The Ethernet Specifications

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Ethernet Basics

Ethernet

- The technology for connecting devices in a network
- Describes how network devices can format and transmit data
- Uses both Data Link and Physical layer specifications
- Electrical and Electronics Engineers (IEEE) defines Ethernet as protocol 802.3

Ethernet Basics

Ethernet

Bandwidth	Common Name	Informal name	IEEE name	Cable Type
10 Mbps	Ethernet	10Base-T	802.3	UTP 100m
100 Mbps	Fast Ethernet	100Base-T	802.3u	UTP 100m
1000 Mbps	Gigabit Ethernet	1000Base-LX	802.3z	Fiber 5000m
1000 Mbps	Gigabit Ethernet	1000Base-T	802.3ab	UTP 100m
10 Gbps	10 Gigabit Ethernet	10GBase-T	802.3an	UTP 100m

Ethernet Basics

Collision Domain

The term collision domain is used to describe a part of a network where packet collisions can occur

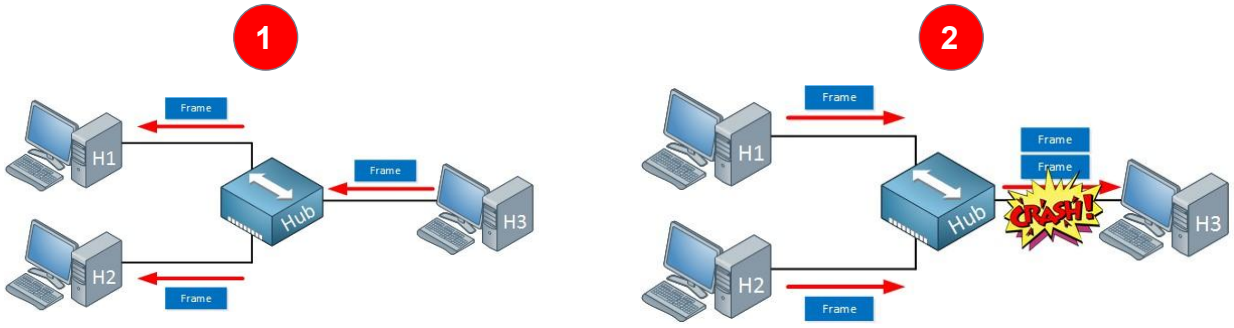
Collisions occur when two devices on a shared network segment send packets simultaneously

The colliding packets must be discarded and sent again, which reduces network efficiency

Ethernet Basics

Collision Domain

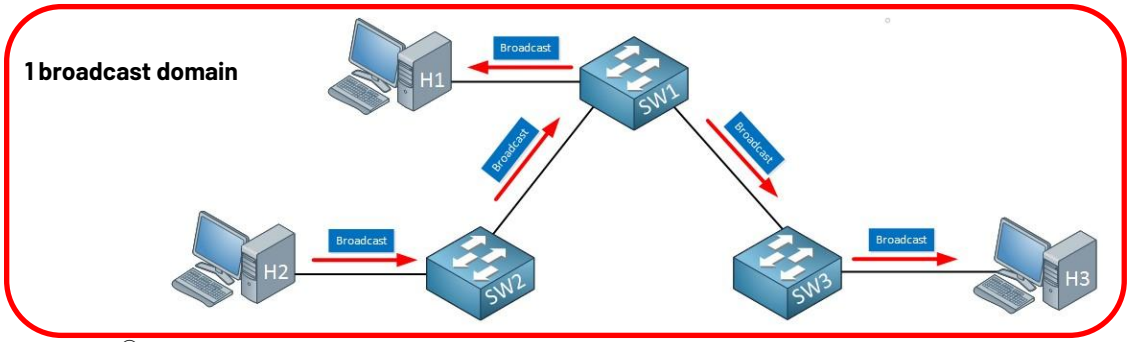
Occurs often in a hub environment



Ethernet Basics

Broadcast Domain

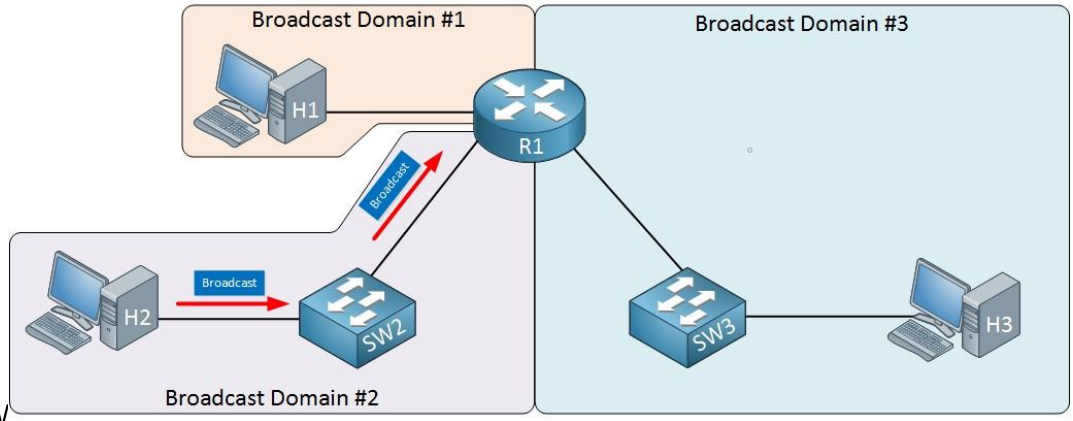
A broadcast domain is a collection of network devices that receive broadcast traffic from each other



Ethernet Basics

Broadcast Domain

The more broadcast domains the more efficient network



Ethernet Basics

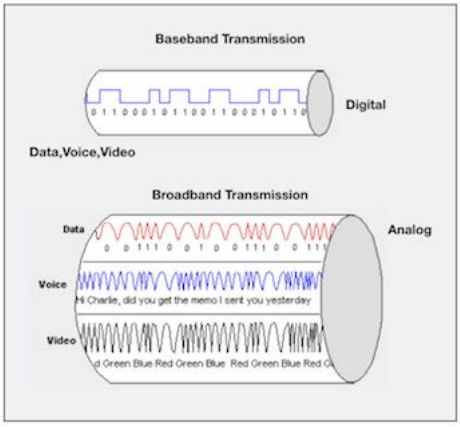
CSMA/CD

- Carrier Sense Multiple Access/Collision Detection is the protocol that is used to detect collisions and to re-transmit frames
- Only **bridges**, **switches**, and **routers**, but not **hubs**, can effectively prevent a transmission from propagating throughout the entire network

Ethernet Basics

Broadband/Baseband

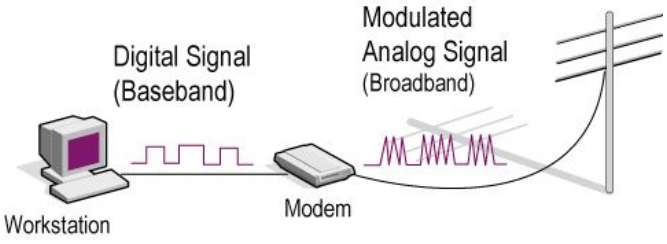
- Baseband
  - Uses digital signals and single channel
  - Communication is bidirectional
  - Short distance
- Broadband
  - Uses analog signals
  - Multiple transmissions are possible
  - Communication is unidirectional
  - Long distance



Ethernet Basics

Broadband/Baseband

If you are using a broadband internet connection for your home internet, the signals from your ISP up to your broadband router are broadband signals. But, the signals used inside your Ethernet LAN are baseband signals.



2 Ethernet at the Data Link Layer

Binary to Decimal and Hexadecimal Conversion
Ethernet Addressing
Ethernet Frames
Ethernet II Frames

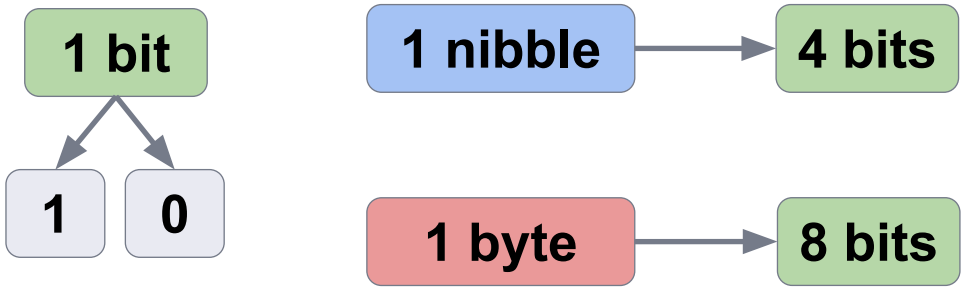
Ethernet at the Data Link Layer

Binary to Decimal and Hexadecimal Conversion

- Ethernet at the Data Link layer is responsible for:
    - **Ethernet addressing** (hardware or MAC addressing)
    - **framing packets** received from the Network layer
- Ethernet MAC addresses are made up of hexadecimal addresses

Ethernet at the Data Link Layer

Binary to Decimal and Hexadecimal Conversion



Ethernet at the Data Link Layer

Binary to Decimal Conversion

Binary Value	Decimal Value
10000000	128
11000000	192
11100000	224
11110000	240
11111000	248
11111100	252
11111110	254
11111111	255

Ethernet at the Data Link Layer

Binary to Decimal and Hexadecimal Conversion

Binary Value	Hexadecimal Value	Decimal Value
0000	0	0
0001	1	1
0010	2	2
0011	3	3
0100	4	4
0101	5	5
0110	6	6
0111	7	7

Binary Value	Hexadecimal Value	Decimal Value
1000	8	8
1001	9	9
1010	A	10
1011	B	11
1100	C	12
1101	D	13
1110	E	14
1111	F	15

Ethernet at the Data Link Layer

Binary to Decimal and Hexadecimal Conversion

Example:

What is the binary value of **0x4E (or 4Eh)?**
(0x and h means that the value is hexadecimal or hex)

binary: 4 = 0100, E = 1110 → 01001110

Ethernet at the Data Link Layer

Binary to Decimal and Hexadecimal Conversion

What is the binary value of **27h**?

Ethernet at the Data Link Layer

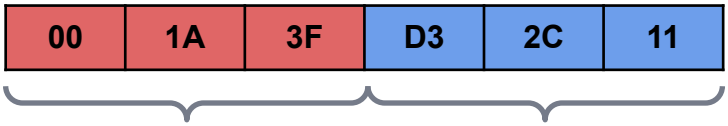
Binary to Decimal and Hexadecimal Conversion

What is the binary value of **0xF9**?

Ethernet at the Data Link Layer

Ethernet Addressing

- MAC (Media Access Control) Address
  - 48-bit (6 bytes or 12-digit hex) hardware number
  - unique
  - embedded into the network card, not changeable
  - represented as **00:1A:3F:D3:2C:11** or **00-1A-3F-D3-2C-11**

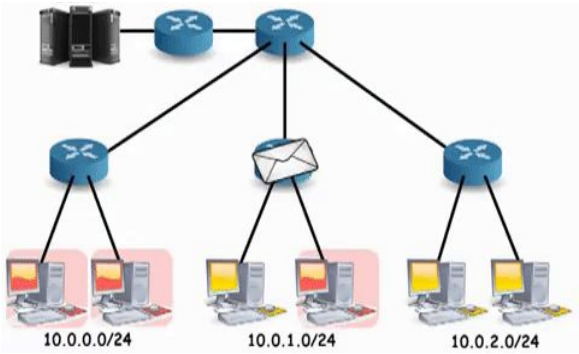


Organizationally Unique Identifier (OUI) Network Interface Controller Specific

Ethernet at the Data Link Layer

Types of MAC Address

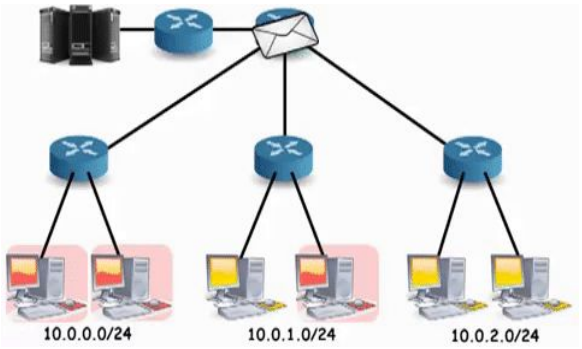
1. Unicast:
   - A specific NIC on the network
   - Only one sender and only one receiver



Ethernet at the Data Link Layer

Types of MAC Address

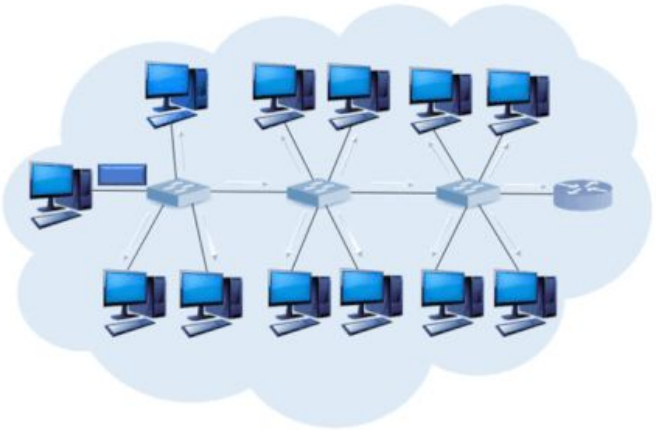
2. Multicast:
   - A group of receivers
   - OUI is **01:00:5E**



Ethernet at the Data Link Layer

Types of MAC Address

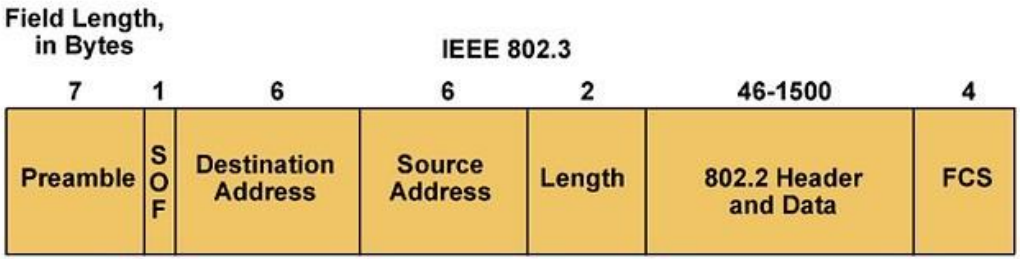
3. Broadcast:
   - All devices on the network are recipients
   - MAC Address is: **FF:FF:FF:FF:FF:FF**



Ethernet at the Data Link Layer

Ethernet Frames

- Encapsulated data defined by the Network Access layer is called an Ethernet frame
- The Ethernet frame structure is defined in the IEEE 802.3 standard



THANKS!

Any questions?

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