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Chapter 6.1 Introduction and Link Layer Services

6.1.1 Introduction

- Terminology:
  - Hosts and routers are **nodes**.
  - Communication channels that connect adjacent nodes along a communication path are **links**. There are *wired links*, *wireless links*, and *LANs*.
  - Layer-2 packets are used. Datagrams are encapsulated in a **link-layer frame**, which is transmitted into the link.
- Datagrams are transferred by different link protocols over different links. For example, ethernet is transferred over the first link, frame relay on intermediate links, and 802.11 on the last link.
- Each link protocol provides different services. They may or may not provide rdt over link.

6.1.2 Link Layer Services

- Framing, link access:
  - Encapsulates datagrams into frames. Also adds header and trailer.
  - Provides channel access if it is on a shared medium.
  - The source and destination is determined by the *"MAC" address* placed in the frame header, which is different from the IP address.
- Reliable deliver between adjacent nodes:
  - Already learned (chapter 3).
  - This is seldom used on low bit-error links (such as *fiber, twisted pair*...).
  - Wireless links have high error rates.
- Flow control:
  - Pacing between adjacent sending and receiving nodes.
- Error detection:
  - Detects errors caused by weakening signals and noise.
  - Receiver detects presence of these errors, and it signals the sender to retransmit or to drop the frame.
- Error correction:
  - The receiver identifies and corrects bit errors without asking for retransmission.
- Half-duplex and full-duplex
  - With half duplex, nodes at both ends of a link can transmit, but not at the same time.

6.1.3 Where is Link Layer Implemented

- The link layer is *implemented in each and every host*.
- It is either implemented in an adapter (network interface card) or on a chip. Common examples are on *Ethernet cards, 802.11 cards, Ethernet chipsets...*).
- It attaches into a host's system buses.
- The link layer is a combination of hardware, software, and firmware.

6.1.4 Adaptors Communicating

- The sender:
  - Encapsulates datagrams into frames.
  - Adds error checking bits, rdt, flow control...
- The receiving side:
  - Looks for errors, rdt, flow control...
  - Extracts datagrams and passes them to the upper layer.