

# FINAL EXAM REVIEW



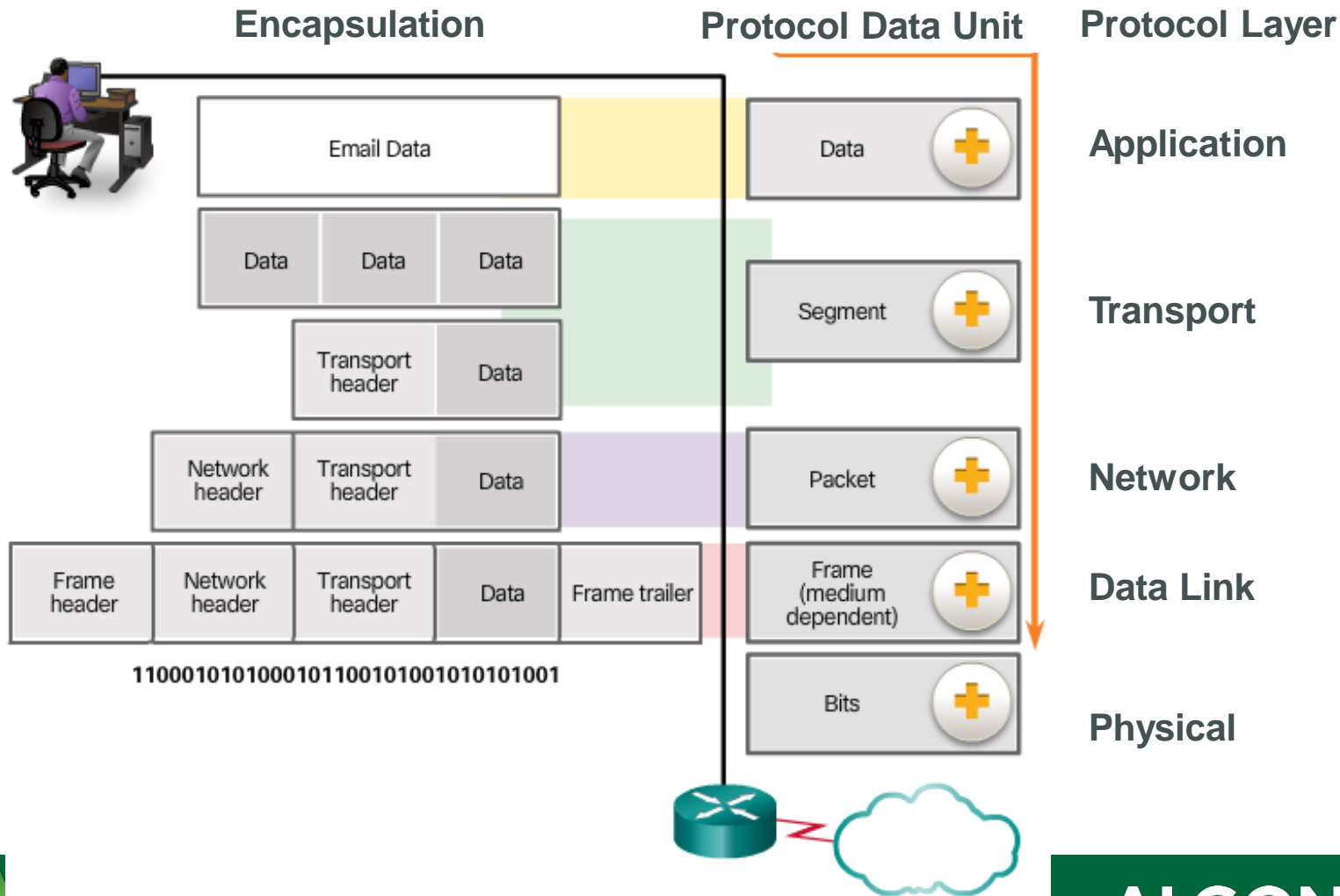
What is the name of the Protocol Data Unit at the Data Link Layer?

- A) Frame
- B) Segment
- C) Packet
- D) Block



# Protocol Data Units

- Segmentation – partition of application data into blocks of data
- A data block with its headers is called a Protocol Data Unit (PDU)

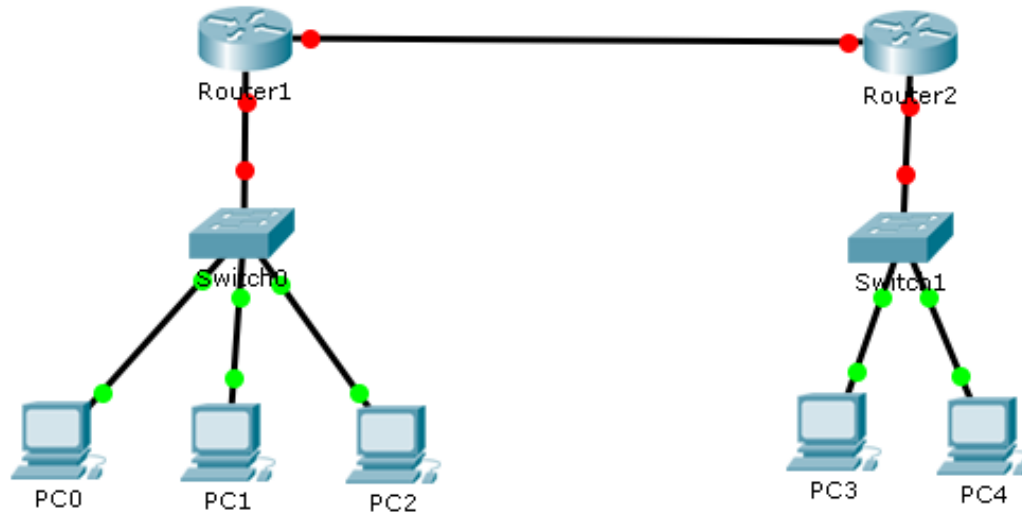


The Data Link layer encapsulates what type of PDU?

- A) Frame
- B) Segment
- C) Packet
- D) Block



How many collision domains and broadcast domains are in this network?



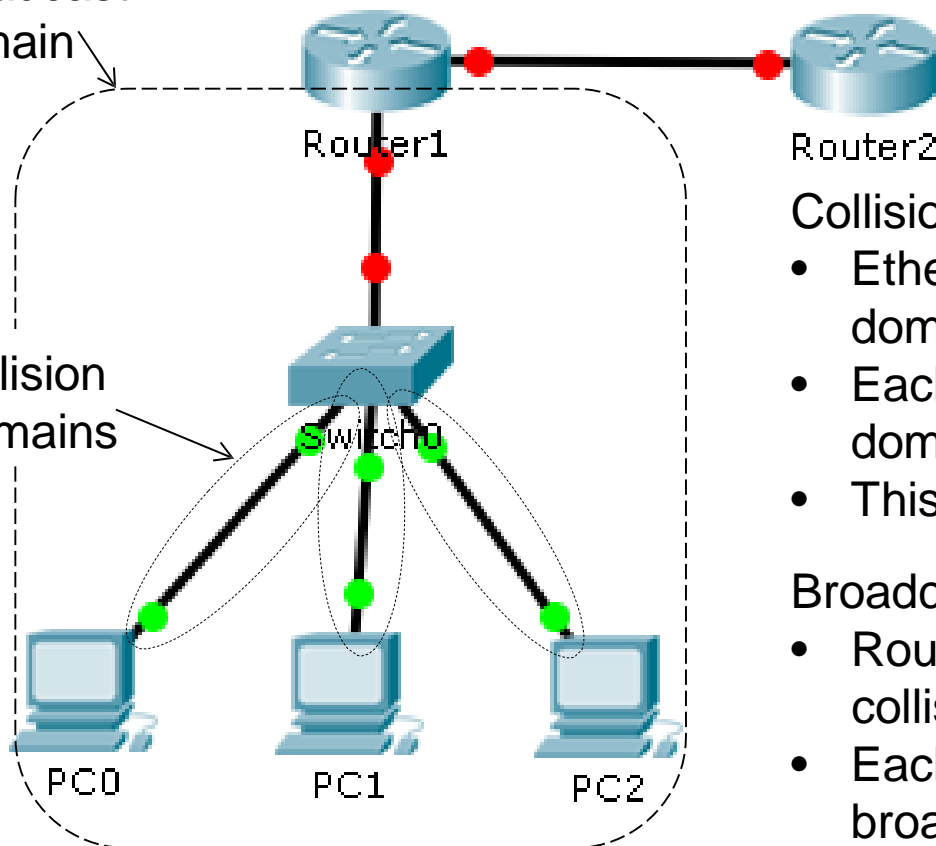
- A) 7 collision domains and 3 broadcast domains
- B) 8 collision domains and 3 broadcast domains
- C) 8 collision domains and 2 broadcast domains
- D) 5 collision domains and 3 broadcast domains



# Collision Domain & Broadcast Domain: Ethernet Switched Network

broadcast  
domain

collision  
domains



Router2

Collision Domain:

- Ethernet Switches break up collision domains into point-to-point links.
- Each Switch port forms a separate collision domain
- This is due to the switching function

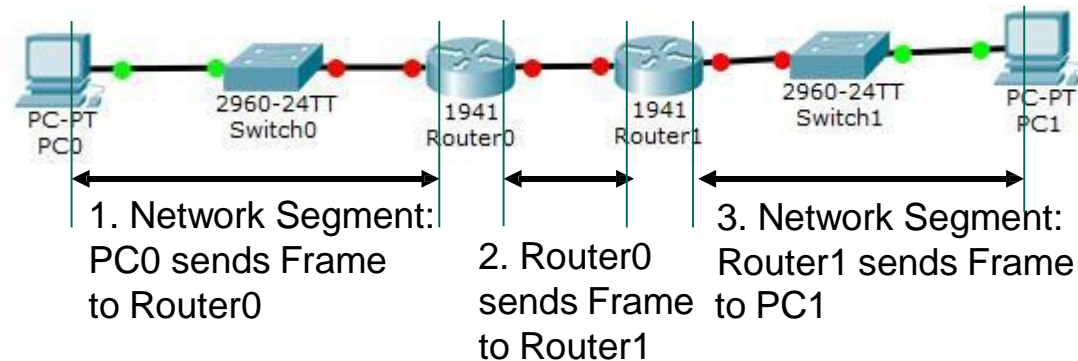
Broadcast Domain:

- Routers break up broadcast domains and collision domains.
- Each Router port forms a separate broadcast domain
- Routers do not forward broadcasts
- The switch prevents collisions in the broadcast domain.

This is important for capacity planning

# How Many Destination MAC Addresses

## How Many ARP Requests



IP Addresses are added during encapsulation at which layer?

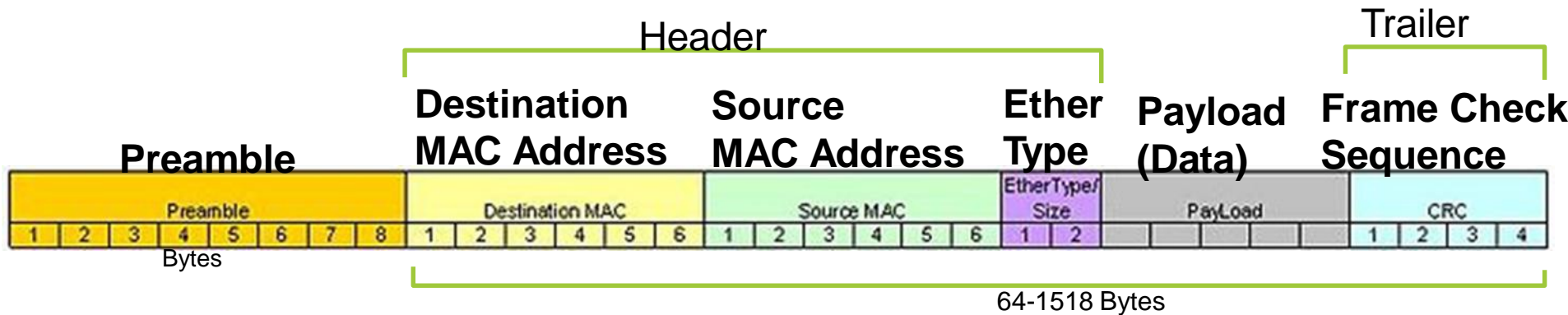
MAC Addresses are added during encapsulation at which layer?





# Ethernet Encapsulation

## IEEE 802.3 Standard / Ethernet II



**Preamble:** sequence of 10101 for bit synchronization

**Destination and Source MAC Address:**

**EtherType:** Identifies upper layer Protocol, see table below for examples

**Frame Check Sequence:** Redundant information for error detection

EtherType for some notable protocols

EtherType	Protocol
0x0800	Internet Protocol version 4 (IPv4)
0x0806	Address Resolution Protocol (ARP)
0x0842	Wake-on-LAN <sup>[8]</sup>
0x22F3	IETF TRILL Protocol
0x6003	DECnet Phase IV
0x8035	Reverse Address Resolution Protocol

What packet sequence does TCP use to set up a connection?

What packet sequence does TCP use to take down a connection?



What does traceroute provide that ping does not?

What field in the incoming packet does a router use to forward it to the outgoing interface.



From the Command prompt of your PC, what command can you use to discover the MAC address of your gateway interface?

A) `arp -d *`

B) `arp -a`

C) `arp -c`

D) `ipconfig /arp`



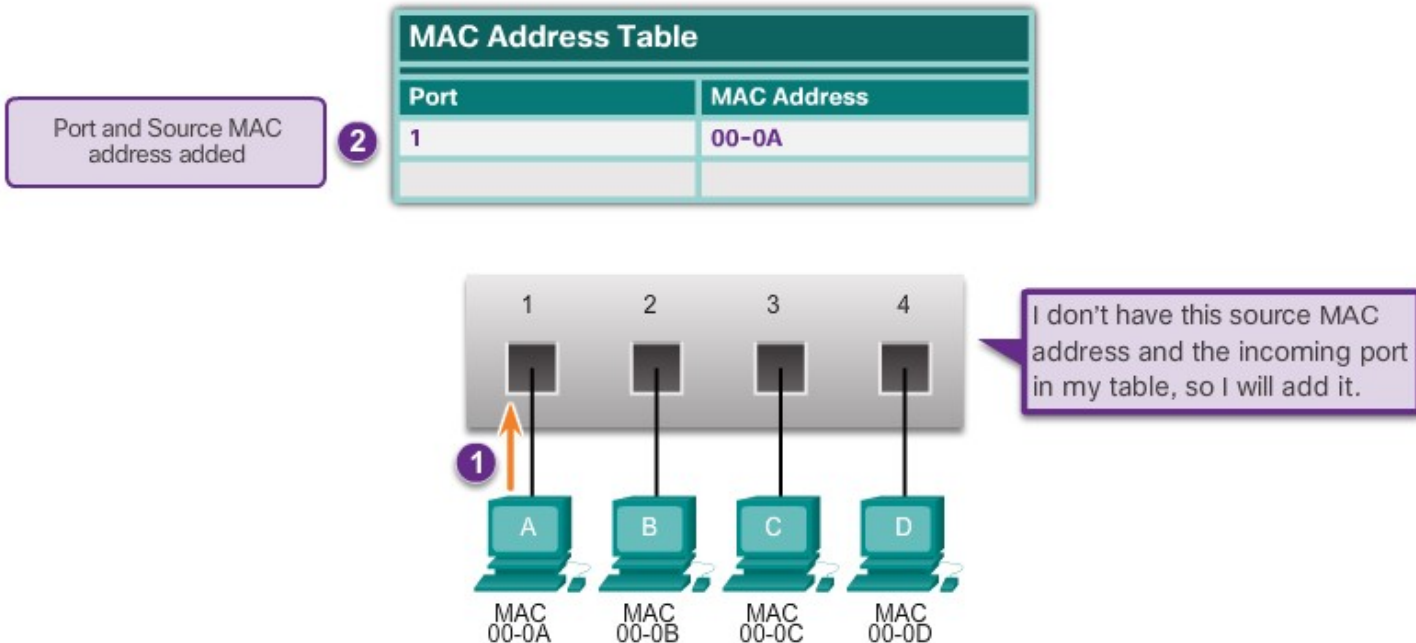
What is the basic operation of an Ethernet Switch?



# Layer 2 Switching - 1

## Step 1: Learn MAC Address

Learn: Examine Source MAC Address



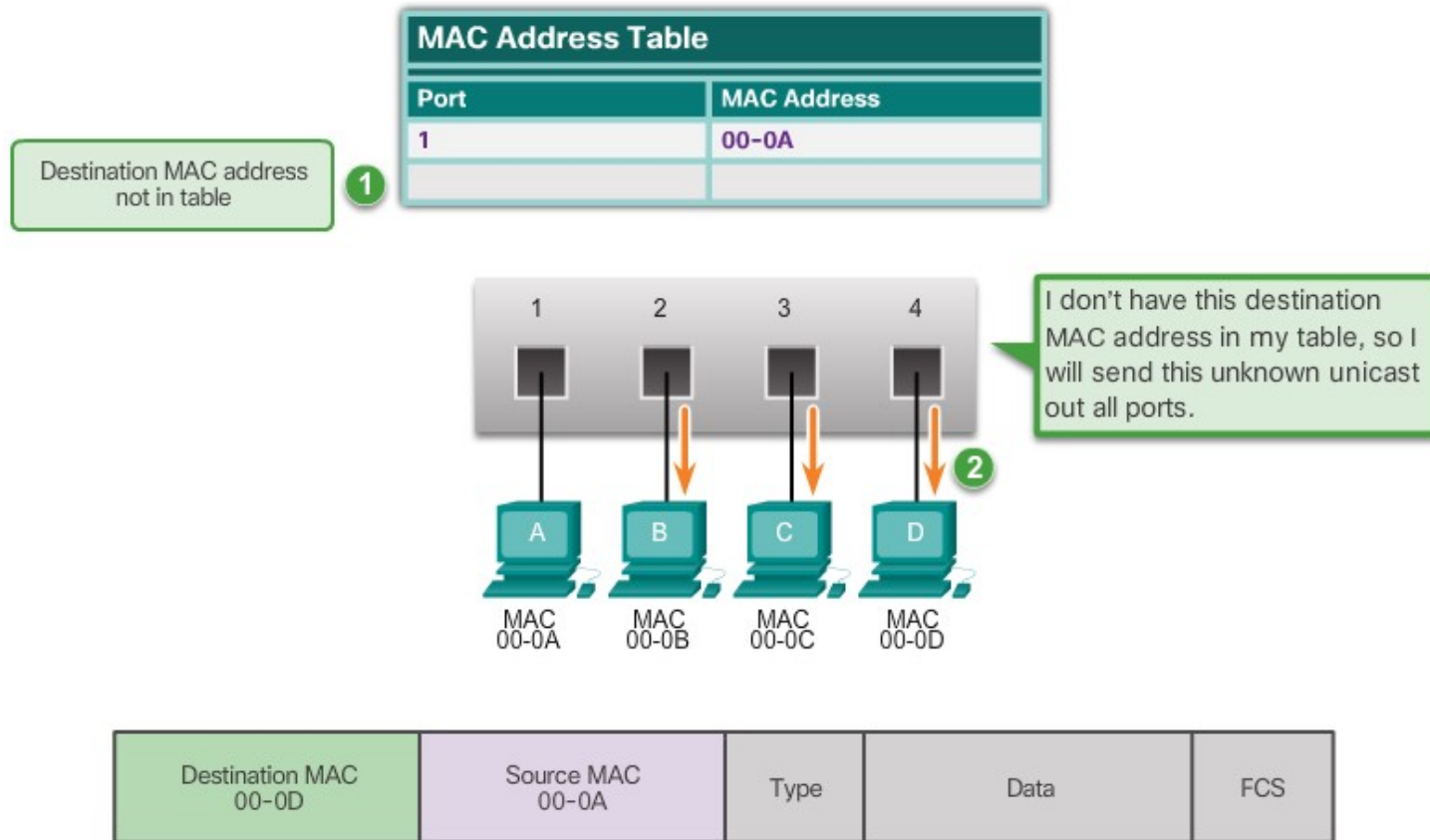
Destination MAC 00-0D	Source MAC 00-0A	Type	Data	FCS
--------------------------	---------------------	------	------	-----

MAC addresses are shortened for demonstration purposes.

# Layer 2 Switching - 2

## Step 2: Forward the Frame

### Forward: Examine Destination MAC Address

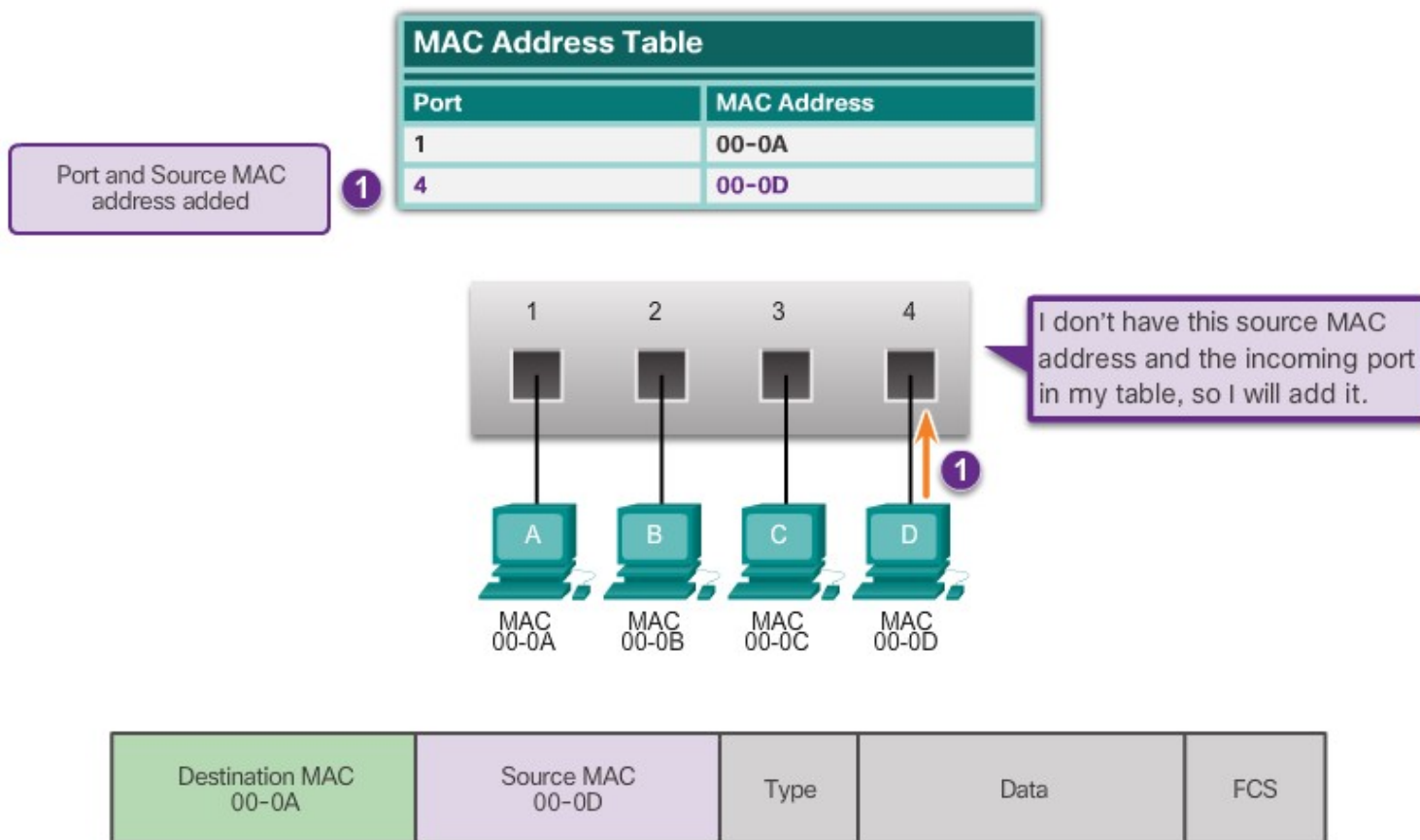


MAC addresses are shortened for demonstration purposes.

# Layer 2 Switching – 3

## Step 1: Learn MAC Address

PC-D sends a frame back to PC-A and the switch learns PC-D's MAC address.

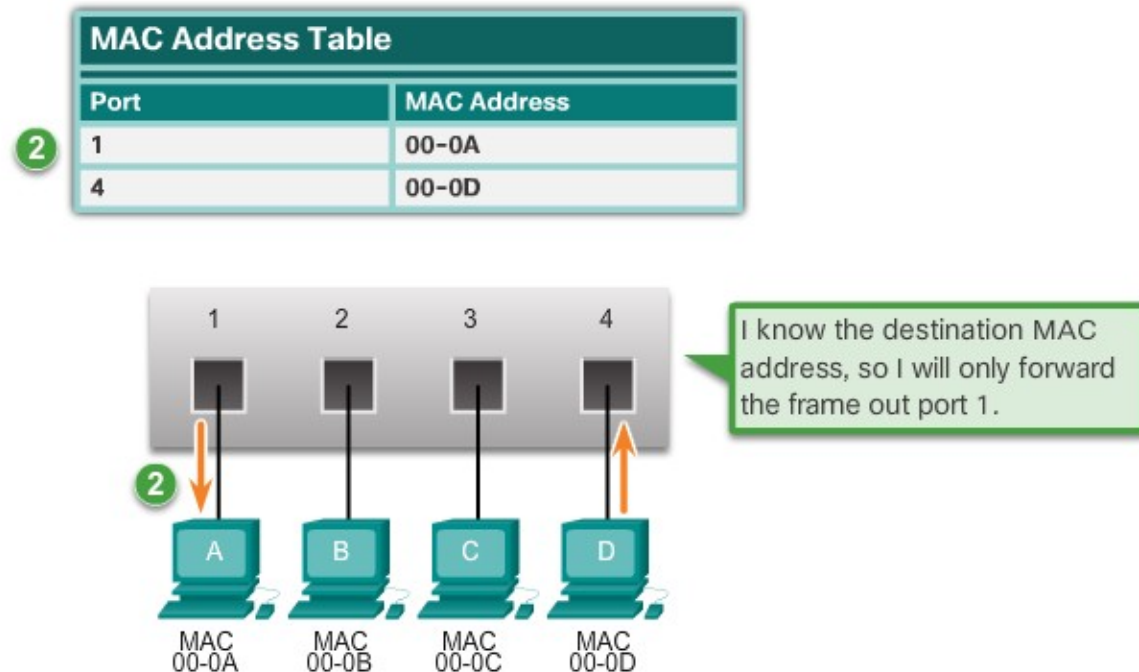




# Layer 2 Switching - 4

## Step 1: Forward the Frame

Since the Switch MAC Address table contains PC-A's MAC Address, it sends the frame out only port 1.



Destination MAC 00-0A	Source MAC 00-0D	Type	Data	FCS
--------------------------	---------------------	------	------	-----

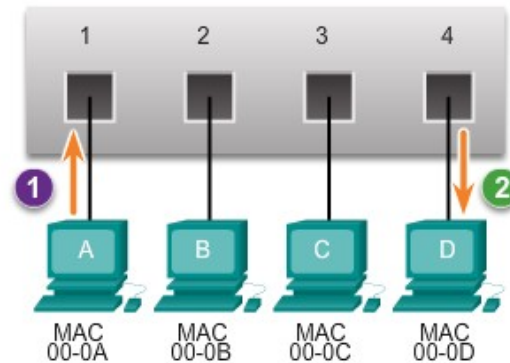


# Layer 2 Switching – Forward Only

## Step 1: Forward the Frame

PC-A sends another frame to PC-D. The switch's table now contains PC-D's MAC address, so it sends the frame out only port 4.

MAC Address Table	
Port	MAC Address
1	00-0A
4	00-0D



Destination MAC 00-0D	Source MAC 00-0A	Type	Data	FCS
--------------------------	---------------------	------	------	-----

What are the four messages involved in a DHCP configuration?

Which commands are based on the ICMP protocol?



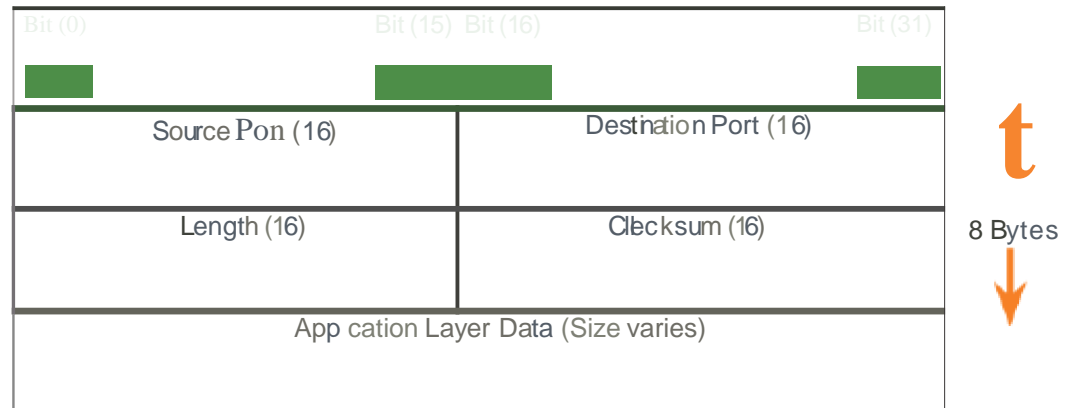
# TCP Features

- Segmentation
- Connection-Oriented
  - Syn-Syn/Ack-Ack; Fin-Ack-Fin-Ack
- Ordered Delivery
  - Sequence Numbers
- Reliable Service
  - Acknowledgement
- Flow and Congestion Control
  - Window and Rate Control
- Multiplexing
  - Ports



# UDP Header

- UDP is a stateless protocol. Neither the sender or the receiver is obligated to keep track of the state of the communication session.
- Reliability must be handled by the application.
- Live video and voice applications must quickly deliver data and can tolerate some data loss; they are perfectly suited to UDP.
- The pieces of communication in UDP are called datagrams.
- These datagrams are sent as best-effort by the transport layer protocol.
- UDP has a low overhead of 8 bytes.



# Wireshark Capture Questions:

- Application Protocols
- Layer 2, Layer 3 Addressing
- Port Numbers
- TCP session



What are the layers of the OSI protocol stack?

What are components of a MAC address?



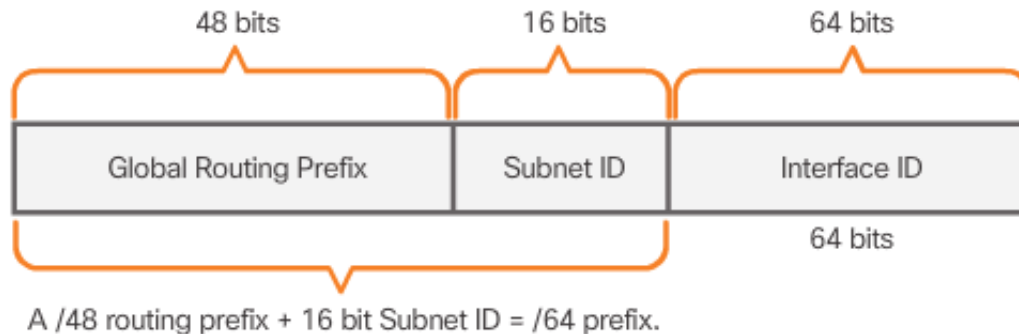
Explain the operation of arp and options.

Routing is done at which layer?

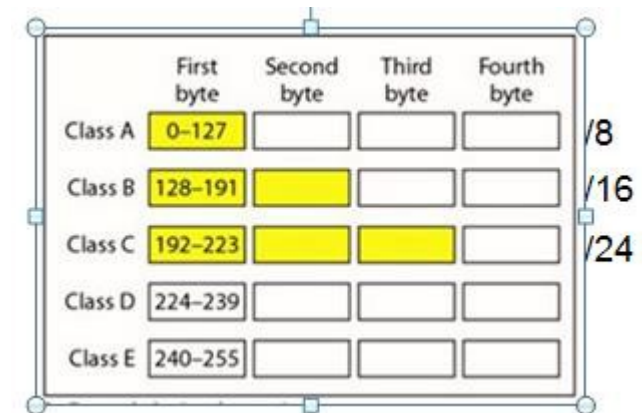




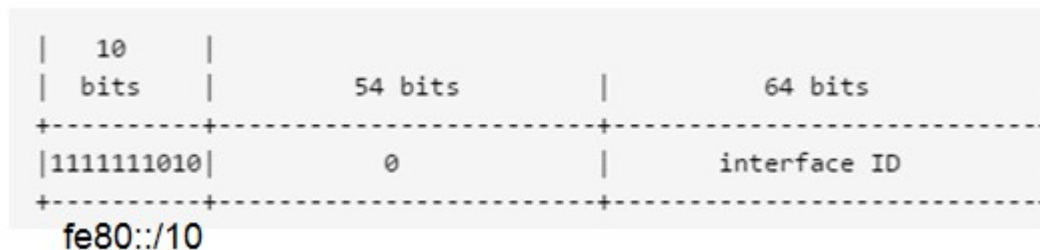
# Information Sheet



IPv6 Global Unicast Format



Address Classes



IPv6 Link Local Format

Class	Starting IP Address	Ending IP Address	# of Hosts
A	10.0.0.0	10.255.255.255	16,777,216
B	172.16.0.0	172.31.255.255	1,048,576
C	192.168.0.0	192.168.255.255	65,536

Private Addresses



What is the purpose of the Sequence Number and Acknowledgement Numbers in the TCP and UDP protocols?



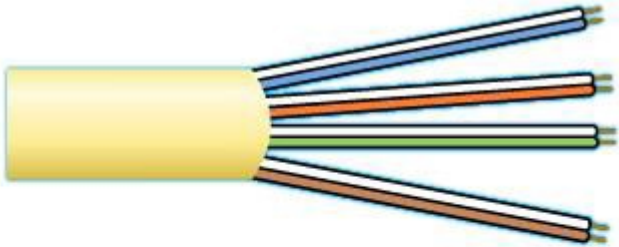
Identify application layer protocols that use TCP and UDP.



TTL is found in which network layer?



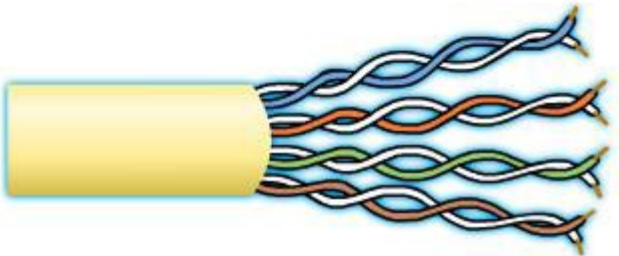
# UTP Cabling Standards



Category 3 Cable (UTP)

## Category 3 Cable (UTP)

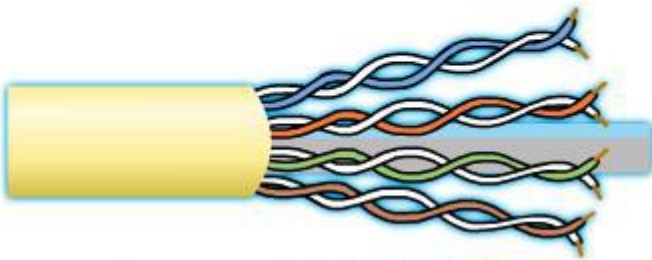
- Used for voice communication
- Most often used for phone lines



Category 5 and 5e Cable (UTP)

## Category 5 and 5e Cable (UTP)

- Used for data transmission
- Cat5 supports 100 Mb/s and can support 1000 Mb/s, but it is not recommended
- Cat5e supports 1000 Mb/s



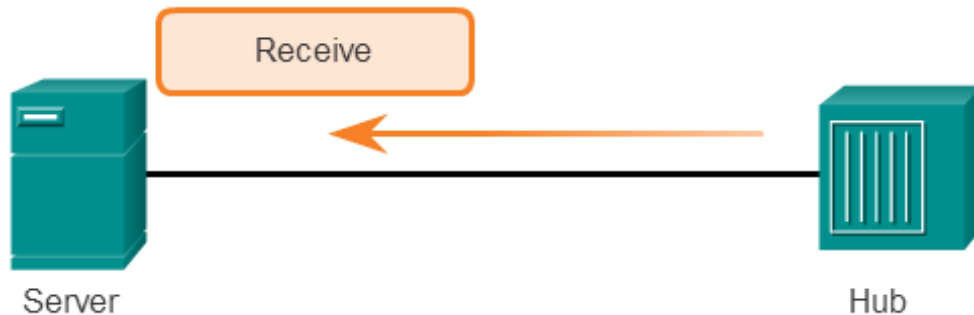
Category 6 Cable (UTP)

## Category 6 Cable (UTP)

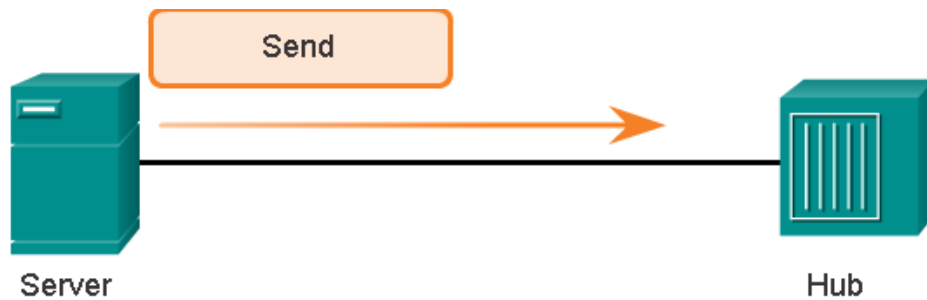
- Used for data transmission
- An added separator is between each pair of wires allowing it to function at higher speeds
- Supports 1000 Mb/s - 10 Gb/s, though 10 Gb/s is not recommended



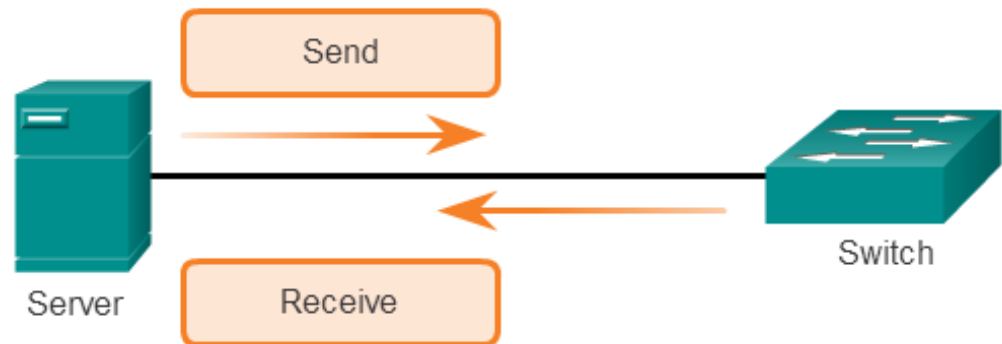
# Half and Full Duplex



Half-Duplex Communication

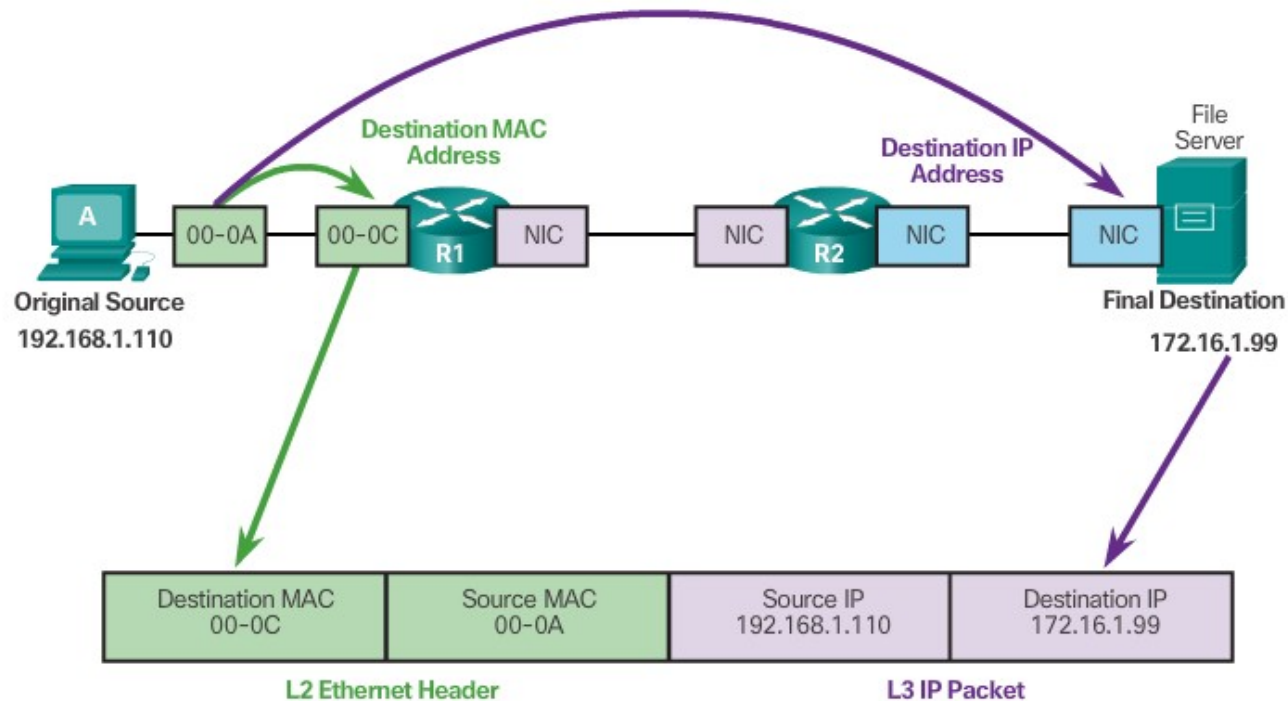


Full-Duplex Communication



# Destination on a Remote Network

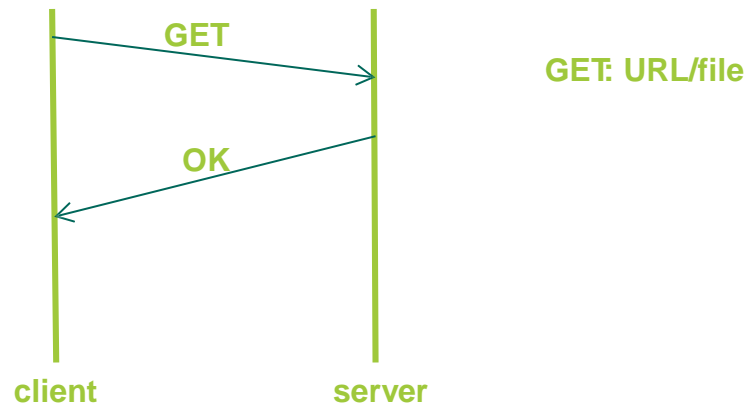
## Communicating to a Remote Network



MAC addresses are shortened for demonstration purposes.

# HTTP(S) – Hypertext Transfer Protocol

- Purpose: Transfer a file (resource). Resources include HTML files, audio, video, etc.
- Model: client / server
- Transport Layer: TCP
- Well Known Port Number: 80 (unencrypted); 443 (secured with TLS)
- Example Message Sequence:



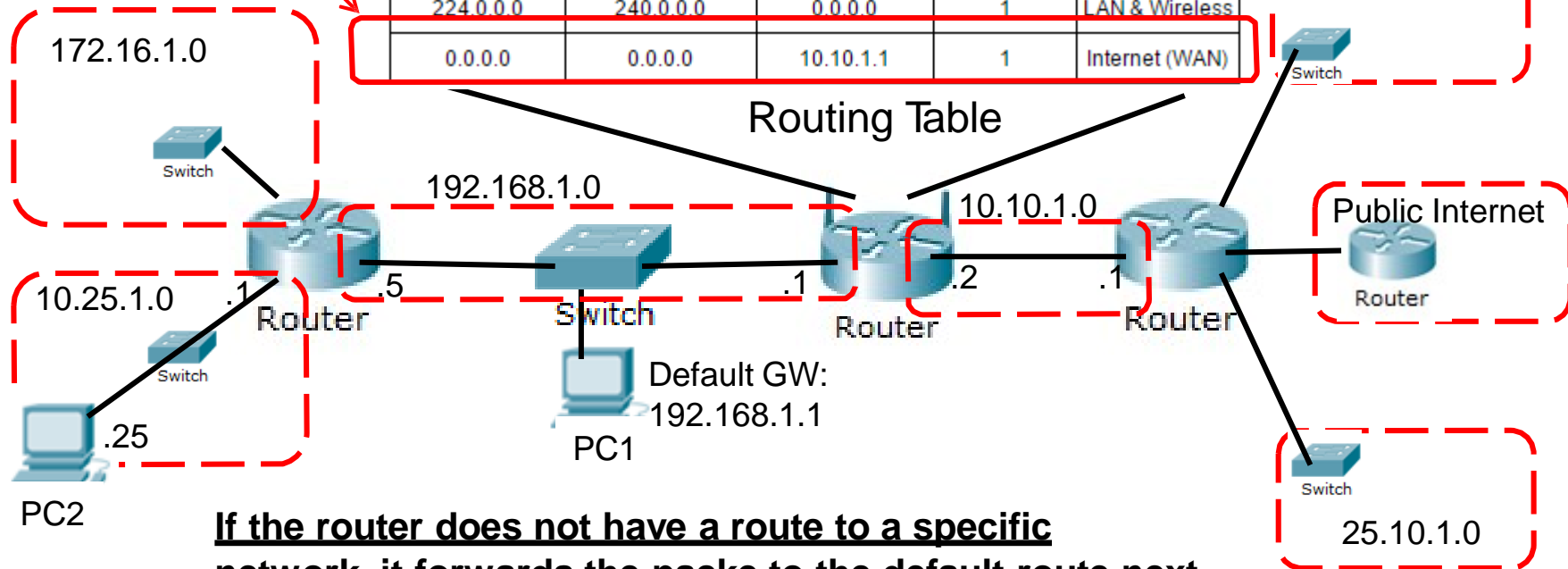


# Routing Table

Connected Networks

Destination LAN IP	Subnet Mask	Gateway	Hop Count	Interface
25.10.1.0	255.255.255.0	10.10.1.1	1	Internet (WAN)
192.168.1.0	255.255.255.0	0.0.0.0	1	LAN & Wireless
10.10.1.0	255.255.255.0	0.0.0.0	1	Internet (WAN)
172.16.1.0	255.255.255.0	192.168.1.5	1	LAN & Wireless
10.25.1.0	255.255.255.0	192.168.1.5	1	LAN & Wireless
30.10.2.0	255.255.255.0	10.10.1.1	1	Internet (WAN)
224.0.0.0	240.0.0.0	0.0.0.0	1	LAN & Wireless
0.0.0.0	0.0.0.0	10.10.1.1	1	Internet (WAN)

Default Route

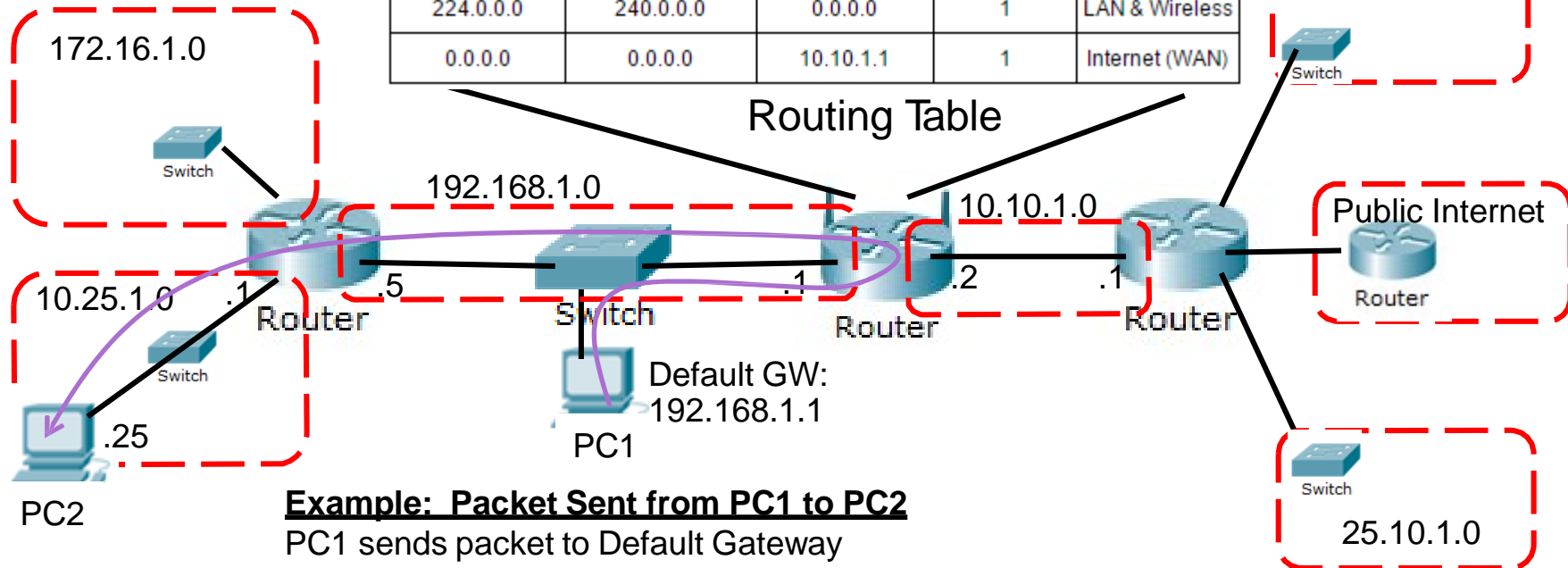


**If the router does not have a route to a specific network, it forwards the packe to the default route next-hop address.**

# Forwarding to a Remote Network

Connected Networks

Destination LAN IP	Subnet Mask	Gateway	Hop Count	Interface
25.10.1.0	255.255.255.0	10.10.1.1	1	Internet (WAN)
192.168.1.0	255.255.255.0	0.0.0.0	1	LAN & Wireless
10.10.1.0	255.255.255.0	0.0.0.0	1	Internet (WAN)
172.16.1.0	255.255.255.0	192.168.1.5	1	LAN & Wireless
10.25.1.0	255.255.255.0	192.168.1.5	1	LAN & Wireless
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224.0.0.0	240.0.0.0	0.0.0.0	1	LAN & Wireless
0.0.0.0	0.0.0.0	10.10.1.1	1	Internet (WAN)



## Example: Packet Sent from PC1 to PC2

PC1 sends packet to Default Gateway

Router forwards packet to 192.168.1.5 based on Routing Table lookup

Router forwards packet to egress interface

Router does ARP to get PC2 MAC Address

Router egress interfaces forwards frame to PC2

# Compress and Decompress IPv6 Address?



What does NAT change when a packet enters the external/public network?



A PC sends a TCP Window size of 0. What does this mean?

- a) The PC can receive unlimited data.
- b) The PC cannot receive any data.
- c) The PC will stop sending a data.
- d) The PC will send unlimited data.



A network service provider assigns you a global routing prefix of 2001:db8:acad::/48. What is the compressed network address for subnet 10 decimal?

Answer: 2001:db8acad:a::/64



Complete the following sentence: Sockets pairs use

- a) the destination port number to act as a return address for the requesting application.
- b) the source port number to act as a return address for the requesting application.
- c) IP source and destination addresses to uniquely identify processes on different machines.
- d) the physical addresses of the devices to uniquely identify processes on different machines.

What is wrong with the following declaration:

```
class MyThread extends Runnable {  
    public void run() {  
        System.out.println("this thread is running...");  
    }  
}
```

- a) It should be "public void start()"
- b) It should be "public run()"
- c) It should be "class MyThread implements Runnable"
- d) It should be "class Runnable implements MyThread"





# Synchronization

- a) prevents the condition where two or more threads simultaneously access the same data, possibly leading to inconsistent state.
- b) is used by sockets to ensure data is reliably exchanged between two end-points.
- c) prevents the condition where socket end-points simultaneously send data, possibly leading to inconsistent state.
- d) used to ensure two or more threads complete their tasks by a program-specified deadline.