Network Topology : 5

- This topology is designed with inter-VLAN configuration. For this setup, three VLANs are created: VLAN 100, VLAN 200, and VLAN 300.
- These VLANs are interconnected, and intercommunication is configured with the help of a multilayer switch, as shown in Figure 5.1

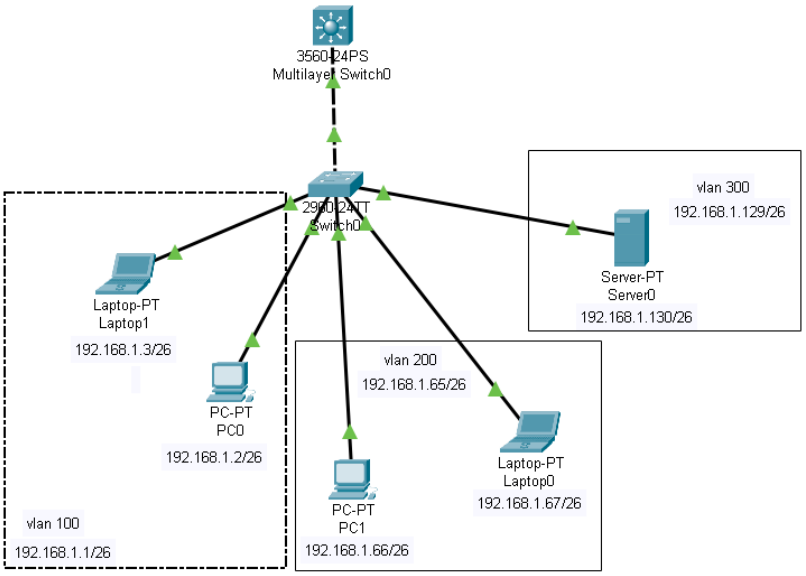


Fig: 5.1

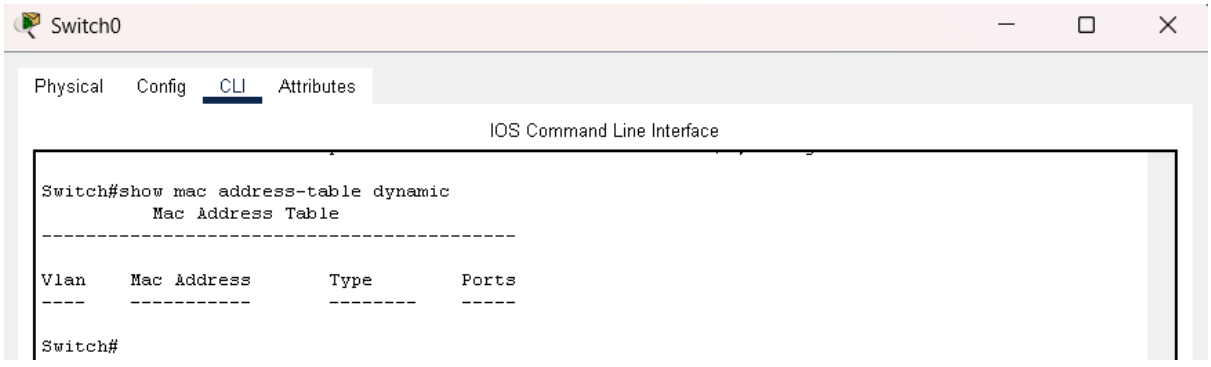


Fig: 5.2

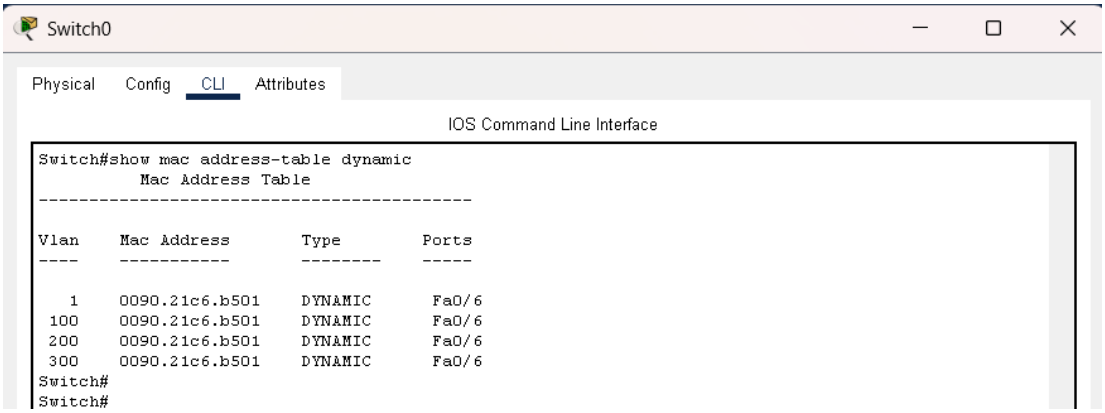


Fig: 5.3

- Figures 5.2 and 5.3 display the MAC tables of the switch before and after the ARP broadcast.

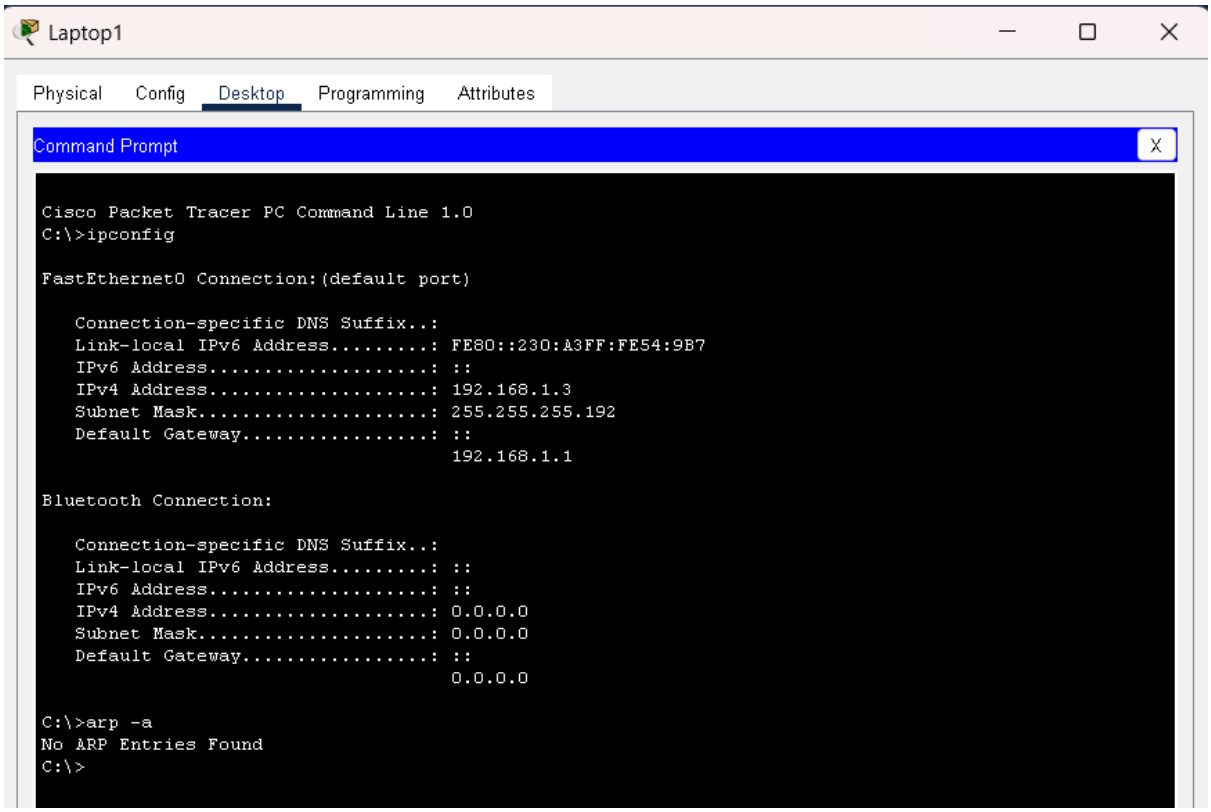


Fig: 5.4

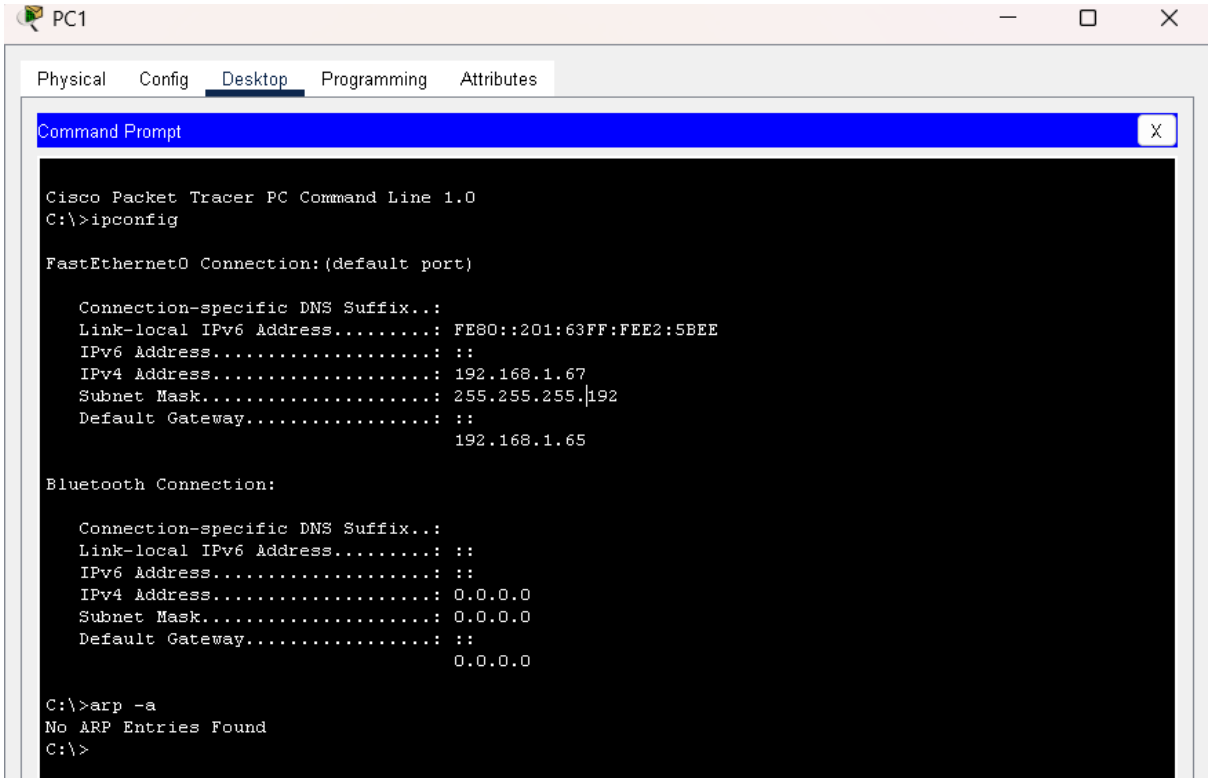
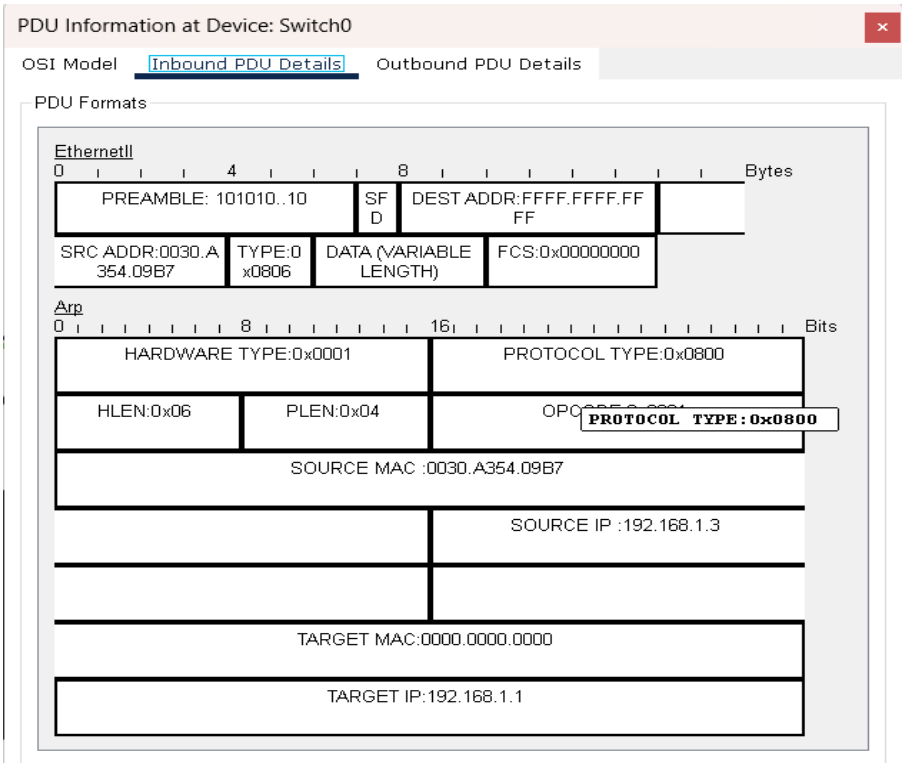


Fig:5.5

- Before the ARP broadcast, the ARP cache in both the source and destination devices is empty.
- The source device has the IP address 192.168.1.3 and the destination device has the IP address 192.168.1.66. As shown in Figure 5.4 and Fig 5.5.
- These two devices are in different VLANs, where the source belongs to VLAN 100 and the destination to VLAN 200.
- When the ARP request is initiated from the source device 192.168.1.3, the switch broadcasts it, and it is forwarded to the default gateway 192.168.1.1.
- The multilayer switch then sends the ARP response back to the source device 192.168.1.3, where the source IP in the reply becomes the default gateway of the device, i.e., 192.168.1.1.
- We can see this process in Fig 5.6, Fig: 5.7 and Fig: 5.8.


PDU Information at Device: Switch0
OSI Model
Inbound PDU Details
Outbound PDU Details
PDU Formats
EthernetII
0
4
8
Bytes
PREAMBLE: 101010..10
SFD
DEST ADDR:FFFF.FFFF.FFFF
SRC ADDR:0030.A354.09B7
TYPE:0x0806
DATA (VARIABLE LENGTH)
FCS:0x00000000
Arp
0
8
16
Bits
HARDWARE TYPE:0x0001
PROTOCOL TYPE:0x0800
HLEN:0x06
PLEN:0x04
PROTOCOL TYPE:0x0800
SOURCE MAC :0030.A354.09B7
SOURCE IP :192.168.1.3
TARGET MAC:0000.0000.0000
TARGET IP:192.168.1.1

Fig; 5.6

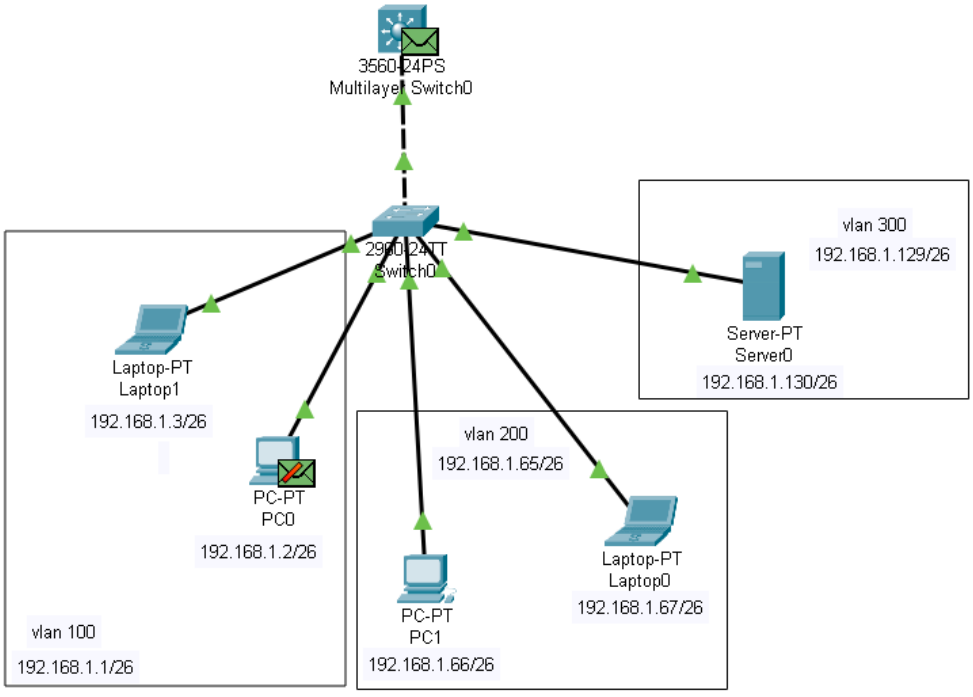

3560-24PS
Multilayer Switch0
2960-24TT
Switch0
vlan 300
192.168.1.129/26
Server-PT
Server0
192.168.1.130/26
Laptop-PT
Laptop1
192.168.1.3/26
PC-PT
PC0
192.168.1.2/26
vlan 100
192.168.1.1/26
vlan 200
192.168.1.65/26
PC-PT
PC1
192.168.1.66/26
Laptop-PT
Laptop0
192.168.1.67/26

Fig: 5.7

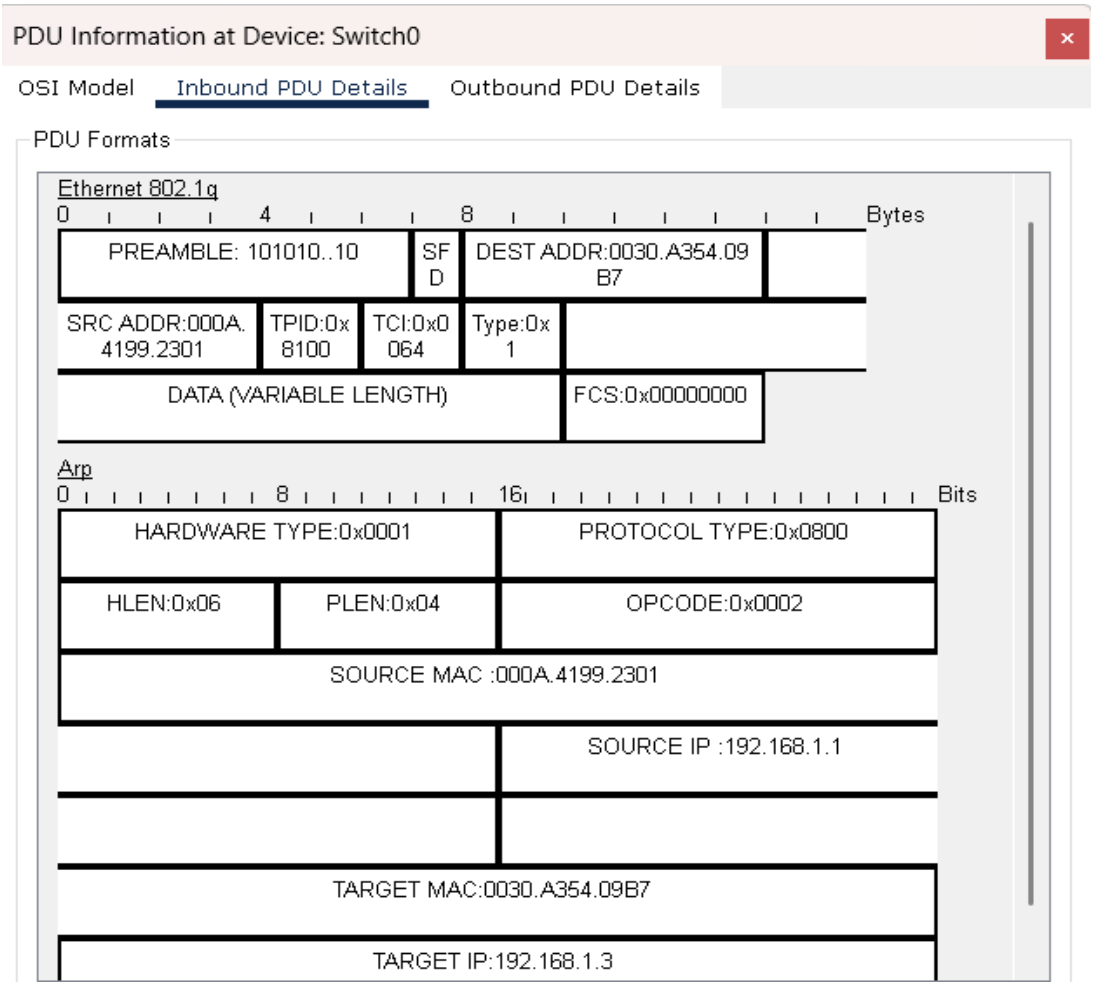


Fig: 5.8

- After this ARP exchange, an ICMP packet is sent from 192.168.1.3 to the destination 192.168.1.66.
- The ICMP type is 0x08 and the code is 0x00. Initially, the packet is dropped at the multilayer switch because it does not know the MAC address of the destination IP 192.168.1.66.
- At this point, the multilayer switch generates a new ARP request for the destination address. In this ARP request, the source IP is 192.168.1.65, since this is the default gateway for 192.168.1.66 as configured in the multilayer switch.
- The request is then broadcast within VLAN 200. The packet is dropped at 192.168.1.67 because it is not the intended target; instead, the search is for 192.168.1.66.
- In 5.9 and 5,10 we can see the packet initiation and drop at default gateway.

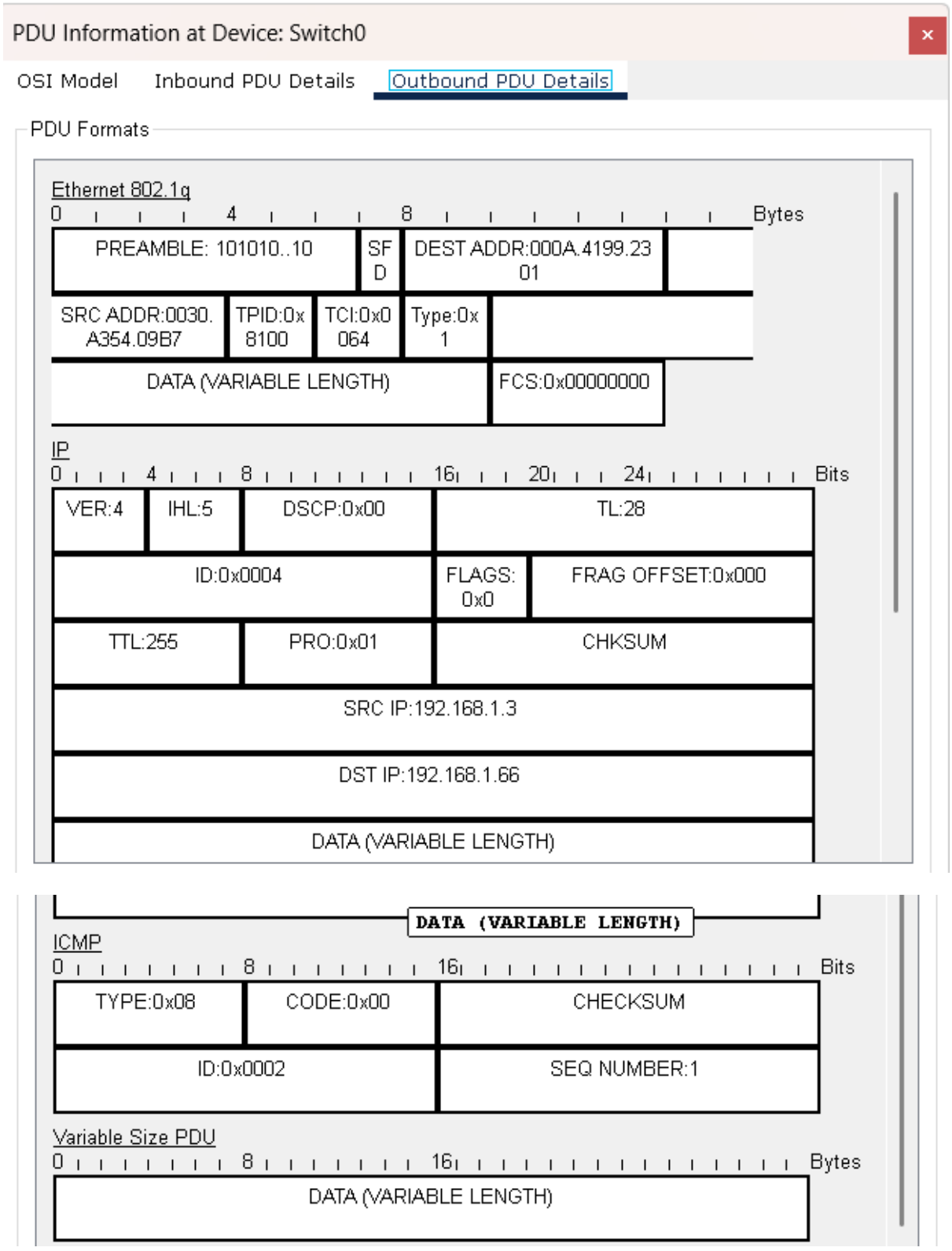

PDU Information at Device: Switch0
OSI Model
Inbound PDU Details
Outbound PDU Details
PDU Formats
Ethernet 802.1q
0
4
8
Bytes
PREAMBLE: 101010..10
SFD
DEST ADDR:000A.4199.2301
SRC ADDR:0030.A354.09B7
TPID:0x8100
TCI:0x0064
Type:0x1
DATA (VARIABLE LENGTH)
FCS:0x00000000
IP
0
4
8
16
20
24
Bits
VER:4
IHL:5
DSCP:0x00
TL:28
ID:0x0004
FLAGS:0x0
FRAG OFFSET:0x000
TTL:255
PRO:0x01
CHKSUM
SRC IP:192.168.1.3
DST IP:192.168.1.66
DATA (VARIABLE LENGTH)
DATA (VARIABLE LENGTH)
ICMP
0
8
16
Bits
TYPE:0x08
CODE:0x00
CHECKSUM
ID:0x0002
SEQ NUMBER:1
Variable Size PDU
0
8
16
Bytes
DATA (VARIABLE LENGTH)

Fig: 5.9

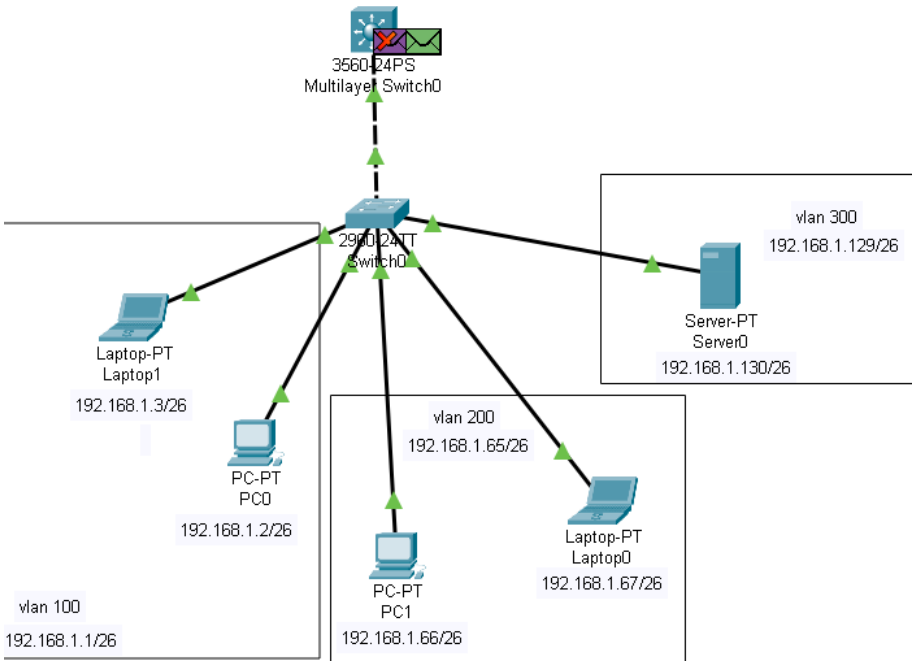


Fig: 5.10

- In this ARP request, the source IP is 192.168.1.65, since this is the default gateway for 192.168.1.66 as configured in the multilayer switch.
- The request is then broadcast within VLAN 200. The packet is dropped at 192.168.1.67 because it is not the intended target; instead, the search is for 192.168.1.66.

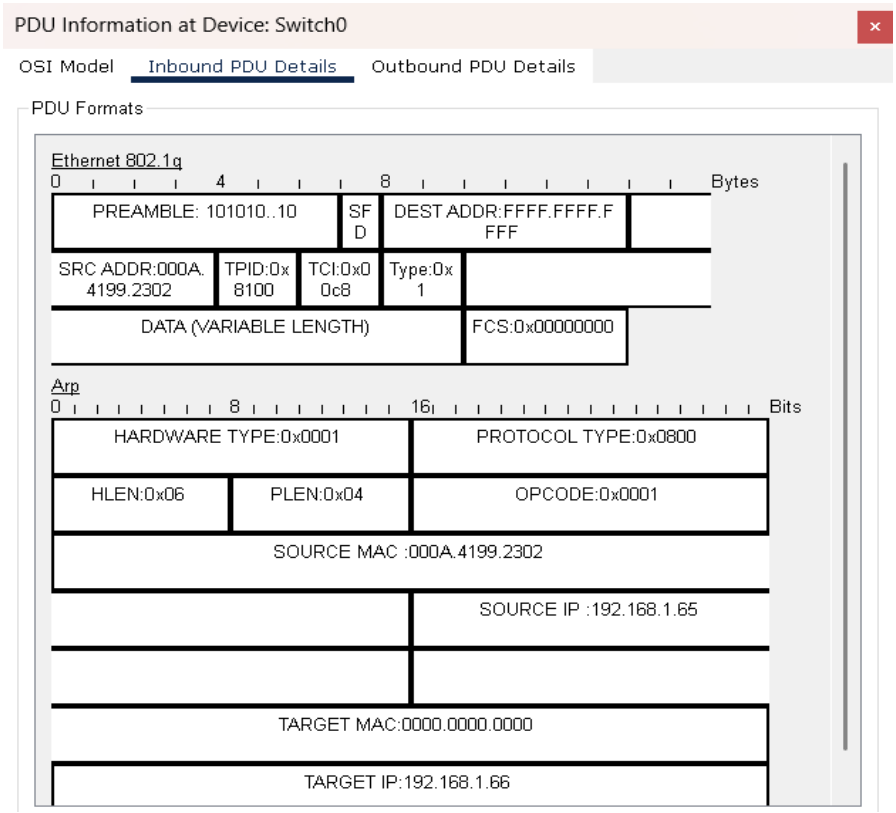


Fig: 5.11

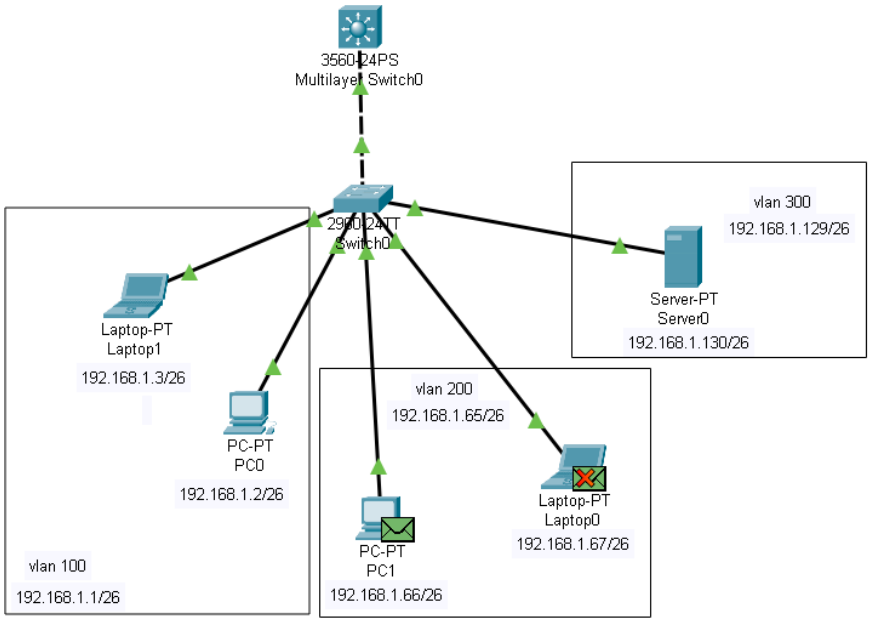


Fig: 5.12

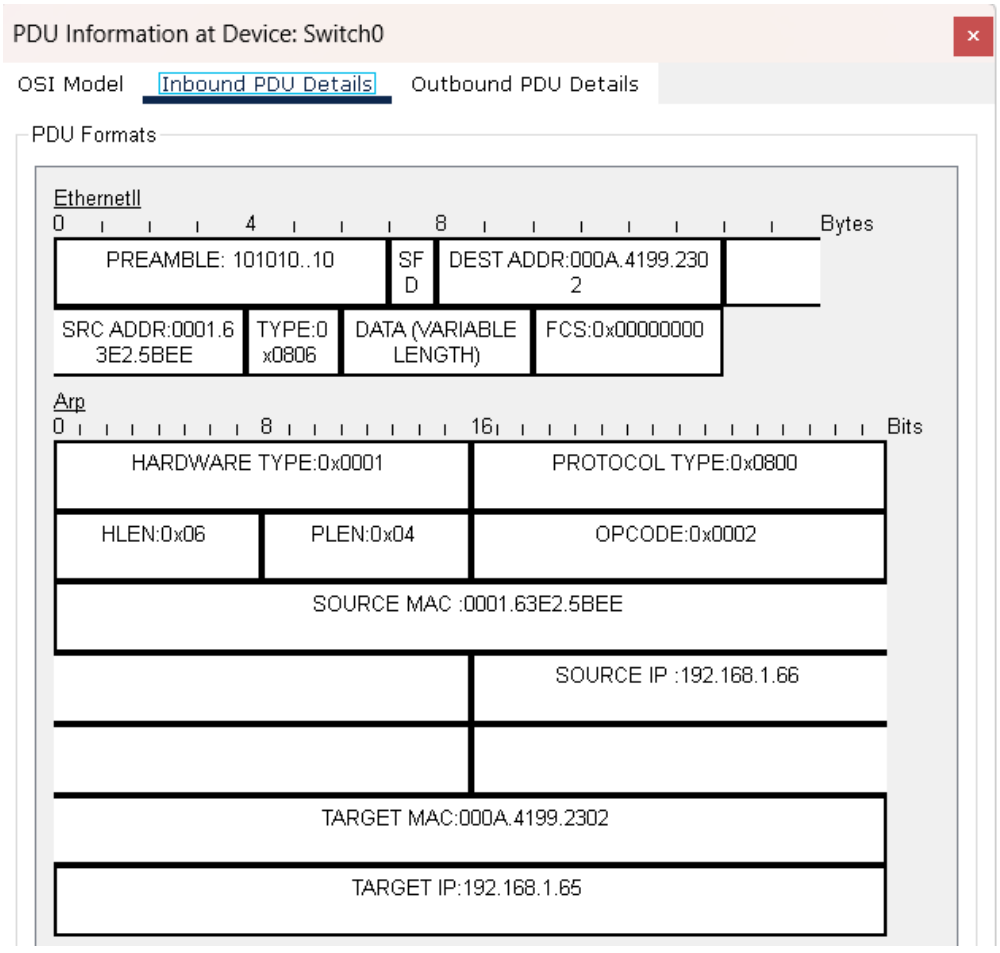


Fig: 5.13 – ARP response

- Once the correct device **192.168.1.66** is found, it replies with an ARP response to the default gateway.
- This ARP response has the source IP **192.168.1.66** and is directed toward the gateway at **192.168.1.65**.
- After receiving this reply, the ICMP packet flow resumes successfully from the source device **192.168.1.3** in VLAN 100 to the destination device **192.168.1.66** in VLAN 200.
- The destination then sends back an ICMP echo reply to the source with type **0x00**, confirming successful inter-VLAN communication.

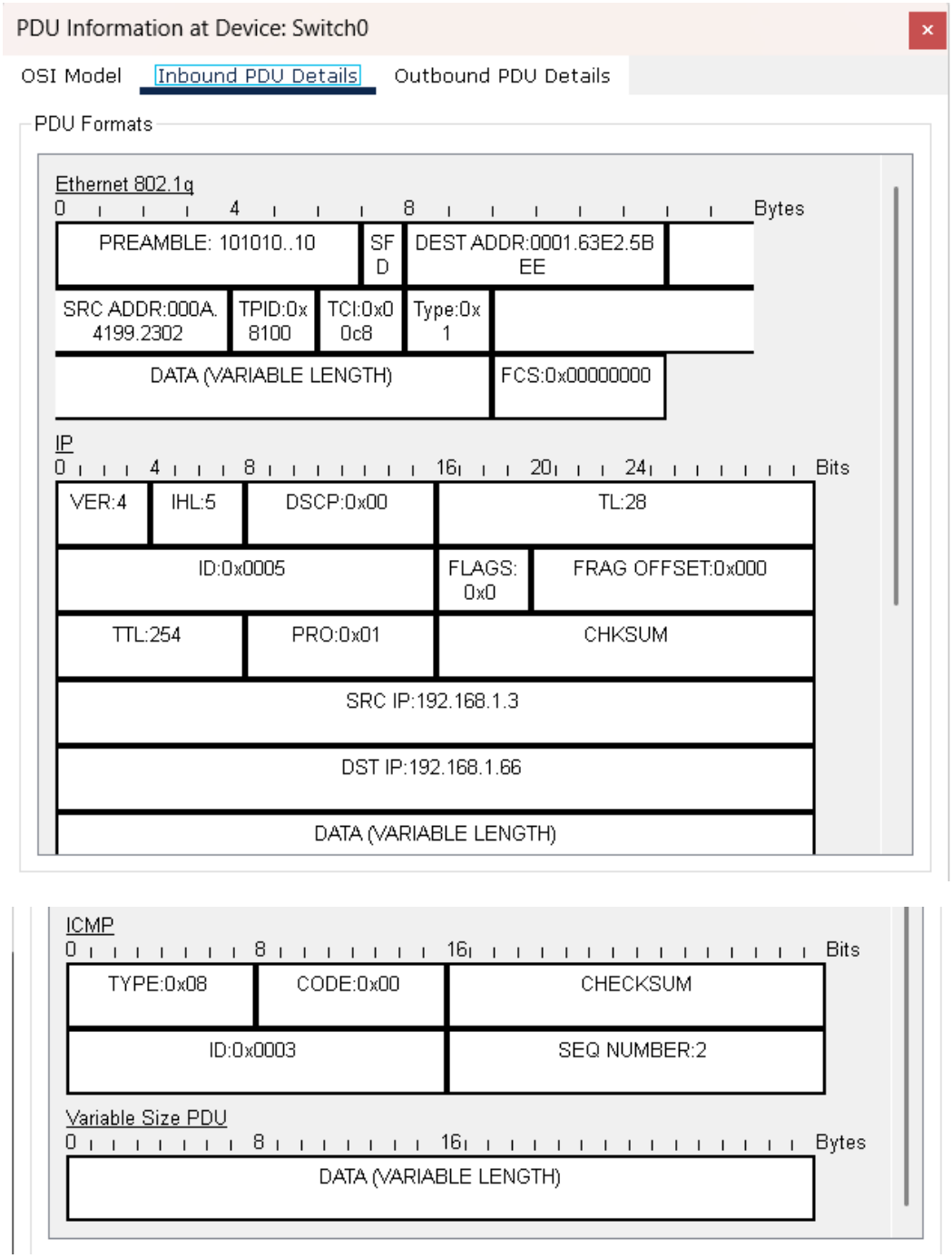


Fig: 5.14 – Echo Request

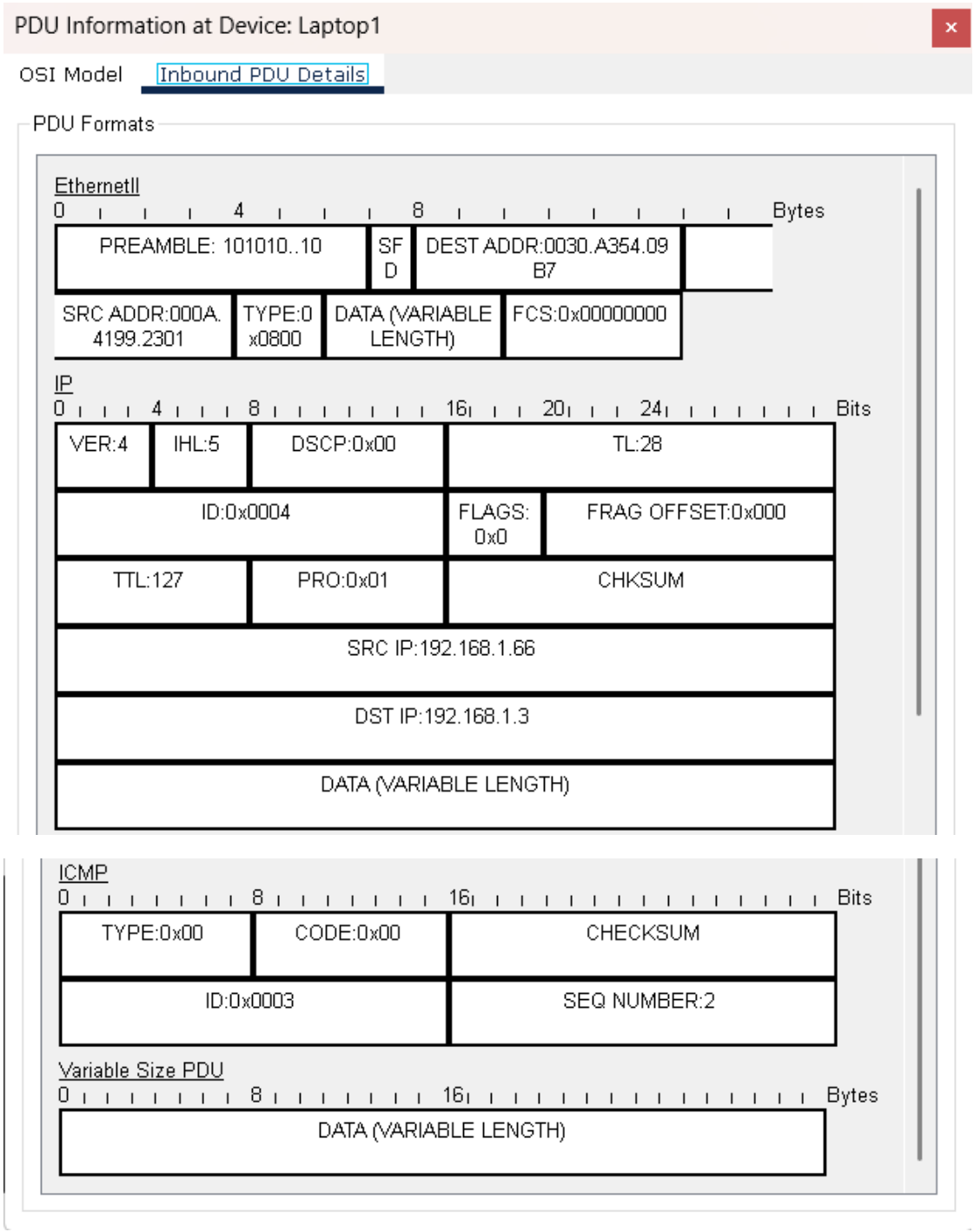
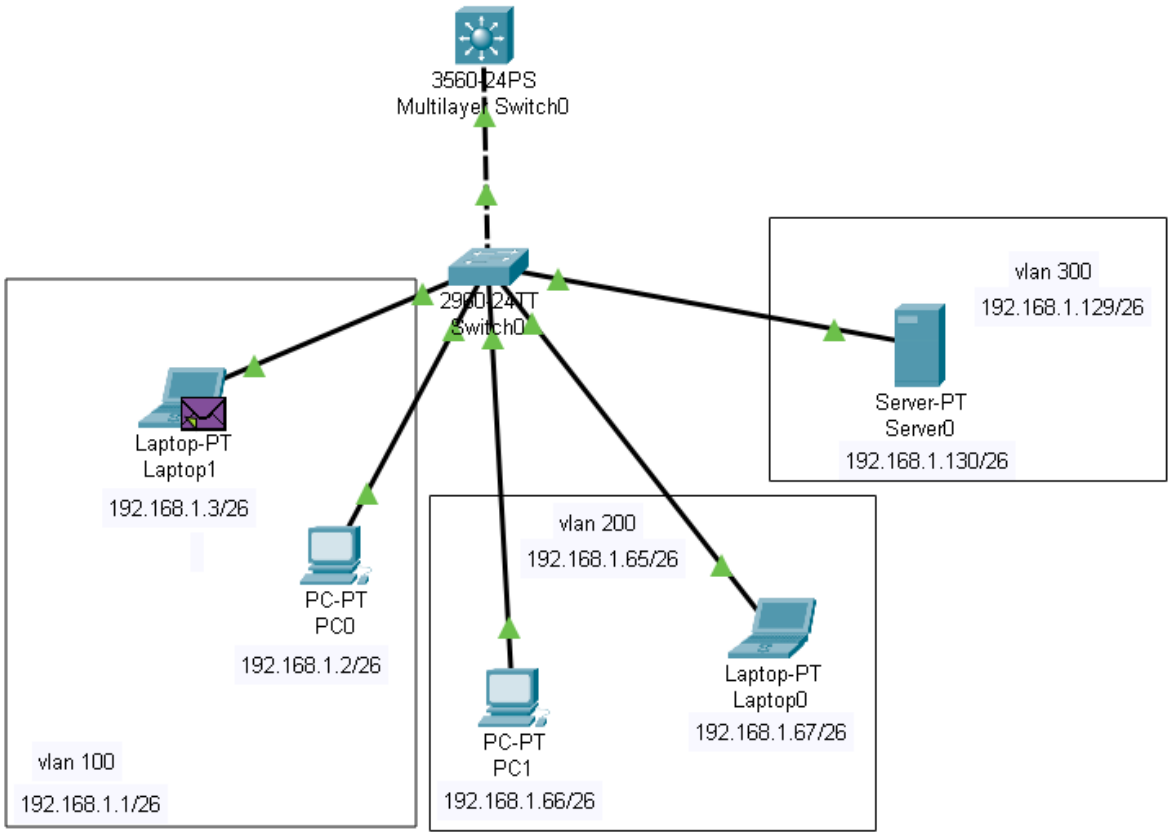


Fig: 5.14 – Echo Response



- This successful packet flow is achieved through inter-VLAN configuration, also called Switch Virtual Interface (SVI) configuration, on the multilayer switch.
- To configure this, the required VLANs are created on the switch: VLAN 100, VLAN 200, and VLAN 300. Each VLAN is assigned a subnet. For this setup, a /26 subnet is used, providing four subnets, and three of them are allocated to the VLANs.
- After creating VLANs on the switch, the interfaces are tagged according to their VLAN and subnet. In this topology, VLAN 100 has two devices, VLAN 200 has two devices, and VLAN 300 has one device.
- The port connecting to the multilayer switch is configured as a trunk port so it can carry traffic for multiple VLANs, and the corresponding port on the multilayer switch is also configured as trunk.

- On the multilayer switch, IP routing is enabled. Then, SVI interfaces for each VLAN are created with their IP addresses:
    - VLAN 100 → IP 192.168.1.1, Subnet mask 255.255.255.192
      vlan 100
      interface vlan 100
      ip address 192.168.1.1 255.255.255.192
      no shutdown
    - VLAN 200 → IP 192.168.1.65, Subnet mask 255.255.255.192
      vlan 200
      interface vlan 200
      ip address 192.168.1.65 255.255.255.192
      no shutdown
    - VLAN 300 → IP 192.168.1.129, Subnet mask 255.255.255.192
      vlan 300
      interface vlan 300
      ip address 192.168.1.129 255.255.255.192
      no shutdown
- For each interface VLAN, the commands include assigning the IP address, applying the subnet mask, and using the no shutdown command to activate the interface.
- Once these VLANs and SVIs are configured, inter-VLAN communication between VLAN 100, VLAN 200, and VLAN 300 is established successfully.