

# Computer Networks

## Point-to-Point Protocol

Based on Computer Networking, 4<sup>th</sup> Edition by Kurose and Ross

Stan Kurkovsky

### Point to Point Data Link Control

- one sender, one receiver, one link: easier than broadcast link:
  - no Media Access Control
  - no need for explicit MAC addressing
  - e.g., dialup link, ISDN line
- popular point-to-point DLC protocols:
  - PPP (point-to-point protocol)
  - HDLC: High level data link control (Data link used to be considered "high layer" in protocol stack!)

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## PPP Design Requirements [RFC 1557]

- **packet framing**: encapsulation of network-layer datagram in data link frame
  - carry network layer data of any network layer protocol (not just IP) *at same time*
  - ability to demultiplex upwards
- **bit transparency**: must carry any bit pattern in the data field
- **error detection** (no correction)
- **connection liveness**: detect, signal link failure to network layer
- **network layer address negotiation**: endpoint can learn/configure each other's network address

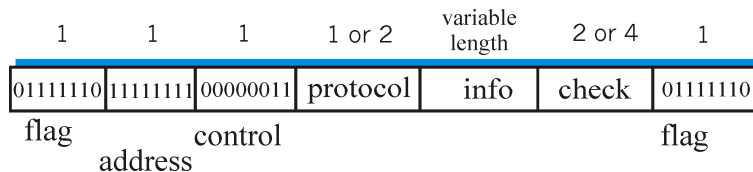
### PPP non-requirements

- no error correction/recovery
- no flow control
- out of order delivery OK
- no need to support multipoint links (e.g., polling)
- **Error recovery, flow control, data re-ordering all relegated to higher layers!**

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## PPP Data Frame

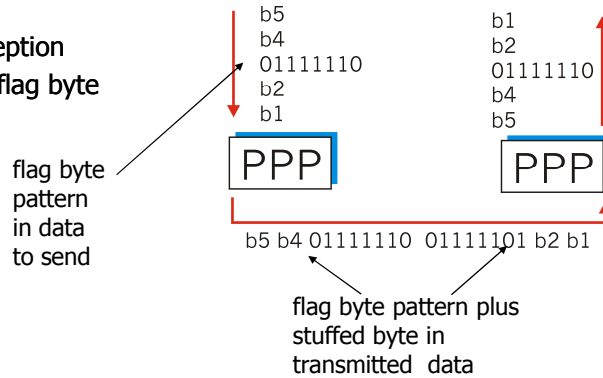
- **Flag**: delimiter (framing)
- **Address**: does nothing (only one option)
- **Control**: does nothing; in the future possible multiple control fields
- **Protocol**: upper layer protocol to which frame delivered (eg, PPP-LCP, IP, IPCP, etc)
- **Info**: upper layer data being carried
- **Check**: cyclic redundancy check for error detection



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## Byte Stuffing

- "data transparency" requirement: data field must be allowed to include flag pattern <01111110>
  - **Q:** is received <01111110> data or flag?
- **Sender:** adds ("stuffs") extra < 01111110> byte after each < 01111110> *data* byte
- **Receiver:**
  - two 01111110 bytes in a row: discard first byte, continue data reception
  - single 01111110: flag byte

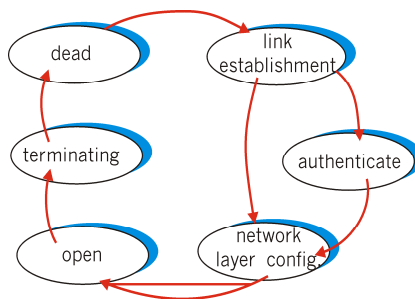


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## PPP Data Control Protocol

Before exchanging network-layer data, data link peers must

- **configure PPP link** (max. frame length, authentication)
- **learn/configure network layer information**
  - for IP: carry IP Control Protocol (IPCP) msgs (protocol field: 8021) to configure/learn IP address



Stan Kurkovsky