CSE3151

COMPUTER NETWORKS

DR. ASIF ZAMAN
ASSOCIATE PROFESSOR, CSE, RU

April 03, 2018

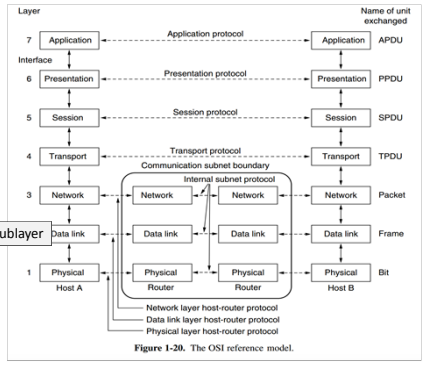


Figure 1-20. The OSI reference model.

ETHERNET

- Many of the designs for personal, local, and metropolitan area networks have been standardized under the name of **IEEE 802**.
- A few have survived but many have not.
- The most important of the survivors are:
  - 802.3 (Ethernet) and
  - 802.11 (wireless LAN)
  - Bluetooth (wireless PAN) is widely deployed but has now been standardized outside of 802.15.
    With 802.16 (wireless MAN)

ETHERNET

- Two kinds of Ethernet exist:
  - Classic Ethernet
  - Switch Ethernet
- **CLASSIC ETHERNET:** ran at rates from **3 to 10 Mbps**.
- **SWITCHED ETHERNET:** runs at **100, 1000, and 10,000** Mbps, in forms called
  - fast Ethernet,
  - gigabit Ethernet, and
  - 10 gigabit Ethernet

ETHERNET

- **CLASSIC ETHERNET:**
  - Classic Ethernet snaked around the building as a single long cable to which all the computers were attached.

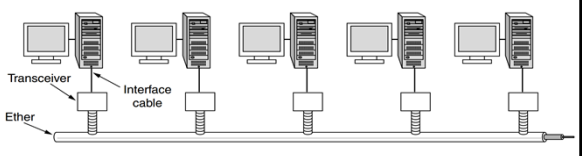


Figure 4-13. Architecture of classic Ethernet.

ETHERNET

- **CLASSIC ETHERNET:**
  - Thick Ethernet
    - The first variety, popularly called thick Ethernet, resembled a yellow garden hose, with **markings every 2.5 meters** to show where to attach computers.
    - 500m per segment
    - 100 machine /segment
  - Thin Ethernet
    - which bent more easily and made connections using industry-standard BNC connectors
    - 185m per segment
    - 30 machine / segment

ETHERNET

- Each version of Ethernet has a maximum cable length per segment (i.e., unamplified length) over which the signal will propagate.
- To allow larger networks, multiple cables can be connected by **REPEATERS**.
- A **REPEATER** is a physical layer device that receives, amplifies (i.e., regenerates), and retransmits signals in both directions.
- An Ethernet could contain multiple cable segments and multiple repeaters, but no two transceivers could be more than 2.5 km apart and no path between any two transceivers could traverse more than four repeaters

ETHERNET

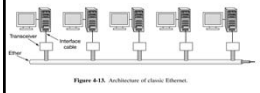


Figure 4-13. Architecture of classic Ethernet.

Collision Doman

- Hub vs Switch

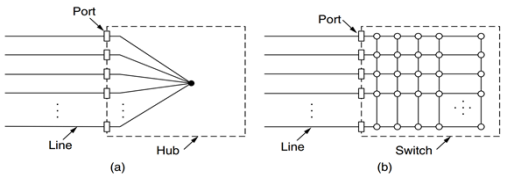


Figure 4-17. (a) Hub. (b) Switch.

ETHERNET

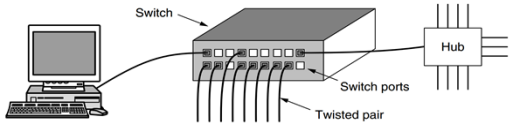


Figure 4-18. An Ethernet switch.

DATA LINK LAYER

Medium Access Sublayer: Pure and slotted ALOHA, Persistent and Non persistent CSMA, CSMA with collision detection and collision free protocols, IEEE standard 802.3 and Ethernet.

Data Link Layer: Types of errors, framing, error detection & correction methods; Flow control, Stop & wait ARQ, Go-Back- N ARQ, Selective repeat ARQ, HDLC.

DATA LINK LAYER

DATA LINK LAYER DESIGN ISSUES

1. Providing a well-defined service interface to the network layer.
2. Dealing with transmission errors.
3. Regulating the flow of data so that slow receivers are not swamped by fast senders.

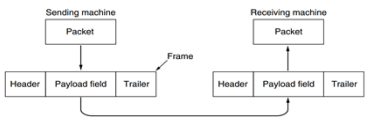


Figure 3-1. Relationship between packets and frames.

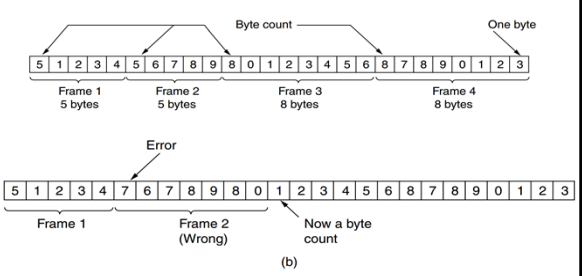
DATA LINK LAYER

- Framing:
  - Breaking up the bit stream into frames
- Four methods

1. Byte count.
2. Flag bytes with byte stuffing.
3. Flag bits with bit stuffing.
4. Physical layer coding violations.

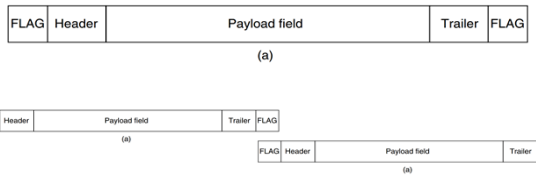
DATA LINK LAYER

- **BYTE COUNT**



DATA LINK LAYER

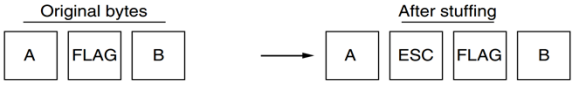
- **FLAG BYTE WITH BYTE STUFFING**

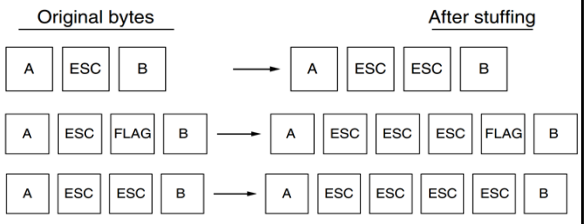


- Two consecutive flag bytes indicate the end of one frame and the start of the next.

DATA LINK LAYER

- It may happen that the flag byte occurs in the data, especially when binary data such as photographs or songs are being transmitted. This situation would interfere with the framing.
- One way to solve this problem is to have the sender's data link layer insert a special escape byte (ESC) just before each ''accidental'' flag byte in the data. This technique is called byte stuffing





DATA LINK LAYER

- **FLAG BITS WITH BIT STUFFING**

- Each frame begins and ends with a special bit pattern, **01111110** or **0x7E** in hexadecimal.