Routing Concept

Contents

Chapter 1: Introduction

Using GNS3 and Packet Tracer to analyze the concept of routing between two different subnets

- Cisco Router 2691
- Two 2960 Switches
- Two Windows PCs

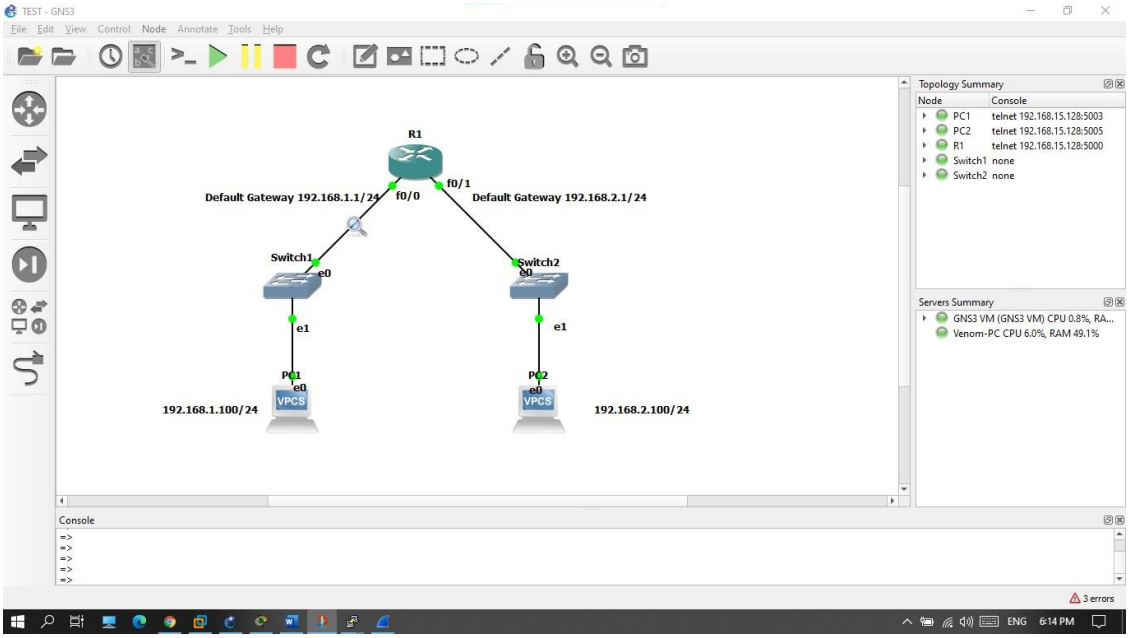

Figure 1: GNS3 Topology

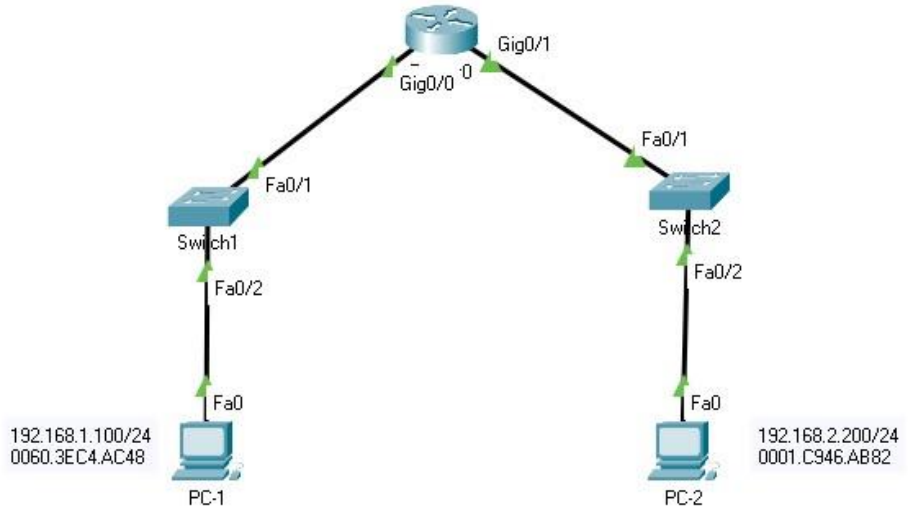

Figure 2: Packet Tracer Topology

Chapter 2: Concepts

Why Router?

The router is responsible for the routing of traffic between networks

So basically, to communicate within same network a switch can be used, since it has the layer 2 table to make the forwarding decision.

But in a scenario of two different network. You will need a router to interconnect different network. Router forwarding decision is based on the IP address. that's where the default gateway comes in the role.

When the Router receive a packet. It checks first whether the network is directly connected if its not then it checks the Routing Table.

ARP RESOLUTION

A. PC-1 needs to ping PC-2. Where PC-1 doesn't know the route to it. Therefore, it generates an ARP Request to find default gateway mac address. B. It sends the frame to Switch1.
   a. If the source mac address doesn't exist in MAC address table. Then it will add the port and mac address in the table.
   b. For every 5mins it refreshes the table if the port changes with different device.

C. After getting the mac address of default gateway. It generates a ping packet. And it keeps the destination IP address has pc 2 and destination mac address has router.

D. Since PC-1 can't reach the 192.168.2.100 directly. It will send the packet to the Default Gateway.

ROUTING

1. The data packet generated by the PC-1 should access the default gateway of the router.
   a. Example - The PC must have connectivity to the router Default Gateway Ip address.
2. Switch1 will send the ICMP Request to the Router
3. Router interfaces must be assigned with the IP address which means the default gateway to represent the network.
4. Where router has the Routing table with the information of Port and the network

PORTS	NETWORK
Fa0/0	192.168.1.1
Fa0/1	192.168.2.1

5. Router will make sure whenever it sees a packet to be sent for 192.168.2.100 it will forward it from the F0/1.
6. Before that the Router will send ARP request to identify the mac address of the devices within the network. And store them in the ARP table.

ARP Table for Router0

IP Address	Hardware Address	Interface
192.168.1.1	00E0.F7A2.7501	GigabitEthernet0/0
192.168.1.100	0060.3EC4.AC48	GigabitEthernet0/0
192.168.2.1	00E0.F7A2.7502	GigabitEthernet0/1
192.168.2.100	0001.C946.AB82	GigabitEthernet0/1

Figure 3: Router ARP Table

7. Now it will send to the Switch2 and if the destination mac address isn't in the ARP table. Then the switch will flood it and find the destination mac address and the port of the PC-2.

MAC Table for Switch2

VLAN	Mac Address	Port
1	0001.C946.AB82	FastEthernet0/2
1	00E0.F7A2.7502	FastEthernet0/1

Figure 4: Switch 2 MAC Table

8. And it forwards the packet to the destination mac address to the correct port which is PC-2.

Chapter 3: ARP Resolving

The green packet represents the ARP packet. Where the target IP address will be Default Gateway and the target mac address will be filled with zeros.

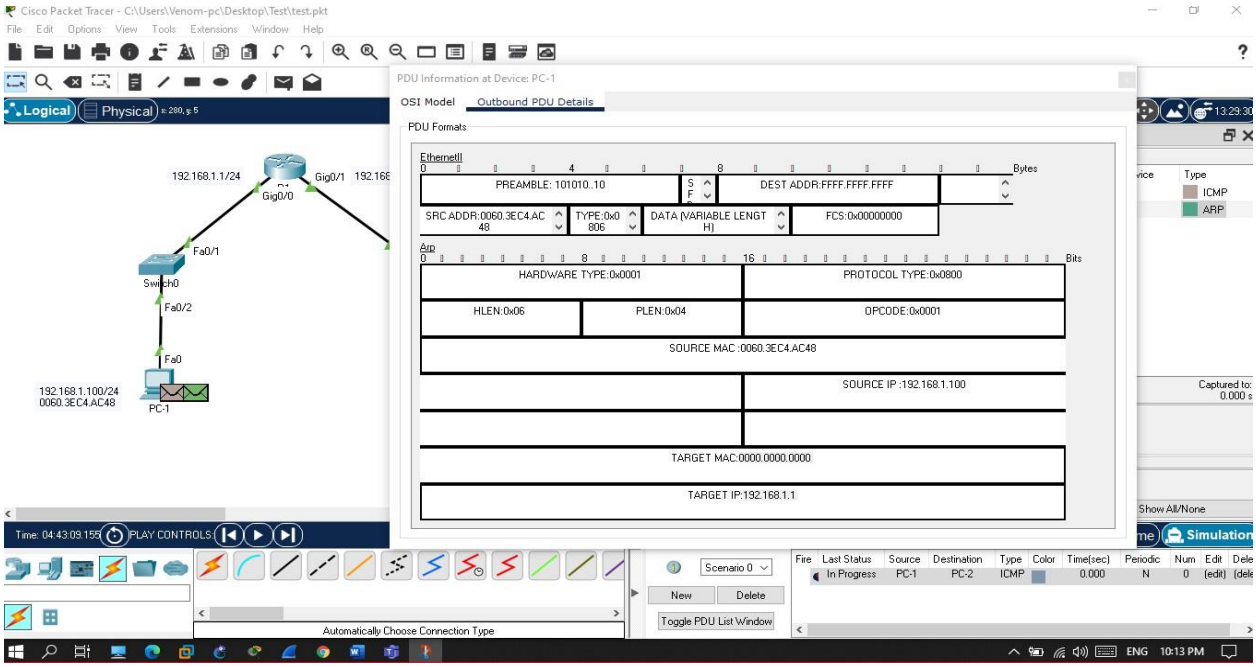

Figure 5: ARP Request Outbound PDU Details

After the reply of ARP packet, the Target Mac Address will be filled with the Routers MAC ADDRESS

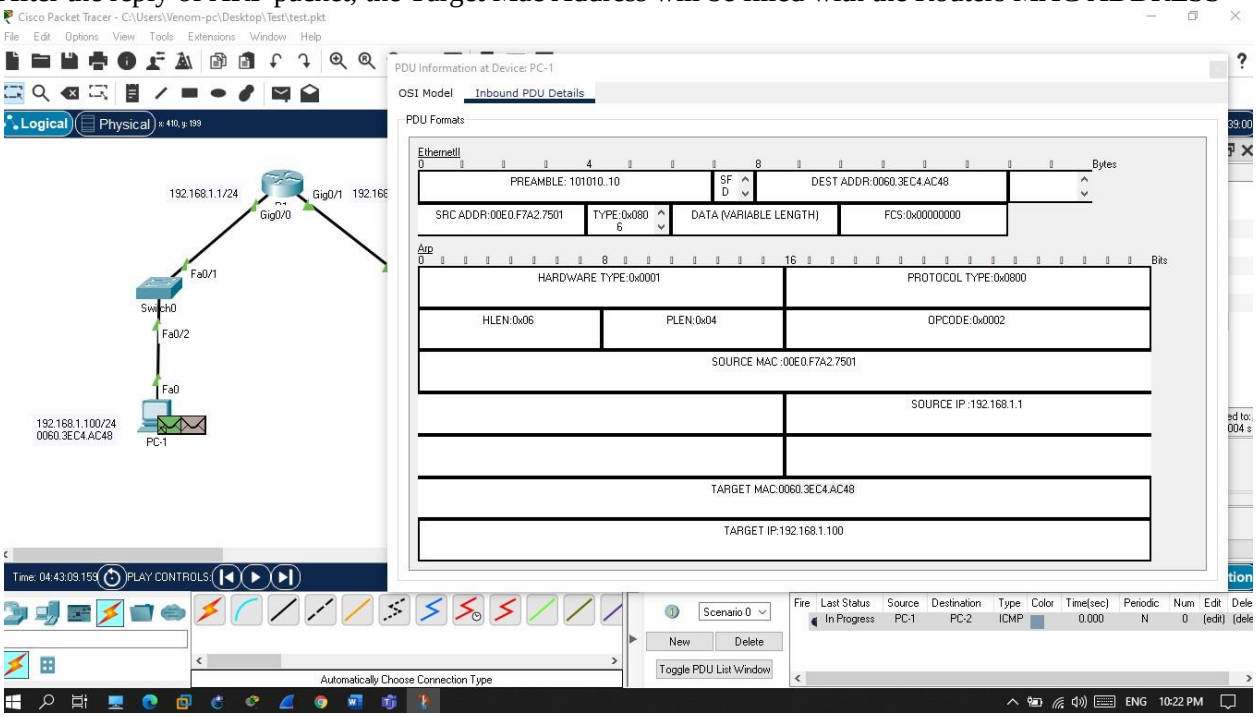

Figure 6: ARP Reply Inbound PDU Details

ICMP ECHO REQUEST

Every time the packet goes through router, then the TTL value will be decremented by -1

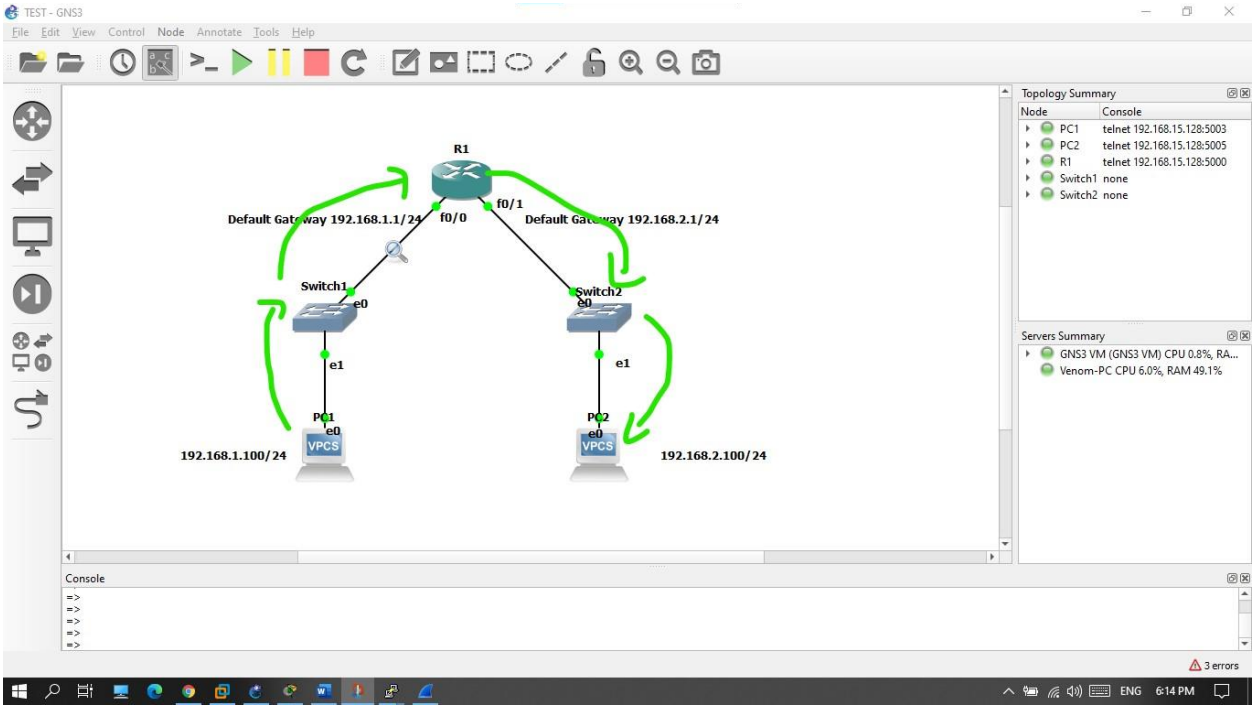

Figure 7: ICMP Echo Request Diagram Explain

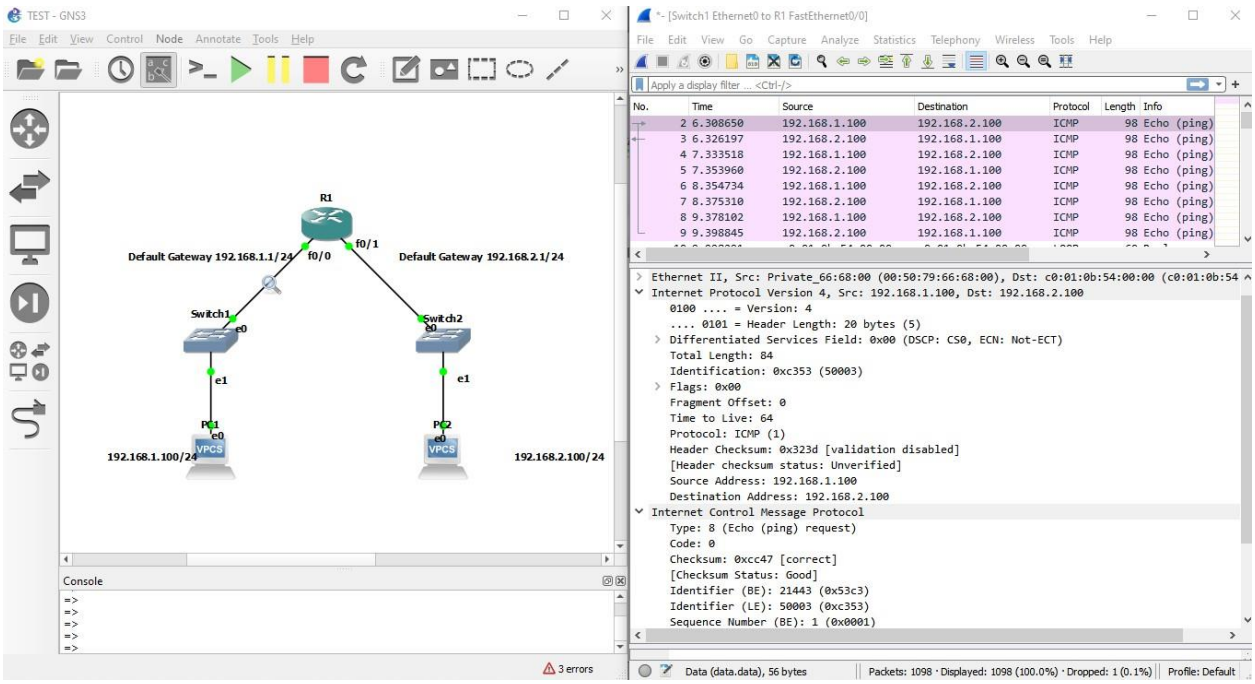

Figure 8: Wireshark Captured ICMP Echo Request Packet

ICMP ECHO REPLY

Every time the packet goes through router, then the TTL value will be decremented by -1

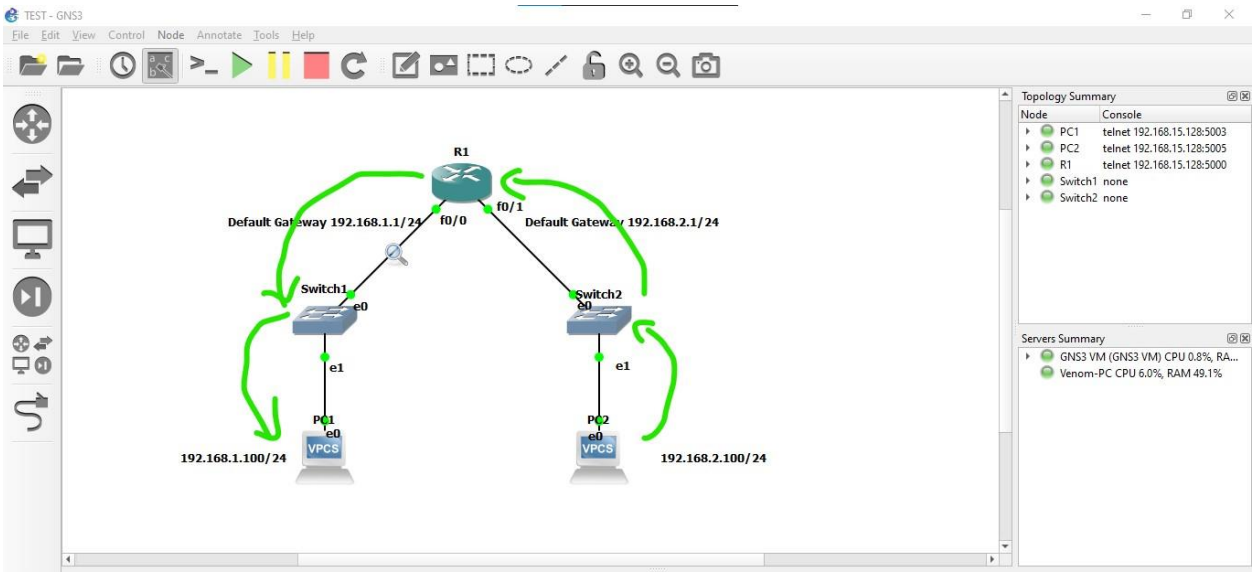

Figure 9: ICMP Echo Reply Diagram Explain

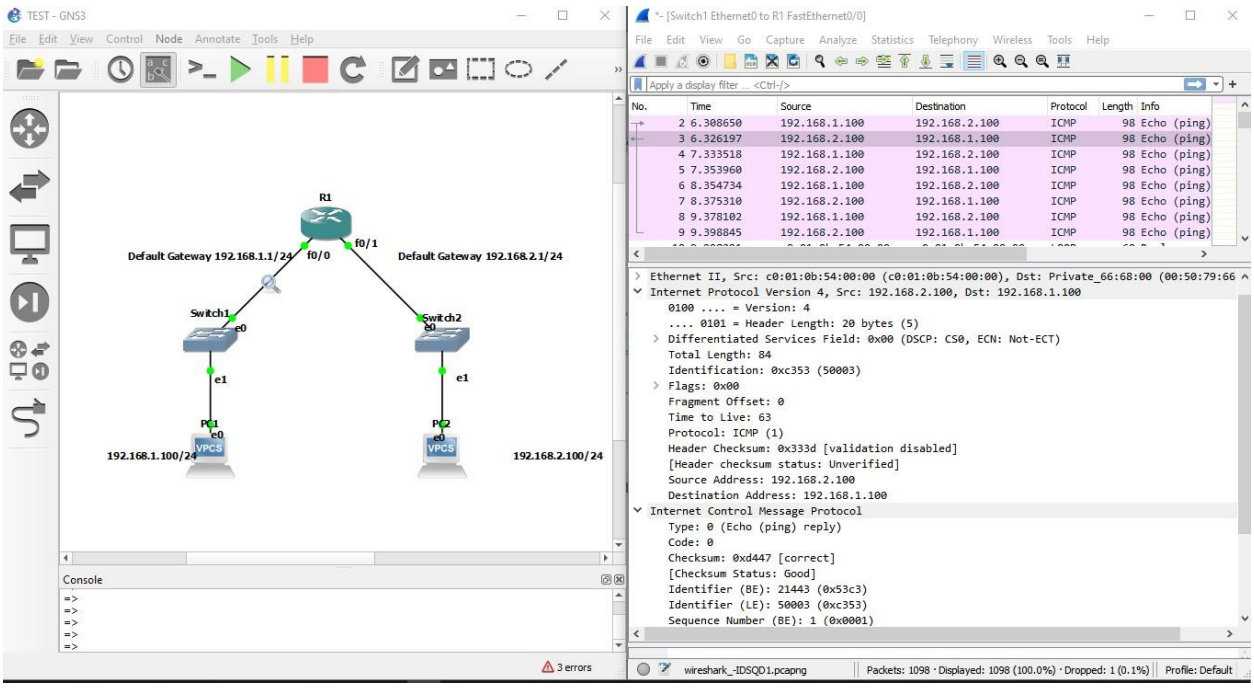

Figure 10: Wireshark Captured ICMP Echo Reply Packet

Chapter 4: Live Simulation

Sending the ICMP Echo Request – 8

This explains the process of each layer in **OSI Model**.

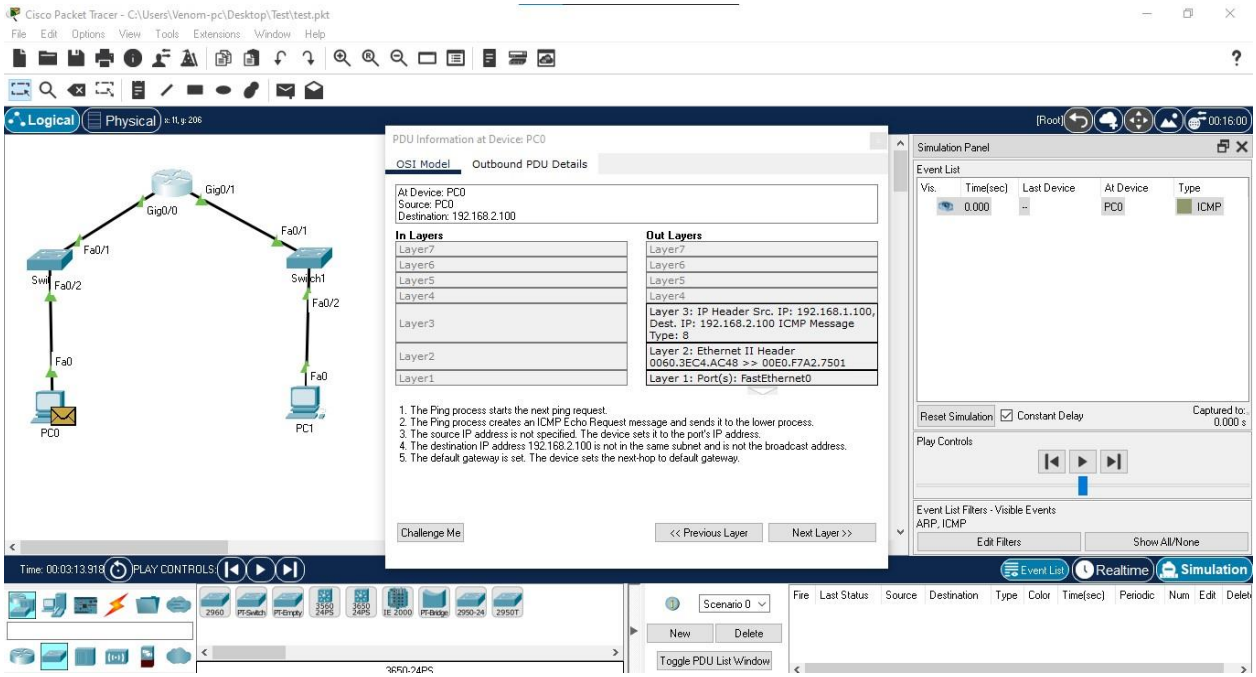

Figure 11: Step 01 Ping Process Starts

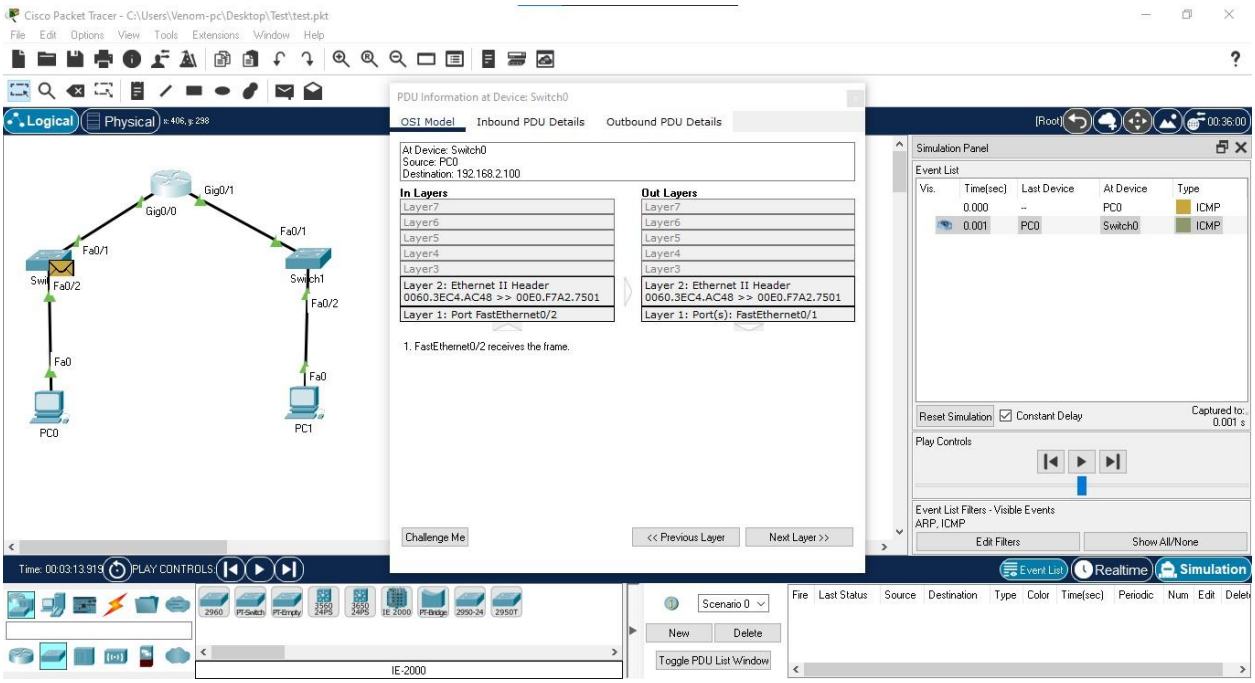

Figure 12: Step 02 Ping Process

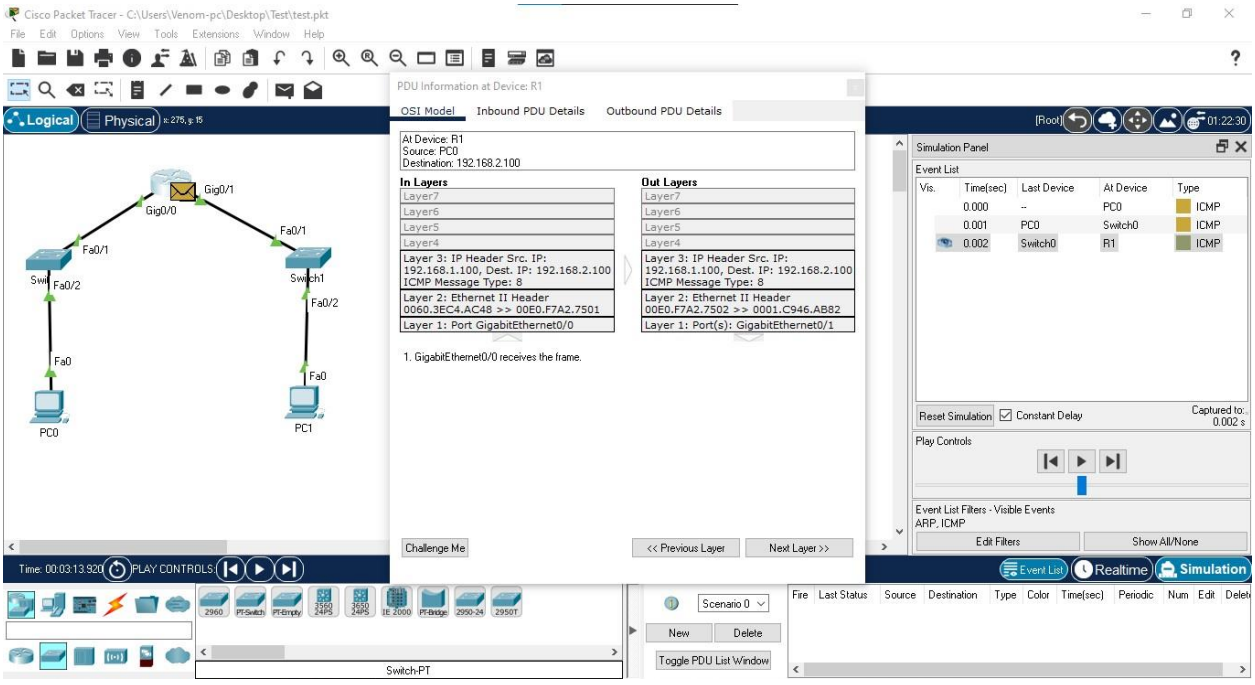

Figure 13: Step 03 Ping Process

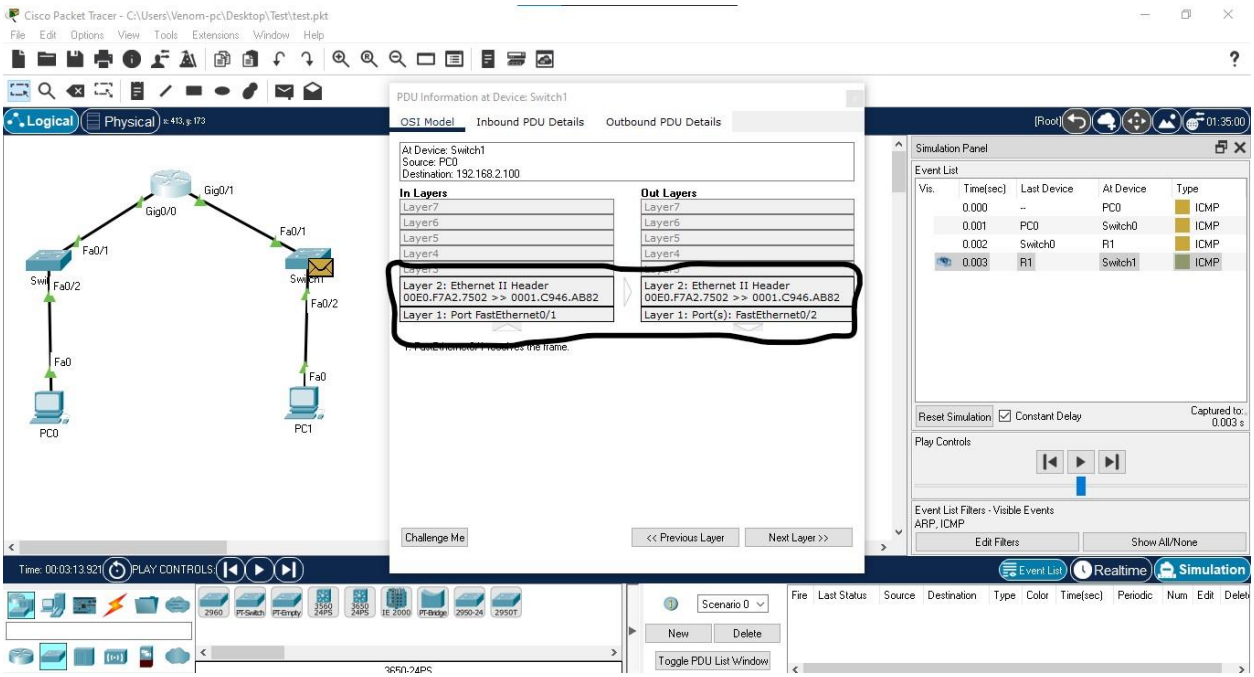

Figure 14: Step 04 Ping Process

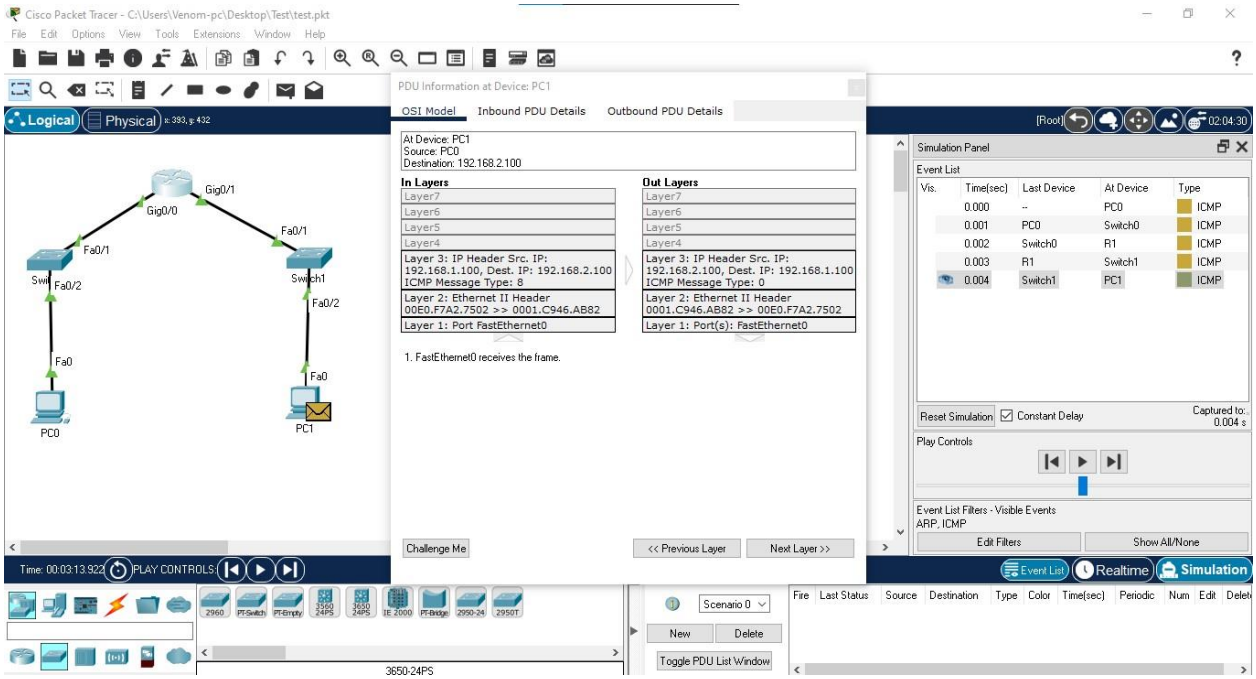

Figure 15: Step 05 Ping Process Stops

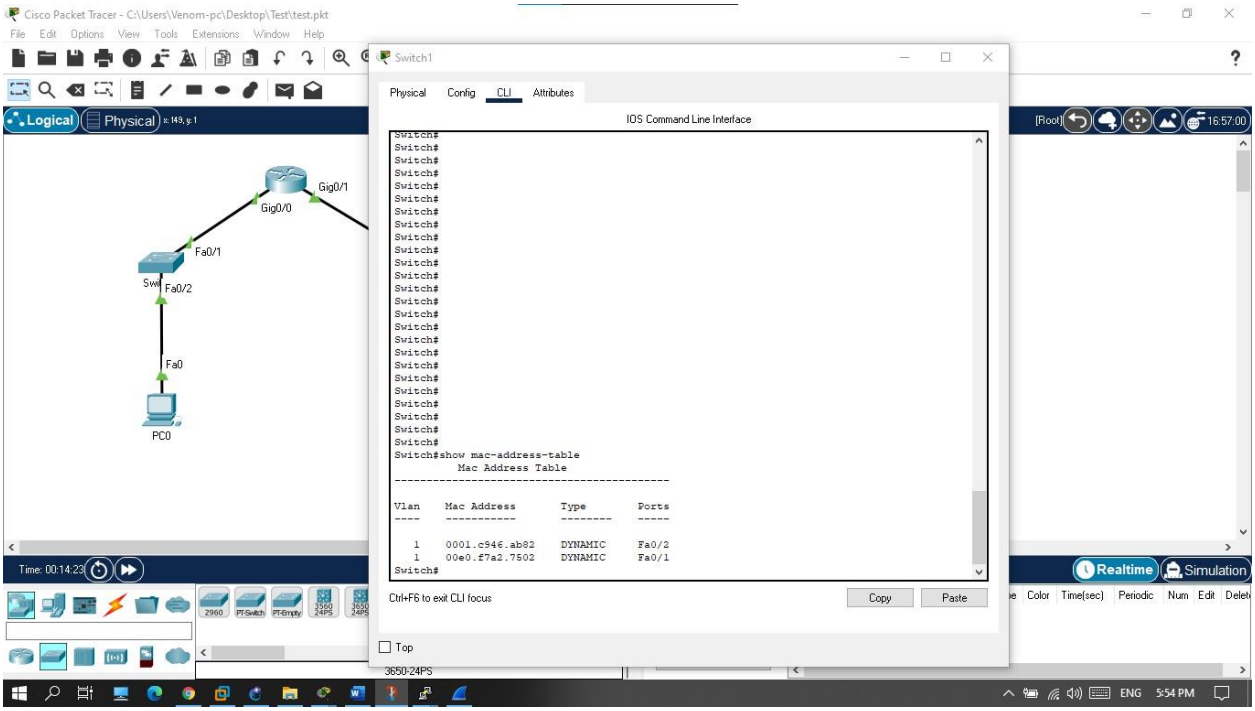

Figure 16: Step 06 192.168.1.0 Network's Switch Mac Address Table

Replying with ICMP Echo Reply - 0

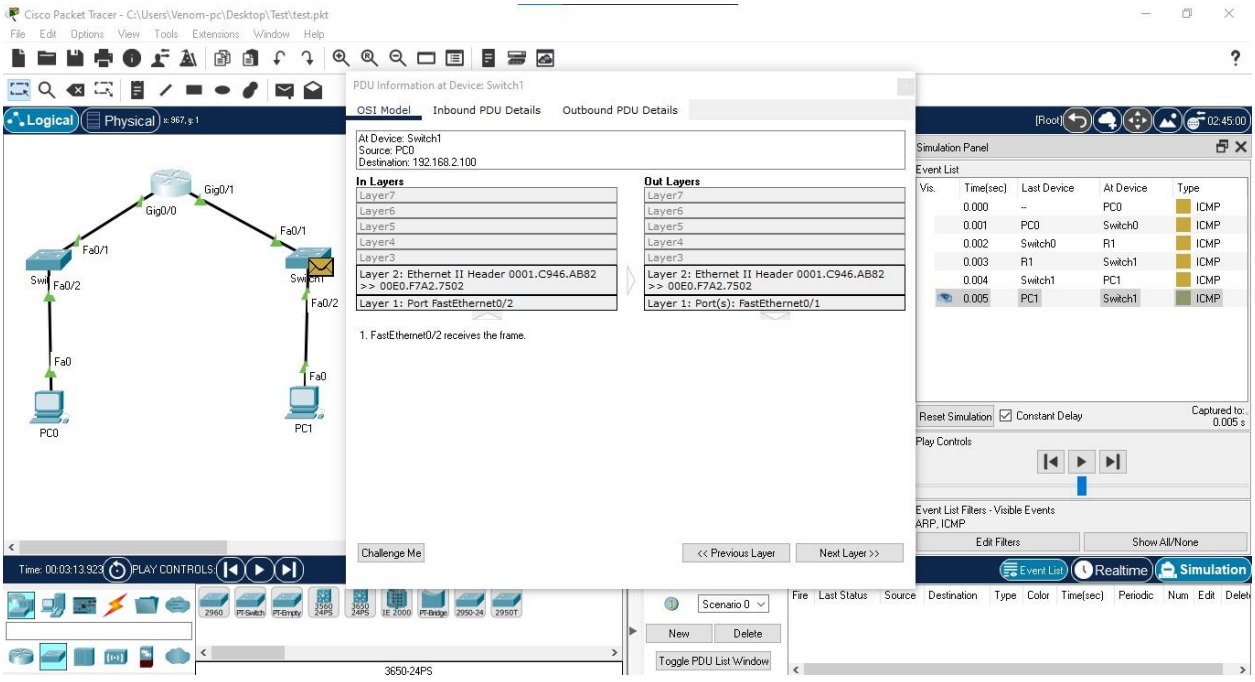

Figure 17: Step 07 Ping Process

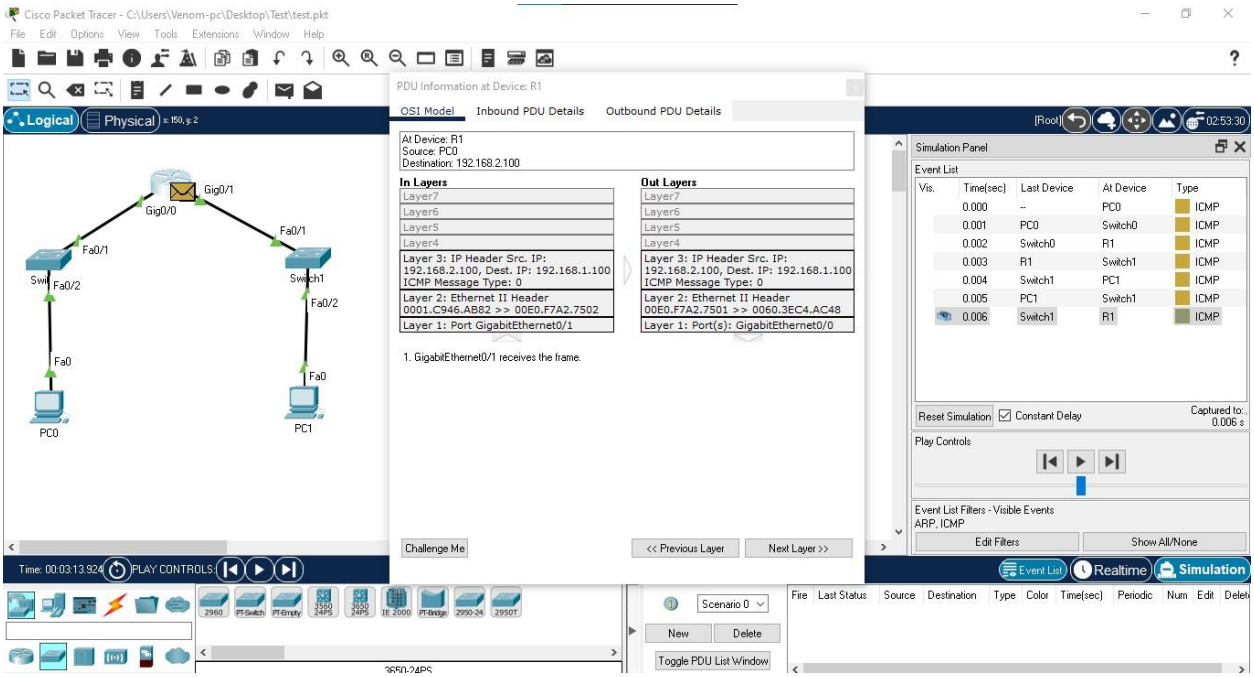

Figure 18: Step 08 Ping Process

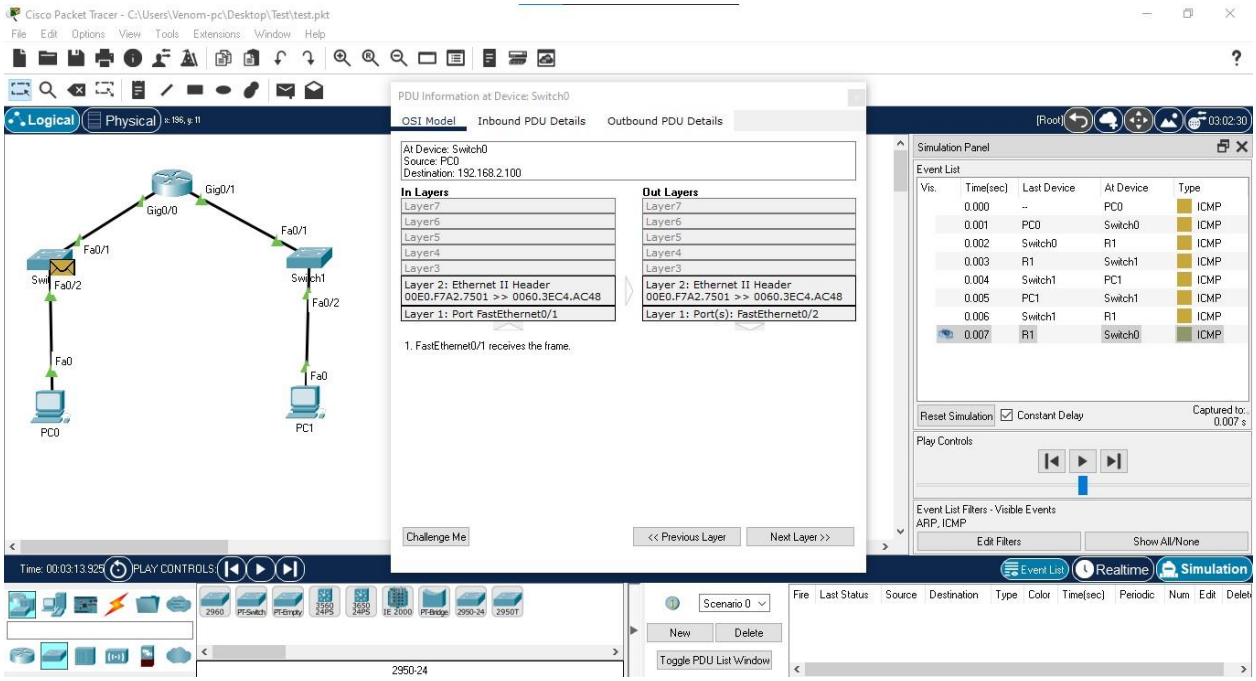

Figure 19: Step 09 Ping Process

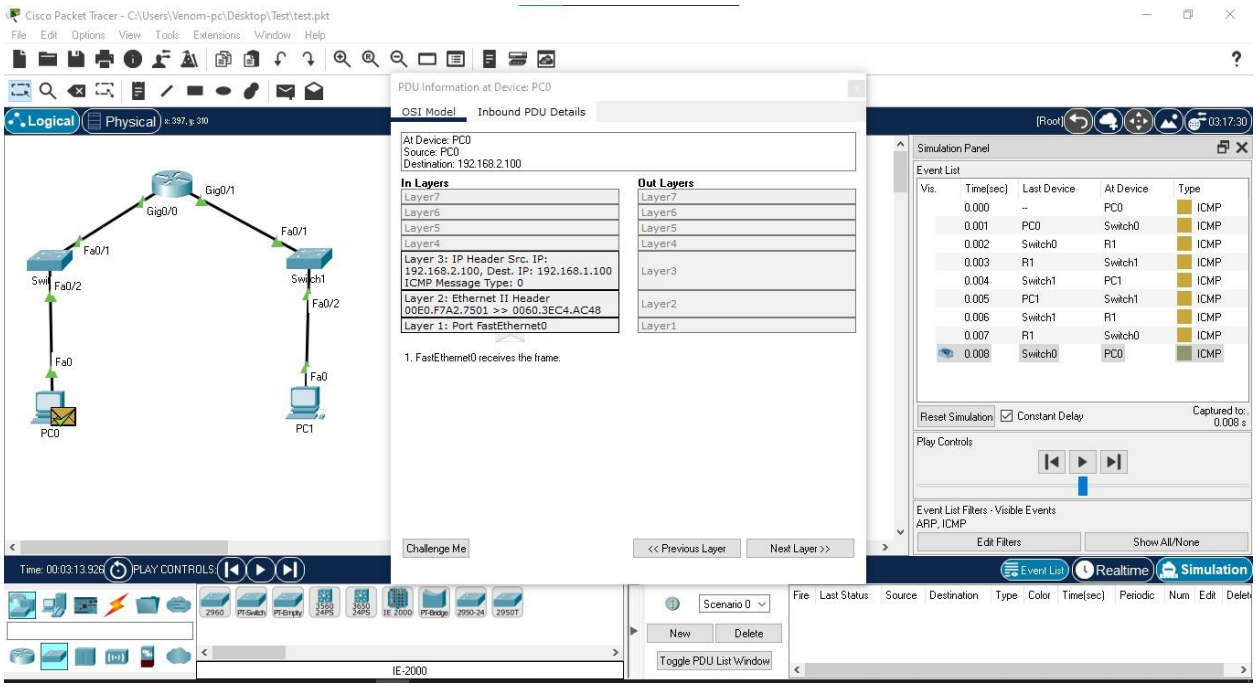

Figure 20: Step 10 Ping Process Successful

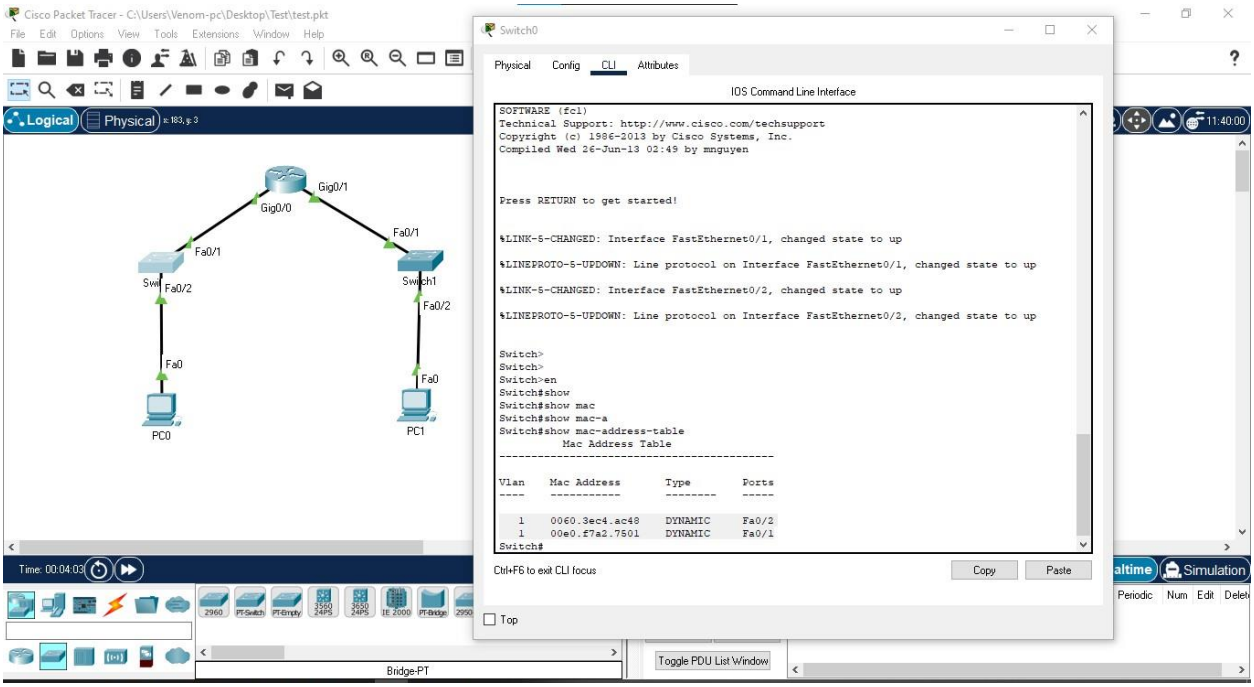

Figure 21: Step 11 192.168.2.0 Network's Switch Mac Address Table