Routing & Switching Project Report

By Rixte

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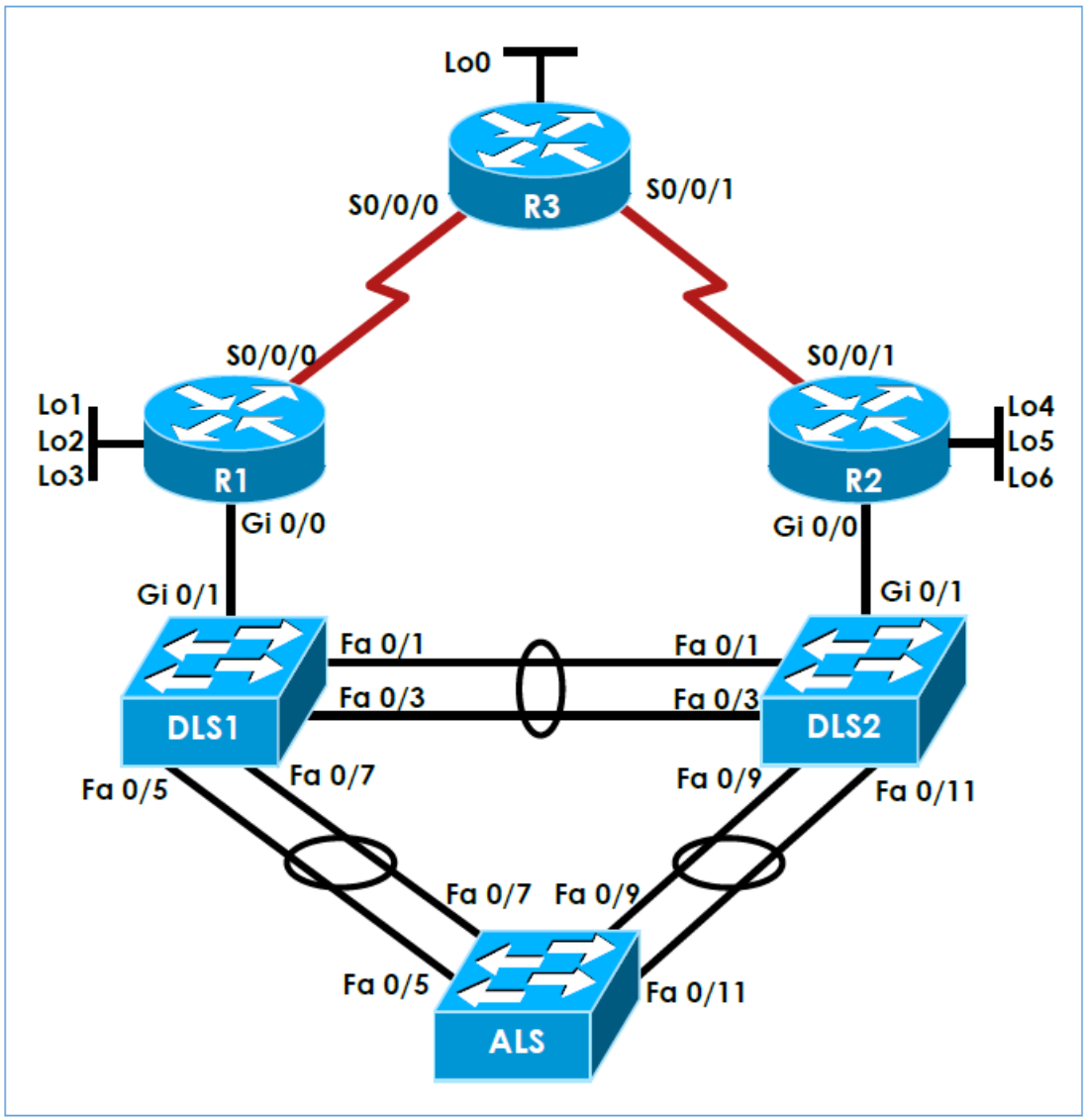
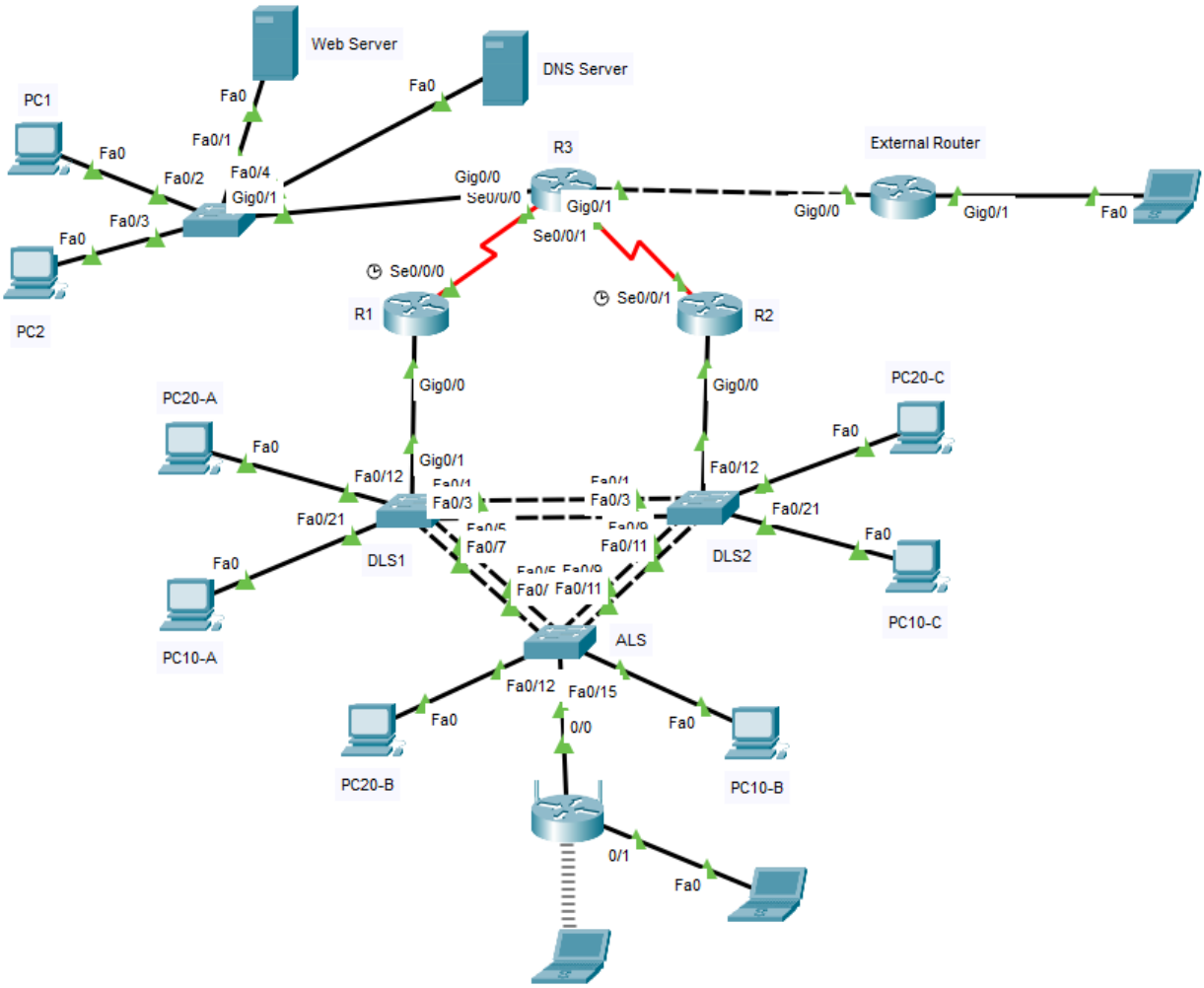
1.0 Scenario

You are a Network Engineer in a small-medium sized enterprise company. Your company is implementing a wired network that can support growth over the next five years. Setup and configure the network using packet tracer and verify its connectivity. Your manager has given you the following requirements to ensure connectivity and network security within the wired LAN.



1.1 Network Topology



My topology consists of 3 routers, R1, R2 and R3, as well as 3 switches, DLS1, DLS2 and ALS.

R3 is a DHCP server and R1 and R2 are the DHCP relay agents, where the PCs 10-A, 10-B, 10-C, 20-A, 20-B, 20-C obtain their IPv4 addresses through DHCP.

For my Web Server and DNS Server enhancement, I connected a switch to R3. The switch is connected to a Web Server and a DNS Server, as well as 2 PCs to demonstrate DNS.

For my NAT enhancement, I connected a laptop to an External Router and connected the External Router to R3.

For my Wireless Router enhancement, I connected a Wireless Router to my ALS switch, and a laptop to configure the enhancement, where I connected a laptop at the end wirelessly to the Wireless Router.

1.2 IPv4 Address Planning Table

Table 1: Addressing				
Device	**Interface**	**IP Address**	**Subnet Mask**	**Default Gateway**
R1	G0/0.10	10.23.10.1	255.255.255.0	
	G0/0.20	10.23.20.1	255.255.255.0	
	G0/0.88	10.23.88.1	255.255.255.0	
	G0/0.99	10.23.99.1	255.255.255.0	
	S0/0/0	13.1.1.1	255.255.255.252	
	Lo1	11.1.1.1	255.255.255.0	
	Lo2	11.2.1.1	255.255.255.0	
	Lo3	11.3.1.1	255.255.255.0	
R2	G0/0.10	10.23.10.2	255.255.255.0	
	G0/0.20	10.23.20.2	255.255.255.0	
	G0/0.88	10.23.88.2	255.255.255.0	
	G0/0.99	10.23.99.2	255.255.255.0	
	S0/0/1	23.1.1.1	255.255.255.252	
	Lo4	12.1.1.1	255.255.255.0	
	Lo5	12.2.1.1	255.255.255.0	
	Lo6	12.3.1.1	255.255.255.0	
R3	S0/0/0	13.1.1.2	255.255.255.252	
	S0/0/1	23.1.1.2	255.255.255.252	
	Lo0	209.165.200.225	255.255.255.248	
DLS1	VLAN 99	10.23.99.11	255.255.255.0	10.23.99.1
DLS2	VLAN 99	10.23.99.12	255.255.255.0	10.23.99.2
ALS	VLAN 99	10.23.99.13	255.255.255.0	10.23.99.2

Table 2: VLAN and Port Assignments		
VLAN	**Name**	**Interface**
10	Staff	F0/21-24
20	Guest	F0/12-20
88	Native	G0/1
99	Management	VLAN 99

2.0 Verification Tests

2.1 Automatic Assignment of IP Addresses (DHCP)

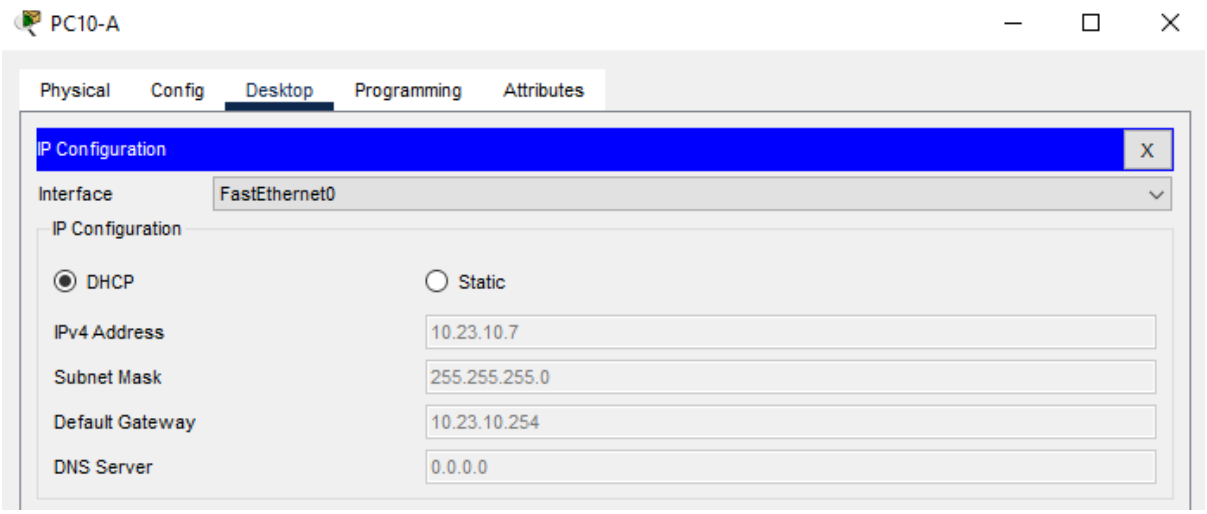
DHCP is where an IP address, a subnet mask and a default gateway can be automatically assigned to PCs, hence manually assigning IP addresses, subnet masks and default gateways is not required.

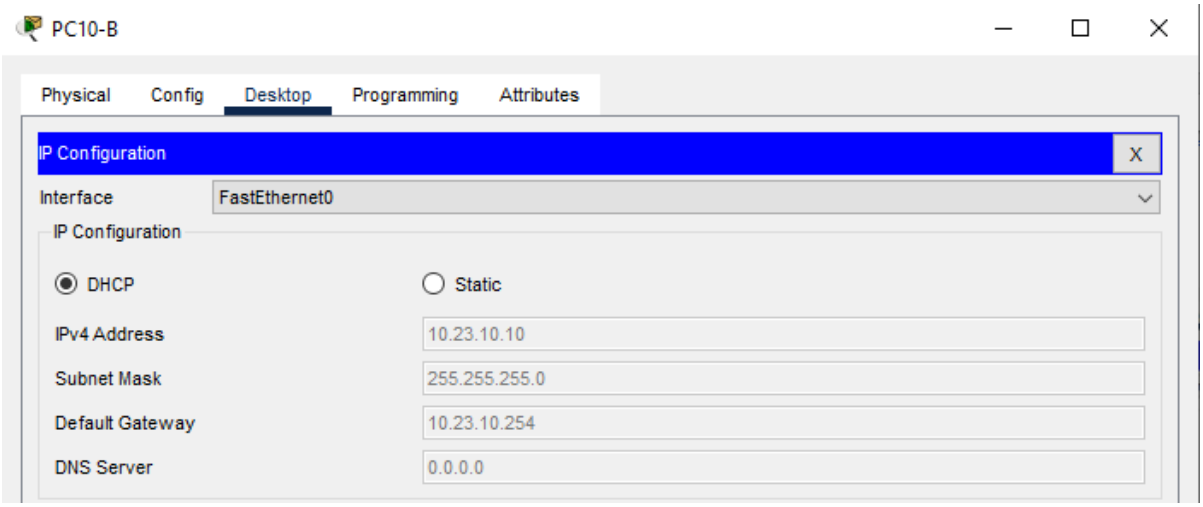
Why DHCP?
IP addresses for computers that are removed from the network must be manually reclaimed then it can be reassigned to another device on the network. With DHCP, IP addresses that are not used anymore are automatically returned to the IP address pool for reallocation to another device. DHCP also minimizes errors caused by manually assigning IP addresses, and end devices do not have to be rebooted for DHCP to automatically assign an IP address.

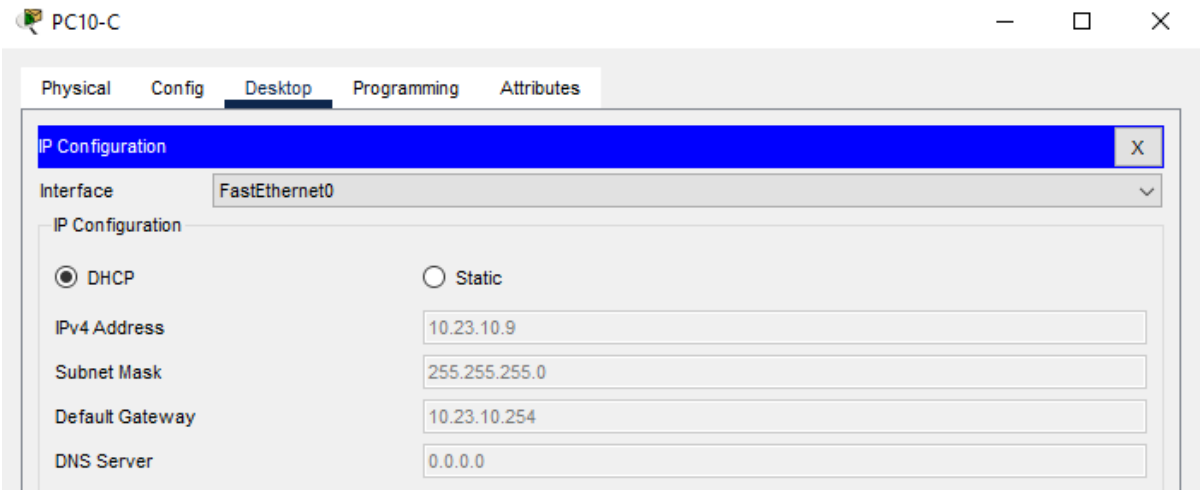
Table 3: Automatic Assignment of IP Addresses (DHCP)

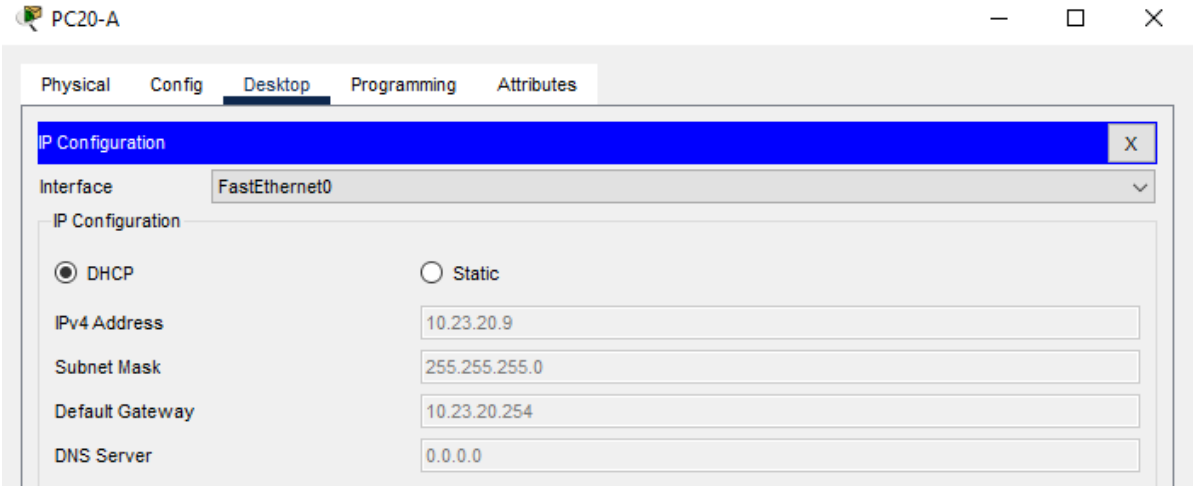
PC	DHCP Successful?	Assigned IP Address
PC10-A	Successful	10.23.10.7
PC10-B	Successful	10.23.10.10
PC10-C	Successful	10.23.10.9
PC20-A	Successful	10.23.20.9
PC20-B	Successful	10.23.20.12
PC20-C	Successful	10.23.20.7

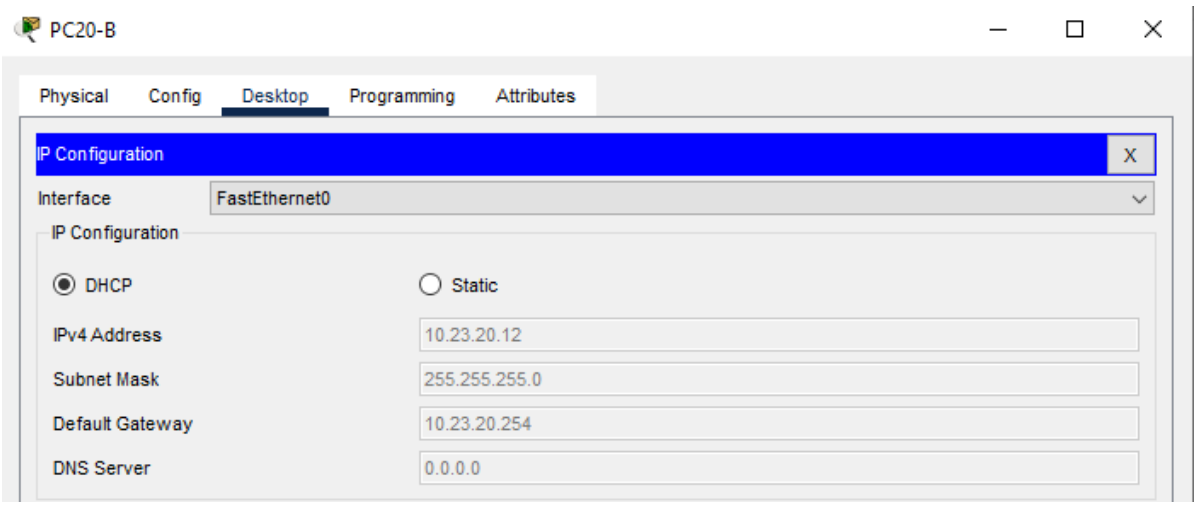
DHCP Screenshots

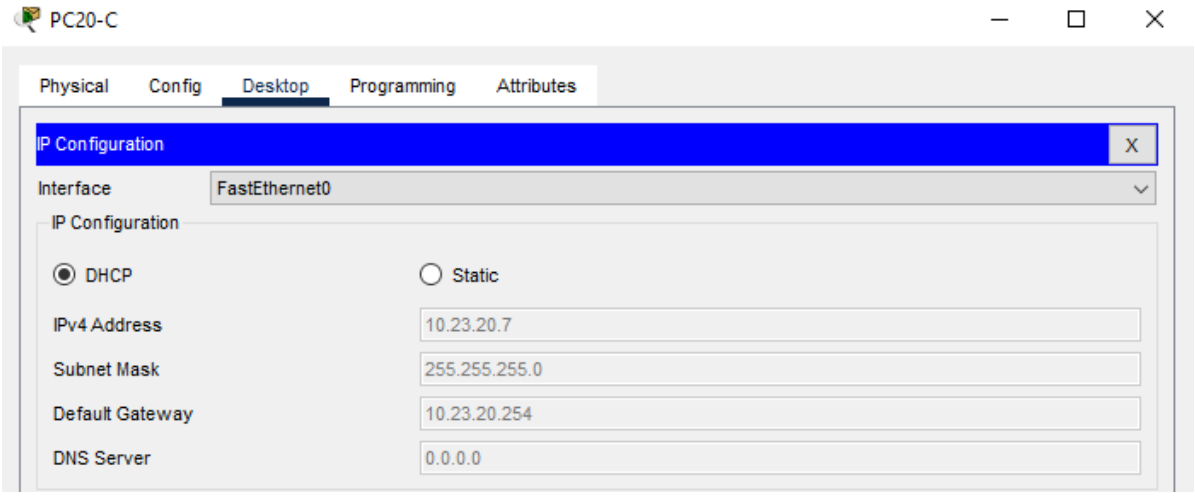







PC20-A
Physical
Config
Desktop
Programming
Attributes
IP Configuration
X
Interface
FastEthernet0
IP Configuration
DHCP
Static
IPv4 Address
10.23.20.9
Subnet Mask
255.255.255.0
Default Gateway
10.23.20.254
DNS Server
0.0.0.0


PC20-B
Physical
Config
Desktop
Programming
Attributes
IP Configuration
X
Interface
FastEthernet0
IP Configuration
DHCP
Static
IPv4 Address
10.23.20.12
Subnet Mask
255.255.255.0
Default Gateway
10.23.20.254
DNS Server
0.0.0.0


PC20-C
Physical
Config
Desktop
Programming
Attributes
IP Configuration
X
Interface
FastEthernet0
IP Configuration
DHCP
Static
IPv4 Address
10.23.20.7
Subnet Mask
255.255.255.0
Default Gateway
10.23.20.254
DNS Server
0.0.0.0

2.2 Connectivity Test to Routers & Switches (Ping Test)

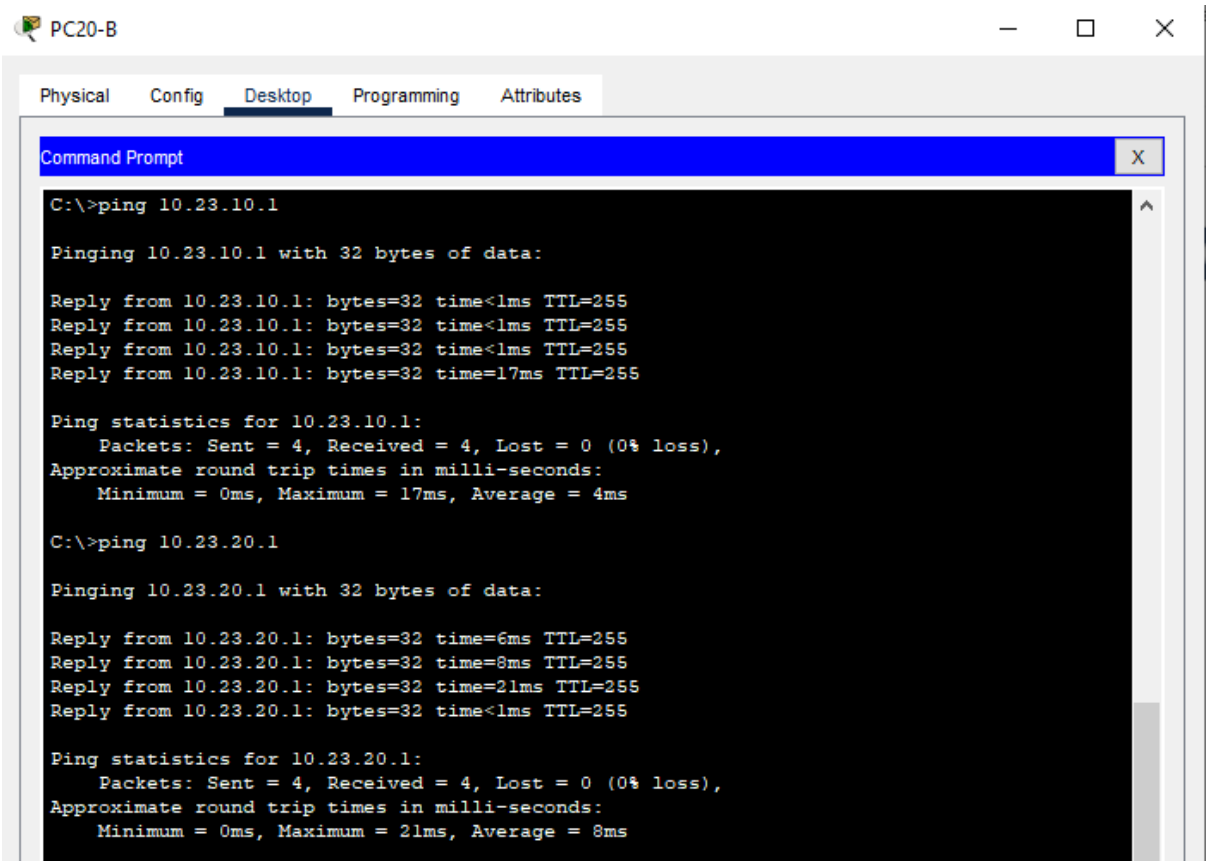
Table 4: Connectivity Test to Routers & Switches (Ping Test)

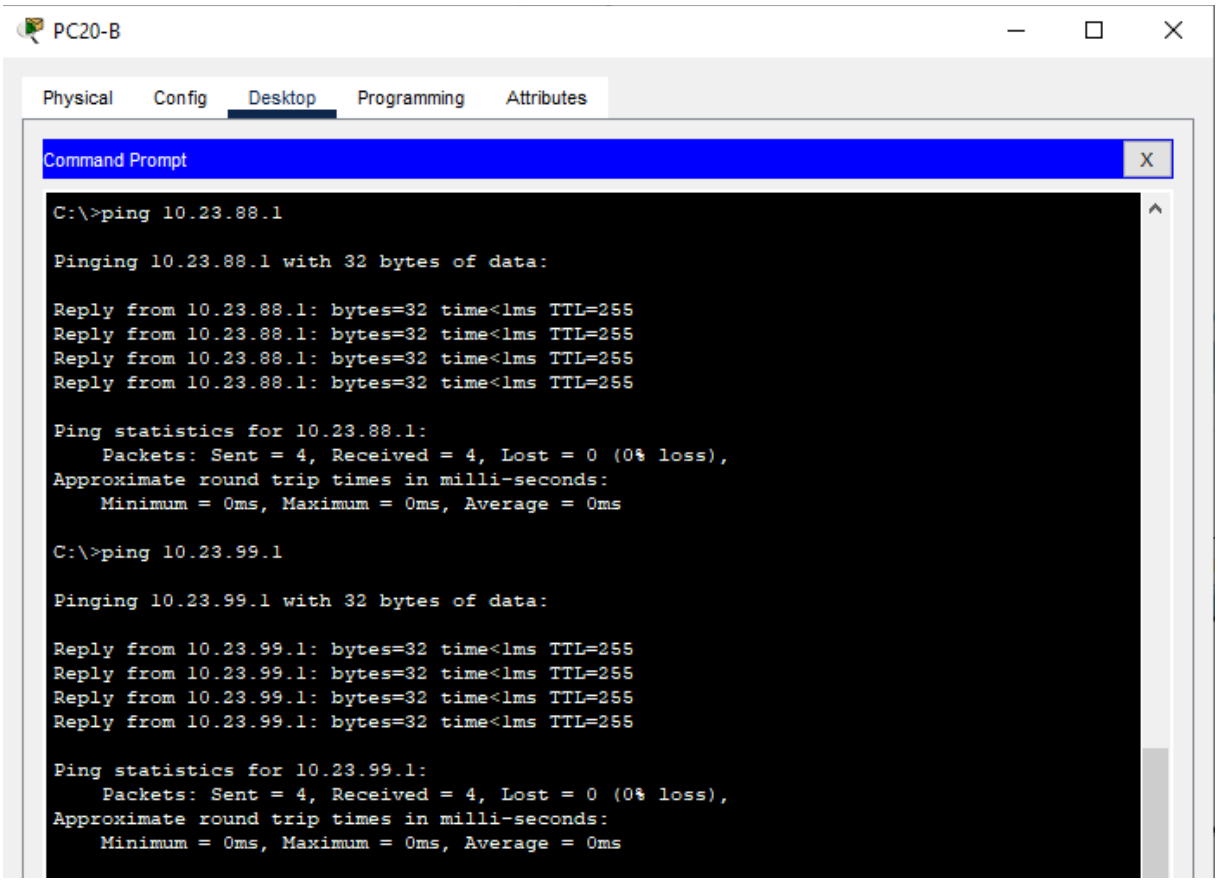
From originator PC	To	IP Address	Ping Test	Comments
PC20-B	R1	10.23.10.1	Successful	
		10.23.20.1	Successful	
		10.23.88.1	Successful	
		10.23.99.1	Successful (NY)	
		13.1.1.1	Successful (NY)	
		11.1.1.1	Failed	Successful when R1 is the active router for VLAN 20, failure is due to HSRP
		11.2.1.1	Failed	
		11.3.1.1	Failed	
	R2	10.23.10.2	Successful	
		10.23.20.2	Successful	
		10.23.88.2	Successful	
		10.23.99.2	Successful	
		23.1.1.1	Successful	
		12.1.1.1	Successful	
		12.2.1.1	Successful	
		12.3.1.1	Successful	
	R3	13.1.1.2	Successful	
		23.1.1.2	Successful	
		209.165.200.225	Successful	
	DLS1	10.23.99.11	Successful	
	DLS2	10.23.99.12	Successful	
	ALS	10.23.99.13	Successful	

Connectivity Test to Routers (Ping Test) Screenshots

To R1 (including loopback addresses)

Note: R1 loopback addresses pinged when R1 was set as active router for VLAN 20





PC20-B

Physical Config Desktop Programming Attributes

Command Prompt

```
C:\>ping 13.1.1.1

Pinging 13.1.1.1 with 32 bytes of data:

Reply from 13.1.1.1: bytes=32 time=1ms TTL=255
Reply from 13.1.1.1: bytes=32 time=1ms TTL=255
Reply from 13.1.1.1: bytes=32 time=1ms TTL=255
Reply from 13.1.1.1: bytes=32 time=1ms TTL=255

Ping statistics for 13.1.1.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 1ms, Maximum = 1ms, Average = 1ms

C:\>ping 11.1.1.1

Pinging 11.1.1.1 with 32 bytes of data:

Reply from 11.1.1.1: bytes=32 time<1ms TTL=255
Reply from 11.1.1.1: bytes=32 time<1ms TTL=255
Reply from 11.1.1.1: bytes=32 time<1ms TTL=255
Reply from 11.1.1.1: bytes=32 time=16ms TTL=255

Ping statistics for 11.1.1.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 16ms, Average = 4ms
```

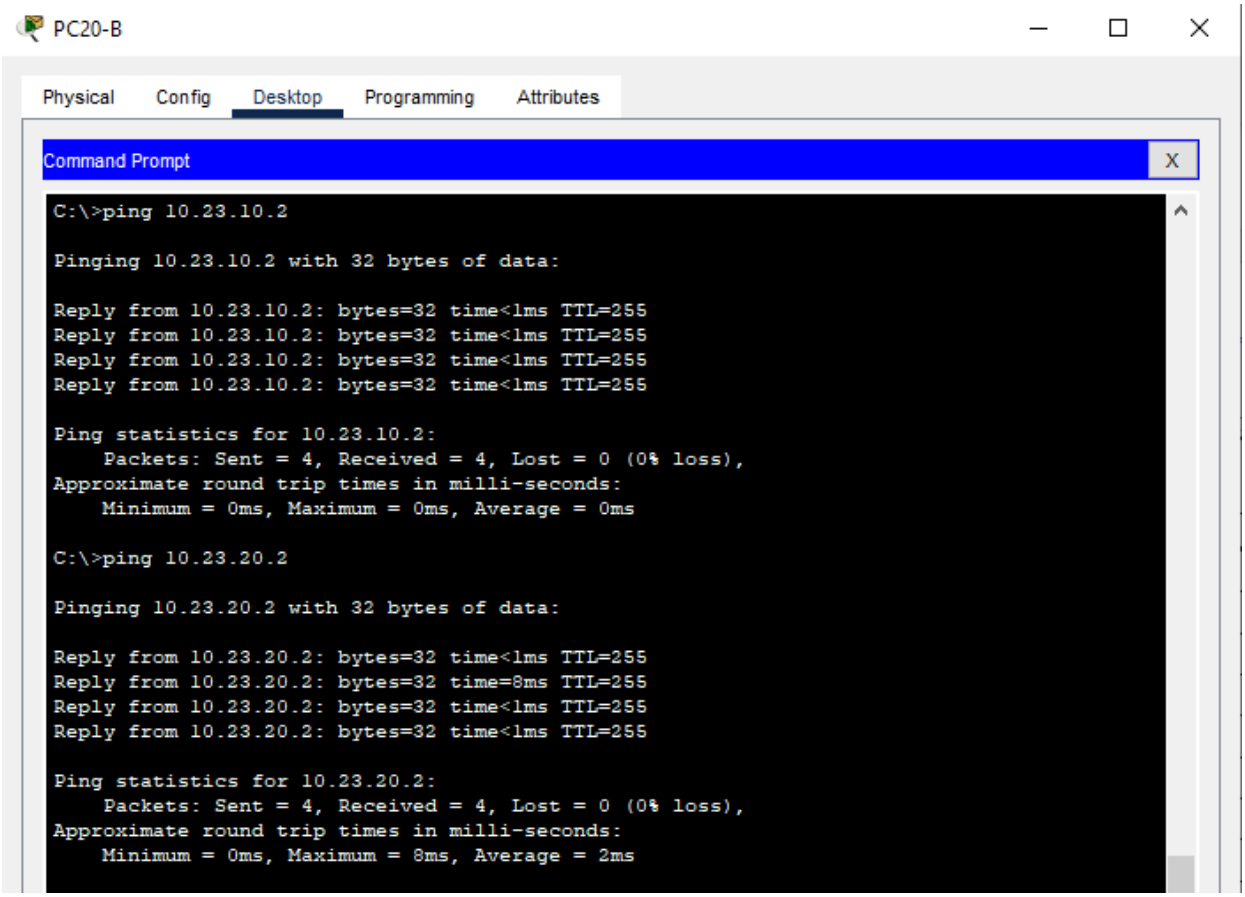
PC20-B

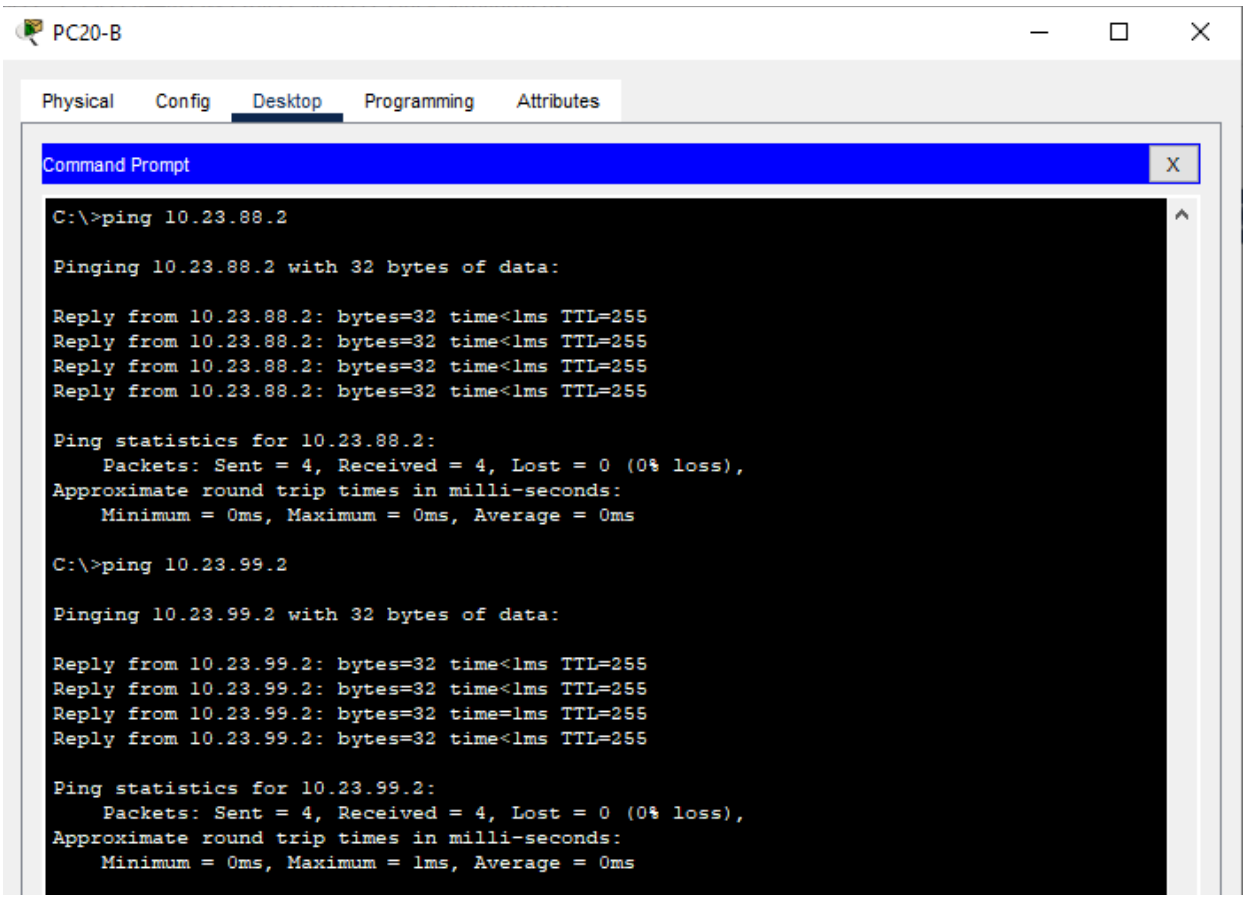
Physical Config Desktop Programming Attributes

Command Prompt

```
C:\>ping 11.2.1.1

Pinging 11.2.1.1 with 32 bytes of data:

Reply from 11.2.1.1: bytes=32 time<1ms TTL=255
Reply from 11.2.1.1: bytes=32 time<1ms TTL=255
Reply from 11.2.1.1: bytes=32 time=1ms TTL=255
Reply from 11.2.1.1: bytes=32 time=1ms TTL=255

Ping statistics for 11.2.1.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 1ms, Average = 0ms

C:\>ping 11.3.1.1

Pinging 11.3.1.1 with 32 bytes of data:

Reply from 11.3.1.1: bytes=32 time<1ms TTL=255
Reply from 11.3.1.1: bytes=32 time<1ms TTL=255
Reply from 11.3.1.1: bytes=32 time<1ms TTL=255
Reply from 11.3.1.1: bytes=32 time<1ms TTL=255

Ping statistics for 11.3.1.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms
```

To R2 (including loopback addresses)





PC20-B

Physical Config Desktop Programming Attributes

Command Prompt

```
C:\>ping 23.1.1.1

Pinging 23.1.1.1 with 32 bytes of data:

Reply from 23.1.1.1: bytes=32 time<1ms TTL=255
Reply from 23.1.1.1: bytes=32 time<1ms TTL=255
Reply from 23.1.1.1: bytes=32 time<1ms TTL=255
Reply from 23.1.1.1: bytes=32 time<1ms TTL=255

Ping statistics for 23.1.1.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>ping 12.1.1.1

Pinging 12.1.1.1 with 32 bytes of data:

Reply from 12.1.1.1: bytes=32 time=15ms TTL=255
Reply from 12.1.1.1: bytes=32 time<1ms TTL=255
Reply from 12.1.1.1: bytes=32 time<1ms TTL=255
Reply from 12.1.1.1: bytes=32 time<1ms TTL=255

Ping statistics for 12.1.1.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 15ms, Average = 3ms
```

PC20-B

Physical Config Desktop Programming Attributes

Command Prompt

```
C:\>ping 12.2.1.1

Pinging 12.2.1.1 with 32 bytes of data:

Reply from 12.2.1.1: bytes=32 time<1ms TTL=255
Reply from 12.2.1.1: bytes=32 time<1ms TTL=255
Reply from 12.2.1.1: bytes=32 time<1ms TTL=255
Reply from 12.2.1.1: bytes=32 time<1ms TTL=255

Ping statistics for 12.2.1.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>ping 12.3.1.1

Pinging 12.3.1.1 with 32 bytes of data:

Reply from 12.3.1.1: bytes=32 time<1ms TTL=255
Reply from 12.3.1.1: bytes=32 time<1ms TTL=255
Reply from 12.3.1.1: bytes=32 time<1ms TTL=255
Reply from 12.3.1.1: bytes=32 time<1ms TTL=255

Ping statistics for 12.3.1.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms
```

To R3 (including loopback address)

PC20-B

Physical Config Desktop Programming Attributes

Command Prompt

```
C:\>ping 13.1.1.2

Pinging 13.1.1.2 with 32 bytes of data:

Reply from 13.1.1.2: bytes=32 time=1ms TTL=254
Reply from 13.1.1.2: bytes=32 time=1ms TTL=254
Reply from 13.1.1.2: bytes=32 time=1ms TTL=254
Reply from 13.1.1.2: bytes=32 time=1ms TTL=254

Ping statistics for 13.1.1.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 1ms, Maximum = 1ms, Average = 1ms

C:\>ping 23.1.1.2

Pinging 23.1.1.2 with 32 bytes of data:

Reply from 23.1.1.2: bytes=32 time=1ms TTL=254
Reply from 23.1.1.2: bytes=32 time=10ms TTL=254
Reply from 23.1.1.2: bytes=32 time=2ms TTL=254
Reply from 23.1.1.2: bytes=32 time=2ms TTL=254

Ping statistics for 23.1.1.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 1ms, Maximum = 10ms, Average = 3ms
```

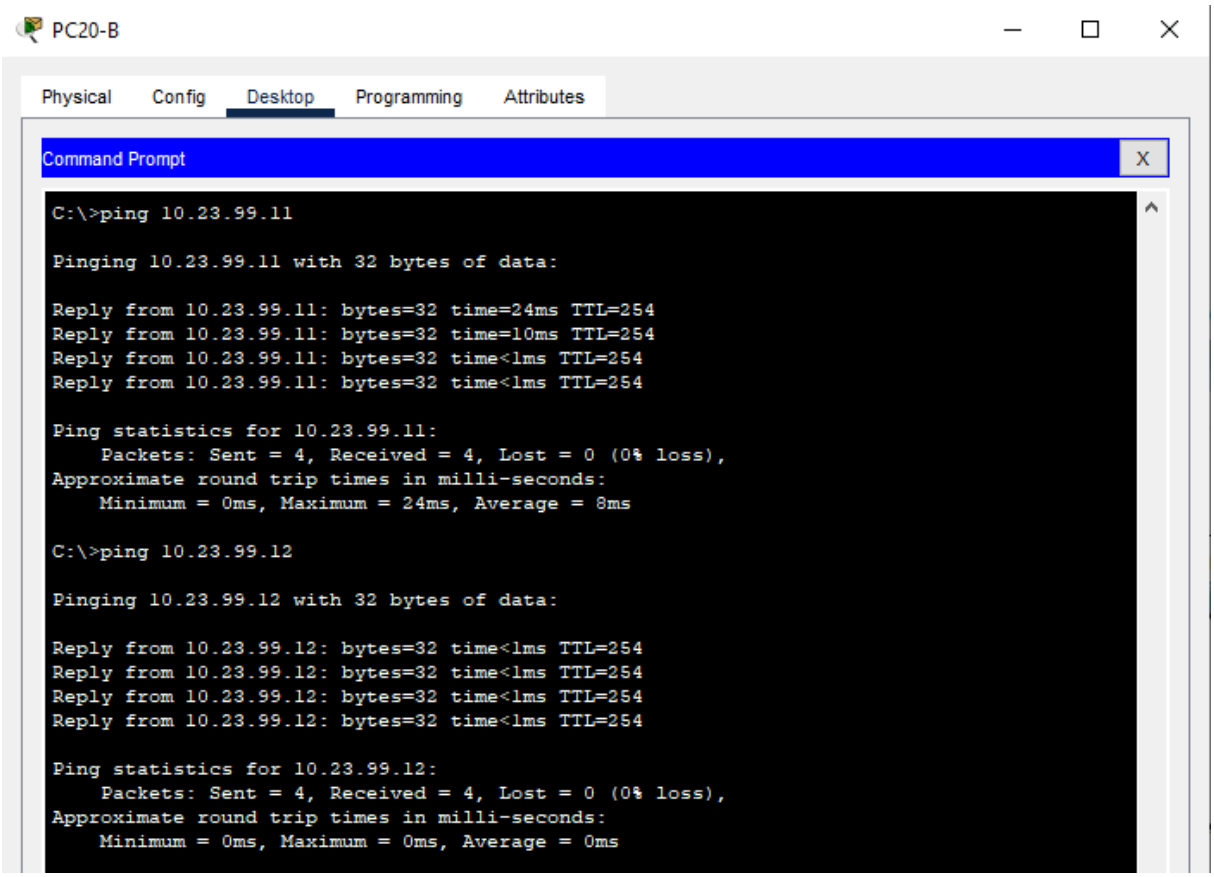
PC20-B

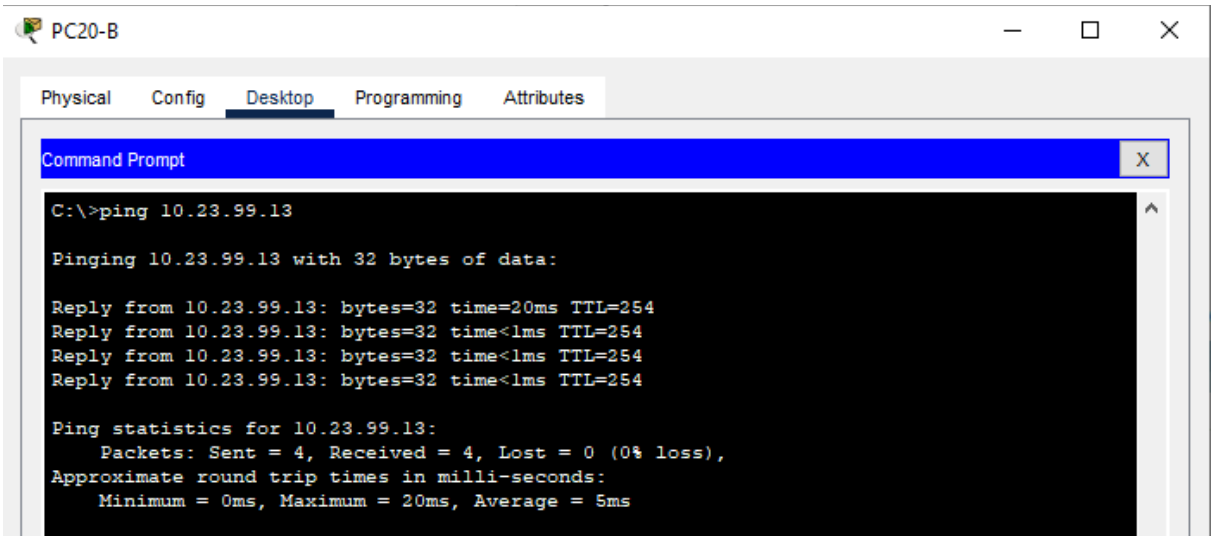
Physical Config Desktop Programming Attributes

Command Prompt

```
C:\>ping 209.165.200.225

Pinging 209.165.200.225 with 32 bytes of data:

Reply from 209.165.200.225: bytes=32 time=1ms TTL=254
Reply from 209.165.200.225: bytes=32 time=1ms TTL=254
Reply from 209.165.200.225: bytes=32 time=1ms TTL=254
Reply from 209.165.200.225: bytes=32 time=15ms TTL=254

Ping statistics for 209.165.200.225:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 1ms, Maximum = 15ms, Average = 4ms
```

Connectivity Test to Switches (Ping Test) Screenshots



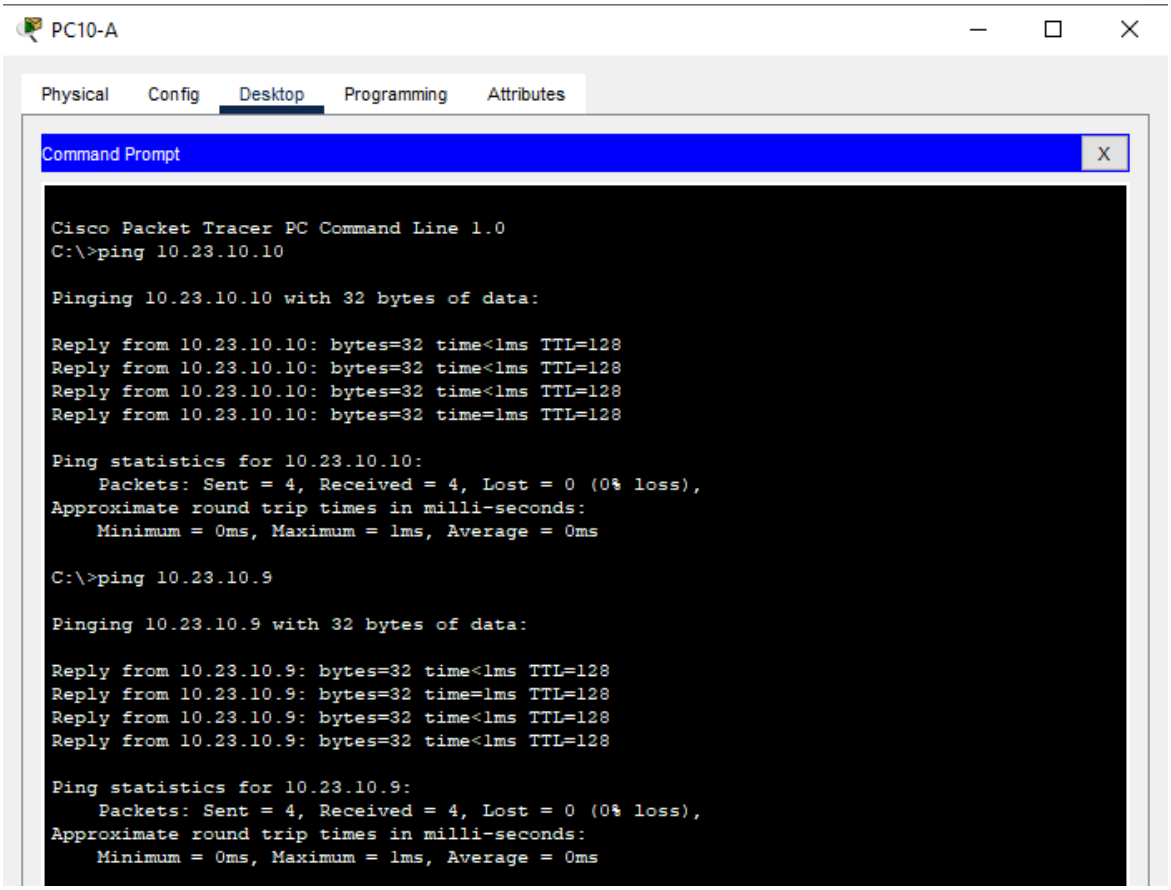


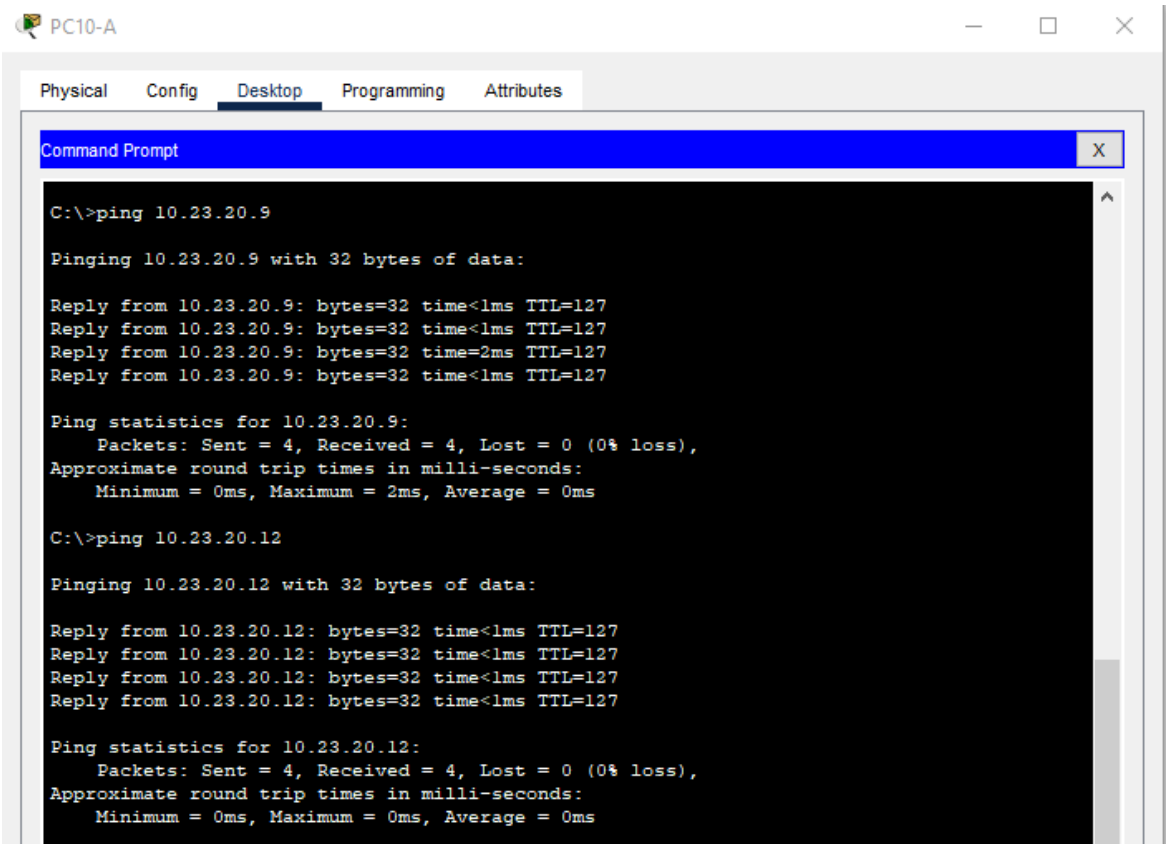
2.3 All PCs can ping each other (Ping Test)

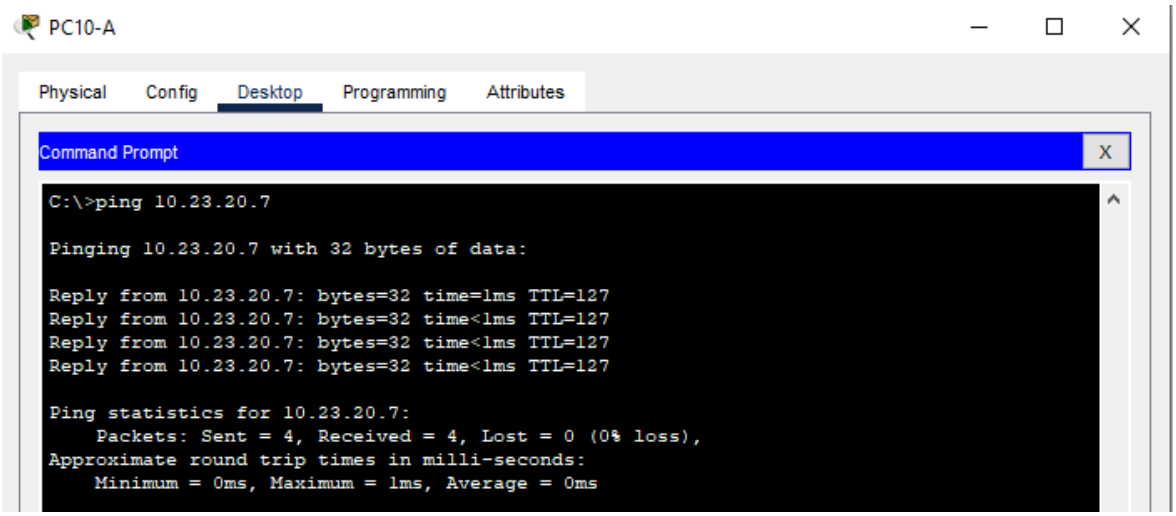
Table 5: All PCs can ping each other (Ping Test)		
Ping from:	Ping to:	Ping Test
PC10-A (10.23.10.7)	PC10-B (10.23.10.10)	Successful
	PC10-C (10.23.10.9)	Successful
	PC20-A (10.23.20.9)	Successful
	PC20-B (10.23.20.12)	Successful
	PC20-C (10.23.20.7)	Successful
PC10-B (10.23.10.10)	PC10-A (10.23.10.7)	Successful
	PC10-C (10.23.10.9)	Successful
	PC20-A (10.23.20.9)	Successful
	PC20-B (10.23.20.12)	Successful
	PC20-C (10.23.20.7)	Successful
PC10-C (10.23.10.9)	PC10-A (10.23.10.7)	Successful
	PC10-B (10.23.10.10)	Successful
	PC20-A (10.23.20.9)	Successful
	PC20-B (10.23.20.12)	Successful
	PC20-C (10.23.20.7)	Successful
PC20-A (10.23.20.9)	PC10-A (10.23.10.7)	Successful
	PC10-B (10.23.10.10)	Successful
	PC10-C (10.23.10.9)	Successful
	PC20-B (10.23.20.12)	Successful
	PC20-C (10.23.20.7)	Successful
PC20-B (10.23.20.12)	PC10-A (10.23.10.7)	Successful
	PC10-B (10.23.10.10)	Successful
	PC10-C (10.23.10.9)	Successful
	PC20-A (10.23.20.9)	Successful
	PC20-C (10.23.20.7)	Successful
PC20-C (10.23.20.7)	PC10-A (10.23.10.7)	Successful
	PC10-B (10.23.10.10)	Successful
	PC10-C (10.23.10.9)	Successful
	PC20-A (10.23.20.9)	Successful
	PC20-B (10.23.20.12)	Successful

All PCs ping each other (Ping Test) Screenshots

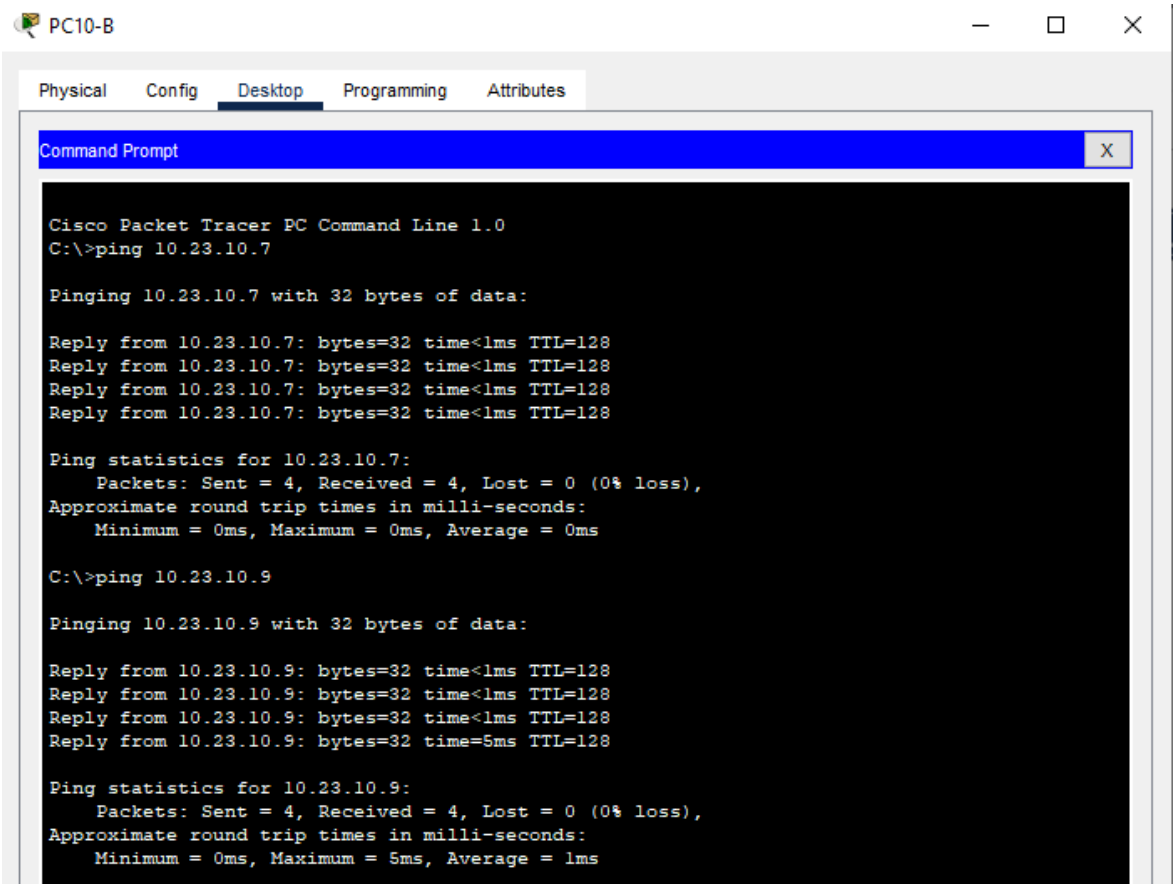
PC10-A screenshots

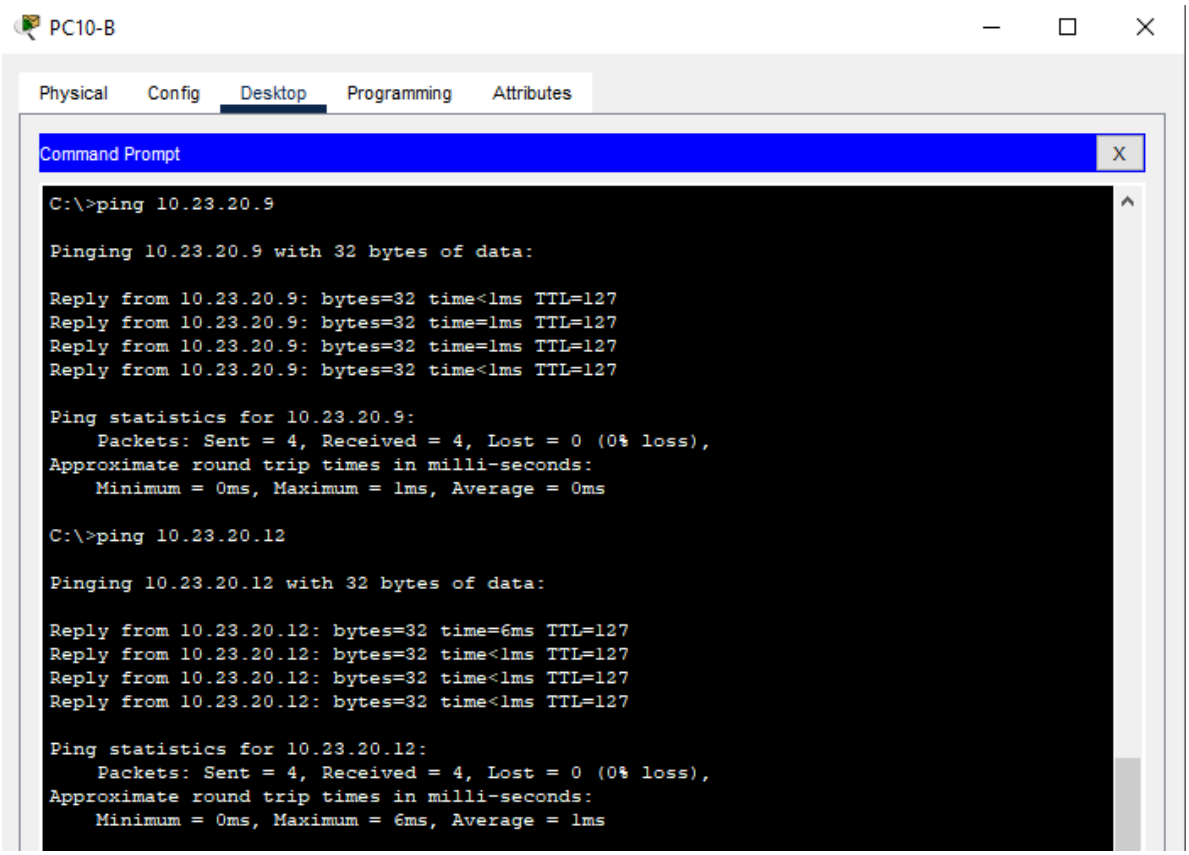


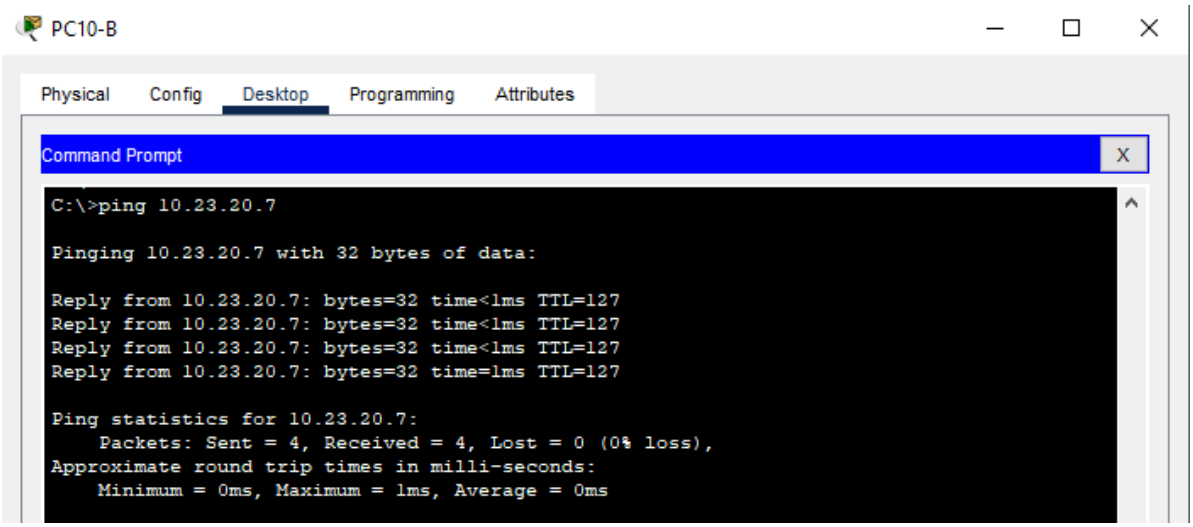




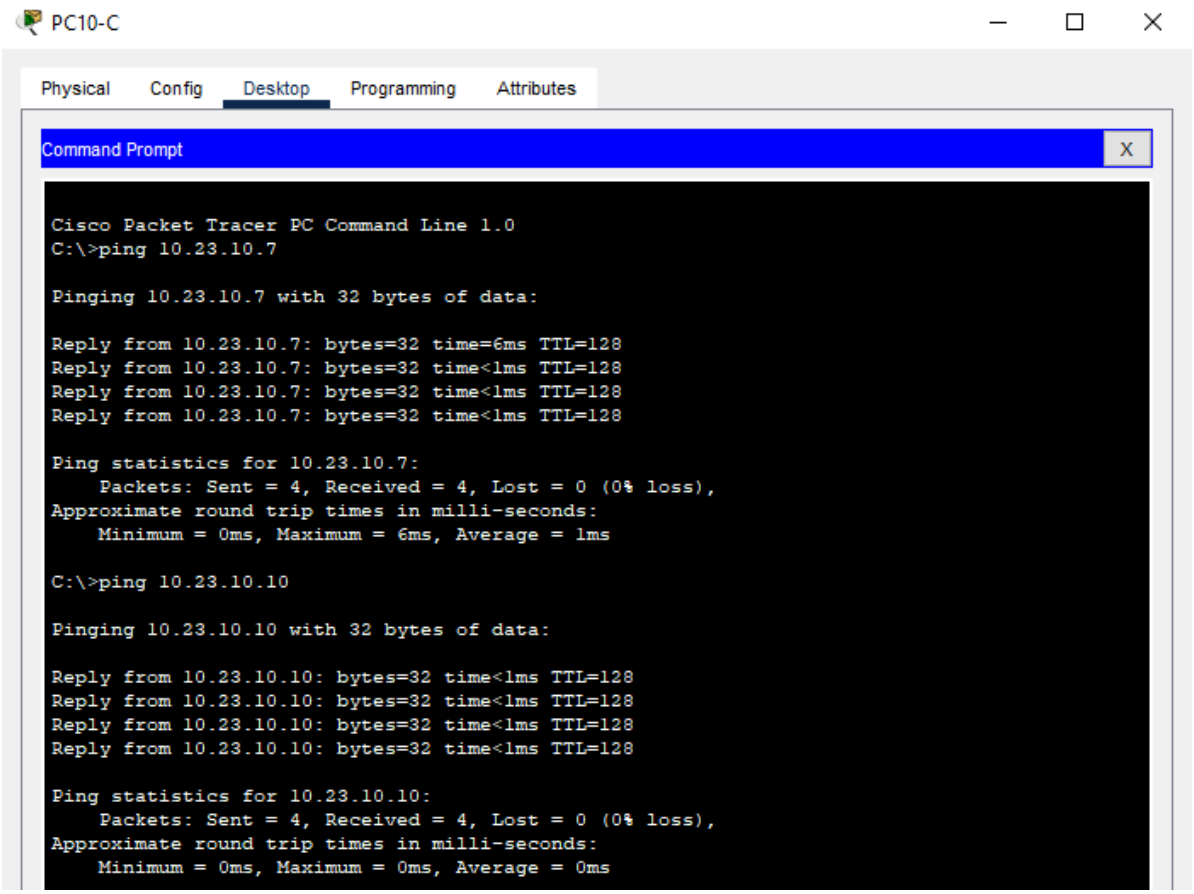
PC10-B screenshots

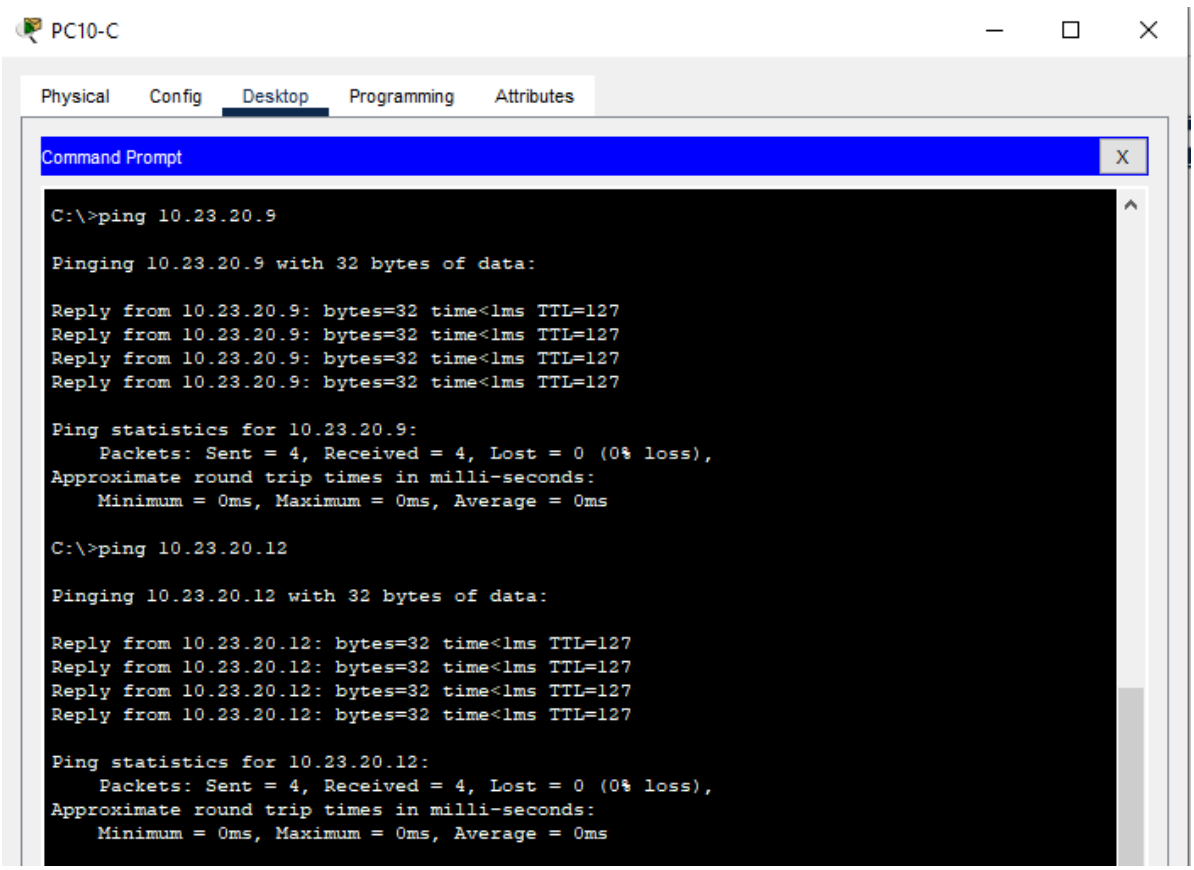


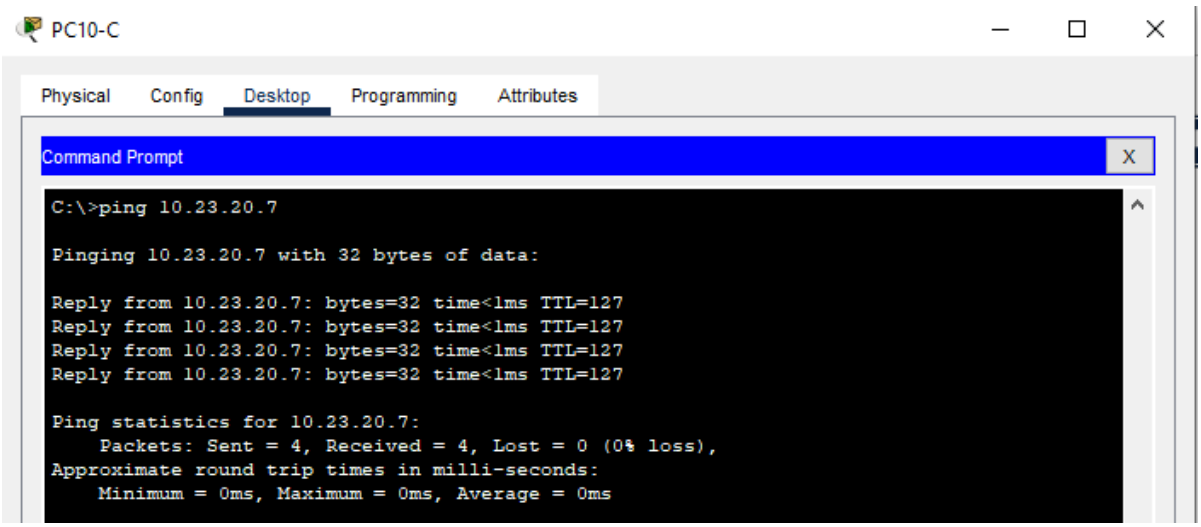

PC10-B
Physical
Config
Desktop
Programming
Attributes
Command Prompt
X
C:\>ping 10.23.20.9
Pinging 10.23.20.9 with 32 bytes of data:
Reply from 10.23.20.9: bytes=32 time<1ms TTL=127
Reply from 10.23.20.9: bytes=32 time=1ms TTL=127
Reply from 10.23.20.9: bytes=32 time=1ms TTL=127
Reply from 10.23.20.9: bytes=32 time<1ms TTL=127
Ping statistics for 10.23.20.9:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum = 1ms, Average = 0ms
C:\>ping 10.23.20.12
Pinging 10.23.20.12 with 32 bytes of data:
Reply from 10.23.20.12: bytes=32 time=6ms TTL=127
Reply from 10.23.20.12: bytes=32 time<1ms TTL=127
Reply from 10.23.20.12: bytes=32 time<1ms TTL=127
Reply from 10.23.20.12: bytes=32 time<1ms TTL=127
Ping statistics for 10.23.20.12:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum = 6ms, Average = 1ms


PC10-B
Physical
Config
Desktop
Programming
Attributes
Command Prompt
X
C:\>ping 10.23.20.7
Pinging 10.23.20.7 with 32 bytes of data:
Reply from 10.23.20.7: bytes=32 time<1ms TTL=127
Reply from 10.23.20.7: bytes=32 time<1ms TTL=127
Reply from 10.23.20.7: bytes=32 time<1ms TTL=127
Reply from 10.23.20.7: bytes=32 time=1ms TTL=127
Ping statistics for 10.23.20.7:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum = 1ms, Average = 0ms

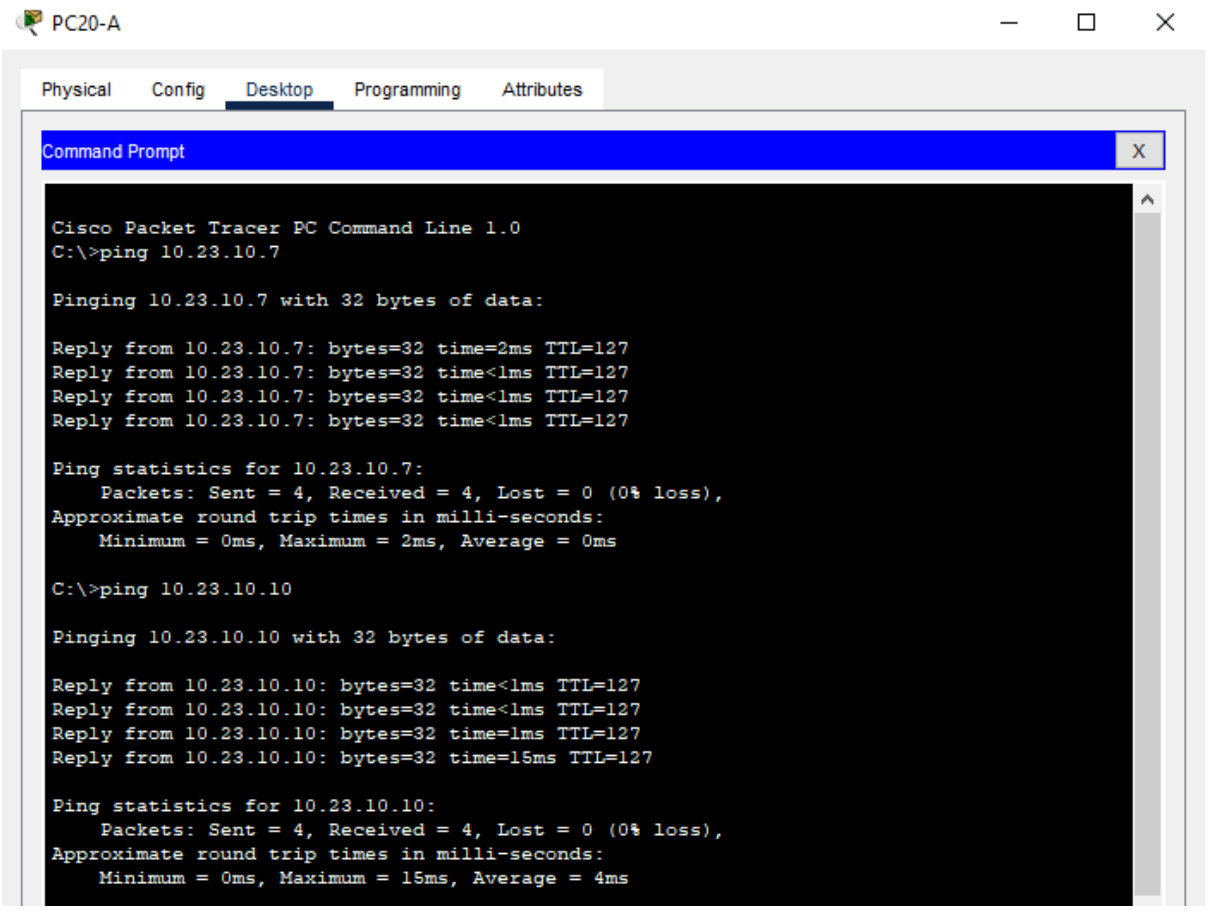
PC10-C screenshots

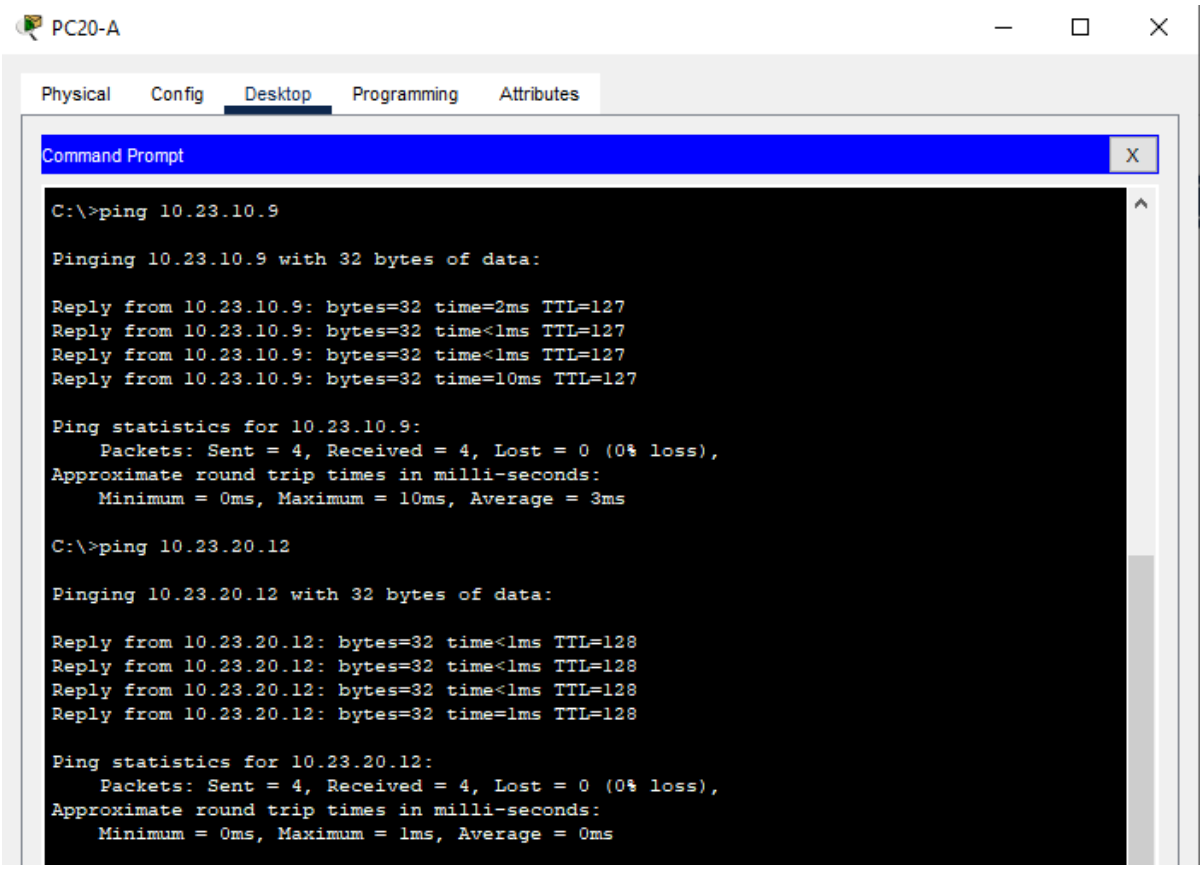


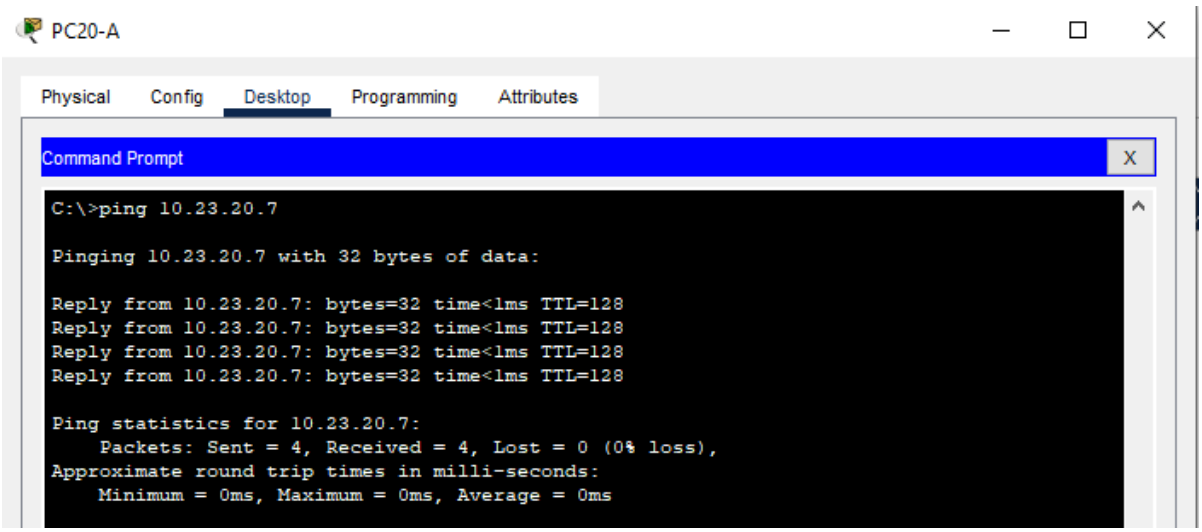



PC10-C
Physical
Config
Desktop
Programming
Attributes
Command Prompt
X
C:\>ping 10.23.20.7
Pinging 10.23.20.7 with 32 bytes of data:
Reply from 10.23.20.7: bytes=32 time<1ms TTL=127
Reply from 10.23.20.7: bytes=32 time<1ms TTL=127
Reply from 10.23.20.7: bytes=32 time<1ms TTL=127
Reply from 10.23.20.7: bytes=32 time<1ms TTL=127
Ping statistics for 10.23.20.7:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum = 0ms, Average = 0ms

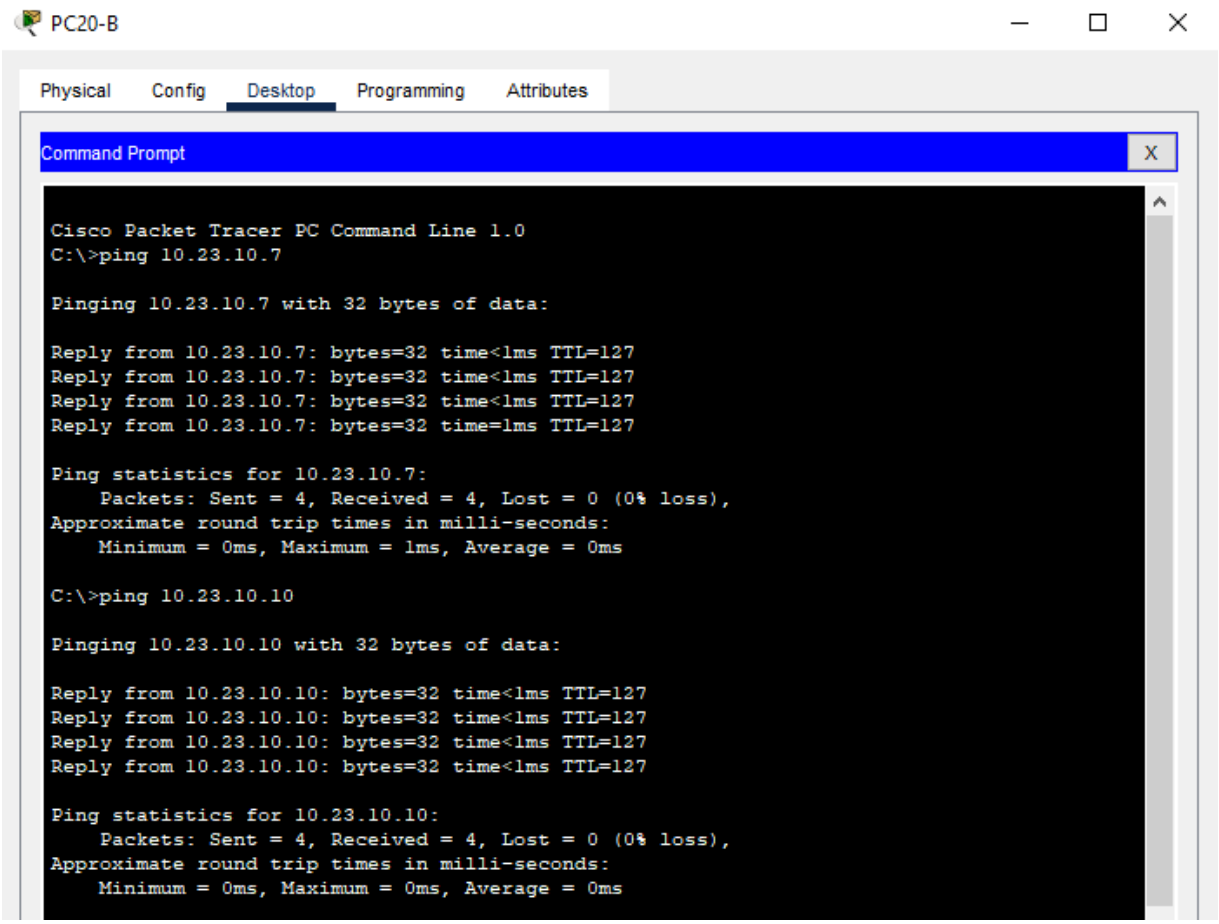
PC20-A screenshots

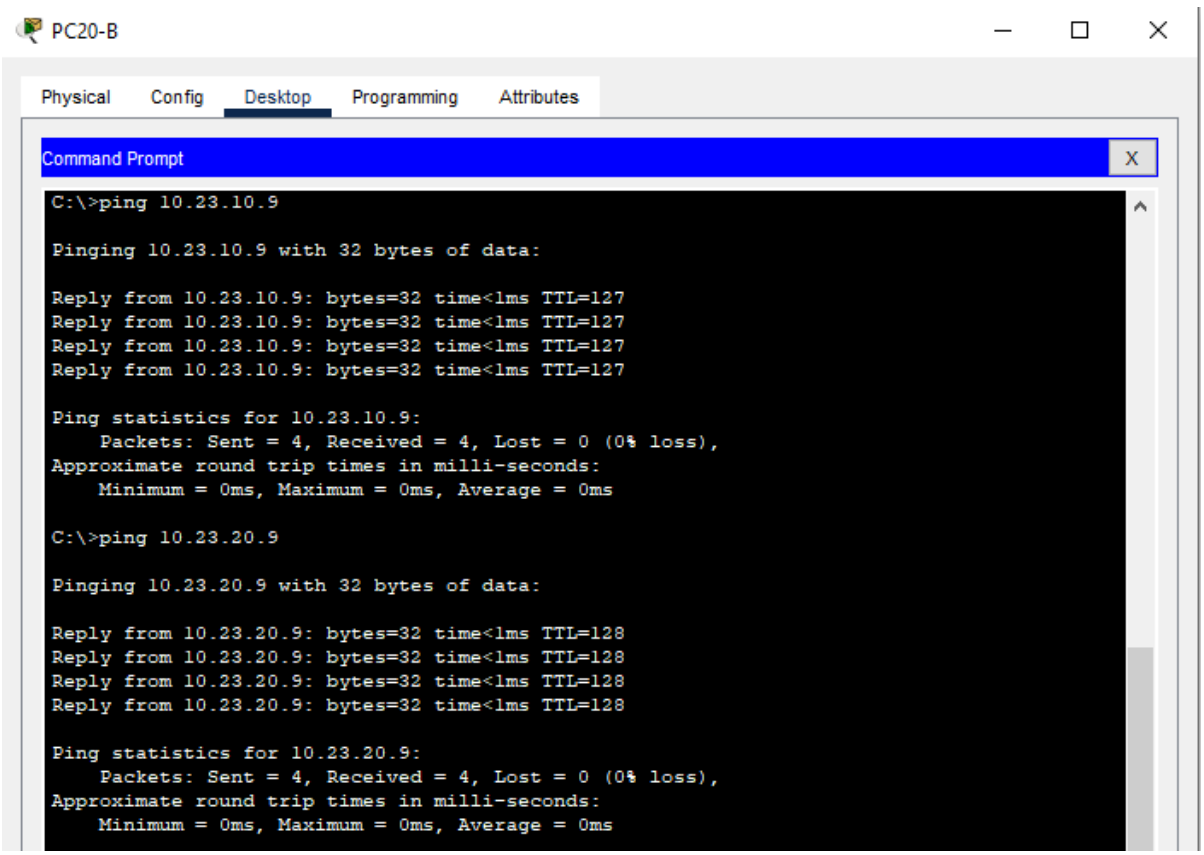


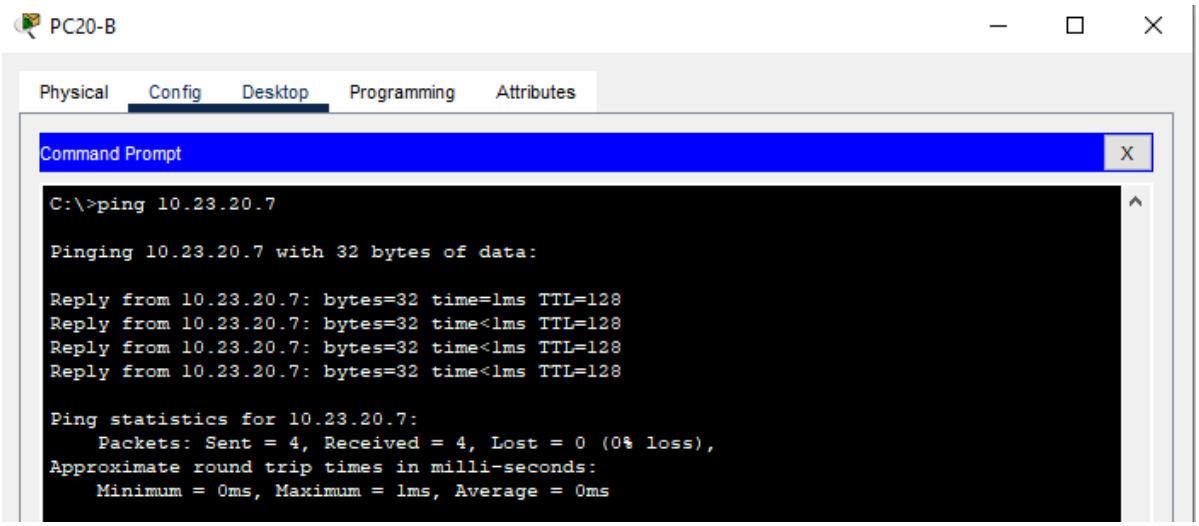

PC20-A
Physical
Config
Desktop
Programming
Attributes
Command Prompt
X
C:\>ping 10.23.10.9
Pinging 10.23.10.9 with 32 bytes of data:
Reply from 10.23.10.9: bytes=32 time=2ms TTL=127
Reply from 10.23.10.9: bytes=32 time<1ms TTL=127
Reply from 10.23.10.9: bytes=32 time<1ms TTL=127
Reply from 10.23.10.9: bytes=32 time=10ms TTL=127
Ping statistics for 10.23.10.9:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum = 10ms, Average = 3ms
C:\>ping 10.23.20.12
Pinging 10.23.20.12 with 32 bytes of data:
Reply from 10.23.20.12: bytes=32 time<1ms TTL=128
Reply from 10.23.20.12: bytes=32 time<1ms TTL=128
Reply from 10.23.20.12: bytes=32 time<1ms TTL=128
Reply from 10.23.20.12: bytes=32 time=1ms TTL=128
Ping statistics for 10.23.20.12:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum = 1ms, Average = 0ms


PC20-A
Physical
Config
Desktop
Programming
Attributes
Command Prompt
X
C:\>ping 10.23.20.7
Pinging 10.23.20.7 with 32 bytes of data:
Reply from 10.23.20.7: bytes=32 time<1ms TTL=128
Reply from 10.23.20.7: bytes=32 time<1ms TTL=128
Reply from 10.23.20.7: bytes=32 time<1ms TTL=128
Reply from 10.23.20.7: bytes=32 time<1ms TTL=128
Ping statistics for 10.23.20.7:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum = 0ms, Average = 0ms

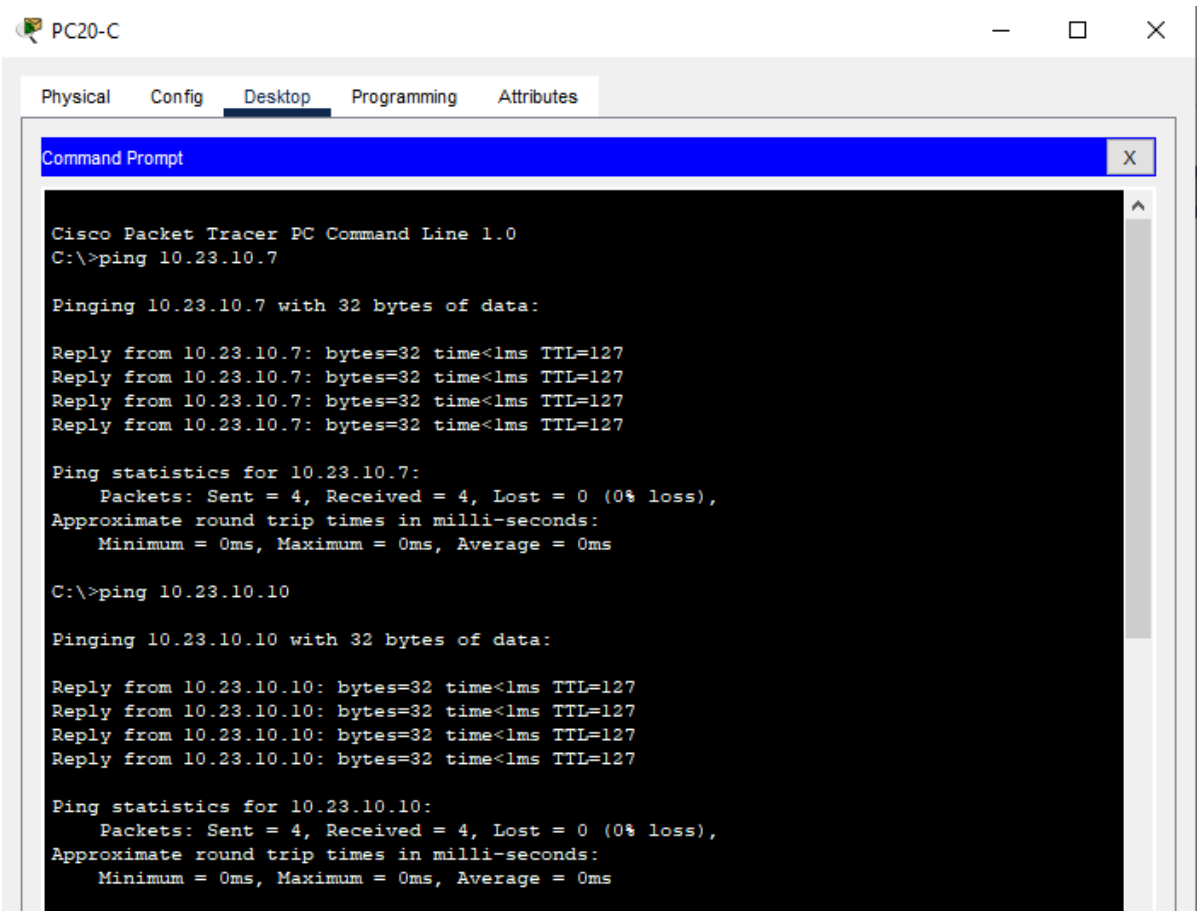
PC20-B screenshots

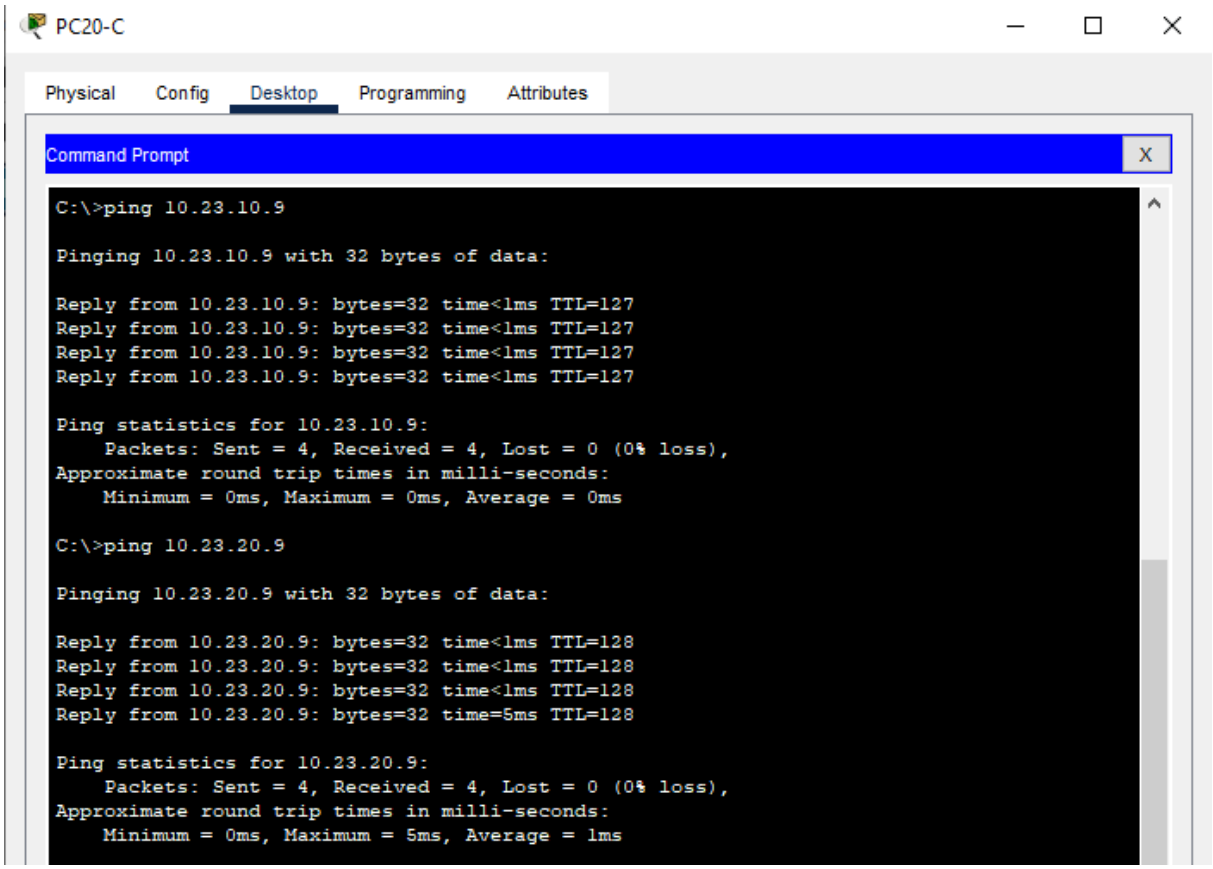


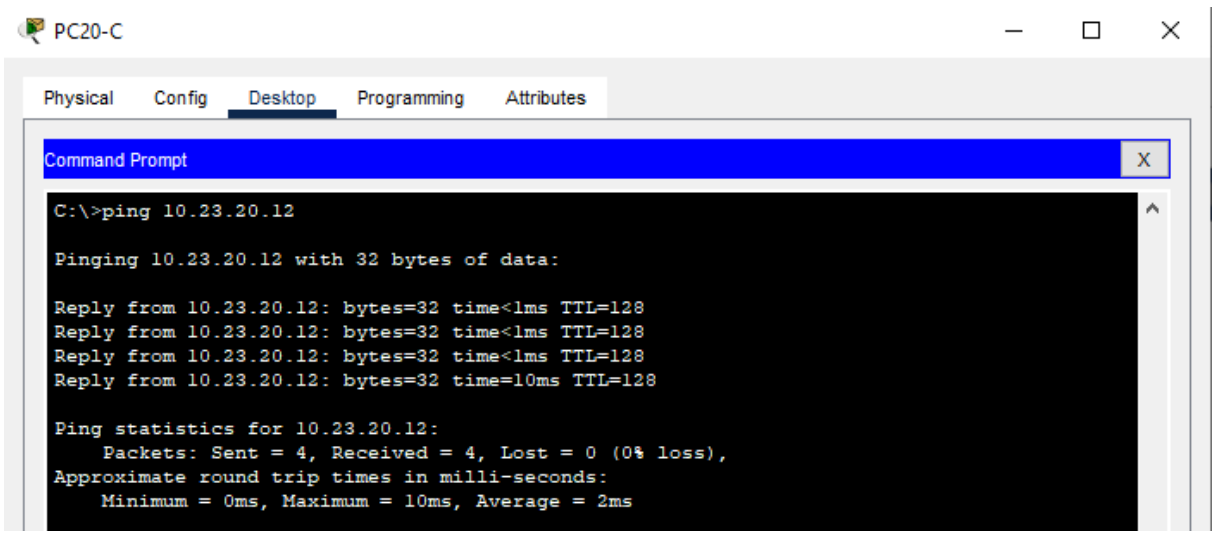




PC20-C screenshots




PC20-C
Physical
Config
Desktop
Programming
Attributes
Command Prompt
X
C:\>ping 10.23.10.9
Pinging 10.23.10.9 with 32 bytes of data:
Reply from 10.23.10.9: bytes=32 time<1ms TTL=127
Reply from 10.23.10.9: bytes=32 time<1ms TTL=127
Reply from 10.23.10.9: bytes=32 time<1ms TTL=127
Reply from 10.23.10.9: bytes=32 time<1ms TTL=127
Ping statistics for 10.23.10.9:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum = 0ms, Average = 0ms
C:\>ping 10.23.20.9
Pinging 10.23.20.9 with 32 bytes of data:
Reply from 10.23.20.9: bytes=32 time<1ms TTL=128
Reply from 10.23.20.9: bytes=32 time<1ms TTL=128
Reply from 10.23.20.9: bytes=32 time<1ms TTL=128
Reply from 10.23.20.9: bytes=32 time=5ms TTL=128
Ping statistics for 10.23.20.9:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum = 5ms, Average = 1ms


PC20-C
Physical
Config
Desktop
Programming
Attributes
Command Prompt
X
C:\>ping 10.23.20.12
Pinging 10.23.20.12 with 32 bytes of data:
Reply from 10.23.20.12: bytes=32 time<1ms TTL=128
Reply from 10.23.20.12: bytes=32 time<1ms TTL=128
Reply from 10.23.20.12: bytes=32 time<1ms TTL=128
Reply from 10.23.20.12: bytes=32 time=10ms TTL=128
Ping statistics for 10.23.20.12:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum = 10ms, Average = 2ms

2.4 Show that port security works

Layer 2 devices are considered to be the weakest link in a company's security infrastructure. Port security is one of the solutions to counter this issue. It is the simplest and most effective method to prevent MAC address table overflow attacks from occurring. It can limit the number of valid MAC addresses allowed on a port, to control unauthorised access to the network.

```
ALS#show port-security int fa0/12
Port Security              : Enabled
Port Status                : Secure-up
Violation Mode             : Shutdown
Aging Time                 : 0 mins
Aging Type                 : Absolute
SecureStatic Address Aging : Disabled
Maximum MAC Addresses      : 1
Total MAC Addresses        : 1
Configured MAC Addresses   : 0
Sticky MAC Addresses       : 1
Last Source Address:Vlan   : 0090.2104.7603:20
Security Violation Count   : 0
```

Figure 2.4.1: Issuing the show port-security command, we can see that the Security Violation Count is 0.

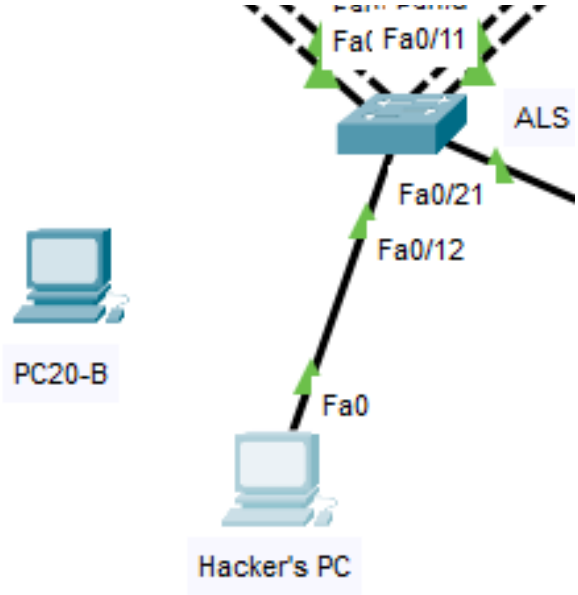


Figure 2.4.2: The FastEthernet0/12 interface was connected to PC20-B, and the FastEthernet0/12 interface is now connected to a "Hacker's PC".

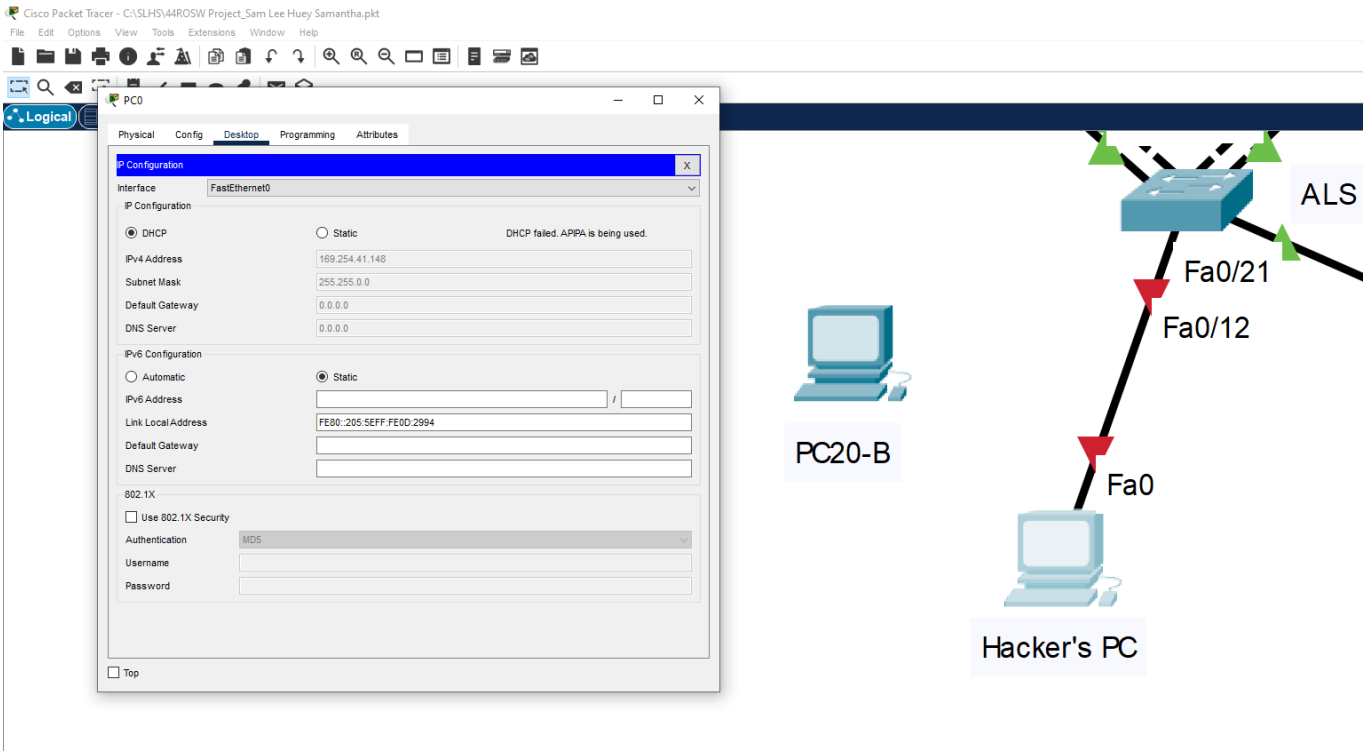


Figure 2.4.3: When requesting for an IP address through DHCP, the port immediately shuts down as it is the violation mode set.

```
ALS$show port-security int fa0/12
Port Security              : Enabled
Port Status                : Secure-shutdown
Violation Mode             : Shutdown
Aging Time                 : 0 mins
Aging Type                 : Absolute
SecureStatic Address Aging : Disabled
Maximum MAC Addresses      : 1
Total MAC Addresses        : 1
Configured MAC Addresses   : 0
Sticky MAC Addresses       : 1
Last Source Address:Vlan   : 0005.5E0D.2994:20
Security Violation Count   : 1
```

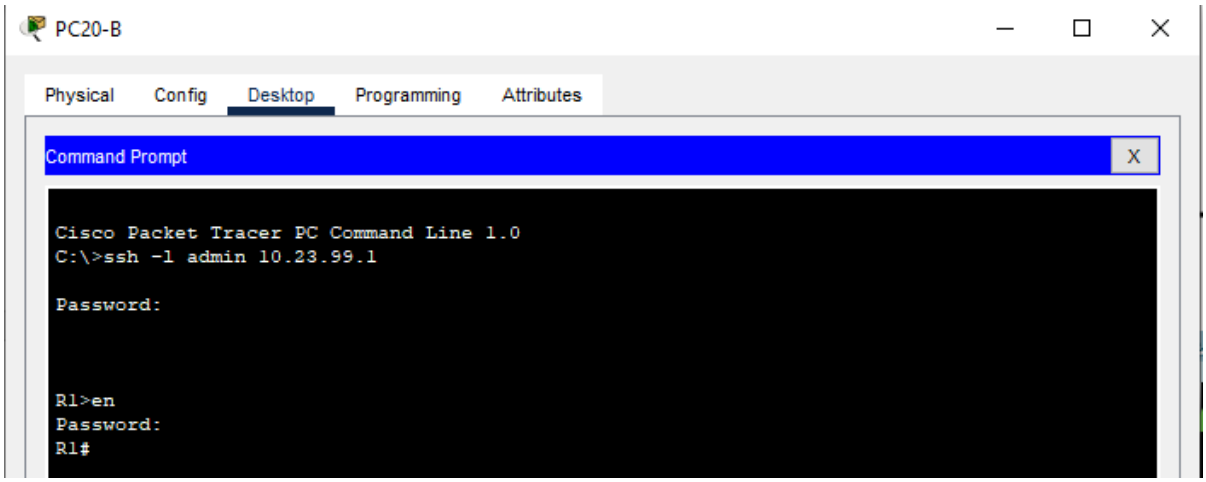
Figure 2.4.4: Using the show port-security interface fa0/12 command after the port is shutdown, we can see the Security Violation Count went up by 1.

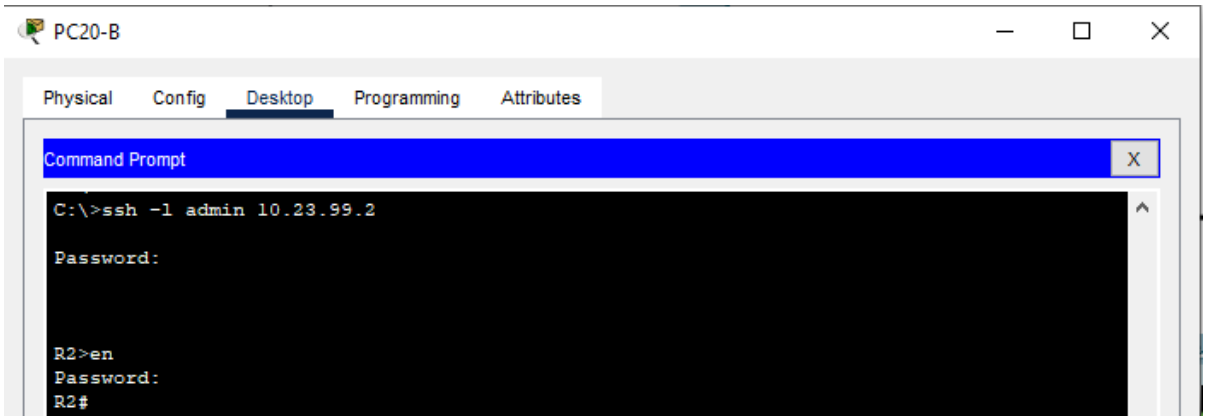
2.5 Show that Management VLAN can remotely access the switches & routers

SSH and Telnet enable logins to remote computers, where SSH is more secure than Telnet because SSH can encrypt data that is exchanged between end devices.

Accessing R1 and R2 through SSH using originator PC20-B

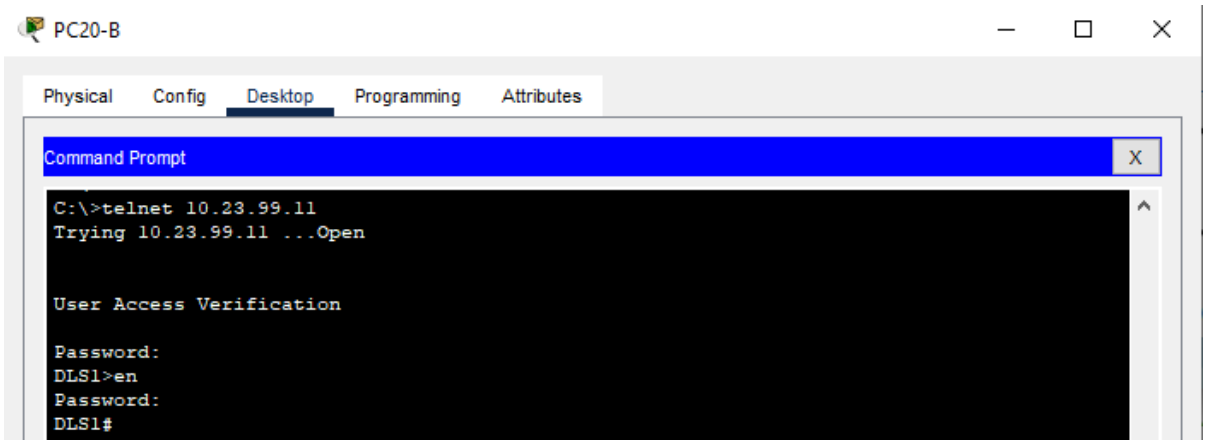
(Passwords are cisco, 12345)

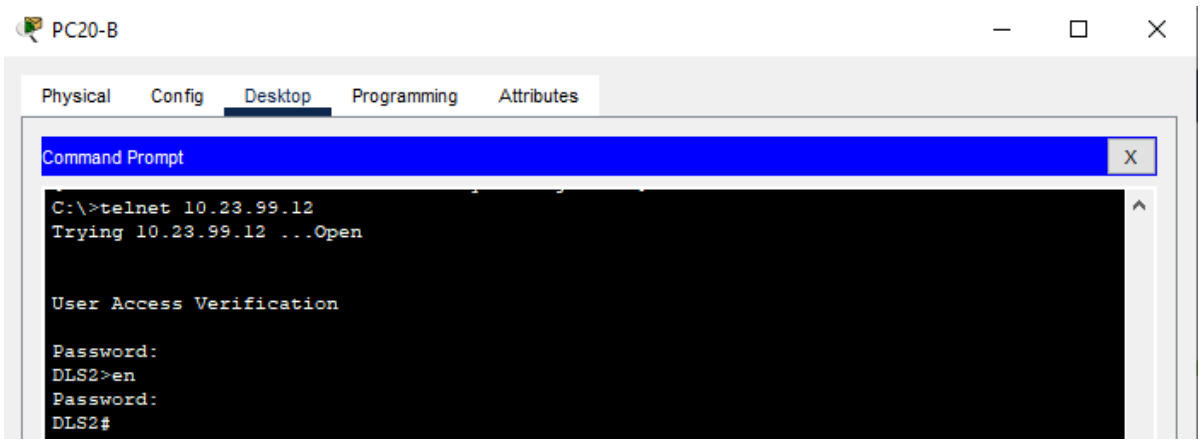


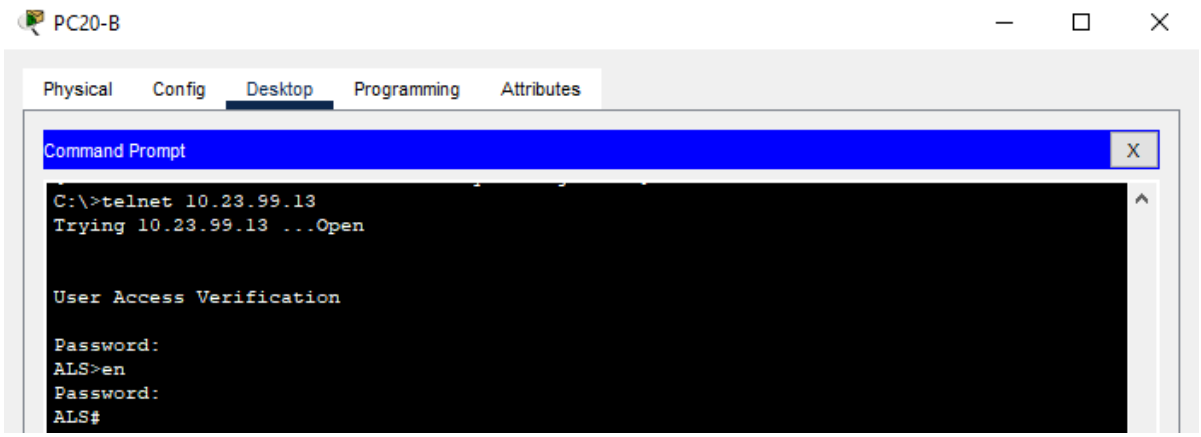


Accessing DLS1, DLS2 and ALS through Telnet using originator PC20-B

(Passwords are cisco, 12345)







2.6 Show that the etherchannels have been setup

Etherchannels help provides fault tolerance and high bandwidth.

```
DLS1#show etherchannel summary
Flags:  D - down        P - in port-channel
        I - stand-alone s - suspended
        H - Hot-standby (LACP only)
        R - Layer3      S - Layer2
        U - in use      f - failed to allocate aggregator
        u - unsuitable for bundling
        w - waiting to be aggregated
        d - default port


Number of channel-groups in use: 2
Number of aggregators:           2

Group  Port-channel  Protocol    Ports
------+-------------+-----------+-----------------------------------------------

1      Po1(SU)           -      Fa0/1(P) Fa0/3(P)
3      Po3(SU)           PAgP   Fa0/5(P) Fa0/7(P)
```

```
DLS2#show etherchannel summary
Flags:  D - down        P - in port-channel
        I - stand-alone s - suspended
        H - Hot-standby (LACP only)
        R - Layer3      S - Layer2
        U - in use      f - failed to allocate aggregator
        u - unsuitable for bundling
        w - waiting to be aggregated
        d - default port


Number of channel-groups in use: 2
Number of aggregators:           2

Group  Port-channel  Protocol    Ports
------+-------------+-----------+-----------------------------------------------

1      Po1(SU)           -      Fa0/1(P) Fa0/3(P)
2      Po2(SU)           LACP   Fa0/9(P) Fa0/11(P)
```

```
ALS#show etherchannel summary
Flags:  D - down        P - in port-channel
        I - stand-alone s - suspended
        H - Hot-standby (LACP only)
        R - Layer3      S - Layer2
        U - in use      f - failed to allocate aggregator
        u - unsuitable for bundling
        w - waiting to be aggregated
        d - default port


Number of channel-groups in use: 2
Number of aggregators:           2

Group  Port-channel  Protocol    Ports
------+-------------+-----------+-----------------------------------------------

2      Po2(SU)           LACP   Fa0/9(P) Fa0/11(P)
3      Po3(SU)           PAgP   Fa0/5(P) Fa0/7(P)
```

2.7 Show that HSRP works

Hot Standby Router Protocol (HSRP) provides redundancy for IP networks, ensuring that user traffic immediately and transparently recovers from first hop router failures. HSRP allows multiple routers on a single LAN to share a virtual IP and MAC address which is configured as the default gateway on the hosts.

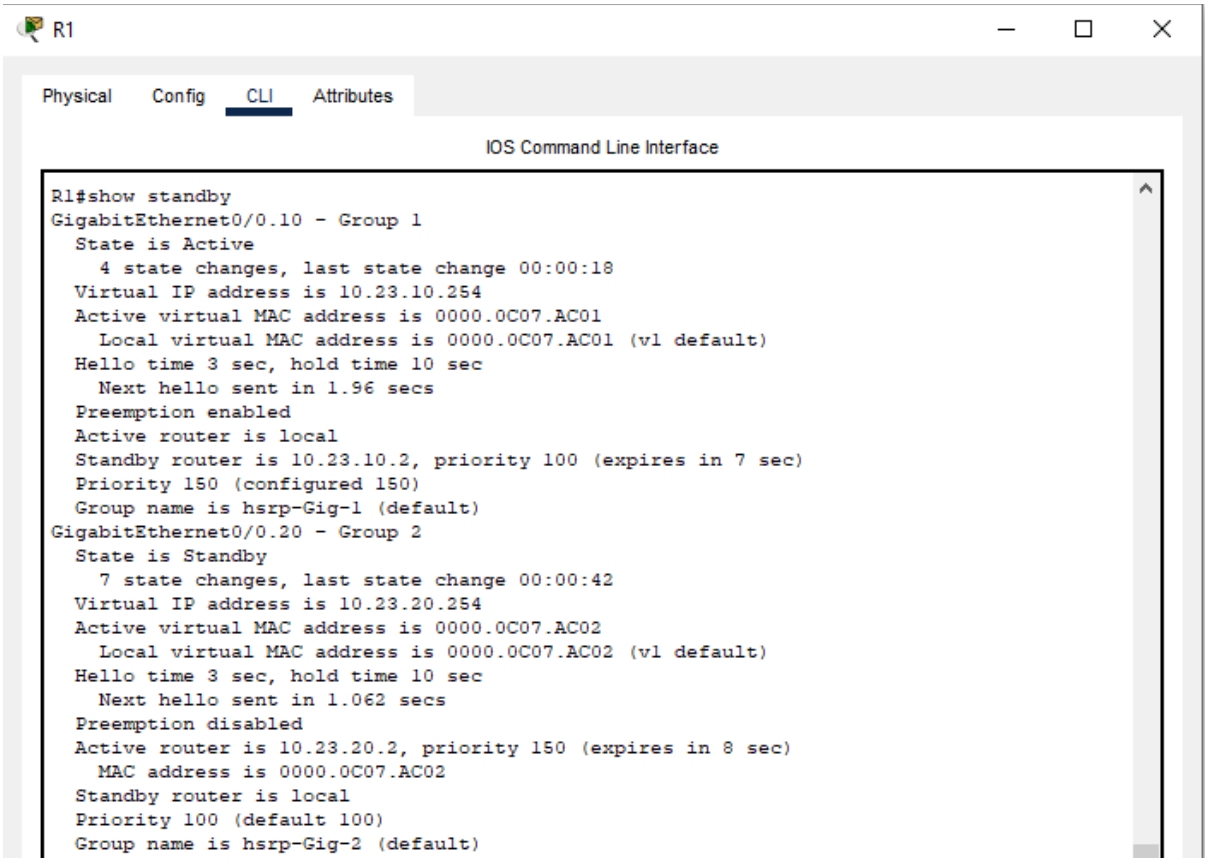


Figure 2.7.1: Issuing the show standby command on R1, we can see that for VLAN 10, R1 is the active router. For VLAN 20, R1 is the standby router.

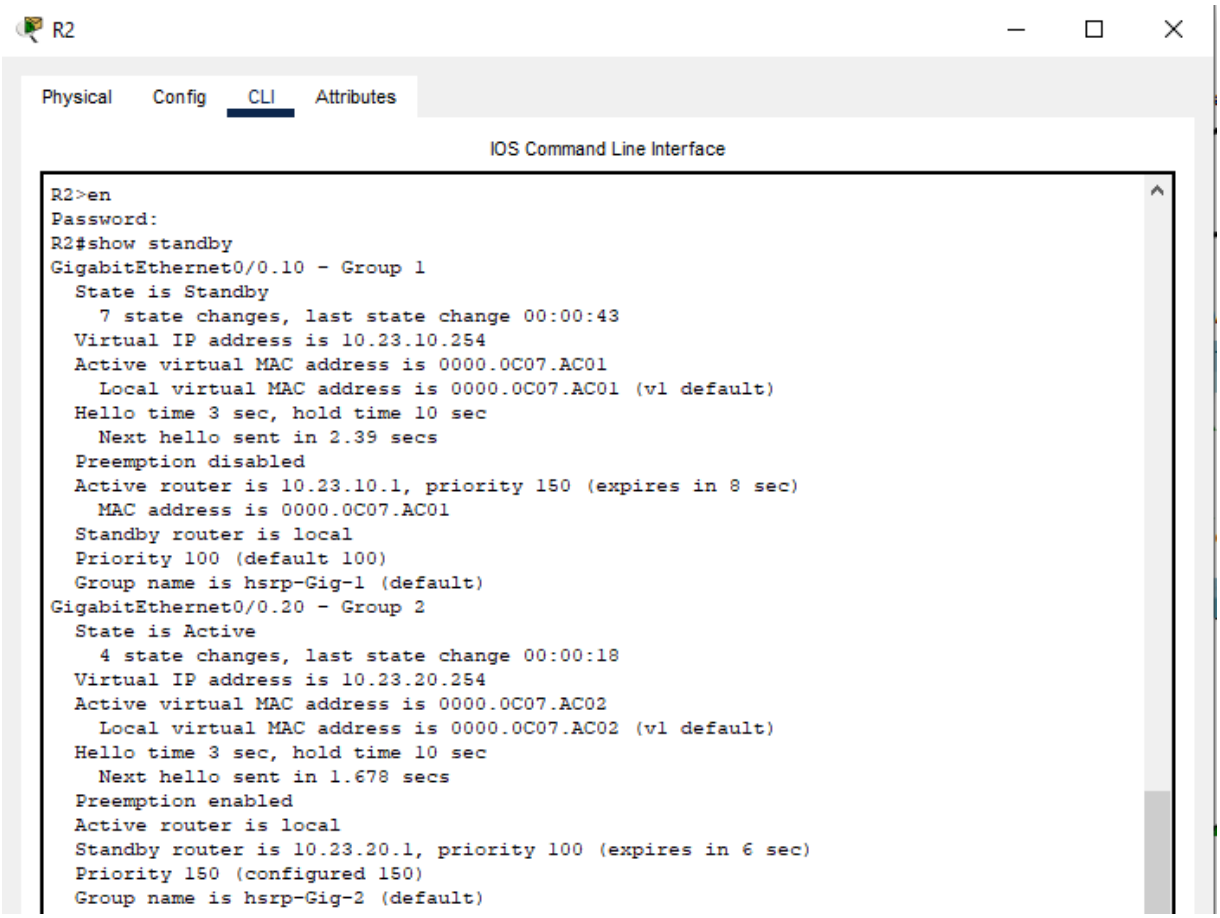


Figure 2.7.2: Issuing the show standby command on R2, we can see that for VLAN 10, R2 is the standby router. For VLAN 20, R2 is the active router.

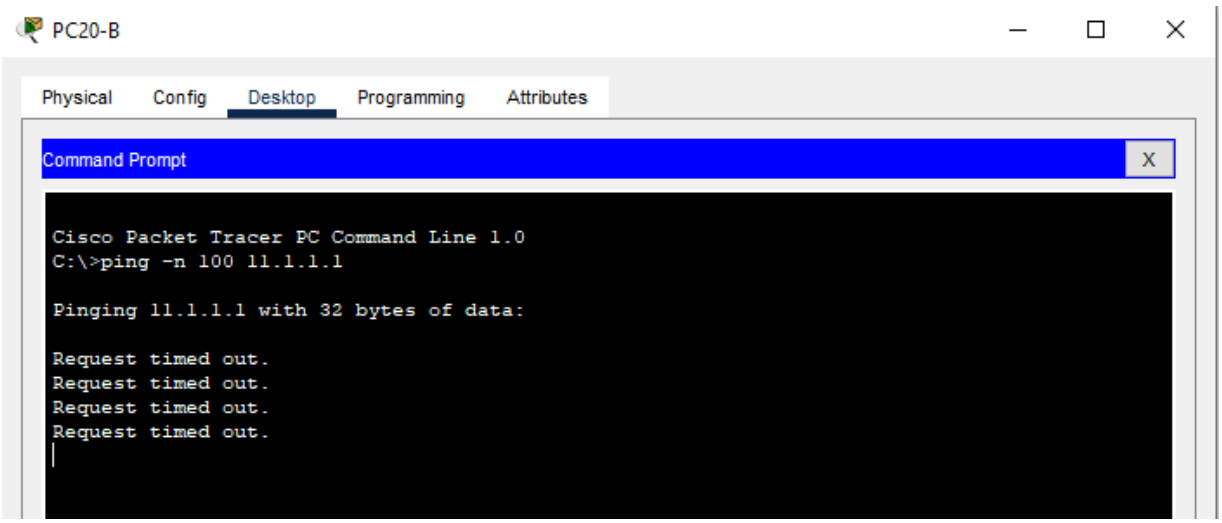


Figure 2.7.3: From my originator PC20-B, I am pinging one of R1's loopback addresses, 11.1.1.1. Since my PC20-B is in VLAN 20, its active router is R2, and the pings to R1 are unsuccessful at this time.

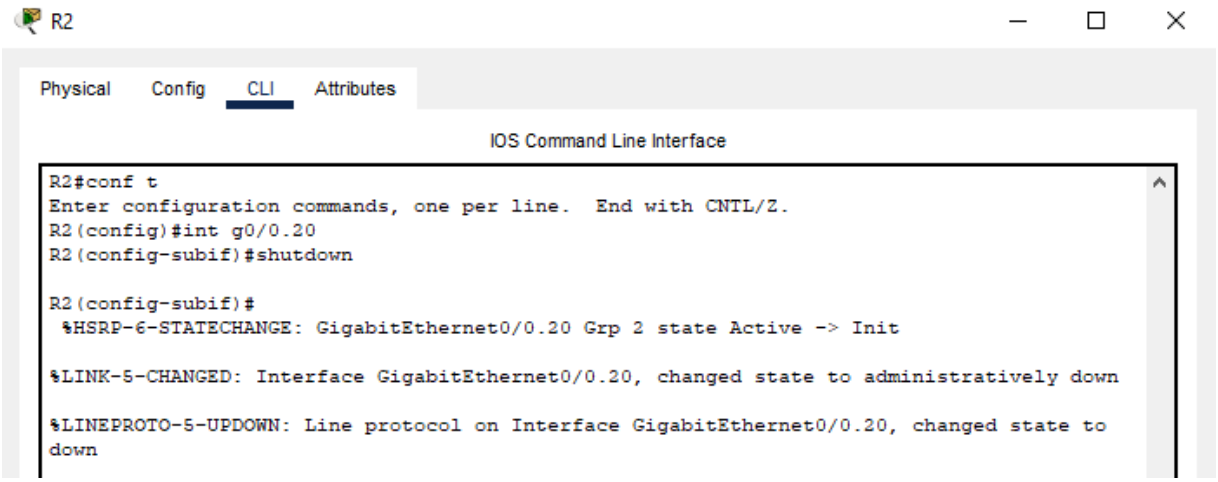


Figure 2.7.4: Next, I shutdown the g0/0.20 interface.

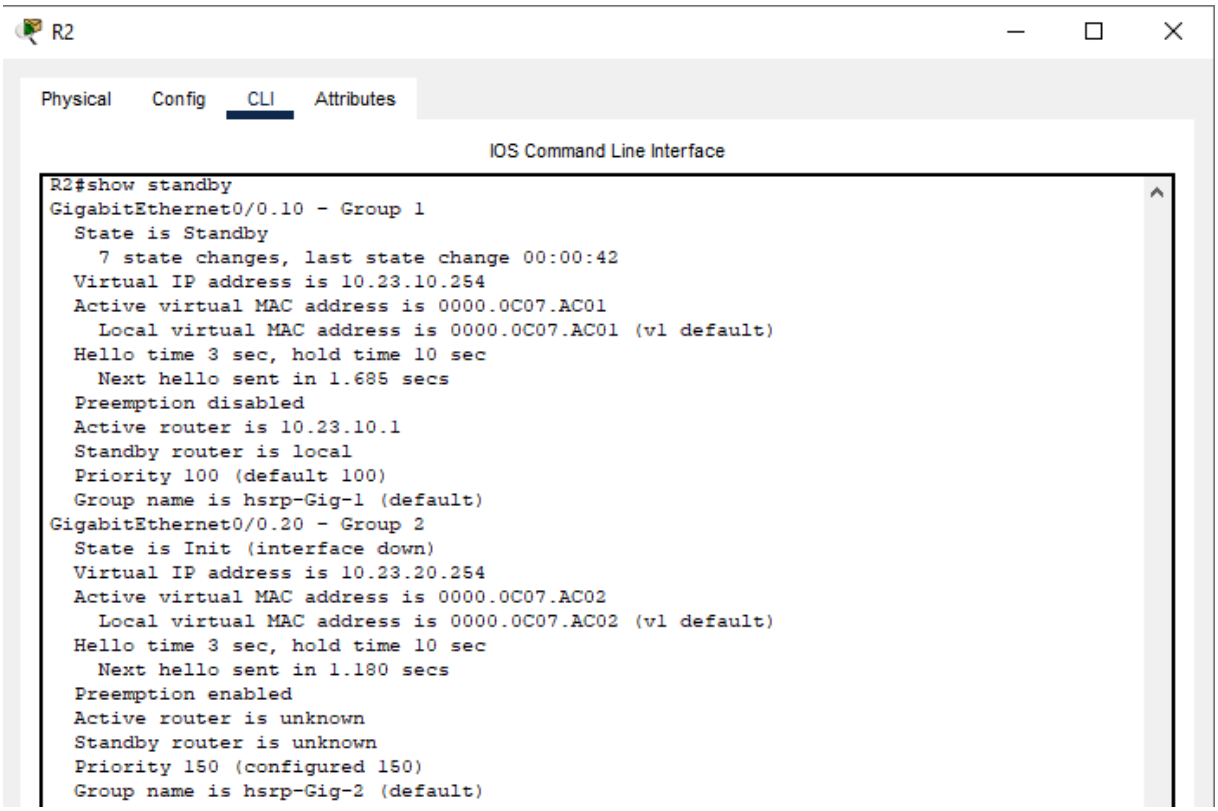


Figure 2.7.5: Running the show standby command on R2 again, we can see that the state of the router is now Init instead of Active as the g0/0.20 interface is down.

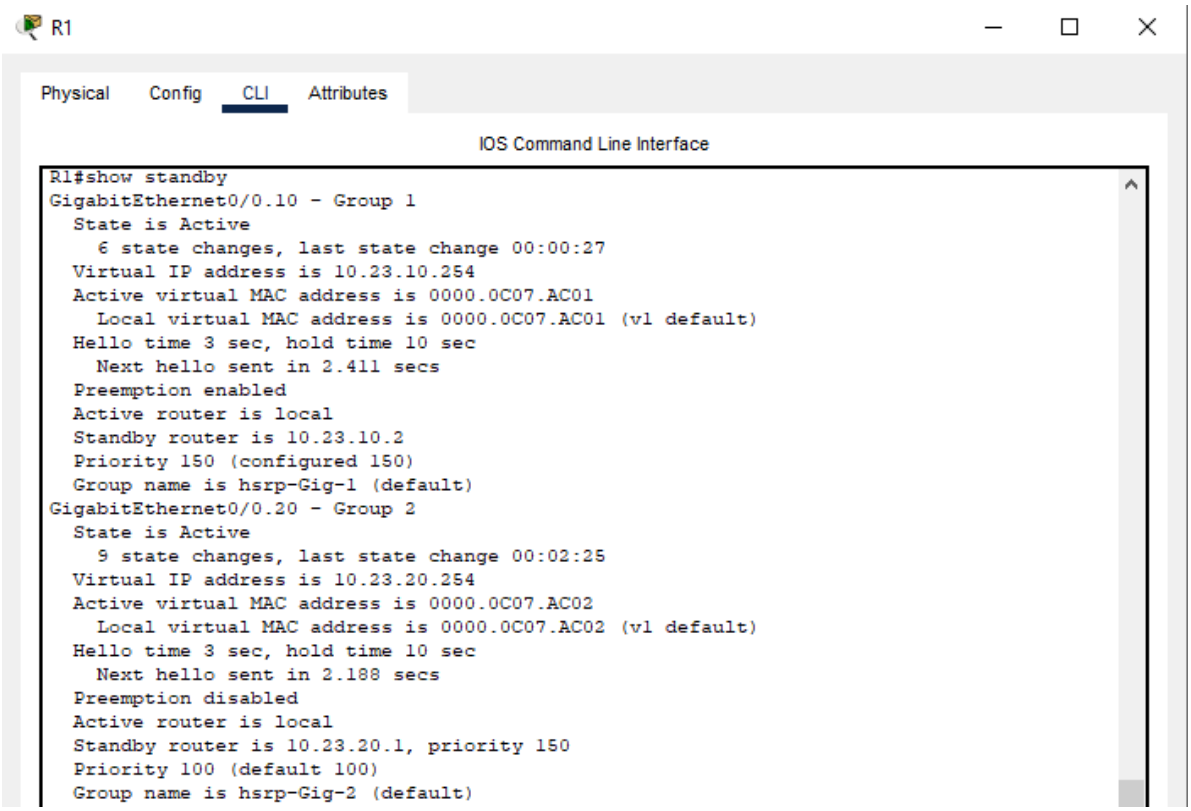


Figure 2.7.6: Running the show standby command on R1 again, we can see that the state of the router is now Active instead of Standby.

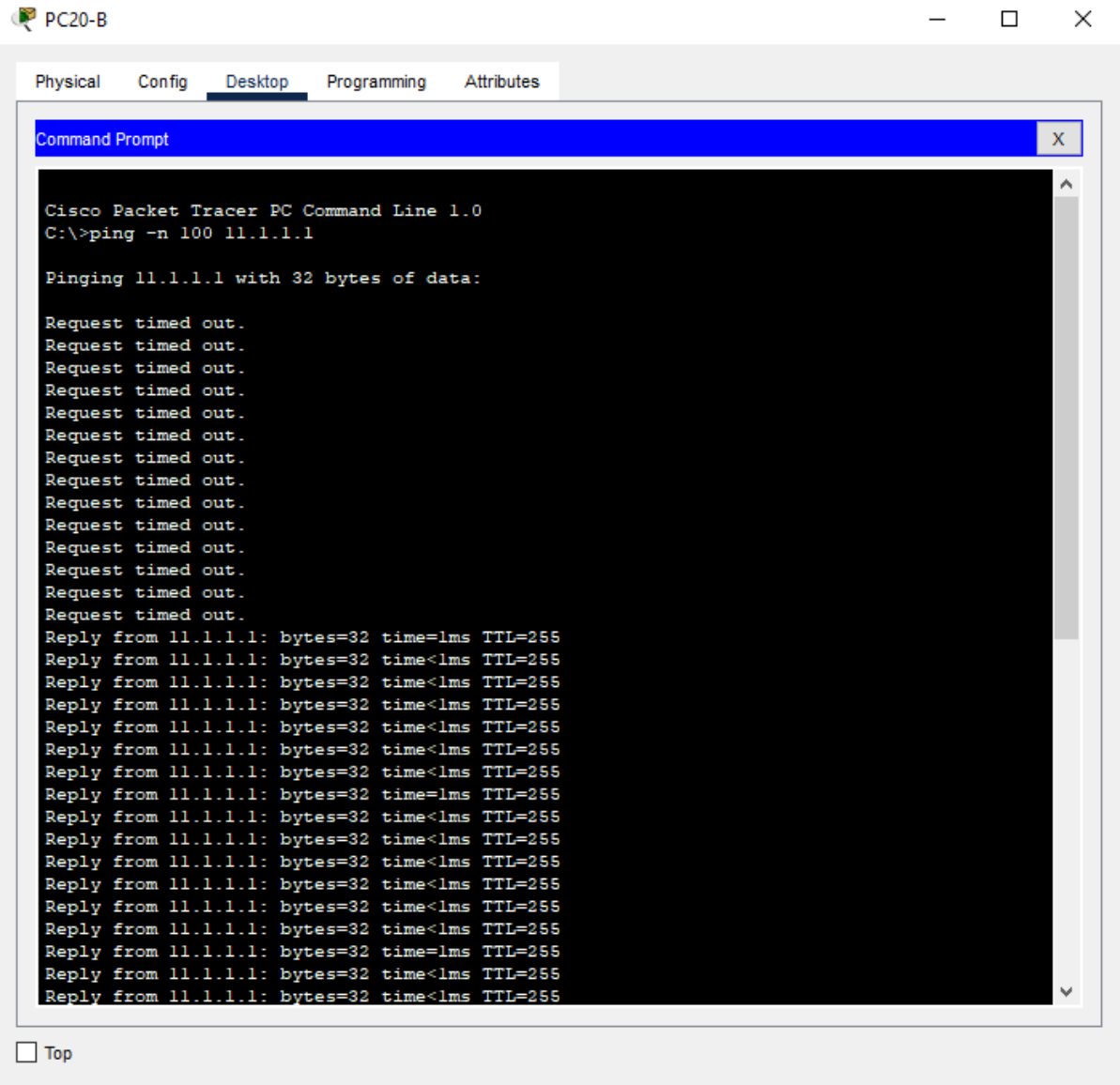


Figure 2.7.7: From the ping test started in Figure 2.7.3, in this figure we can see that the ping from PC20-B to R1's loopback address of 11.1.1.1 is now successful. This is because R1 has become the Active Router for VLAN 20.

To a user on a PC, the network has had no disruptions. This is because the Active Router and Standby Router share a Virtual IP Address.

3.0 Enhancements

3.1 Enhancement 1: DNS Server + Web Server

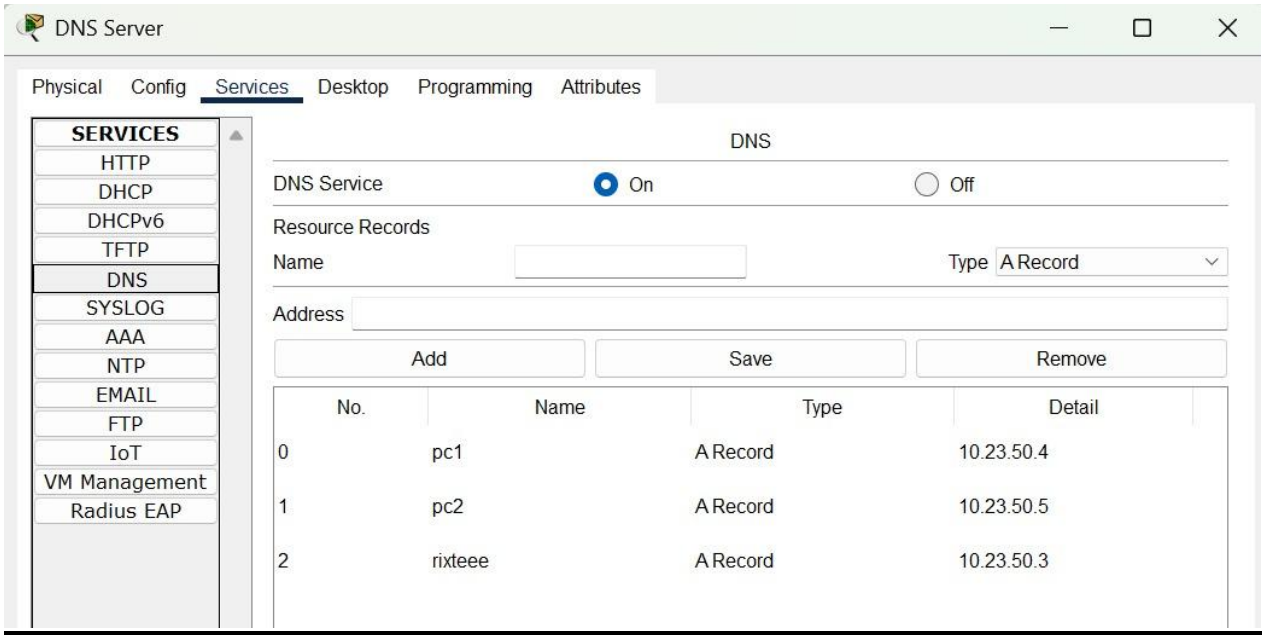


Figure 3.1.1: Created DNS names along with the respective IPv4 Addresses.

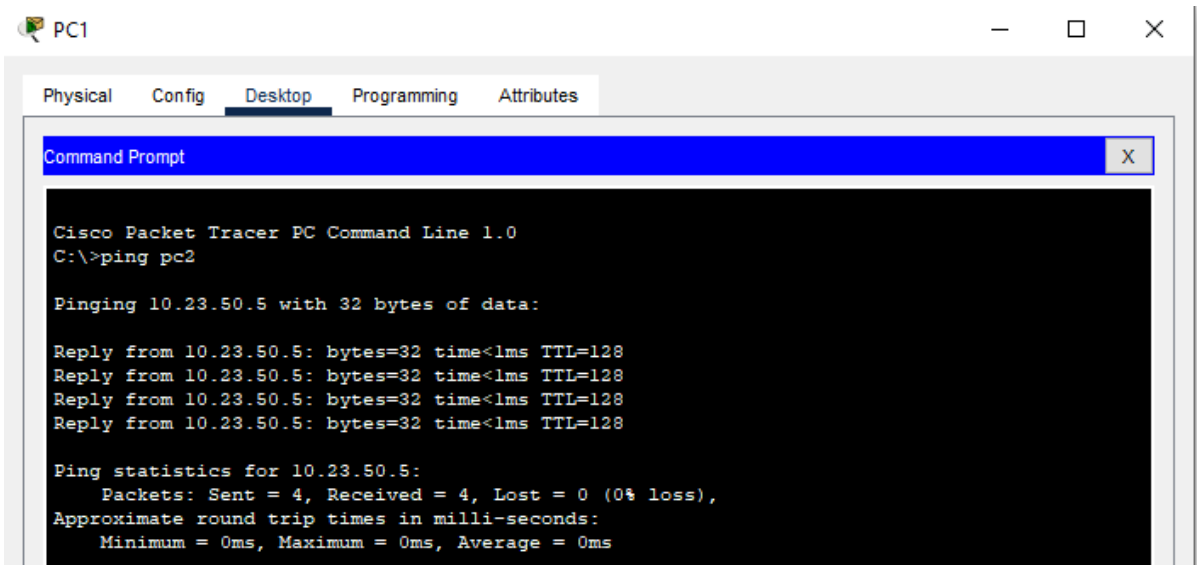


Figure 3.1.2: Pinging PC2 using the DNS name pc2 from PC1, without typing PC2's IPv4 Address of 10.23.50.5

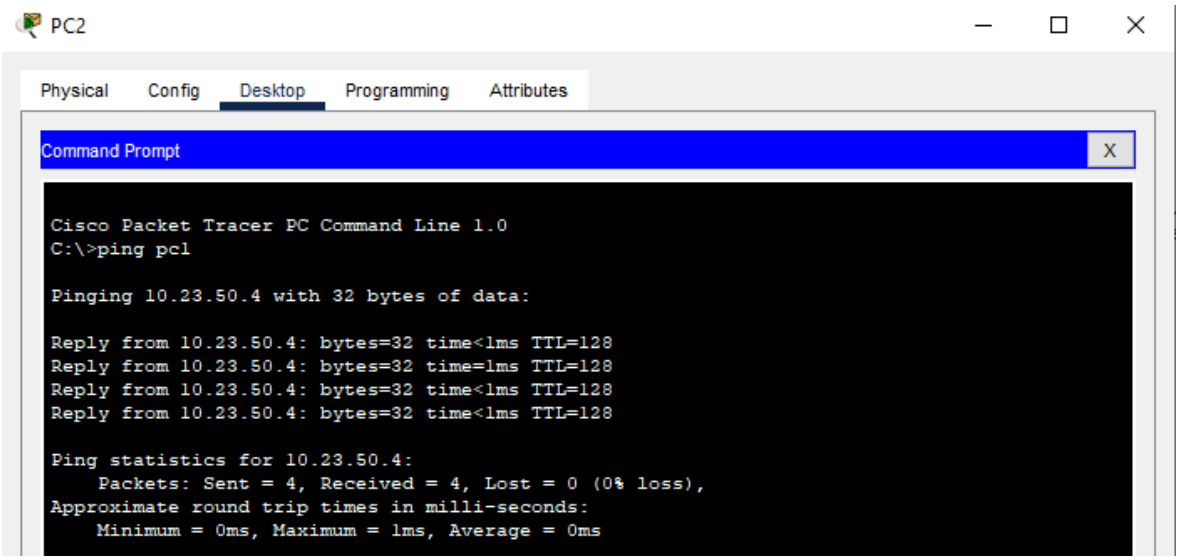


Figure 3.1.3: Pinging PC1 using the DNS name pc1 from PC2, without typing PC1's IPv4 Address of 10.23.50.4

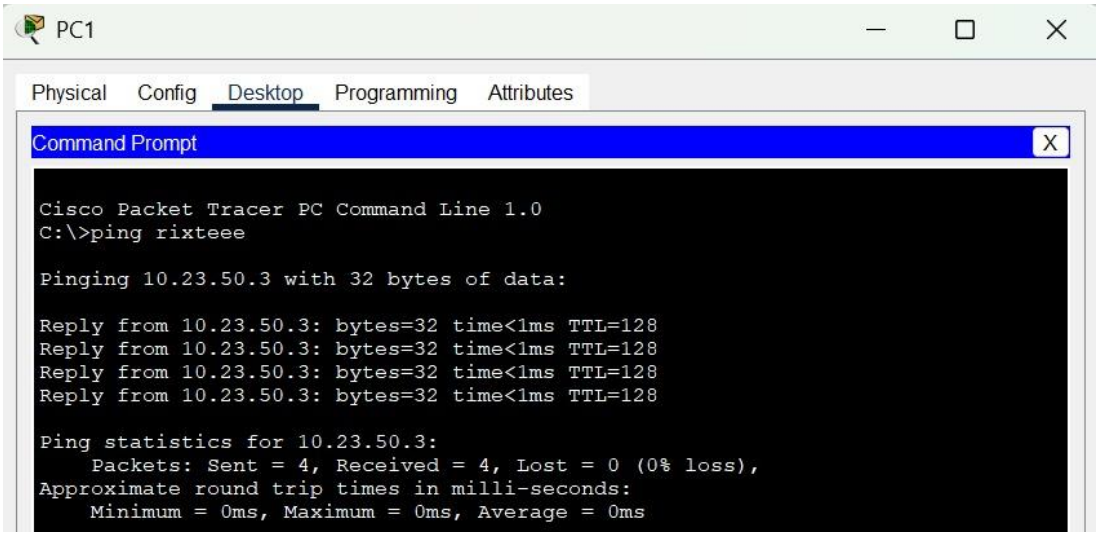


Figure 3.1.4: Pinging the Web Server using the DNS name rixteee from PC1, without typing the Web Server's IPv4 Address of 10.23.50.3

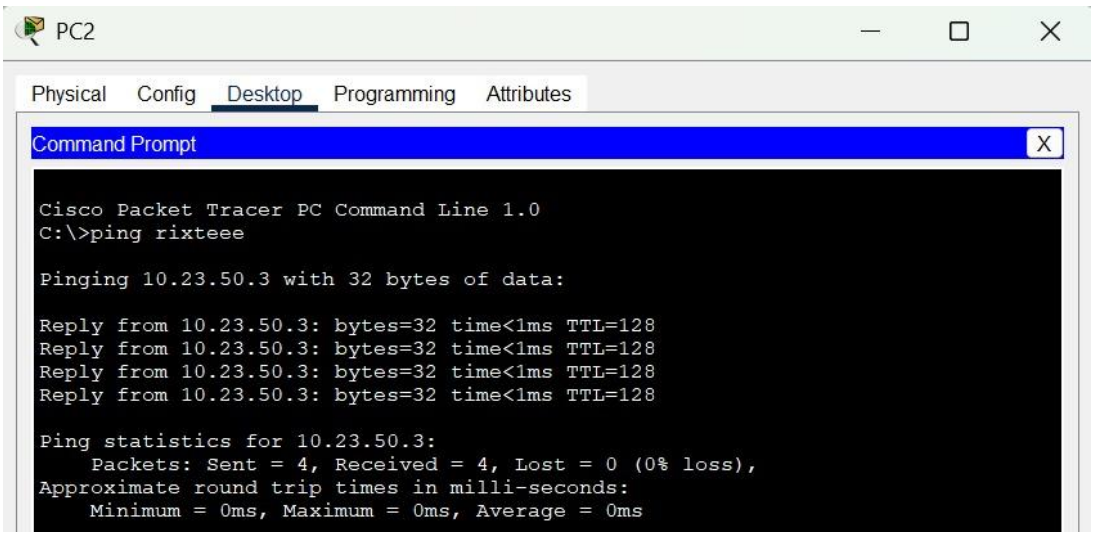


Figure 3.1.5: Pinging the Web Server using the DNS name rixteee from PC2, without typing the Web Server's IPv4 Address of 10.23.50.3

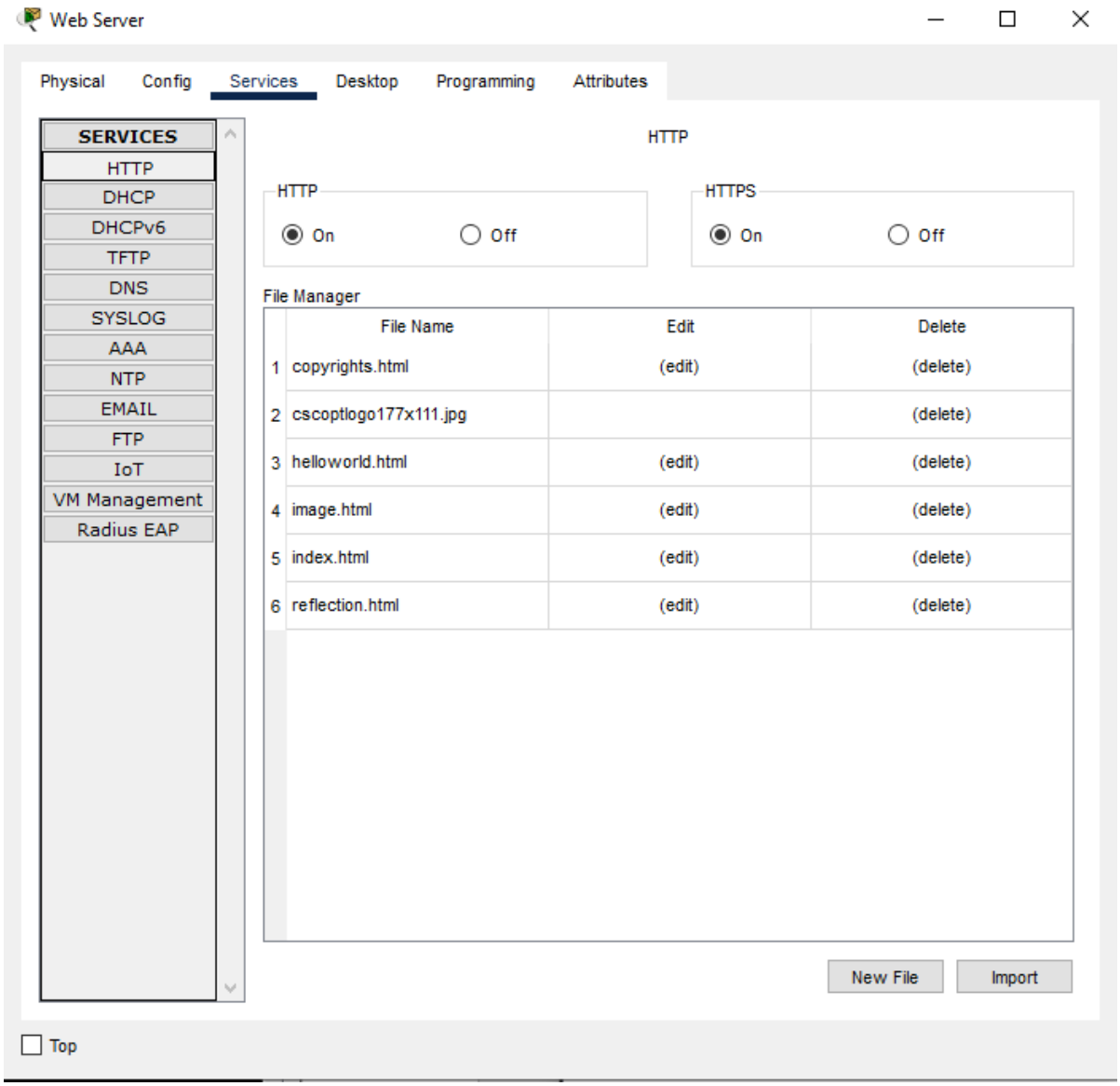


Figure 3.1.6 Created a file in the Web Server called reflection.html and edited it, and edited the index.html file.

Figure 3.1.7: The index.html file has been edited and the user interface looks like this.

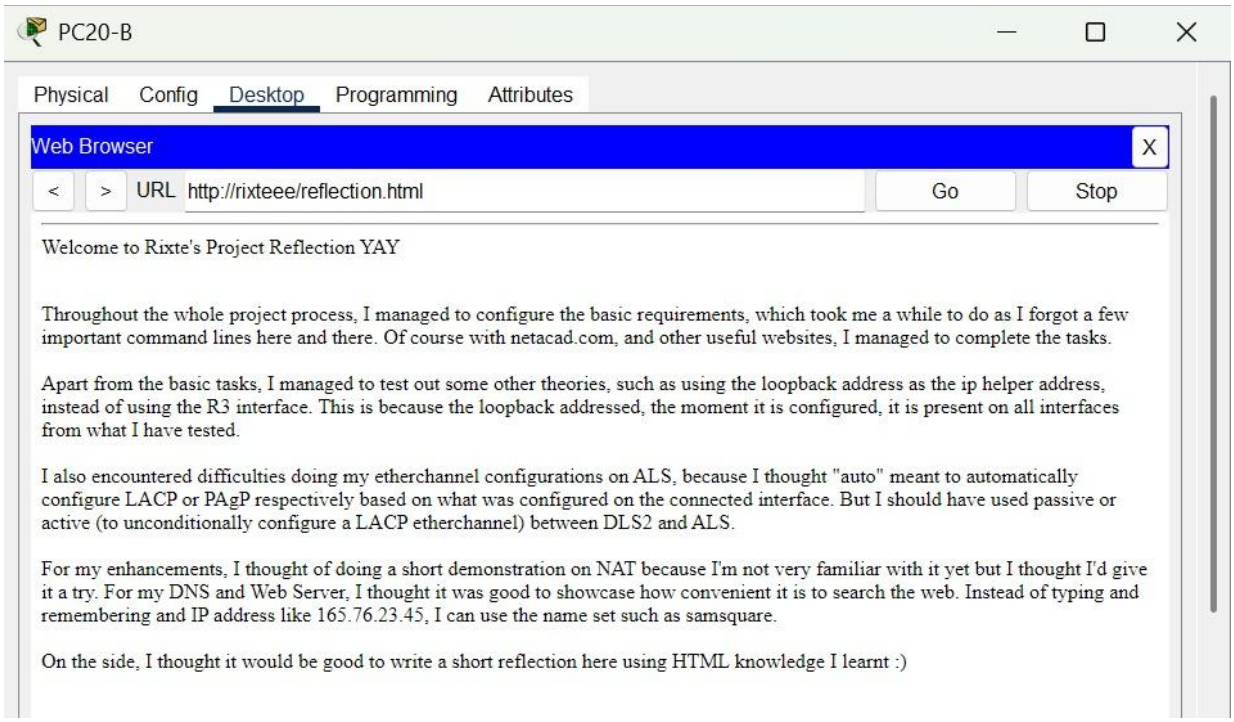


Figure 3.1.8: The reflection.html file has been edited using html commands I learnt from a Object-Oriented Programming module to write my reflection to present it better.

3.2 Network Address Translation (NAT)

From what I have read on netacad.com, to allow a device with a private IPv4 address to access devices and resources outside of the local network, the private address must first be translated to a public address. NAT also provides security to a network because it helps to hide internal IPv4 addresses from outside networks.

Using the command “ip nat inside source static 78.0.0.2 42.0.0.1”, I created a mapping between the inside local address and the inside global addresses. The 78.0.0.2 inside local address and the 42.0.0.1 inside global address are configured as a static NAT translation.

After the mapping is configured, the interfaces participating in the translation are configured as inside or outside relative to NAT. In my Packet Tracer, the External Router G0/0 interface is an outside interface and G0/1 interface is an inside interface.

```
External_Router#show ip nat translations
Pro  Inside global     Inside local       Outside local      Outside global
---  42.0.0.1          78.0.0.2           ---                ---
```

Figure 3.2.1: Using the “show ip nat translations” command on the External Router, I can see the inside global and inside local addresses set.

```
External_Router#show ip nat translations
Pro  Inside global     Inside local       Outside local      Outside global
icmp 42.0.0.1:10       78.0.0.2:10        10.23.20.12:10     10.23.20.12:10
icmp 42.0.0.1:11       78.0.0.2:11        10.23.20.12:11     10.23.20.12:11
icmp 42.0.0.1:12       78.0.0.2:12        10.23.20.12:12     10.23.20.12:12
icmp 42.0.0.1:13       78.0.0.2:13        10.23.20.12:13     10.23.20.12:13
icmp 42.0.0.1:3        78.0.0.2:3         10.23.20.12:3      10.23.20.12:3
icmp 42.0.0.1:4        78.0.0.2:4         10.23.20.12:4      10.23.20.12:4
icmp 42.0.0.1:5        78.0.0.2:5         10.23.20.12:5      10.23.20.12:5
icmp 42.0.0.1:6        78.0.0.2:6         10.23.20.12:6      10.23.20.12:6
icmp 42.0.0.1:7        78.0.0.2:7         10.23.20.12:7      10.23.20.12:7
icmp 42.0.0.1:8        78.0.0.2:8         10.23.20.12:8      10.23.20.12:8
icmp 42.0.0.1:9        78.0.0.2:9         10.23.20.12:9      10.23.20.12:9
---  42.0.0.1          78.0.0.2           ---                ---
```

Figure 3.2.2: If the same “show ip nat translations” command is used during an active session, then the output will also show the address of the outside device as shown.

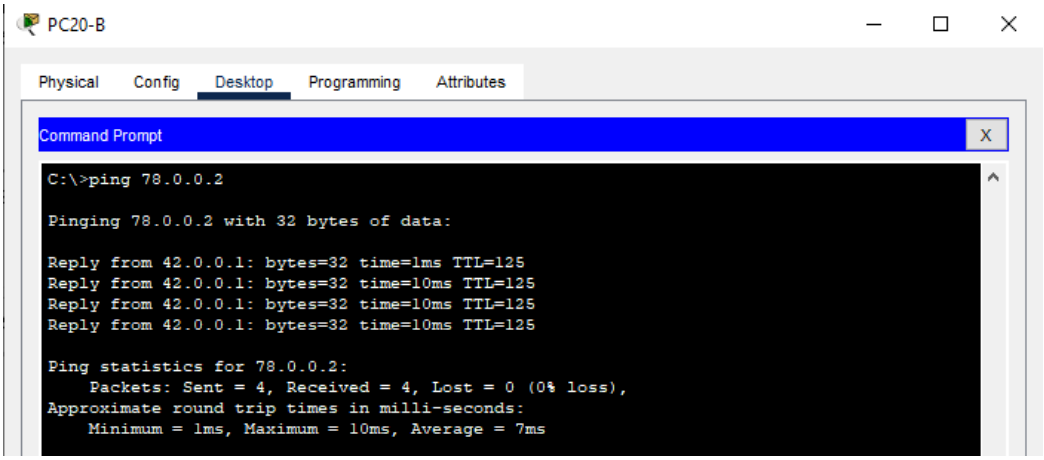


Figure 3.2.3: To show that my NAT works, I pinged the PC directed connected to the External Router. Instead of the private address, the reply is from the public address.

3.3 Wireless Router

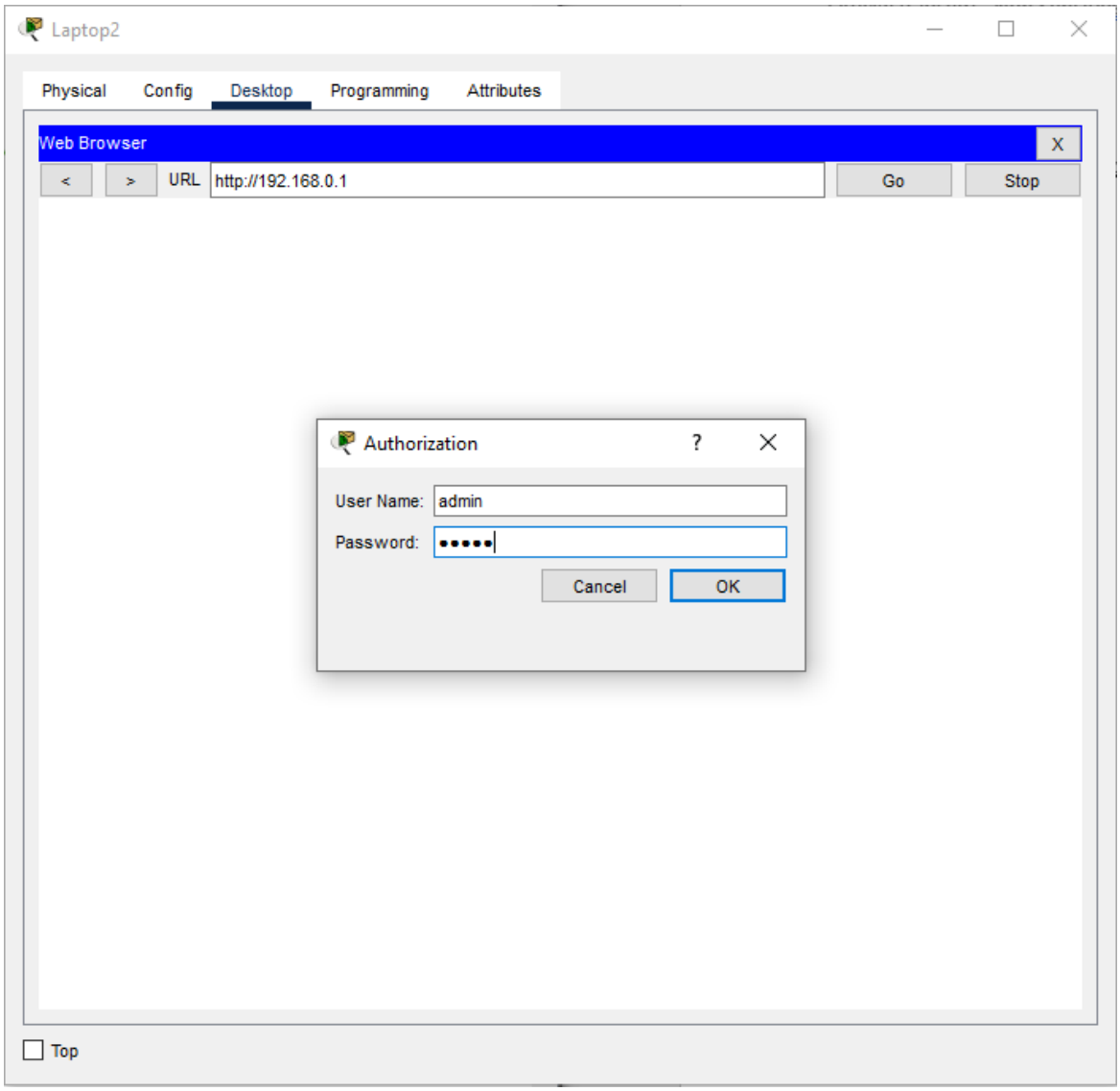


Figure 3.3.1: So first I had to log into the router from a web browser, where I connected a laptop to the Wireless Router and logged into the router from the laptop. In my case I left the password as "admin" and did not change it. It can be changed under "Administration".

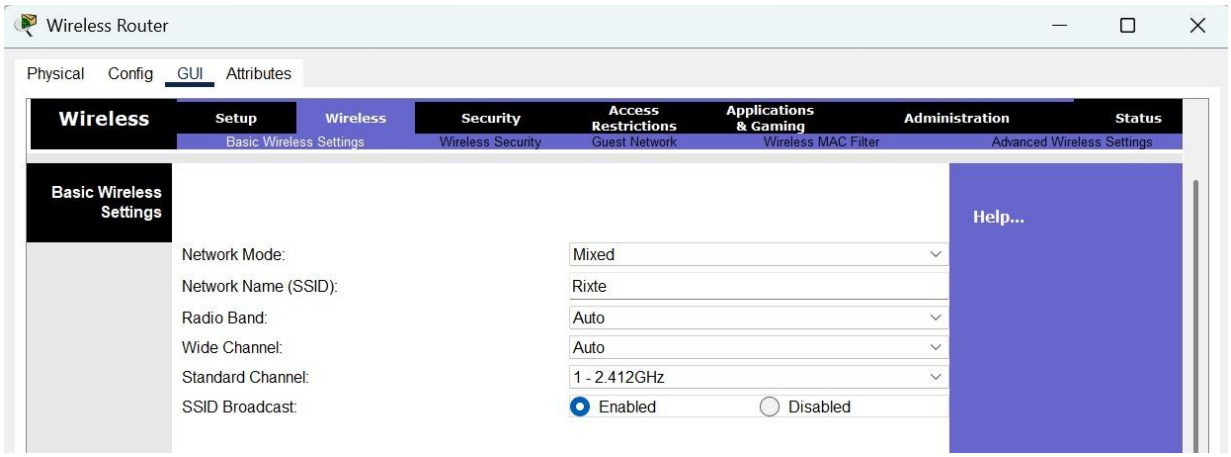


Figure 3.3.2: Under Wireless, Basic Wireless Settings, I configured the Service Set Identified (SSID) to "Rixte".

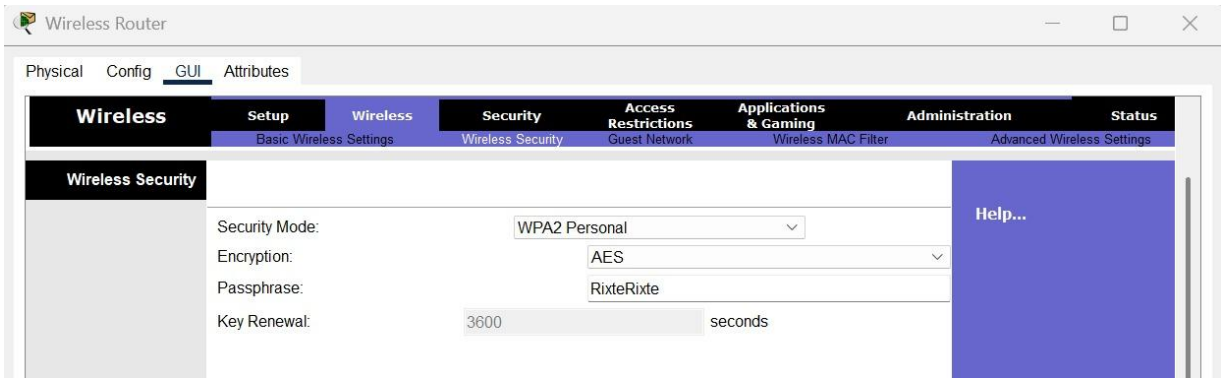


Figure 3.3.3: I set the Security Mode to the personal version of Wi-Fi Protected Access version 2 (also known as WPA2 Personal). I also configured the Passphrase “RixteRixte”. I save all the settings.

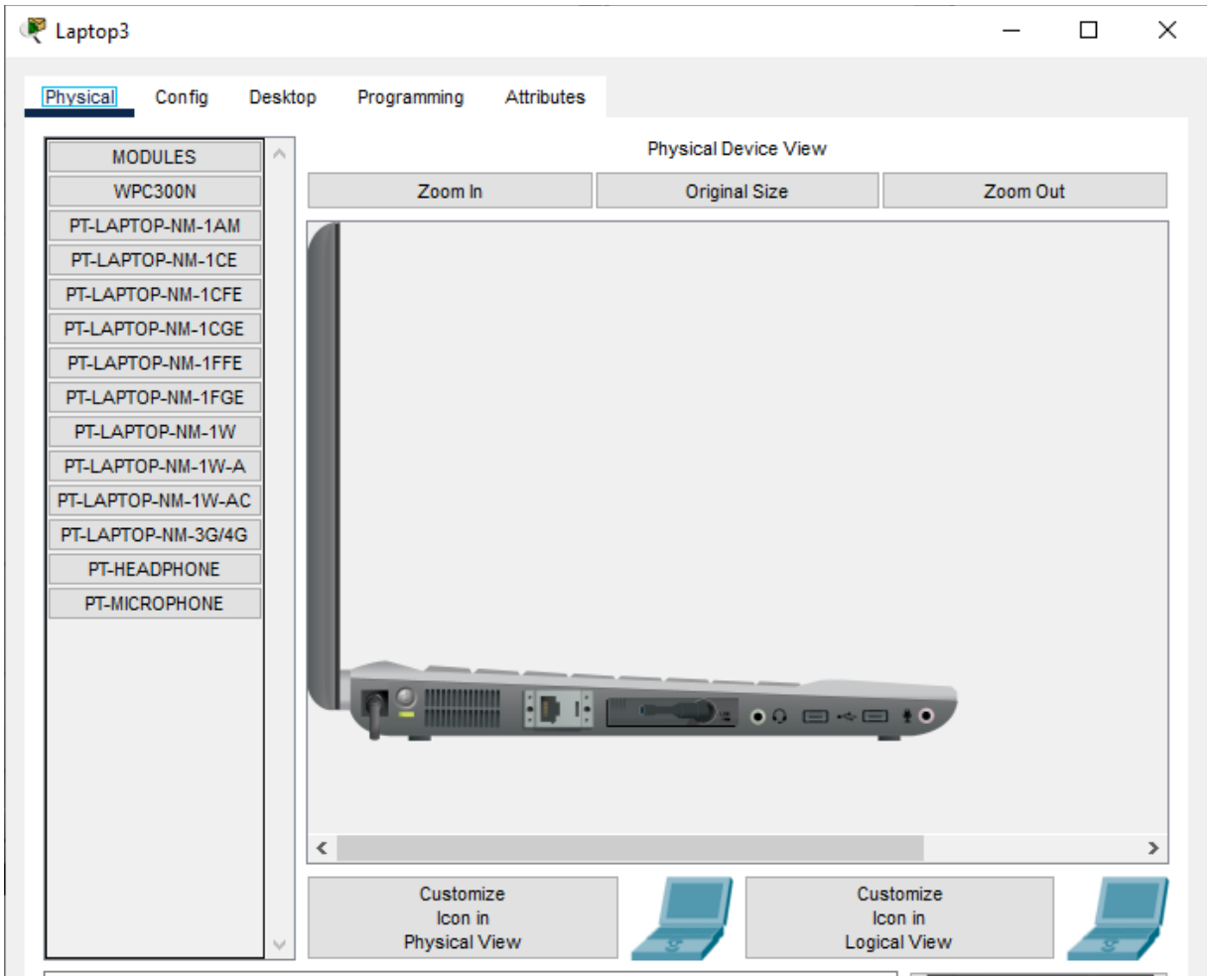


Figure 3.3.4: I go to the laptop I want to connect wirelessly, and power it off. Then I remove the module from the laptop and added a WPC300N module, and turned the laptop back on.

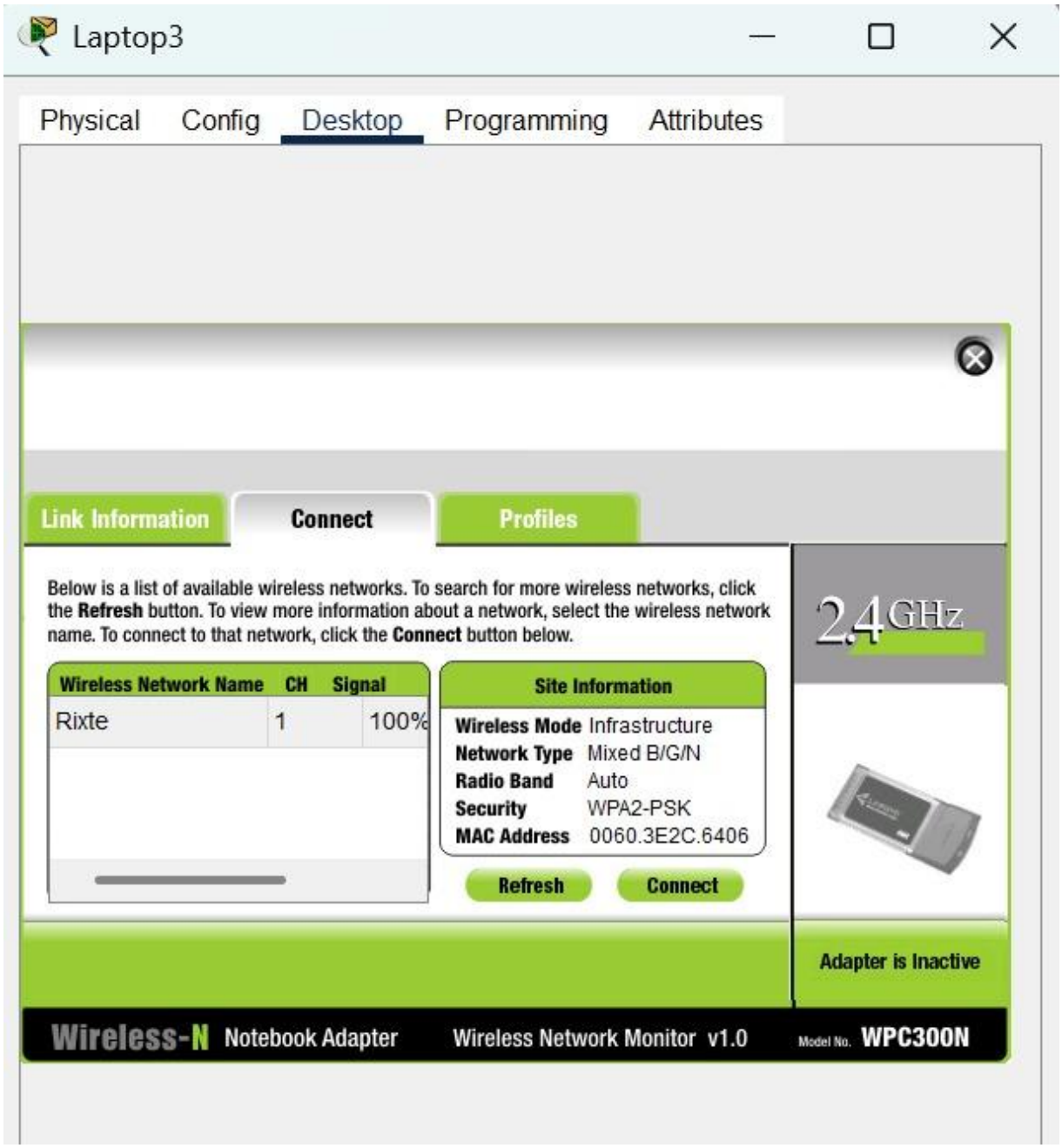


Figure 3.3.5: Afterwards, I click on the Desktop tab and then PC Wireless. I go to the connect tab and select the Wireless Network Name (SSID) “Rixte”.

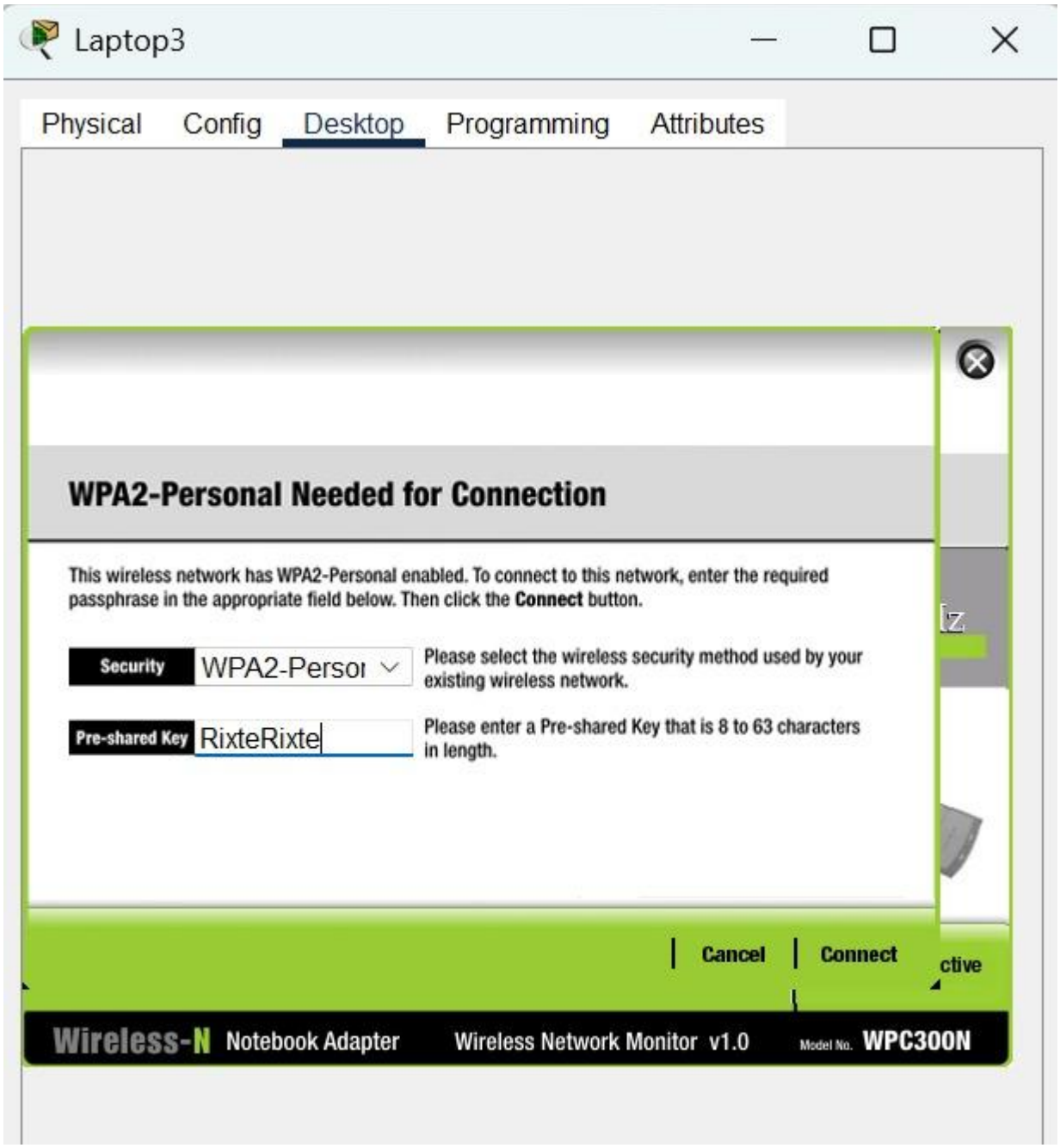


Figure 3.3.6: I enter the passphrase “RixteRixte” and click Connect.

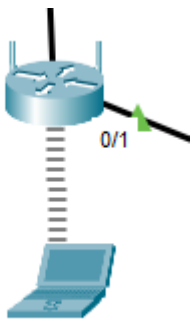


Figure 3.3.7: From the topology, we can see my laptop is now connected to the router wirelessly.

4.0 Reflection

Throughout the whole project process, I managed to configure the basic requirements. This took me some time because I did not fully remember all the commands required. Hence, I did use some references to guide me.

Apart from the basic tasks, I managed to test out some other theories, such as using the loopback address as the ip helper address, instead of using the R3 interface. This is because the loopback addresses, the moment it is configured, it is present on all interfaces from what I have tested.

I also encountered difficulties doing my etherchannel configurations on ALS, because I thought "auto" meant to automatically configure LACP or PAgP respectively based on what was configured on the connected interface. But I should have used passive or active (to unconditionally configure a LACP etherchannel) between DLS2 and ALS.

For my enhancements, I thought of doing a short demonstration on NAT because I'm not very familiar with it yet, but I thought I'd give it a try. For my DNS and Web Server, I thought it was good to showcase how convenient it is to search the web. Instead of typing and remembering and IP address like 165.76.23.45, I can use the DNS name set such as samsquare.

I have learnt a lot from this project and I hope to be able to pass on my knowledge from this to my next Cisco Networking Project.

5.0 Commands

Passwords for SSH/Telnet: Cisco, 12345

Passwords to enter router: qwe, 12345

Passwords to enter switch = 12345

Basic Setup on all Routers (for switches it is without the line console 0 password)

```
R1(config)#enable secret 12345
R1(config)#line con 0
R1(config-line)#password qwe
R1(config-line)#login
R1(config-line)#exit
R1(config)#service password-encryption
```

Main Commands for Basic Tasks

DLS1

```
DLS1>en
DLS1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
DLS1(config)#vlan 10
DLS1(config-vlan)#name Staff
DLS1(config-vlan)#vlan 20
DLS1(config-vlan)#name Guest
DLS1(config-vlan)#vlan 88
DLS1(config-vlan)#name Native
DLS1(config-vlan)#vlan 99
DLS1(config-vlan)#name Management
DLS1(config)#int vlan 99
DLS1(config-if)#ip add 10.23.99.11 255.255.255.0
DLS1(config-if)#ip default-gateway 10.23.99.1
```

Assign ports to VLAN subnets

```
DLS1(config)#int range f0/21-24
DLS1(config-if-range)#switchport mode access
DLS1(config-if-range)#switchport access vlan 10
DLS1(config-if-range)#int range f0/12-20
DLS1(config-if-range)#switchport mode access
DLS1(config-if-range)#switchport access vlan 20
```

Etherchannel Configurations

```
DLS1(config)#int range f0/1, f0/3
DLS1(config-if-range)#shutdown
DLS1(config-if-range)#channel-group 1 mode on
DLS1(config-if-range)#no shutdown
DLS1(config-if-range)#int port-channel 1
DLS1(config-if)#switchport mode trunk
DLS1(config-if)#switchport trunk native vlan 88

DLS1(config-if)#int range f0/5, f0/7
DLS1(config-if-range)#shutdown
```

DLS1(config-if-range)#channel-group 3 mode ?
active Enable LACP unconditionally
auto Enable PAgP only if a PAgP device is detected
desirable Enable PAgP unconditionally
on Enable Etherchannel only
passive Enable LACP only if a LACP device is detected
DLS1(config-if-range)#channel-group 3 mode desirable
DLS1(config-if-range)#no shutdown
DLS1(config-if-range)#int port-channel 3
DLS1(config-if)#switchport mode trunk
DLS1(config-if)#switch trunk native vlan 88

Inter-VLAN Routing
DLS1(config)#int g0/1
DLS1(config-if)#switchport mode trunk
DLS1(config-if)#switchport trunk native vlan 88

Spanning Tree Configurations
DLS1(config)#spanning-tree vlan 10,88 root primary
DLS1(config)#spanning-tree vlan 20,99 root secondary

Port Security
DLS1(config)#int range f0/12-24
DLS1(config-if-range)#switchport mode access
DLS1(config-if-range)#switchport port-security
DLS1(config-if-range)#switchport port-security maximum 1
DLS1(config-if-range)#switchport port-security mac-address sticky
DLS1(config-if-range)#int range f0/2, f0/4, f0/6, f0/8-11, g0/2, vlan 1
DLS1(config-if-range)#shutdown

Telnet
DLS1(config)#line vty 0 15
DLS1(config-line)#password cisco
DLS1(config-line)#login
DLS1(config-line)#transport input telnet

DLS2
DLS2>en
DLS2#conf t
Enter configuration commands, one per line. End with CNTL/Z.
DLS2(config)#vlan 10
DLS2(config-vlan)#name Staff
DLS2(config-vlan)#vlan 20
DLS2(config-vlan)#name Guest
DLS2(config-vlan)#vlan 88
DLS2(config-vlan)#name Native
DLS2(config-vlan)#vlan 99
DLS2(config-vlan)#name Management
DLS2(config)#int vlan 99
DLS2(config-if)#ip add 10.23.99.12 255.255.255.0
DLS2(config-if)#ip default-gateway 10.23.99.2

Assign ports to VLAN Subnets
DLS2(config)#int range f0/21-24

DLS2(config-if-range)#switchport mode access
DLS2(config-if-range)#switchport access vlan 10
DLS2(config-if-range)#int range f0/12-20
DLS2(config-if-range)#switchport mode access
DLS2(config-if-range)#switchport access vlan 20

Etherchannel Configurations
DLS2(config)#int range f0/1, f0/3
DLS2(config-if-range)#shutdown
DLS2(config-if-range)#channel-group 1 mode on
DLS2(config-if-range)#no shutdown
DLS2(config-if-range)#int port-channel 1
DLS2(config-if)#switchport mode trunk
DLS2(config-if)#switchport trunk native vlan 88

DLS2(config-if)#int range f0/9, f0/11
DLS2(config-if-range)#shutdown
DLS2(config-if-range)#channel-group 2 mode ?
active Enable LACP unconditionally
auto Enable PAgP only if a PAgP device is detected
desirable Enable PAgP unconditionally
on Enable Etherchannel only
passive Enable LACP only if a LACP device is detected
DLS2(config-if-range)#channel-group 2 mode active
DLS2(config-if-range)#no shutdown
DLS2(config-if-range)#int port-channel 2
DLS2(config-if)#switchport mode trunk
DLS2(config-if)#switchport trunk native vlan 88

Inter-VLAN Routing
DLS2(config)#int g0/1
DLS2(config-if)#switchport mode trunk
DLS2(config-if)#switchport trunk native vlan 88

Spanning Tree Configurations
DLS2(config)#spanning-tree vlan 20,99 root primary
DLS2(config)#spanning-tree vlan 10,88 root secondary

Port Security Configurations
DLS2(config)#int range f0/12-24
DLS2(config-if-range)#switchport mode access
DLS2(config-if-range)#switchport port-security
DLS2(config-if-range)#switchport port-security maximum 1
DLS2(config-if-range)#switchport port-security mac-address sticky
DLS2(config)#int range f0/2, f0/4-8, f0/10, g0/2, vlan 1
DLS2(config-if-range)#shutdown

Telnet
DLS2(config)#line vty 0 15
DLS2(config-line)#password cisco
DLS2(config-line)#login
DLS2(config-line)#transport input telnet

ALS

```
ALS>en
ALS#conf t
Enter configuration commands, one per line. End with CNTL/Z.
ALS(config)#vlan 10
ALS(config-vlan)#name Staff
ALS(config-vlan)#vlan 20
ALS(config-vlan)#name Guest
ALS(config-vlan)#vlan 88
ALS(config-vlan)#name Native
ALS(config-vlan)#vlan 99
ALS(config-vlan)#name Management
ALS(config-vlan)#int vlan 99
ALS(config-if)#ip add 10.23.99.13 255.255.255.0
ALS(config-if)#ip default-gateway 10.23.99.2
```

Assign ports to VLAN Subnets

```
ALS(config)#int range f0/21-24
ALS(config-if-range)#switchport mode access
ALS(config-if-range)#switchport access vlan 10
ALS(config-if-range)#int range f0/12-20
ALS(config-if-range)#switchport mode access
ALS(config-if-range)#switchport access vlan 20
ALS(config)#int g0/1
ALS(config-if)#switchport mode access
ALS(config-if)#switchport access vlan 88
```

Etherchannel Configurations

```
ALS(config)#int range f0/5, f0/7
ALS(config-if-range)#shutdown
ALS(config-if-range)#channel-group 3 mode desirable
ALS(config-if-range)#no shutdown
ALS(config-if-range)#int port-channel 3
ALS(config-if)#switchport mode trunka
ALS(config-if)#switchport trunk native vlan 88

ALS(config-if)#int range f0/9, f0/11
ALS(config-if-range)#shutdown
ALS(config-if-range)#channel-group 2 mode active
ALS(config-if-range)#no shutdown
ALS(config-if-range)#int port-channel 2
ALS(config-if)#switchport mode trunk
ALS(config-if)#switchport trunk native vlan 88
```

Port Security Configurations

```
ALS(config)#int range f0/12-24
ALS(config-if-range)#switchport mode access
ALS(config-if-range)#switchport port-security
ALS(config-if-range)#switchport port-security maximum 1
ALS(config-if-range)#switchport port-security mac-address sticky
ALS(config)#int range f0/1-4, f0/6, f0/8, f0/10, g0/2, vlan 1
ALS(config-if-range)#shutdown
```

Telnet

```
ALS(config)#line vty 0 15
ALS(config-line)#password cisco
```

```
ALS(config-line)#login
ALS(config-line)#transport input telnet
```

R1

```
R1(config)#int g0/0.10
R1(config-subif)#encapsulation dot1q 10
R1(config-subif)#ip add 10.23.10.1 255.255.255.0
R1(config-subif)#int g0/0.20
R1(config-subif)#encapsulation dot1q 20
R1(config-subif)#ip add 10.23.20.1 255.255.255.0
R1(config-subif)#int g0/0.88
R1(config-subif)#encapsulation dot1q 88 native
R1(config-subif)#ip add 10.23.88.1 255.255.255.0
R1(config-subif)#int g0/0.99
R1(config-subif)#encapsulation dot1q 99
R1(config-subif)#ip add 10.23.99.1 255.255.255.0

R1(config-subif)#exit
R1(config)#int s0/0/0
R1(config-if)#ip add 13.1.1.1 255.255.255.252

R1(config)#int lo1
R1(config-if)#ip add 11.1.1.1 255.255.255.0
R1(config-if)#int lo2
R1(config-if)#ip add 11.2.1.1 255.255.255.0
R1(config-if)#no shut
R1(config-if)#int lo3
R1(config-if)#ip add 11.3.1.1 255.255.255.0

R1(config-subif)#int g0/0
R1(config-if)#no shut
```

Static default route to R3

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

Loopback ip route

```
R1(config)#ip route 11.1.1.0 255.255.255.0 lo1
R1(config)#ip route 11.2.1.0 255.255.255.0 lo2
R1(config)#ip route 11.3.1.0 255.255.255.0 lo3
```

HSRP

```
int g0/0.10
standby 1 ip 10.23.10.254
standby 1 priority 150
standby 1 preempt

int g0/0.20
standby 2 ip 10.23.20.254
```

SSH

```
R1(config)#ip domain-name ccna-lab.com
R1(config)#crypto key generate rsa
R1(config)#line vty 0 15
R1(config-line)#transport input ssh
R1(config-line)#password cisco
```

```
R1(config-line)#login local
R1(config-line)#username admin secret cisco
```

DHCP

```
R1(config)#int g0/0.10
R1(config-subif)#ip helper-address 209.165.200.225
R1(config-subif)#int g0/0.20
R1(config-subif)#ip helper-address 209.165.200.225
```

Copy run start

R2

```
R2(config)#int g0/0.10
R2(config-subif)#encapsulation dot1q 10
R2(config-subif)#ip add 10.23.10.2 255.255.255.0
R2(config-subif)#int g0/0.20
R2(config-subif)#encapsulation dot1q 20
R2(config-subif)#ip add 10.23.20.2 255.255.255.0
R2(config-subif)#int g0/0.88
R2(config-subif)#encapsulation dot1q 88 native
R2(config-subif)#ip add 10.23.88.2 255.255.255.0
R2(config-subif)#int g0/0.99
R2(config-subif)#encapsulation dot1q 99
R2(config-subif)#ip add 10.23.99.2 255.255.255.0
R2(config-subif)#int s0/0/1
R2(config-if)#ip add 23.1.1.1 255.255.255.252

R2(config-if)#int g0/0
R2(config-if)#no shut

R2(config-if)#int lo4
R2(config-if)#ip add 12.1.1.1 255.255.255.0
R2(config-if)#no shut
R2(config-if)#int lo5
R2(config-if)#ip add 12.2.1.1 255.255.255.0
R2(config-if)#no shut
R2(config-if)#int lo6
R2(config-if)#ip add 12.3.1.1 255.255.255.0
R2(config-if)#no shut
```

Static default route to R3

```
R2(config)#ip route 0.0.0.0 0.0.0.0 s0/0/1
```

HSRP

```
int g0/0.20
standby 2 ip 10.23.20.254
standby 2 priority 150
standby 2 preempt

int g0/0.10
standby 1 ip 10.23.10.254
```

SSH

```
R2(config)#ip domain-name ccna-lab.com
```

```
R2(config)#crypto key generate rsa
R2(config)#line vty 0 15
R2(config-line)#transport input ssh
R2(config-line)#password cisco
R2(config-line)#login local
R2(config-line)#username admin secret cisco
```

DHCP

```
R2(config)#int g0/0.10
R2(config-subif)#ip helper-address 209.165.200.225
R2(config-subif)#int g0/0.20
R2(config-subif)#ip helper-address 209.165.200.225
```

Copy run start

R3

```
R3(config)#int s0/0/0
R3(config-if)#ip add 13.1.1.2 255.255.255.252
R3(config-if)#int s0/0/1
R3(config-if)#ip add 23.1.1.2 255.255.255.252
R3(config-if)#int lo0
R3(config-if)#ip add 209.165.200.225 255.255.255.248
R3(config-if)#no shut
```

Static routing to subnets of VLAN

```
R3(config)#ip route 10.23.10.0 255.255.255.0 13.1.1.1
R3(config)#ip route 10.23.88.0 255.255.255.0 13.1.1.1
R3(config)#ip route 10.23.20.0 255.255.255.0 23.1.1.1
R3(config)#ip route 10.23.99.0 255.255.255.0 23.1.1.1
```

SSH

```
R3(config)#ip domain-name ccna-lab.com
R3(config)#crypto key generate rsa
R3(config)#line vty 0 15
R3(config-line)#transport input ssh
R3(config-line)#password cisco
R3(config-line)#login local
R3(config-line)#username admin secret cisco
```

DHCP

```
R3(config)#ip dhcp excluded-address 10.23.10.1 10.23.10.5
R3(config)#ip dhcp excluded-address 10.23.10.254
R3(config)#ip dhcp excluded-address 10.23.20.1 10.23.20.5
R3(config)#ip dhcp excluded-address 10.23.20.254
R3(config)#ip dhcp pool Vlan10
R3(dhcp-config)#network 10.23.10.0 255.255.255.0
R3(dhcp-config)#default-router 10.23.10.254
R3(dhcp-config)#domain-name ccna-lab.com
R3(dhcp-config)#ip dhcp pool Vlan20
R3(dhcp-config)#network 10.23.20.0 255.255.255.0
R3(dhcp-config)#default-router 10.23.20.254
R3(dhcp-config)#domain-name ccna-lab.com
```

Copy run start

6.0 References

DNS Server + Web Server:
https://www.cdnetworks.com/web-performance-blog/what-is-a-dns-server/#:~:text=The%20DNS%20server%20contains%20a,web%20servers%20that%20host%20websites.
https://www.youtube.com/watch?v=nNFHfr55sr8

HSRP:
https://community.cisco.com/t5/networking-knowledge-base/hsrp-overview-and-basic-configuration/ta-p/3131590#:~:text=Hot%20Standby%20Router%20Protocol%20(HSRP,default%20gateway%20on%20the%20hosts.

NAT:
https://www.computernetworkingnotes.com/ccna-study-guide/how-to-configure-static-nat-in-cisco-router.html
https://www.youtube.com/watch?v=NIaP2Bkzs6k

SSH:
https://phoenixnap.com/kb/telnet-vs-ssh#:~:text=The%20most%20important%20is%20that,encrypt%20traffic%20in%20both%20directions.

Wireless Router:
https://contenthub.netacad.com/srwe-dl/13.1.4
https://www.youtube.com/watch?v=84rpfWWU22Q