VxLEARN Networks

Networking & Cybersecurity Track
Simulated Employment Program

Lab Report:
Observe Traffic Flow in a Routed Network

Prepared by:
Kudzaishe Majeza
Junior Network Engineer – VxLEARN Networks

Mentor:
Titus Majeza
Senior Network Engineer

Date: 11 November 2025

Table of Contents

1. Introduction

This report demonstrates how network segmentation and routing improve efficiency in a growing business environment.

Using Cisco Packet Tracer, we observed how broadcast traffic behaves in a single flat network, then reconfigured the network into separate routed subnets, and compared the traffic patterns before and after routing.

2. Background and Scenario

XYZ LLC is expanding rapidly and is currently using a single flat network for all departments. With approximately 150 connected devices, this design has led to performance issues due to excessive broadcast traffic.

To address this, a routed network design will be implemented. Routing separates departments into independent subnetworks, improving traffic handling, segmentation, and scalability.

3. Objectives

- Observe communication in a single broadcast domain.
- Reconfigure the network to support multiple routed networks.
- Compare network behavior before and after routing is applied.

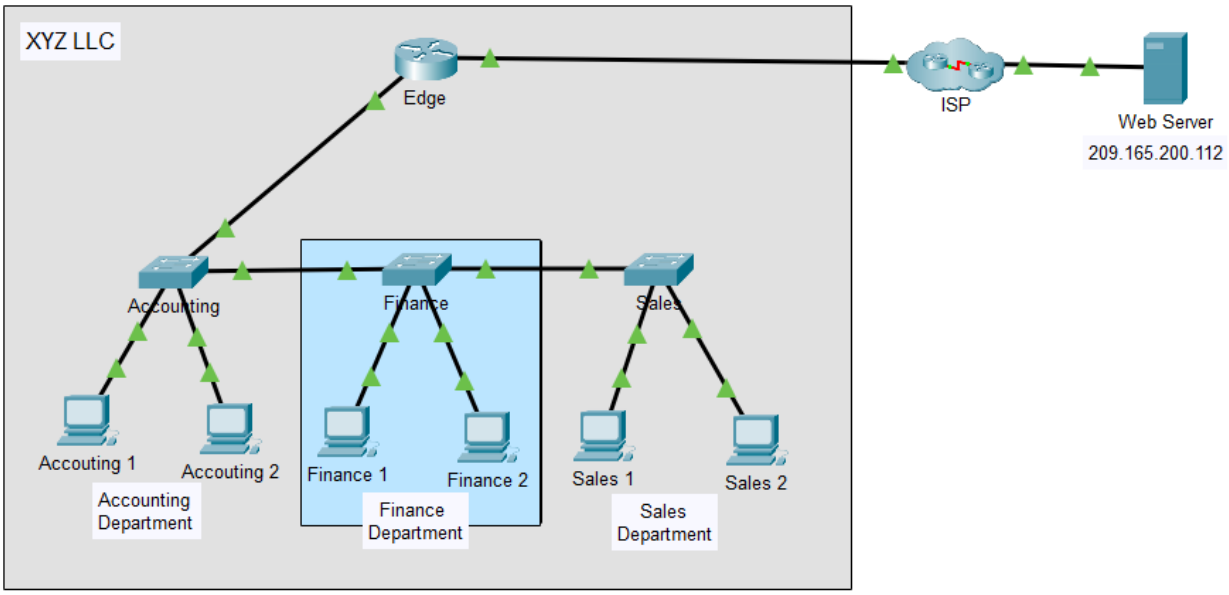
4. Network Topology Overview

Initially:

- All hosts are in one LAN.
- The router only provides connectivity to the ISP.

After reconfiguration:

- The router separates Accounting, Finance, and Sales into distinct IP networks.
- Hosts receive new IP addresses via DHCP from the router.

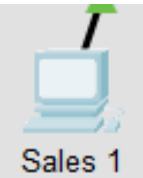


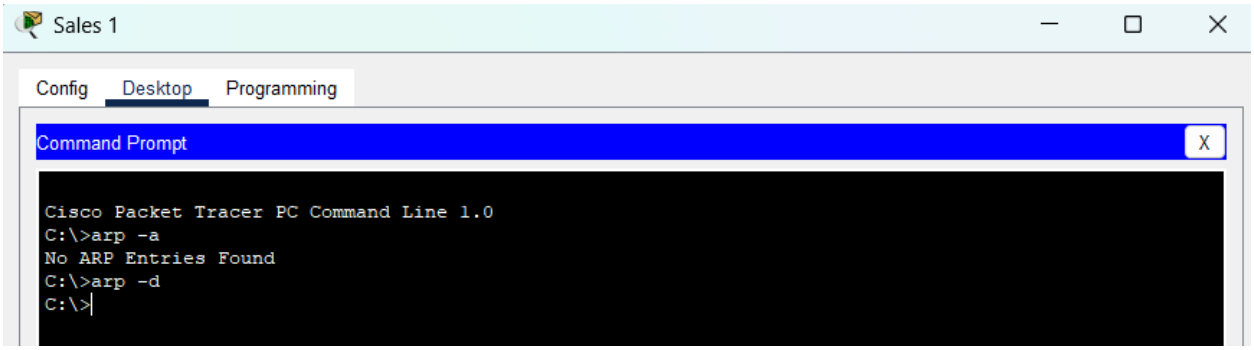
5. Part 1 – Observe Traffic Flow in an Unrouted LAN

Step 1 – Clear ARP Cache (Sales 1)

`arp -a`

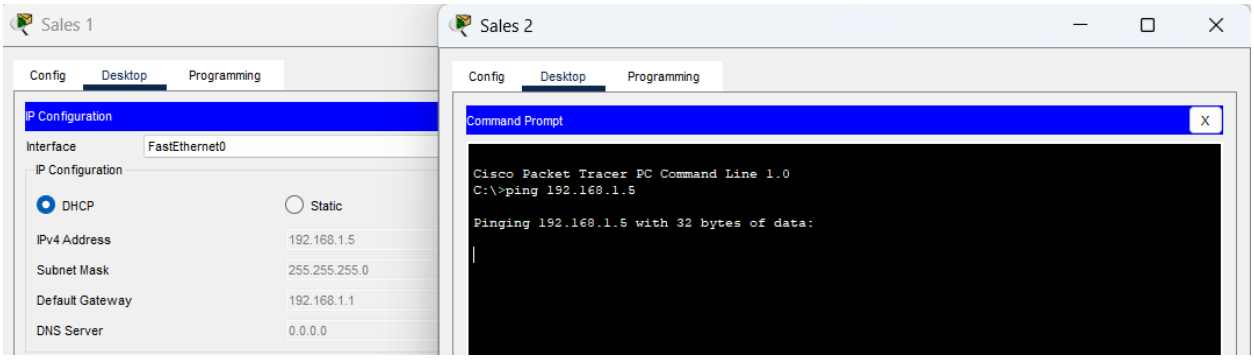
`arp -d`



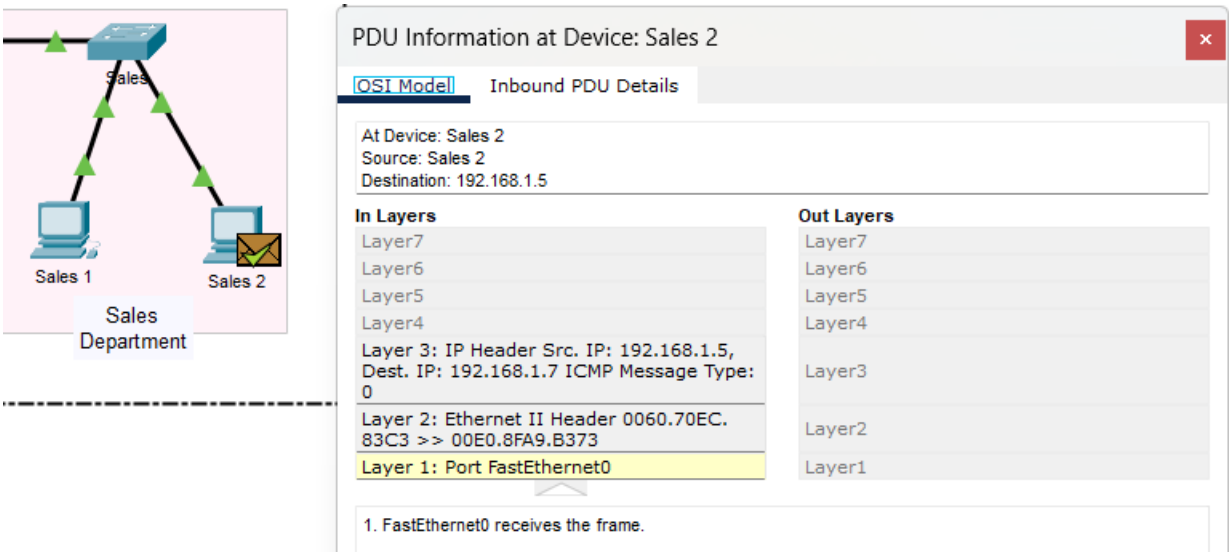


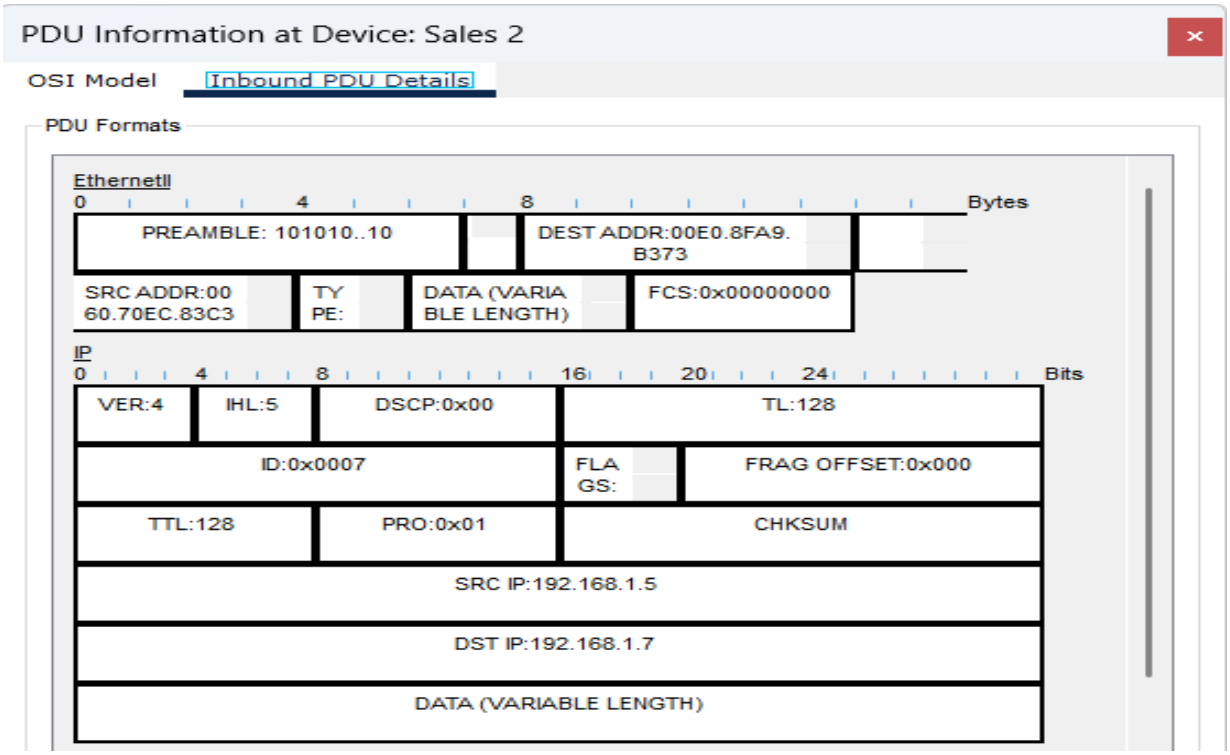
Step 2: Observe Traffic Flow in Simulation Mode

- Sales 2 pings Sales 1.



- The first packet generates an ARP Broadcast.



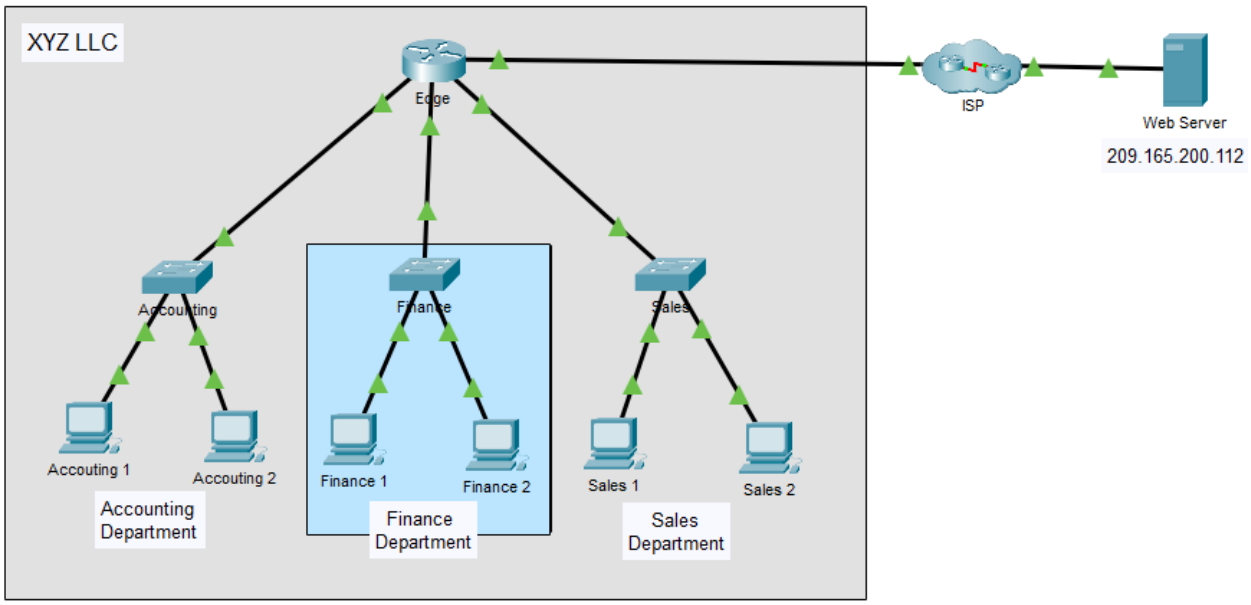


ARP broadcast

6. Part 2: Reconfiguring the Network for Routed Communication

Step 1 – Re-cable Each Switch Directly to the Router

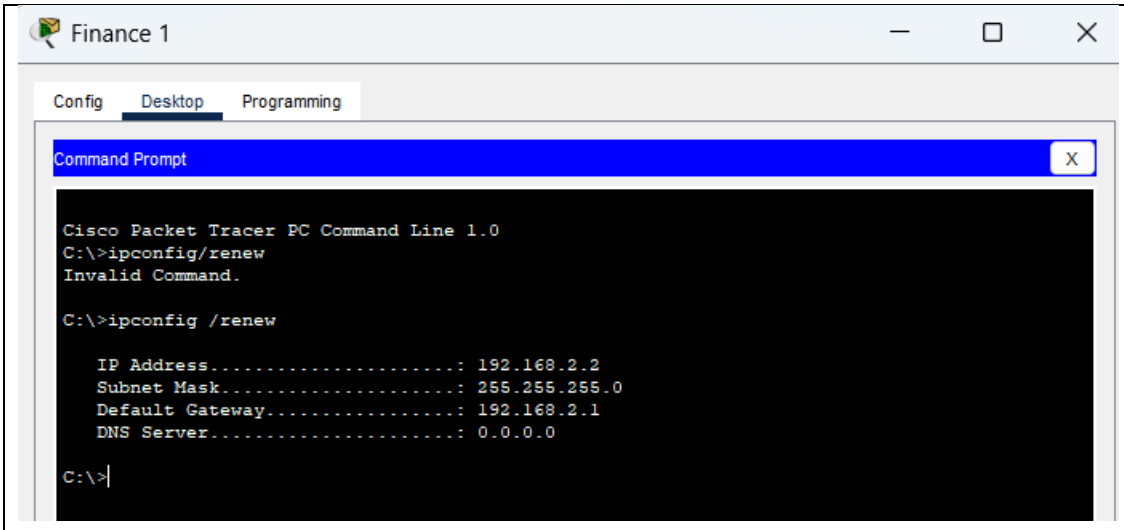
Sales, Finance, Accounting → connect individually to Edge Router GigabitEthernet interfaces.

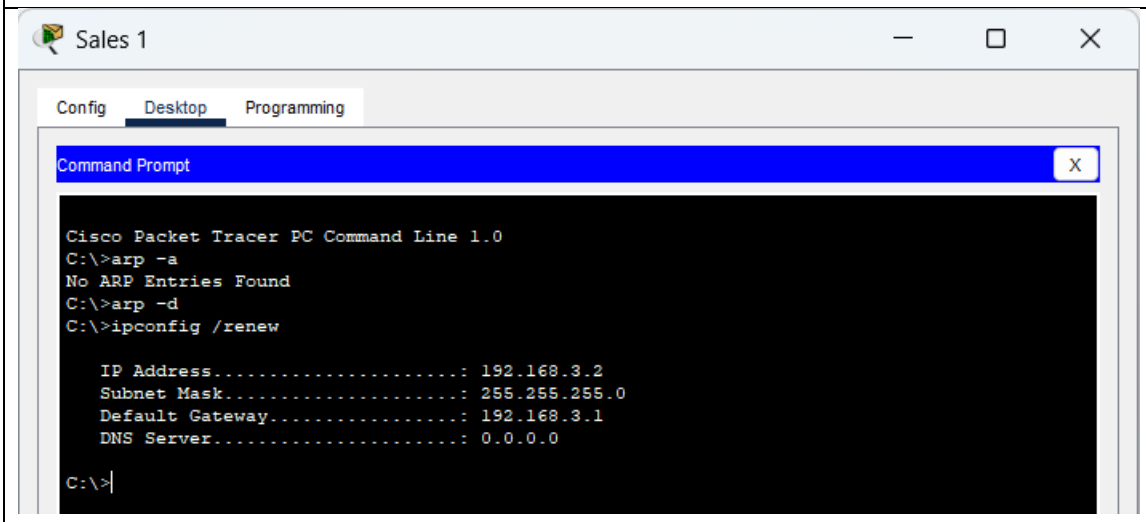


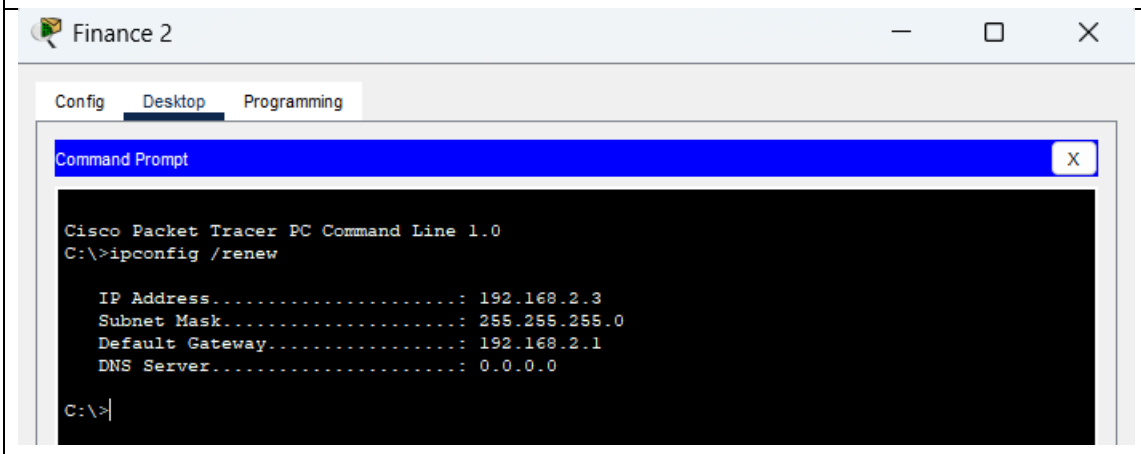
Updated Topology

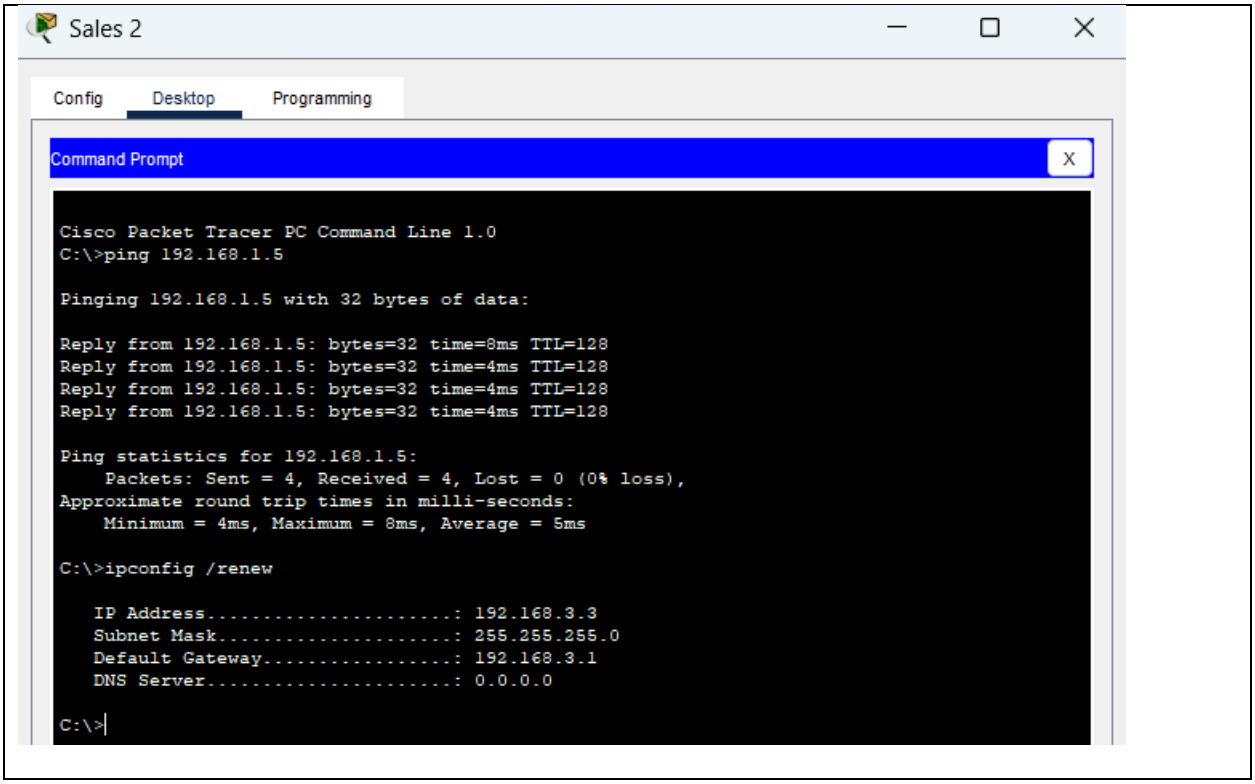
Step 2 – Force Clients to Renew IP Addresses

ipconfig /renew









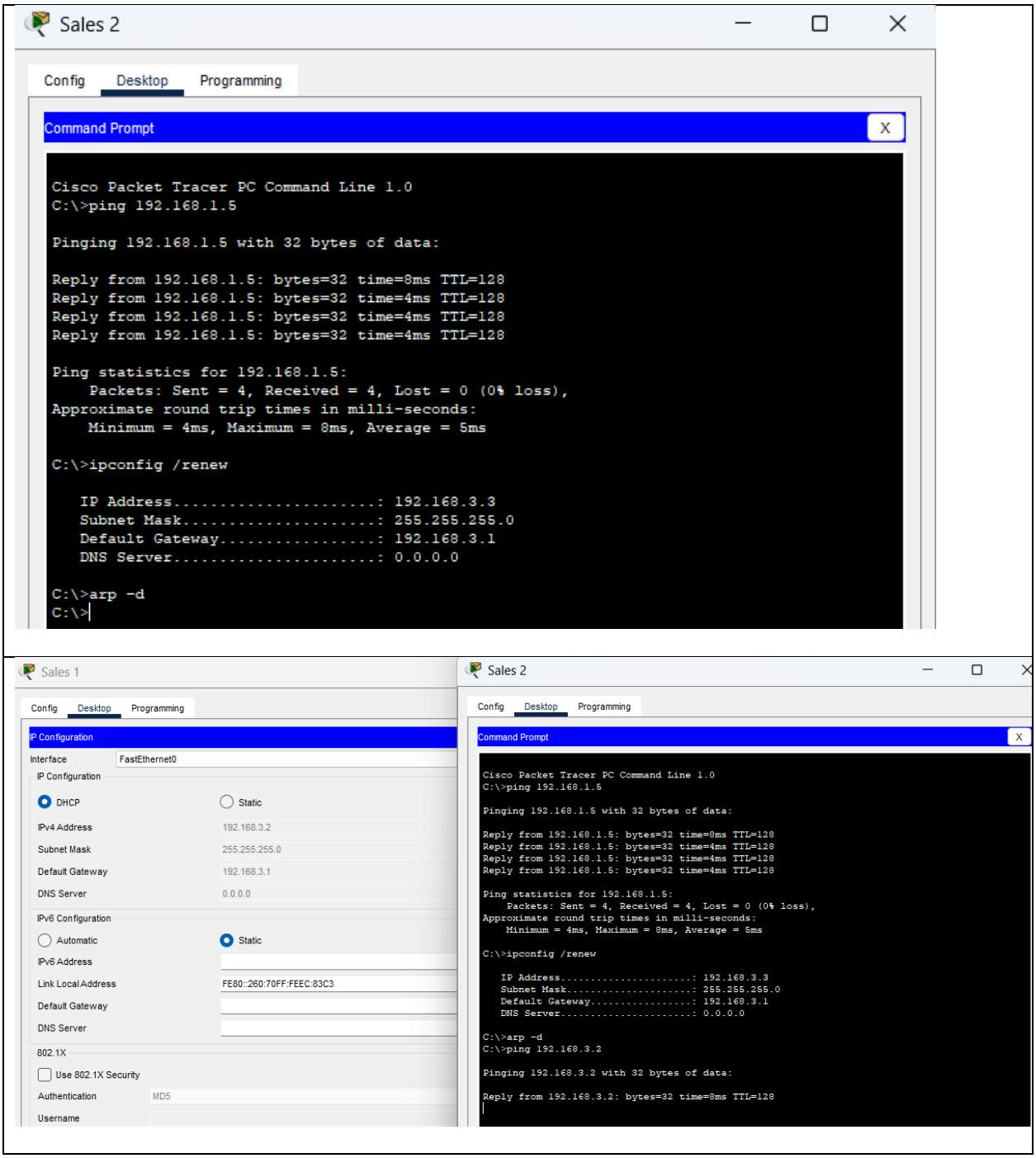
Record New Networks

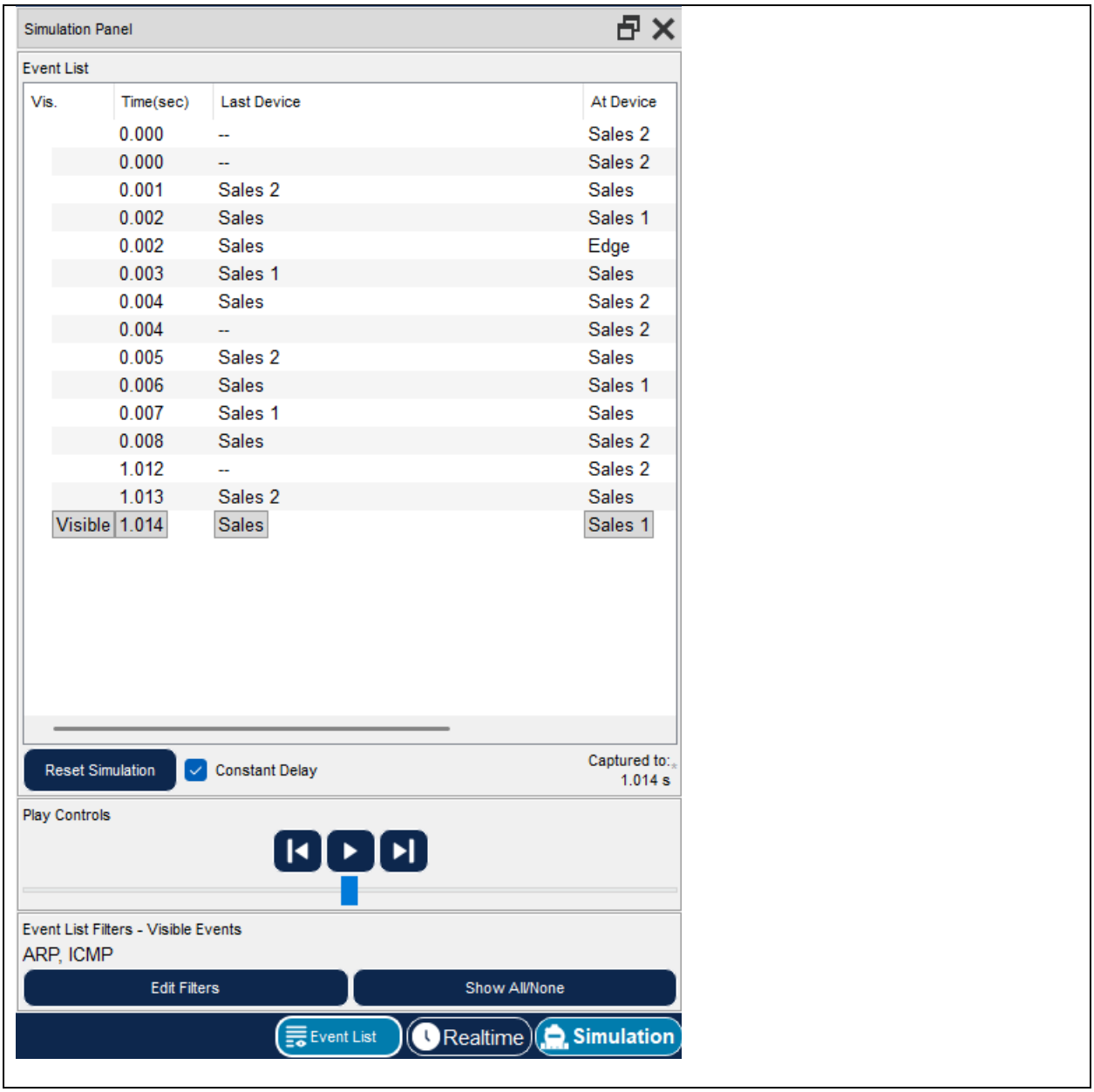
Department	New IPv4 Network	Gateway Address
Finance	192.168.2.2	192.168.2.1
Sales	192.168.3.2	192.168.3.1

7. Part 3 – Observe Traffic Flow in the Routed Network

Step 1 – Ping Sales 1 from Sales 2 Again

Repeat ARP + Ping in Simulation Mode.





Routed ARP Behaviour

Question

Which devices receive ARP broadcasts now?

Only devices inside the same LAN subnet (Sales network only).

Broadcasts no longer propagate across the entire company network.

Question

Benefit of using multiple IPv4 subnets?

Reduced broadcast traffic, improved scalability, improved performance, easier network management, stronger security boundaries.

8. Results and Findings

Criteria	Before Routing	After Routing
Broadcast Traffic	High	Reduced
Network Efficiency	Low	Improved
Host Communication	Direct via LAN	Routed via Gateway
Scalability	Poor	Strong

Routing significantly improved performance and created a more scalable network structure.

9. Conclusion

This lab demonstrated the critical role of routing in enterprise networks.

By segmenting the network into multiple subnets:

- Broadcast traffic was reduced.
- Network efficiency and performance improved.
- Traffic paths became controlled and predictable.

Routing is essential as business networks grow.

10. Reflection Questions

Question	Answer
1. What types of cables were used?	Copper straight-through Ethernet cables.
2. Did cables change how PDUs were handled?	No, PDUs are handled the same regardless of copper cabling.
3. Did the Access Point modify PDUs?	No, it only forwards them.
4. Did the Access Point change addressing?	No, it retains original MAC/IP addressing.
5. Highest OSI layer used by AP?	Layer 2 Data Link.
6. Layer at which cables & APs operate?	Layer 1 (Physical) and Layer 2 (Data Link).
7. Which MAC appears first in PDU details?	Destination MAC appears first.
8. Meaning of Red X vs Green ✓?	Red X indicates drop or failure; Green ✓ means successful delivery.
9. Where did MAC addresses change?	At the router, which forwards between networks.
10. Which device uses MACs starting with 00D0:BA?	The router interface.
11. Other MAC addresses belonged to?	End devices (PCs) and switches.
12. Did IPv4 addresses change?	No, only MAC addresses changed.
13. What happens in reply (pong)?	Source and destination swap roles.
14. Why are router interfaces in different networks?	To enable routing between subnets.
15. Which networks are connected?	192.168.1.0/24, 192.168.2.0/24, 192.168.3.0/24, and ISP network.