ECCS-3631
Networks and Data Communications

Module 3
Link Layer and Random Access Protocols
Module 3-1 Link-Layer and CRC

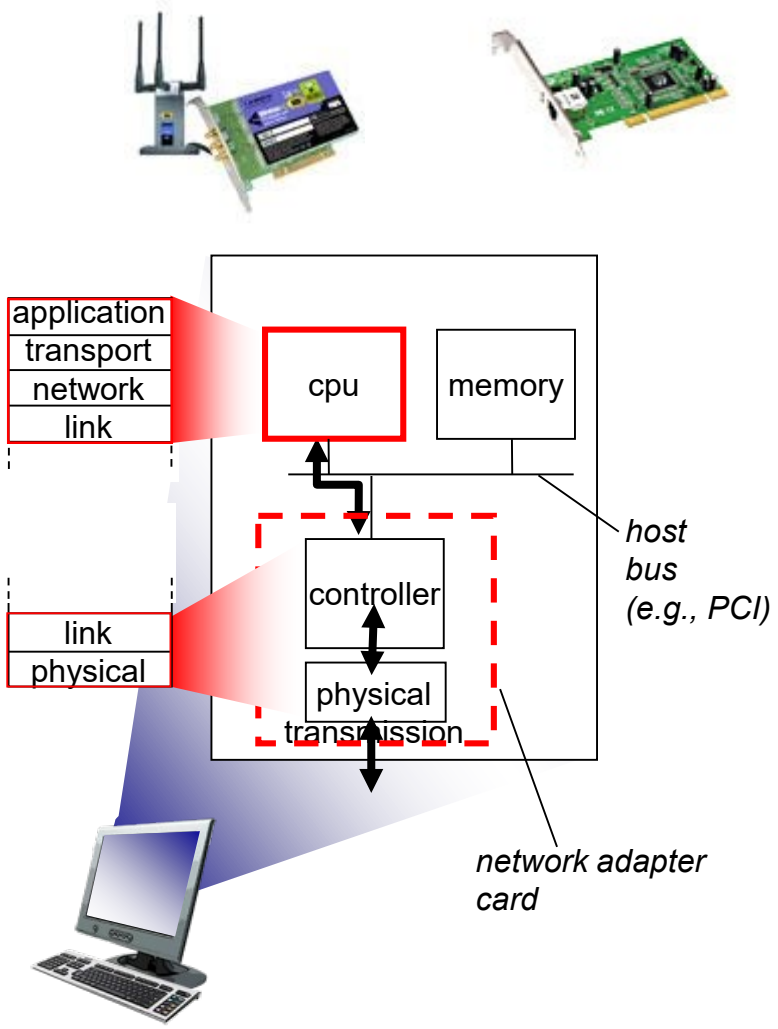
Dr. Ajmal Khan

Link Layer Services

- **Framing**: Link-layer protocols encapsulate each network-layer datagram within a link-layer frame before transmission over the link.
- **Link Access**: A medium access control (MAC) protocol specifies the rules by which a frame is transmitted onto the link.
- **Reliable Delivery**: A link-layer reliable delivery service can be achieved with acknowledgments and retransmissions. A link-layer reliable delivery service is often used for links that are prone to high error rates, such as a wireless link, with the goal of correcting an error locally. Seldom used on low-error links.
- **Error Detection and Correction**: Errors caused by signal attenuation or electromagnetic noise. Link-layer can detect and correct the presence of errors.

Where is the Link Layer Implemented?

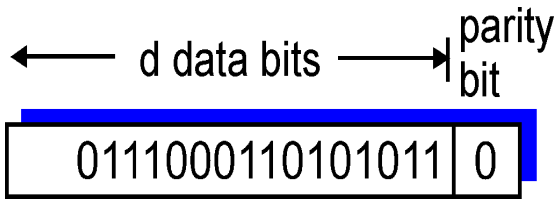
- Link layer is implemented in a network adapter, (also known as a Network Interface Card (NIC)), or WiFi adapter.
- There is a special purpose chip that implements many of the link-layer services.
- Link layer functionality is implemented in hardware and software.
- On the sending side, the controller takes a datagram from network layer, encapsulates the datagram in a link-layer frame, and then transmits the frame into the communication link.
- On the receiving side, a controller receives the entire frame, and extracts the network-layer datagram.



Error Detection; Parity Checking

single bit parity:

- Add a single bit
- *d*etect single bit errors



For an Even Parity

- An additional bit (1 or 0) is added to make the total number of 1s is even

For an Odd Parity

- An additional bit (1 or 0) is added to make the total number of 1s is Odd

Cyclic Redundancy Check (CRC)

- more powerful error-detection coding
- can detect all burst errors less than r+1 bits
- widely used in practice (Ethernet, 802.11 WiFi, ATM)