

# Inter-VLAN Routing Report

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COS370 / COS372 — Computer Networks

# 1. Network Topology

The Inter-VLAN lab uses Router R1 (router-on-a-stick), two switches S1 and S2, and two PCs in different VLANs. PC1 (VLAN 10, 188.16.0.53) connects to S1; PC2 (VLAN 20, 188.17.0.54) connects to S2. S1 connects to S2 via a trunk link, and to R1 via f0/0. R1 uses sub-interfaces e0/0.10 and e0/0.20 with dot1Q encapsulation as gateways for each VLAN. R1 uses sub-interfaces e0/0.10 and e0/0.20 with dot1Q encapsulation as gateways for each VLAN.

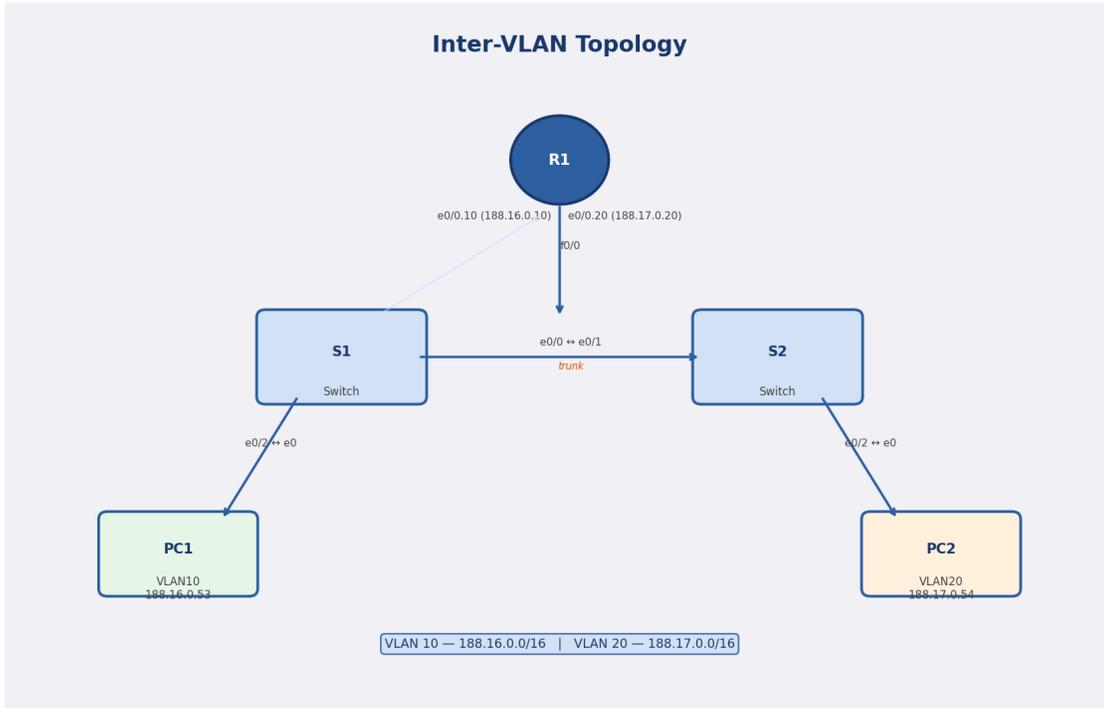


Figure 1 — Inter-VLAN Topology (R1, S1, S2, PC1, PC2)

# 2. Message Table

Two ICMP messages were captured: an Echo Request from PC1 to PC2 crossing VLAN 10 → R1 → VLAN 20, and the corresponding Echo Reply.

#	Source IP	Destination IP	Message	Protocol
1	188.16.0.53	188.17.0.54	Echo (ping) request id=0x0195, seq=1/256, ttl=64	ICMP
2	188.17.0.54	188.16.0.53	Echo (ping) reply id=0x0195, seq=1/256, ttl=64	ICMP

Figure 2 — Captured ICMP Messages

### 3. ICMP Ping Flow

The flow below shows the inter-VLAN ping path: PC1 sends to its gateway (R1 sub-interface e0/0.10), R1 routes the packet to VLAN 20 via e0/0.20, then S2 delivers it to PC2. PC2 replies along the reverse path.

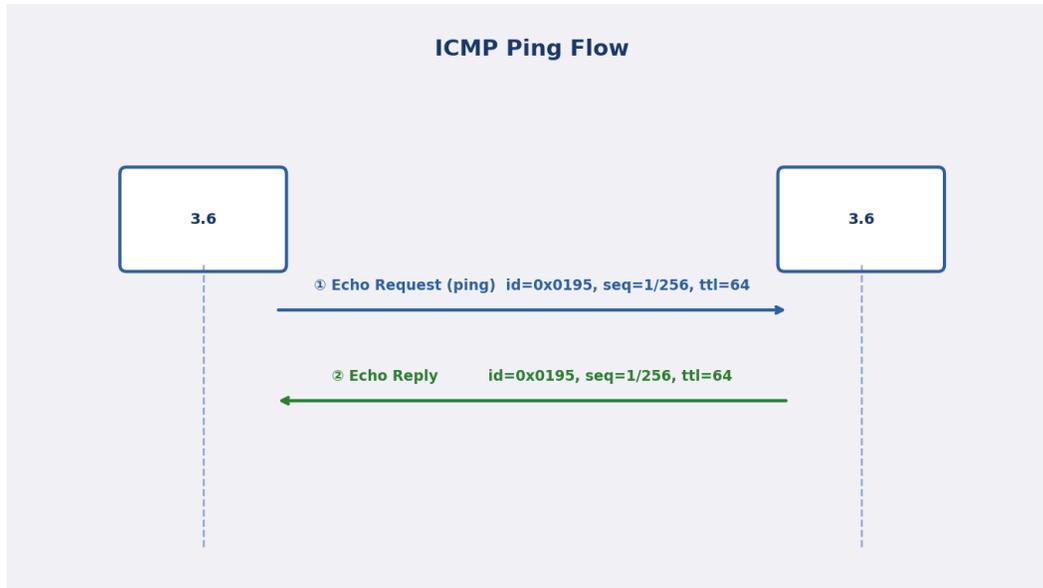


Figure 3 — ICMP Ping Flow Diagram

## 4. Ethernet Frame Structure

Each ICMP packet is encapsulated in an Ethernet frame. On trunk links between switches, an 802.1Q tag is inserted to identify the VLAN. The diagrams below show both the standard (untagged) frame and the tagged frame used on trunk ports.

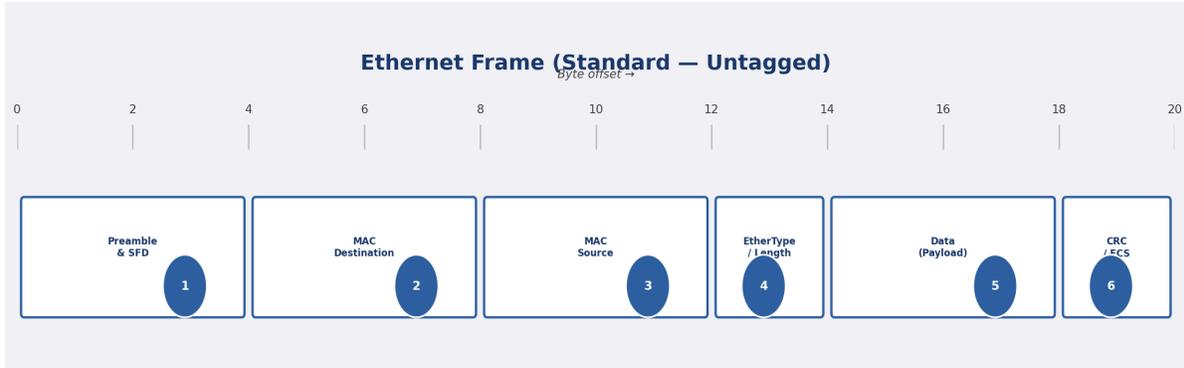


Figure 4a — Standard Ethernet Frame Layout (numbered)

Ethernet Frame Field Reference		
#	Field Name	Role / Notes
1	Preamble & SFD	7 bytes preamble + 1 byte SFD — synchronisation
2	MAC Destination	6 bytes — destination MAC address
3	MAC Source	6 bytes — source MAC address
4	EtherType / Length	2 bytes — 0x0800 = IPv4, 0x0806 = ARP
5	Data (Payload)	46-1500 bytes — encapsulated IP packet / payload
6	CRC / FCS	4 bytes — frame check sequence (error detection)

Figure 4b — Ethernet Frame Field Reference

## 5. 802.1Q Tagged Frame (Trunk Link)

On the trunk link between S1 and S2, the switch inserts a 4-byte 802.1Q tag after the source MAC address. This tag carries the VLAN ID (10 for Echo Request, 20 for Echo Reply).

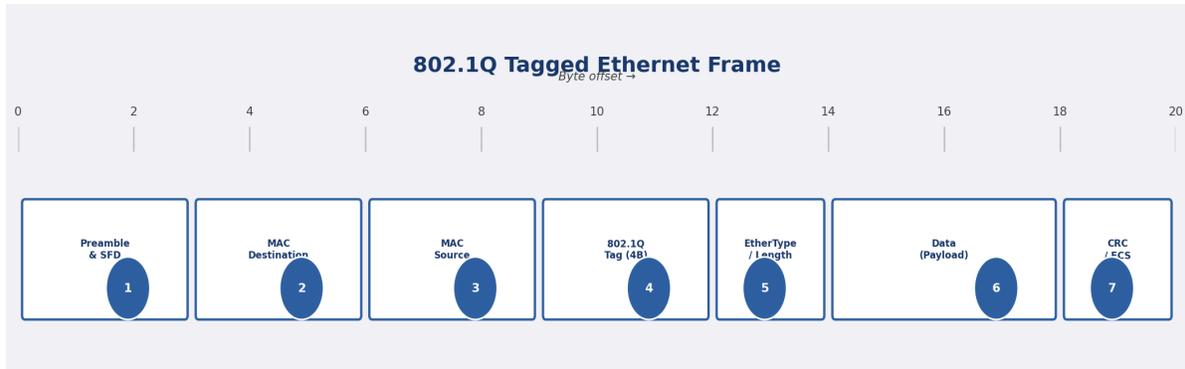


Figure 5a — 802.1Q Tagged Ethernet Frame Layout (numbered)

802.1Q Tag Field Reference		
#	Field Name	Role / Notes
1	Preamble & SFD	7 bytes preamble + 1 byte SFD — synchronisation
2	MAC Destination	6 bytes — destination MAC address
3	MAC Source	6 bytes — source MAC address
4	802.1Q Tag (4 B)	TPID 0x8100 + TCI (PCP 3-bit, DEI 1-bit, VID 12-bit)
5	EtherType / Length	2 bytes — 0x0800 = IPv4 (inner type after tag)
6	Data (Payload)	46-1500 bytes — encapsulated IP packet
7	CRC / FCS	4 bytes — frame check sequence

Figure 5b — 802.1Q Tagged Frame Field Reference

## 6. 802.1Q Tag Detail

The 4-byte tag consists of TPID (0x8100), Priority Code Point (PCP, 3 bits), Drop Eligible Indicator (DEI/CFI, 1 bit), and the 12-bit VLAN ID.

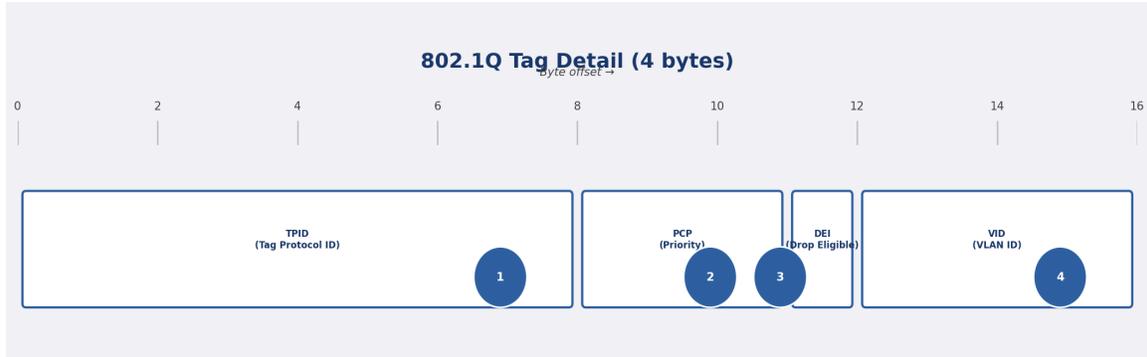


Figure 6a — 802.1Q Tag Fields (numbered)

802.1Q Tag Field Reference		
#	Field Name	Role / Notes
1	<b>TPID — Tag Protocol ID</b>	0x8100 — identifies this as an 802.1Q tagged frame
2	<b>PCP — Priority Code Point</b>	3 bits — Class of Service (0 = best effort)
3	<b>DEI — Drop Eligible</b>	1 bit — may be dropped under congestion (formerly CFI)
4	<b>VID — VLAN Identifier</b>	12 bits — VLAN ID (0-4094); e.g. 10 or 20 in this lab

Figure 6b — 802.1Q Tag Field Reference

## 7. ICMP Packet Structure

The ICMP Echo Request (M1) was sent from 188.16.0.53 to 188.17.0.54 (id=0x0195, seq=1/256, ttl=64). The Echo Reply (M2) returned from 188.17.0.54. Both packets share the same ICMP structure shown below.

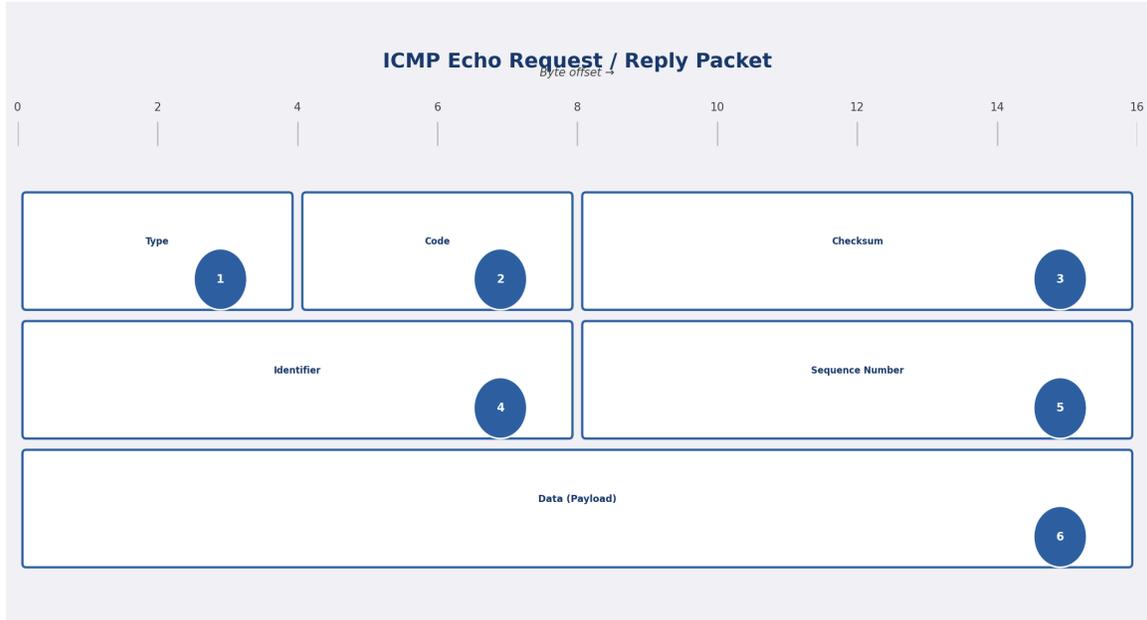


Figure 7a — ICMP Packet Layout (numbered)

ICMP Echo Field Reference		
#	Field Name	Role / Notes
1	Type	8 = Echo Request, 0 = Echo Reply
2	Code	0 — always zero for Echo Request/Reply
3	Checksum	16-bit ones-complement checksum of ICMP message
4	Identifier	0x0195 — used to match requests with replies
5	Sequence Number	Starts at 1/256, increments per ping
6	Data (Payload)	Arbitrary pattern bytes (0x00-0x3f in this capture)

Figure 7b — ICMP Field Reference Table

## 8. S1 Configuration Commands

Switch S1 creates VLAN 10 and 20, assigns e0/2 to VLAN 10 (access), and configures e0/0–e0/1 as 802.1Q trunk ports.

```
1  config terminal
2  hostname S1
3  vlan10
4  exit
5  vlan20
6  exit
7  interface e0/2
8  switchport mode access
9  switchport access vlan 10
10 interface range e0/0-1
11 switchport trunk encapsulation dot1q
12 switchport mode trunk
13 end
14 show vlan brief
```

VLAN	Name	Status	Ports
1	default	active	Et0/3, Et1/0–Et3/3
10	VLAN0010	active	Et0/2
20	VLAN0020	active	—

## 9. S2 Configuration Commands

Switch S2 creates VLAN 10 and 20, assigns e0/2 to VLAN 20 (access), and configures e0/1 as a trunk port toward S1.

```
1  config terminal
2  hostname s2
3  vlan10
4  exit
5  vlan20
6  exit
7  interface e0/2
8  switchport mode access
9  switchport access vlan 20
10 interface e0/1
11 switchport trunk encapsulation dot1q
12 switchport mode trunk
13 end
14 show vlan brief
```

VLAN	Name	Status	Ports
1	default	active	Et0/0, Et0/3, Et1/0–Et3/3
10	VLAN0010	active	—
20	VLAN0020	active	Et0/2

## 10. R1 Configuration Commands

Router R1 uses router-on-a-stick with two sub-interfaces on f0/0. e0/0.10 is the gateway for VLAN 10 (188.16.0.10); e0/0.20 is the gateway for VLAN 20 (188.17.0.20).

```
1  config terminal
2  hostname R1
3  interface f0/0
4  no shutdown
5  exit
6  interface e0/0.10
7  encapsulation dot1Q 10
8  ip address 188.16.0.10 255.255.0.0
9  interface e0/0.20
10 encapsulation dot1Q 20
11 ip address 188.17.0.20 255.255.0.0
12 end
```

Interface	IP-Address	Status	Protocol
FastEthernet0/0	unassigned	up	up
FastEthernet0/0.10	188.16.0.10	up	up
FastEthernet0/0.20	188.17.0.20	up	up