IEEE
Standards

October 30, 2020

Network Interface Card

A number of computers and devices interconnected by a shared transmission medium (wired or wireless) may be arranged in

- a bus,

- ring,

- star topology.

Regardless of the connection topology the stations need to "communicate to the network".

The device achieving this goal is called "Network Interface Card".

IEEE 802: The Network Interface Card

- Computers and devices connected to the system via a NIC (Network Interface Card) or LAN adaptor card which coordinates information transfer between computer and network.

- The NIC communicates in parallel with computer RAM and serially with network. Parallel/Serial conversion as well as buffering are necessary.

- NIC cards have a port meeting connector specs, and ROM allowing implementation of MAC standards. The NIC physical address is burned into the ROM: and consists of the vendor ID plus a unique number for the card specified by the vendor.
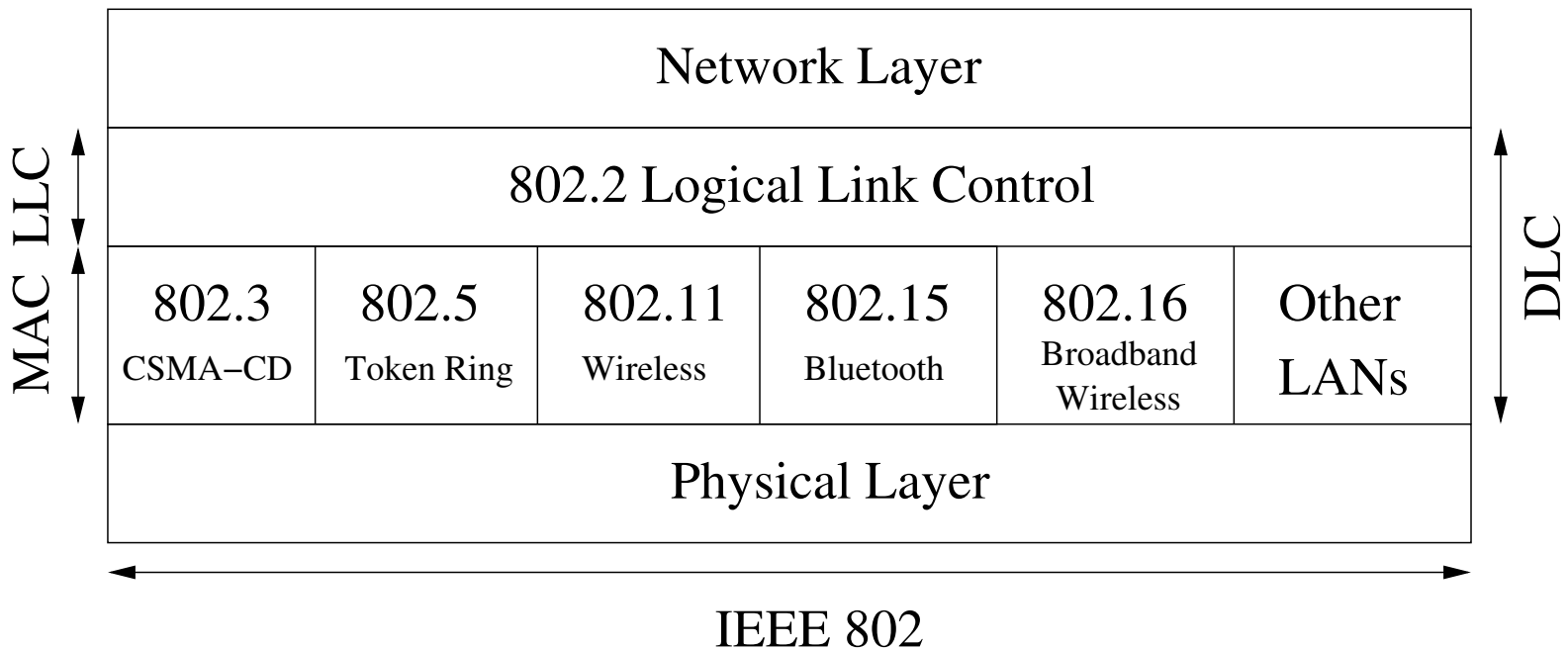
Network Adaptors

Network adaptors programmed by software running on host's CPU.
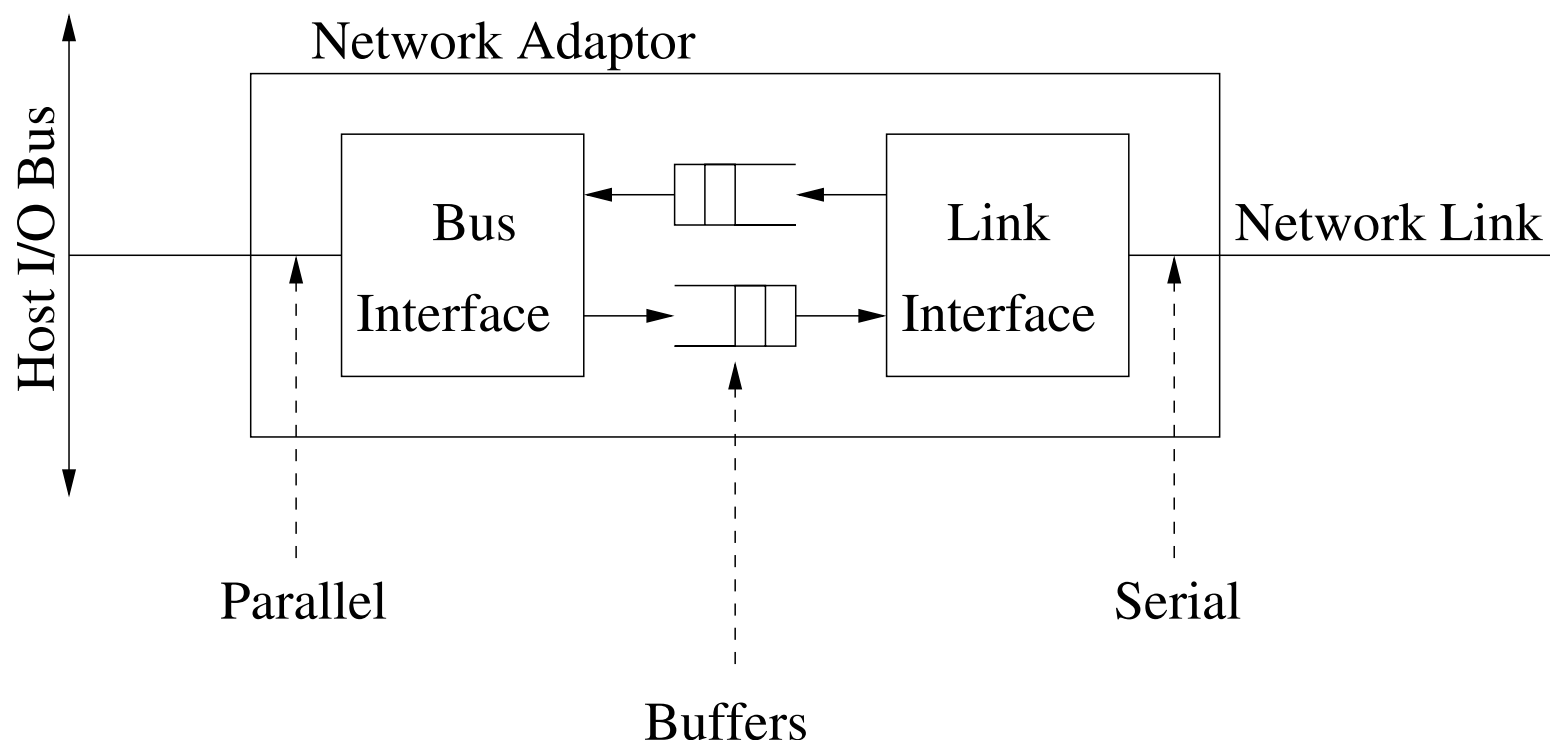
Adaptor exports Cotrol Status Register (CSR) that can be read and written by CPU. e.g., CPU writes to CSR to instruct it to transmit and/or receive frame. CPU reads CSR to learn adaptor's status.

IEEE 802 Layering Standards

Network Layer					
802.2 Logical Link Control					
802.3 CSMA–CD	802.5 Token Ring	802.11 Wireless	802.15 Bluetooth	802.16 Broadband Wireless	Other LANs
Physical Layer					

MAC LLC

DLC
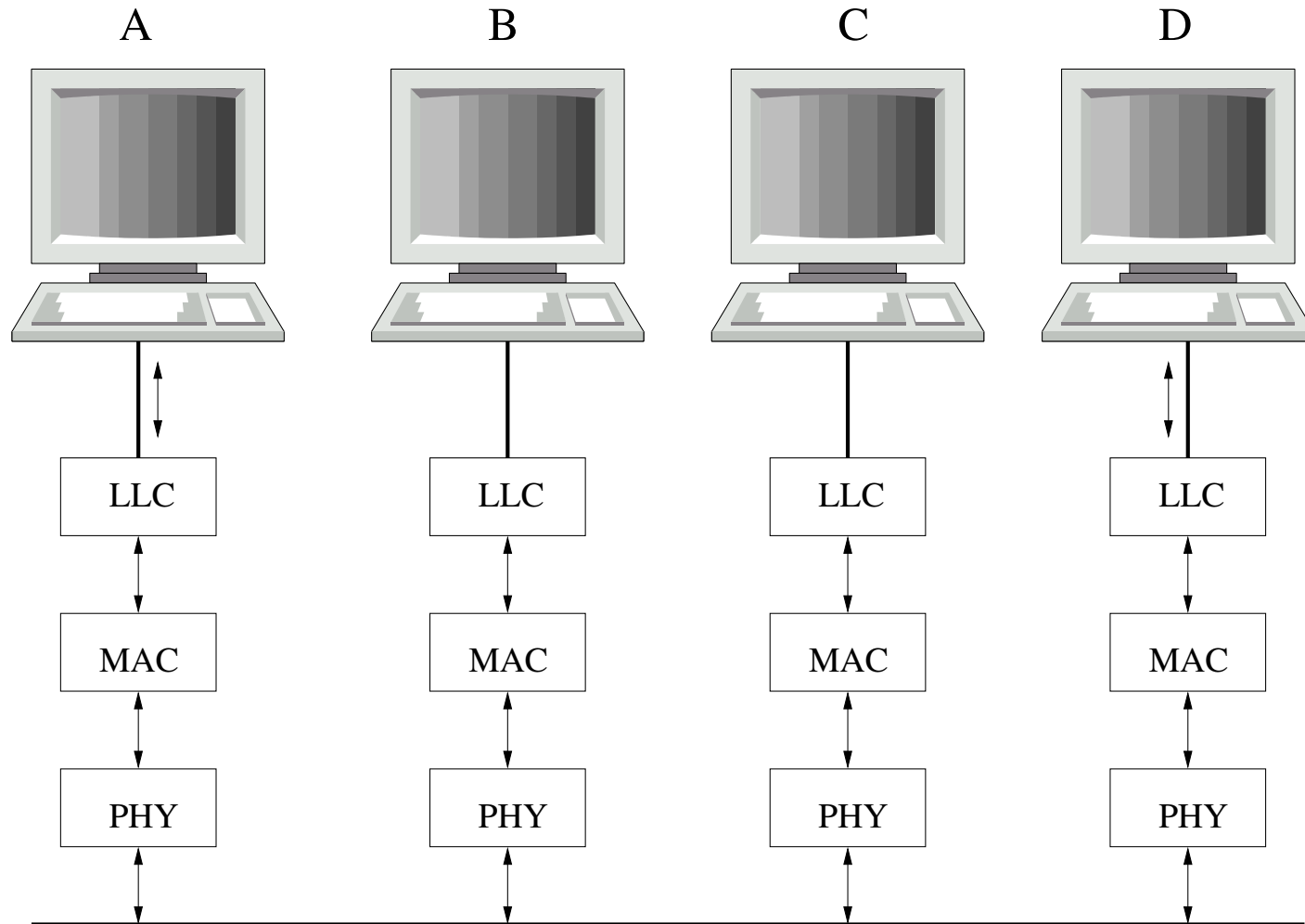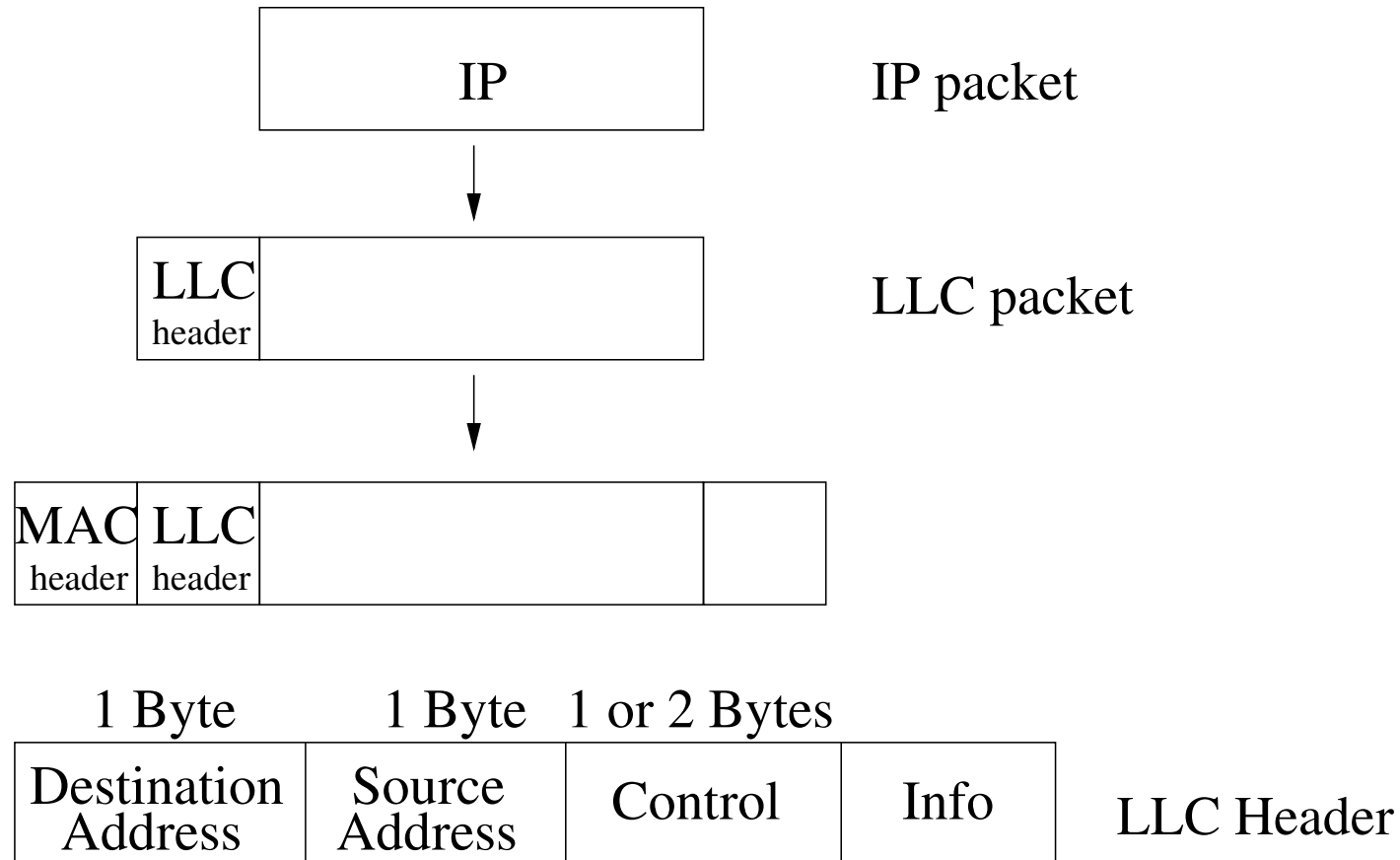
IEEE 802

IEEE 802 Layering Standards (up to 802.25)

802.4 (Token Bus),

802.6 (Dual Queue, Dual Bus),

802.7 (Broadband Advisory Group),

802.8 (Fiber Optics Advisory Group),

802.9 (Isochronous Networks),

802.10 (VPNs, Security),

802.11 (Wireless),

802.12 (AnyLan from HP),

802.13 (Unlucky),

802.14 (Cable Modems),

802.17 (Resilient Ring).

IEEE 802 Layering Standards

IEEE 802 Packetization

| IP | IP packet |

| LLC header | | LLC packet |

| MAC header | LLC header | |

1 Byte   1 Byte   1 or 2 Bytes

| Destination Address | Source Address | Control | Info | LLC Header |

October 30, 2020

IEEE 802.3: Ethernet Standard

- Developped by Xerox in the 1970s.

- In the 1980s, DEC, Intel, and Xerox completed the "DIX Ethernet" standard for a 10 Mbps LAN based on coaxial transmission.

- "DIX Ethernet" became the basis for the IEEE 802.3 Standard.

- IEEE 802.3 Standard frequently revised and expanded over the years.

- Specifications have been issued for running the protocol on coaxial cable, twisted pair, single-mode and multi-mode optical fiber.

- High-speed versions for Fast Ethernet (100 Mbps) and Gigabit Ethernet (1000 Mbps) have also been approved.

October 30, 2020

IEEE 802.3: Ethernet Protocol (1/2)

- CSMA/CD being used on bus based coaxial-cable.

- A node with a frame to transmit waits until channel is silent.

- When channel silent, node transmits but continues to listen for collisions.

- If collision occurs station aborts transmission and schedules a later random time when it will reattempt to transmit.

- If no collision occurs node knows it has captured the channel.

IEEE 802.3: Ethernet Protocol (2/2)

- Binary exponential backoff is being used for retransmission:

  if a frame is about to undergo its nth retransmission attempt then it reschedules transmission by selecting at random an integer in the range

  $$1 \ldots 2^{\min\{n, 10\}} - 1.$$

- Up to sixteen retransmissions will be attempted after which the system gives up.

IEEE 802.3: Frames

	7	1	2 or 6	2 or 6	2			4
Data Frame	Pre	SD	Destination address	Source address	Length	Information	Pad	FCS

0	Single address

1	Group address

0	Local address

1	Group address

Pre(amble) used for synchronization, SD is Frame Start. Addresses are either single or global, as well as local or universal. The number of possible global addresses is 2^{46}.

Ethernet (802.3)

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                    ┌──────────────┐
                    │    802.3     │
                    └──────┬───────┘
             ┌─────────────┴─────────────┐
    ┌────────┴────────┐         ┌─────────┴────────┐
    │     Digital     │         │      Analog      │
    │    Baseband     │         │    Broadband     │
    │   (Manchester)  │         │      (PSK)       │
    └─────────────────┘         └──────────────────┘
```
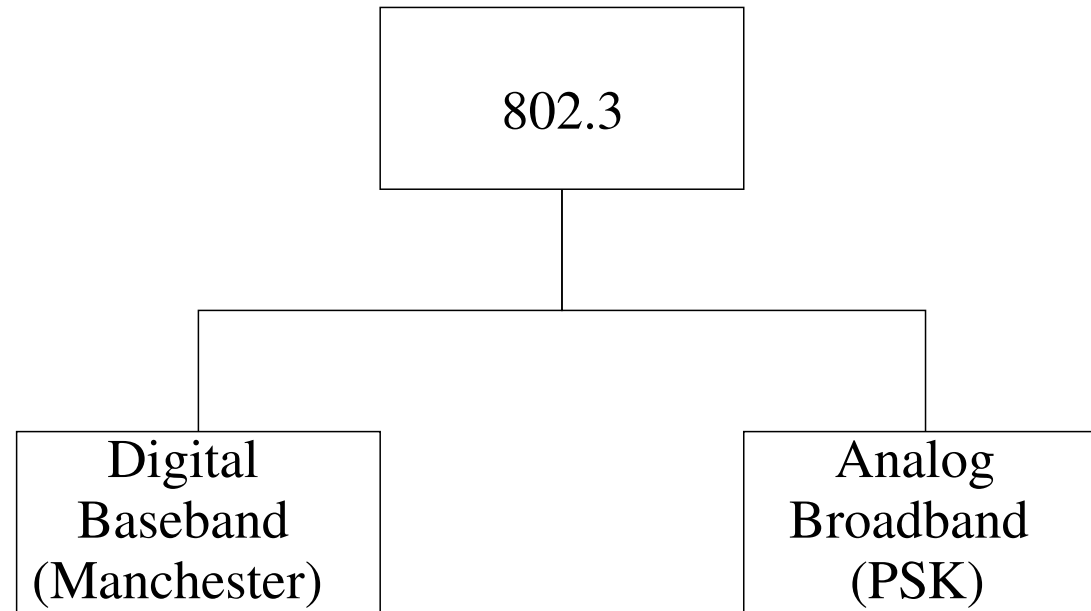
The baseband category has five varieties: 10Base5, 10Base2, 10Base-T, 1Base5, 100Base-T (first number is speed in Mbps, last number or letter is is max cable length/type).

The broadband category has only one specification: 10Broad36 (10 is data rate, 36 max cable length).