CMPE 80N Section

Jordan Liss

Jliss@ucsc.edu

OH: Wed 2-4 in GSC 204

How do you check your grades?

- http://users.soe.ucsc.edu/~jliss/ce80n
  - Please email me if you have any issues

Data Link/Network Layer

Open Systems Interconnection model (OSI Model)

OSI Model				
Layer		Data unit	Function[3]	Examples
Host layers	7. Application	Data	High-level APIs, including resource sharing, remote file access, directory services and virtual terminals	HTTP, FTP, SMTP, SSH, TELNET
	6. Presentation		Translation of data between a networking service and an application; including character encoding, data compression and encryption/decryption	HTML, CSS, GIF
	5. Session		Managing communication sessions, i.e. continuous exchange of information in the form of multiple back-and-forth transmissions between two nodes	RPC, PAP, SSL, SQL
	4. Transport	Segments	Reliable transmission of data segments between points on a network, including segmentation, acknowledgement and multiplexing	TCP, UDP, NETBEUI
Media layers	3. Network	Packet/Datagram	Structuring and managing a multi-node network, including addressing, routing and traffic control	IPv4, IPv6, IPsec, AppleTalk, ICMP
	2. Data link	Bit/Frame	Reliable transmission of data frames between two nodes connected by a physical layer	PPP, IEEE 802.2, L2TP, MAC, DHCP, LLDP
	1. Physical	Bit	Transmission and reception of raw bit streams over a physical medium	Ethernet physical layer, DSL, USB, ISDN, DOCSIS

Important Definitions

- MAC: Media Access Control
  - Organizational Unique Identifier (24 bits)+ Vendor Assigned(24 bits)
  - Interfaces between logical link control (LLC) and physical layer
  - Every network device in the world has a pseudo-unique MAC address
    - Computers, Routers, Switches, etc.
    - https://regauth.standards.ieee.org/standards-ra-web/pub/view.html#registries
- IP Address: Internet Protocol
- LAN: Local Area Network (Network w/o router)
  - Wi-fi, LAN parties
- Multiplexing: Sharing data through the same media.
  - Fiber Optics or Ethernet
- Multi-access protocol: Everyone's connected and listening
- Random access protocol: Whoever is first, goes first
- Controlled access: Talking stick method
- Network Interface Controller (NIC): Connects computer to a network

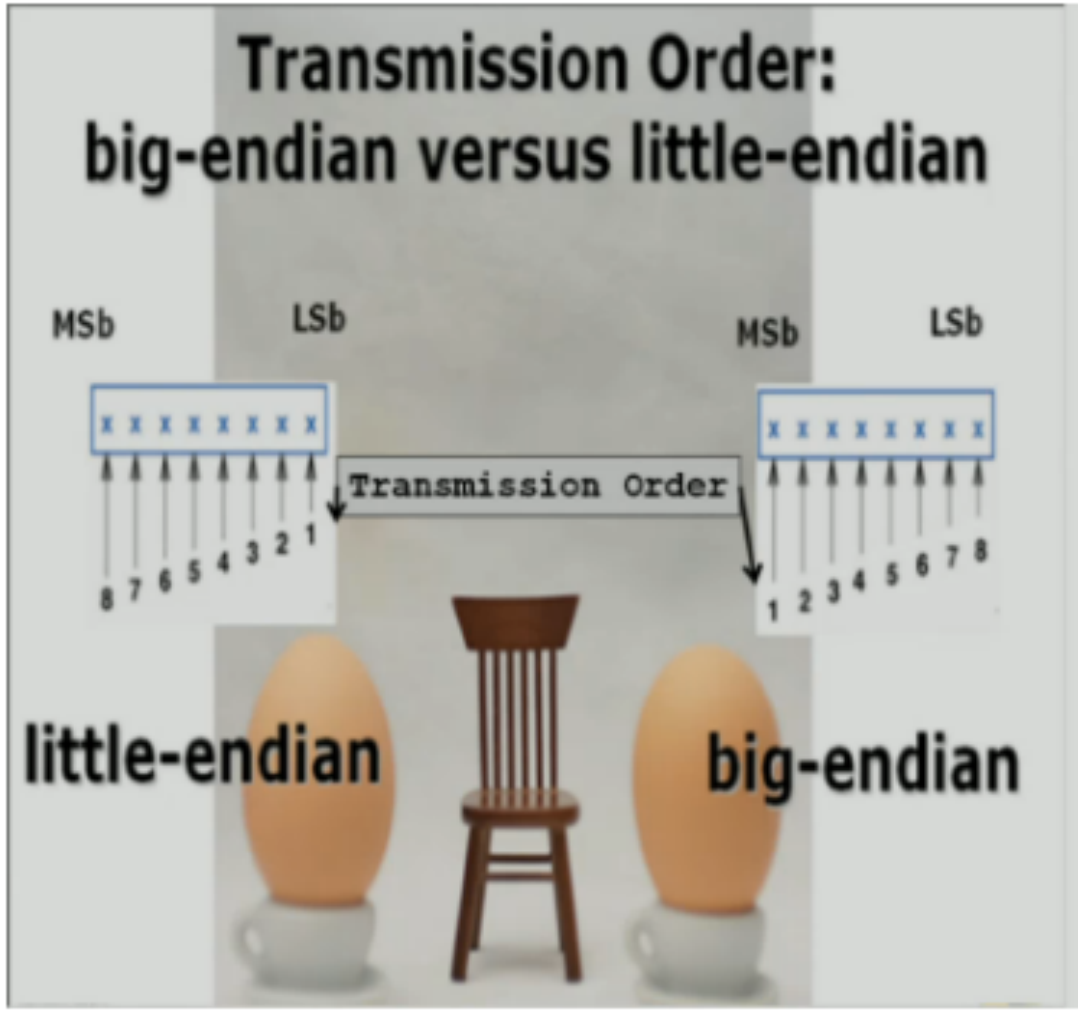
Review of Hexadecimal

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

Ex: MAC Address

- 00 22 6B 42 12 BA

Transmission Order: Big-Endian and Little Endian



MSB: Most Significant byte
LSB: Least Significant byte

Big-endian: MSB is sent first, then LSB

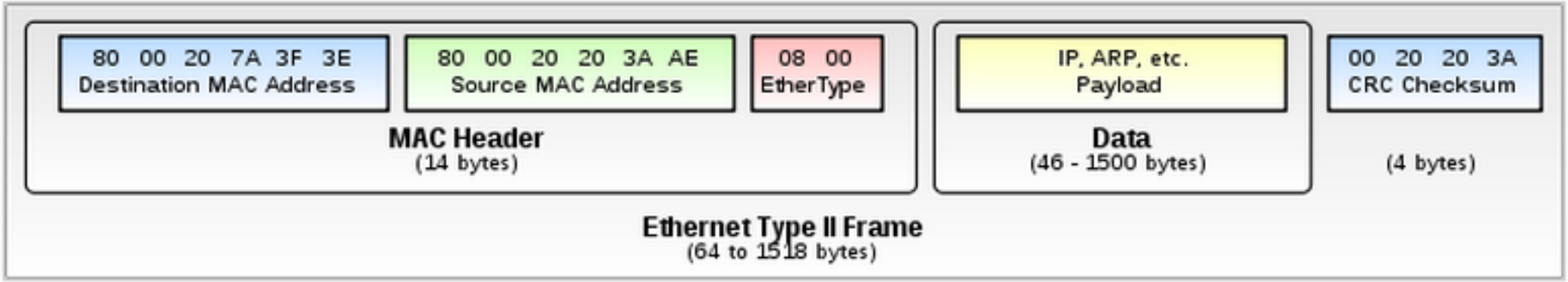
- Common in Computers
- EX: D4 CF A3

Little-endian: LSB is sent first, then MSB

- Common in Microprocessors
- EX: A3 CF D4

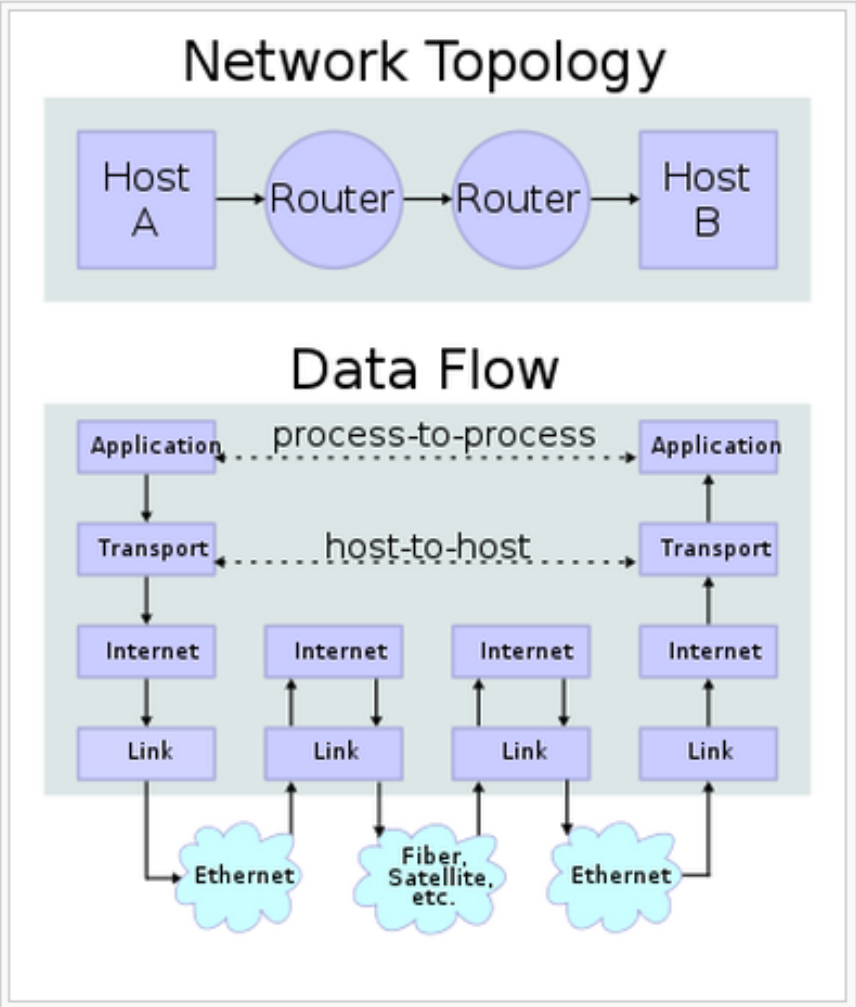
Packets, Blocks, Frames

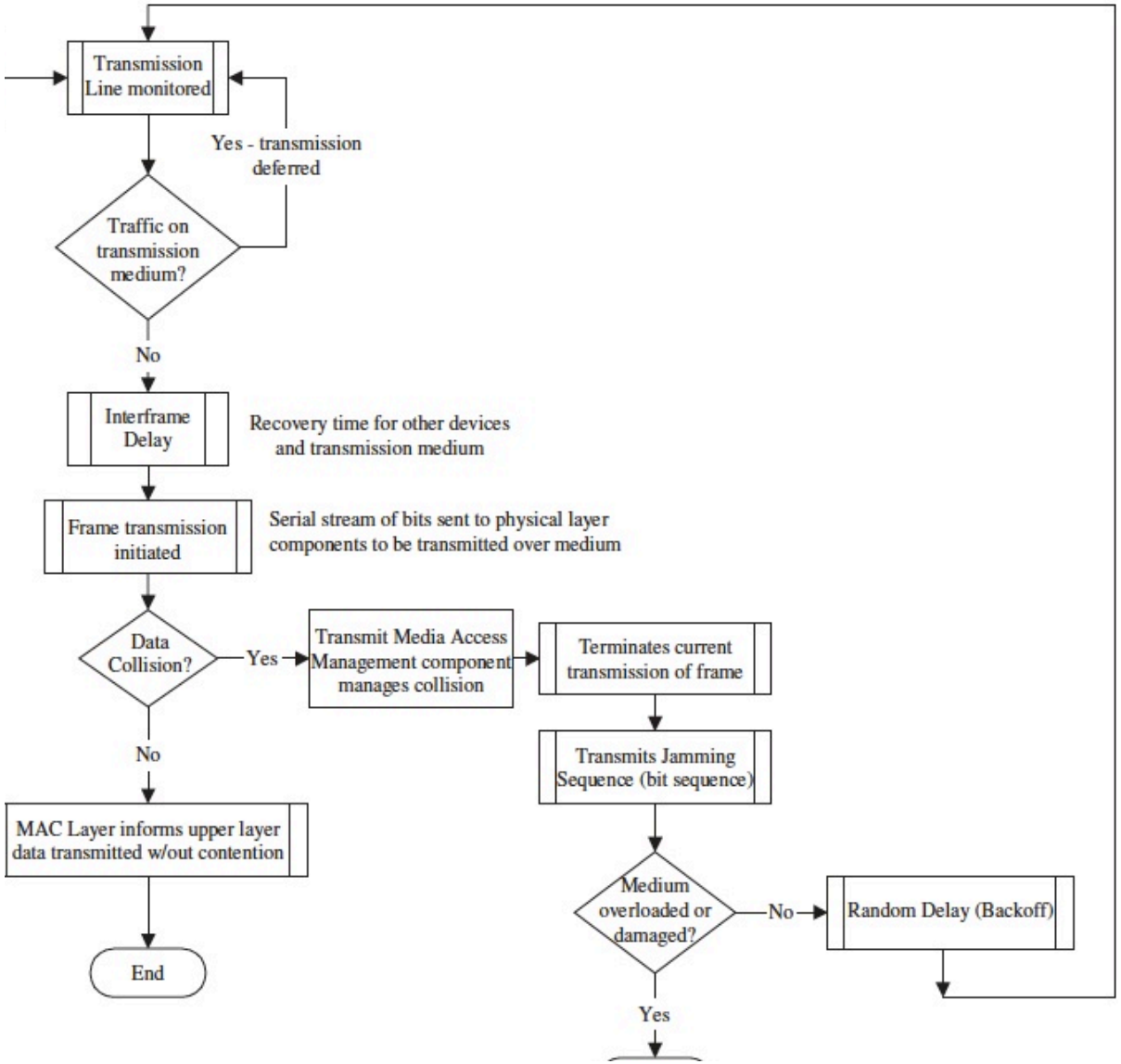
- Network data is sent in packet, blocks, frames
- Will include:
  - Address and payload (Actual data being sent)
  - Address: IP address and MAC address
    - IP address are assigned by the network
    - MAC address are assigned for the device by the manufacturer



The most common Ethernet Frame format, type II

Ethernet Protocol





In other words,

- NIC acquires data from CPU
- Wait for idle channel
  - Use random exponential back-off to wait for open channel
- If there is no collision, send
- If there is a collision, make adjustments

Ethernet Collision

- Carrier Sense
  - Checks the medium to see if there's no transmission traffic from node to node.
- CSMA/CA: Carrier sense multiple access with collision avoidance
  - Listen for open channel, everyone's listening, collision avoidance
- Collision Avoidance
  - Wait for a period of time stop transmitting before listening again for a free communications channel.
  - **Request to Send/Clear to Send** (RTS/CTS)
  - **Transmission**

Great Links with more info.

- https://en.wikipedia.org/wiki/Ethernet_frame
- https://askleo.com/whats_the_difference_between_a_mac_address_and_an_ip_address/
- https://www.bestvpn.com/blog/28721/5-best-vpn-services-october-2015-update/
  - VPN (Learn how to use servers from other countries to hide your location)