ALGONQUIN COLLEGE

FINAL EXAM REVIEW

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

A) Frame

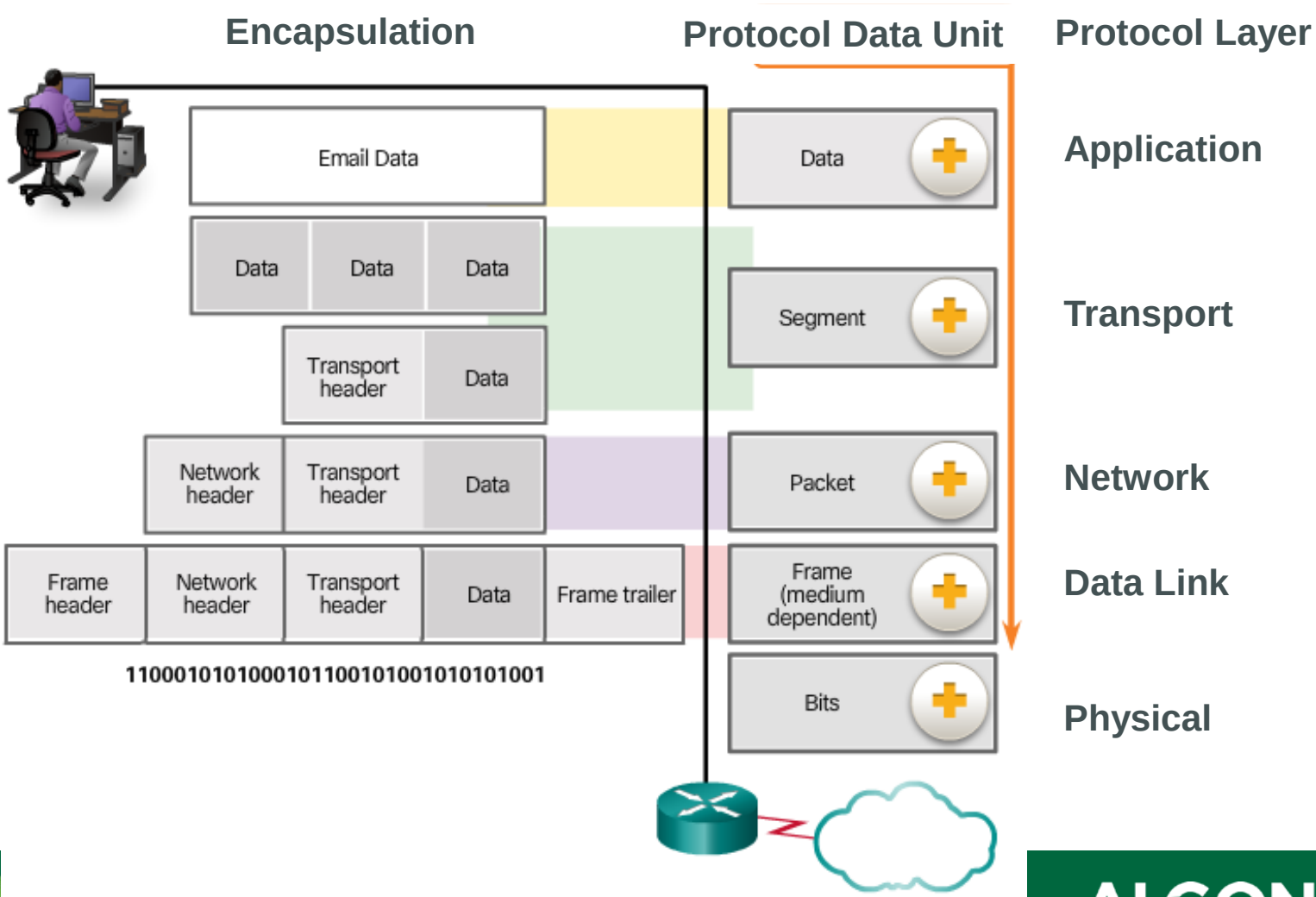
B) Segment

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?

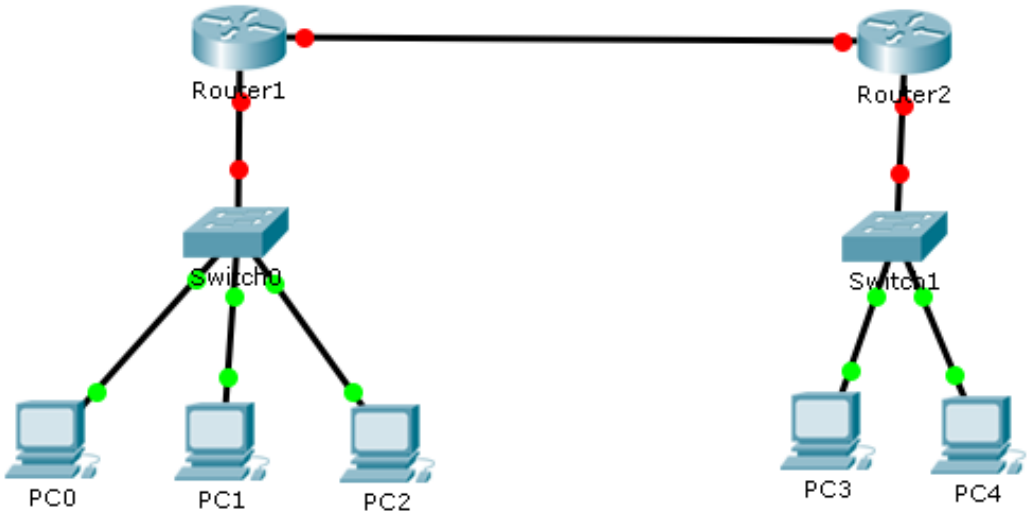
A) Frame

B) Segment

C) Packet

D) Block

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



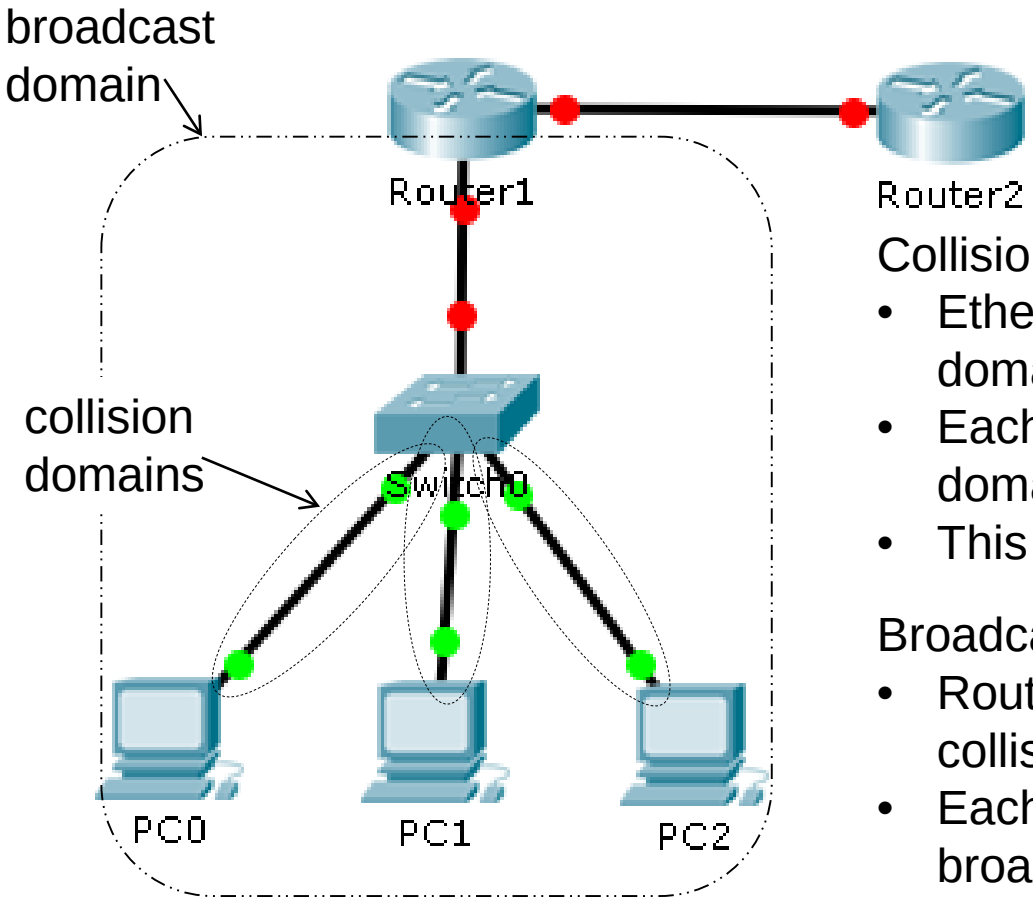
A) 7 collision domains and 3 broadcast domains

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



Collision Domain:

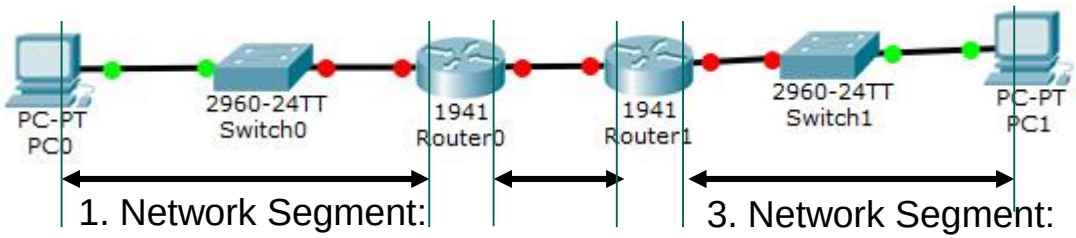
- Ethernet Switches break up collision domains into point-to-point links.
- Each Switch port forms a separate collision domain
- This is due to the switching function

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 3
How Many ARP Requests 3



1. Network Segment: PC0 sends Frame to Router0

2. Router0 sends Frame to Router1

3. Network Segment: Router1 sends Frame to PC1

IP Addresses are added during encapsulation at which layer?

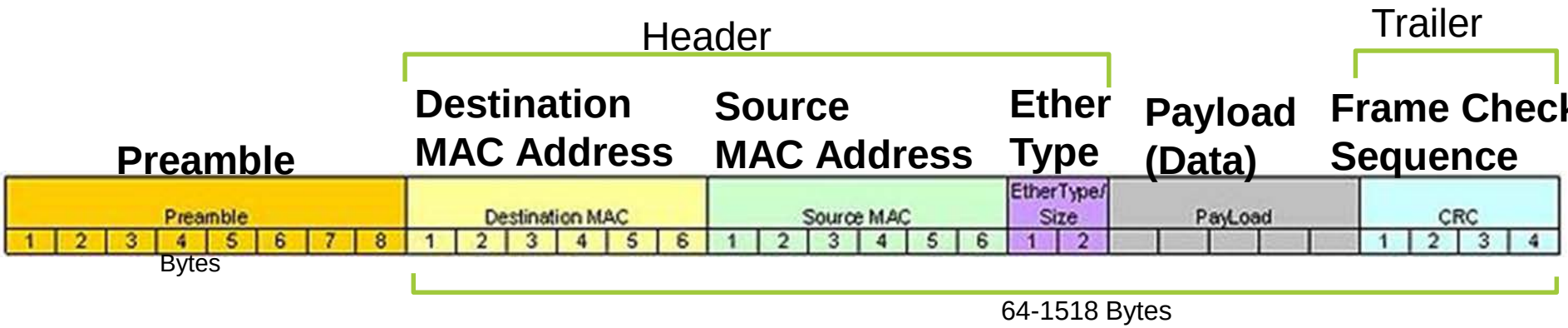
3

MAC Addresses are added during encapsulation at which layer?

2

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

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

SYN, SYN-ACK, ACK

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

FIN, ACK

What does tracert provide that ping does not?

List of Routers between source and destination.

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

IP Destination Address

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

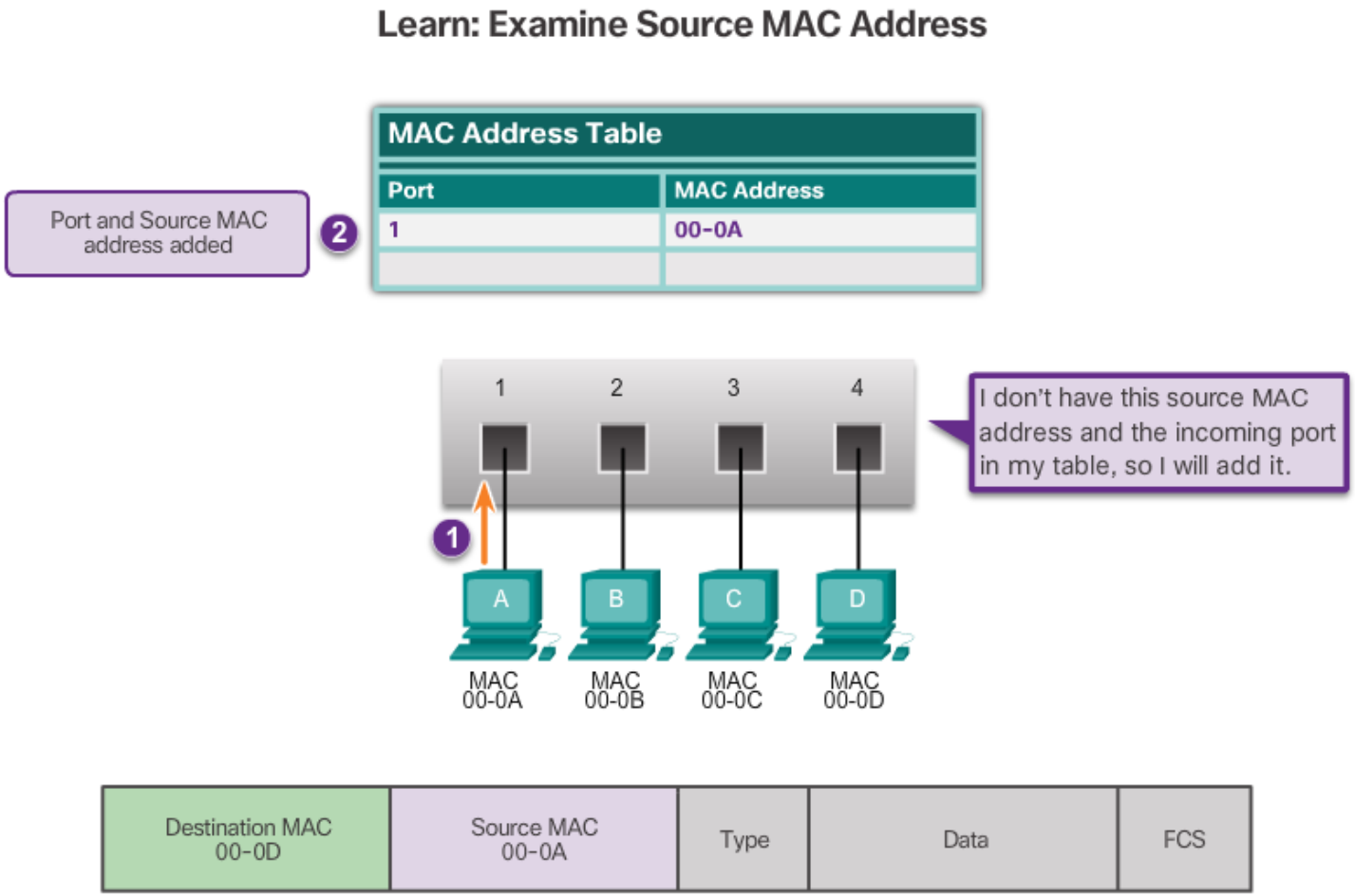
D) ipconfig /arp

What is the basic operation of an Ethernet Switch?

See next slides.

Layer 2 Switching - 1

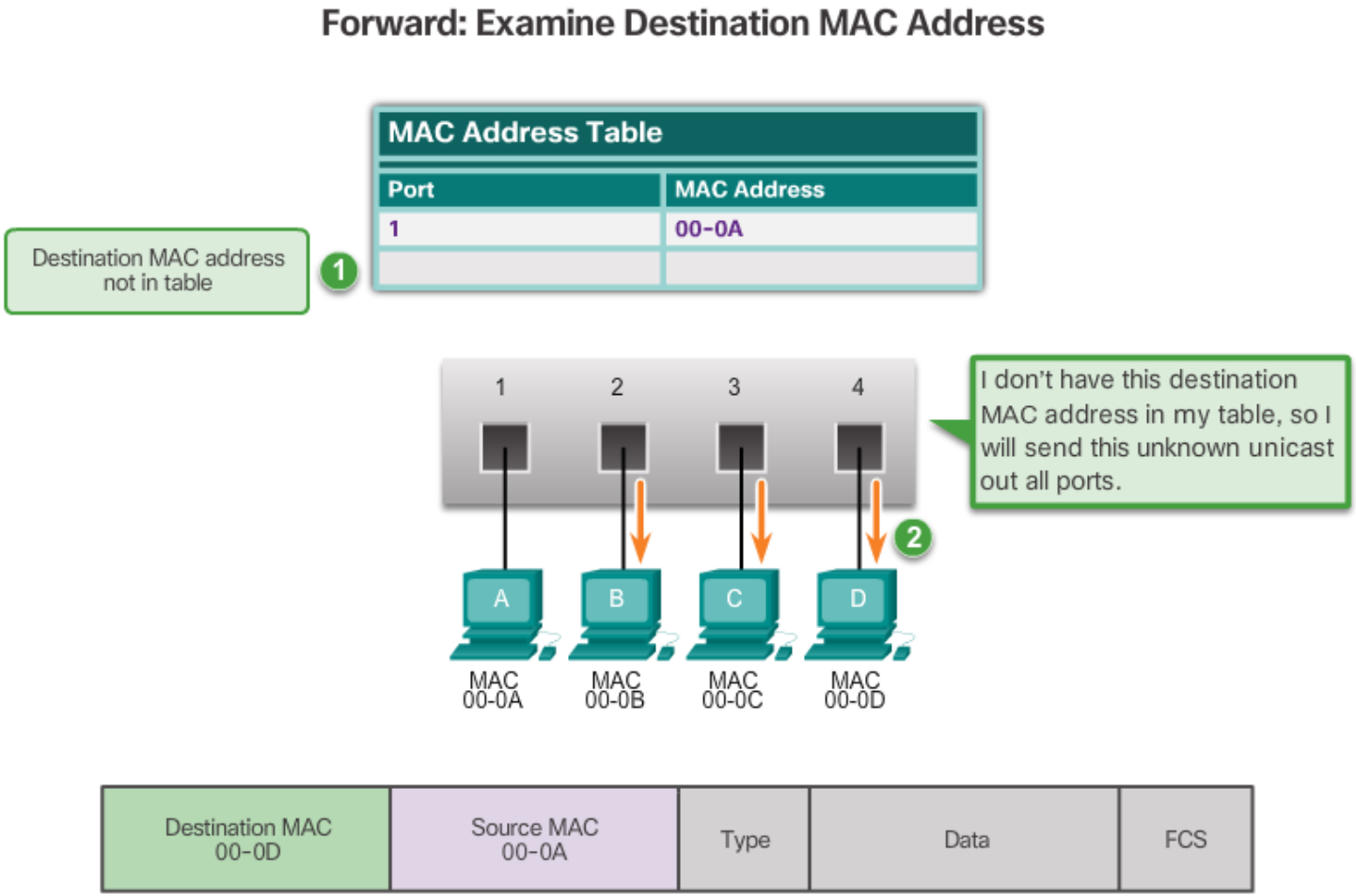
Step 1: Learn MAC Address



MAC addresses are shortened for demonstration purposes.

Layer 2 Switching - 2

Step 2: Forward the Frame

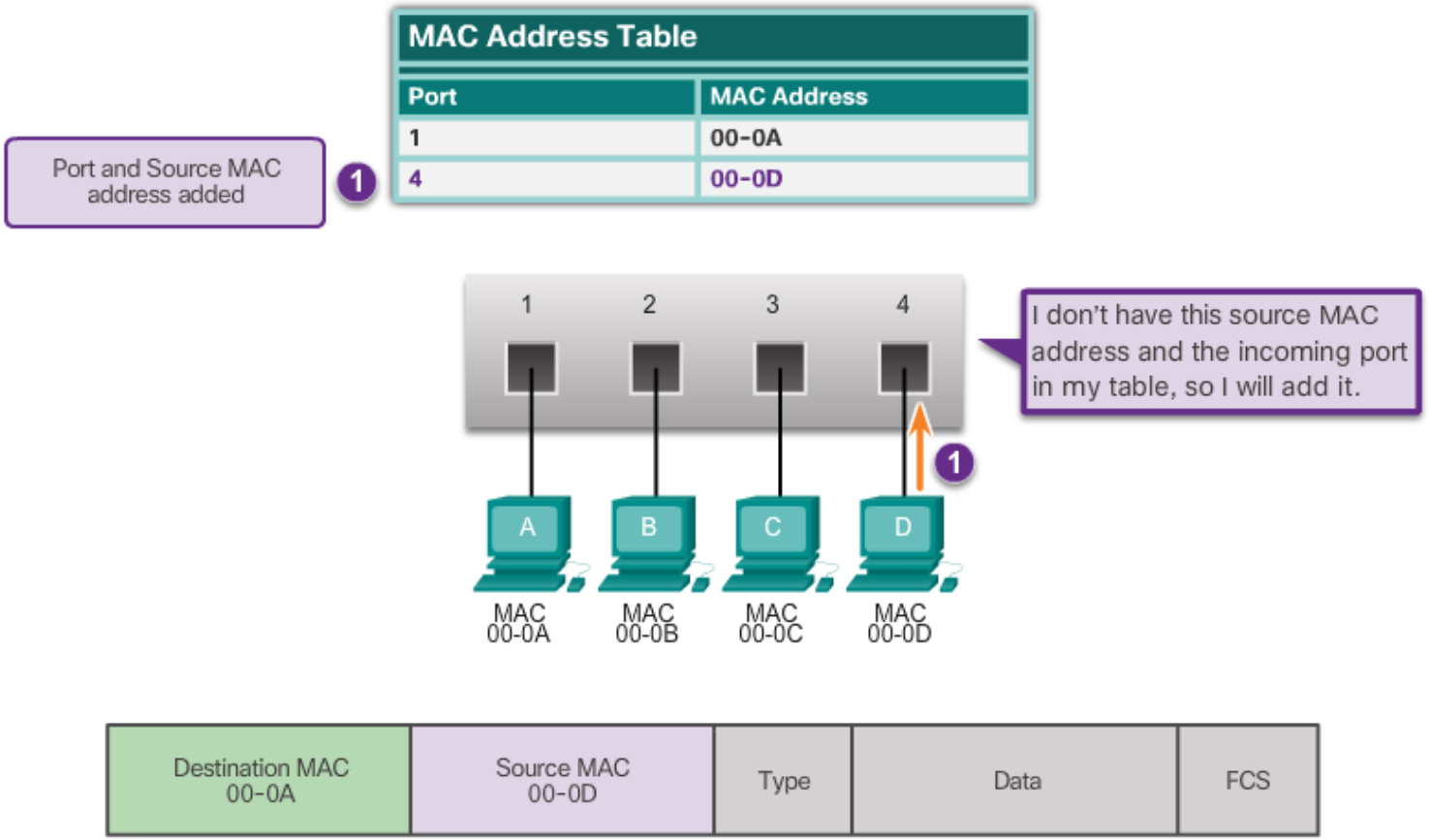


MAC addresses are shortened for demonstration purposes.

Layer 2 Switching – 3

Step 1: Learn MAC Address

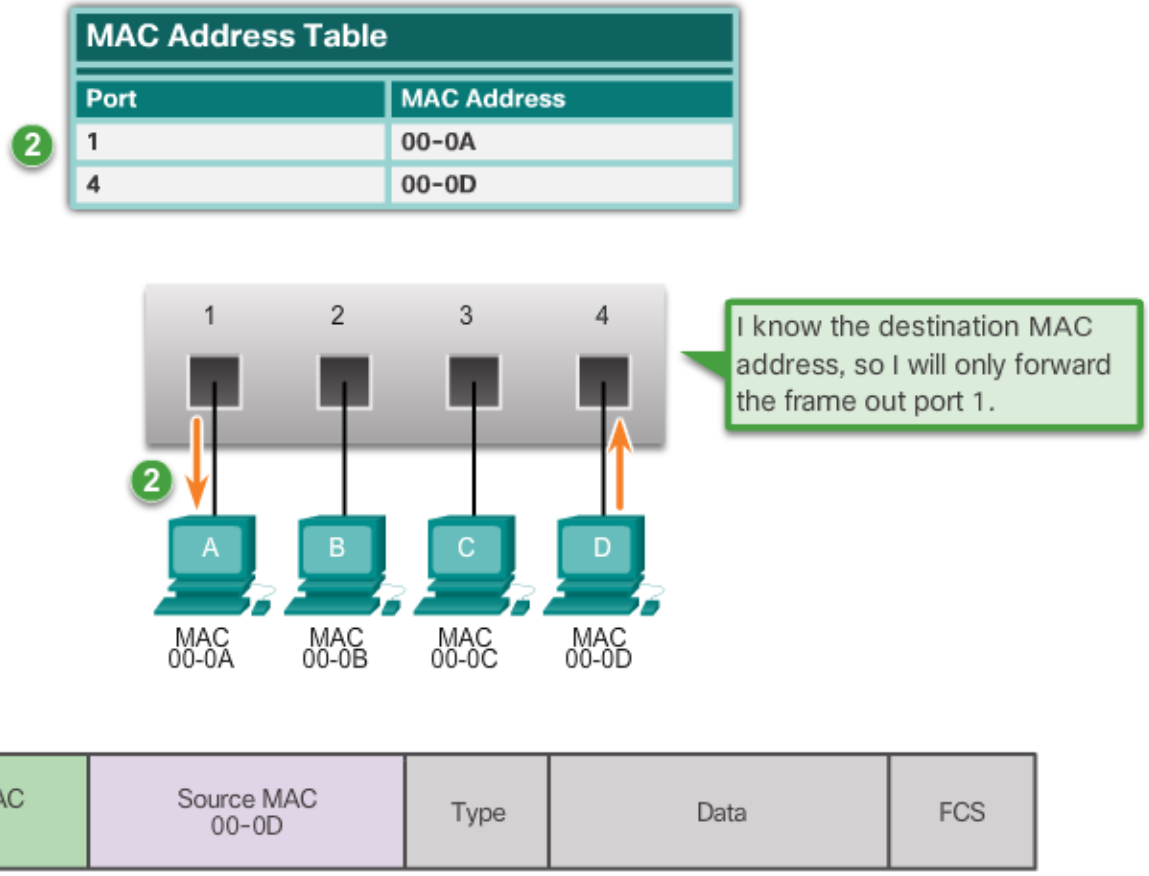
PC-D sends a frame back to PC-A and the switch learns PC-D's MAC address.



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.

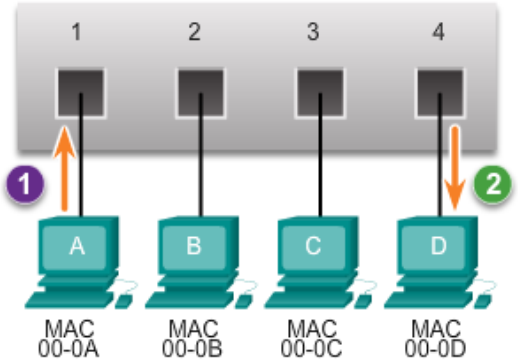


Layer 2 Switching – Forward Only

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



What are the four message involved in a DHCP configuration?

Discover, Offer, Request, Ack

Which commands are based on the ICMP protocol?

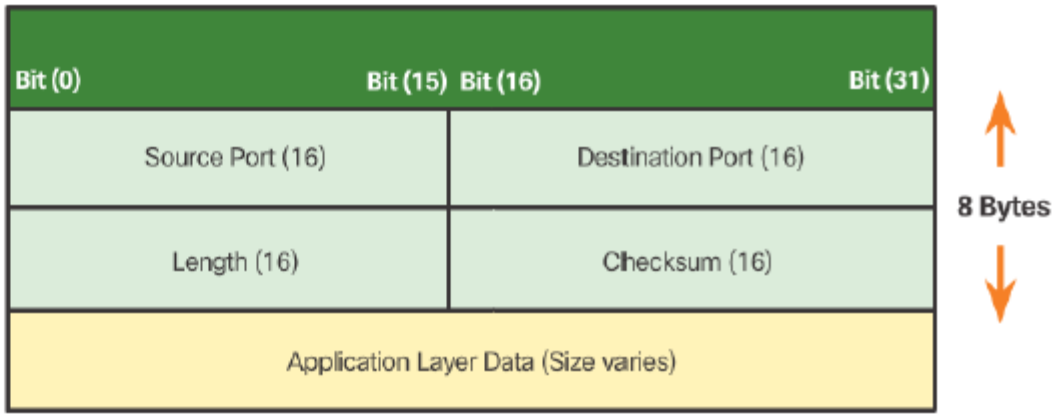
Ping and Trace Route (tracert)

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?

7 Application
6 Presentation
5 Session
4 Transport
3 Network
2 Data Link
1 Physical

What are components of a MAC address?

1st 3 bytes are the OUI, last 3 bytes are a unique number

Explain the operation of arp and options.

ARP Protocol is used to find a MAC address corresponding to a given IP Address.

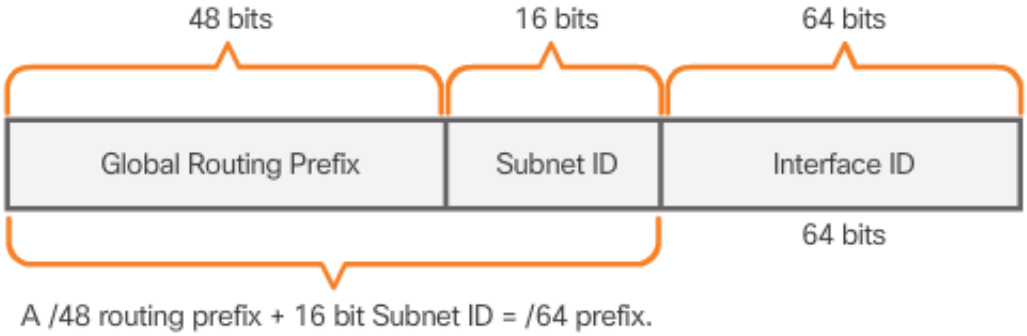
ARP Command

arp –a ← shows content of arp table

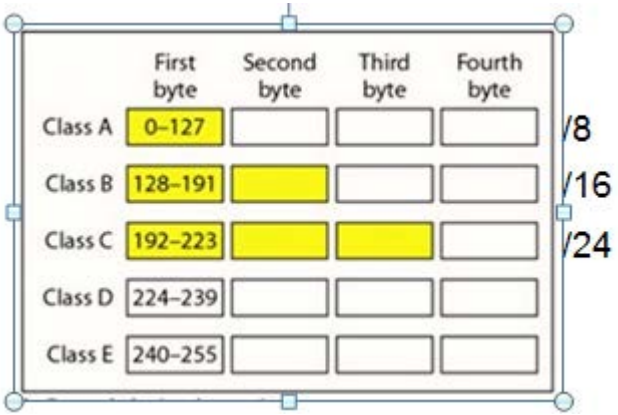
arp –d * ← deletes all entries in the arp table

Routing is done at which layer? 3

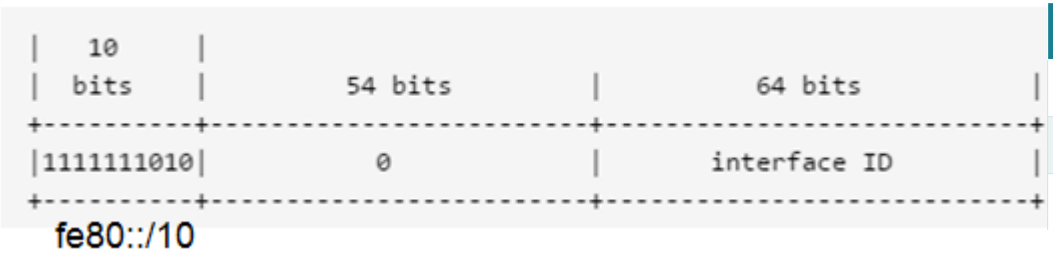
Information Sheet



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?

Reliability
Segments can be placed in the proper order.
Confirmation that each segment has been received. Retransmission as required.

Identify application layer protocols that use TCP and UDP.

TCP

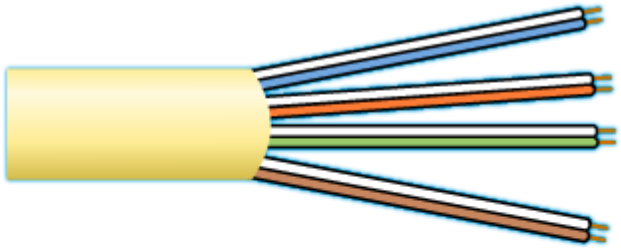
FTP, HTTP, HTTPS, POP3,…

UDP

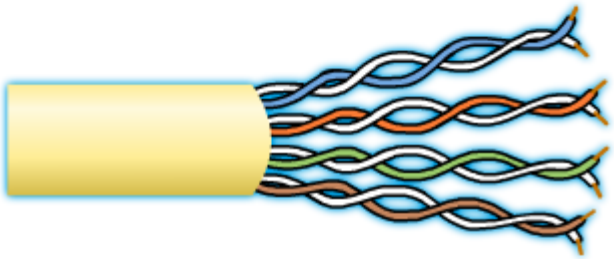
TFTP, DNS, DHCP, VoIP,…

TTL is found in which network layer? 3

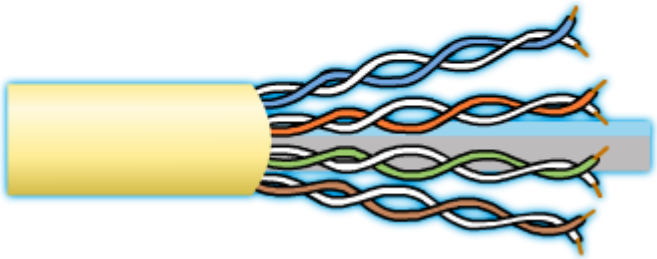
UTP Cabling Standards



Category 3 Cable (UTP)



Category 5 and 5e Cable (UTP)



Category 6 Cable (UTP)

Category 3 Cable (UTP)

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

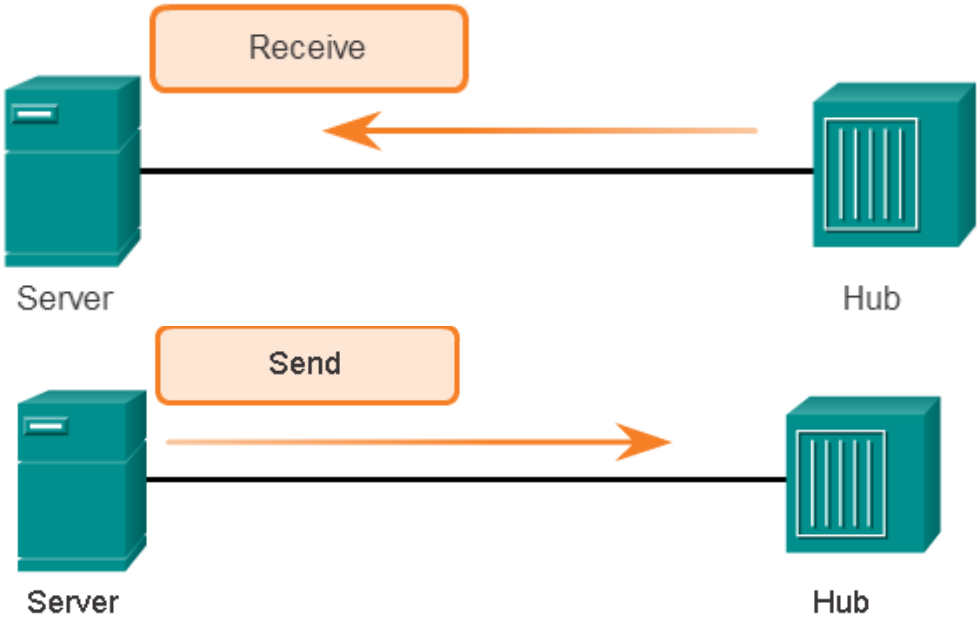
Category 5 and 5e Cable (UTP)

- 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)

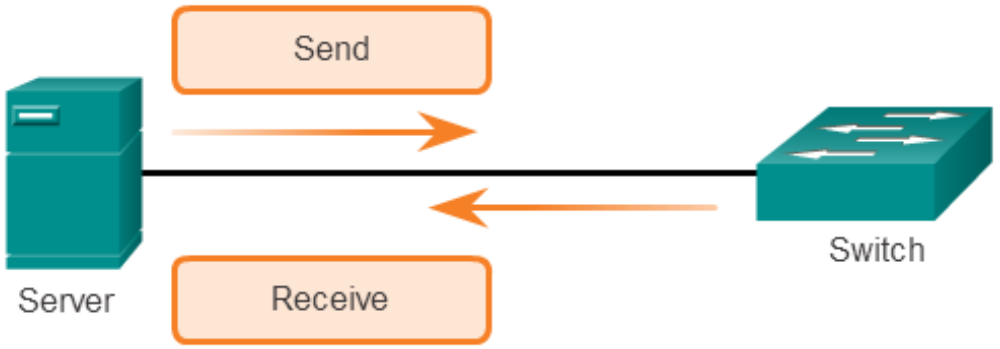
- Used for data transmission
- An added separator is between each pair of wires allowing it to function at higher speeds
- Supports 1000 Mb/s – 10 Gb/s, though 10 Gb/s is not recommended

Half and Full Duplex

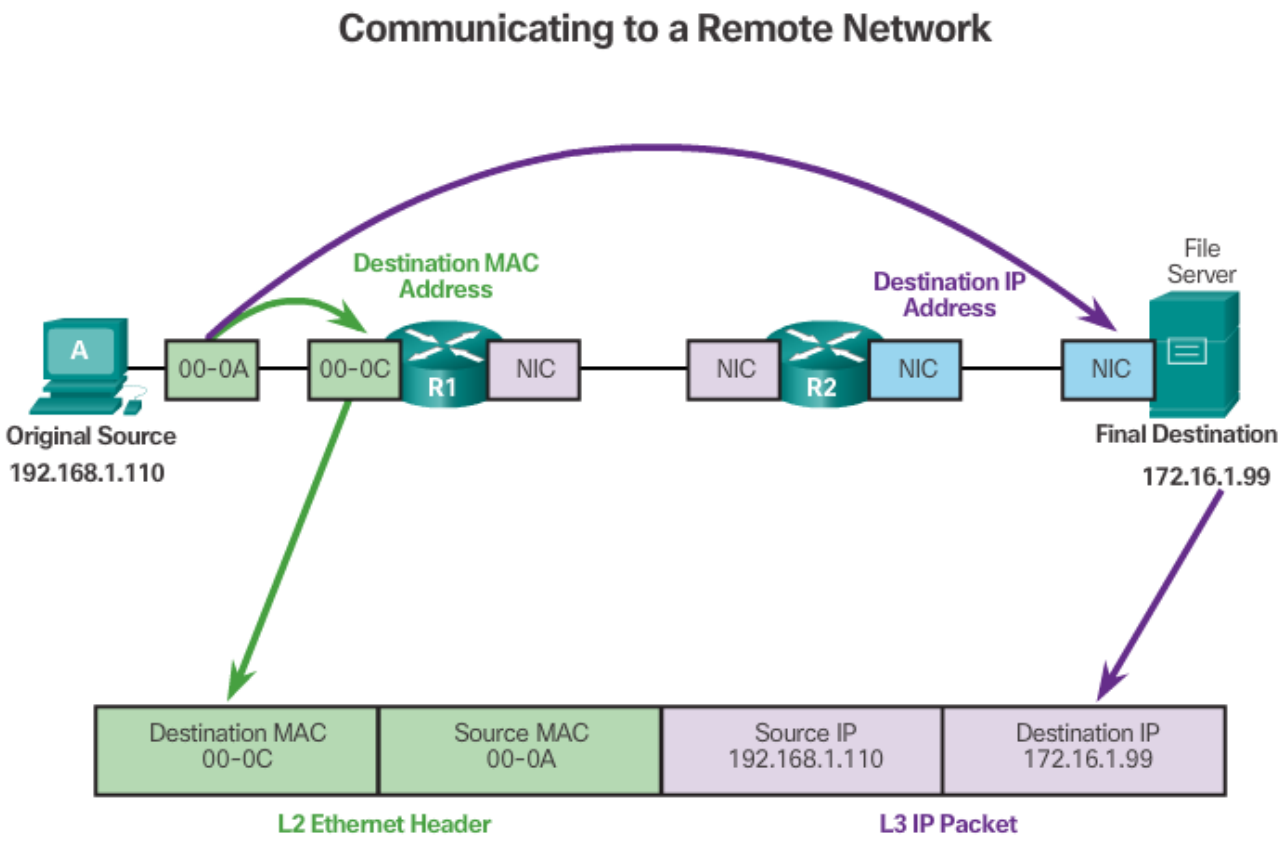


Half-Duplex Communication

Full-Duplex Communication



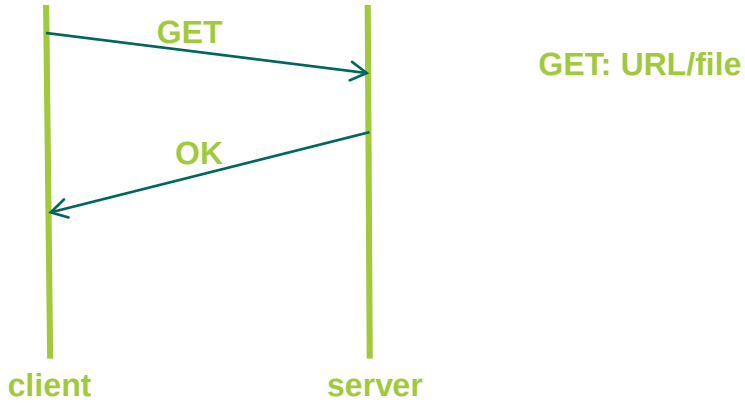
Destination on a Remote Network



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:



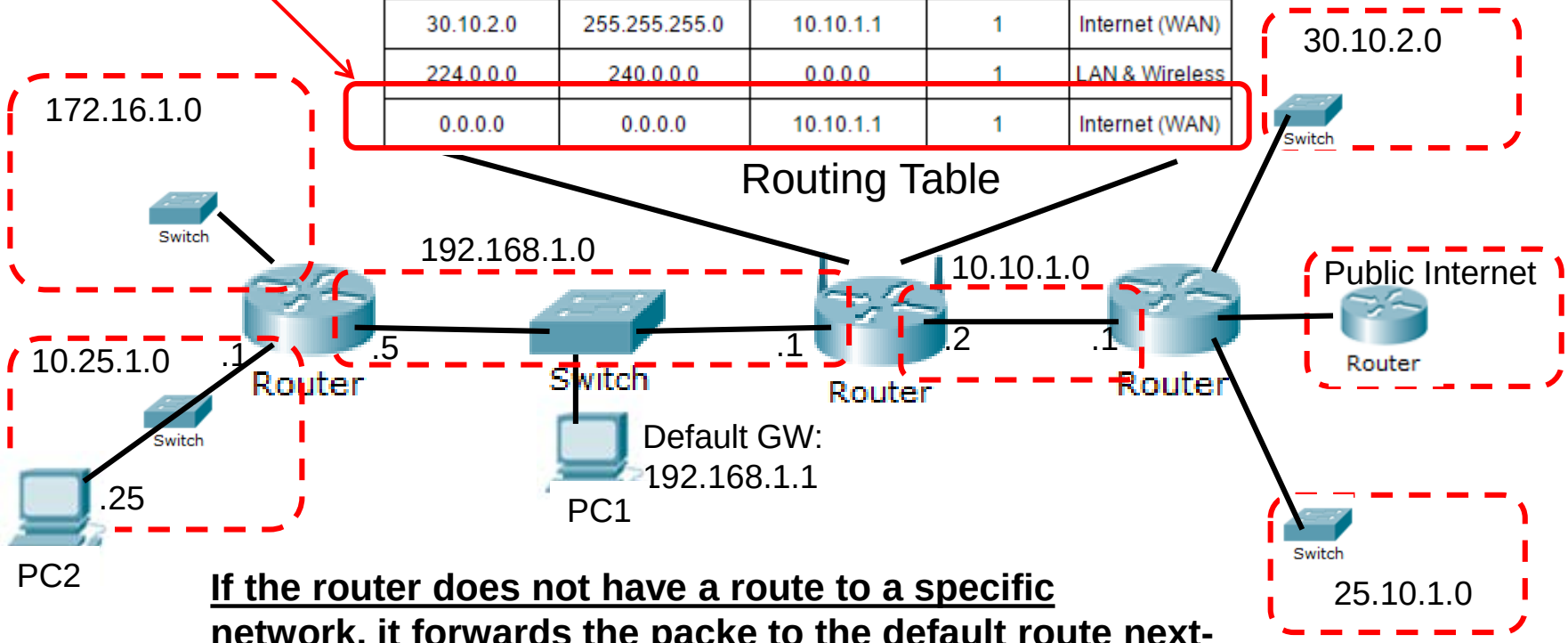
Routing Table

Connected Networks

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



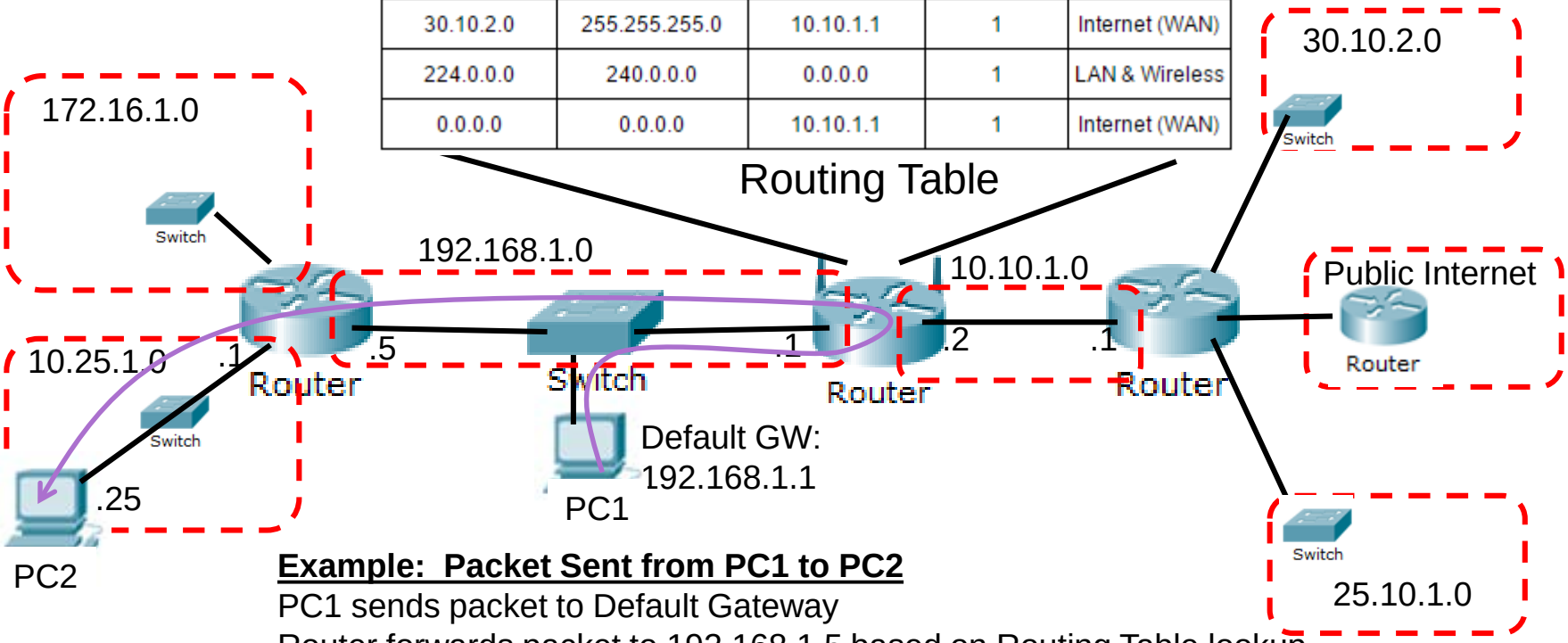
If the router does not have a route to a specific network, it forwards the packe to the default route next-hop address.

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
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



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 Addres
Router egress interfaces forwards frame to PC2

Compress and Decompress IPv6 Address?

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

Source IP

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:db8:acad:a::/64