IK1203 #9 2019-02-13 (english)

Link layer

Hosts and routers: nodes
layer-2 packet: frame, encapsulates datagram.
- header and trailer
- channel access
  - "MAC" addresses (Medium Access Control)

Error handling
- Seldom used on reliable fibers
- important for wireless links.
- flow control
- error detection
- error correction
- half-duplex and full-duplex

Link layer is partly implemented in hardware and partly in software.

Error Detection and Correction bits are sent (EDC)
- In practice bit-errors and lost packets are regarded as the same thing.

Error detection functions
- Even parity, 1 bit, the number of ones should be even, detects single bit error.
  - Used in Memory and RAID disks
- Internet checksum, 16 bits, modular sum
  - Used in IP, TCP and UDP
- CRC-32, 32 bits, cyclic code (polynomial division), detects burst errors.
  - Used in Ethernet

Two types of "links"
- point-to-point (Ethernet)
- broadcast (old Ethernet, wireless)

Multi access protocol
- We want:
  - bandwith should be divided equaly
  - decetralization
  - no need to synchronize clocks
- three broad classes
  - channel partitioning (time slots, frequency bands, different coding)
    - TDMA, FDMA, CDMA
  - random access. Collissions can happen and we should be able to recover.
    - Ethernet, IEEE802.11
  - "taking turns" Coordinated
    - Bluetooth

Random access protocols

CSMA (Carrier sense multiple access)
- listen to see if anyone else is sending.
- collisions can still happen
- can't recover from collisions

CSMA/CD (collision detection)
- stop sending if collision is detected
- listen and compare with sent data.
- used in wired networks

MAC addresses and ARP
- MAC addresses are burned into the hardware at the factory
  - each adapter has a unique address.
  - IEEE allocates addresses
- ARP: address resolution protocol
  - maps IP address to MAC address
  - ARP query is broadcasted to FF-FF-FF-FF-FF-FF
  - Information is cached until TTL-timeout
  - "plug-and-play"

Ethernet
- most common for LAN networks
- used to use common bus
- now uses switches instead
- Ethernet frame includes preamble, addresses, type, data and CRC
  - preamble used to synchronize clock rates.