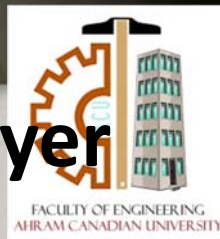




Lecture (05)

Network Access layer fundamentals II LAN, & WAN



By:

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Agenda

- Ethernet Addressing
- Ethernet Framing

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Ethernet Addressing

Terms:

- Ethernet LAN addressing identifies either individual devices or groups of devices on a LAN
- *Term unicast addresses, or individual addresses, is used because it identifies an individual LAN interface card.*
- While terms *broadcast, multicast, refers to a group addresses.*

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Ethernet Addressing (2)

How dose it work?

- For instance, imagine that Fred and Barney are on the same Ethernet, and Fred sends Barney a frame.
- Fred puts his own Ethernet MAC address in the Ethernet header as the source address and uses Barney's Ethernet MAC address as the destination.
- When Barney receives the frame, he notices that the destination address is his own address, so Barney processes the frame.
- If Barney receives a frame with some other device's unicast address in the destination address field, Barney simply does not process the frame.

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Ethernet Addressing (3)

IEEE standard MAC addresses:

- The IEEE requires globally unique unicast MAC addresses on all LAN interface cards.
- manufacturers encodes the MAC address onto the card, usually in a ROM chip.
- The first half of the address identifies the manufacturer of the card -*organizationally unique identifier (OUI)*-.
• the second half of the address being assigned a number that this manufacturer has never used on another card.

Ethernet Addressing (4)

Group addresses

- The IEEE defines two general categories of group addresses for Ethernet:
 1. **Broadcast addresses** have a value of FFFF.FFFF.FFFF (hexadecimal notation). The broadcast address implies that all devices on the LAN should process the frame. Ethernet Data-Link Protocols
 2. **Multicast addresses**—are used to allow a subset of devices on a LAN to communicate. Some applications need to communicate with multiple other devices.

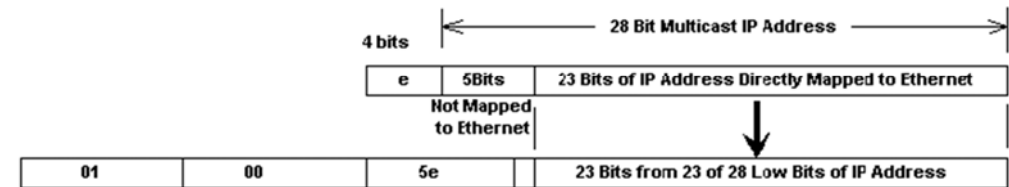
Ethernet Addressing (5)

- When we use a switch to connect hosts, multicast messages are actually forwarded to all hosts on the hub or the switch.
- As you should know, devices actually use MAC addresses to communicate on the local network segment.
- When the device on the local segment needs to send a multicast message, it will use a frame with a special MAC address.
- Special multicast addresses in the MAC address begin with 01-00-5E.
- The remaining portion of the MAC address is a modified format of the multicast IP address.

- When the switch receives the frame with the multicast MAC address, it will forward the frame out all ports to all connected devices.
- In this case, even devices that are not members of the original IP multicast group will see the frame.
- However, devices that don't belong to the IP multicast group will not process the frame since they will check the destination IP address

- An IP multicast address is in the range 224.0.0.0 through 239.255.255.255.
- In hexadecimal that is E0.00.00.00 to EF.FF.FF.FF. To be a multicast address, the first three bits of the most significant byte must be set and the fourth bit must be clear.
- In the IP address, there are 28 bits for multicasting.
- Therefore there are 5 multicasting bits that cannot be mapped into an Ethernet data packet.
- The 5 bits that are not mapped are the 5 most significant bits.

IP to Ethernet Multicast Address Mapping



- The 28 IP multicast bits are called the multicast group ID.
- A host group listening to a multicast can span multiple networks.

Ethernet Addressing (6)

Summary:

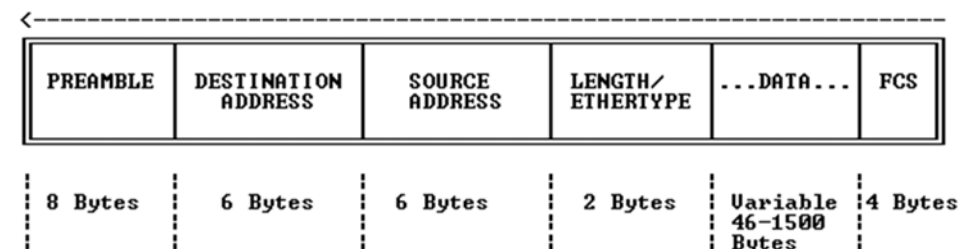
LAN MAC Address Terminology and Features

LAN Addressing Terms and Features	Description
MAC	Media Access Control. 802.3 (Ethernet) and 802.5 (Token Ring) are the MAC sublayers of these two LAN data-link protocols.
Ethernet address, NIC address, LAN address, Token Ring address, card address	Other names often used instead of MAC address. These terms describe the 6-byte address of the LAN interface card.
Burned-in address	The 6-byte address assigned by the vendor making the card. It usually is burned into a ROM or EEPROM on the LAN card and begins with a 3-byte organizationally unique identifier (OUI) assigned by the IEEE.
Unicast address	Fancy term for a MAC that represents a single LAN interface.
Broadcast address	An address that means "all devices that reside on this LAN right now."
Multicast address	Not valid on Token Ring. On Ethernet, a multicast address implies some subset of all devices currently on the LAN.

Ethernet Framing

Definition:

- Framing defines the meaning behind the bits that are transmitted across a network.
- Which refers to the definition of the fields assumed to be in the data that is received.



Ethernet Framing (2)

Real life example:

- For instance, if Fred is sending data to Barney over an Ethernet.
- Fred put Barney's Ethernet address in the Ethernet header so that Barney would know that the Ethernet frame was meant for Barney.
- The IEEE 802.3 standard defines the location of the destination address field inside the string of bits sent across the Ethernet .

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Ethernet Framing (3)

Maximum transmission unit (MTU)

- The IEEE 802.3 specification limits the data portion of the 802.3 frame to a maximum of 1500 bytes.
- The Data field was designed to hold Layer 3 packets; the term *maximum transmission unit (MTU)* defines the maximum Layer 3 packet that can be sent over a medium.
- Because the Layer 3 packet rests inside the data portion of an Ethernet frame, 1500 bytes is the largest IP packet allowed over an Ethernet.

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Ethernet Framing (4)

Identifying the Data Inside an Ethernet Frame

There are three type of Ethernet frame

1. Ethernet DIX (early version of Ethernet by DEC, IBM, and Xeoreox)
2. IEEE Ethernet 802.3
3. IEEE Ethernet with SNAP header (*Subnetwork Access Protocol*)

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Ethernet Framing (5)

1. Ethernet DIX

Ethernet (DIX)

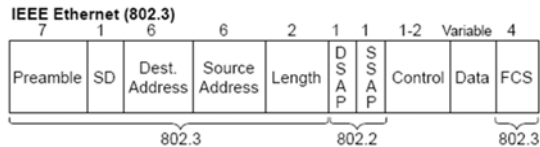
	8	6	6	2 Variable	4
Preamble	Dest. Address	Source Address	T y p e	Data	FCS

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Ethernet Framing (6)

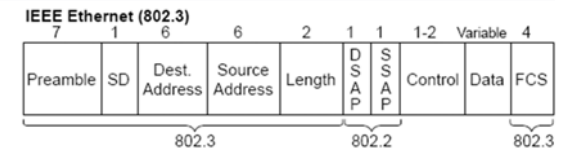
2. IEEE Ethernet (802.3)



Why?

- when the IEEE created 802.2 (Logical Link Control (LLC)), it saw the need for a protocol type field that identified what was inside the field called “data” in an IEEE Ethernet frame.
- The IEEE called its Type field the destination service access point (DSAP).

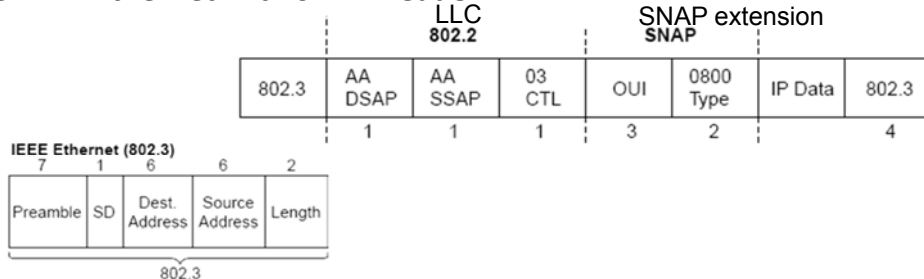
Ethernet Framing (7)



- When the IEEE first created the 802.2 standard, anyone with a little cash could register favorite protocols with the IEEE and receive a reserved value with which to identify those favorite protocols in the DSAP, and SSAP field.
- For instance, Novell registered IPX and was assigned hex E0 by the IEEE.
- However, the IEEE did not plan for a large number of protocols—and it was wrong.
- As it turns out, the 1-byte-long DSAP field is not big enough to number all the protocols.

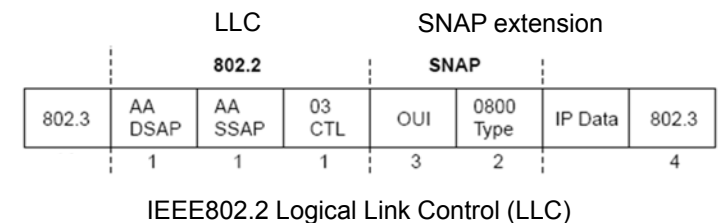
Ethernet Framing (8)

3. IEEE Ethernet with SNAP header



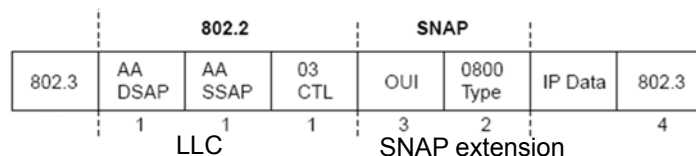
- To accommodate more protocols, the IEEE allowed the use of an extra header, called a Subnetwork Access Protocol (SNAP) header
- *OUI* : *IEEE Organizationally Unique Identifier*

- To identify that type of header, the DSAP, & SSAP field is AA, which implies that a *SNAP header follows the 802.2 header, and the SNAP header includes a 2-byte protocol type field.*
- Which is used for the same purpose as the DSAP field, but because it is 2 bytes long, all the possible protocols can be identified.



Ethernet Framing (9)

- For instance, in Figure, the SNAP type field has a value of 0800, signifying that the next header is an IP header



- IEEE Organizationally Unique Identifier (OUI) followed by a 2-octet protocol ID.
- If the OUI is hexadecimal 000000, the protocol ID is the Ethernet type (Ether Type)

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Ethernet Framing (10)

Other Examples

- Some examples of values in the Ethernet Type and SNAP Protocol fields are 0800 for IP and 8137 for NetWare.
- Examples of IEEE SNAP values are E0 for NetWare, 04 for SNA, and AA
- Interestingly, the IEEE does not have a reserved DSAP value for TCP/IP; SNAP headers must be used to support TCP/IP over IEEE Ethernet.

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Ethernet Framing (11)

Headers summary:

Protocol Type Fields in LAN Headers

Field Name	Length	LAN Type
Ethernet Type	2 bytes	DIX Ethernet
802.2 DSAP and SSAP	1 byte each	IEEE Ethernet, IEEE Token Ring, ANSI FDDI
SNAP Protocol	2 bytes	IEEE Ethernet, IEEE Token Ring, ANSI FDDI

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