

## PRUEBA DE HABILIDADES PRÁCTICAS CNNA

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UNIVERSIDAD NACIONAL ABIERTA Y A DISTANCIA - UNAD  
ESCUELA DE CIENCIAS BÁSICAS TECNOLOGÍA E INGENIERÍA  
MONTERÍA  
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GRUPO: 203092\_26

TRABAJO DIPLOMADO DE PROFUNDIZACIÓN CISCO (DISEÑO E  
IMPLEMENTACIÓN DE SOLUCIONES INTEGRADAS LAN / WAN)

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## **RESUMEN**

Actualmente se hace necesario la implementación de las telecomunicaciones en el sector empresarial y tener nociones sobre la administración de redes. Por tal razón es importante conocer dicho rol en cada entorno, entendiendo el funcionamiento de la información mediante las redes de información.

En esta actividad individual se relacionan conceptos de arquitectura, estructura, funciones y componentes en dos escenarios con medios y operaciones de redes introducidos para proporcionar una función específica. Como solución a la tarea se hace necesario configurar e interconectar entre sí cada dispositivo, estableciendo configuraciones básicas acorde con los parámetros establecidos para el direccionamiento IP, protocolos de enrutamiento y otros aspectos que reúnen la topología de red. Esto finalmente con el firme propósito de obtener los alcances necesarios en el desarrollo del curso CISCO CCNA, que serán mostrados a lo largo de este trabajo.

**PALABRAS CLAVE:** switch, redes, configuraciones, dispositivos, escenarios, protocolos.

## **ABSTRACT**

Currently it is necessary to implement telecommunications in the business sector and have notions about network administration. For this reason it is important to know this role in each environment, understanding the operation of information through information networks.

In this individual activity, concepts of architecture, structure, functions and components in two scenarios are related to media and network operations introduced to provide a specific function. As a solution to the task it is necessary to configure and interconnect each device, establishing basic configurations according to the parameters established for IP addressing, routing protocols and other aspects that bring together the network topology. This finally with the firm intention of obtaining the necessary scopes in the development of the CISCO CCNA course, which will be shown throughout this work.

**KEYWORDS:** switch, networks, configurations, devices, scenarios, protocols.

## **INTRODUCCIÓN**

El siguiente trabajo está enmarcado sobre las pruebas de habilidades prácticas del DIPLOMADO DE PROFUNDIZACIÓN CISCO (DISEÑO E IMPLEMENTACIÓN DE SOLUCIONES INTEGRADAS LAN / WAN), donde podemos encontrar la solución de dos casos planteados como escenarios empleando los conocimientos adquiridos en cada unidad desarrollada.

Las destrezas adquiridas se integran para lograr soluciones integradas en redes LAN y WLAN con la aplicación de conceptos para lograr la configuración de direcciones IP, inicialización de dispositivos, configuración básica de routers, switches, establecimiento de seguridad, routing, Vlans, protocolo RIP, servicio de DHCP, protocolo de enrutamiento OSPF, listas de acceso, NAT, configuración de encapsulamiento, entre otros. Estas actividades han sido desarrolladas mediante el software de simulación Packet Tracer, imitando de una forma virtual los escenarios con su respectiva solución.

## **OBJETIVOS**

### **OBJETIVO GENERAL**

Analizar los ejercicios propuestos como escenarios para generar su solución, aplicando las habilidades obtenidas usando las herramientas y recursos necesarios consignados en las temáticas del Diplomado CISCO CCNA.

### **OBJETIVOS ESPECÍFICOS**

- Identificar los dispositivos a utilizar para la construcción de la topología de red para cada escenario.
- Configurar los dispositivos de comunicación como routers, switch, servidores.
- Conocer y aplicar los diferentes protocolos de enrutamiento.
- Comprobar la conectividad de los dispositivos de la red.
- Implementar seguridad en los elementos que compone la red, entre otras políticas necesarias.
- Establecer los servicios de OPSFv2, protocolo dinámico de Routing, DHCP, NAT, RIP Ver2.

## 1. DESARROLLO DE LOS DOS ESCENARIOS

### 1.1. 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.

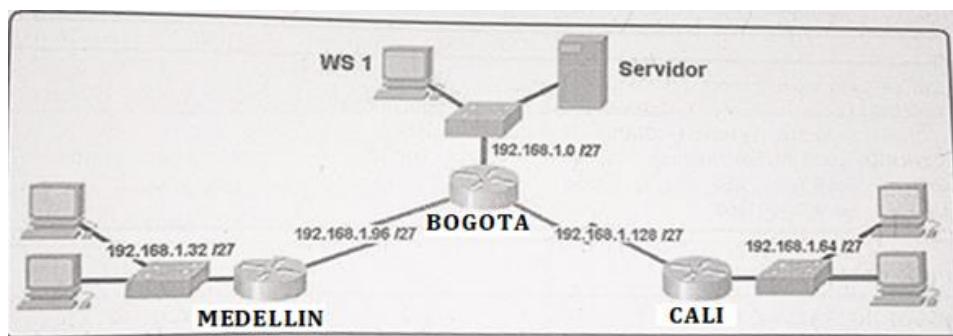


Figura 1. Topología de la red.

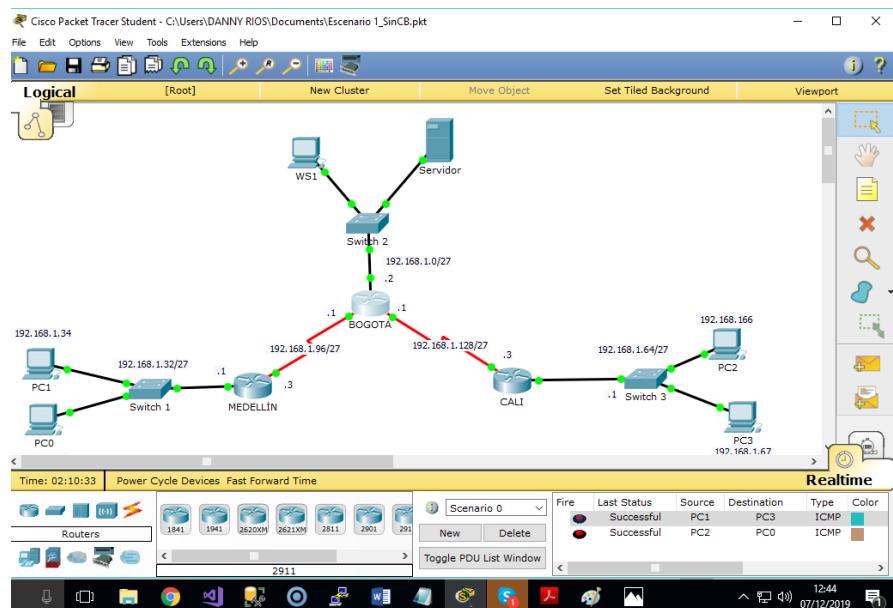


Figura 2. Topología de la red en Packet Tracer.

	R1	R2	R3
Nombre de Host	MEDELLIN	BOGOTA	CALI
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 FA 0/0	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

Tabla 1. Tabla de configuración.

En primer lugar se realizan las configuraciones básicas de los routers

#### 1.1.1. Configuración básica router 1 (Medellín)

```

Router>enable
Router#config terminal
Router(config)#no ip domain-lookup
Router(config)#hostname R1
R1(config)#enable secret cisco
R1(config)#line console 0
R1(config-line)#password cisco
R1(config-line)#login
R1(config-line)#exit
R1(config-line)#line vty 0 4
R1(config-line)#password cisco
R1(config-line)#login
R1(config-line)#exit
R1(config)#service password-encryption

```

```
R1(config)#banner motd #Acceso solo a personal autorizado#  
R3(config)#exit  
R3#copy running-config startup-config
```

### **1.1.2. Configuración básica router 2 (Bogotá)**

```
Router>enable  
Router#config terminal  
Router(config)#no ip domain-lookup  
Router(config)#hostname R2  
R2(config)#enable secret cisco  
R2(config)#line console 0  
R2(config-line)#password cisco  
R2(config-line)#login  
R2(config-line)#exit  
R2(config-line)#line vty 0 4  
R2(config-line)#password cisco  
R2(config-line)#login  
R2(config-line)#exit  
R2(config)#service password-encryption  
R2(config)#banner motd #Acceso solo a personal autorizado#  
R3(config)#exit  
R3#copy running-config startup-config
```

### **1.1.3. Configuración básica router 3 (Cali)**

```
Router>enable  
Router#config terminal  
Router(config)#no ip domain-lookup  
Router(config)#hostname R3  
R3(config)#enable secret cisco  
R3(config)#line console 0  
R3(config-line)#password cisco  
R3(config-line)#login  
R3(config-line)#exit  
R3(config-line)#line vty 0 15  
R3(config-line)#password cisco  
R3(config-line)#login  
R3(config-line)#exit  
R3(config)#service password-encryption  
R3(config)#banner motd #Acceso solo a personal autorizado#  
R3(config)#exit  
R3#copy running-config startup-config
```

### **1.1.4. Configuración básica switch 1**

```
Switch>enable  
Switch#configure terminal  
Switch(config)#hostname S1
```

```
S1(config)#enable secret cisco  
S1(config)#line console 0  
S1(config-line)#password cisco  
S1(config-line)#login  
S1(config-line)#exit  
S1(config)#line vty 0 4  
S1(config-line)#password cisco  
S1(config-line)#login  
S1(config-line)#service password-encryption  
S1(config)#banner motd #Prohibido el acceso no autorizado!#  
S1(config)#exit  
S1#copy running-config startup-config
```

### **1.1.5. Configuración básica switch 2**

```
Switch>enable  
Switch#configure terminal  
Switch(config)#hostname S2  
S2(config)#enable secret cisco  
S2(config)#line console 0  
S2(config-line)#password cisco  
S2(config-line)#login  
S2(config-line)#exit  
S2(config)#line vty 0 4
```

```
S2(config-line)#password cisco  
S2(config-line)#login  
S2(config-line)#service password-encryption  
S2(config)#banner motd #Prohibido el acceso no autorizado!#  
S2(config)#exit  
S2#copy running-config startup-config
```

#### **1.1.6. Configuración básica switch 3**

```
Switch>enable  
Switch#configure terminal  
Switch(config)#hostname S3  
S3(config)#enable secret cisco  
S3(config)#line console 0  
S3(config-line)#password cisco  
S3(config-line)#login  
S3(config-line)#exit  
S3(config)#line vty 0 4  
S3(config-line)#password cisco  
S3(config-line)#login  
S3(config-line)#service password-encryption  
S3(config)#banner motd #Prohibido el acceso no autorizado!#  
S3(config)#exit  
S3#copy running-config startup-config
```

### **1.1.7. Asignación de interfaz fastethernet y serial**

En esta parte procedemos a entrar a la configuracion de la interfaz fastethernet y serial 0/0 y asignarle IP y su respectiva máscara de red.

#### **1.1.7.1. Router Medellín**

En esta parte procedemos a entrar a la configuracion de la interfaz fasethernet y serial 0/0 y asignarle IP y su respectiva máscara de red.

Router>enable

Router#configure terminal

Router(config)#interface fastethernet 0/0

Router(config-if)#ip address 192.168.1.33 255.255.255.224

Router(config-if)#no shutdown

Router(config-if)#

Router(config-if)#exit

Router(config)#interface serial 0/0

Router(config-if)#ip address 192.168.1.99 255.255.255.224

Router(config-if)#no shutdown

Router(config-if)#

Router(config-if)#exit

Router(config)#

Router>enable

Router#configure terminal

Router(config)#ip route 192.168.1.0 255.255.255.224 192.168.1.97

Router(config)#ip route 192.168.1.64 255.255.255.224 192.168.1.97

```
Router(config)#exit  
Router#copy running-config startup-config
```

### 1.1.7.2. Router Bogotá

```
Router>enable  
Router#configure terminal  
Enter configuration commands, one per line. End with CNTL/Z.  
Router(config)#interface fastethernet 0/0  
Router(config-if)#ip address 192.168.1.1 255.255.255.224  
Router(config-if)#no shutdown  
Router(config-if)#  
Router(config-if)#exit  
Router(config)#interface serial 0/0  
Router(config-if)#ip address 192.168.1.98 255.255.255.224  
Router(config-if)#no shutdown  
Router(config-if)#exit  
Router(config)#interface serial 0/1  
Router(config-if)#ip address 192.168.1.130 255.255.255.224  
Router(config-if)#no shutdown  
Router(config-if)#exit  
Router(config)#  
Router>enable  
Router#configure terminal  
Router(config)#ip route 192.168.1.64 255.255.255.224 192.168.1.131
```

```
Router(config)#ip route 192.168.1.32 255.255.255.224 192.168.1.99  
Router(config)#exit  
Router#copy running-config startup-config
```

#### **1.1.7.3. Router Cali**

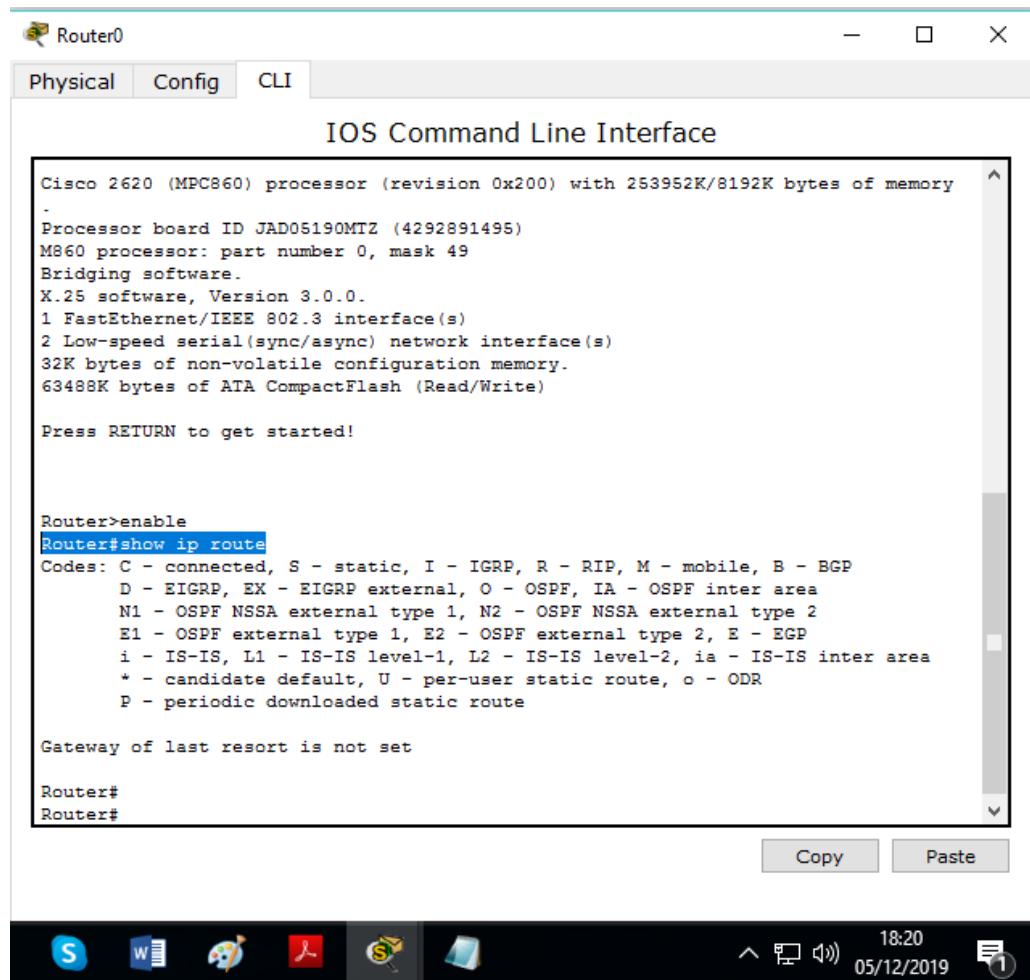
```
Router>enable  
Router#configure terminal  
Enter configuration commands, one per line. End with CNTL/Z.  
Router(config)#interface fastethernet 0/0  
Router(config-if)#ip address 192.168.1.65 255.255.255.224  
Router(config-if)#no shutdown  
Router(config-if)#  
Router(config-if)#exit  
Router(config)#interface serial 0/0  
Router(config-if)#ip address 192.168.1.131 255.255.255.224  
Router(config-if)#no shutdown  
Router(config-if)#  
Router(config-if)#exit  
Router(config)#  
Router(config)#ip route 192.168.1.0 255.255.255.224 192.168.1.129  
Router(config)#ip route 192.168.1.32 255.255.255.224 192.168.1.129  
Router(config)#exit  
Router#copy running-config startup-config
```

### 1.1.8. Verificación tabla de enrutamiento

Para verificar la tabla de enrutamiento utilizamos el comando show ip route.

#### 1.1.8.1. Router Medellín

➤ Antes de configurar los routers tenemos:



The screenshot shows a Windows application window titled "Router0" with three tabs: "Physical", "Config", and "CLI". The "CLI" tab is selected and displays the following text:

```
Cisco 2620 (MPC860) processor (revision 0x200) with 253952K/8192K bytes of memory
Processor board ID JAD05190MTZ (4292891495)
M860 processor: part number 0, mask 49
Bridging software.
X.25 software, Version 3.0.0.
1 FastEthernet/IEEE 802.3 interface(s)
2 Low-speed serial(sync/async) network interface(s)
32K bytes of non-volatile configuration memory.
63488K bytes of ATA CompactFlash (Read/Write)

Press RETURN to get started!

Router>enable
Router#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 not set

Router#
Router#
```

At the bottom of the window, there are "Copy" and "Paste" buttons. The taskbar at the bottom of the screen shows several icons and the system tray indicates the date and time as 05/12/2019 18:20.

Figura 3. Tabla de enrutamiento.

➤ Despues de la configuración:

```

Cisco IOS Software, C2600 Software (revision 0x200)
Processor board ID JAD05190MZ (4292891495)
M860 processor: part number 0, mask 49
Bridging software.
X.25 software, Version 3.0.0.
1 FastEthernet/IEEE 802.3 interface(s)
2 Low-speed serial(sync/async) network interface(s)
32K bytes of non-volatile configuration memory.
63488K bytes of ATA CompactFlash (Read/Write)

Press RETURN to get started!

Router>enable
Router#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 not set

      192.168.1.0/27 is subnetted, 4 subnets
S        192.168.1.0 [1/0] via 192.168.1.97
C        192.168.1.32 is directly connected, FastEthernet0/0
S        192.168.1.64 [1/0] via 192.168.1.97
C        192.168.1.96 is directly connected, Serial0/0
Router#
```

Figura 4. Verificación tabla de enrutamiento (Medellín).

➤ Router Bogotá antes

```

Cisco 2620 (MPC860) processor (revision 0x200) with 253952K/8192K bytes of memory
.
Processor board ID JAD05190MZ (4292891495)
M860 processor: part number 0, mask 49
Bridging software.
X.25 software, Version 3.0.0.
1 FastEthernet/IEEE 802.3 interface(s)
2 Low-speed serial(sync/async) network interface(s)
32K bytes of non-volatile configuration memory.
63488K bytes of ATA CompactFlash (Read/Write)

Press RETURN to get started!

Router>enable
Router#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 not set

Router#
```

Figura 5. Tabla de enrutamiento (Bogotá).

➤ Despues:

```

Router(config-if)*
Router(config-if)#exit
Router(config)#interface Serial0/0
Router(config-if)*
Router(config-if)#exit
Router(config)#interface Serial0/1
Router(config-if)*exit
Router(config)*exit
Router(config)#exit
Router#
$SYS-5-CONFIG_I: Configured from console by console

Router>enable
Router>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 not set

  192.168.1.0/27 is subnetted, 5 subnets
C    192.168.1.0 is directly connected, FastEthernet0/0
S    192.168.1.32 [1/0] via 192.168.1.99
S    192.168.1.64 [1/0] via 192.168.1.131
C    192.168.1.96 is directly connected, Serial0/0
C    192.168.1.128 is directly connected, Serial0/1
Router#

```

Figura 6. Verificación tabla de enrutamiento (Bogotá).

➤ Router Cali antes

```

Compiled Wed 27-Apr-04 19:01 by mhwang
Cisco 2620 (MPC860) processor (revision 0x200) with 253952K/8192K bytes of memory
.
Processor board ID JAD06190MTZ (4292891495)
M860 processor: part number 0, mask 49
Bridging software.
X.25 software, Version 3.0.0.
1 Fast-Ethernet/IEEE 802.3 interface(s)
2 Low-speed serial(sync/async) network interface(s)
32K bytes of non-volatile configuration memory.
63488K bytes of ATA CompactFlash (Read/Write)

Press RETURN to get started!

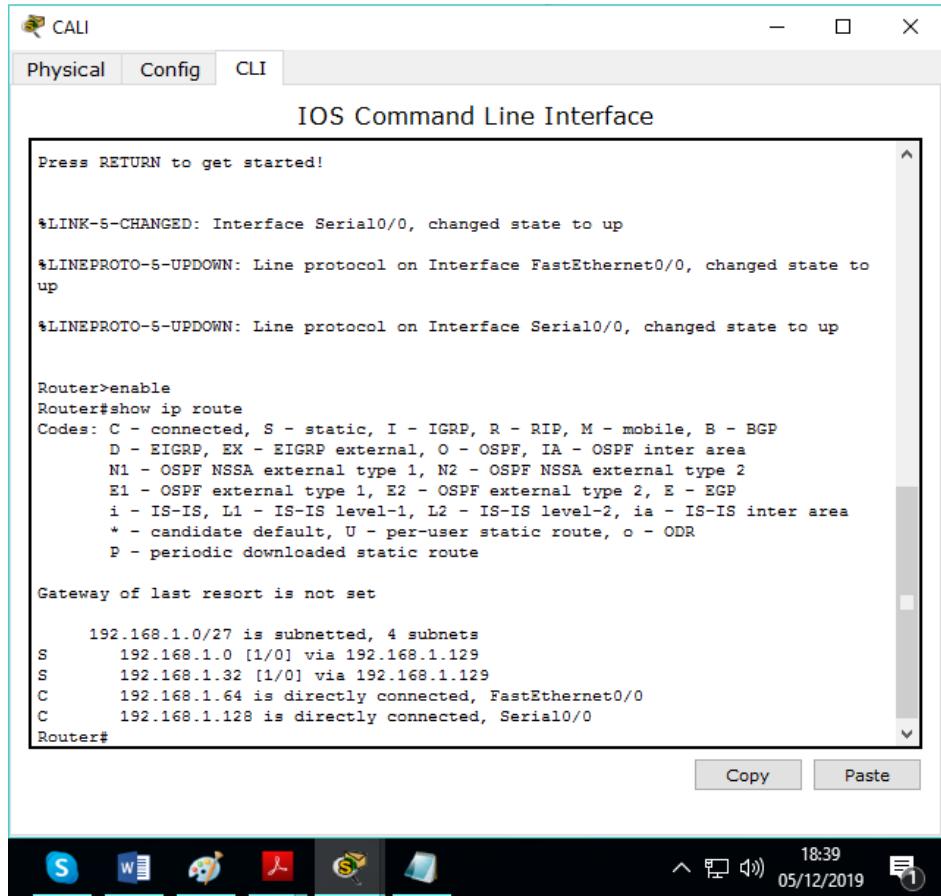
Router>enable
Router>show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
      D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
      N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
      E1 - OSPF external type 1, E2 - OSPF external type 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 not set
Router#

```

Figura 7. Tabla de enrutamiento (Cali).

➤ Despues



The screenshot shows the CALI software interface with the 'CLI' tab selected. The main window is titled 'IOS Command Line Interface'. It displays the following output from the router's CLI:

```
Press RETURN to get started!

*LINK-5-CHANGED: Interface Serial0/0, changed state to up
*LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up
*LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0, changed state to up

Router>enable
Router#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 not set

  192.168.1.0/27 is subnetted, 4 subnets
S        192.168.1.0 [1/0] via 192.168.1.129
S        192.168.1.32 [1/0] via 192.168.1.129
C        192.168.1.64 is directly connected, FastEthernet0/0
C        192.168.1.128 is directly connected, Serial0/0
Router#
```

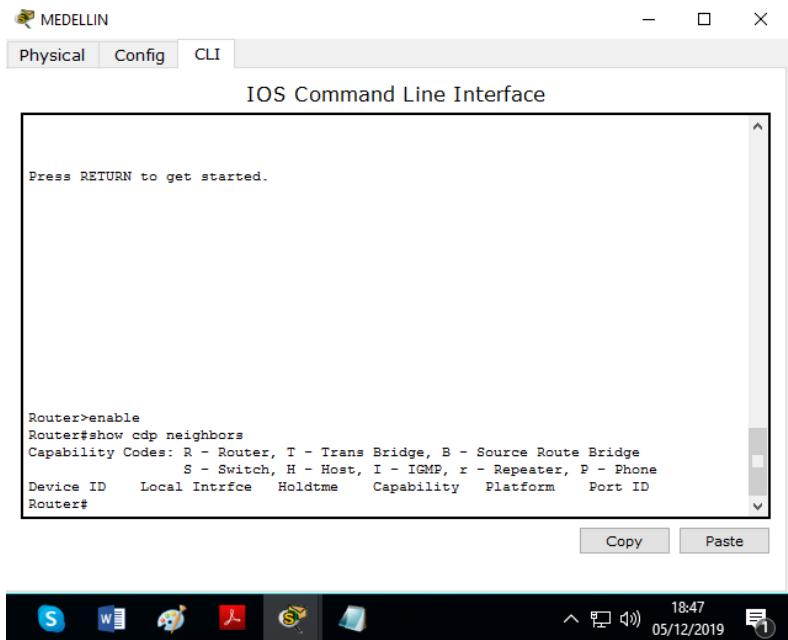
At the bottom of the window are 'Copy' and 'Paste' buttons. The system tray at the bottom of the screen shows icons for file, edit, and other system functions, along with the date and time (18:39, 05/12/2019).

Figura 8. Verificación tabla de enrutamiento (Cali).

### 1.1.9. Diagnóstico de vecinos.

El comando adecuado para verificar es “cdp neighbors”, antes de esto se debe habilitar con cdp run:

## ➤ Router Medellín (Antes)



The screenshot shows the Cisco IOS Command Line Interface (CLI) running on a Windows host named "MEDELLIN". The window title is "IOS Command Line Interface". The tabs at the top are "Physical", "Config", and "CLI", with "CLI" being active. The main pane displays the command output:

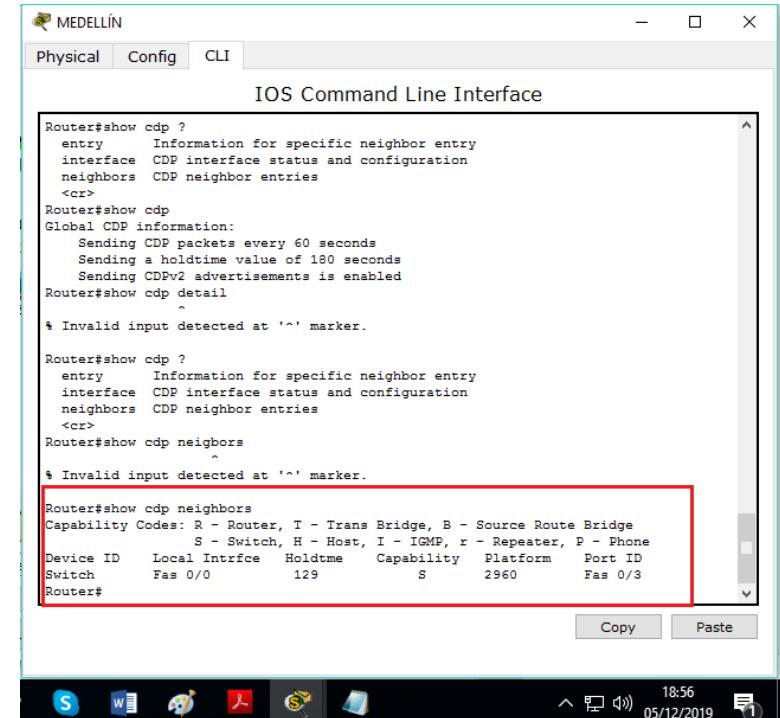
```
Press RETURN to get started.

Router>enable
Router#show cdp neighbors
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
Router#
```

At the bottom right of the CLI window are "Copy" and "Paste" buttons. Below the CLI window is a taskbar with various icons and the system status: 18:47, 05/12/2019.

Figura 9. Vista vecinos (Medellín).

## ➤ Router Medellín (Después)



The screenshot shows the Cisco IOS Command Line Interface (CLI) running on a Windows host named "MEDELLIN". The window title is "IOS Command Line Interface". The tabs at the top are "Physical", "Config", and "CLI", with "CLI" being active. The main pane displays the command output:

```
Router#show cdp ?
entry      Information for specific neighbor entry
interface  CDP interface status and configuration
neighbors  CDP neighbor entries
<cr>
Router#show cdp
Global CDP information:
  Sending CDP packets every 60 seconds
  Sending a holdtime value of 180 seconds
  Sending CDPv2 advertisements is enabled
Router#show cdp detail
^
* Invalid input detected at '^' marker.

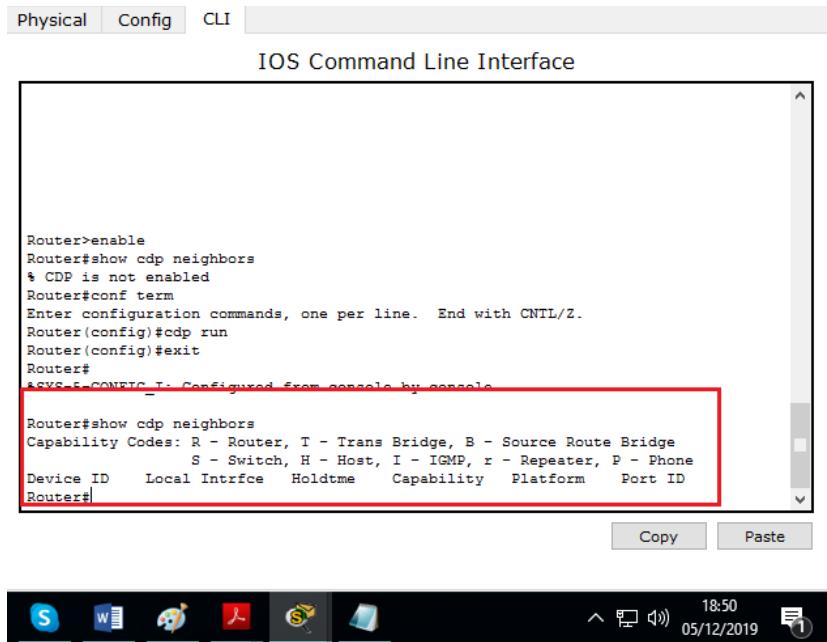
Router#show cdp ?
entry      Information for specific neighbor entry
interface  CDP interface status and configuration
neighbors  CDP neighbor entries
<cr>
Router#show cdp neighbors
^
* Invalid input detected at '^' marker.

Router#show cdp neighbors
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
Switch        Fas 0/0        129          S    2960        Fas 0/3
Router#
```

A red rectangular box highlights the last part of the output where the neighbor table is displayed. At the bottom right of the CLI window are "Copy" and "Paste" buttons. Below the CLI window is a taskbar with various icons and the system status: 18:56, 05/12/2019.

Figura 10. Verificación lista vecinos (Medellín).

## ➤ Router Bogotá (Antes)



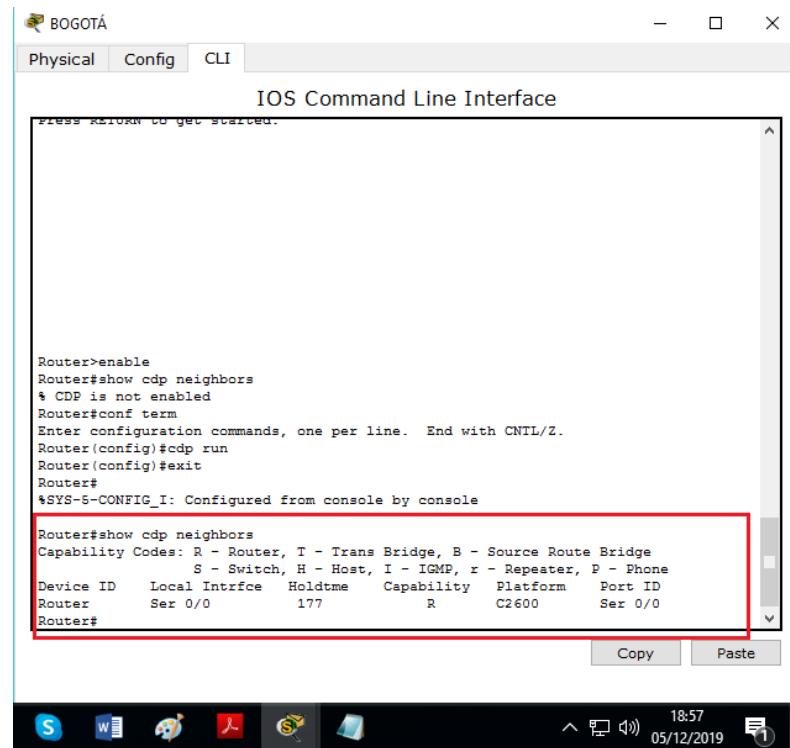
The screenshot shows the Cisco IOS Command Line Interface (CLI) window titled "IOS Command Line Interface". At the top, there are tabs for "Physical", "Config" (which is selected), and "CLI". Below the tabs, the text "IOS Command Line Interface" is displayed. The main area contains the following CLI session:

```
Router>enable
Router#show cdp neighbors
% CDP is not enabled
Router#conf term
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#cdp run
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console
Router#show cdp neighbors
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
Router#
```

A red box highlights the output of the "show cdp neighbors" command, which shows a single neighbor entry for a device with a local interface of "Ser 0/0" and a port ID of "Ser 0/0".

Figura 11. Vista vecinos (Bogotá).

## Router Bogotá (Después)



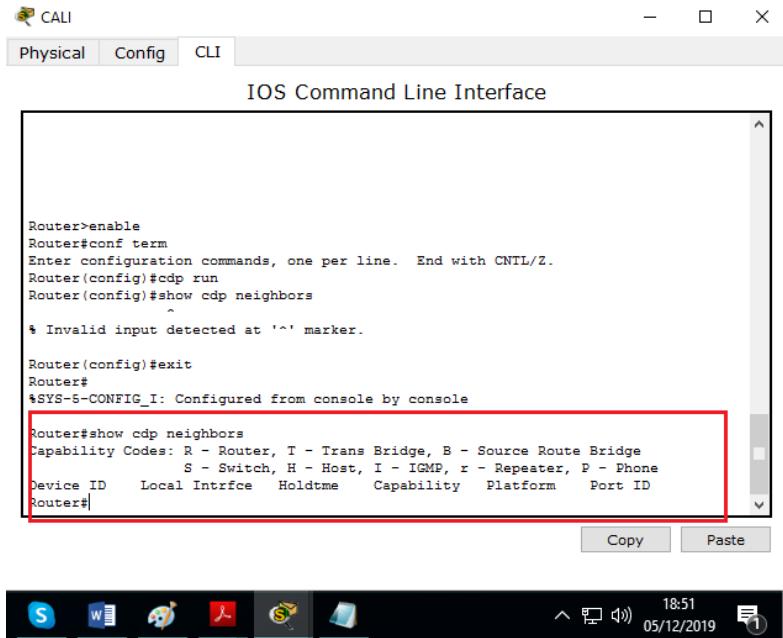
The screenshot shows the Cisco IOS Command Line Interface (CLI) window titled "IOS Command Line Interface". At the top, there are tabs for "Physical", "Config" (which is selected), and "CLI". Below the tabs, the text "IOS Command Line Interface" is displayed. The main area contains the following CLI session:

```
Router>enable
Router#show cdp neighbors
% CDP is not enabled
Router#conf term
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#cdp run
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console
Router#show cdp neighbors
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
Router        Ser 0/0          177         R           C2600    Ser 0/0
Router#
```

A red box highlights the output of the "show cdp neighbors" command, which now shows two neighbor entries. The first neighbor is a "Router" with a local interface of "Ser 0/0" and a port ID of "Ser 0/0". The second neighbor is a "Switch" with a local interface of "Ser 0/0" and a port ID of "Ser 0/0".

Figura 12. Verificación lista vecinos (Bogotá).

➤ Router Cali (Antes)



```
Router>enable
Router#conf term
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#cdp run
Router(config)#show cdp neighbors
^
* Invalid input detected at '^' marker.

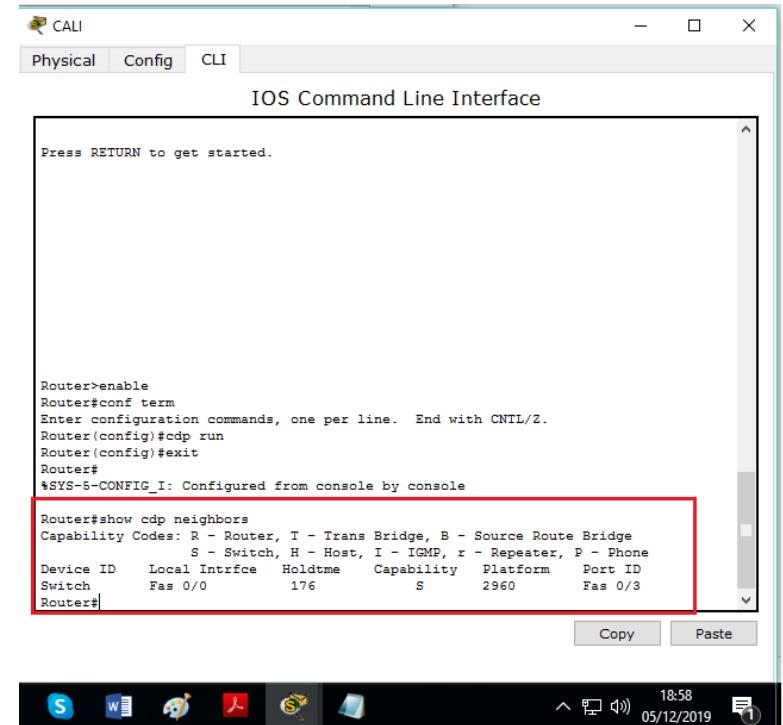
Router(config)#exit
Router#
*SYS-5-CONFIG_I: Configured from console by console

Router#show cdp neighbors
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
Router#
```

The screenshot shows the Cisco IOS CLI interface. The title bar says "CALI". The tabs at the top are "Physical", "Config" (which is selected), and "CLI". The main window is titled "IOS Command Line Interface". The command entered was "show cdp neighbors". The output shows a single neighbor entry with a red box around it. The neighbor's device ID is "Router#", its local interface is "Fas 0/0", its holdtime is "176", its capability is "S", its platform is "2960", and its port ID is "Fas 0/3". Below the command line, there are "Copy" and "Paste" buttons. The taskbar at the bottom shows various icons and the date/time "18:51 05/12/2019".

Figura 13. Vista vecinos (Cali).

➤ Router Cali (Después)



```
Press RETURN to get started.

Router>enable
Router#conf term
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#cdp run
Router(config)#exit
Router#
*SYS-5-CONFIG_I: Configured from console by console

Router#show cdp neighbors
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
Router#
```

This screenshot is identical to Figure 13, showing the Cisco IOS CLI interface on a router named "CALI". It displays the same "show cdp neighbors" command output, with a red box highlighting the neighbor entry for "Router#". The taskbar at the bottom shows the date/time "18:58 05/12/2019".

Figura 14. Verificación lista vecinos (Bogotá).

### 1.1.10. Balanceo de cargas

Este proceso se hace para los que poseen dos seriales conectados en el mismo Router, con diferentes opciones para llevar la carga. Para visualizar se usa el comando show ip route, que nos permite observar que no hay balanceo de carga.

```
MEDELLIN
Physical Config CLI
IOS Command Line Interface
Press RETURN to get started!

*LINK-5-CHANGED: Interface Serial0/0, changed state to up
*LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up
*LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0, changed state to up

Router>enable
Router#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 not set

  192.168.1.0/27 is subnetted, 4 subnets
S        192.168.1.0 [1/0] via 192.168.1.97
C        192.168.1.32 is directly connected, FastEthernet0/0
S        192.168.1.64 [1/0] via 192.168.1.97
C        192.168.1.96 is directly connected, Serial0/0

Router#
```

Figura 15. Verificación balanceo de cargas (Medellín).

```
BOGOTÁ
Physical Config CLI
IOS Command Line Interface
ROUTER(CONFIG-IF)#
Router(config-if)#exit
Router(config)#interface Serial0/0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface Serial0/1
Router(config-if)#exit
Router(config)#exit
Router#
*SYS-5-CONFIG_I: Configured from console by console

Router#enable
Router#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 not set

  192.168.1.0/27 is subnetted, 5 subnets
C        192.168.1.0 is directly connected, FastEthernet0/0
S        192.168.1.32 [1/0] via 192.168.1.99
S        192.168.1.64 [1/0] via 192.168.1.131
C        192.168.1.96 is directly connected, Serial0/0
C        192.168.1.128 is directly connected, Serial0/1

Router#
```

Figura 16. Verificación balanceo de cargas (Bogotá).

```

CALI
Physical Config CLI
IOS Command Line Interface
Press RETURN to get started!

*LINK-5-CHANGED: Interface Serial0/0, changed state to up
*LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up
*LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0, changed state to up

Router>enable
Router#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 not set

  192.168.1.0/27 is subnetted, 4 subnets
S        192.168.1.0 [1/0] via 192.168.1.129
S        192.168.1.32 [1/0] via 192.168.1.129
C        192.168.1.64 is directly connected, FastEthernet0/0
C        192.168.1.128 is directly connected, Serial0/0
Router#

```

Copy Paste

18:39 05/12/2019

Figura 17. Verificación balanceo de cargas (Cali).

### 1.1.11. Configuración de enrutamiento.

Se asigna el protocolo de enrutamiento EIGRP a los routers considerando el direccionamiento diseñado.

#### 1.1.11.1. Router Medellín

Router>enable

Router#conf term

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

Router(config)#router eigrp 200

Router(config-router)#network 192.168.1.96 0.0.0.31

Router(config-router)#network 192.168.1.32 0.0.0.31

Router(config-router)#network 192.168.1.128 0.0.0.31

Router(config-router)#+

### **1.1.11.2. Router Bogotá**

```
Router>enable
Router#configure term
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#router eigrp 200
Router(config-router)#network 192.168.1.0 0.0.0.31
Router(config-router)#network 192.168.1.96 0.0.0.31
Router(config-router)#
Router(config-router)#network 192.168.1.128 0.0.0.31
Router(config-router)#no auto-summary
Router(config-router)#
Router(config-router)#
Router#
```

### **1.1.11.3. Router Cali**

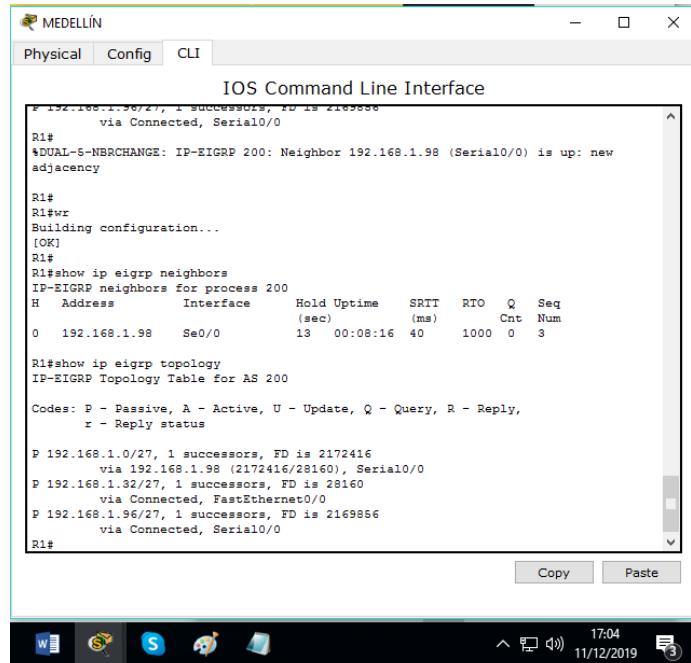
```
Router>enable
Router#conf term
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#router eigrp 200
Router(config-router)#network 192.168.1.128 0.0.0.31
Router(config-router)#network 192.168.1.64 0.0.0.31
Router(config-router)#no auto-summary
```

## **1.1.12. Verificación de vecindad con los routers configurados con EIGRP.**

Para esto tenemos los comandos

```
show ip eigrp neighbors
show ip eigrp topology
```

### 1.1.12.1. Router Medellín



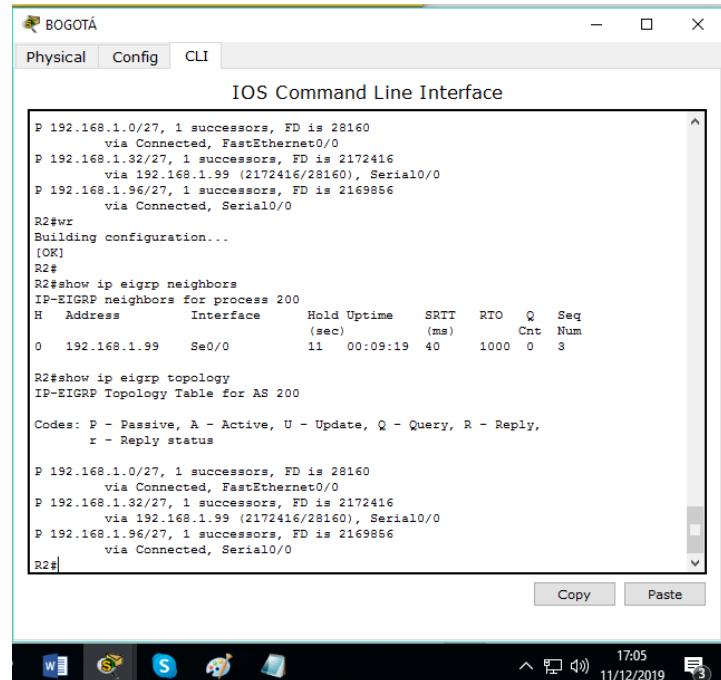
The screenshot shows the Cisco IOS CLI interface for a router named 'MEDELLÍN'. The window title is 'MEDELLÍN' and the tab selected is 'CLI'. The command-line output displays the following information:

```
R1#  
*DUAL-5-NBRCHANGE: IP-EIGRP 200: Neighbor 192.168.1.98 (Serial0/0) is up: new  
adjacency  
  
R1#  
R1#wr  
Building configuration...  
[OK]  
R1#  
R1#show ip eigrp neighbors  
IP-EIGRP neighbors for process 200  
H Address Interface Hold Uptime SRTT RTO Q Seq  
   (sec) (ms)  
0 192.168.1.98 Se0/0    13 00:08:16 40 1000 0 3  
  
R1#show ip eigrp topology  
IP-EIGRP Topology Table for AS 200  
  
Codes: P - Passive, A - Active, U - Update, Q - Query, R - Reply,  
       r - Reply status  
  
P 192.168.1.0/27, 1 successors, FD is 2172416  
via 192.168.1.98 (2172416/28160), Serial0/0  
P 192.168.1.32/27, 1 successors, FD is 28160  
via Connected, FastEthernet0/0  
P 192.168.1.96/27, 1 successors, FD is 2169856  
via Connected, Serial0/0  
R1#
```

At the bottom right of the window, there are 'Copy' and 'Paste' buttons. The taskbar at the bottom of the screen shows icons for various applications like Word, Excel, and File Explorer.

Figura 18. Verificación vecindad y EIGRP (Medellín).

### 1.1.12.2. Router Bogotá



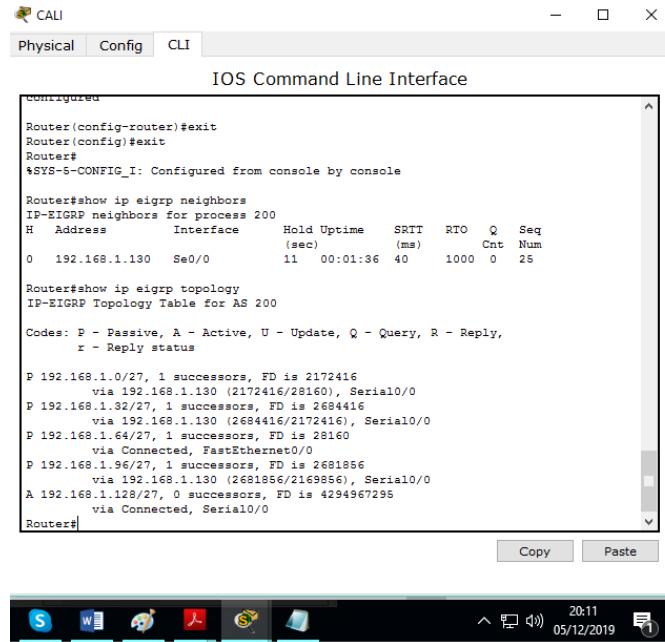
The screenshot shows the Cisco IOS CLI interface for a router named 'BOGOTÁ'. The window title is 'BOGOTÁ' and the tab selected is 'CLI'. The command-line output displays the following information:

```
R2#  
*DUAL-5-NBRCHANGE: IP-EIGRP 200: Neighbor 192.168.1.99 (Serial0/0) is up: new  
adjacency  
  
R2#  
R2#wr  
Building configuration...  
[OK]  
R2#  
R2#show ip eigrp neighbors  
IP-EIGRP neighbors for process 200  
H Address Interface Hold Uptime SRTT RTO Q Seq  
   (sec) (ms)  
0 192.168.1.99 Se0/0    11 00:09:19 40 1000 0 3  
  
R2#show ip eigrp topology  
IP-EIGRP Topology Table for AS 200  
  
Codes: P - Passive, A - Active, U - Update, Q - Query, R - Reply,  
       r - Reply status  
  
P 192.168.1.0/27, 1 successors, FD is 28160  
via Connected, FastEthernet0/0  
P 192.168.1.32/27, 1 successors, FD is 2172416  
via 192.168.1.99 (2172416/28160), Serial0/0  
P 192.168.1.96/27, 1 successors, FD is 2169856  
via Connected, Serial0/0  
R2#
```

At the bottom right of the window, there are 'Copy' and 'Paste' buttons. The taskbar at the bottom of the screen shows icons for various applications like Word, Excel, and File Explorer.

Figura 19. Verificación vecindad Y EIGRP (Bogotá).

### 1.1.12.3. Router Cali



The screenshot shows the Cisco IOS CLI interface for Router CALI. The command entered was `Router#show ip eigrp neighbors`. The output displays the IP-EIGRP neighbors for process 200, listing one neighbor at 192.168.1.130. It also shows the IP-EIGRP Topology Table for AS 200, listing routes via various interfaces like Serial0/0 and FastEthernet0/0.

```
Router#show ip eigrp neighbors
IP-EIGRP neighbors for process 200
H  Address           Interface      Hold Uptime   SRIT  RTO   Q   Seq
  0  192.168.1.130  Serial0/0       11  00:01:36  40    1000  0  25

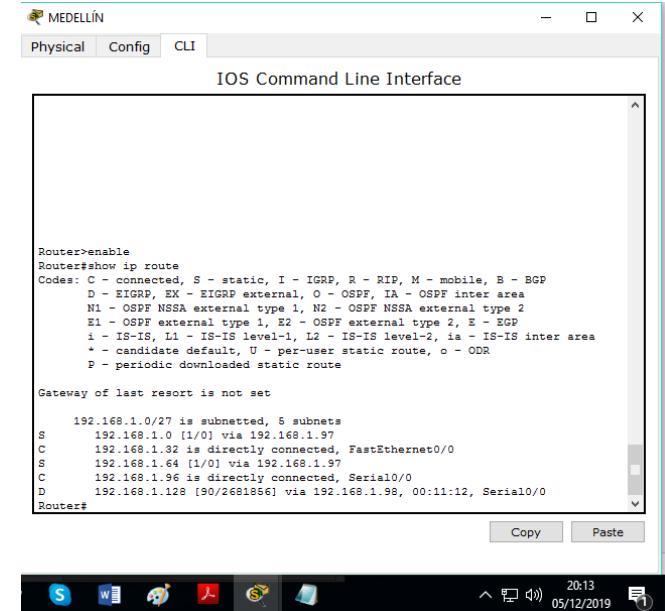
Router#show ip eigrp topology
IP-EIGRP Topology Table for AS 200
Codes: P - Passive, A - Active, U - Update, Q - Query, R - Reply,
       r - Reply status
       P 192.168.1.0/27, 1 successors, FD is 2172416
             via 192.168.1.130 (2172416/28160), Serial0/0
       P 192.168.1.32/27, 1 successors, FD is 2684416
             via 192.168.1.130 (2684416/2172416), Serial0/0
       P 192.168.1.64/27, 1 successors, FD is 28160
             via Connected, FastEthernet0/0
       P 192.168.1.96/27, 1 successors, FD is 2681856
             via 192.168.1.130 (2681856/2169856), Serial0/0
       A 192.168.1.128/27, 0 successors, FD is 4294967295
             via Connected, Serial0/0
Router#
```

Figura 20. Verificación vecindad Y EIGRP (Cali).

### 1.1.13. Comprobación de las tablas de enrutamiento.

Para esto el comando indicado es `show ip route`

#### 1.1.13.1. Router Medellín



The screenshot shows the Cisco IOS CLI interface for Router MEDELLIN. The command entered was `Router>enable` followed by `Router#show ip route`. The output displays the routing table, which includes entries for 192.168.1.0/27, 192.168.1.32/27, 192.168.1.64/27, 192.168.1.96/27, and 192.168.1.128/27. It also lists the gateway of last resort as 192.168.1.98.

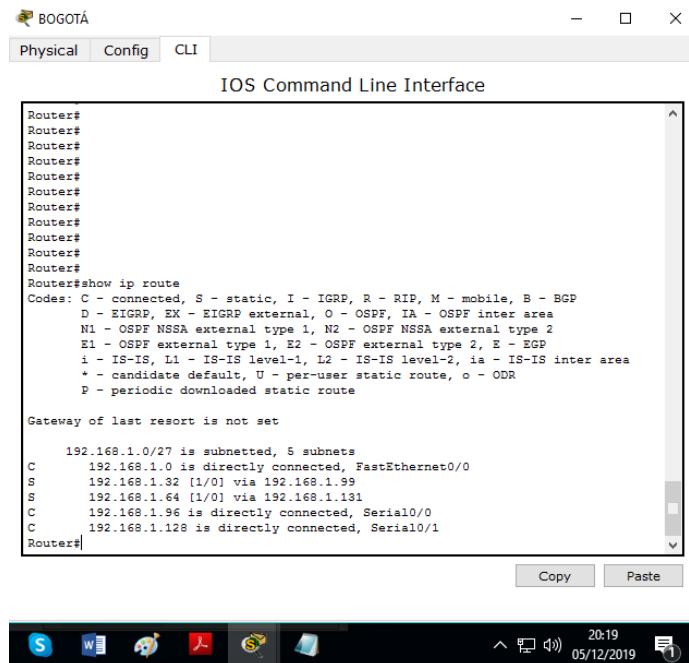
```
Router>enable
Router#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external 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 not set

      192.168.1.0/27 is subnetted, 5 subnets
S        192.168.1.0 [1/0] via 192.168.1.97
C        192.168.1.32 [1/0] via 192.168.1.97
S        192.168.1.64 [1/0] via 192.168.1.97
C        192.168.1.96 [1/0] via 192.168.1.97
D        192.168.1.128 [90/2681856] via 192.168.1.98, 00:11:12, Serial0/0
Router#
```

Figura 21. Tabla de enrutamiento (Medellín).

### 1.1.13.2. Router Bogotá



```

Router# 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

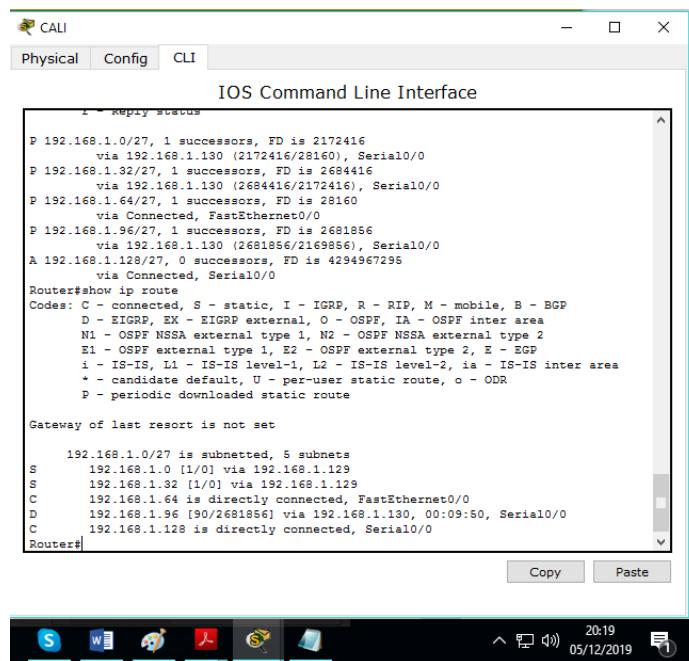
Gateway of last resort is not set

 192.168.1.0/27 is subnetted, 5 subnets
C         192.168.1.0 is directly connected, FastEthernet0/0
S           192.168.1.32 [1/0] via 192.168.1.98
S           192.168.1.64 [1/0] via 192.168.1.131
C         192.168.1.96 is directly connected, Serial0/0
C         192.168.1.128 is directly connected, Serial0/1
Router#

```

Figura 22. Tabla de enrutamiento (Bogotá).

### 1.1.13.3. Router Cali



```

i - reply status
P 192.168.1.0/27, 1 successors, FD is 2172416
  via 192.168.1.130 (2172416/28160), Serial0/0
P 192.168.1.32/27, 1 successors, FD is 2684416
  via 192.168.1.130 (2684416/2172416), Serial0/0
P 192.168.1.64/27, 1 successors, FD is 28160
  via Connected, FastEthernet0/0
P 192.168.1.96/27, 1 successors, FD is 2681856
  via 192.168.1.130 (2681856/2169886), Serial0/0
A 192.168.1.128/27, 0 successors, FD is 4294967295
  via Connected, Serial0/0
Router# 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 not set

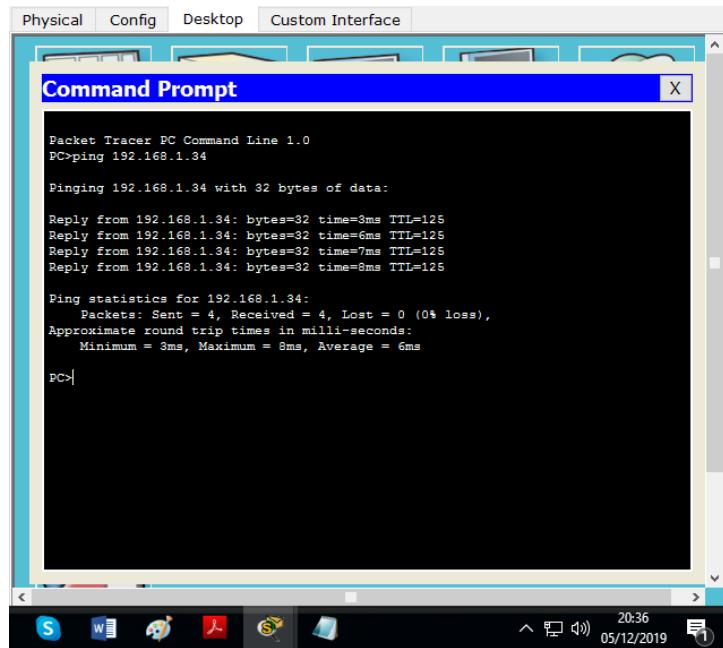
 192.168.1.0/27 is subnetted, 5 subnets
S         192.168.1.0 [1/0] via 192.168.1.129
S         192.168.1.32 [1/0] via 192.168.1.129
C         192.168.1.64 is directly connected, FastEthernet0/0
D         192.168.1.96 [30/2681856] via 192.168.1.130, 00:09:50, Serial0/0
C         192.168.1.128 is directly connected, Serial0/0
Router#

```

Figura 23. Tabla de enrutamiento (cali).

#### 1.1.14. Diagnóstico de conectividad entre los puntos de la red.

##### 1.1.14.1. Ping desde el PC del router Cali a PC router Medellín



```
Packet Tracer PC Command Line 1.0
PC>ping 192.168.1.34

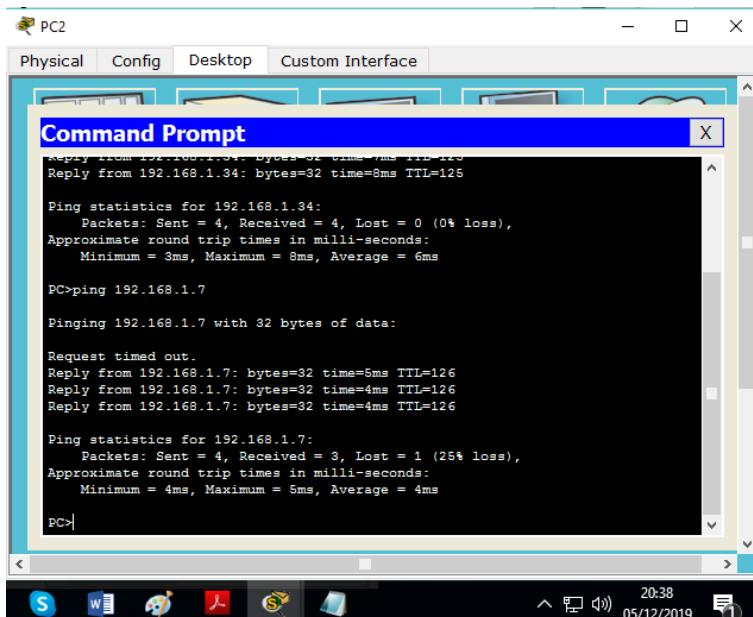
Pinging 192.168.1.34 with 32 bytes of data:
Reply from 192.168.1.34: bytes=32 time=3ms TTL=125
Reply from 192.168.1.34: bytes=32 time=6ms TTL=125
Reply from 192.168.1.34: bytes=32 time=7ms TTL=125
Reply from 192.168.1.34: bytes=32 time=8ms TTL=125

Ping statistics for 192.168.1.34:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 3ms, Maximum = 8ms, Average = 6ms

PC>
```

Figura 24. Conectividad Cali – Medellín.

##### 1.1.14.2. Ping desde el PC del router Cali a PC router Bogotá (Servidor)



```
PC2
Physical Config Desktop Custom Interface
Command Prompt
Reply from 192.168.1.34: bytes=32 time=7ms TTL=125
Reply from 192.168.1.34: bytes=32 time=8ms TTL=125

Ping statistics for 192.168.1.34:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 3ms, Maximum = 8ms, Average = 6ms

PC>ping 192.168.1.7

Pinging 192.168.1.7 with 32 bytes of data:

Request timed out.
Reply from 192.168.1.7: bytes=32 time=5ms TTL=126
Reply from 192.168.1.7: bytes=32 time=4ms TTL=126
Reply from 192.168.1.7: bytes=32 time=4ms TTL=126

Ping statistics for 192.168.1.7:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 4ms, Maximum = 5ms, Average = 4ms

PC>
```

Figura 25. Conectividad Cali – Bogotá.

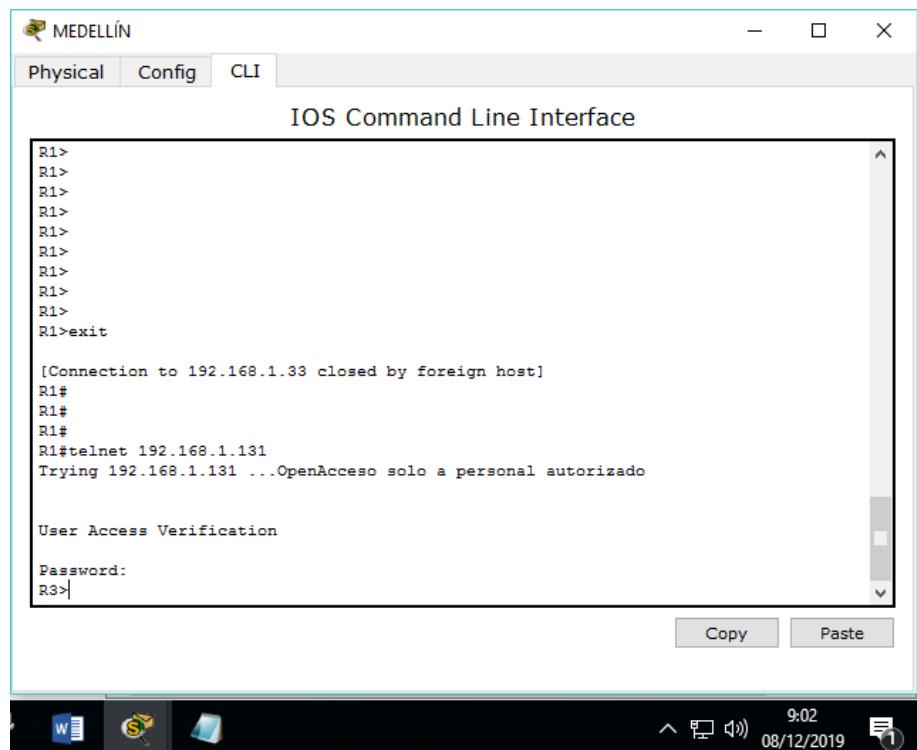
### **1.1.15. Configuración de las listas de Control de Acceso.**

En este momento cualquier usuario de la red tiene acceso a todos sus dispositivos y estaciones de trabajo. El jefe de redes le solicita implementar seguridad en la red. Para esta labor se decide configurar listas de control de acceso (ACL) a los routers.

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

Como ya se había habilitado la configuración telnet con la línea vty podemos tener acceso a los routers, de igual forma podemos entrar a cualquier dispositivo de la red, por tal razón se a continuación se muestra evidencia de las conexiones.

#### **1.1.15.1. Router Medellín a Cali**



The screenshot shows a Windows Command Line Interface window titled "MEDELLÍN". The window has tabs at the top: "Physical", "Config", and "CLI". The "CLI" tab is selected. The main area is titled "IOS Command Line Interface". The terminal output is as follows:

```
R1>
R1>
R1>
R1>
R1>
R1>
R1>
R1>
R1>exit

[Connection to 192.168.1.33 closed by foreign host]
R1#
R1#
R1#
R1#telnet 192.168.1.131
Trying 192.168.1.131 ...OpenAccesso solo a personal autorizado

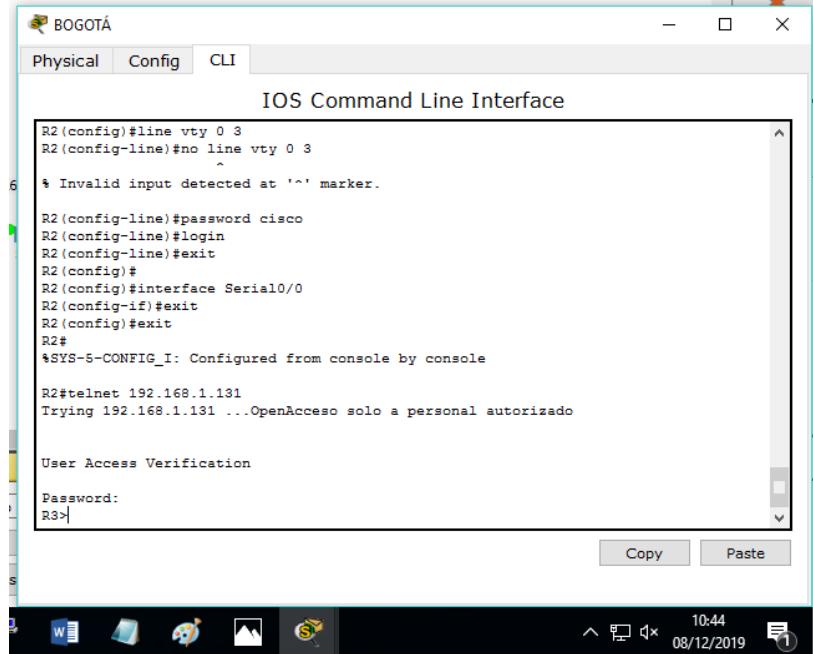
User Access Verification

Password:
R3>
```

At the bottom right of the window, there are "Copy" and "Paste" buttons. The taskbar at the bottom of the screen shows icons for Microsoft Word, a yellow folder, and a blue folder. The system tray indicates the date is 08/12/2019 and the time is 9:02.

Figura 26. Conexión Telnet Medellín - Cali.

### 1.1.15.2. Router Bogotá a Cali



```
R2(config)#line vty 0 3
R2(config-line)#no line vty 0 3
^
* Invalid input detected at '^' marker.

R2(config-line)#password cisco
R2(config-line)#login
R2(config-line)#exit
R2(config)#
R2(config)#interface Serial0/0
R2(config-if)#exit
R2(config)#
R2#
*SYS-5-CONFIG_I: Configured from console by console

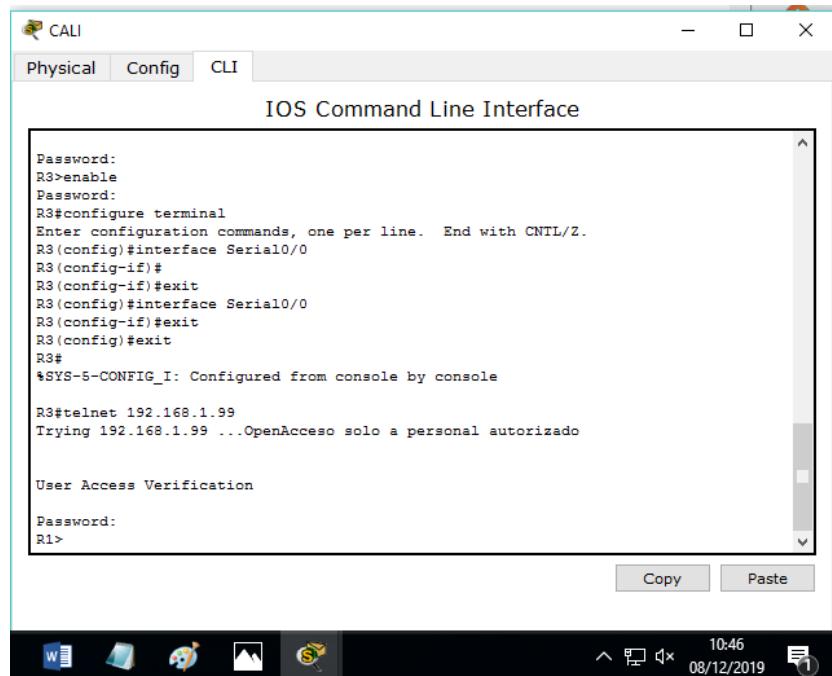
R2#telnet 192.168.1.131
Trying 192.168.1.131 ...OpenAcceso solo a personal autorizado

User Access Verification

Password:
R3>
```

Figura 27. Conexión Telnet Cali – Bogotá.

### 1.1.15.3. Router Cali a Medellín



```
Password:
R3#enable
Password:
R3#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
R3(config)#interface Serial0/0
R3(config-if)#
R3(config-if)#exit
R3(config)#interface Serial0/0
R3(config-if)#exit
R3(config)#exit
R3#
*SYS-5-CONFIG_I: Configured from console by console

R3#telnet 192.168.1.99
Trying 192.168.1.99 ...OpenAcceso solo a personal autorizado

User Access Verification

Password:
R1>
```

Figura 28. Conexión Telnet Cali – Medellín.

#### 1.1.15.4. Router Cali a Bogotá

```
R3(config-if)#exit
R3(config)#exit
R3#
%SYS-5-CONFIG_I: Configured from console by console

R3#telnet 192.168.1.99
Trying 192.168.1.99 ...OpenAccesso solo a personal autorizado

User Access Verification

Password:
R1>exit

[Connection to 192.168.1.99 closed by foreign host]
R3#telnet 192.168.1.98
Trying 192.168.1.98 ...OpenAccesso solo a personal autorizado

User Access Verification

Password:
R2>
```

Figura 29. Conexión Telnet Cali – Bogotá.

#### 1.1.15.5. Router Medellín a Bogotá

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

*DUAL-5-NBRCHANGE: IP-EIGRP 200: Neighbor 192.168.1.98 (Serial0/0) is up: new
adjacency

Acceso solo a personal autorizado

User Access Verification

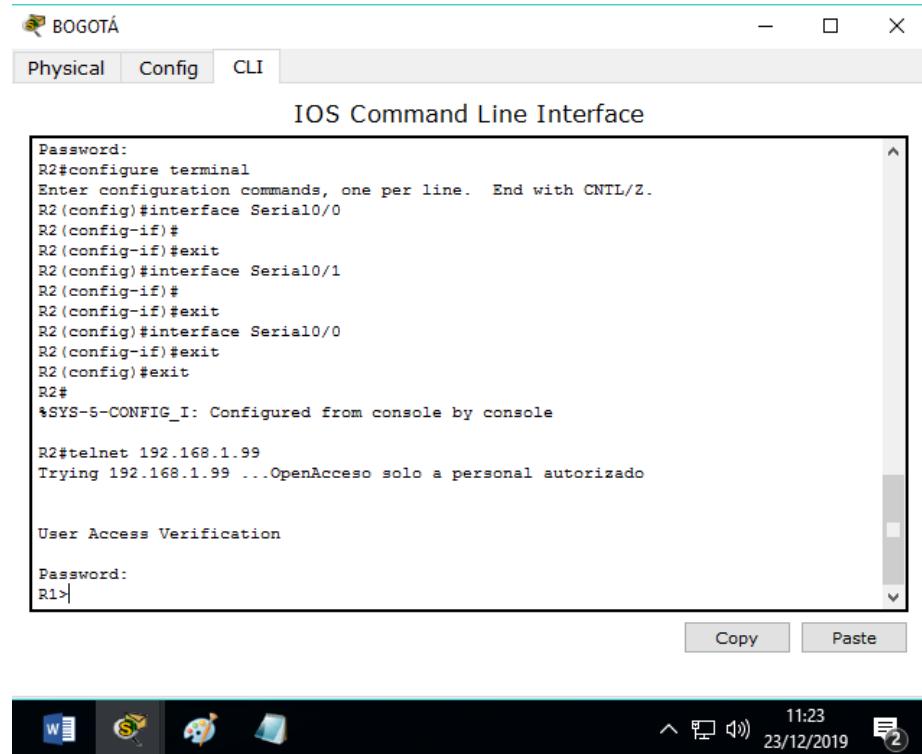
Password:
R1>enable
Password:
R1#telnet 192.168.1.98
Trying 192.168.1.98 ...OpenAccesso solo a personal autorizado

User Access Verification

Password:
R2>
```

Figura 30. Conexión Telnet Medellín – Bogotá.

### 1.1.15.6. Router Bogotá Medellín



The screenshot shows a Windows desktop environment. In the foreground, there is a window titled "BOGOTÁ" which contains an "IOS Command Line Interface". The interface shows a Telnet session to a router. The command history includes configuration commands like "R2#configure terminal", "R2(config)#interface Serial0/0", and "R2(config-if)#exit". It also shows the router attempting a telnet connection to 192.168.1.99 with the message "Trying 192.168.1.99 ...OpenAcceso solo a personal autorizado". A "User Access Verification" prompt follows, asking for a password. The taskbar at the bottom of the screen shows various icons and the system tray indicates the date and time as 23/12/2019 11:23.

```
Password:  
R2#configure terminal  
Enter configuration commands, one per line. End with CNTL/Z.  
R2(config)#interface Serial0/0  
R2(config-if)#  
R2(config-if)#exit  
R2(config)#interface Serial0/1  
R2(config-if)#  
R2(config-if)#exit  
R2(config)#interface Serial0/0  
R2(config-if)#exit  
R2(config)#exit  
R2#  
%SYS-5-CONFIG_I: Configured from console by console  
  
R2#telnet 192.168.1.99  
Trying 192.168.1.99 ...OpenAcceso solo a personal autorizado  
  
User Access Verification  
  
Password:  
R1>
```

Figura 31. Conexión Telnet Bogotá - Medellín.

- b. El equipo WS1 y el servidor se encuentran en la subred de administración. Solo el servidor de la subred de administración debe tener acceso a cualquier otro dispositivo en cualquier parte de la red.

Procedemos a realizar la configuración en el router de Bogotá:

```
R2#conf term  
Enter configuration commands, one per line. End with CNTL/Z.  
R2(config)#access-list 1 deny 192.168.1.4  
R2(config)#access-list 1 permit any  
R2(config)#interface f 0/0  
R2(config-if)#ip access-group 1 in  
R2(config-if)#exit
```

c. Las estaciones de trabajo en las LAN de MEDELLIN y CALI no deben tener acceso a ningún dispositivo fuera de su subred, excepto para interconectar con el servidor.

Router Cali

R3#conf term

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

R3(config)#access-list 10 permit 192.168.1.7

R3(config)#access-list 10 deny 192.168.1.96 0.0.0.31

R3(config)#access-list 10 deny 192.168.1.4

R3(config)#int serial 0/0

R3(config-if)#ip access-group 10 in

R3(config-if)#exit

Para mostrar las listas de acceso utilizamos el comando “show access-lists” en cada router.

The screenshot shows a Windows application window titled "IOS Command Line Interface". The window has tabs at the top: "Physical", "Config" (which is selected), and "CLI". The main area displays the following CLI session:

```
R3(config)#access-list 10 deny 192.168.1.96 0.0.0.31
R3(config)#access-list 10 deny 192.168.1.4
R3(config)#int serial 0/0
R3(config-if)#ip access-group 10 in
R3(config-if)#exit
R3(config)#
%DUAL-5-NBRCHANGE: IP-EIGRP 10: Neighbor 192.168.1.130 (Serial0/0) is down:
holding time expired

R3(config)#show access-lists
^
% Invalid input detected at '^' marker.

R3(config)#exit
R3#
%SYS-5-CONFIG_I: Configured from console by console

R3#show access-lists
Standard IP access list 10
  10 permit host 192.168.1.7 (2 match(es))
  20 deny 192.168.1.96 0.0.0.31
  30 deny host 192.168.1.4
```

At the bottom of the window are "Copy" and "Paste" buttons. The taskbar at the bottom of the screen shows several icons, and the system tray indicates the date and time as 10/12/2019 22:22.

Figura 32. Lista ACL router Cali.

```

BOGOTÁ
Physical Config CLI
IOS Command Line Interface

limit exceeded

R2(config)#
*DUAL-5-NBRCHANGE: IP-EIGRP 10: Neighbor 192.168.1.131 (Serial0/1) is up: new
adjacency

R2(config)#exit
R2#
*SYS-5-CONFIG_I: Configured from console by console

R2#
*DUAL-5-NBRCHANGE: IP-EIGRP 10: Neighbor 192.168.1.131 (Serial0/1) is down: retry
limit exceeded

R2#show
*DUAL-5-NBRCHANGE: IP-EIGRP 10: Neighbor 192.168.1.131 (Serial0/1) is up: new
adjacency
a
R2#show access-list
Standard IP access list 1
    10 deny host 192.168.1.4 (13 match(es))
    20 permit any (16 match(es))
R2#

```

Copy Paste

22:23 10/12/2019 3

Figura 33. Lista ACL router Bogotá.

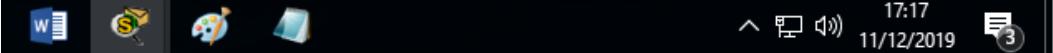
#### 1.1.16. Comprobación de la red instalada.

- Se debe probar que la configuración de las listas de acceso fue exitosa.
- Comprobar y Completar la siguiente tabla de condiciones de prueba para confirmar el óptimo funcionamiento de la red e.

	ORIGEN	DESTINO	RESULTADO
TELNET	Router MEDELLIN	Router CALI	Fallido
	WS_1	Router BOGOTA	Fallido
	Servidor	Router CALI	Exitoso
	Servidor	Router MEDELLIN	Exitoso
TELNET	LAN del Router MEDELLIN	Router CALI	Fallido
	LAN del Router CALI	Router CALI	Exitoso
	LAN del Router MEDELLIN	Router MEDELLIN	Exitoso

	<b>LAN del Router CALI</b>	<b>Router MEDELLIN</b>	Fallido
<b>PING</b>	<b>LAN del Router CALI</b>	<b>WS_1</b>	Fallido
	<b>LAN del Router MEDELLIN</b>	<b>WS_1</b>	Fallido
	<b>LAN del Router MEDELLIN</b>	<b>LAN del Router CALI</b>	Fallido
	<b>LAN del Router CALI</b>	<b>Servidor</b>	Exitoso
<b>PING</b>	<b>LAN del Router MEDELLIN</b>	<b>Servidor</b>	Exitoso
	<b>Servidor</b>	<b>LAN del Router MEDELLIN</b>	Exitoso
	<b>Servidor</b>	<b>LAN del Router CALI</b>	Exitoso
	<b>Router CALI</b>	<b>LAN del Router MEDELLIN</b>	Fallido
	<b>Router MEDELLIN</b>	<b>LAN del Router CALI</b>	Fallido

Tabla 2. Verificaciones listas de acceso.



MEDELLÍN

Physical Config CLI

IOS Command Line Interface

```
R1#
R1#show ip eigrp neighbors
IP-EIGRP neighbors for process 200
H   Address           Interface      Hold Uptime    SRTT     RTO      Q      Seq
     (sec)             (ms)          Cnt Num
0   192.168.1.98     Se0/0          13   00:08:16  40       1000    0      3

R1#show ip eigrp topology
IP-EIGRP Topology Table for AS 200

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

P 192.168.1.0/27, 1 successors, FD is 2172416
      via 192.168.1.98 (2172416/28160), Serial0/0
P 192.168.1.32/27, 1 successors, FD is 28160
      via Connected, FastEthernet0/0
P 192.168.1.96/27, 1 successors, FD is 2169856
      via Connected, Serial0/0
R1#telnet 192.168.1.131
Trying 192.168.1.131 ...
% Connection timed out; remote host not responding
R1#
```

Copy Paste

Figura 34. Telnet router Medellín Cali.

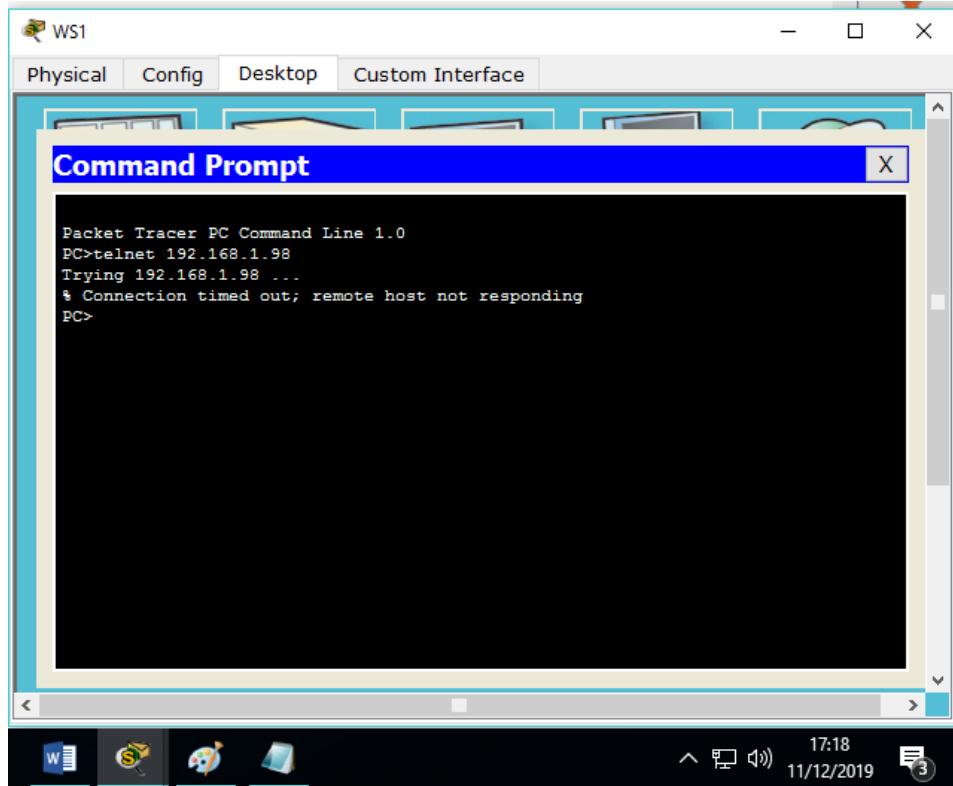


Figura 35. Telnet WS1 a router Bogotá.

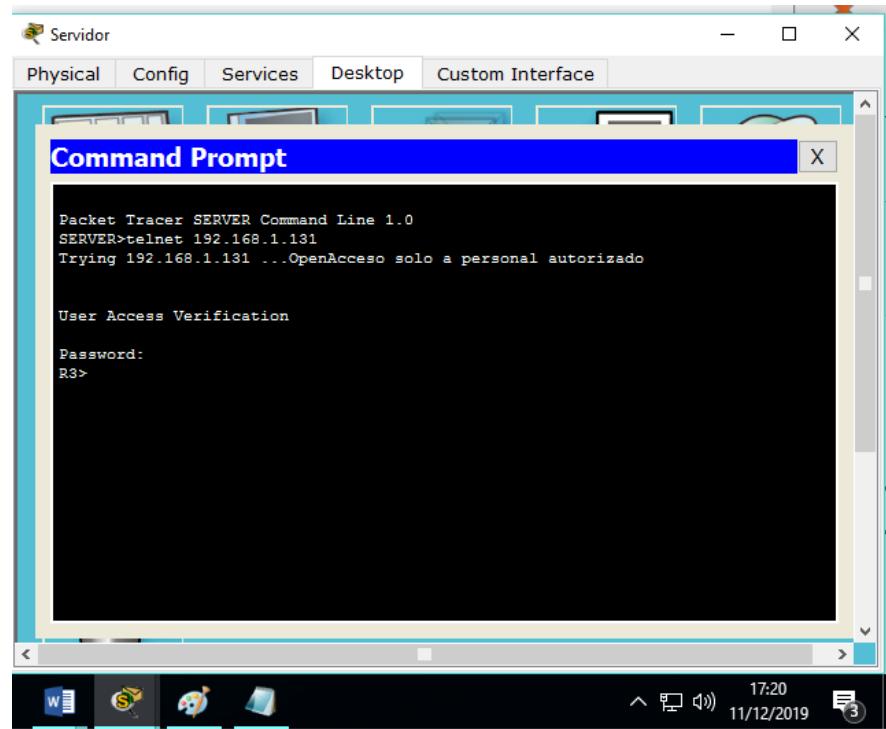


Figura 36. Telnet servidor a router Cali.

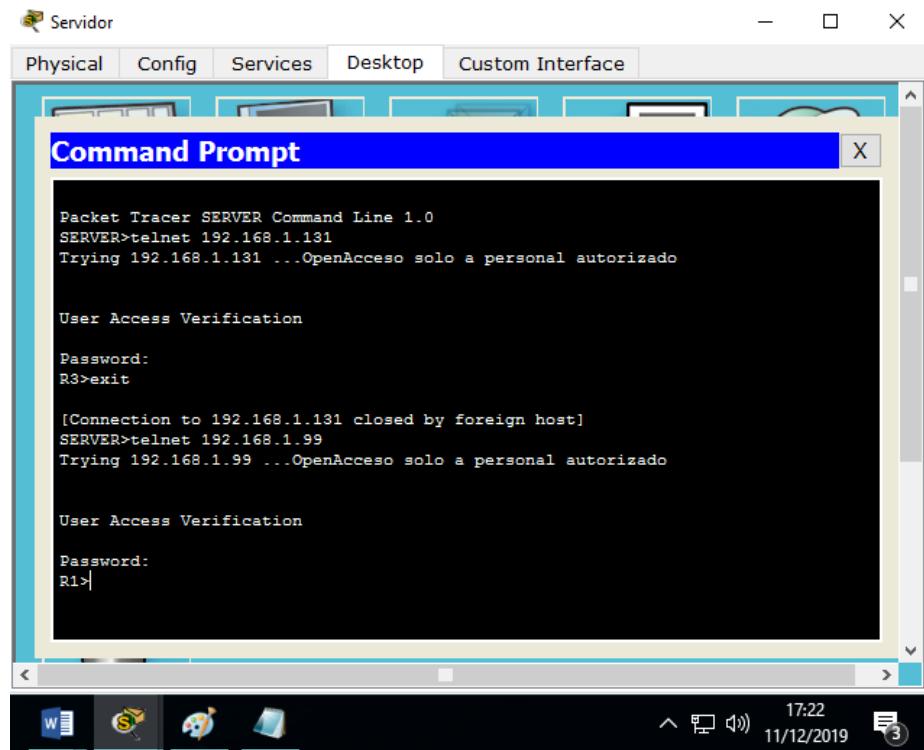


Figura 37. Telnet servidor a router Medellín.

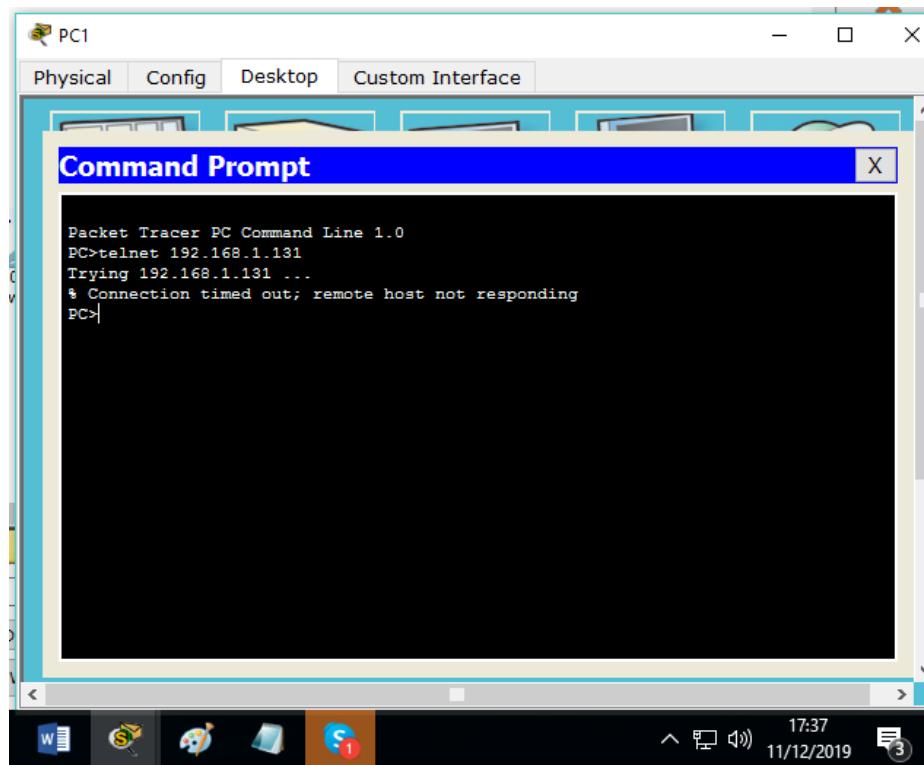


Figura 38. LAN del router Medellín a router Cali.

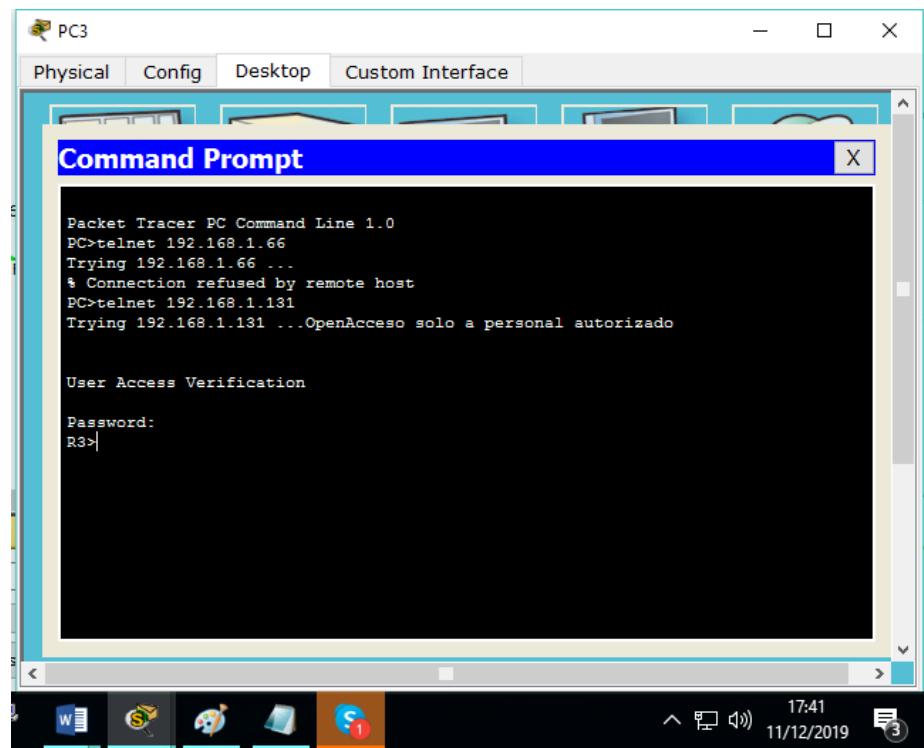


Figura 39. LAN del router Cali a router Cali.

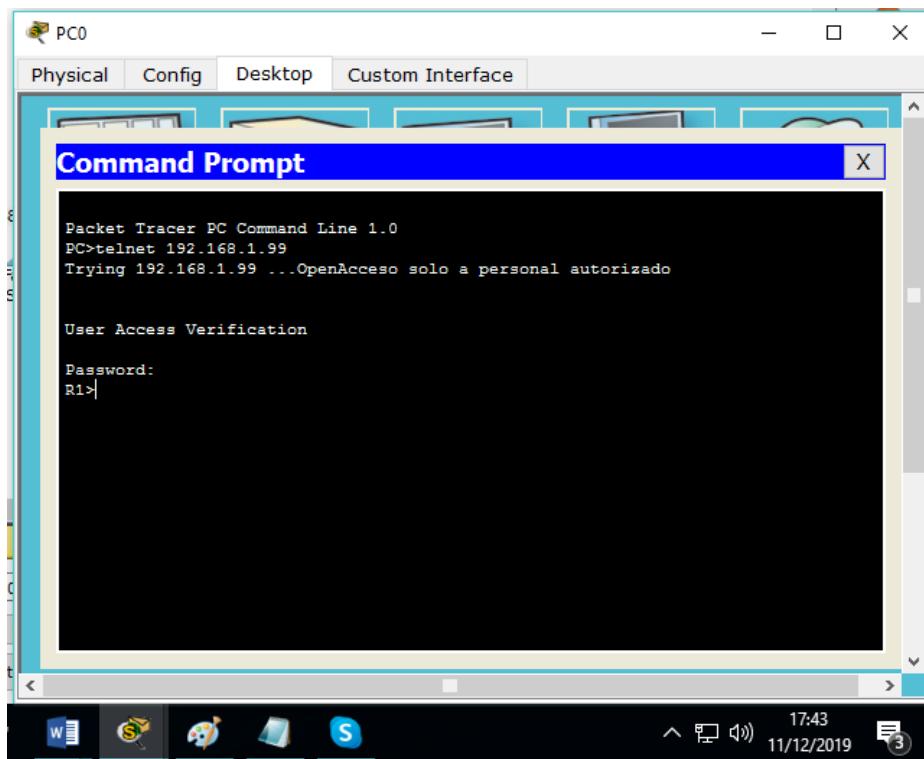


Figura 40. LAN del router Medellín a router Medellín.

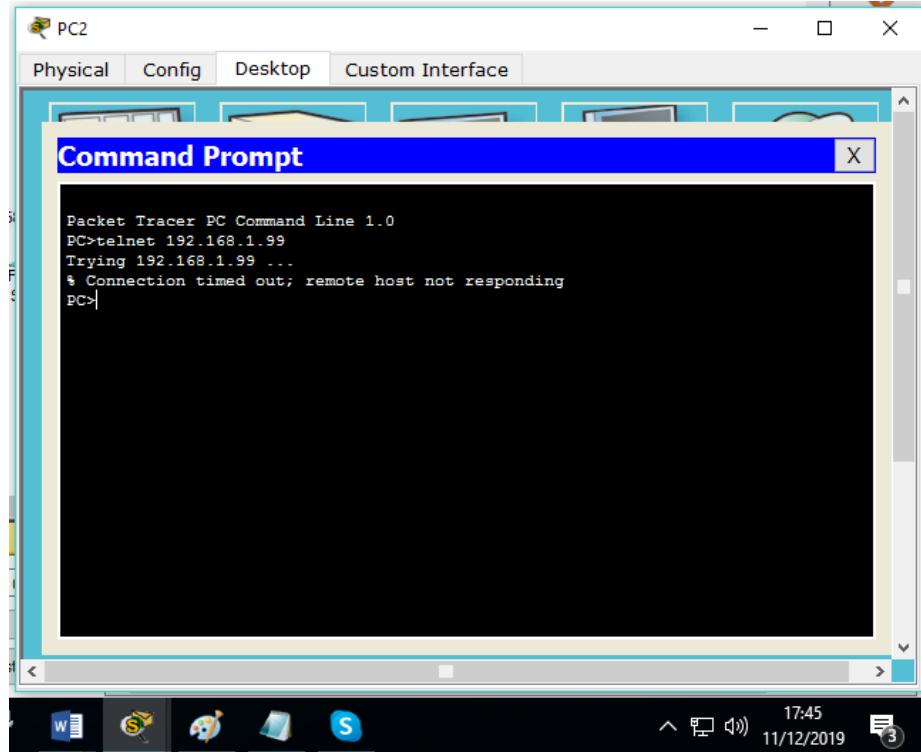


Figura 41. LAN del Router Cali a router Medellín.

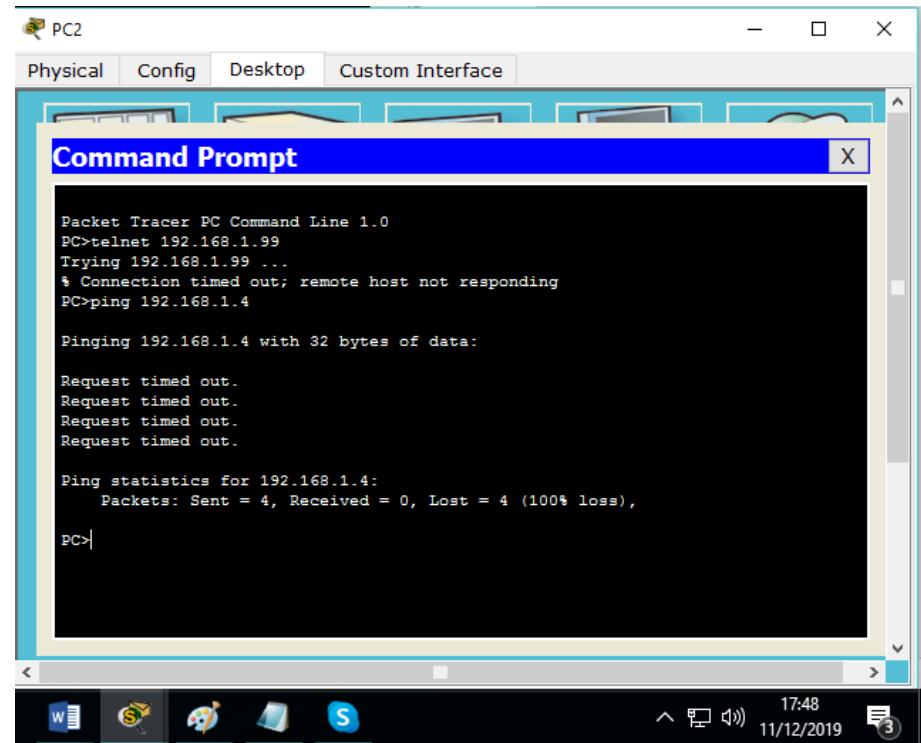


Figura 42. LAN del router Cali WS\_1.

PC>telnet 192.168.1.99  
Trying 192.168.1.99 ...OpenAcceso solo a personal autorizado

User Access Verification

Password:  
R1>exit

[Connection to 192.168.1.99 closed by foreign host]

PC>ping 192.168.1.4

Pinging 192.168.1.4 with 32 bytes of data:

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

Ping statistics for 192.168.1.4:  
Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

PC>

Figura 43. LAN del router Medellín WS\_1.

Pinging 192.168.1.4 with 32 Bytes of data.

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

Ping statistics for 192.168.1.4:  
Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

PC>ping 192.168.1.66

Pinging 192.168.1.66 with 32 bytes of data:

Reply from 192.168.1.131: Destination host unreachable.  
Reply from 192.168.1.131: Destination host unreachable.  
Reply from 192.168.1.131: Destination host unreachable.  
Reply from 192.168.1.131: Destination host unreachable.

Ping statistics for 192.168.1.66:  
Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

PC>

Figura 44. LAN del router a LAN router de Cali.

PC2

Physical Config Desktop Custom Interface

Command Prompt

```
Request timed out.  
Request timed out.  
Request timed out.  
Request timed out.  
  
Ping statistics for 192.168.1.4:  
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),  
  
PC>ping 192.168.1.7  
  
Pinging 192.168.1.7 with 32 bytes of data:  
  
Reply from 192.168.1.7: bytes=32 time=1ms TTL=126  
Reply from 192.168.1.7: bytes=32 time=2ms TTL=126  
Reply from 192.168.1.7: bytes=32 time=10ms TTL=126  
Reply from 192.168.1.7: bytes=32 time=6ms TTL=126  
  
Ping statistics for 192.168.1.7:  
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),  
    Approximate round trip times in milli-seconds:  
        Minimum = 1ms, Maximum = 10ms, Average = 4ms  
  
PC>
```

W S 17:58 11/12/2019

Figura 45. LAN del router Cali a Servidor.

PC1

Physical Config Desktop Custom Interface

Command Prompt

```
Packet Tracer PC Command Line 1.0  
PC>telnet 192.168.1.131  
Trying 192.168.1.131 ...  
% Connection timed out; remote host not responding  
PC>ping 192.168.1.7  
  
Pinging 192.168.1.7 with 32 bytes of data:  
  
Reply from 192.168.1.7: bytes=32 time=7ms TTL=126  
Reply from 192.168.1.7: bytes=32 time=8ms TTL=126  
Reply from 192.168.1.7: bytes=32 time=4ms TTL=126  
Reply from 192.168.1.7: bytes=32 time=7ms TTL=126  
  
Ping statistics for 192.168.1.7:  
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),  
    Approximate round trip times in milli-seconds:  
        Minimum = 4ms, Maximum = 8ms, Average = 6ms  
  
PC>
```

W S 17:58 11/12/2019

Figura 46. LAN del router Medellín a Servidor.

User Access Verification  
Password:  
R1>  
[Connection to 192.168.1.99 closed by foreign host]  
SERVER>ping 192.168.1.34  
Pinging 192.168.1.34 with 32 bytes of data:  
Reply from 192.168.1.34: bytes=32 time=2ms TTL=126  
Reply from 192.168.1.34: bytes=32 time=9ms TTL=126  
Reply from 192.168.1.34: bytes=32 time=6ms TTL=126  
Reply from 192.168.1.34: bytes=32 time=1ms TTL=126  
Ping statistics for 192.168.1.34:  
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),  
Approximate round trip times in milli-seconds:  
Minimum = 1ms, Maximum = 9ms, Average = 4ms  
SERVER>|

Figura 47. Servidor a LAN del router Medellín.

Reply from 192.168.1.34: bytes=32 time=0ms TTL=126  
Reply from 192.168.1.34: bytes=32 time=1ms TTL=126  
Ping statistics for 192.168.1.34:  
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),  
Approximate round trip times in milli-seconds:  
Minimum = 1ms, Maximum = 9ms, Average = 4ms  
SERVER>ping 192.168.1.66  
Pinging 192.168.1.66 with 32 bytes of data:  
Reply from 192.168.1.66: bytes=32 time=1ms TTL=126  
Reply from 192.168.1.66: bytes=32 time=2ms TTL=126  
Reply from 192.168.1.66: bytes=32 time=7ms TTL=126  
Reply from 192.168.1.66: bytes=32 time=1ms TTL=126  
Ping statistics for 192.168.1.66:  
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),  
Approximate round trip times in milli-seconds:  
Minimum = 1ms, Maximum = 7ms, Average = 2ms  
SERVER>

Figura 48. Servidor a LAN del router Cali.

The screenshot shows a Cisco IOS Command Line Interface window titled "CALI". The window has tabs for "Physical", "Config", and "CLI", with "CLI" selected. The title bar also displays "IOS Command Line Interface". The main pane shows the following command-line session:

```
R3(config-if)#
R3(config-if)#exit
R3(config)#interface Serial0/0
R3(config-if)#exit
R3(config)#exit
R3#
%SYS-5-CONFIG_I: Configured from console by console

R3#ping 192.168.1.7

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.7, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 3/4/6 ms

R3#ping 192.168.1.34

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.34, timeout is 2 seconds:
.....
Success rate is 0 percent (0/5)

R3#
```

At the bottom right of the window are "Copy" and "Paste" buttons. The taskbar at the bottom of the screen shows icons for Microsoft Word, Paint, and File Explorer, along with the system clock (18:05) and date (11/12/2019).

Figura 49. Router Cali a LAN del router Medellín.

The screenshot shows a Cisco IOS Command Line Interface window titled "MEDELLÍN". The window has tabs for "Physical", "Config", and "CLI", with "CLI" selected. The title bar also displays "IOS Command Line Interface". The main pane shows the following command-line session:

```
R1(config)#interface Serial0/0
R1(config-if)#
R1(config-if)#exit
R1(config)#interface FastEthernet0/0
R1(config-if)#
R1(config-if)#exit
R1(config)#interface Serial0/0
R1(config-if)#
R1(config-if)#exit
R1(config)#interface Serial0/0
R1(config-if)#
R1(config-if)#exit
R1(config)#
R1#
%SYS-5-CONFIG_I: Configured from console by console

R1#ping 192.168.1.66

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.66, timeout is 2 seconds:
.....
Success rate is 0 percent (0/5)

R1#
```

At the bottom right of the window are "Copy" and "Paste" buttons. The taskbar at the bottom of the screen shows icons for Microsoft Word, Paint, and File Explorer, along with the system clock (18:06) and date (11/12/2019).

Figura 50. Router Medellín a LAN del router Cali.

## 1.2. 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.

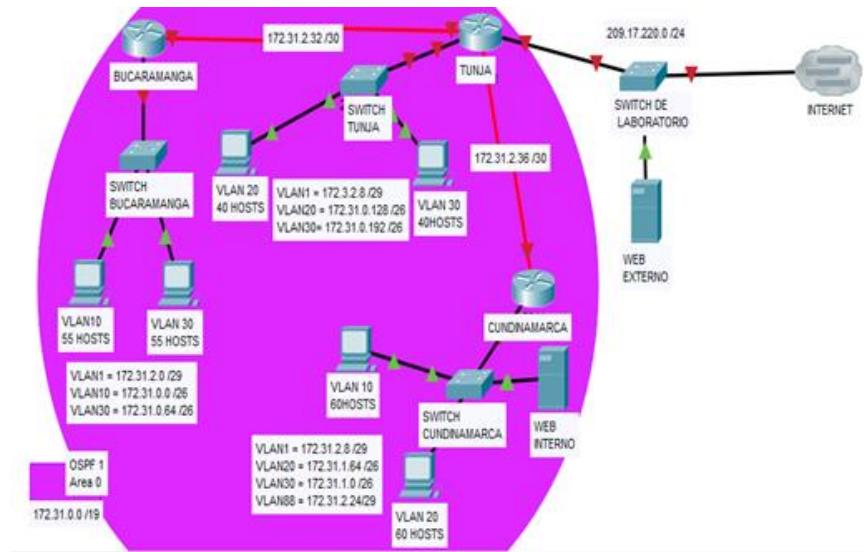


Figura 51. Topología escenario 2.

### 1.2.1. Configuraciones router Bucaramanga

#### 1.2.1.1. Básicas

```
Router>enable
Router#config terminal
Router(config)#hostname RBucaramanga
RBucaramanga (config)#no ip domain-lookup
RBucaramanga (config)#enable secret cisco
RBucaramanga (config)#line console 0
RBucaramanga (config-line)#password cisco
RBucaramanga (config-line)#login
RBucaramanga (config)#line vty 0 4
```

```
RBucaramanga (config-line)#password cisco
RBucaramanga (config-line)#login
RBucaramanga (config-line)#exit
RBucaramanga (config)#service password-encryption
RBucaramanga (config)#banner motd #Prohibido el acceso no autorizado!#
RBucaramanga (config)#exit
RBucaramanga #copy running-config startup-config
```

#### **1.2.1.2. Interfaces y seriales**

```
RBucaramanga (config)#int serial 0/0/0
RBucaramanga (config-if)# ip add 172.31.2.34 255.255.255.252
RBucaramanga (config-if)#no shutdown
RBucaramanga (config-if)#exit
```

```
RBucaramanga(config)#int g0/0.1
RBucaramanga(config-subif)#encapsulation dot1q 1
RBucaramanga(config-subif)#ip add 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 add 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 add 172.31.0.65 255.255.255.192
RBucaramanga(config-subif)#int g0/0
RBucaramanga(config-if)#no shutdown
RBucaramanga (config-if)# int serial 0/0/0
RBucaramanga(config-if)#ip address 172.31.2.34 255.255.255.252
RBucaramanga(config-if)#no shutdown

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
```

### 1.2.1.3. Autenticación AAA

```
RBucaramanga(config)#username ubucaramanga secret cisco
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
```

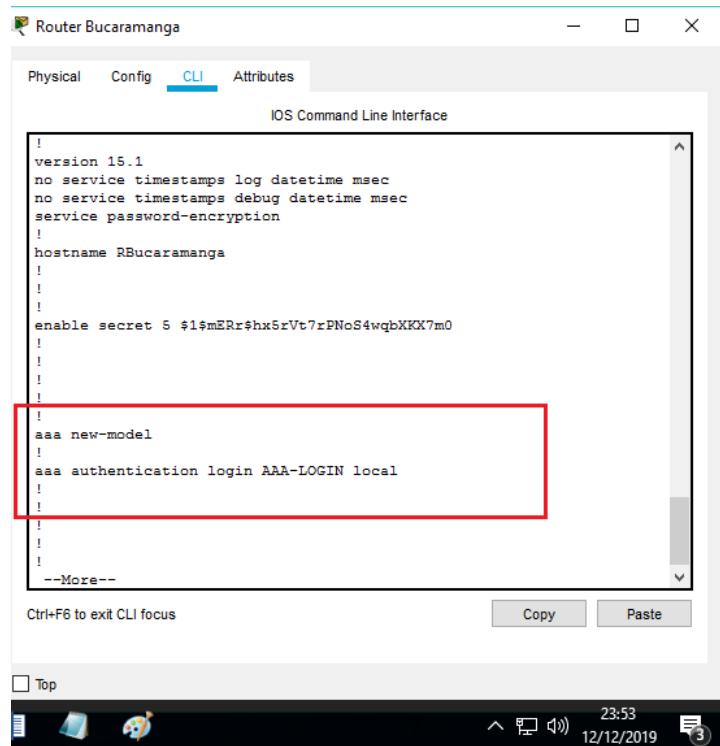


Figura 52. Verificación autenticación AAA router Bucaramanga.

#### **1.2.1.4. Número de internos y tiempo máximo al detectar ataques.**

```
RBucaramanga(config-line)#login block-for 10 attempts 3 within 60
```

#### **1.2.2. Configuraciones router Tunja**

##### **1.2.2.1. Básicas**

```
Router>enable
```

```
Router#config terminal
```

```
Router(config)#hostname RTunja
```

```
RTunja (config)#enable secret cisco
```

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

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

```
RTunja (config-line)#password cisco
```

```
RTunja (config-line)#login
```

```
RTunja (config-line)#exit
```

```
RTunja (config)#line vty 0 4
```

```
RTunja(config-line)#password cisco
```

```
RTunja(config-line)#login
```

```
RTunja (config-line)#exit
```

```
RTunja (config)#banner motd #Prohibido el acceso no autorizado!#
```

```
RTunja (config)#exit
```

```
RTunja #copy running-config startup-config
```

##### **1.2.2.2. Interfaces y seriales**

```
RTunja (config)#int serial 0/0/0
```

```
RTunja (config-if)# ip add 172.31.2.33 255.255.255.252
```

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

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

```
RTunja (config)#int serial 0/0/1
RTunja(config-if)#ip address 172.31.2.37 255.255.255.252
RTunja (config-if)#no shutdown
RTunja (config-if)#exit

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)#exit
RTunja (config)#int g0/1
RTunja(config-if)#ip address 209.165.220.1 255.255.255.0
RTunja (config-if)#no shutdown

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
```

### 1.2.2.3. Autenticación AAA

```
RTunja(config)#username utunja secret cisco
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
```

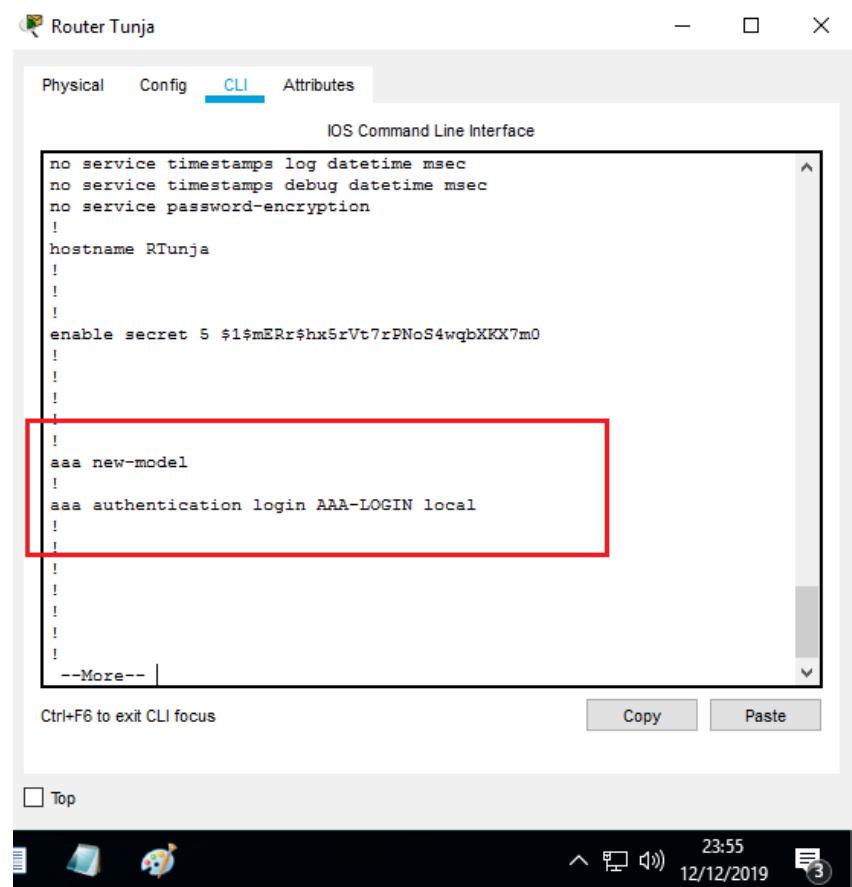


Figura 53. Verificación autenticación AAA router Tunja.

### 1.2.2.4. Número de intentos y tiempo máximo al detectar ataques.

```
RTunja(config-line)#login block-for 10 attempts 4 within 60
```

### **1.2.3. Configuraciones del router Cundinamarca**

#### **1.2.3.1. Básicas**

```
Router>enable  
Router#config terminal  
Router(config)#hostname RCundinamarca  
RCundinamarca (config)#enable secret cisco  
RCundinamarca (config)#service password-encryption  
RCundinamarca (config)#no ip domain-lookup  
RCundinamarca (config)#line console 0  
RCundinamarca (config-line)#password cisco  
RCundinamarca (config-line)#login  
RCundinamarca (config)#line vty 0 4  
RCundinamarca (config-line)#password cisco  
RCundinamarca (config-line)#login  
RCundinamarca (config-line)#exit  
RCundinamarca (config)#banner motd #Prohibido el acceso no autorizado!#  
RCundinamarca (config)#exit  
RCundinamarca #copy running-config startup-config
```

#### **1.2.3.2. Interfaces y seriales**

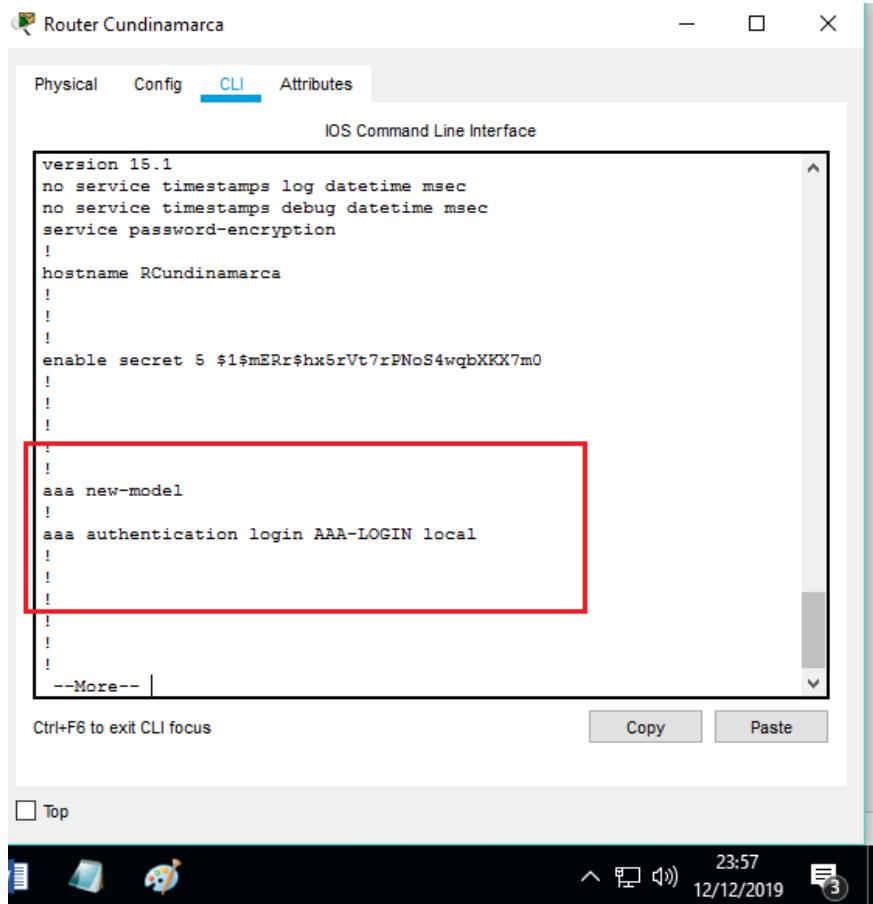
```
RCundinamarca(config)#int g0/0.1  
RCundinamarca(config-subif)#encapsulation dot1q 1  
RCundinamarca(config-subif)#ip address 172.31.2.9 255.255.255.248  
RCundinamarca(config-subif)#int g0/0.20  
RCundinamarca(config-subif)#encapsulation dot1q 20  
RCundinamarca(config-subif)#ip address 172.31.1.65 255.255.255.192  
RCundinamarca(config-subif)#int g0/0.30  
RCundinamarca(config-subif)#encapsulation dot1q 30
```

```
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)#int s0/0/0
RCundinamarca(config-if)#ip address 172.31.2.38 255.255.255.252
RCundinamarca(config-if)#no shutdown
```

```
RCundinamarca(config)#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
```

### 1.2.3.3. Autenticación AAA

```
RCundinamarca(config)#username ucundinamarca secret cisco
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
```



The screenshot shows the Router Cundinamarca configuration interface. The title bar says "Router Cundinamarca". Below it, there are tabs: Physical, Config, **CLI**, and Attributes. The main area is titled "IOS Command Line Interface". The configuration code is as follows:

```
version 15.1
no service timestamps log datetime msec
no service timestamps debug datetime msec
service password-encryption
!
hostname RCundinamarca
!
!
enable secret 5 $1$mERr$hx5rVt7rPNoS4wqbXKX7m0
!
!
!
!
aaa new-model
!
aaa authentication login AAA-LOGIN local
!
!
!
!
--More--
```

A red box highlights the "aaa new-model" and "aaa authentication" lines. At the bottom of the window, there are "Copy" and "Paste" buttons. The taskbar at the bottom shows icons for File, Edit, and Help, along with system status: 23:57, 12/12/2019, and a notification icon with a '3'.

Figura 54. Verificación autenticación AAA router Cundinamarca.

#### 1.2.3.4. Número de intentos y tiempo máximo al detectar ataque

RCundinamarca(config-line)#login block-for 10 attempts 4 within 60

### 1.2.4. Configuraciones del switch Bucaramanga

#### 1.2.4.1. Básicas

Switch>enable

Switch#conf term

Switch(config)#hostname SBucaramanga

SBucaramanga (config)#enable password cisco

SBucaramanga (config)#line console 0

```
SBucaramanga (config-line)# exec-timeout 6 0
SBucaramanga (config-line)# logging synchronous
SBucaramanga (config-line)#password cisco
SBucaramanga (config-line)#login
SBucaramanga (config-line)#line vty 0 15
SBucaramanga (config-line)# exec-timeout 6 0
SBucaramanga (config-line)# logging synchronous
SBucaramanga (config-line)#password cisco
SBucaramanga (config-line)#login
SBucaramanga (config-line)#exit
SBucaramanga (config)#exit
SBucaramanga #copy running-config startup-config
```

#### **1.2.4.2. Vlans switch**

```
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
```

```

Switch Bucaramanga
Physical Config CLI Attributes
IOS Command Line Interface

Fa0/17, Fa0/18
Fa0/21, Fa0/22
Gig0/2
10 VLAN0010      active   Fa0/10
30 VLAN0030      active   Fa0/14
1002 fddi-default active
1003 token-ring-default active
1004 fddinet-default active
1005 trnet-default active

VLAN Type SAID      MTU Parent RingNo BridgeNo Stp BrdgMode
Trans1 Trans2
----- -----
1 enet 100001      1500 -     -     -     -     -     0
0
10 enet 100010      1500 -     -     -     -     -     0
0
30 enet 100030      1500 -     -     -     -     -     0
0
1002 fddi 101002    1500 -     -     -     -     -     0
0
--More-- |
```

Ctrl+F6 to exit CLI focus     

Top

23:41 12/12/2019 [Icons]

Figura 55. Verificación vlans Switch Bucaramanga.

## 1.2.5. Configuraciones del switch Tunja

### 1.2.5.1. Básicas

```

Switch>enable
Switch#conf term
Switch(config)#hostname STunja
STunja (config)#enable password cisco
STunja (config)#line console 0
STunja (config-line)# exec-timeout 6 0
STunja (config-line)# logging synchronous
STunja (config-line)#password cisco
STunja (config-line)#login
```

```
STunja (config-line)#line vty 0 15
STunja (config-line)# exec-timeout 6 0
STunja (config-line)# logging synchronous
STunja (config-line)#password cisco
STunja (config-line)#login
STunja (config-line)#exit
STunja (config)#exit
STunja #copy running-config startup-config
```

### **1.2.5.2. Vlans switch**

```
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)#int vlan 1
STunja(config-if)#ip address 172.3.2.11 255.255.255.248
STunja(config-if)#no shutdown
STunja(config-if)#ip default-gateway 172.3.2.9
STunja(config-if)#exit
```

The screenshot shows the Cisco IOS Command Line Interface (CLI) window titled "Switch Tunja". The "CLI" tab is selected. The output displays VLAN configuration information:

```

Fa0/17, Fa0/18
Fa0/19, Fa0/20,
Fa0/21, Fa0/22
Fa0/23, Fa0/24,
Gig0/2
20  VLAN0020          active   Fa0/10
30  VLAN0030          active   Fa0/14
1002 fddi-default      active
1003 token-ring-default active
1004 fddinet-default   active
1005 trnet-default     active

VLAN Type SAID        MTU    Parent RingNo BridgeNo Stp  BrdgMode
Trans1 Trans2
-----
1  enet  100001       1500   -     -     -     -     -     0
0
20 enet  100020       1500   -     -     -     -     -     0
0
30 enet  100030       1500   -     -     -     -     -     0
0
1002 fddi 101002      1500   -     -     -     -     -     0
0
--More--

```

At the bottom of the CLI window, there are "Copy" and "Paste" buttons. The taskbar at the bottom right shows the date and time as 23:47 12/12/2019.

Figura 56. Verificación vlans switch Tunja.

## 1.2.6. Configuraciones switch Cundinamarca

### 1.2.6.1. Básicas

Switch>enable

Switch#conf term

Switch(config)#hostname SCundinamarca

SCundinamarca (config)#enable password cisco

SCundinamarca (config)#line console 0

SCundinamarca (config-line)# exec-timeout 6 0

SCundinamarca (config-line)# logging synchronous

SCundinamarca (config-line)#password cisco

SCundinamarca (config-line)#login

```
SCundinamarca (config-line)#line vty 0 15
SCundinamarca (config-line)# exec-timeout 6 0
SCundinamarca (config-line)# logging synchronous
SCundinamarca (config-line)#password cisco
SCundinamarca (config-line)#login
SCundinamarca (config-line)#exit
SCundinamarca (config)#exit
SCundinamarca #copy running-config startup-config
```

#### **1.2.6.2. Vlans switch**

```
SCundinamarca(config)#vlan 1
SCundinamarca(config-vlan)#vlan 20
SCundinamarca(config-vlan)#vlan 30
SCundinamarca(config-vlan)#vlan 88
SCundinamarca(config-vlan)#exit
SCundinamarca(config)#int f0/10
SCundinamarca(config-if)#switchport mode access
SCundinamarca(config-if)#switchport access vlan 20
SCundinamarca(config-if)#int fa0/14
SCundinamarca(config-if)#switchport mode access
SCundinamarca(config-if)#switchport access vlan 30
SCundinamarca(config-if)#int fa0/20
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)#int vlan 1
SCundinamarca(config-if)#ip address 172.31.2.11 255.255.255.248
SCundinamarca(config-if)#no shutdown
```

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

```
Switch Cundinamarca  
Physical Config CLI Attributes  
IOS Command Line Interface  
Fa0/12, Fa0/13 Fa0/15, Fa0/16,  
Fa0/17, Fa0/18 Fa0/19, Fa0/21,  
Fa0/22, Fa0/23 Fa0/24, Gig0/2  
20 VLAN0020 active Fa0/10  
30 VLAN0030 active Fa0/14  
88 VLAN0088 active Fa0/20  
1002 fddi-default active  
1003 token-ring-default active  
1004 fddinet-default active  
1005 trnet-default active  
  
VLAN Type SAID MTU Parent RingNo BridgeNo Stp BrdgMode  
Trans1 Trans2  
---- ----- ---- - - - - -  
1 enet 100001 1500 - - - - - 0  
0  
20 enet 100020 1500 - - - - - 0  
0  
30 enet 100030 1500 - - - - - 0  
0  
--More-- |  
Ctrl+F6 to exit CLI focus Copy Paste  
Top  
23:08 12/12/2019
```

Figura 57. Verificación vlans switch Cundinamarca.

### 1.2.7. Servidor TFTP (web interno) y almacenamiento de archivos de routers.

Con el siguiente comando podemos copiar configuración del router al tftp server.

#### 1.2.7.1. Router Cundinamarca

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

```
[OK - 1747 bytes]
1747 bytes copied in 3.011 secs (580 bytes/sec)
RCundinamarca#copy running-config tftp
Address or name of remote host []? 172.31.2.27
Destination filename [RCundinamarca-cfg]?
Writing running-config...!!
[OK - 1747 bytes]
```

### **1.2.7.2. Router Tunja**

```
RTunja>enable
Password:
RTunja#copy running-config tftp
Address or name of remote host []? 172.31.2.27
Destination filename [RTunja-cfg]?
Writing running-config...!!
[OK - 1634 bytes]
1634 bytes copied in 0.005 secs (326800 bytes/sec)
```

### **1.2.7.3. Router Bucaramanga**

```
RBucaramanga>enable
Password:
RBucaramanga#copy running-config tftp
Address or name of remote host []? 172.31.2.27
Destination filename [RBucaramanga-cfg]?
Writing running-config...!!
[OK - 1591 bytes]
1591 bytes copied in 0.001 secs (1591000 bytes/sec)
```

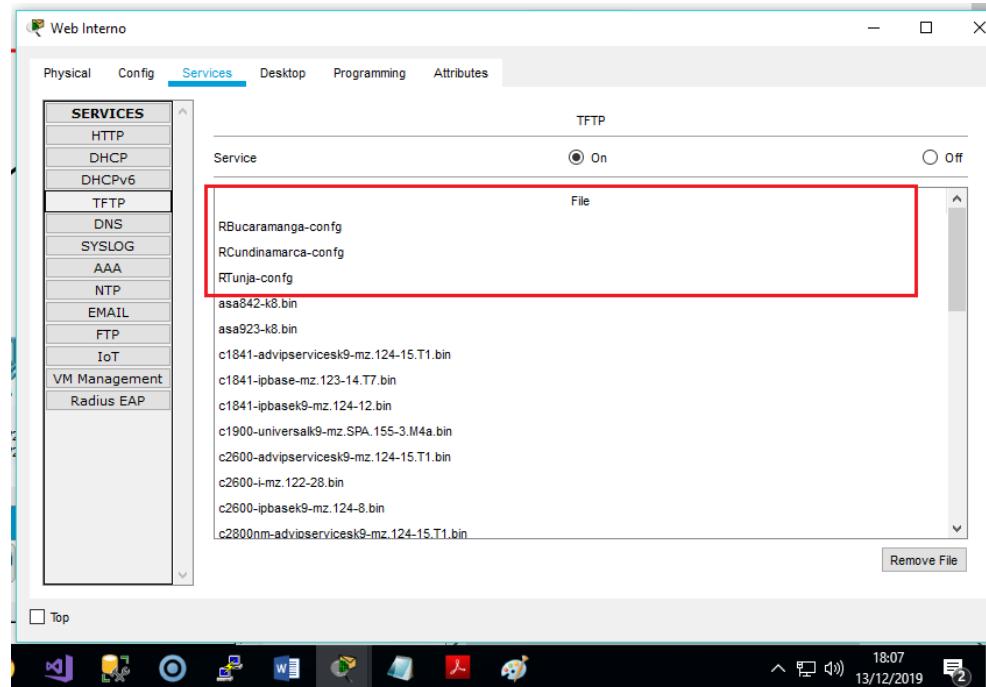


Figura 58. Almacenamiento de archivos TFTP.

## 1.2.8. Proporcionando solo direcciones a los hosts de Bucaramanga y Cundinamarca

### 1.2.8.1. Router Bucaramanga

```
RBucaramanga#conf term
Enter configuration commands, one per line. End with CNTL/Z.
RBucaramanga(config)#interface 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
```

### 1.2.8.2. Router Cundinamarca

```
RTunja#conf term
```

```
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)#end
```

### **1.2.8.3. Router Tunja**

```
RCundinamarca#conf term
Enter configuration commands, one per line. End with CNTL/Z.
RCundinamarca(config)#int g0/0.20
RCundinamarca(config-subif)#ip helper-address 172.31.2.37
RCundinamarca(config-subif)#int g0/0.30
RCundinamarca(config-subif)#ip helper-address 172.31.2.37
RCundinamarca(config-subif)#end
```

### **1.2.9. Web server con NAT estático y equipos con NAT de sobrecarga (PAT).**

Para este caso debemos hacer la configuración en el router de Tunja, de la siguiente forma:

#### **1.2.9.1. Router Tunja**

```
RTunja#conf term
```

```
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#wr

Building configuration...

[OK]

```
Router Bucaramanga
Physical Config CLI Attributes
IOS Command Line Interface

Password:
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, 00:04:01, 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, 00:04:01,
Serial0/0/0
O     172.31.0.192/26 [110/65] via 172.31.2.33, 00:04:01,
Serial0/0/0
O     172.31.1.0/26 [110/129] via 172.31.2.33, 00:03:51,
Serial0/0/0
O     172.31.1.64/26 [110/129] via 172.31.2.33, 00:03:51,
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, 00:03:51,
Serial0/0/0
O     172.31.2.24/29 [110/129] via 172.31.2.33, 00:03:51,
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, 00:04:01,
Serial0/0/0
O*E2 0.0.0.0/0 [110/1] via 172.31.2.33, 00:01:34, Serial0/0/0

Ctrl+F6 to exit CLI focus           Copy           Paste
                                         ^   18:25
                                         13/12/2019
```

Figura 59. Configuración NAT router Bucaramanga.

```

Router Tunja
Physical Config CLI Attributes
IOS Command Line Interface

(Router)
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, 00:05:18, Serial0/0/0
O       172.31.0.64/26 [110/65] via 172.31.2.34, 00:05:18,
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       172.31.0.1/26 [110/65] via 172.31.2.38, 00:05:18, Serial0/0/1
O       172.31.1.64/26 [110/65] via 172.31.2.38, 00:05:18,
Serial0/0/1
O       172.31.2.0/29 [110/65] via 172.31.2.34, 00:05:18, Serial0/0/0
O       172.31.2.8/29 [110/65] via 172.31.2.38, 00:05:18, Serial0/0/1
      172.31.2.24/29 [110/65] via 172.31.2.38, 00:05:18,
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

```

Ctrl+F6 to exit CLI focus      Copy      Paste

18:26 13/12/2019

Figura 60. Configuración NAT router Tunja.

```

Router Cundinamarca
Physical Config CLI Attributes
IOS Command Line Interface

Password:
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, 00:07:24, Serial0/0/0
      172.31.0.0/16 is variably subnetted, 15 subnets, 4 masks
O       172.31.0.0/26 [110/129] via 172.31.2.37, 00:07:24,
Serial0/0/0
O       172.31.0.64/26 [110/129] via 172.31.2.37, 00:07:24,
Serial0/0/0
O       172.31.0.128/26 [110/65] via 172.31.2.37, 00:07:24,
Serial0/0/0
O       172.31.0.192/26 [110/65] via 172.31.2.37, 00:07:24,
Serial0/0/0
C       172.31.1.0/26 is directly connected, GigabitEthernet0/0.30
L       172.31.1.1/32 is directly connected, GigabitEthernet0/0.30
C       172.31.1.64/26 is directly connected, GigabitEthernet0/0.20
L       172.31.1.65/32 is directly connected, GigabitEthernet0/0.20
O       172.31.2.0/29 [110/129] via 172.31.2.37, 00:07:24,
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, 00:07:24,
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 [110/0] via 172.31.2.37, 00:05:02, Serial0/0/0

```

Ctrl+F6 to exit CLI focus      Copy      Paste

18:28 13/12/2019

Figura 61. Configuración NAT router Cundinamarca.

## 1.2.10. El enrutamiento deberá tener autenticación.

### 1.2.10.1. Router Bucaramanga

RBucaramanga#configure terminal

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

RBucaramanga(config)#interface s0/0/0

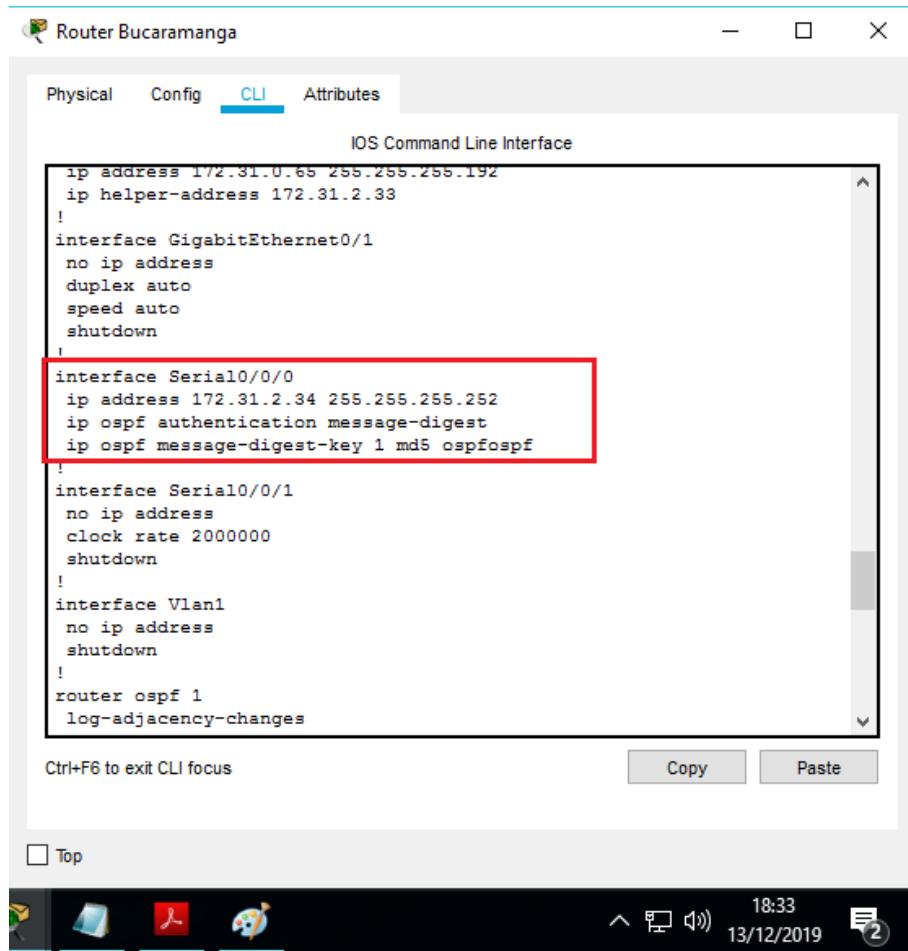
RBucaramanga(config-if)#ip ospf authentication message-digest

RBucaramanga(config-if)#ip ospf message-digest-key 1 md5 ospfospf

RBucaramanga(config-if)#exit

RBucaramanga(config)#exit

RBucaramanga#



The screenshot shows the CLI interface for 'Router Bucaramanga'. The 'CLI' tab is selected. The configuration text is as follows:

```
ip address 172.31.0.65 255.255.255.192
ip helper-address 172.31.2.33
!
interface GigabitEthernet0/1
no ip address
duplex auto
speed auto
shutdown
!
interface Serial0/0/0
ip address 172.31.2.34 255.255.255.252
ip ospf authentication message-digest
ip ospf message-digest-key 1 md5 ospfospf
!
interface Serial0/0/1
no ip address
clock rate 2000000
shutdown
!
interface Vlan1
no ip address
shutdown
!
router ospf 1
log-adjacency-changes
```

A red box highlights the configuration for interface Serial0/0/0, specifically the lines:

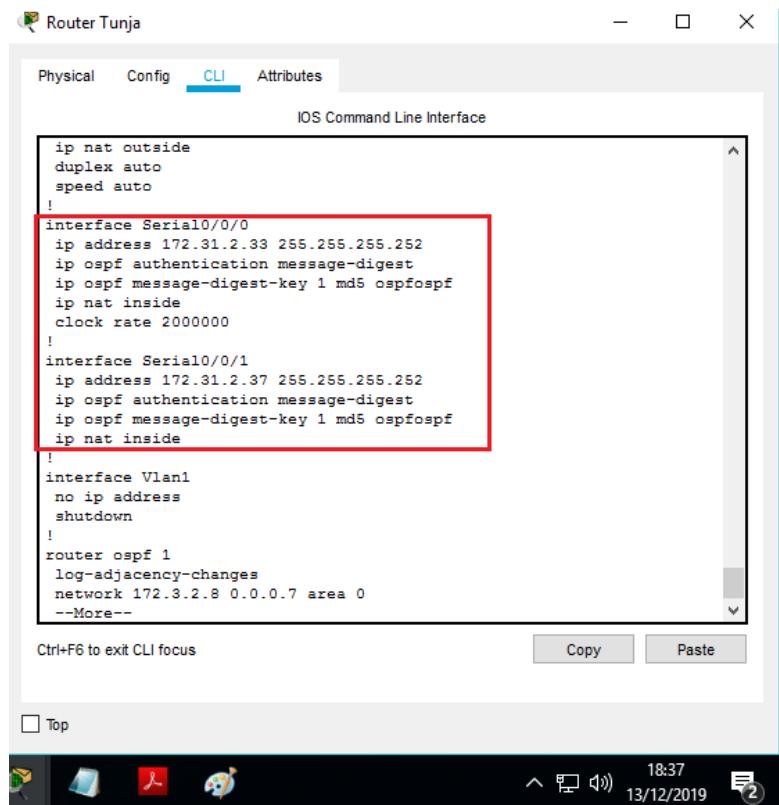
```
ip ospf authentication message-digest
ip ospf message-digest-key 1 md5 ospfospf
```

At the bottom of the window, there are 'Copy' and 'Paste' buttons, and a status bar showing 'Ctrl+F6 to exit CLI focus', the time '18:33', the date '13/12/2019', and a notification icon with the number '2'.

Figura 62. Autenticación de enrutamiento router Bucaramanga.

### 1.2.10.2. Router Tunja

```
RTunja#configure terminal
RTunja(config)#interface 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)#
00:15:10: %OSPF-5-ADJCHG: Process 1, Nbr 172.31.2.34 on Serial0/0/0 from
LOADING to FULL, Loading Done
interface s0/0/1
RTunja(config-if)#interface 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)#end
```



```
Router Tunja
Physical Config CLI Attributes
IOS Command Line Interface
ip nat outside
duplex auto
speed auto
!
interface Serial0/0/0
ip address 172.31.2.33 255.255.255.252
ip ospf authentication message-digest
ip ospf message-digest-key 1 md5 ospfospf
ip nat inside
clock rate 2000000
!
interface Serial0/0/1
ip address 172.31.2.37 255.255.255.252
ip ospf authentication message-digest
ip ospf message-digest-key 1 md5 ospfospf
ip nat inside
!
interface Vlan1
no ip address
shutdown
!
router ospf 1
log-adjacency-changes
network 172.3.2.8 0.0.0.7 area 0
--More--
Ctrl+F6 to exit CLI focus
Copy Paste
Top
```

Figura 63. Autenticación de enrutamiento router Tunja.

### 1.2.10.3. Router Cundinamarca

RCundinamarca#configure terminal

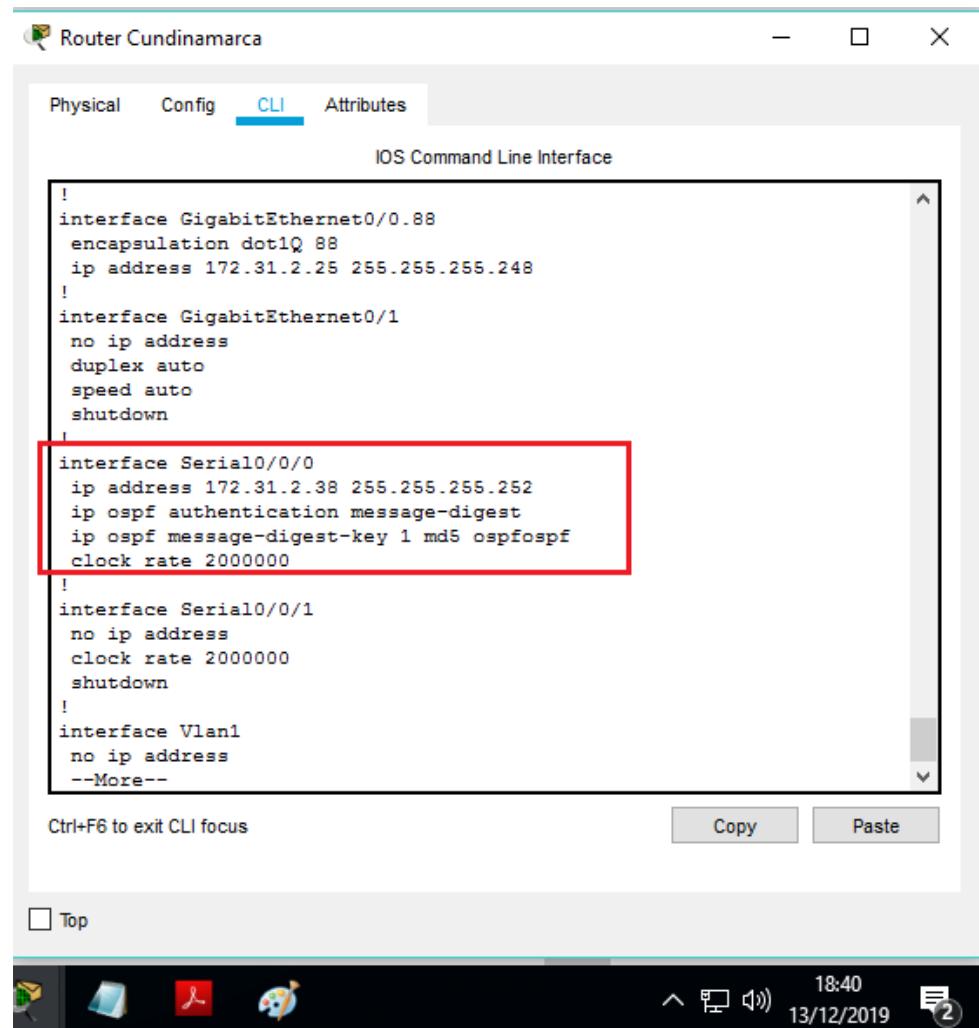
Enter configuration commands, one per line. End with CNTL/Z.

RCundinamarca(config)#interface 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)#end



```
!
interface GigabitEthernet0/0.88
 encapsulation dot1Q 88
 ip address 172.31.2.25 255.255.255.248
!
interface GigabitEthernet0/1
 no ip address
 duplex auto
 speed auto
 shutdown
!
interface Serial0/0/0
 ip address 172.31.2.38 255.255.255.252
 ip ospf authentication message-digest
 ip ospf message-digest-key 1 md5 ospfospf
 clock rate 2000000
!
interface Serial0/0/1
 no ip address
 clock rate 2000000
 shutdown
!
interface Vlan1
 no ip address
--More--
```

Ctrl+F6 to exit CLI focus

Copy

Paste

Top

18:40  
13/12/2019

Figura 64. Autenticación de enrutamiento router Cundinamarca.

### 1.2.11. Listas de control de acceso:

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

Configuración que debe realizarse en el router Cundinamarca.

```
RCundinamarca#conf term
```

```
RCundinamarca(config)#access-list 152 deny ip 172.31.1.64 0.0.0.63
209.165.220.0 0.0.0.255
RCundinamarca(config)#access-list 152 permit udp any any eq bootps
RCundinamarca(config)#access-list 152 permit ip any any
RCundinamarca(config)#int g0/0.20
RCundinamarca(config-subif)#ip access-group 152 in
RCundinamarca(config-subif)#end
```

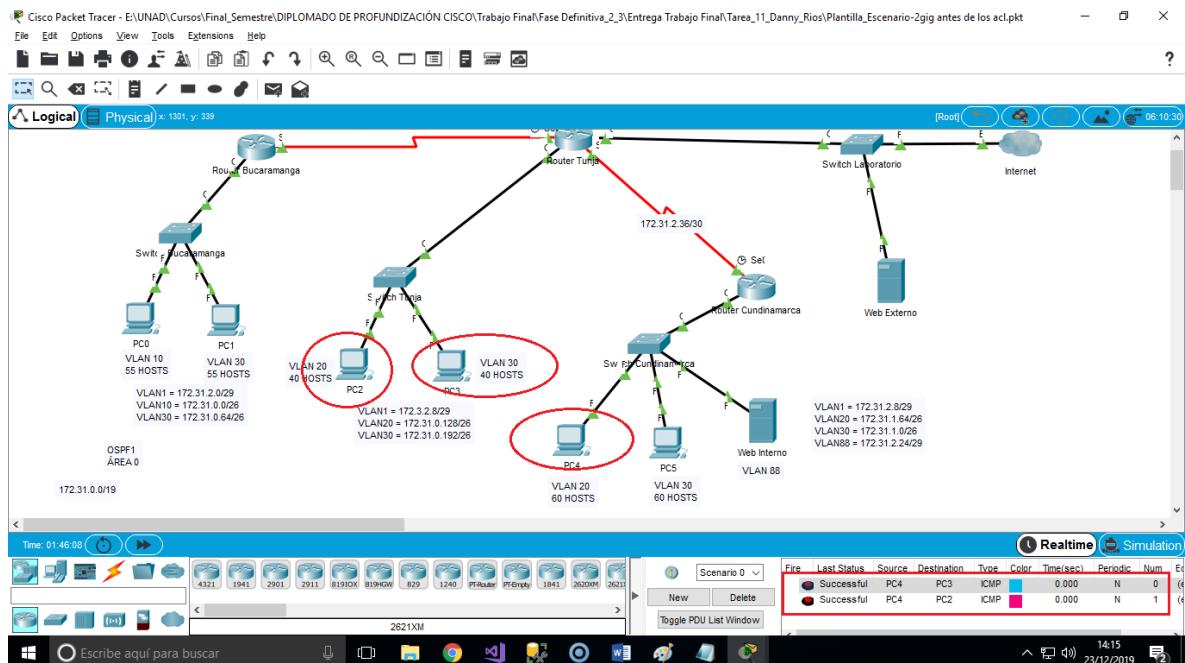


Figura 65. ACL vlan 20 router Cundinamarca a red interna Tunja.

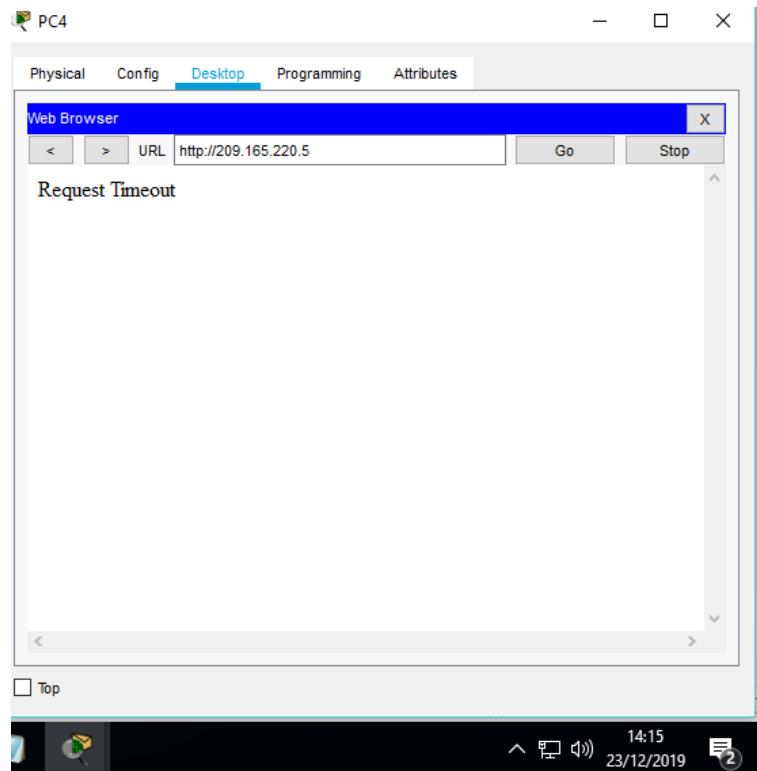


Figura 66. ACL pc vlan 20 sin acceso a internet.

- Los hosts de VLAN 30 en Cundinamarca si acceden a internet y no a la red interna de Tunja.

Configuración que debe realizarse en el router Cundinamarca.

```
RCundinamarca#conf term
```

```
RCundinamarca(config)#access-list 153 permit tcp 172.31.1.0 0.0.0.63 host  
209.165.220.5 eq 80
```

```
RCundinamarca(config)#access-list 153 deny ip any any
```

```
RCundinamarca(config)#int g0/0.30
```

```
RCundinamarca(config-subif)#ip access-group 153 in
```

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

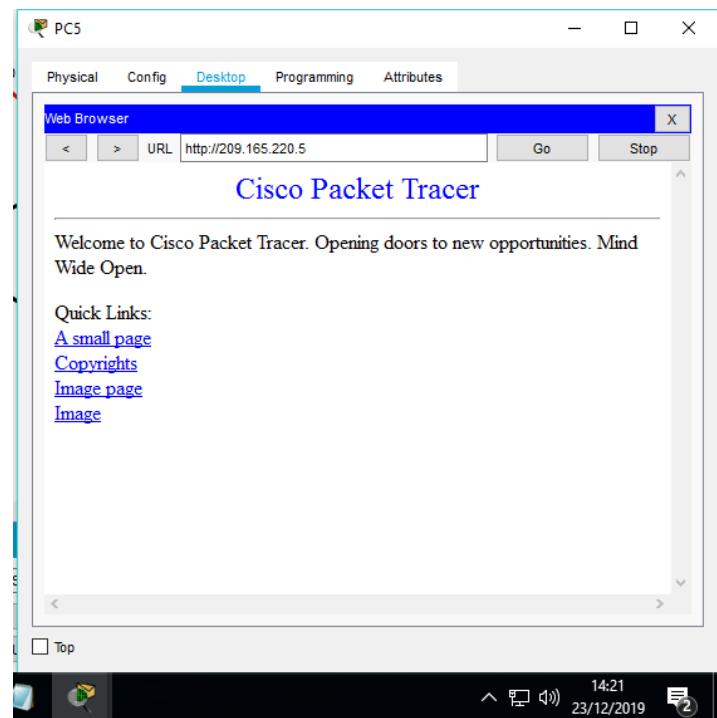


Figura 67. ACL pc vlan 30 Cundinamarca con acceso a internet.

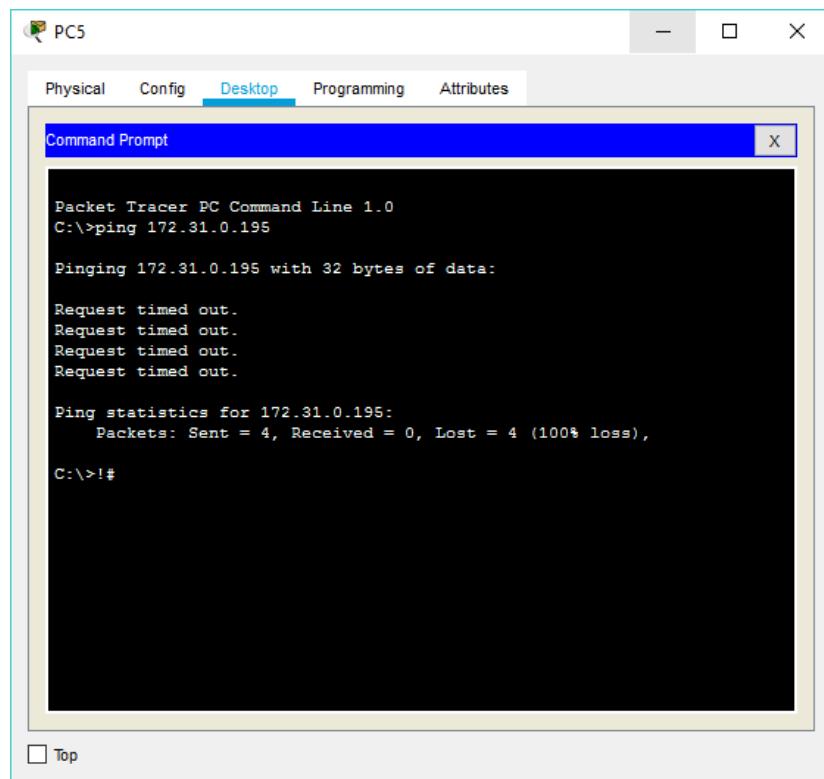


Figura 68. ACL pc vlan 30 Cundinamarca a pc red de Tunja.

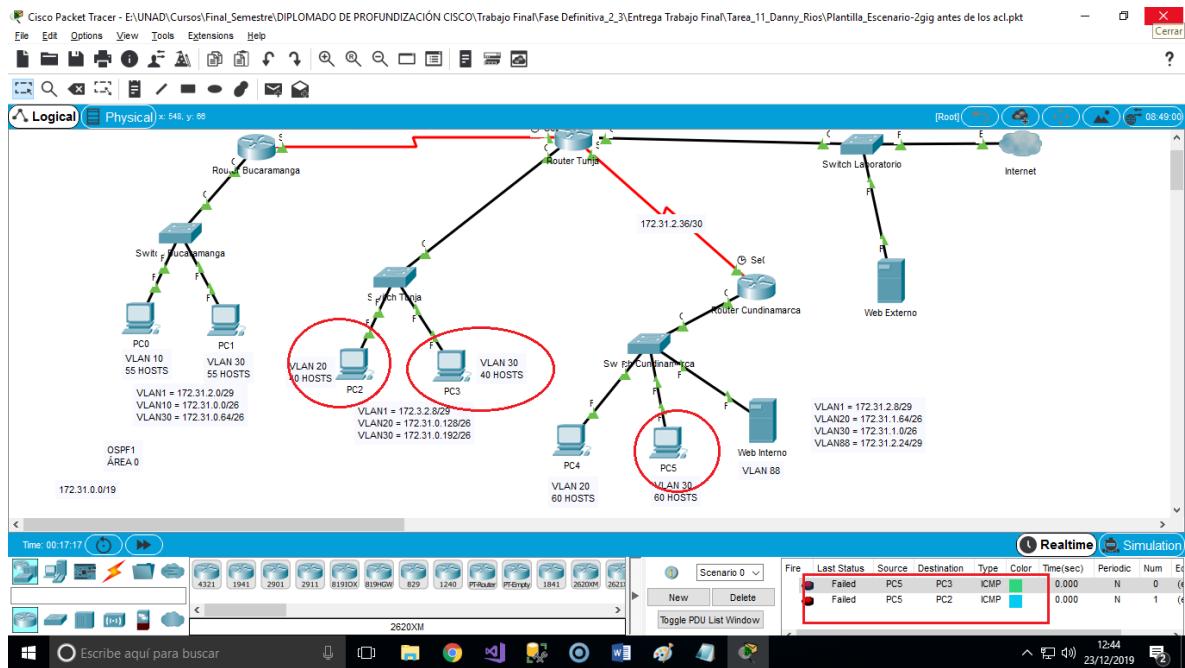


Figura 69. Mensajes vlan 30 Cundinamarca a pc red de Tunja.

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

Configuración que debe realizarse en el router Tunja.

RTunja#configure terminal

```
RTunja(config)#access-list 152 permit tcp 172.31.0.192 0.0.0.63 209.165.220.5
0.0.0.255 eq 80
```

```
RTunja(config)#access-list 152 permit tcp 172.31.0.192 0.0.0.63 209.165.220.5
0.0.0.255 eq 21
```

```
RTunja(config)#int g0/0.30
```

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

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

The screenshot shows a Windows desktop environment with a window titled "PC3". The window has tabs: Physical, Config, Desktop (which is selected), Programming, and Attributes. Inside the window, there is a "Command Prompt" window with the following text:

```
C:\>ftp 209.165.220.5
Trying to connect...209.165.220.5
Connected to 209.165.220.5
220- Welcome to FT Ftp server
Username:cisco
331- Username ok, need password
Password:
230- Logged in
(passive mode On)
ftp>
```

The desktop taskbar at the bottom shows icons for Word, File Explorer, Task View, Task Switcher, and Paint, along with the date and time (13/12/2019, 19:09).

Figura 70. ACL vlan 30 acceso tfp.

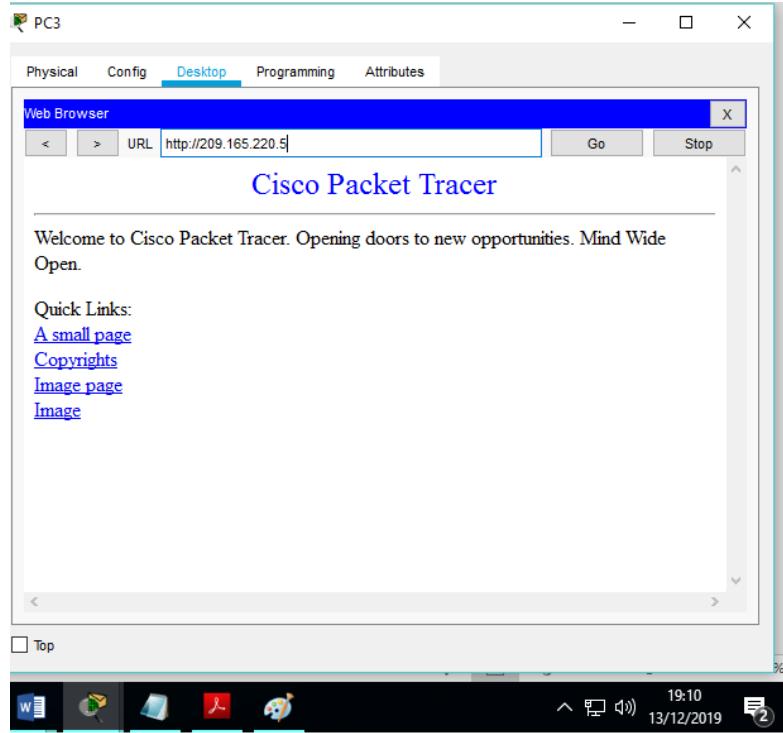


Figura 71. ACL vlan 30 acceso internet.

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

Configuración que debe realizarse en el router Tunja.

```
RTunja#conf term
```

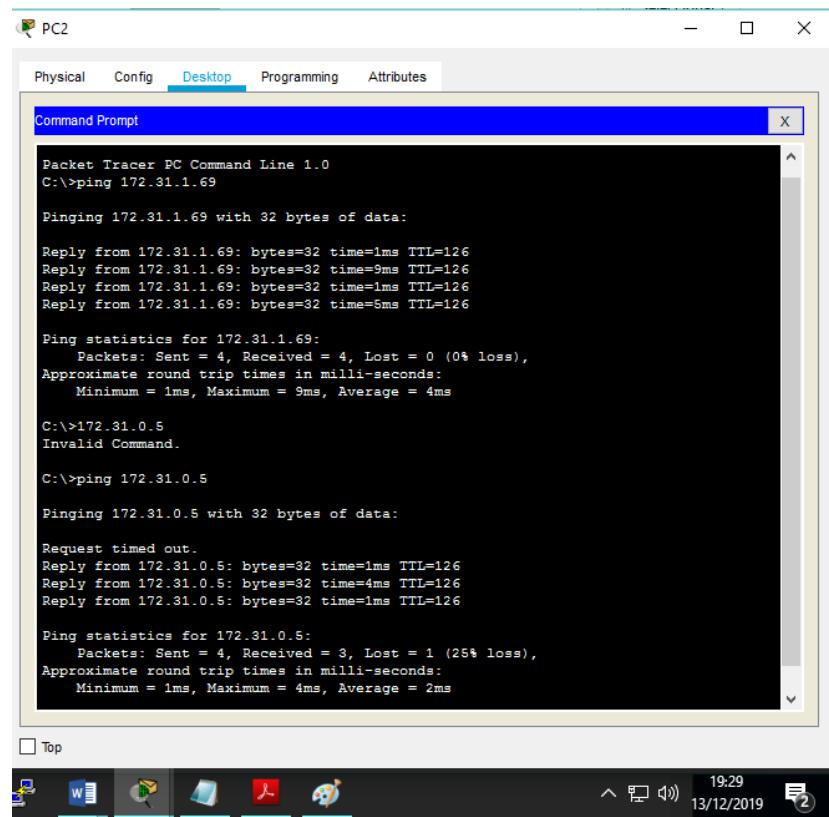
```
RTunja(config)#access-list 153 permit ip 172.31.0.128 0.0.0.63 172.31.1.64
0.0.0.63
```

```
RTunja(config)#access-list 153 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 153 in
```

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



```
PC2
Physical Config Desktop Programming Attributes
Command Prompt
Packet Tracer PC Command Line 1.0
C:>ping 172.31.1.69

Pinging 172.31.1.69 with 32 bytes of data:
Reply from 172.31.1.69: bytes=32 time=1ms TTL=126
Reply from 172.31.1.69: bytes=32 time=9ms TTL=126
Reply from 172.31.1.69: bytes=32 time=1ms TTL=126
Reply from 172.31.1.69: bytes=32 time=5ms TTL=126

Ping statistics for 172.31.1.69:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 9ms, Average = 4ms

C:>172.31.0.5
Invalid Command.

C:>ping 172.31.0.5

Pinging 172.31.0.5 with 32 bytes of data:
Request timed out.
Reply from 172.31.0.5: bytes=32 time=1ms TTL=126
Reply from 172.31.0.5: bytes=32 time=4ms TTL=126
Reply from 172.31.0.5: bytes=32 time=1ms TTL=126

Ping statistics for 172.31.0.5:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 4ms, Average = 2ms
```

Figura 72. Verificación acceso a la vlan 20 y 10

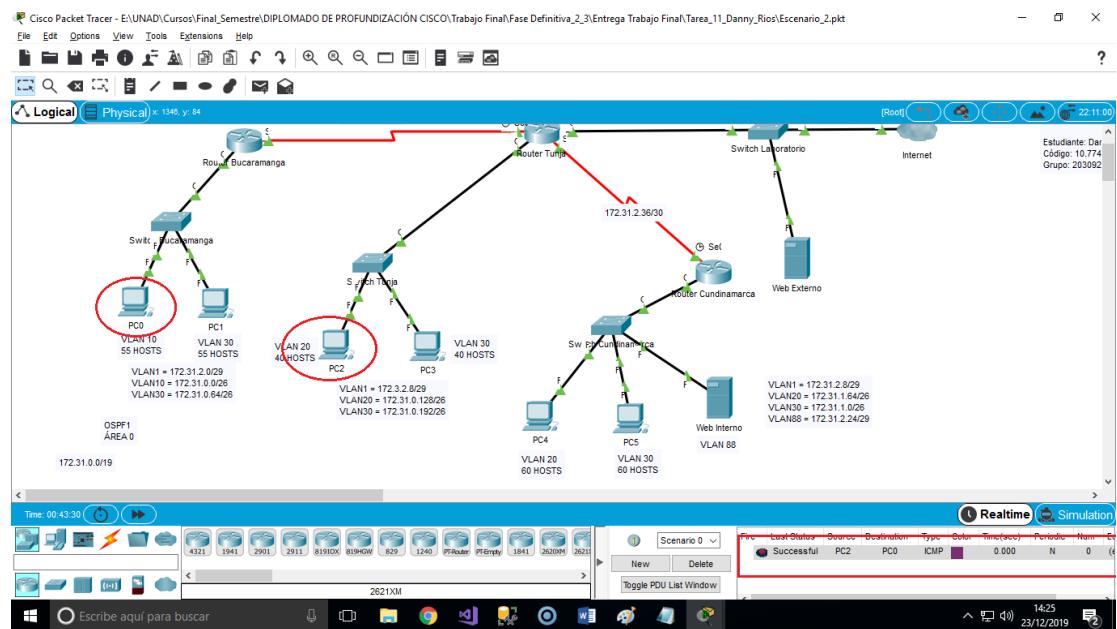


Figura 73. acceso a vlan 20 Tunja a vlan 10 Bucaramanga.

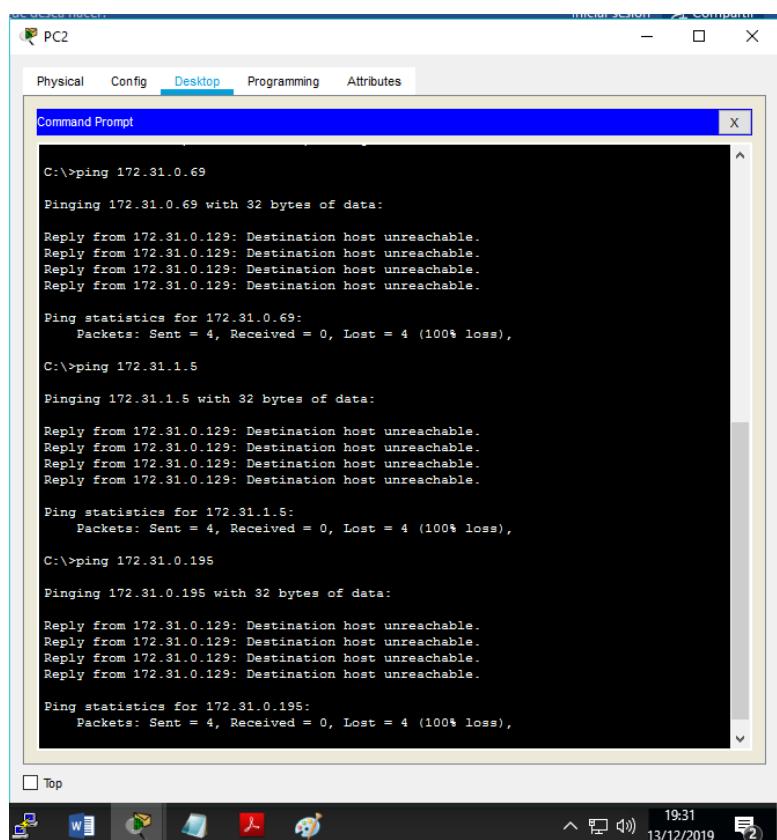


Figura 74. Verificación rechazo a vlan fuera del ACL

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

Configuración que debe realizarse en el router Bucaramanga.

```
RBucaramanga#configure terminal
```

```
RBucaramanga(config)#access-list 152 permit tcp 172.31.0.64 0.0.0.63 host
209.165.220.5 eq 80
```

```
RBucaramanga(config)#int g0/0.30
```

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

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

```
RBUCARAMANGA(config)#access-list 153 permit ip 172.31.0.64 0.0.0.63
172.31.0.0 0.0.0.63
```

```
RBUCARAMANGA(config)#access-list 153 deny ip any any
```

```
RBUCARAMANGA(config)# int g0/0.30
```

```
RBUCARAMANGA(config-subif)#ip access-group 153 in
```

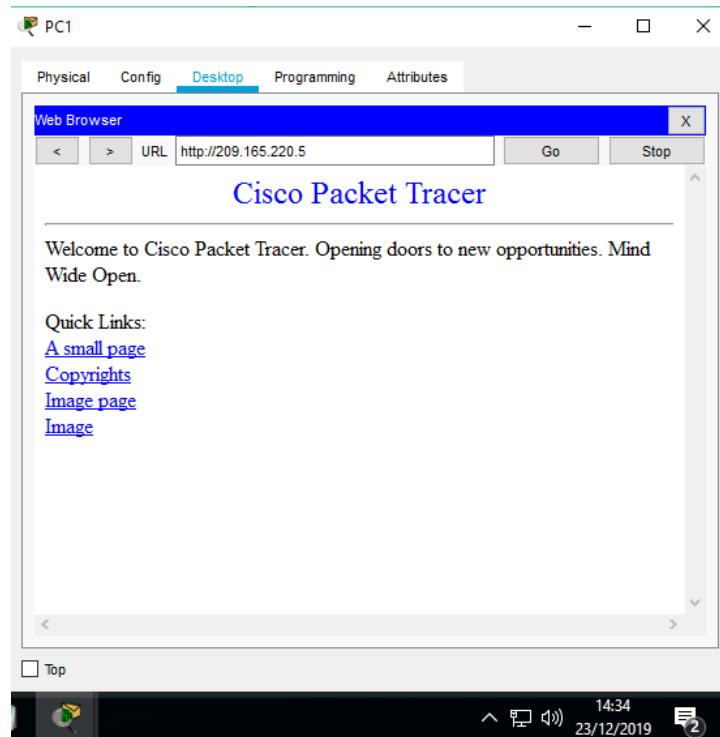


Figura 75. Acceso vlan 30 Bucaramanga a internet.

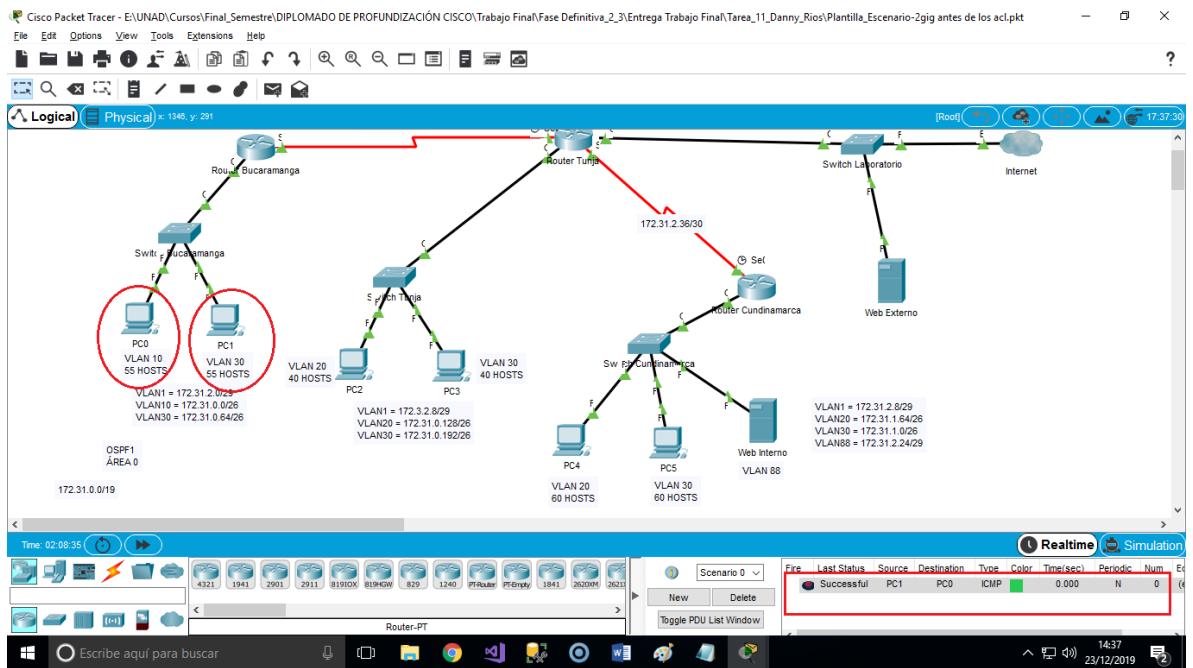


Figura 76. Acceso vlan 30 a vlan 10.

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

Configuración que debe realizarse en el router Bucaramanga.

```
RBucaramanga#conf term
```

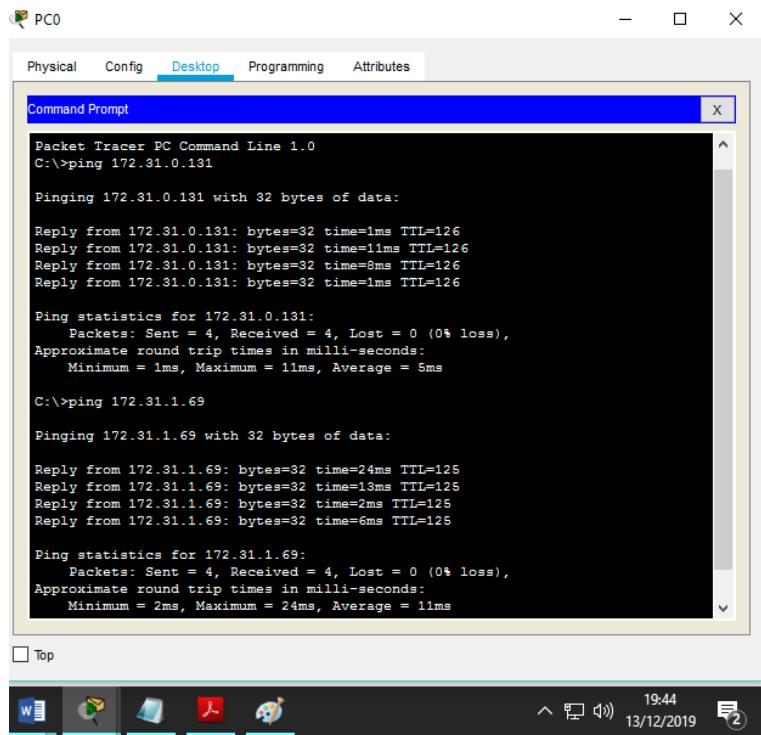
```
RBucaramanga(config)#access-list 152 permit ip 172.31.0.0 0.0.0.63 172.31.1.64
0.0.0.63
```

```
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)#end
```



The screenshot shows a software application window titled "PCO". At the top, there are tabs: Physical, Config, Desktop (which is selected), Programming, and Attributes. Below the tabs is a "Command Prompt" window with the following text:

```

Packet Tracer PC Command Line 1.0
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=1ms TTL=126
Reply from 172.31.0.131: bytes=32 time=11ms TTL=126
Reply from 172.31.0.131: bytes=32 time=9ms TTL=126
Reply from 172.31.0.131: bytes=32 time=1ms 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 = 1ms, Maximum = 11ms, Average = 5ms

C:\>ping 172.31.1.69

Pinging 172.31.1.69 with 32 bytes of data:

Reply from 172.31.1.69: bytes=32 time=24ms TTL=125
Reply from 172.31.1.69: bytes=32 time=13ms TTL=125
Reply from 172.31.1.69: bytes=32 time=2ms TTL=125
Reply from 172.31.1.69: bytes=32 time=6ms TTL=125

Ping statistics for 172.31.1.69:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 2ms, Maximum = 24ms, Average = 11ms

```

The status bar at the bottom shows "19:44 13/12/2019".

Figura 77. Acceso vlan 10 Bucaramanga a Cundinamarca y Tunja vlan 20.

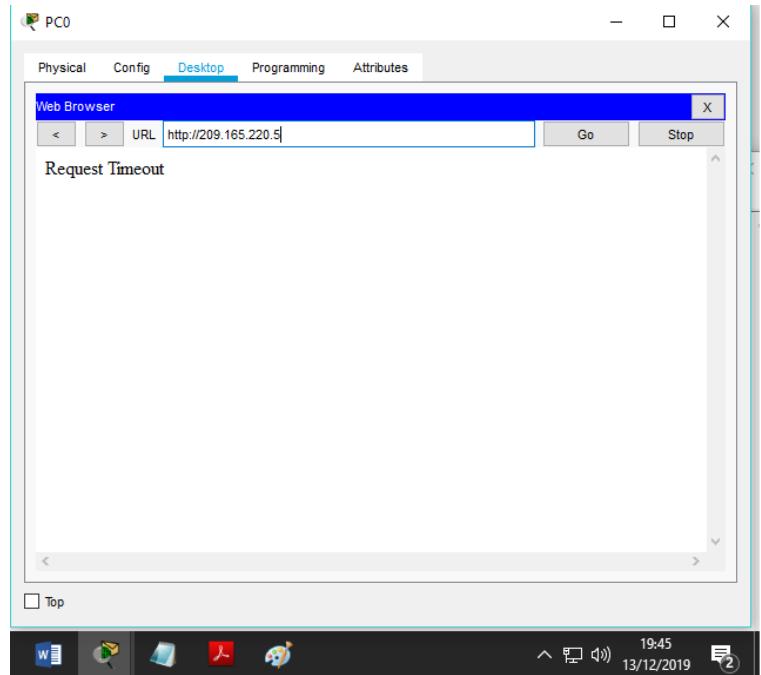


Figura 78. Internet vlan 10 Bucaramanga a Cundinamarca y Tunja vlan 20.

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

Configuración que debe realizarse en:

✓ **Router Bucaramanga**

```
RBucaramanga#configure terminal
RBucaramanga(config)#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)#end
```

✓ **Router Tunja**

```
RTunja#configure terminal
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)#end
```

✓ Router Cundinamarca

RCundinamarca#configure terminal

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)#end

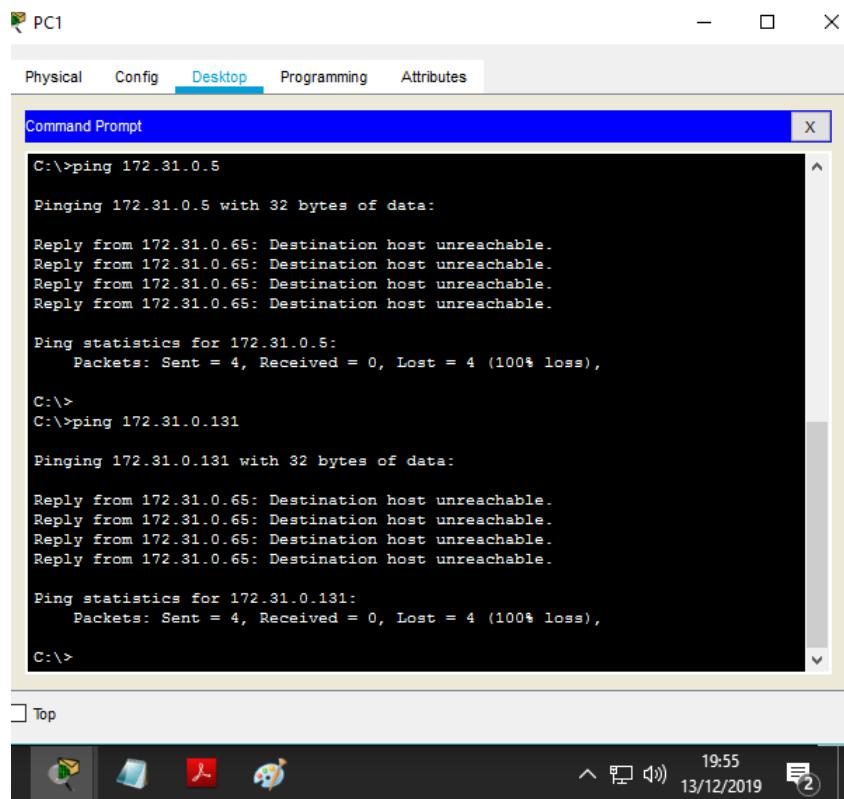


Figura 79. Vlan 30 Bucaramanga a vlan 20 Tunja

The screenshot shows a Windows desktop environment with a Command Prompt window open. The window title is "Command Prompt". The content of the window is as follows:

```
PC3
Physical Config Desktop Programming Attributes
Command Prompt
>vge
ftp>
ftp>
ftp>
ftp>
ftp>
ftp>exit
  Invalid or non supported command.
ftp>
ftp>
ftp>exit
  Invalid or non supported command.
ftp>quit

221- Service closing control connection.
C:\>ping 172.31.1.69

Pinging 172.31.1.69 with 32 bytes of data:

Reply from 172.31.0.193: Destination host unreachable.

Ping statistics for 172.31.1.69:
  Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
C:\>
```

The taskbar at the bottom shows various icons and the date/time: 19:58 13/12/2019.

Figura 80. vlan 30 Tunja a vlan 20 Cundinamarca.

The screenshot shows a Windows desktop environment with a Command Prompt window open. The window title is "Command Prompt". The content of the window is as follows:

```
PC5
Physical Config Desktop Programming Attributes
Command Prompt
Packet Tracer PC Command Line 1.0
C:\>ping 172.31.0.69

Pinging 172.31.0.69 with 32 bytes of data:

Reply from 172.31.1.1: Destination host unreachable.

Ping statistics for 172.31.0.69:
  Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
C:\>
```

The taskbar at the bottom shows various icons and the date/time: 19:59 13/12/2019.

Figura 81. Vlan 30 Cundinamarca a vlan 30 Bucaramanga

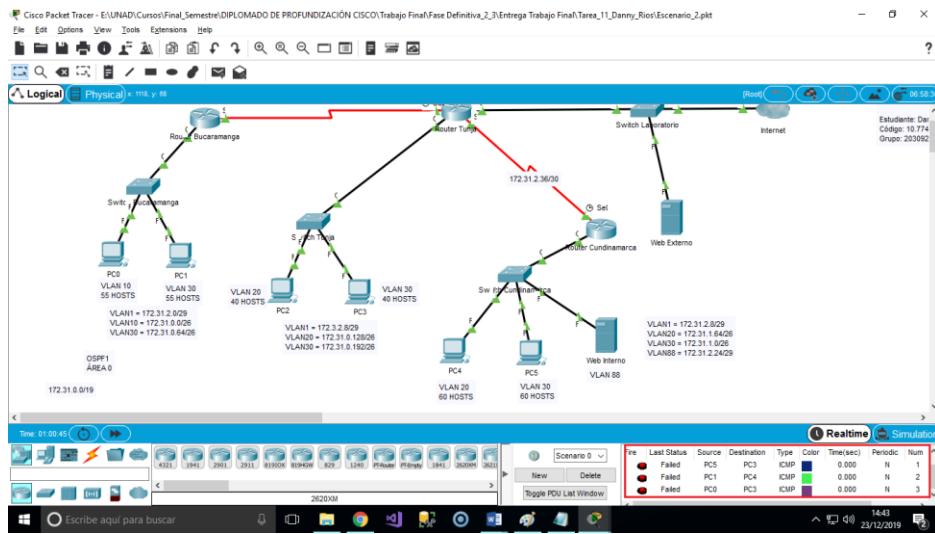


Figura 82. sin acceso entre host a diferentes vlan.

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

Configuración que debe realizarse en:

✓ **Router Bucaramanga**

RBucaramanga#configure terminal

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

RBucaramanga(config)#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)#end

✓ **Router Tunja**

RTunja#configure terminal

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

```
RTunja(config)#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)#end
```

✓ Router Cundinamarca

```
RCundinamarca#configure terminal  
Enter configuration commands, one per line. End with CNTL/Z.  
RCundinamarca(config)#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)#end
```

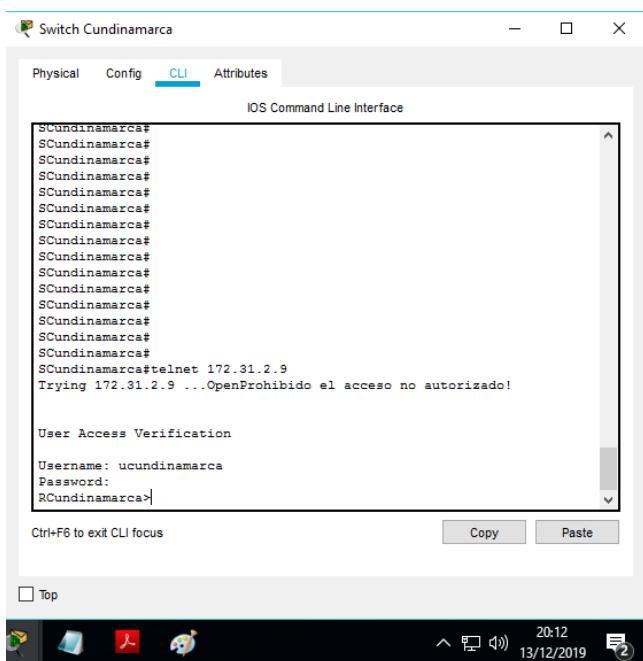


Figura 83. Verificación acceso a router Cundinamarca.

The screenshot shows the Router Bucaramanga configuration interface. The 'CLI' tab is selected, displaying the IOS Command Line Interface. The terminal window contains the following text:

```
RBucaramanga(config-if)#  
RBucaramanga(config-if)#exit  
RBucaramanga(config)#interface GigabitEthernet0/1  
RBucaramanga(config-if)#  
RBucaramanga(config-if)#exit  
RBucaramanga(config-if)#  
RBucaramanga(config-if)#exit  
RBucaramanga(config-if)#exit  
RBucaramanga(config-if)#exit  
RBucaramanga(config-if)#exit  
RBucaramanga(config-if)#exit  
RBucaramanga(config-if)#!$SYS-5-CONFIG_I: Configured from console by console  
RBucaramanga#telnet 172.31.2.33  
Trying 172.31.2.33 ...  
% Connection refused by remote host  
RBucaramanga#telnet 172.31.2.33  
Trying 172.31.2.33 ...  
% Connection refused by remote host  
RBucaramanga#telnet 172.31.2.38  
Trying 172.31.2.38 ...  
% Connection refused by remote host  
RBucaramanga#
```

Below the terminal window, there are 'Copy' and 'Paste' buttons. The taskbar at the bottom shows icons for File, Edit, Insert, Format, and Paint, along with the date and time (20:16, 13/12/2019).

Figura 84. Verificación acceso a router Bucaramanga.

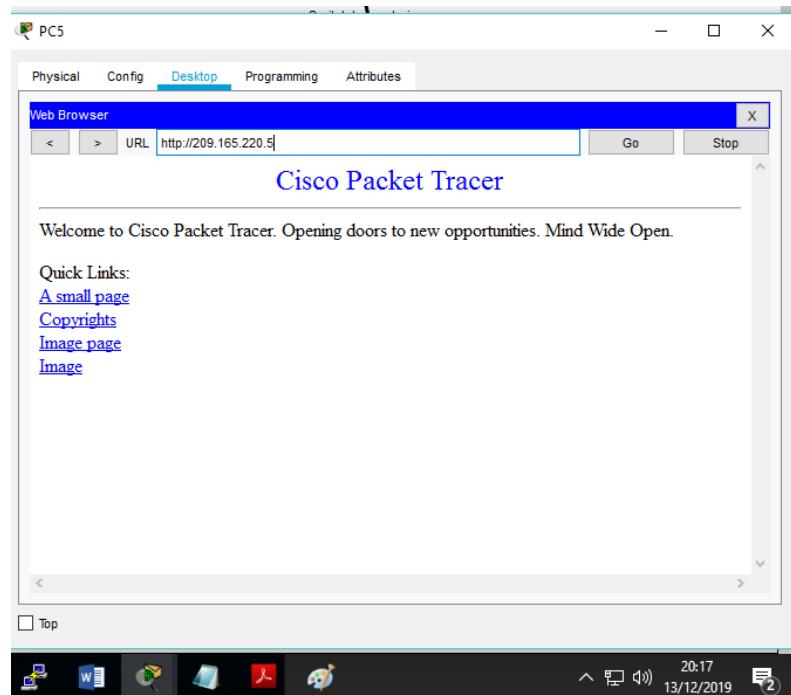


Figura 85. Verificación acceso a internet.

## CONCLUSIONES

Mediante el desarrollo de los escenarios propuestos como actividad final se generaron diversos conocimientos para realizar tareas que permiten una adecuada administración de redes, ingresando los comandos y configuraciones necesarios que establecen acciones y controles, de los cuales podemos mencionar:

- Se comprendieron y usaron los protocolos de routing disponibles ante la necesidad de la red.
- El uso de las configuraciones básicas de los dispositivos como switches y routers.
- La implementación de los distintos protocolos DHCP que permiten en un equipo obtener su configuración en forma dinámica.
- La aplicación y análisis de la configuración de dispositivos de red para el óptimo funcionamiento de la misma.
- Se aplicaron los conceptos para establecer la conectividad IPv4 usando direcciones IP
- Se validaron los principales conceptos de enrutamiento, comenzando por el protocolo RIP y OSPF.
- El análisis y ejecución de las instrucciones para las ACL estándar y extendidas en los dispositivos.
- El establecimiento de VLAN, que permiten organizar y distribuir terminales generando un buen tráfico en la red.
- Se identificaron las funciones, incluyendo la configuración y aplicación de DHCPv4.
- Se trabajó con el protocolo NAT para traducir IPs Privadas a IPs públicas, aprovechando recursos públicos, proporcionando un entorno seguro.
- El uso de NAT dinámica / estática como característica que traduce conexiones TCP y UDP realizadas por un host y un puerto en una red externa a otra dirección y puerto de la red interna.

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