**链路层提供的服务**

成帧（framing），链路接入（link access）

encapsulate datagram into frame, adding header, trailer

channel access if shared medium

媒体访问控制 Medium Access Control（MAC） addresses used in frame headers to identify source, destination

different from IP address

reliable delivery between adjacent nodes

seldom used on low bit-error link (fiber, some twisted pair)

wireless links: high error rates

flow control

在相邻的发送和接收节点之间来回踱步

error detection

errors caused by signal attenuation, noise

receiver detects presence of errors:

signals sender for retransmission or drops frame

error correction

receiver identifies and corrects bit error(s) without resorting to retransmission

half-duplex and full-duplex 半双工和全双工

with half duplex, nodes at both ends of link can transmit, but not at same time

**链路层在何处实现？**

in each and every host

link layer implemented in “adaptor” (aka network interface card NIC) or on a chip

Ethernet card, 802.11 card; Ethernet chipset

implements link, physical layer

attaches into host’s system buses

combination of hardware, software, firmware

