PROJECT 1:

FINAL LAB REPORT — Interconnecting Two Sites Using VLANs, Routers, and Static Routing

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Project Title: Interconnecting HQ and Branch Offices Using VLANs and Static Routing
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Date: November 03, 2025

1. Introduction

This project demonstrates the configuration of a small enterprise network interconnecting two offices — Headquarters (HQ) and Branch — using Cisco routers and switches in Packet Tracer. The design implements VLAN segmentation, Router-on-a-Stick Inter-VLAN routing, secure SSH remote management, and static routing between sites over a WAN link.

2. Network Topology Overview

Devices Used:
- 2 × Cisco 1941 Routers (HQ & Branch)
- 4 × Cisco 2960-24TT Switches (2 per site)
- 6 × PCs (3 in HQ, 3 in Branch)

Topology Summary:
- HQ and Branch connected via Serial WAN link (10.10.10.193 /30)
- VLANs created for Management, Sales/Departments, and Marketing
- Trunking configured between switches and routers
- SSH configured for secure access to all devices

3. IP Addressing & VLAN Schema

Location	VLAN Name	VLAN ID	Subnet Address	1st Usable	Last Usable	Gateway
HQ	MGMT	100	10.10.10.0	10.10.10.1	10.10.10.30	10.10.10.1
HQ	Sales	2	10.10.10.32	10.10.10.33	10.10.10.62	10.10.10.33
HQ	Marketing	3	10.10.10.64	10.10.10.65	10.10.10.94	10.10.10.65
Branch	MGMT	100	10.10.10.160	10.10.10.161	10.10.10.190	10.10.10.161
Branch	Dept1	5	10.10.10.96	10.10.10.97	10.10.10.126	10.10.10.97
Branch	Dept2	6	10.10.10.128	10.10.10.129	10.10.10.158	10.10.10.129
WAN	Inter-Router	-	10.10.10.192	10.10.10.193	10.10.10.194	-

4. Device Security Configuration

Device	Hostname	Console Pass	Enable Pass	SSH User / Pass	SVI IP	Default GW
SW1_HQ	SW1-HQ-Odulaja	Ajoke1311@	Ajoke1311@	Ayobami / Ajoke1311@	10.10.10.2	10.10.10.1
SW2_HQ	SW2-HQ-Odulaja	Ajoke1311@	Ajoke1311@	Ayobami / Ajoke1311@	10.10.10.3	10.10.10.1
Router_HQ	HQ-Router-Odulaja	Ajoke1311@	Ajoke1311@	Ayobami / Ajoke1311@	-	-
SW1_Branch	SW1-Branch-Odulaja	Ajoke1311@	Ajoke1311@	Ayobami / Ajoke1311@	10.10.10.162	10.10.10.161
SW2_Branch	SW2-Branch-Odulaja	Ajoke1311@	Ajoke1311@	Ayobami / Ajoke1311@	10.10.10.163	10.10.10.161
Router_Branch	Branch-Router-Odulaja	Ajoke1311@	Ajoke1311@	Ayobami / Ajoke1311@	-	-

5. Key Configurations

Sample configurations for both routers:

HQ Router Configuration:

```
interface g0/0.2
 encapsulation dot1Q 2
 ip address 10.10.10.33 255.255.255.224
!
interface g0/0.3
 encapsulation dot1Q 3
 ip address 10.10.10.65 255.255.255.224
!
interface g0/0.100
 encapsulation dot1Q 100
 ip address 10.10.10.1 255.255.255.224
!
interface s1/0
 ip address 10.10.10.193 255.255.255.252
 no shutdown
!
ip route 10.10.10.96 255.255.255.224 10.10.10.194
ip route 10.10.10.128 255.255.255.224 10.10.10.194
ip route 10.10.10.160 255.255.255.224 10.10.10.194
```

Branch Router Configuration:

```
interface g0/0.5
 encapsulation dot1Q 5
 ip address 10.10.10.97 255.255.255.224
!
interface g0/0.6
 encapsulation dot1Q 6
 ip address 10.10.10.129 255.255.255.224
!
interface g0/0.100
 encapsulation dot1Q 100
```

```
 ip address 10.10.10.161 255.255.255.224
!
interface s1/0
 ip address 10.10.10.194 255.255.255.252
 no shutdown
!
ip route 10.10.10.0 255.255.255.224 10.10.10.193
ip route 10.10.10.32 255.255.255.224 10.10.10.193
ip route 10.10.10.64 255.255.255.224 10.10.10.193
```

6. Verification Results

All ping tests between HQ and Branch PCs were successful, confirming full end-to-end communication.
Trunk ports were verified using 'show interfaces trunk', and routing tables confirmed with 'show ip route'.
SSH and console access tested with configured credentials.

7. Conclusion

The network design meets all requirements: VLAN segmentation, inter-VLAN routing, static routing, and secure management. All devices were configured successfully and verified through connectivity tests.

PROJECT SOLUTION.

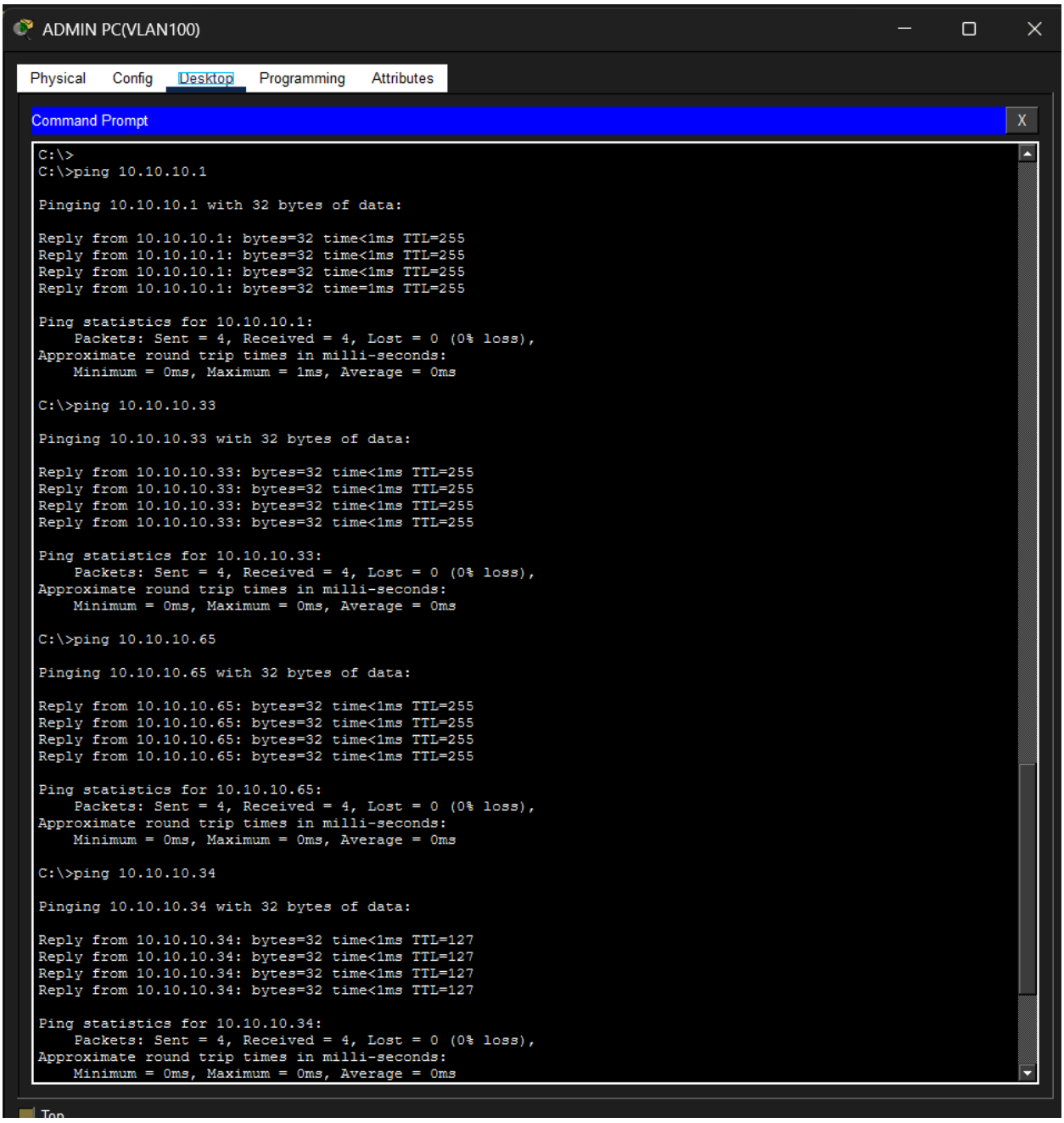
Step 1: Verify Intra-HQ Connectivity,

From Admin PC:

ping 10.10.10.1 ← its gateway

ping 10.10.10.33 ← Sales gateway

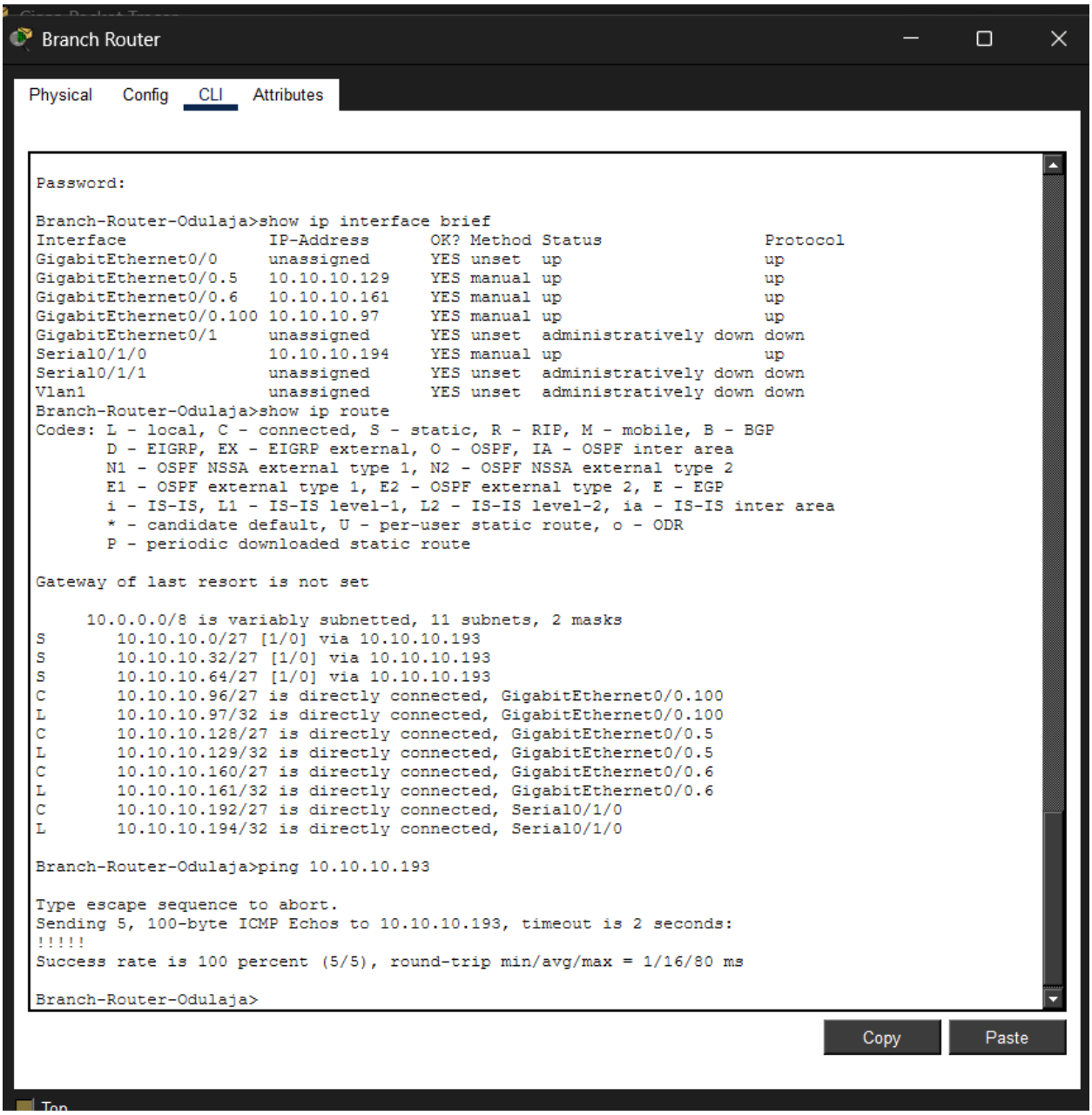
ping 10.10.10.65 ← Marketing gateway


ADMIN PC(VLAN100)
Physical
Config
Desktop
Programming
Attributes
Command Prompt
X
C:\>
C:\>ping 10.10.10.1
Pinging 10.10.10.1 with 32 bytes of data:
Reply from 10.10.10.1: bytes=32 time<1ms TTL=255
Reply from 10.10.10.1: bytes=32 time<1ms TTL=255
Reply from 10.10.10.1: bytes=32 time<1ms TTL=255
Reply from 10.10.10.1: bytes=32 time=1ms TTL=255
Ping statistics for 10.10.10.1:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum = 1ms, Average = 0ms
C:\>ping 10.10.10.33
Pinging 10.10.10.33 with 32 bytes of data:
Reply from 10.10.10.33: bytes=32 time<1ms TTL=255
Reply from 10.10.10.33: bytes=32 time<1ms TTL=255
Reply from 10.10.10.33: bytes=32 time<1ms TTL=255
Reply from 10.10.10.33: bytes=32 time<1ms TTL=255
Ping statistics for 10.10.10.33:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum = 0ms, Average = 0ms
C:\>ping 10.10.10.65
Pinging 10.10.10.65 with 32 bytes of data:
Reply from 10.10.10.65: bytes=32 time<1ms TTL=255
Reply from 10.10.10.65: bytes=32 time<1ms TTL=255
Reply from 10.10.10.65: bytes=32 time<1ms TTL=255
Reply from 10.10.10.65: bytes=32 time<1ms TTL=255
Ping statistics for 10.10.10.65:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum = 0ms, Average = 0ms
C:\>ping 10.10.10.34
Pinging 10.10.10.34 with 32 bytes of data:
Reply from 10.10.10.34: bytes=32 time<1ms TTL=127
Reply from 10.10.10.34: bytes=32 time<1ms TTL=127
Reply from 10.10.10.34: bytes=32 time<1ms TTL=127
Reply from 10.10.10.34: bytes=32 time<1ms TTL=127
Ping statistics for 10.10.10.34:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum = 0ms, Average = 0ms
Top

Step 2: Verify HQ ↔ Branch WAN Link

On HQ Router

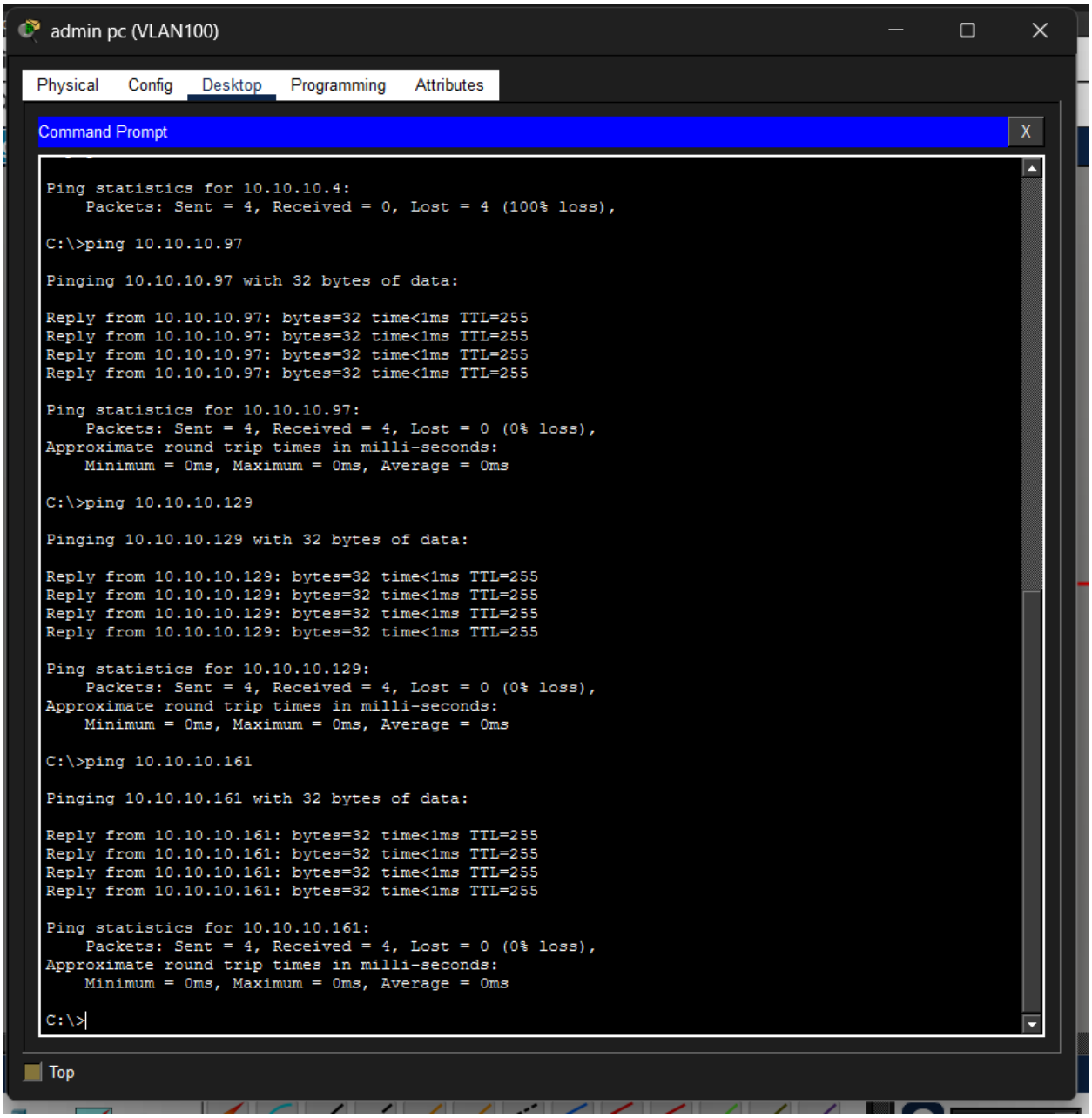
On Branch Router:



Step 3: Verify Inter-Branch VLANs:

VLAN	Description	Subinterface	Gateway	Example PC
5	Dept 1	G0/0.5	10.10.10.97	10.10.10.98
6	Dept 2	G0/0.6	10.10.10.129	10.10.10.130
100	Admin	G0/0.100	10.10.10.161	10.10.10.162

From Branch Admin PC



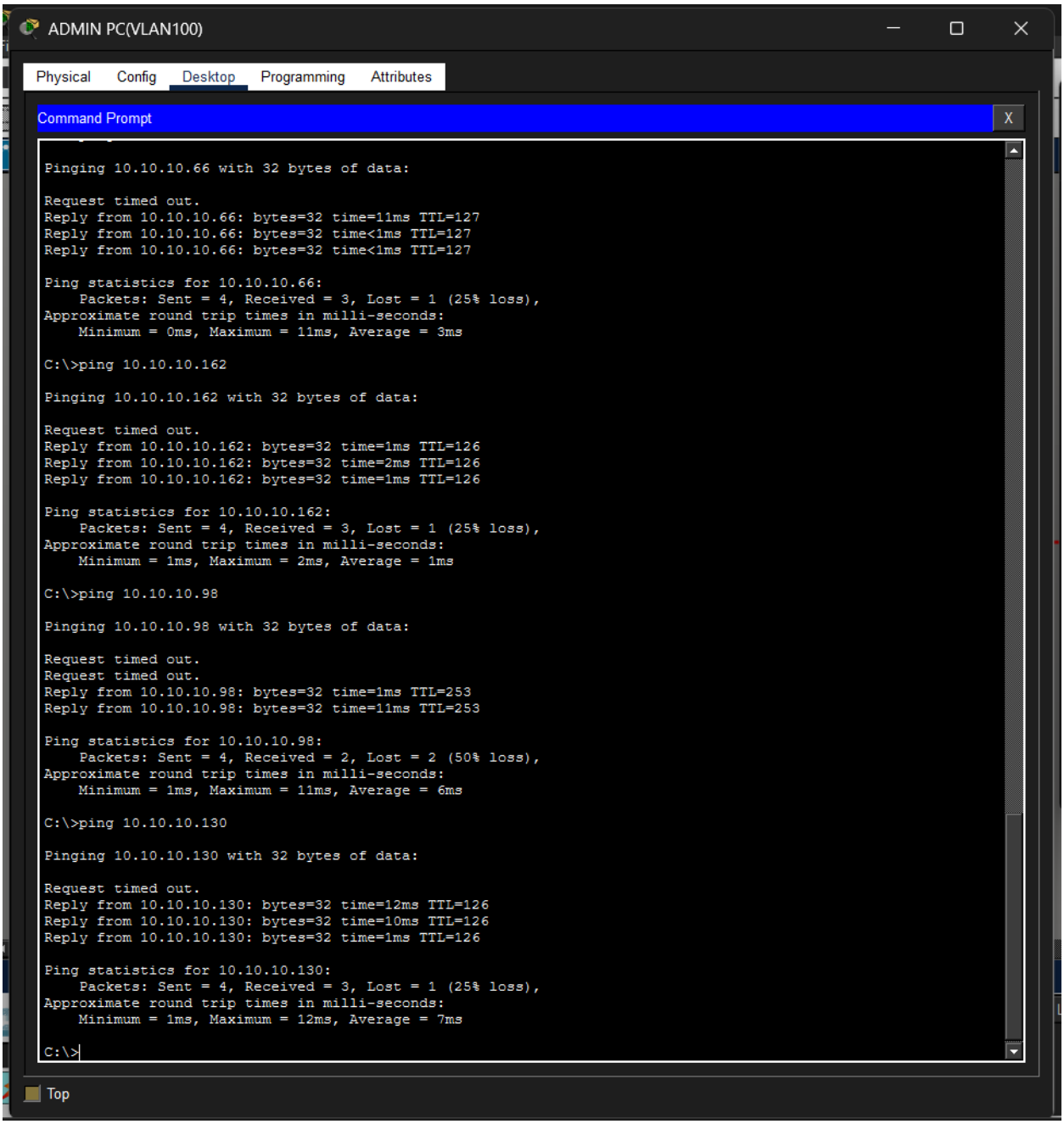
Step 4: Verify HQ ↔ Branch Inter-VLAN Routing:

ping 10.10.10.162 ← Branch Admin PC

ping 10.10.10.98 ← Branch Dept 1 PC

ping 10.10.10.130 ← Branch Dept 2 PC

From HQ Admin PC:



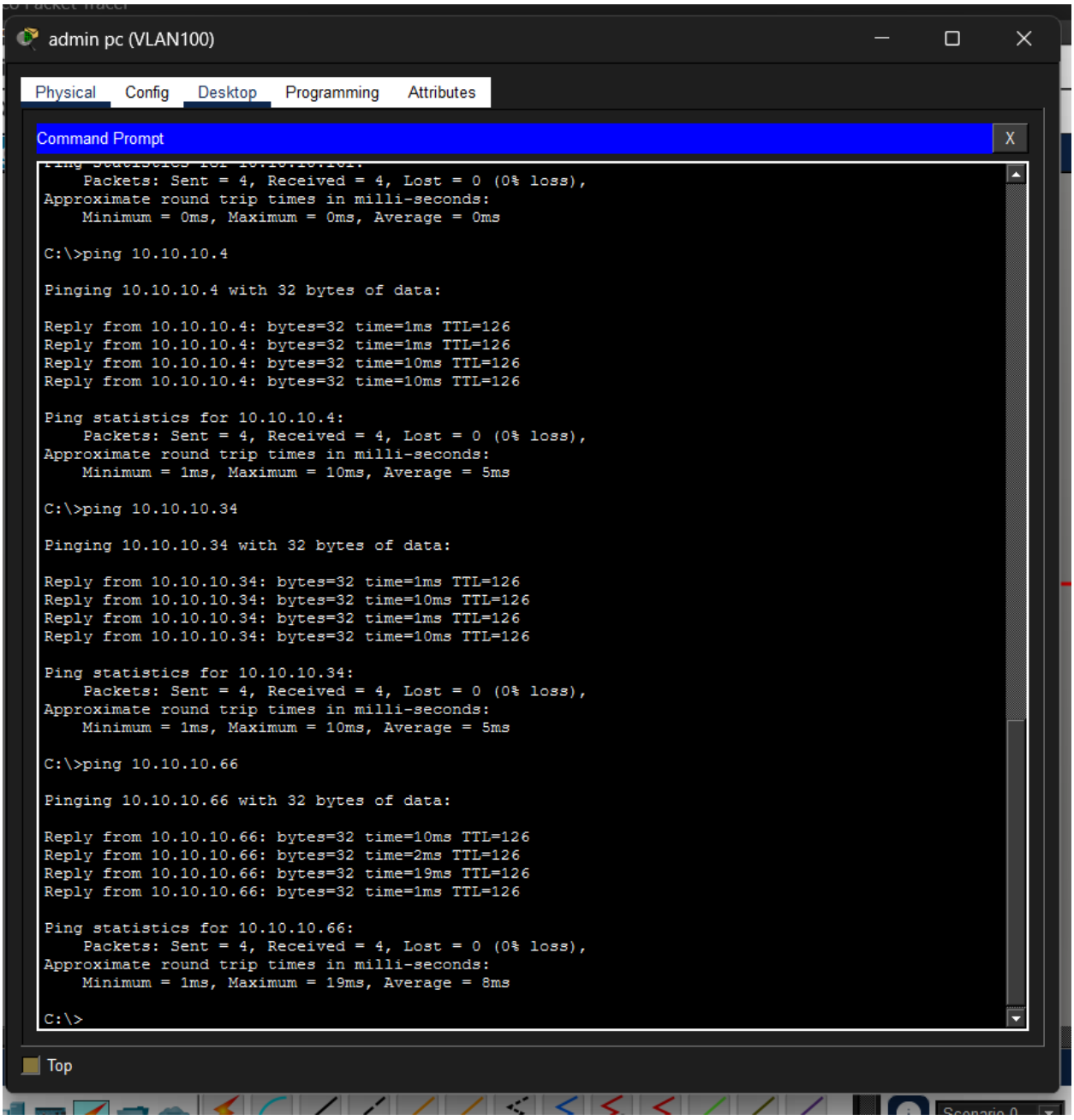
From Branch Admin PC:

ping 10.10.10.4 ← HQ Admin PC

ping 10.10.10.34 ← HQ Sales PC

ping 10.10.10.66 ← HQ Marketing PC

From Branch Admin PC:



Part 2 — Theory / Design & Configuration Answers

1) **What network address was assigned?**

Answer:

10.10.10.0/24 (Base Network)

2) **How many bits were borrowed from the host portion to create 7 subnets?**

Answer:

You need at least **3 bits** (since $2^3 = 8 \geq 7$).

3) **What is the prefix length and subnet mask for these subnets?**

Answer:

Prefix length: /27

Subnet mask: 255.255.255.224

Each subnet contains **32 IP addresses** (30 usable hosts).

4) **How many usable addresses are in each subnet?**

Answer:

30 usable addresses per subnet (2 addresses are reserved for network + broadcast).

Pka @ 100%