Data Link Layer Protocol

- Asynchronous Transfer Mode
- Ethernet
- Fiber Distributed Data Interface
- Frame Relay
- High-Level Data Link Control
- IEEE 802.2
- IEEE 802.11
- Point-to-Point Protocol
- Etc.

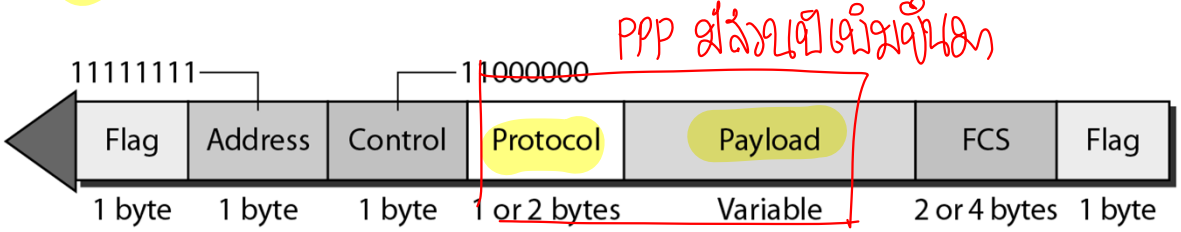
POINT-TO-POINT PROTOCOL

mostly use in WAN

- Although HDLC is a general protocol that can be used for both point-to-point and multipoint configurations, one of the most common protocols for point-to-point access is the Point-to-Point Protocol (PPP). PPP is a byte-oriented protocol.
  - Framing
  - Transition Phases
  - Multiplexing
  - Multilink PPP

PPP frame format

- PPP is based on the High-Level Data Link Control (HDLC) protocol
- The difference between PPP frames and HDLC frames is that PPP frames contain protocol and Link Control Protocol (LCP) fields
- LCP
  - Described in RFCs 1548, 1570, 1661, 2153, and 2484
  - Describes PPP organization and methodology, including basic LCP extensions



HDLC & PPP frame format

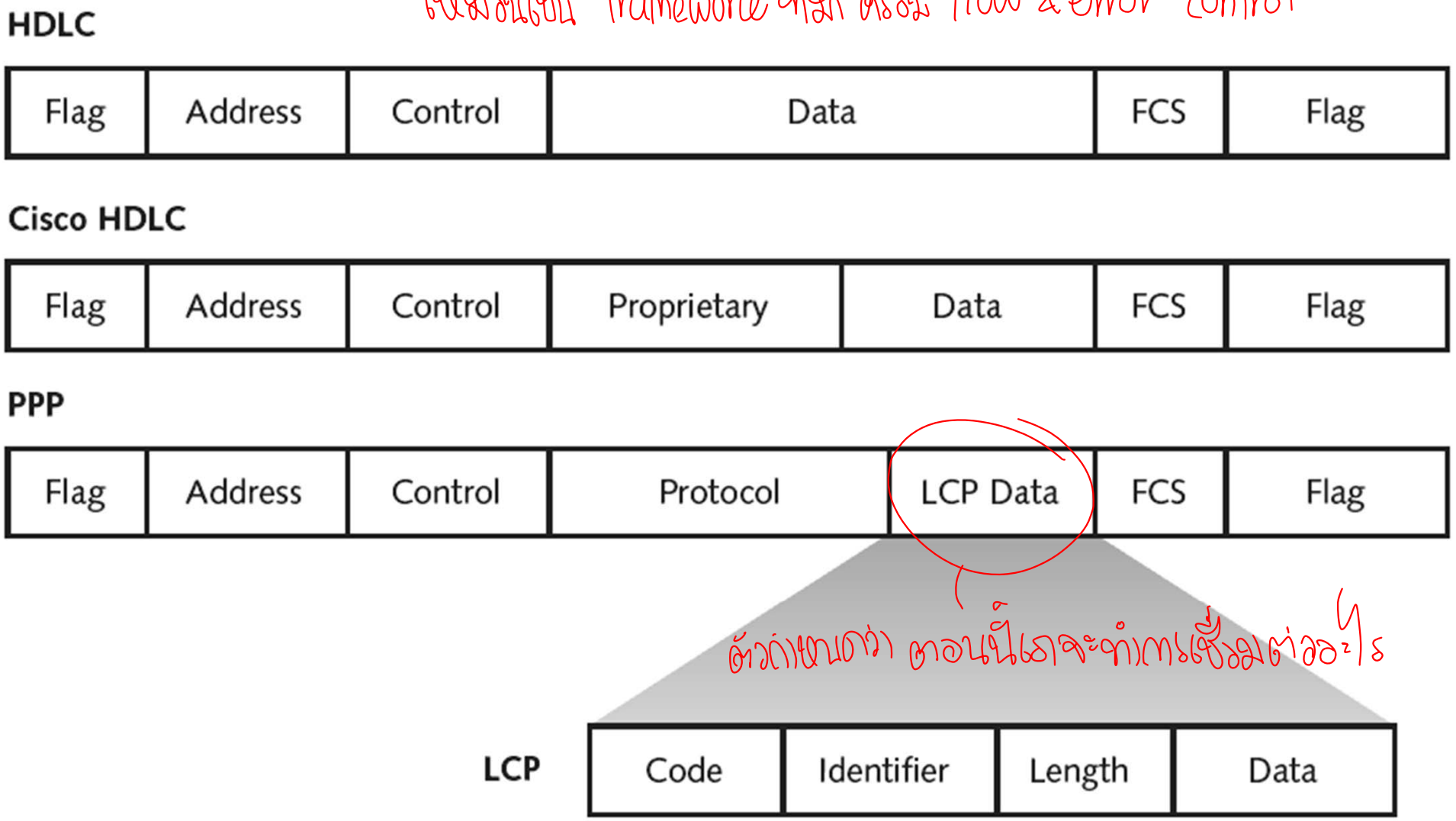
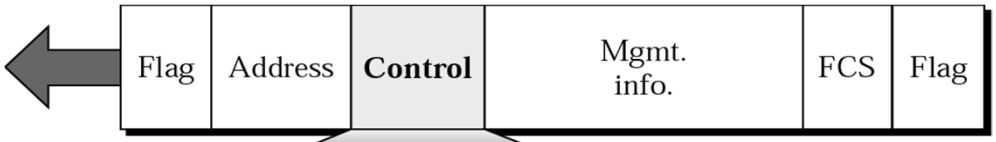
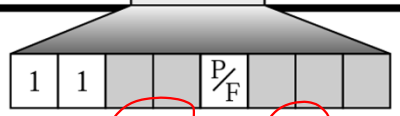


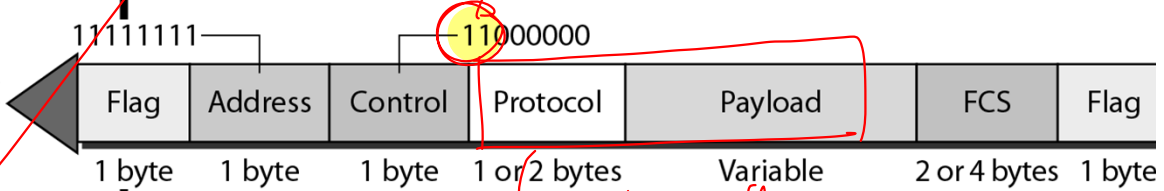
Figure 11-2 HDLC and PPP packet structure

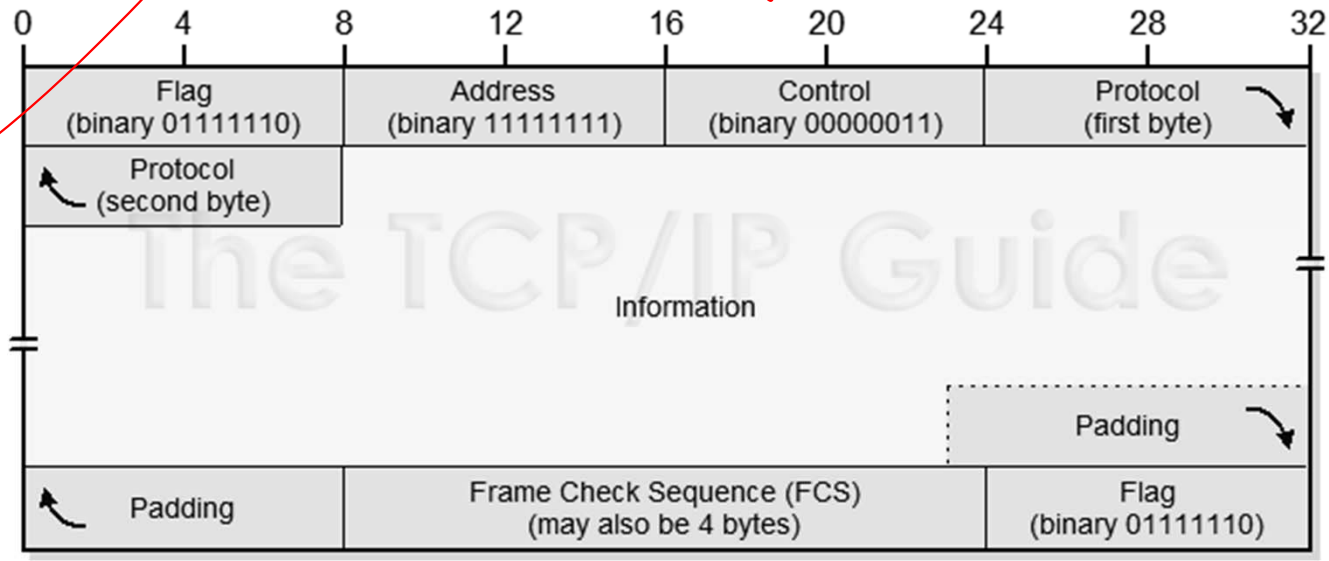
HDLC & PPP frame format





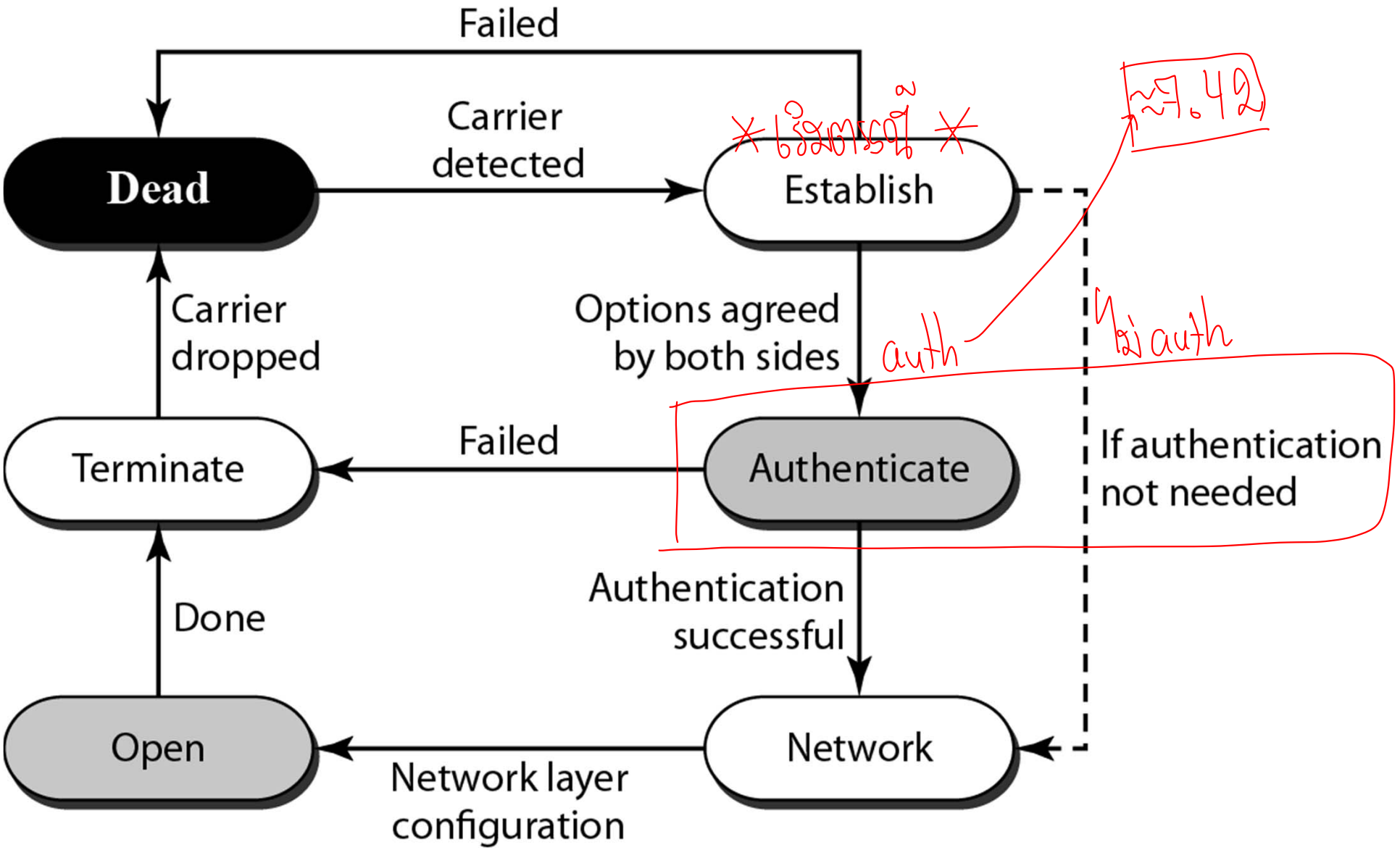
Code		Command	Response
00	001	SNRM	
11	011	SNRME	
11	100	SABM	DM
11	110	SABME	
00	000	UI	UI
00	110		UA
00	010	DISC	RD
10	000	SIM	RIM
00	100	UP	
11	001	RSET	
11	101	XID	XID
10	001		FRMR



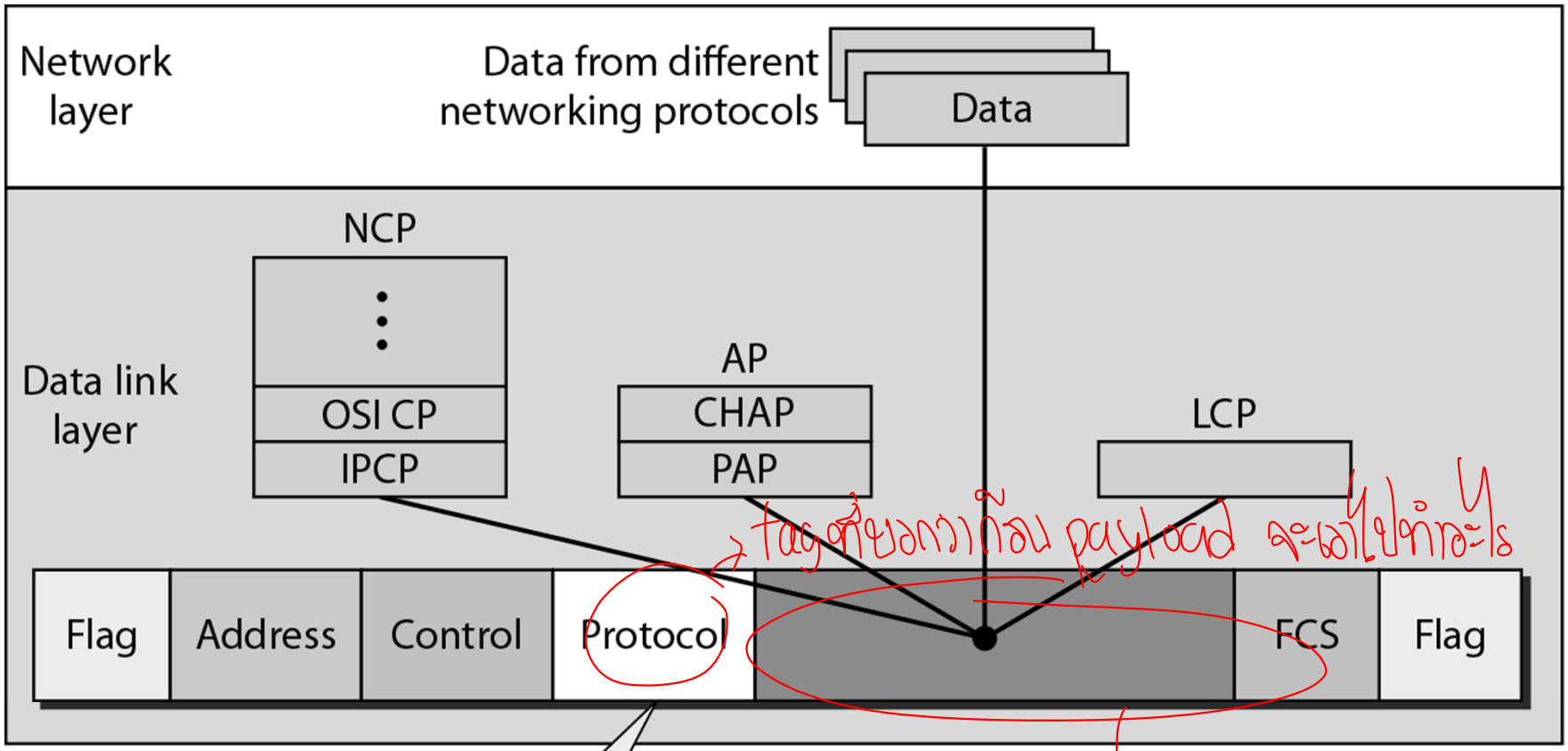


Transition phases

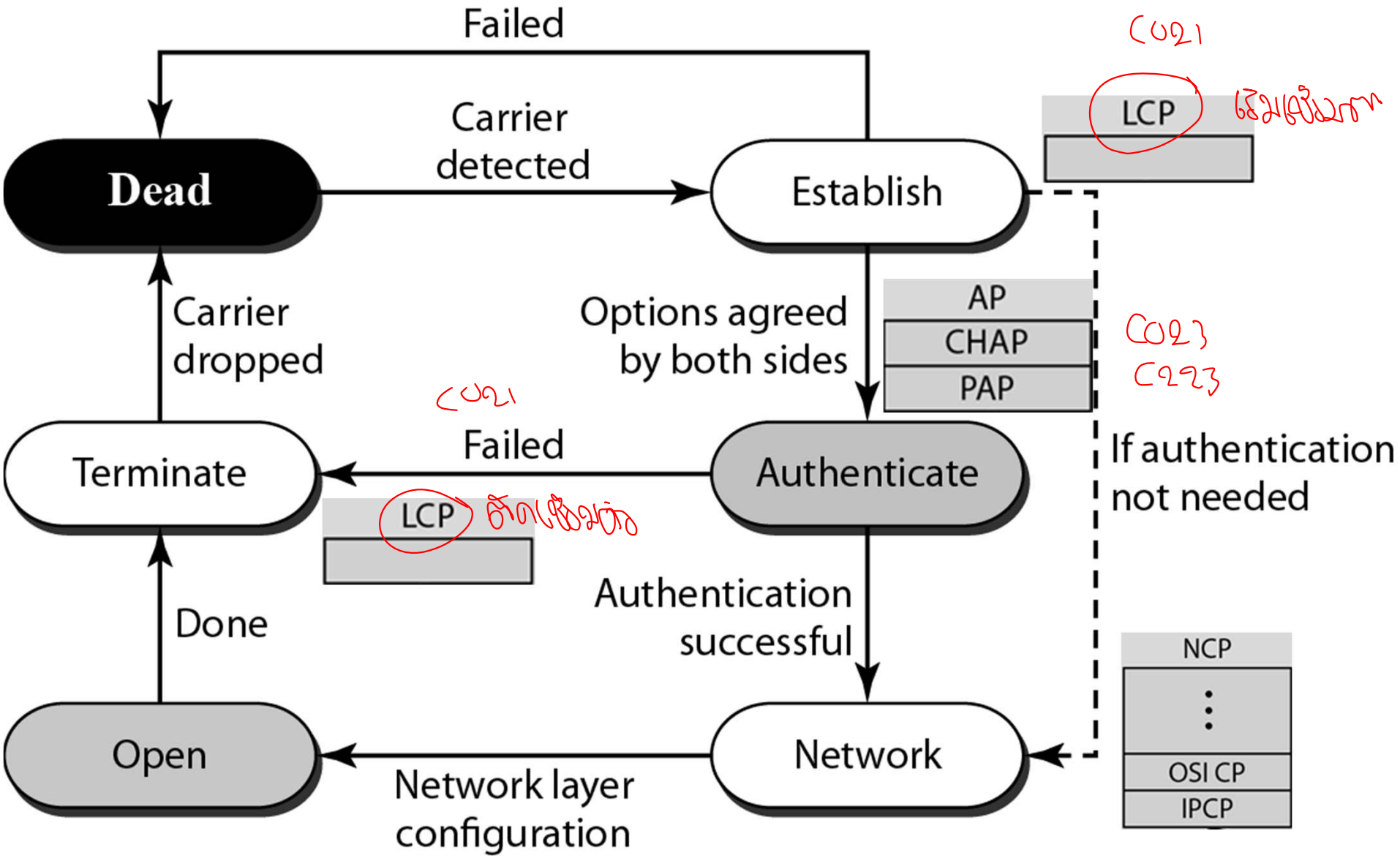
PPP เริ่มจากมา HDLC ก็ไม่มี authentication.



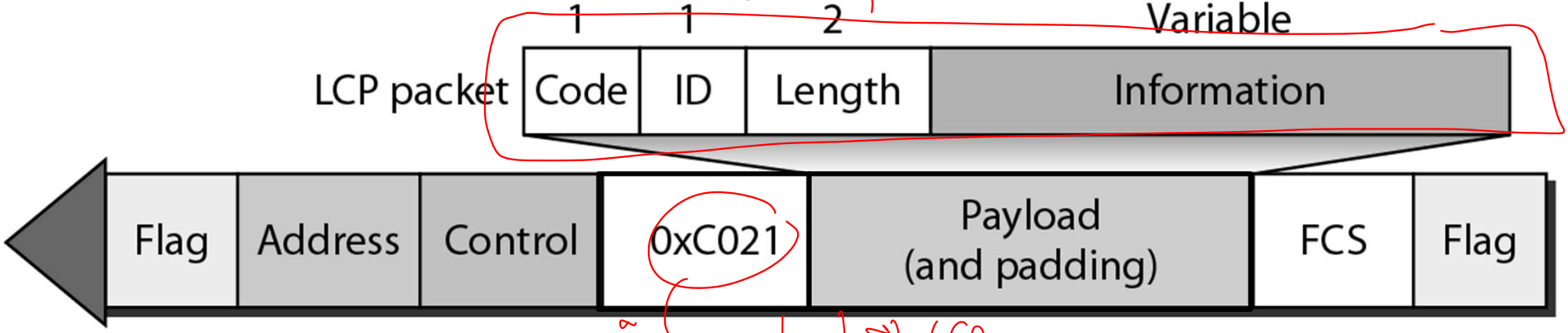
Multiplexing in PPP



Transition phases



LCP packet encapsulated in a frame



- Responsible
  - Establishing
  - Maintaining
  - Configuring
  - Terminating links.

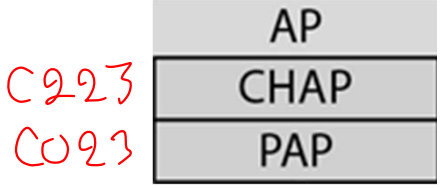
LCP packets

Code	*Packet Type*	*Description*
0x01	Configure-request	Contains the list of proposed options and their values
0x02	Configure-ack	Accepts all options proposed
0x03	Configure-nak	Announces that some options are not acceptable
0x04	Configure-reject	Announces that some options are not recognized
0x05	Terminate-request	Request to shut down the line
0x06	Terminate-ack	Accept the shutdown request
0x07	Code-reject	Announces an unknown code
0x08	Protocol-reject	Announces an unknown protocol
0x09	Echo-request	A type of hello message to check if the other end is alive
0x0A	Echo-reply	The response to the echo-request message
0x0B	Discard-request	A request to discard the packet

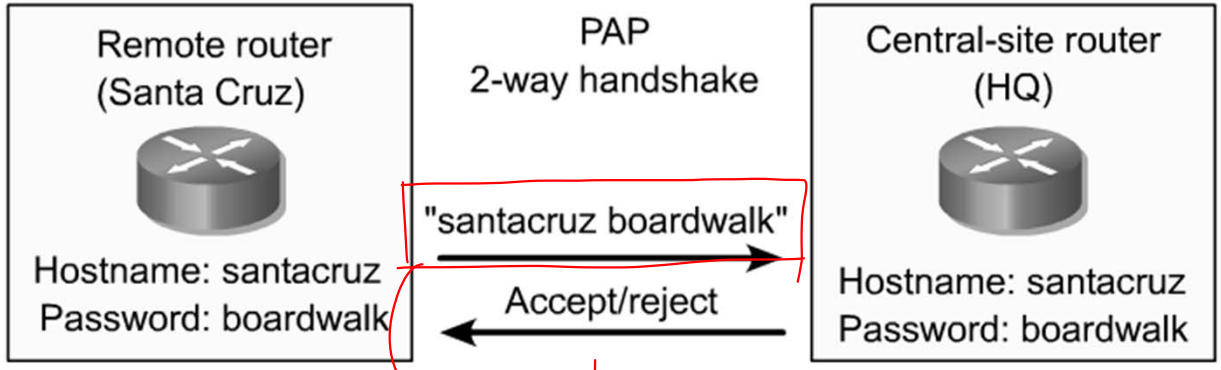
Common options

Option	*Default*
Maximum receive unit (payload field size)	1500
Authentication protocol	None
Protocol field compression	Off
Address and control field compression	Off

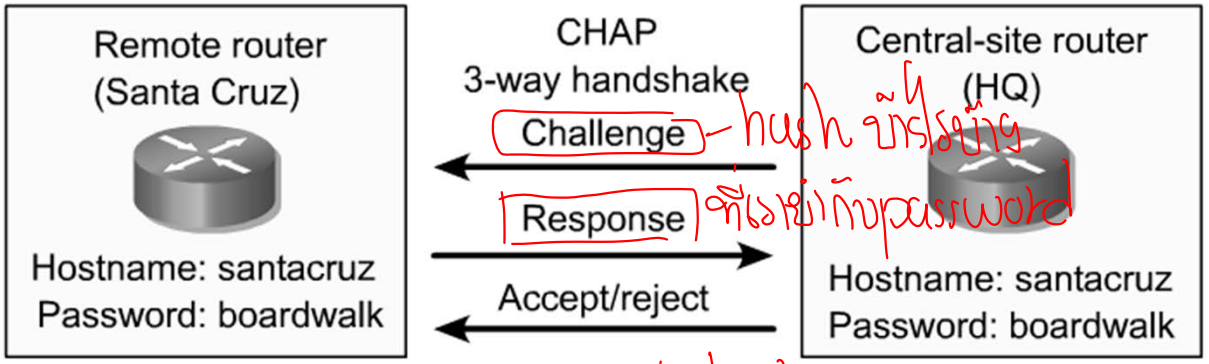
Authentication Protocol



- PAP: Password Authentication Protocol

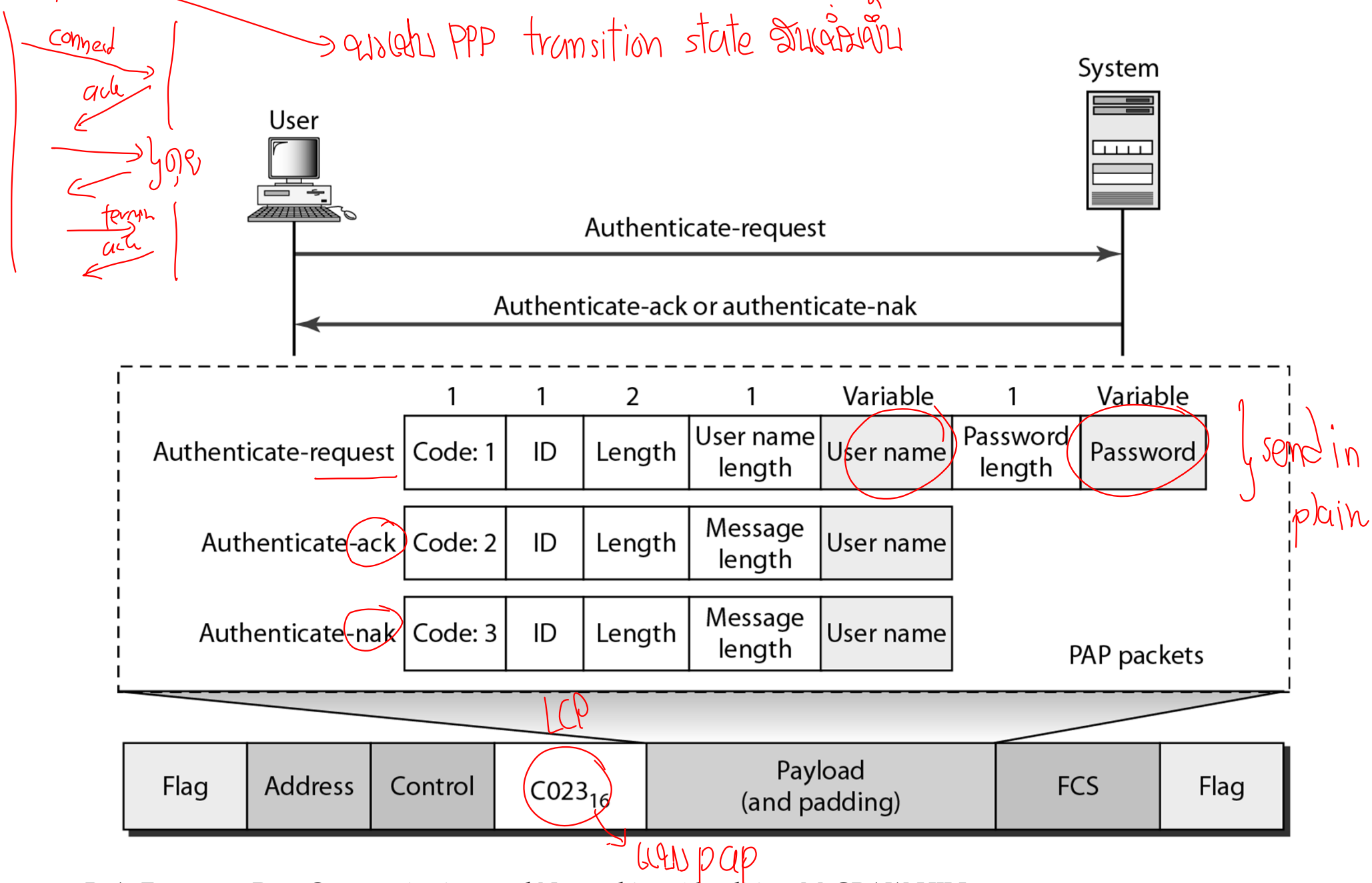


- CHAP: Challenge-Handshake Authentication Protocol

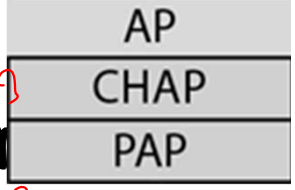


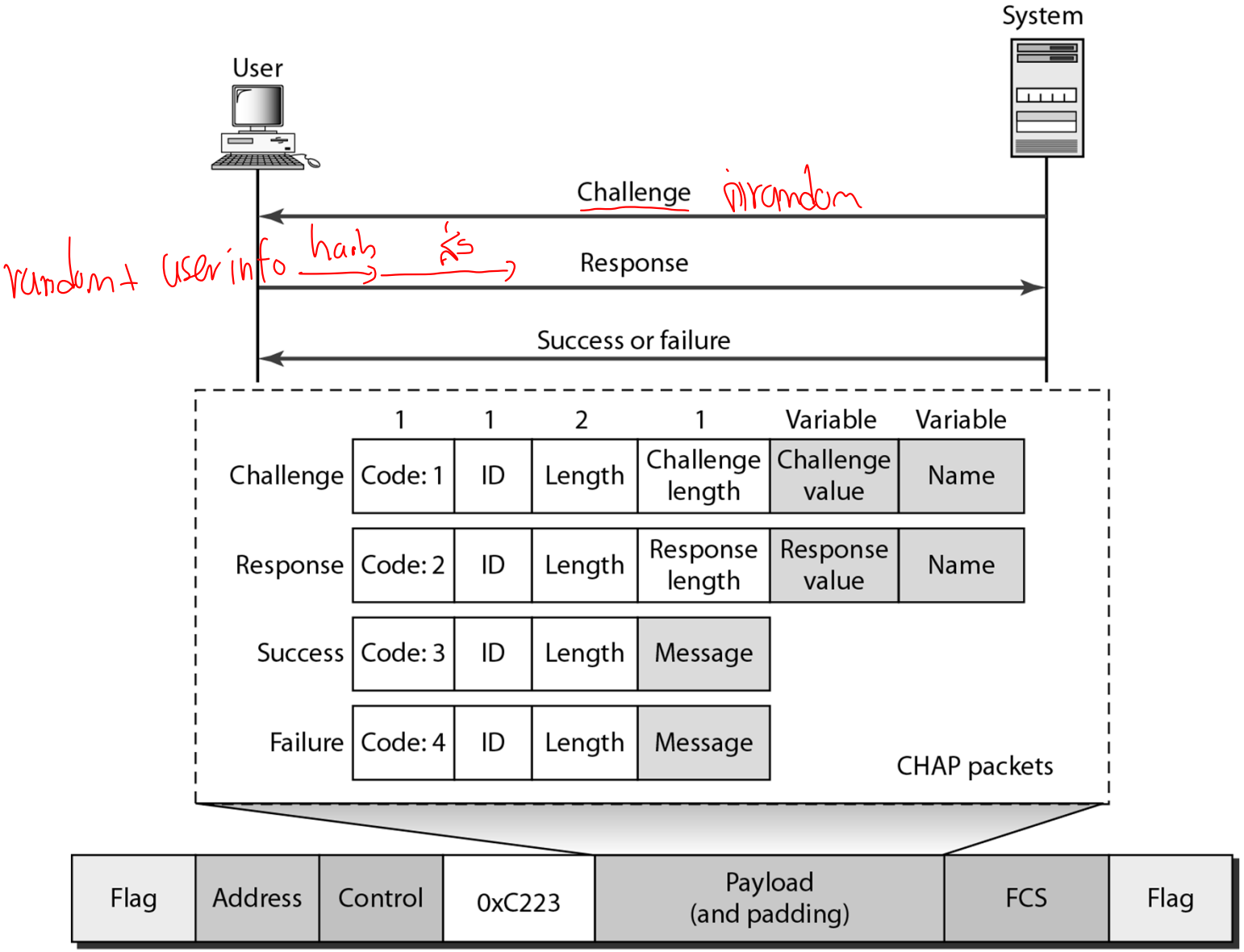
PAP packets encapsulated in a PPP fram

AP
CHAP
PAP

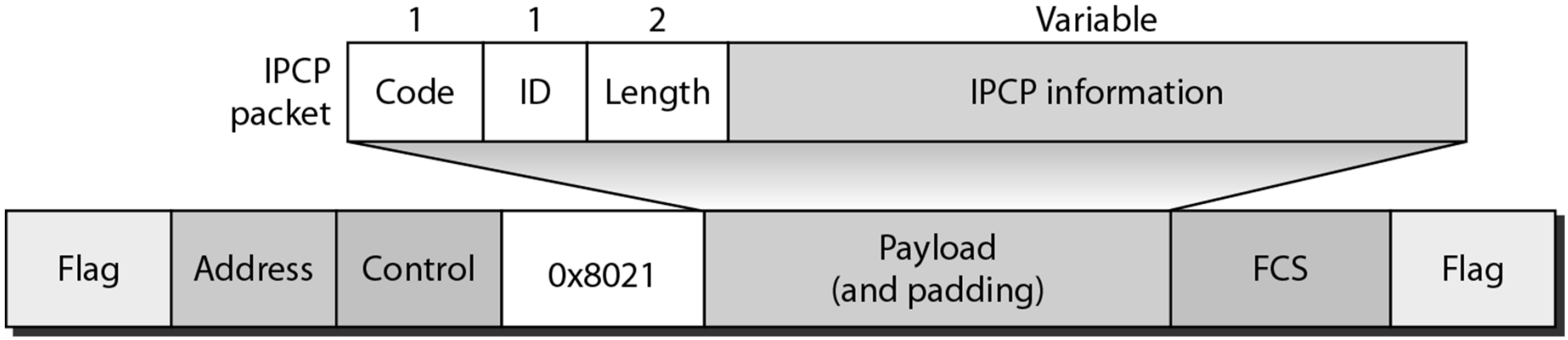


CHAP packets encapsulated in a PPP frame



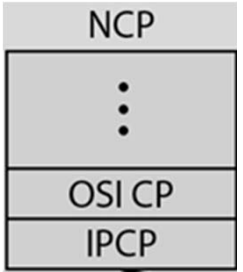


IPCP packet encapsulated in PPP frame

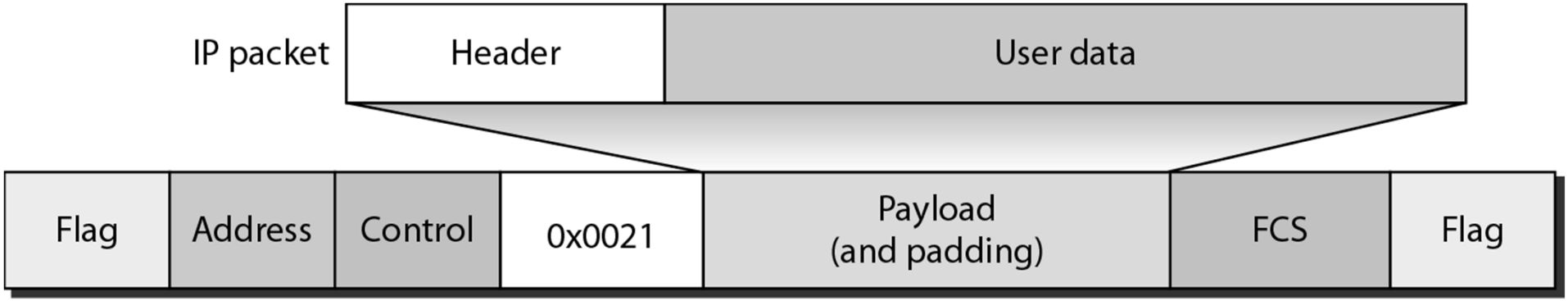


- Code value for IPCP packets

Code	*IPCP Packet*
0x01	Configure-request
0x02	Configure-ack
0x03	Configure-nak
0x04	Configure-reject
0x05	Terminate-request
0x06	Terminate-ack
0x07	Code-reject

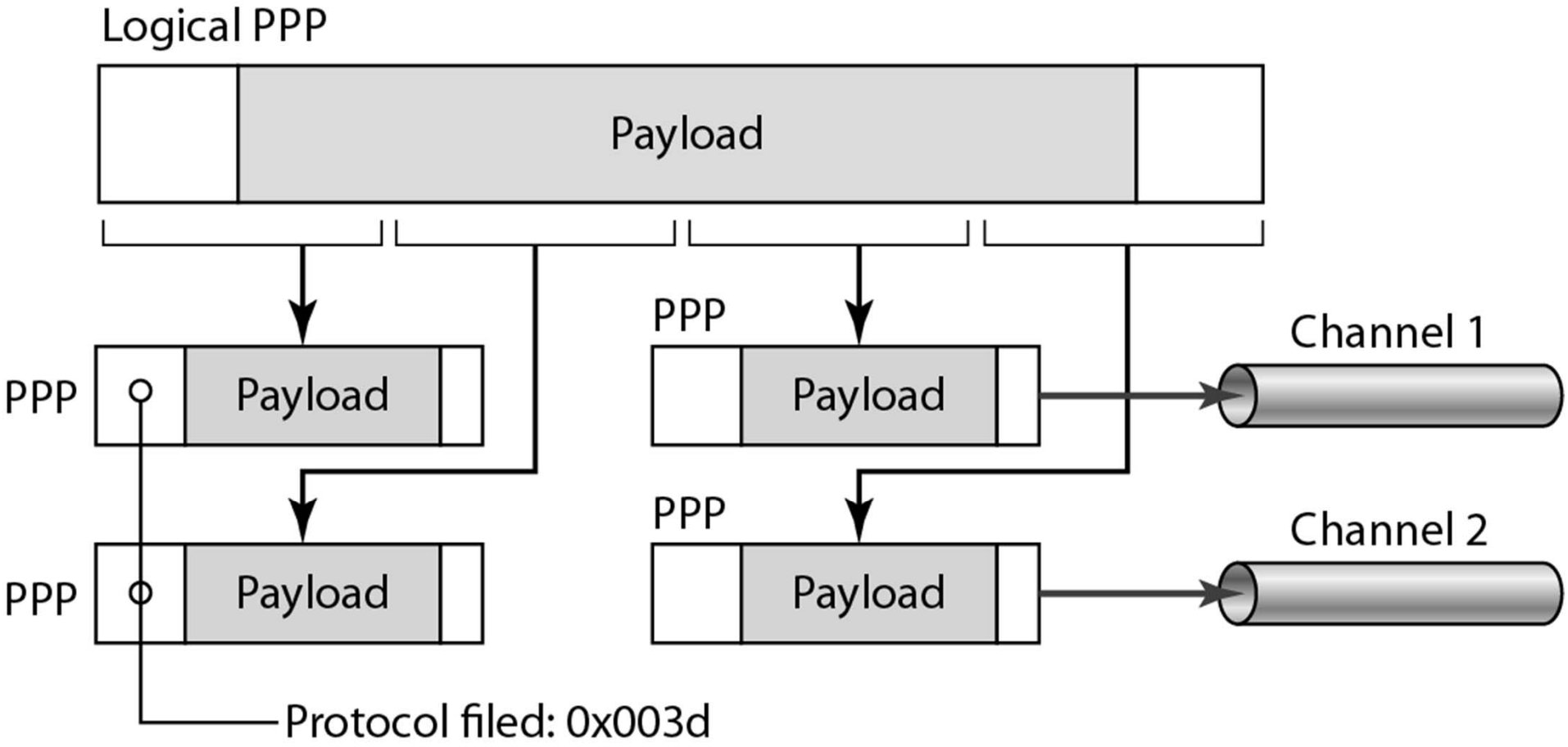


IP datagram encapsulated in a PPP frame



Code	IPCP Packet
01	Configure-request
02	Configure-ack
03	Configure-nak
04	Configure-reject
05	Terminate-request
06	Terminate-ack
07	Code-reject

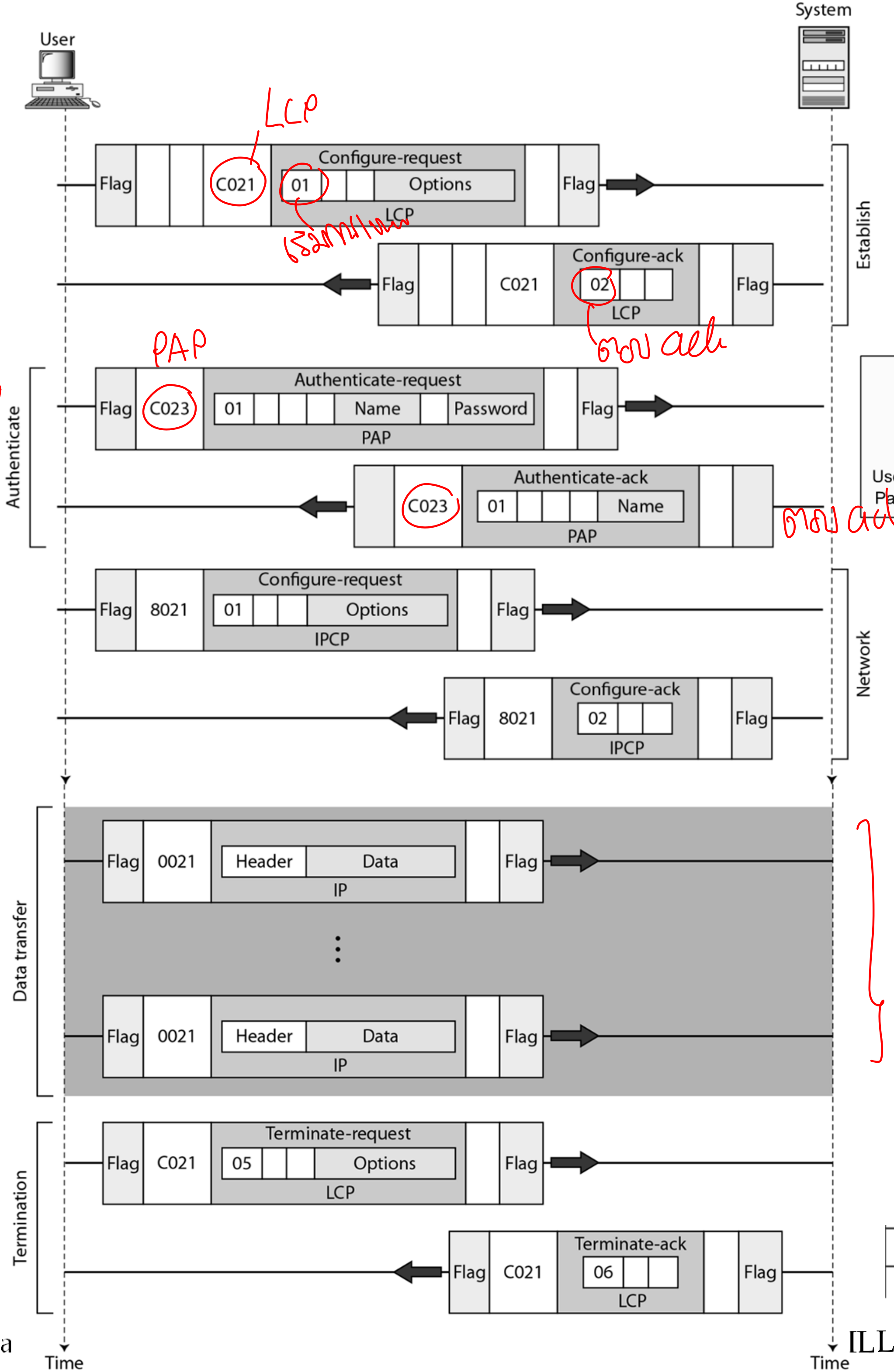
Multilink PPP

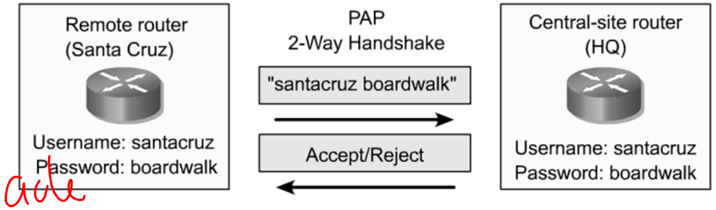


LCP: 0xC021
AP: 0xC023 and 0xC223
NCP: 0x8021 and ....
Data: 0x0021 and ....

LCP packets

Code	Packet Type
0x01	Configure-request
0x02	Configure-ack





IPCP packets

Code	IPC
0x01	Configure-request
0x02	Configure-ack

LCP packets

0x05	Terminate-request
0x06	Terminate-ack

noise