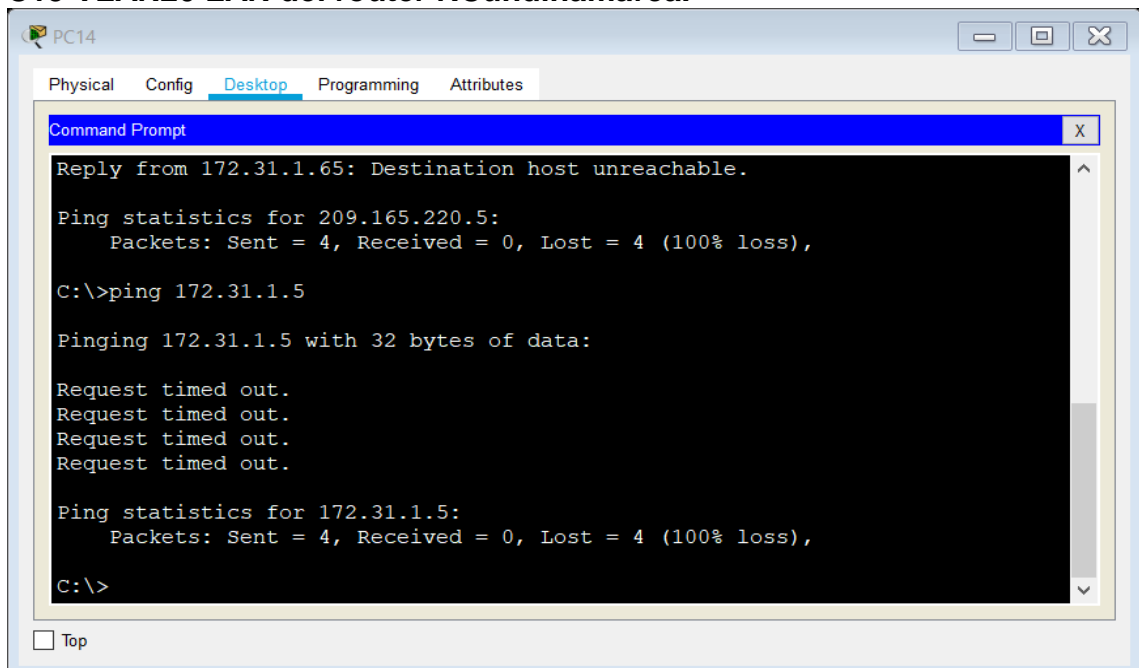
Reply from 172.31.0.129: Destination host unreachable.
Reply from 172.31.0.129: Destination host unreachable.
Reply from 172.31.0.129: Destination host unreachable.
Reply from 172.31.0.129: Destination host unreachable.

Ping statistics for 172.31.0.195:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

C:\>
```

Fuente: Gomez, Cristian Alberto. 2019 [Captura de pantalla].

Ilustración 43. PING desde PC14 VLAN10 LAN del router RCundinamarca a PC15 VLAN20 LAN del router RCundinamarca.



```
PC14
Physical Config Desktop Programming Attributes
Command Prompt
Reply from 172.31.1.65: Destination host unreachable.

Ping statistics for 209.165.220.5:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

C:\>ping 172.31.1.5

Pinging 172.31.1.5 with 32 bytes of data:

Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 172.31.1.5:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

C:\>
```

Fuente: Gomez, Cristian Alberto. 2019 [Captura de pantalla].

- **Solo los hosts de las VLAN administrativas y de la VLAN de servidores tienen acceso a los routers e internet.**

ROUTER BUCARAMANGA:

```
RBucaramanga(config-subif)#access-list 9 permit 172.31.2.0 0.0.0.7
RBucaramanga(config)#access-list 9 permit 172.3.2.8 0.0.0.7
RBucaramanga(config)#access-list 9 permit 172.31.2.8 0.0.0.7
RBucaramanga(config)#line vty 0 4
RBucaramanga(config-line)#access-class 9 in
RBucaramanga(config-line)#
```

ROUTER TUNJA:

```
RTunja(config-subif)#access-list 9 permit 172.31.2.0 0.0.0.7
RTunja(config)#access-list 9 permit 172.3.2.8 0.0.0.7
RTunja(config)#access-list 9 permit 172.31.2.8 0.0.0.7
RTunja(config)#line vty 0 4
RTunja(config-line)#access-class 9 in
RTunja(config-line)#
```

ROUTER CUNDINAMARCA:

```
RCundinamarca(config-subif)#access-list 9 permit 172.31.2.0 0.0.0.7
RCundinamarca(config)#access-list 9 permit 172.3.2.8 0.0.0.7
RCundinamarca(config)#access-list 9 permit 172.31.2.8 0.0.0.7
RCundinamarca(config)#line vty 0 4
RCundinamarca(config-line)#access-class 9 in
RCundinamarca(config-line)#
```

Ilustración 44. TELNET desde SWITCH SBucaramanga a router RTunja.

The screenshot shows a Telnet session from switch SBucaramanga to router RTunja. The terminal output is as follows:

```
SBucaramanga>en
SBucaramanga#telnet 172.31.2.33
Trying 172.31.2.33 ...OpenAdvertencia: Acceso no autorizado!!

User Access Verification

Username: adminadmin
Password:
RTunja>en
Password:
RTunja#exit

[Connection to 172.31.2.33 closed by foreign host]
SBucaramanga#
```

The interface includes a 'CLI' tab, a 'Top' checkbox, and 'Copy' and 'Paste' buttons.

Fuente: Gomez, Cristian Alberto. 2019 [Captura de pantalla].

Ilustración 45. TELNET desde SWITCH SCundinamarca a router RCundinamarca.

The screenshot shows a Telnet session from switch SCundinamarca to router RCundinamarca. The terminal output is as follows:

```
SCundinamarca>en
SCundinamarca#telnet 172.31.2.9
Trying 172.31.2.9 ...OpenAdvertencia: Acceso no autorizado!!

User Access Verification

Username: adminadmin
Password:
RCundinamarca>en
Password:
RCundinamarca#exit

[Connection to 172.31.2.9 closed by foreign host]
SCundinamarca#
```

The interface includes a 'CLI' tab, a 'Top' checkbox, and 'Copy' and 'Paste' buttons.

Fuente: Gomez, Cristian Alberto. 2019 [Captura de pantalla].

4. LINK ARCHIVOS PKT

- **Escenario 1:**
https://drive.google.com/file/d/1_XCM1inGJjC8wNVNPagJHjaU4NY7DsTL/view?usp=sharing
- **Escenario 2:**
<https://drive.google.com/file/d/1smmPBMfkvn11FVmBb6c3lcJCMRkOdC9D/view?usp=sharing>

5. CONCLUSIONES

Con el desarrollo del presente trabajo, el leer y analizar los contenidos y recursos sugeridos para el estudio, que se dispusieron oportunamente para el óptimo desarrollo temático, se obtuvieron los resultados esperados, y se comprendió así la importancia de aplicar correctamente los aspectos básicos y avanzados a tener en cuenta para el correcto diseño e implementación de una solución integrada, aspectos de los cuales podemos destacar: habilitar VLAN en cada switch y permitir su enrutamiento, enrutamiento OSPF con autenticación en cada router, servicio DHCP en los routers, configuración de NAT estático y de sobrecarga, establecer una lista de control de acceso de acuerdo con los criterios señalados, entre otros.

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