

# Lecture 7a - Inter-VLAN Routing

Type Lecture

Materials Empty

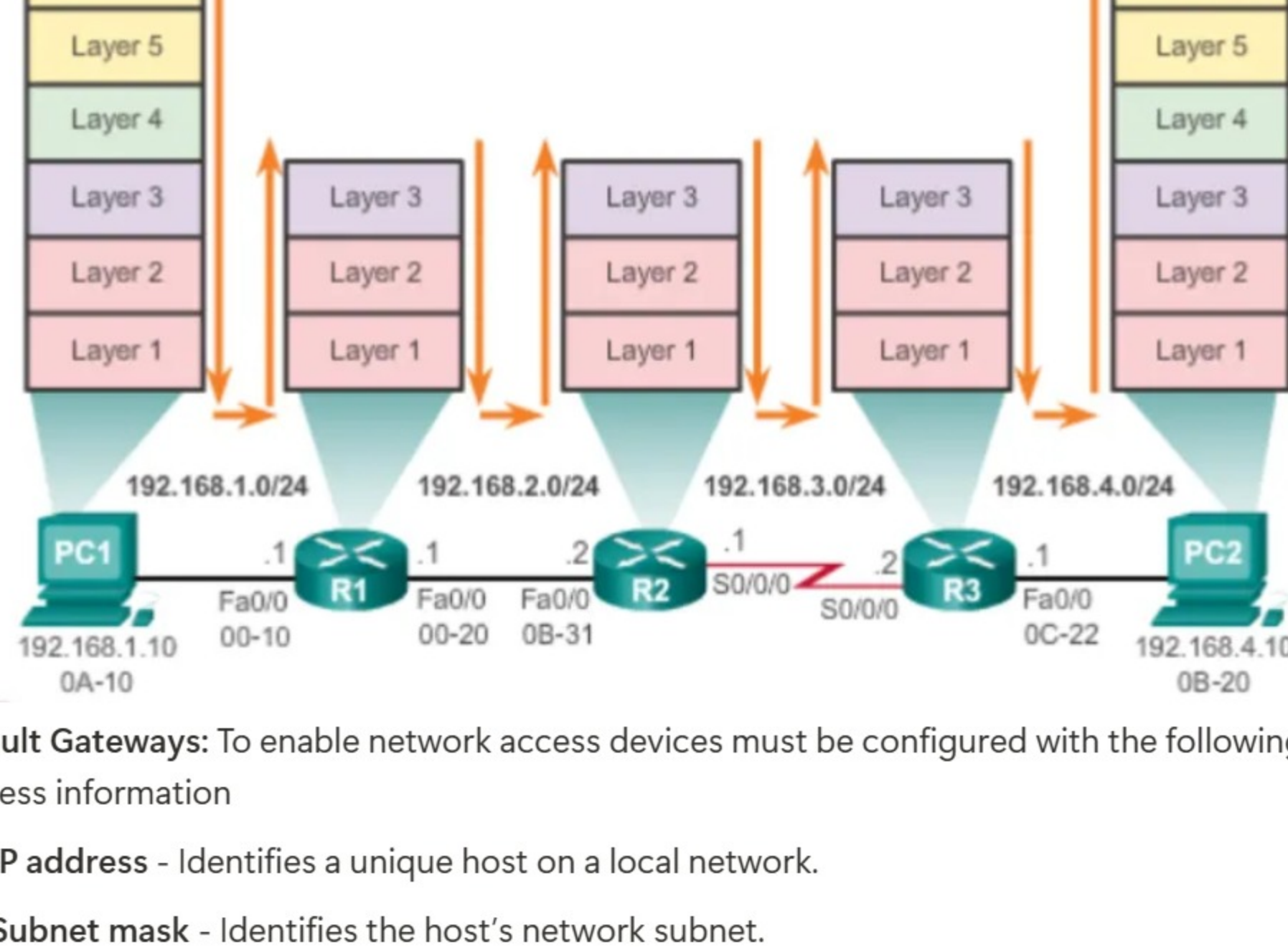
Reviewed ☒

1. Review - Routing
2. Review - VLANs
3. Inter-vlan Routing Basics
4. Router Interfaces
5. Interfaces and Subinterfaces

## 1. Review - Routing

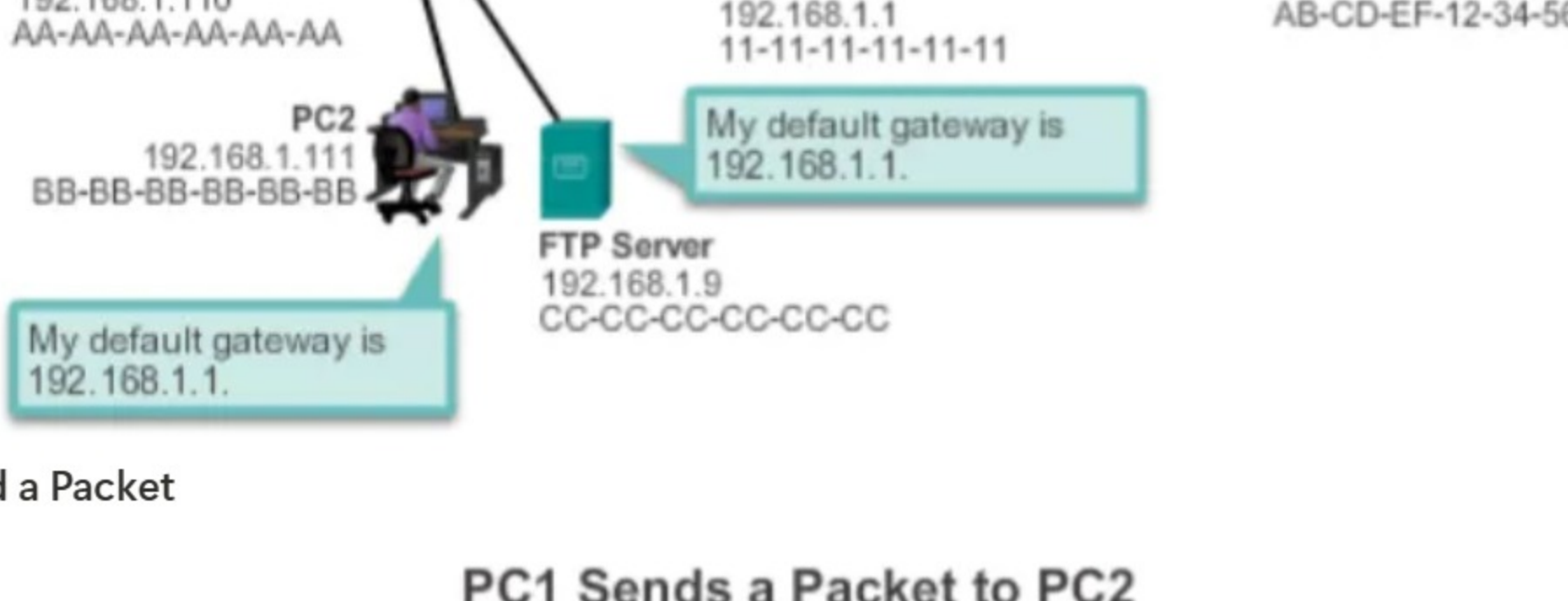
- The router is responsible for the routing of traffic between networks.
- Up and Down the Stack

### Encapsulating and De-Encapsulating Packets



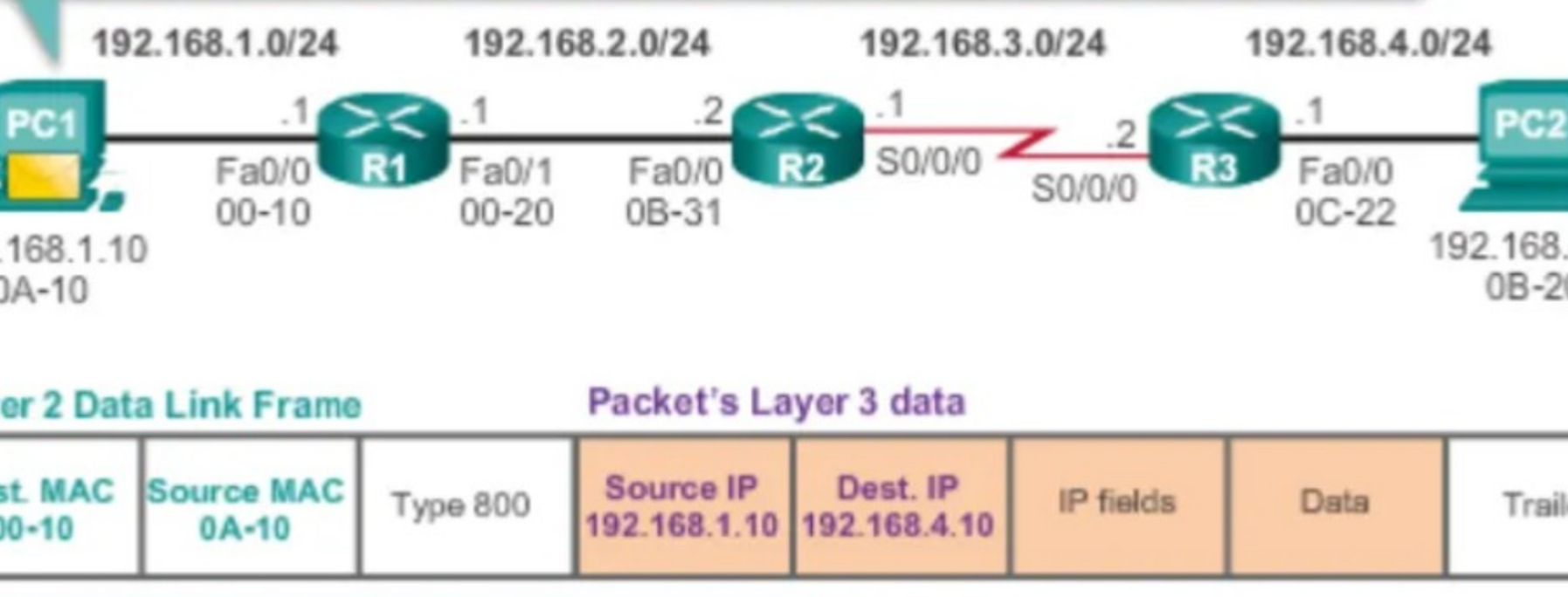
- Default Gateways:** To enable network access devices must be configured with the following IP address information
  - IP address** - Identifies a unique host on a local network.
  - Subnet mask** - Identifies the host's network subnet.
  - Default gateway** - Identifies the router a packet is sent to when the destination is not on the same local network subnet.

Destination MAC Address	Source MAC Address	Source IP Address	Destination MAC Address	Data
11-11-11-11-11-11	AA-AA-AA-AA-AA-AA	192.168.1.110	172.16.1.99	



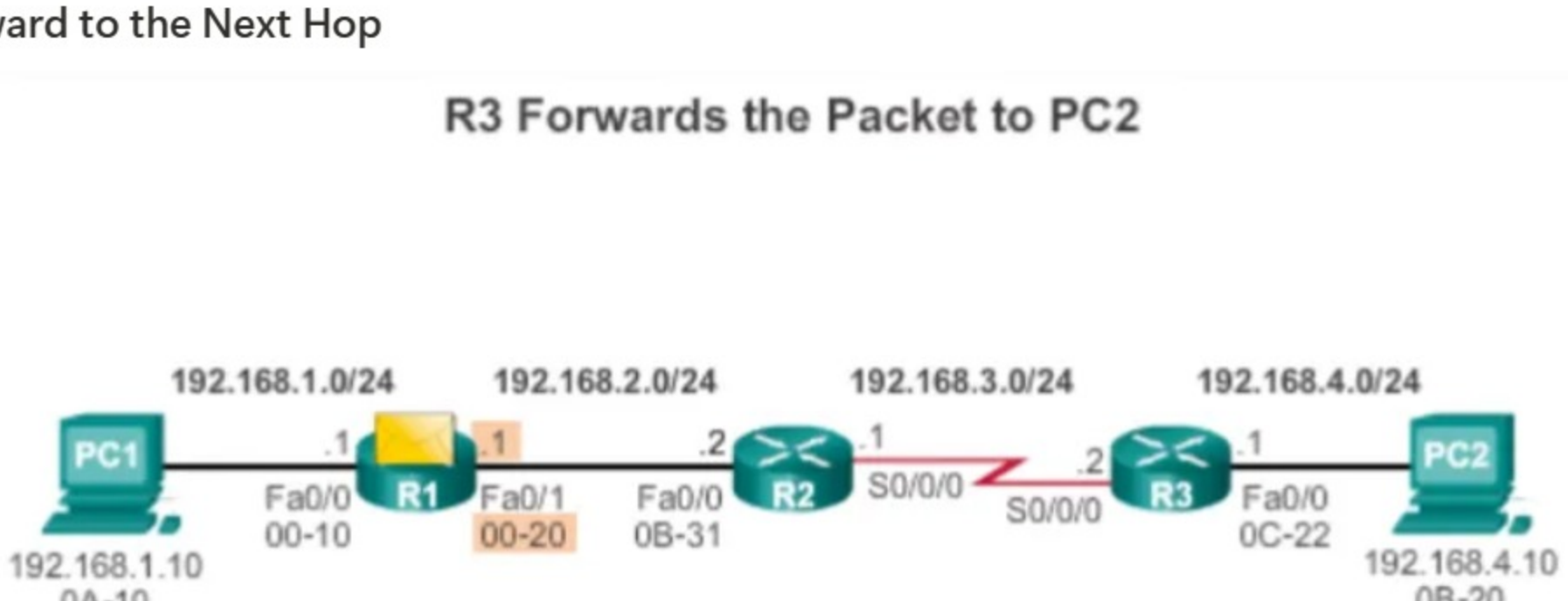
- Send a Packet

### PC1 Sends a Packet to PC2



- Forward to the Next Hop

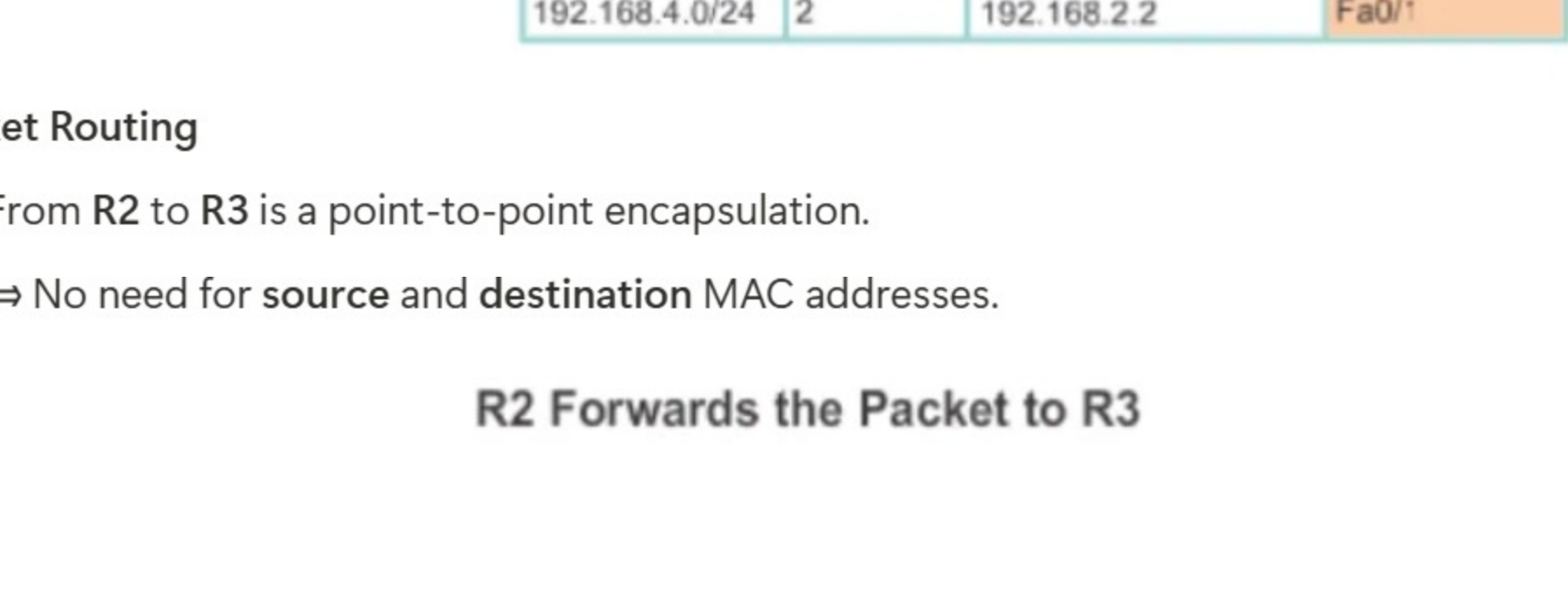
### R3 Forwards the Packet to PC2



- Packet Routing

- From R2 to R3 is a point-to-point encapsulation.
- ⇒ No need for source and destination MAC addresses.

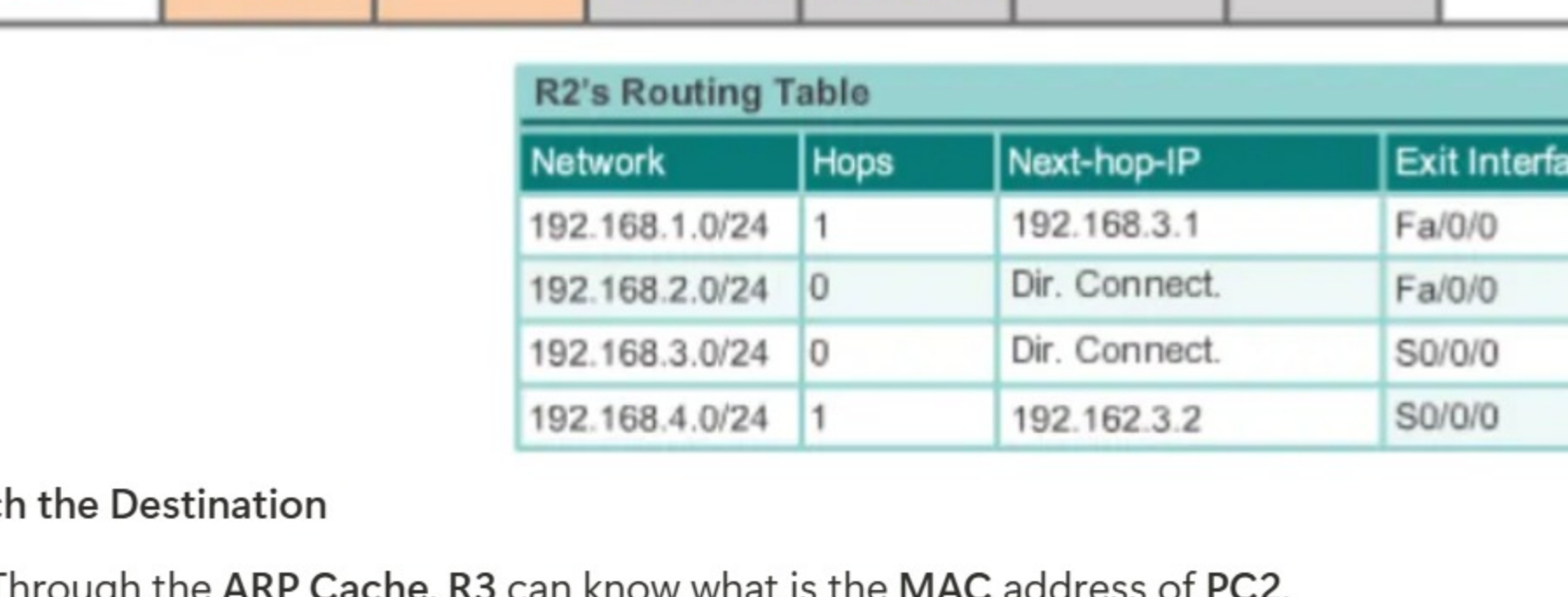
### R2 Forwards the Packet to R3



- Reach the Destination

- Through the ARP Cache, R3 can know what is the MAC address of PC2.
- If info of PC2 is not in R3's ARP Cache, it will need to send the ARP request.

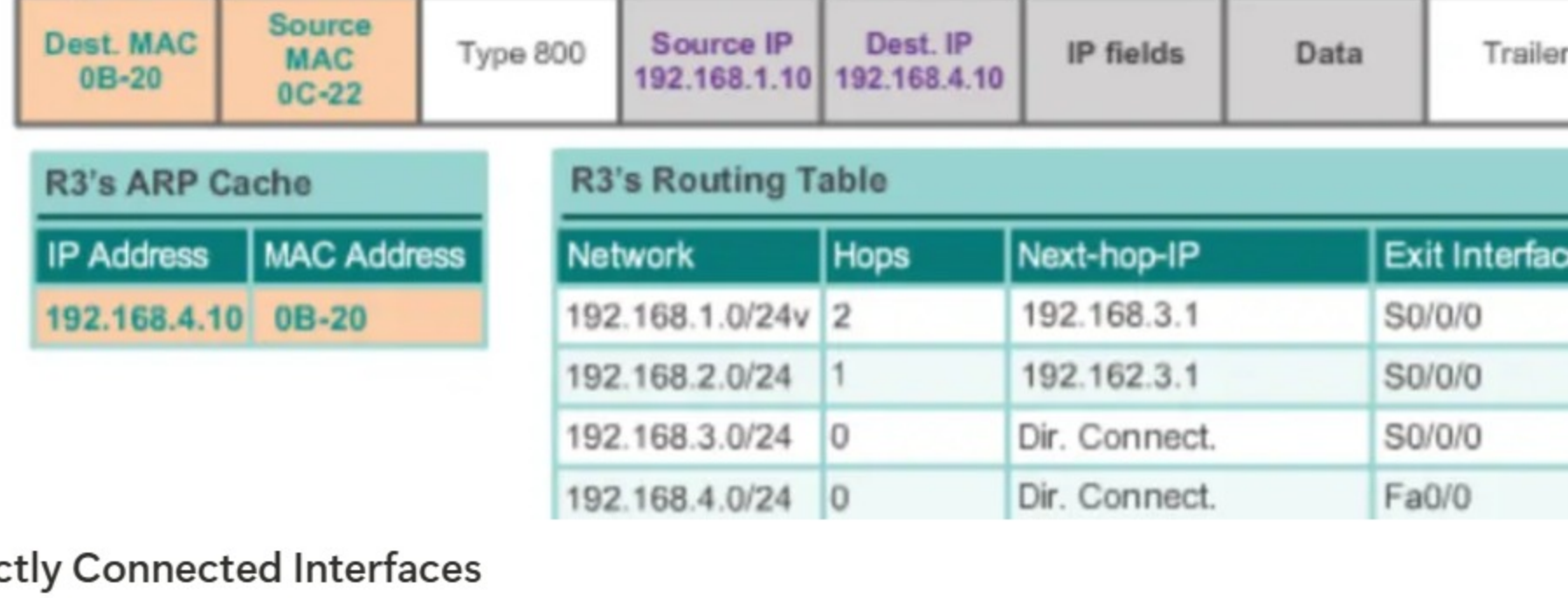
### R3 Forwards the Packet to PC2



- Directly Connected Interfaces

- In this Unit, we build "one-hop" networks. The router is connected to all subnets
- A clean router has an empty routing table
- An active, configured, directly connected interface creates two routing table entries:
  - Link Local (L)
  - Directly Connected (C)

### Directly Connected Network Entry Identifiers

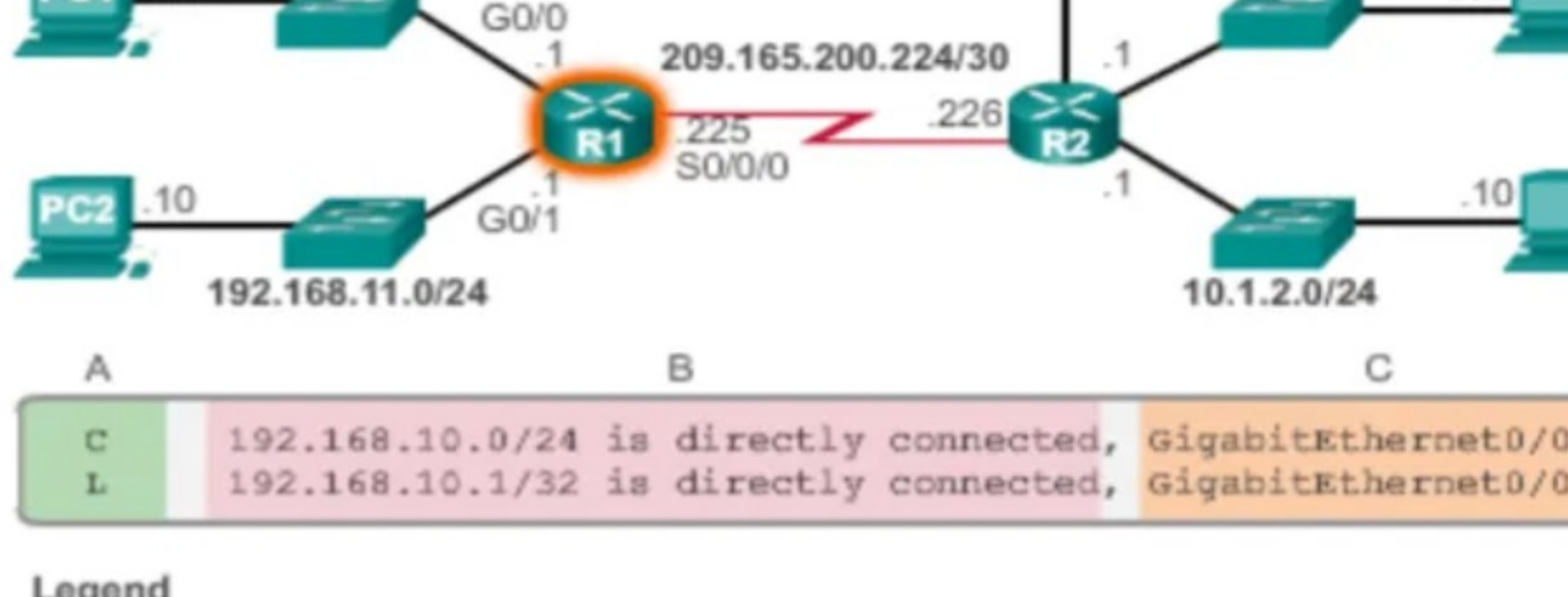


- Legend

- Identifies how the network was learned by the router.
- Identifies the destination network and how it is connected.
- Identifies the interface on the router connected to the destination network.

## 2. Review - VLANs

- Trunking Operation

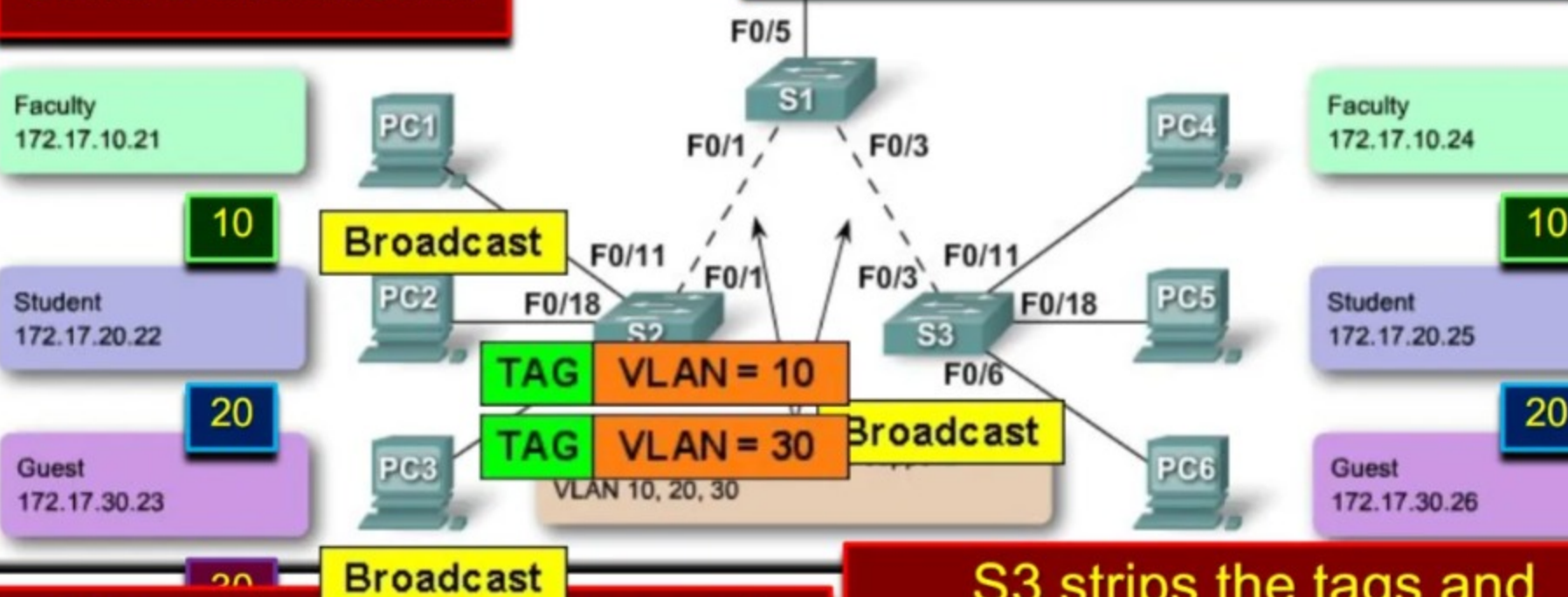


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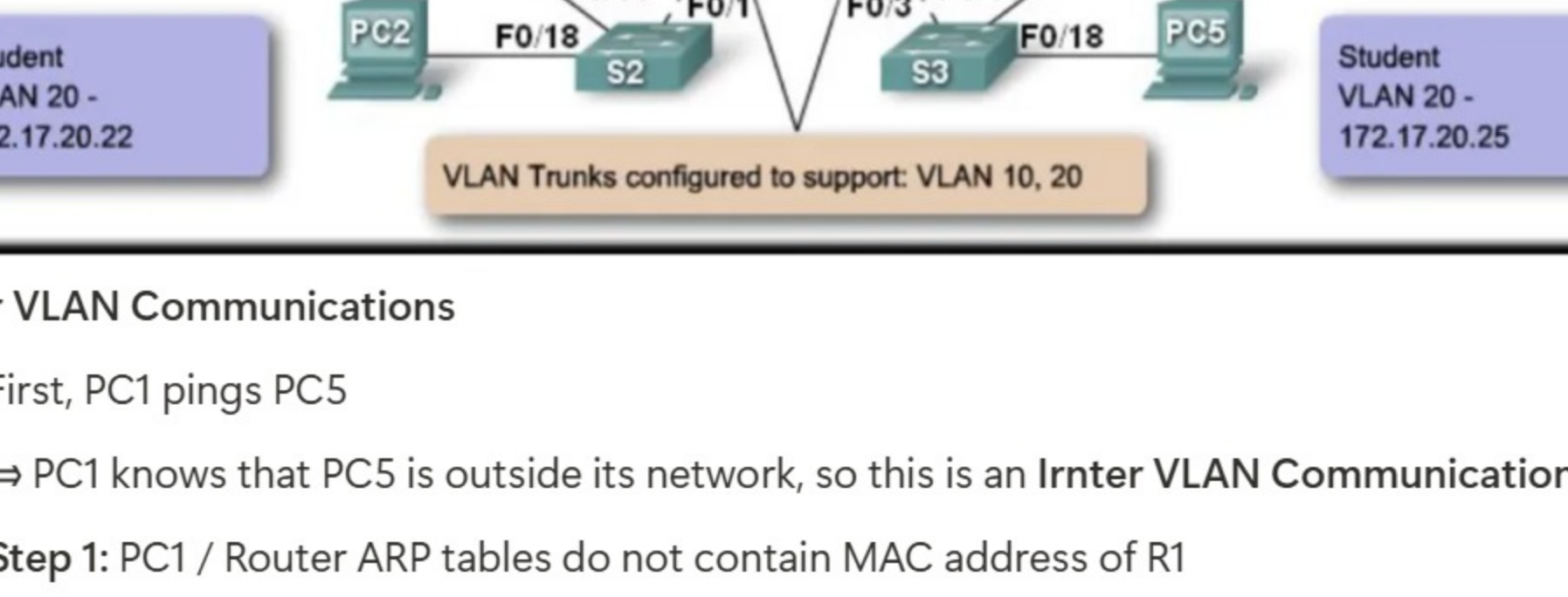


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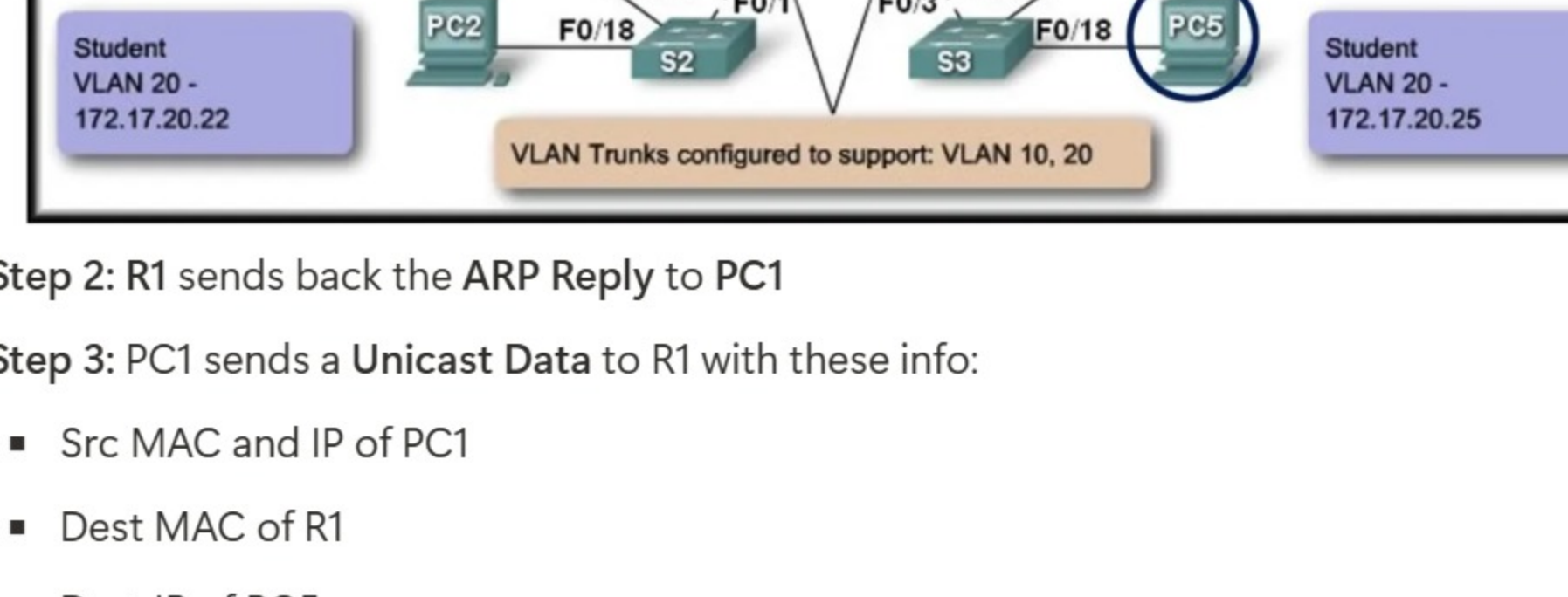
- Intra VLAN Communications

- PC1 pings PC4
- ⇒ PC1 knows that PC4 is in the same subnet, so this is an Intra VLAN Communication
- PC1 ARP table does not contain MAC address of PC4
- ⇒ It will need to send out the Broadcast ARP Request packet to all hosts that are in the same VLAN.
- An ARP Request is a Broadcast



- Inter VLAN Communications

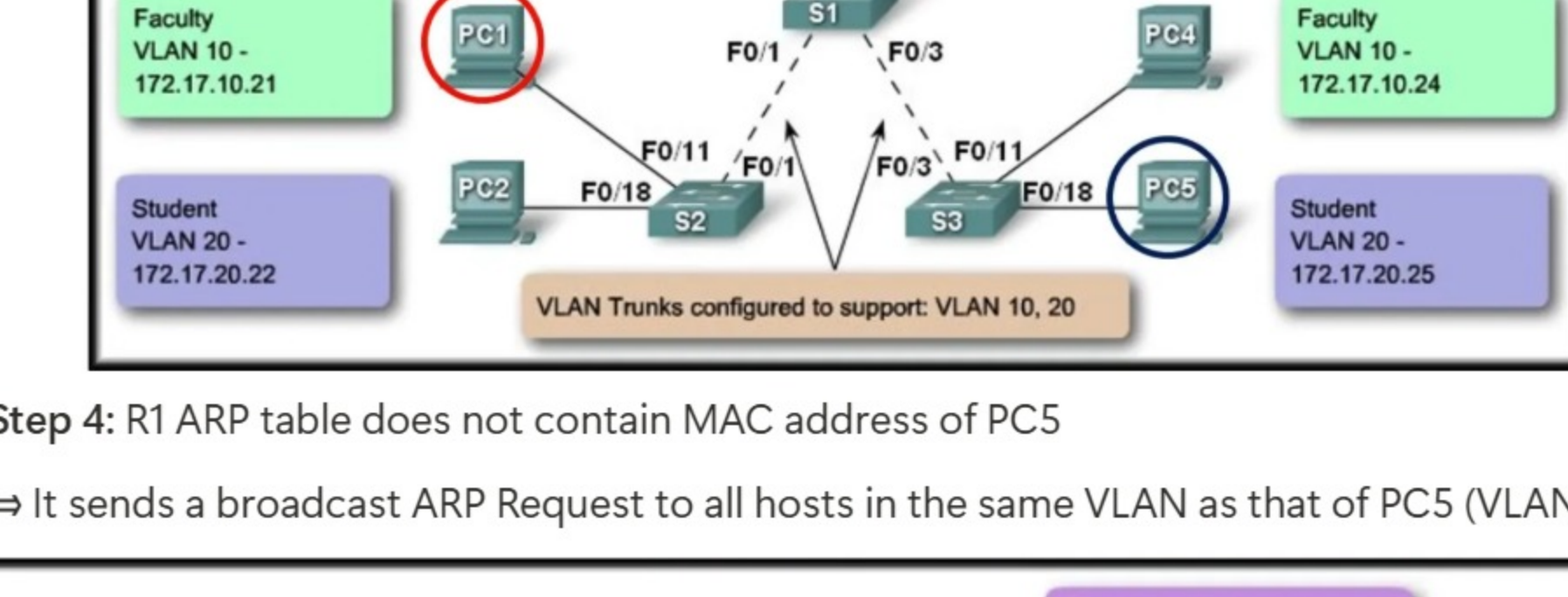
- First, PC1 pings PC5
- ⇒ PC1 knows that PC5 is outside its network, so this is an Inter VLAN Communication
- Step 1: PC1 / Router ARP tables do not contain MAC address of R1
- ⇒ PC1 first need to know the MAC address of R1 (its default gateway), so it will send out the Broadcast ARP Request packet to all hosts that are in the same VLAN.
- ⇒ This ARP Request is a layer 2 frame.



- Step 2: R1 sends back the ARP Reply to PC1

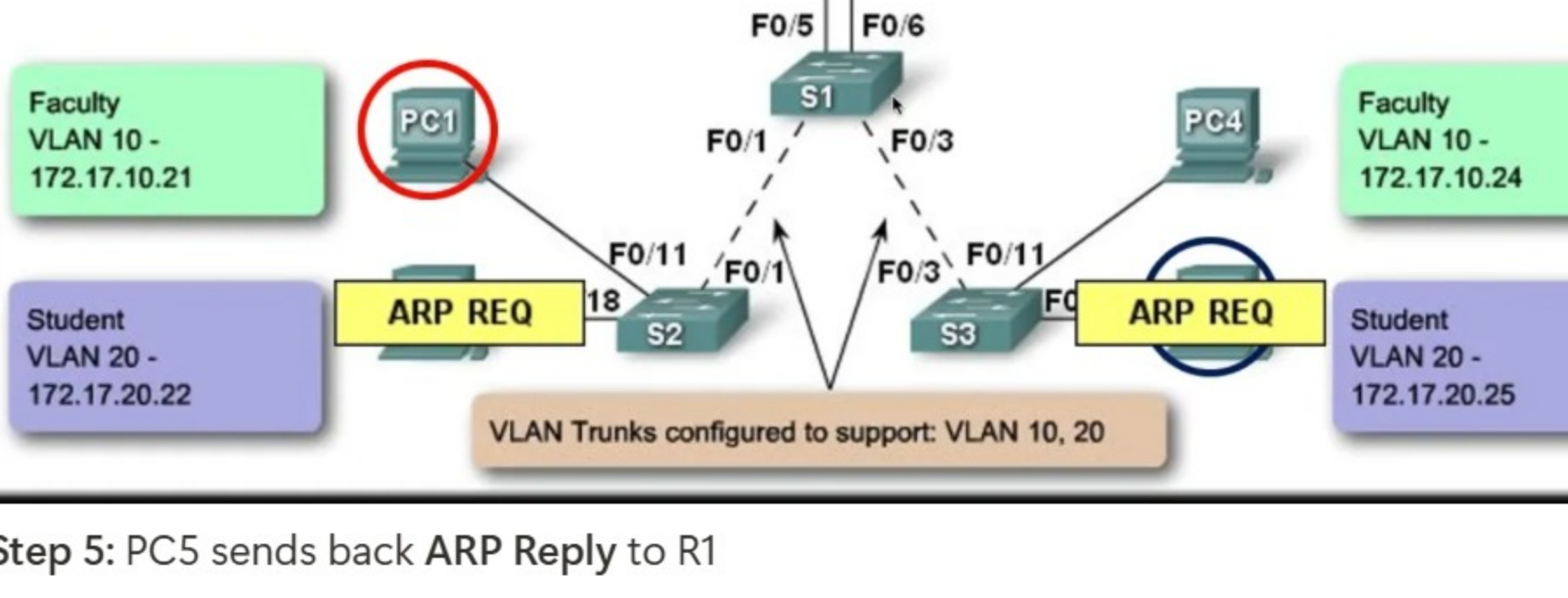
- Step 3: PC1 sends a Unicast Data to R1 with these info:

- Src MAC and IP of PC1
- Dest MAC of R1
- Dest IP of PC5



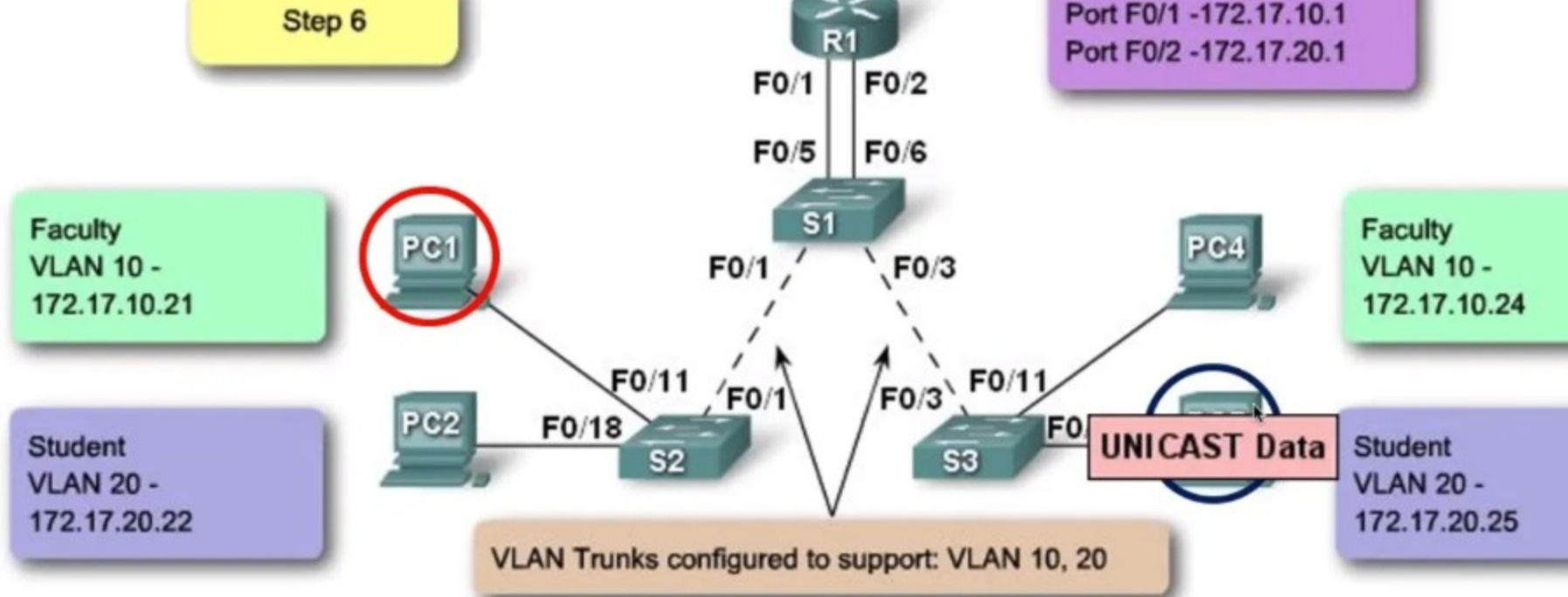
- Step 4: R1 ARP table does not contain MAC address of PC5

- ⇒ It sends a broadcast ARP Request to all hosts in the same VLAN as that of PC5 (VLAN 20).



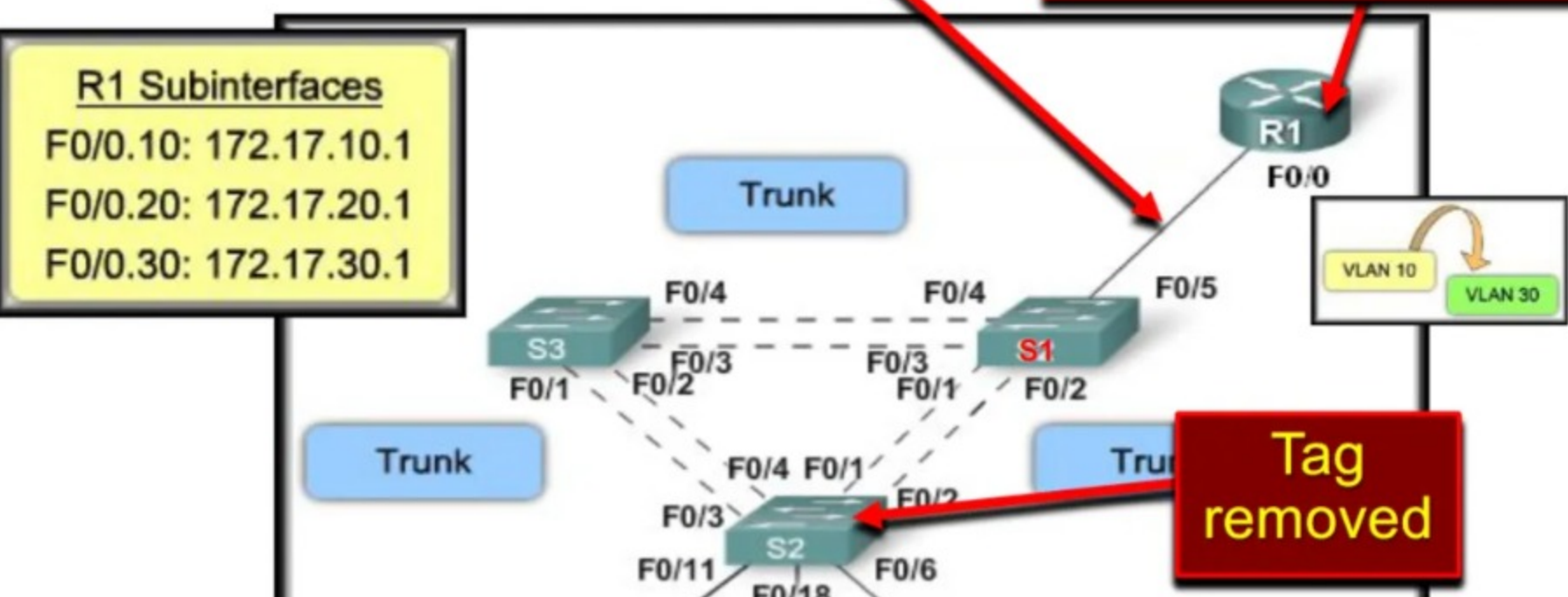
- Step 5: PC5 sends back ARP Reply to R1

- Step 6: R1 sends a Unicast Data to PC5.



## 3. Inter-vlan Routing Basics

- What is Inter-VLAN routing?
- Layer 2 switches cannot forward traffic between VLANs without the assistance of a router
- Inter-VLAN routing is a process for forwarding network traffic from one VLAN to another, using a router
- Router-on-a-Stick
  - One router interface for *all* VLANs.



## 4. Router Interfaces

- Physical and Logical interfaces
- Sub interfaces on a router can be used to divide a single physical interface into multiple logical interfaces.
- Each physical interface can have up to 65,535 logical interfaces.

## 5. Interfaces and Subinterfaces

Physical Interface	Subinterface
One physical interface per VLAN	One physical interface for many VLANs
No bandwidth contention	Bandwidth contention
Connected to access mode switch port	Connected to trunk mode switch port
More expensive	Less expensive
Less complex connection configuration	More complex connection configuration