Cisco Networking Academy
Mind Wide Open

Chapter 5: Ethernet

Introduction to Networks v5.1

Chapter Outline

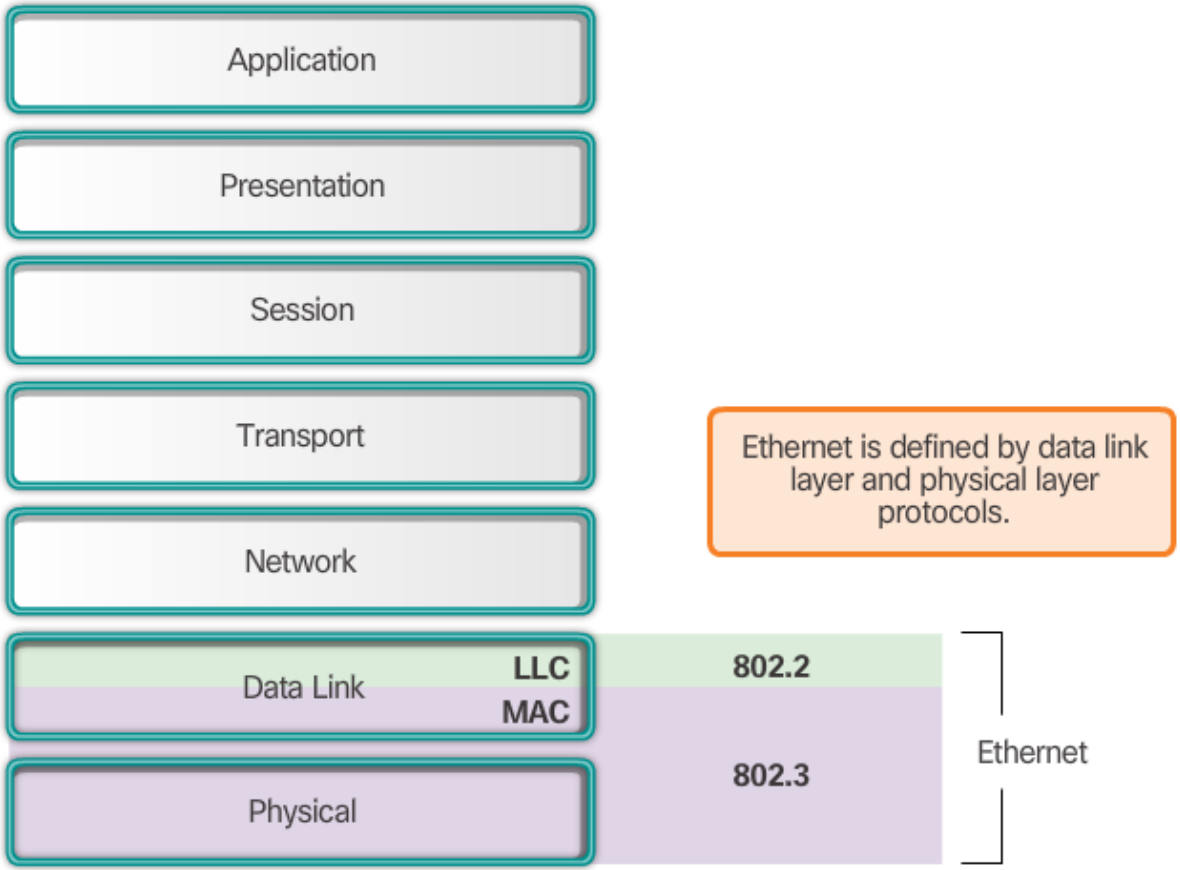
Section 5.1:
Ethernet Protocol

Upon completion of this section, you should be able to:

- Explain how the Ethernet sublayers are related to the frame fields.
- Describe the Ethernet MAC address.

Topic 5.1.1:
Ethernet Frame

Ethernet Encapsulation



Ethernet Encapsulation (cont.)

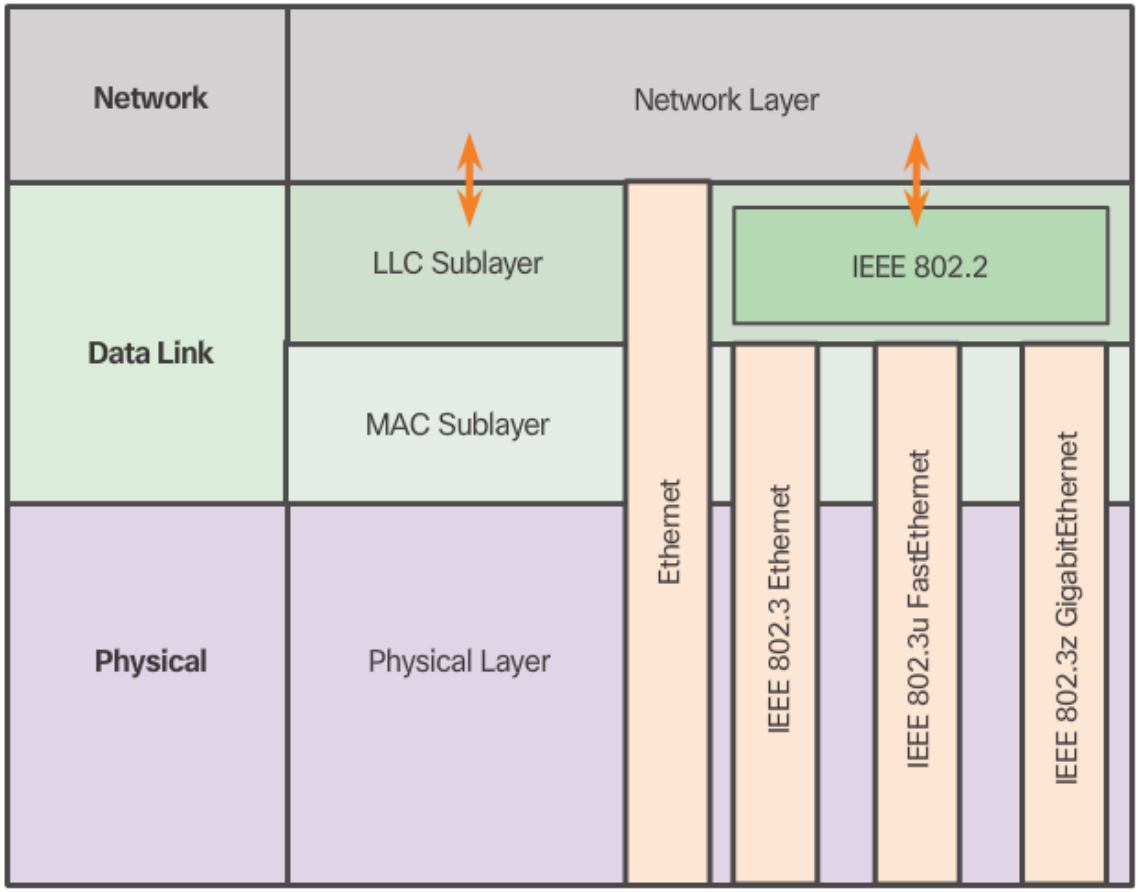
Ethernet

- Most widely used LAN technology
- Operates in the data link layer and the physical layer
- Family of networking technologies that are defined in the IEEE 802.2 and 802.3 standards
- Supports data bandwidths of 10, 100, 1000, 10,000, 40,000, and 100,000 Mbps (100 Gbps)

Ethernet standards

- Define Layer 2 protocols and Layer 1 technologies
- Two separate sub layers of the data link layer to operate - Logical link control (LLC) and the MAC sublayers

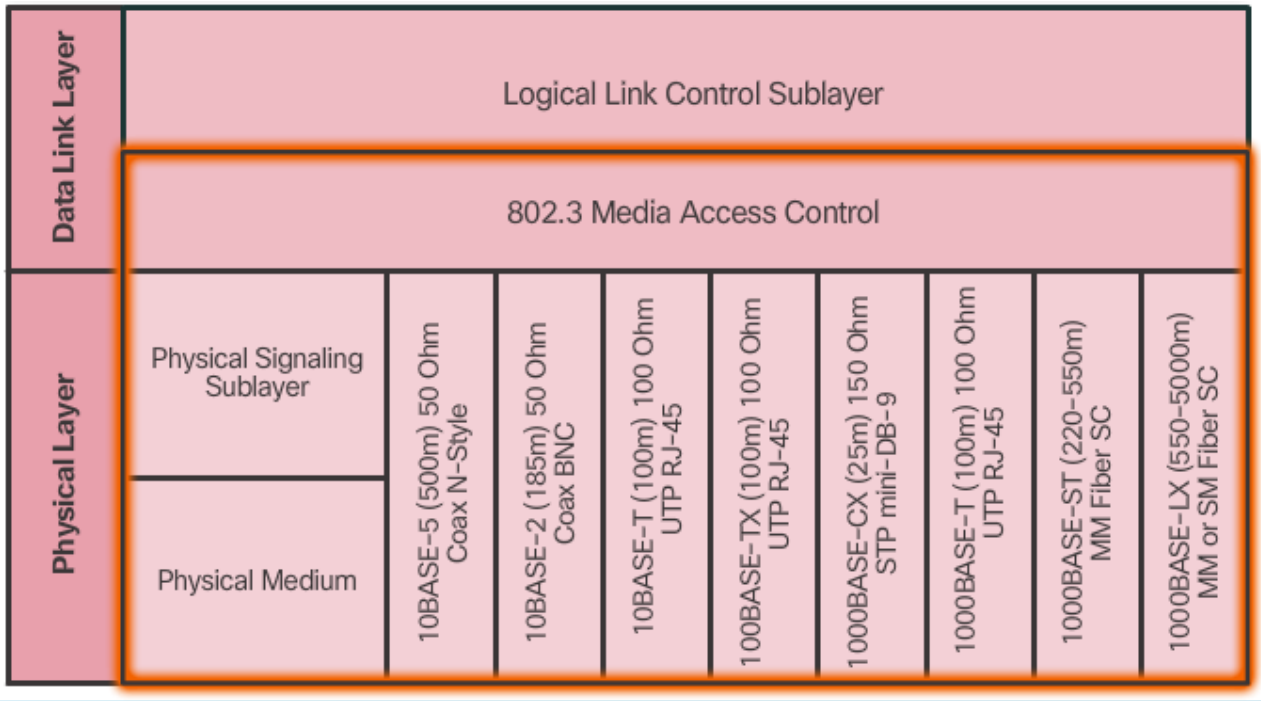
Ethernet Encapsulation(cont.)



Mac Sublayer

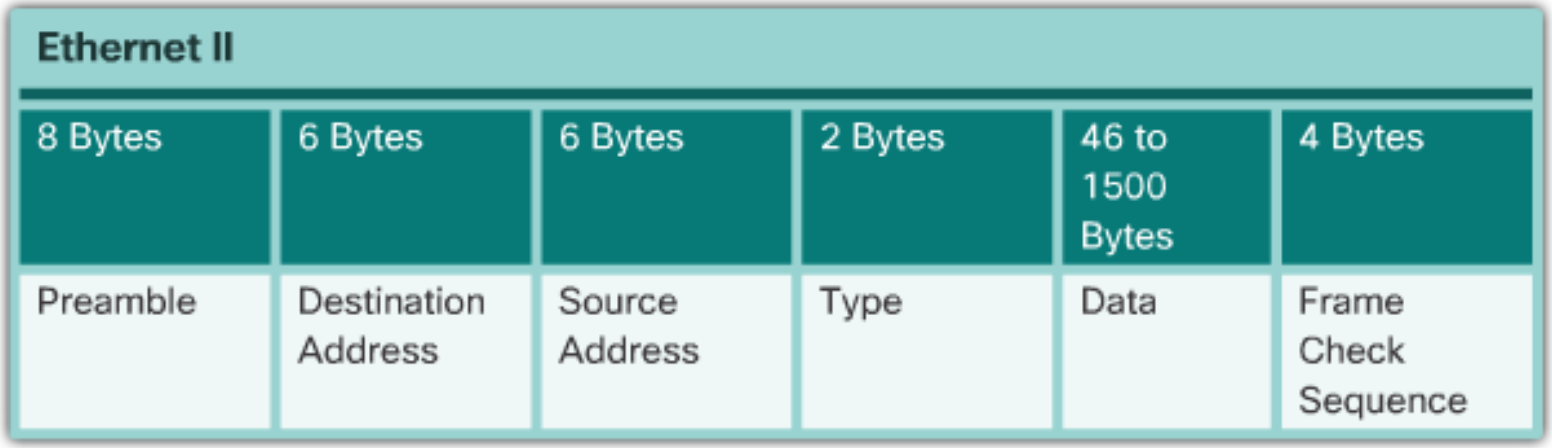
Primary responsibilities:

- Data encapsulation
- Media access control



Ethernet Evolution

Ethernet II Frame Structure and Field Size



Ethernet II Frame Fields

- Minimum Ethernet frame size is 64 bytes (Collision Frame or Runt)
- Maximum Ethernet frame size is 1518 bytes (Jumbo or Baby Giant)

Topic 5.1.2:
Ethernet MAC Address

MAC Address and Hexadecimal

Hexadecimal Numbering

Decimal and Binary equivalents of 0 to F Hexadecimal

Decimal	Binary	Hexadecimal
0	0000	0
1	0001	1
2	0010	2
3	0011	3
4	0100	4
5	0101	5
6	0110	6
7	0111	7
8	1000	8
9	1001	9
10	1010	A
11	1011	B
12	1100	C
13	1101	D
14	1110	E
15	1111	F

MAC Address and Hexadecimal (cont.)

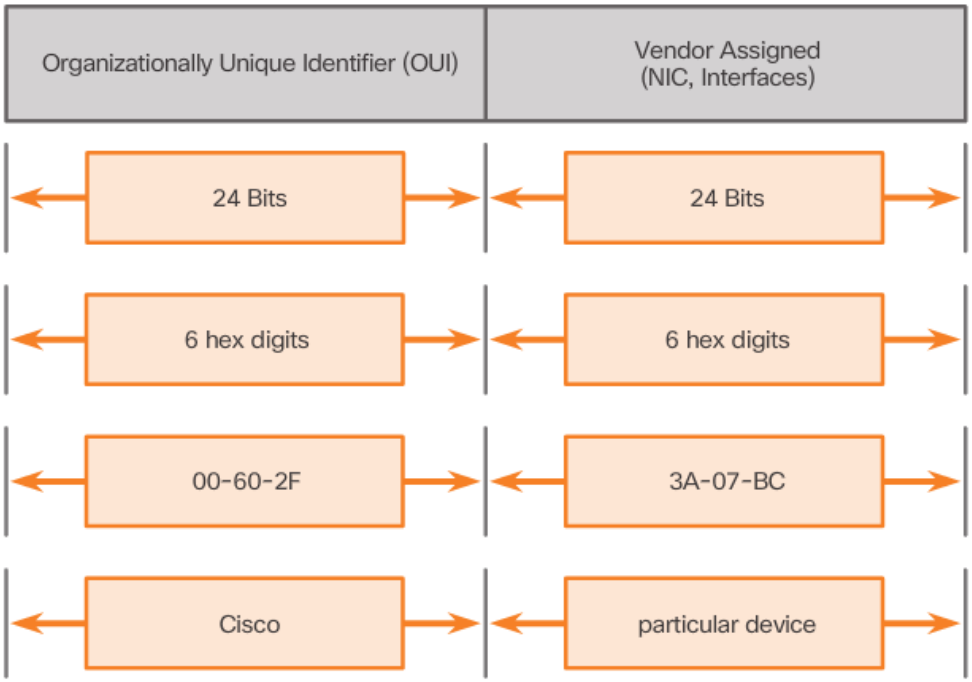
Hexadecimal Numbering

Selected Decimal, Binary, and Hexadecimal equivalents

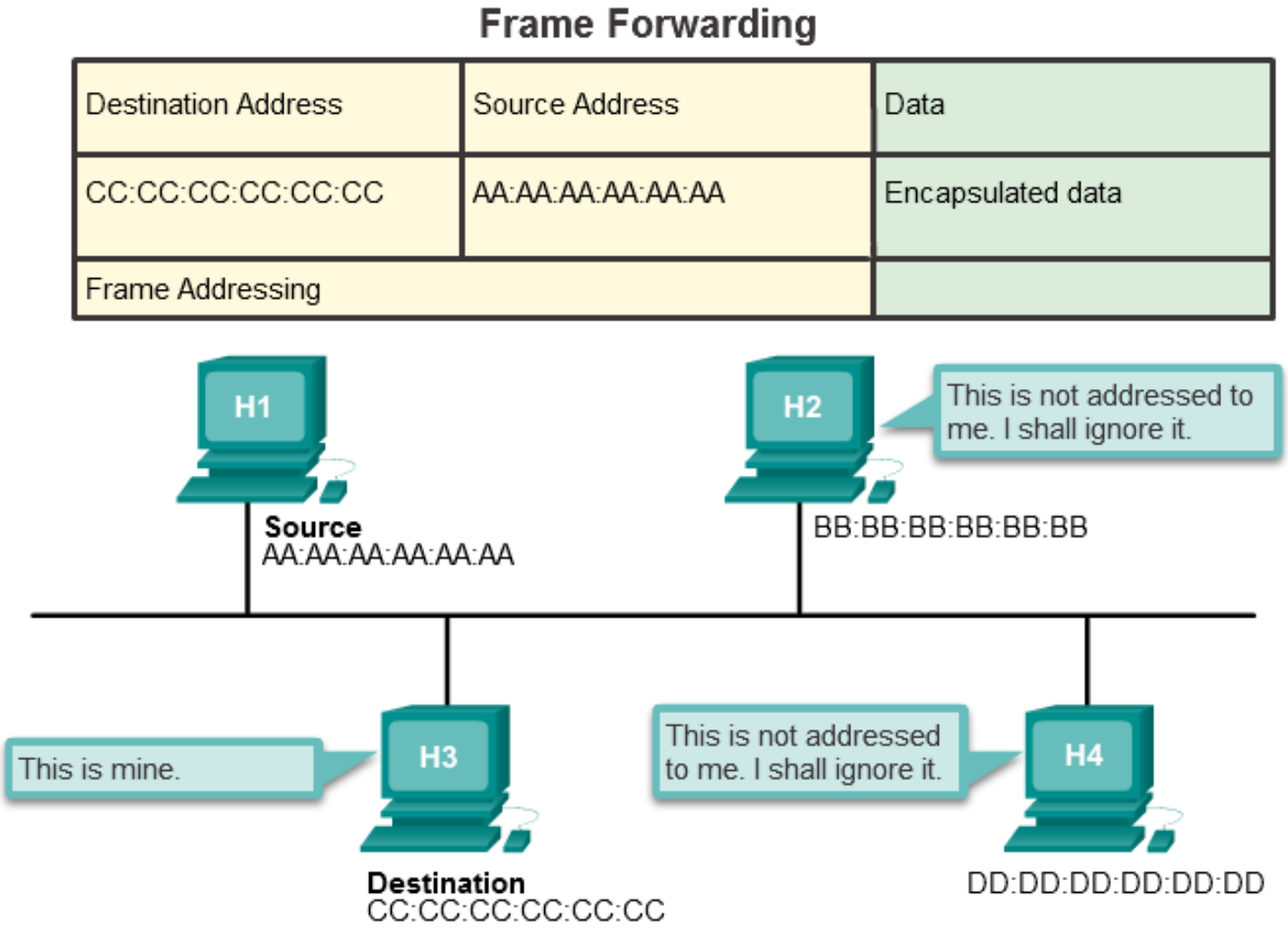
Decimal	Binary	Hexadecimal
0	0000 0000	00
1	0000 0001	01
2	0000 0010	02
3	0000 0011	03
4	0000 0100	04
5	0000 0101	05
6	0000 0110	06
7	0000 0111	07
8	0000 1000	08
10	0000 1010	0A
15	0000 1111	0F
16	0001 0000	10
32	0010 0000	20
64	0100 0000	40
128	1000 0000	80
192	1100 0000	C0
202	1100 1010	CA
240	1111 0000	F0
255	1111 1111	FF

MAC Address: Ethernet Identity

- Layer 2 Ethernet MAC address is a 48-bit binary value expressed as 12 hexadecimal digits.
- IEEE requires a vendor to follow two simple rules:
  - Must use that vendor's assigned OUI as the first three bytes.
  - All MAC addresses with the same OUI must be assigned a unique value in the last three bytes.



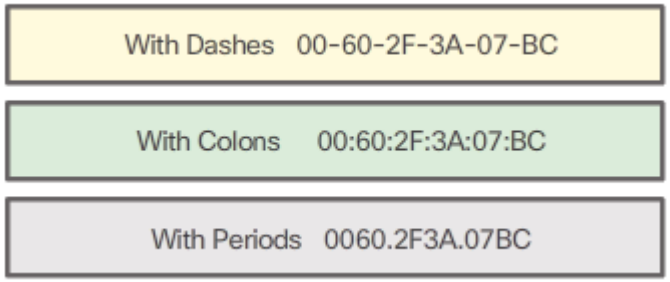
Frame Processing



Frame Processing (cont.)

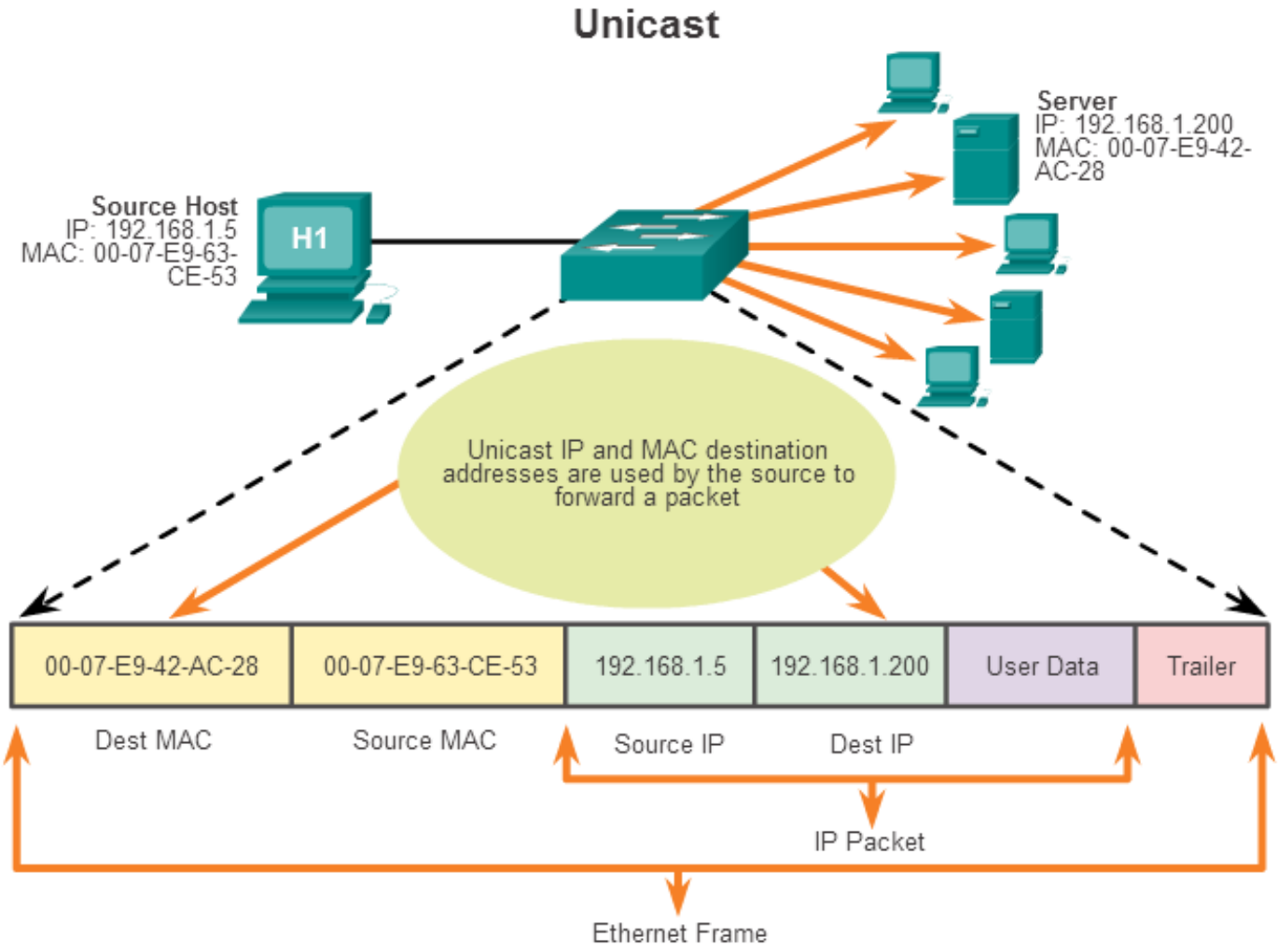
- The NIC views information to see if the destination MAC address in the frame matches the device's physical MAC address stored in RAM.
- If there is no match, the device discards the frame.
- If there is a match, the NIC passes the frame up the OSI layers, where the de-encapsulation process takes place.

MAC Address Representations

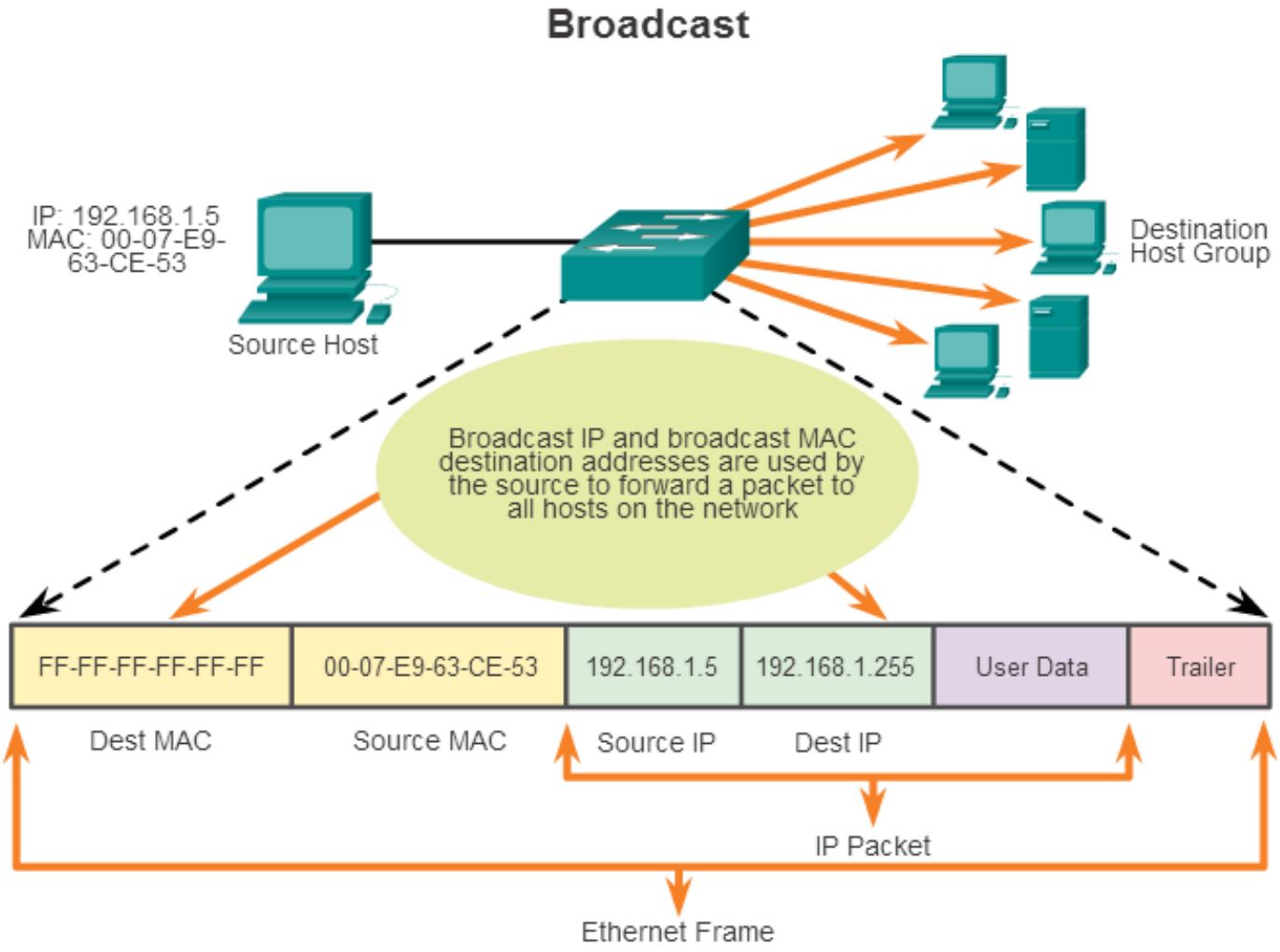



```
C:\> ipconfig/all

Ethernet adapter Local Area Connection:

   Connection-specific DNS Suffix  . : example.com
   Description . . . . . . . . . . . : Intel(R) Gigabit Network Connection
   Physical Address. . . . . . . . . : 00-18-DE-DD-A7-B2
   DHCP Enabled. . . . . . . . . . . : Yes
   Autoconfiguration Enabled . . . . : Yes
   Link-local IPv6 Address . . . . . : fe80::449f:c2:de06:ebad%10(Preferred)
   IPv4 Address. . . . . . . . . . . : 10.10.10.2(Preferred)
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Lease Obtained. . . . . . . . . . : Monday, June 01, 2015 11:19:48 AM
   Lease Expires . . . . . . . . . . : Thursday, June 04, 2015 11:19:49 PM
   Default Gateway . . . . . . . . . : 10.10.10.1
   DHCP Server . . . . . . . . . . . : 10.10.10.1
   DNS Servers . . . . . . . . . . . : 10.10.10.1
```

Unicast MAC Address



Broadcast MAC Address



Multicast MAC Address