

**FINAL EXAM
REVIEW**



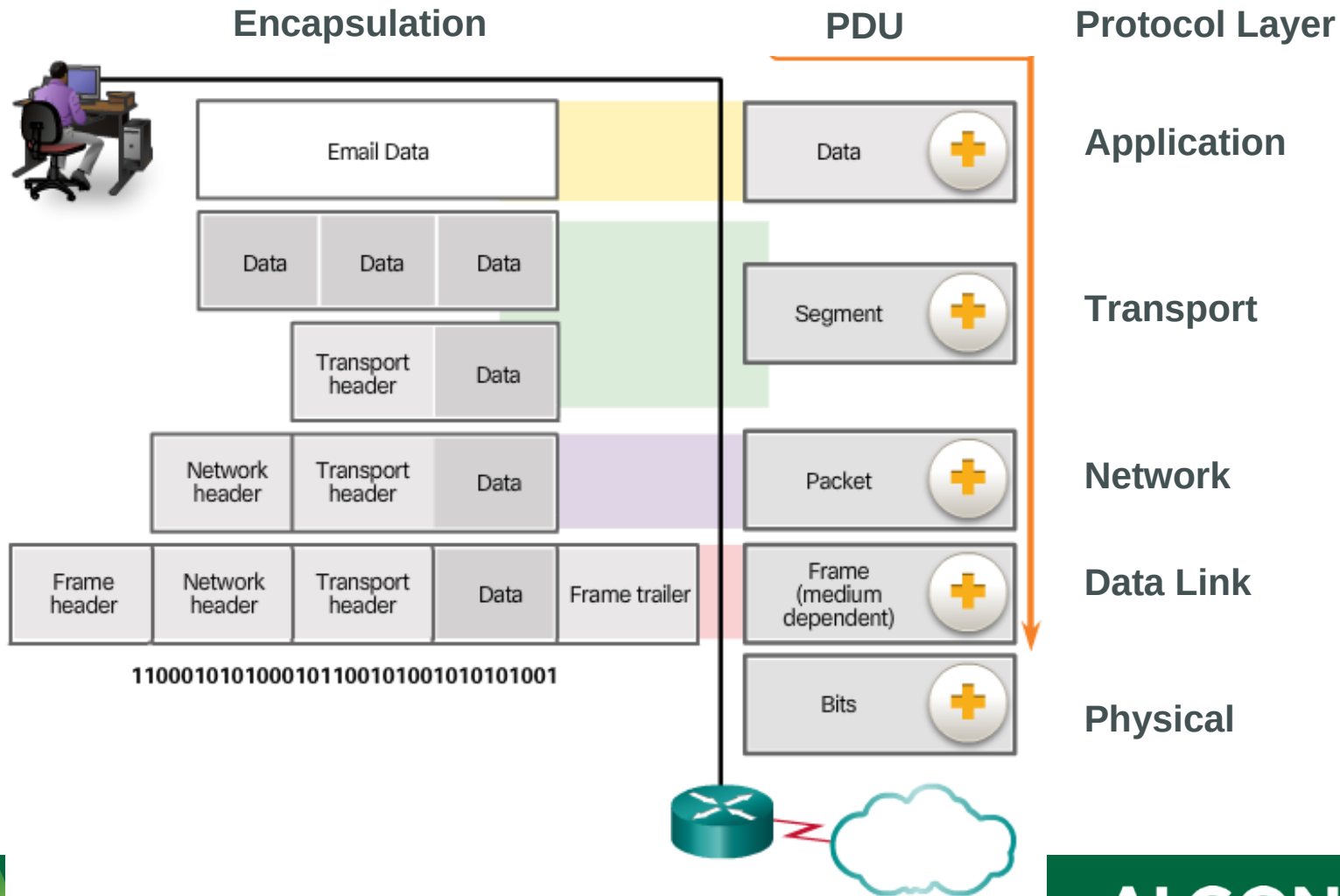
1. What is the name of the PDU at the Data Link Layer?

- 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)

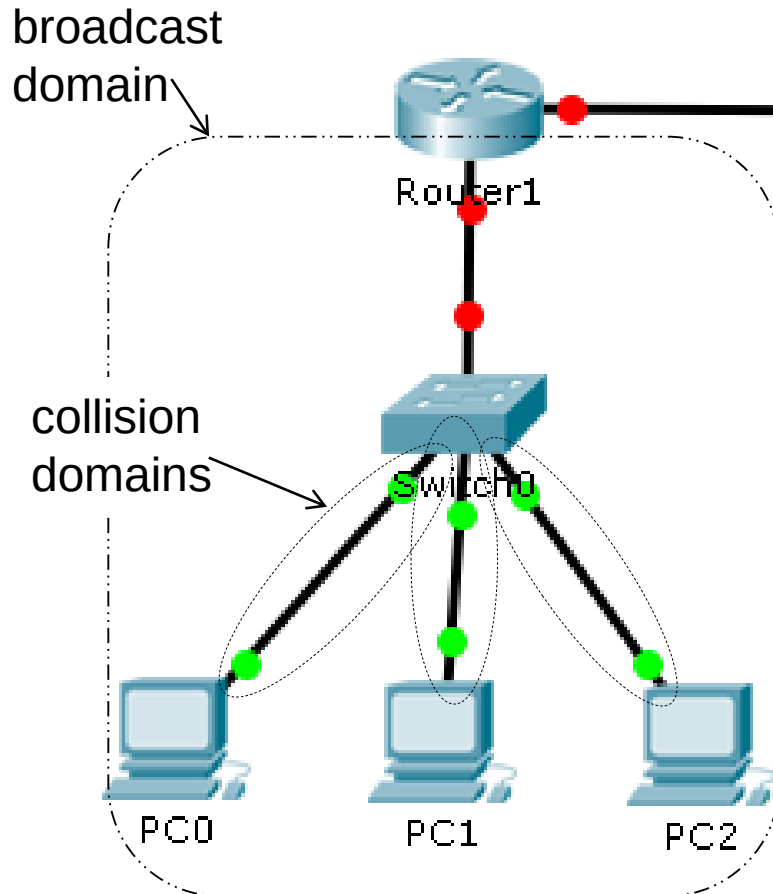


2. The Network layer encapsulates what type of PDU?

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



Collision Domain and Broadcast Domain



Router2

Collision Domain:

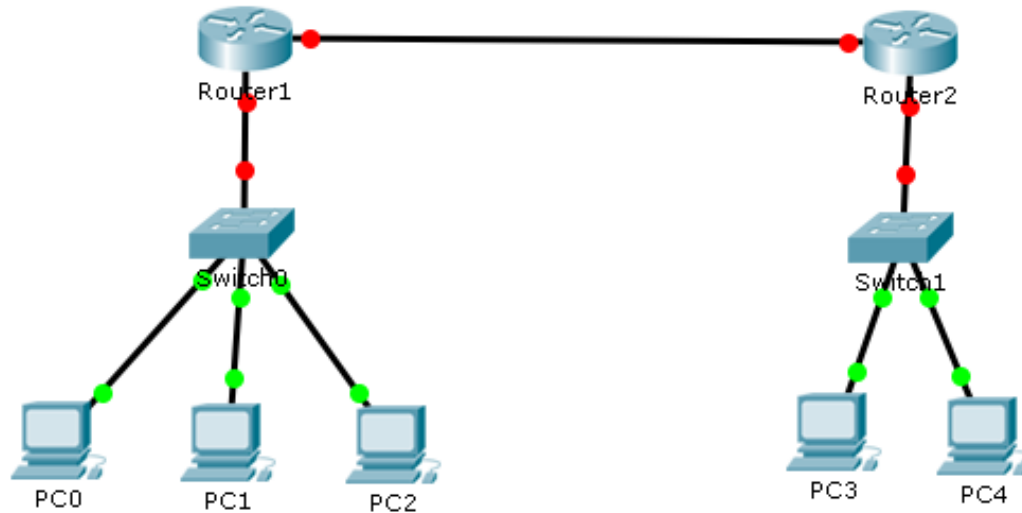
- Ethernet Switches break up collision domains into point-to-point links.
- Each Switch port forms a separate collision domain
- This is due to the switching function

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

3. How many collision domains and broadcast domains?



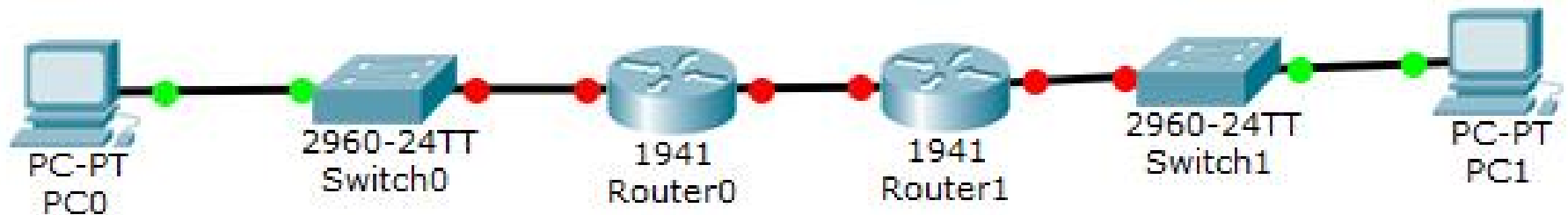
- A) 7 collision domains and 3 broadcast domains
- B) 8 collision domains and 3 broadcast domains
- C) 8 collision domains and 2 broadcast domains
- D) 5 collision domains and 3 broadcast domains



PC0 sends a frame to PC1

4. How many destination MAC addresses are there?

5. How many ARP requests are there?



Data Encapsulated at Different Layers

6. IP Addresses are added at which layer?

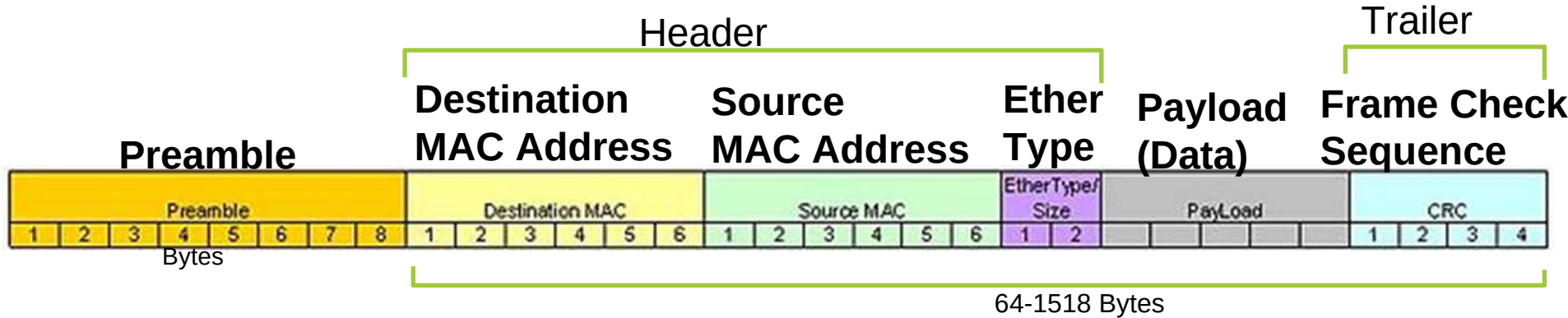
7. MAC Addresses are added at which layer?

8. Port numbers are added 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 ^[6]
0x22F3	IETF TRILL Protocol
0x6003	DECnet Phase IV
0x8035	Reverse Address Resolution Protocol

TCP Connection Sequences

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

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



11. What does tracert provide that ping doesn't?

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



tracert versus ping

tracert to www.google.com (142.251.41.36), 30 hops max, 60 byte packets

```
1 ControlPanel.Home (192.168.1.1) 0.495 ms 0.537 ms 0.698 ms
2 lo0-0-lns02-tor2.teksavvy.com (206.248.155.244) 10.807 ms 10.802 ms 10.886 ms
3 ae0-2112-bdr01-tor.teksavvy.com (206.248.149.10) 22.146 ms 22.193 ms 22.241 ms
4 142.250.168.170 (142.250.168.170) 11.770 ms 12.150 ms 12.208 ms
5 209.85.249.37 (209.85.249.37) 13.114 ms 13.174 ms 13.444 ms
6 216.239.49.189 (216.239.49.189) 12.252 ms 11.364 ms 11.674 ms
7 yyz12s08-in-f4.1e100.net (142.251.41.36) 11.395 ms 10.686 ms 10.888 ms
```

PING www.google.com (142.251.41.36) 56(84) bytes of data.

```
64 bytes from yyz12s08-in-f4.1e100.net (142.251.41.36): icmp_seq=1 ttl=118 time=10.9 ms
64 bytes from yyz12s08-in-f4.1e100.net (142.251.41.36): icmp_seq=2 ttl=118 time=10.7 ms
64 bytes from yyz12s08-in-f4.1e100.net (142.251.41.36): icmp_seq=3 ttl=118 time=10.7 ms
64 bytes from yyz12s08-in-f4.1e100.net (142.251.41.36): icmp_seq=4 ttl=118 time=10.6 ms
```

4 packets transmitted, 4 received, 0% packet loss, time 3006ms

rtt min/avg/max/mdev = 10.620/10.713/10.869/0.094 ms



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

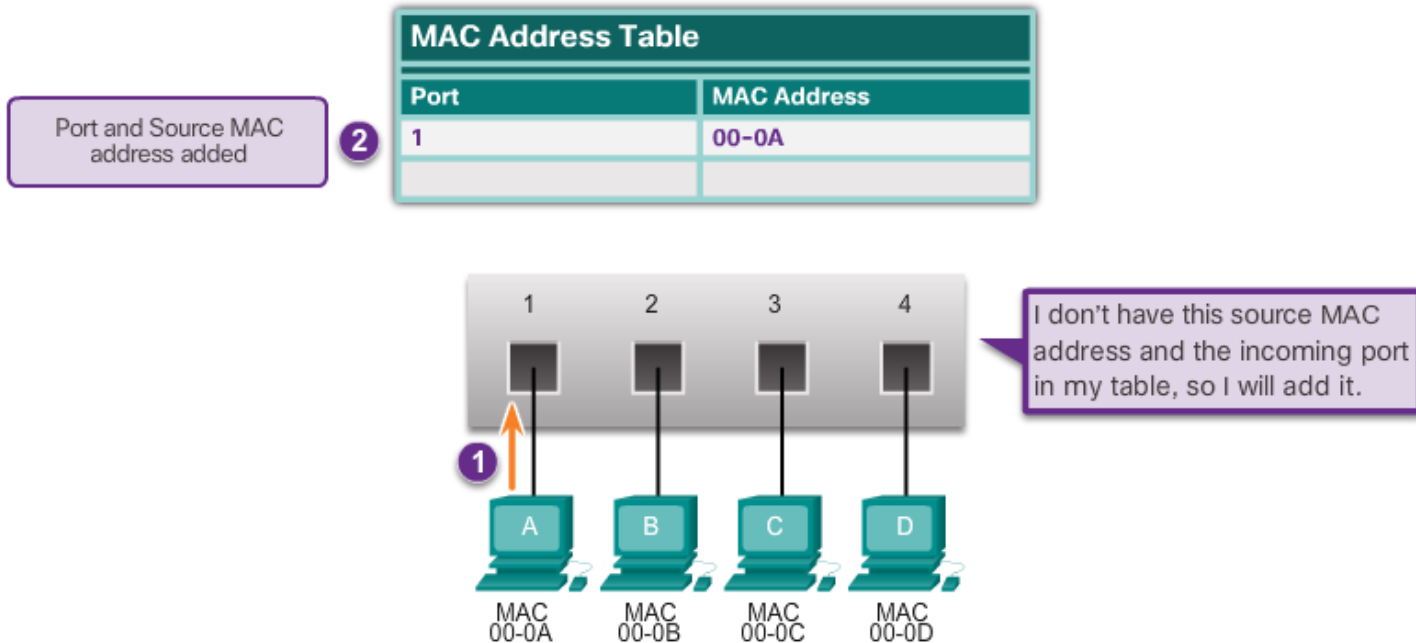
- A) arp -d *
- B) arp -a
- C) arp -c
- D) ipconfig /arp



Layer 2 Switching - 1

Step 1: Learn MAC Address

Learn: Examine Source MAC Address



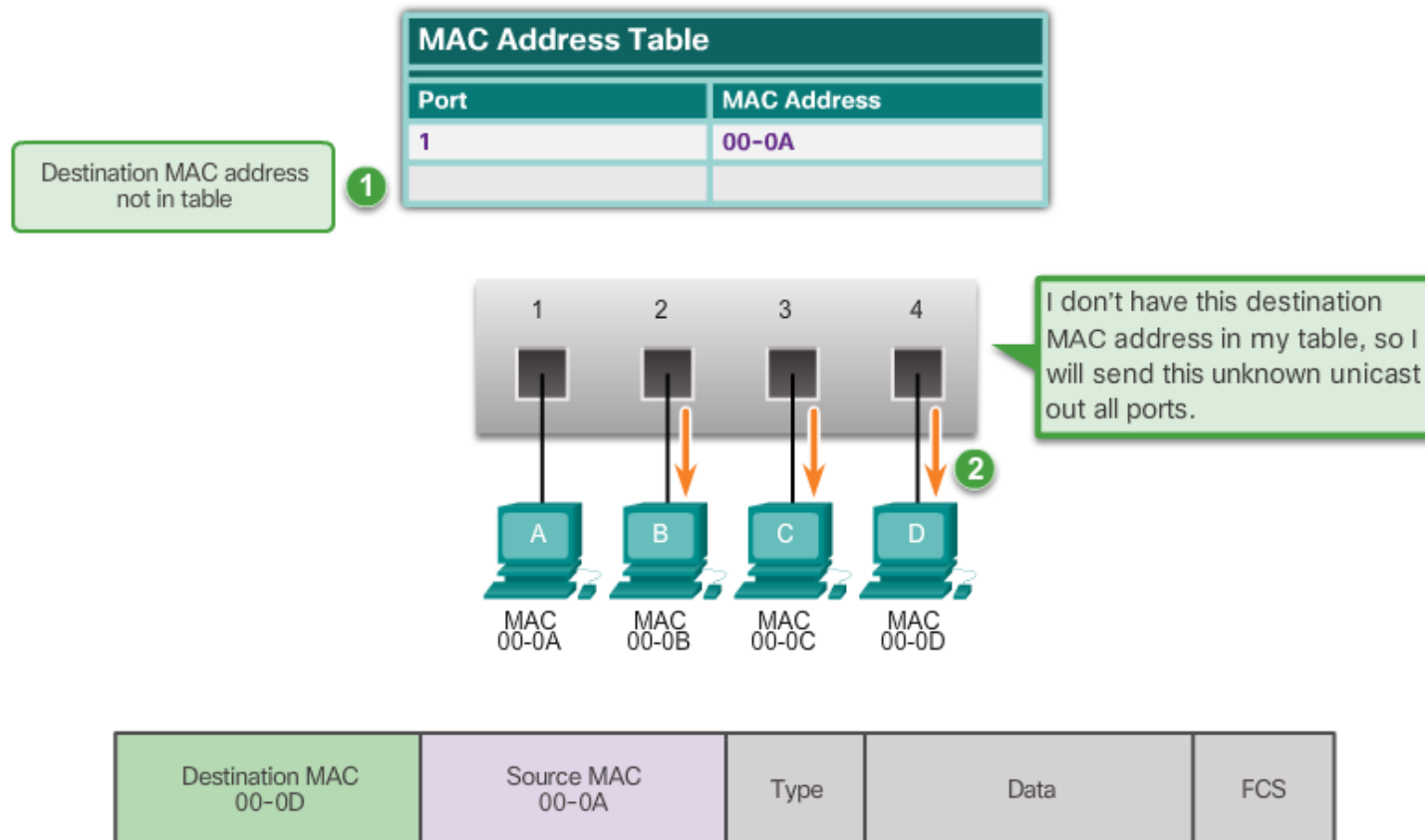
Destination MAC 00-0D	Source MAC 00-0A	Type	Data	FCS
--------------------------	---------------------	------	------	-----

MAC addresses are shortened for demonstration purposes.

Layer 2 Switching - 2

Step 2: Forward the Frame

Forward: Examine Destination MAC Address

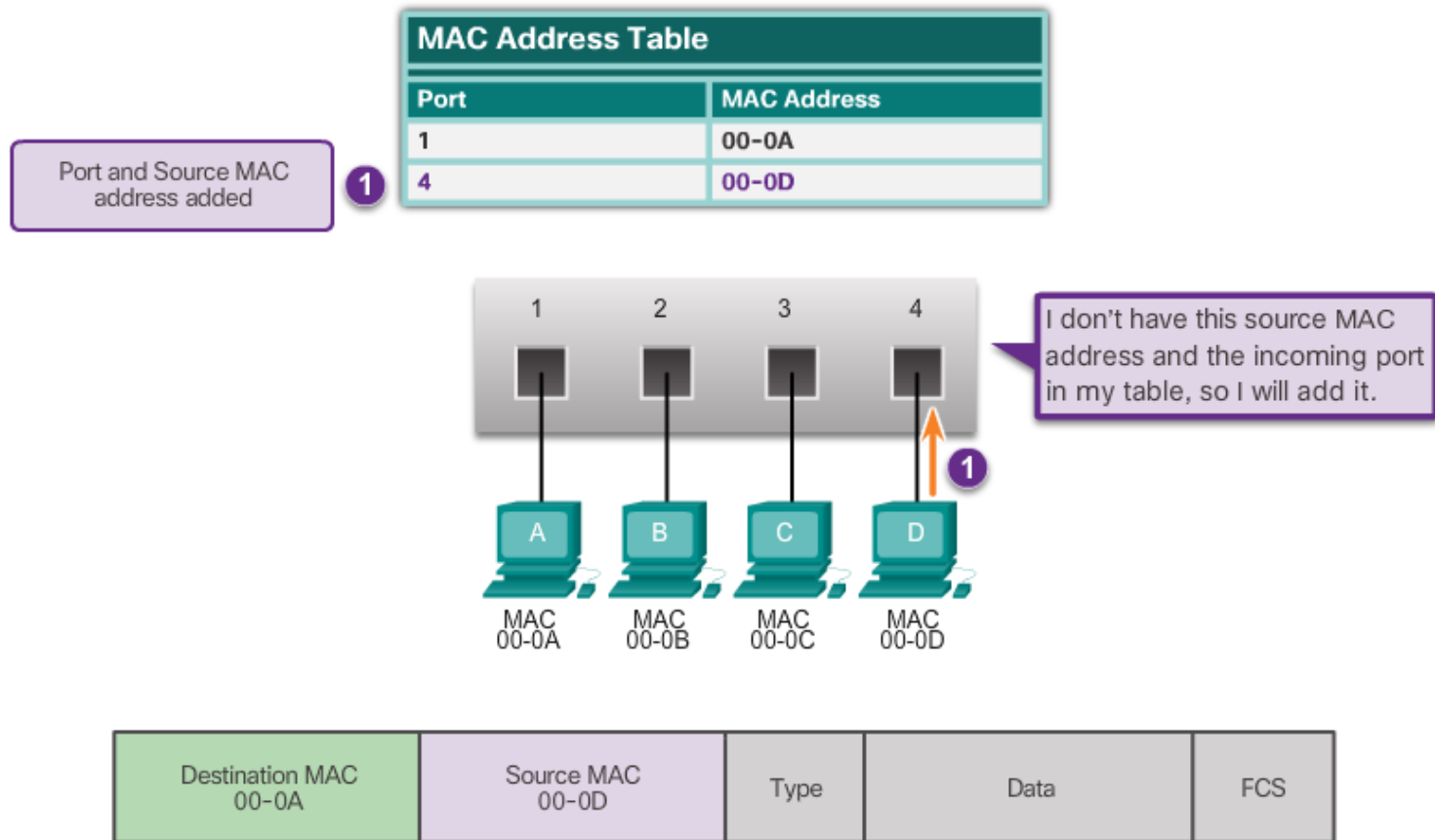


MAC addresses are shortened for demonstration purposes.

Layer 2 Switching – 3

Step 1: Learn MAC Address

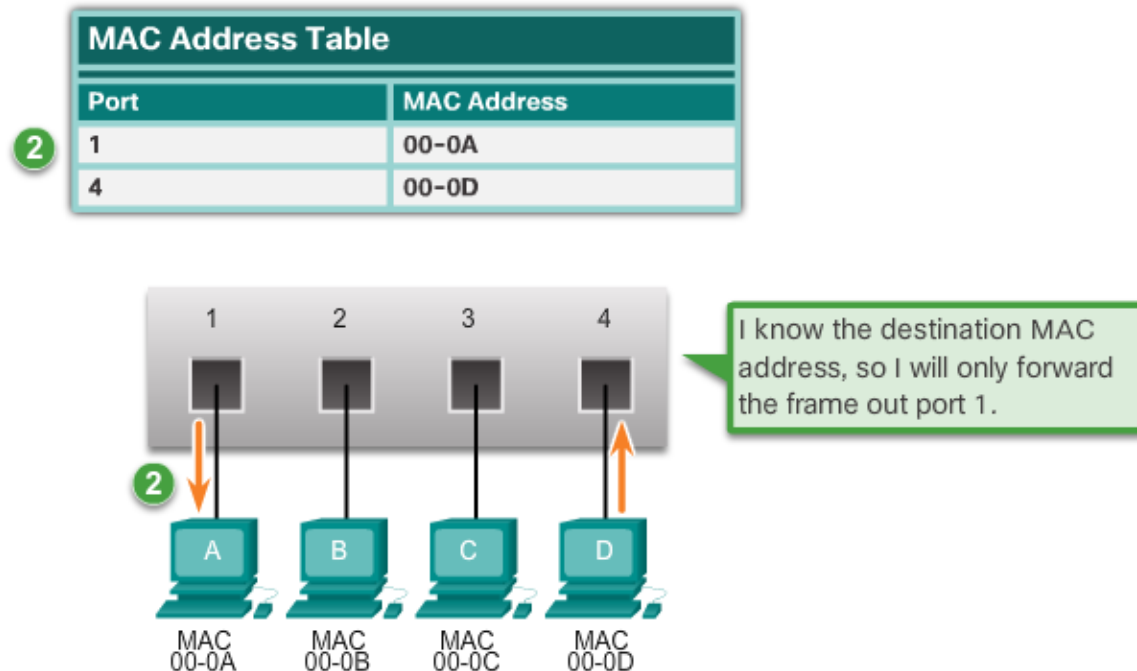
PC-D sends a frame back to PC-A and the switch learns PC-D's MAC address.



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
--------------------------	---------------------	------	------	-----

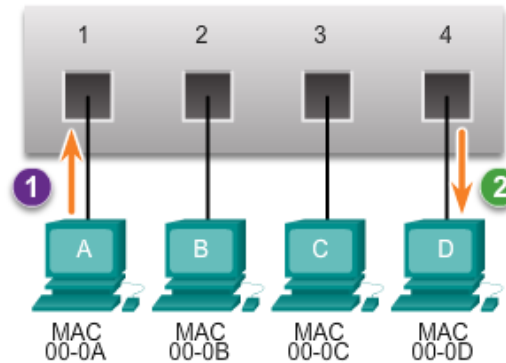


Layer 2 Switching – Forward Only

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
--------------------------	---------------------	------	------	-----



13. What are the four message involved in a DHCP configuration?

14. Which commands are based on the ICMP protocol?



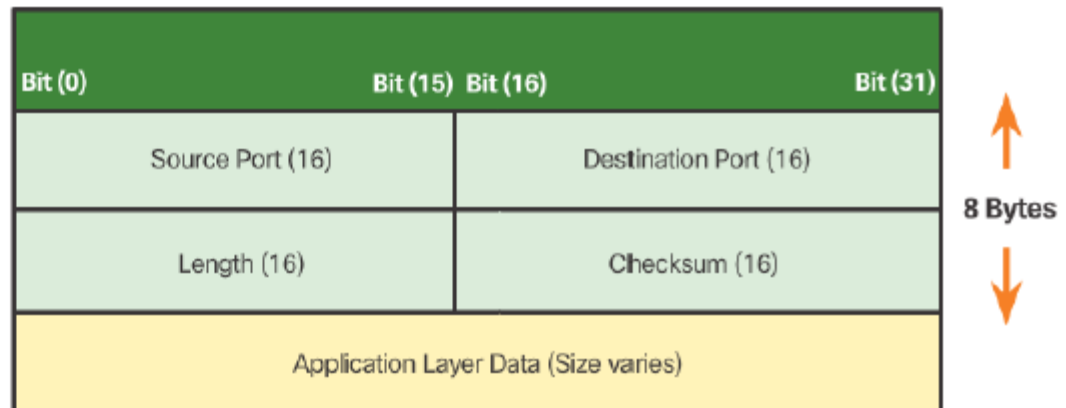
TCP Features

- **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.



15. What are the layers of the OSI protocol stack?

16. A MAC address is built from 2 values.
How are they assigned?



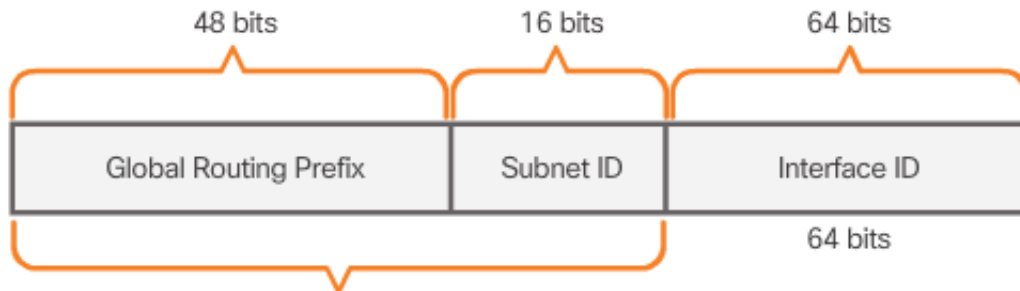
17. What does **arp -a** do?

18. What does **arp -d *** do?

19. Routing is done at which layer?

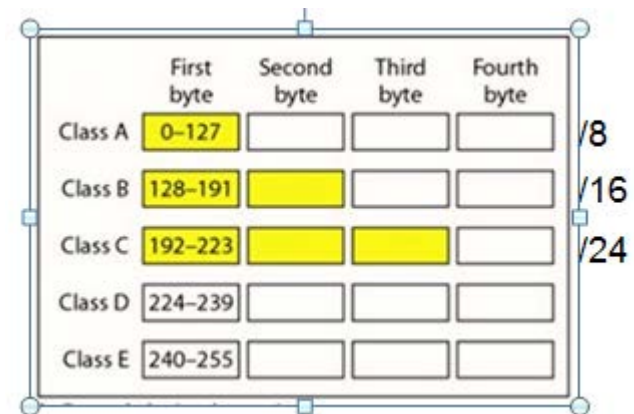


Information Sheet

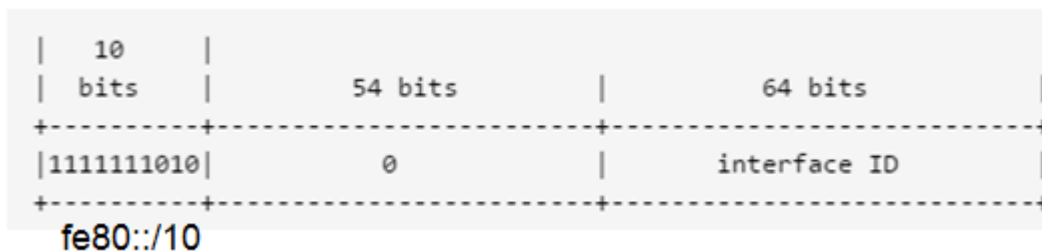


A /48 routing prefix + 16 bit Subnet ID = /64 prefix.

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



20. What is the purpose of the Sequence Number and Acknowledgement Numbers in the TCP protocol?



21. Which application layer protocols use TCP and which use UDP?

FTP, HTTP, HTTPS, POP3,...

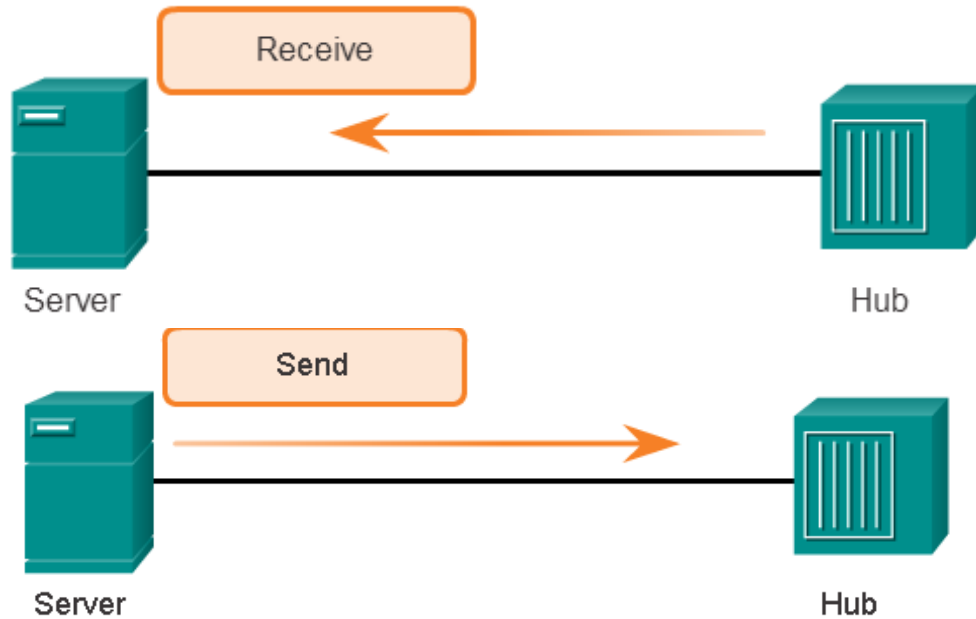
TFTP, DNS, DHCP, VoIP,...



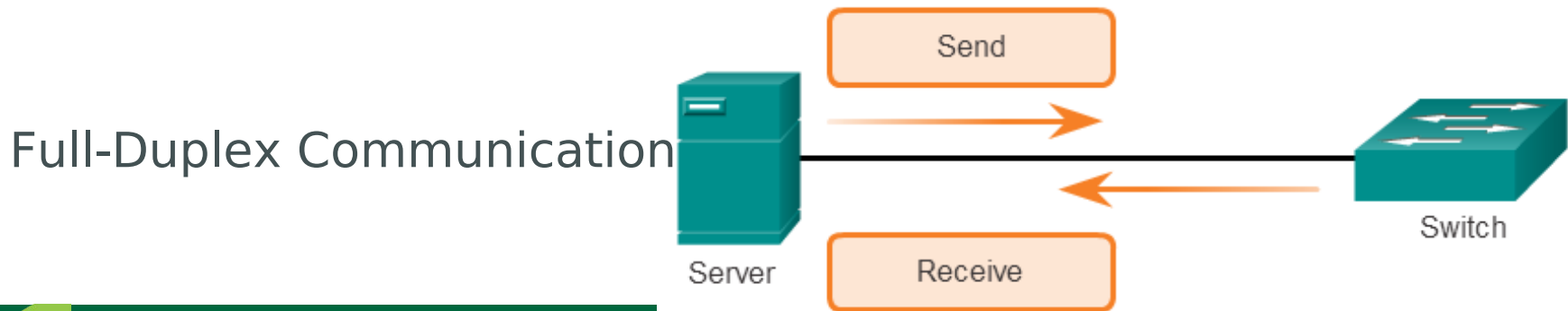
22. TTL is found in which network layer?



Half and Full Duplex



Half-Duplex Communication

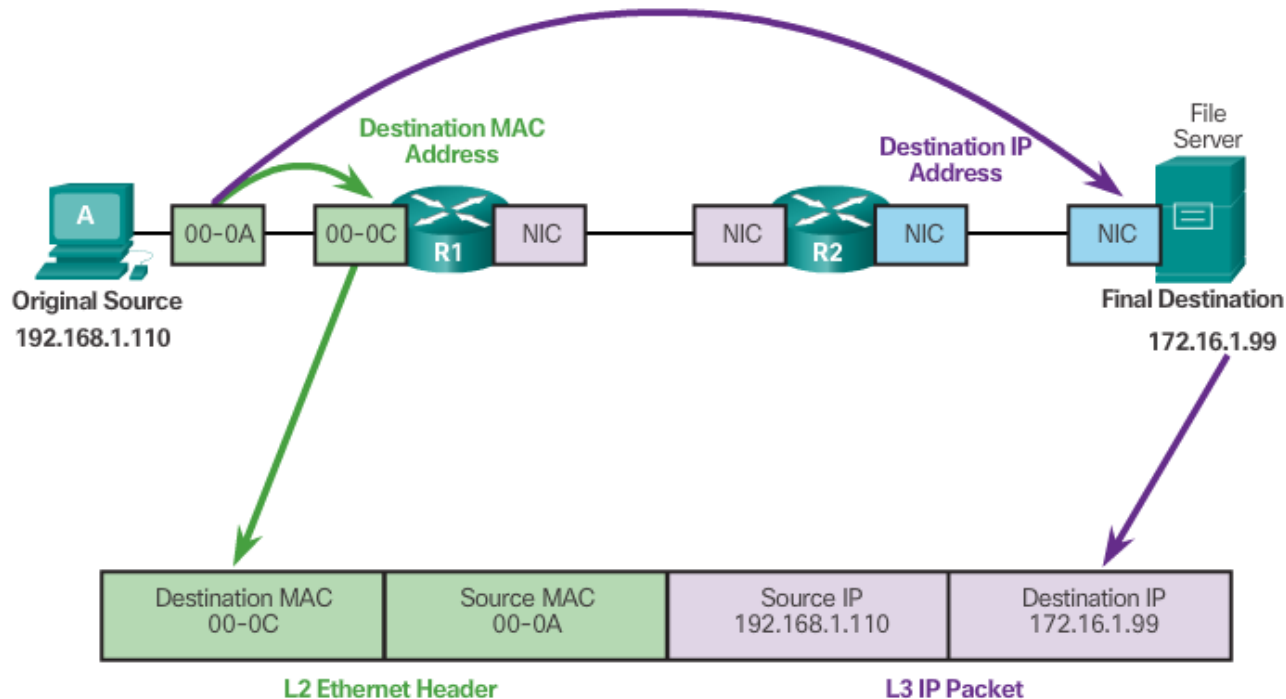


Full-Duplex Communication



Destination on a Remote Network

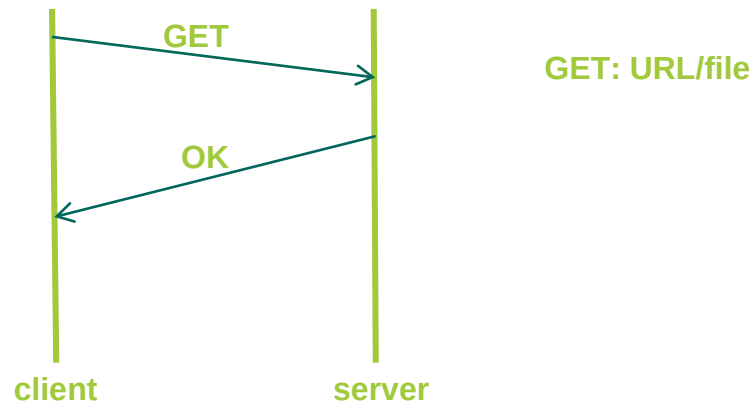
Communicating to a Remote Network



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:

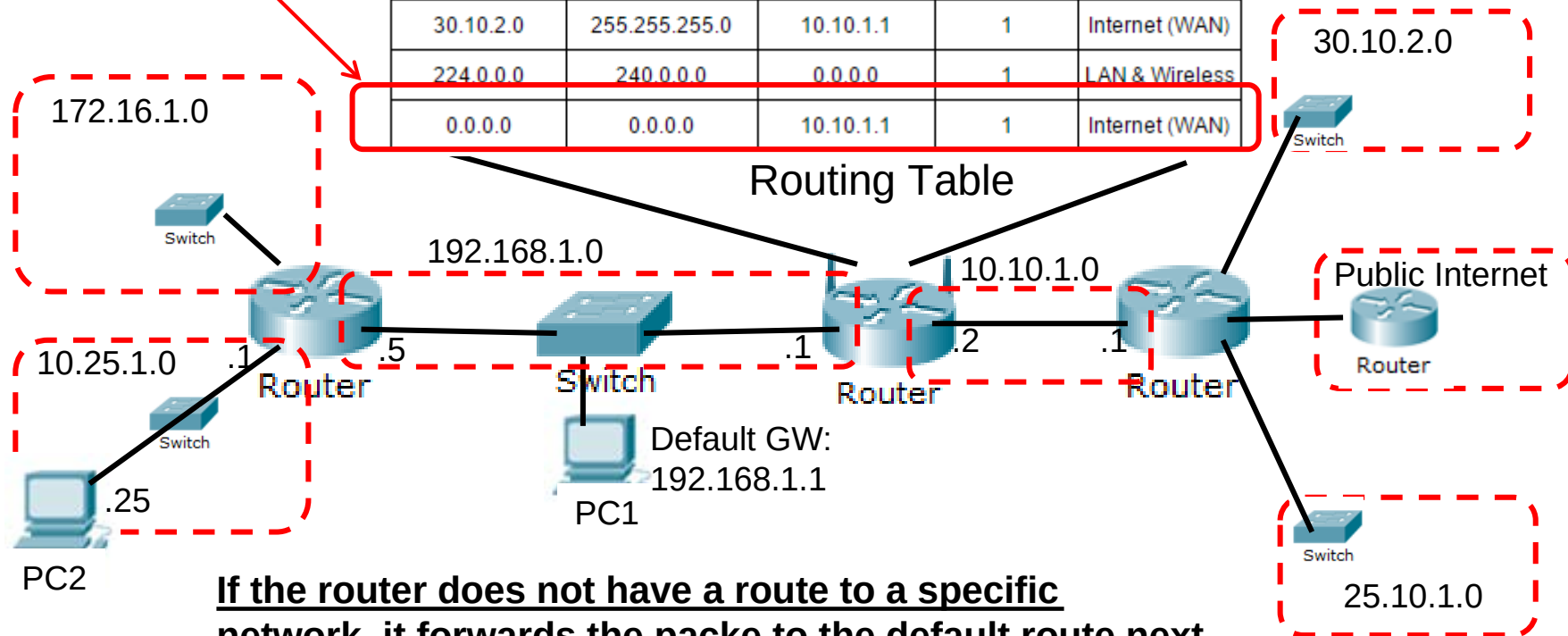


Connected Networks

Default Route

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)

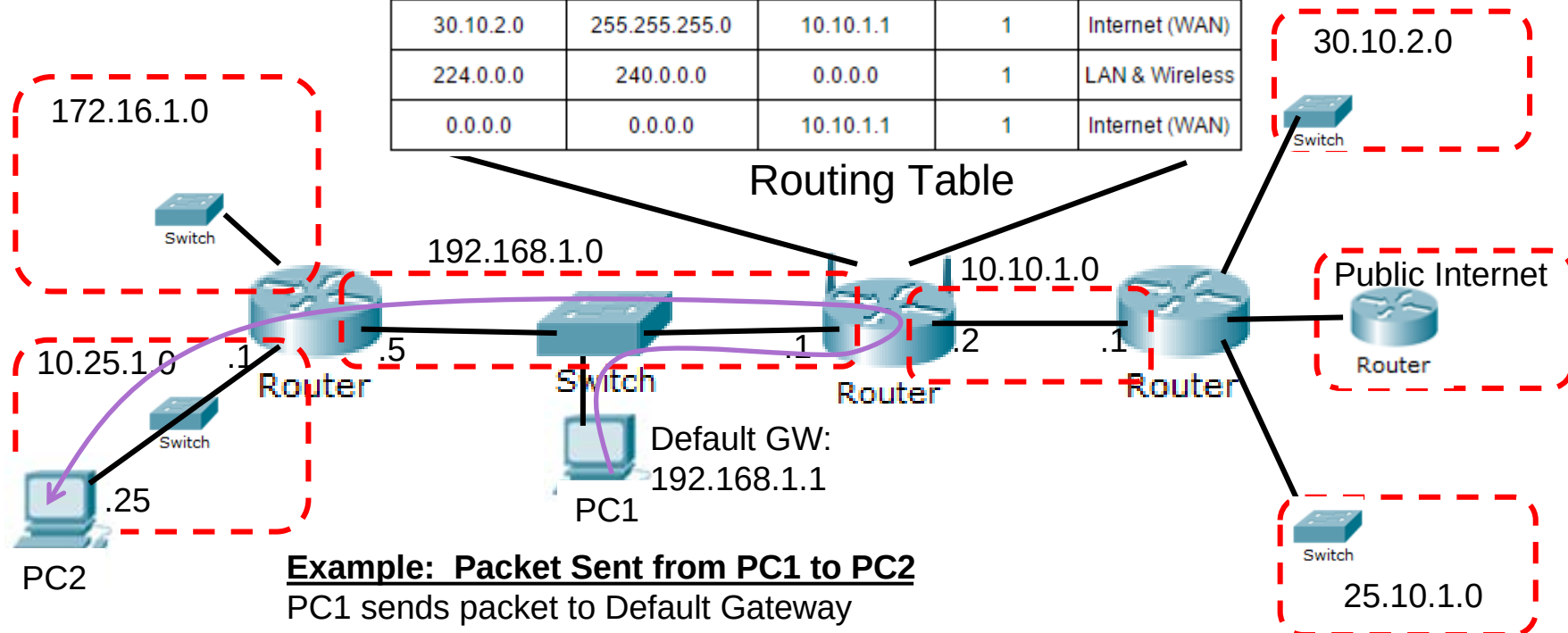
Routing Table



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

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)



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

23. Compress the following IPv6 Address:

2001:0db1:00a3:0000:0000:0000:0000:7334



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



25. 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.



26. 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?

