1 Project Overview

The VLAN (Virtual LAN) Project is designed to demonstrate the implementation and management of VLANs in a small network environment. VLANs are logical subdivisions of a physical network that allow devices to be grouped together based on function, department, or project. By segmenting the network, VLANs improve performance, enhance security, and simplify network management.

In this project, you will configure VLANs on Cisco switches, establish trunking between switches, and implement inter-VLAN routing using a router. You will also test connectivity between devices in the same VLAN and across VLANs to ensure proper network communication.

2 Objectives

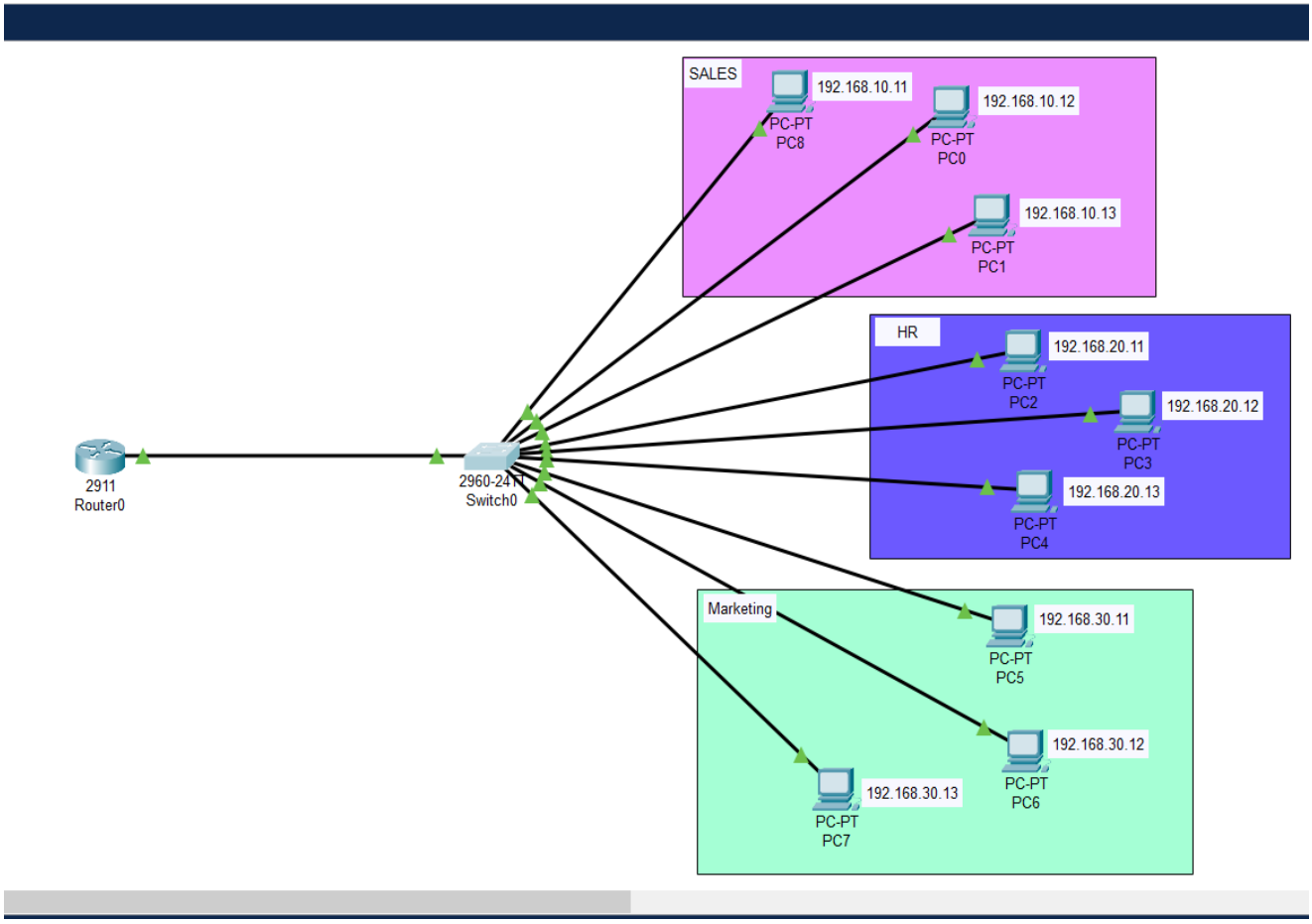
- **Create and assign VLANs:** Learn to configure VLANs on switches and assign switch ports to appropriate VLANs based on departmental requirements.
- **Configure trunking:** Set up trunk links between switches to allow VLAN information to pass across multiple switches.
- **Configure inter-VLAN routing:** Use a router or Layer 3 switch to enable communication between devices on different VLANs.
- **Test connectivity:** Validate network functionality by testing device connectivity both within the same VLAN and across VLANs using network utilities like ping.
- **Understand network segmentation benefits:** Gain insight into how VLANs help improve security, reduce broadcast domains, and manage network traffic efficiently.

3 Network Topology

This project utilizes a simple network topology consisting of:

- **Devices:**
  - 3 Cisco switches
  - 1 Router
  - 3 PCs connected to each switch
- **VLANs:**
  - **VLAN 10 – Sales Department**
  - **VLAN 20 – HR Department**
  - **VLAN 30 – Marketing Department**
- **Connections:**
  - PCs are connected to switch access ports corresponding to their department VLAN.
  - Switches are connected via trunk ports to allow VLAN traffic to flow between switches.
  - The router provides inter-VLAN routing to enable communication between VLAN 10 and VLAN 20.

- **Topology Diagram:**



4 Step by Step Configuration

4.1 Assign VLANs to switch ports:

```
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/9, changed state to up

%LINK-5-CHANGED: Interface FastEthernet0/1, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state to up

%LINK-5-CHANGED: Interface FastEthernet0/24, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/24, changed state to up


Switch>enable
Switch#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#vlan 10
Switch(config-vlan)#name SALES
Switch(config-vlan)#exit
Switch(config)#vlan 20
Switch(config-vlan)#name HR
Switch(config-vlan)#exit
Switch(config)#vlan 30
Switch(config-vlan)#name Marketing
Switch(config-vlan)#exit
Switch(config)#interface range f
Switch(config)#interface range fastEthernet 0/1-3
Switch(config-if-range)#switch
Switch(config-if-range)#switchport mode access
Switch(config-if-range)#switchport access vlan 10
Switch(config-if-range)#no shutdown
Switch(config-if-range)#exit
Switch(config)#interface range fa
Switch(config)#interface range fastEthernet 0/4-6
Switch(config-if-range)#switchport mode access
Switch(config-if-range)#switchport access vlan 20
Switch(config-if-range)#no shutdown
Switch(config-if-range)#exit
Switch(config)#interface range fastEthernet 0/7-9
Switch(config-if-range)#switchport mode access
Switch(config-if-range)#switchport access vlan 30
Switch(config-if-range)#no shutdown
Switch(config-if-range)#exit
Switch(config)#
```

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Explanation:

- `switchport mode access` sets the port to access mode, meaning it carries traffic for only one VLAN.
- `switchport access vlan X` assigns the specific VLAN to the port.
- `no shutdown` activates the port.

4.2 Configure trunking between switches:

```
Switch(config)#interfa
Switch(config)#interface f
Switch(config)#interface fastEthernet 0/24
Switch(config-if)#switchport mode trunk
Switch(config-if)#no shutdown
Switch(config-if)#
```

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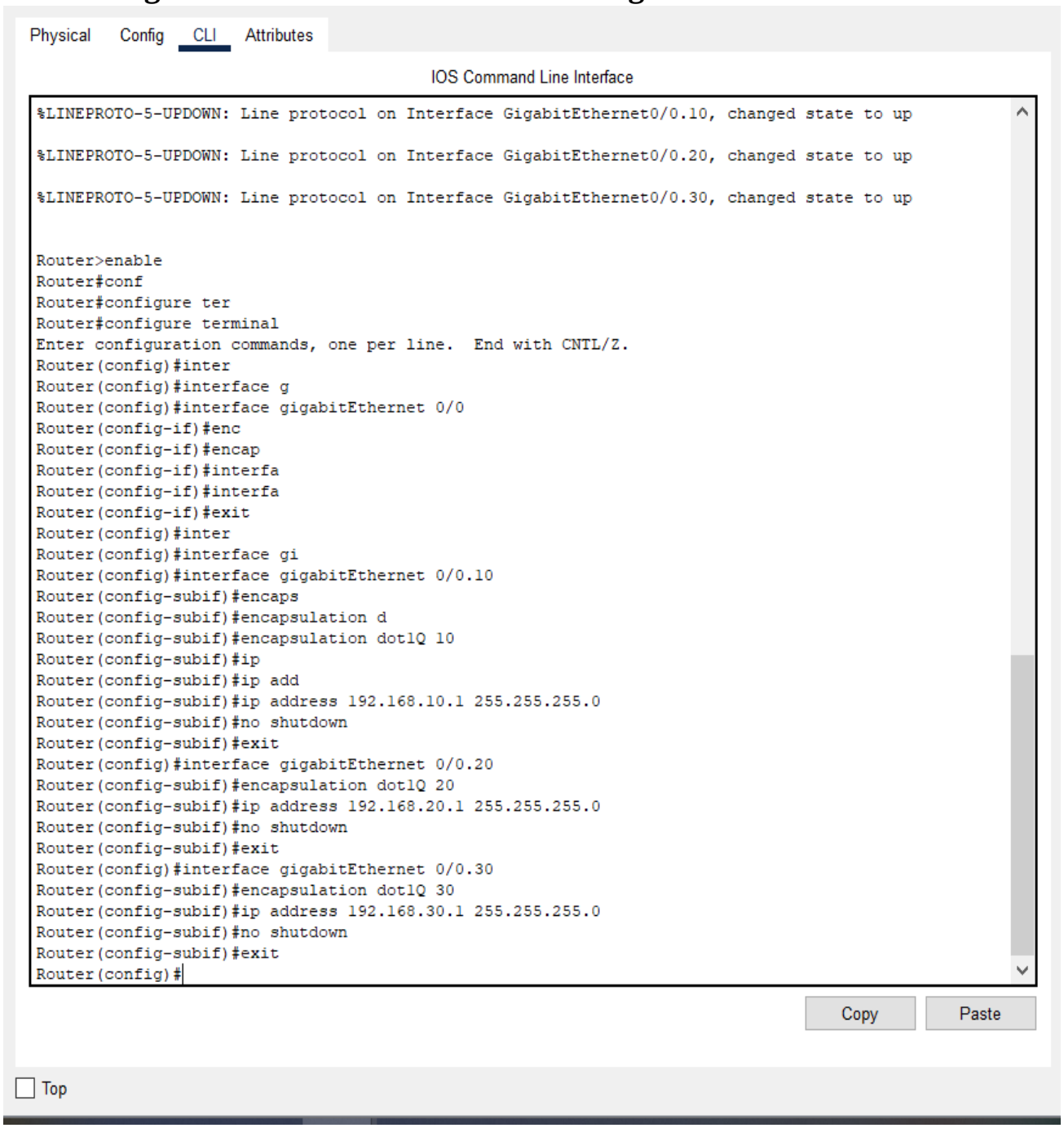
Explanation:

- `switchport mode trunk` configures the port to carry traffic from all VLANs.
- This allows VLAN tagging using the 802.1Q standard, which identifies which VLAN each frame belongs to.

4.3 Configure router for inter-VLAN routing:

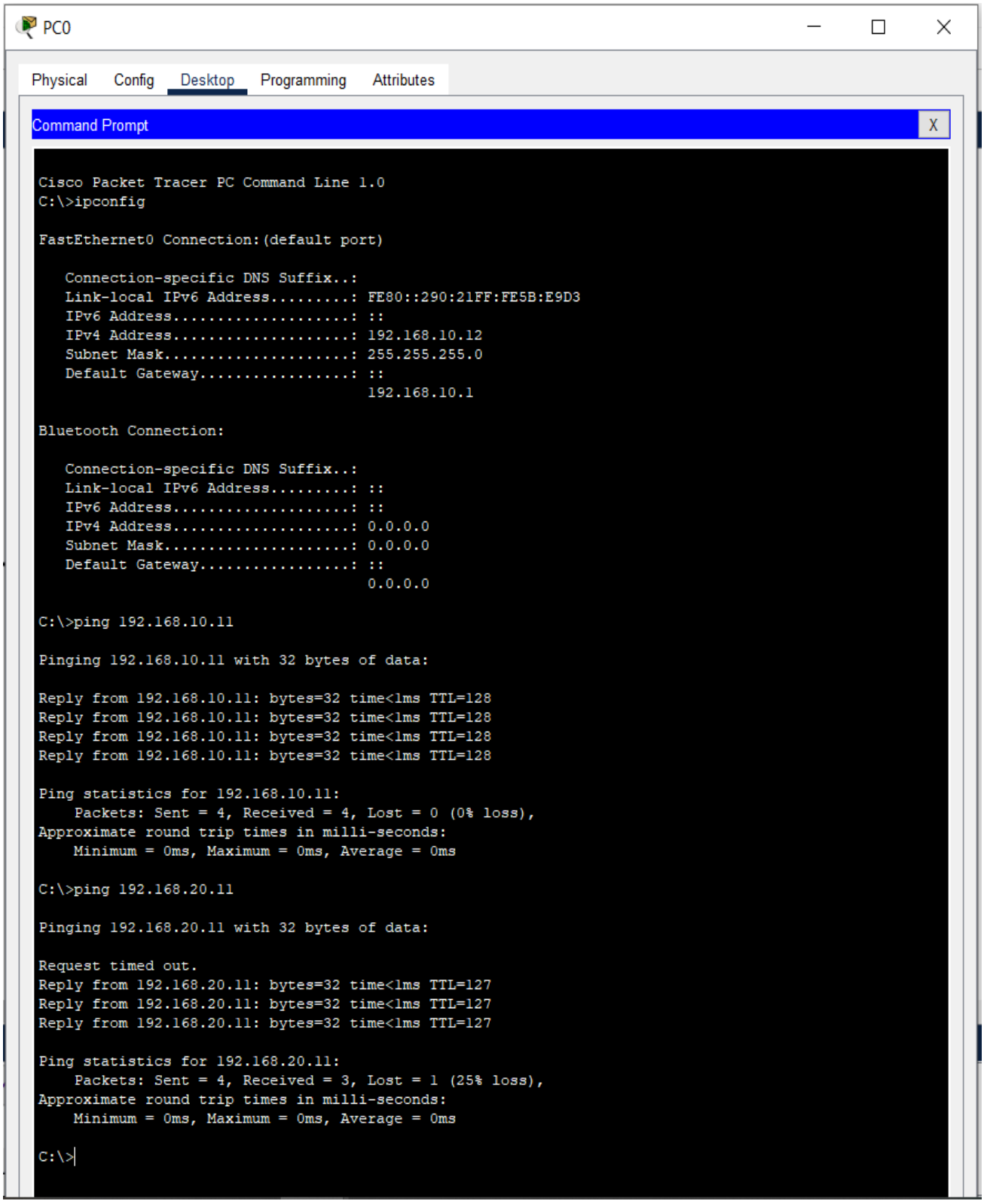


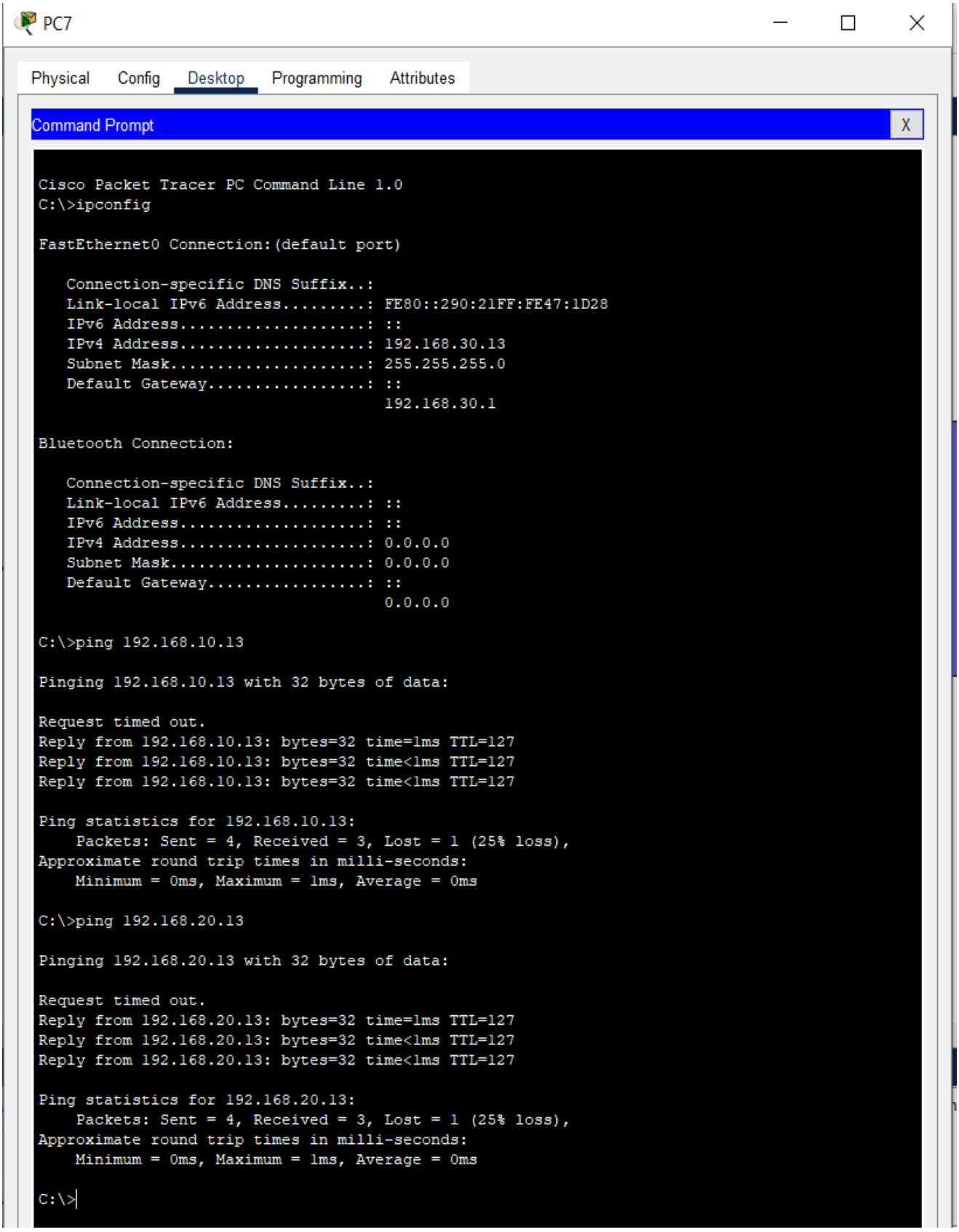
Explanation:

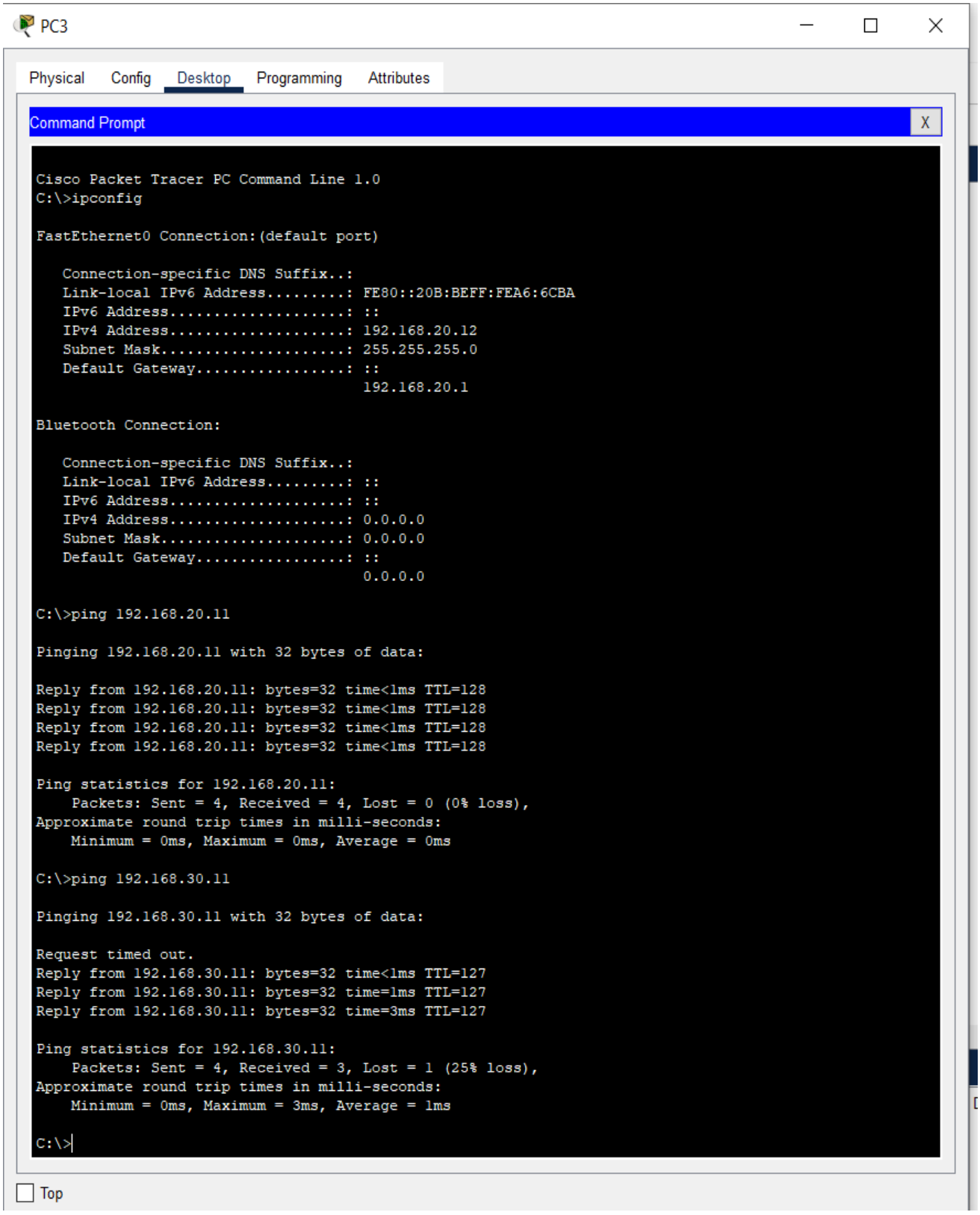
- `encapsulation dot1Q X` tells the router which VLAN the sub-interface belongs to.
- Each VLAN has a unique IP subnet.
- Devices use the router IP as their default gateway to communicate with other VLANs.

5 Testing

5.1 Used `ping` command from PCs to check connectivity within the same VLAN and between VLANs.




PC7
Physical
Config
Desktop
Programming
Attributes
Command Prompt
X
Cisco Packet Tracer PC Command Line 1.0
C:\>ipconfig
FastEthernet0 Connection:(default port)
Connection-specific DNS Suffix..:
Link-local IPv6 Address.....: FE80::290:21FF:FE47:1D28
IPv6 Address.....: ::
IPv4 Address.....: 192.168.30.13
Subnet Mask.....: 255.255.255.0
Default Gateway.....: ::
192.168.30.1
Bluetooth Connection:
Connection-specific DNS Suffix..:
Link-local IPv6 Address.....: ::
IPv6 Address.....: ::
IPv4 Address.....: 0.0.0.0
Subnet Mask.....: 0.0.0.0
Default Gateway.....: ::
0.0.0.0
C:\>ping 192.168.10.13
Pinging 192.168.10.13 with 32 bytes of data:
Request timed out.
Reply from 192.168.10.13: bytes=32 time=1ms TTL=127
Reply from 192.168.10.13: bytes=32 time<1ms TTL=127
Reply from 192.168.10.13: bytes=32 time<1ms TTL=127
Ping statistics for 192.168.10.13:
Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum = 1ms, Average = 0ms
C:\>ping 192.168.20.13
Pinging 192.168.20.13 with 32 bytes of data:
Request timed out.
Reply from 192.168.20.13: bytes=32 time=1ms TTL=127
Reply from 192.168.20.13: bytes=32 time<1ms TTL=127
Reply from 192.168.20.13: bytes=32 time<1ms TTL=127
Ping statistics for 192.168.20.13:
Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum = 1ms, Average = 0ms
C:\>



Explanation:

- **Ping within the same VLAN**: Ensure devices on the same VLAN can communicate.
- **Ping across VLANs**: Ensure devices in different VLANs can communicate via the router.

5.2 Verified VLAN assignments using "`show vlan brief`"

```
Switch>
Switch>
Switch>
Switch>
Switch>show vlan brief

VLAN Name                              Status    Ports
---- --------------------------------- --------- -------------------------------
1    default                           active    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
10   SALES                             active    Fa0/1, Fa0/2, Fa0/3
20   HR                                active    Fa0/4, Fa0/5, Fa0/6
30   Marketing                         active    Fa0/7, Fa0/8, Fa0/9
1002 fddi-default                      active
1003 token-ring-default                active
1004 fddinet-default                   active
1005 trnet-default                     active
Switch>
```

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Explanation:

- **Verify VLAN assignments:** Use `show vlan brief` on switches to check port assignments.

6 Conclusion

This VLAN Project demonstrates the fundamental concepts of network segmentation, VLAN configuration, trunking, and inter-VLAN routing. By completing this project, learners gain practical experience in organizing network devices, managing traffic efficiently, and implementing security measures in a LAN environment. Proper VLAN implementation enhances network performance, reduces broadcast traffic, and creates a structured and secure network.