

Practical – 9

Aim of the Practical :- To implement and simulate VLAN (Virtual LAN) in Packet Tracer for network segmentation and verify inter-VLAN communication using a router.

Objective:

To understand the concept of VLANs and how they help in network segmentation within a switched network.

1. To create and configure multiple VLANs on a managed switch and assign ports to specific VLANs.
2. To configure inter-VLAN communication using a router (Router-on-a-Stick configuration).
3. To verify VLAN functionality and inter-VLAN communication using network testing commands.

LAB TASK:

1. IP Address and VLAN Number Generation

| Generated VLAN and IP Address Details | | | |
|---|----------------|----------------------|-----------------|
| Two separate tables are generated for VLAN-1 and VLAN-2 with their PC configurations. | | | |
| VLAN-1 Configuration | | VLAN-2 Configuration | |
| FIELD | VALUE | FIELD | VALUE |
| Student Number | 202352304 | Student Number | 202352304 |
| VLAN-1 ID | 14 | VLAN-2 ID | 24 |
| VLAN-1 Subnet | 192.168.2.0/24 | VLAN-2 Subnet | 192.168.20.0/24 |
| Default Gateway | 192.168.2.1 | Default Gateway | 192.168.20.1 |
| PC0 IP | 192.168.2.11 | PC2 IP | 192.168.20.21 |
| PC1 IP | 192.168.2.12 | PC3 IP | 192.168.20.22 |

Image1: Screenshot showing the generated IP addresses and VLAN numbers of my number 202352304.

2. Network Topology Diagram

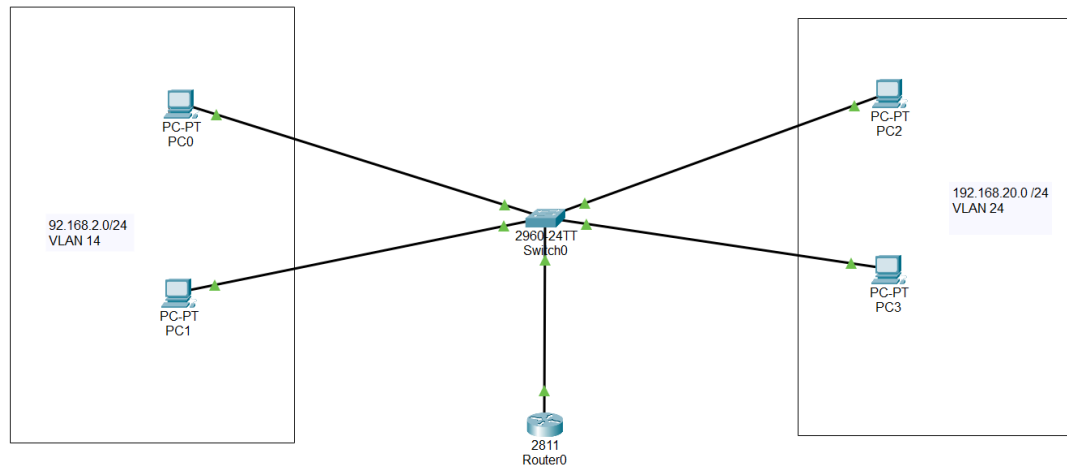


Image2: This network diagram shows two VLANs (VLAN 14 and VLAN 24) connected to a central switch, which uses a single router (Router0) to enable communication between them.

3. Configuration of All Devices

a) PC Configurations:

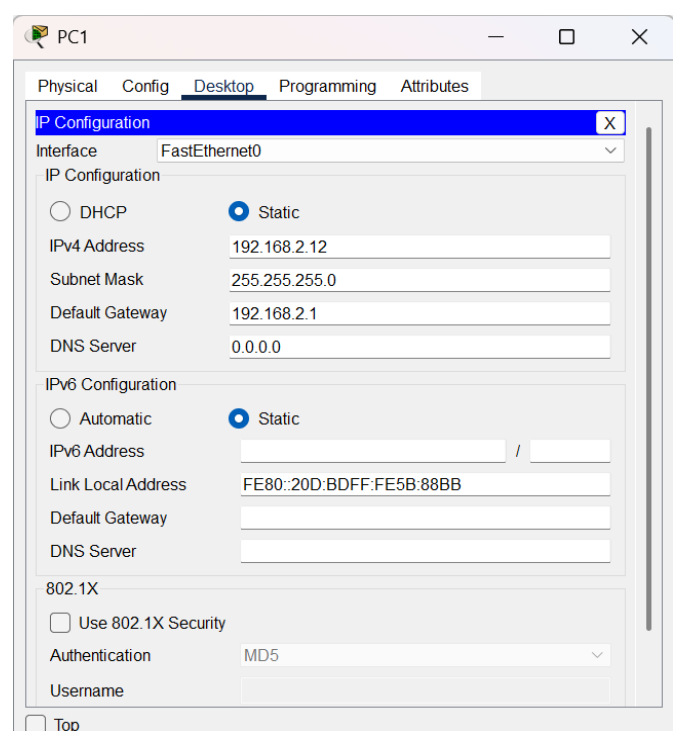
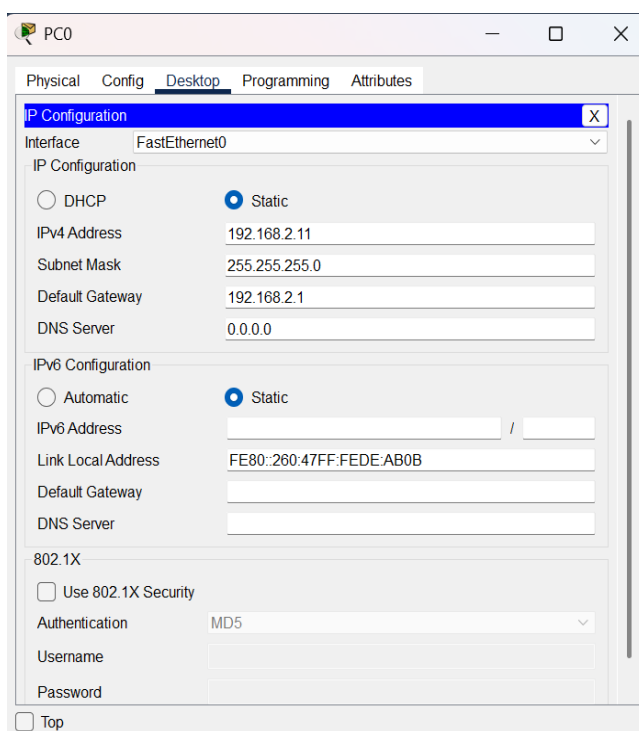


Image 3 and 4: PC0 is assigned 192.168.2.11 and PC1 is assigned 192.168.2.12, with both devices using 192.168.2.1 as their default gateway.

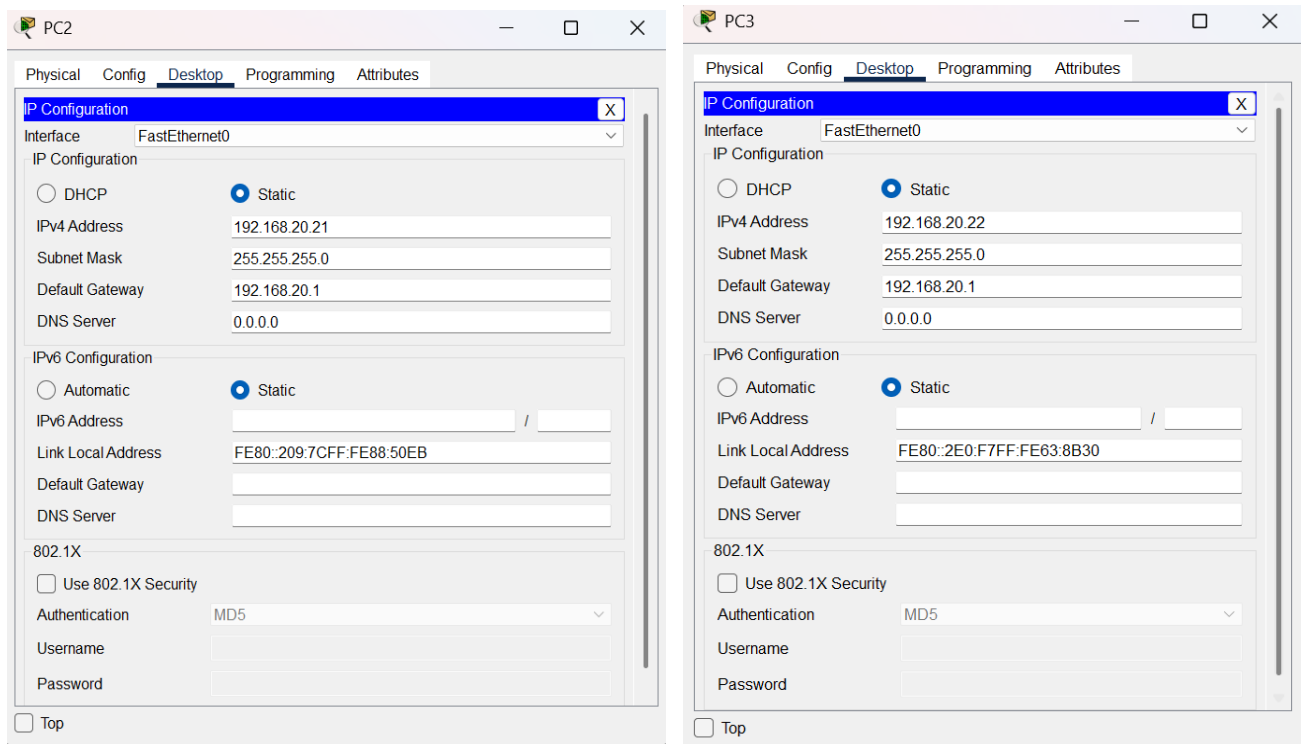


Image 5 and 6: The above images display the static IP configurations for PC2 and PC3, which belong to a different subnet. PC2 has the IP address 192.168.20.21, and PC3 has 192.168.20.22, with both using 192.168.20.1 as their default gateway.

b) Switch Configuration:

VLAN creation

```
Switch>en
Switch#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#vlan 14
Switch(config-vlan)#name lab-9a
Switch(config-vlan)#exit
Switch(config)#vlan 24
Switch(config-vlan)#name lab-9b
Switch(config-vlan)#exit
Switch(config)#exit
Switch#
```

Image 7: This image shows the switch configuration commands used to create two new VLANs. VLAN 14 is created with the name "lab-9a", and VLAN 24 is created with the name "lab-9b".

VLAN Port Assignment Image

```
Switch#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#interface fastE
Switch(config)#interface fastEthernet 0/1
Switch(config-if)#switchport mode
Switch(config-if)#switchport mode ac
Switch(config-if)#switchport mode access
Switch(config-if)#switchport ac
Switch(config-if)#switchport access vlan
Switch(config-if)#switchport access vlan 14
Switch(config-if)#exit
Switch(config)#interface fastEthernet 0/2
Switch(config-if)#switchport mode access
Switch(config-if)#switchport access vlan 14
Switch(config-if)#exit
Switch(config)#interface fastEthernet 0/3
Switch(config-if)#switchport mode access
Switch(config-if)#switchport access vlan 24
Switch(config-if)#exit
Switch(config)#interface fastEthernet 0/4
Switch(config-if)#switchport mode access
Switch(config-if)#switchport access vlan 24
Switch(config-if)#exit
Switch(config)#exit
```

Image 8: This switch configuration output shows interfaces FastEthernet 0/1 and 0/2 being assigned to VLAN 14, while interfaces FastEthernet 0/3 and 0/4 are assigned to VLAN 24.

Switch Running Configuration Image

```
Switch#show running-config
Building configuration...

Current configuration : 1284 bytes
!
version 15.0
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname Switch
!
!
!
!
!
spanning-tree mode pvst
spanning-tree extend system-id
!
interface FastEthernet0/1
 switchport access vlan 14
 switchport mode access
!
interface FastEthernet0/2
 switchport access vlan 14
 switchport mode access
!
interface FastEthernet0/3
 switchport access vlan 24
 switchport mode access
!
interface FastEthernet0/4
 switchport access vlan 24
 switchport mode access
!
interface FastEthernet0/5
!
interface FastEthernet0/6
!
interface FastEthernet0/7
!
```

Image 9: Output of the show running-config command on the switch.

c) Router Configuration:

```
Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface fastEthernet 0/0
Router(config-if)#no shut
Router(config-if)#no shutdown

Router(config-if)#
%LINK-5-CHANGED: Interface FastEthernet0/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up

Router(config-if)#interface fa0/0.14
Router(config-subif)#
%LINK-5-CHANGED: Interface FastEthernet0/0.14, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0.14, changed state to up

Router(config-subif)#encapsulation dot
Router(config-subif)#encapsulation dot1 Q 14
Router(config-subif)#ip add 192.168.2.1
% Incomplete command.
Router(config-subif)#ip add 192.168.2.1 255.255.255.0
Router(config-subif)#interface fa0/0.24
Router(config-subif)#
%LINK-5-CHANGED: Interface FastEthernet0/0.24, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0.24, changed state to up

Router(config-subif)#encapsulation dot1 Q 24
Router(config-subif)#ip add 192.168.20.1 255.255.255.0
Router(config-subif)#exit
```

Router Running Configuration

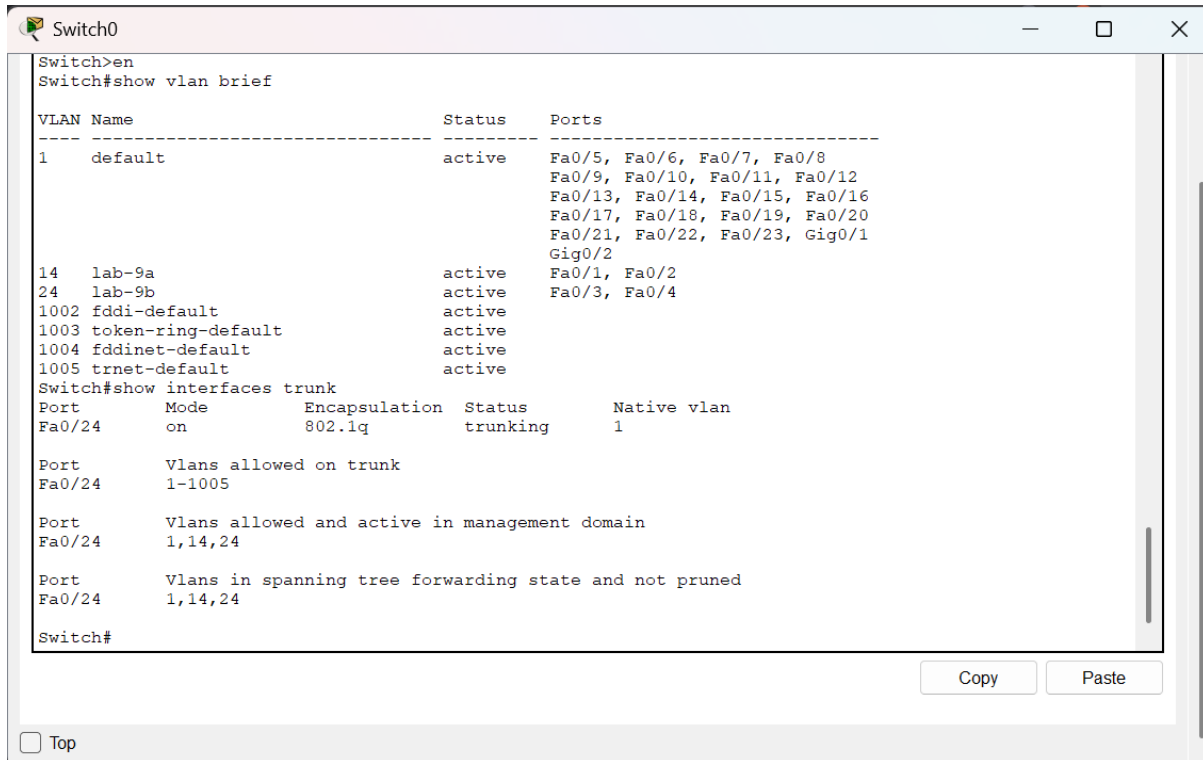
```
Router#show running-config
Building configuration...

Current configuration : 779 bytes
!
version 15.1
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname Router
!
!
!
!
!
!
!
ip cef
no ipv6 cef
!
!
!
!
license udi pid CISCO2811/K9 sn FTX1017E4V6-
!
!
!
```

```
!  
!  
!  
!  
!  
!  
spanning-tree mode pvst  
!  
!  
!  
!  
!  
interface FastEthernet0/0  
no ip address  
duplex auto  
speed auto  
!  
interface FastEthernet0/0.14  
encapsulation dot1Q 14  
ip address 192.168.2.1 255.255.255.0  
!  
interface FastEthernet0/0.24  
encapsulation dot1Q 24  
ip address 192.168.20.1 255.255.255.0  
!  
interface FastEthernet0/1  
no ip address  
duplex auto  
speed auto  
shutdown  
!  
interface Vlan1  
no ip address  
shutdown  
!  
ip classless  
!  
ip flow-export version 9  
!  
!  
!  
!  
!  
!  
line con 0  
!  
line aux 0  
!  
line vty 0 4  
login  
!  
!  
!  
end
```

Router#

4. VLAN Verification



```
Switch0
Switch>en
Switch#show vlan brief

VLAN Name                Status    Ports
-----
1    default                active    Fa0/5, Fa0/6, Fa0/7, Fa0/8
                                           Fa0/9, Fa0/10, Fa0/11, Fa0/12
                                           Fa0/13, Fa0/14, Fa0/15, Fa0/16
                                           Fa0/17, Fa0/18, Fa0/19, Fa0/20
                                           Fa0/21, Fa0/22, Fa0/23, Gig0/1
                                           Gig0/2
14   lab-9a                  active    Fa0/1, Fa0/2
24   lab-9b                  active    Fa0/3, Fa0/4
1002 fddi-default          active
1003 token-ring-default    active
1004 fddinet-default        active
1005 trnet-default          active

Switch#show interfaces trunk
Port      Mode      Encapsulation  Status      Native vlan
Fa0/24    on        802.1q         trunking    1

Port      Vlans allowed on trunk
Fa0/24    1-1005

Port      Vlans allowed and active in management domain
Fa0/24    1,14,24

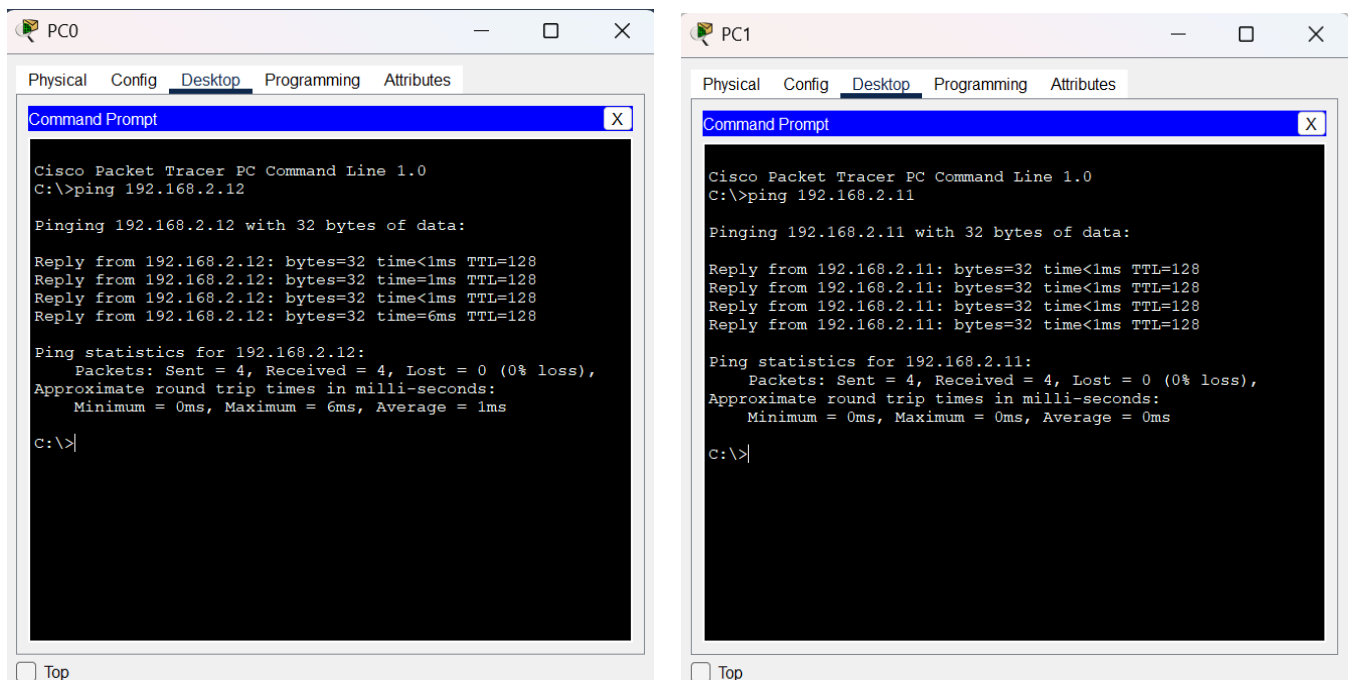
Port      Vlans in spanning tree forwarding state and not pruned
Fa0/24    1,14,24

Switch#
```

Image 10: This CLI output verifies VLAN port assignments for VLANs 14 and 24, and confirms port Fa0/24 is operating as a trunk.

5. Connectivity Testing

Ping Results: Same VLAN 14



```
PC0
Physical Config Desktop Programming Attributes
Command Prompt
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 192.168.2.12

Pinging 192.168.2.12 with 32 bytes of data:

Reply from 192.168.2.12: bytes=32 time<1ms TTL=128
Reply from 192.168.2.12: bytes=32 time<1ms TTL=128
Reply from 192.168.2.12: bytes=32 time<1ms TTL=128
Reply from 192.168.2.12: bytes=32 time=6ms TTL=128

Ping statistics for 192.168.2.12:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 6ms, Average = 1ms
C:\>

PC1
Physical Config Desktop Programming Attributes
Command Prompt
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 192.168.2.11

Pinging 192.168.2.11 with 32 bytes of data:

Reply from 192.168.2.11: bytes=32 time<1ms TTL=128
Reply from 192.168.2.11: bytes=32 time<1ms TTL=128
Reply from 192.168.2.11: bytes=32 time<1ms TTL=128
Reply from 192.168.2.11: bytes=32 time<1ms TTL=128

Ping statistics for 192.168.2.11:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms
C:\>
```

Image 11: Ping Test from PC0 to PC1 in same VLAN 14

Image 12: Ping Test from PC1 to PC0 in same VLAN 14

Same VLAN 24

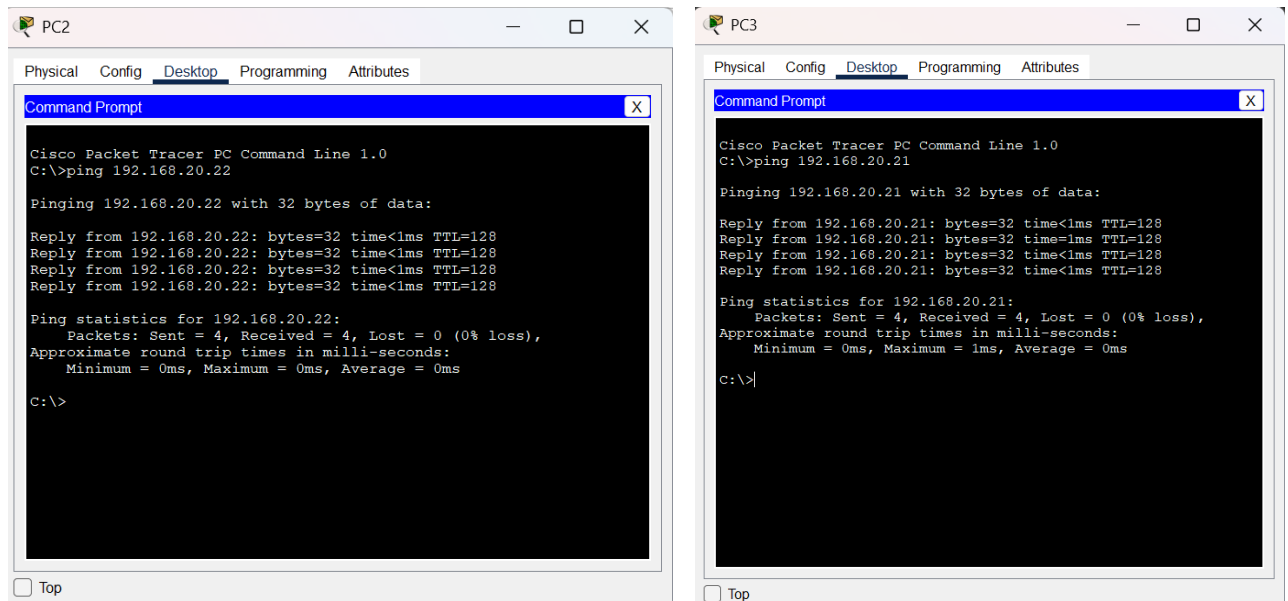


Image 13: Ping Test from PC2 to PC3 in same VLAN 24

Image 14: Ping Test from PC3 to PC2 in same VLAN 24

Inter-VLAN Routing

From VLAN 14 to VLAN 24

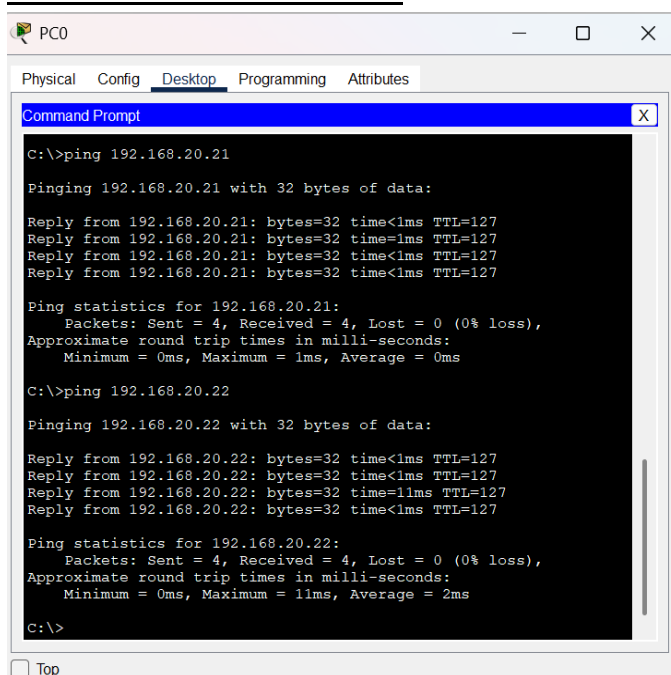


Image 15: Ping Test Result from PC0 of VLAN 14 to PC2 and PC3 of VLAN 24

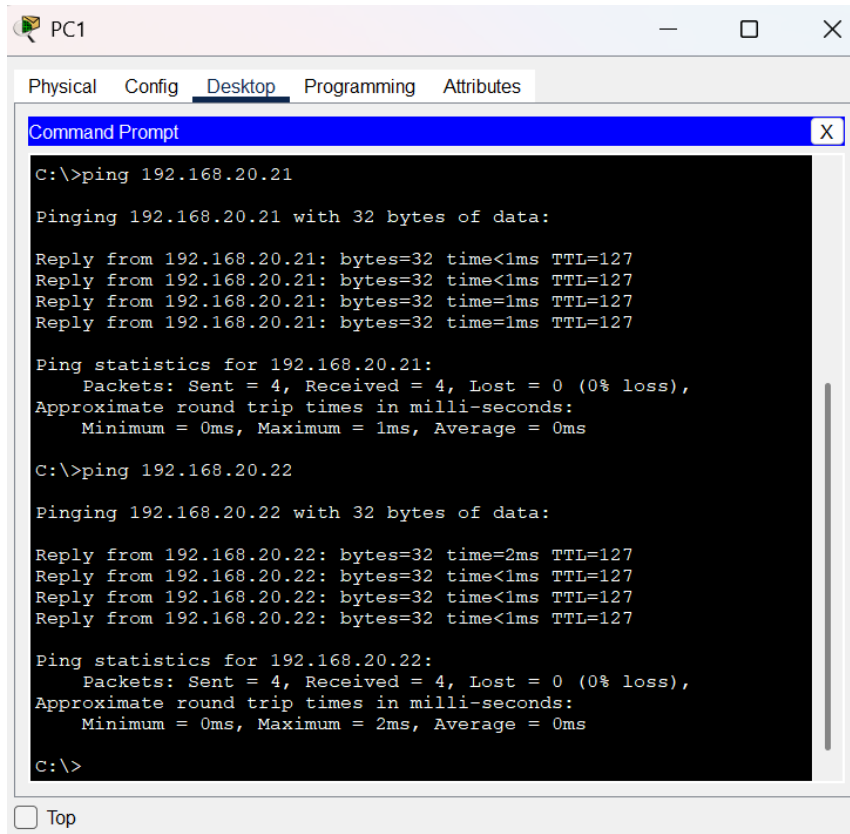


Image 16: Ping Test Result from PC1 of VLAN 14 to PC2 and PC3 of VLAN 24

From VLAN 24 to VLAN 14

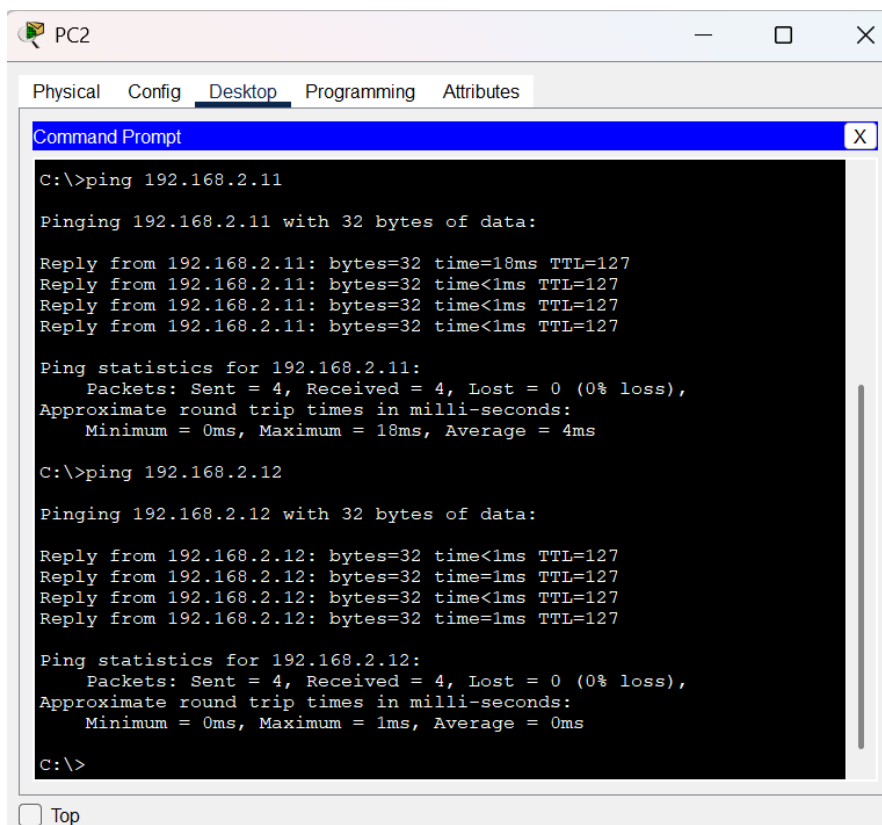


Image 17: Ping Test Result from PC2 of VLAN 24 to PC0 and PC1 of VLAN 14

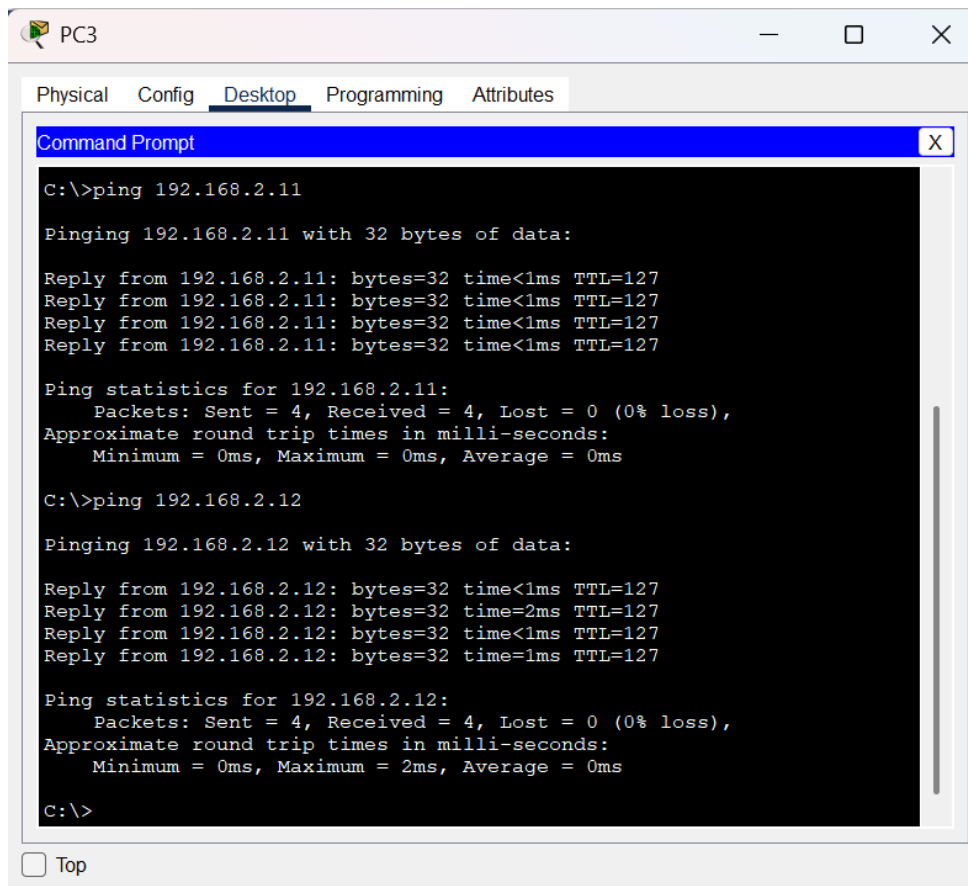


Image 18:
Ping Test
Result from
PC3 of VLAN
24 to PC0
and PC1 of
VLAN 14

Conclusion

This practical successfully implemented a "Router-on-a-Stick" configuration, achieving the lab's goal of network segmentation. VLAN 14 (lab-9a) and VLAN 24 (lab-9b) were created and ports were assigned, successfully isolating the two networks. This was confirmed by successful ping tests between PCs within the same VLAN, such as PC0 to PC1 and PC2 to PC3.

Inter-VLAN communication was enabled by configuring 802.1Q sub interfaces on the router and a corresponding trunk port on the switch. The final ping tests, which showed successful communication from VLAN 14 to VLAN 24 (e.g., PC0 to PC2), confirmed that the router was correctly routing traffic between the two isolated networks, meeting all objectives.