

DIPLOMADO DE PROFUNDIZACIÓN CISCO LAN / WAN
PRUEBA DE HABILIDADES PRACTICAS

ALVARO ENRIQUE CABAS FAILLACE

UNIVERSIDAD NACIONAL ABIERTA Y A DISTANCIA
ESCUELA DE CIENCIAS BASICAS, TECNOLOGIA E INGENIERIA
INGENIERIA DE SISTEMAS
SANTA MARTA
2020

DIPLOMADO DE PROFUNDIZACIÓN CISCO LAN / WAN
PRUEBA DE HABILIDADES PRACTICAS

ALVARO ENRIQUE CABAS FAILLACE

Diplomado de opción de grado
presentado para optar el título de
INGENIERO DE SISTEMAS

DIRECTOR:
MSc. JUAN CARLOS VESGA FERREIRA

UNIVERSIDAD NACIONAL ABIERTA Y A DISTANCIA
ESCUELA DE CIENCIAS BASICAS, TECNOLOGIA E INGENIERIA
INGENIERIA ELECTRONICA
SANTA MARTA
2020

NOTA DE ACEPTACIÓN

Presidente del Jurado

Jurado

Jurado

Santa Marta, 20 de enero de 2020

AGRADECIMIENTOS

Primero que todo agradecer a Dios que me permitió esta oportunidad de poder avanzar día a día y no desfallecer a pesar de las adversidades que se me presentaban.

Segundo a mi familia por el apoyo que me brindo durante el desarrollo de mis estudios, fueron fundamentales en este camino que decidí emprender de convertirme en Ingeniero de Sistemas, a mis hijos que me perdonen por no dedicarle más tiempo, pero ellos lo entenderán más adelante cuando vean que todo era para que se sientan orgullosos de su padre, que con mucho esfuerzo y sacrificio logro graduarse.

Tercero, a la Universidad Nacional Abierta y a Distancia - UNAD por brindarme las herramientas necesarias para cumplir ese sueño de convertirme en Ingeniero de Sistemas.

TABLA DE CONTENIDO

AGRADECIMIENTOS.....	4
LISTA DE TABLAS	6
LISTA DE FIGURAS.....	7
GLOSARIO.....	9
RESUMEN.....	10
ABSTRACT.....	10
INTRODUCCIÓN.....	11
Escenarios Prueba de Habilidades Practicas	12
ESCENARIO 1.....	12
Parte 1: Asignación de direcciones IP.....	15
Parte 2: Configuración Básica.....	15
Parte 3: Configuración de Enrutamiento.....	23
Parte 4: Configuración de las listas de Control de Acceso.....	29
Parte 5: Comprobación de la red instalada.....	31
ESCENARIO 2.....	39
Parte 1: Todos los routers deberán tener lo siguiente.....	39
Parte 2: El DHCP deberá proporcionar solo direcciones a los hosts de Bucaramanga y Cundinamarca.....	45
Parte 3: El web server deberá tener NAT estático y el resto de los equipos de la topología emplearan NAT de sobrecarga (PAT).....	48
Parte 4: El enrutamiento deberá tener autenticación.....	52
Parte 5: Listas de control de acceso.....	52
CONCLUSIONES	61
BIBLIOGRAFIA.....	62

LISTA DE TABLAS

Tabla 1. Diagnóstico sobre estructura de red	13
Tabla 2. Diagnóstico del Switch	14
Tabla 3. Direcciones IP en las ciudades	15
Tabla 4. Direcciones IP y enrutamiento	16
Tabla 5. Tabla de enrutamiento	31

LISTA DE FIGURAS

Figura 1. Topología de red _____	12
Figura 2. Estructura Packet Tracer _____	13
Figura 3. Tabla de enrutamiento Bogotá _____	18
Figura 4. Estructura en packet tracer de estaciones de trabajo Medellín, Bogotá, Cali ___	19
Figura 5. Tabla de enrutamiento Medellín _____	19
Figura 6. Tabla de enrutamiento Cali _____	20
Figura 7. Determinación conexión de los vecinos Bogotá _____	22
Figura 8. Determinación conexión de los vecinos Medellín _____	22
Figura 9. Prueba conectividad pc14 _____	23
Figura 10. Existencia de vecindad en los routers _____	24
Figura 11. Enrutamiento Router Bogotá _____	26
Figura 12. Enrutamiento Router Medellín _____	27
Figura 13. Enrutamiento Router Cali _____	28
Figura 14. Diagnóstico de conectividad entre equipos _____	28
Figura 15. Diagnóstico de conexión del switch _____	29
Figura 16. Comprobación de conectividad _____	30
Figura 17. Diagnostico conectividad _____	32
Figura 18. Diagnostico conectividad ws-1 _____	32
Figura 19. Diagnostico conectividad ws-1 #2 _____	32
Figura 20. Diagnostico conectividad pc12 _____	33
Figura 21. Diagnostico conectividad pc10 _____	33
Figura 22. Diagnostico conectividad pc12 #2 _____	34
Figura 23. Diagnostico conectividad pc10 #2 _____	34
Figura 24. Diagnostico conectividad pc10 #3 _____	35
Figura 25. Diagnostico conectividad pc12 #3 _____	35
Figura 26. Diagnostico conectividad server 0 _____	36
Figura 27. Diagnostico conectividad pc12 #4 _____	36
Figura 28. Diagnostico conectividad pc10 #4 _____	37
Figura 29. Acceso al switch _____	37
Figura 30. Acceso no autorizado al switch _____	38

Figura 31. Topología de red escenario 2	39
Figura 32. Tabla de servicios server 88	45
Figura 33. Dirección IP pc10	46
Figura 34. Dirección IP pc15	47
Figura 35. Dirección IP pc14	47
Figura 36. Dirección IP pc11	48
Figura 37. Diagnostico conectividad pc15	51
Figura 38. Tabla de estadísticas del router	51
Figura 39. Diagnostico conectividad pc14	53
Figura 40. Diagnostico conectividad pc15 #2	53
Figura 41. Diagnostico conectividad pc13	54
Figura 42. Diagnostico conectividad pc13 #2	54
Figura 43. Diagnostico conectividad pc12	55
Figura 44. Diagnostico conectividad pc11	56
Figura 45. Diagnostico conectividad pc10	57
Figura 46. Diagnostico conectividad pc12 #2	58
Figura 47. Diagnostico conectividad pc10 #2	58
Figura 48. Verificación listas de control de acceso en switch 1	59
Figura 49. Verificación listas de control de acceso en switch 2	60

GLOSARIO

EIGRP: protocolo de Enrutamiento de Puerta de enlace Interior Mejorado, es un protocolo de encaminamiento de vector distancia, propiedad de Cisco Systems, que ofrece lo mejor de los algoritmos de vector de distancia. Se considera un protocolo avanzado que se basa en las características normalmente asociadas con los protocolos del estado de enlace.

Smart Lab: es un centro especializado en difusión de conocimiento, intercambio de experiencias y espacios compartidos de trabajo vinculado a las ciudades inteligentes. El objetivo es crear un entorno compartido que estimule el intercambio de ideas y la generación de proyectos innovadores.

SWITCH: los switches se utilizan para conectar varios dispositivos a través de la misma red dentro de un edificio u oficina. Por ejemplo, un switch puede conectar sus computadoras, impresoras y servidores, creando una red de recursos compartidos.

DHCP: es un servidor que usa protocolo de red de tipo cliente/servidor en el que generalmente un servidor posee una lista de direcciones IP dinámicas y las va asignando a los clientes conforme éstas van quedando libres, sabiendo en todo momento quién ha estado en posesión de esa IP, cuánto tiempo la ha tenido y a quién se la ha asignado después.

OSPFv2: es la versión del protocolo OSPF que actualmente utilizamos en redes IPv4. En este caso, el formato del router ID coincide con el formato de las direcciones IP utilizadas en las interfaces por lo que es posible utilizar la dirección IP de una interfaz como router ID, de manera tal que no es obligatorio configurar un router-id y el sistema operativo puede tomar la dirección IP de una interfaz para ser utilizada en esta función.

VLAN: es un método para crear redes lógicas independientes dentro de una misma red física.¹ Varias VLAN pueden coexistir en un único conmutador físico o en una única red física.

RESUMEN

Con este proyecto lo que se busca básicamente es afianzar los conocimientos y conocer los diversos temas en el área de seguridad y Networking los cuales tratamos e interactuamos con los diferentes ejercicios que se plantearon durante el curso. También se interactuó con los diferentes esquemas topológicos de red para los módulos de CCNA1 y CCNA 2 en un ambiente de simulación lógica.

Unos de los objetivos principales y fundamentales es brindarle al estudiante la idea clara del funcionamiento en el área de las telecomunicaciones que le permita tener una base sólida para el mejoramiento del pensamiento crítico y la capacidad de analizar situaciones conflictivas que le van a permitir al estudiante afrontar de una manera muy profesional todos los retos en campo.

Palabras Clave: Sistemas, Redes, CISCO, Telecomunicaciones.

ABSTRACT

With this project, what is basically sought is to strengthen knowledge and learn about the various topics in the area of security and Networking, which we deal with and interact with the different exercises that were raised during the course. We also interacted with the different network topological schemes for the CCNA1 and CCNA 2 modules in a logical simulation environment.

One of the main and fundamental objectives is to provide the student with the clear idea of the operation in the area of telecommunications that allows him to have a solid base for the improvement of critical thinking and the ability to analyze conflict situations that will allow the student to face in a very professional way all the challenges in the field.

Keywords: Systems, Networking, CISCO, Telecommunications.

INTRODUCCIÓN

El ser humano viene viviendo en pasos muy acelerados la transformación tecnológica que se viene presentando día a día, lo podemos observar en las telecomunicaciones y las nuevas técnicas de información y comunicación las cuales han logrado grandes avances a nivel mundial y cumplen un rol fundamental en nuestra vida cotidiana.

A nivel de la educación se presenta como algo fundamental para la orientación e implementación de estas nuevas tecnologías, todo esto se puede observar en las plataformas educativas ya que se implementan muchos las aulas virtuales donde no es necesario ir a un salón de clase.

Teniendo en cuenta lo anterior se puede apreciar los dos tipos de casos que se nos presentan donde debemos de implementar todos los conocimientos básicos y fundamentales para darle vida a este proyecto y entender su funcionamiento.

Las prácticas de las pruebas de habilidades son una herramienta de evaluación del Diplomado de Profundización CISCO LAN / WAN, con la cual se busca medir las habilidades y competencias que el estudiante logró alcanzar mediante el desarrollo del diplomado y cada una de sus actividades. Esta evaluación pondrá a prueba al estudiante mediante la solución de problemas relacionados con las redes y telecomunicaciones.

Esta actividad final cuenta con dos (2) escenarios en la cual se desarrollará cada una de las configuraciones respectivas para solventar los problemas propuestos, anexando las evidencias que brindan la solución a cada problema.

Escenarios Prueba de Habilidades Practicas

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.

Topología de red

Los requerimientos solicitados son los siguientes:

Parte 1: Para el direccionamiento IP debe definirse una dirección de acuerdo con el número de hosts requeridos.

Parte 2: Considerar la asignación de los parámetros básicos y la detección de vecinos directamente conectados.

Parte 3: La red y subred establecidas deberán tener una interconexión total, todos los hosts deberán ser visibles y poder comunicarse entre ellos sin restricciones.

Parte 4: Implementar la seguridad en la red, se debe restringir el acceso y comunicación entre hosts de acuerdo con los requerimientos del administrador de red.

Parte 5: Comprobación total de los dispositivos y su funcionamiento en la red.

Parte 6: Configuración final.

Figura 1. Topología de red

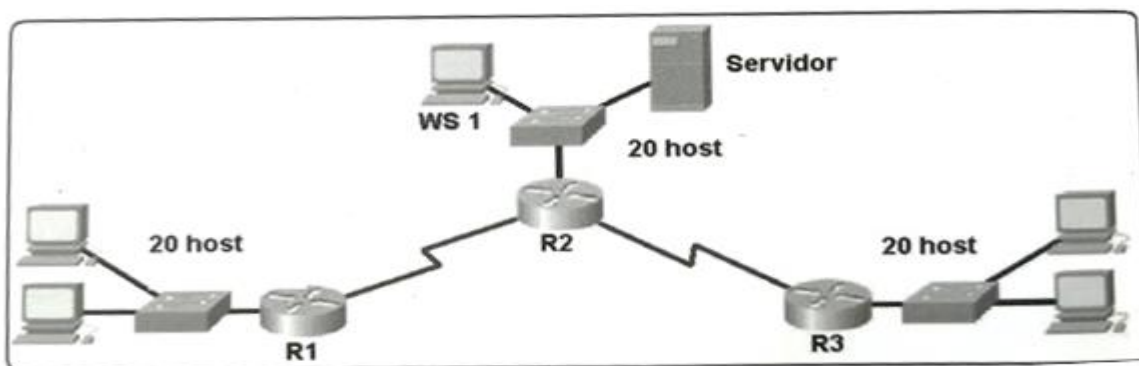
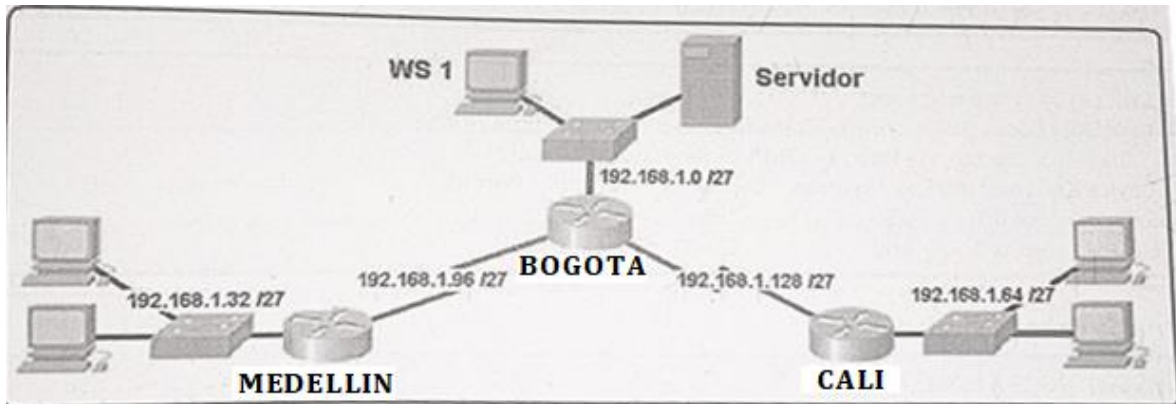


Figura 2. Estructura Packet Tracer



Desarrollo

Como trabajo inicial se debe realizar lo siguiente.

Realizar las rutinas de diagnóstico y dejar los equipos listos para su configuración (asignar nombres de equipos, asignar claves de seguridad, etc).

Tabla 1. Diagnóstico sobre estructura de red

```
Router(config)#hostname bogota
bogota(config)#no ip domain-lookup
bogota(config)#service password-encryption
bogota(config)#banner motd $El Acceso no autorizado est prohibido$
bogota(config)#enable secret class1
bogota(config)#line console 0
bogota(config-line)#password cisco1
bogota(config-line)#login
bogota(config-line)#line vty 0 15
bogota(config-line)#password cisco1
bogota(config-line)#login

Router(config)#hostname medellin
medellin(config)#no ip domain-lookup
medellin(config)#service password-encryption
medellin(config)#banner motd $El Acceso no autorizado est prohibido$
medellin(config)#enable secret class1
medellin(config)#line console 0
medellin(config-line)#password cisco1
medellin(config-line)#login
```

```
medellin(config-line)#line vty 0 15
medellin(config-line)#password cisco1
medellin(config-line)#login
```

```
Router(config)#hostname cali
cali(config)#no ip domain-lookup
cali(config)#service password-encryption
cali(config)#banner motd $El Acceso no autorizado est prohibido$
cali(config)#enable secret class1
cali(config)#line console 0
cali(config-line)#password cisco1
cali(config-line)#login
cali(config-line)#line vty 0 15
cali(config-line)#password cisco1
cali(config-line)#login
```

Se Realiza el mismo proceso para los switch

Tabla 2. Diagnóstico del Switch

```
Switch(config)#hostname switchbogota
switchbogota(config)#no ip domain-lookup
switchbogota(config)#service password-encryption
switchbogota(config)#banner motd $El Acceso no autorizado est prohibido$
switchbogota(config)#enable secret class1
switchbogota(config)#line console 0
switchbogota(config-line)#password cisco1
switchbogota(config-line)#login
switchbogota(config-line)#line vty 0 15
switchbogota(config-line)#password cisco1
switchbogota(config-line)#login
```

```
Switch#conf term
switchmedellin(config)#hostname switchmedellin
switchmedellin(config)#no ip domain-lookup
switchmedellin(config)#service password-encryption
switchmedellin(config)#banner motd $El Acceso no autorizado est prohibido$
switchmedellin(config)#enable secret class1
switchmedellin(config)#line console 0
switchmedellin(config-line)#password cisco1
switchmedellin(config-line)#login
switchmedellin(config-line)#line vty 0 15
switchmedellin(config-line)#password cisco1
switchmedellin(config-line)#login
```

```

Switch(config)#hostname switchcali
switchcali(config)#no ip domain-lookup
switchcali(config)#service password-encryption
switchcali(config)#banner motd $El Acceso no autorizado est prohibido$
switchcali(config)#enable secret class1
switchcali(config)#line console 0
switchcali(config-line)#password cisco1
switchcali(config-line)#login
switchcali(config-line)#line vty 0 15
switchcali(config-line)#password cisco1
switchcali(config-line)#login
switchcali(config-line)#

```

Realizar la conexión física de los equipos con base en la topología de red
 Configurar la topología de red, de acuerdo con las siguientes especificaciones.

Parte 1: Asignación de direcciones IP.

Se debe dividir (subnetear) la red creando una segmentación en ocho partes, para permitir crecimiento futuro de la red corporativa.
 Asignar una dirección IP a la red.

Tabla 3. Direcciones IP en las ciudades

Bogota-LAN	192.168.1.0/27
Medellín-LAN	192.168.1.32/27
Cali-LAN	192.168.1.64/27
Bogota-Medellín	192.168.1.96/27
Bogota-Cali	192.168.1.128/27
Disponible	192.168.1.160/27
Disponible	192.168.1.192/27
Disponible	192.168.1.224/27

Parte 2: Configuración Básica.

Completar la siguiente tabla con la configuración básica de los routers, teniendo en cuenta las subredes diseñadas.

Tabla 4. Direcciones IP y enrutamiento

	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

configurar cada una de las interfaces y se configuramos nuestro protocolo de enrutamiento.

Configuración Interfaces Router Bogotá.

```

bogota(config)#int s0/0/0
bogota(config-if)#ip address 192.168.1.98 255.255.255.224
bogota(config-if)#no shutdown
bogota(config-if)#int s0/0/1
bogota(config-if)#ip address 192.168.1.130 255.255.255.224
bogota(config-if)#no shutdown
bogota(config-if)#int f0/0
bogota(config-if)#ip address 192.168.1.1 255.255.255.224
bogota(config-if)#no shutdown
bogota(config-if)#router eigrp 200
bogota(config-router)#no auto-summary
bogota(config-router)#network 192.168.1.0
bogota(config-router)#end
    
```

Configuración Interfaces Router Medellín.

```

medellin(config)#int s0/0/0
medellin(config-if)#ip address 192.168.1.99 255.255.255.224
medellin(config-if)#no shutdown
medellin(config-if)#
medellin(config-if)#int f0/0
medellin(config-if)#ip address 192.168.1.33 255.255.255.224
medellin(config-if)#no shutdown
medellin(config-if)#
medellin(config-if)#router eigrp 200
    
```

```
medellin(config-router)#no auto-summary
medellin(config-router)#network 192.168.1.0
medellin(config-router)#end
```

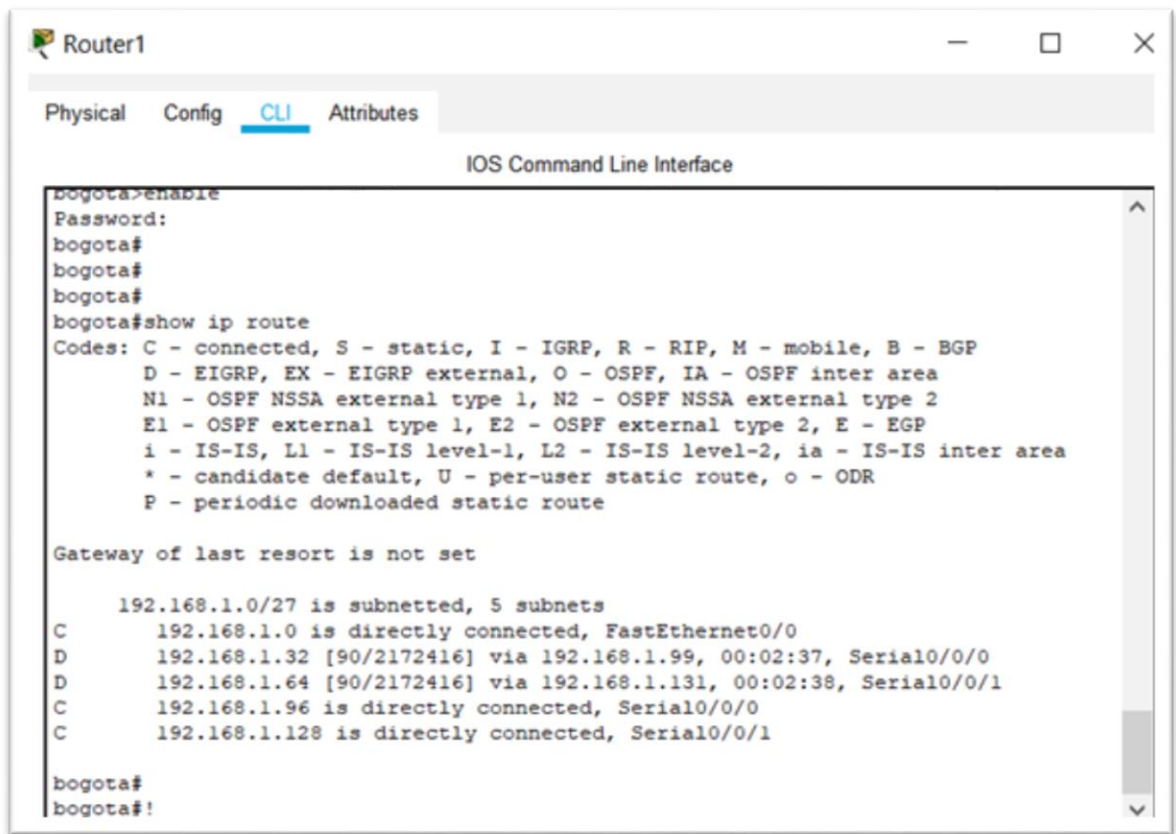
Configuración Interfaces Router Cali.

```
cali(config)#int s0/0/0
cali(config-if)#ip address 192.168.1.231 255.255.255.224
cali(config-if)#no shutdown
cali(config-if)#int f0/0
cali(config-if)#ip address 192.168.1.65 255.255.255.224
cali(config-if)#no shutdown
cali(config-if)#router eigrp 200
cali(config-router)#no auto-summary
cali(config-router)#network 192.168.1.0
cali(config-router)#end
cali#
```

Después de cargada la configuración en los dispositivos, verificar la tabla de enrutamiento en cada uno

```
bogota#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
D 192.168.1.32 [90/2172416] via 192.168.1.99, 00:04:34, Serial0/0/0
D 192.168.1.64 [90/2172416] via 192.168.1.231, 00:03:31, Serial0/0/1
C 192.168.1.96 is directly connected, Serial0/0/0
C 192.168.1.128 is directly connected, Serial0/0/1
```

Figura 3. Tabla de enrutamiento Bogotá



```
Router1
Physical Config CLI Attributes
IOS Command Line Interface
bogota>enable
Password:
bogota#
bogota#
bogota#
bogota#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
D       192.168.1.32 [90/2172416] via 192.168.1.99, 00:02:37, Serial0/0/0
D       192.168.1.64 [90/2172416] via 192.168.1.131, 00:02:38, Serial0/0/1
C       192.168.1.96 is directly connected, Serial0/0/0
C       192.168.1.128 is directly connected, Serial0/0/1

bogota#
bogota#!
```

```
medellin#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
D 192.168.1.0 [90/2172416] via 192.168.1.98, 00:04:41, Serial0/0/0
C 192.168.1.32 is directly connected, FastEthernet0/0
D 192.168.1.64 [90/2684416] via 192.168.1.98, 00:03:38, Serial0/0/0
C 192.168.1.96 is directly connected, Serial0/0/0
D 192.168.1.128 [90/2681856] via 192.168.1.98, 00:03:44, Serial0/0/0
```

Figura 4. Estructura en packet tracer de estaciones de trabajo Medellín, Bogotá, Cali

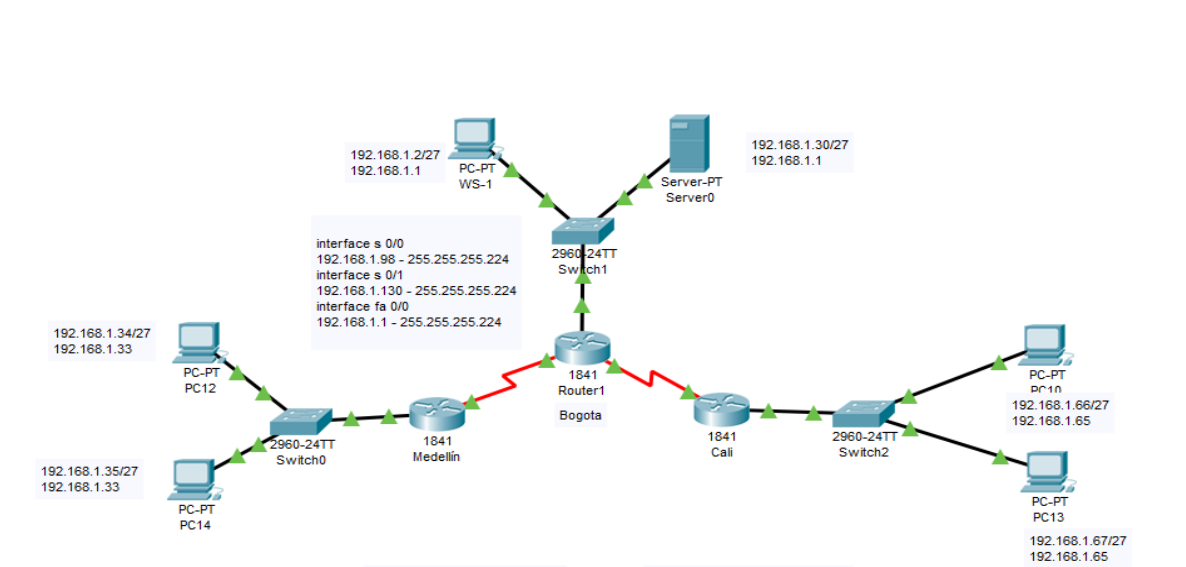


Figura 5. Tabla de enrutamiento Medellín



cali#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

D 192.168.1.0 [90/2172416] via 192.168.1.130, 00:03:47, Serial0/0/0

D 192.168.1.32 [90/2684416] via 192.168.1.130, 00:03:47, Serial0/0/0

C 192.168.1.64 is directly connected, FastEthernet0/0
 D 192.168.1.96 [90/2681856] via 192.168.1.130, 00:03:47, Serial0/0/0
 C 192.168.1.128 is directly connected, Serial0/0/0

Figura 6. Tabla de enrutamiento Cali

```

Physical  Config  CLI  Attributes
IOS Command Line Interface
cali#
cali#
cali#show ip route
^
% Invalid input detected at '^' marker.

cali#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
D       192.168.1.0 [90/2172416] via 192.168.1.130, 00:03:42, Serial0/0/0
D       192.168.1.32 [90/2684416] via 192.168.1.130, 00:03:41, Serial0/0/0
C       192.168.1.64 is directly connected, FastEthernet0/0
D       192.168.1.96 [90/2681856] via 192.168.1.130, 00:03:42, Serial0/0/0
C       192.168.1.128 is directly connected, Serial0/0/0

cali#!
  
```

Verificar el balanceo de carga que presentan los routers.

bogota#show ip eigrp topology

IP-EIGRP Topology Table for AS 200/ID(192.168.1.130)
 Codes: P - Passive, A - Active, U - Update, Q - Query, R - Reply,
 r - Reply status
 P 192.168.1.0/27, 1 successors, FD is 28160
 via Connected, FastEthernet0/0
 P 192.168.1.32/27, 1 successors, FD is 2172416
 via 192.168.1.99 (2172416/28160), Serial0/0/0
 P 192.168.1.64/27, 1 successors, FD is 2172416
 via 192.168.1.231 (2172416/28160), Serial0/0/1
 P 192.168.1.96/27, 1 successors, FD is 2169856
 via Connected, Serial0/0/0
 P 192.168.1.128/27, 1 successors, FD is 2169856
 via Connected, Serial0/0/1
 medellin#show ip eigrp topology

```
IP-EIGRP Topology Table for AS 200/ID(192.168.1.99)
Codes: P - Passive, A - Active, U - Update, Q - Query, R - Reply,
r - Reply status
P 192.168.1.0/27, 1 successors, FD is 2172416
via 192.168.1.98 (2172416/28160), Serial0/0/0
P 192.168.1.32/27, 1 successors, FD is 28160
via Connected, FastEthernet0/0
P 192.168.1.64/27, 1 successors, FD is 2684416
via 192.168.1.98 (2684416/2172416), Serial0/0/0
P 192.168.1.96/27, 1 successors, FD is 2169856
via Connected, Serial0/0/0
P 192.168.1.128/27, 1 successors, FD is 2681856
via 192.168.1.98 (2681856/2169856), Serial0/0/0
cali#show ip eigrp topology
```

```
IP-EIGRP Topology Table for AS 200/ID(192.168.1.231)
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), Serial0/0/0
P 192.168.1.32/27, 1 successors, FD is 2684416
via 192.168.1.130 (2684416/2172416), Serial0/0/0
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), Serial0/0/0
P 192.168.1.128/27, 1 successors, FD is 2169856
via Connected, Serial0/0/0
```

Realizar un diagnóstico de vecinos usando el comando cdp.

```
bogota#show cdp neighbor
```

```
Capability Codes: R - Router, T - Trans Bridge, B - Source Route Bridge
S - Switch, H - Host, I - IGMP, r - Repeater, P - Phone
Device ID Local Intfrc Holdtme Capability Platform Port ID
switchbogota
Fas 0/0 176 S 2960 Fas 0/1
medellin Ser 0/0/0 145 R C1841 Ser 0/0/0
cali Ser 0/0/1 148 R C1841 Ser 0/0/0
```

Figura 7. Determinación conexión de los vecinos Bogotá

```
bogota#show cdp neighbor
Capability Codes: R - Router, T - Trans Bridge, B - Source Route Bridge
                  S - Switch, H - Host, I - IGMP, r - Repeater, P - Phone
Device ID      Local Intrfce  Holdtme  Capability  Platform  Port ID
switchbogota
  Fas 0/0      135      S          2960      Fas 0/1
cali           Ser 0/0/1   143      R          C1841     Ser 0/0/0
MEDELLIN      Ser 0/0/0   144      R          C1841     Ser 0/0/0
bogota#
bogota#
```

medellin#show cdp neighbor

```
Capability Codes: R - Router, T - Trans Bridge, B - Source Route Bridge
S - Switch, H - Host, I - IGMP, r - Repeater, P - Phone
Device ID Local Intrfce Holdtme Capability Platform Port ID
switchmedellin
Fas 0/0 231 S 2960 Fas 0/1
bogota Ser 0/0/0 136 R C1841 Ser 0/0/0
```

Figura 8. Determinación conexión de los vecinos Medellín

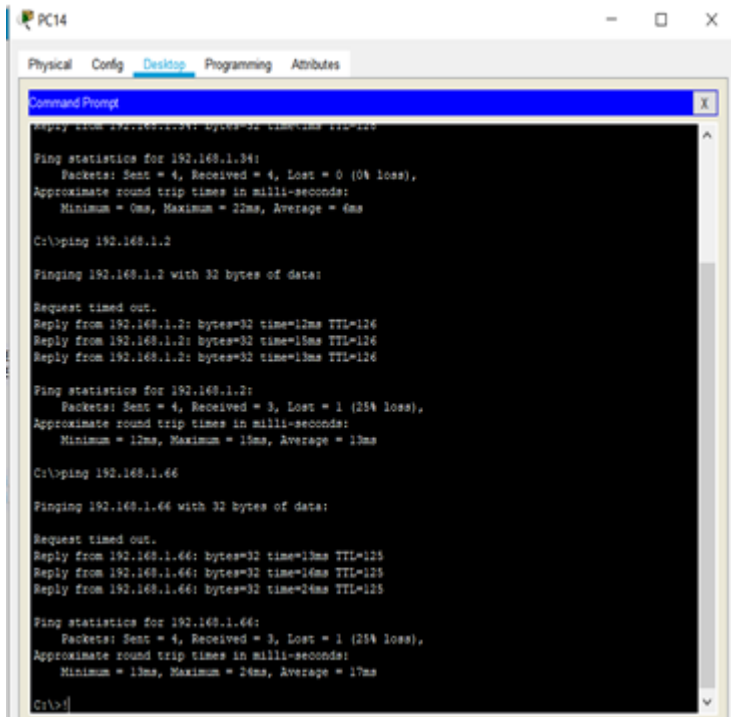
```
MEDELLIN#
MEDELLIN#show cdp neighbor
Capability Codes: R - Router, T - Trans Bridge, B - Source Route Bridge
                  S - Switch, H - Host, I - IGMP, r - Repeater, P - Phone
Device ID      Local Intrfce  Holdtme  Capability  Platform  Port ID
switchmedellin
  Fas 0/0      147      S          2960      Fas 0/1
bogota         Ser 0/0/0    148      R          C1841     Ser 0/0/0
MEDELLIN#
```

cali#show cdp neighbor

```
Capability Codes: R - Router, T - Trans Bridge, B - Source Route Bridge
S - Switch, H - Host, I - IGMP, r - Repeater, P - Phone
Device ID Local Intrfce Holdtme Capability Platform Port ID
switchcali Fas 0/0 126 S 2960 Fas 0/1
bogota Ser 0/0/0 126 R C1841 Ser 0/0/1
```

Realizar una prueba de conectividad en cada tramo de la ruta usando Ping.

Figura 9. Prueba conectividad pc14



```
PC14
Physical Config Desktop Programming Attributes
Command Prompt
Reply from 192.168.1.34: bytes=32 time=6ms 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 = 6ms, Maximum = 22ms, Average = 6ms

C:\>ping 192.168.1.2

Pinging 192.168.1.2 with 32 bytes of data:

Request timed out.
Reply from 192.168.1.2: bytes=32 time=12ms TTL=126
Reply from 192.168.1.2: bytes=32 time=15ms TTL=126
Reply from 192.168.1.2: bytes=32 time=13ms TTL=126

Ping statistics for 192.168.1.2:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 12ms, Maximum = 15ms, Average = 13ms

C:\>ping 192.168.1.66

Pinging 192.168.1.66 with 32 bytes of data:

Request timed out.
Reply from 192.168.1.66: bytes=32 time=13ms TTL=125
Reply from 192.168.1.66: bytes=32 time=14ms TTL=125
Reply from 192.168.1.66: bytes=32 time=24ms TTL=125

Ping statistics for 192.168.1.66:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 13ms, Maximum = 24ms, Average = 17ms

C:\>|
```

Parte 3: Configuración de Enrutamiento.

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

Este paso ya estaba hecho antes, se realizó nuevamente Configuración Interfaces Router Bogotá.

```
bogota(config-if)#
bogota(config-if)#router eigrp 200
bogota(config-router)#no auto-summary
bogota(config-router)#network 192.168.1.0
bogota(config-router)#end
bogota#
```

Configuración Interfaces Router Medellín.

```
medellin(config-if)#
medellin(config-if)#router eigrp 200
medellin(config-router)#no auto-summary
```

```
medellin(config-router)#network 192.168.1.0
medellin(config-router)#end
medellin#
```

Configuración Interfaces Router Cali.

```
cali(config-if)#router eigrp 200
cali(config-router)#no auto-summary
cali(config-router)#network 192.168.1.0
cali(config-router)#end
cali#
```

Verificar si existe vecindad con los routers configurados con EIGRP.

SHOW IP EIGRP NEIGHBORS

```
bogota#show ip eigrp neighbor
IP-EIGRP neighbors for process 200
H Address Interface Hold Uptime SRTT RTO Q Seq
(sec) (ms) Cnt Num
0 192.168.1.99 Se0/0/0 13 00:04:34 40 1000 0 7
1 192.168.1.231 Se0/0/1 12 00:03:31 40 1000 0 7
```

Figura 10. Existencia de vecindad en los routers

```
bogota#show ip eigrp neighbor
IP-EIGRP neighbors for process 200
H Address Interface Hold Uptime SRTT RTO Q Seq
(sec) (ms) Cnt Num
0 192.168.1.131 Se0/0/1 13 00:16:13 40 1000 0 7
1 192.168.1.99 Se0/0/0 13 00:16:11 40 1000 0 7

bogota#
```

```
medellin#show ip eigrp neighbor
IP-EIGRP neighbors for process 200
H Address Interface Hold Uptime SRTT RTO Q Seq
(sec) (ms) Cnt Num
0 192.168.1.98 Se0/0/0 11 00:04:40 40 1000 0 7
cali#show ip eigrp neighbor
IP-EIGRP neighbors for process 200
H Address Interface Hold Uptime SRTT RTO Q Seq
(sec) (ms) Cnt Num
0 192.168.1.130 Se0/0/0 12 00:03:47 40 1000 0 8
```

SHOW IP EIGRP TOPOLOGY

```

bogota#show ip eigrp topology
IP-EIGRP Topology Table for AS 200/ID(192.168.1.130)
Codes: P - Passive, A - Active, U - Update, Q - Query, R - Reply,
r - Reply status
P 192.168.1.0/27, 1 successors, FD is 28160
via Connected, FastEthernet0/0
P 192.168.1.32/27, 1 successors, FD is 2172416
via 192.168.1.99 (2172416/28160), Serial0/0/0
P 192.168.1.64/27, 1 successors, FD is 2172416
via 192.168.1.231 (2172416/28160), Serial0/0/1
P 192.168.1.96/27, 1 successors, FD is 2169856
via Connected, Serial0/0/0
P 192.168.1.128/27, 1 successors, FD is 2169856
via Connected, Serial0/0/1
medellin#show ip eigrp topology
IP-EIGRP Topology Table for AS 200/ID(192.168.1.99)
Codes: P - Passive, A - Active, U - Update, Q - Query, R - Reply,
r - Reply status
P 192.168.1.0/27, 1 successors, FD is 2172416
via 192.168.1.98 (2172416/28160), Serial0/0/0
P 192.168.1.32/27, 1 successors, FD is 28160
via Connected, FastEthernet0/0
P 192.168.1.64/27, 1 successors, FD is 2684416
via 192.168.1.98 (2684416/2172416), Serial0/0/0
P 192.168.1.96/27, 1 successors, FD is 2169856
via Connected, Serial0/0/0
P 192.168.1.128/27, 1 successors, FD is 2681856
via 192.168.1.98 (2681856/2169856), Serial0/0/0
cali#show ip eigrp topology
IP-EIGRP Topology Table for AS 200/ID(192.168.1.231)
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), Serial0/0/0
P 192.168.1.32/27, 1 successors, FD is 2684416
via 192.168.1.130 (2684416/2172416), Serial0/0/0
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), Serial0/0/0
P 192.168.1.128/27, 1 successors, FD is 2169856
via Connected, Serial0/0/0

```

Realizar la comprobación de las tablas de enrutamiento en cada uno de los routers para verificar cada una de las rutas establecidas.

SHOW IP ROUTE

```
bogota#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
D 192.168.1.32 [90/2172416] via 192.168.1.99, 00:04:34, Serial0/0/0
D 192.168.1.64 [90/2172416] via 192.168.1.231, 00:03:31, Serial0/0/1
C 192.168.1.96 is directly connected, Serial0/0/0
C 192.168.1.128 is directly connected, Serial0/0/1
```

Figura 11. Enrutamiento Router Bogotá

```
bogota#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
D       192.168.1.32 [90/2172416] via 192.168.1.99, 00:24:50, Serial0/0/0
D       192.168.1.64 [90/2172416] via 192.168.1.131, 00:24:51, Serial0/0/1
C       192.168.1.96 is directly connected, Serial0/0/0
C       192.168.1.128 is directly connected, Serial0/0/1

bogota#
```

```
medellin#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
```

```

D 192.168.1.0 [90/2172416] via 192.168.1.98, 00:04:41, Serial0/0/0
C 192.168.1.32 is directly connected, FastEthernet0/0
D 192.168.1.64 [90/2684416] via 192.168.1.98, 00:03:38, Serial0/0/0
C 192.168.1.96 is directly connected, Serial0/0/0
D 192.168.1.128 [90/2681856] via 192.168.1.98, 00:03:44, Serial0/0/0

```

Figura 12. Enrutamiento Router Medellín

```

MEDELLIN#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
D       192.168.1.0 [90/2172416] via 192.168.1.98, 00:23:59, Serial0/0/0
C       192.168.1.32 is directly connected, FastEthernet0/0
D       192.168.1.64 [90/2684416] via 192.168.1.98, 00:23:59, Serial0/0/0
C       192.168.1.96 is directly connected, Serial0/0/0
D       192.168.1.128 [90/2681856] via 192.168.1.98, 00:23:59, Serial0/0/0

MEDELLIN#|

```

```

cali#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
D 192.168.1.0 [90/2172416] via 192.168.1.130, 00:03:47, Serial0/0/0
D 192.168.1.32 [90/2684416] via 192.168.1.130, 00:03:47, Serial0/0/0
C 192.168.1.64 is directly connected, FastEthernet0/0
D 192.168.1.96 [90/2681856] via 192.168.1.130, 00:03:47, Serial0/0/0
C 192.168.1.128 is directly connected, Serial0/0/0

```

Figura 13. Enrutamiento Router Cali

```
cali#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 are
       * - 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
D       192.168.1.0 [90/2172416] via 192.168.1.130, 00:25:48, Serial0/0/0
D       192.168.1.32 [90/2684416] via 192.168.1.130, 00:25:47, Serial0/0/0
C       192.168.1.64 is directly connected, FastEthernet0/0
D       192.168.1.96 [90/2681856] via 192.168.1.130, 00:25:48, Serial0/0/0
C       192.168.1.128 is directly connected, Serial0/0/0
```

Realizar un diagnóstico para comprobar que cada uno de los puntos de la red se puedan ver y tengan conectividad entre sí. Realizar esta prueba desde un host de la red LAN del router CALI, primero a la red de MEDELLIN y luego al servidor.

Obtenemos respuesta desde cada una de las subredes configuradas

Figura 14. Diagnóstico de conectividad entre equipos

```
MEDELLIN#
MEDELLIN#
MEDELLIN#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 80 percent (4/5), round-trip min/avg/max = 0/1/4 ms
MEDELLIN#ping 192.168.1.35
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.35, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 0/3/12 ms
MEDELLIN#ping 192.168.1.2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.2, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/7/14 ms
MEDELLIN#ping 192.168.1.30
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.30, timeout is 2 seconds:
!!!!
Success rate is 80 percent (4/5), round-trip min/avg/max = 1/7/15 ms
MEDELLIN#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 100 percent (5/5), round-trip min/avg/max = 2/11/20 ms
MEDELLIN#ping 192.168.1.67
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.67, timeout is 2 seconds:
!!!!
Success rate is 80 percent (4/5), round-trip min/avg/max = 13/13/14 ms
```

Parte 4: Configuración de las listas de Control de Acceso.

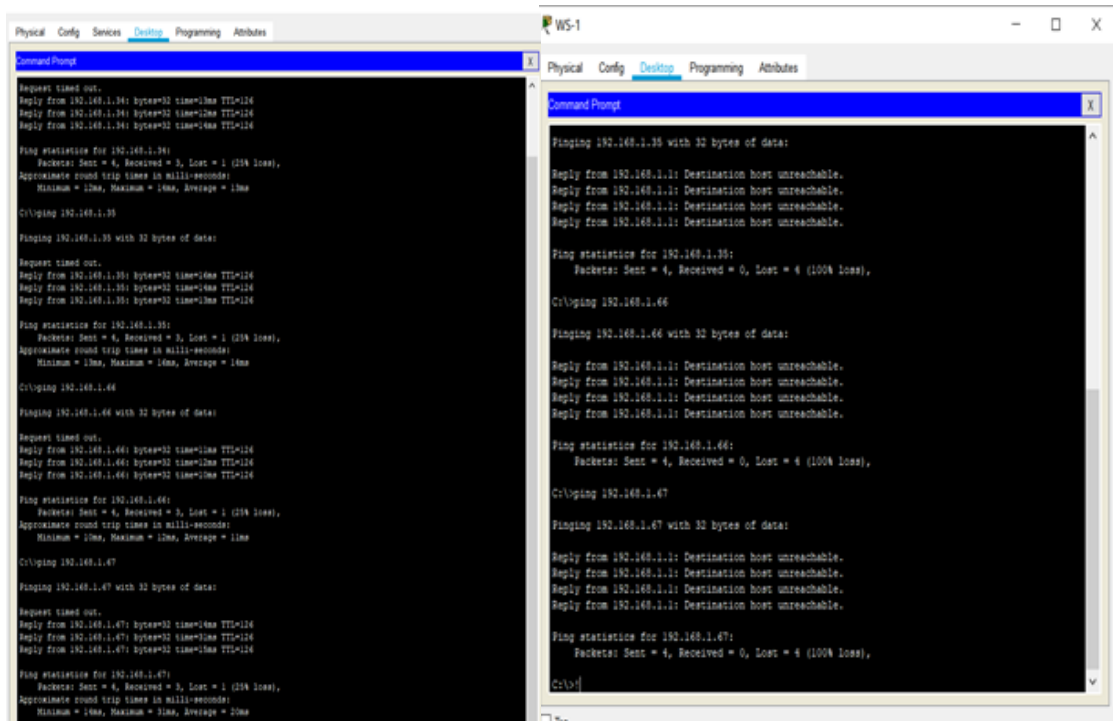
En este momento cualquier usuario de la red tiene acceso a todos sus dispositivos y estaciones de trabajo. El jefe de redes le solicita implementar seguridad en la red. Para esta labor se decide configurar listas de control de acceso (ACL) a los routers. Las condiciones para crear las ACL son las siguientes:

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

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.

```
bogota(config)#access-list 131 permit ip host 192.168.1.30 any
bogota(config)#int f0/0
bogota(config-if)#ip access-group 131 in
bogota(config-if)#
```

Figura 15. Diagnóstico de conexión del switch



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.

```
medellin(config)#access-list 131 permit ip 192.168.1.32 0.0.0.31 host 192.168.1.30
medellin(config)#int f0/0
medellin(config-if)#ip access-group 131 in
medellin(config-if)#
cali(config)#access-list 131 permit ip 192.168.1.64 0.0.0.31 host 192.168.1.30
cali(config)#int f0/0
cali(config-if)#ip access-group 131 in
cali(config-if)#
```

Figura 16. Comprobación de conectividad

```
Packet Tracer PC Command Line 1.0
C:\>ping 192.168.1.34

Pinging 192.168.1.34 with 32 bytes of data:

Reply from 192.168.1.34: bytes=32 time=1ms TTL=128
Reply from 192.168.1.34: bytes=32 time<1ms TTL=128
Reply from 192.168.1.34: bytes=32 time<1ms TTL=128
Reply from 192.168.1.34: bytes=32 time<1ms TTL=128

Ping statistics for 192.168.1.34:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 1ms, Average = 0ms

C:\>ping 192.168.1.66

Pinging 192.168.1.66 with 32 bytes of data:

Reply from 192.168.1.33: Destination host unreachable.
Reply from 192.168.1.33: Destination host unreachable.
Reply from 192.168.1.33: Destination host unreachable.
Reply from 192.168.1.33: Destination host unreachable.

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

C:\>ping 192.168.1.30

Pinging 192.168.1.30 with 32 bytes of data:

Request timed out.
Reply from 192.168.1.30: bytes=32 time=15ms TTL=126
Reply from 192.168.1.30: bytes=32 time=1ms TTL=126
Reply from 192.168.1.30: bytes=32 time=22ms TTL=126

Ping statistics for 192.168.1.30:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
Approximate round trip times in milli-seconds:
    Minimum = 1ms, Maximum = 22ms, Average = 12ms
```

Parte 5: 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.

Tabla 5. Tabla de enrutamiento

	ORIGEN	DESTINO	RESULTADO
TELNET	Router MEDELLIN	Router CALI	Éxito
	WS_1	Router BOGOTA	Falla
	Servidor	Router CALI	Éxito
	Servidor	Router MEDELLIN	Éxito
TELNET	LAN del Router MEDELLIN	Router CALI	Falla
	LAN del Router CALI	Router CALI	Falla
	LAN del Router MEDELLIN	Router MEDELLIN	Falla
	LAN del Router CALI	Router MEDELLIN	Falla
PING	LAN del Router CALI	WS_1	Falla
	LAN del Router MEDELLIN	WS_1	Falla
	LAN del Router MEDELLIN	LAN del Router CALI	Falla
PING	LAN del Router CALI	Servidor	Éxito
	LAN del Router MEDELLIN	Servidor	Éxito
	Servidor	LAN del Router MEDELLIN	Éxito
	Servidor	LAN del Router CALI	Éxito
	Router CALI	LAN del Router MEDELLIN	Falla
	Router MEDELLIN	LAN del Router CALI	Falla

Figura 17. Diagnostico conectividad

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

medellin#telnet 192.168.1.131
Trying 192.168.1.131 ...OpenEl Acceso no autorizado est prohibido

User Access Verification
```

Figura 18. Diagnostico conectividad ws-1

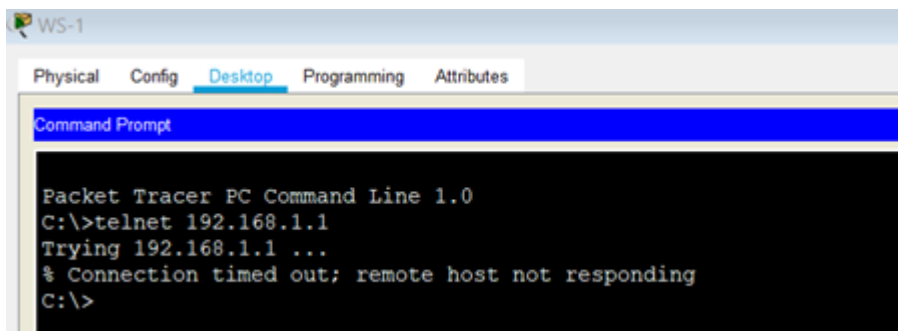
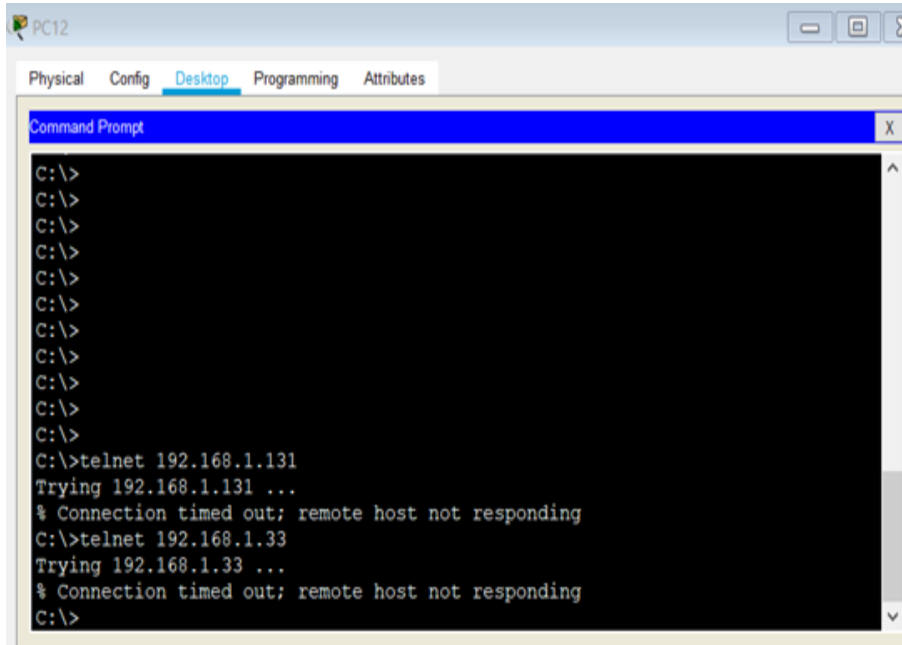


Figura 19. Diagnostico conectividad ws-1 #2

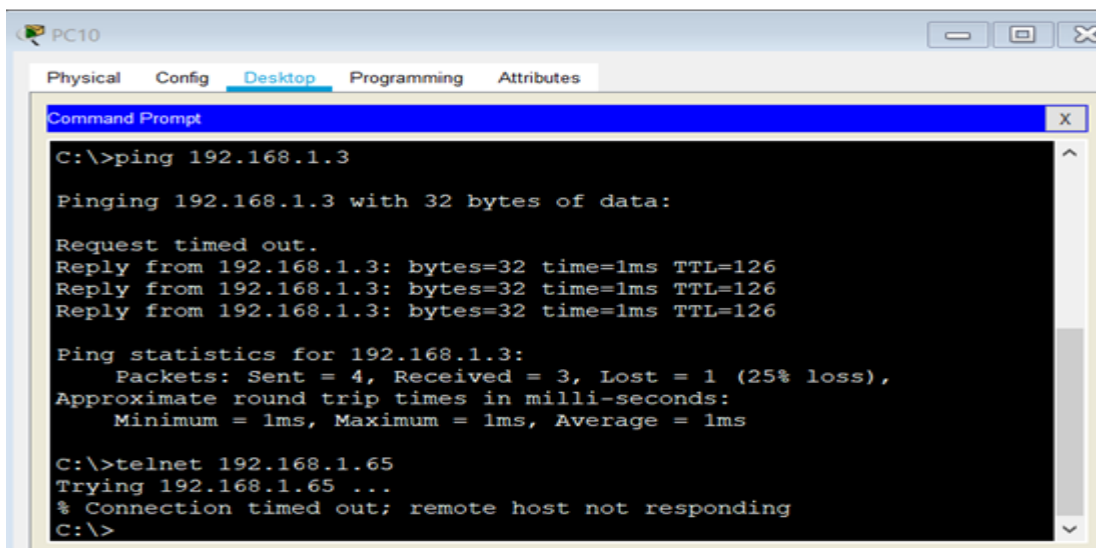


Figura 20. Diagnostico conectividad pc12



```
PC12
Physical Config Desktop Programming Attributes
Command Prompt
C:\>
C:\>
C:\>
C:\>
C:\>
C:\>
C:\>
C:\>
C:\>
C:\>
C:\>
C:\>
C:\>telnet 192.168.1.131
Trying 192.168.1.131 ...
% Connection timed out; remote host not responding
C:\>telnet 192.168.1.33
Trying 192.168.1.33 ...
% Connection timed out; remote host not responding
C:\>
```

Figura 21. Diagnostico conectividad pc10



```
PC10
Physical Config Desktop Programming Attributes
Command Prompt
C:\>ping 192.168.1.3

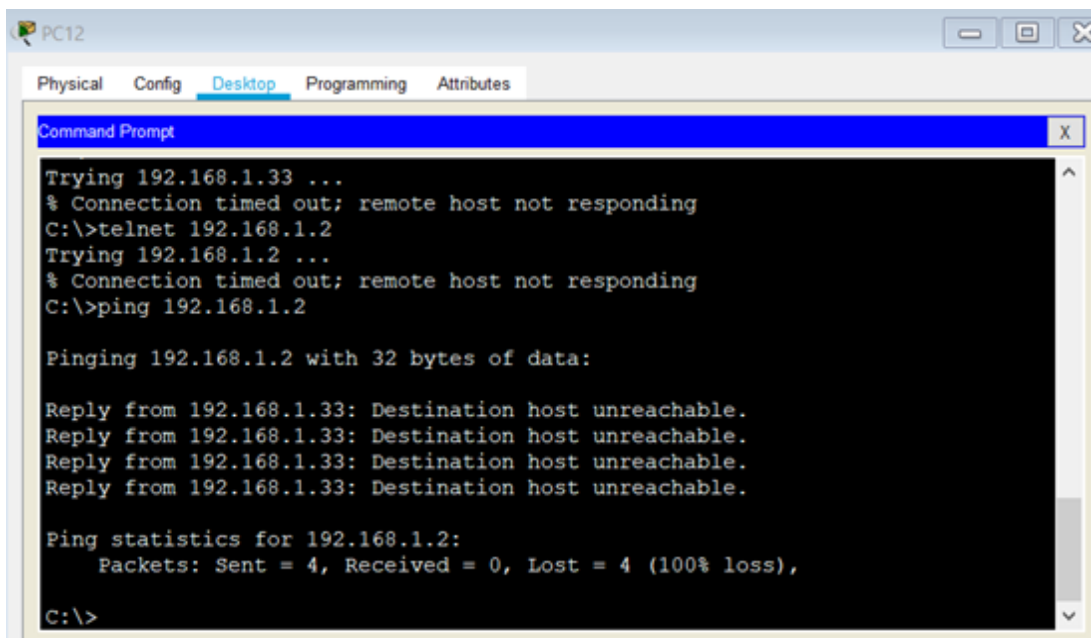
Pinging 192.168.1.3 with 32 bytes of data:

Request timed out.
Reply from 192.168.1.3: bytes=32 time=1ms TTL=126
Reply from 192.168.1.3: bytes=32 time=1ms TTL=126
Reply from 192.168.1.3: bytes=32 time=1ms TTL=126

Ping statistics for 192.168.1.3:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 1ms, Average = 1ms

C:\>telnet 192.168.1.65
Trying 192.168.1.65 ...
% Connection timed out; remote host not responding
C:\>
```

Figura 22. Diagnostico conectividad pc12 #2



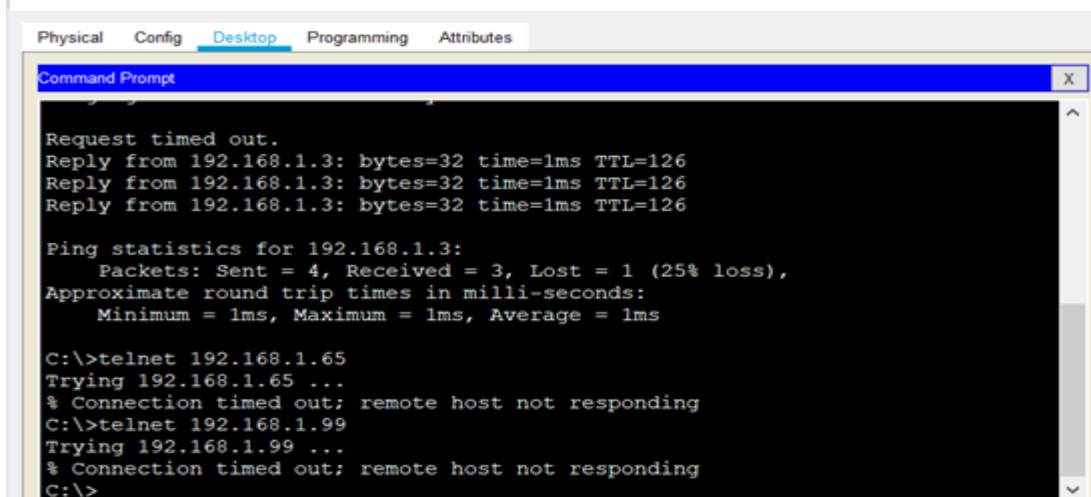
```
PC12
Physical Config Desktop Programming Attributes
Command Prompt
Trying 192.168.1.33 ...
% Connection timed out; remote host not responding
C:\>telnet 192.168.1.2
Trying 192.168.1.2 ...
% Connection timed out; remote host not responding
C:\>ping 192.168.1.2

Pinging 192.168.1.2 with 32 bytes of data:

Reply from 192.168.1.33: Destination host unreachable.
Reply from 192.168.1.33: Destination host unreachable.
Reply from 192.168.1.33: Destination host unreachable.
Reply from 192.168.1.33: Destination host unreachable.

Ping statistics for 192.168.1.2:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
C:\>
```

Figura 23. Diagnostico conectividad pc10 #2

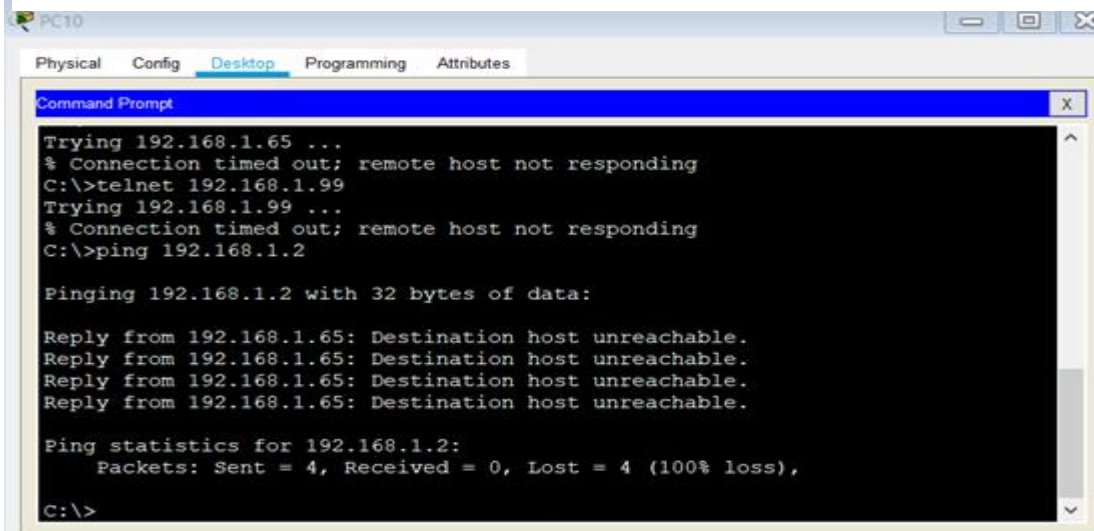


```
PC10
Physical Config Desktop Programming Attributes
Command Prompt
Request timed out.
Reply from 192.168.1.3: bytes=32 time=1ms TTL=126
Reply from 192.168.1.3: bytes=32 time=1ms TTL=126
Reply from 192.168.1.3: bytes=32 time=1ms TTL=126

Ping statistics for 192.168.1.3:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 1ms, Average = 1ms

C:\>telnet 192.168.1.65
Trying 192.168.1.65 ...
% Connection timed out; remote host not responding
C:\>telnet 192.168.1.99
Trying 192.168.1.99 ...
% Connection timed out; remote host not responding
C:\>
```

Figura 24. Diagnostico conectividad pc10 #3



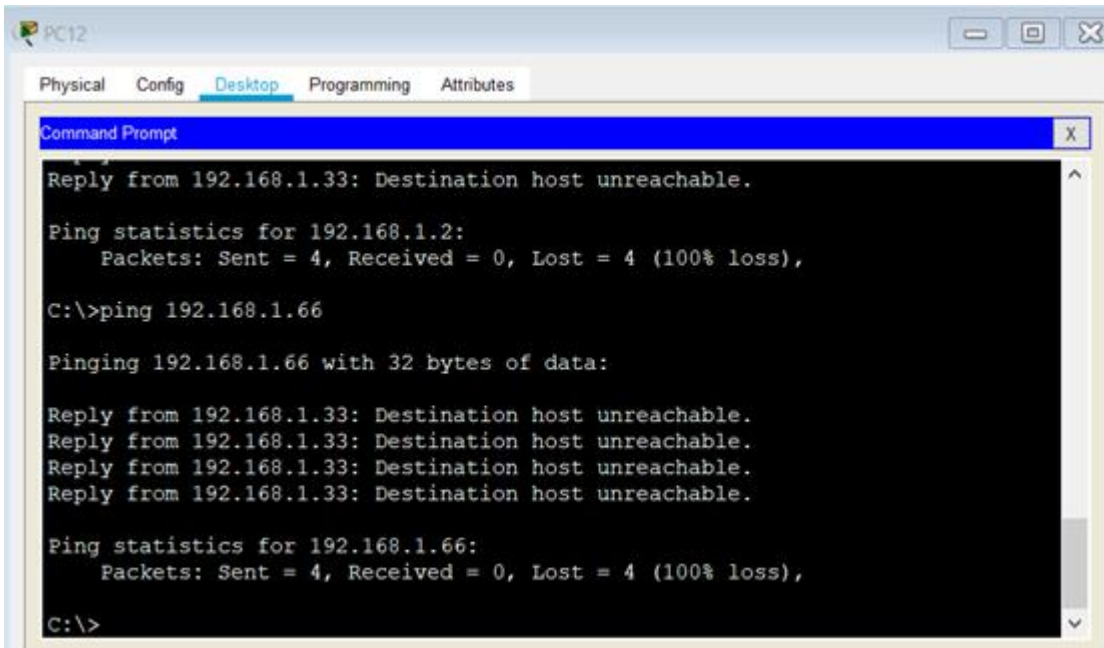
```
PC10
Physical Config Desktop Programming Attributes
Command Prompt
Trying 192.168.1.65 ...
% Connection timed out; remote host not responding
C:\>telnet 192.168.1.99
Trying 192.168.1.99 ...
% Connection timed out; remote host not responding
C:\>ping 192.168.1.2

Pinging 192.168.1.2 with 32 bytes of data:

Reply from 192.168.1.65: Destination host unreachable.
Reply from 192.168.1.65: Destination host unreachable.
Reply from 192.168.1.65: Destination host unreachable.
Reply from 192.168.1.65: Destination host unreachable.

Ping statistics for 192.168.1.2:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
C:\>
```

Figura 25. Diagnostico conectividad pc12 #3



```
PC12
Physical Config Desktop Programming Attributes
Command Prompt
Reply from 192.168.1.33: Destination host unreachable.

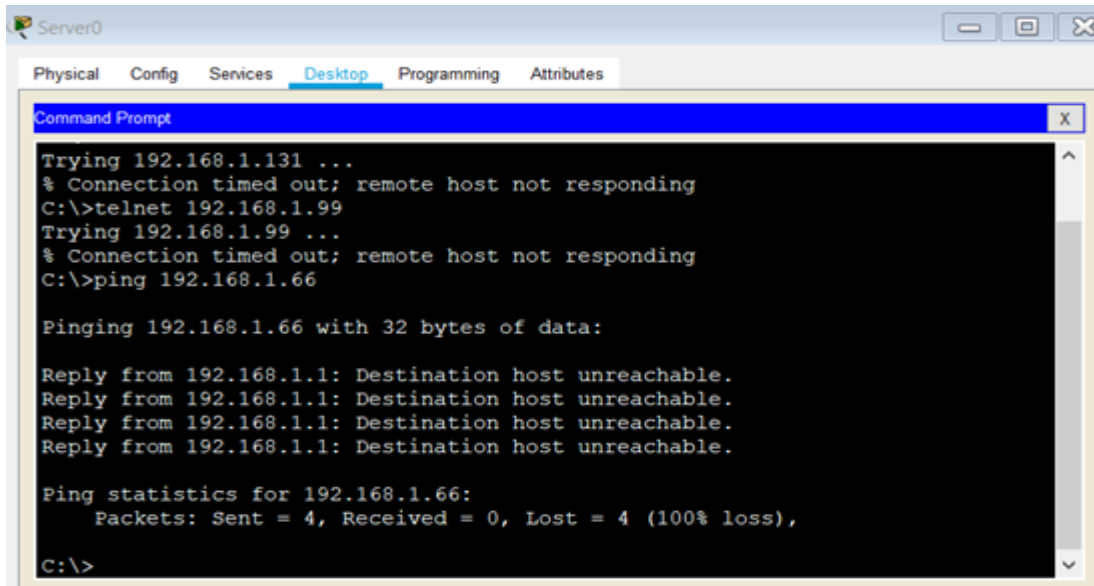
Ping statistics for 192.168.1.2:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
C:\>ping 192.168.1.66

Pinging 192.168.1.66 with 32 bytes of data:

Reply from 192.168.1.33: Destination host unreachable.
Reply from 192.168.1.33: Destination host unreachable.
Reply from 192.168.1.33: Destination host unreachable.
Reply from 192.168.1.33: Destination host unreachable.

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

Figura 26. Diagnostico conectividad server 0



```
Server0
Physical Config Services Desktop Programming Attributes
Command Prompt
Trying 192.168.1.131 ...
% Connection timed out; remote host not responding
C:\>telnet 192.168.1.99
Trying 192.168.1.99 ...
% Connection timed out; remote host not responding
C:\>ping 192.168.1.66

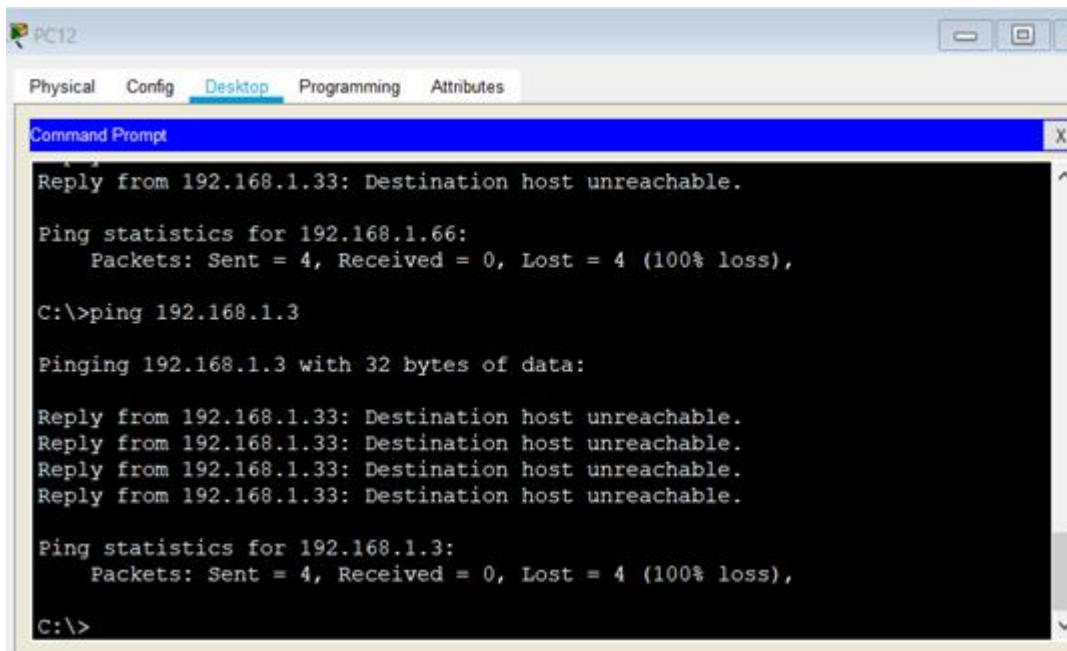
Pinging 192.168.1.66 with 32 bytes of data:

Reply from 192.168.1.1: Destination host unreachable.
Reply from 192.168.1.1: Destination host unreachable.
Reply from 192.168.1.1: Destination host unreachable.
Reply from 192.168.1.1: Destination host unreachable.

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

C:\>
```

Figura 27. Diagnostico conectividad pc12 #4



```
PC12
Physical Config Desktop Programming Attributes
Command Prompt
Reply from 192.168.1.33: Destination host unreachable.

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

C:\>ping 192.168.1.3

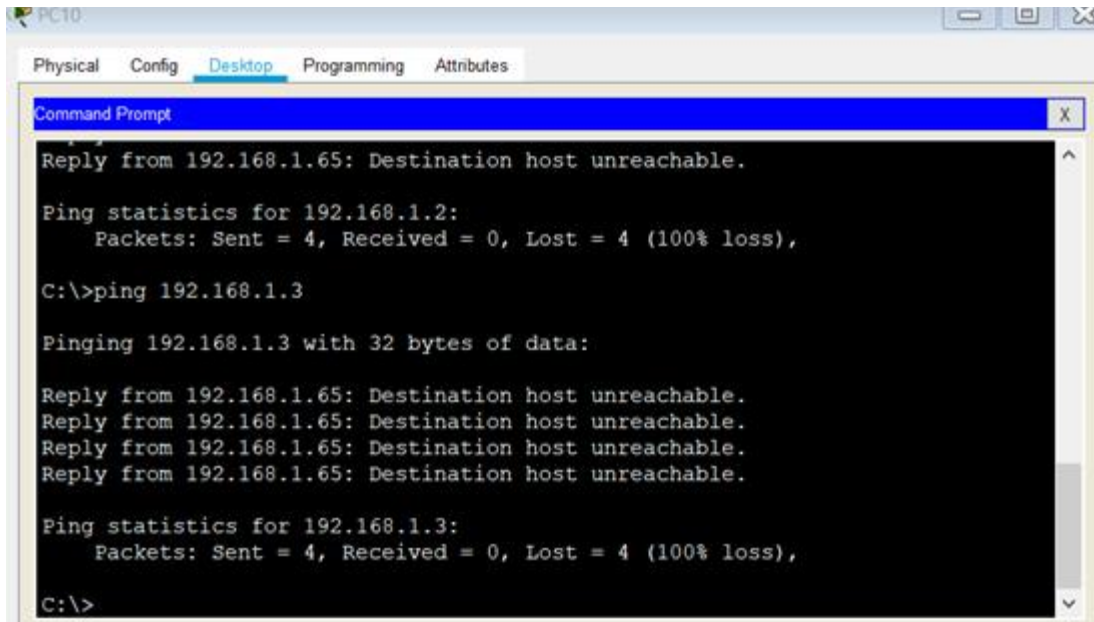
Pinging 192.168.1.3 with 32 bytes of data:

Reply from 192.168.1.33: Destination host unreachable.
Reply from 192.168.1.33: Destination host unreachable.
Reply from 192.168.1.33: Destination host unreachable.
Reply from 192.168.1.33: Destination host unreachable.

Ping statistics for 192.168.1.3:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

C:\>
```

Figura 28. Diagnostico conectividad pc10 #4



The screenshot shows a PC10 desktop environment with a Command Prompt window open. The window title is "Command Prompt" and it has a close button (X). The desktop background is black. The Command Prompt shows the following text:

```
Reply from 192.168.1.65: Destination host unreachable.  
Ping statistics for 192.168.1.2:  
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),  
C:\>ping 192.168.1.3  
Pinging 192.168.1.3 with 32 bytes of data:  
Reply from 192.168.1.65: Destination host unreachable.  
Reply from 192.168.1.65: Destination host unreachable.  
Reply from 192.168.1.65: Destination host unreachable.  
Reply from 192.168.1.65: Destination host unreachable.  
Ping statistics for 192.168.1.3:  
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),  
C:\>
```

Figura 29. Acceso al switch

```
User Access Verification  
  
Password:  
cali>en  
Password:  
cali# (You have open connections) [confirm]  
  
[Connection to 192.168.1.131 closed by foreign host]  
medellin#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)
```

Figura 30. Acceso no autorizado al switch

```
El Acceso no autorizado est prohibido

User Access Verification

Password:

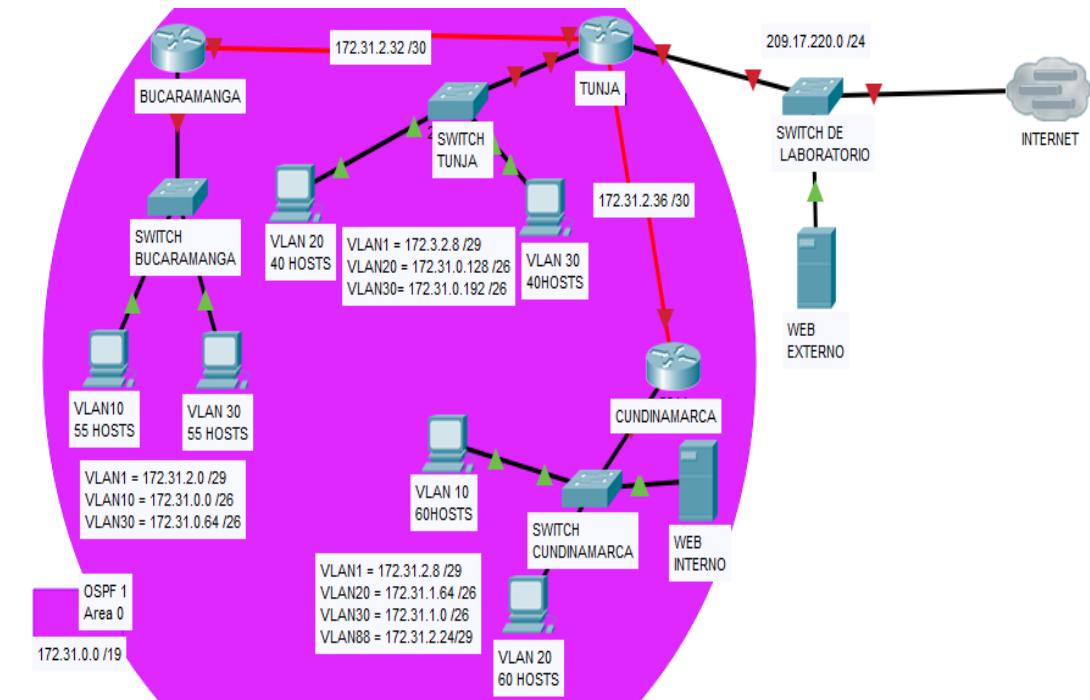
cali>en
Password:
cali#ping 192.168.1.34

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)
```

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 31. Topología de red escenario 2



Desarrollo

Los siguientes son los requerimientos necesarios:

Parte 1: Todos los routers deberán tener lo siguiente.

Configuración básica.

```
Router(config)#hostname bucaramanga
bucaramanga(config)#no ip domain-lookup
bucaramanga(config)#banner motd $EI Acceso no autorizado está prohibido$
bucaramanga(config)#enable secret class1
bucaramanga(config)#line console 0
bucaramanga(config-line)#password cisco1
bucaramanga(config-line)#login
bucaramanga(config-line)#line vty 0 15
```

```
bucaramanga(config-line)#password cisco1
bucaramanga(config-line)#login
bucaramanga(config)#int f0/0.1
bucaramanga(config-subif)#encapsulation dot1q 1
bucaramanga(config-subif)#ip address 172.31.2.1 255.255.255.248
bucaramanga(config-subif)#int f0/0.10
bucaramanga(config-subif)#encapsulation dot1q 10
bucaramanga(config-subif)#ip address 172.31.0.1 255.255.255.192
bucaramanga(config-subif)#int f0/0.30
bucaramanga(config-subif)#encapsulation dot1q 30
bucaramanga(config-subif)#ip address 172.31.0.65 255.255.255.192
bucaramanga(config-subif)#int f0/0
bucaramanga(config-if)#no shutdown
bucaramanga(config-if)#int s0/0/0
bucaramanga(config-if)#ip address 172.31.2.34 255.255.255.252
bucaramanga(config-if)#no shutdown
bucaramanga(config-if)#
bucaramanga(config-if)#router ospf 1
bucaramanga(config-router)#network 172.31.0.0 0.0.0.63 area 0
bucaramanga(config-router)#network 172.31.0.64 0.0.0.63 area 0
bucaramanga(config-router)#network 172.31.2.0 0.0.0.7 area 0
bucaramanga(config-router)#network 172.31.2.32 0.0.0.3 area 0
bucaramanga(config-router)#end
bucaramanga#
bucaramanga#
```

```
Router(config)#hostname tunja
tunja(config)#no ip domain-lookup
tunja(config)#banner motd $El Acceso no autorizado est prohibido$
tunja(config)#enable secret class1
tunja(config)#line console 0
tunja(config-line)#password cisco1
tunja(config-line)#login
tunja(config-line)#line vty 0 15
tunja(config-line)#password cisco1
tunja(config-line)#login
tunja(config)#int f0/0.1
tunja(config-subif)#encapsulation dot1q 1
tunja(config-subif)#ip address 172.3.2.9 255.255.255.248
tunja(config-subif)#int f0/0.20
tunja(config-subif)#encapsulation dot1q 20
tunja(config-subif)#ip address 172.31.0.129 255.255.255.192
tunja(config-subif)#int f0/0.30
```

```
tunja(config-subif)#encapsulation dot1q 30
tunja(config-subif)#ip address 172.31.0.193 255.255.255.192
tunja(config-subif)#int f0/0
tunja(config-if)#no shutdown
tunja(config-if)#int s0/0/0
tunja(config-if)#ip address 172.31.2.33 255.255.255.252
tunja(config-if)#no shutdown
tunja(config-if)#int s0/0/1
tunja(config-if)#ip address 172.31.2.37 255.255.255.252
tunja(config-if)#no shutdown
tunja(config-if)#int f0/1
tunja(config-if)#ip address 209.165.220.1 255.255.255.0
tunja(config-if)#no shutdown
tunja(config-if)#router ospf 1
tunja(config-router)#network 172.3.2.8 0.0.0.7 area 0
tunja(config-router)#network 172.31.0.128 0.0.0.63 area 0
tunja(config-router)#network 172.31.0.192 0.0.0.63 area 0
tunja(config-router)#network 172.31.2.32 0.0.0.3 area 0
tunja(config-router)#network 172.31.2.36 0.0.0.3 area 0
tunja(config-router)#end
tunja#
```

```
Router(config)#hostname cundinamarca
cundinamarca(config)#no ip domain-lookup
cundinamarca(config)#banner motd $El Acceso no autorizado est prohibido$
cundinamarca(config)#enable secret class1
cundinamarca(config)#line console 0
cundinamarca(config-line)#password cisco1
cundinamarca(config-line)#login
cundinamarca(config-line)#line vty 0 15
cundinamarca(config-line)#password cisco1
cundinamarca(config-line)#login
cundinamarca(config)#int f0/0.1
cundinamarca(config-subif)#encapsulation dot1q 1
cundinamarca(config-subif)#ip address 172.31.2.9 255.255.255.248
cundinamarca(config-subif)#int f0/0.20
cundinamarca(config-subif)#encapsulation dot1q 20
cundinamarca(config-subif)#ip address 172.31.1.65 255.255.255.192
cundinamarca(config-subif)#int f0/0.30
cundinamarca(config-subif)#encapsulation dot1q 30
cundinamarca(config-subif)#ip address 172.31.1.1 255.255.255.192
cundinamarca(config-subif)#int f0/0.88
cundinamarca(config-subif)#encapsulation dot1q 88
```

```

cundinamarca(config-subif)#ip address 172.31.2.25 255.255.255.248
cundinamarca(config-subif)#int f0/0
cundinamarca(config-if)#no shutdown
cundinamarca(config-if)#int s0/0/0
cundinamarca(config-if)#ip address 172.31.2.38 255.255.255.252
cundinamarca(config-if)#no shutdown
cundinamarca(config-if)#router ospf 1
cundinamarca(config-router)#network 172.31.1.0 0.0.0.63 area 0
cundinamarca(config-router)#network 172.31.1.64 0.0.0.63 area 0
cundinamarca(config-router)#network 172.31.2.8 0.0.0.7 area 0
cundinamarca(config-router)#network 172.31.2.24 0.0.0.7 area 0
cundinamarca(config-router)#network 172.31.2.36 0.0.0.3 area 0
cundinamarca(config-router)#end
cundinamarca#

```

Se realiza la configuración de los SWITCH, creación de las VLAN y las respectivas asignaciones de las interfaces.

```

Switch(config)#hostname switchbucaramanga
switchbucaramanga(config)#vlan 1
switchbucaramanga(config-vlan)#vlan 10
switchbucaramanga(config-vlan)#vlan 30
switchbucaramanga(config-vlan)#int f0/10
switchbucaramanga(config-if)#switchport mode access
switchbucaramanga(config-if)#switchport access vlan 10
switchbucaramanga(config-if)#int f0/14
switchbucaramanga(config-if)#switchport mode access
switchbucaramanga(config-if)#switchport access vlan 30
switchbucaramanga(config-if)#int f0/1
switchbucaramanga(config-if)#switchport mode trunk
switchbucaramanga(config-if)#int vlan 1
switchbucaramanga(config-if)#ip address 172.31.2.3 255.255.255.248
switchbucaramanga(config-if)#no shutdown
switchbucaramanga(config-if)#ip default-gateway 172.31.2.1
switchbucaramanga(config)#

```

```

Switch(config)#hostname swtichtunja
swtichtunja(config)#vlan 1
swtichtunja(config-vlan)#vlan 20
swtichtunja(config-vlan)#vlan 30
swtichtunja(config-vlan)#int f0/10
swtichtunja(config-if)#switchport mode access
swtichtunja(config-if)#switchport access vlan 20

```

```
swichtunja(config-if)#int f0/14
swichtunja(config-if)#switchport mode access
swichtunja(config-if)#switchport access vlan 30
swichtunja(config-if)#int f0/1
swichtunja(config-if)#switchport mode trunk
swichtunja(config-if)#int vlan 1
swichtunja(config-if)#ip address 172.3.2.11 255.255.255.248
swichtunja(config-if)#no shutdown
swichtunja(config-if)#ip default-gateway 172.3.2.9
swichtunja(config)#
swichtunja(config)#
```

```
Switch(config)#hostname swithccundinamarca
swithccundinamarca(config)#vlan 1
swithccundinamarca(config-vlan)#vlan 20
swithccundinamarca(config-vlan)#vlan 30
swithccundinamarca(config-vlan)#vlan 88
swithccundinamarca(config-vlan)#exit
swithccundinamarca(config)#int f0/10
swithccundinamarca(config-if)#switchport mode access
swithccundinamarca(config-if)#switchport access vlan 20
swithccundinamarca(config-if)#int f0/14
swithccundinamarca(config-if)#switchport mode access
swithccundinamarca(config-if)#switchport access vlan 30
swithccundinamarca(config-if)#int f0/20
swithccundinamarca(config-if)#switchport mode access
swithccundinamarca(config-if)#switchport access vlan 88
swithccundinamarca(config-if)#int f0/1
swithccundinamarca(config-if)#switchport mode trunk
swithccundinamarca(config-if)#int vlan 1
swithccundinamarca(config-if)#ip address 172.31.2.11 255.255.255.248
swithccundinamarca(config-if)#no shutdown
swithccundinamarca(config-if)#ip default-gateway 172.31.2.9
```

El proceso es realizar la configuración de la autenticación AAA, este proceso se describe a continuación, debe aplicarse a los 3 routers

Autenticación local con AAA.

```
bucaramanga(config-line)#username admin01 secret admin01pass
bucaramanga(config)#aaa new-model
bucaramanga(config)#aaa authentication login aaalocal local
bucaramanga(config)#line console 0
bucaramanga(config-line)#login authentication aaalocal
```

```
bucaramanga(config-line)#line vty 0 15
bucaramanga(config-line)#login authentication aaalocal
tunja(config-line)#username admin01 secret admin01pass
tunja(config)#aaa new-model
tunja(config)#aaa authentication login aaalocal local
tunja(config)#line console 0
tunja(config-line)#login authentication aaalocal
tunja(config-line)#line vty 0 15
tunja(config-line)#login authentication aaalocal
cundinamarca(config-line)#username admin01 secret admin01pass
cundinamarca(config)#aaa new-model
cundinamarca(config)#aaa authentication login aaalocal local
cundinamarca(config)#line console 0
cundinamarca(config-line)#login authentication aaalocal
cundinamarca(config-line)#line vty 0 15
cundinamarca(config-line)#login authentication aaalocal
```

Cifrado de contraseñas.

```
bucaramanga(config)#service password-encryption
tunja(config)#service password-encryption
cundinamarca(config)#service password-encryption
```

Un máximo de internos para acceder al router.

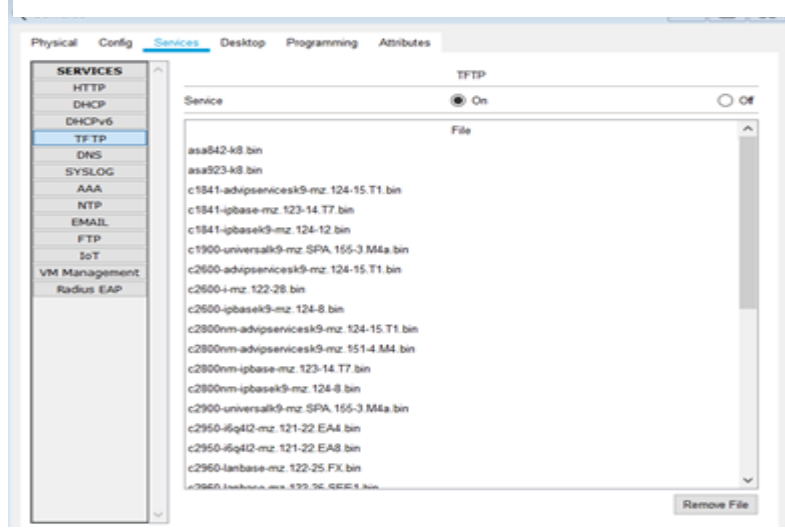
```
bucaramanga(config-line)#login block-for 20 attempts 10 within 60
tunja(config-line)#login block-for 20 attempts 10 within 60
cundinamarca(config-line)#login block-for 20 attempts 10 within 60
```

Máximo tiempo de acceso al detectar ataques.

```
bucaramanga(config-line)#login block-for 20 attempts 10 within 60
tunja(config-line)#login block-for 20 attempts 10 within 60
cundinamarca(config-line)#login block-for 20 attempts 10 within 60
```

Establezca un servidor TFTP y almacene todos los archivos necesarios de los routers.

Figura 32. Tabla de servicios server 88



Parte 2: El DHCP deberá proporcionar solo direcciones a los hosts de Bucaramanga y Cundinamarca.

```
tunja(config)#ip dhcp excluded-address 172.31.0.1 172.31.0.3
tunja(config)#ip dhcp excluded-address 172.31.0.65 172.31.0.67
tunja(config)#ip dhcp excluded-address 172.31.1.65 172.31.1.67
tunja(config)#ip dhcp excluded-address 172.31.1.1 172.31.1.3
tunja(config)#ip dhcp pool vlan10buc
tunja(dhcp-config)#network 172.31.0.0 255.255.255.192
tunja(dhcp-config)#default-router 172.31.0.1
tunja(dhcp-config)#dns-server 8.8.8.8
tunja(dhcp-config)#ip dhcp pool lan30buc
tunja(dhcp-config)#network 172.31.0.64 255.255.255.192
tunja(dhcp-config)#default-router 172.31.0.65
tunja(dhcp-config)#dns-server 8.8.8.8
tunja(dhcp-config)#ip dhcp pool vlan20cun
tunja(dhcp-config)#network 172.31.1.64 255.255.255.192
tunja(dhcp-config)#default-router 172.31.1.65
tunja(dhcp-config)#dns-server 8.8.8.8
tunja(dhcp-config)#ip dhcp pool vlan30cun
tunja(dhcp-config)#network 172.31.1.0 255.255.255.192
tunja(dhcp-config)#default-router 172.31.1.1
tunja(dhcp-config)#dns-server 8.8.8.8
```

Se configuran cada uno de los routers para que puedan tener acceso a estos POOL de direcciones.

```

bucaramanga(config)#int f0/0.10
bucaramanga(config-subif)#ip helper-address 172.31.2.33
bucaramanga(config-subif)#int f0/0.30
bucaramanga(config-subif)#ip helper-address 172.31.2.33
bucaramanga(config-subif)#end
bucaramanga#
cundinamarca(config)#int f0/0.20
cundinamarca(config-subif)#ip helper-address 172.31.2.37
cundinamarca(config-subif)#int f0/0.30
cundinamarca(config-subif)#ip helper-address 172.31.2.37
cundinamarca(config-subif)#end
cundinamarca#

```

Verificamos que cada uno de los PC de las VLAN de los routers de Bucaramanga y Cundinamarca obtenga sus direcciones IP empleando DHCP.

Figura 33. Dirección IP pc10

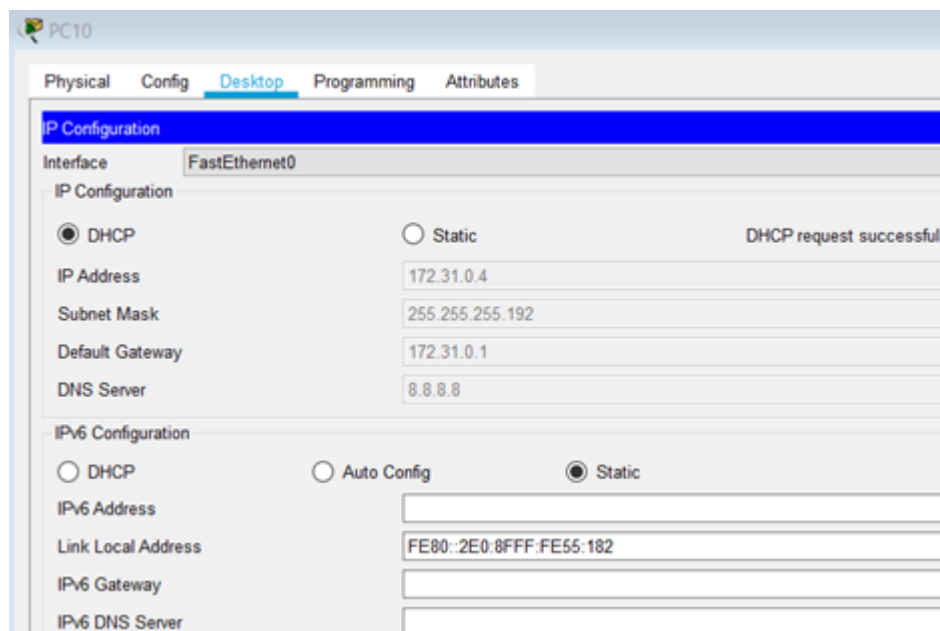


Figura 34. Dirección IP pc15

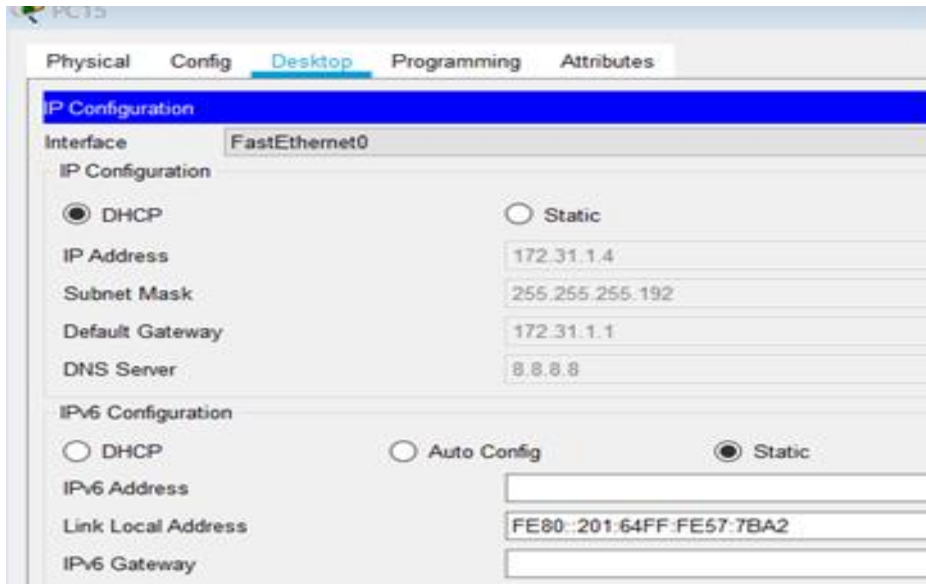


Figura 35. Dirección IP pc14

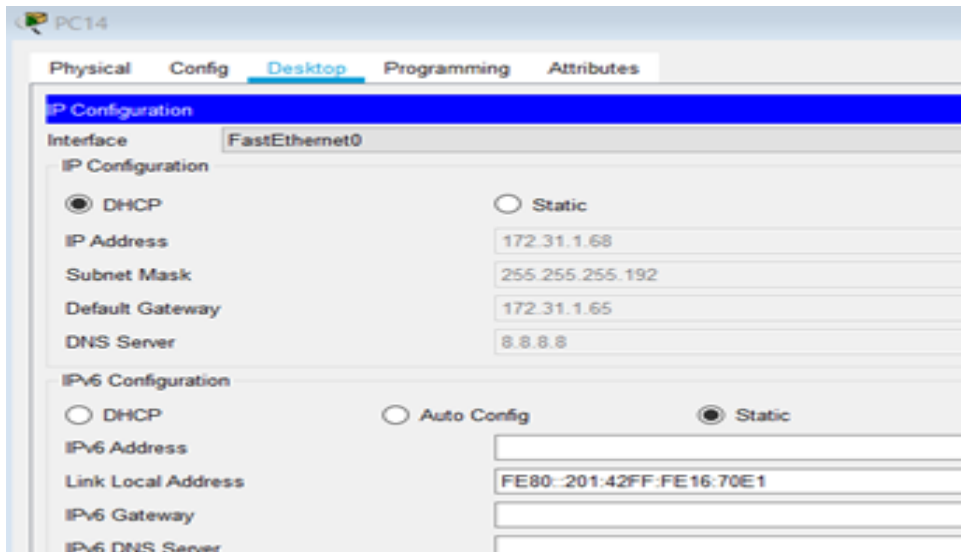
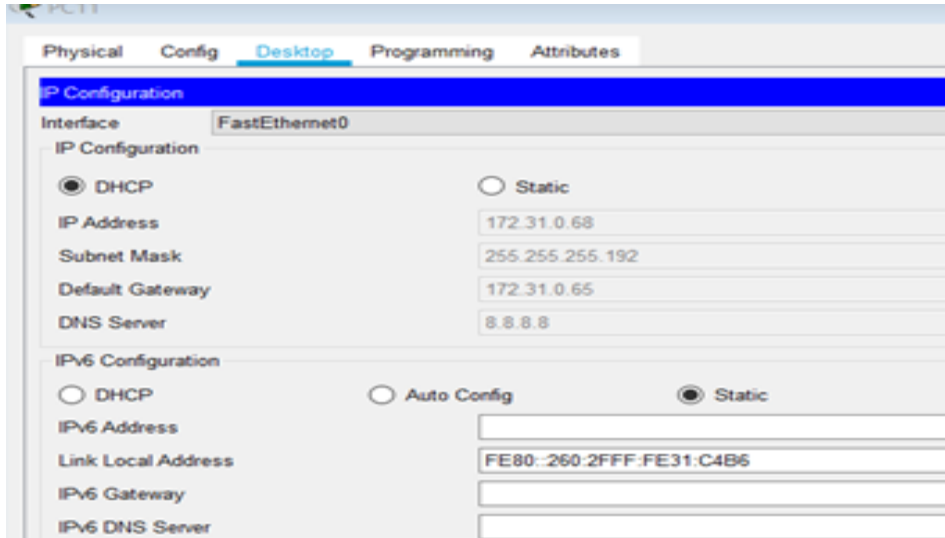


Figura 36. Dirección IP pc11



Parte 3: El web server deberá tener NAT estático y el resto de los equipos de la topología emplearán NAT de sobrecarga (PAT).

```
tunja(config)#ip nat inside source static 172.31.2.28 209.165.220.10
tunja(config)#access-list 11 permit 172.0.0.0 0.255.255.255
tunja(config)#ip nat inside source list 11 interface f0/1 overload
tunja(config)#int f0/1
tunja(config-if)#ip nat outside
tunja(config-if)#int f0/0.1
tunja(config-subif)#ip nat inside
tunja(config-subif)#int f0/0.20
tunja(config-subif)#ip nat inside
tunja(config-subif)#int f0/0.30
tunja(config-subif)#ip nat inside
tunja(config-subif)#int s0/0/0
tunja(config-if)#ip nat inside
tunja(config-if)#int s0/0/1
tunja(config-if)#ip nat inside
tunja(config-if)#exit
tunja(config)#ip route 0.0.0.0 0.0.0.0 209.165.220.4
tunja(config)#router ospf 1
tunja(config-router)#default-information originate
tunja(config-router)#end
```

tunja#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 209.165.220.4 to network 0.0.0.0
172.3.0.0/29 is subnetted, 1 subnets
C 172.3.2.8 is directly connected, FastEthernet0/0.1
172.31.0.0/16 is variably subnetted, 11 subnets, 3 masks
O 172.31.0.0/26 [110/65] via 172.31.2.34, 00:10:47, Serial0/0/0
O 172.31.0.64/26 [110/65] via 172.31.2.34, 00:10:47, Serial0/0/0
C 172.31.0.128/26 is directly connected, FastEthernet0/0.20
C 172.31.0.192/26 is directly connected, FastEthernet0/0.30
O 172.31.1.0/26 [110/65] via 172.31.2.38, 00:10:47, Serial0/0/1
O 172.31.1.64/26 [110/65] via 172.31.2.38, 00:10:47, Serial0/0/1
O 172.31.2.0/29 [110/65] via 172.31.2.34, 00:10:47, Serial0/0/0
O 172.31.2.8/29 [110/65] via 172.31.2.38, 00:10:47, Serial0/0/1
O 172.31.2.24/29 [110/65] via 172.31.2.38, 00:10:47, Serial0/0/1
C 172.31.2.32/30 is directly connected, Serial0/0/0
C 172.31.2.36/30 is directly connected, Serial0/0/1
C 209.165.220.0/24 is directly connected, FastEthernet0/1
S* 0.0.0.0/0 [1/0] via 209.165.220.4
tunja#

bucaramanga#show ip route

Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
* - candidate default, U - per-user static route, o - ODR
P - periodic downloaded static route
Gateway of last resort is 172.31.2.33 to network 0.0.0.0
172.3.0.0/29 is subnetted, 1 subnets
O 172.3.2.8 [110/65] via 172.31.2.33, 00:11:18, Serial0/0/0
172.31.0.0/16 is variably subnetted, 11 subnets, 3 masks
C 172.31.0.0/26 is directly connected, FastEthernet0/0.10

```
C 172.31.0.64/26 is directly connected, FastEthernet0/0.30
O 172.31.0.128/26 [110/65] via 172.31.2.33, 00:11:18, Serial0/0/0
O 172.31.0.192/26 [110/65] via 172.31.2.33, 00:11:18, Serial0/0/0
O 172.31.1.0/26 [110/129] via 172.31.2.33, 00:11:18, Serial0/0/0
O 172.31.1.64/26 [110/129] via 172.31.2.33, 00:11:18, Serial0/0/0
C 172.31.2.0/29 is directly connected, FastEthernet0/0.1
O 172.31.2.8/29 [110/129] via 172.31.2.33, 00:11:18, Serial0/0/0
O 172.31.2.24/29 [110/129] via 172.31.2.33, 00:11:18, Serial0/0/0
C 172.31.2.32/30 is directly connected, Serial0/0/0
O 172.31.2.36/30 [110/128] via 172.31.2.33, 00:11:18, Serial0/0/0
O*E2 0.0.0.0/0 [110/1] via 172.31.2.33, 00:00:51, Serial0/0/0
bucaramanga#
```

cundinamarca#show ip route

```
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
* - candidate default, U - per-user static route, o - ODR
P - periodic downloaded static route
Gateway of last resort is 172.31.2.37 to network 0.0.0.0
172.3.0.0/29 is subnetted, 1 subnets
O 172.3.2.8 [110/65] via 172.31.2.37, 00:12:02, Serial0/0/0
172.31.0.0/16 is variably subnetted, 11 subnets, 3 masks
O 172.31.0.0/26 [110/129] via 172.31.2.37, 00:11:52, Serial0/0/0
O 172.31.0.64/26 [110/129] via 172.31.2.37, 00:11:52, Serial0/0/0
O 172.31.0.128/26 [110/65] via 172.31.2.37, 00:12:02, Serial0/0/0
O 172.31.0.192/26 [110/65] via 172.31.2.37, 00:12:02, Serial0/0/0
C 172.31.1.0/26 is directly connected, FastEthernet0/0.30
C 172.31.1.64/26 is directly connected, FastEthernet0/0.20
O 172.31.2.0/29 [110/129] via 172.31.2.37, 00:11:52, Serial0/0/0
C 172.31.2.8/29 is directly connected, FastEthernet0/0.1
C 172.31.2.24/29 is directly connected, FastEthernet0/0.88
O 172.31.2.32/30 [110/128] via 172.31.2.37, 00:12:02, Serial0/0/0
C 172.31.2.36/30 is directly connected, Serial0/0/0
O*E2 0.0.0.0/0 [110/1] via 172.31.2.37, 00:01:34, Serial0/0/0
cundinamarca#
```

Figura 37. Diagnostico conectividad pc15

```

Packet Tracer PC Command Line 1.0
C:\>ping 209.165.220.4

Pinging 209.165.220.4 with 32 bytes of data:

Request timed out.
Reply from 209.165.220.4: bytes=32 time=1ms TTL=126
Reply from 209.165.220.4: bytes=32 time=1ms TTL=126
Reply from 209.165.220.4: bytes=32 time=1ms TTL=126

Ping statistics for 209.165.220.4:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 1ms, Average = 1ms

C:\>ping 209.165.220.4

Pinging 209.165.220.4 with 32 bytes of data:

Reply from 209.165.220.4: bytes=32 time=2ms TTL=126
Reply from 209.165.220.4: bytes=32 time=1ms TTL=126
Reply from 209.165.220.4: bytes=32 time=1ms TTL=126
Reply from 209.165.220.4: bytes=32 time=1ms TTL=126

Ping statistics for 209.165.220.4:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 2ms, Average = 1ms
    
```

Figura 38. Tabla de estadísticas del router

```

Router0
Physical Config CLI Attributes

IOS Command Line Interface

00:00:10: %OSPF-5-ADJCHG: Process 1, Nbr 172.31.2.38 on
Serial0/0/1 from LOADING to FULL, Loading Done
El Acceso no autorizado est prohibido

tunja>
tunja>enable
tunja#
tunja#show ip nat tra
Pro Inside global      Inside local      Outside local
Outside global
icmp 209.165.220.1:3   172.31.0.11:3    209.165.220.4:3
209.165.220.4:3
icmp 209.165.220.1:4   172.31.0.11:4    209.165.220.4:4
209.165.220.4:4
icmp 209.165.220.1:5   172.31.0.11:5    209.165.220.4:5
209.165.220.4:5
icmp 209.165.220.1:6   172.31.0.11:6    209.165.220.4:6
209.165.220.4:6
icmp 209.165.220.1:7   172.31.0.11:7    209.165.220.4:7
209.165.220.4:7
icmp 209.165.220.1:8   172.31.0.11:8    209.165.220.4:8
209.165.220.4:8
--- 209.165.220.10     172.31.2.28      ---              ---
tunja#!
    
```

Parte 4: El enrutamiento deberá tener autenticación.

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

Parte 5: Listas de control de acceso.

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

```
cundinamarca(config-if)#access-list 131 deny ip 172.31.1.64 0.0.0.63
209.165.220.0 0.0.0.255
cundinamarca(config)#access-list 131 permit ip any any
cundinamarca(config)#int f0/0.20
cundinamarca(config-subif)#ip access-group 131 in
cundinamarca(config-subif)#
```

Figura 39. Diagnostico conectividad pc14

```
Physical Config Desktop Programming Attributes
Command Prompt
Pinging 209.165.220.4 with 32 bytes of data:
Reply from 172.31.1.65: Destination host unreachable.
Reply from 172.31.1.65: Destination host unreachable.
Reply from 172.31.1.65: Destination host unreachable.
Ping statistics for 209.165.220.4:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
C:\>ping 172.31.0.130
Pinging 172.31.0.130 with 32 bytes of data:
Request timed out.
Reply from 172.31.0.130: bytes=32 time=17ms TTL=126
Reply from 172.31.0.130: bytes=32 time=14ms TTL=126
Reply from 172.31.0.130: bytes=32 time=1ms TTL=126
Ping statistics for 172.31.0.130:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 17ms, Average = 10ms
```

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

```
cundinamarca(config-subif)#access-list 132 permit ip 172.31.1.0 0.0.0.63
209.165.220.0 0.0.0.255
cundinamarca(config)#access-list 132 deny ip any any
cundinamarca(config)#int f0/0.30
cundinamarca(config-subif)#ip access-group 132 in
cundinamarca(config-subif)#
```

Figura 40. Diagnostico conectividad pc15 #2

```
Physical Config Desktop Programming Attributes
Command Prompt
Packet Tracer PC Command Line 1.0
C:\>ping 2019.165.220.4
Ping request could not find host 2019.165.220.4. Please check
C:\>
C:\>
C:\>ping 209.165.220.4
Pinging 209.165.220.4 with 32 bytes of data:
Request timed out.
Reply from 209.165.220.4: bytes=32 time=1ms TTL=126
Reply from 209.165.220.4: bytes=32 time=15ms TTL=126
Reply from 209.165.220.4: bytes=32 time=1ms TTL=126
Ping statistics for 209.165.220.4:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 15ms, Average = 5ms
C:\>ping 172.31.0.130
Pinging 172.31.0.130 with 32 bytes of data:
Reply from 172.31.1.1: Destination host unreachable.
Reply from 172.31.1.1: Destination host unreachable.
Reply from 172.31.1.1: Destination host unreachable.
Reply from 172.31.1.1: Destination host unreachable.
Ping statistics for 172.31.0.130:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
```

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

```
tunja(config)#access-list 131 permit tcp 172.31.0.192 0.0.0.63 209.165.220.0
0.0.0.255 eq www
tunja(config)#access-list 131 permit tcp 172.31.0.192 0.0.0.63 209.165.220.0
0.0.0.255 eq ftp
tunja(config)#int f0/0.30
tunja(config-subif)#ip access-group 131 in
tunja(config-subif)#
```

Figura 41. Diagnostico conectividad pc13

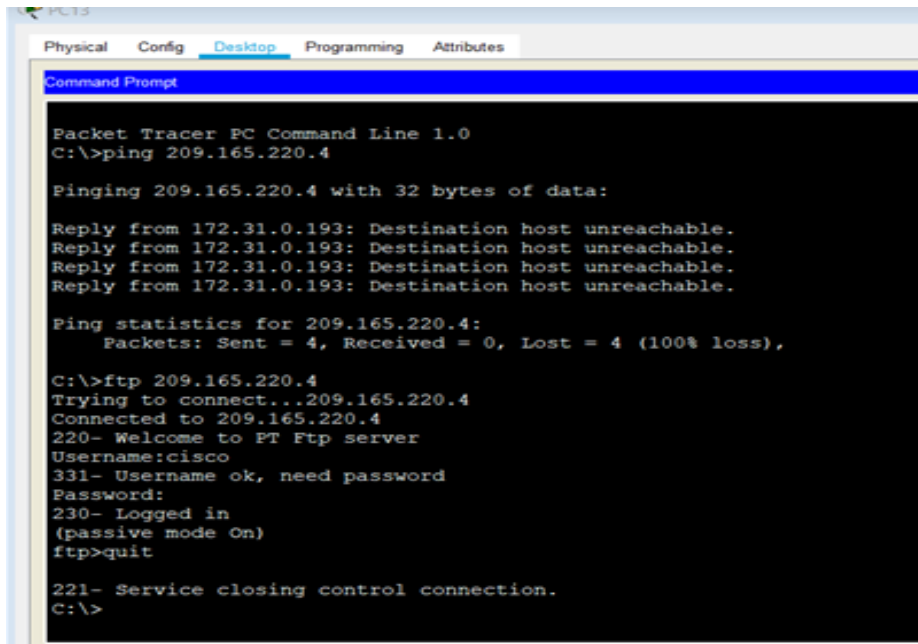
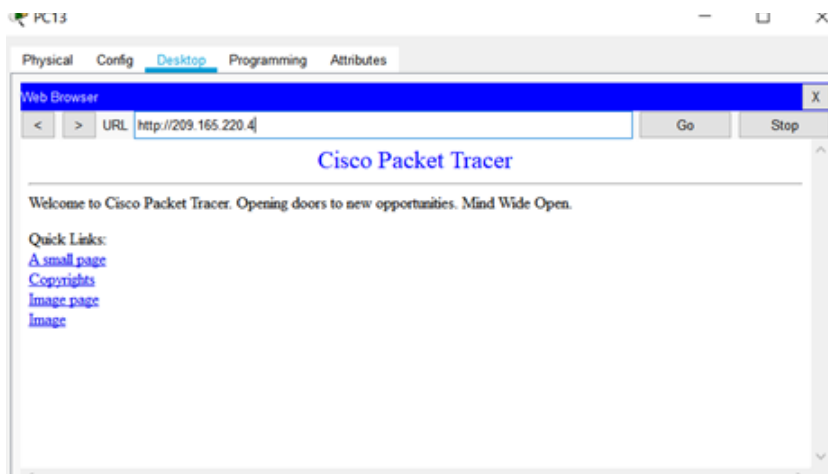


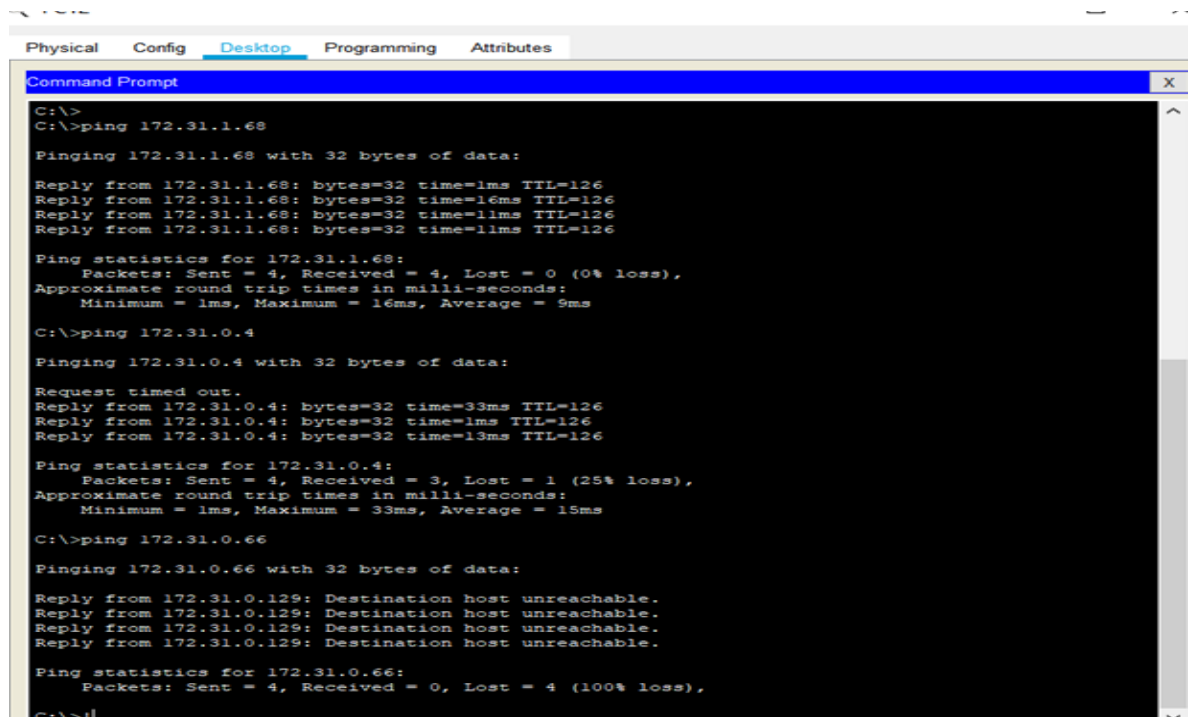
Figura 42. Diagnostico conectividad pc13 #2



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

```
tunja(config-subif)#access-list 132 permit ip 172.31.0.128 0.0.0.63 172.31.1.64 0.0.0.63
tunja(config)#access-list 132 permit ip 172.31.0.128 0.0.0.63 172.31.0.0 0.0.0.63
tunja(config)#int f0/0.20
tunja(config-subif)#ip access-group 132 in
tunja(config-subif)#
```

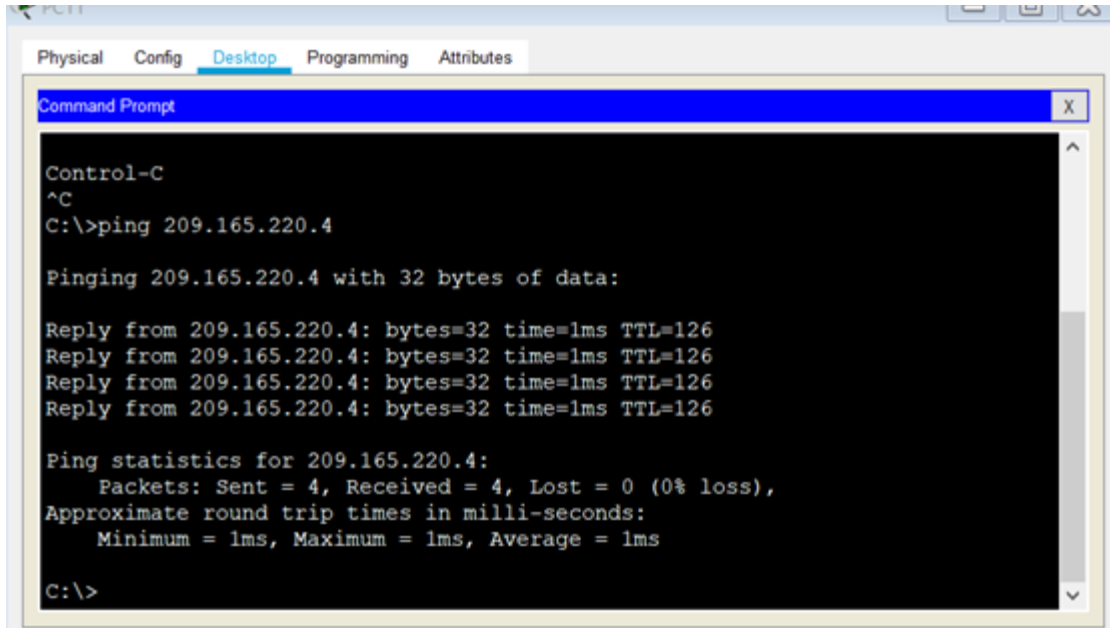
Figura 43. Diagnostico conectividad pc12



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

```
bucaramanga(config)#access-list 131 permit ip 172.31.0.64 0.0.0.63 209.165.220.0 0.0.0.255
bucaramanga(config)#int f0/0.30
bucaramanga(config-subif)#ip access-group 131 in
bucaramanga(config-subif)#
```

Figura 44. Diagnostico conectividad pc11



```
Physical  Config  Desktop  Programming  Attributes
Command Prompt
Control-C
^C
C:\>ping 209.165.220.4

Pinging 209.165.220.4 with 32 bytes of data:

Reply from 209.165.220.4: bytes=32 time=1ms TTL=126
Reply from 209.165.220.4: bytes=32 time=1ms TTL=126
Reply from 209.165.220.4: bytes=32 time=1ms TTL=126
Reply from 209.165.220.4: bytes=32 time=1ms TTL=126

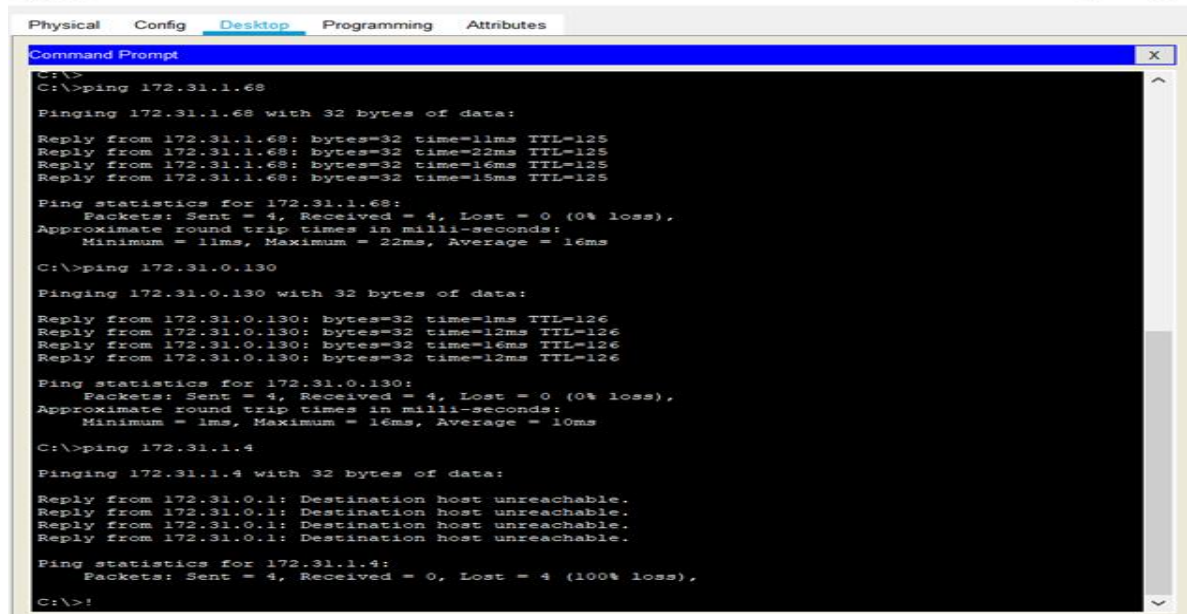
Ping statistics for 209.165.220.4:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 1ms, Average = 1ms

C:\>
```

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

```
bucaramanga(config-subif)#access-list 132 permit ip 172.31.0.0 0.0.0.63
172.31.1.64 0.0.0.63
bucaramanga(config)#access-list 132 permit ip 172.31.0.0 0.0.0.63 172.31.0.128
0.0.0.63
bucaramanga(config)#int f0/0.10
bucaramanga(config-subif)#ip access-group 132 in
bucaramanga(config-subif)#
```

Figura 45. Diagnostico conectividad pc10



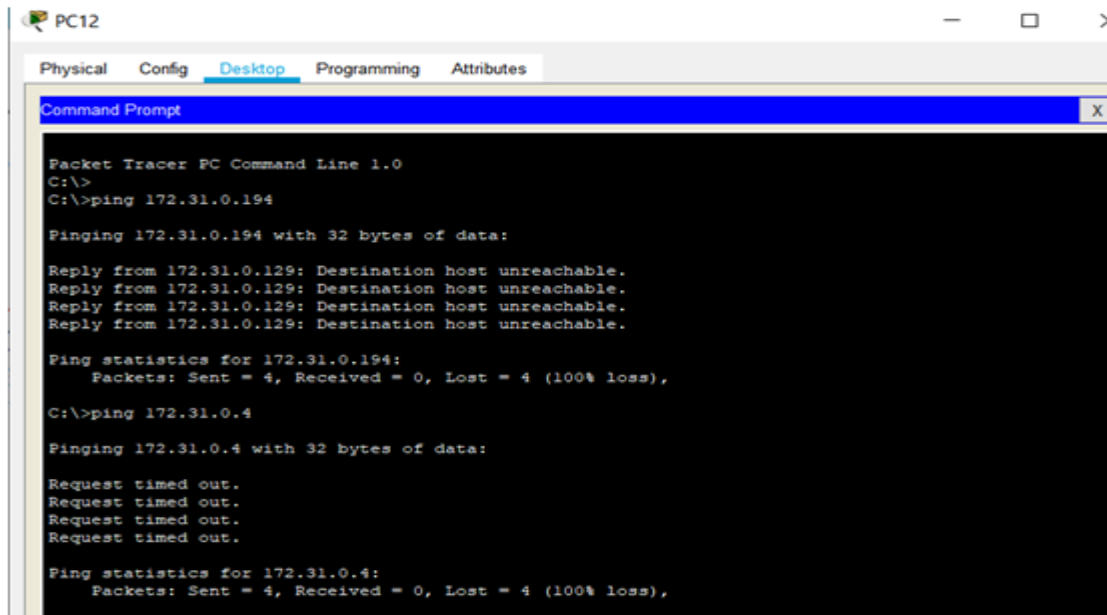
```
Physical  Config  Desktop  Programming  Attributes
Command Prompt
C:\>
C:\>ping 172.31.1.68
Pinging 172.31.1.68 with 32 bytes of data:
Reply from 172.31.1.68: bytes=32 time=11ms TTL=125
Reply from 172.31.1.68: bytes=32 time=22ms TTL=125
Reply from 172.31.1.68: bytes=32 time=16ms TTL=125
Reply from 172.31.1.68: bytes=32 time=15ms TTL=125
Ping statistics for 172.31.1.68:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 11ms, Maximum = 22ms, Average = 16ms
C:\>ping 172.31.0.130
Pinging 172.31.0.130 with 32 bytes of data:
Reply from 172.31.0.130: bytes=32 time=1ms TTL=126
Reply from 172.31.0.130: bytes=32 time=12ms TTL=126
Reply from 172.31.0.130: bytes=32 time=16ms TTL=126
Reply from 172.31.0.130: bytes=32 time=12ms TTL=126
Ping statistics for 172.31.0.130:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 16ms, Average = 10ms
C:\>ping 172.31.1.4
Pinging 172.31.1.4 with 32 bytes of data:
Reply from 172.31.0.1: Destination host unreachable.
Reply from 172.31.0.1: Destination host unreachable.
Reply from 172.31.0.1: Destination host unreachable.
Reply from 172.31.0.1: Destination host unreachable.
Ping statistics for 172.31.1.4:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
C:\>!
```

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

```
bucaramanga(config-subif)#access-list 123 deny ip 172.31.2.0 0.0.0.7 172.31.0.0
0.0.0.63
bucaramanga(config)#access-list 123 deny ip 172.31.0.64 0.0.0.63 172.31.0.0
0.0.0.63
bucaramanga(config)#access-list 123 permit ip any any
bucaramanga(config)#int f0/0.10
bucaramanga(config-subif)#ip access-group 123 out
bucaramanga(config-subif)#
tunja(config)#access-list 123 deny ip 172.3.2.8 0.0.0.7 172.31.0.128 0.0.0.63
tunja(config)#access-list 123 deny ip 172.3.0.192 0.0.0.63 172.31.0.128 0.0.0.63
tunja(config)#access-list 123 permit ip any any
tunja(config)#int f0/0.20
tunja(config-subif)#ip access-group 123 out
tunja(config-subif)#
cundinamarca(config)#access-list 123 deny ip 172.31.2.8 0.0.0.7 172.31.1.64
0.0.0.63
cundinamarca(config)#access-list 123 deny ip 172.31.1.0 0.0.0.63 172.31.1.64
0.0.0.63
cundinamarca(config)#access-list 123 deny ip 172.31.2.24 0.0.0.7 172.31.1.64
0.0.0.63
cundinamarca(config)#access-list 123 permit ip any any
cundinamarca(config)#int f0/0.20
```

```
cundinamarca(config-subif)#ip access-group 123 out
cundinamarca(config-subif)#
```

Figura 46. Diagnostico conectividad pc12 #2



```
PC12
Physical Config Desktop Programming Attributes
Command Prompt
Packet Tracer PC Command Line 1.0
C:\>
C:\>ping 172.31.0.194

Pinging 172.31.0.194 with 32 bytes of data:

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

Ping statistics for 172.31.0.194:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

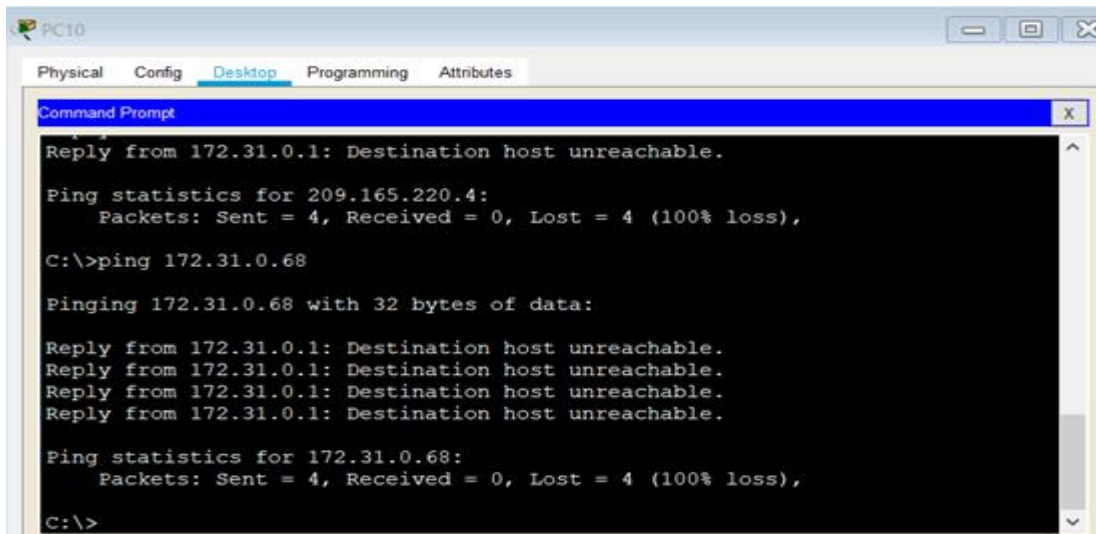
C:\>ping 172.31.0.4

Pinging 172.31.0.4 with 32 bytes of data:

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

Ping statistics for 172.31.0.4:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
```

Figura 47. Diagnostico conectividad pc10 #2



```
PC10
Physical Config Desktop Programming Attributes
Command Prompt
Reply from 172.31.0.1: Destination host unreachable.

Ping statistics for 209.165.220.4:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

C:\>ping 172.31.0.68

Pinging 172.31.0.68 with 32 bytes of data:

Reply from 172.31.0.1: Destination host unreachable.
Reply from 172.31.0.1: Destination host unreachable.
Reply from 172.31.0.1: Destination host unreachable.
Reply from 172.31.0.1: Destination host unreachable.

Ping statistics for 172.31.0.68:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

C:\>
```

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

```

bucaramanga(config-subif)#access-list 10 permit 172.31.2.0 0.0.0.7
bucaramanga(config)#access-list 10 permit 172.3.2.8 0.0.0.7
bucaramanga(config)#access-list 10 permit 172.31.2.8 0.0.0.7
bucaramanga(config)#line vty 0 15
bucaramanga(config-line)#access-class 10 in
bucaramanga(config-line)#
tunja(config-subif)#access-list 10 permit 172.31.2.0 0.0.0.7
tunja(config)#access-list 10 permit 172.3.2.8 0.0.0.7
tunja(config)#access-list 10 permit 172.31.2.8 0.0.0.7
tunja(config)#line vty 0 15
tunja(config-line)#access-class 10 in
tunja(config-line)#
cundinamarca(config-subif)#access-list 10 permit 172.31.2.0 0.0.0.7
cundinamarca(config)#access-list 10 permit 172.3.2.8 0.0.0.7
cundinamarca(config)#access-list 10 permit 172.31.2.8 0.0.0.7
cundinamarca(config)#line vty 0 15
cundinamarca(config-line)#access-class 10 in
cundinamarca(config-line)#

```

Figura 48. Verificación listas de control de acceso en switch 1

The screenshot shows a network switch CLI interface with tabs for Physical, Config, CLI, and Attributes. The CLI tab is active, displaying the following text:

```

switchbucaramanga>en
switchbucaramanga#telnet 172.31.2.1
Trying 172.31.2.1 ...OpenEl Acceso no autorizado est
prohibido

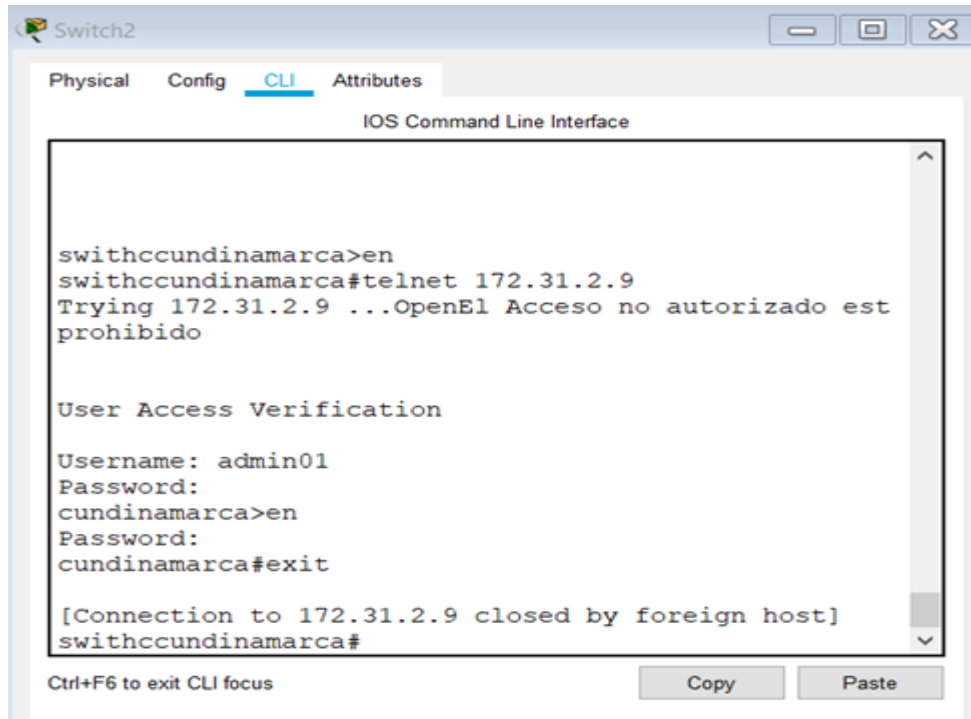
User Access Verification

Username: admin01
Password:
bucaramanga>en
Password:
bucaramanga#exit

[Connection to 172.31.2.1 closed by foreign host]
switchbucaramanga#

```

Figura 49. Verificación listas de control de acceso en switch 2



```
Switch2
Physical Config CLI Attributes
IOS Command Line Interface

switchcundinamarca>en
switchcundinamarca#telnet 172.31.2.9
Trying 172.31.2.9 ...OpenEl Acceso no autorizado est
prohibido

User Access Verification
Username: admin01
Password:
cundinamarca>en
Password:
cundinamarca#exit

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

Ctrl+F6 to exit CLI focus Copy Paste

CONCLUSIONES

Con esta actividad se resolvió el planteamiento de un primer escenario siendo este parte del trabajo final del curso de profundización, se configuro la topología física calculando el direccionamiento de acuerdo con las especificaciones dadas en la guía, posteriormente se procedió a encontrar la solución de acuerdo a las indicaciones, luego se verifico la conectividad y demás pruebas referentes.

Luego se procedió con el segundo escenario, donde se configuró la topología a través del programa Packet Tracer, cumpliendo así con los lineamientos solicitados en el estudio de caso. Con esta configuración inicial se aplicó una configuración dirigida a los protocolos OSPF, así como el EIGRP, sobre los diferentes dispositivos de red.

Esto nos llevó a configurar prioritariamente los Routers y RID, a través de los comandos ping, tracer y show se procedió a revisar el funcionamiento observando la tabla de enrutamiento y la configuración de la tabla aplicada

BIBLIOGRAFIA

Morales, J. M. Introducción al CLI en routers y switches cisco. Recuperado de: <https://pics.unlugarenelmundo.es/hechoencasa/CLInRoutersySwitchesCisco.pdf>

Packet Tracer

http://cisco.netacad.net/cnams/content/templates/LibraryHome.jsp#/resource/lc_ms/nams_site/english/generic_site_areas/library/index_role.htmlCCNA1Exploration

Configuring a LAN with DHCP and VLANs

Cisco. (2007, 26 septiembre). Configuring a LAN with DHCP and VLANs [Support]. Recuperado 19 julio, 2019, de <https://www.cisco.com/en/US/docs/routers/access/800/850/software/configuration/guide/dhcpvlan.html>

Cisco IOS LAN Switching Command Reference

Cisco. (2013, 7 octubre). Cisco IOS LAN Switching Command Reference - show vlan turlough spanning-tree vlan [Support]. Recuperado 19 julio, 2019, de https://www.cisco.com/c/en/us/td/docs/ios/lanswitch/command/reference/lsw_book/lsw_s2.html

IP Addressing

Cisco. (2017a, 15 julio). IP Addressing: DHCP Configuration Guide, Cisco IOS Release 12.4 - Configuring the Cisco IOS DHCP Client [Support]. Recuperado 19 julio, 2019, de https://www.cisco.com/c/en/us/td/docs/iosxml/ios/ipaddr_dhcp/configuration/12-4/dhcp-12-4-book/config-dhcp-client.html

Macfarlane, J. (2014). Network Routing Basics : Understanding IP Routing in Cisco Systems. Recuperado de: <http://bibliotecavirtual.unad.edu.co:2048/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=e000xww&AN=158227&lang=es&site=ehost-live>

Lucas, M. (2009). Cisco Routers for the Desperate : Router and Switch Management, the Easy Way. San Francisco: No Starch Press. Recuperado de: <http://bibliotecavirtual.unad.edu.co:2048/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=e000xww&AN=440032&lang=es&site=ehost-live>

Odom, W. (2013). CISCO Press (Ed). CCNA ICND1 Official Exam Certification Guide. Recuperado de: <http://ptgmedia.pearsoncmg.com/images/9781587205804/samplepages/9781587205804.pdf>

Odom, W. (2013). CISCO Press (Ed). CCNA ICND2 Official Exam Certification Guide. Recuperado de: <http://een.iust.ac.ir/profs/Beheshti/Computer%20networking/Auxiliary%20materials/Cisco-ICND2.pdf>

Lammle, T. (2010). CISCO Press (Ed). Cisco Certified Network Associate Study Guide. Recuperado de: <https://gonda.nic.in/swangonda/pdf/ccna1.pdf>

DHCP. Principios de Enrutamiento y Conmutación. (2014) Recuperado de: <https://static-courseassets.s3.amazonaws.com/RSE50ES/module10/index.html#10.0.1.1>

Teare, D., Vachon B., Graziani, R. (2015). CISCO Press (Ed). Implementing IPv4 in the Enterprise Network. Implementing Cisco IP Routing (ROUTE) Foundation Learning Guide CCNP ROUTE 300-101. Recuperado de <https://1drv.ms/b/s!AmIJYei-NT1IlnMfy2rhPZHwEoWx>

Segui, F. B. (2015). Configuración DHCP en routers CISCO.
Chamorro Serna, L., Montaña Torres, O., Guzmán Pérez, E. H., Daza Navia, M. Y., & Castillo Ortiz, O. F. (2018). Diplomado de Profundización Cisco-Enrutamiento en soluciones de red.

Es.wikipedia.org. (2018). Open Shortest Path First. [online] disponible en: https://es.wikipedia.org/wiki/Open_Shortest_Path_First [28 May 2018].