Link Layer

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Contents

1 Layer encapsulation

- The link layer shields upper layers from the specific connection type

2 Transmitted Bits

- Bits are transmitted using encoding schemes
- Transmission is based on varying something overtime; for example:
  - Voltage or frequency, with synchronisation

3 Function of the link layer

- Transmits **frames** over physical media
- Received frames, passing IP datagrams up the TCP/IP Stack
- Detects and handles **transmission errors**

4 Data Frames

4.1 Framing

- Each sequence of link layer bits need to be framed
  - Determines start and end

4.2 Ethernet Example

- A data frame over ethernet containes the following:
  - Checkum
  - Data payload
    - IP, ARP, etc, Payload
  - MAC Header
    - Destination MAC address
    - Source MAC address
    - EtherType

5 Link Layer ACKs

Three general link layers techniques can be used

- Connectionless - With no acknowledgments
  - For low error rate links such as ethernet
  - "Connectionless" - No signalling path is established in advance
    - Frames go through "send and forget"
- Acknowledged, connectionless service
  - For wireless services such as wifi
- Acknowledged, connection-oriented services
  - For unreliable links with long delay - such as satellite

5.1 Handling ACKs

- Stop and Wait Automatic Repeat Request
  - Send a frame, wait for ACK, send next frame, etc
  - Will not get an ACK if frame is lost or damaged
- Can be improved by pipelining
  - Send multiple frames before receiving the first ACK
    - Go-back-N ARQ
    - Selective-Repeat ARQ

6 Error detection/correction

6.1 Methods of detection

- Parity bit
  - Adds an extra bit to ensure the total number of 1s is either even or odd.
  - Simple method useful for detecting single-bit errors.
- Cyclic Redundancy Check
  - Uses polynomial division to generate a checksum for the data.
  - Effective at detecting burst errors and multiple bit errors.

7 MAC - Media Access Protocol

- Really tightly coupled and related to the *physical layer*
- Send frames two and from the physical mediums and managed channels/frequencies/collisions
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8 Colision Detection

- Original Ethernet used **CSMA/CD**
  - Carrier Sense Multiple Access with Collision Detection
- Ensures only one sender transmits on the same phyical layer at once
  - More important on radio networks these days